Approaches to Software Testing: An Introduction

Customized and presented to:

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Who am I?

- Chief Technologist of PerfTestPlus
- Executive Director of the Association of Software Testing
- Co-Founder of the Workshop on Performance and Reliability
- An international speaker and contributer to various publications
- My specialties include
    - Testing and analyzing performance for complex systems
    - Developing customized testing methodologies
    - Embedded systems testing
    - Testing biometric identification and security systems
- I am a member of
    - IEEE
    - American MENSA
    - the Context-Driven School of Software Testing

    -and a signatory to the Manifesto for Agile Software Development

Who am I?

My name is Scott and I'm a...

Test-o-holic.

Welcome & Overview

Logistics/Facilities?

Who are each of you?

- Name
- Business Card Title
- What you actually **do**
- What you hope to take away from this seminar
- What is distracting you

Welcome & Overview

What are we going to be talking about?

- How and where testing fits in
- The purpose of testing
- The value of testing

How will this help me do my job better?

- Who is responsible for what & when
- How to work together to improve the quality of the product
- Avoiding “turf-wars”
- Improving the fit between process and purpose

Seminar Objectives

At the conclusion of this seminar, attendees will be familiar with and have a basic understanding of the following items, the contexts where they are generally practiced, their strengths and weaknesses in context and where to go for more information:

- Popular system test life-cycles and their relationship to popular software development life-cycles
- Industry common system testing approaches
- Industry common system testing practices

Agenda

Self-Categorization
- Testing “School”
- Testing Life Cycle
- Testing Techniques/Practices

Break

Approaches/Schools

Life Cycles

Break

Techniques/Practices

Putting it all Together

Wrap-up

Self-Categorization

On the walls of the room are several flip-chart sheets with descriptions of certain common classifications related to software testing.

I have provided each of you with "voting stickers" that you will use to indicate how well your project fits into the described category.

On each chart is a horizontal scale. You can place one sticker per sheet anywhere along the scale indicating if your project fits each description:

- Extremely well
- Somewhat well
- Not at all well

If you are completely uncertain where your project fits, place your sticker in the box labeled

Ready... Set...

•

Go!

Descriptions Revealed

The Four "Schools" of Software Testing

- Analytical/Mathematical
- Factory/Process
- Quality Control
- Context-Driven

Descriptions Revealed

Software Testing Life Cycles

- Waterfall/Big Bang
- Iterative/Spiral
- Test First/TDD
- Agile

Descriptions Revealed

Software Testing Techniques/Practices

- Scripted Manual/Automated
- Black Box/UAT
- Exploratory
- Unit/Developer/White Box

Questions

10 Min Break

Testing “Schools”

What are they?

Why make the distinction?

How do they relate to your project?

Note The slides in this segment heavily reference the original Four Schools of Software Testing as coined and presented by Brett Pettichord which can be found at www.pettichord.com.

Four Views of Software Testing

__**Analytic School**__ - sees testing as rigorous and technical with many proponents in academia

__**Factory School**__ - sees testing as a way to measure progress with emphasis on cost and repeatable standards

__**Quality School**__ - emphasizes process, policing developers and acting as the gatekeeper

__**Context-Driven School**__ - emphasizes people, setting out to find the bugs that will be most important to stakeholders

Why Classify Testing into Schools?

Understand why testing experts disagree

- Not simply a matter of personality or experience
- There are often underlying reasons for disagreement

Improve the basis for debate

- Differences in values may explain why we favor different policies
- Explain how my school differs from the others

But it can lead to oversimplification

What is a School?

A school is not a technique.

A school is defined by:
- Standards of criticism
- Exemplar techniques
- Hierarchies of values

Analytic School: Core Beliefs

Software is a logical artifact

Testing is a branch of CS/Mathematics (i.e. Objective, rigorous and comprehensive)

Testing techniques must have a logico-mathematical form (i.e. "one right answer")

Testing is technical

Key Question:
Which techniques should we use?

Analytic School Exemplar

Code Coverage

- aka“Structural” testing
- Dozens of code-coverage metrics have been designed and compared
- Provides an objective measure of testing

Analytic School

Implications

- Require precise and detailed specifications
- Testers verify whether the software conforms to its specification
- Anything else isn't testing

Most prevalent

- Academia
- Telecom
- Safety-Critical

Factory School: Core Beliefs

Testing must be managed (i.e. Predictable, repeatable, planned)

Testing must be cost-effective (i.e. Low-skilled workers require direction)

Testing validates the product

Testing measures development progress

Key Questions:

- How can we measure whether we're making progress?
- When will we be done?

Factory School Exemplar

Traceability Matrix

- Make sure that every requirement has been tested

Factory School

Implications

- Require clear boundaries between testing and other activities (start/stop criteria)
- Resist changing plans (complicates progress tracking)
- Software testing assembly line (V-model)
- Accept management assumptions about testing
- Encourage standards, "best practices," and certification

Most prevalent

- Enterprise IT
- Government

Quality School: Core Beliefs

Software quality requires discipline

Testing determines whether development processes are being followed.

