Emergent Architecture

Just Enough Just In Time

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Emergent Architecture

With Scrum and other forms of agile software development we focus on incrementally evolving architecture one sprint or iteration at a time and avoid the potential waste of big design up front.

- What's this really mean?
- We talk about doing just enough just in time.
- We need to deliver a potentially shippable increment of working software every sprint.

So, who designed this thing anyway?

Manifesto for Agile Software Development

We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:

Individuals and interactions over processes and tools
Working software over comprehensive documentation
Customer collaboration over contract negotiation
Responding to change over following a plan

That is, while there is value in the items on the right, we value the items on the left more.

Agile Manifesto Principles

Our highest priority is to **satisfy the customer** through early and continuous delivery of valuable software.

Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.

Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.

Business people and developers must **work together** daily throughout the project.

Build projects around **motivated individuals**. Give them the environment and support they need, and trust them to get the job done.

The most efficient and effective method of conveying information to and within a development team is **face to- face conversation**.

Working software is the primary measure of progress.

Agile processes promote **sustainable development**. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.

Continuous attention to **technical excellence** and good design enhances agility.

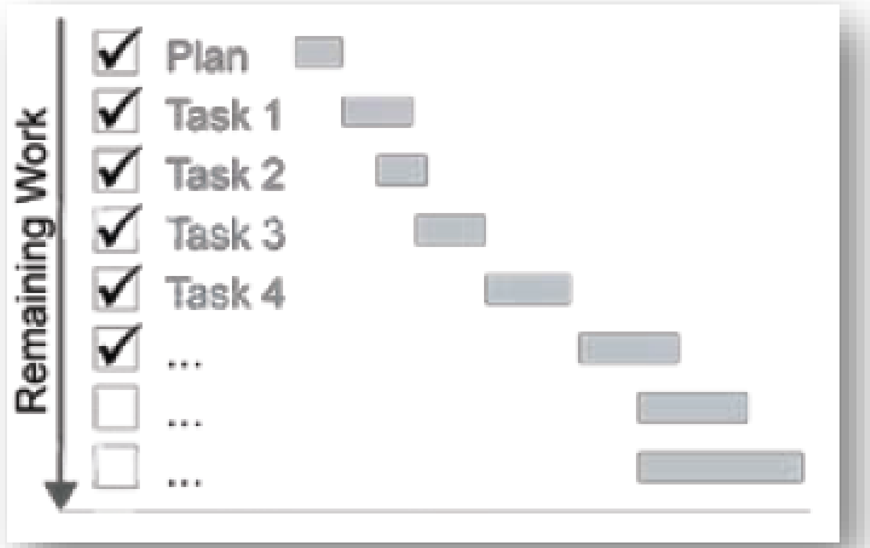
Simplicity--the art of maximizing the amount of work not done--is essential.

The best architectures, requirements, and designs emerge from **self-organizing teams**.

At regular intervals, the team **reflects** on how to become more effective, then tunes and adjusts its behavior accordingly.

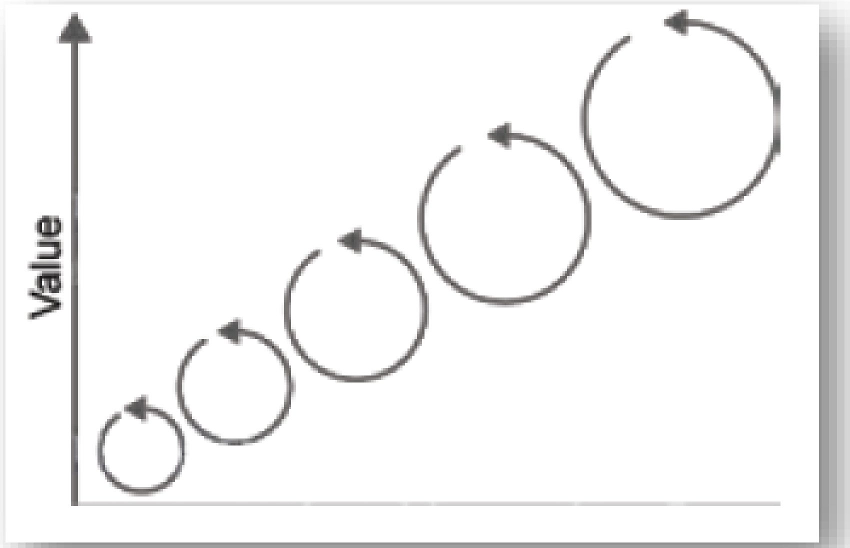
The Wisdom of Building Roads and Bridges …

- Building a Bridge



- Design risks are low
- Design costs are low relative to construction costs
- Schedule and resource the tasks
- Cannot deliver incrementally

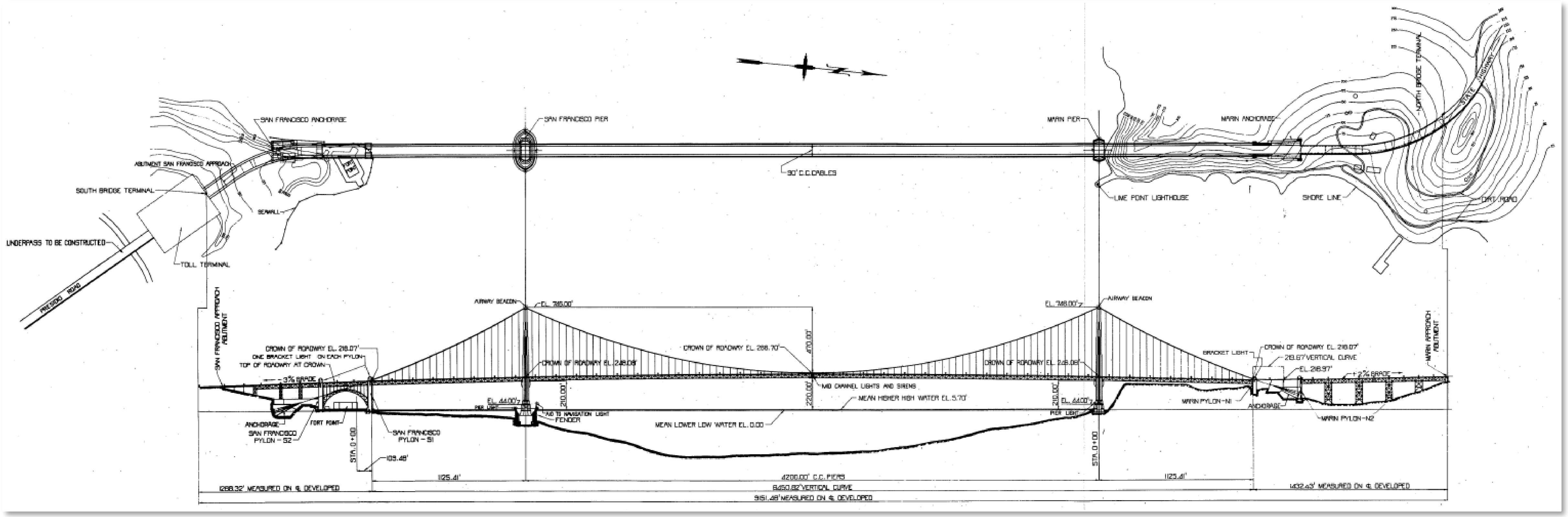
- **Building Software**



- More is unknown than known
- Design risks are greater
- Value-up measures value delivered incrementally

BDUF = Big Design Up Front

- The approach in which the design is to be completed <u>and perfected</u> before implementation starts



