

Product quality:

The product quality is the degree, to which a product satisfies specified (customer) requirements.

Process quality:

Relevant for process quality is not the result, but the process of development.

Good processes



Good products

Approach:

Product quality is set determined by the quality and the realization of processes.

To make the concept of quality in terms of product and service quality manageable it is recommended to derive various quality dimensions (quality aspects):

- Functional value

This provides information on the suitability for the intended use. Since this value can be measured, products or services are usually rated according to each benefit criteria.

For example: For a TV the functional value can be defined as the sharpness, sound quality or color accuracy.

Functional value factors for services sector are such as punctuality or a prompt service.

- Reliability

The probability for a product to stay functional in a given period of time. This period can be measured. Such measurements require the use of a product over a period of time.

- Compliance with standards

This is the extent to which certain products or services comply with standardized specifications.

- ...see the ISO 25000 "Software Engineering - Software product Quality Requirements and Evaluation (SQuaRE)" for the definition of other quality dimensions (functional suitability, reliability, operability, performance efficiency, security, maintainability, transferability, plus subcategories)

What is the quality manager interested in?

- How do we make customers (very) satisfied?
- What do we have to do for that?
 - no more, no less
- How to communicate the goals to my employees?
- Which methods and tools do I need?
- How do we improve over time?



Quality planning – *define target*

„Identification of project-relevant quality standards and the determination, how to fulfill them.“

Quality planning covers:

- ➔ Product requirements / determination of processes
 - ➔ determine, refine, and structure Q-goals
 - ➔ Tools for measurement and assessment

Result ➔ Quality-assurance plan



Quality assurance – *achieve target*

„Sum of all QA-activities during project run time, to ensure that the quality goals are fulfilled.“

This covers the *verification*

- of process quality (compliance of processes with guidelines)
- of working-product quality with respect to the fulfillment of product requirements and product guidelines
- *Methods*: reviews, inspections, audits, testing etc., as well as preventive measures

Challenges of quality assurance

- **Many places** to start with potential for improvements. There are many deviations.
- **Lack of resources** (time, money, personal) – unlimited resources enable infinite improvement possibilities.
- In practice, measures have to be **prioritized**.
- Quite often the cost and needed time for QA is underestimated.
- **How to find the right balance** – no more, no less.

Who is responsible for the quality?

“Quality is everyone’s job”

-> “Nobody is responsible” ???

Responsible are
all persons involved

- The “quality-carrying department” should not be the only one to carry the responsibility.
- Sole verification does not add quality to a product.
- Quality is not separately developed from the product.

➔ QA-responsible persons may **constructively** contribute to quality

Quality management – QM

Determines necessary processes for the fulfillment of the desired product quality.



Quality assurance – QA

Responsible for maintaining all measures, determined by quality management.

- Quality assurance officer, quality engineer

Independence – quality assurance is usually subordinate to quality management or the management board, to ensure independence of instructions from the development department (a constraint of Automotive SPICE).

Typical tasks of a quality manager

- Quality-strategy guideline for projects, corporate divisions, and strategic thinking
- **Adaptations** of the strategy within projects
- **Monitoring** the realization of Q-measures (continuously or as part of deadlines)
- **Status-reporting** for several projects
- **Improvements** of quality management within the organization
- **Contact** for customers
- Resolving technical problems / **escalation**

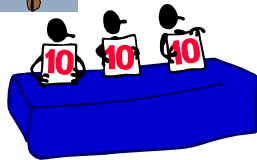
Typical tasks of a quality assurer (project level)



