Introducing Joseph

- Founder and Architect, The Refactory, Inc.
- Pattern enthusiast, author and Hillside Board President
- Author of the Big Ball of Mud Pattern
- Adaptive Systems expert (programs adaptive software, consults on adaptive architectures, author of adaptive architecture patterns, metatdata maven, website: adaptiveobjectmodel.com)
- Agile enthusiast and practitioner
- Business owner (leads a world class development company)
- Consults and trains top companies on design, refactoring, pragmatic testing
- Amateur photographer, motorcycle enthusiast, enjoys dancing samba!!!
- Loves Sushi, Ramen, Taiko Drums ☺

What is Software Engineering?

Software engineering (SE) is the application of engineering to the development of software in a systematic method….Wikipedia

Software Engineering

Definition of SOFTWARE ENGINEERING
: a **branch** of **computer science** that deals with the **design**, **implementation**, and **maintenance** of **complex** computer **programs**

software engineer
noun

Webster's Definition

Software Engineering

Definition of SOFTWARE ENGINEERING

1. **Development** of **procedures** and systematic **applications** that are used on electronic machines. Software engineering **incorporates** various accepted **methodologies** to **design** software…takes into consideration what **type of machine** the software will be used on, **how the software will work** with the machine, and what **elements** need to be put in place to **ensure reliability**.
2. **Higher education degree program**, which usually requires a certain number of courses to be completed in order to receive certification or a degree.

Business Dictionary's Definition

Software Engineering

Definition of SOFTWARE ENGINEERING

: detailed **study** of **engineering** to the **design**, **development** and **maintenance** of software. Software engineering was introduced to **address** the issues of **low-quality** software projects. Problems arise when a software generally exceeds timelines, budgets, and reduced levels of quality. It **ensures** that the application is **built consistently**, **correctly**, **on time** and **on budget** and **within requirements**.

Economic Times Definition

Software Engineering

Definition of SOFTWARE ENGINEERING
: the **process** of **analyzing** user needs and **designing**, **constructing**, and **testing** end user applications that will **satisfy** these **needs** through use of software programming languages. It is the **application** of engineering **principles** to software **development**. In contrast to simple programming, software engineering is used for **larger** and more **complex** software systems, which are used as critical systems for businesses and organizations.

Techopedia's Definition

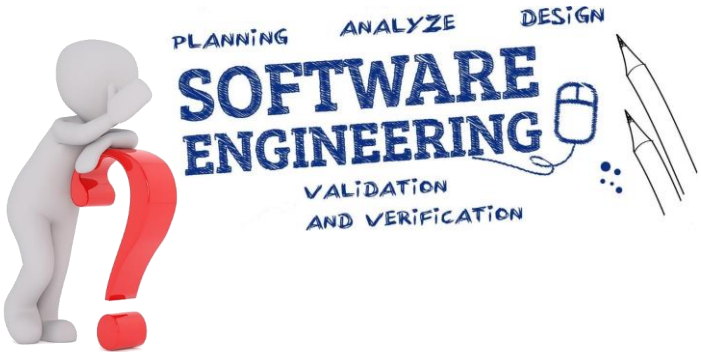
Software Engineering

Definition of SOFTWARE ENGINEERING
: the **application** of principles used in the field of engineering, which usually deals with physical systems, to the design, development, testing, deployment and management of software systems.

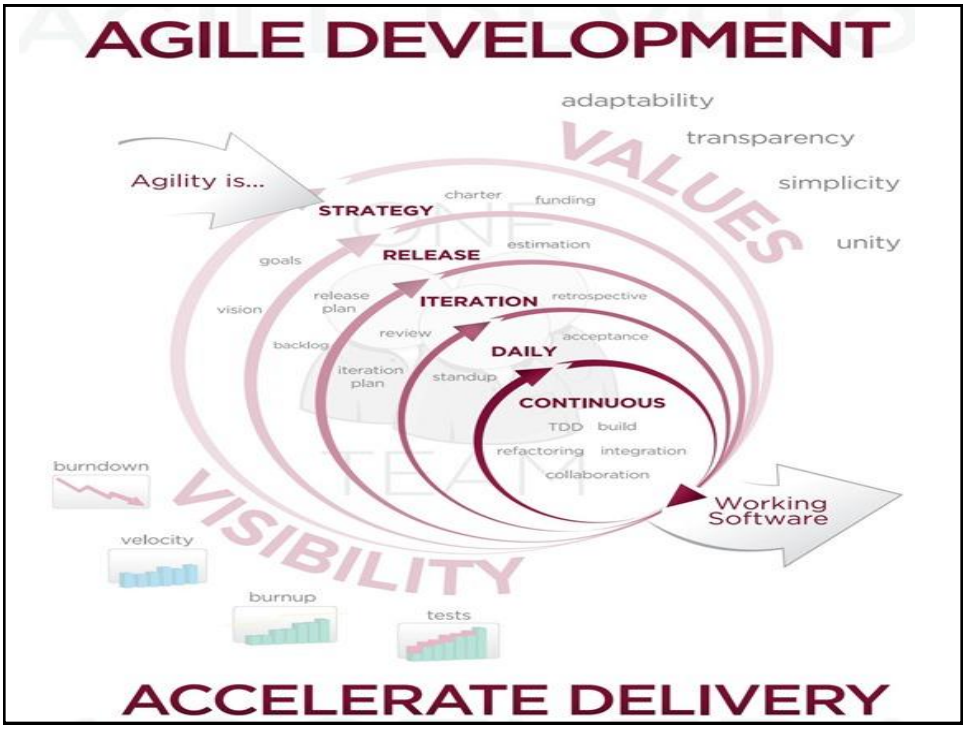
Uses a **disciplined**, **structured approach** to programming … with the goal of **improving** the **quality**, **time** and **budget** efficiency, along with the assurance of structured testing and engineering certification.

TechTarget's Definition

So Really…What is Software Engineering???



What about Agile?



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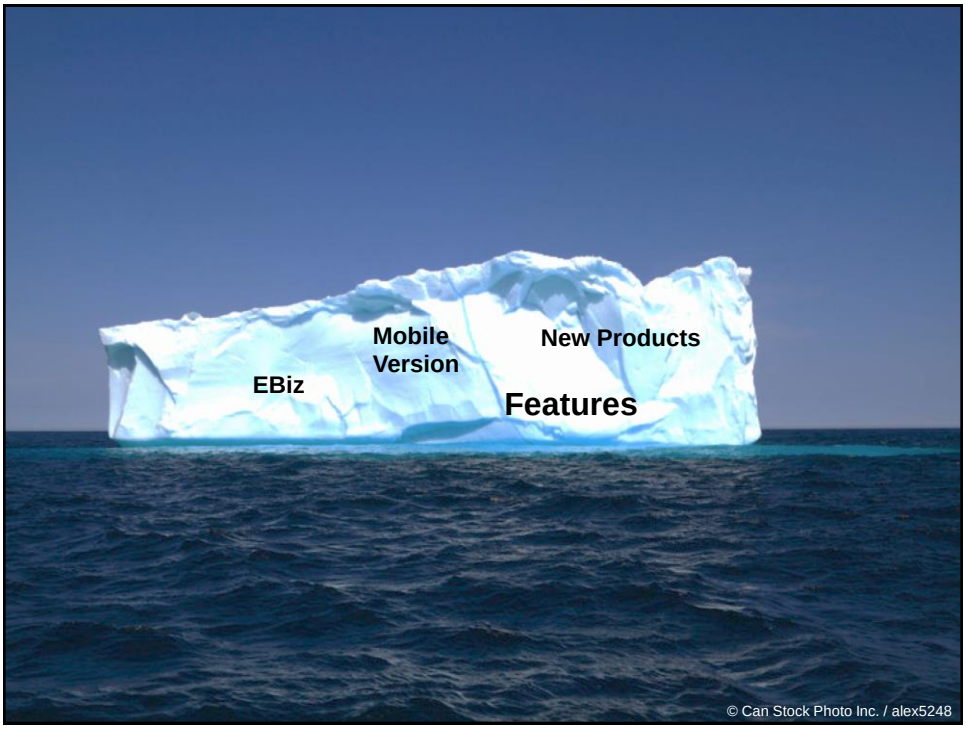
architecture quality can be invisible


Mobile
Version
New Products
EBiz
Features
© Can Stock Photo Inc. / alex5248


The Solution
© Can Stock Photo Inc. / Freezingpicture

What's below the waterline?

all those "ilities" we can't ignore

…

Agile Myths

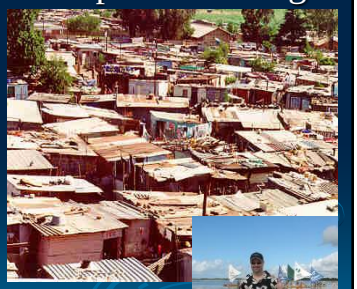
- Simple solutions are always best
- We can easily adapt to changing requirements (new requirements)
- Scrum/TDD will ensure good Design/Architecture
- Good architecture simply emerges from "good" development practice
- You always go fast when doing agile
- Make significant architecture changes at the last moment

"www.agilemyths.com"

Big Ball of Mud

Alias: Shantytown, Spaghetti Code

A BIG BALL OF MUD is haphazardly structured, sprawling, sloppy, duct-tape and bailing wire, spaghetti code jungle.



