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CMPE-142

Networking Homework

1. Subnetting and Address Allocation: 2 points. Better Zelle has been assigned the IPv6 address block 2001:0db8:85a3::/48 and wants to create 100 subnets for different departments.

a. Question: What prefix length should each subnet use, and how many available addresses will each subnet have? How would you represent the first and last address of the first subnet?

We would need 7 bits to represent 100 = 1100011

Host Bits = $128 - 7 - 48 = 73$

Subnet 2^{73} different addresses = $9.4 \cdot 10^{21}$

first Subnet: 2001:0db8:85a3:0000:0000 0000 0000 0000

last subnet: 2001:0db8:85a3:07ff:ffff:ffff:ffff:ffff

2. IPv6 Address Compression: 1 point. Given the following uncompressed IPv6 address: fe80:0000:0000:0000:0202:b3ff:fe1e:8329

a. Question: Compress this IPv6 address as much as possible. Then explain the steps and rules you followed to compress the address.

A. fe80:0000:0000:0000:0202:b3ff:fe1e:8329

Remove 0

Fe80:0:0:0:202:b3ff:fe1e:8329

This can be compressed into fe80::202:b3ff:fe1e:8329.

3. Hierarchical IP Design: 2 points. You are a network administrator tasked with designing an efficient IP addressing scheme for Better Zelle with 10 different regional offices. Each region must support at least 10,000 devices, and the company plans to use both IPv4 and IPv6.

a. Question: Propose an IP addressing scheme for both IPv4 and IPv6 that optimizes routing, scalability, and address utilization.

A. HostID for 10,000 devices = 14 bits minimum
NetworkId for 10 regions = 14 bits minimum

IPv4

Net ID	Subnet	Host ID
8 Bits	10 Bits	14 bits

IPv6

Net ID	Subnet	Host ID
48 Bits	16 Bits	64 bits

4. IPv4 Address Conservation: 2 points. Better Zelle has IPv4 address block 192.168.0.0/24 and wants to divide it into subnets to efficiently use the address space, each subnet must accommodate up to 50 devices.

a. Question: What subnet mask should be used to meet this requirement, and how many subnets will be created? Provide the network address and the broadcast address for the first two subnets.

A. for 50 Bits = 6 bits

Network ID and Subnet is 24 bits total

2 Bits used for Host ID

Subnet = 8 bits

||||||| ||||||| ||||||| 00000000

Subnet mask = 255.255.255.0

Subnet Count = 2^6 subnets = 256

Net ID = 192.168.0.0/24

Broadcast IP = 192.168.0.255

5. IPv6 Address Aggregation: 2 points. An ISP has been allocated the IPv6 prefix 2001:0db8:abcd::/32 and wants to aggregate addresses for 5000 customer networks.

a. Question: Design a plan for aggregating these customer networks into a single route advertisement. What prefix length should be used for each customer network, and how would you ensure efficient aggregation while minimizing routing table size?

a. $2^n \geq 5000$
 $8192 \geq 8192$ network $n = 13$
 Prefix length $\rightarrow 32 + 13 = 45$

Subnet		
32 Prefix	13 bits	82 host

To have an efficient aggregation and reducing the routing table with one route, $2001:0db8:abcd::/32$ can be used by all customer networks.

6. Explain the difference between classful and classless addressing. Why is classless addressing more efficient? 2 points.

The main difference how they split the network and host Id. In classful addressing, The boundary stop at end of the quadrant (IPV4) or Octet (IPV6). In classless, The boundary can occur in any bit of the address. Classless is more efficient.

7. Given the IP address 192.168.10.10/26, calculate: 1 point

- Network address
- Broadcast address
- Number of valid hosts
- First and last usable addresses

a. 192.168.10.0
 B. 192.168.10.63
 C. 62 host
 D. first = 192.168.10.1
 last = 192.168.10.62

8. What is the role of the subnet mask in IP addressing? 1 point. Given the subnet mask 255.255.255.192, how many subnets and hosts per subnet can you create within the 192.168.1.0/24 network, and what is the broadcast address for each subnet?

The Subnet mask is used to allow the user/computer to calculate the number of bits being used

||||| ||||| ||||| ||000000
 SN Host

2 bits → 4 subnets

9. What is an aggregation (supernetting) and how does it improve routing efficiency? 2 points. Enumerate the supernet for the sets of IP subnets listed below.

- Set 1: 192.168.10.0/24 and 192.168.11.0/24
- Set 2: 172.16.32.0/24, 172.16.33.0/24, 172.16.34.0/24, 172.16.35.0/24

Supernetting is a technique that uses many small network and combines them into a single larger network. These effectively summarize routes into one routing table. This makes it more

i. Single division, 2 subnets, 2^7 host

Per subnet

192.168.10.0 $\underbrace{}_{\text{Sn}} \underbrace{}_{\text{Host}} / 25$

IP = 192.168.10.0/25

8 172.16.0010 0000.0/24
 172.16.0010 0001.0/24
 172.16.0010 0010.0/24
172.16.0010 0011.0/24

Matching

4 Subnets \rightarrow 2 bits

172.16.0010 00 $\underbrace{}_{\text{Sn}} \underbrace{}_{\text{Host}} / 24$

Sn IP = 172.16.32.0/24

10. Explain the function of routing tables. 1 point.

The purpose of routing table is to tell the router the efficient Path

11. What are the key differences between distance-vector and link-state routing protocols? Provide an example of each. 2 points.

The distance Vector is limited in functionality when it comes to representing distance. It also has better memory utilization

12. What is the impact of network delay versus bandwidth on the performance of a network and what are the key differences? 2 points.

The impact of network delay on the performance of a network is its speed and the time for data.