Take customer guidelines and processes into consideration

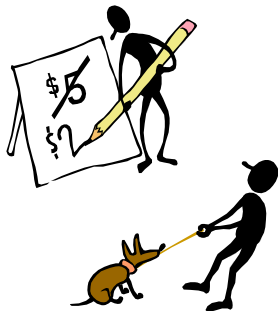


Supervision and carrying out quality measures in specific projects



Carrying out reviews, assessments, and audits

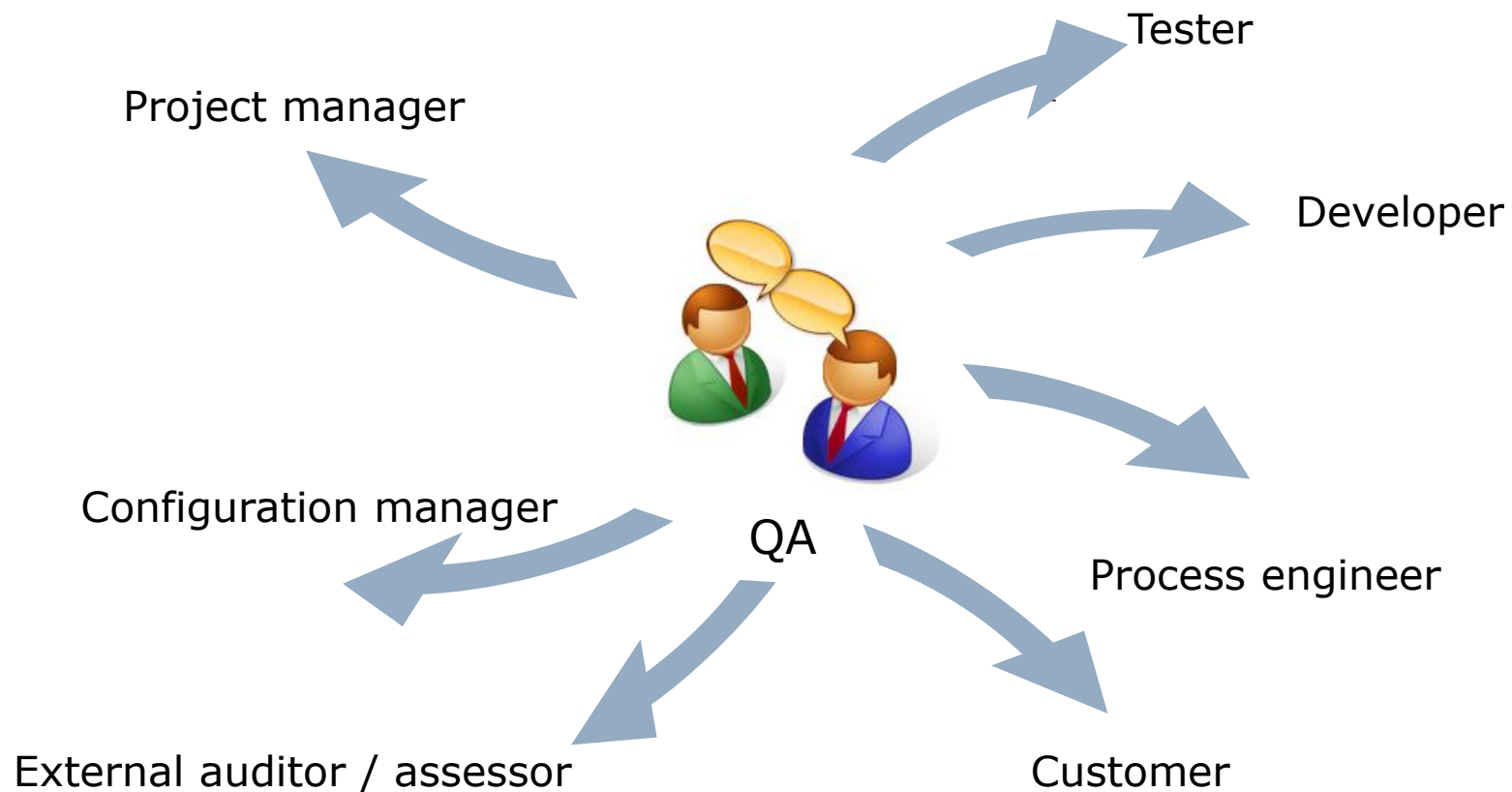
Preparation of customer audits



Provide document templates

Detect problems in carrying out processes and track them

Daily talk



Possibilities to motivate the development team



Quality assurer

inform on time

explain

argue

support

escalate

convince

showing them how
to do ...

mention problems

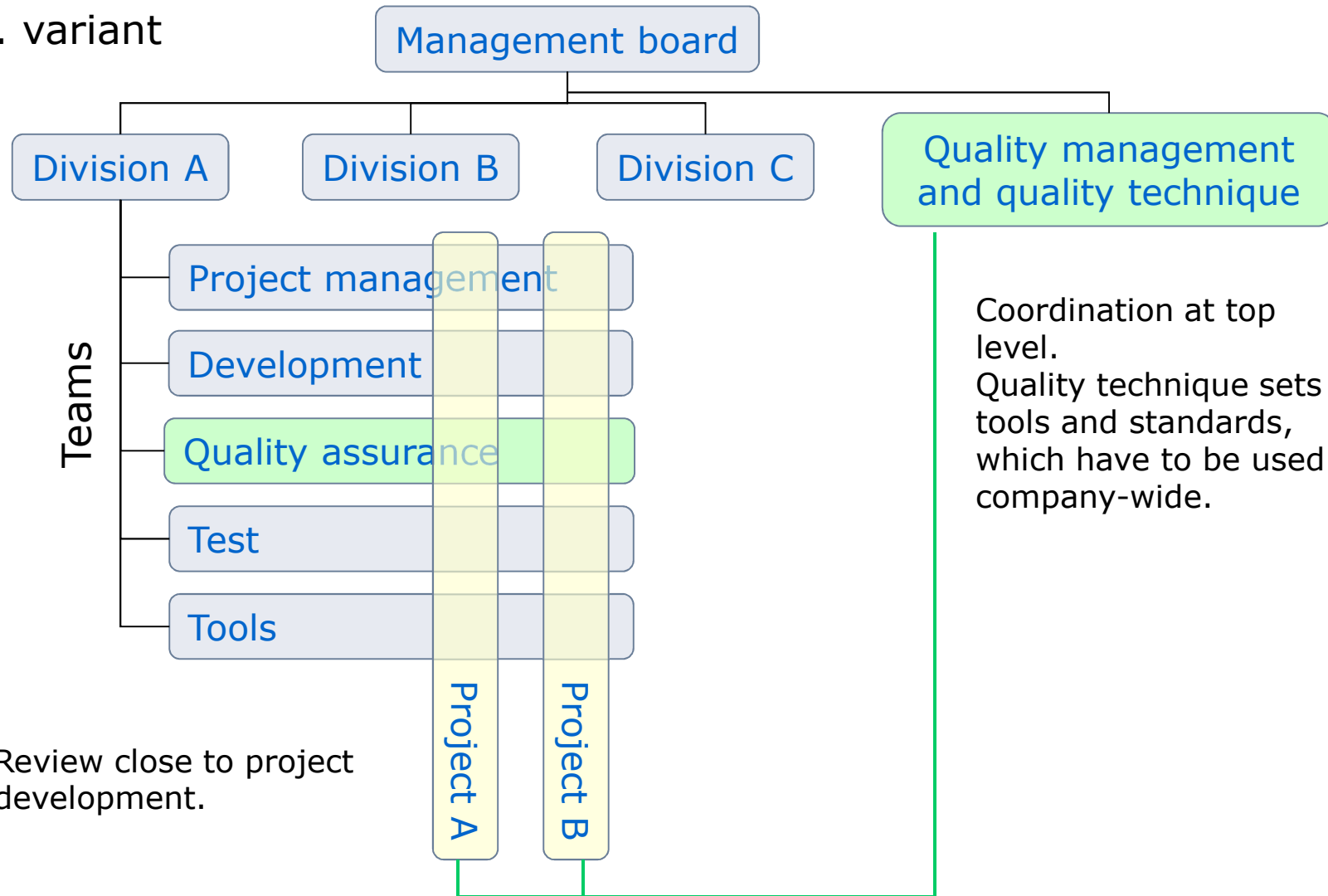


Important!

