May_jun_2024

Q1(a) What is 4G and how it works? List down specifications of 4G.

Explanation:

4G (Fourth Generation) is a mobile communication standard that provides high-speed internet, improved data transmission, and better connectivity compared to its predecessors. It is based on technologies such as LTE (Long-Term Evolution).

How it Works:

1. **OFDM (Orthogonal Frequency Division Multiplexing)**: Splits data into smaller streams for parallel transmission, reducing interference.
2. **MIMO (Multiple Input Multiple Output)**: Uses multiple antennas to increase capacity and reliability.
3. **IP-Based Communication**: Supports VoIP and multimedia applications over an IP backbone.

Specifications:

- **Speed**: Up to 100 Mbps for mobile devices and 1 Gbps for stationary users.
- **Latency**: Reduced to under 50 milliseconds.
- **Bandwidth**: Higher spectrum efficiency.
- **Applications**: Streaming HD videos, online gaming, IoT devices.

Q1(b) Discuss the evolutions of Mobile Communication Technologies in detail.

Explanation:

Mobile communication technologies have evolved through generations:

1. **1G (First Generation)**: Analog voice communication.
2. **2G (Second Generation)**: Digital voice with SMS and basic data services.
3. **3G (Third Generation)**: Introduced mobile broadband, enabling video calling and faster internet.
4. **4G (Fourth Generation)**: High-speed data, IP-based services, HD streaming.
5. **5G (Fifth Generation)**: Enhanced connectivity, ultra-low latency, and support for IoT.

Diagram:

1G --> 2G --> 3G --> 4G --> 5G

Q2(a) Write a short note on Fifth Generation Telecommunication Standard (5G).

Explanation:

5G is the latest generation of mobile communication, designed to provide ultra-fast speeds, low latency, and massive connectivity.

Features:

- **Enhanced Mobile Broadband (eMBB)**: Speeds up to 10 Gbps.
- **Ultra-Reliable Low Latency Communication (URLLC)**: Latency under 1 ms for mission-critical tasks.
- **Massive IoT Connectivity**: Supports billions of devices simultaneously.

Applications:

- Smart cities.
- Autonomous vehicles.

- Real-time remote surgeries.

Q2(b) Explain Massive MIMO technology in detail.

Explanation:

Massive MIMO (Multiple Input Multiple Output) enhances wireless communication by employing a large number of antennas at the base station.

How it Works:

- Uses multiple antennas to transmit and receive data streams simultaneously.
- Increases spectral efficiency and reliability.

Advantages:

- Higher data rates.
- Reduced interference.
- Improved network capacity.

Q3(a) Illustrate the need of Mobile IP and its working with a diagram.

Explanation:

Mobile IP enables seamless internet connectivity for devices moving across different networks. It ensures uninterrupted service by dynamically assigning IP addresses.

Working:

1. **Home Agent (HA)**: Maintains the device's permanent IP address.
2. **Foreign Agent (FA)**: Provides a temporary IP address in the visited network.

3. **Tunneling**: Encapsulates and forwards packets to the current network.

Diagram:

Device --> Foreign Agent --> Tunnel --> Home Agent --> Internet

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Q3(b) Explain VANET Architecture in detail.

Explanation:

Vehicular Ad Hoc Networks (VANETs) enable communication between vehicles and roadside infrastructure.

Components:

1. **Onboard Units (OBUs)**: Vehicle communication devices.
2. **Roadside Units (RSUs)**: Fixed infrastructure for vehicle-to-infrastructure communication.
3. **V2V Communication**: Direct vehicle-to-vehicle interaction.

Applications:

- Traffic management.
- Collision avoidance.
- Emergency alerts.

Q4(a) Write a short note on Hybrid Routing ZRP Protocol and explain with architecture.

Explanation:

The Zone Routing Protocol (ZRP) combines proactive and reactive routing methods for efficient communication in mobile ad hoc networks.

Architecture:

1. **Intra-Zone Routing Protocol (IARP)**: Proactively maintains routes within a zone.
2. **Inter-Zone Routing Protocol (IERP)**: Reactively discovers routes outside the zone.

Diagram:

Node --> Intra-Zone --> Inter-Zone --> Destination

Q4(b) Why is Mobile IP packet required to be forwarded through a tunnel? Explain minimal techniques of encapsulation of Mobile packet.

Explanation:

Mobile IP uses tunneling to forward packets to the device's current location without changing its IP address.

Encapsulation Techniques:

1. **IP-in-IP Encapsulation**: Wraps the original packet in a new IP header.
2. **Minimal Encapsulation**: Reduces header overhead by partially encapsulating the packet.
3. **GRE Tunneling**: Adds flexibility with protocol support.

Q5(a) Explain the working of Mobile TCP and its advantages and disadvantages.

Explanation:

Mobile TCP optimizes TCP performance in mobile environments by managing frequent disconnections and high latency.

Working:

- Splits the connection into two parts: one for the mobile host and another for the fixed network.

