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MCS-231

Mobile Computing

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**Sample Preview
of the
Solved
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Papers**

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QUESTION PAPER

June – 2024

(Solved)

MOBILE COMPUTING

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Time: 3 Hours]

[Maximum Marks : 100

Note: : Question No. 1 is compulsory. Attempt any three questions from the rest.

Q. 1. (a) What is Wavelength Division Multiplexing? What are its advantages, disadvantages and applications?

Ans. Ref.: See Chapter-1, Page No.2, 'Wavelength Division Multiplexing'.

(b) Explain WLAN Wi-Fi IEEE 802.11x networks.

Ans. Ref.: See Chapter-2, Page No. 3, 'Mobile IP, Cellular and WLAN Wi-Fi, IEEE 802.11x Networks'.

(c) What are Actuators? Give some examples of Actuators found in Robots.

Ans. Ref.: See Chapter-3, Page No.30, 'Actuators', 'Robotic System', 'Sensors and Actuators', Page No. 32, Q. No. 5.

(d) Explain the architecture patterns for mobile device data store methods.

Ans. Ref.: See Chapter-8, Page No. 89, 'Mobile Device Data Store Methods'.

Q. 2. (a) Explain the architecture of a content management application.

Ans. Ref.: See Chapter-14, Page No. 141, Q. No. 3.

(b) What do you mean by XML parsing? Explain with an example.

Ans. Ref.: See Chapter-14, Page No. 144, Q. No. 5 and Q. No. 7.

Q. 3. (a) Explain the architecture of J2EE.

Ans. Ref.: See Chapter-15, Page No. 148, 'Introduction to J2EE'.

(b) Write a short note on SWIFT.

Ans. Ref.: See Chapter-15, Page No. 155, Q. No. 9.

Q. 4. (a) Explain the architecture of iOS.

Ans. Ref.: See Chapter-16, Page No. 165, Q. No. 7.

(b) Explain various phases of development process of a mobile application.

Ans. Ref.: See Chapter-16, Page No. 159, 'Development Process'.

Q. 5. (a) What is GPRS ? Explain its features.

Ans. Ref.: See Chapter-1, Page No. 3, 'GPRS and 2.5G'.

(b) What are adhoc networks? Explain their advantages.

Ans. Ref.: See Chapter-2, Page No. 14, 'Adhoc Networks', Chapter-9, Page No. 98, 'Introduction to MANETs'.

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QUESTION PAPER

December – 2023

(Solved)

MOBILE COMPUTING

MCS-231

Time: 3 Hours]

[Maximum Marks : 100

Note: : Question No. 1 is compulsory. Attempt any **three** questions from the rest.

Q. 1. (a) What is Time Division Multiplexing (TDM)? What are its advantages, disadvantages and applications?

Ans. Ref.: See Chapter-1, Page No. 2, 'Time Division Multiplexing'.

(b) What is a Cellular Network? Under what conditions frequency reuse is possible by different cells in the network?

Ans. Ref.: See Chapter-2, Page No. 13, 'Cellular Networks'.

(c) What are Smart Sensors? What are the instances where mobile devices interact with their surroundings with the help of sensors?

Ans. Ref.: See Chapter-3, Page No. 30, 'Smart Sensors', Page No. 31, Q. No. 1, Page No. 33, Q. No. 1.

(d) Write a short note on Mobile Device Database Management.

Ans. Ref.: See Chapter-8, Page No. 89, 'Mobile Device Database Management'.

Q. 2. (a) List various steps in the development of a Mobile App. What are the various components of an Enterprise Mobile Application?

Ans. Ref.: See Chapter-16, Page No. 159, 'Development Process'.

(b) Write a short note on XML.

Ans. Ref.: See Chapter-14, Page No. 144, Q. No. 5

Q. 3. (a) What is J2ME? Explain main components of J2ME.

Ans. Ref.: See Chapter-15, Page No. 149, 'Introduction to J2ME', Page No. 153, Q. No. 5.

(b) Write a short note on Android.

Ans. Ref.: See Chapter-16, Page No. 165, Q. No. 8.

Q. 4. (a) Explain the features of integrated development platforms that are used for Mobile App development.

Ans. Ref.: See Chapter-16, Page No. 159, 'Development Tools and Emulators'.

(b) Explain any five features of Mobile Communications.

Ans. Ref.: See Chapter-1, Page No. 1, 'Features of Mobile Communication'.

Q. 5. (a) Explain the design considerations for Mobile Computing.

Ans. Ref.: See Chapter-2, Page No. 15, 'Design Consideration for Mobile Computing'.

(b) Write a short note on Smart Appliances.

Ans. Ref.: See Chapter-3, Page No. 30, 'Smart Appliances'.