Knowing the benefit, which arises from qualitative work of the development team.

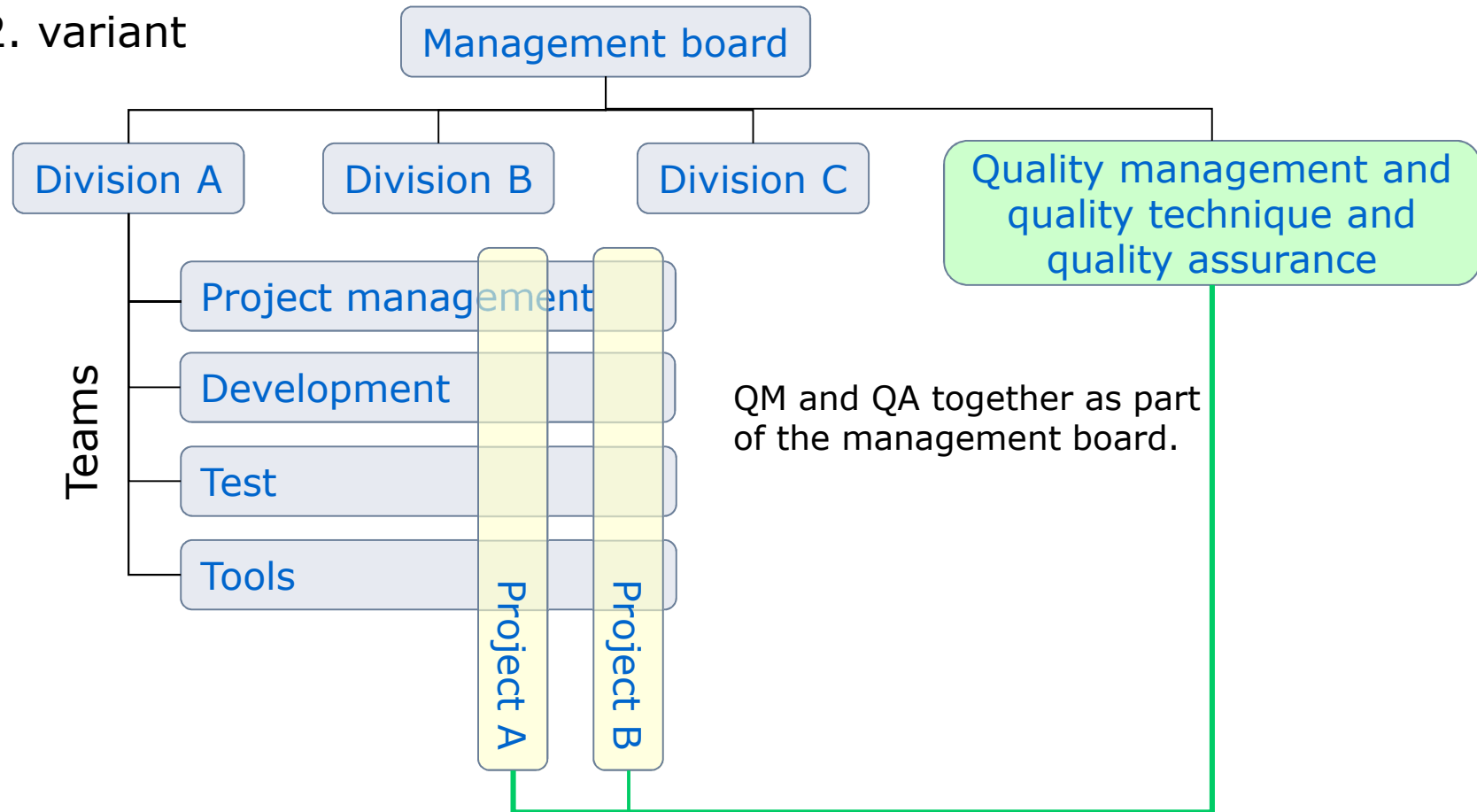
The quality team - organization

1. variant



The quality team - organization

2. variant



Goal of quality planning

- Determination of quality requirements, which are necessary for a project/all relevant working products. This includes the declaration of how to fulfill the requirements. In particular, corresponding quality goals, measures, and resources are identified.
- “Develop a method for the realization of product and process quality assurance at project level.”

[Base Practice 1, SUP.1 Quality assurance, ISO 15504]

Types of quality goals

- External
 - Customer requirements
 - as part of the specification book, adjusted with the customer, documented in the functional specification document and so fixed/tied
- Internal
 - Coding standards and conventions
 - MISRA, naming conventions, project-specific programming style
 - Internal suggestions for improvements
 - Internal processes and guidelines
 - customers are usually not informed about them
 - usually have a low priority

Quality planning – SMART principle

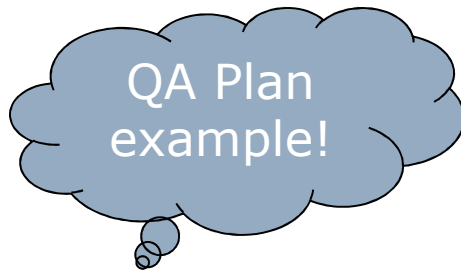
- **S**pecific
- **M**easurable
- **A**ppropriate
- **R**ealistic
- **T**ime-fixed, terminated

With SMART formulated goals help with the project planning.

Minimum requirements are

1. What is verified?
 - A selection of work products and processes
2. Against what is verified?
 - Quality requirements
 - How to verify and how to correct deviations?
3. How often does the verification happen?

