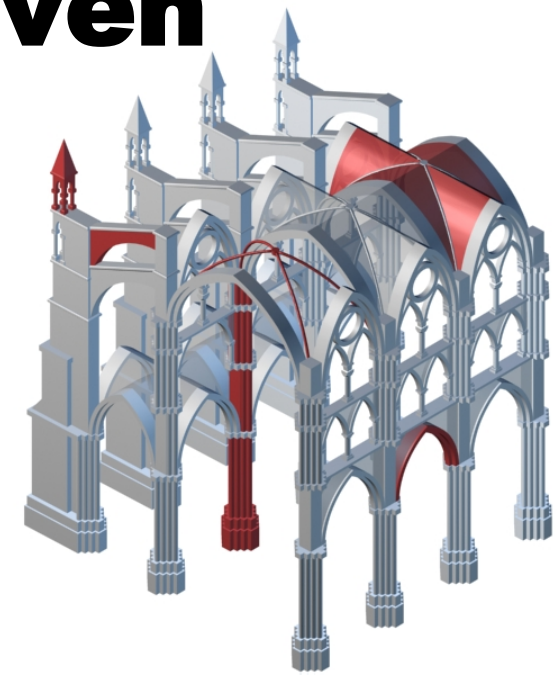
Agile vs. Plan-driven

http://pixabay.com/en/tent-camping-camper-24500/



http://upload.wikimedia.org/wikipedia/commons/5/51/Gotic3d2.jpg

Motivation: Agile vs. Plan-driven

- Some history
  - Software crisis (1968)
  - Chaos report (Standish group: since 1994, every 1-2 years)
  - Similar reports (e.g. recent study by Forrester)

  → Too many software projects (still) fail!

- Success factors:
  - End-user involvement, Top-Management support, clear requirements
- Failure factors:
  - No End-user involvement, unclear and incomplete requirements, high number of requirements changes

→ Software **Engineering**: Systematic / repeatable approaches to build software.

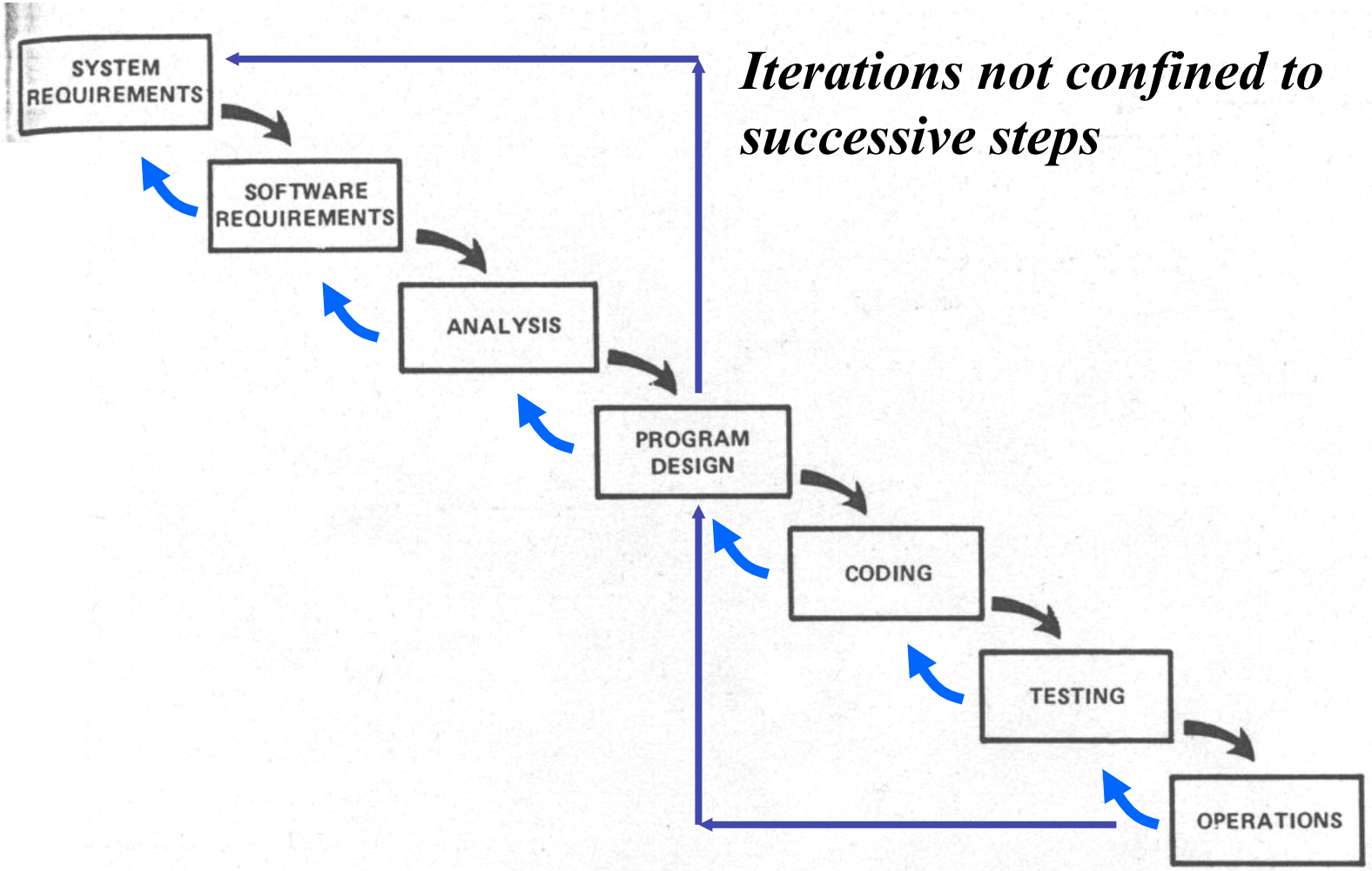


Figure 2. Implementation steps to develop a large computer program for delivery to a customer.

Royce, 1970: http://www.cs.umd.edu/class/spring2003/cmsc838p/Process/waterfall.pdf