The de-facto standard software architecture. Why is the gap between what we **preach** and what we **practice** so large?

We preach we want to build high quality systems but why are BBoMs so prevalent?

MENU FINANCIAL TIMES myFT

working software. Pressure from the business to deliver new features and bug fixes within a large codebase heightens the risk of unnecessary complexity being introduced. Add poor documentation and frequent staff turnover and the overall architecture may become "a big ball of mud". Big mud translates to a high cost of adding new functionality that a company needs to stay competitive.


Lisa Pollack

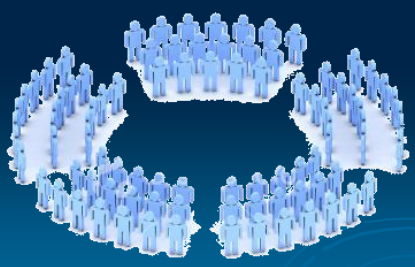
Maintaining code in a tidy state should be part of the work. "But it requires constant attention to this sort of hygiene," Robert Chatley tells me when we meet at Imperial

Worse is Better

- Ideas resembles Gabriel's 1991 "Worse is Better"
- Worse is Better is an argument to release early and then have the market help you design the final product…It is taken as the first published argument for open source, among other things
- Do BBoM systems have a Quality?

What exactly do we mean by "Big"?

Well, for teams I consider > 10^2 big
and for code I consider > 10^5 big



```
; (a)
movf  PSP,w            ; Copy current top of stack frame address
movwf FSR              ; into the File Select register

; (b)
movf  MULTIPLICAND,w   ; Push the Multiplicand into the stack
movwf INDF             ; by copying the datum out
decf  FSR,f            ; and decrementing the FSR

; (c)
movf  MULTIPLIER,w     ; Push the Multiplier into the stack
movwf INDF             ; by copying the datum out
decf  FSR,f            ; and decrementing the FSR

; (d)
call  MUL_S            ; Call the subroutine
```


What is Large???

- 1,000,000 (loc)
- 10,000,000 (loc)
- 100,000,000 (loc)
- 1,000,000,000 (loc)
- Many terabytes of data
- Many dependencies
- Lot's of connected pieces
- Many intertwined systems

Where Mud Comes From?

People Write Code → People make Mud

Keep it Working, Piecemeal Growth, Throwaway Code

Ultra-Large-Scale Systems

Ultra-large-scale (ULS) systems will be interdependent webs of software-intensive systems, people, policies, cultures, and economics…Cloud, IoT, Big data, …

http://www.sei.cmu.edu/uls/

What are Large Scale Systems

Large-scale systems include:

- Many lines of code (loc)
- Many dependencies
- Lots of stored data
- Lot's of connected pieces
- Many intertwined systems
- Many overlapping policies
- Various security issues
- Many people involved

What are Large Scale Systems

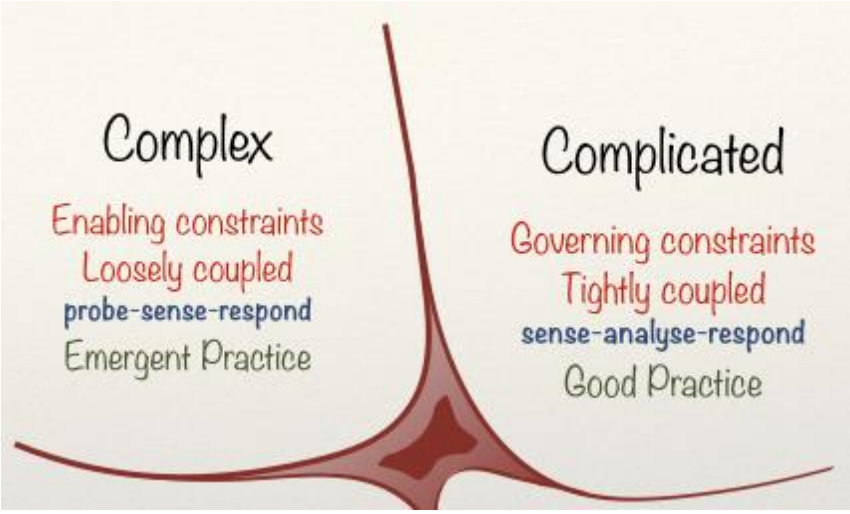
Large-scale systems include:

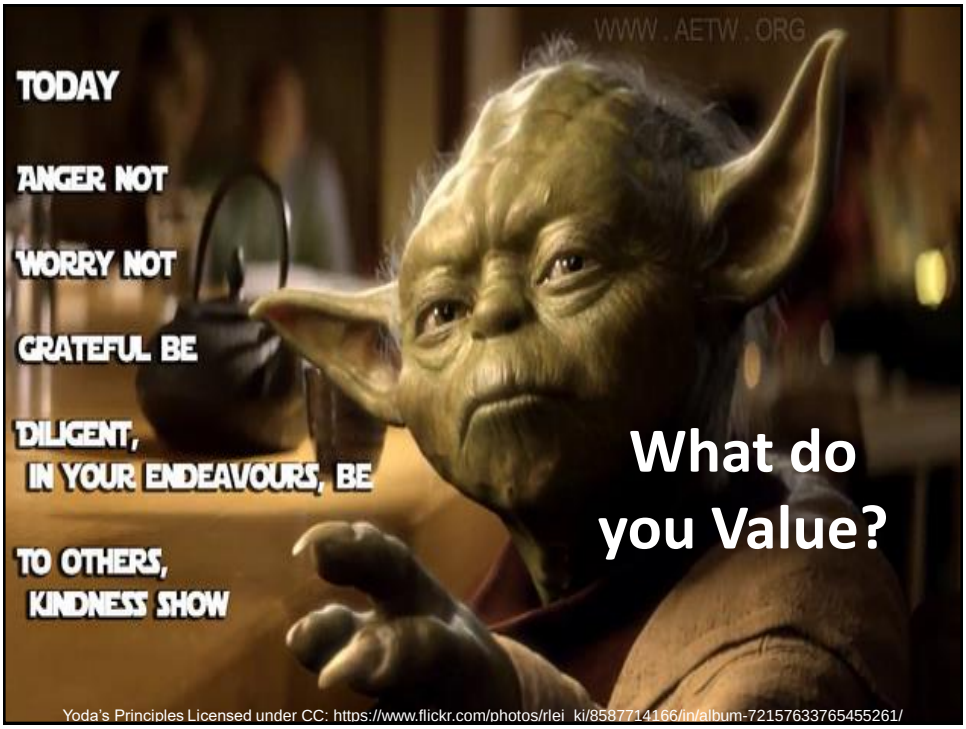
- Very clusters of hardware
- Many networks integrated
- Lot's of possible failure points
- Distributed Systems with multiple data centers around the world
- Systems that were not originally designed to work together
- No single team or timeframe

Need to Balance many forces

Simplicity
Scalability
Adaptability
Flexibility
Performance
Reliability
Features
…

