

What is **Software Architecture**... and **an overview**.

PV260 Software Quality



Ondřej “Ondra” Krajíček
ondrej.krajicek@ysoft.com
@OndrejKrajicek



“Perfection is not achieved when there is nothing to add, but
when there is nothing to remove.”

Antoine de Saint Exupéry

“Insanity is doing the same thing over and over and expecting different results.”

(attributed to) Albert Einstein

“It has to work.”

IETF RFC 1925

Software Architecture is seldom about functional requirements.

THE SOFTWARE



IN REALITY

THE SOFTWARE IN DEMO



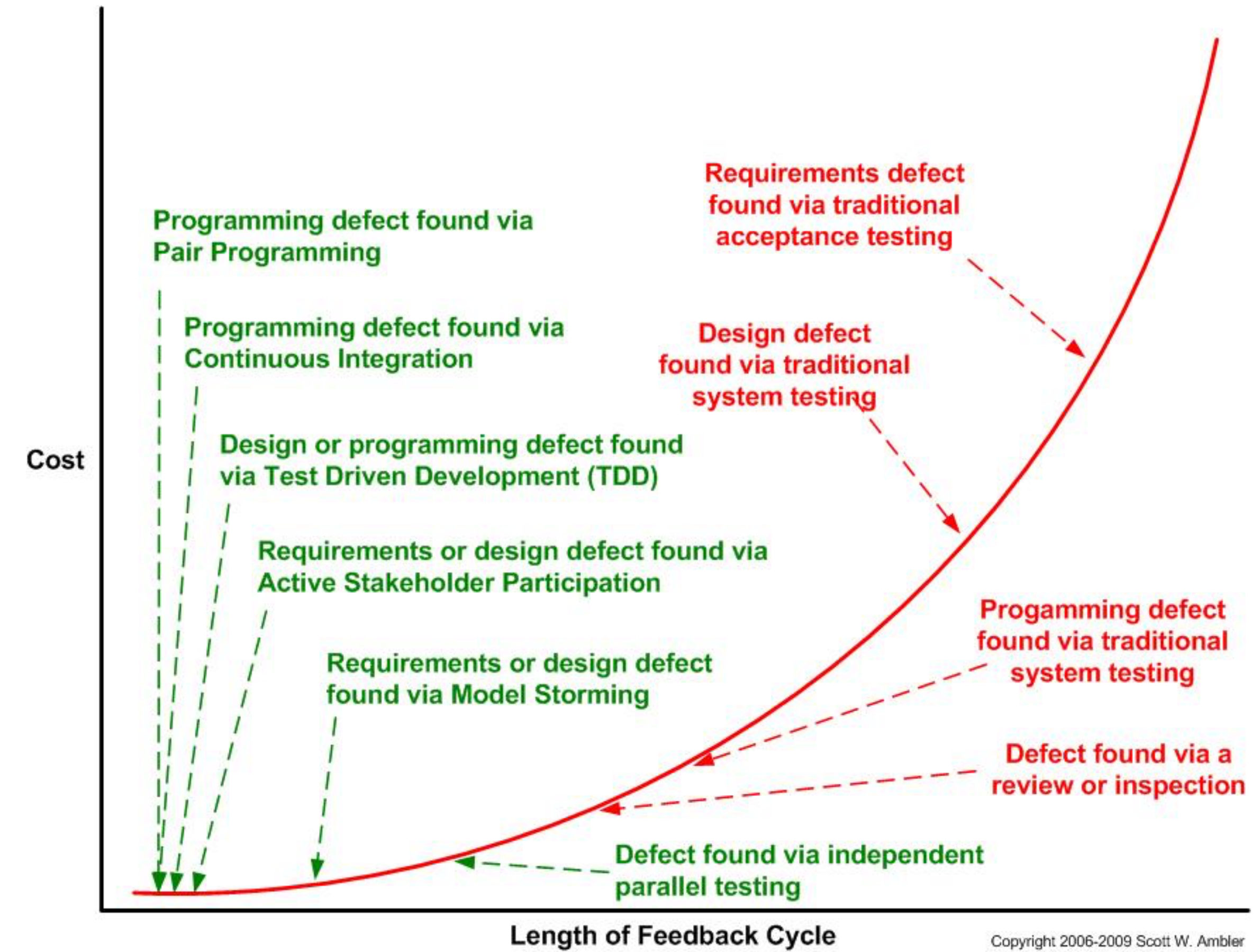
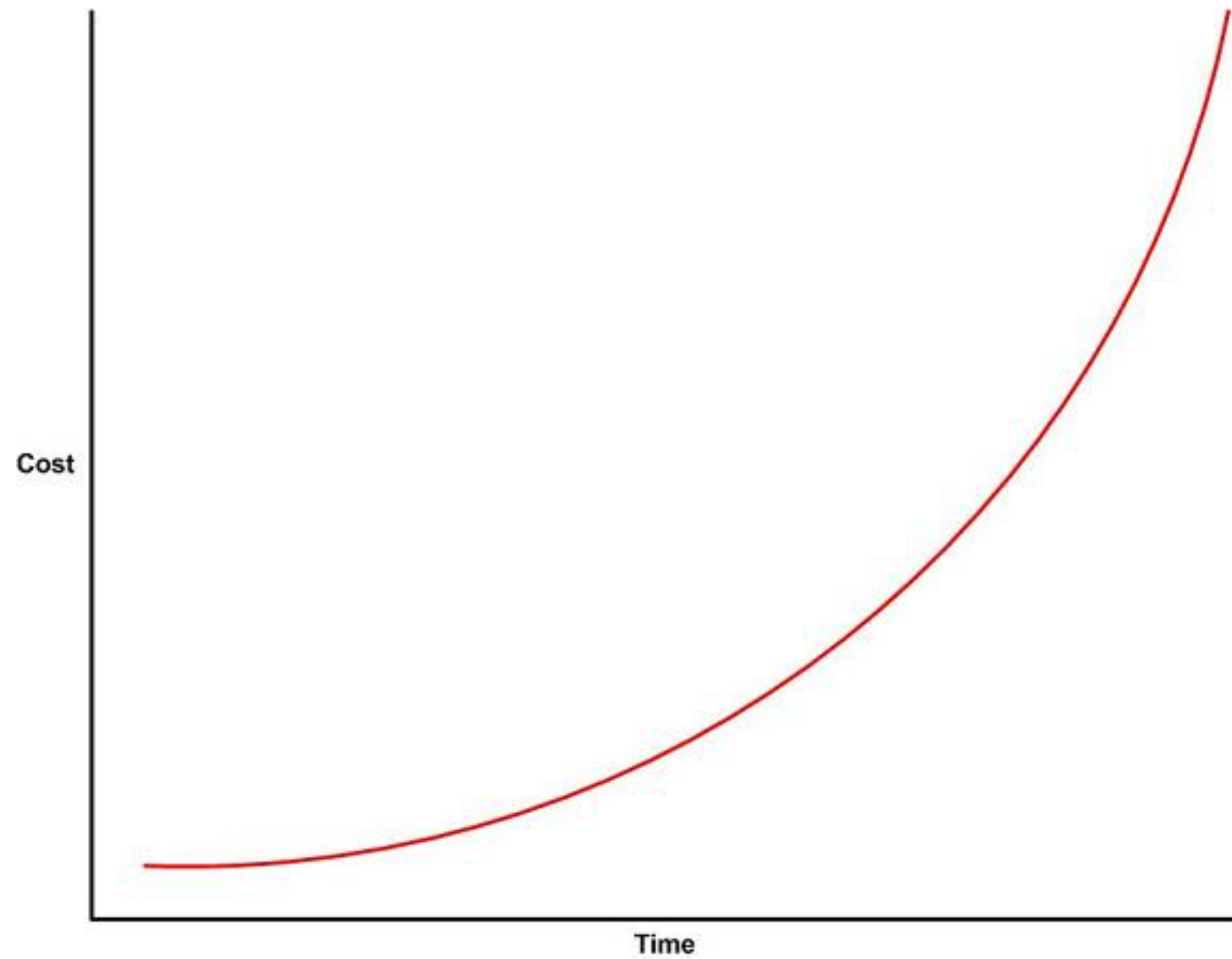
TO THE CUSTOMERS

Software Architecture is the important stuff
(whatever that is).

Ralph Johnson

Cost of Change Curve

Copyright (c) 2006-2009 Scott W Ambler



Copyright 2006-2009 Scott W. Ambler

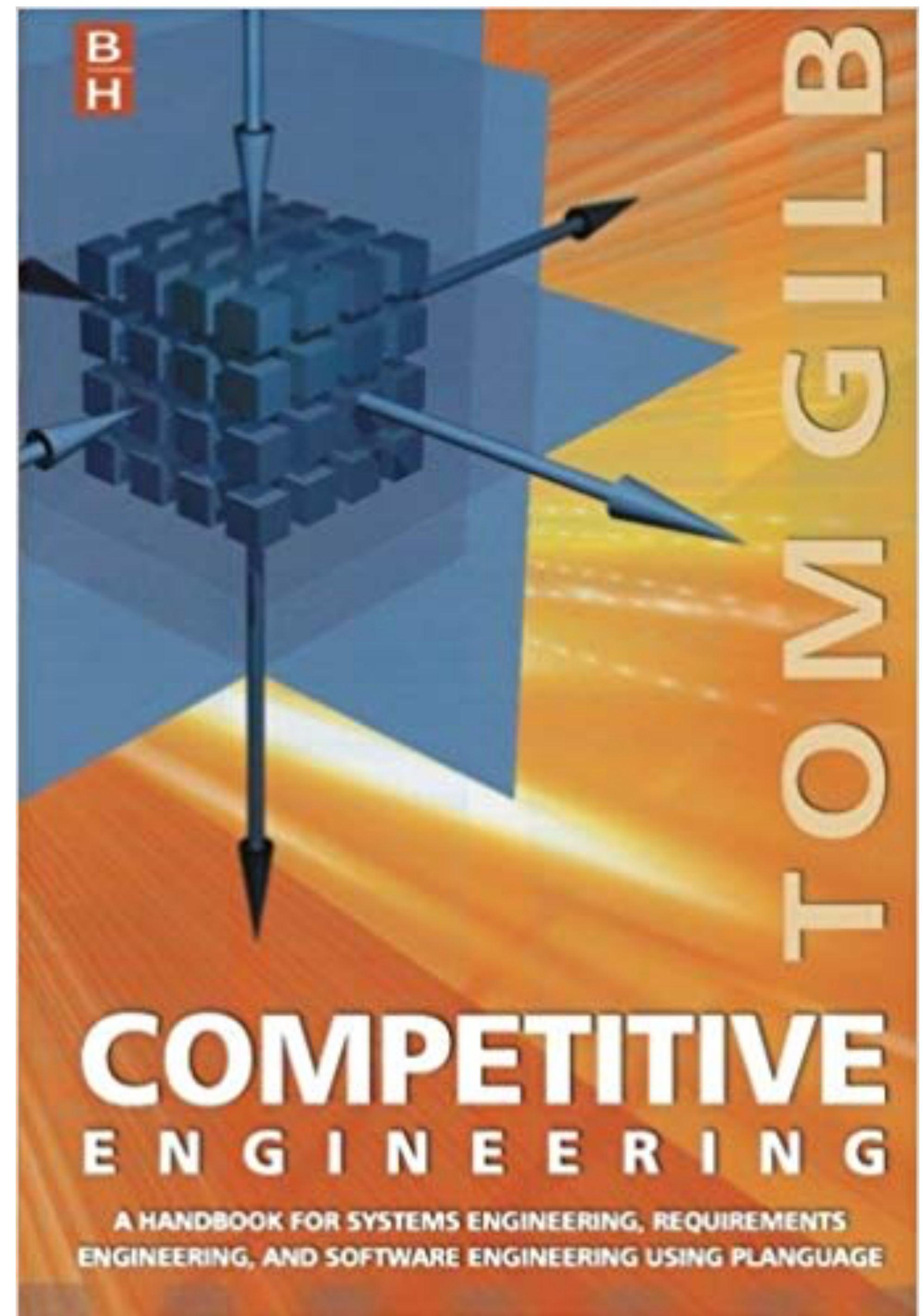
Cost of Change Curve

Copyright (c) 2006-2009 Scott W Ambler

**SOFTWARE ARCHITECTURE IS THE
SERVANT OF HIGH-PRIORITY
STAKEHOLDER VALUES.**

IS AS SIMPLE AS POSSIBLE, BUT NOT
SIMPLER AND IS DESIGNED TO BE
REPLACEABLE.

