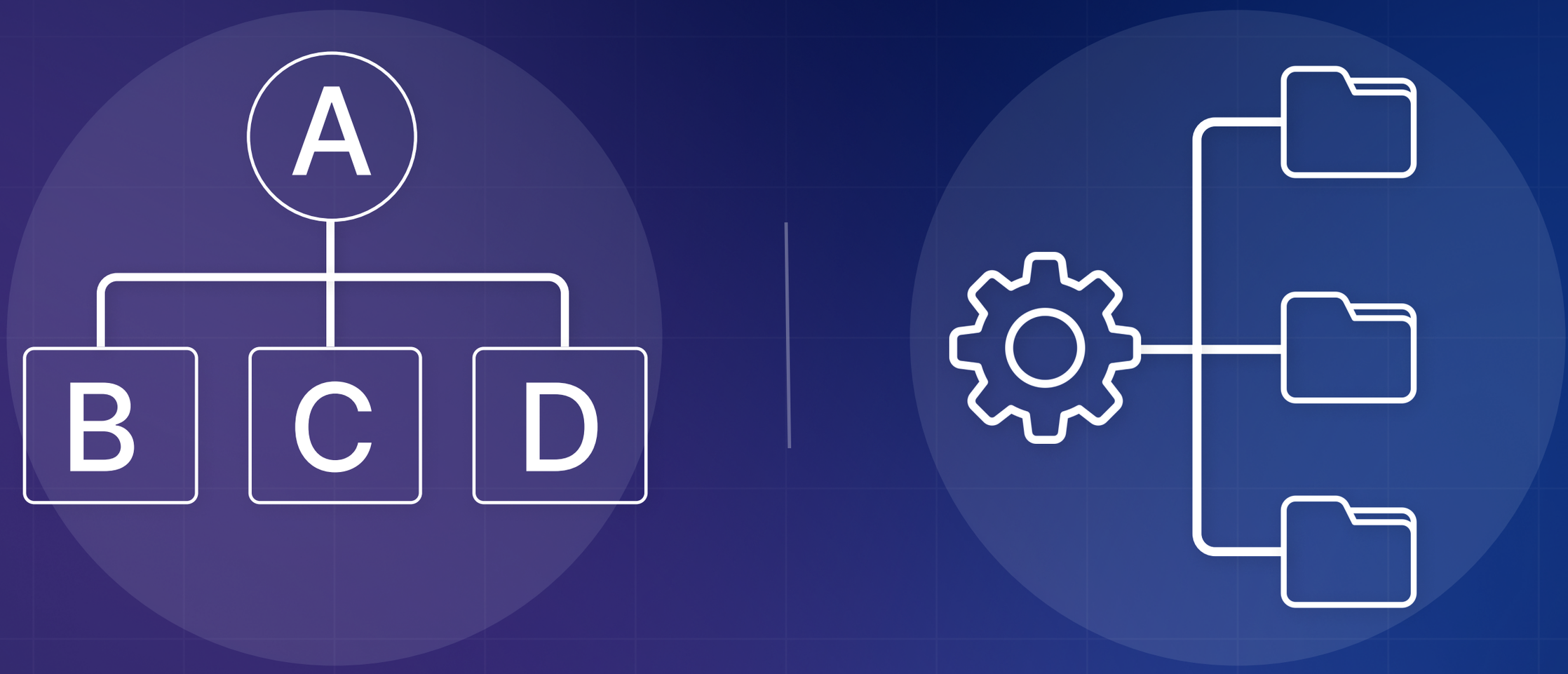
BOSSCODER ACADEMY

COMPLETE HLD & LLD

Guide For System Design Interviews



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Disclaimer

System Design is the most asked topic in tech interviews. So, make sure you prepare it thoroughly.

Take the help of this doc and ace your System Design Interviews

Low-Level Design (LLD) Guide

Basics of Low-Level Design

Question 1:

What is Low-Level Design (LLD)?

Answer 1:

Low-Level Design (LLD) is the process of designing detailed components of a system, focusing on class structures, object relationships, methods, and interactions.

Reference

Question 2:

What is Object-Oriented Design (OOD)?

Answer 2:

Object-Oriented Design (OOD) is a design approach based on objects and classes. It focuses on using objects that interact with one another to design software.

Reference

Question 3:

What are the Four Pillars of Object-Oriented Programming?

Answer 3:

Encapsulation, Abstraction, Inheritance, Polymorphism.

Reference

Question 4:

What is a Class Diagram?

Answer 4:

A class diagram is a static structure diagram in UML that describes the structure of a system by showing its classes, attributes, operations, and relationships between objects.

Reference

Question 5:

What is the Law of Demeter?

Answer 5:

The Law of Demeter is a design guideline that promotes loose coupling between components. It suggests that a class should only communicate with its close dependencies.

Reference

Question 6:

What is the Dependency Inversion Principle?

Answer 6:

This principle suggests that high-level modules should not depend on low-level modules; instead, both should depend on abstractions.

Reference

Question 7:

What are Interfaces in OOP?

Answer 7:

Interfaces define abstract methods that a class must implement, enabling polymorphism and abstraction.

Reference

Question 8:

What is the Observer Design Pattern?

Answer 8:

The Observer Pattern defines a one-to-many dependency, where one object (the subject) notifies all its dependents (observers) of state changes.

Reference

Question 9:

What is the Adapter Design Pattern?

Answer 9:

The Adapter Pattern allows objects with incompatible interfaces to work together by wrapping them with a new interface.

Reference

Question 10:

What is the Strategy Design Pattern?

Answer 10:

The Strategy Pattern defines a family of algorithms and makes them interchangeable by selecting one at runtime.