Why Big Design Up Front *Seems* Good

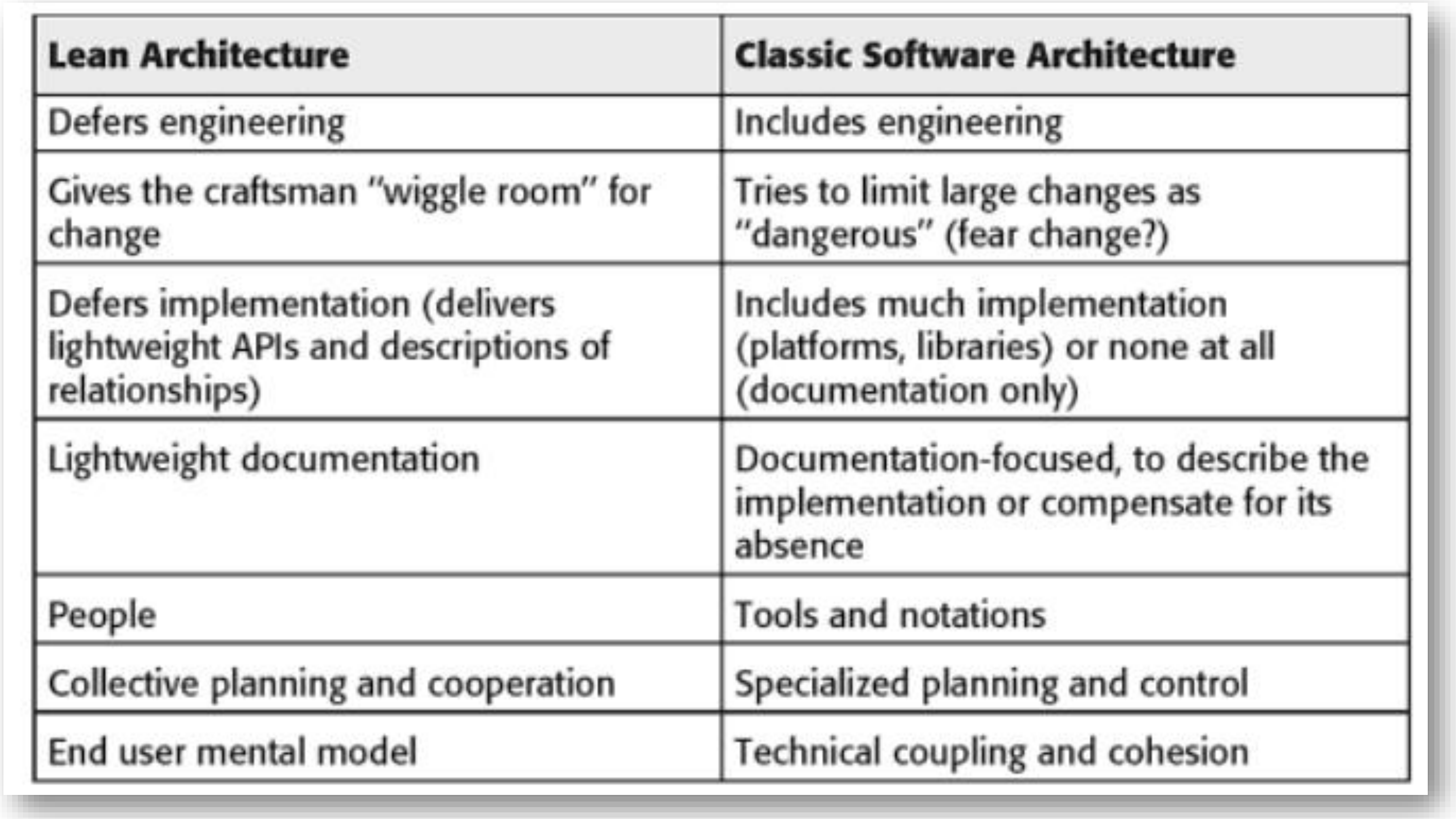
- Requirements are better understood
- Thinking things out ahead of time saves headaches
- Changes to specs are cheaper than changes to code
- Bugs are cheaper to fix early

Why Big Design Up Front *Isn't* Good

- Requirements aren't well known in the first place
- Requirements change
- Developers are not able to foresee all problems
  - Some implementation is required to flesh out the details
- Customers are not able to tell you what they want
  - Only what they don't want … after they see it

- There is no business value in architecture or design!

Lean Architecture



Lean Architecture	Classic Software Architecture
Defers engineering	Includes engineering
Gives the craftsman "wiggle room" for change	Tries to limit large changes as "dangerous" (fear change?)
Defers implementation (delivers lightweight APIs and descriptions of relationships)	Includes much implementation (platforms, libraries) or none at all (documentation only)
Lightweight documentation	Documentation-focused, to describe the implementation or compensate for its absence
People	Tools and notations
Collective planning and cooperation	Specialized planning and control
End user mental model	Technical coupling and cohesion

Impossible!

- It's not impossible, but it isn't easy either
- Here is one of my favorite FAQs

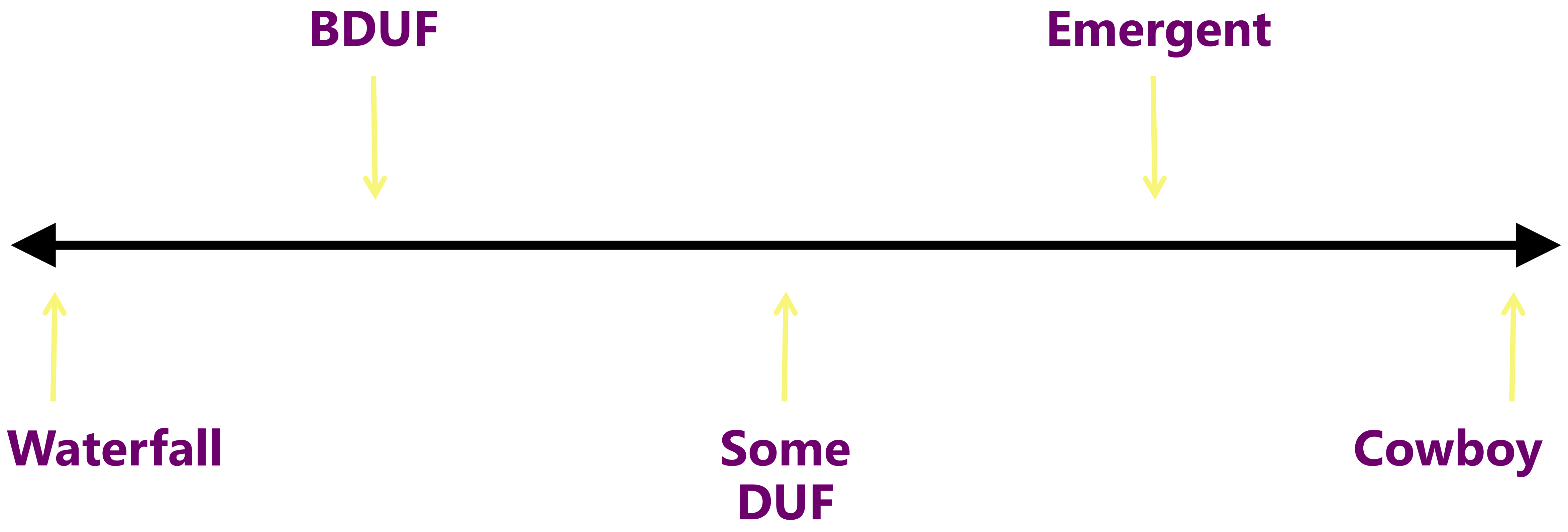
Q. Do you have to be smart to be Agile?

A. No, you have to be smart to develop software.

What is *Emergent Architecture?*

- The opposite of Big Design Up Front
- It allows architecture to emerge as you develop
- Some architectural decisions will need to be made before you write your first line of code
  - Technologies, frameworks, languages, patterns, practices
- Most of these decisions will be hard to change later

Where are you today?



Emergent Architecture

So where and when do we plan, and how much?

What about the big picture?

How does our architecture fit within the enterprise?

How does it facilitate our business objectives?

How do we manage risk?

And, what about all the details?

- What tools are we using, what standards are we adhering to, how are we managing maintainability and all the other NFR's?

Is everything integrating together nicely?

And, what is role of the solution/enterprise architect in an agile world?

How much do you need … and when?

