

# Software Architect – 100+ Lab Exercises (Basic, Intermediate, Advanced)

## □ Basic Level (30+ Exercises)

**Objective:** Establish a solid foundation in software design principles, architecture patterns, and documentation.

### Fundamentals of Software Architecture

- Understand software architecture roles and responsibilities.
- Study Software Development Life Cycle (SDLC) and Agile methodologies.
- Analyze classic architecture styles: Monolithic, Client-Server, Layered.
- Explore SOLID principles and design patterns (Singleton, Factory).
- Document architecture using UML diagrams (class, sequence, use case).

### Requirements & Stakeholder Management

- Conduct requirement elicitation and analysis.
- Develop clear functional and non-functional requirements.
- Map stakeholder concerns to architectural decisions.
- Create quality attribute scenarios (performance, security, scalability).
- Prioritize features and architectural drivers.

### Basic System Design

- Design simple CRUD applications.
- Model database schemas and ER diagrams.
- Define APIs and communication protocols.
- Implement basic authentication and authorization.
- Conduct code reviews and static analysis.

## □ Intermediate Level (40+ Exercises)

**Objective:** Develop expertise in distributed systems, integration patterns, and technology evaluation.



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## Architectural Patterns & Styles

- Design microservices-based architectures.
- Implement event-driven and message-driven patterns.
- Explore service-oriented architecture (SOA).
- Apply CQRS (Command Query Responsibility Segregation).
- Use Domain-Driven Design (DDD) concepts.

## Integration & Communication

- Develop RESTful APIs and GraphQL endpoints.
- Use API gateways and service mesh patterns.
- Design asynchronous communication with message brokers (Kafka, RabbitMQ).
- Implement data synchronization and consistency strategies.
- Model event sourcing and event streaming.

## Performance & Scalability

- Conduct load testing and capacity planning.
- Design for horizontal and vertical scaling.
- Use caching strategies (Redis, Memcached).
- Optimize database indexing and query performance.
- Architect fault-tolerant and resilient systems.

## Security & Compliance

- Define security architecture (authentication, authorization, encryption).
- Implement OAuth2, JWT, and OpenID Connect.
- Design GDPR and compliance-ready systems.
- Perform threat modeling and risk assessment.
- Introduce DevSecOps practices.

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## ☐ Advanced Level (40+ Exercises)

**Objective:** Master enterprise architecture, cloud-native design, AI/ML integration, and governance.

## Enterprise Architecture & Governance

- Develop enterprise architecture frameworks (TOGAF, Zachman).



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- Align business and IT strategies.
- Manage architecture governance and decision records (ADR).
- Perform technology portfolio assessment and roadmap planning.
- Lead architecture reviews and stakeholder workshops.

## Cloud-Native & DevOps Architectures

- Design multi-cloud and hybrid cloud architectures.
- Implement container orchestration (Kubernetes).
- Architect serverless applications.
- Integrate Infrastructure as Code (Terraform, Ansible).
- Design CI/CD pipelines for microservices.

## Emerging Technologies

- Architect AI/ML model integration and data pipelines.
- Implement blockchain-based systems.
- Design IoT architectures with edge computing.
- Apply event-driven, reactive systems at scale.
- Explore quantum computing impact on architecture.

## Soft Skills & Leadership

- Develop technical communication and documentation.
- Lead cross-functional teams and manage conflicts.
- Foster innovation and continuous learning culture.
- Mentor junior architects and developers.
- Conduct architectural risk management.

## Capstone Projects

- Architect a scalable e-commerce platform using microservices.
- Design an event-driven real-time analytics system.
- Build a cloud-native AI-powered recommendation engine.
- Develop a secure, compliant healthcare information system.
- Lead an enterprise-wide cloud migration and transformation.

## □ Tools & Technologies

- UML Modeling (Enterprise Architect, Lucidchart)



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- API Management (Kong, Apigee)
- Messaging Systems (Kafka, RabbitMQ)
- Cloud Platforms (AWS, Azure, GCP)
- Containerization (Docker, Kubernetes)
- Infrastructure as Code (Terraform, Ansible)