Testers may need to police developers to follow the rules.

Testers have to protect users from bad software.

Key Question:

Are we following a good process?

Quality School Exemplar

The Gatekeeper

- The software isn’t ready until QA says it’s ready

Quality School

Implications

- Prefer "Quality Assurance" over "Testing"
- Testing is a stepping stone to "process improvement"
- May alienate developers

Most prevalent

- Large bureaucracies
- Organizations under stress

Context-Driven School: Core Beliefs

Software is created by people. People set the context.

Testing finds bugs. A bug is anything that could bug a stakeholder.

Testing provides information to the project

Testing is a skilled, mental activity

Testing is multidisciplinary

Key Question:

What testing would be most valuable right now?

Context-Driven School Exemplar

Exploratory Testing

- Concurrent test design and test execution
- Rapid learning

Context-Driven School

Implications

- Expect changes. Adapt testing plans based on test results.
- Effectiveness of test strategies can only be determined with field research
- Testing research requires empirical and psychological study
- Focus on skill over practice

Most prevalent

- Commercial, Market-driven Software

What is Testing?

Analytic School says
- A branch of computer science and mathematics

Factory School says
- A managed process

Quality School says
- A branch of software quality assurance

Context-Driven School says
- A branch of development

What school is right for you?

Analytic?

Factory?

Quality?

Context-Driven?

Questions

Software Life Cycles

Waterfall – Sequential, minimal feedback loops

V-Model – Parallel, decoupled, minimal feedback loops

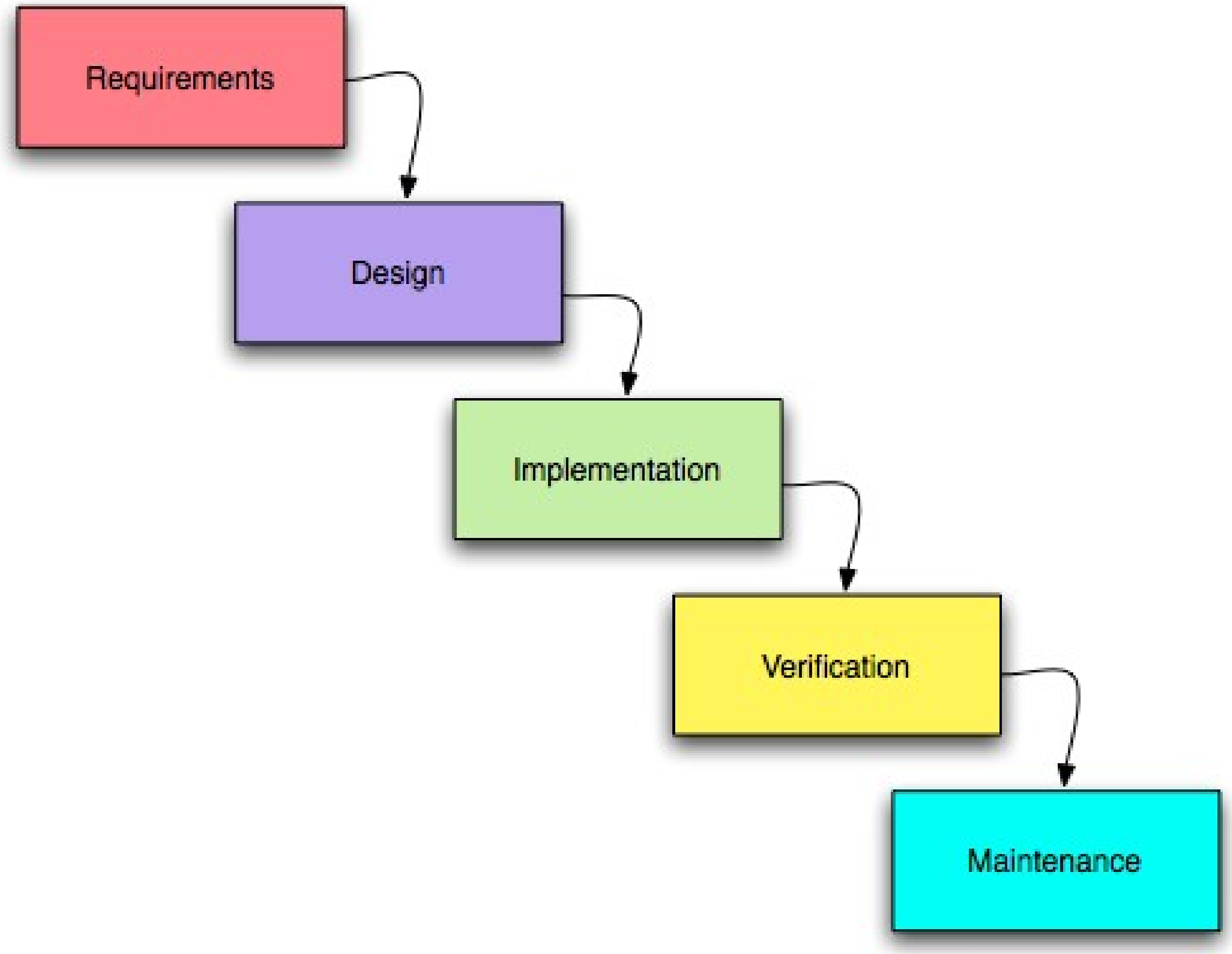
Iterative – Similar to lots of little waterfalls