The “unknown” part of the waterfall

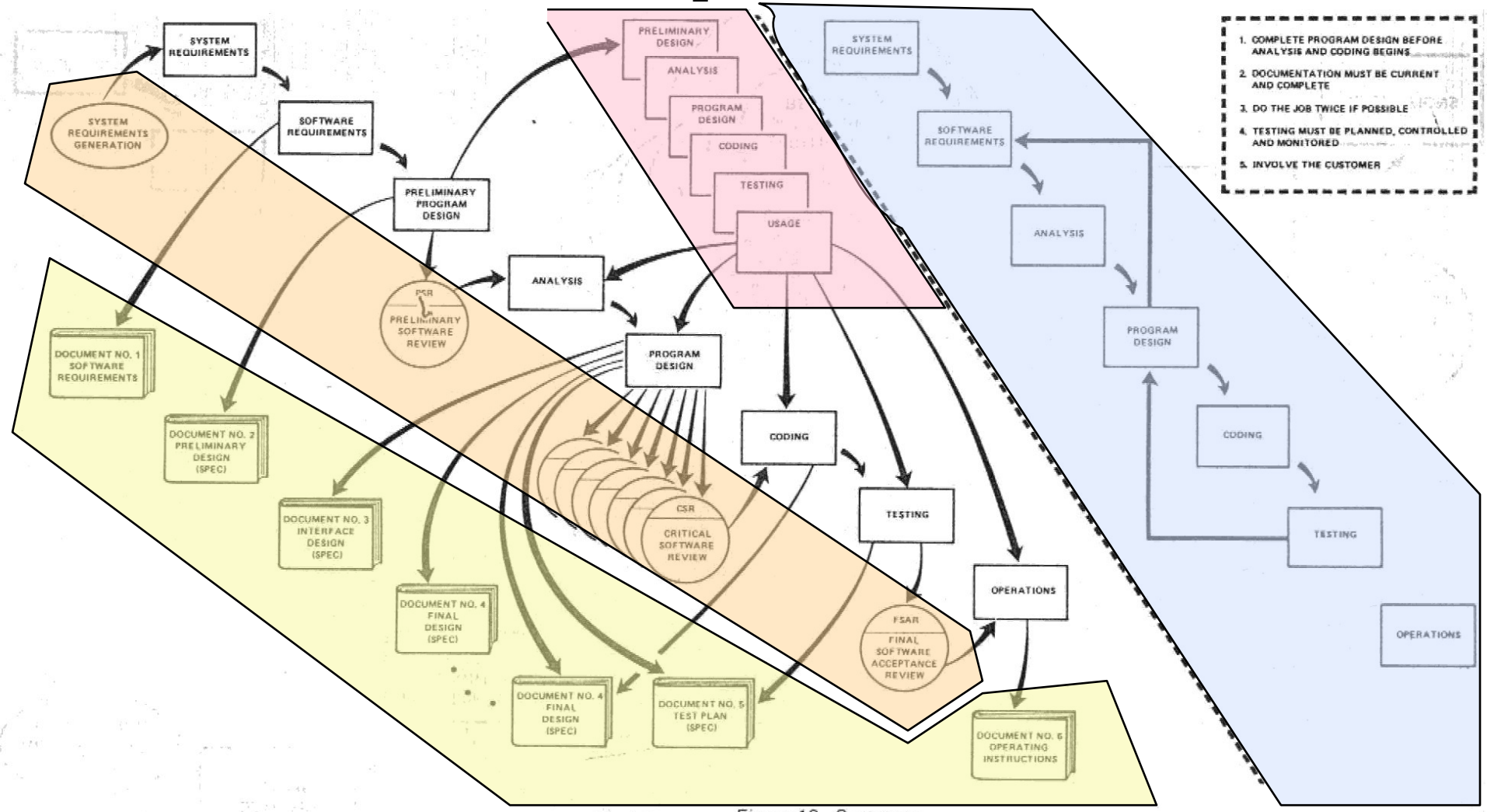


Figure 10. Summary

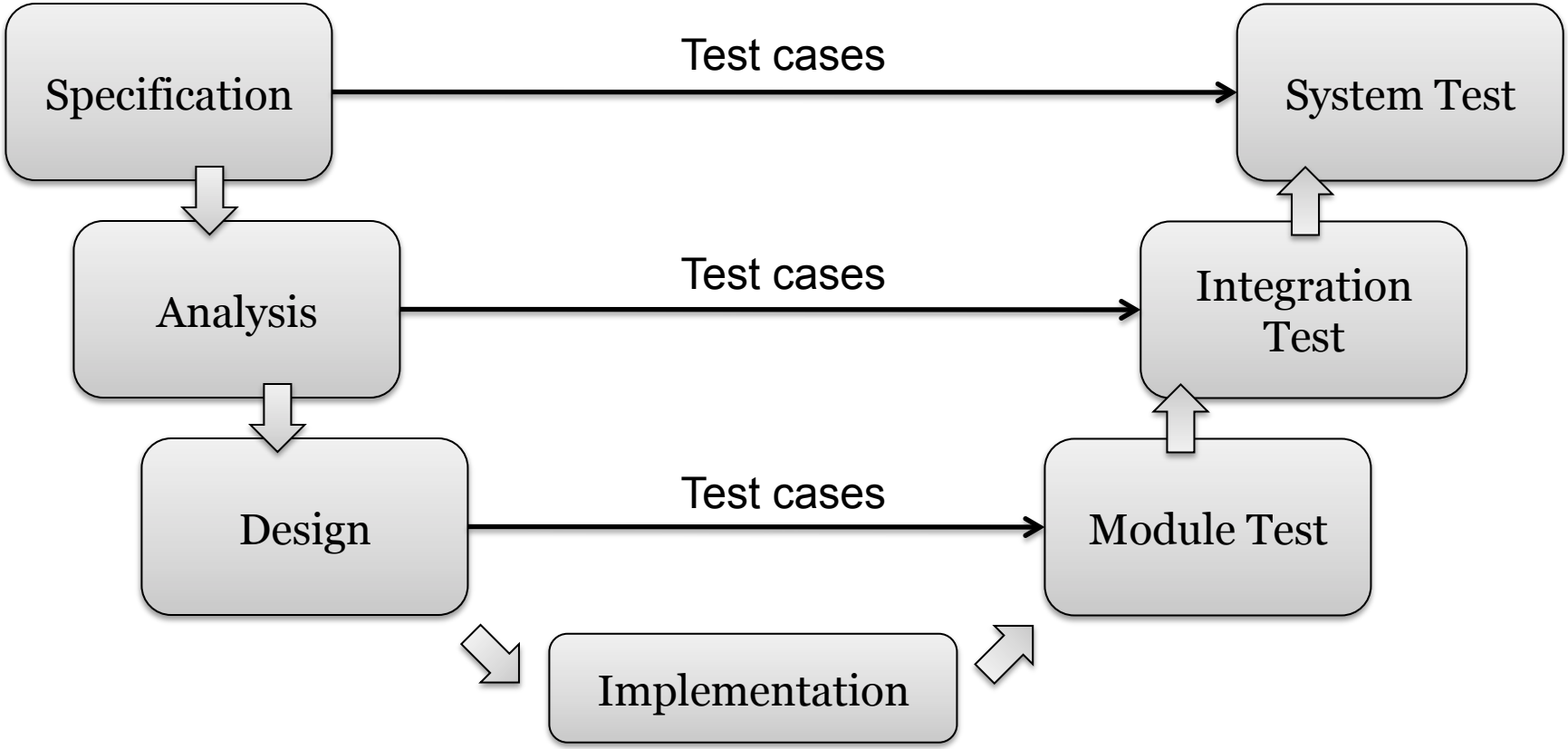
Waterfall Model

- Phases
  - Requirements analysis and definition
  - System and software design
  - Implementation and unit testing
  - Integration and system testing
  - Operation and maintenance
- Main principle: One phase has to be completed before the next phase can be started
- Changes are hard due to implied dependencies between artifacts from different phases

Waterfall Model

- Restrictions
  - Customer's change requests cannot be adapted easily by the ongoing development process
  - The process should only be applied when requirements are pretty complete, well understood by all stakeholders (customer, project manager, developers, testers, …), and changes are not expected
  - Only a few projects fulfill all these preconditions at the beginning
  - Waterfall model is used for large engineering projects, which might be spread over several development sites

V-Model

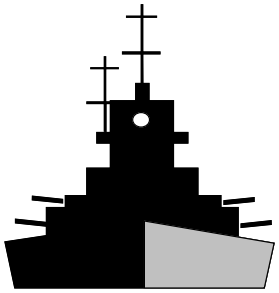

Specification
Test cases
System Test
Analysis
Test cases
Integration Test
Design
Test cases
Module Test
Implementation

V-Model

- Applicability
  - Automotive industry
  - Governmental projects
  - Hierarchical development projects with subcontractors
  - Large engineering projects which are spread over several development sites

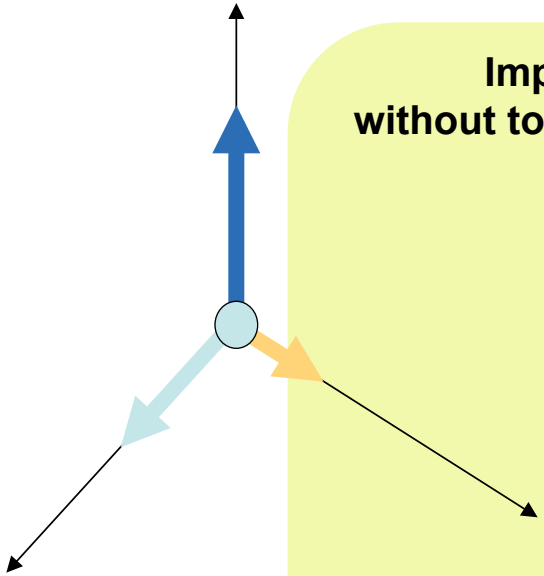
- Restrictions
  - Change requests due to modified requirements could not be adapted easily
  - Sequential development
  - Tayloring only possible with V-Model XT

Field of Tension



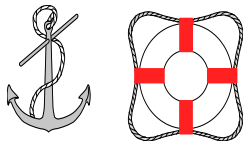
Different needs and priorities

Mature processes
Disciplined approach



Improvement in one area without too much detoriation in others

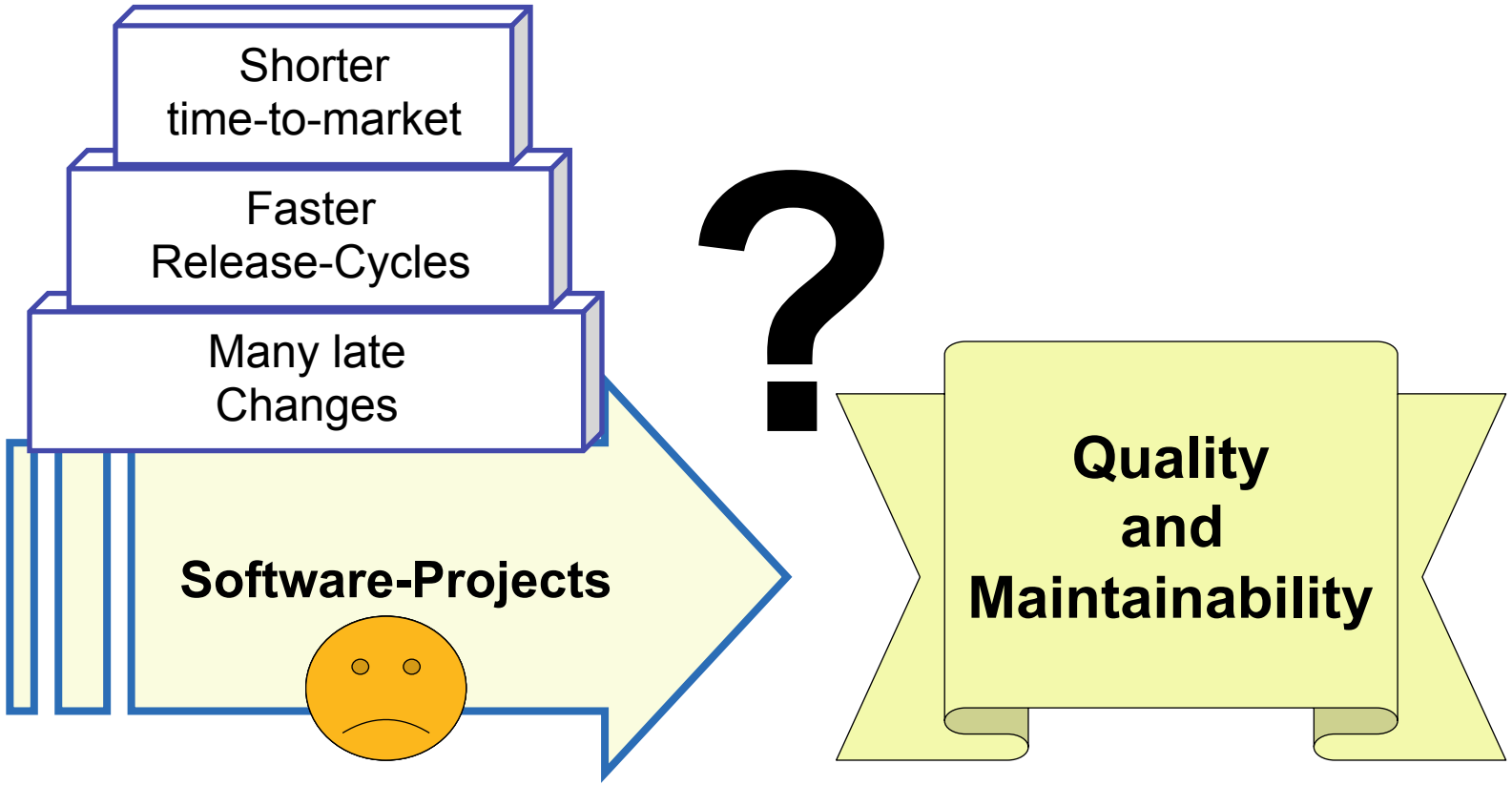
Good ability to react
Quick and flexible



