Software Quality Management

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Last QOT: What is the most important principle in lean development?

"Slow decisions"

"Perfection: Continuously improve the performance of your value stream"

"Best quality"

Of course, there is not the single most important principle in lean.
We discussed that continuous improvement and respect for people are the main pillars, but there
are many other principles in lean.
Slow decisions, quick implementation is one of these principles.
Best quality is a goal of lean.

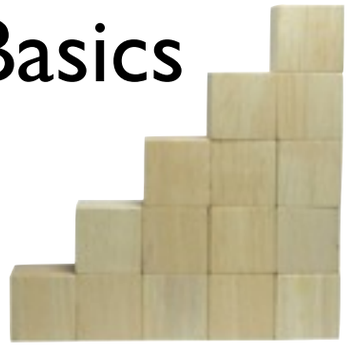
New QOT: "What is the difference between V&V?"

Process simulation

Lean development

Review of last week's lecture.

Basics



Product

Quality

Metrics and

Measurement

Process

Quality

Quality

Management

Certifi-

cation

We are in the part "Quality Management".

Approaches

Quality assurance planning

Today we look at a brief overview of approaches and at quality assurance planning in particular.

Upper picture by Ulrik De Wachter
Lower picture by Trine de Florie

Quality management contains several other activities.
The terminology differs in the literature. It depends what standard or book you use.
It usually contains

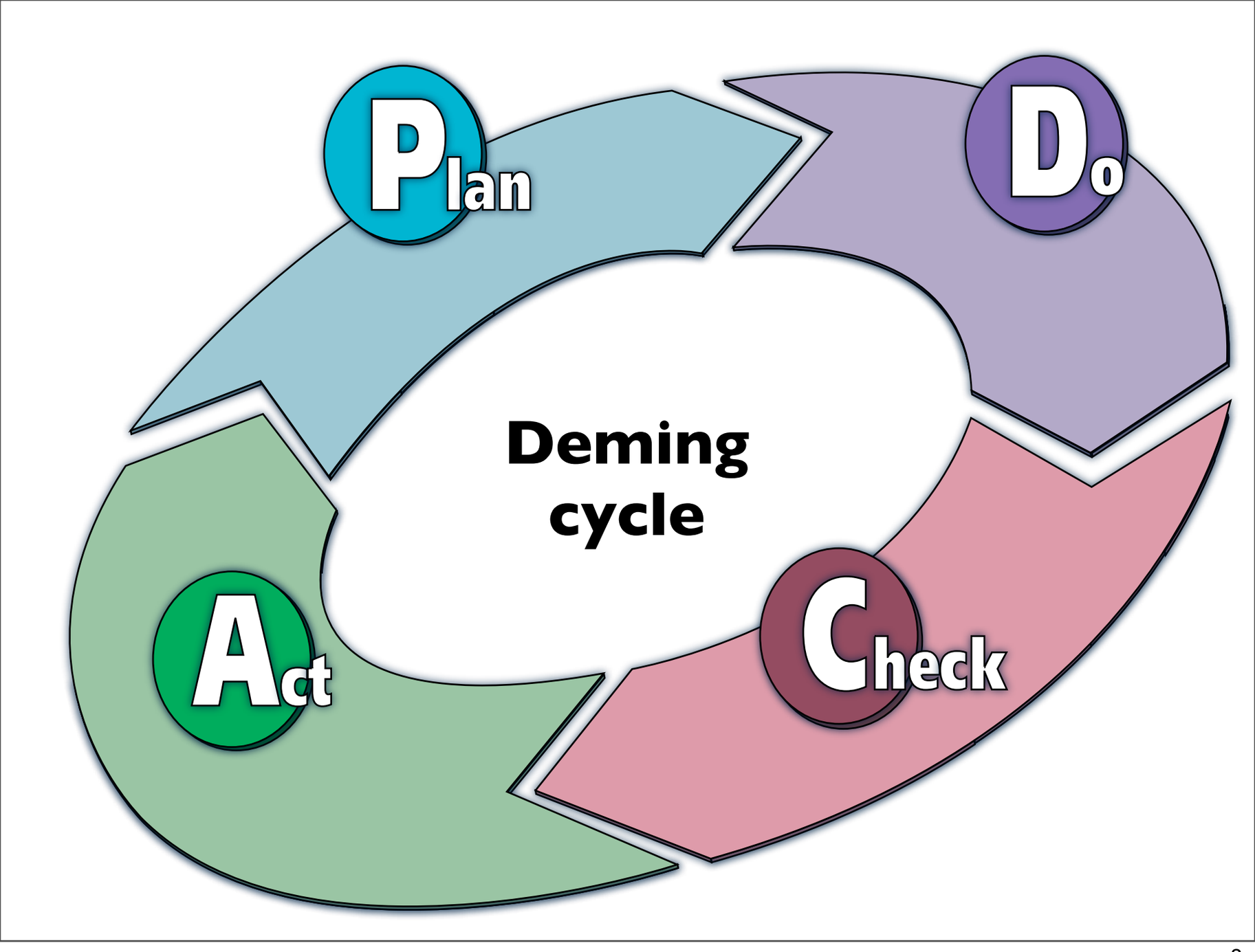
- quality planning that is considered with specifying quality and planning the activities for achieving quality
- quality assurance that are activities that should raise confidence that the quality requirements are achieved
- quality control that checks whether the quality requirements have been achieved
- quality improvment that contains activities for improving anything related to quality
- quality evaluation or assessment that checks the current level of quality