You need to strike a balance, find the right time and effort for your project

- Some upfront planning is critical for large, complex projects
- Ongoing thinking, prototyping, and architecture experiments are important too

Choose the last responsible moment

- Just enough just in time

Some Qualities of Agile Architecture

- Pragmatic, fit for purpose
- Modular
- Strive for simplicity
- No unintended redundancy
- No overlapping functionality
- Supports the important “ilities”
- Sustainable
- Provides business value

Fit for Purpose

- The solution should be suitable for the intended purpose
- Defined by title, user story, and acceptance criteria
- *Example*
  - Title: All cars must stop at One Microsoft Way
  - User Story: As the intersection safety officer I want all cars approaching One Microsoft Way to stop so no geek pedestrians get injured
  - Acceptance Criteria: solution should be universally understood, should be available 24x7, should have a low TCO

It's all About Business Value

- In Agile there is a rule that every sprint generates an increment of potentially-shippable business value
- Therefore:
  - It is not ok to have an "architecture sprint"
  - It is not ok to have an "infrastructure sprint"
  - There is no such thing as sprint 0
  - And while we're on the topic: there's no such thing as "done done"

Business Value and Priority

- Let the customer value and prioritize the *what*, not the *how*
- Architecture and infrastructure decisions are the *how*
  - Architecture exists to serve the team, not the other way around
- Quality attributes (the "ilities") become acceptance criteria or entries on the Definition of Done
- Let the team (not the customer) decide what is fit for purpose

Specifying Acceptance Criteria

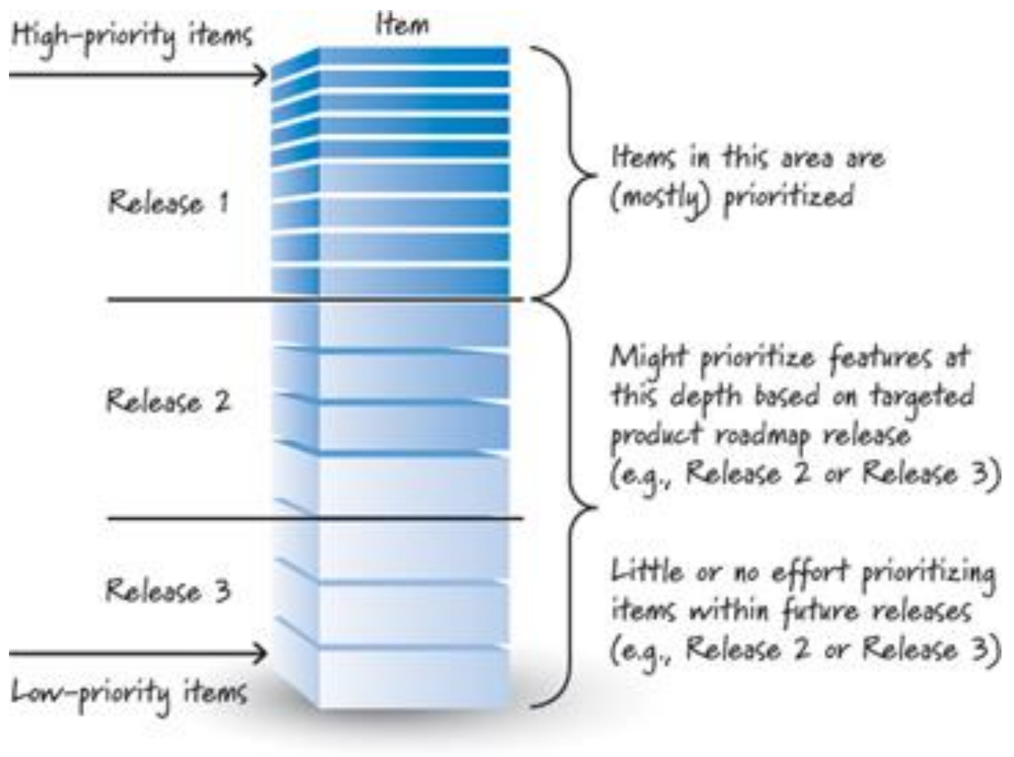
- This can be done incrementally

Disambiguity

1. Initially, a story can just have a title
2. Later, the story can be updated to include a more detailed description
3. Later, the story can be updated to include detailed acceptance criteria
4. Later, the story can be linked to a test case with more detailed criteria
5. Later, the test case can have detailed, manual steps specified
6. Manual tests can be recorded and played-back as automated tests

Architecture is part of the backlog

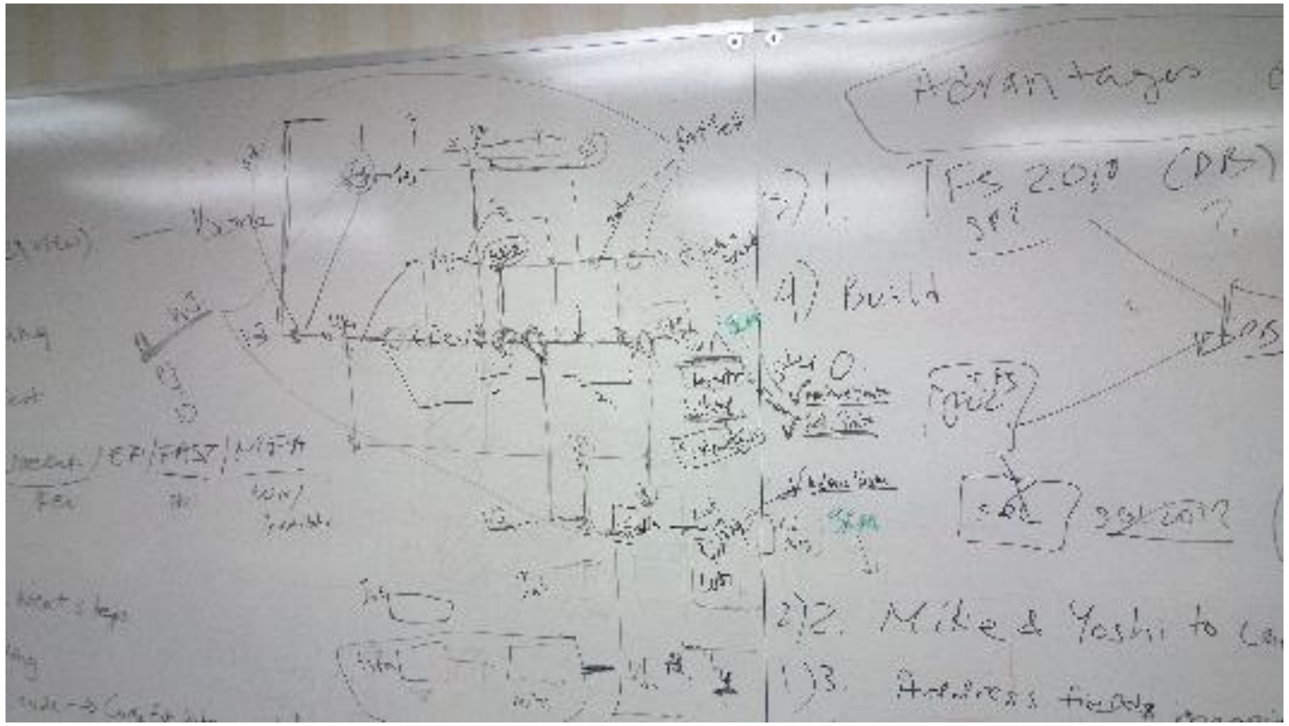
- A good Scrum/Agile product backlog should include:
  - Features
  - Requirements
  - Enhancements
  - Bugs
  - Architecture
  - Knowledge acquisition



High-priority items
Item
Release 1
Release 2
Release 3
Low-priority items
Items in this area are (mostly) prioritized
Might prioritize features at this depth based on targeted product roadmap release (e.g., Release 2 or Release 3)
Little or no effort prioritizing items within future releases (e.g., Release 2 or Release 3)

Agile Models

- Intended to communicate
- Minimal time invested
- Often informal
- Often discarded
- Little "m"



This has worked for me

- One day architecture session
  - Everyone with something to contribute in the room
  - Whiteboards that will persist for life of development
    - Update as needed
  - What we need
    - Infrastructure
    - What we need to integrate with
    - How big is it?
- Works for greenfield & brownfield projects/products

