Architectural Skills

CSSE6400

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Quote

Architecture is the stuff you can't Google.

– Mark Richards [Richards and Ford, 2020]

Quote

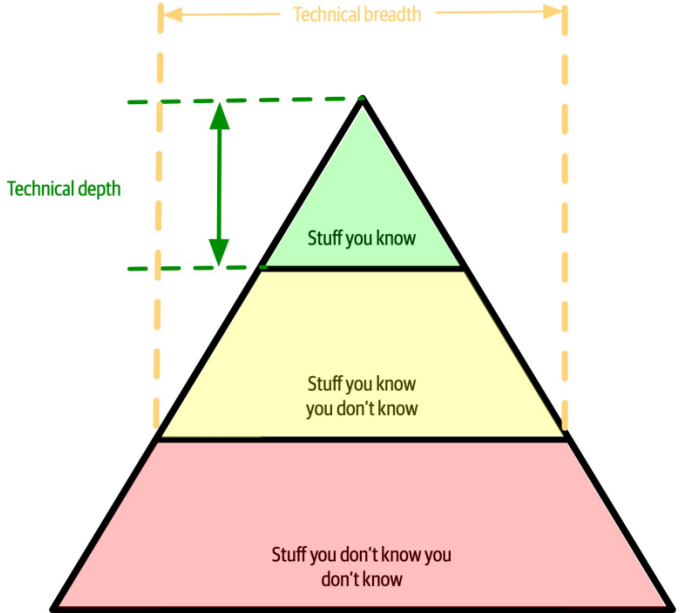
There are no right or wrong answers in architecture—only trade-offs.

– Neal Ford [Richards and Ford, 2020]

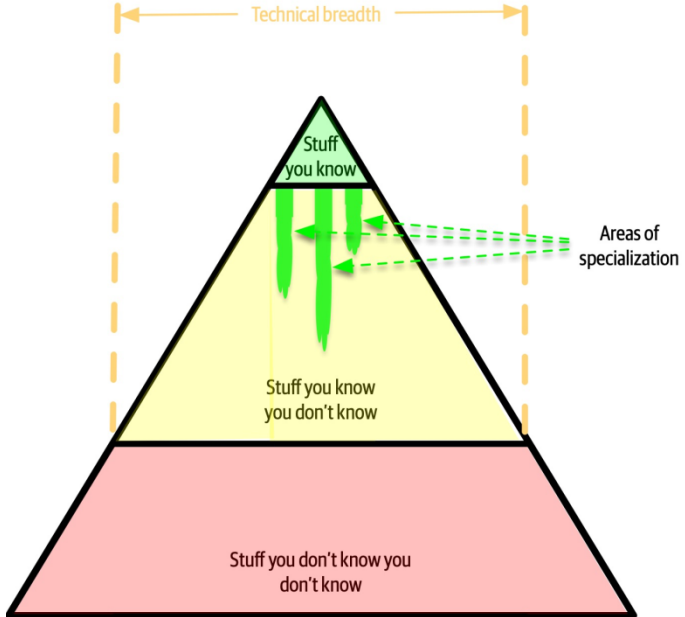
Architectural Design

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 1. 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.

Conway's Law Consequences

- 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.

Conway's Law Consequences

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 2. 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.

- 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.

Evidenced-Based Software Engineering

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

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

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/.