Tom Gilb (Architecture Manifesto)



SERVANT

HIGH-PRIORITY

STAKEHOLDER

VALUES

AS SIMPLE AS POSSIBLE

NOT SIMPLER

REPLACEABLE

Software Architecture is **Strategy**

Strategy is a plan how to deliver on your goals. Your goals are defined by high-priority stakeholders.

SOFTWARE ARCHITECTURE **IS THE STRATEGY HOW TO
DELIVER HIGH-PRIORITY STAKEHOLDER VALUES.**

SOFTWARE ARCHITECTURE **IS THE STRATEGY HOW TO DELIVER HIGH-PRIORITY STAKEHOLDER VALUES.**

It is still important to **accept change** because no battle plan survives the first contact with the enemy.

Software Architecture is **Risk Mitigation**

What happens when things go wrong? Is it important?

Software Architecture is **Communication**

What does it mean? How to deliver and protect stakeholder values?

Software Architect is a **Teacher**



Who **does** software architecture then?

Who **does** software architecture then?

Software Architecture is done by **everyone**.

60 Minutes Software Architecture Crash Course

Architectural Styles

- Tiered Architecture
- Hexagonal Architecture
- Onion Architecture
- Object Oriented Architecture
- Service Oriented Architecture
- Microservices

Which one is the best one?



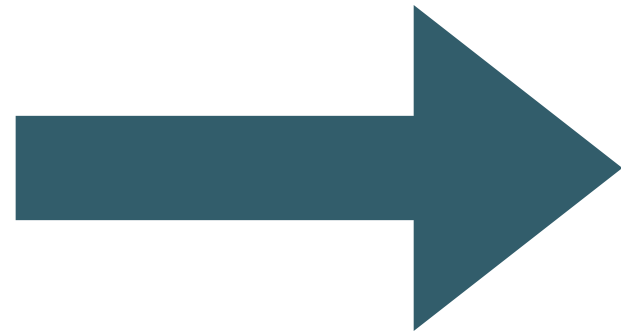
- **Consistency**

- **Consistency**
- **Cohesion**

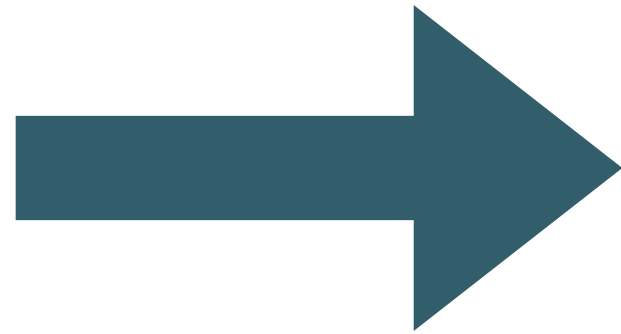
- **Consistency**
- **Cohesion**
- **Coupling**

- **Consistency**
- **Cohesion**
- **Coupling**
- **Clarity**

- **Consistency**
- **Cohesion**
- **Coupling**
- **Clarity**



- **Consistency**
- **Cohesion**
- **Coupling**
- **Clarity**



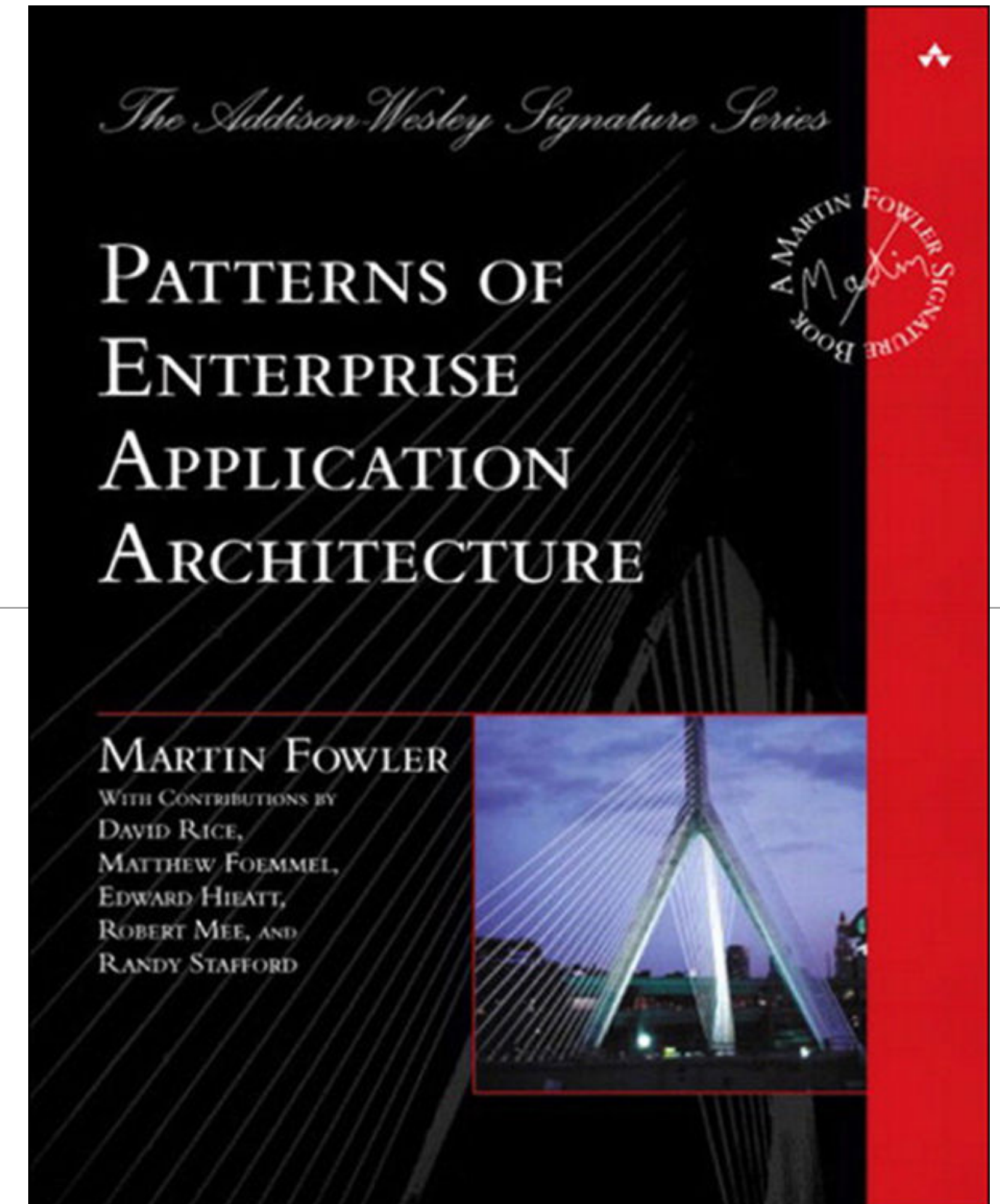
**Cost of
Change**

Principles over Patterns.

Consistency

Principles over Patterns.

Consistency



Principles over Patterns.

Consistency

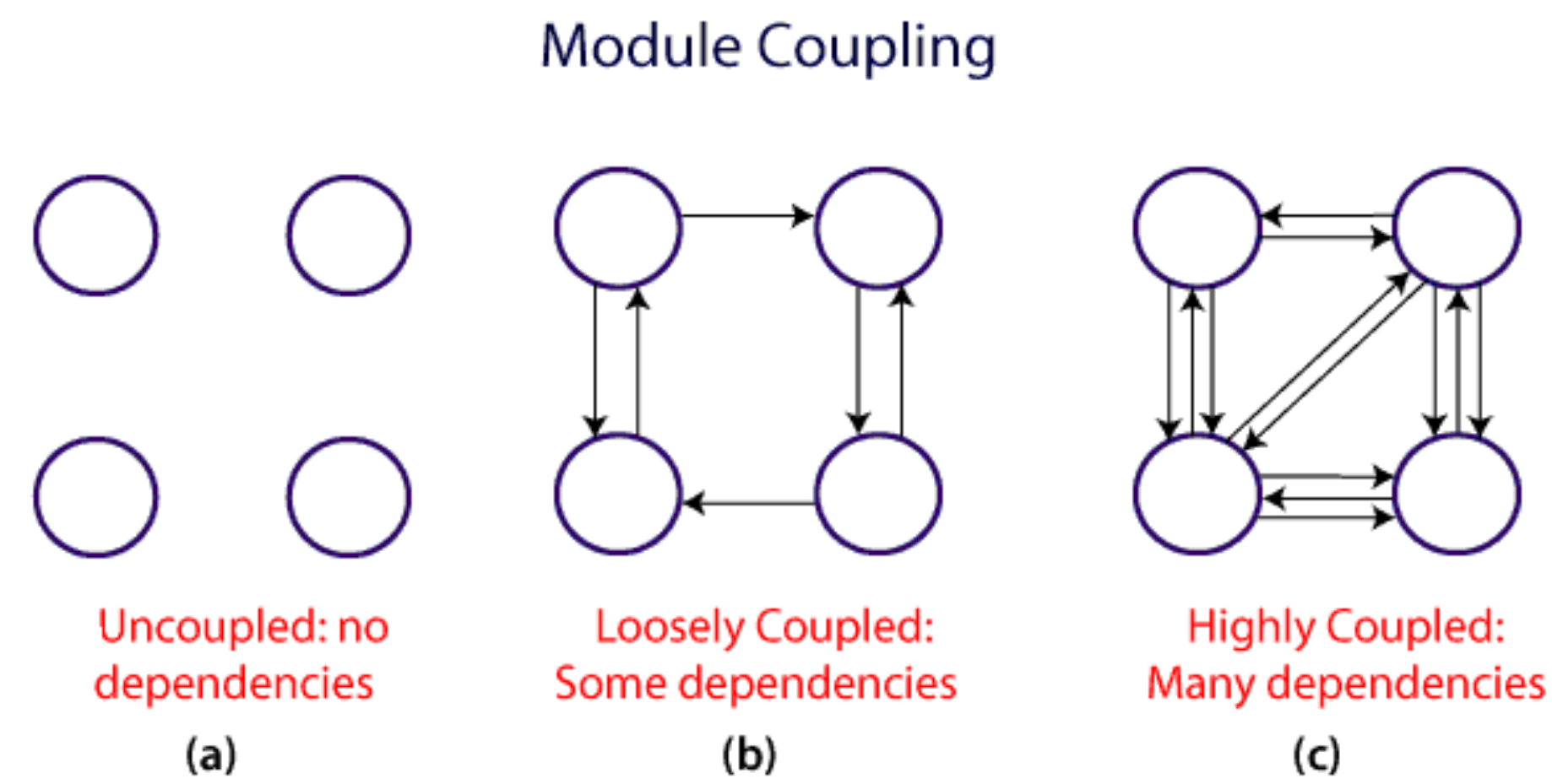


Module, Data, Service, Interaction Dependencies.

Coupling

Module, Data, Service, Interaction Dependencies.