Total quality management

- Customer focus
- Process
- Human side of quality
- Measurement and analysis

Kan, Basili, Shapiro (1994)

The following summary of the key elements of TQM is from Ken, Basili, Shapiro (1994):
Customer focus: the objective is to achieve total customer satisfaction. Customer focus includes studying customers' wants and needs, gathering customer requirements, and measuring and managing customer satisfaction.
Process: the objective is to reduce process variations and to achieve continuous process improvement. Process includes both the business process and the product development process. Through process improvement, product quality will be enhanced.
Human side of quality: the objective is to create a company-wide quality culture. Focus areas include management commitment, total participation, employee empowerment, and other social, psychological, and human factors.
Measurement and analysis: the objective is to drive continuous improvement in all quality parameters by the goal-oriented measurement system.



Deming cycle, Shewhart cycle, PDCA cycle

Plan: Establish objectives and corresponding process to achieve the objectives

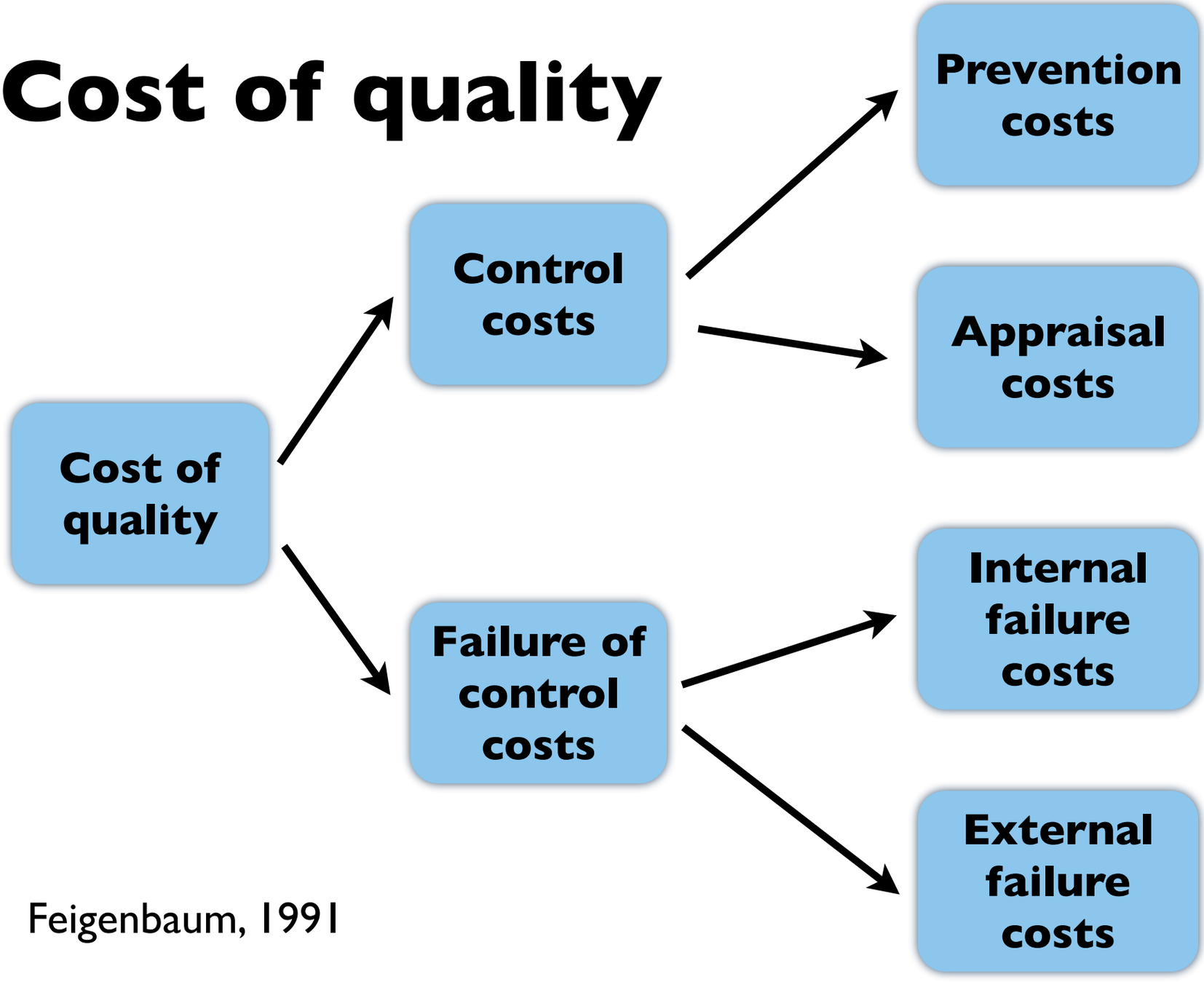
Do: Implement the process

Check: Measure the process and compare to expected results

Act: Analyse the differences, find root causes (e.g., by 5-Whys), determine improvements

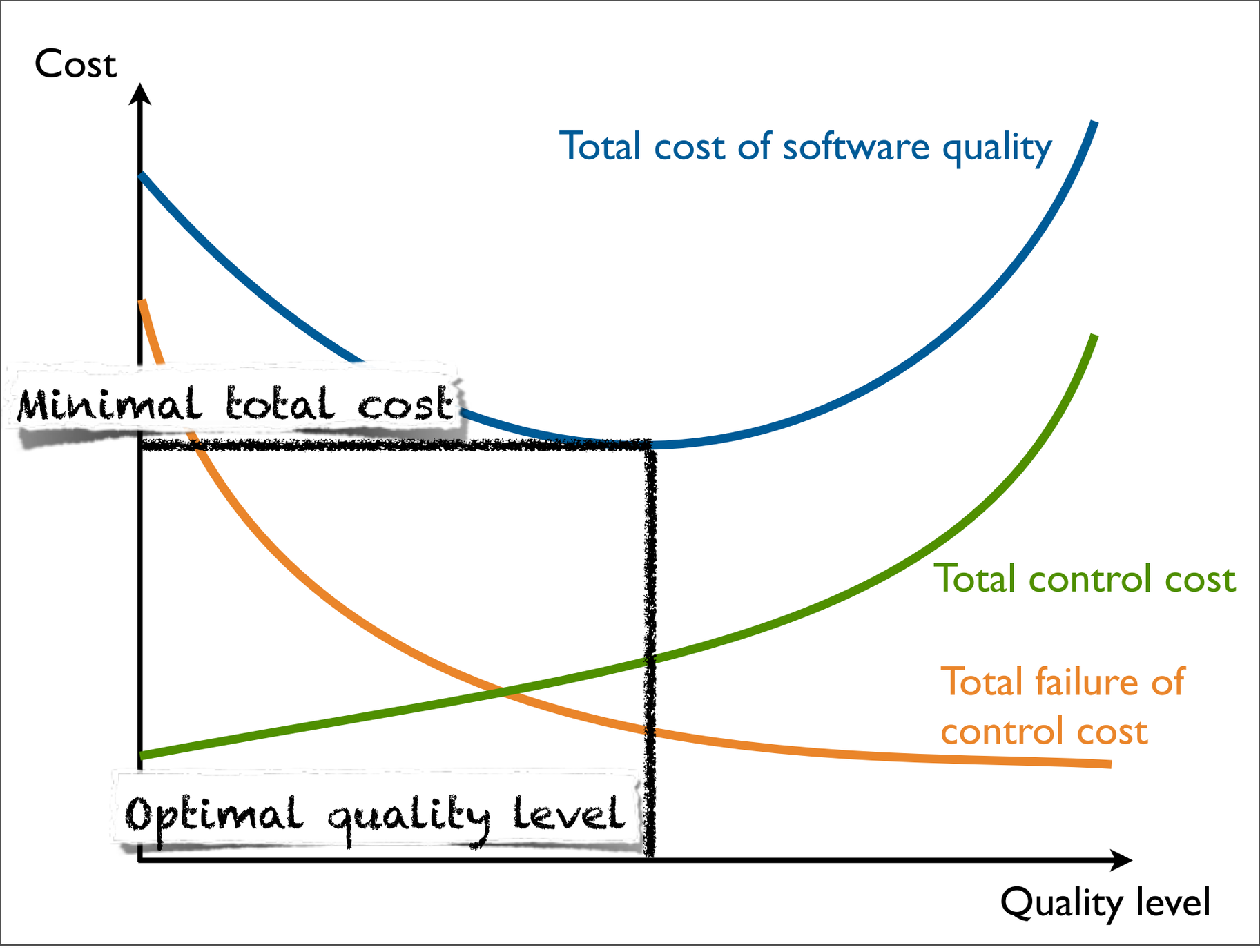
Graphic from Karn G. Bulsuk (http://karnbulsuk.blogspot.com)

