

# 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]*



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

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- 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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- 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/>



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## 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.