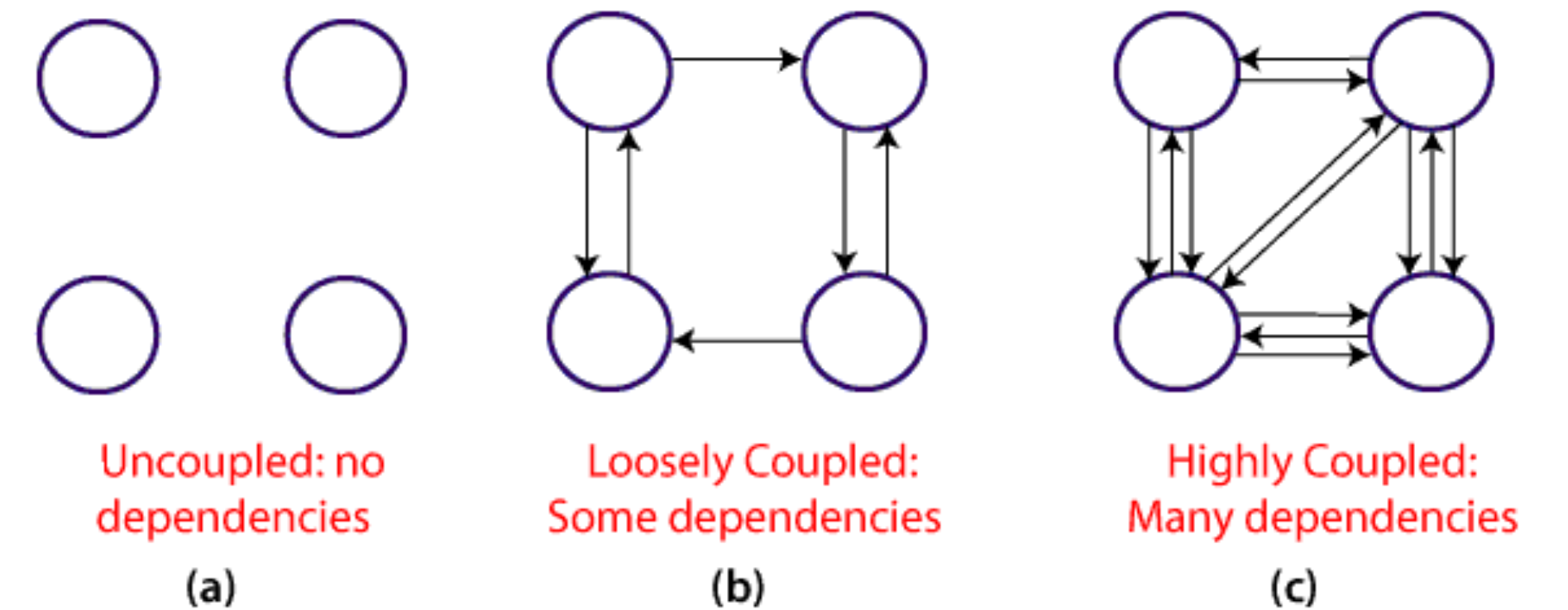
Coupling



Module, Data, Service, Interaction Dependencies.

Coupling

Module Coupling



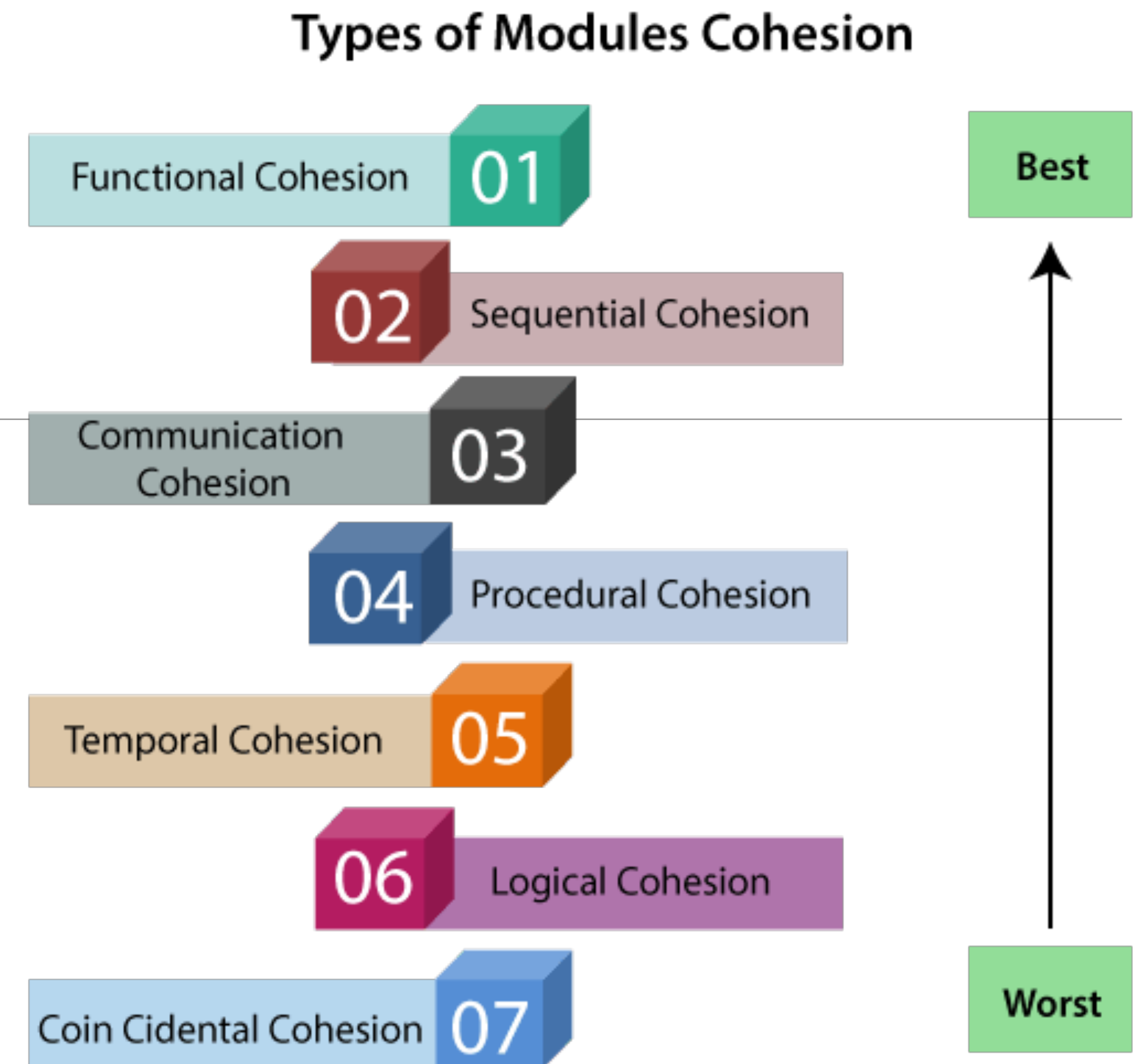
<https://www.javatpoint.com/software-engineering-coupling-and-cohesion>

Well-Designed or Leaking Abstractions.

Cohesion

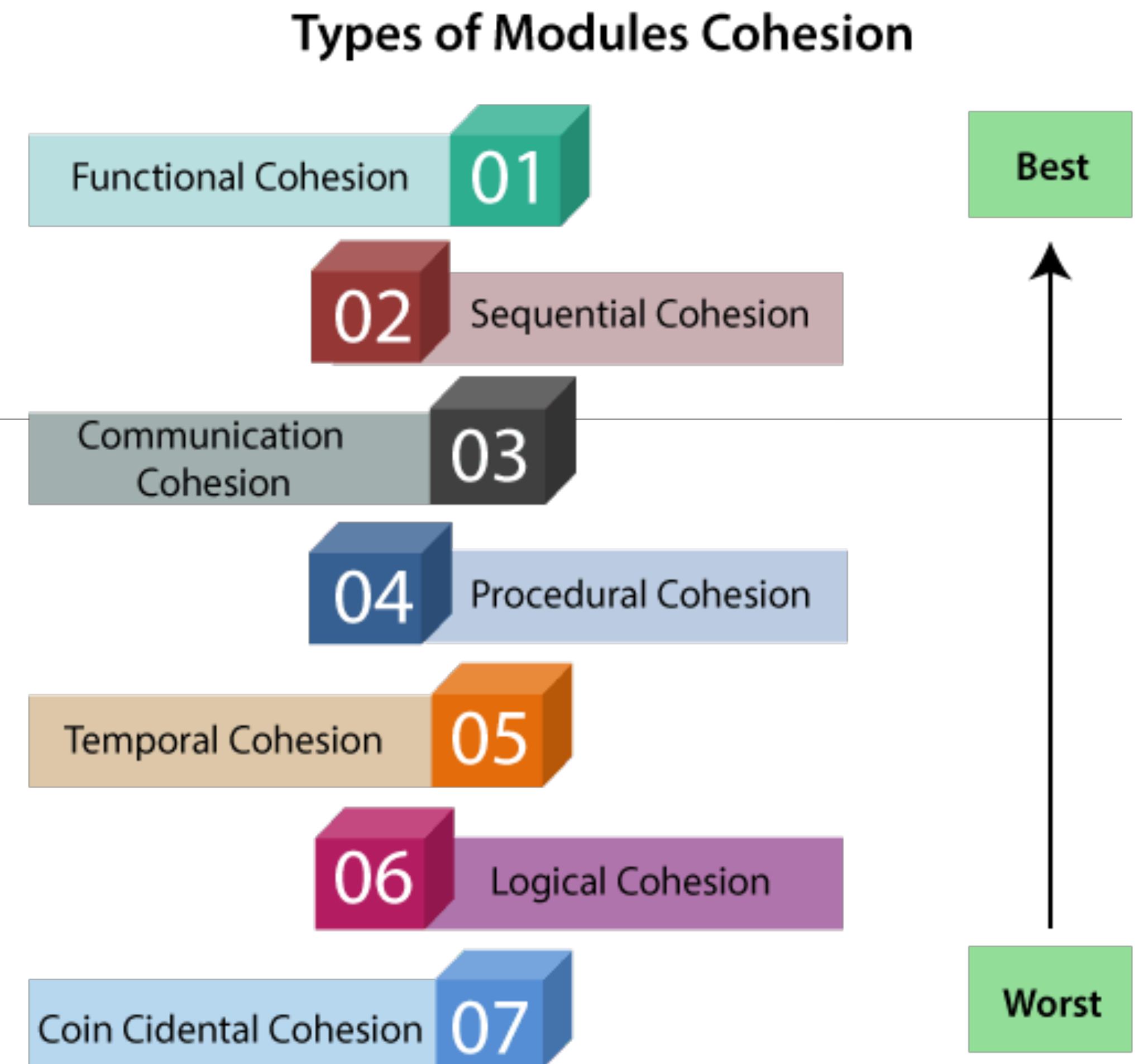
Well-Designed or Leaking Abstractions.

Cohesion



Well-Designed or Leaking Abstractions.