[Source: SPICE in der Praxis, 2006]



The following sources are helpful:

- IEEE Std 730-2002 Standard for Software Quality Assurance Plans
- IEEE Std 730.1-1995 Guide for Software Quality Assurance Planning
- SPICE SUP.1 Qualitätssicherung (Prozessbeschreibung und Arbeitsprodukt 08-13 Quality Plan)

Different area of activity

Project-comprehensive measures

- Company- or division-wide regulations and activities, which force a uniform framework on QA in projects of a company

Project-specific measures

- Specify the regulations for a project

Phase-specific measures

- Project-specific measures with respect to individual phases (opening phase, realization, ...)

Planning and administrative measures - Examples

To make sure that the quality-assurance realization is organized and regulated.

	project-comprehensive	project-specific
planning and administrative	<ul style="list-style-type: none">▪ Creation of the QA-handbook for the company or one division▪ Define criteria for the selection of QA-measures in projects▪ Select, analyze, and understand relevant standards▪ Organize QA training▪ Increase the motivation for Q-questions in the company or the division	<ul style="list-style-type: none">▪ Creation of the project-QA-handbook▪ Create documentation plan▪ Create verification plan▪ Create QA-report planning

Constructive quality measures

create a *structured process* to ensure that the product has certain properties

Target-aimed usage of

- Methods, languages, tools, guidelines, check lists, and standards in the design and the program development
- Every activity with a positive effect on the quality of the software product

Target: Avoid errors early!

It is possible to “build-in” quality into a software product.

Constructive quality measures – examples:

	project-comprehensive	project-specific
constructive	<ul style="list-style-type: none">▪ Usage of process models▪ Tool usage (development environment, compiler, ...)▪ Standardization and reuse of software or software artifacts▪ Define processes	<ul style="list-style-type: none">▪ Conduct project planning (costs, dates, persons)▪ Provide aids and tools for software and system development▪ Usage of methods like Requirements Engineering, SW Design, etc. (left side of V-model)▪ Conduct process tailoring

Analytical (checking) quality measures

measure the existing Q-level and identify the scope and place of defects

Quality assurance of working products → reviews and tests
Assessment of project processes → audits and assessments
Evaluation by using metrics

- Compare actual and debit state

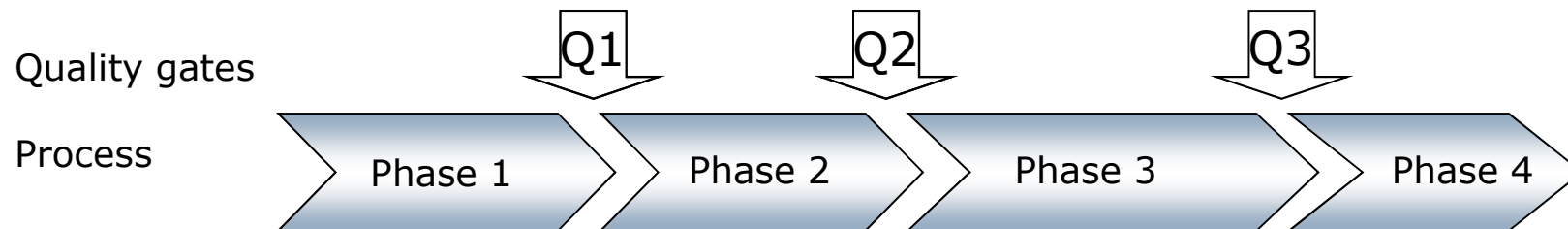
Goal: detect errors!

Analytical (checking) quality measures - examples

	project-comprehensive	project-specific
analytical	<ul style="list-style-type: none">▪ Assess QA-reports	<ul style="list-style-type: none">▪ Dynamic checking<ul style="list-style-type: none">▪ Testing▪ Static checking<ul style="list-style-type: none">▪ Review▪ Project audit▪ Assessment▪ Quality gate▪ Use of aids during the test (check lists, ...)▪ Software analysis

Quality gate

- Quality gate is an approval process of working products in a project phase
- Process: based on the quality assessment of the project progress, one decides about releasing the next project step



- Review progress (e.g., at Q1, Q2, ...) of existing working products
 - Check content and form

Quality gate

- Unique definition for all projects in the company/division
- Part of the process
- Value: comparison of the projects possible (ordinal scale)
- Tool: quality-gate check lists
- Result: quality-gate protocol
 - Maybe also correction measures

Review

Term not consistently used; often a generic term:

- Management review
- Technical review
- Inspection
- Walkthrough
- Audit

[Review types according to IEEE Std 1028-2008]



Four eyes see more than two.

