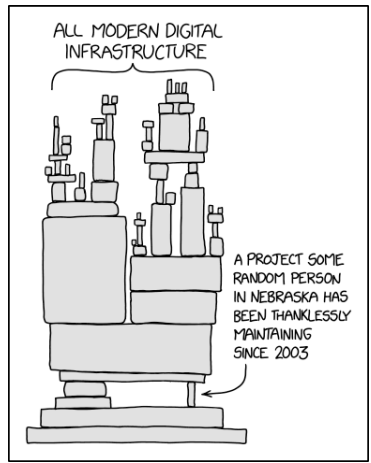
Introduction

Software Architecture

Richard Thomas

February 24, 2025

University of Queensland



Question

What is *Software Architecture*?

Software Architecture is design.

Software Architecture is design.

Design is *not* software architecture.

So...

Software Architecture is hard to define.

Let's hear from an expert

https://www.youtube.com/watch?v=DngAZyWMGR0

Okay so...

Definition 0. Software Architecture

The important stuff; whatever that is.

Question

What do *you* want from this course?

Maybe...

Definition 0. Software Architecture: The Course

A set of tools, processes, and design patterns which enable me to deliver high quality software.

High Quality Software?[1]

Functional Requirements – Functional features to be delivered.

Constraints – Real world constraints on development.

Principles – Ideas adopted to encourage design consistency.

Quality Attributes – Quality of service & cross-cutting concerns.

[1] Yes, "high quality" is intentionally vague.

Functional Requirements

- Architecture must enable delivery of functionality.
- Support interaction model.
  - A mobile dating app may be difficult to deliver using *Pipe and Filter*.
- Don't over architect.
  - A mobile dating app doesn't need a six-layer *PCBMER* architecture.

Constraints

- Externally determined restrictions
- Time and budget
- Technology
  - Interoperability with existing systems
  - Deployment platform
  - Vendor relationships
- People
- Organisation
  - Strategic or tactical system?
  - Politics may limit choices

Principles

- Standards developers are expected to follow
  - Avoid unintentionally breaking the architecture
- e.g. Architectural structure
  - Layering strategy
  - Location of business logic
  - Stateless components

Question

What are *Quality Attributes*?

Question

What are *Quality Attributes*?

Answer

Non-functional requirements for the success of software.

Hint: CSSE3002 / CSSE3012

Quality Attributes: Examples

Modularity Components of the software are separated into *discrete modules*.

Quality Attributes: Examples

Modularity Components of the software are separated into *discrete modules*.

Availability The software is *available to access* by end users, either at any time or on any platform, or both.

Quality Attributes: Examples

Modularity Components of the software are separated into *discrete modules*.

Availability The software is *available to access* by end users, either at any time or on any platform, or both.

Scalability The software can handle peaks of high demand by *taking advantage of available computing resources*.

Quality Attributes: Examples

Modularity Components of the software are separated into *discrete modules*.

Availability The software is *available to access* by end users, either at any time or on any platform, or both.

Scalability The software can handle peaks of high demand by *taking advantage of available computing resources*.

Extensibility Features or extensions can be *easily added* to the base software.

Quality Attributes: Examples

Modularity Components of the software are separated into *discrete modules*.

Availability The software is *available to access* by end users, either at any time or on any platform, or both.

Scalability The software can handle peaks of high demand by *taking advantage of available computing resources*.

Extensibility Features or extensions can be *easily added* to the base software.

Testibility The software is designed so that *automated tests* can be easily deployed.

Problem

Software cannot meet all quality attributes.

“Solution”

Software architects prioritise the important attributes.

"Solution"

Software architects prioritise the important attributes.

---

on a software-by-software basis

Definition 0. The First Law of Software Architecture

[Richards and Ford, 2020]

Everything in software architecture is a trade-off.

Definition 0. Wicked Architecture [Galster and Angelov, 2016]

There are often *no clear problem descriptions*, *no clear solutions*, good or bad solutions, *no clear rules* when to "stop" architecting and mostly team rather than individual work.

Definition 0. Wicked Architecture [Galster and Angelov, 2016]

There are often *no clear problem descriptions*, *no clear solutions*, good or bad solutions, *no clear rules* when to "stop" architecting and mostly team rather than individual work.

Don't expect "clean" solutions.

Why now?

Architecture is more important today thanks to *expectations* and *infrastructure*.

Big design up front is dumb.

Doing no design up front is even dumber.

– *Dave Thomas*

References

[Galster and Angelov, 2016] Galster, M. and Angelov, S. (2016).
What makes teaching software architecture difficult?
In *Proceedings of the 38th International Conference on Software Engineering Companion*, ICSE '16, pages 356–359. Association for Computing Machinery.

[Richards and Ford, 2020] Richards, M. and Ford, N. (2020).
Fundamentals of Software Architecture: An Engineering Approach.
O'Reilly Media, Inc.