Cost of quality



Feigenbaum, 1991

The cost of quality approach was developed by Feigenbaum and others, initially without having software in mind.
It categorises the costs that arise around quality. First, there are costs to control quality and costs that arise if
we fail to control quality.
Second, the control costs are either prevention costs, we prevent defects from being introduced, or appraisal
costs, we search for defects. The failure of control costs are either internal failure costs that are costs that we
have to remove the defect inside the company or external failure costs that are also removal costs, but possible
compensations to customers, for example.



This cost of quality diagram is adapted from Galin (2004).

It shows that, following the cost of quality approach, there is an optimal level of quality for a product. It is
the point at which the sum of control costs and failure of control costs is minimal.

The "quality is free" statement comes from Crosby. It is – in contrast to the common belief from the
magical triangle – based on the cost of quality approach and means that as long as we are below the
optimal quality level, improvements in quality save money instead of cost money.

Excercise

- What is cost of quality in software?
- Find one example for each cost of software quality category:
  - Prevention costs
  - Appraisal costs
  - Internal failure costs
  - External failure costs
- On post-its
- 4 Groups, 10 minutes
- Put on whiteboard when ready


Prevention costs
Appraisal costs
Internal failure costs
External failure costs
Test cases
Refactoring
Refounding
- Continuous Integration Testing
- Re estimation Cost
- System Unstable in Client ENV
Support
Failed Client Acceptance testing
Bug fixing
reduced price
Ship patches