Spiral – Like iterative, but presumes iterations get smaller

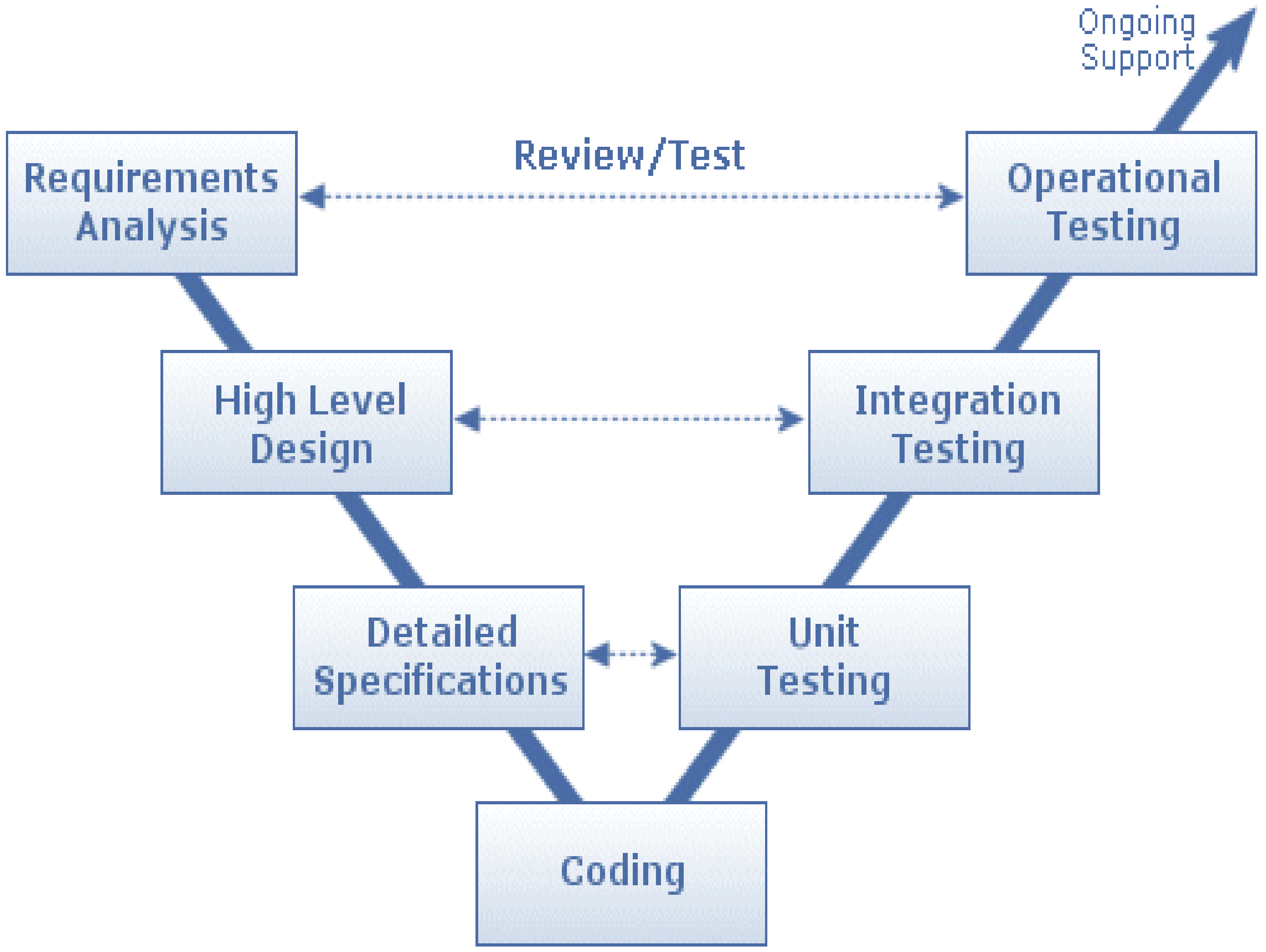
TDD/TFD – Test first, developers do much testing