Aid

- 1028-2008 IEEE standard for software reviews and audits

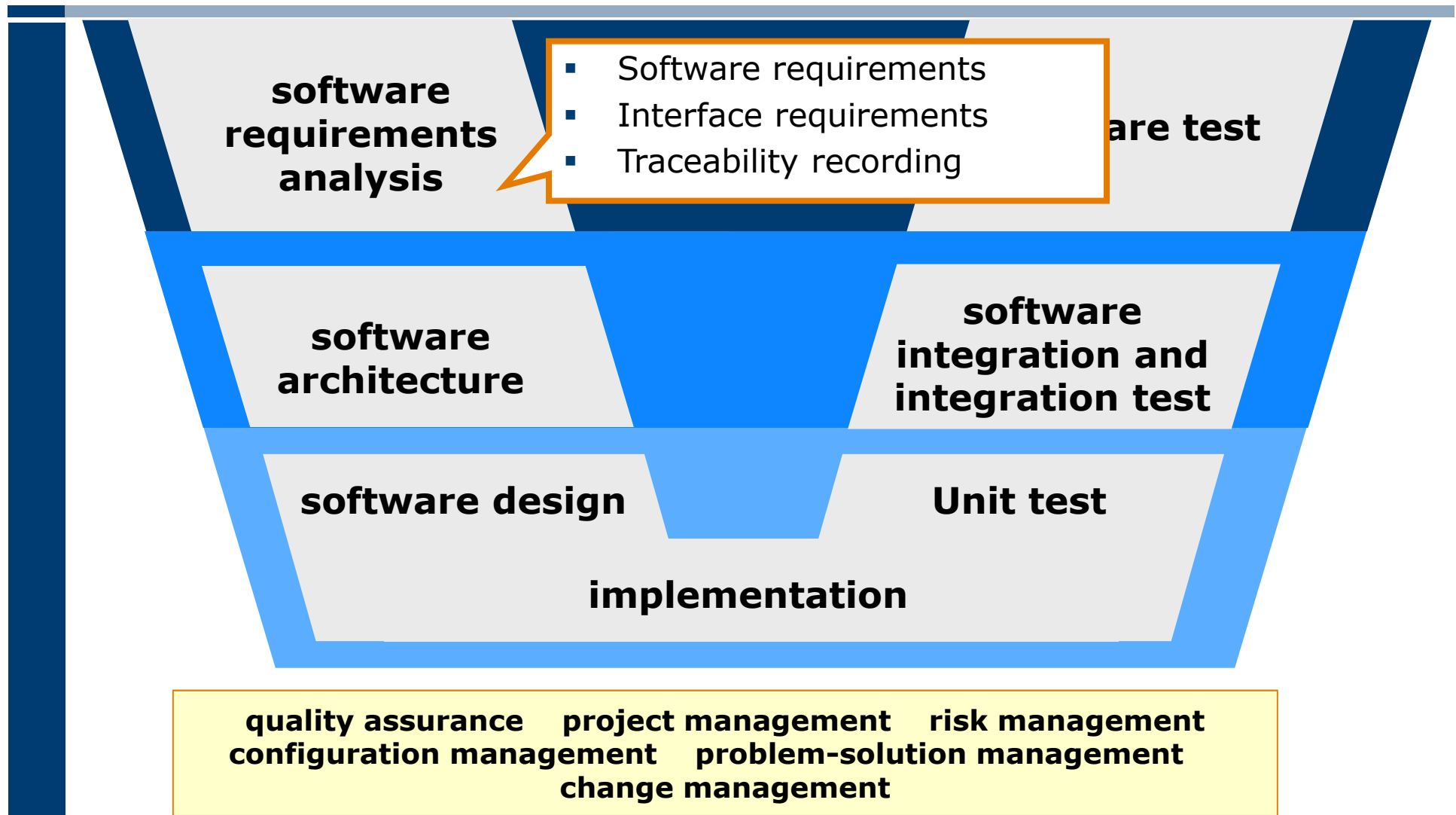
A systematic review means:

- Incorporating the team
- Documented review procedure
- Documented review results
- Ideally – in a review, one detects the errors at their sources, right after the phase, in which they were introduced.

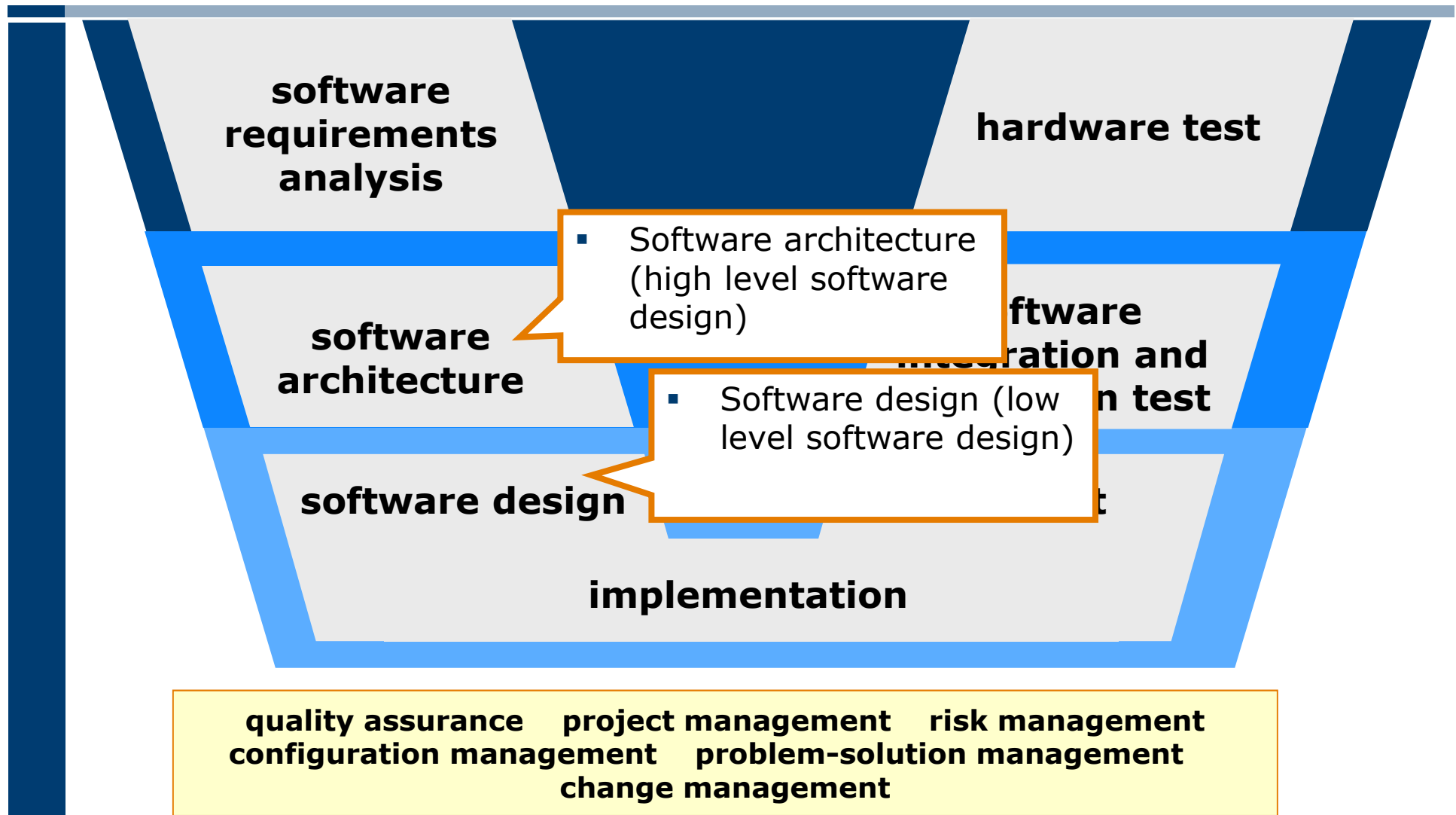
Review types with respect to the review object