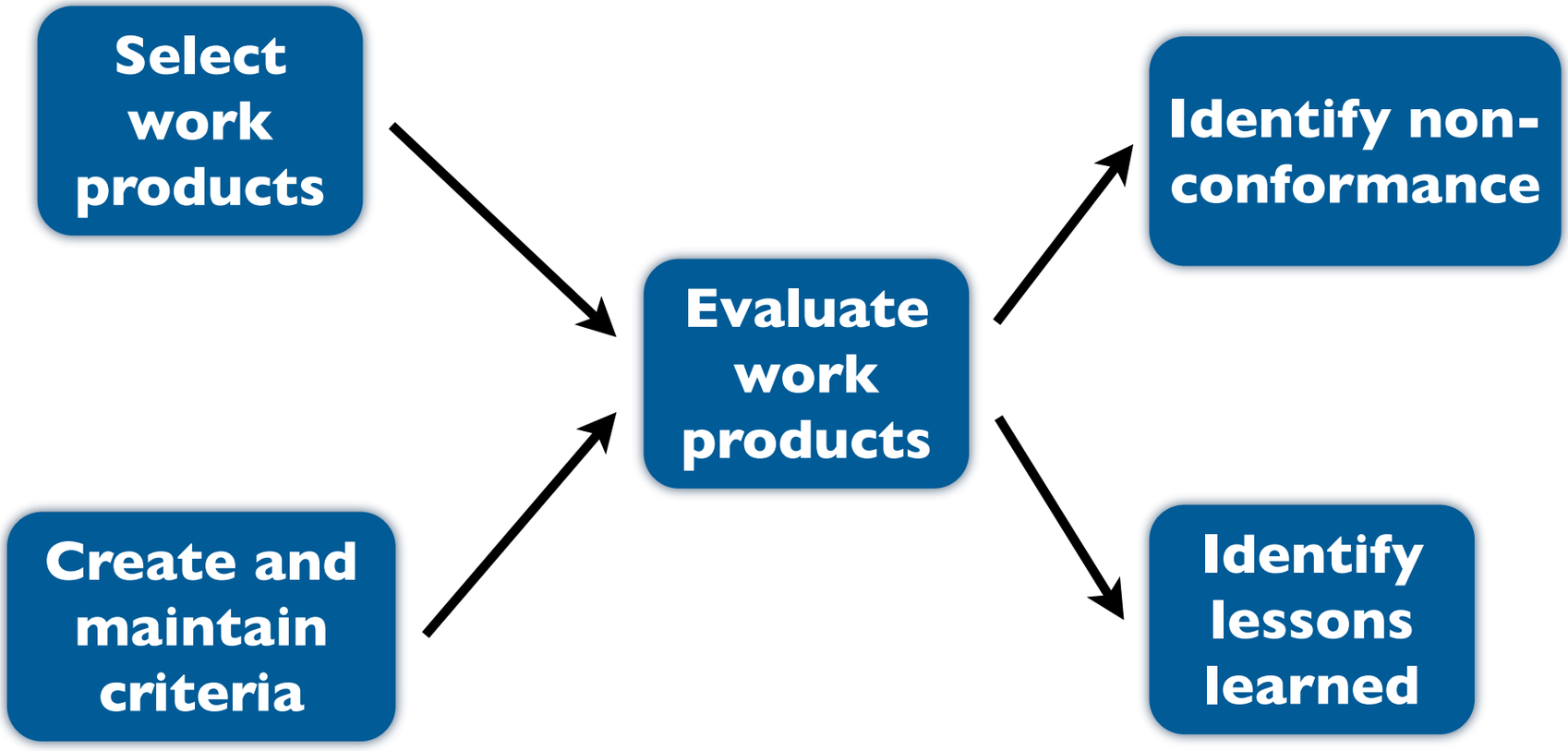
Approaches

Quality assurance planning

Upper picture by Ulrik De Wachter
Lower picture by Trine de Florie


"Quality is never an accident;
it is always the result of
high intention,
sincere effort,
intelligent direction and
skillful execution;
it represents the wise choice of
many alternatives."
–William A. Foster