Cohesion

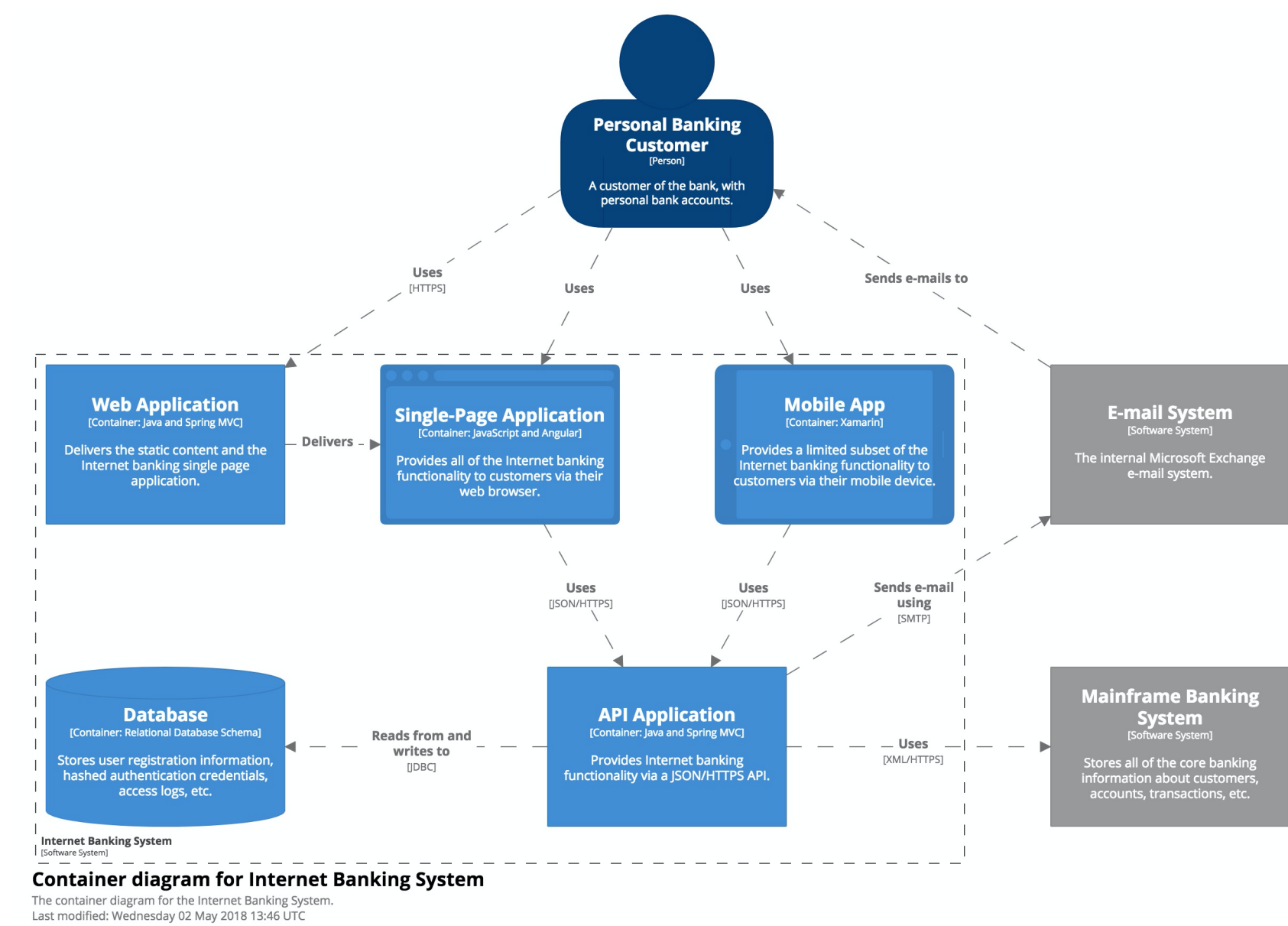


Everyone understands why, how and what to do. System deteriorates slower and technical debt does not grow quickly.

Clarity

Everyone understands why, how and what to do. System deteriorates slower and technical debt does not grow quickly.

Clarity



Replaceable Architecture

Wait, what?



Osaka Castle



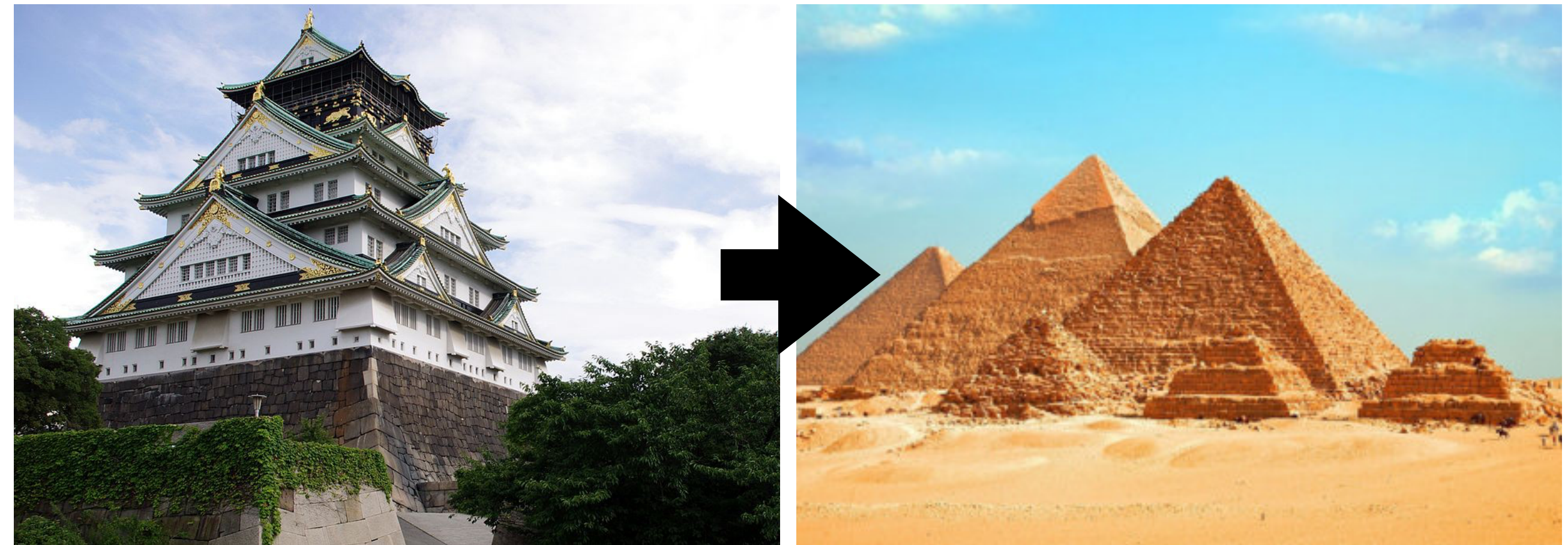
Giza Pyramids

- Built to last: hundreds and thousands of years.

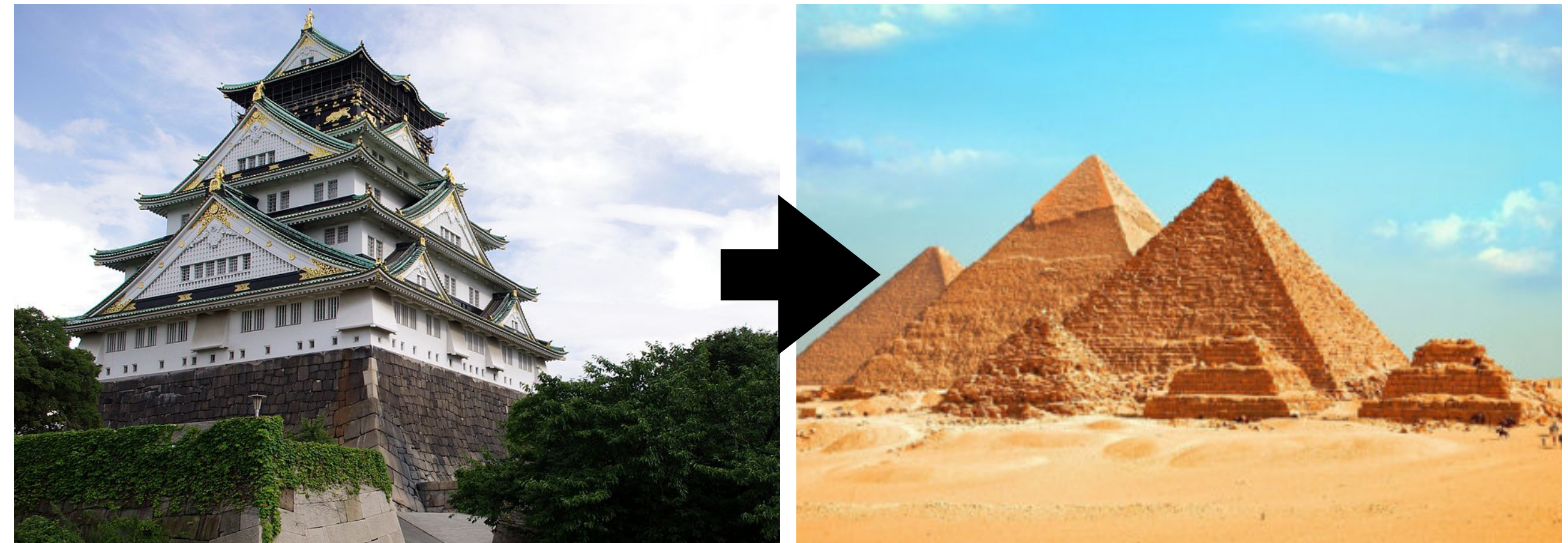
- Built to last: hundreds and thousands of years.
- Built to survive natural disasters, especially earthquakes (shinbashira).

- Built to last: hundreds and thousands of years.
- Built to survive natural disasters, especially earthquakes (shinbashira).
- Both have very different architecture.

- Built to last: hundreds and thousands of years.
- Built to survive natural disasters, especially earthquakes (shinbashira).
- Both have very different architecture.
- You cannot replace one with the other.



- Built to last: hundreds and thousands of years.
- Built to survive natural disasters, especially earthquakes (shinbashira).
- Both have very different architecture.
- You cannot replace one with the other.
- Why would you?

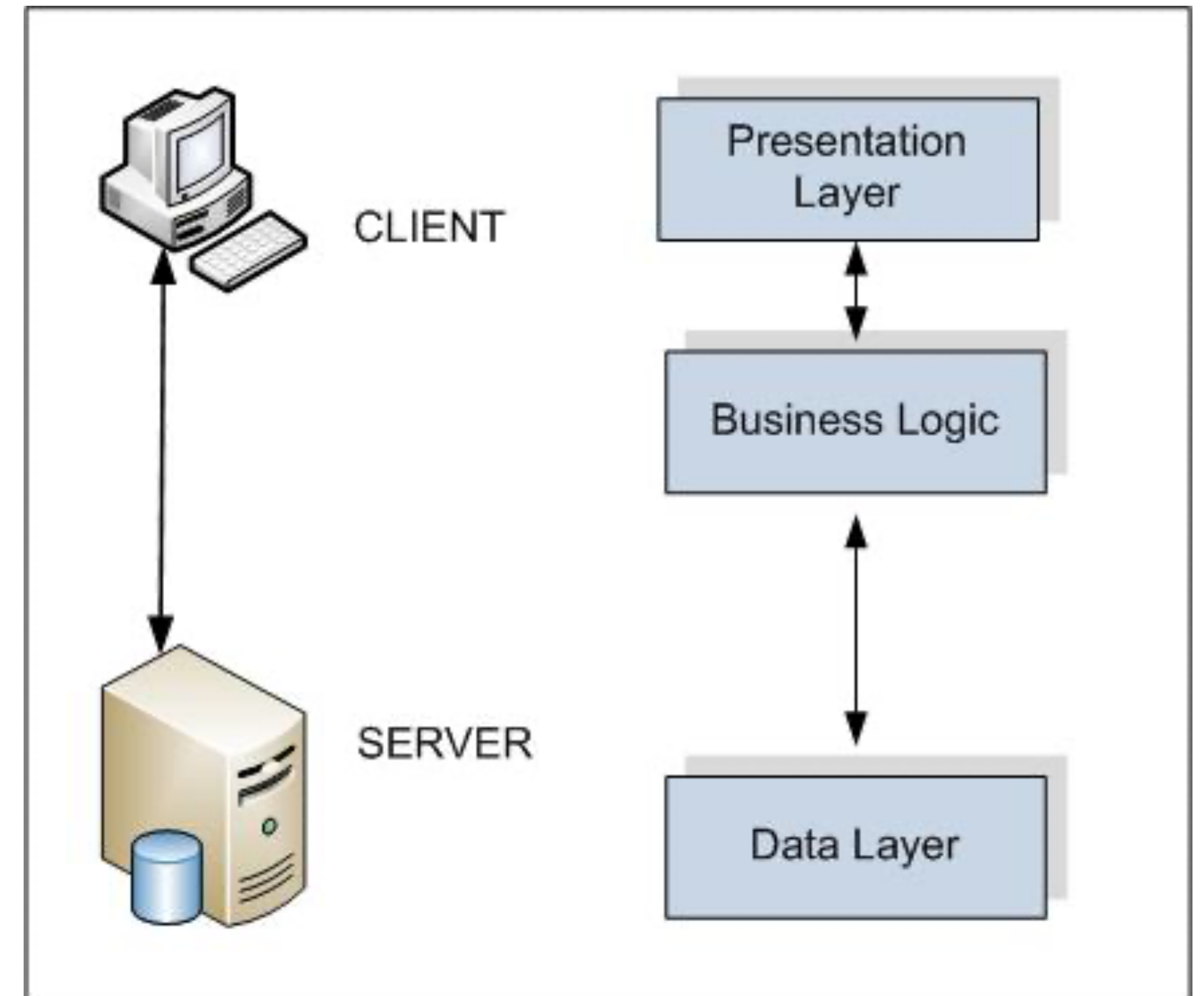


Replaceable as in ***Having rather low Cost of Change***

How to decrease Cost of Change?