Advantages:

- Reduces packet loss.
- Maintains session continuity.

Disadvantages:

- Overhead in maintaining two connections.
- Increased latency in handovers.

Q5(b) Describe briefly WAP protocol stack in detail.

Explanation:

The Wireless Application Protocol (WAP) stack enables internet access on mobile devices.

Layers:

1. **Application Layer**: Runs mobile applications.
2. **Session Layer**: Manages sessions.
3. **Transaction Layer**: Ensures reliable communication.
4. **Security Layer**: Provides encryption and authentication.
5. **Transport Layer**: Handles data transmission.

Q6(a) What is Mobile Agent? Describe different features of Mobile Agent.

Explanation:

Mobile agents are software programs that can migrate across different network nodes autonomously.

Features:

- **Autonomy**: Operates without user intervention.
- **Mobility**: Moves across networks.
- **Communication**: Interacts with other agents.
- **Adaptability**: Adjusts behavior based on the environment.

Q6(b) Compare I-TCP, Snooping TCP, and Mobile TCP.

Feature	**I-TCP**	**Snooping TCP**	**Mobile TCP**
Architecture	Splits connection at FA	Monitors packets at FA	Splits connection in MH
Advantages	Reduces packet loss	Ensures reliability	Maintains session
Disadvantages	Requires FA	High overhead	Increased latency

Q7(a) Describe Application Framework of Android Operating System.

Explanation:

The Android Application Framework provides APIs for building mobile applications.

Components:

1. **Activity Manager**: Manages lifecycle of applications.
2. **Content Providers**: Enables data sharing.
3. **Resource Manager**: Handles external resources.
4. **Notification Manager**: Manages user notifications.
5. **View System**: Handles UI components.

Q7(b) Discuss any three Mobile Operating Systems widely used in mobile phones.

Explanation:

1. **Android**: Open-source, highly customizable.
2. **iOS**: Apple's proprietary OS known for security and performance.
3. **Windows Mobile**: Known for its integration with Microsoft services.

Q8(a) Describe iOS Software Development Kit (SDK) in detail.

Explanation:

The iOS SDK provides tools for developing applications for Apple devices.

Components:

1. **Xcode**: Integrated development environment.
2. **Interface Builder**: Creates UI designs.
3. **Frameworks**: Provides APIs for app functionality.

Q8(b) What is Mobile Payment? Explain types of Mobile Payment in detail.

Explanation:

Mobile payment refers to the use of mobile devices for financial transactions.

Types:

1. **NFC-Based Payments**: Uses near-field communication (e.g., Google Pay, Apple Pay).
2. **SMS Payments**: Transactions via text messages.

3. **Mobile Wallets**: Apps that store payment information (e.g., Paytm, PayPal).

Nov_DEC 2023

Q1(a) Explain the LTE network architecture.

Explanation:

LTE (Long-Term Evolution) is a high-speed wireless communication standard with a flat architecture designed to reduce latency and improve scalability.

Components:

1. **User Equipment (UE)**: Devices like smartphones or IoT gadgets.
2. **eNodeB (Evolved Node B)**: The base station managing radio communication.
3. **EPC (Evolved Packet Core)**: The core network consisting of:
    - **MME (Mobility Management Entity)**: Handles mobility and session management.
    - **SGW (Serving Gateway)**: Routes data packets.
    - **PGW (Packet Gateway)**: Connects to external networks.
4. **HSS (Home Subscriber Server)**: Stores subscriber data.

Diagram:

UE --> eNodeB --> EPC (MME, SGW, PGW) --> Internet

Q1(b) Explain the Second Generation of wireless communication with its standards.

Explanation:

Second Generation (2G) introduced digital communication for better voice clarity and SMS.

Standards:

1. **GSM (Global System for Mobile Communications)**:
    - Circuit-switched voice calls.
    - Data speed: 9.6 kbps.
2. **CDMA (Code Division Multiple Access)**:
    - Better spectrum efficiency.
    - Supports multiple users with unique codes.

Features:

- Enhanced call quality.
- Introduced encryption for secure communication.
- Support for SMS and basic internet services.

Q2(a) Explain in detail the Third Generation Wireless Networks (3G).

Explanation:

3G networks enabled high-speed internet, video calls, and multimedia applications.

Features:

- **Data Speed**: Up to 2 Mbps.
- **Technologies**:
    - UMTS (Universal Mobile Telecommunications System).
    - CDMA2000.
- **Applications**:
    - Video conferencing.
    - Mobile TV.
    - E-commerce.

Diagram:

Mobile Device --> Radio Network Controller --> Core Network --> Internet

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Q2(b) Explain the 5G technology with advantages and disadvantages.

Explanation:

5G is the latest mobile communication standard, offering ultra-fast speeds, low latency, and massive connectivity.

Advantages:

1. **High Data Speeds**: Up to 10 Gbps.
2. **Low Latency**: Under 1 ms.
3. **Massive IoT Support**: Connects billions of devices.