Agile/XP – Adaptive, incremental, just-in-time, just enough

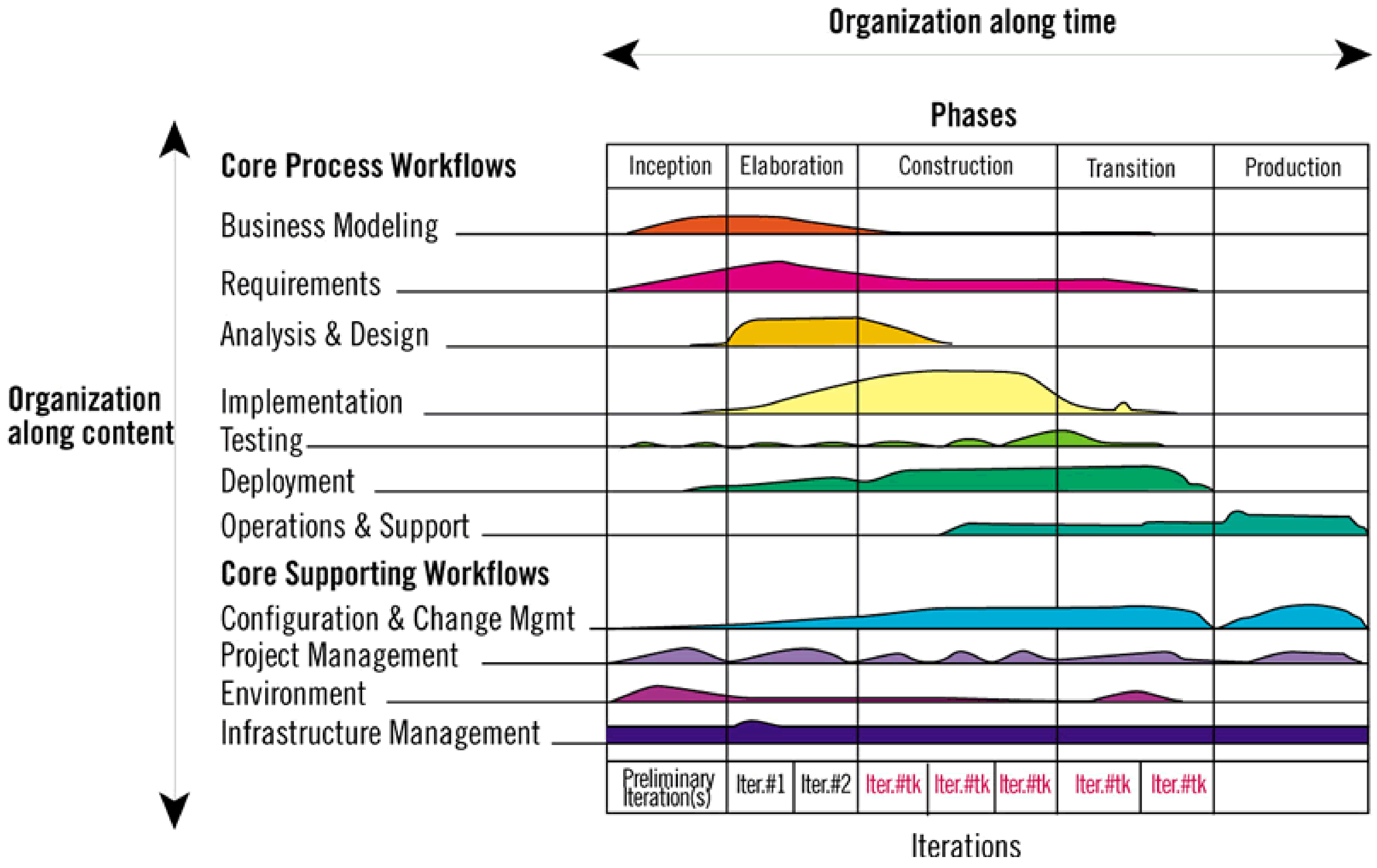
Waterfall


Requirements
Design
Implementation
Verification
Maintenance