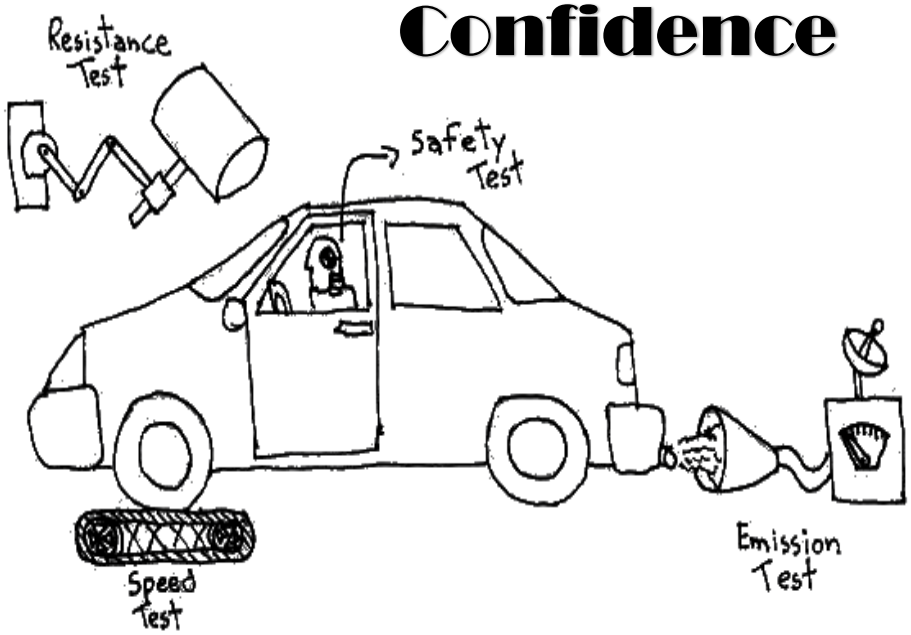
Complex vs Complicated Systems (Cynefin Framework)





How can I be more confident

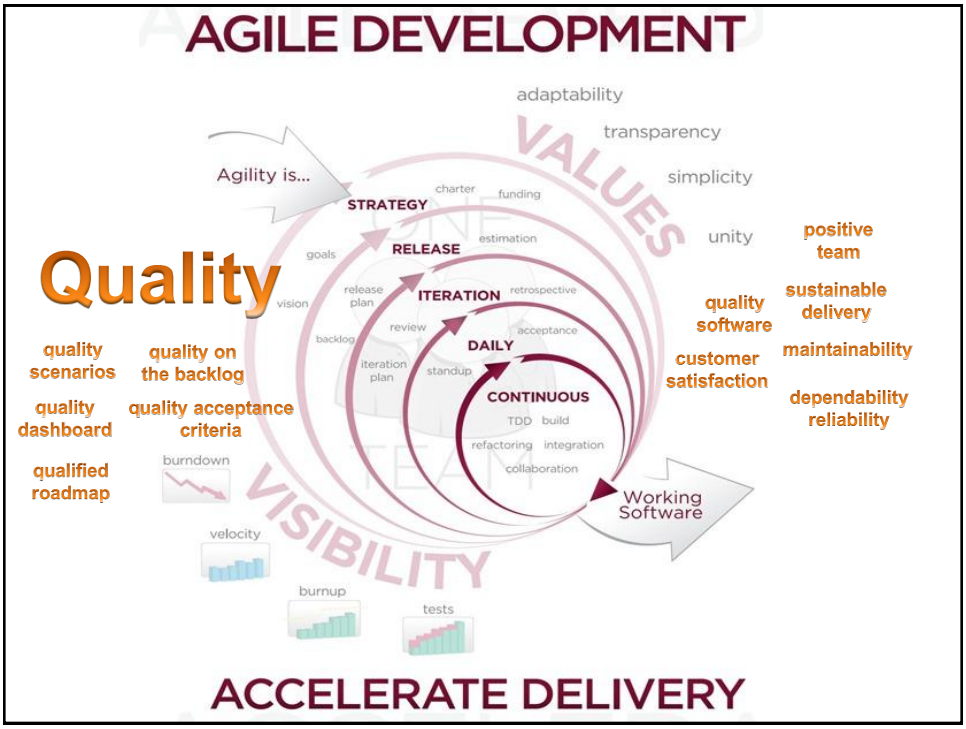
Confidence



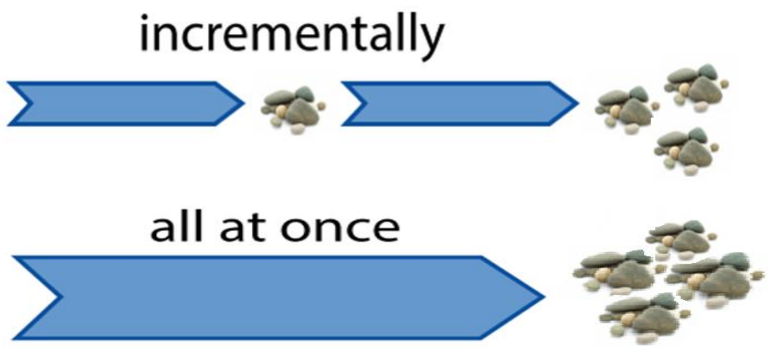
Values Drive Practices

Agile/Lean Design Values

- Core values:
  - **Design Simplicity**
  - **Quick Feedback**
  - **Frequent Releases**
  - **Continuous Improvement**
  - **Teamwork/Trust**
  - **Satisfying stakeholder needs**
  - ***Building Quality Software***
- **Keep Learning**
- **Sustainable Development**



Delivery Size???



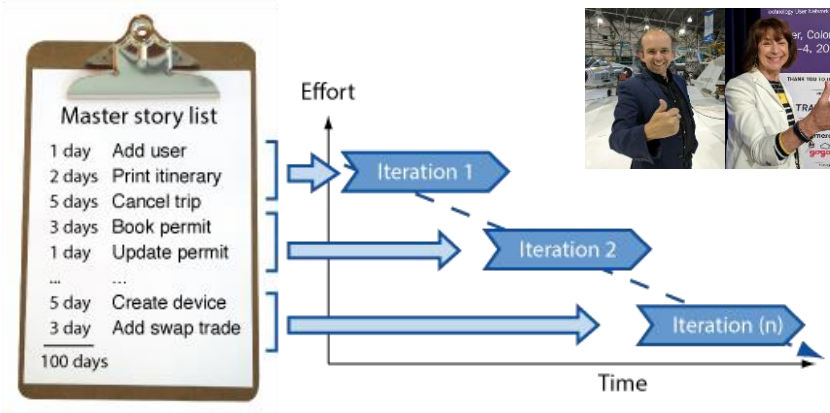
Delivery Size is Key

Large Delivery Size can cause many issues

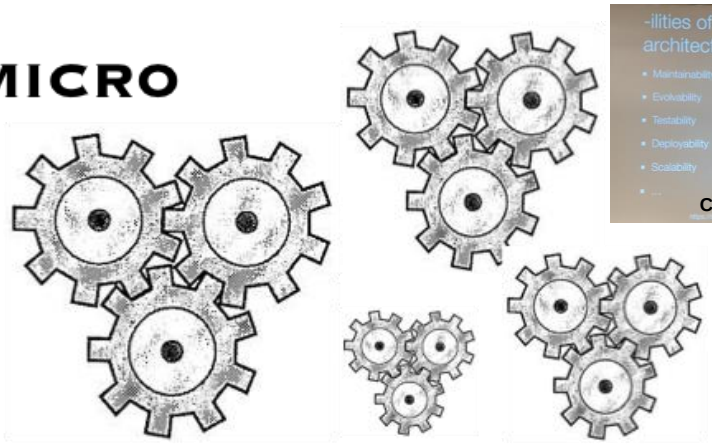
Issues:

- More potential defects
- Longer time to get feedback
- Slower adjust time
- Harder to experiment
- Problems take a long time to fix

Small Deliveries
Quick Feedback



MICRO

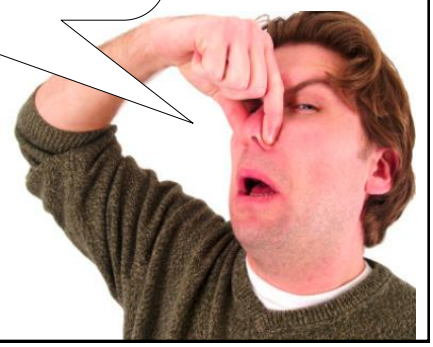


SERVICES

What about Quality?

Bad Code Smells

Have you ever looked at a piece of software that doesn't smell very nice?



A code smell is any symptom in the source code that can indicate a problem!

Neglect Is Contagious

- Disorder increases and software rots over time
- Don't tolerate a broken window

http://www.pragmaticprogrammer.com/ppbook/extracts/no_broken_windows.html

Is it better to clean little by little?

Or to let dirt and mess accumulate?

Some dirt becomes very hard to clean if you do not clean it right away!

Technical Debt?