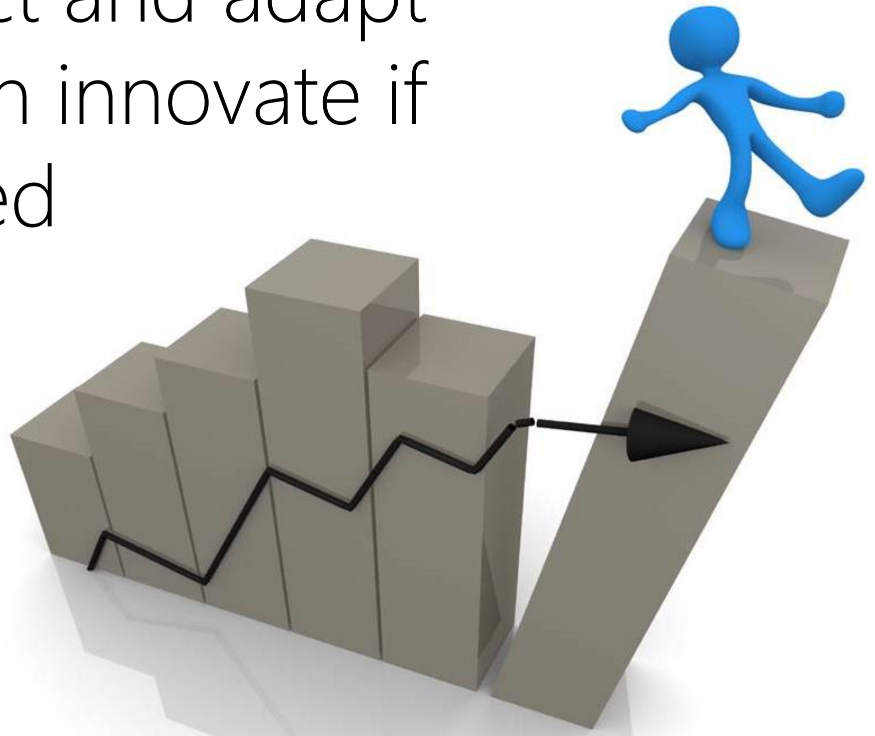
Risk

Types of Project Risks

- Schedule & budget
- Operational
  - execution
  - resources
  - communications
- Technical
  - too complex
  - poorly defined
  - misunderstood

Reduce, Mitigate Risk

- Develop incrementally
- Integrate often
- Inspect and adapt
- Design innovate if needed



Spikes

- A spike solution is a simple program to figure out answers to tough technical or design problems
- It only addresses the problem under examination and ignores all other concerns
- Most are not good enough to keep, expect it to be a throw away
- Typically within the time-box of a sprint

An Architect is part of the team

- No ivory towers
- Involved as a member of the development team
- Hands-on, do what's needed
- Architectural leadership
- Mentors others
- Engaged with the business

Communities of Practice

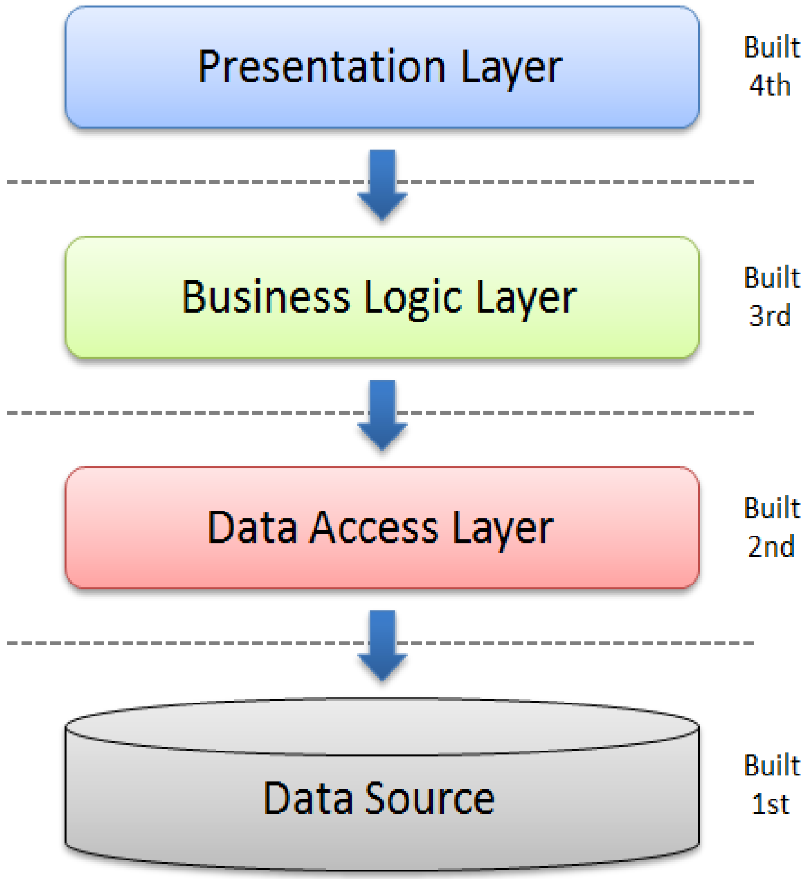
- A group of people who share a craft and/or a profession
- Meet regularly, collaborate for integration and improvement

Developing architecture

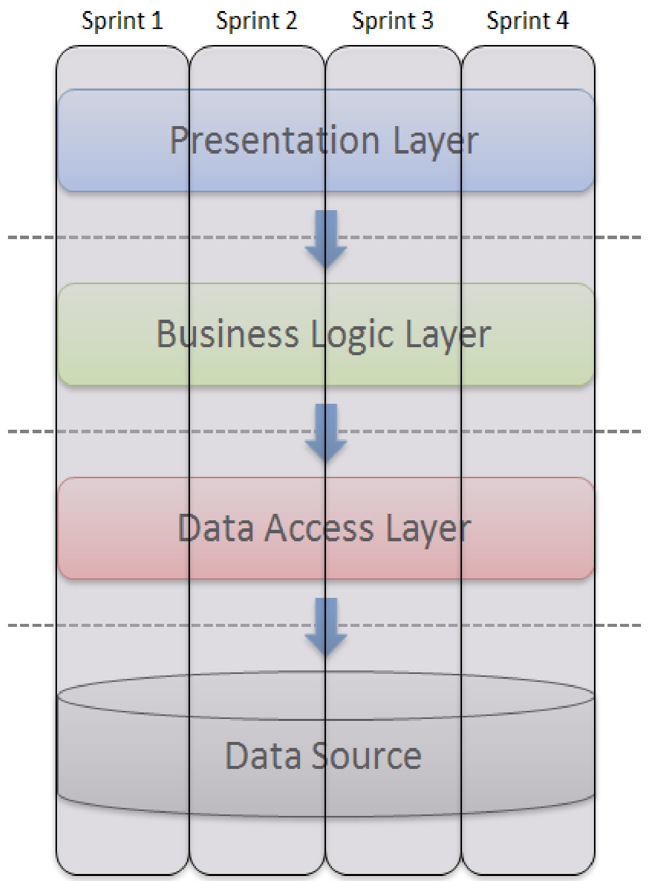
- The team performs design as part of the sprint to provide a solid basis to support their sprint goal
- Some sprints (i.e. sprint 1) will be more design-heavy than others
  - The team should keep this in mind as they make their commitments
  - Every sprint delivers potentially shippable increment(s) of functionality

Think in Slices Not Layers

- Layers = delayed value



- Slices = value every Sprint



Make Smart Decisions

- Leverage popular, maintainable, and testable architectures, frameworks, and patterns
- Build in the flexibility to adapt to reasonable changes without building a meta-product
- Don't gold plate