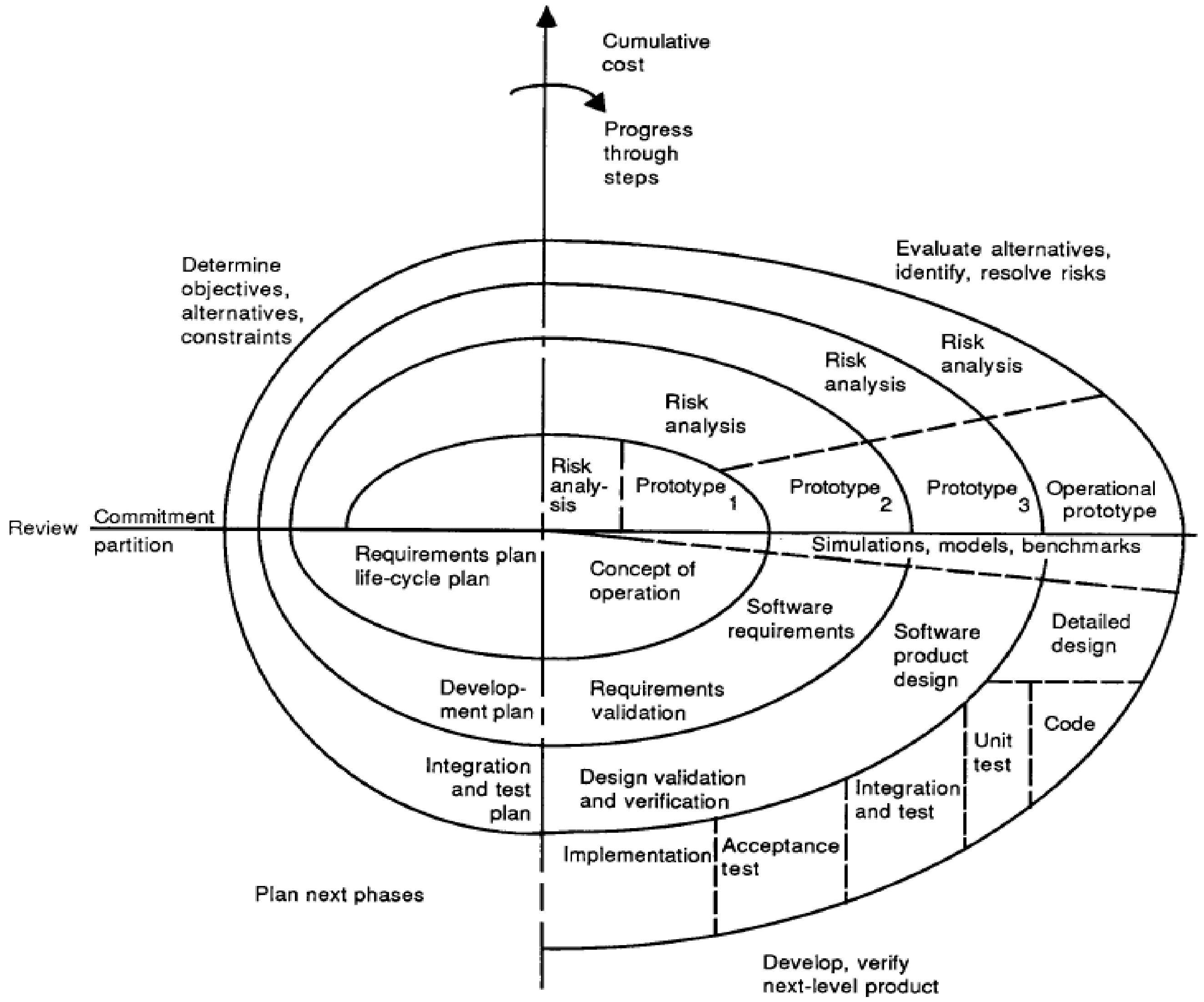
V-model


Ongoing Support
Review/Test
Requirements Analysis
Operational Testing
High Level Design
Integration Testing
Detailed Specifications
Unit Testing
Coding