Clean Code Doesn't Just Happen

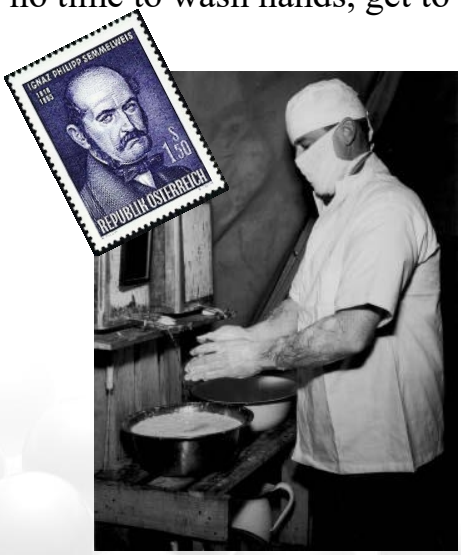
- You have to craft it
- You have to maintain it
- You have to make a professional commitment

"Any fool can write code that a computer can understand. Good programmers write code that humans can understand."
– Martin Fowler

But We Don't Have Time!

Professional Responsibility

There's no time to wash hands, get to the next patient!



http://en.wikipedia.org/wiki/Image:I_Semmelweis.jpg

Professionalism

Make it your responsibility to create software:

- ✓ Delivers business value
- ✓ Is clean
- ✓ Is tested
- ✓ Is simple
- ✓ Good design principles

When working with existing code:

- ✓ If you break it, you fix it
- ✓ You never make it worse than it was
- ✓ You always make it better

Refactoring

"If you **value** clean code…"

Refactorings

Behavior Preserving
Program Transformations

- Rename Instance Variable
- Promote Method to Superclass
- Move Method to Component

Always done for a reason!!!

Refactoring is key and integral to most Agile processes!!!

Sustaining Your Architecture

Two Refactoring Types*

Floss Refactorings—frequent, small changes, intermingled with other programming
(daily health)

Root canal refactorings—infrequent, protracted refactoring, during which programmers do nothing else (major repair)

* Emerson Murphy-Hill and Andrew Black in "Refactoring Tools: Fitness for Purpose"
http://web.cecs.pdx.edu/~black/publications/IEEESoftwareRefact.pdf

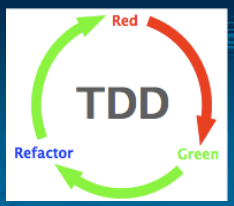
Safe Refactorings

- Rename is always safe!!!
- New Abstract Class moving common features up
- Extract Method (always safe)
- Extract Interface / Extract Constant
- Pull Up / Push Down
- Create common component for shared internal methods
  - Fairly safe but can be harder to share

You Must Test

When you find smelly code, you often apply refactorings to clean your code.

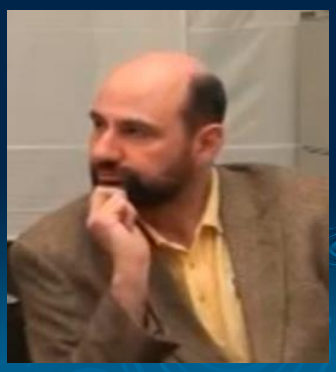
Testing is a key principle for safe refactoring!



Common Wisdom

Work refactoring into your daily routine…

"In almost all cases, I'm opposed to setting aside time for refactoring. In my view refactoring is not an activity you set aside time to do. **Refactoring** is something you **do all the time** in little bursts." — Martin Fowler



Strangler Pattern

Gradually create a new system around the edges of the old, letting it grow slowly over several years until the old system is strangled…

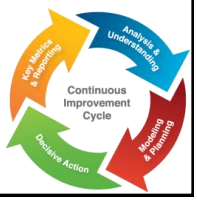
A natural wonder of the rain forests in Australia are the huge strangler vines. They seed in the upper branches of a fig tree and gradually work their way down the tree until they root in the soil. Over many years they grow into fantastic and beautiful shapes, meanwhile strangling and killing the tree that was their host.

PAUSE POINTS HELP

Kaizen 改善

The Sino-Japanese word "**kaizen**" simply means "change for better", with no inherent meaning of either "continuous" or "philosophy" in Japanese dictionaries or in everyday use. The word refers to any improvement, one-time or continuous, large or small, in the same sense as the English word "improvement". (Wikipedia)

Most view it as Continuous Improvement…



Slack Time

Need Slack time to improve

Ways to get slack time…

- Monitor and Make Visible
- Reduce Waste (Muda)
- Inject time into process
  (retros, daily cleanup, …)

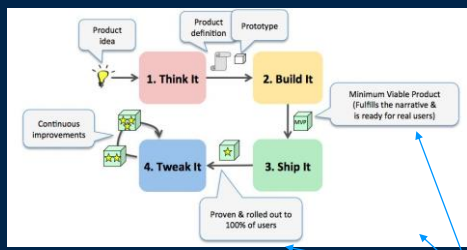
Try little experiments…

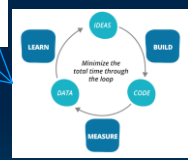
Continuous Improvement

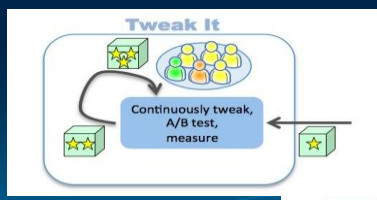
"Retrospectives are Key!!!"

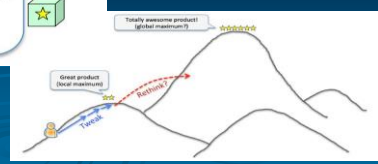
Small Steps we can take - next sprint!!!

Spotify: Innovation

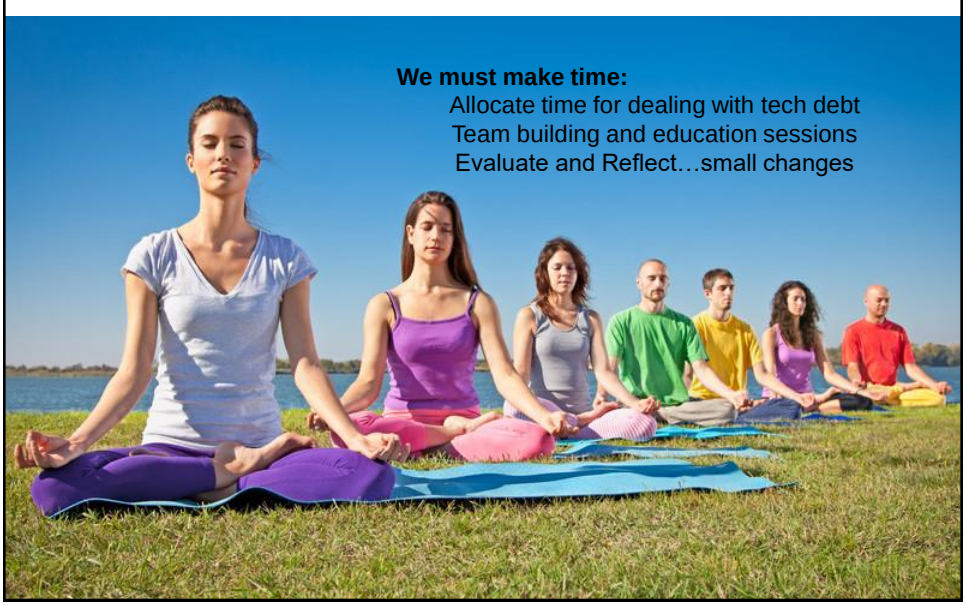








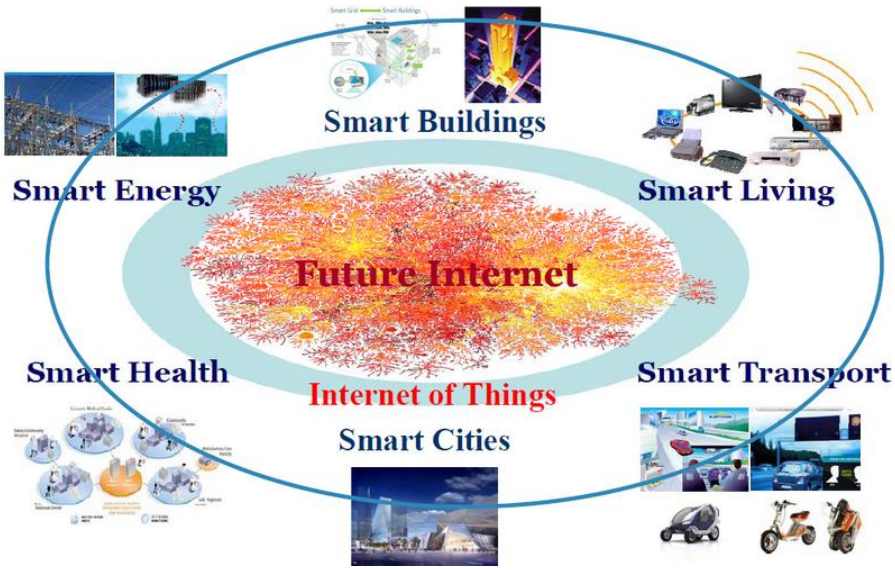
Regular Practices



We must make time:

Allocate time for dealing with tech debt
Team building and education sessions
Evaluate and Reflect…small changes

As we become more connected…



Large Scale SE Principles

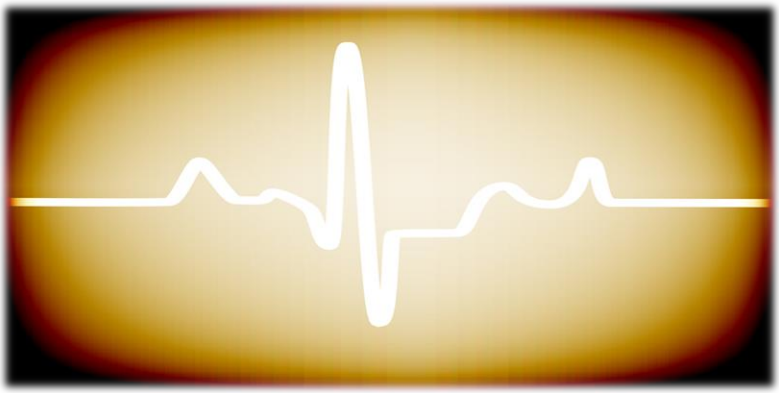
- **Building Infrastructure**
  - Identify common problems, build infrastructure to address them
    - Important to not try to satisfy everyone
    - Perfection is the enemy of “Good Enough”
  - Don't build infrastructure just for its own sake
    - Identify common needs and address them
    - Don't imagine unlikely potential needs that aren't really there
- **Design for Growth**
  - Try to anticipate how requirements will evolve
  - Keep likely features in mind as you design base system
  - Think how design will scale if growth changes by 10X or 100X

Large Scale SE Principles

- **Design for Low Latency**
  - Low avg. times (happy users ☺) – 90% average idle time is ok
  - Lot's of caching and parallelism can be helpful
- **Make Applications Robust**
  - Aggressive load balancing
  - Failover to other replicas/datacenters
  - Bad backend detection: disable live requests until gets better
  - Do something reasonable even if not all is right
    - Better to give users limited functionality than an error page
- **Keep Software Clean**
  - Code reviews
  - Design reviews
  - Lots of testing
    - unit tests for individual modules
    - larger tests for whole systems
    - continuous testing system

HOW SYSTEM QUALITY WORK CAN FIT INTO YOUR RHYTHMS

Build architectural quality into your project rhythms



"QUALITY IS NOT AN ACT, IT IS A HABIT."
—ARISTOTLE

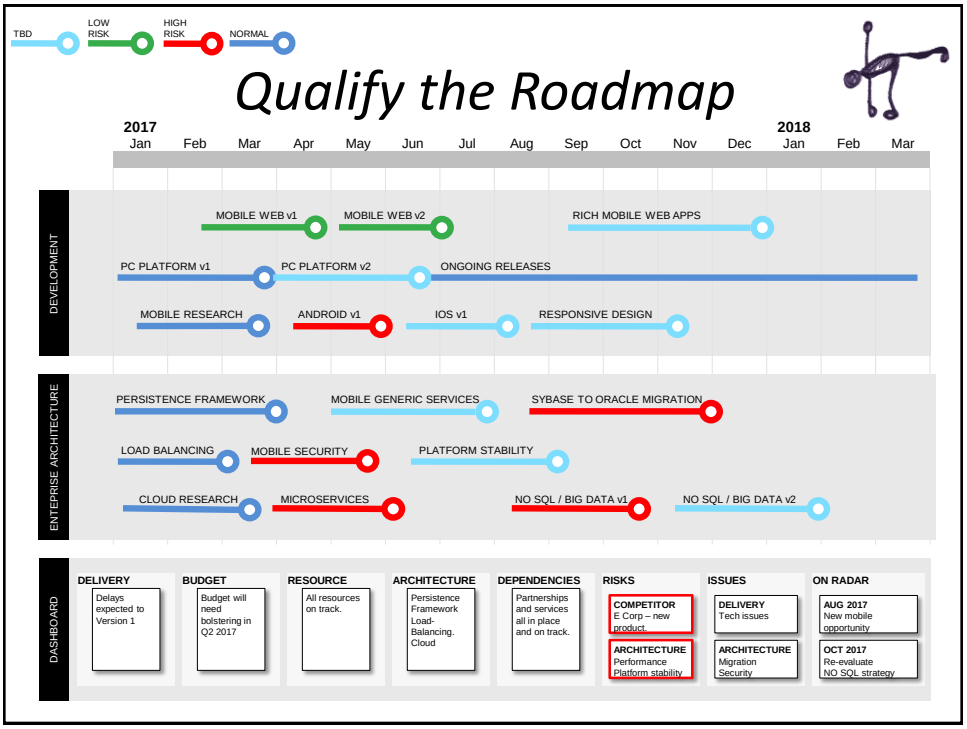
Some decisions are too important to leave until The Last Responsible Moment

so

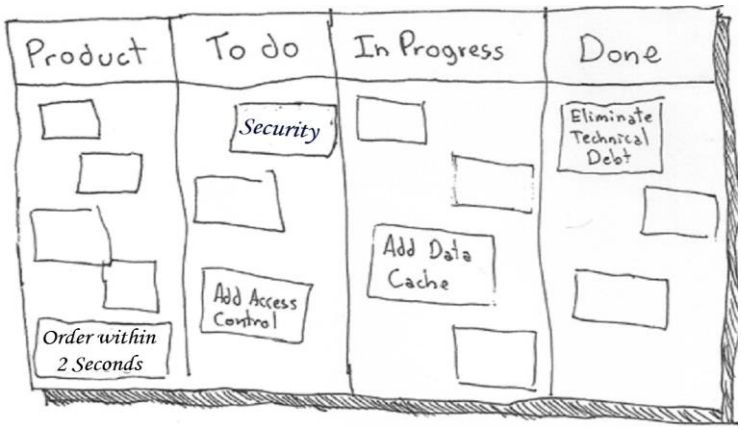
CHOOSE THE MOST RESPONSIBLE MOMENT

Qualify the Roadmap

"All you need is the plan, the roadmap, and the courage to press on to your destination"
— Earl Nightingale



Qualify the Backlog



You can add backlog items for technical debt and quality-related architecture work… yes, you can

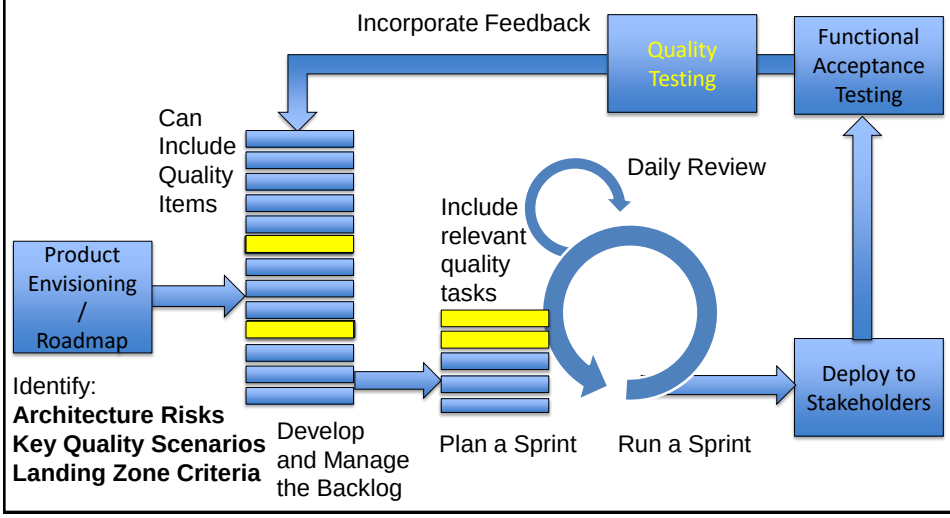
Make Architecture Work Visible and Explicit

	Visible	Invisible
Positive Value	Visible Feature	Invisible Architectural Feature
Negative Value	Visible Defect	Technical Debt