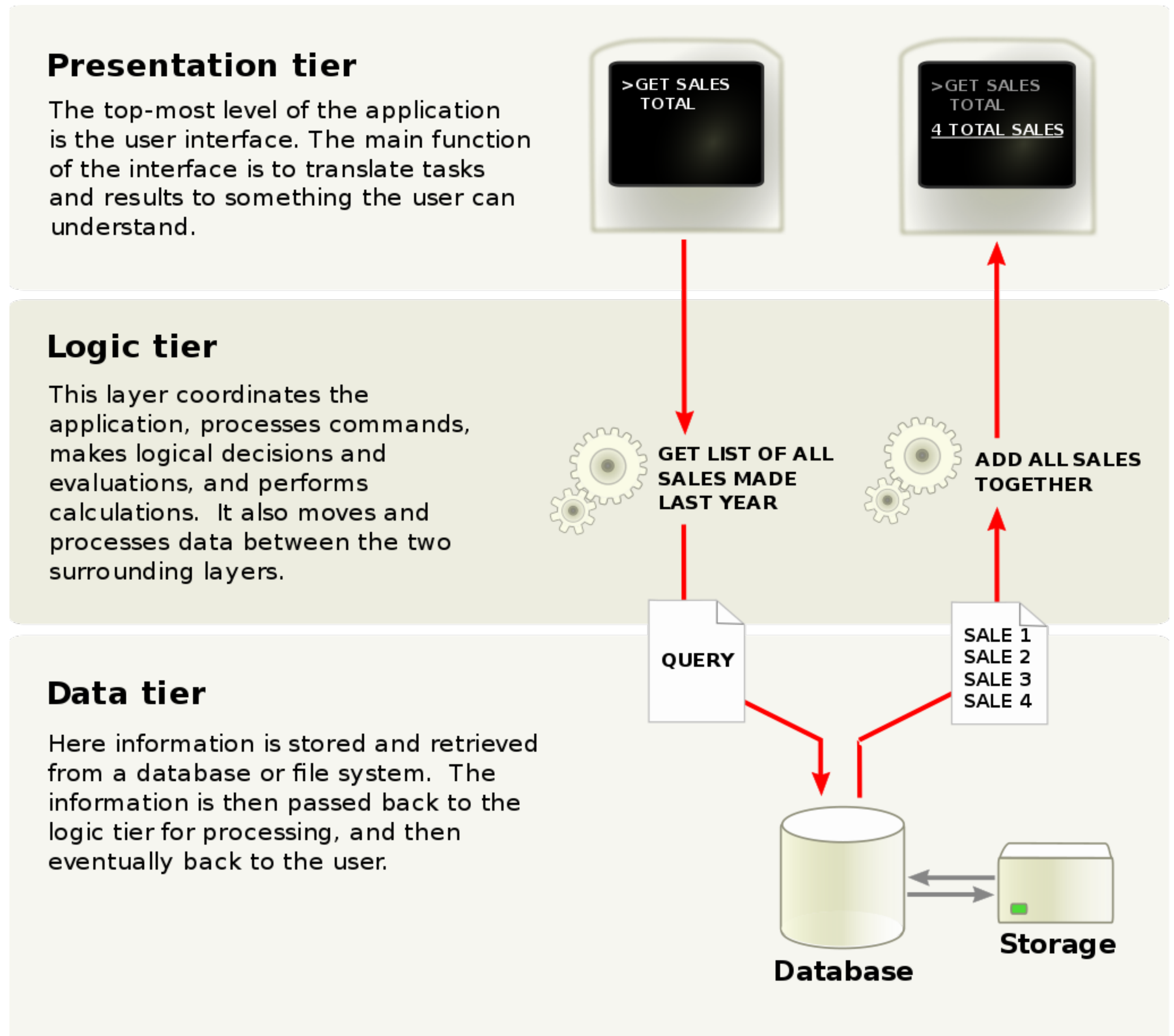
2-Tier Architecture

- Original Client / Server
- Business Logic is implemented on the client, server or both.
- What are the issues?



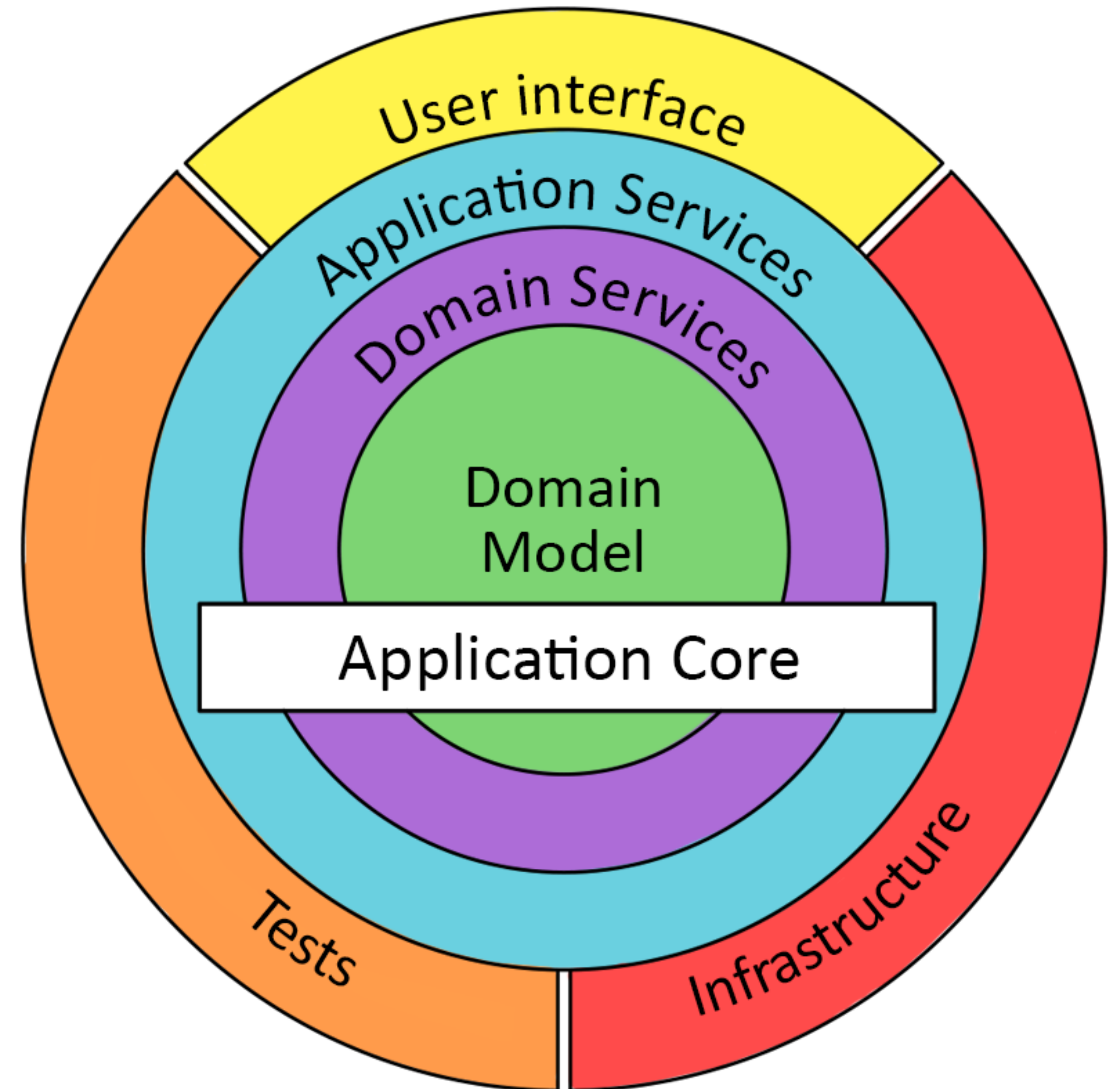
3-Tier Architecture

- Decouple presentation from business logic. Business logic is isolated from client and server.
- Business layer often historically hosted in *application* servers with obscure technologies (j2ee, Microsoft ASP, PHP, ColdFusion, etc.).
- How is it different from 2-Tier?



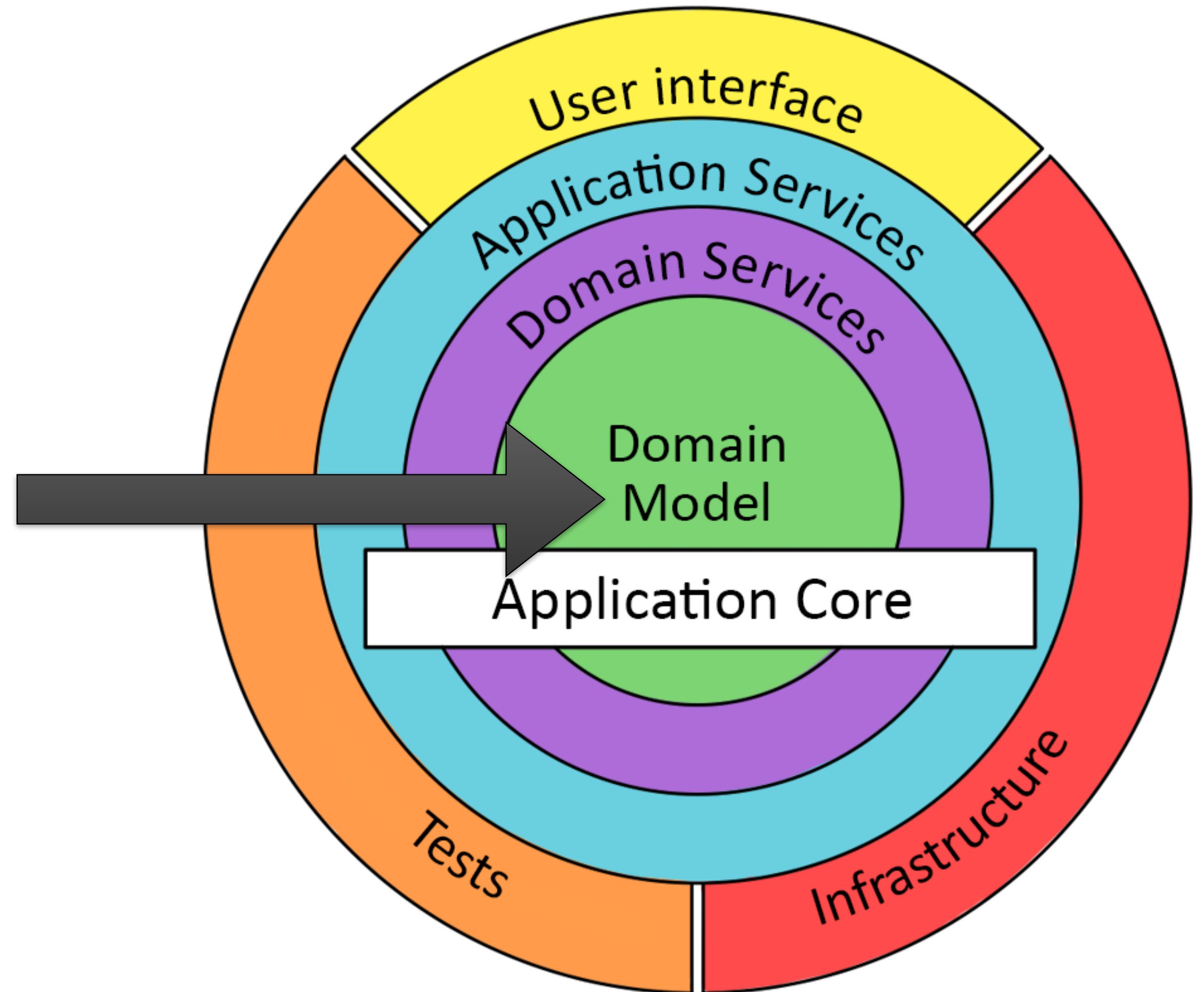
Onion Architecture

- Built on the observation that most / all interfaces are alike.
- Outer layers depend on inner layers.
- Inner layers must not depend on outer layers.
- Enforces Inversion of Control.
- How is it different from N-Tier?



