

A large video file of size 100 Megabytes (MB) needs to be downloaded from a server. The internet connection has a bandwidth of 10 Megabits per second (Mbps).

a) Calculate the download time in seconds.

b) If the video file has an additional 10% overhead for headers and control information during transmission, what will be the total download time?

A user types in the web address "www.example.com" into their browser. The average round-trip time (RTT) between the user's computer and the DNS server is 50 milliseconds (ms).

- **a) Assuming a hierarchical DNS resolution with two levels (root server and TLD server), calculate the estimated total time to resolve the web address if there are no caching mechanisms involved.**

2. TCP Window Size and Throughput:

A TCP connection is established for file transfer between two computers. The bandwidth of the network path is 10 Mbps, and the average round-trip time (RTT) is 200 milliseconds (ms).

- **a) Given a TCP window size of 4 segments, calculate the maximum achievable throughput for the connection.**

1. Routing Protocols:

- You are tasked with designing a network for a university campus with multiple buildings and departments. Each department needs to communicate with others efficiently.
 - **a) Compare and contrast RIP and OSPF routing protocols.**
 - **b) Considering factors like network size, scalability, and convergence time, which routing protocol would be more suitable for the university campus network and why?**

2. Network Security:

- A company website is experiencing a Denial-of-Service (DoS) attack. The website becomes inaccessible due to overwhelming traffic.
 - **a) Explain different types of DoS attacks.**
 - **b) Describe two security measures the company can implement to mitigate DoS attacks.**

3. Network Address Translation (NAT):

- A company has a private network address space (e.g., 192.168.1.0/24) but needs its internal devices to access the internet with a single public IP address.
 - **a) Explain the concept of NAT and how it works.**
 - **b) Describe two different types of NAT (Static NAT and Port Address Translation) and their applications.**

4. Virtual Private Network (VPN):

- A company allows employees to work remotely and securely access the company network from home.
 - **a) Explain how a VPN tunnel is established and how it provides secure communication.**
 - **b) Describe two benefits and one drawback of using a VPN for remote access.**

5. Subnet Mask and Usable Hosts:

A network administrator is assigned a network address of 172.16.0.0 with a subnet mask of /20.

- **a) Determine the network address and broadcast address for this subnet.**
- **b) Calculate the total number of usable IP addresses available within this subnet (excluding network and broadcast addresses).**

6. Latency vs. Bandwidth:

- **a) Differentiate between latency and bandwidth in network communication.**
- **b) Provide an example of a network application where latency is more critical and another where bandwidth is more important.**

9. UDP vs. TCP:

- **a) Compare and contrast the characteristics of UDP and TCP protocols.**
- **b) Indicate which protocol (UDP or TCP) would be more suitable for a real-time video streaming application and why.**

10. Port Numbers:

- **a) Explain the purpose of well-known port numbers in network communication.**
- **b) Provide an example of a commonly used port number and the associated service (e.g., port 80 for HTTP).**

3. IP Fragmentation:

A large file of 1.5 Megabytes (MB) needs to be transmitted over a network with a Maximum Transmission Unit (MTU) of 1500 bytes.

- **a) Calculate the total number of fragments required to transmit the entire file.**
- **b) Considering an additional 20 bytes of header information per fragment, what will be the total size of all the fragments combined?**

4. Parity Check:

- **a) Explain the concept of even parity and odd parity used for error detection in data transmission.**
- **b) Given a data byte of 10110011, calculate the parity bit for both even parity and odd parity schemes.**

5. Application Security:

- **a) Describe two common application-layer security threats (e.g., SQL injection, Cross-Site Scripting).**
- **b) Explain how developers can implement security measures to mitigate these threats.**

6. Application Performance:

- **a) List two factors that can affect the performance of a web application.**
- **b) Describe techniques used to optimize web application performance (e.g., caching, content delivery networks).**

7. Web APIs:

- **a) Explain the concept of web APIs and their role in data exchange between applications.**
- **b) Describe two common API design styles (e.g., RESTful APIs).**

A network administrator is monitoring network performance. They observe the following data:

- Total packets transmitted: 10,000
- Packets dropped: 200
- Total data transferred: 50 Megabytes (MB)
- **a) Calculate the packet delivery ratio (percentage of packets delivered successfully).**
- **b) Assuming an average packet size of 1000 bytes, calculate the network throughput in Mbps.**

4. Wireless Network Security:

A company uses a wireless network with Wi-Fi Protected Access (WPA) security.

- **a) Compare and contrast two wireless network authentication methods (e.g., WPA and WPA2).**
- **b) Describe an additional security measure (e.g., MAC address filtering) that can be used to enhance wireless network security.**

5. Network Cabling Standards:

A network technician needs to choose the appropriate cabling standard for a new office building.

- **a) Differentiate between two common network cabling standards (e.g., Cat5e and Cat6).**
- **b) Considering factors like bandwidth requirements and future-proofing, which cabling standard might be a better choice and why?**

6. Presentation Layer Protocols:

- **a) List two common presentation layer protocols and their primary functions (e.g., ASCII, JPEG).** (Note: While ASCII is a data format, JPEG is an application layer protocol. Consider options like ASN.1 or even mentioning limitations of well-known protocol examples)
- **b) Explain how these protocols facilitate data exchange and presentation between applications on a network.**

7. Impact of Presentation Layer on Applications:

- **a) Describe how the presentation layer impacts the user experience of network applications (e.g., multimedia streaming, file transfer).**
- **b) Explain how advancements in presentation layer technologies can contribute to improved performance and reliability of network communication.**

