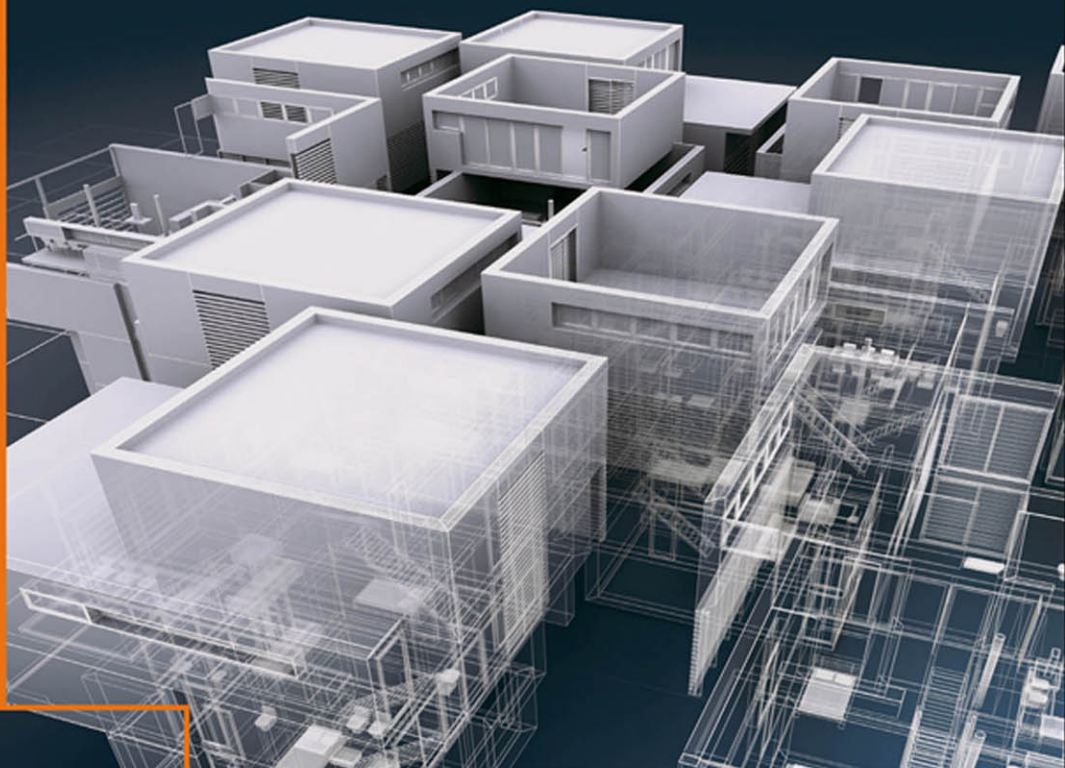




Designing Software Architectures

A Practical Approach



Humberto Cervantes

Rick Kazman

Designing Software Architectures

Designing Software Architectures: A Practical Approach

Table of Contents

Cover

Title Page

Copyright Page

Contents

Preface

Acknowledgments

CHAPTER 1 Introduction

1.1 Motivations

1.2 Software Architecture

1.2.1 The Importance of Software Architecture

1.2.2 Life-Cycle Activities

1.3 The Role of the Architect

1.4 A Brief History of ADD

1.5 Summary

1.6 Further Reading

CHAPTER 2 Architectural Design

2.1 Design in General

2.2 Design in Software Architecture

2.2.1 Architectural Design

2.2.2 Element Interaction Design

2.2.3 Element Internals Design

2.3 Why Is Architectural Design So Important?

Table of Contents

2.4 Architectural Drivers

- 2.4.1 Design Purpose
- 2.4.2 Quality Attributes
- 2.4.3 Primary Functionality
- 2.4.4 Architectural Concerns
- 2.4.5 Constraints

2.5 Design Concepts: The Building Blocks for Creating Structures

- 2.5.1 Reference Architectures
- 2.5.2 Architectural Design Patterns
- 2.5.3 Deployment Patterns
- 2.5.4 Tactics
- 2.5.5 Externally Developed Components

2.6 Architecture Design Decisions

2.7 Summary

2.8 Further Reading

CHAPTER 3 The Architecture Design Process

3.1 The Need for a Principled Method

3.2 Attribute-Driven Design 3.0

- 3.2.1 Step 1: Review Inputs
- 3.2.2 Step 2: Establish the Iteration Goal by Selecting Drivers
- 3.2.3 Step 3: Choose One or More Elements of the System to Refine
- 3.2.4 Step 4: Choose One or More Design Concepts That Satisfy the Selected Drivers
- 3.2.5 Step 5: Instantiate Architectural Elements, Allocate Responsibilities, and Define Interfaces
- 3.2.6 Step 6: Sketch Views and Record Design Decisions
- 3.2.7 Step 7: Perform Analysis of Current Design and Review Iteration Goal and Achievement of Design Purpose
- 3.2.8 Iterate If Necessary

