COMPUTER COMMUNICATIONS NETWORKS

CT-376

COMPLEX COMPUTING PROBLEM

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RUBRICS

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Complex Computing Problem Assessment Rubrics

Course Code: CT-376			**Course Title: Computer Communication Networks**
Criteria and Scales			
Excellent (3)	**Good (2)**	**Average (1)**	**Poor (0)**
Criterion 1: Understanding the Problem: How well the problem statement is understood by the student			
Understands the problem clearly and identify the underlying issues and functionalities.	Adequately understands the problem and identifies the underlying issues and functionalities.	Inadequately defines the problem and identifies the underlying issues and functionalities.	Fails to define the problem adequately and does not identify the underlying issues and functionalities.
Criterion 2: Research: The amount of research that is used in solving the problem			
Contains all the information needed for solving the problem	Good research leads to a successful solution	Mediocre research which may or may not lead to an adequate solution	No apparent research
Criterion 3: Code: How complete the code is along with the assumptions?			
Complete the code according to the selected functionalities of the given case with clear assumptions	Incomplete code according to the selected functionalities of the given case with clear assumptions	Incomplete code according to the selected functionalities of the given case with unclear assumptions	Wrong code and naming conventions
Criterion 4: Report: How thorough and well organized is the solution?			
All the necessary information is organized for easy use insolving the problem	Good information organized well could lead to a good solution	Mediocre information which may or may not lead to a solution	No report provided
Criterion 5: Labeling: How well defined and labeled is the solution?			
All the necessary information is labelled (i.e. port no.) for better understanding	Good information about the topology is labelled	Incomplete label according to the selected functionalities	Not Labelled

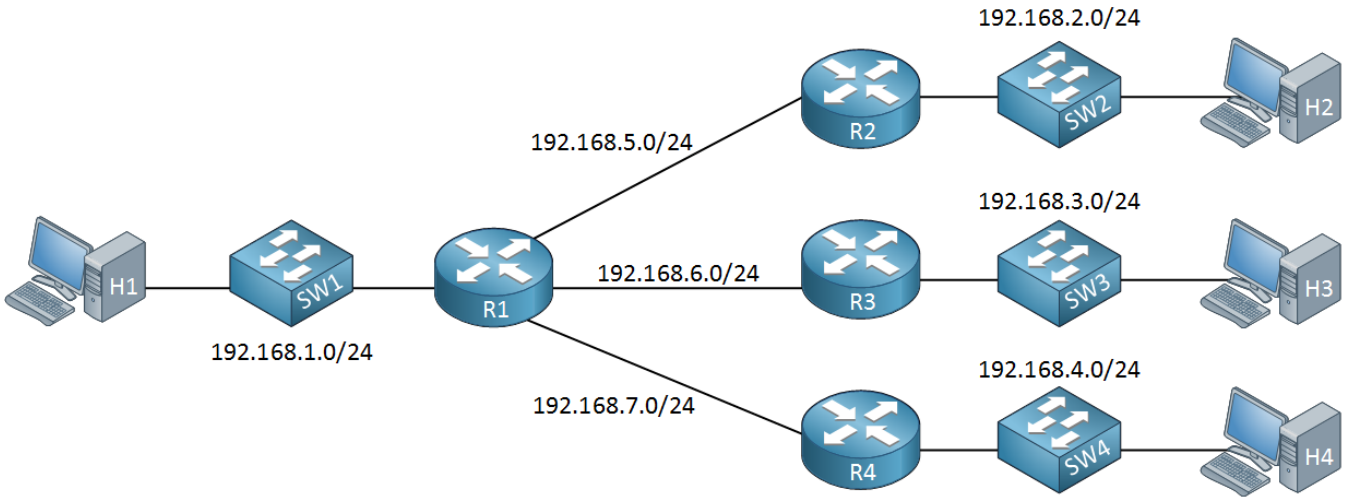
TERMINOLOGIES

Subnetting

The process of dividing a network into sub networks for effectively managing the ip address is called subnetting. It also improves the network performance.

It creates subnets with unique network addresses.

Uses: Helps to optimize network resources followed by its performance and hence enhancing the security by logically segmenting the network.



Configuration

R2
[Huawei-GigabitEthernet0/0/3]ip address
10.120.192.37/28
[Huawei-GigabitEthernet0/0/2]ip address
10.120.192.21/28
[Huawei-GigabitEthernet0/0/1]ip address
10.120.192.57/30
[Huawei-GigabitEthernet0/0/0]ip address
10.120.192.1/28

- Purpose: Interface IP assignment.
- Justification: /28 subnet ensures 14 usable addresses, optimizing resource use.