■ ■

Sample Preview of The Chapter

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MOBILE COMPUTING

Introduction to Mobile Communications

INTRODUCTION

Mobile communication has evolved tremendously, saving time and money. In the past, it lacked mobility as people were tethered to wired devices for calls. Now, smartwatches and voice commands make it more flexible, promising further innovation in the future. Outdated techniques continue to inspire advanced communication devices.

Communication devices come in distinct types:

- Fixed and wired, e.g., desktop PCs, unsuitable for mobility due to weight and power usage.
- Mobile and wired, e.g., laptops, portable and network flexible.
- Fixed and wireless, e.g., network installations in historical structures to avert damage from wiring.
- Mobile and wireless, e.g., GSM, unrestricted by cables, switching between wireless networks.

CHAPTER AT A GLANCE

MOBILE COMPUTING

Mobile communication infrastructure ensures reliable services. It encompasses protocols, services, bandwidth, and data format definition, preventing clashes with similar systems. This radio wave-based overlay transmits signals to compatible devices through unguided media.

User Mobility

An individual who has access to the same or similar telecommunications services at different locations is referred to as a mobile user. The user can move between different geographical locations, networks, communication devices and different applications.

Device Mobility

Devices and networks employ mechanisms to sustain communication during device mobility, enabling seamless transitions between locations and networks.

FEATURES OF MOBILE COMMUNICATION

A high-capacity load balancer is vital for both wired and wireless infrastructures. It automatically shifts to an available access point when one is overloaded.

Scalability: Scalability allows wireless networks to expand without overextending coverage and capacity.

Network Management System: Network management systems help handle the growing array of components in wireless networks.

Role based Access Control: Role-based access control lets you assign access based on various factors, enforcing policies accordingly.

Provide Outdoor and Indoor Coverage Options: Ensuring both indoor and outdoor coverage is crucial, with secure registration procedures for network access control.

Manage Mobile Devices: Managing mobile devices involves seamless roaming and potential redundancy.

The right firewall is essential for security, offering control, antivirus protection, deep packet inspection, and defence against various threats.

WHAT IS MULTIPLEXING?

Multiplexing combines multiple signals into one shared medium in electronics and signal processing. It's used in mobile computing, communications, and networks, whether through radio frequency or

cable. For instance, one telephone wire can multiplex multiple calls.

Types of Multiplexing

1. Frequency Division Multiplexing (FDM)
2. Time Division Multiplexing(TDM)
3. Code Division Multiplexing(CDM)

Frequency Division Multiplexing (FDM)

Multiple signals transmit simultaneously, each within an assigned frequency range. Adjacent signals are spaced apart to prevent overlap and collisions. Logical channels in the frequency spectrum match bandwidths, reducing interference through guard bands in radio and TV transmissions.

Advantages of FDM: Benefits of FDM include ease of implementation, efficiency with constant traffic, no need for equalization, potential capacity increase via knowledge bit rate reduction and digital codes, adaptable to technological advances, and cost-effectiveness with low bit rates in comparison to delay spread, reducing Inter Symbol Interference (ISI).

Disadvantages of FDM: Drawbacks of FDM encompass the need for guard bands that can be viewed as capacity wastage, time-critical network planning, low traffic capacity, expensive multi-channel receivers, potential increased costs for RF filters meeting stringent specifications, and idle channels in a general system due to single-user channel assignments.

Applications of FDM: FDM applications include telephone systems, radio broadcasting, cable TV,

walkie-talkies, closed user group mobile networks (e.g., Wi-Fi), TACS, and 2G mobile communication.

Time Division Multiplexing (TDM)

Time Division Multiplexing (TDM) carries multiple data signals in distinct time slots over a shared channel, with one complete signal transmission constituting a frame. Time slots divide the time domain.

Synchronous TDM: Synchronous TDM assigns each time slot to a fixed source, assuming data will be available. This leads to channel capacity wastage when slots remain unused.

Asynchronous TDM: Asynchronous TDM, or statistical division multiplexing, allocates time slots to machines with data to send, optimizing resource use.

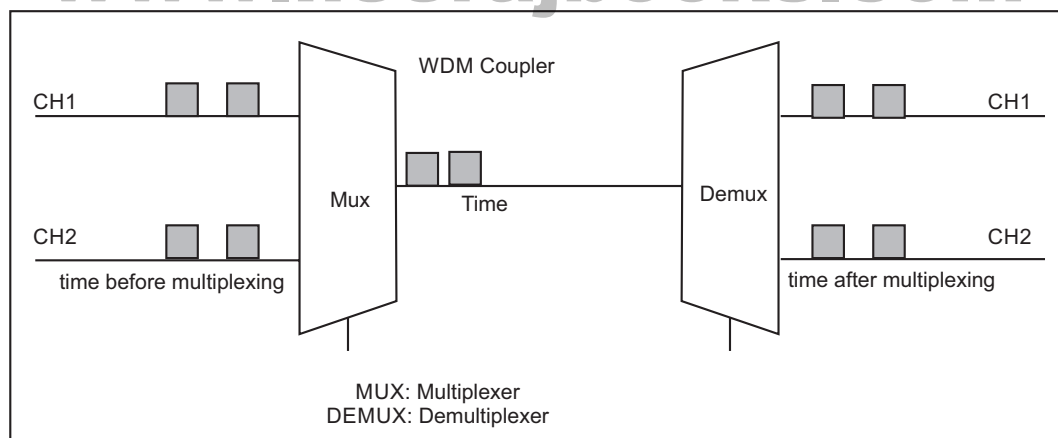
Advantages of TDM: TDM benefits include flexibility, simplified circuitry, reduced crosstalk, and full channel bandwidth utilization for each channel.

