

# Introduction

## *Software Architecture*

Richard Thomas

February 20, 2023

*University of Queensland*



*Question*

What is *Software Architecture*?

*Software Architecture* is design.

*Design* is not software architecture.

*But...*

*Software Architecture* is hard to define.

*Let's hear from an expert*



---

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

*Okay so...*

*Definition 1.* Software Architecture

The important stuff; whatever that is.

*Question*

What do *you* want from this course?

*Maybe...*

*Definition 2.* Software Architecture: The Course

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



# High Quality Software?<sup>1</sup>

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 and cross-cutting concerns.

---

<sup>1</sup>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.

## 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.

**Testability** 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.

### *Definition 3.* The First Law of Software Architecture

*[Richards and Ford, 2020]*

Everything in software architecture is a trade-off.

*Definition 4. 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 5. 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.