Suitability of means
(Checklists, Templates, ...)
low overhead

Where is the biggest utility for a company/project?

Typical problems in software development



Projektplan (classical)

c.f. IEEE Std 729-1983

Defines 6 questions

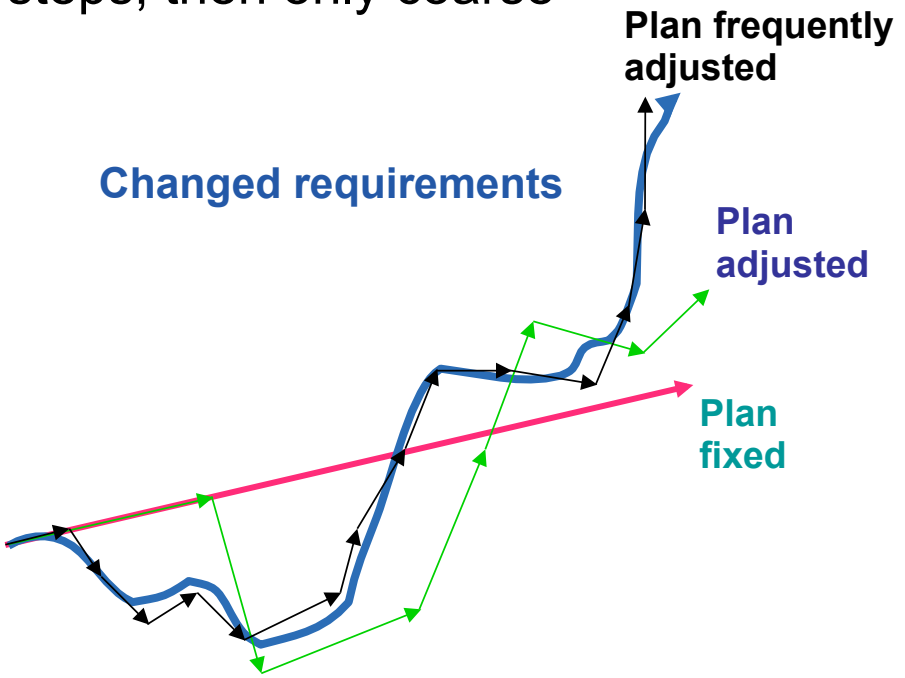
- What will be done
- Why
- For how much money
- By whom
- When
- With what resources (Developmen- and Management-aids and -techniques)

To be defined

- Responsibility of Project Manager
- Necessary tasks (as far as they can be known)
- Expected results
  - In detail: Software, Documentation, Servicesdetaillierter
    - E.g. for Doc.: table of contents, intended readers, level of detail
  - Ideal: Acceptance criteria, even for Documents

What is different in agile?

- Observation: Planning has limitations
- Therefore: Fine-grained plan for next steps, then only coarse
- Precondition:
  Continuous progress control
  and feedback



- Example for agile “Micromanagement”: SCRUM

Agile Manifesto

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.

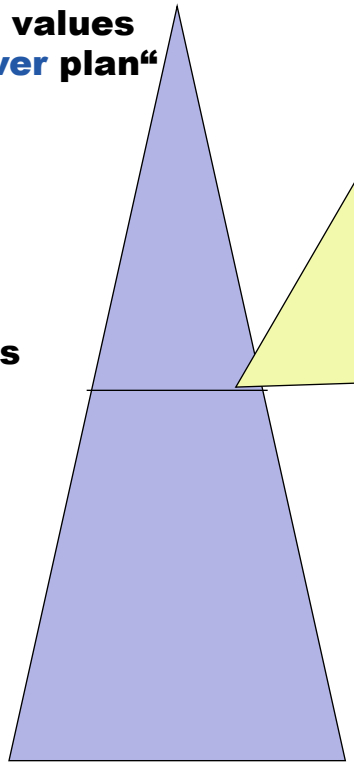
Kent Beck
Mike Beedle
Arie van Bennekum
Alistair Cockburn
Ward Cunningham
Martin Fowler

James Grenning
Jim Highsmith
Andrew Hunt
Ron Jeffries
Jon Kern
Brian Marick

Robert C. Martin
Steve Mellor
Ken Schwaber
Jeff Sutherland
Dave Thomas

Structure of agile methods

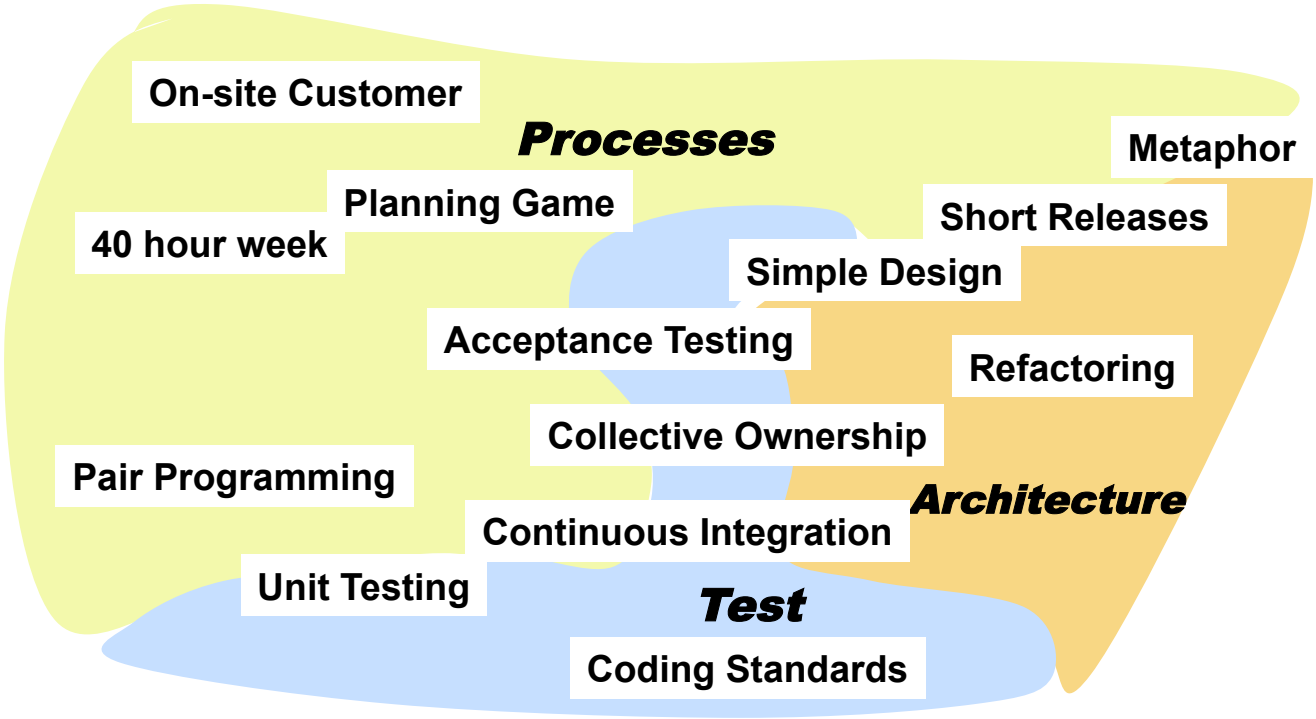
Generally



- **Highes priority: Customer Satisfaction**
  - **early and continuous delivery of valuable software**
- **Simplicity**
  - **Avoid unnecessary work**
- **Even late changes are welcome**
  - **Imply improved service to customer**
- **...**
- **Direct face-to-face communication**
  - **Best way to exchange information**
- **Regular reflection on how to become more effective**
  - **Feedback on several levels**

eXtreme Programming

- Practices
  - Interact and support each other
  - Interplay of Process, Testing, and Architectural issues