Disadvantages of TDM: TDM drawbacks involve the need for synchronization, complex implementation, and vulnerability to slow narrowband fading potentially affecting all channels.

Applications of TDM: TDM finds applications in SONET, public switched telephone networks, wired telephone lines, digital audio mixing systems, half-duplex communication systems, and GSM.

Wavelength Division Multiplexing

Wavelength Division Multiplexing (WDM) enables concurrent data transmission over a shared frequency band, enhancing security through spreading codes. It's suitable for multiple users on a single channel.



Advantages of WDM: WDM advantages include enhanced cell communication security, increased client capacity per MHz, excellent voice quality, flexible resource allocation, high efficiency, no synchronization requirements, and simultaneous data transmission to many clients.

Disadvantages of WDM: WDM drawbacks include time synchronization requirements, performance degradation with more clients, complexities in code length selection, diminishing service quality with client growth, and issues like close-far and self-sticking.

Applications of WDM: WDM finds applications in military and commercial sectors, mobile communications, as well as radar and navigation systems.

GSM (GLOBAL SYSTEM FOR MOBILE COMMUNICATION)

GSM technology underpins mobile phones with four frequency bands: 850 MHz, 900 MHz, 1800 MHz, and 1900 MHz, utilizing FDMA and TDMA. Bell Laboratories' 1970s system inspired GSM. GSM networks comprise mobile phones, base station system (BSS), network switching system (NSS), and operation and support system (OSS). The BSS, consisting of the base transceiver station (BTS) and base station controller (BSC), manages data transfer between cellphones and network system servers. NSS (core network) tracks caller locations for cellular services, featuring mobile switching centre (MSC) and home location register (HLR), similar to ISDN or PSTN switching nodes.

Advantages of GSM

GSM benefits include global roaming, high security, spectrum efficiency, clear calls, features like caller ID, call hold, call forwarding, and availability on ISDN and other telephone services.

Disadvantages of GSM

GSM drawbacks involve potential bandwidth lag from shared usage, interference issues in places like hospitals and airports, the need for repeaters to extend coverage, limited call range (35 km), and lack of end-to-end user data encryption.

GPRS AND 2.5G

As part of GSM's global system for mobile communications (GSM), General Packet Radio Service (GPRS) is a packet-oriented mobile data standard. As a response to CDPD and i-mode packet-switched cellular technology, the European Telecommunications Standards Institute (ETSI) developed GPRS. The 3GPP is now responsible for maintaining it. A GPRS network is a packet-switching communications protocol that uses the best-effort packet

switching method. The technology allows mobile data to be transmitted and received more efficiently, more quickly, and more cheaply. Mobile devices using GPRS are always connected to the internet, making them always online and liable for data usage charges. When used, the device only keeps the connection busy. So, capacity is better utilized, and more data can be exchanged simultaneously. There is a maximum speed range of 7 KB/s to 14 KB/S on GPRS. It is

called 2.5G, which is the state of wireless technology between the second and third generations of wireless technology: before and after General Packet Radio Services (GPRS). A generation is not official. It is called so because it is in the middle of 2G and 3G. There is still support for 2G and 3G within M2M. In contrast to the circuit-based switching protocols of 2G, GPRS uses packet-switching communications. Due to this, data delivery is best effort; there can be a variation in latency and deliverability. The Quality of Service (QoS) of GPRS is difficult to manage due to the number of concurrent users. In the past, GPRS (2.5G) speeds have been quoted over 2G networks; GPRS can theoretically transmit around 120 kilobits per second over 2G networks. In real-world conditions, you can expect speeds of 20-50 kbps. Latency may vary, but typically will range from .5 to 1 second.

Features of GPRS

Packet-based for non-real-time Internet tasks like email and web browsing.

- Multi-user sharing of radio channels and time slots.
- Supports more users compared to HSCSD.
- Based on GSM with redesigned air interface.
- Max data speed of 171.2 kbps with 8 timeslots.
- Requires application-level error correction for data payloads.

