

Distributed & Cloud Computing - Detailed Revision Guide

1. Distributed Computing Basics

- Definition: A model where multiple computers (nodes) work together to achieve a common goal.
- Key Characteristics: Scalability, fault tolerance, resource sharing, transparency (user sees one system).
- Example: Google Search uses thousands of distributed servers to process queries in milliseconds.

2. Cloud Computing Basics

- Definition: Delivery of computing services (servers, storage, databases, networking, software) over the internet.
- Service Models: IaaS (AWS EC2), PaaS (Google App Engine), SaaS (Gmail, Microsoft 365).
- Deployment Models: Public, Private, Hybrid, Community Cloud.
- Example: Netflix uses AWS Cloud to stream videos globally with scalability and reliability.

3. Differences: Distributed vs Cloud Computing

- Distributed computing is the architectural style; cloud computing is a business/operational model built on distributed systems.
- Distributed: Focuses on how tasks are divided across nodes.
- Cloud: Focuses on delivering services (on-demand, pay-as-you-go) using distributed infrastructure.

4. Advantages of Distributed & Cloud Systems

- High Availability: Services remain available despite node failures (e.g., Google Cloud load balancing).
- Cost-Effectiveness: Cloud eliminates upfront hardware costs.
- Performance: Parallel processing speeds up tasks (e.g., Apache Hadoop for big data).
- Flexibility & Elasticity: Scale up/down based on demand.

5. Challenges

- Distributed: Synchronization, data consistency, fault tolerance.
- Cloud: Security, compliance, vendor lock-in, latency issues.
- Example: Outage in AWS US-East region affected many apps worldwide (2020).

6. Virtualization & Containers

- Virtualization: Running multiple OS on one physical machine (e.g., VMware, Hyper-V).
- Containers: Lightweight, OS-level virtualization (e.g., Docker, Kubernetes).
- Use Case: Spotify uses Kubernetes to orchestrate its microservices.

7. Real-World Applications

- Banking: Fraud detection using distributed computing clusters.
- Healthcare: Cloud-based patient record management (HIPAA compliant).
- Education: Online learning platforms (Coursera, Zoom) run on cloud infrastructure.

8. Future Trends

- Serverless Computing (AWS Lambda).
- Edge Computing for IoT (processing closer to devices).
- AI & ML workloads running on cloud GPUs (Google TPU, AWS SageMaker).