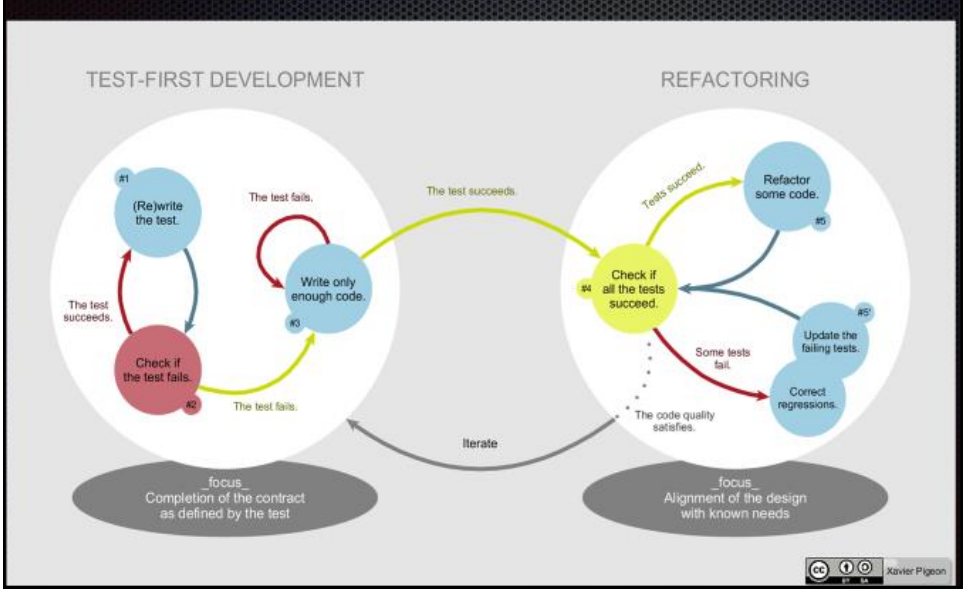
Color your backlog—Phillipe Kruchten

http://philippe.kruchten.com/2013/12/11/the-missing-value-of-software-architecture/

How Quality Fits Into An Agile Process



Test Driven Development



Mob Programming

A Whole Team Approach

Illustration © 2012 - Andrea Zuill

mobprogramming.org Twitter: @WoodyZuill

Large Scale Thinking

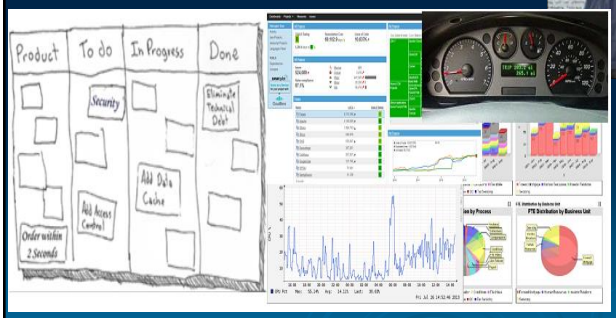
- Get feedback and advice early and often
  it is is ok to brainstorm and think
- Talk with colleagues and chat at a whiteboard
  Discuss designs & evaluate (spike solutions)
- Constantly monitor what is going on…
  Build operational dashboards and more
- Think carefully about interfaces
  (how will others use the interface)
  - Get feedback on your interfaces, evolve as needed
  - Learn from proven well-designed interfaces

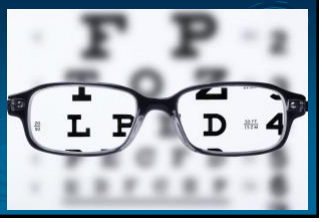
Large Scale Practices

- **Good Modularity and Abstraction principles still work**
  - **no one group (and no single timeframe) has created all the software, so do only what you can**
- **Be expansive in exception handling**
  - **When one happens, log all the relevant details; write the exception handler to try to repair the problems or at least continue in some fashion**
- **Log stuff just in case**
- **Write code to check consistency and validity of data, and run that code periodically or continuously in the background**
- **Write code to repair inconsistent or invalid data, preferably by reconstructing it from sources other than the bad data itself**
- **Don't assume synchronization is perfect; tolerate messed up data**

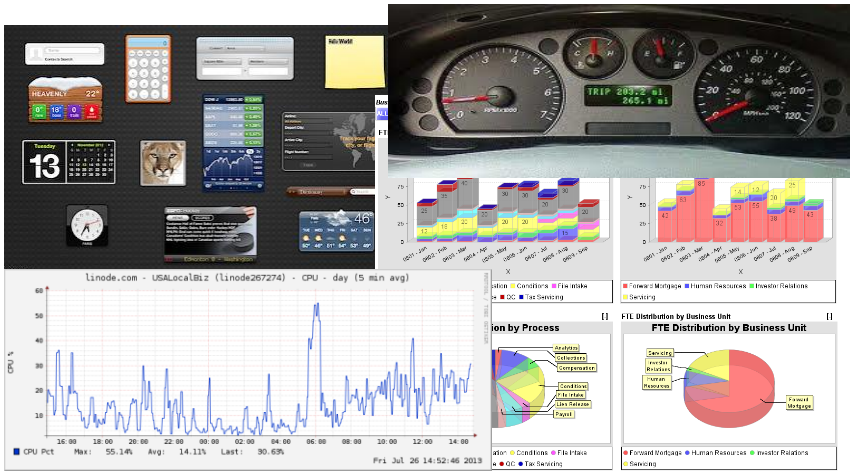
ONGOING QUALITY ACTIVITIES

Visibility is Important





Monitor System Qualities—
Build An Operational Dashboard



Quality Focused Checklists

- Release Checklists*
  - Agreed upon checklist for quality and major architecture concerns
- Use at pause points
  - sprint planning, release planning, …

*Thanks, James Thorpe for sharing your company's checklist

Development Release Checklist

The code and architecture should be examined prior to release into our test environment. If any checkbox cannot be checked, exceptions should be noted and communicated to the Product Owner and QA lead.

Code quality

- ☐ All code complies with the relevant coding standard.
- ☐ All code compiles without any errors or warnings (full clean and build)
- ☐ Appropriate logging has implemented throughout the code.
- ☐ All possible exceptions have been handled appropriately.
- ☐ The code has been checked for memory leaks.
- ☐ All test and debug code has been removed.
- ☐ Code is appropriately documented.
- ☐ All dead code has been removed.
- ☐ All unit tests have been run without error.
- ☐ Unit tests have been written for all new code or code changes.

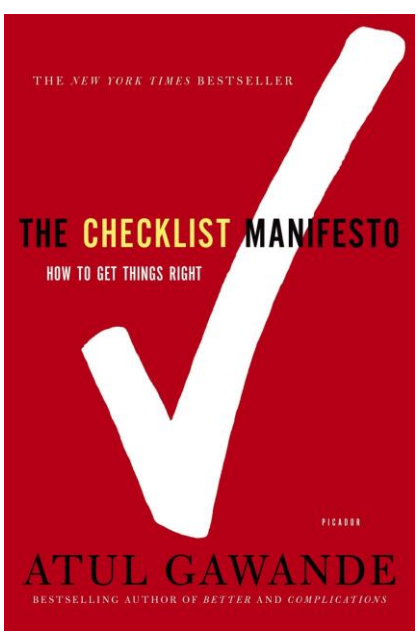
Architecture

- ☐ No web service APIs have been created or modified without full documentation and architectural sign-off
- ☐ No web service data structures have been created or modified without full documentation and architectural sign-off.
- ☐ No database structures have been created or modified without full documentation and architectural sign-off

Performance

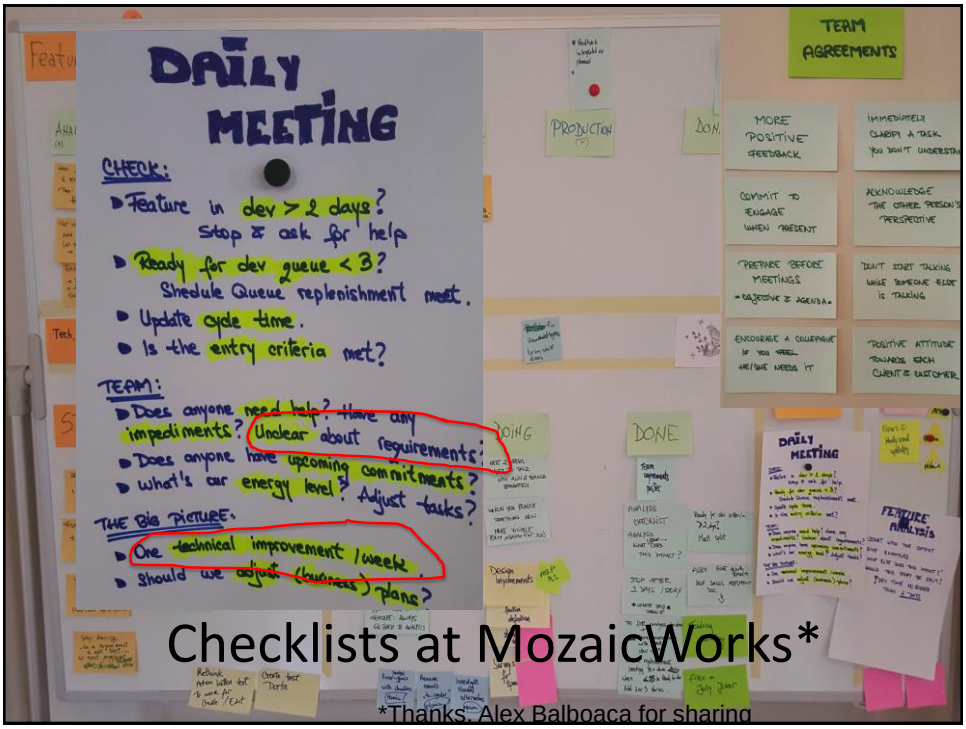
- ☐ All web pages render in under 500 ms with a production workload
- ☐ All reports are generated in under 500 ms with a production workload
- ☐ No query takes more than 500 ms to return data with production data volumes.