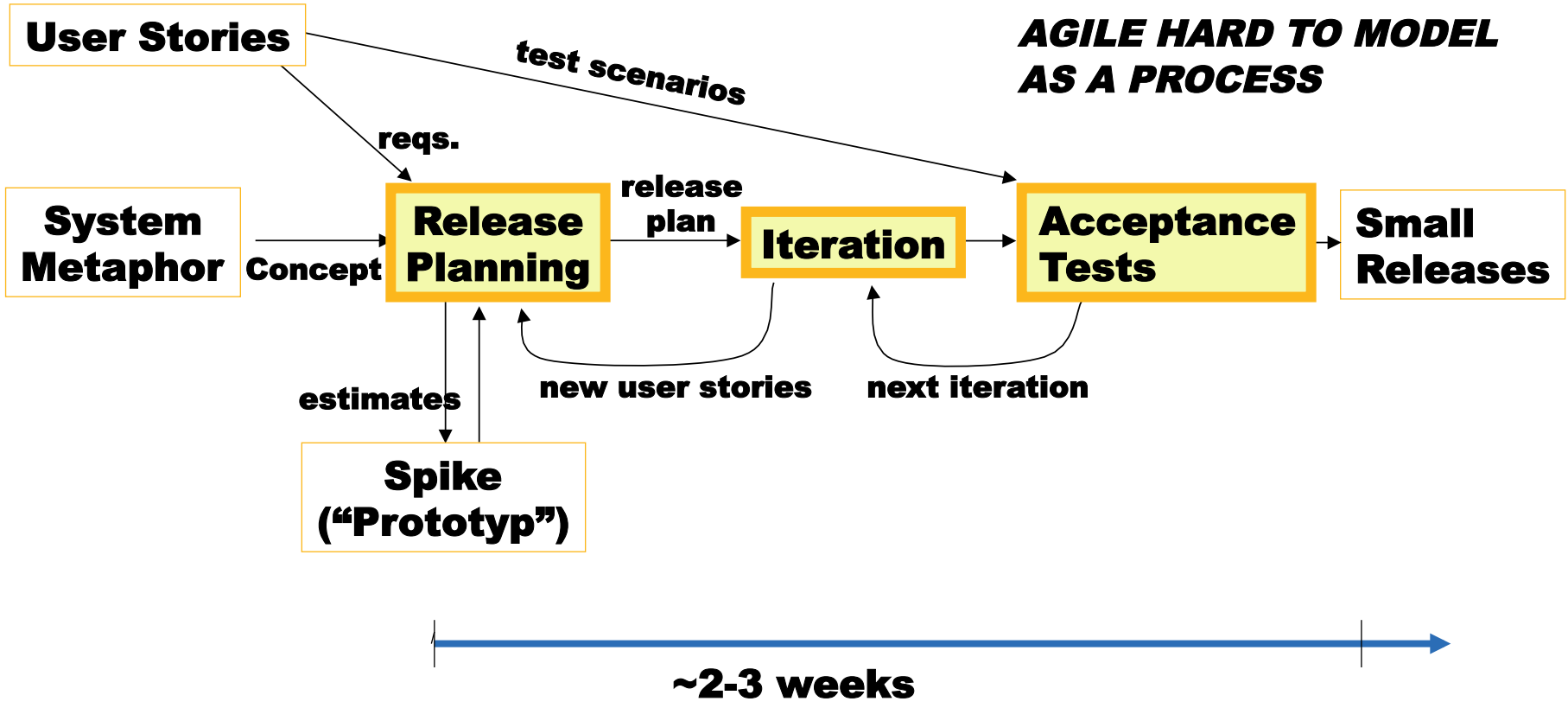


Processes in XP

based on Practices

***OBS!* Many practices are not shown explicitly in this model!**

AGILE HARD TO MODEL AS A PROCESS



c.f. J. Donovan Wells, Copyright 2000

How much planning does a project need?

Inspired by Barry Boehm

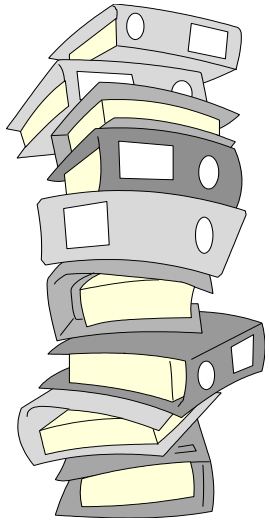
Fine grained Contracts

++ clear basis for work

+ financial security

- - very high effort

- - Changes very hard to achieve



How much planning does a project need?

Inspired by Barry Boehm

ad hoc

+ low planning effort
+ individual freedom
- - result hard to anticipate
- - depending on “Hero”

Fine grained
Contracts

How much planning does a project need?

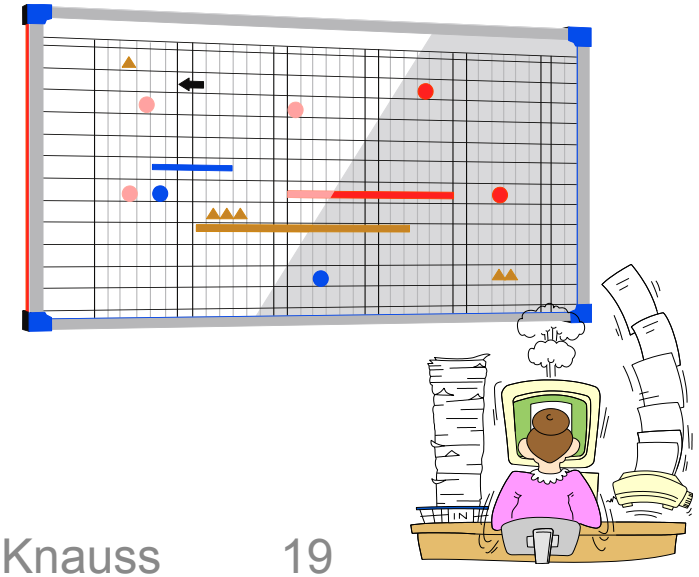
Inspired by Barry Boehm

Milestone & Plan Driven

+ long term predictions
+ good status control
- - Changes difficult
- - unrealistic assumptions hard to eliminate

ad hoc

Fine grained Contracts



How much planning does a project need?

Inspired by Barry Boehm

Milestone and Risk Driven

++ active

+ Partial results early

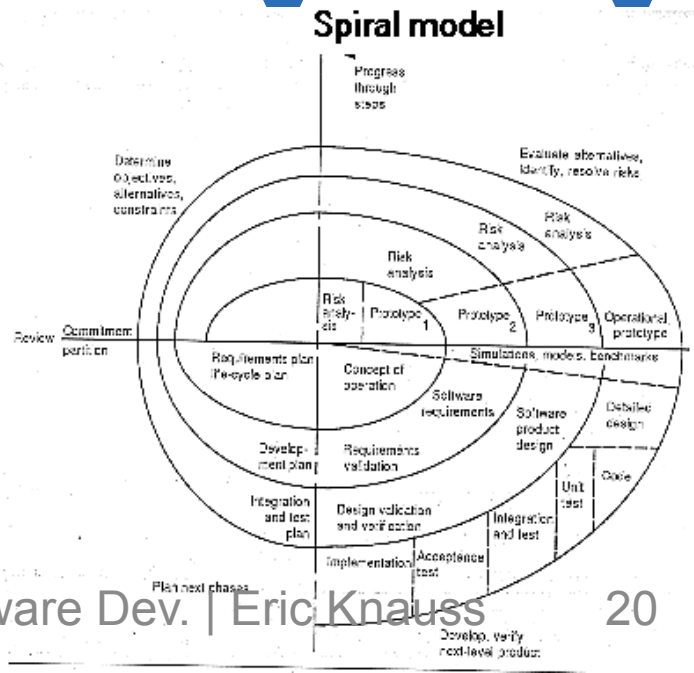
- Hard: long-term planning

- Relatively high effort

ad hoc

Milestone & Plan Driven

Fine grained Contracts



How much planning does a project need?

Inspired by Barry Boehm

eXtreme Programming
+ Early core results
++ Changes unproblematic
- Hard to do in large projects
- Relies on self-discipline

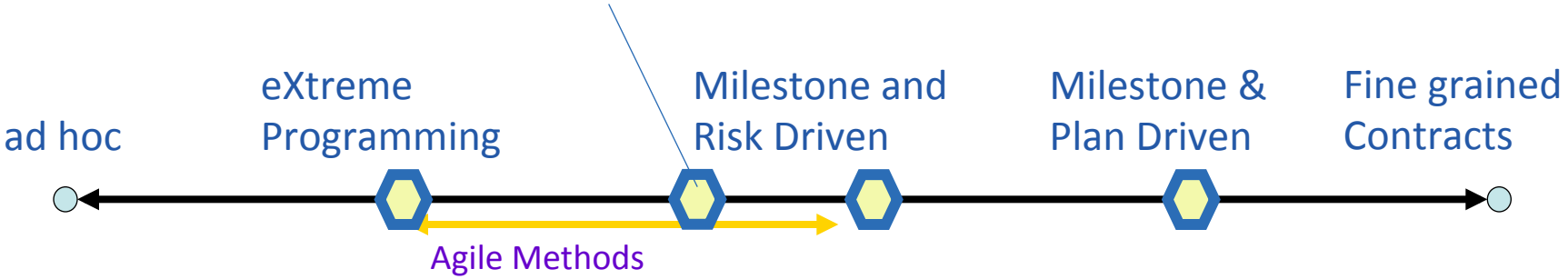
ad hoc — Milestone and Risk Driven — Milestone & Plan Driven — Fine grained Contracts