Disadvantages:

1. High infrastructure costs.
2. Limited coverage in rural areas.

Q3(a) What is Tunneling and Encapsulation in Mobile IP?

Explanation:

Tunneling is a technique used to forward packets to mobile devices while maintaining the same IP address.

Encapsulation Techniques:

1. **IP-in-IP Encapsulation**: Encapsulates the entire IP packet into another.
2. **Minimal Encapsulation**: Reduces overhead by encapsulating only necessary parts.
3. **GRE (Generic Routing Encapsulation)**: Adds flexibility for other protocols.

Q3(b) Explain in detail the DHCP protocol mechanism.

Explanation:

Dynamic Host Configuration Protocol (DHCP) assigns IP addresses dynamically to devices in a network.

Working:

1. **Discovery**: The device broadcasts a request for an IP address.
2. **Offer**: DHCP server offers an available IP address.
3. **Request**: The device requests the offered IP.
4. **Acknowledgment**: Server confirms and assigns the IP address.

Q4(a) How can the agent be discovered using Mobile IP? Give the overlay of agent advertisement packet which includes mobility extension.

Explanation:

Mobile IP uses agent discovery to locate foreign or home agents.

Steps:

1. Agents broadcast **Agent Advertisement Packets**.
2. Mobile devices listen and register with the agent.

Packet Overlay:

- Type: Defines the packet type.
- Code: Specifies mobility functions.
- Lifetime: Time until the advertisement expires.
- Mobility Extension: Contains agent-related information.

Q4(b) Describe DSDV and DSR routing algorithms for adhoc networks.

Explanation:

1. **DSDV (Destination-Sequenced Distance-Vector)**:
    - Proactive routing protocol.
    - Maintains routing tables with sequence numbers.
2. **DSR (Dynamic Source Routing)**:
    - Reactive routing protocol.
    - Uses route discovery and maintenance.

Comparison:

- DSDV reduces latency but requires constant updates.
- DSR is more efficient in dynamic networks.

Q5(a) Explain WTP Protocol. Can we use Snooping TCP as a transparent TCP?

WTP (Wireless Transaction Protocol):

- Lightweight protocol for transaction-oriented communication.
- Operates on unreliable networks by ensuring reliability at the application level.

Snooping TCP:

- Monitors TCP packets at the base station.
- Enhances TCP performance by locally retransmitting lost packets.

Q5(b) Explain the requirements for the evolution of new mobile IP protocol.

Explanation:

The evolution of mobile IP requires:

1. **Seamless Mobility**: Support for fast handovers.
2. **Security**: Enhanced encryption and authentication mechanisms.
3. **Scalability**: Handle billions of devices.
4. **Energy Efficiency**: Minimize power consumption.

Q6(a) Explain in detail the WAP model architecture.

Explanation:

The Wireless Application Protocol (WAP) model enables internet access on mobile devices.

Layers:

1. **Application Layer**: Hosts mobile web applications.
2. **Session Layer**: Manages communication sessions.
3. **Transaction Layer**: Ensures reliable data exchange.
4. **Security Layer**: Encrypts data.
5. **Transport Layer**: Facilitates data transmission.

Q6(b) Explain Slow Start, Fast Retransmit/Fast Recovery in regard to TCP.

Explanation:

TCP mechanisms optimize data transmission:

1. **Slow Start**: Gradually increases the congestion window to avoid overwhelming the network.
2. **Fast Retransmit**: Retransmits lost packets upon receiving duplicate acknowledgments.
3. **Fast Recovery**: Adjusts the congestion window without returning to slow start.

Q7(a) Write short notes on:

i) Symbian OS:

- Early mobile OS known for multitasking and power efficiency.
- Features rich APIs for application development.

ii) Android:

- Open-source OS based on Linux.
- Highly customizable with support for millions of applications.

Q7(b) Discuss the security issues in M-Commerce.

Explanation:

M-Commerce security challenges include:

1. **Data Theft**: Unauthorized access to sensitive information.
2. **Phishing Attacks**: Fraudulent attempts to steal user data.
3. **Transaction Fraud**: Unauthorized financial transactions.

Solutions:

- Use encryption and secure protocols (e.g., HTTPS).
- Implement multi-factor authentication.

Q8(a) Explain the components of Mobile Operating System.

Explanation:

1. **Kernel**: Manages hardware resources.
2. **Middleware**: Provides libraries and APIs.
3. **Application Framework**: Supports application development.
4. **User Interface**: Offers graphical and input controls for users.

Q8(b) Write a note on Software Development Kit - iOS SDK and Android SDK.

Explanation:

1. **iOS SDK**:
    - Tools like Xcode and Interface Builder.
    - Frameworks for UI design, animations, and data handling.
2. **Android SDK**:
    - Tools like Android Studio and Emulator.
    - Supports Java/Kotlin for app development.