Notes or Exceptions to the above:



Two Kinds of Checklists

1. Read-review
2. Do-confirm

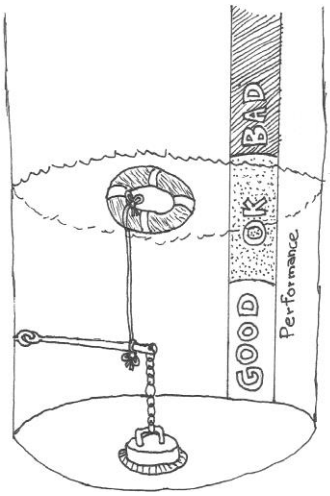


Checklists at MozaicWorks*

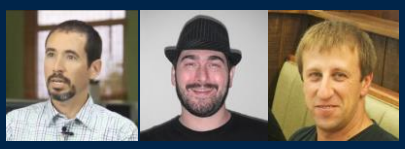
*Thanks, Alex Balboaca for sharing

Define Architecture Triggers

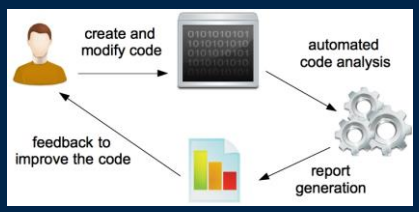
- Conditions that cause architecture investigation/ tasks
  - Quality target no longer met
  - Code quality metrics violations
  - …
- Have broad system impact



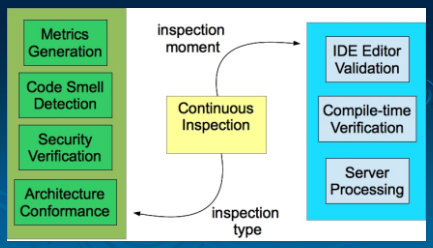
Continuous Inspection



Asian PLoP 2014 Paper



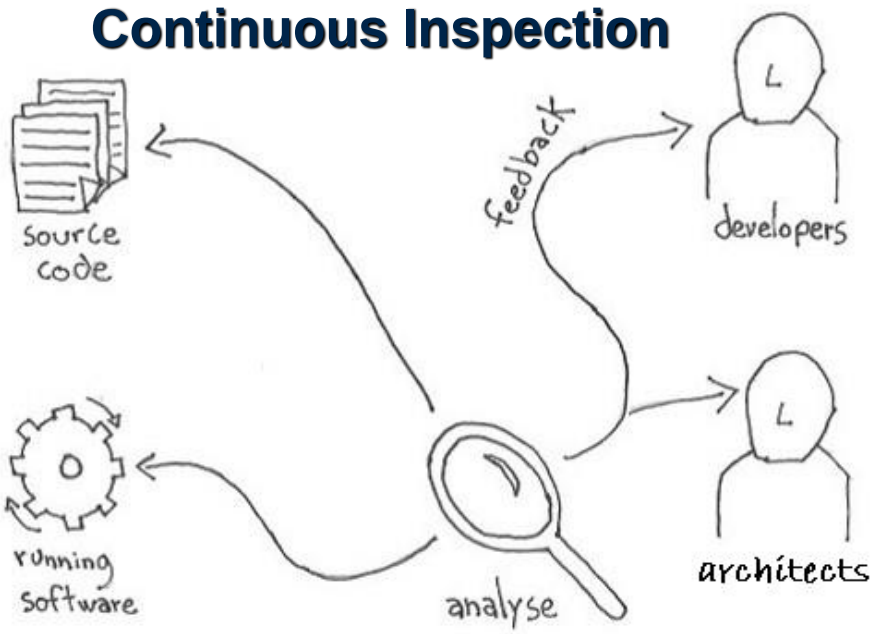
- *Code Smell Detection*
- *Metrics (Test Coverage, Cyclomatic complexity, Technical Debt, Sizes, …)*
- *Application Security Checks*
- *Architectural Conformance*



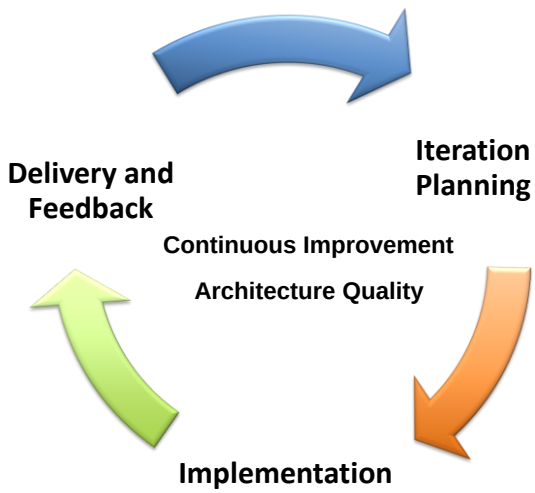
Automate where you can!!!

Sustaining Your Architecture

Continuous Inspection



Periodically Re-Evaluate Architecture Risks



Agile Values Can Drive Architectural Practices

- Do something. Don't debate or discuss architecture too long
- Do something that buys you information
- Prove your architecture ideas
- Reduce risks
- Make it testable
- Prototype realistic scenarios that answer specific questions
- Incrementally refine your architecture
- Defer architectural decisions that don't need to be immediately made

Patterns for Evolving Agile Architecture

USA PLoP 2015

Plan for Responsible Moments

How can you handle the technical challenges in the beginning of the project without a full architectural design upfront?

Create a technical plan for how and when to handle each of the technical challenges and evolve it throughout the project. This plan needs to define how to identify these important responsible moments and circumstances when it is appropriate address these technical challenges.

can include...

to plan tasks related to the architecture

Architectural Spike

How can you explore and decide on architectural issues that are not completely understood by the team?

When more information is needed, add an Architecture Spike task to your backlog to perform some study, test or alternatives investigation that support architectural decisions.

Architectural Trigger

How can the team know when current conditions should cause work on the architecture?

Define conditions or scenarios in the architecture that if they happen can trigger the addition of one or more architectural tasks to the backlog.

Architecture in the Backlog

How can you ensure that the architecture will adequately evolve during the project, meeting the necessary capabilities to fulfill the software requirements?

Add important architectural capabilities to the backlog as they become apparent to make sure that they are prioritized and implemented at the Most Responsible Moments.

can add new tasks...

to be aware of problems in the architecture

Technical Debt Management

How can the team avoid an uncontrolled growth of technical debt?

Identify and manage the technical debt present in the project along with the respective effort to fix and the interest that accrues if the debt is not paid off.

can be included as part of the...

Continuous Inspection

How can you detect architecture and code problems as soon as possible?

Use available automated tools to continuously inspect code, generate a report on the overall code health, and point out if any violation was detected.

can use...

Patterns for Evolving Agile Architecture

Asian PLoP 2015

to start working with the architecture

Climbing on the Shoulders of Giants

How can you quickly define the basic application architecture and the main component types that will satisfy the requirements?

Use an existing reference compatible with the application platform and suitable to its needs as a starting point.

Find Where it Hurts

How can you identify relevant points where the architectural design should focus?

Early on, identify the challenging technical requirements that are important for the project, so they can be handled at the optimal time.

to prepare to handle the most critical issues

can guide the choice of...

Plan for Responsible Moments

How can you handle the technical challenges in the beginning of the project without a full architectural design upfront?

Create a technical plan for how and when to handle each of the technical challenges and evolve it throughout the project. This plan needs to define how to identify these important responsible moments and circumstances when it is appropriate address these technical challenges.

to know how tests should be created

Tracer Bullets

How can you define low-level details about the architecture without spending a lot of time upfront on a detailed investigation?

