Architectural Skills

CSSE6400

Richard Thomas

May 26, 2025

Architecture is the stuff you can't Google.

 – Mark Richards *[Richards and Ford, 2020]*

There are no right or wrong answers in architecture—only trade-offs.
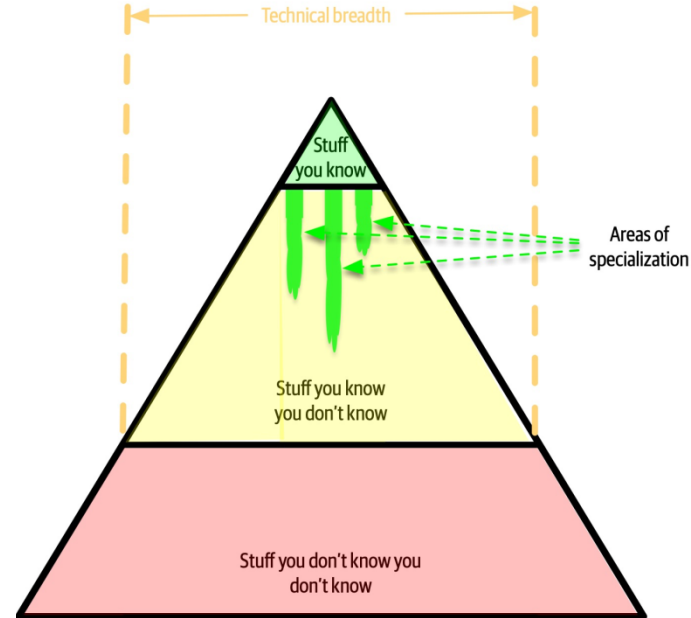
– Neal Ford [Richards and Ford, 2020]

Architectural Design

Architects use knowledge and experience to analyse trade-offs to design architectures appropriate to the system context.

Developers – Technical Depth [Richards and Ford, 2020]

Architects – Technical Breadth [Richards and Ford, 2020]

- Architects need greater technical breadth than depth.
- Breadth allows better consideration of trade-offs.
- Avoid trying to become an expert across many areas.
  – you'll fail
- Don't stop learning – increase your breadth.
  – don't let your knowledge become stale

> **Definition 0.** Conway's Law
>
> Organisations design systems whose structure is inevitably a copy of the organisation's communication structure *[Conway, 1968] [MacCormack et al., 2012]*.

- First citation is original article.
- Second is one of several about MIT and Harvard research into the phenomenon, calling it the *mirroring hypothesis*.
  - Compared open source to commercial packages (e.g. Linux to Solaris).
- Elaborate on this point and Coplien's research into organisational sociology.
- Reasons
  - Governance structures constrain communication paths.
  - This constrains space in which to search for solutions, constraining problem solving approaches.

- Business Process Management

- Microservices to reflect organisation structure

- Teams formed around services

- BPM: Redesign organisation structure to reflect system you want.

- Microservices: Design system to reflect your organisation.

- Elaborate on benefits of both approaches.

- Comment on benefits of small focused teams.

Team insularity – more loyal to team than organisation.

- Amazon order tracking example from 2022 week 11.
  - Negotiation difficulties with other teams.
- Need to ensure inter-team cooperation.
- Possibly move people between teams.
- Microservices can encourage insularity.
- Many teams can also encourage insularity.
- Intra-team communication becomes more difficult with large teams.

Conway's Law Issues

- Cross-cutting concerns
  - e.g. Security

- Organisation structure should align with market structure

- Physical location of teams

- Cross-cutting concerns span services, & consequently teams.
- Can't have a "security" service.
  - Needs to be part of every service.
- Teams solely based around Conway's law and services may not deliver some cross-cutting concerns.
- Cooperation, documentation and audits may be necessary.
- Market structure may complement team structure to place teams closer to their end users.
- Global development and outsourcing mean different teams are likely to be in different locations.
- Requires additional overhead and documentation for cooperation between teams.

Definition 0. Peopleware

People involved in development of systems.
– Peter G. Neumann (1977)

Stakeholders [Coplien and Bjørnvig, 2010]

- End users

- Organisation

- Customers / Sponsors

- Domain Experts

- Developers

- Organisation for whom system is being developed.

- Customers / Sponsors are those who are responsible for the end user's work process (e.g. managers).

- Domain Experts understand details of problem and/or solution domain.

Communication

- Written
  - For those who are not there

- Oral
  - Immediate & interactive

- Both apply to all types of stakeholders.
- Time Dimension: Written is available in the future.
- Extent of either depends on SE process.
- Extent also depends on engagement of each type of stakeholder.
- Technical Documentation guest lecture in week 10 only touched on written for developers.

Circumventing Conway's Law [Woods, 2017]

- Cloud Platforms

- Microservices

- APIs

- *Culture*

- Culture is most important
- Easily deployed & accessible services with good APIs opens possibility of communication outside of organisation silos.

Don't follow fads, seek evidence for good practice.

Elaborate on finding reliable sources of information and confirming facts yourself.

Software Engineering's Greatest Hits

**what we actually know about software development
and why we believe it's true**

Greg Wilson

https://youtu.be/HrVtA-ue-x0

References

[Conway, 1968] Conway, M. E. (1968).
How do committees invent?
Datamation.

[Coplien and Bjørnvig, 2010] Coplien, J. O. and Bjørnvig, G. (2010).
Learn Architecture for Agile Software Development.
Wiley.
https://www.amazon.com/
Lean-Architecture-Agile-Software-Development/dp/0470684208.

[MacCormack et al., 2012] MacCormack, A., Baldwin, C., and Rusnak, J. (2012).
Exploring the duality between product and organizational architectures: A test
of the "mirroring" hypothesis.
Research Policy, 41(8):1309–1324.

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

[Woods, 2017] Woods, D. (2017).
  How platforms are neutralizing conway's law.
  https://www.forbes.com/sites/danwoods/2017/08/15/
  how-platforms-are-neutralizing-conways-law/.