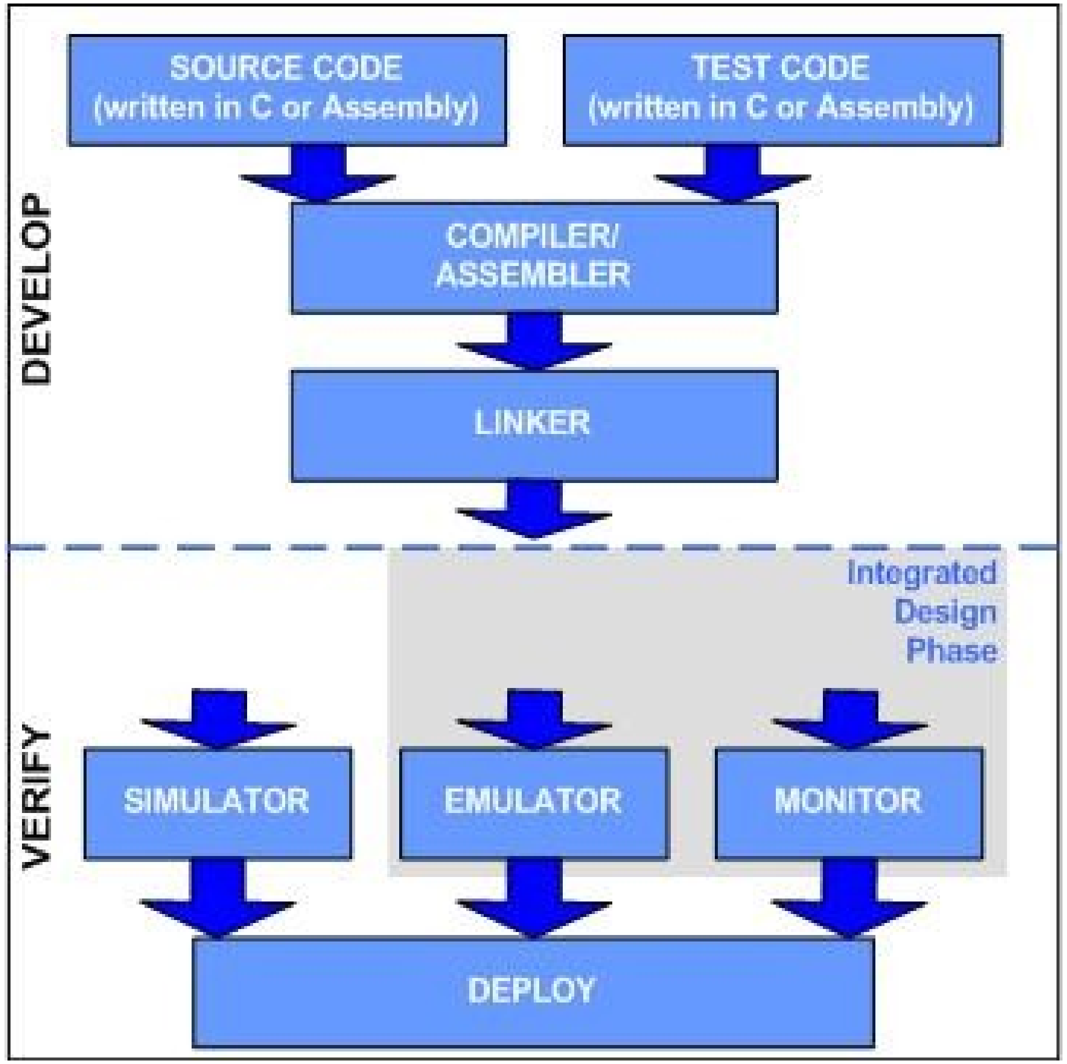
Iterative

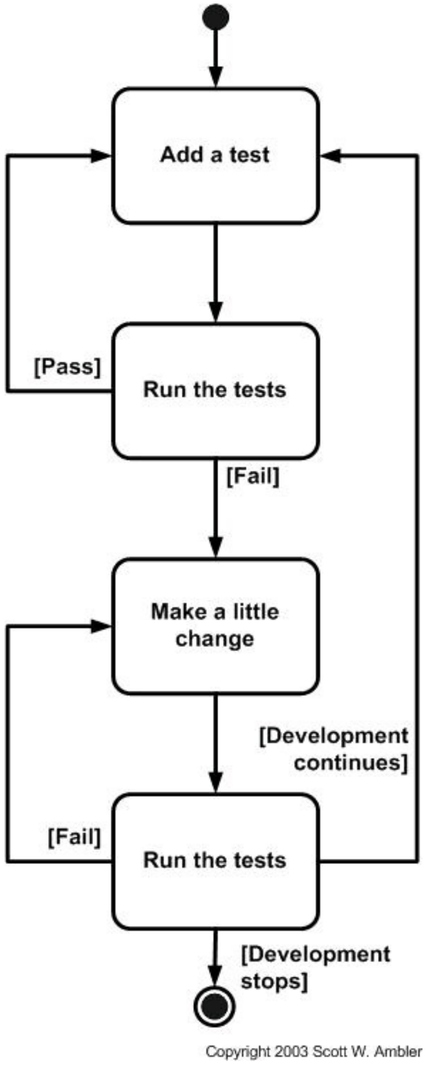

Organization along time
Phases
Inception
Elaboration
Construction
Transition
Production
Organization along content
Core Process Workflows
Business Modeling
Requirements
Analysis & Design
Implementation
Testing
Deployment
Operations & Support
Core Supporting Workflows
Configuration & Change Mgmt
Project Management
Environment
Infrastructure Management
Preliminary Iteration(s)
Iter.#1
Iter.#2
Iter.#tk
Iter.#tk
Iter.#tk
Iter.#tk
Iter.#tk
Iterations