Select the smallest set of architectural relevant user stories and implement them as references for upcoming functionality. Use this implementation to face technical challenges that were planned to be targeted before the project iterations.

can validate each other

Test Architecture

How can you define how architectural components should be tested?

Define the test approach for each kind of component, considering its scope, technique, and kind of tests and tools that are going to be used.

can include...

Patterns for Being Agile at Quality

Core Patterns
- Breaking Down Barriers
- Integrate Quality

Becoming Agile at Quality
- Whole Team
- Quality Focused Sprints
- Product Quality Champion
- Agile Quality Specialist
- Spread the Quality Workload
- Shadow the Quality Expert
- Pair with a Quality Advocate

Identifying Qualities
- Finding the Qualities
- Agile Quality Scenarios
- Quality Stories
- Measureable System Qualities
- Fold-out Qualities
- Agile Landing Zone
- Recalibrate the Landing Zone
- Agree on Quality Targets

Making Qualities Visible
- System Quality Dashboard
- System Quality Radiator
- Qualify the Roadmap
- Qualify the Backlog
- Automate First
- Quality Checklists

QA to AQ

Patterns about transitioning from Quality Assurance to Agile Quality

Joseph W. Yoder [1], Rebecca Wirfs-Brock[2], Ademar Aguiar[3]

[1] The Refactory, Inc.,

[2]Wirfs-Brock Associates, Inc.

[3] FEUP

joe@refactory.com, rebecca@wirfs-brock.com, ademar.aguiar@fe.up.pt

Abstract. *As organizations transition from waterfall to agile processes, Quality Assurance (QA) activities and roles need to evolve. Traditionally, QA activities have occurred late in the process, after the software is fully functioning. As a consequence, QA departments have been "quality gatekeepers" rather than actively engaged in the ongoing development and delivery of quality software. Agile teams incrementally deliver working software. Incremental delivery provides an opportunity to engage in QA activities much earlier, ensuring that both functionality and important system qualities are addressed just in time, rather than too late. Agile teams embrace a "whole team" approach. Even though special skills may be required to perform certain development and Quality Assurance tasks, everyone on the team is focused on the delivery of quality software. This paper outlines 21 patterns for transitioning from a traditional QA practice to a more agile process. Six of the patterns are completely presented that focus on where quality is addressed earlier in the process and QA plays a more integral role.*

Categories and Subject Descriptors

- QA to AQ: Patterns about transitioning from Quality Assurance to Agile Quality, AsianPLoP 2014
- QA to AQ Part Two: Shifting from Quality Assurance to Agile Quality, PLoP 2014
- QA to AQ Part Three: Shifting from Quality Assurance to Agile Quality "Tearing Down the Walls", SugarLoafPLoP 2014
- QA to AQ Part Four: Shifting from Quality Assurance to Agile Quality "Prioritizing Qualities and Making them Visible", PLoP 2015
- QA to AQ Part Five: Being Agile At Quality "Growing Quality Awareness and Expertise", AsianPLoP 2016
- QA to AQ Part Sox: Being Agile At Quality "Enabling and Infusing Quality", AsianPLoP 2016
- Patterns to Develop and Evolve Architecture in an Agile Project, PLoP 2016,
- Continuous Inspection, AsianPLoP 2016

…PATTERNS FOR TRANSITIONING FROM TRADITIONAL TO AGILE QA AND AGILE ARCHITECTURE

Copies available off our websites.

Indicators You've Paid Enough Attention to Architecture

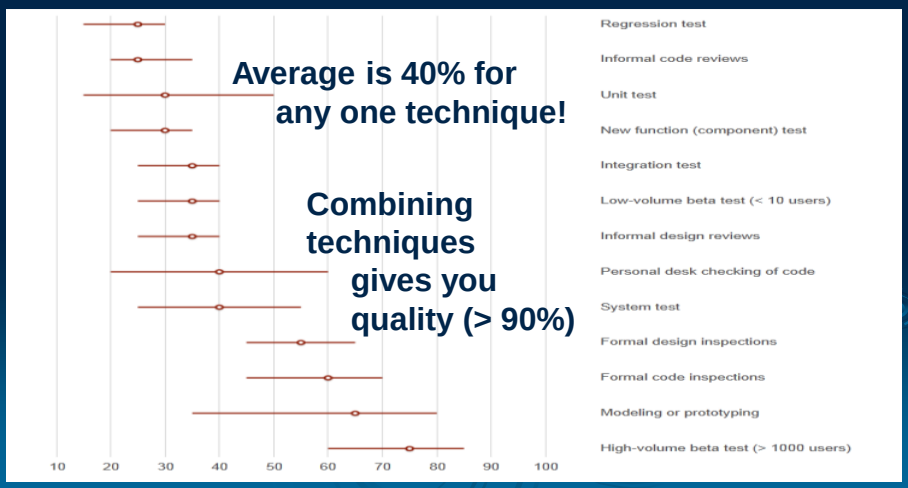
- Defects are localized
- Stable interfaces
- Consistency
- Developers can easily add new functionality
- New functionality doesn't "break" existing architecture
- Few areas that developers avoid because they are too difficult to work in
- Able to incrementally integrate new functionality

Sustaining Your Architecture

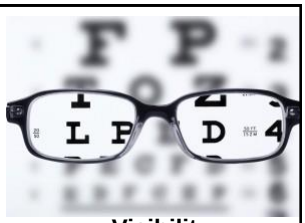
Other Techniques for Improving Quality

Steve McConnell

http://kev.inburke.com/kevin/the-best-ways-to-find-bugs-in-your-code/

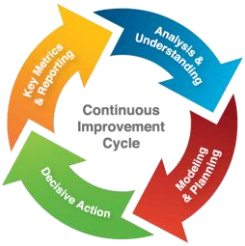


Small Frequent Releases!!!



Visibility

VALUES DRIVE PRACTICE
CALL TO ACTION



Daily Practices

Sustainable Development

(CC) by muffinn on Flickr

Manifesto for Agile Software Development

"We are uncovering easier ways of developing valuable products by doing it and helping others to do it. Through this work we have come to value:"

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.

Relaxed ~~Lazy~~ Manifesto

"We are uncovering easier ways of developing valuable products by doing it and helping others to do it. Through this work we have come to value:"

- Keeping slack over being busy all the time
- Small high quality software over large complex software
- Doing only what is necessary over exhaustively discovering all tasks
- Doing less to deliver the same over doing more to deliver less


Harada Kiro

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

Principles of Relaxed ~~Lazy~~ Manifesto

"We follow these principles when they don't add work:"

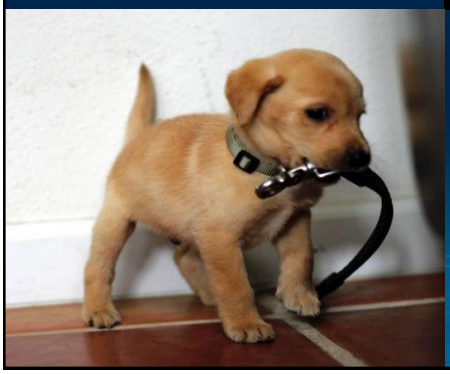
- Doing nothing is always an option.
- We seek to minimize the number of backlog items while keeping the value of the backlog.
- We believe to keep increasing velocity is not always good.
- We try to eliminate tasks that generate no value.
- We try to combine tasks to reduce latency and rework.
- We try to rearrange tasks to find problems early.
- We try to simplify all tasks as much as possible
- We are not afraid of eliminating our own tasks / processes by continuously acquiring new skills / capabilities.
- We expand capabilities over increasing capacities.
- We only work hard to make our work easier and safer.
- We always look to get help while we provide help to others with minimum effort.
- We never try to add an unnecessary principle simply to match with the other manifesto :)


Harada Kiro

Dogmatic

Synonyms: **bullheaded, dictative**, **doctrinaire**, **fanatical**, **intolerant**

Antonyms: amenable, flexible, manageable



Pragmatic

Synonyms: **common**, **commonsense**, **logical**, **practical**, **rational**, **realistic**, **sensible**

Antonyms: idealistic, unrealistic

Being Pragmatic

Lot's of Upfront Planning

Lot of Design & Architecture

Traditional or Waterfall

☹

Rough Adaptive Plan (changing)

Right Balance of Design & Architecture

Being Agile

☺

No Planning

No Design or Architecture

Sometimes called Agile

☹

Balance Between…

It is a Journey

Commitment

Follow-through

Deliberate practices

Slack Time to Improve

Paying attention

Continuous Learning