Architectural Patterns

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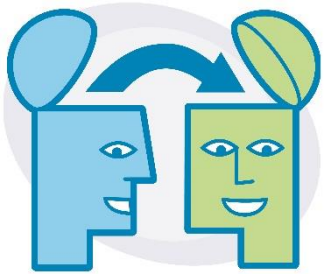
Architectural Patterns

- An architectural pattern is a general, reusable **solution** to a recurring **problem** in software architecture
- It documents knowledge about a common problem
- It is supposed to be reused across applications



Patterns in Software

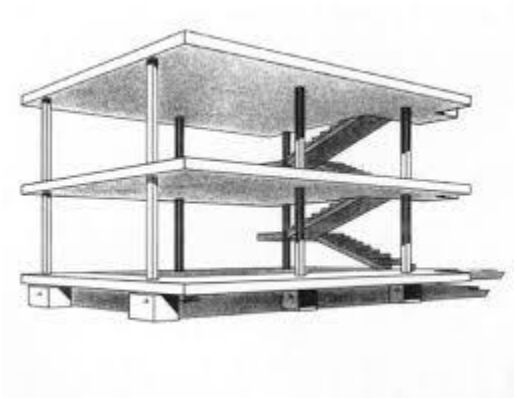
- Architecture patterns represent general architecture structures
  - Design patterns (detailed design)
  - Idioms (programming)
- Architecture patterns define the high level structure of a system
  - Design patterns and idioms are used in successive phases

All Patterns are Template

- (Architectural) Patterns **do not** define a complete solution
  - The partial solution should be refined
- Examples of refinements
  - To include program-specific components and relationships
  - To define design patterns and idioms to detail the solution

Reference Architecture

- A software system is unique
  - However, several software systems may share similar architectures
- A system may use an architectural pattern as a reference
  - Architecture style and reference architecture are similar concepts



Key Elements of a Pattern

- The choice of an architectural pattern is part of the problem solution
- Architectural patterns usually define
  - A set of components
  - Responsibility of the involved components (roles)
  - Relationships among components

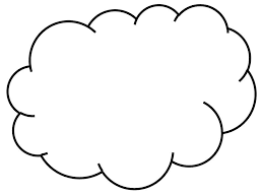
Choosing an Architecture

- Architectural patterns define ways to organize the system general structure
  - Each architectural pattern may favor specific system properties

- Therefore, it is important to know alternative architectural patterns to achieve particular software needs

Non-Functional Requirements

- The choice of an architectural pattern is largely dependent of
  - The type of system
  - Non-functional requirements
- Questions to be considered
  - Is the system interactive?
  - Does it require frequent changes?
  - What non-functional requirements are important? Reliability? Performance?



Composition of Patterns

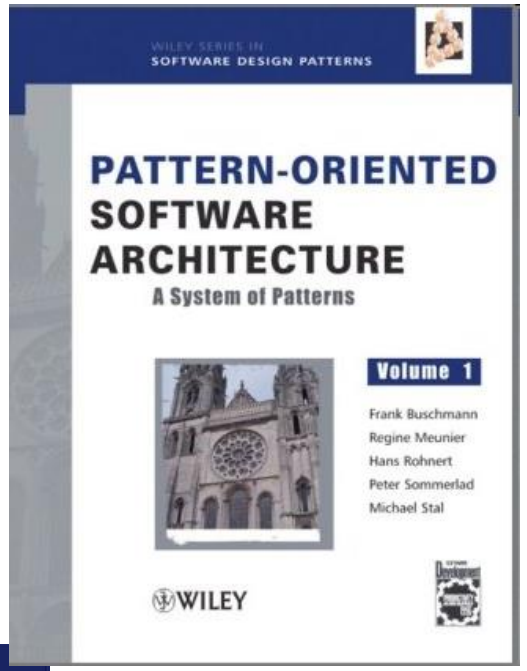
- Each architectural pattern focuses on specific non-functional requirements
  - There are also alternative patterns to address similar problems
- Complex systems may follow several architectural patterns
  - Similarly, a system may include several design patterns

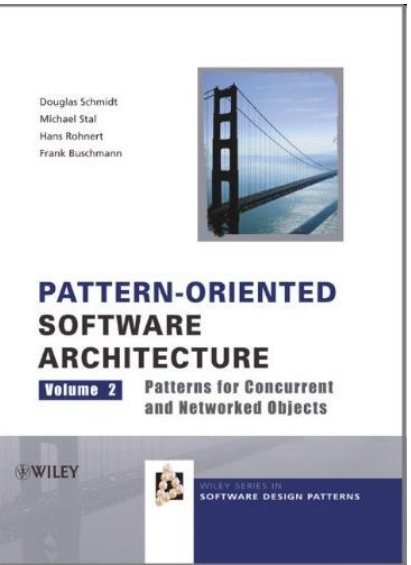
Architectural Patterns (POSA)

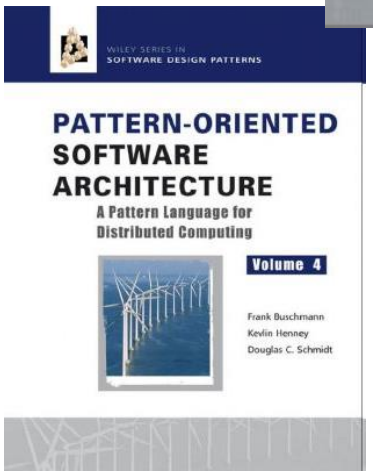
- From Mud to Structure
  - Layered Architecture
  - Blackboard
  - Pipes and Filters
- Distributed Systems
  - Client-Server
  - Broker
- Interactive Systems
  - Model-View-Controller (MVC)
  - Presentation-Abstraction-Control
- Adaptable Systems
  - Microkernel
  - Reflection

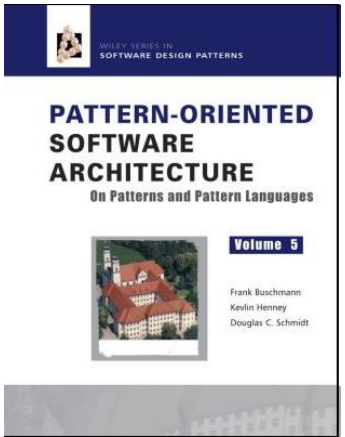
Architectural Patterns Books

- Pattern-Oriented Software Architecture: A System of Patterns (Vol. 1)









Bibliography

- F. Buschmann et al. **Pattern-Oriented Software Architecture: A System of Patterns**. John Wiley & Sons, 1996.
  - Chap. 2 Architectural Patterns
- Ian Sommerville. **Software Engineering**, 9th Edition. Pearson Education, 2011.
  - Chapter 6 Architectural Design