Computer Networks

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Assignment no1

Q no1

(i) → Instead of dedicated bandwidth for each communication session, packet switching dynamically allocates bandwith enabling better utilization of available capacity

→ Packet switching facilitates scalability by enabling the network to handle large number of simultaneous connections and varying traffic loads.

→ In the event of network failures or congestion, packets can be rerouted dynamically along alternative paths to reach their destinations, minimizing disruption to service.

→ Packet switching allows for implementation of Quality of Service mechanisms to prioritize different types of traffic based on their requirements

(ii) Physical layer :-

In packet-switched communications, this layer digital data into electrical signals for transmission across the network.

Data link layer :-

This layer will transform the company's data into frames.

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Network Layer:-

This layer will select routes for individual packets using routing algorithms and maintain routing tables.

Transport Layer:-

The layer will segment data into smaller packets for transmission and reassemble them at the destinations.

Session Layer:-

This layer manages session synchronization, checkpointing and recovery to ensure reliable data exchange.

Presentation Layer:-

Tasks such as data compression, encryption and data representation conversion occur at this layer.

Application Layer:-

This layer provides interfaces and protocols for applications to exchange data.

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(iii) Packet Loss:-

Packet loss refers to the failure of one or more data packets to reach their destination in a network

Effect on Reliability of data:-

Packet loss degrades the reliability of data transmissions by causing delays, retransmissions, and potential data corruption.

Minimizing Packet Loss:-

Network administrators can implement measures such as QoS mechanisms to prioritize critical traffic, traffic shaping to regulate bandwidth usage, error detection and correction techniques to minimize packet loss.

(iv) HTTP :-

Hypertext Transfer Protocol operates as a request-response protocol. A Client sends a request to a server for resources and the server responds with the requested data.

Client Server Model:

Clients such web browsers initiate requests for web resources, and servers, which host these resources, respond to requests.

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Request Methods :-

HTTP defines several request methods such as GET, POST, PUT, DELETE, etc. Each method specifies the action to be performed on the requested resource.

URI :-

Uniform Resource Identifiers (URIs) are used to identify resources on the web such as webpages, images and files

Headers :-

Headers provide metadata about the message such as content type, content lengths, caching directives and authentication credentials.

Status Codes :-

HTTP defines a set of status codes to indicate the outcome of the request.

Stateless :-

HTTP is a stateless protocol, meaning that each request from a client to a server is independent and does not retain any information about previous requests.

Connection Management :-

HTTP uses both

persistent and non persistent connections between clients and servers

- Security :- HTTP is not secure but HTTPS extends HTTP with encryption using TLS or SSL.

v.) Performance Enhancing using Web Caching :-

Web caching improves performance and efficiency of web applications by storing frequently accessed resources such as web pages, images, and files, closer to the user. When a user requests a cached resource, it can be delivered quickly from the cache instead of fetching it from the original server, reducing latency and server load. Caching also conserves network bandwidth and improves scalability by minimizing redundant data transfer. Additionally, it enhances user experience by providing faster page loads and smoother browsing.

vi) Protocols :-

Protocols ensure that data is transmitted reliably, efficiently and securely across the network. Protocols specify how devices should format and transmit data packets, establish connections, detect errors and handle congestion.

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Facilitation of Communication:-

Protocols enable interoperability b/w diverse network devices and facilitate the exchange of information, supporting tasks such as file sharing, web browsing and email communications.

Relation to human protocol :-

Protocols in computer networks are like spoken language and social etiquett in human communication. Just as language provides a structured framework for conveying information b/w individuals, protocols define rules and conventions for transmitting data b/w devices.

Q no 2

(i) Issues Reported :-

- Slow internet speed

Causes :-

→ insufficient bandwidth
→ Network congestion
→ Outdated networking equipment

Solution :-

→ Upgrade bandwidth
→ Optimize network traffic prioritization

→ replace outdated networking hardware

- Intermittent Connectivity

Causes :-

→ Network congestion
→ Wireless interference
→ Outdated firmware

Solutions :-

→ Optimize network traffic management
→ Perform a wireless site survey and adjust channels
→ update firmware on networking devices

Disruption in Accessing Shared Resources :-

Causes :-

→ Network permission issues
→ Server overload
→ misconfigured ACLs
→ DNS resolution problems

Solutions :-

→ Adjust network permissions
→ optimize server resources
→ adjust ACL configs
→ troubleshoot DNS

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Trouble shooting plan :-

Step 1 :- Initial Assessment :-

→ Identify ~~underly~~ issues

Step 2 :- Network Infrastructure audit :-

→ audit network infrastructure to identify misconfigurations

Step 3 Establish a theory of probable cause :-

→ Find all possible underlying causes

Step 4 :- Test the theory :-

→ Test the theory to pinpoint the cause

Step 5 :- Performance Optimizations :-

→ Optimize network configurations such as QOS settings

→ Upgrade networking hardware

→ Conduct wireless survey to identify causes of interference and signal degrading

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Step 6 :- Documentation :-

→ Document findings so the same problems may be resolved faster in the future.

(ii) Potential Causes :-

1.) ISP infrastructure Problems
2.) ISP Maintenance
3.) ISP Routing issues

Potential Solutions :-

1.) Diversify internet Connectivity
2.) Negotiate SLAs
3.) Monitor ISP performance
4.) Engage in proactive communication

Troubleshooting Steps :-

1.) Verify Local Network Connectivity
2.) Check ISP status
3.) Perform external network tests
4.) If issues persist, implement contigency plans

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(iii) Possible Causes:-

-> Bandwidth limitations
-> Packet loss
-> Network Congestion

Possible Solutions:-

-> Upgrade Network infrastructure
-> QoS implementation
-> Packet loss detection and Correction

(iv) Network Challenges:-

-> Network Congestion
-> limited wifi coverage

Solutions:-

-> Network Segmentation
-> ~~Using~~ Upgrading equipment
-> Implement QoS
-> Network Optimization

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Strategies to improve wifi Coverage :-

-> Placement of Access points strategically
-> Wireless site survey
-> Use of Mesh Networking
-> Channel optimization

(v) (a) Edge devices :-

-> smartphones
-> laptops

Core devices :-

-> Routers
- Switches
- ISP
-> Terminals
-> Bank's servers
-> Wireless Accespoints

Protocols :-

-> IPsec
-> SSL
-> TLS
-> SNMP

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Applications :-

→ Online banking platforms
→ Core banking systems
→ Payment processing Applications
→ Anti fraud systems
→ Risk Management Systems

(b) Edge Network :-

→ ~~a~~. Optimizing Bank operations
→ Providing localized Customer support

Web cache :-

→ Enhancing performance of online banking portal.
→ Reduce latency.

P2P Networks :-

→ Sharing internal networks files
→ decentralized transaction processing using blockchains

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HTTP :-

→ For implementing Online banking transactions.

(c)
→ Deep understanding of Network protocols such as TCP/IP, UDP, HTTPS, etc
→ Proficiency in network architecture including LANs, WANs, VLANs, VPNs, subnets, routing, switching and network segmentation
→ Knowledge of security best practices
→ Troubleshooting skills
→ Staying informed and adapting to new environments

(d)
→ It helps keeping pace with technological advancements.
→ It helps in optimizing network performance and efficiency
→ It allows us to mitigate security risks