- A *(product-) review* is a static test of a result (document or program code) by a group
 - e.g., code inspection
- A *(project-) review* is a verification of the project progress and/or a retrospection at a certain time frame (end of a project phase, reaching a milestone, end-project review)
 - e.g., quality-gate review

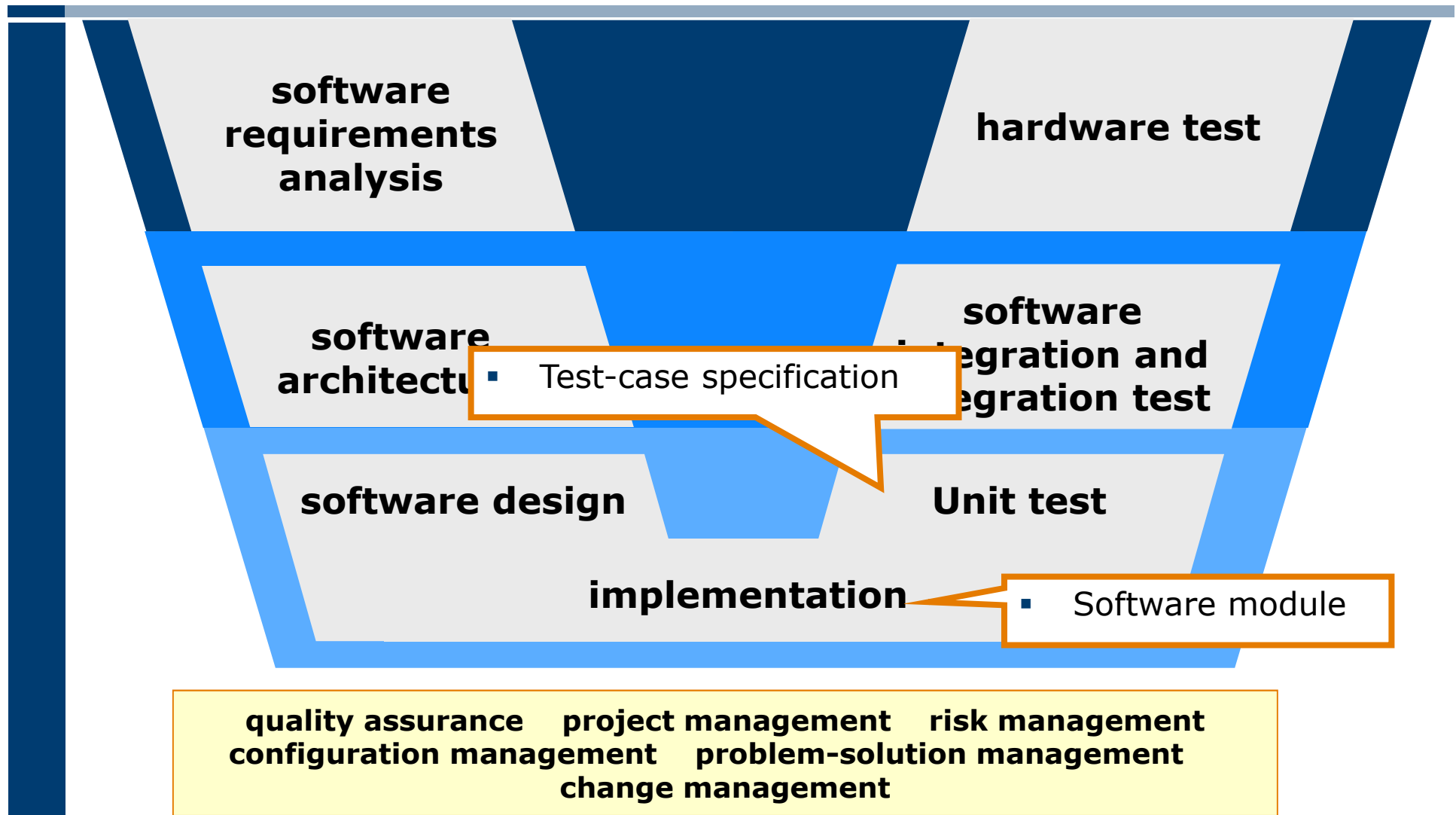
Review –
reviews V-model-based system development (example)