Quality assurance process

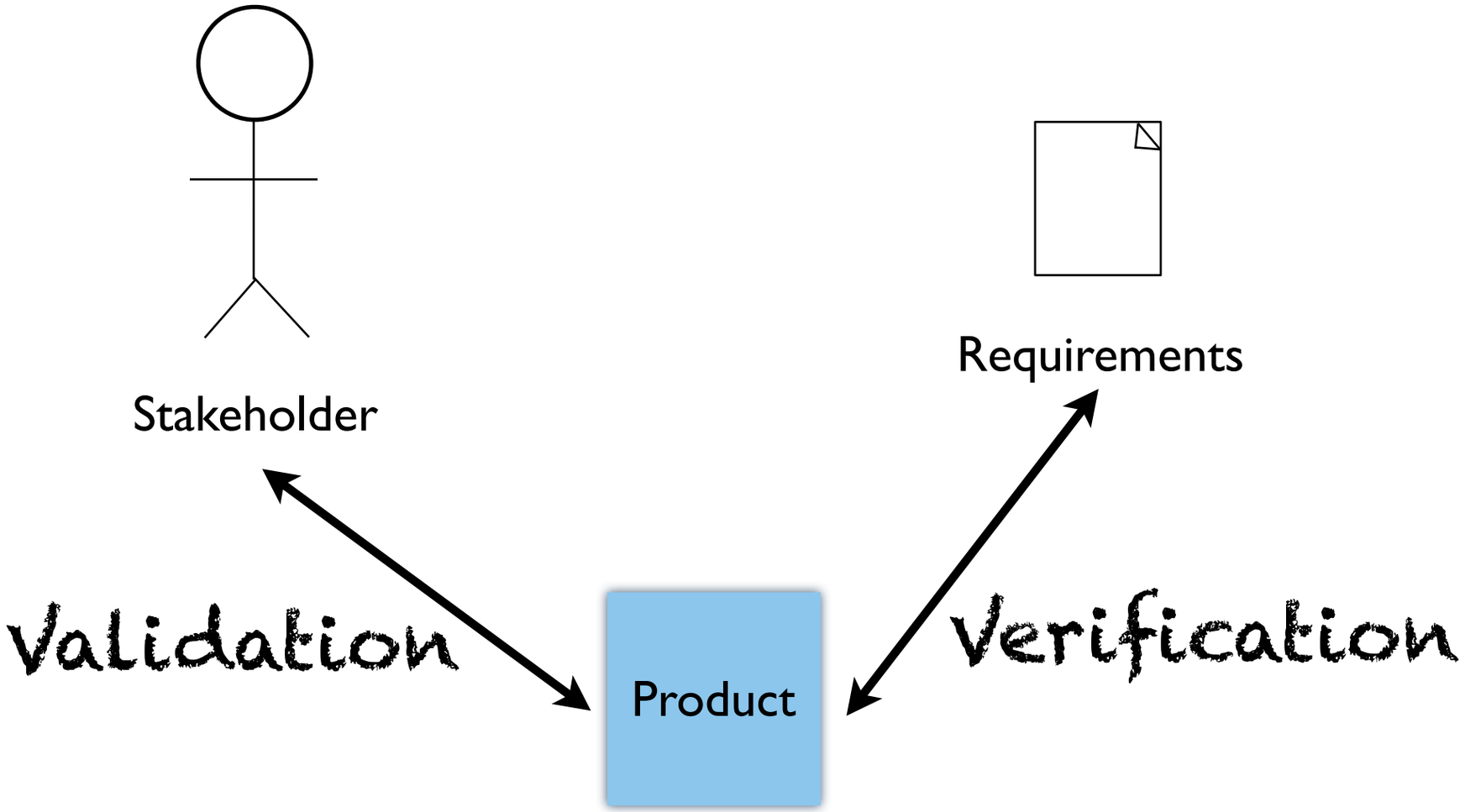


based on CMMI PPQA

The Process and Product Quality Assurance process area involves the following:

- Objectively evaluating performed processes, work products, and services against the applicable process descriptions, standards, and procedures
- Identifying and documenting noncompliance issues
- Providing feedback to project staff and managers on the results of quality assurance activities
- Ensuring that noncompliance issues are addressed

Verification & validation



Verification: Have we done the product right?
Validation: Have we done the right product?

V&V planning

Overview

Processes

Reporting requirements

Administrative requirements

Test documentation requirements

IEEE Std. 1012-2004

These are the main sections that the standard proposes for a V&V plan.

