

Overview of Mobile Computing

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Quick-reference guide – concise, organized, and easy to read

1. What Is Mobile Computing?

Aspect	Description
Definition	Use of portable devices (smartphones, tablets, wearables, embedded sensors) to access network resources and run applications while on the move.
Key Goal	Deliver seamless, context-aware services regardless of location, time, or network conditions.
Core Components	• Mobile Devices – hardware & OS (Android, iOS, Windows, embedded RTOS). • Wireless Networks – cellular (4G/5G), Wi-Fi, Bluetooth, NFC, LPWAN. • Backend Services – cloud/edge servers, APIs, databases. • Middleware – communication protocols, security layers, synchronization engines.

2. Architectural Layers

Application Layer (apps, UI, services)
Middleware Layer (OS, VM, APIs, security)
Network Layer (radio, protocols, routing)
Physical Layer (antenna, chipset, sensors)

Layer	Primary Functions
Application	User interaction, business logic, offline support.
Middleware	Resource management, device abstraction, data synchronization, security services.
Network	Packet forwarding, mobility management (handoffs, roaming), QoS enforcement.

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Layer	Primary Functions
Physical	Signal transmission, power management, sensor data acquisition.

3. Key Technologies & Standards

Category	Examples	Typical Use Cases
Cellular	4G LTE, 5G NR, LTE-Advanced	High-speed broadband, video streaming, IoT backhaul.
Wi-Fi	802.11ac/ax (Wi-Fi 6/6E), Wi-Fi 7	Indoor high-throughput, hotspot offloading.
Short-Range	Bluetooth LE, Zigbee, Thread	Peripheral connectivity (headsets, wearables, smart home).
Location	GPS, GLONASS, Galileo, A-GNSS, Wi-Fi positioning	Navigation, geofencing, asset tracking.
IoT LPWAN	LoRaWAN, NB-IoT, Sigfox	Low-power, long-range sensor networks.
Edge Computing	Mobile Edge Computing (MEC), Cloudlets	Latency-sensitive processing (AR/VR, autonomous driving).
Security	TLS/DTLS, IPsec, SIM-based authentication, Secure Enclave	Data confidentiality, device integrity.

4. Mobility Management

Concept	Description
Handoff / Handover	Transfer of an active session from one base station or AP to another without interrupting service.
Roaming	Use of a device on a foreign network, requiring authentication and billing coordination.
Location Update	Periodic or event-driven reporting of device's current cell/area to the network.
Seamless Connectivity	Combining multiple interfaces (e.g., cellular + Wi-Fi) using multi-homing or make-before-break techniques.

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5. Challenges & Design Considerations

Challenge	Mitigation Strategies
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Limited Power	
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