Distributed Computing Notes

Key Topics Based on Past Exam Questions

1. Introduction to Distributed Systems

- Goals and Advantages of Distributed Systems
- Distribution Transparency (types and challenges)

2. Distributed System Architectures

- Client-Server vs. Peer-to-Peer Models
- Overlay Networks: Definition and Communication Methods

3. Consistency Models

- Types of Consistency: Strong, Weak, Causal
- Client-Centric Consistency Models: Monotonic Reads, Writes, etc.
- Trade-offs between Consistency and Responsiveness

4. Concurrency and Synchronization

- Logical Clocks: Lamport Timestamps, Vector Clocks
- Mutual Exclusion: Ricart-Agrawala Algorithm for Critical Section Access

5. Replication and Fault Tolerance

- Replication Techniques: Strategies for Data Redundancy
- Fault Models: Byzantine, Crash Failures
- Fault Tolerance Mechanisms (e.g., k fault tolerance)

6. Leader Election and Consensus Protocols

- Bully Algorithm and Ring Algorithm for Leader Election
- Two-Phase Commit (2PC) and Three-Phase Commit (3PC) for Consensus

7. Reliability and Fault Recovery

- Disaster Recovery and Cascaded Rollback Techniques
- Forward and Backward Error Recovery Mechanisms

8. Distributed File Systems and Caching

- Cache Consistency: Strong vs. Weak Models in Distributed File Systems
- File Replication and Failure Management Techniques

9. Security and Access Control

- Commit Protocols for Group Approval: Two-Phase Commit
- Access Control in Distributed File Systems

10. Middleware and Communication Protocols

- Middleware Role in System Interactions: Importance in Heterogeneous Systems
- Remote Procedure Calls (RPC) and Code Migration for Scalability