3.3 Following a Design Roadmap According to System Type

Table of Contents

3.3.1 Design of Greenfield Systems for Mature Domains

3.3.2 Design of Greenfield Systems for Novel Domains

3.3.3 Design for an Existing System (Brownfield)

3.4 Identifying and Selecting Design Concepts

3.4.1 Identification of Design Concepts

3.4.2 Selection of Design Concepts

3.5 Producing Structures

3.5.1 Instantiating Elements

3.5.2 Associating Responsibilities and Identifying Properties

3.5.3 Establishing Relationships Between the Elements

3.6 Defining Interfaces

3.6.1 External Interfaces

3.6.2 Internal Interfaces

3.7 Creating Preliminary Documentation During Design

3.7.1 Recording Sketches of the Views

3.7.2 Recording Design Decisions

3.8 Tracking Design Progress

3.8.1 Use of an Architectural Backlog

3.8.2 Use of a Design Kanban Board

3.9 Summary

3.10 Further Reading

CHAPTER 4 Case Study: FCAPS System

4.1 Business Case

4.2 System Requirements

4.2.1 Use Case Model

4.2.2 Quality Attribute Scenarios

4.2.3 Constraints

4.2.4 Architectural Concerns

4.3 The Design Process

Table of Contents

4.3.1 ADD Step 1: Review Inputs

4.3.2 Iteration 1: Establishing an Overall System Structure

4.3.3 Iteration 2: Identifying Structures to Support Primary Functionality

4.3.4 Iteration 3: Addressing Quality Attribute Scenario Driver (QA-3)

4.4 Summary

4.5 Further Reading

CHAPTER 5 Case Study: Big Data System

5.1 Business Case

5.2 System Requirements

5.2.1 Use Case Model

5.2.2 Quality Attribute Scenarios

5.2.3 Constraints

5.2.4 Architectural Concerns

5.3 The Design Process

5.3.1 ADD Step 1: Review Inputs

5.3.2 Iteration 1: Reference Architecture and Overall System Structure

5.3.3 Iteration 2: Selection of Technologies

5.3.4 Iteration 3: Refinement of the Data Stream Element

5.3.5 Iteration 4: Refinement of the Serving Layer

5.4 Summary

5.5 Further Reading

CHAPTER 6 Case Study: Banking System

6.1 Business Case

6.1.1 Use Case Model

6.1.2 Quality Attribute Scenarios

6.1.3 Constraints

6.1.4 Architectural Concerns

6.2 Existing Architectural Documentation

6.2.1 Module View

Table of Contents

6.2.2 Allocation View

6.3 The Design Process

6.3.1 ADD Step 1: Review Inputs

6.3.2 Iteration 1: Supporting the New Drivers

6.4 Summary

6.5 Further Reading

CHAPTER 7 Other Design Methods

7.1 A General Model of Software Architecture Design

7.2 Architecture-Centric Design Method

7.3 Architecture Activities in the Rational Unified Process

7.4 The Process of Software Architecting

7.5 A Technique for Architecture and Design

7.6 Viewpoints and Perspectives Method

7.7 Summary

7.8 Further Reading

CHAPTER 8 Analysis in the Design Process

8.1 Analysis and Design

8.2 Why Analyze?

8.3 Analysis Techniques

8.4 Tactics-Based Analysis

8.5 Reflective Questions

8.6 Scenario-Based Design Reviews

8.7 Architecture Description Languages

8.8 Summary

8.9 Further Reading

CHAPTER 9 The Architecture Design Process in the Organization

Table of Contents

9.1 Architecture Design and the Development Life Cycle

9.1.1 Architecture Design During Pre-Sales

9.1.2 Architecture Design During Development and Operation

9.2 Organizational Aspects

9.2.1 Designing as an Individual or as a Team

9.2.2 Using a Design Concepts Catalog in Your Organization

9.3 Summary

9.4 Further Reading

CHAPTER 10 Final Words

10.1 On the Need for Methods

10.2 Next Steps

10.3 Further Reading

APPENDIX A: A Design Concepts Catalog

A.1 Reference Architectures

A.1.1 Web Applications

A.1.2 Rich Client Applications

A.1.3 Rich Internet Applications

A.1.4 Mobile Applications

A.1.5 Service Applications

A.2 Deployment Patterns

A.2.1 Nondistributed Deployment

A.2.2 Distributed Deployment

A.2.3 Performance Patterns: Load-Balanced Cluster

A.3 Architectural Design Patterns

A.3.1 Structural Patterns

A.3.2 Interface Partitioning

A.3.3 Concurrency

A.3.4 Database Access

A.4 Tactics

Table of Contents

A.4.1 Availability Tactics

A.4.2 Interoperability Tactics

A.4.3 Modifiability Tactics

A.4.4 Performance Tactics

A.4.5 Security Tactics

A.4.6 Testability Tactics

A.4.7 Usability Tactics

A.5 Externally Developed Components

A.5.1 Spring Framework

A.5.2 Swing Framework

A.5.3 Hibernate Framework

A.5.4 Java Web Start Framework

A.6 Summary

A.7 Further Reading

APPENDIX B: Tactics-Based Questionnaires

B.1 Using the Questionnaires

B.2 Availability

B.3 Interoperability

B.4 Modifiability

B.5 Performance

B.6 Security

B.7 Testability

B.8 Usability

B.9 DevOps

B.10 Further Reading

Glossary

A

B

Table of Contents

C

D

E

G

I

M

P

Q

R

S

T

About the Authors

Index