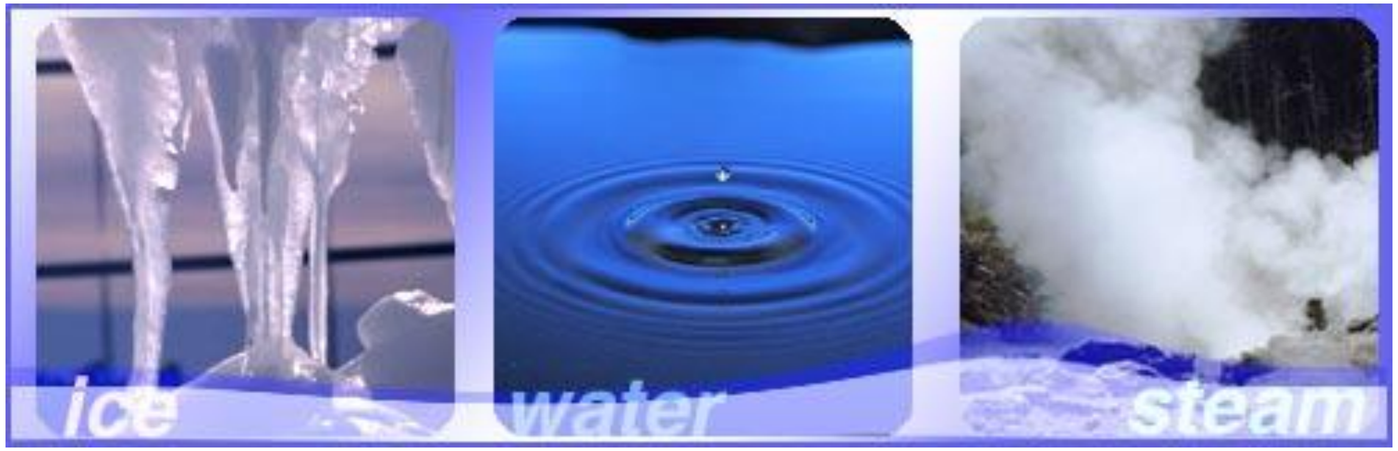
Don’t Over-Architect the Product

- Build at least one increment of business functionality every sprint
- Build enough of the architecture and design to support that business functionality
- Build adequate architecture and design to meet any non-functional requirements

- Solve today’s problem today, tomorrow’s problem tomorrow

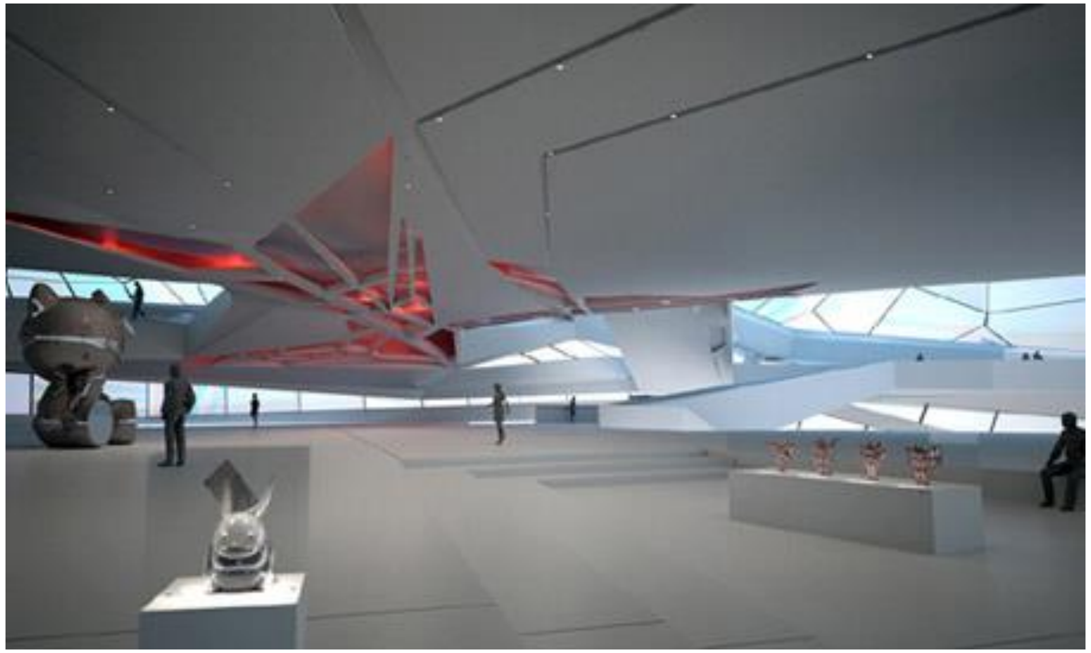
Nature is not Linear

- There are boundaries where conditions change
- Boundaries likely have chaotic behavior
- Nature is not linear, nor is software



Your Architecture Will Change

- You'll encounter boundaries
- Handle today's problems today and tomorrow's problems tomorrow



Minimize Documentation

- Create just enough documentation as a basis of discussion
  - Choose whiteboards over electronic media
- Models can help you
  - Understand and visualize a system, application, or component
- Models can hurt you
  - Don’t model what’s not in scope for that sprint
  - Don’t become a slave to the model
- Let the Team decide if and when to use models
  - Burn them at the earliest responsible time

When Should you Maintain Documentation?

- When there is business value in that documentation
  - i.e. an ISV providing API docs
- When the documentation can be auto-generated or serves additional technical purposes
  - i.e. generating Sequence diagrams
  - i.e. using Layer diagrams for validation

Layer Diagrams

- Layer diagrams allow you to visualize the logical architecture of your system
- A layer diagram organizes the physical artifacts in your system into logical, abstract groups called layers
- These layers help you identify, describe, and differentiate the kinds of tasks that those artifacts perform
- More than just pretty pictures, these diagrams can be used for ongoing validation

Effective Emergent Architecture

- Use Principles, Patterns, and Practices
- Refactor
- Test early, often, and automatically
- Application Lifecycle Management
- Deploy frequently

Principles, Patterns, and Practices

- Use popular Principles effectively
  - Coupling, cohesion, composition, encapsulation, …
- Use popular Patterns effectively
  - GoF, .NET, Microsoft P&P, MVC, MVP, MVVM, …
- Use popular Practices effectively

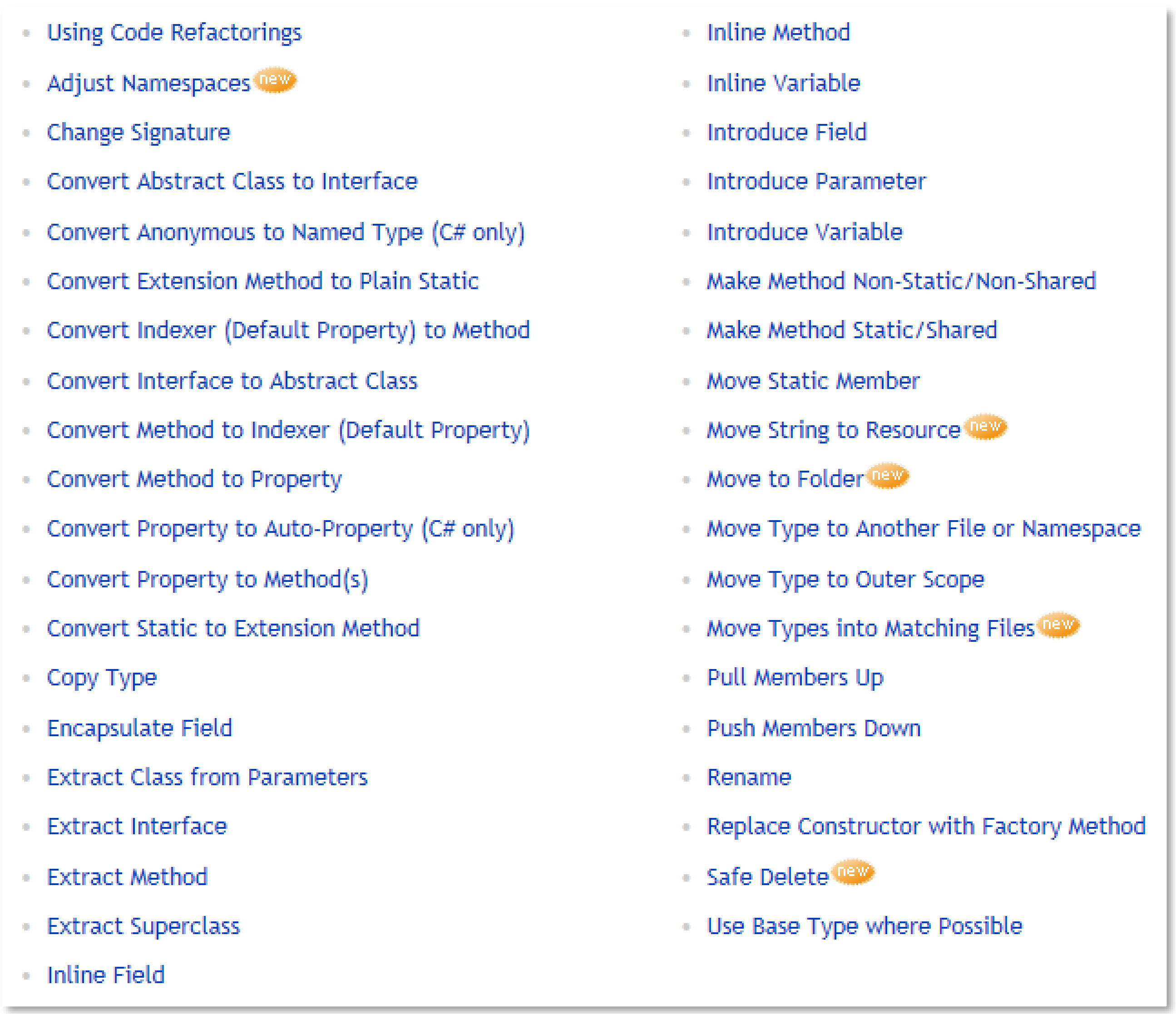
Behavior-Driven Development (BDD)	Domain-Driven Design (DDD)	Liskov Substitution Principle (LSP)
Defensive Programming	Don't Repeat Yourself (DRY)	Open-Closed Principle (OCP)
Dependency Injection (DI)	Interface Segregation Principle (ISP)	Separation of Concerns (SoC)
Dependency Inversion	Inversion of Control (IoC)	Single Responsibility
Design by Contract (DbC)	Principle of Least Privilege (PLP)	Test-Driven Development (TDD)

