

Advanced Software Architecture

Prof. Dr.-Ing. Andreas Heil

 Licensed under a Creative Commons Attribution 4.0 International license. Icons by The Noun Project.

v1.0.3

Software Architecture

Introduction

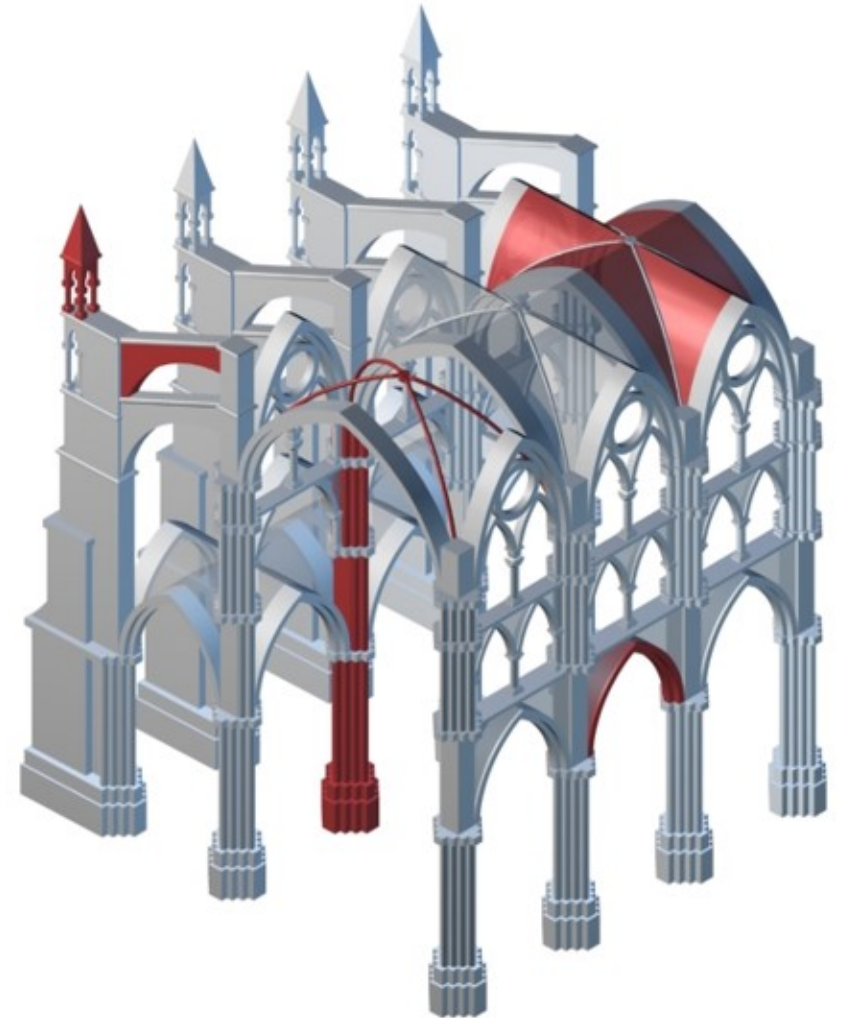
What is an Architectural Style

What is an »architectural style«?



Architectural Style Example

- An example: Gothic style
- Gothic style provides the following features:
 - cross-ribbed vault
 - two instead of four roman arches
 - high, broken-up walls
 - rose windows
 - pointed arches
 - gothic buttress



Architectural Style Example

- An example: Instance of Gothic style
- Gothic style provides the following features:
 - cross-ribbed vault
 - two instead of four roman arches
 - high, broken-up walls
 - rose windows
 - pointed arches
 - gothic buttress



Software Architecture vs Software Design

Software Architecture

Technopedia says²:

Software architecture is a structured framework used to **conceptualize software elements, relationships and properties**. This term also references software architecture documentation, which facilitates stakeholder communication while ****documenting early and high-level decisions regarding design and design component and pattern reuse for different projects**. The software architecture process works through the abstraction and separation of these concerns to reduce complexity.

Software Design

Ian Sommerville, Software Engineering, 10. Edition:

Architectural design is concerned with understanding how a system should be organized and designing the overall structure of that system. In the model of the software development process, [...], architectural design is the first stage in the software design process. It is the critical link between design and requirements engineering, as it identifies the main structural components in a system and the relationships between them. The output of the architectural design process is an architectural model that describes how the system is organized as a set of communicating components.

Software Architecture Design

The Process of Describing Software Architectures

From Boxes...

