Mobile Cloud Computing (MCC) and Fog Computing – Revision Notes

Mobile Cloud Computing (MCC)

***Definition*:**

MCC is a combination of mobile computing and cloud computing where data processing and storage are offloaded to the cloud to save energy and improve performance.

Key Challenges:

- **Dynamic Application Partitioning** to optimize:
  - ☑ Energy saving
  - ☑ Execution time
- **Middleware Required**: To decide at **app launch** which components run on mobile or cloud.
- **Optimization Problem**: Similar to **job scheduling / task partitioning problem**.

Task Partitioning Problem in MCC

***Input*:**

- **Call graph** of app method sequence.
- Each node (method) has:
  - Energy for mobile execution.
  - Energy for remote transfer.

***Output*:**

- Partition methods:
  - Run on **Mobile**
  - Run on **Cloud**

***Goals & Constraints*:**

1. **Minimize energy**
2. **Execution time limit**
3. Some methods **must** run on mobile (hard constraint)
4. **Cost** constraints (optional)

Partitioning Types

Type	Description
Static Partitioning	Done at launch using **ILP solver** or heuristics.
Dynamic Partitioning	Done **during execution**, adapts to environment/input.

Code Offloading

- Execution of app parts on **remote servers**.
- Uses **Wi-Fi/short-range radios** → Saves battery.
- Reduces **latency** using **single-hop** networks.

Cloud Computing: Overview

***Typical Characteristics*:**

- **Dynamic Scalability**
- **No Infrastructure Management**
- **Metered Service** (Pay-as-you-go)

***Challenges*:**

- Processing **huge data**
- **Centralized datacenters** → Congestion
- **High response time** required for critical apps

Fog Computing (aka Edge Computing)

***Definition*:**

Fog computing brings **computation, storage, and networking** closer to the edge of the network (near data source).

***Initiated By*: Cisco Systems**

***Benefits*:**

- Reduces need to send all data to cloud
- Decreases **latency**
- Saves **bandwidth** and **cost**
- Supports **real-time interactions**

***Fog Computing vs Cloud Computing*:**

Aspect	Fog Computing	Cloud Computing
Location	**Network edge**	**Centralized data center**
Latency	**Low**	**High**

Data transfer **Less** (aggregated) **More**

Fog Computing Enablers

- **Virtualization** (VMs at edge)
- **Containers** (e.g., Docker)
- **SOA** (Service Oriented Architecture)
- **SDN** (Software Defined Networking using OpenFlow)

Security Issues in Fog/MCC

- Authentication at **gateways & nodes**
- **Man-in-the-middle attacks**
- **Privacy leakage**
- **IP spoofing & tampering** (e.g., smart meters)

Cloud Computing Limitations

- Requires **high bandwidth**
- **Client link bottlenecks**
- **High latency**
- **Security vulnerabilities**

Applicability Areas

- Smart Grids
- Smart Traffic Lights
- IoT (Internet of Things)
- Wireless Sensor Networks
- SDN (Software Defined Networks)

Connected Vehicles (CV) + Fog

- **Car-to-car** and **car-to-infra** communication
- **Fog = ideal** for CV due to:
    - Geo-distribution
    - Mobility awareness
    - Low latency
    - Real-time support