Services offered by GPRS

GPRS extends GSM's data capabilities, offering services like SMS, MMS, PoC, instant messaging, P2P, Internet access via WAP, P2M, and faster SMS transmission (30 messages/minute vs. 6-10 in GSM).

THIRD GENERATION (3G)

In the 1980s, ITU developed 3G technology enabling high-speed data and voice services on handheld devices, merging multimedia services.

3G WiFi

A device with both 3G and Wi-Fi capabilities is known as 3G Wi-Fi. Products like Apple's iPad and Amazon's Kindle have integrated this connectivity, allowing users to access the internet from virtually anywhere with 3G, while Wi-Fi requires proximity to a hotspot.

Advantages of 3G

New radio spectrum eases overcrowding. Boosts network capacity, security, and reliability. 3G, a packet-based, always-online system, offers higher bandwidth for video and web applications. Enhanced data transfer and voice quality over 2G, 2.5G, GPRS, and 2.75G EDGE.

3G includes wireless voice, video, and data services. Supports 144 kbit/s transfer rate, with 3.5G and 3.7G releases providing mobile broadband access for smartphones and mobile modems. Used for voice calls, Internet access, mobile TV, and more. 3G systems encompass UMTS, W-CDMA, and CDMA 2000.

Disadvantages of 3G

- Needs specific handsets.
- Limited bandwidth.
- High power usage.
- Expensive base station and infrastructure upgrades.
- Requires closer base stations, increasing costs.
- Expensive spectrum licenses, network deployment, and handset subsidies.

3G is being Phased Out for What Reason?

AT&T plans to shut down its 3G network to prioritize advanced 5G development, impacting non-VOLTE users of 3G and some 4G devices who may lose internet access.

FOURTH GENERATION (4G)

4G mobile phones offer broadband cellular services in an IP-based system, following ITU's IMT-Advanced standards. They use MIMO and OFDM for improved capacity and bandwidth compared to 3G's TDMA and CDMA. OFDM provides higher speeds.

Features of 4G Network:

- The network offers IP-based transmission of voice, data, signals, and multimedia.
- IMT-Advanced specifies 100Mbps peak rates for high mobility (trains, cars) and 1Gbps for low mobility (residences).
- 4G networks require 1 Gbps downlink over ≤ 67 MHz bandwidth.
- Ensures high-quality, 24/7 services irrespective of location or time.

LONG-TERM EVOLUTION (LTE)

LTE technology, an advancement from 3G, combines UMTS/HSPA and GSM/EDGE to deliver high-speed mobile communication. It offers greater network capacity and speed than 3G, reaching up to 100 Mbps downlink and 30 Mbps uplink. Often called 4G LTE, it follows 2G GSM and 3G UMTS standards. The ITU originally defined it as capable of 1 Gbps for stationary users and 100 Mbps for mobile users, though it's not considered true 4G by ITU standards.

Features of LTE

- LTE's 2011 global average download speed reached 17 Mbps, with uploads at 12 Mbps.

- VOLTE ensures jitter-free voice calls.
- LTE-Advanced boasts 2-3 times faster speeds than standard LTE.

LTE-Advanced handsets enhance signal, speed, and reliability through multi-carrier frequency combinations, offering up to 100 MHz bandwidth.

WORLDWIDE INTEROPERABILITY FOR MICROWAVE ACCESS (WiMAX)

WiMAX, sometimes called 4G, offers mobile wireless broadband access with 128 Mbps downlink and 56 Mbps uplink rates via 20 MHz channels. Based on IEEE 802.16, first published in 2001 as fixed WiMAX.

Features of WiMAX:

- Advances Broadband Wireless Access (BWA) networks.
- Initially offered 30-40 Mbps data rates, later reaching 1 Gbps in 2011.
- Known as "Wi-Fi on steroids," with higher data rates, outdoor use, and IEEE 802.16 standards.
- Dynamic bandwidth allocation from 2 GHz to 11 GHz as needed.

EXERCISE

Q. 1. How do you define mobility in mobile computing?

Ans. Mobility in mobile computing refers to the capability of a computing device, such as a smartphone or laptop, to operate seamlessly while on the move. It encompasses the device's ability to connect to various wireless networks, adapt to changing locations, and maintain network connectivity without interruption. Mobility also involves the device's capacity to switch between different network technologies like Wi-Fi, cellular, or satellite, depending on availability and user preferences. Moreover, it relates to the software and applications that support user mobility, enabling tasks to be performed from any location. In essence, mobility in mobile computing empowers users to access information, communicate, and perform tasks irrespective of their physical location.

Q. 2. What are the uses of mobile computing?

Ans. Mobile computing has become an integral part of modern life, with a wide range of uses and applications:

1. Communication: Mobile devices enable voice calls, text messaging, and a variety of messaging apps for real-time communication.

2. Internet Access: Users can browse the web, access social media, and email on the go.