FACULTY OF COMPUTING

SE3020 – Distributed Systems
BSc (Hons) in Information Technology
Software Engineering Specialization
3rd Year

2025 - Practical
Lab 01

1. What does a software architecture focus on?
   a) Physical placement of software components
   b) Logical organization and interaction of software components
   c) Networking hardware components
   d) Distributed file systems

2. Which of the following best describes system architecture?
   a) Only focuses on software modules
   b) Describes the placement of software components on physical machines
   c) Only concerns databases and storage systems
   d) Defines programming languages used in distributed systems

3. Which of the following is NOT a distributed system architecture style?
   a) Layered architecture
   b) Component-based architecture
   c) Data-centered architecture
   d) Monolithic architecture

4. In a layered architecture, each layer typically:
   a) Can interact with all other layers directly
   b) Interacts only with its neighboring layers
   c) Shares memory with all components
   d) Does not have any defined responsibility

5. The main purpose of data-centered architectures is to:
   a) Facilitate communication through shared data repositories
   b) Distribute user interface components
   c) Provide direct peer-to-peer communication
   d) Reduce event-based interactions

6. An event-based architecture typically involves:
   a) Synchronous message passing
   b) Decoupled sender and receiver communication
   c) Only direct client-server interactions
   d) Physical shared memory

7. Which of the following is a centralized distributed system architecture?
   a) Peer-to-peer
   b) Hybrid
   c) Client-server
   d) Edge computing

8. In a decentralized system architecture:
   a) A central server manages all communication
   b) Nodes operate independently and interact in a horizontal manner
   c) Clients always send requests to a single master node
   d) Communication is strictly hierarchical

9. Hybrid architectures combine:
   a) Edge computing and cloud computing
   b) Centralized and decentralized models
   c) Layered and event-based architectures
   d) Data-centric and fault-tolerant approaches

10. In a traditional client-server model:
    a) The server requests services from clients
    b) Clients request services from servers
    c) Both clients and servers have equal roles
    d) Peer nodes act as both client and server

11. What is a major disadvantage of a two-tiered client-server architecture?
    a) Increased scalability
    b) High workload on the server
    c) Reduced communication overhead
    d) Better fault tolerance

12. What is a three-tiered architecture?
    a) A system where clients interact with multiple independent servers
    b) A system where a middle layer processes requests between client and database
    c) A peer-to-peer system where data is exchanged between three nodes
    d) A system with three different networking protocols

13. Which of the following is an advantage of P2P over client-server systems?
    a) Centralized control over communication
    b) Increased resistance to single points of failure
    c) Less reliance on data replication
    d) Reduced complexity in resource discovery

14. What is a structured P2P network?
    a) A network where nodes communicate randomly
    b) A network that uses Distributed Hash Tables (DHTs)
    c) A network where a single node acts as the controller
    d) A network that depends on a central registry

15. Unstructured P2P networks are commonly used in:
    a) Distributed file sharing (e.g., BitTorrent)
    b) Blockchain systems
    c) Data-center architectures
    d) Cloud storage systems

16. A superpeer in a hybrid system:
    a) Acts as an intermediary between clients and peers
    b) Only acts as a client
    c) Only acts as a server
    d) Does not have any indexing function

17. Which of the following is an example of a hybrid architecture?
    a) A DNS system
    b) BitTorrent
    c) A relational database system
    d) A simple web server

18. Load balancing in distributed architectures is used to:
    a) Assign all workloads to a single node
    b) Distribute computational loads among multiple nodes
    c) Reduce the number of servers needed
    d) Eliminate the need for data replication

19. In a fault-tolerant architecture, the system:
    a) Stops working when a fault occurs
    b) Continues to function even when some components fail
    c) Does not require backup systems
    d) Needs all components to work at full capacity

20. Horizontal distribution is commonly used in:
    a) Traditional client-server systems
    b) Peer-to-peer networks
    c) Single-node processing systems
    d) Standalone file servers

21. Which of the following increases scalability in a distributed system?
    a) Centralized control
    b) Decentralized processing
    c) Single-threaded execution
    d) Reducing node redundancy

22. What is middleware in a distributed system?
    a) The physical hardware layer connecting servers
    b) The software layer that enables communication between applications and platforms
    c) A type of peer-to-peer architecture
    d) A replacement for operating systems in networked computers

23. A key purpose of middleware is to:
    a) Replace databases in a system
    b) Provide distribution transparency for applications
    c) Replace the need for a network layer
    d) Reduce the number of servers needed

24. Which of the following is an example of middleware?
    a) Operating systems like Windows or Linux
    b) CORBA (Common Object Request Broker Architecture)
    c) Internet browsers
    d) Physical network switches

25. What is the purpose of Distributed Hash Tables (DHT) in P2P networks?
    a) To manage central server nodes
    b) To provide a decentralized data lookup mechanism
    c) To replace all TCP/IP communication
    d) To act as a single point of failure

26. In the Chord DHT system, what is a finger table used for?
    a) Encrypting messages between peers
    b) Storing IP addresses of all nodes in the network
    c) Efficiently routing lookups in logarithmic time
    d) Preventing any new nodes from joining the network

27. A distributed system should be scalable in terms of:
    a) Number of users
    b) Number of resources
    c) Both users and resources
    d) None of the above

28. Which of the following is NOT a challenge of scalability?
    a) Performance loss
    b) Preventing resource exhaustion
    c) Adding more centralized servers
    d) Avoiding performance bottlenecks