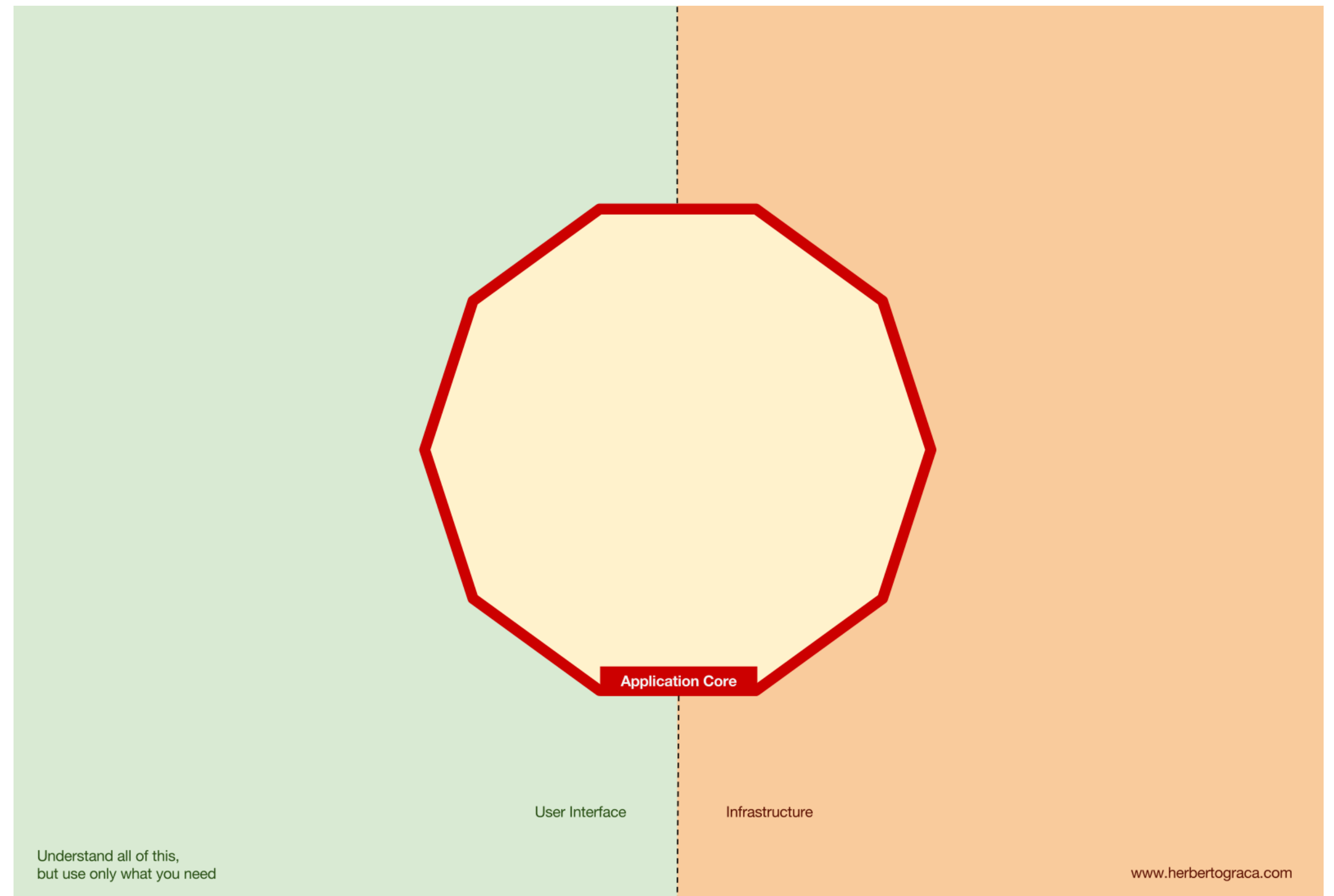
Onion Architecture

- Built on the observation that most / all interfaces are alike.
- Outer layers depend on inner layers.
- Inner layers must not depend on outer layers.
- Enforces Inversion of Control.
- How is it different from N-Tier?



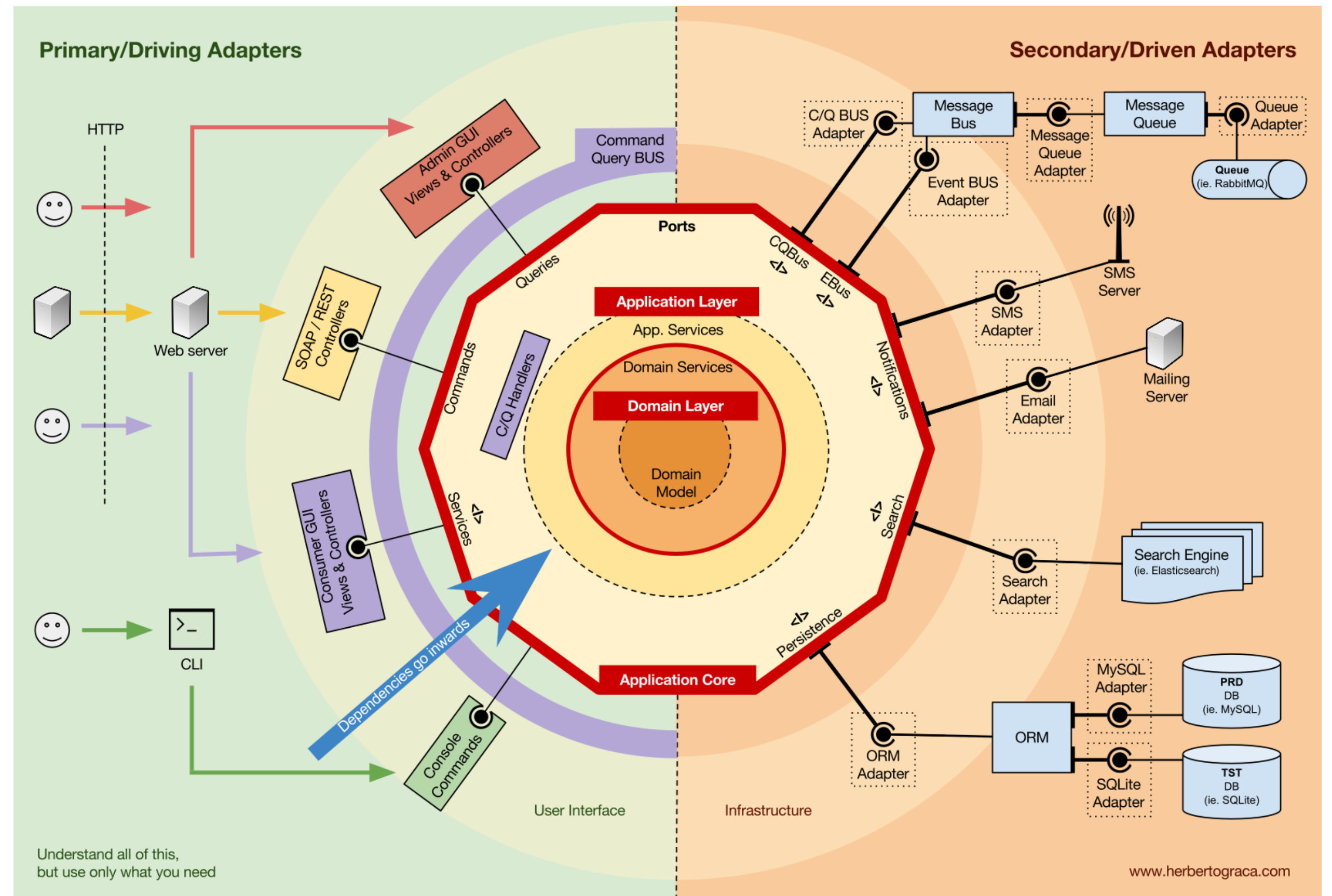
Hexagonal Architecture

- Ports and Adapters Architecture
- Sometimes Onion and Hexagonal are viewed as the same.
- Hexagonal Architecture is more explicit and structured.
- Recommended reading:
<https://herbertograca.com/2017/11/16/explicit-architecture-01-ddd-hexagonal-onion-clean-cqrs-how-i-put-it-all-together/>



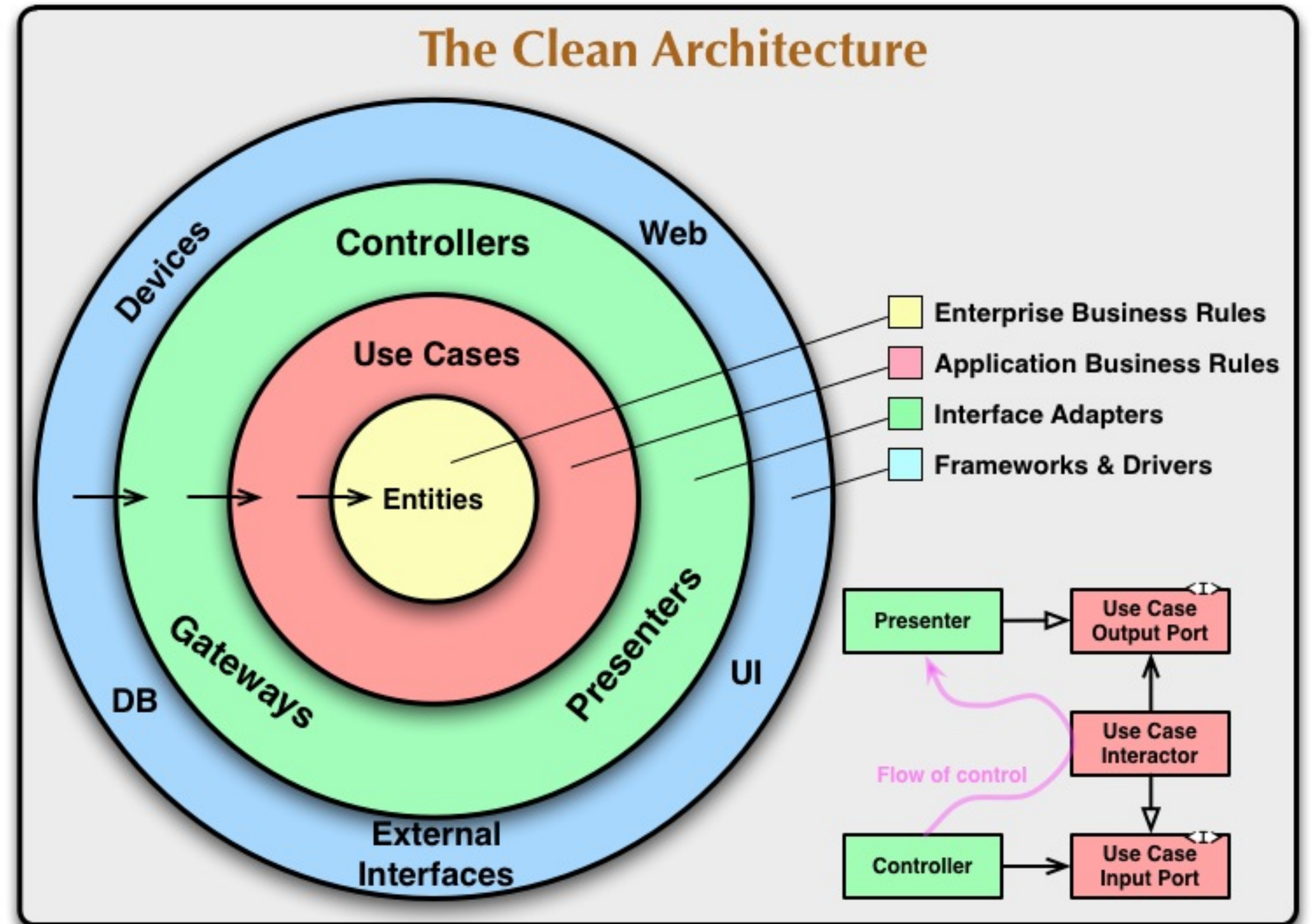
Hexagonal Architecture

- Ports and Adapters Architecture
- Sometimes Onion and Hexagonal are viewed as the same.
- Hexagonal Architecture is more explicit and structured.
- Recommended reading:
<https://herbertograca.com/2017/11/16/explicit-architecture-01-ddd-hexagonal-onion-clean-cqrs-how-i-put-it-all-together/>