Telnet

A netwrok layer protocol that is used for remotely accessing and managing the devices, like servers and routers followed by switches. It has the CLI for configuation and troublershooting.

It helps to remotely configure the devices, perform diagnostics scan wihout the physcial contact with the device.

Configuration

```
[Huawei]telnet server enable
info: The Telnet server has been enabled.
[Huawei]user-interface vty 0 4
[Huawei-ui-vty0-4]authentication-mode password
[Huawei-ui-vty0-4]set authentication password cipher taha123
[Huawei-ui-vty0-4]q
```

Authentication Mode Password: Requires a password for Telnet access, enhancing security.

Set Authentication Password Cipher: Specifies the password for Telnet access, encrypted for security.

Virtual Terminal Range (VTY 0 4): Defines the range of virtual terminal lines for Telnet connections.

Access Control List

Security

ACL

The access control list are a set of rules that has the abilty to control the traffic flow inside the outside of the network devices. It is based on the source and destination IP addresses, ports and protocols.

The ACLs are used to enhance network security by allowing or denying specific types of traffic, it can control access to resources, can implement firewalls and protect against unauthorised access and attacks.

Configuration

```
[Huawei]acl 2000
[Huawei-acl-basic-2000]rule 5 deny source 192.168.20.2 0.0.0.0
[Huawei-acl-adv-3000]q
[Huawei]interface GigabitEthernet0/0/1
[Huawei-GigabitEthernet0/0/1]traffic-filter outbound acl 2000
```

Justification: Controls outgoing traffic based on ACL rules, further enhancing network security by filtering traffic leaving the device.

Eth-Trunk - LACP

It is also called the link aggregation or eth trunk. It has the potential to combine multiple physical links into a single logical link to increase the bandwidth and provide redundancy and improve load balancing.

The Eth with LACP enahnces the network performance by aggregating bandwidth from multiple links and hence provinign fault tolerence, hence enabling effiecnet use of network resources.

Configuration:

```
LSW1
interface Eth-Trunk1
 port link-type trunk
 port trunk allow-pass vlan 10 20 30 40
 mode lacp
interface Ethernet0/0/13
 eth-trunk 1
interface Ethernet0/0/11
 eth-trunk 1
interface Ethernet0/0/12
 eth-trunk 1

LSW11
vlan batch 10 20 30 40
interface Eth-Trunk1
 port link-type trunk
 port trunk allow-pass vlan 10 20 30 40
 mode lacp
interface Ethernet0/0/13
 eth-trunk 1
interface Ethernet0/0/11
 eth-trunk 1
interface Ethernet0/0/12
 eth-trunk 1
```

Static Routes

These are the manually configured routing entries in network devices that helps to define the specific paths for forwarding the traffic to destination networks or hosts.

- Uses: Used to direct the traffic along the predetermined paths and ensures efficient data routing and bypass dynamic routing protocls.

Configuration

R1
<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]ip route-static 10.10.10.0 24 30.30.30.1
[Huawei]ip route-static 20.20.20.0 24 40.40.40.1
[Huawei]q

R3
<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]ip route-static 20.20.20.0 24 10.10.10.1
[Huawei]ip route-static 40.40.40.0 24 30.30.30.2
[Huawei]q

R4
<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]ip route-static 30.30.30.0 24 10.10.10.2
[Huawei]ip route-static 40.40.40.0 24 20.20.20.2
[Huawei]q

Router In Protocol

RIP

It is a routing information protocol which is used by routers to exchnage the routing informnation and update the roting tables based on the hop count metrics.

Use: It helps to faciliates the automatic route discovery and selection, updates the routing tables dynamically, supports small to medium sized network and enables routers to adapt chnags to netwrok topology.

Configuration

```
rip
rip version 2
network 60.0.0.0
network 50.0.0.0
```

STP Convergence

STP convergence refers to how the Spanning Tree Protocol (STP) reacts to changes in a network topology. When a switch detects a topology change, like a link failure or a new switch added, STP goes through a process to recalculate the optimal paths and block redundant ones. This ensures a loop-free network but can cause brief traffic interruptions.

Use:
The main use of STP convergence is to maintain a loop-free network path even when there are changes in the network topology. These changes could be:

- When a cable connecting switches breaks, STP needs to reroute traffic around the break.
- New switches need to be integrated into the spanning tree, while removed ones need to be gracefully taken out of the loop.
- A port that constantly goes up and down confuses STP and requires recalculations.