29. How does horizontal distribution improve scalability?

    a) By assigning all tasks to a single high-performance server

    b) By distributing workloads across multiple equal-capacity nodes

    c) By centralizing control in one main node

    d) By eliminating redundancy in the system

30. A major security challenge in distributed systems is:

    a) Ensuring that all data is stored in a single location

    b) Providing uniform access to all users without restrictions

    c) Handling authentication and authorization across different components

    d) Preventing the use of middleware

31. Which of the following is a common security mechanism in distributed systems?

    a) Firewalls

    b) Load balancers

    c) Data compression algorithms

    d) Memory caching

32. A denial-of-service (DoS) attack targets a distributed system by:

    a) Encrypting all communication

    b) Overloading the system with excessive requests

    c) Providing additional nodes to balance traffic

    d) Disabling data encryption protocols

33. What is fault tolerance in distributed systems?

    a) The ability of a system to continue functioning despite hardware or software failures

    b) The process of designing software with no errors

c) A method of preventing users from accessing system resources

d) A security mechanism to block unauthorized users

34. Redundancy in distributed systems is used to:

a) Increase system reliability

b) Reduce the number of active nodes

c) Eliminate the need for databases

d) Prevent any node from failing

35. How does rollback recovery help in fault tolerance?

a) It prevents system failures from occurring

b) It restores a system to a previously stable state after a failure

c) It blocks external network requests

d) It eliminates the need for backups

36. What is an example of volunteer computing?

a) Centralized banking systems

b) SETI@Home (Search for Extraterrestrial Intelligence)

c) Client-server web applications

d) DNS lookup servers

37. Edge computing improves performance by:

a) Processing data close to the source rather than sending it to a central server

b) Increasing network latency

c) Storing all data in one location

d) Eliminating the need for middleware

38. In cloud-based office suites, the data layer is responsible for:

    a) User authentication

    b) Document storage and retrieval

    c) Running spreadsheet calculations

    d) Managing user interface interactions

39. In an e-commerce website, which of the following layers is responsible for handling user payments?

    a) Presentation layer

    b) Business logic layer

    c) Data layer

    d) Networking layer

40. A load balancer in a distributed web system:

    a) Routes incoming traffic to multiple servers to prevent overload

    b) Blocks unauthorized access

    c) Encrypts all user data

    d) Stores all user sessions on a single server

41. Which of the following is a disadvantage of tiered architectures?

    a) Increased complexity and communication overhead

    b) Reduced security risks

    c) Less fault tolerance

    d) Lack of modularity

42. What is a major advantage of a hybrid system architecture?

    a) It combines the best features of client-server and P2P models

b) It eliminates the need for communication protocols

c) It centralizes all user interactions into a single node

d) It prevents scalability

43. Which architectural style would be best for a real-time stock market tracking system?

a) Event-based architecture

b) Layered architecture

c) Monolithic architecture

d) File-based storage architecture

44. Which of the following best describes a superpeer in a hybrid P2P system?

a) A central server managing all requests

b) A node that acts as both a client and a mini-server for connected peers

c) A storage-only node that does not participate in routing

d) A node that only connects to a single other peer

45. What is an example of vertical distribution in distributed systems?

a) Multiple servers performing the same function

b) Separation of functionalities across multiple tiers, such as UI, logic, and database

c) Nodes equally sharing resources in a P2P network

d) Using multiple redundant servers for fault tolerance

46. A shared data-space architecture is a combination of:

a) Data-centered and event-based architectures

b) Client-server and peer-to-peer architectures

c) Monolithic and layered architectures

d) Load balancing and vertical distribution

47. What is a key challenge of member joins in P2P networks?

a) Ensuring the new peer does not disrupt existing data placement

b) Preventing the new peer from accessing any data

c) Converting the P2P network into a centralized system

d) Restricting all new peers to a single supernode

48. In a distributed transaction processing system, what is a major challenge?

a) Synchronizing updates across multiple distributed databases

b) Preventing client requests from reaching the database

c) Eliminating concurrency in the system

d) Avoiding all data replication

49. What is a major reason for using middleware in hybrid architectures?

a) It reduces the need for security protocols

b) It provides a uniform interface for different components to communicate

c) It replaces the need for all communication layers

d) It eliminates peer-to-peer connections

50. Which of the following is an advantage of a decentralized system over a centralized one?

a) No single point of failure

b) Lower communication overhead

c) Complete elimination of network congestion

d) Immediate data consistency

Scenario:

Imagine you are a software architect for a global e-learning platform called **EduX**, which allows students to access courses, watch videos, submit assignments, and participate in live discussions. The platform currently operates using a **two-tier client-server architecture**, where clients communicate directly with a central server that handles both business logic and database storage.

Recently, the platform has experienced **significant performance issues** due to a rapid increase in users. The server is overloaded, leading to **slow response times, frequent crashes, and inconsistent availability** for users in different time zones.

To address these challenges, your company is considering **redesigning the architecture**.

Case Study Questions:

1. What are the main limitations of the current two-tier client-server architecture in this scenario?
2. Which architectural style would you recommend for improving the system, and why?
3. How can a Peer-to-Peer (P2P) model improve certain functionalities of EduX?
4. What security challenges might arise in a distributed system for EduX, and how can they be addressed?
5. If EduX wants to introduce real-time interactive discussions, which architecture would be best?