The Clean Architecture

- Onion + Screaming Architecture.
- Independent of Frameworks.
- Testable: all parts and as a whole.
- Independent of Interfaces.
- Independent of the data store / database / object persistence.
- Independent of any external impact.



So what does the architecture of your application *scream*?

So what does the architecture of your application *scream*?

So what does the architecture of your application *scream*?

When you look at the top level directory structure, and the source files in the highest level package; do they scream: **Health Care System**, or **Accounting System**, or **Inventory Management System**?

So what does the architecture of your application *scream*?

When you look at the top level directory structure, and the source files in the highest level package; do they scream: **Health Care System**, or **Accounting System**, or **Inventory Management System**?

So what does the architecture of your application *scream*?

When you look at the top level directory structure, and the source files in the highest level package; do they scream: **Health Care System**, or **Accounting System**, or **Inventory Management System**?

Do they scream **global**, **distributed**, **consistent** or **available**?

So what does the architecture of your application *scream*?

When you look at the top level directory structure, and the source files in the highest level package; do they scream: **Health Care System**, or **Accounting System**, or **Inventory Management System**?

Do they scream **global**, **distributed**, **consistent** or **available**?

So what does the architecture of your application *scream*?

When you look at the top level directory structure, and the source files in the highest level package; do they scream: **Health Care System**, or **Accounting System**, or **Inventory Management System**?

Do they scream **global**, **distributed**, **consistent** or **available**?

Or do they scream: **Rails**, or **Spring/Hibernate**, or **ASP**?

So what does the architecture of your application *scream*?

When you look at the top level directory structure, and the source files in the highest level package; do they scream: **Health Care System**, or **Accounting System**, or **Inventory Management System**?

Do they scream **global**, **distributed**, **consistent** or **available**?

Or do they scream: **Rails**, or **Spring/Hibernate**, or **ASP**?

So what does the architecture of your application *scream*?

When you look at the top level directory structure, and the source files in the highest level package; do they scream: **Health Care System**, or **Accounting System**, or **Inventory Management System**?

Do they scream **global**, **distributed**, **consistent** or **available**?

Or do they scream: **Rails**, or **Spring/Hibernate**, or **ASP**?

Recommended viewing: <https://www.youtube.com/watch?v=ZsHMHukIIJY>

Microservices

also known as the *current silver bullet*.

<https://www.cgl.ucsf.edu/Outreach/pc204/NoSilverBullet.html>

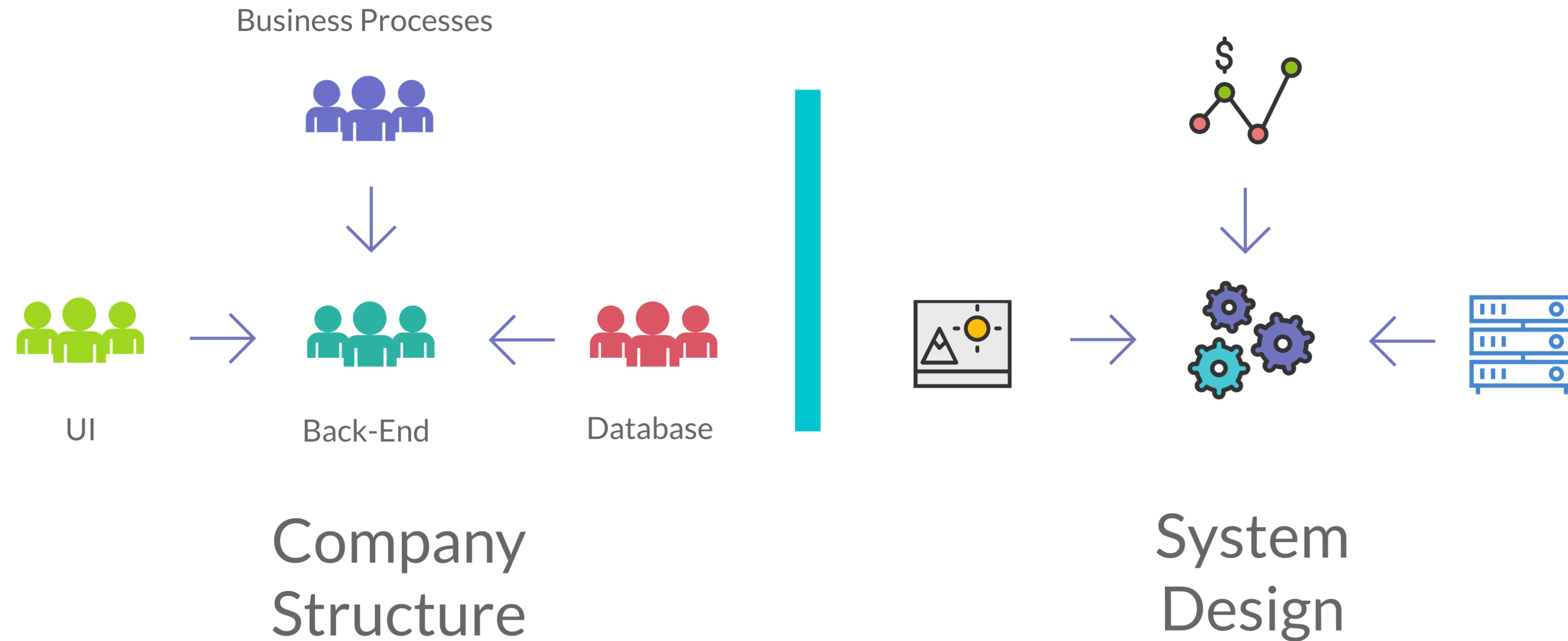


Microservices

also known as the *current silver bullet*.

<https://www.cgl.ucsf.edu/Outreach/pc204/NoSilverBullet.html>

Conway's Law

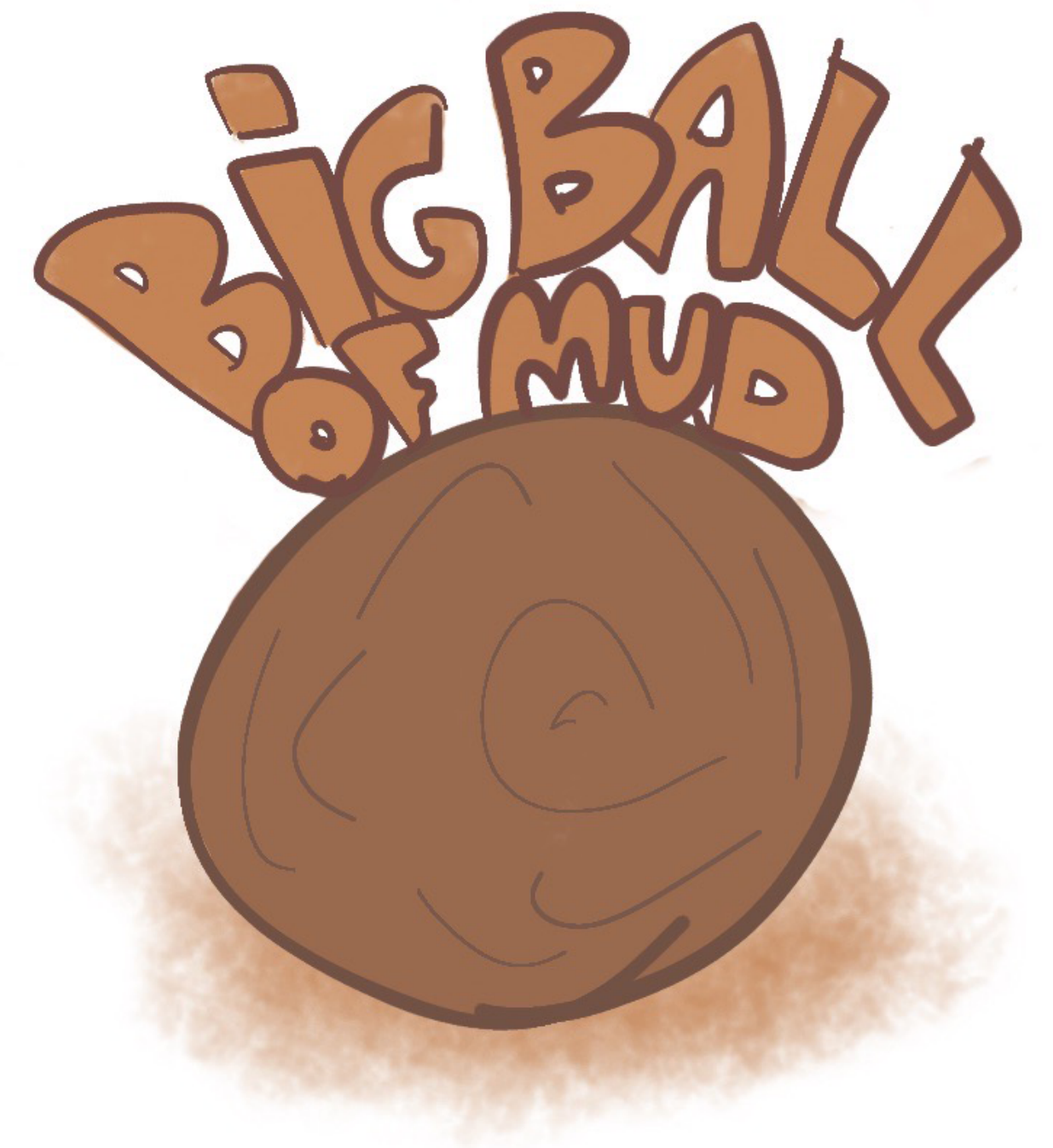


Organization structure determines
system architecture / design.