- Software architecture based on the process: »software architect design«
- Software architecture design is a process where data structures, algorithms and software components are organized in a way to achieve the desired behaviour of a system
- Requirements are mapped to software components



... and Lines

- Relationships between components usually consist of
 - control flows
 - data flows
 - dependencies
- The collaboration of the components is described using these relationships



control flow



data flow



dependency

How to Choose Architectures

Practical tips

- There is not the »one and only« architecture for a requirement
- Requirements can be fulfilled using various architectures
- New technologies might require an architectural change
- Architectures are often based on the experience, external factors (e.g. company guidelines) or even the personal preferences of an architect

Let me tell you something a true story about someone who wanted to call himself an »Architect«...

Levels of Abstraction

- To fully describe an architecture you probably need various levels of abstraction
- Examples
 - Static view (system components)
 - Dynamic view (processes, programm sequence)
 - Developer view (classes, packages)
 - Physical view (infrastructure, physical components)
 - Deployment view (virtual machines, containers)
- Use different views based on your needs
- **Good bet: Do not put everything on one single view - been there, seen it!**

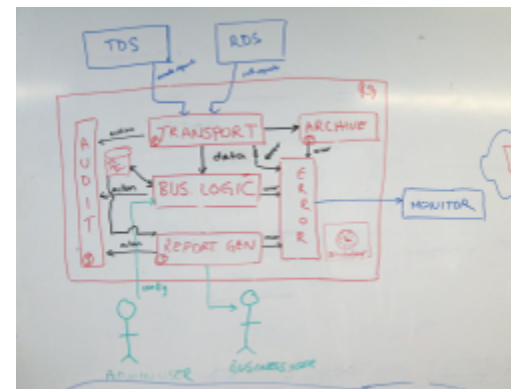
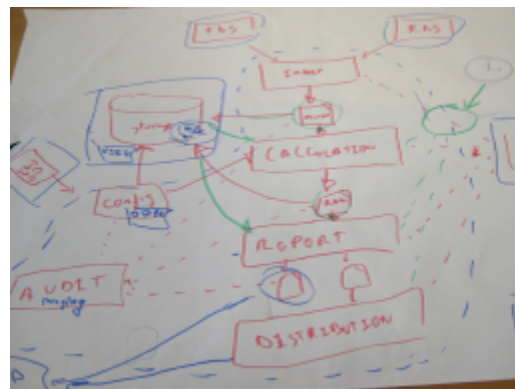
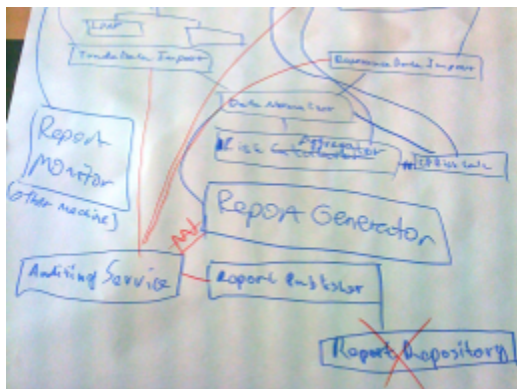
Documentation Approaches

- There are various approaches how to document software architectures
- Architectural description languages (ADL): Formal languages which allow you to talk about architectures
- Various research projects do exist²
- UML-based approaches: ArchMate, SysML
- Problem 1: No or little acceptance within the industry
- Problem 2: Formal approaches are neglected in favour for the much simpler boxes and lines

Consequence: simple boxes and lines are the most common approach for documenting and communicating architectures