VLANS (ROAS)

VLANs segment a network, creating isolated broadcast domains. ROAS lets VLANs talk to each other by using a single router interface split into sub-interfaces (one per VLAN) that communicate with a switch trunk port. It's like having multiple virtual cables for VLAN traffic on one physical link. This is good for saving on router interfaces but can be a bottleneck for high traffic and requires good security measures.

Use:

- Keeps traffic and access controlled within specific areas.
- Isolates sensitive data from unauthorized access.
- Reduces broadcast traffic congestion.
- Makes it easier to manage and troubleshoot issues in specific VLANs.

Configuration

```
<Huawei> system-view
[Huawei] vlan batch 10 20 30 40
[Huawei] interface Ethernet0/0/1
[Huawei-Ethernet0/0/1] port link-type access
[Huawei-Ethernet0/0/1] port default vlan 10
[Huawei-Ethernet0/0/1] quit
[Huawei] interface Ethernet0/0/2
[Huawei-Ethernet0/0/2] port link-type access
[Huawei-Ethernet0/0/2] port default vlan 20
[Huawei-Ethernet0/0/2] quit
[Huawei] interface Ethernet0/0/3
[Huawei-Ethernet0/0/3] port link-type access
[Huawei-Ethernet0/0/3] port default vlan 30
[Huawei-Ethernet0/0/3] quit
[Huawei] interface Ethernet0/0/4
[Huawei-Ethernet0/0/4] port link-type access
[Huawei-Ethernet0/0/4] port default vlan 40
[Huawei-Ethernet0/0/4] quit
[Huawei] interface Ethernet0/0/5
[Huawei-Ethernet0/0/5] port link-type trunk
[Huawei-Ethernet0/0/5] port trunk allow-pass vlan 10 20 30 40
[Huawei-Ethernet0/0/5] quit
```

DHCP

DHCP, or Dynamic Host Configuration Protocol, is a network protocol that automates the process of assigning IP addresses and other network settings to devices on a network. Imagine it as a leasing agent for your network addresses.

Use:

- DHCP eliminates the need to manually configure each device with a unique IP address, reducing errors and simplifying network management.
- A DHCP server manages a pool of IP addresses, ensuring efficient allocation and preventing conflicts.
- Beyond IP addresses, DHCP can provide other settings like subnet mask, default gateway, and DNS server addresses, all in one go.

Configuration

Router R1 DHCP Server Configuration:

```
dhcp enable

ip pool 1
gateway-list 172.16.1.1
network 172.16.1.0 mask 255.255.255.0
dns-list 150.100.15.1 150.100.15.2
domain-name neduet.edu.pk
static-bind ip-address 172.16.1.33 mac-address 5489-9860-57
2B
```

```
interface Ethernet0/0/0
ip address 150.100.12.1 255.255.255.0
dhcp select global

ip route-static 172.16.1.0 255.255.255.0 150.100.12.2
```

Router R2 DHCP Relay Configuration:

```
dhcp enable

interface Ethernet0/0/0
ip address 150.100.12.2 255.255.255.0
#
interface Ethernet0/0/1
ip address 172.16.1.1 255.255.255.0
dhcp select relay
dhcp relay server-ip 150.100.12.1
```

File Transfer Protocol

FTP

FTP, or File Transfer Protocol, is a way to move computer files between devices on a network. It's like a set of instructions computers use to talk to each other and exchange files. FTP has been around for a long time, and it's still used for things like uploading files to websites or downloading software.

Use:

- Businesses can leverage FTP to securely share files between employees, partners, or clients.
- Web developers and administrators use FTP to manage website content, like uploading images, videos, or text files.
- FTP servers can be used to distribute software updates or installers.

Configuration

```
[FTP-SERVER-Ethernet0/0/0]ip address 10.2.2.1 24
[FTP-SERVER-Ethernet0/0/0]q
[FTP-SERVER]ftp server enable
Info: Succeeded in starting the FTP server.
[FTP-SERVER]set default ftp-directory flash:/
[FTP-SERVER]aaa
[FTP-SERVER-aaa]local-user taha password cipher taha123
Info: Add a new user.
[FTP-SERVER-aaa]local-user taha service-type ftp
[FTP-SERVER-aaa]local-user taha ftp-directory flash:/
[FTP-SERVER-aaa]q
```