Spiral

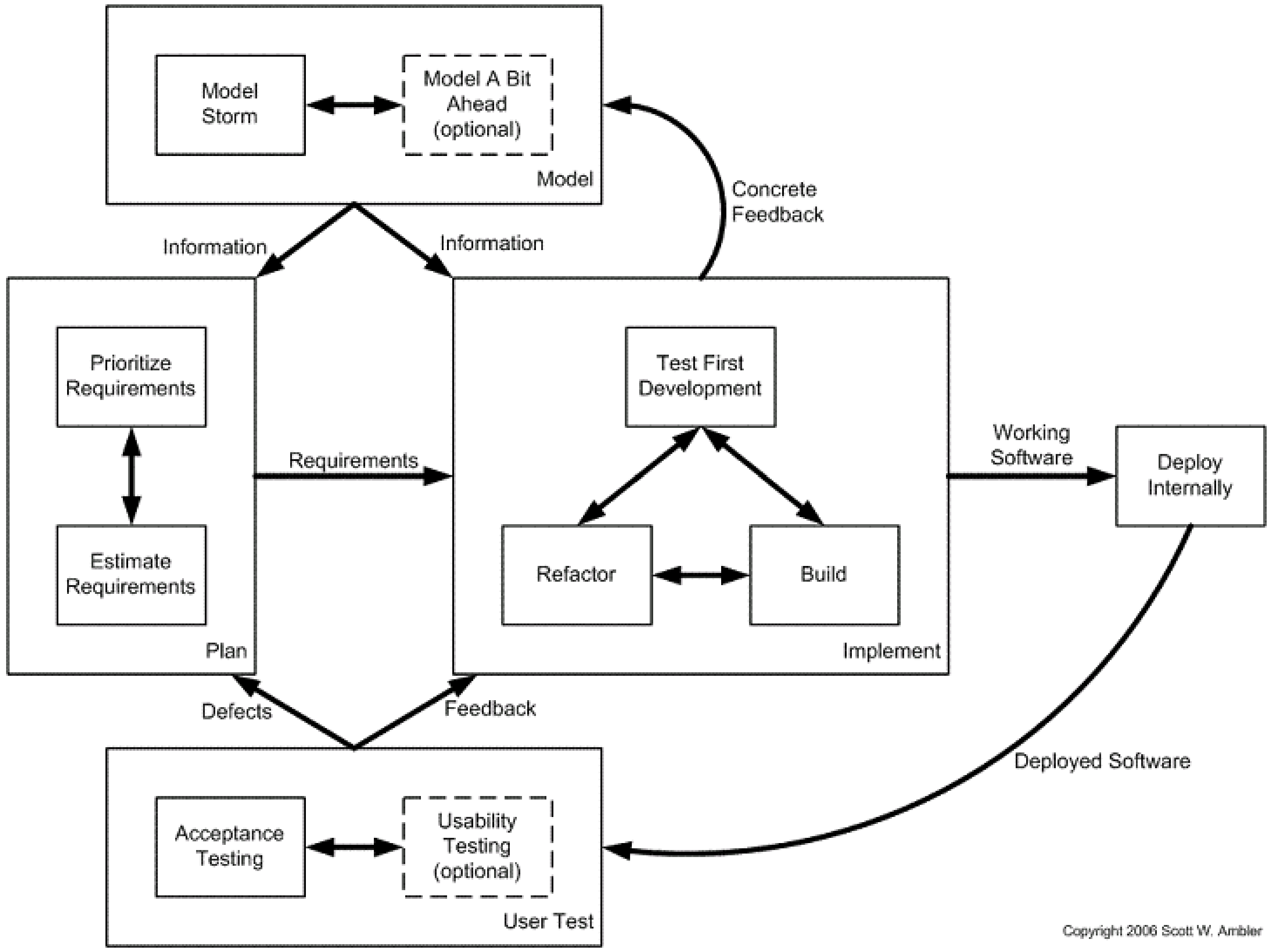

Cumulative cost
Progress through steps
Determine objectives, alternatives, constraints
Evaluate alternatives, identify, resolve risks
Risk analysis
Risk analysis
Risk analysis
Risk analy- sis
Prototype 1
Prototype 2
Prototype 3
Operational prototype
Review
Commitment partition
Simulations, models, benchmarks
Requirements plan life-cycle plan
Concept of operation
Software requirements
Software product design
Detailed design
Develop- ment plan
Requirements validation
Code
Unit test
Integration and test plan
Design validation and verification
Integration and test
Acceptance test
Implementation
Plan next phases
Develop, verify next-level product

Test Driven/Test First Development





Agile / XP


Model Storm
Model A Bit Ahead (optional)
Model
Concrete Feedback
Information
Information
Prioritize Requirements
Estimate Requirements
Plan
Requirements
Test First Development
Refactor
Build
Implement
Working Software
Deploy Internally
Defects
Feedback
Deployed Software
Acceptance Testing
Usability Testing (optional)
User Test
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Life Cycle Summary

Which Life Cycle does your project use?

What are the pros/cons of that Life Cycle Model?

Which Testing Schools seem to fit with which Life Cycles?

How about Hybrids?

Are there others?