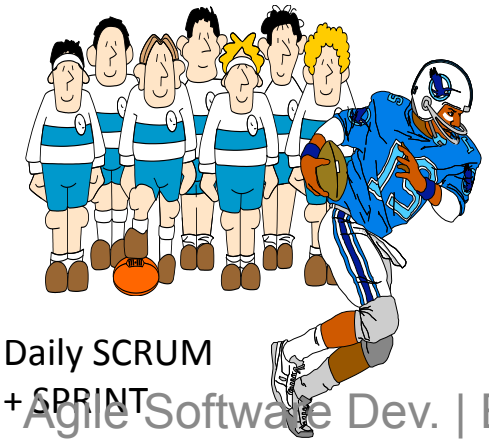
Just enough planning

Inspired by Barry Boehm

Agile Example: SCRUM

+ midterm planning
+ quick reaction
- Relies on team qualification
- End-product not specified





Daily SCRUM
+ SPRINT

Agile thinking

Based on Frühauf, Conquest 2001

	Traditional	Agile
Customer collaboration	unlikely	Critical success factor
Delivery of something useful	Only after some (longer) time	At least every 6 weeks
Develop the right system by	Thinking ahead, detailed specification	Develop core, show, improve
Required discipline	formal, low	informal, high
Changes	Create resistance	Are expected and tolerated
Communication	Via documents	Face-to-face
Prepare for changes	By planning ahead	By being flexible

Introduce agile methods_

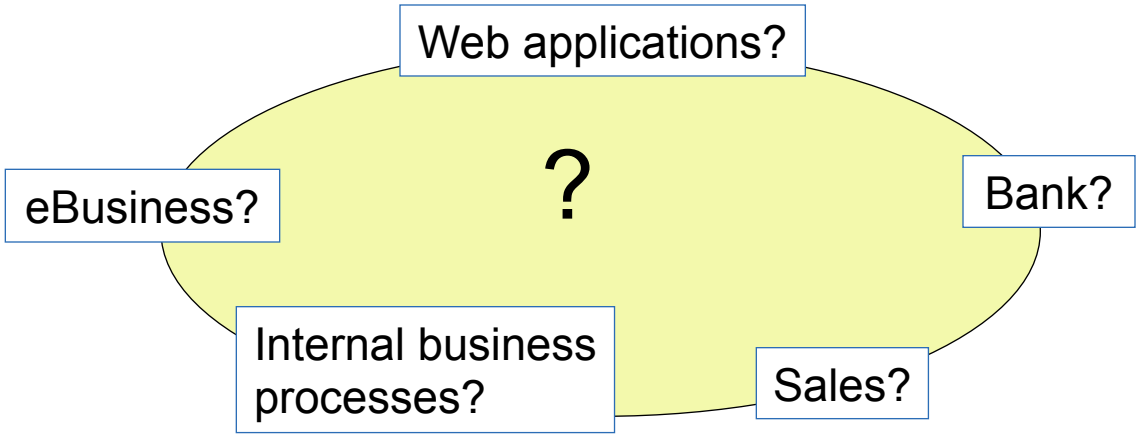
- How do
  - Line managers
  - Engineers in software maintainance
  - Customers

  with a plan-driven background feel if you propose agile?

- Beware!
  - There are many false pretenses and excuses
  - There are also crucial points that reoccur

- Whoever offers agile methods needs to take these crucial issues very seriously!

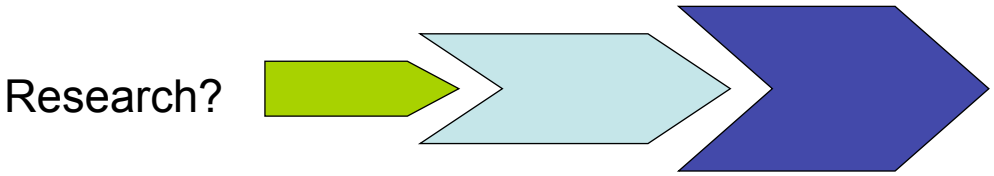
Agile in a large company?



Business Processes

Embedded Software

R&D?



(Serial-) Production?

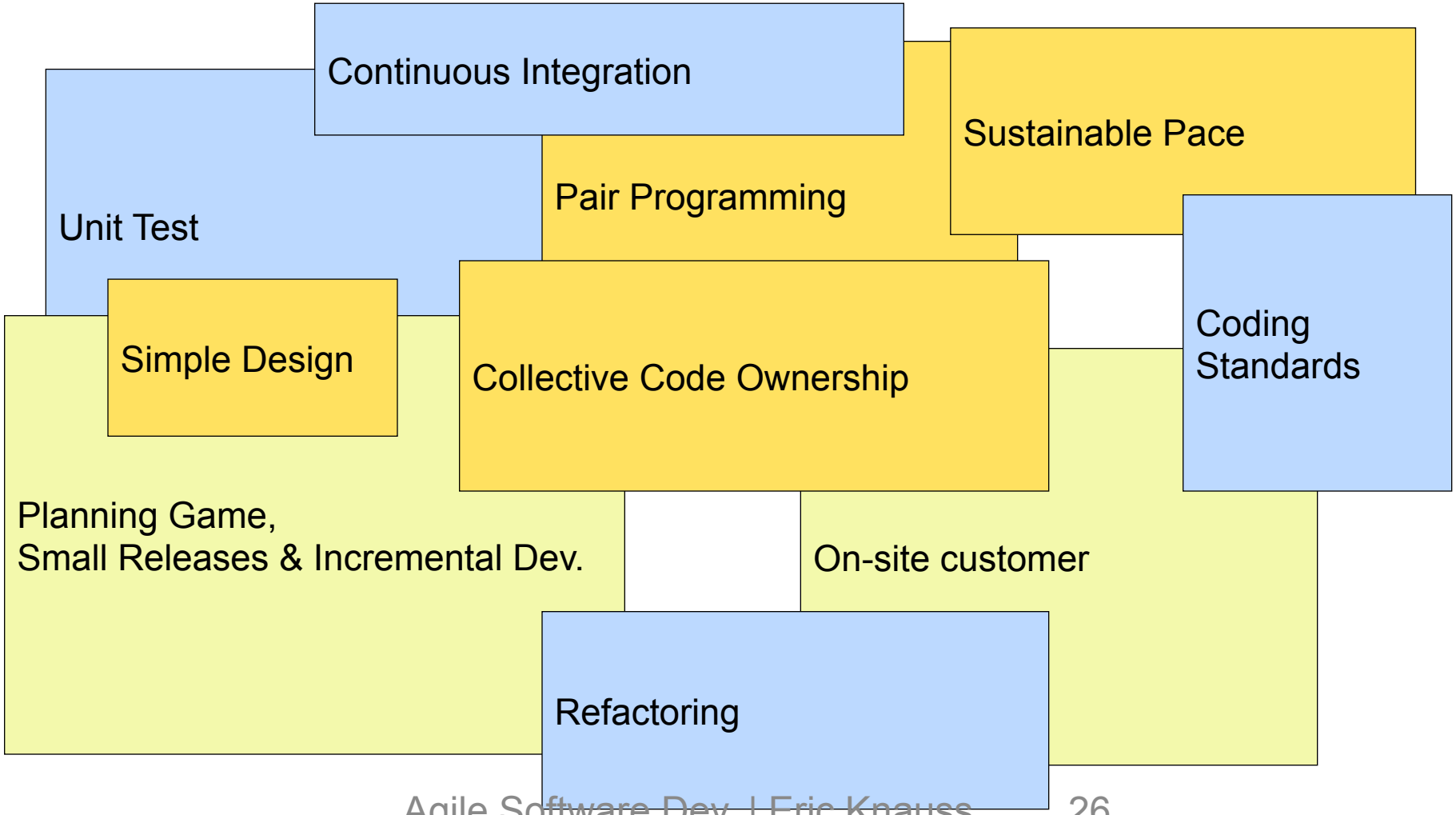
Safety-relevant Software?

Schneider, K. (2003): SQM congress 2003, Köln, SQS

Implications of agile

(example here: XP)

„The heart of Agile Modeling is its practices“ ***Scott W. Ambler***



Common objections

Schneider, K. (2003):
SQM congress 2003, Köln, SQS

Might look like that, but...

On the first glance ...

- Working in pairs is a waste of time
- Our large systems do not allow for fast releases
- Sustainable pace? I don‘t care, we have a 35h week!

Ok, let‘s check

More serious

- Our people will hate collective code ownership and working in pairs...
- Our type of systems do not allow for refactoring/cont. integration/test first

General Objections

Well known killerphrases

- That is nothing new! 20 years old
- This does not work here.
- We are already doing that – I mean wild hacking, hahaha!

Real crucial issues

Did I get you right?

- You implement without knowing what we want?
- You want a customer representative on site permanently?
- You try to *avoid* documentation?
- You want to make work for you as simple as possible? What about QM?

Be honest!

You feel anxious because so much is changing. How will you keep the overview? Or would you prefer failing in a proven way over a risky success?

Schneider, K. (2003): SQM congress 2003, Köln, SQS

What do we get?

- We write comprehensive specifications so that we know what we get. And now?
- How do we know what we get in the 5th increment?
- We won't get new money after each increment!
- We work with fixed-price contrats. Does this work here as well?
- Why should we trust this agile contractor?

