Complete System Design Syllabus (FAANG Level)

End-to-end system design curriculum covering HLD, LLD, scalability, distributed systems, and real-world case studies.

1. Foundations

- What is System Design and why it is asked
- HLD vs LLD
- Functional vs Non-functional requirements
- Scalability concepts and trade-offs
- Capacity estimation basics

2. Networking & Communication

- HTTP/HTTPS, REST, GraphQL, gRPC
- HTTP/1.1 vs HTTP/2 vs HTTP/3
- DNS, TCP vs UDP
- Load balancing strategies
- WebSockets and real-time communication

3. Data Storage Systems

- SQL databases (MySQL, PostgreSQL)
- NoSQL databases (Redis, MongoDB, Cassandra)
- Indexing and query optimization
- Replication and sharding strategies
- Schema design and data modeling

4. Caching

- Client-side, server-side, and CDN caching
- Cache-aside, write-through, write-back
- Eviction policies (LRU, LFU, TTL)
- Cache invalidation strategies

5. Distributed Systems

- CAP theorem
- Consistency models
- Leader election
- Quorum reads and writes
- Distributed locks

6. Messaging & Streaming

- Kafka, RabbitMQ, SQS
- Event-driven architecture
- Async processing

- Dead letter queues
- Exactly-once vs at-least-once delivery

7. Microservices Architecture

- Monolith vs Microservices
- Service discovery
- API Gateway
- Circuit breaker and rate limiting
- Inter-service communication

8. Security

- Authentication and authorization
- OAuth2, JWT, Sessions
- Encryption in transit and at rest
- Secrets management
- DDoS protection

9. Observability & Reliability

- Logging, metrics, and tracing
- SLA, SLO, SLI
- Health checks
- Auto-scaling
- Disaster recovery

10. DevOps & Deployment

- CI/CD pipelines
- Docker fundamentals
- Kubernetes basics
- Blue-green and canary deployments

11. Design Patterns & LLD

- SOLID principles
- Creational, structural, behavioral patterns
- Concurrency design
- Thread safety

12. Real-world System Design Problems

- URL Shortener
- Rate Limiter
- Chat Application
- Social Media Feed
- Food Delivery App
- Payment System

13. Interview Strategy

- Requirement clarification
- Back-of-the-envelope calculations
- High-level architecture
- Bottleneck analysis
- Trade-off discussion