Architectural Skills

CSSE6400

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Quote

Architecture is the stuff you can't Google.

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

Quote

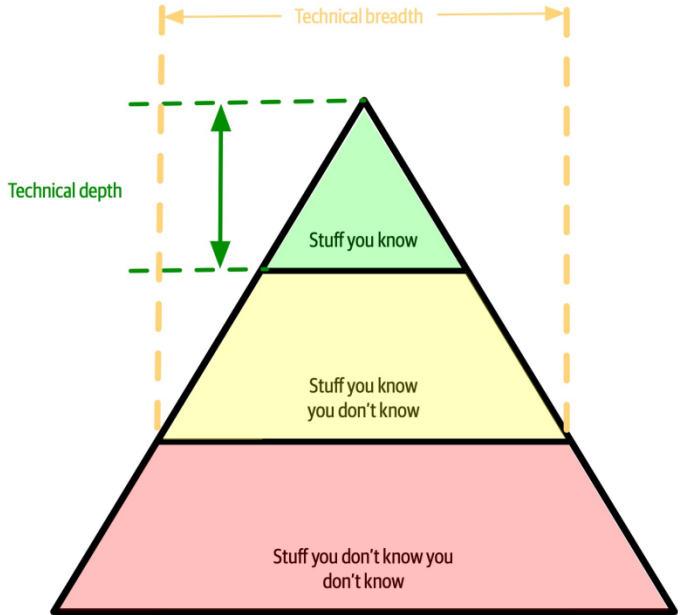
There are no right or wrong answers in architecture—only trade-offs.

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

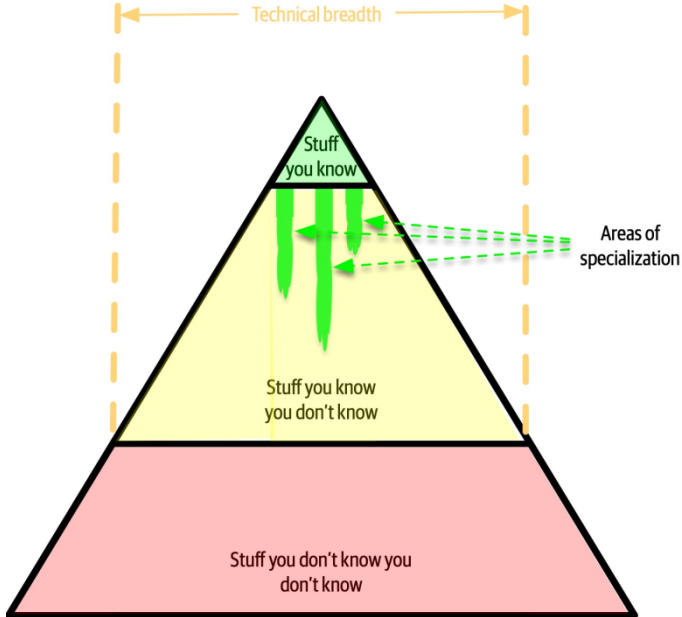
Architectural Design

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]*



Question

What are the benefits of a monolith architecture?

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Answer

- Simple deployment

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- Simple communication between modules

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- Simple deployment
- Simple communication between modules
- Simple system testing & debugging

Question

Why do monoliths have a bad name?

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- Many legacy system nightmares were monoliths
- Easy to defeat modularity
- Cannot scale components of system
- Monolith databases scale poorly

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What can be done if a monolith architecture is no longer suitable?

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Answer

- Greenfields replacement

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- Greenfields replacement
- Migrate to another architecture

Question

How do I migrate a monolith to a new architecture?

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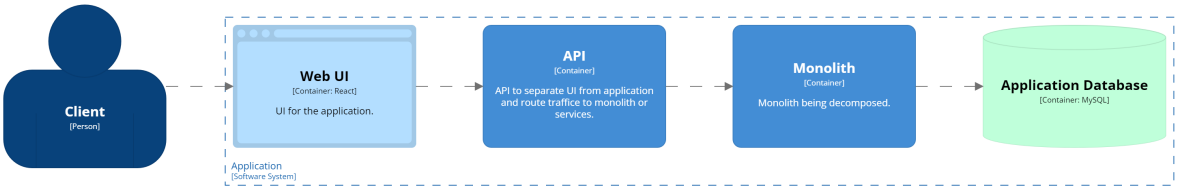
Answer

Decompose the monolith into services.