- Not any more!
  - Specifications are too expensive and outdated while being written. Yes, uncertainty remains.
- We don't know, we assume
  - Make a master plan and change it
  - And: we are not stupid!
- Right; apply for all of it now.
- Yes:
  - Based on exploration phase
  - Based on a good domain description
  - Simple changes without changing contract
- Based on good experience in exploration phase

Schneider, K. (2003): SQM congress 2003, Köln, SQS

On-Site Customer

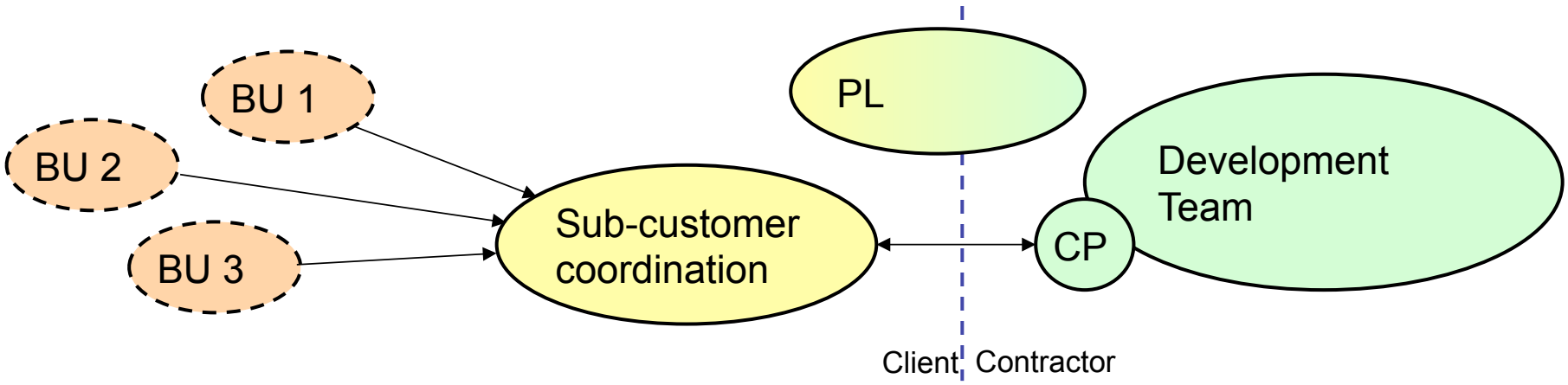
- We cannot do with out this person!
- Several business units are part of this. The one customer does not exist!
- Nobody can know all business units in detail
- To avoid errors, a lot of coordination is required
- Does not the On-site Customer lose attachment to the business unit?
- Every business unit representative will will favor *their* unit

- Fulltime is rare
  - Sometimes availability on the phone sufficient
  - Consider Customer Proxy! (below)
- You need to define one!
  - (can be changed later)
- No need to know all the details!
  - Changes are possible, errors allowed
  - Important: Ability to decide – without coordination
- Can happen!
  - In long projects: exchange!
- Customer proxy Concept
  - Product manager plays customer

Schneider, K. (2003): SQM congress 2003, Köln, SQS

"Customer Proxy" Concept

- Developer plays "customer"
  - Good domain knowledge
  - Intensive contact with developers
  - Participates in coordination of sub-customers
- Important
  - Quick decision by one person
  - Wrong decisions can be revised
  - We observed this in industry and did it ourselves: It works!



Schneider, K. (2003): SQM congress 2003, Köln, SQS

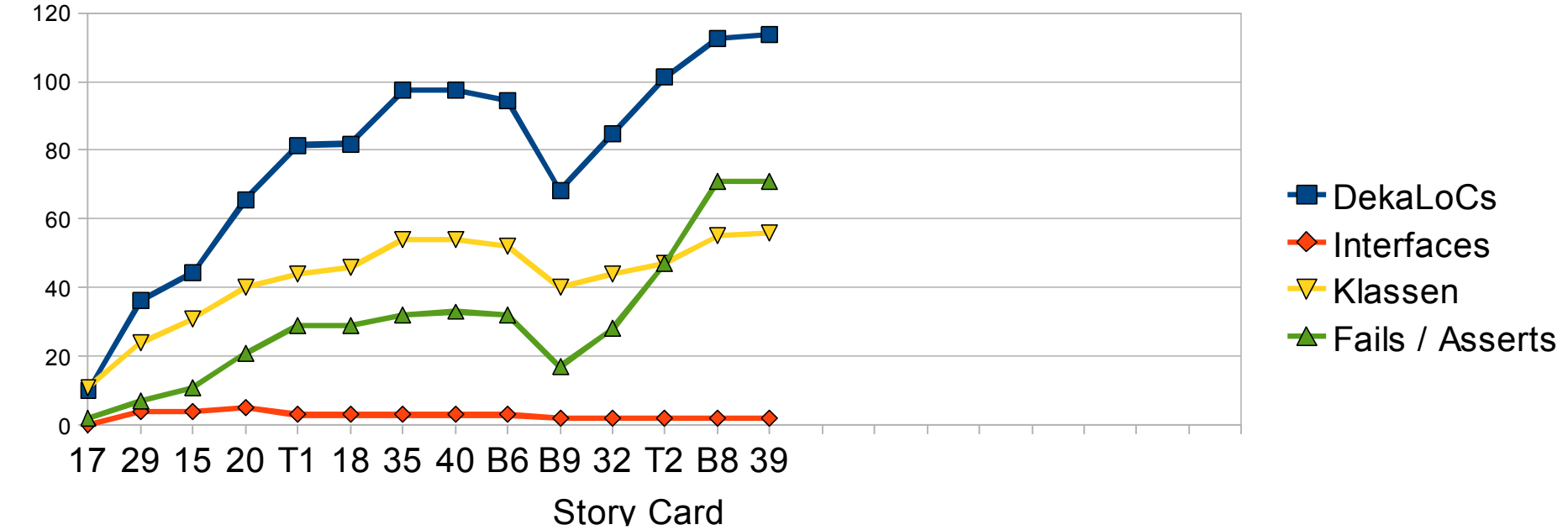
QM, Documentation (etc.) and internal Rules

- Software without documentation is useless
- Development teams change – we are lost without technical documentation
- QM-handbooks etc. require many documents, reviews, activities
  - Shall we give up all of that?
  - Do we need a two-class society?
- Can agile approaches adhere to all these rules and still be agile?

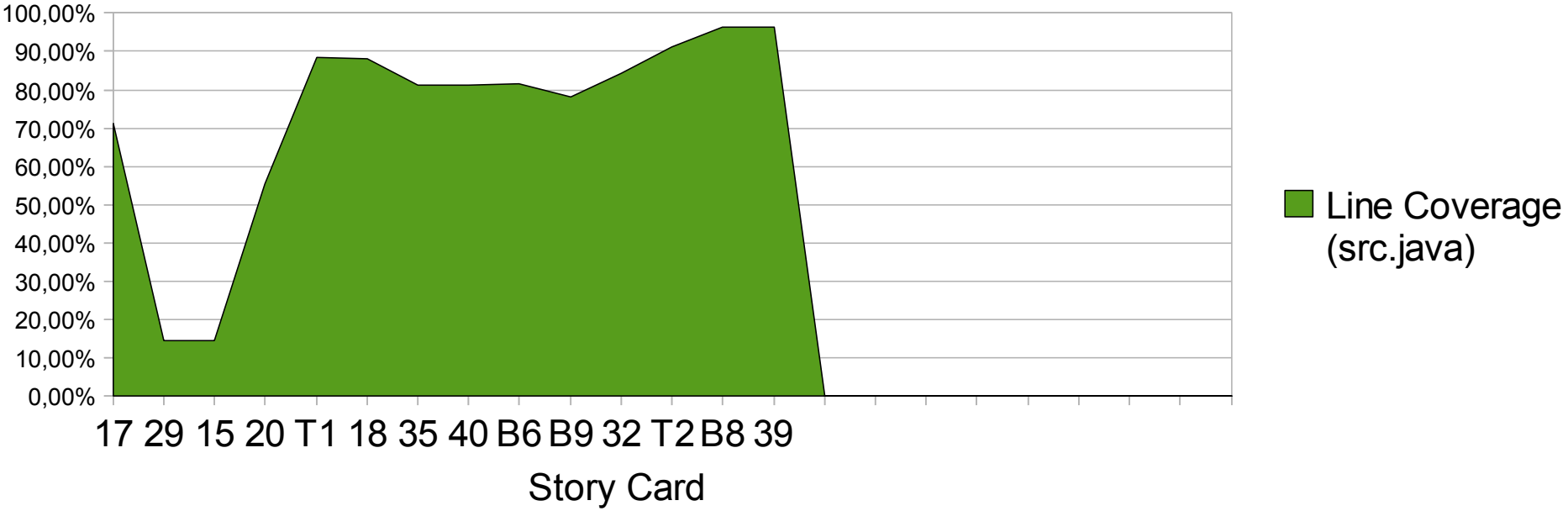
- Right!
  - If you need it, order it (and pay for it!)
- Really?
  - Even with the generated / embedded documentation?
  - If yes: order it and loose agility!
- Four-step approach
  1. Map agile activities to rules
  2. Include QM unit
  3. Negotiate about what is still missing
  4. Build an agile variant with QM
- Not if you take it all
  - That would be magic
  - Travel light: Abandon inefficient parts
  - Keep all agile quality aspects!