Reference

Question 11:

What is the difference between an Abstract Class and an Interface?

Answer 11:

Abstract Class: Can have both abstract and concrete methods and is used for shared behavior. Interface: Only contains abstract methods (before Java 8), used for defining a contract.

Reference

Question 12:

What is Aggregation in OOP?

Answer 12:

Aggregation represents a 'whole-part' relationship where the contained objects can exist independently of the container.

Reference

Question 13:

What is the Strategy Design Pattern?

Answer 13:

The Strategy Pattern defines a family of algorithms and makes them interchangeable by selecting one at runtime.

Reference

Question 14:

What is Composition in OOP?

Answer 14:

Composition is a 'whole-part' relationship where the lifetime of the contained objects depends on the lifetime of the container.

Reference

Question 15:

What is Polymorphism in OOP?

Answer 15:

Polymorphism allows objects of different classes to be treated as objects of a common superclass, achieved via method overriding or method overloading.

Reference

Question 16:

What is Cohesion and Coupling in Design?

Answer 16:

Cohesion measures how closely related the responsibilities of a single module or class are. Coupling measures how dependent different modules or classes are on one another.

Reference

Practical Questions for LLD

Question 1:

Design a Parking Lot System

Practice

Question 2:

Design an Online Book Rental System

Practice

Question 3:

Design a Movie Ticket Booking System

Practice

Question 4:

Design an ATM System

Practice

Question 5:

Design a Hotel Management System

Practice

Question 6:

Design a Food Delivery System

Practice

Question 7:

Design a Ride-Sharing System (Like Uber/Lyft)

Practice

High-Level Design (HLD) Guide

Basics of High-Level Design

Question 1:

What is High-Level Design (HLD)?

Answer 1:

High-Level Design (HLD) focuses on the overall architecture of a system, describing its major components, their relationships, and the flow of data.

Reference

Question 2:

What are the key components of High-Level Design?

Answer 2:

Architectural Patterns: Client-server, microservices, and layered architecture. Data Flow: Describes the movement of data within and between system components. Databases: Choosing between SQL and NoSQL databases, data partitioning, and replication. Communication: HTTP, RPC, or message queues.

Reference

Question 3:

What is a Load Balancer?

Answer 3:

A load balancer distributes network or application traffic across multiple servers to avoid overwhelming a single server, improving availability and reliability

Reference

Question 4:

What is Horizontal and Vertical Scaling?

Answer 4:

Horizontal Scaling: Adding more machines to handle the load (scale-out). Vertical Scaling: Increasing the capacity of a single machine (scale-up).

Reference

Question 5:

What is Caching, and why is it used?

Answer 5:

Caching stores frequently accessed data in memory to improve performance by reducing access time for that data.

Reference

Question 6:

What are Databases in HLD?

Answer 6:

SQL (Relational): Structured databases like MySQL, PostgreSQL.
NoSQL (Non-relational): Schema-less, unstructured databases like MongoDB, Cassandra.

Reference

Question 7:

What is the CAP Theorem?

Answer 7:

The CAP Theorem states that a distributed system can provide only two out of three properties: Consistency, Availability, and Partition Tolerance.

Reference

Question 8:

What are Message Queues?

Answer 8:

Message Queues decouple different components of a system by sending messages asynchronously. Examples: RabbitMQ, Kafka etc.

Reference

Question 9:

What is Sharding in Databases?

Answer 9:

Sharding splits a database into smaller, more manageable pieces, called shards, each containing a subset of the data.

Reference

Question 10:

What is Data Partitioning?

Answer 10:

Data Partitioning splits large datasets into smaller segments, improving performance and enabling distributed storage.

Reference

Question 11:

What are Microservices?

Answer 11:

Microservices architecture breaks a system into small, loosely coupled services, each responsible for specific functionality.

Reference

Question 12:

What is a CDN (Content Delivery Network)?

Answer 12:

A CDN is a network of distributed servers that deliver content based on the geographic location of the user, origin of the webpage, and the delivery server.

Reference

Question 13:

What is Eventual Consistency?

Answer 13:

Eventual Consistency means that a system will become consistent over time, given that no new updates are made.

Reference

Question 14:

What is the Circuit Breaker Pattern?

Answer 14:

The Circuit Breaker Pattern is used to detect failure and prevent an application from trying to execute operations that are likely to fail.

Reference

Question 15:

What is Rate Limiting?

Answer 15:

Rate Limiting controls the number of requests a user or system can make to a service over a set period of time.

Reference

Practical Questions for HLD

Question 1:

Design a URL Shortening Service (Like Bitly)

Practice

Question 2:

Design a Content Delivery Network (CDN)

Practice

Question 3:

Design a Ride-Sharing System (Like Uber/Lyft)

Practice

Question 4:

Design a Chat System (Like WhatsApp)

Practice

Question 5:

Design a Distributed File Storage System (Like Google Drive)

Practice

Question 6:

Design a Video Streaming Service (Like Netflix)

Practice

Question 7:

Design an E-Commerce System (Like Amazon)

Practice

Projects for LLD and HLD Implementation

LLD Projects

Project 1:

Ride-Sharing App (Like Uber/Lyft)

Reference

Project 2:

Library Management System

Reference

Project 3:

Library Management System

Reference

Project 5:

Hotel Management System

Reference

Project 6:

ATM Machine System

Reference

HLD Projects

Project 1:

Scalable Video Streaming Platform

Reference

Project 2:

Distributed File Storage System

Reference

Project 3:

Social Media Platform

Reference

Project 4:

Real-Time Chat System

Reference

Project 5:

Online Marketplace System

Reference

Project 6:

ATM Machine System

Reference

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