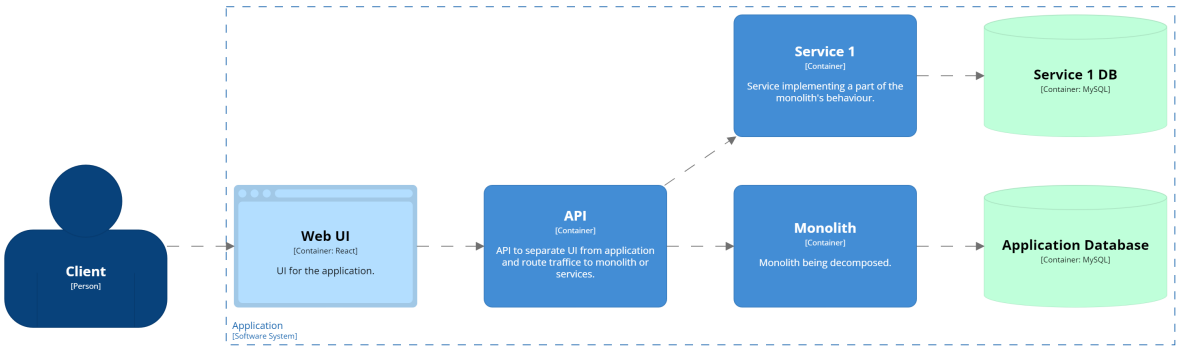
Strangler Fig Pattern

- Develop API for application's UI
- Proxy intercepts API calls
  - Proxy directs calls to application or new services
- Implement a service
  - Redirect calls to service
- Progressively replace monolith
- Shadow & Blue-Green Deployment

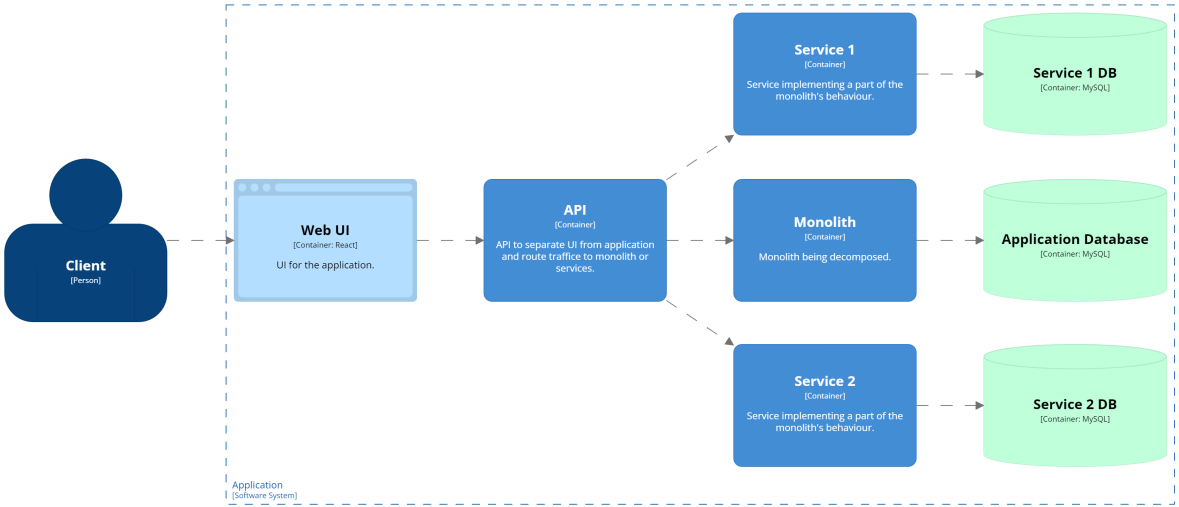
Monolith Deployment



Monolith Decompose: Step 1



Monolith Decompose: Step 2



Decomposition Process

- Identify bounded-contexts
- Simple first service
  - e.g. Authentication
- Minimise dependency from services to monolith
  - Monolith may use services

Decomposition Process

- Reduce coupling between bounded- contexts
  - e.g. Customer account management
    - Profile, Wish List, Payment Preferences – separate services
- Decouple vertically
  - Service delivers entire bounded-context
    - Data is decoupled from monolith

Decomposition Process

- Focus on pain points
  - Bottlenecks
  - Frequently changing behaviour
- Rewrite, don't reuse
  - Redesign for new infrastructure
  - Reuse complex logic
    - e.g. Discounts based on customer loyalty and behaviour, bundle offers, ...

Atomic Decomposition

- Refactor monolith
  - Use service to deliver application functionality
    - Monolith may need to invoke service
  - Remove service logic from monolith

Stepwise Decomposition

Replace application functionality one service at a time.

Definition 1. Macroservice

Separate service, but may span more than one domain or share a database with the monolith or other services.

Definition 2. Nanoservice

Service that depends on other services and cannot be deployed independently – its context is too small.

Definition 3. Conway's Law

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

Conway's Law Consequences

- Business Process Management
- Microservices to reflect organisation structure
- Teams formed around services

Conway's Law Consequences

Team insularity – more loyal to team than organisation.

Conway's Law Issues

- Cross-cutting concerns
  - e.g. Security
- Organisation structure should align with market structure
- Physical location of teams

Evidenced-Based Software Engineering

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

Let's hear from an expert

Software Engineering's Greatest Hits

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

Greg Wilson

http://third-bit.com/talks/greatest-hits/

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

References

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

[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.