Schneider, K. (2003): SQM congress 2003, Köln, SQS

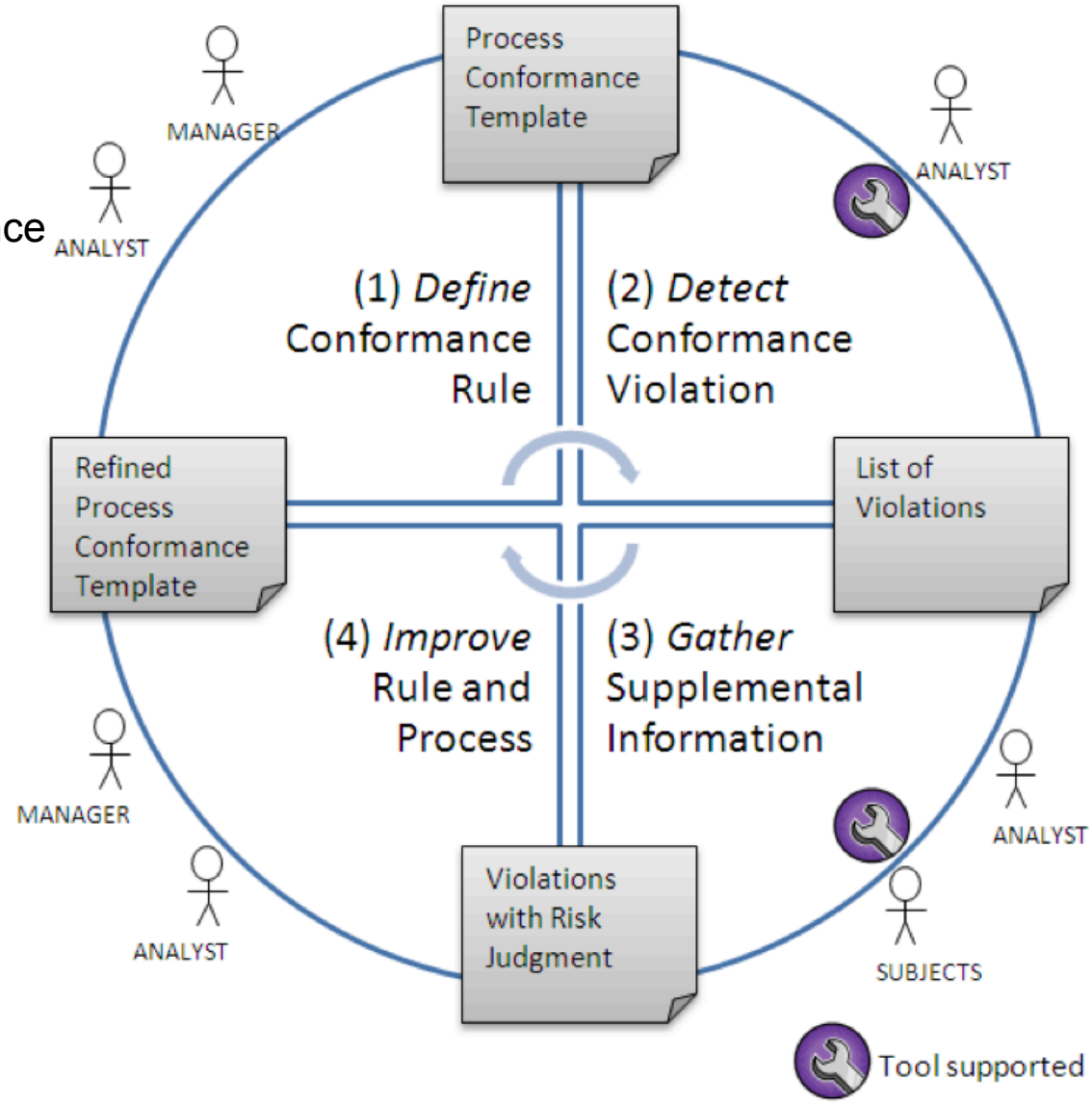
Process Conformance



Testabdeckung



- Measure conformance
  - Manage agile teams
  - Control for non-conformance in scientific studies



Zazworka et al.: Are Developers Complying with the Process: An XP Study, *ESEM'10*, 2010, Bolzano-Bozen, Italy.

Example:

Conformance Template

Pr. Name	Test-Driven Development
Pr. Focus	Improved correctness.
Process Description	For each component (i.e. Java class) developers are supposed to create a JUnit test class (collection of test cases) prior to the development of the component.
Collected Data	Subversion code history. Developers are advised to use following file naming scheme for implementation and test classes: Implementation class: `SomeName.java` Test class: `SomeNameTest.java`
Process Violations	**Syntactic**: (1) Implementation classes (but not interface classes) without test classes. Violation detection: Implementation class is checked into the Subversion repository before its according test class. **Semantic:** (1) The line coverage of the test cases is below 70% (2) The branch coverage of the test cases is below 70%

Zazworka et al.: Are Developers Complying with the Process: An XP Study, *ESEM'10*, 2010, Bolzano-Bozen, Italy.

Example:

Conformance Template

Process Name	Continuous Refactoring
Process Focus	Improved maintainability (extendibility).
Process Description	Refactoring activities should be a continuous part of code development.
Collected Data	• Manually: SVN commit template includes change type (e.g. refactoring) • Implicitly: SVN data provides us with information about changes of architecture. Further Code Metrics /Code Smells can provide insight into decay of code.
Process Violations	**Syntactic:** (1) No refactoring activities in the commit template at all (during whole project) (2) Large refactoring only in a single stage (e.g. at the end of the project) **Semantic:** (3) Increasing amount of God Class code smells

Zazworka et al.: Are Developers Complying with the Process: An XP Study, *ESEM'10*, 2010, Bolzano-Bozen, Italy.

Example:

Conformance Template

Process Name	Collective Code Ownership (Pair Programming + Pair Switching)
Process Focus	Code is collectively owned, high Truck Factor
Process Description	Pair Switching: subjects are supposed to switch their pair programming partner with each new story card and between iterations.
Collected Data	Manually: SVN commit template include name of programmers and story card number
Process Violations	**Syntactic**: (1) The same developer pair working together on two consecutive *story cards* (2) The same developer pair working together on two consecutive *iterations* **Semantic:** (1) The project's Truck Factor (explained later is low

Zazworka et al.: Are Developers Complying with the Process: An XP Study, *ESEM'10*, 2010, Bolzano-Bozen, Italy.

Collective-Code Ownership

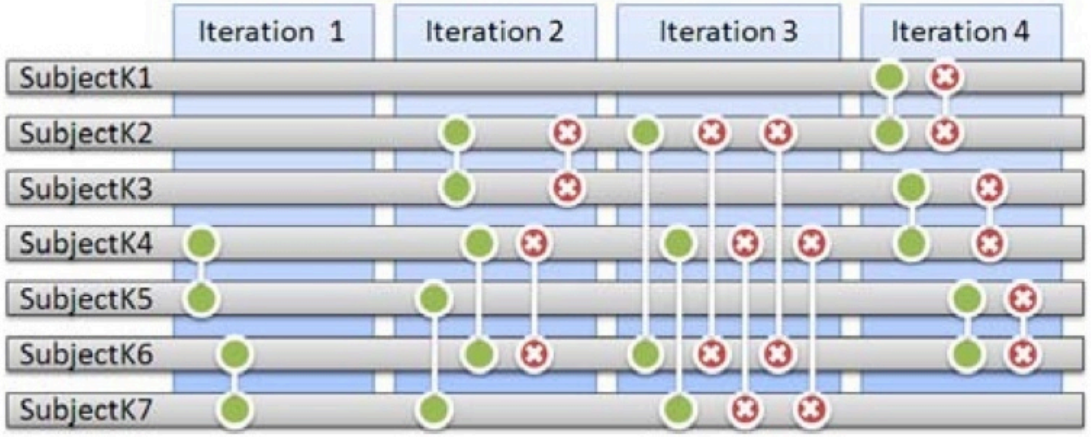


Figure 4: Pair-Switching for team KlaRa.