And my favorite: YAGNI (You Ain't Gonna Need It)

Refactoring

- A disciplined technique for restructuring an existing body of code, altering its internal structure without changing its external behavior
- You should refactor …
  - Little and often
  - At the unit as well as architecture level
  - Using automated unit tests, CI, and code coverage
  - Using automated regression tests
  - Using modern tools

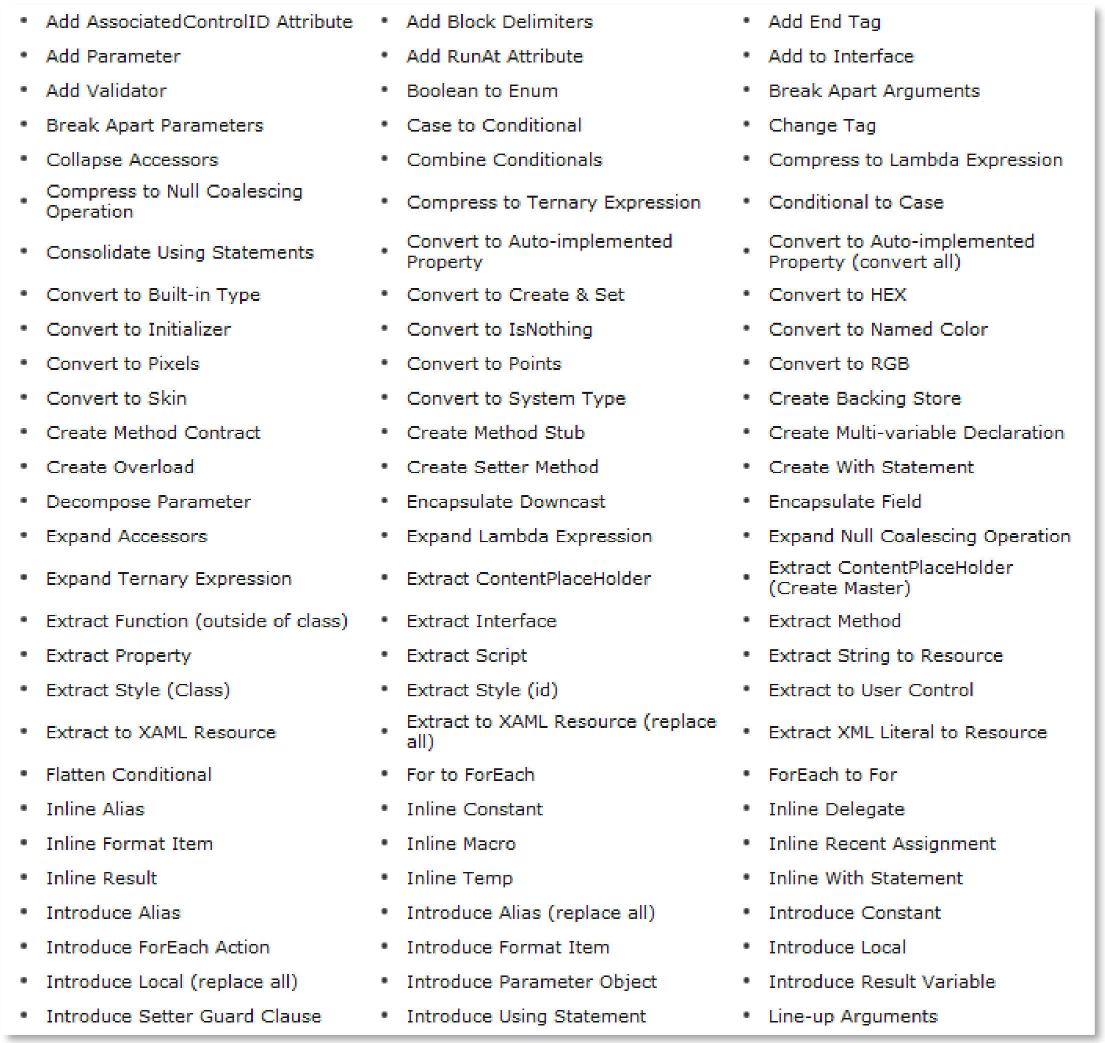
Refactoring Support



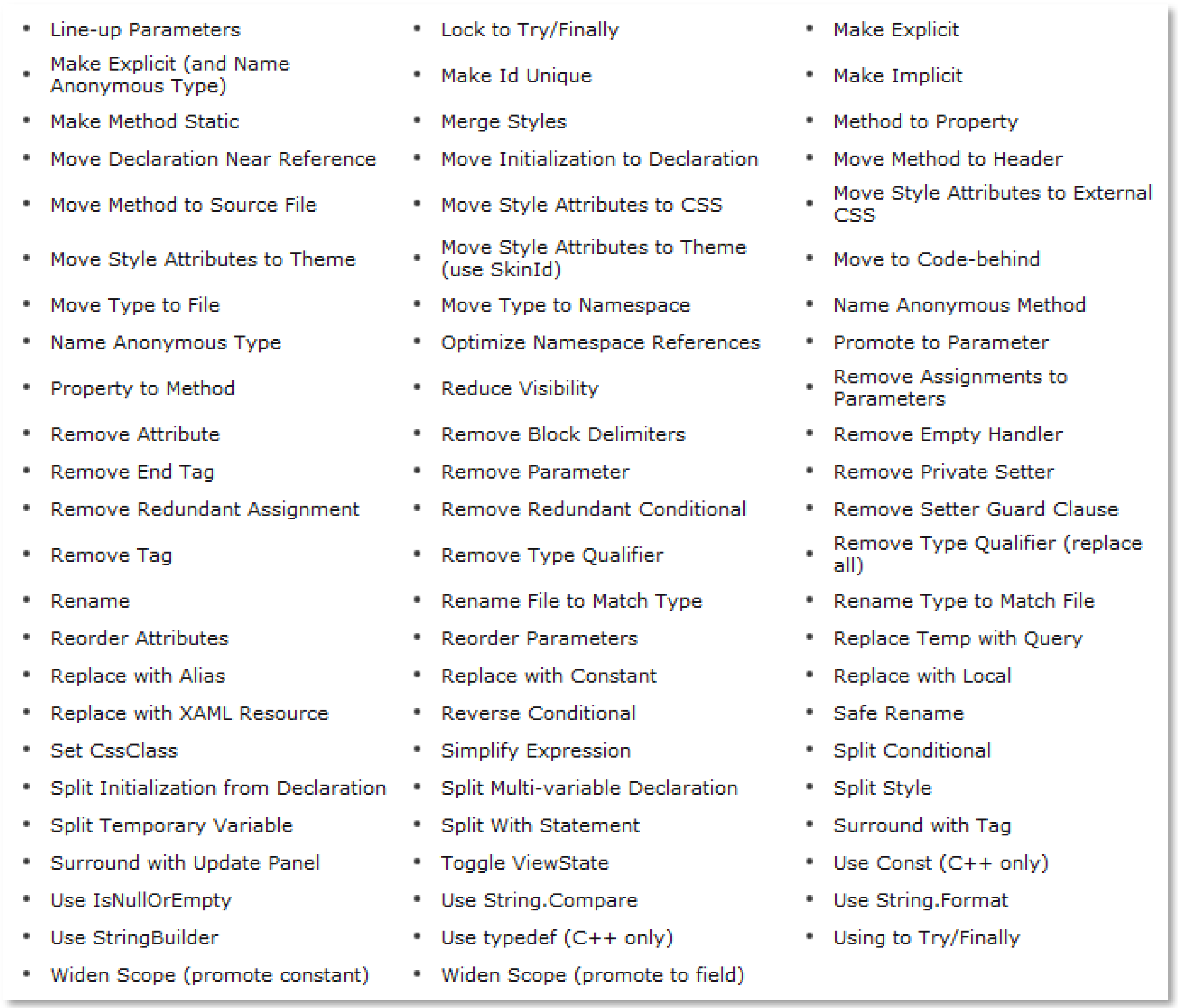
- Using Code Refactorings
- Adjust Namespaces new
- Change Signature
- Convert Abstract Class to Interface
- Convert Anonymous to Named Type (C# only)
- Convert Extension Method to Plain Static
- Convert Indexer (Default Property) to Method
- Convert Interface to Abstract Class
- Convert Method to Indexer (Default Property)
- Convert Method to Property
- Convert Property to Auto-Property (C# only)
- Convert Property to Method(s)
- Convert Static to Extension Method
- Copy Type
- Encapsulate Field
- Extract Class from Parameters
- Extract Interface
- Extract Method
- Extract Superclass
- Inline Field
- Inline Method
- Inline Variable
- Introduce Field
- Introduce Parameter
- Introduce Variable
- Make Method Non-Static/Non-Shared
- Make Method Static/Shared
- Move Static Member
- Move String to Resource new
- Move to Folder new
- Move Type to Another File or Namespace
- Move Type to Outer Scope
- Move Types into Matching Files new
- Pull Members Up
- Push Members Down
- Rename
- Replace Constructor with Factory Method
- Safe Delete new
- Use Base Type where Possible

Refactor! Pro™ FOR VISUAL STUDIO

Refactoring Support



- Add AssociatedControlID Attribute
- Add Block Delimiters
- Add End Tag
- Add Parameter
- Add RunAt Attribute
- Add to Interface
- Add Validator
- Boolean to Enum
- Break Apart Arguments
- Break Apart Parameters
- Case to Conditional
- Change Tag
- Collapse Accessors
- Combine Conditionals
- Compress to Lambda Expression
- Compress to Null Coalescing Operation
- Compress to Ternary Expression
- Conditional to Case
- Consolidate Using Statements
- Convert to Auto-implemented Property
- Convert to Auto-implemented Property (convert all)
- Convert to Built-in Type
- Convert to Create & Set
- Convert to HEX
- Convert to Initializer
- Convert to IsNothing
- Convert to Named Color
- Convert to Pixels
- Convert to Points
- Convert to RGB
- Convert to Skin
- Convert to System Type
- Create Backing Store
- Create Method Contract
- Create Method Stub
- Create Multi-variable Declaration
- Create Overload
- Create Setter Method
- Create With Statement
- Decompose Parameter
- Encapsulate Downcast
- Encapsulate Field
- Expand Accessors
- Expand Lambda Expression
- Expand Null Coalescing Operation
- Expand Ternary Expression
- Extract ContentPlaceHolder
- Extract ContentPlaceHolder (Create Master)
- Extract Function (outside of class)
- Extract Interface
- Extract Method
- Extract Property
- Extract Script
- Extract String to Resource
- Extract Style (Class)
- Extract Style (id)