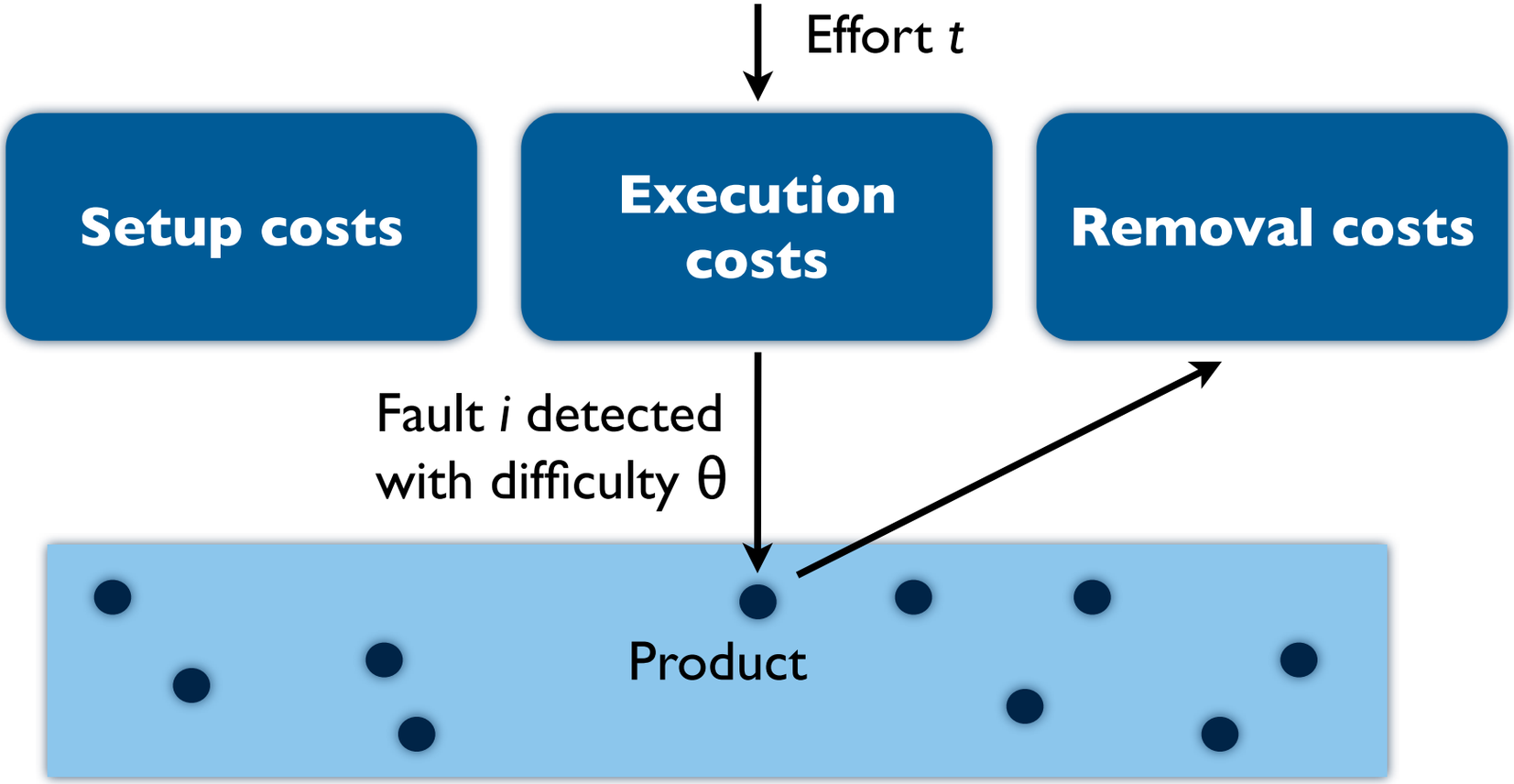
V&V planning overview

- Organisation
- Master schedule
- Software integrity level scheme
- Resources summary
- Responsibilities
- Tools, techniques, methods

V&V processes

- Management of V&V
- Akquisition V&V
- Planning V&V
- Requirements V&V
- Design V&V
- Implementation V&V
- ...

Quality economics optimisation



$$E[d(t)] = u + e(t) + \sum_i (1 - \theta(i,t))v(i)$$

Wagner (2008)

This is a part of a theory that describes quality economics of analytical quality assurance. It states that there are always fixed setup costs, e.g., setting up a test environment, flexible execution costs,
e.g., a varying number of test cases, and removal costs depending on the defect detection.

It is important here that the core is the difficulty θ. It is dependent on the fault to be detected and the
used defect detection technique. Different defect detection techniques are more or less capable of finding
different defects.

Wojcicki and Strooper

	A	B	C	D
1	L[M]		L[M]	
2	M[H]	M[H]		
3		L[M]		
4			H[H]	H[M]

Step 1: Pre-selection
Step 2: Maximise completeness
Step 3: Minimise effort
Step 4: Post-selection

Wojcicki and Strooper proposed a very simplified approach to build a V&V plan that, however, can give a
first direction. For the defect detection techniques 1-4, we have to estimate the effort and effectiveness for
finding the defect types A-D.
Then we go through the 4 steps, possibly in iterations, to reach a first V&V plan.

Excercise

- Find best V&V plan for the following data
- Group work
- 10 minutes

	Timing	Interface	Function	Docum.
Bug finding tools		L[H]		
Inspection with checklist		H[L]	H[M]	M[H]
WB test	H[M]	M[H]	H[H]	
BB test	H[L]	M[M]	H[H]	

Effort[Effectiveness]

I would expect:
Inspection with checklist is needed because its the only technique that finds documentation defects
As inspections do not find timing defects, we need either white-box or black-box tests. Because BB tests have lower effort there, we choose black-box test.

The QA plan hence consists of inspections with checklists and black-box tests.