Questions

10 Min Break

Testing Techniques/Practices

Scripted – Follow the well-defined predetermined steps

Regression – Find changes from previous release

Ad Hoc – One time test to answer a specific question

Automated – Computer conducts tests and reports results

Exploratory – Simultaneous learning, test design & test execution to detect defects of interest to a stakeholder

Unit/Developer/White Box – Tests not using the UI

Black Box/UAT – Expected usage and error modes

Shotgun – "If you use a shotgun, you don't have to aim that carefully"

Testing Techniques/Practices

What testing techniques have you seen work...
- Particularly well
- Particularly poorly
- Well in specific circumstances

What other techniques/practices...
- Do you know of
- Would you recommend
- Would you like to know more about or try

Questions

Examples of what works well together

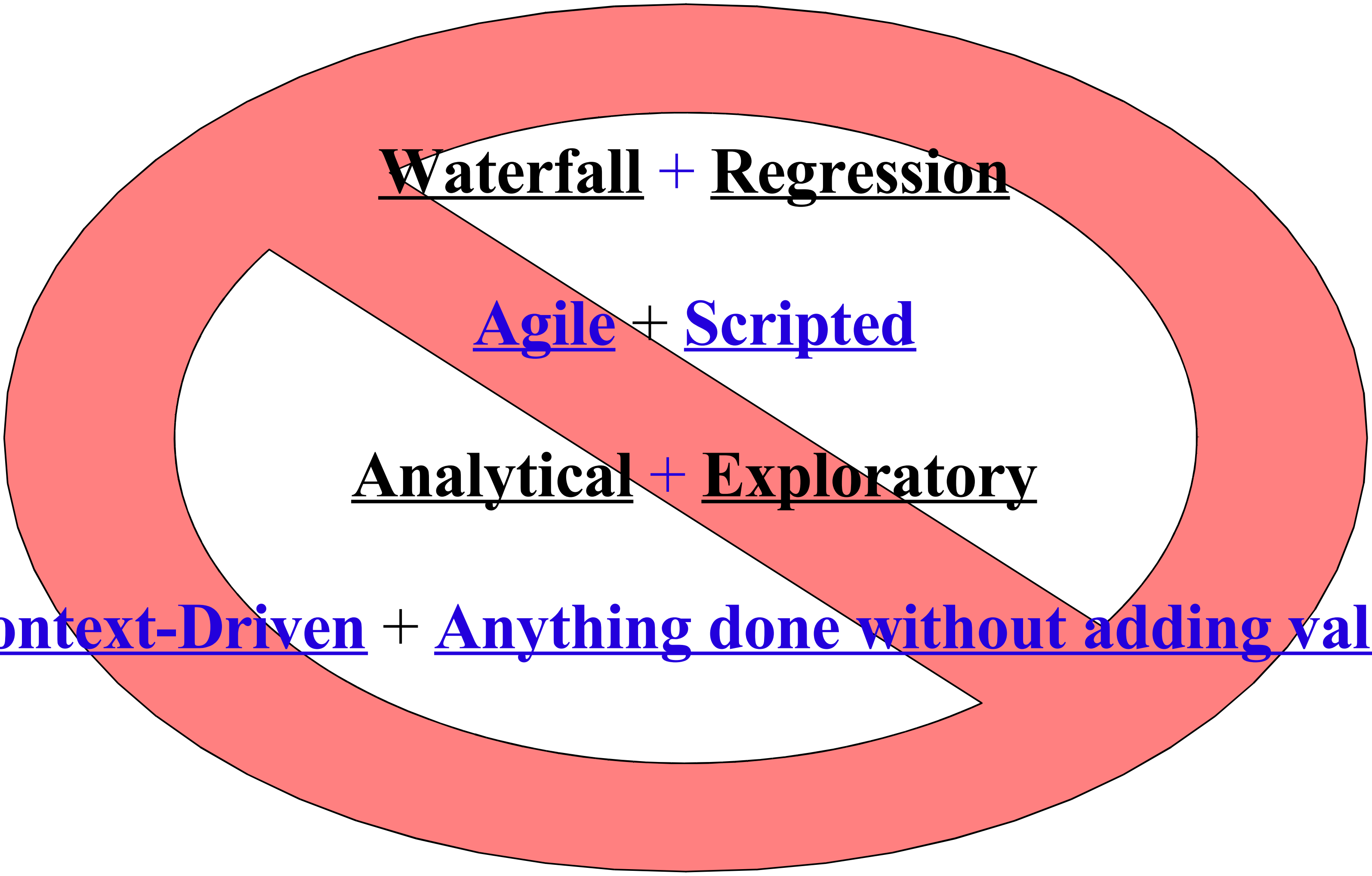
<u>**Waterfall**</u> + <u>**Unit Tests**</u> + <u>**Scripted**</u> + <u>**UAT**</u> = <u>**Factory**</u>

<u>**V-Model**</u> + <u>**Unit Tests**</u> + <u>**Scripted**</u> = <u>**Analytical**</u>

<u>**Iterative**</u> + <u>**Regression**</u> + <u>**Scripted**</u> + <u>**UAT**</u> = <u>**Quality**</u>

<u>**TDD/TFP**</u> + <u>**Unit Tests**</u> + <u>**Exploratory**</u> = <u>**Context-Driven**</u>

Examples of what doesn't work together



Waterfall + Regression

Agile + Scripted

Analytical + Exploratory

Context-Driven + Anything done without adding value

Moving Forward

Compared to where you placed your stickers earlier, where would you **like** those stickers to be in the future and why?

Questions

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