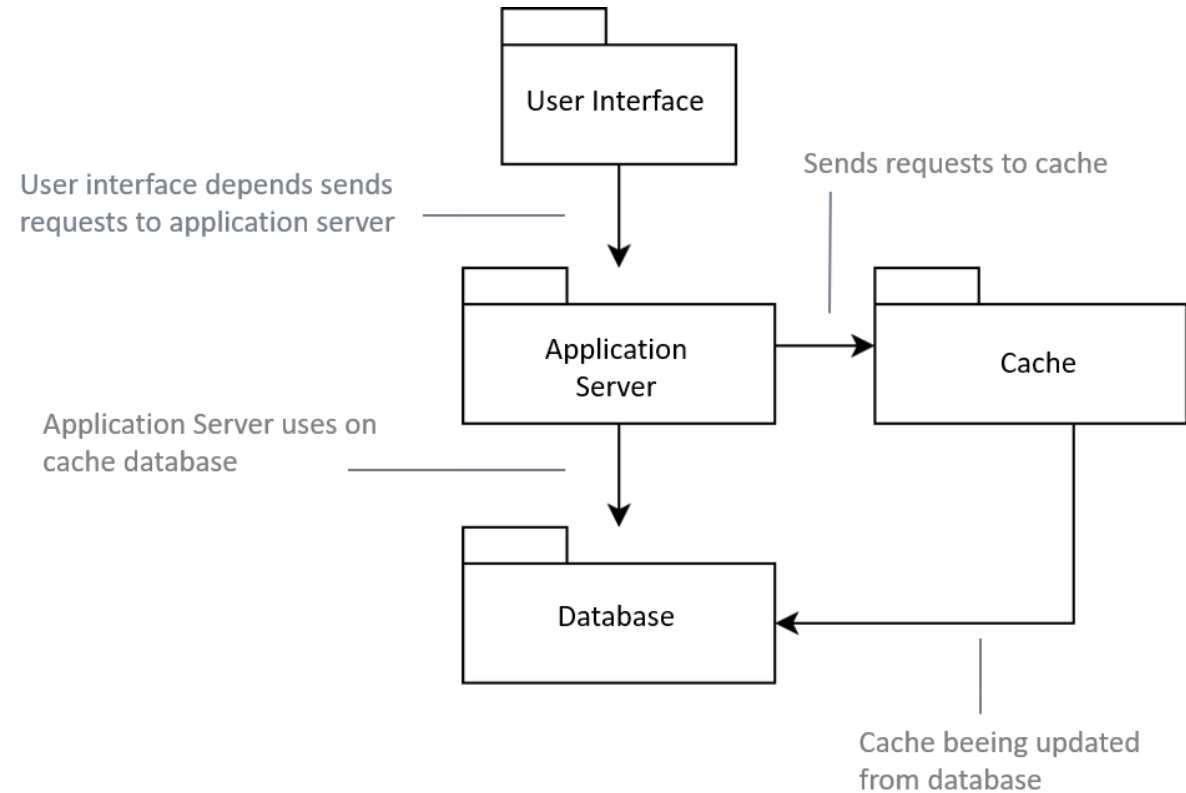
Software Architecture Challenge

- These are real world examples^{^3}
- Would you be able to build the drawn system based on those architectural drawings?



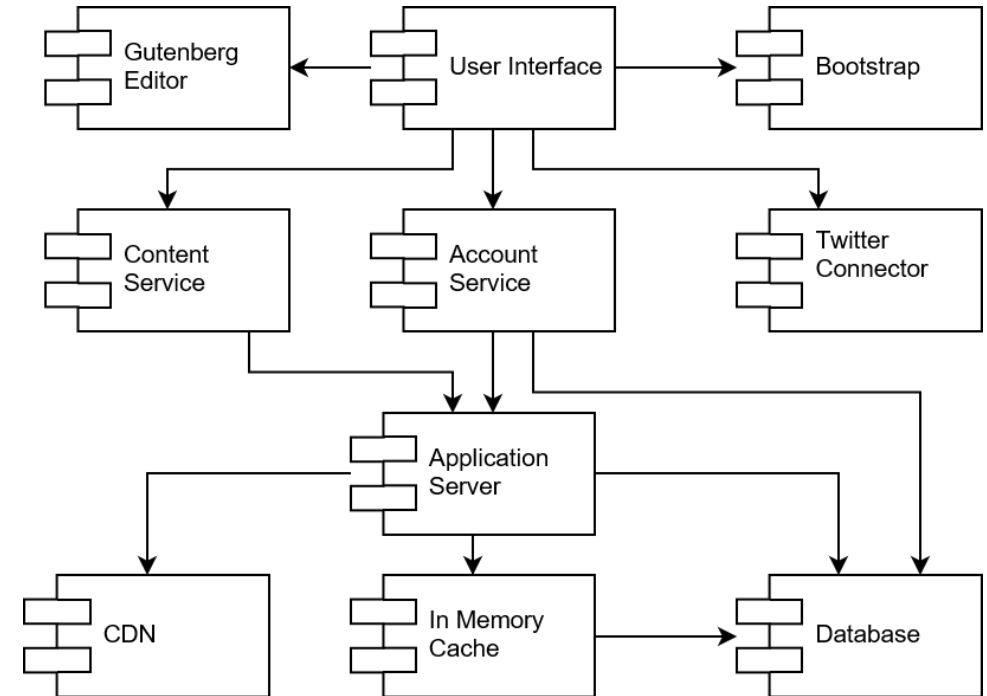
Usage of UML (1)

- Usage of UML package structures
- Bear in mind, there is only *one* view on the architecture
- But you see various levels of abstractions



Usage of UML (2)

- Usage of UML component structure
- This is *another* view on the previous architecture
- Still different levels of abstractions



Acknowledgments

Photographs used under public domain or fair usage. No copyright infringement intended. If used accidentally under wrong license please contact to be removed.