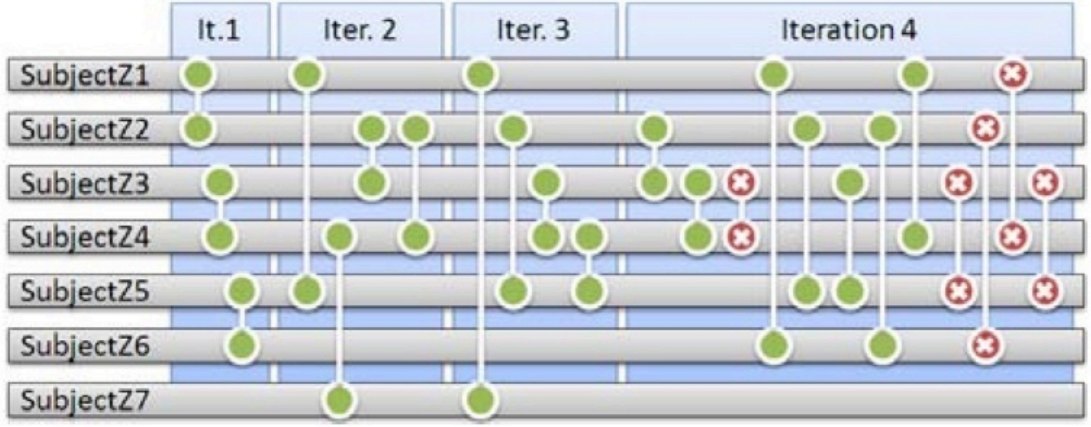
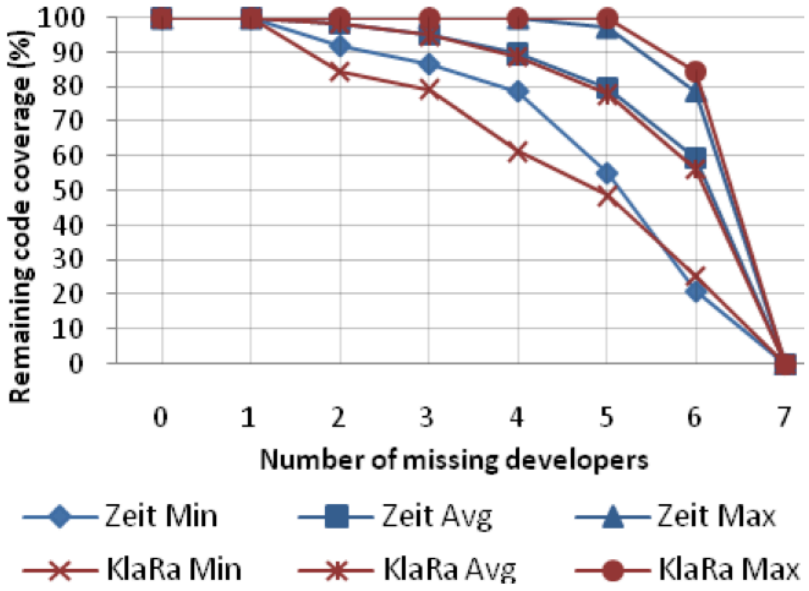
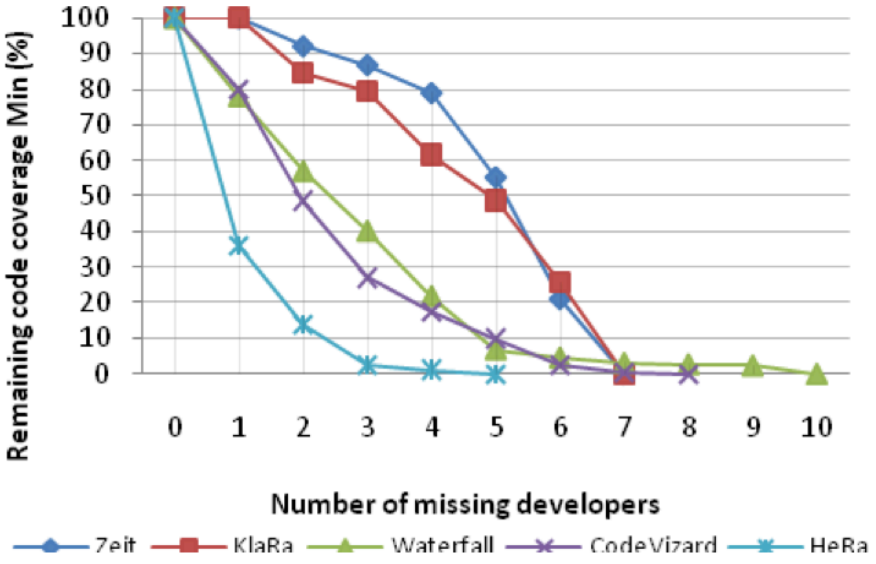


Figure 4: Pair-Switching for team Zeit

Zazworka et al.: Are Developers Complying with the Process: An XP Study, *ESEM'10*, 2010, Bolzano-Bozen, Italy.

Truck factor analysis





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Knowledge and understanding	Skills and ability	Judgement and approach
Compare agile and traditional softw. dev,	Forming a team organically	Explain: people/commun. centric dev.
Relate lean and agile development	Collaborate in small software dev. teams	Apply fact: people drive project success
Contrast different agile methodologies	Interact and show progress continuously	Describe: No single methodology fits all
Use the agile manifest and its accompanying principles	Develop SW using small and frequent iterations	Discuss: methodology needs to adopt to culture
Discuss what is different when leading an agile team	Use test-driven dev. and automated tests	
	Refactor a program/design	
	Be member of agile team	
	Incremental planning using user stories	

Sprint 1

Sprint 2

Sprint 3

	Knowledge and understanding	Skills and ability	Judgement and approach
Sprint 1	Compare agile and traditional softw. dev,	Forming a team organically	Explain: people/commun. centric dev.
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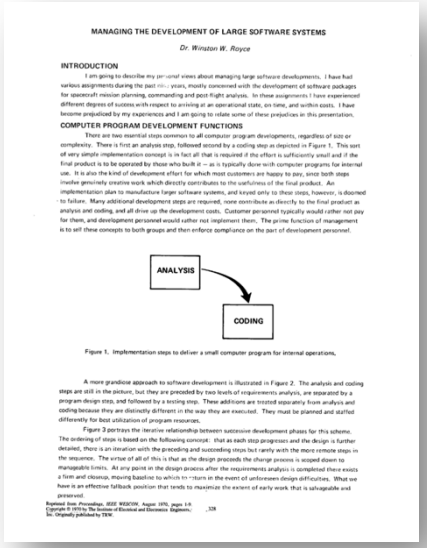
Sprint 2		Refactor a program/design	
		Be member of agile team	
		Incremental planning using user stories	

Sprint 3

Legend
Addressed
Open
Mainly in project
Focus today

Thanks! (...and optional further reading)



MANAGING THE DEVELOPMENT OF LARGE SOFTWARE SYSTEMS

Dr. Winston W. Royce

INTRODUCTION

I am going to describe my personal views about managing large software developments. I have had various assignments during the past nine years, mostly concerned with the development of software packages for spacecraft mission planning, commanding and post-flight analysis. In these assignments I have experienced different degrees of success with respect to arriving at an operational state, on time, and within costs. I have become prejudiced by my experiences and I am going to relate some of these prejudices in this presentation.

COMPUTER PROGRAM DEVELOPMENT FUNCTIONS

There are two essential steps common to all computer program developments, regardless of size or complexity. There is first an analysis step, followed second by a coding step as depicted in Figure 1. This sort of very simple implementation concept is in fact all that is required if the effort is sufficiently small and if the final product is to be operated by those who built it -- as is typically done with computer programs for internal use. It is also the kind of development effort for which most customers are happy to pay, since both steps involve genuinely creative work which directly contributes to the usefulness of the final product. An implementation plan to manufacture larger software systems, and keyed only to these steps, however, is doomed to failure. Many additional development steps are required, none contribute as directly to the final product as analysis and coding, and all drive up the development costs. Customer personnel typically would rather not pay for them, and development personnel would rather not implement them. The prime function of management is to sell these concepts to both groups and then enforce compliance on the part of development personnel.

Figure 1. Implementation steps to deliver a small computer program for internal operations.

A more grandiose approach to software development is illustrated in Figure 2. The analysis and coding steps are still in the picture, but they are preceded by two levels of requirements analysis, are separated by a program design step, and followed by a testing step. These additions are treated separately from analysis and coding because they are distinctly different in the way they are executed. They must be planned and staffed differently for best utilization of program resources.

Figure 3 portrays the iterative relationship between successive development phases for this scheme. The ordering of steps is based on the following concept: that as each step progresses and the design is further detailed, there is an iteration with the preceding and succeeding steps but rarely with the more remote steps in the sequence. The virtue of all of this is that as the design proceeds the change process is scoped down to manageable limits. At any point in the design process after the requirements analysis is completed there exists a firm and closeup, moving baseline to which to return in the event of unforeseen design difficulties. What we have is an effective fallback position that tends to maximize the extent of early work that is salvageable and preserved.

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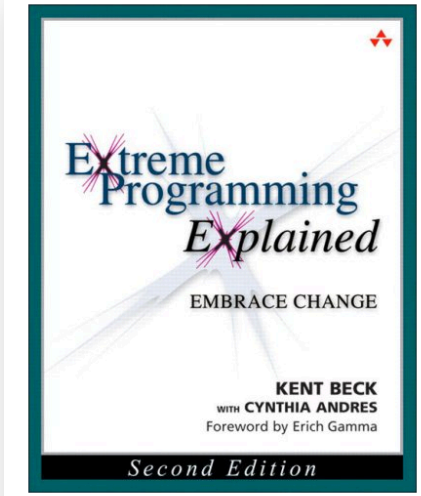
Winston W. Royce: Managing the Development of Large Software Systems. In: Proceedings of IEEE WESCON, pages 1-9, 1970



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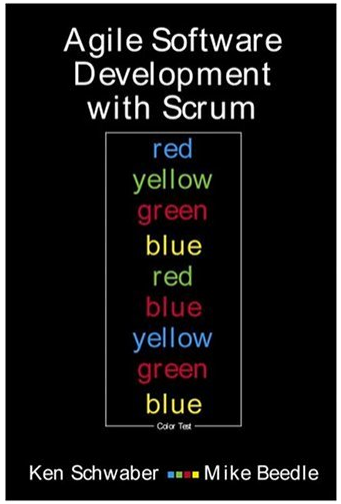

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