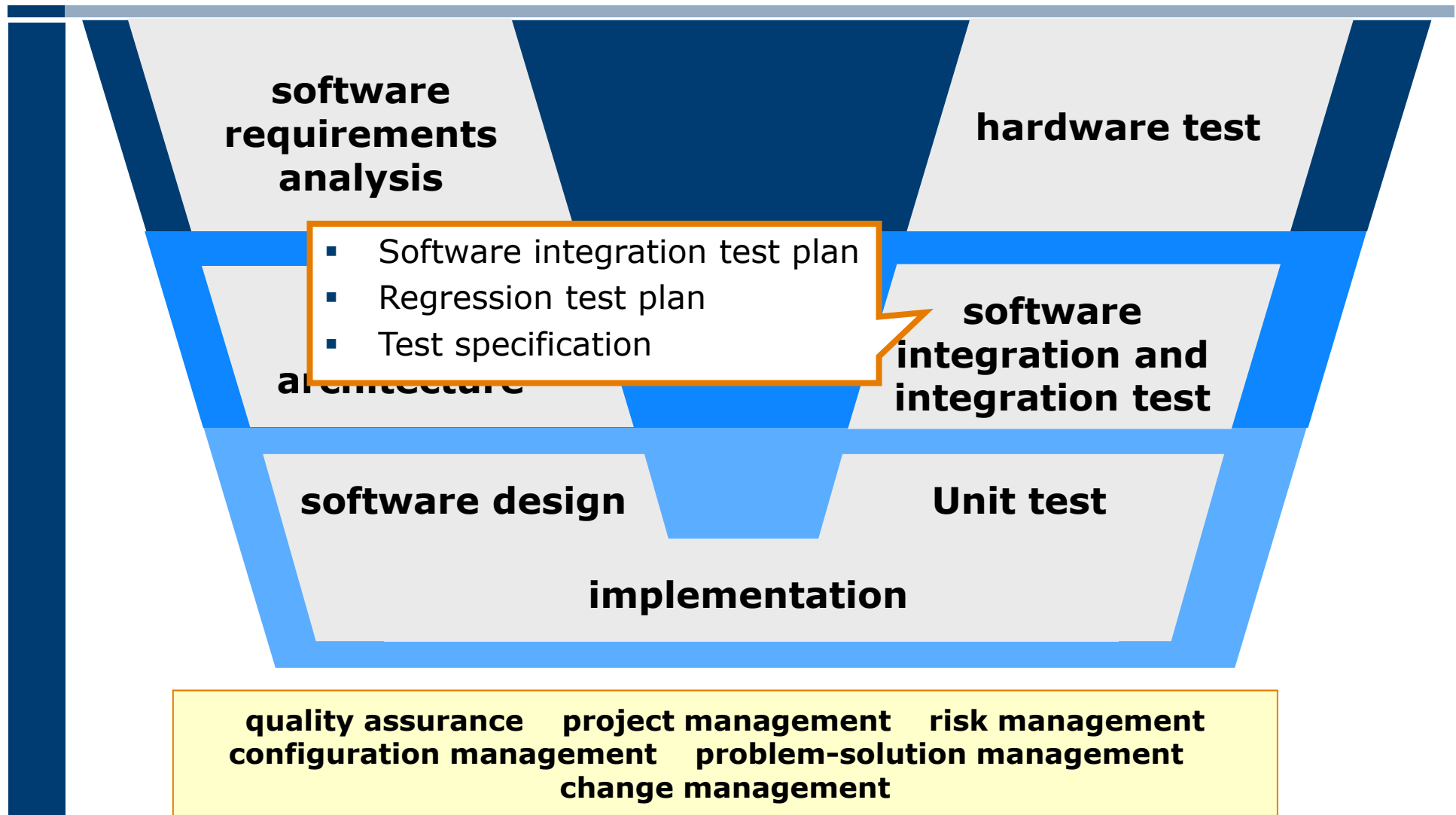
Review –
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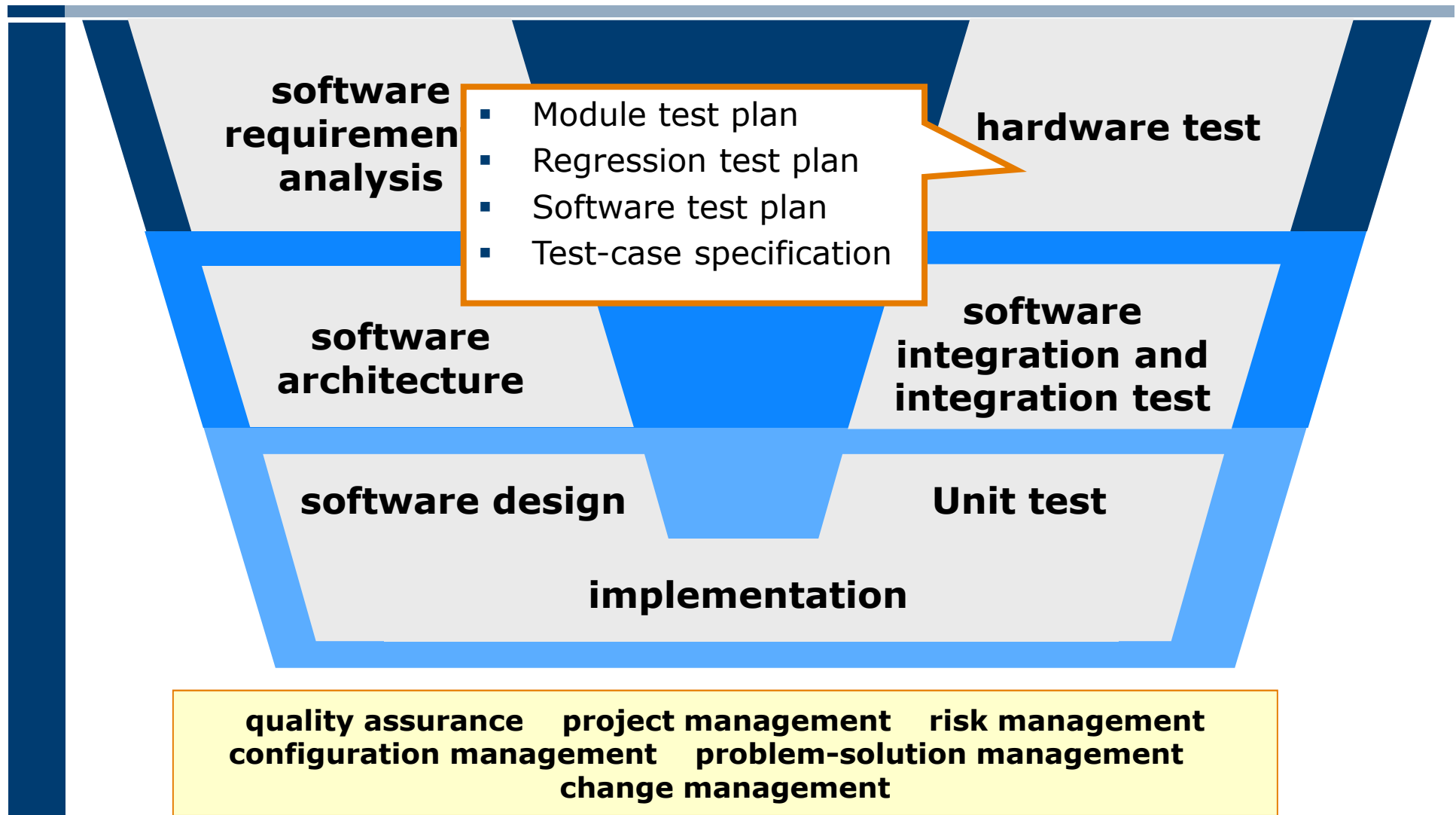
Review – reviews V-model-based system development (example)