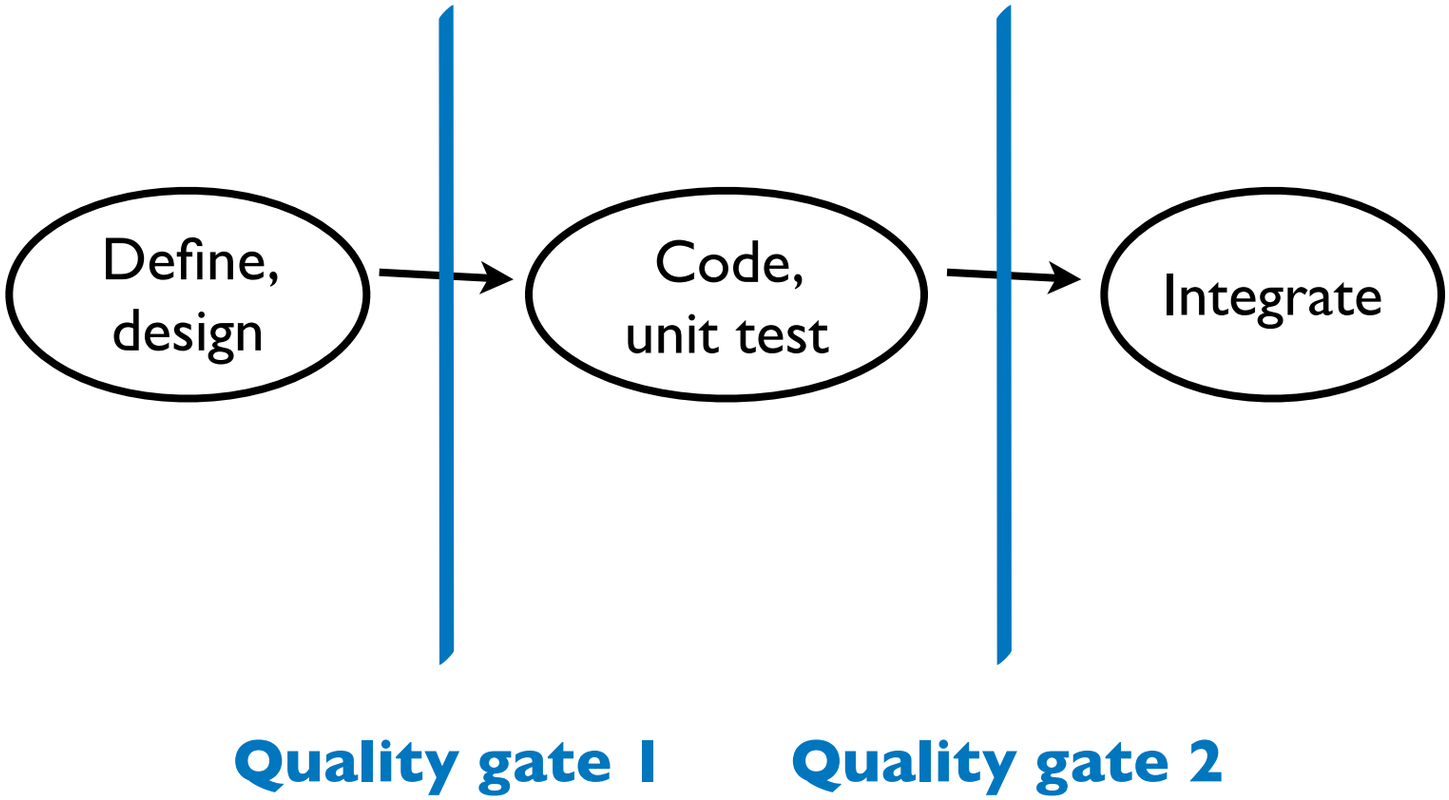
Of course there are dependencies between the techniques. It might be desirable to use bug finding tools in addition, because
(1) it has a higher effectiveness in interface defects and
(2) it needs only low effort that might lead to less effort in inspections and black-box tests.

IEEE Std. 730-2002

- Software quality assurance plan
- Documentation
- Software reviews
- Tests
- Problem reporting and corrective action
- Tools, techniques, methodologies
- Risk management

This standard goes beyond V&V and defines a structure for a complete quality assurance plan, which includes,
for example, the problem reporting process and tools as well as risk management.

Quality gates



Quality gates define specific criteria that have to be met to be allowed to go to the next phase.

Plans are only good intentions unless they immediately degenerate into hard work.

–Peter Drucker

Approaches

Quality assurance planning

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