- Extract to User Control
- Extract to XAML Resource
- Extract to XAML Resource (replace all)
- Extract XML Literal to Resource
- Flatten Conditional
- For to ForEach
- ForEach to For
- Inline Alias
- Inline Constant
- Inline Delegate
- Inline Format Item
- Inline Macro
- Inline Recent Assignment
- Inline Result
- Inline Temp
- Inline With Statement
- Introduce Alias
- Introduce Alias (replace all)
- Introduce Constant
- Introduce ForEach Action
- Introduce Format Item
- Introduce Local
- Introduce Local (replace all)
- Introduce Parameter Object
- Introduce Result Variable
- Introduce Setter Guard Clause
- Introduce Using Statement
- Line-up Arguments



- Line-up Parameters
- Lock to Try/Finally
- Make Explicit
- Make Explicit (and Name Anonymous Type)
- Make Id Unique
- Make Implicit
- Make Method Static
- Merge Styles
- Method to Property
- Move Declaration Near Reference
- Move Initialization to Declaration
- Move Method to Header
- Move Method to Source File
- Move Style Attributes to CSS
- Move Style Attributes to External CSS
- Move Style Attributes to Theme
- Move Style Attributes to Theme (use SkinId)
- Move to Code-behind
- Move Type to File
- Move Type to Namespace
- Name Anonymous Method
- Name Anonymous Type
- Optimize Namespace References
- Promote to Parameter
- Property to Method
- Reduce Visibility
- Remove Assignments to Parameters
- Remove Attribute
- Remove Block Delimiters
- Remove Empty Handler
- Remove End Tag
- Remove Parameter
- Remove Private Setter
- Remove Redundant Assignment
- Remove Redundant Conditional
- Remove Setter Guard Clause
- Remove Tag
- Remove Type Qualifier
- Remove Type Qualifier (replace all)
- Rename
- Rename File to Match Type
- Rename Type to Match File
- Reorder Attributes
- Reorder Parameters
- Replace Temp with Query
- Replace with Alias
- Replace with Constant
- Replace with Local
- Replace with XAML Resource
- Reverse Conditional
- Safe Rename
- Set CssClass
- Simplify Expression
- Split Conditional
- Split Initialization from Declaration
- Split Multi-variable Declaration
- Split Style
- Split Temporary Variable
- Split With Statement
- Surround with Tag
- Surround with Update Panel
- Toggle ViewState
- Use Const (C++ only)
- Use IsNullOrEmpty
- Use String.Compare
- Use String.Format
- Use StringBuilder
- Use typedef (C++ only)
- Using to Try/Finally
- Widen Scope (promote constant)
- Widen Scope (promote to field)

Know when you are “Done”

- Done defines when an increment of product functionality is potentially shippable
- Definition of Done (DoD)
  - A simple, auditable checklist owned by the team
  - It can be influenced by organizational standards and specific requirements of the product or release
- Can be maintained …
  - In a document or wiki
  - In your ALM tooling

Example: A Simple Definition of Done

- Designed
- Refactored
- Coded
- No clever techniques
- Code review
- Design review
- Unit tested
- Functional tested
- Unit test harness
- User Acceptance tested
- Integration tested
- Regression tested
- Performance tested
- Security tested