<https://medium.com/@learnstuff.io/conways-law-in-software-dev-3aa6324ead52>

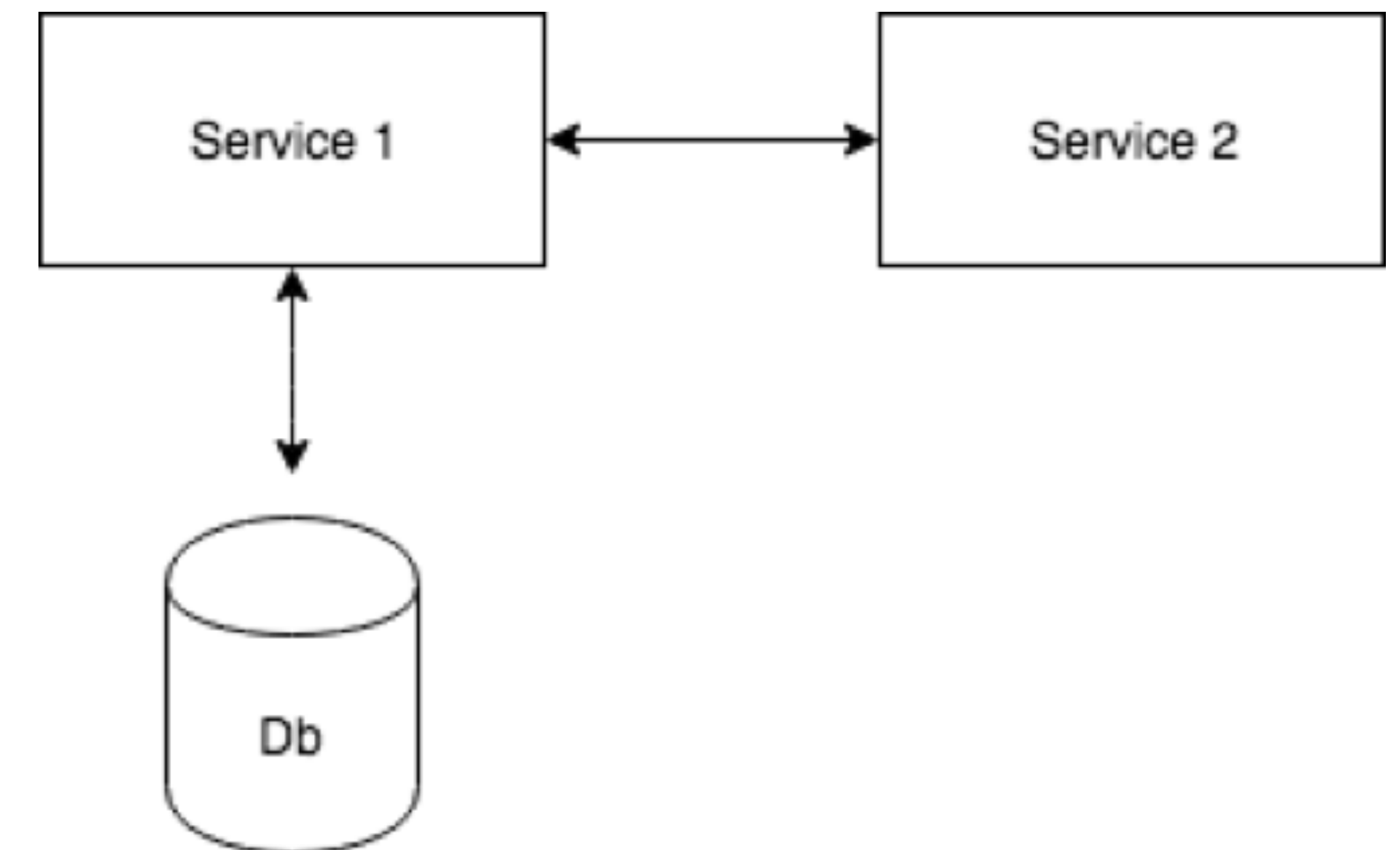
As the systems get larger, complexity grows quickly and systems become unmanageable.

<http://www.laputan.org/mud/mud.html#BigBallOfMud>



- Split system in a set of loosely coupled, cohesive services.
- Each service does only one thing and does it well.
- Each service is represented only by its API.
- Each service has its own data.

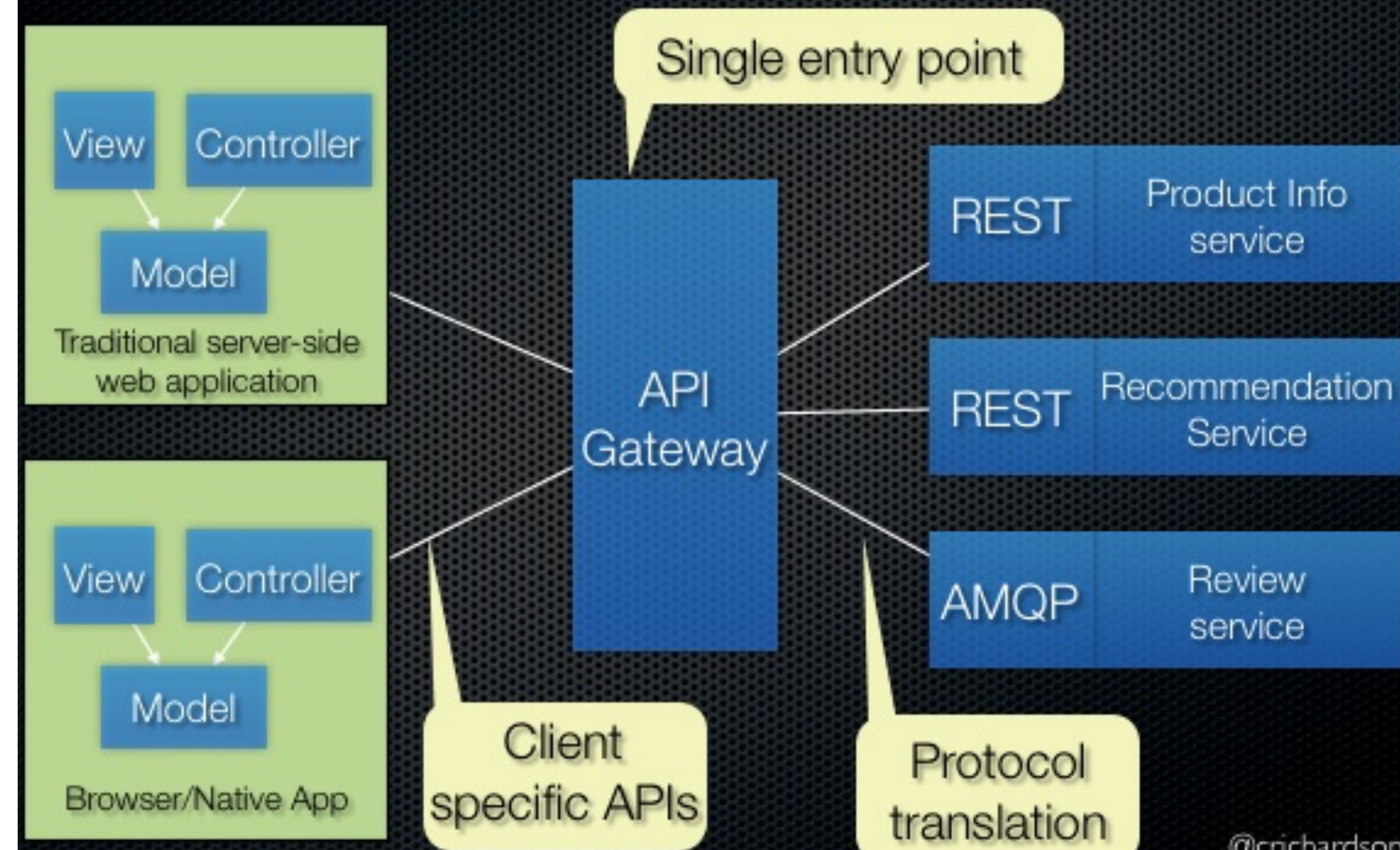
Microservices



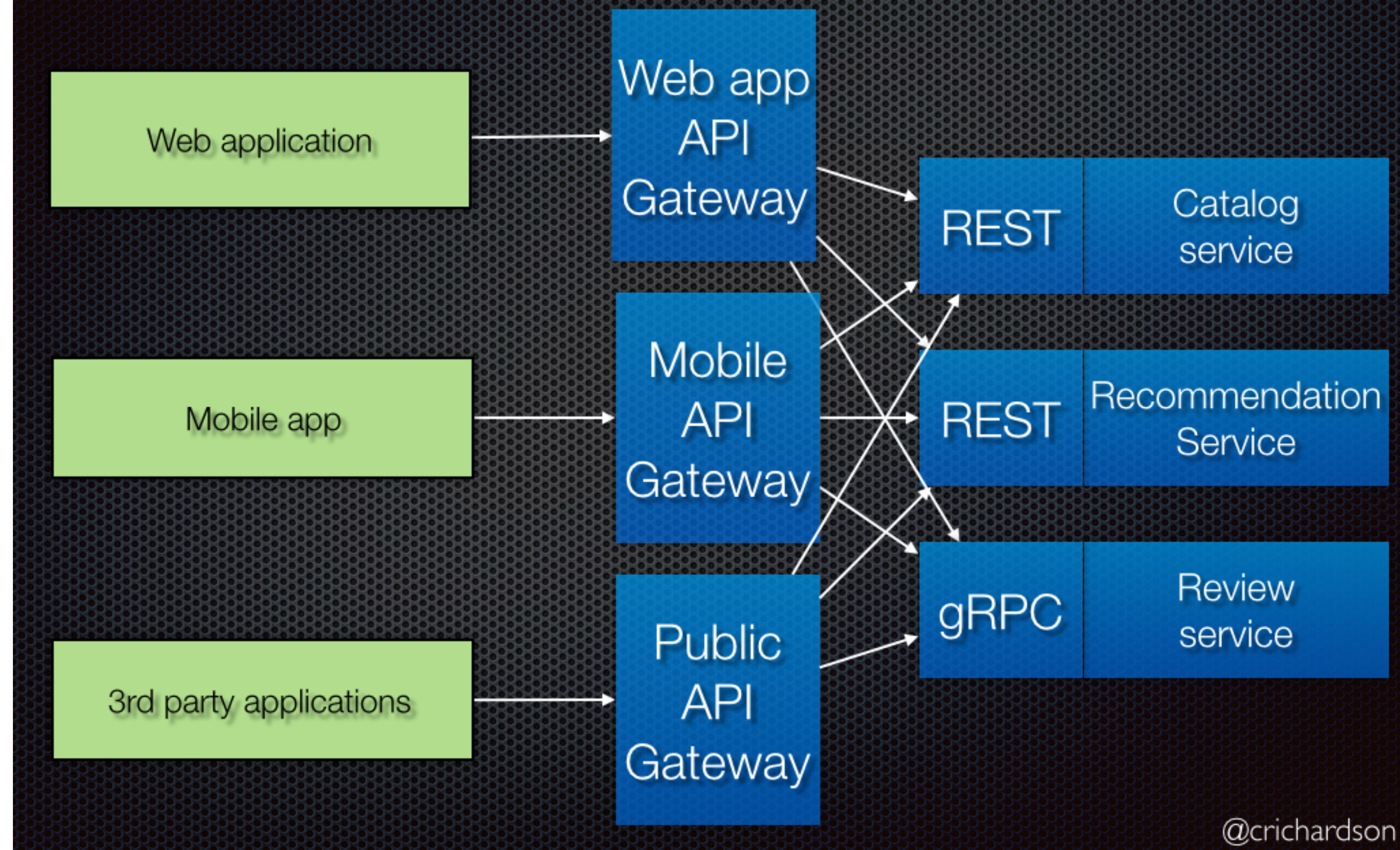
What are the challenges of Microservices?

Compensating for high decentralisation. Patterns are emerging.

Use an API gateway



Variation: Backends for frontends



<https://microservices.io/patterns/apigateway.html>

API Gateway Pattern

Thank you NETFLIX!

The absolute minimum to remeber.

Architecture is a servant of high priority stakeholder values.

Architecture is a servant of high priority stakeholder values.

Is as simple as possible, but not simpler.

Architecture is a servant of high priority stakeholder values.

Is as simple as possible, but not simpler.

Is designed to be replaceable.

Software Architecture is a Strategy.

Software Architecture is a Strategy.

Software Architecture is Communication.

Software Architecture is a Strategy.

Software Architecture is Communication.

Software Architect is a Teacher.

Feel free to connect.