Be Transparent

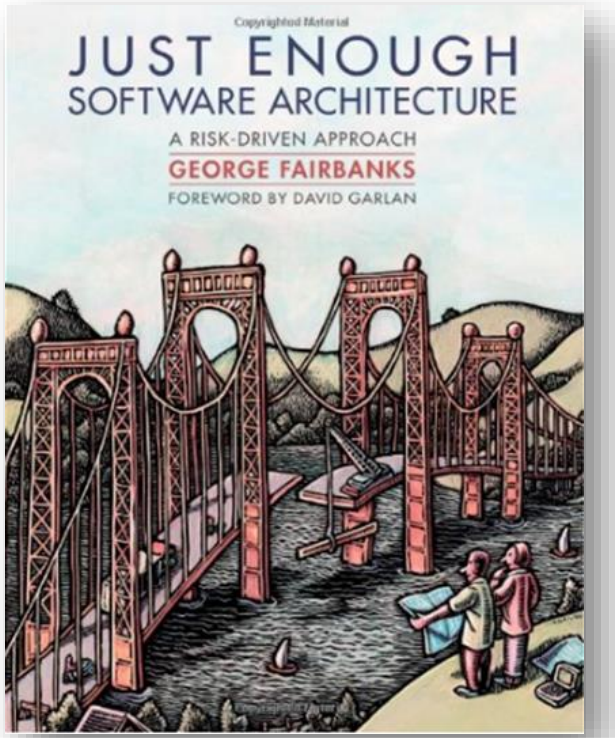
- Everyone should be able to inspect …
  - The team's Definition of Done (DoD)
  - The product backlog (user stories)
  - The sprint backlog (tasks)
  - The impediments
  - Deployments
  - Test results
  - Bugs
- Everyone should adapt to these inspections

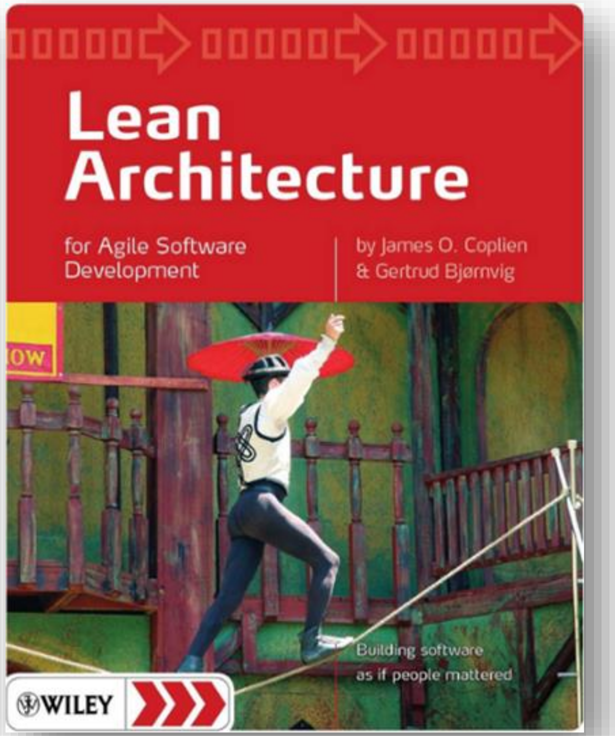
Burndown

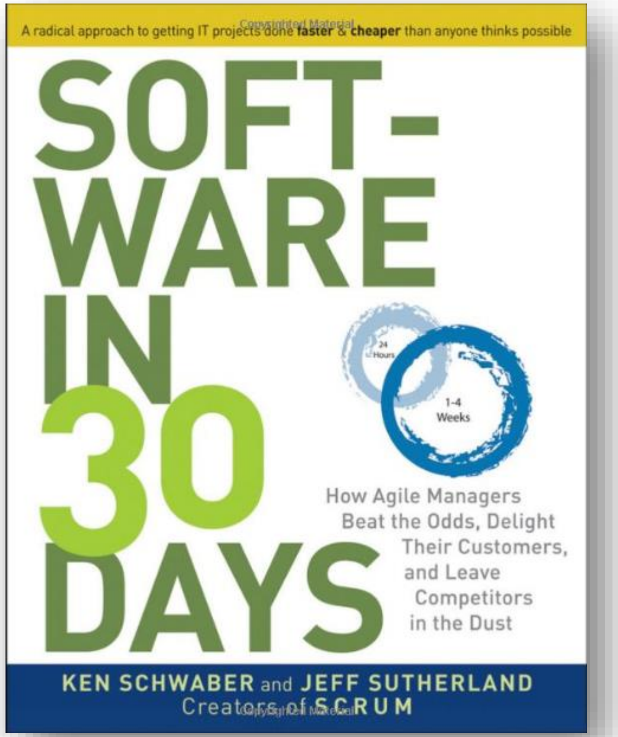
What can we consider done?

- Deliver business value each Sprint
- Big design up front is waste
- Architects are active members of the development teams
- Delay requirements until last responsible moment
- Only keep documentation if it delivers business value
- Choose popular principles, patterns, practices
- It takes smart developers to write software

Learning More



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How Agile Managers
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Their Customers,
and Leave
Competitors
in the Dust

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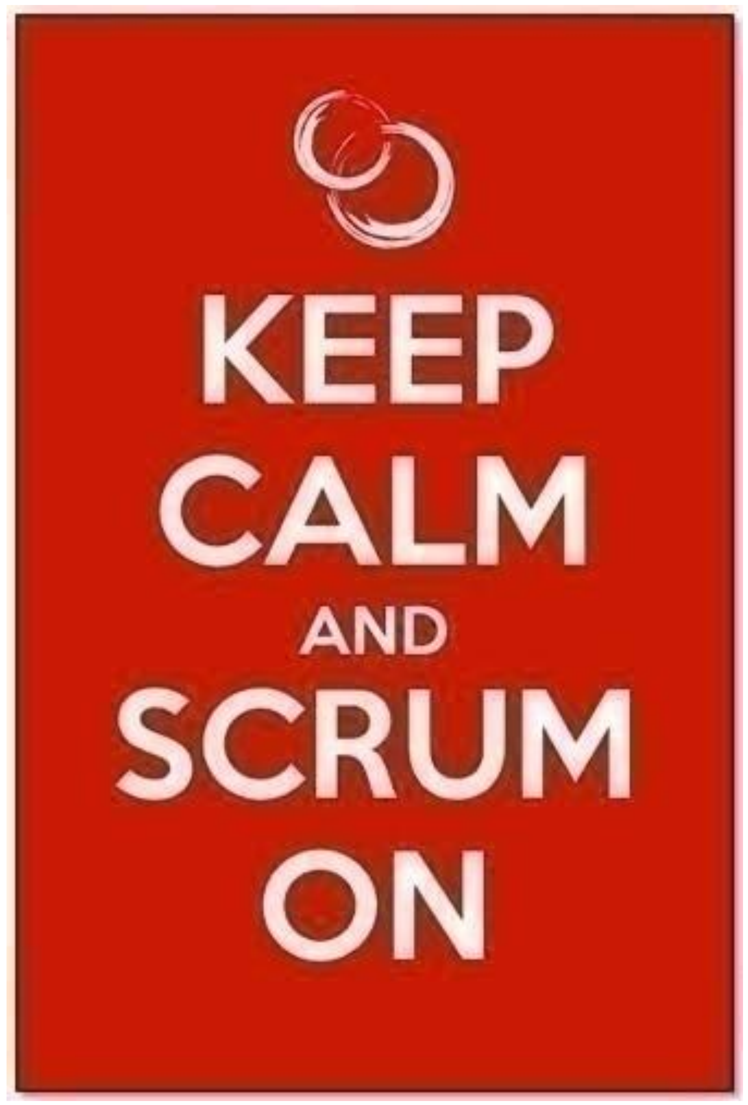
For More Info

- https://www.scrum.org/Resources/Nexus
- http://blog.accentient.com/emergent-architecture-presentation-at-teched-2011/
- http://www.scaledagileframework.com/agile-architecture/
- http://www.mountaingoatsoftware.com/blog/agile-design-intentional-yet-emergent
- http://www.infoq.com/news/2013/08/architecture-scrum
- http://www.slideshare.net/rwirfs-brock/why-we-need-architects-and-architecture-on-agile-projects

Thank You!



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