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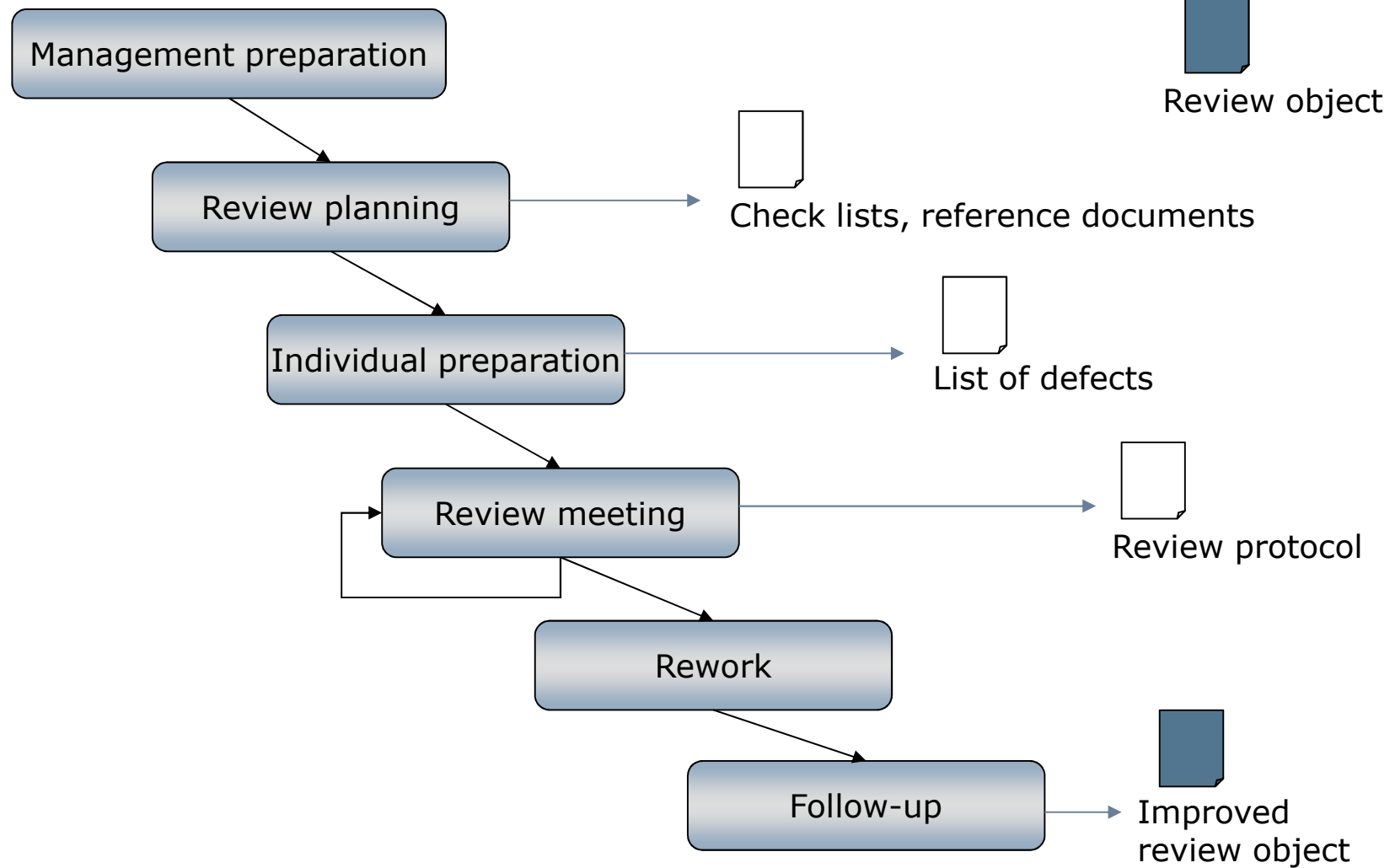
- Additional product reviews in the project
 - Offers, contracts
 - Review approvals (also partial ones) with selected products; together with the customer
 - Release documents
- Additional project reviews:
 - Regular management reviews
 - Maybe milestone reviews
 - Project retrospection

Review roles – standard cast

- Review organizer
- Moderator
- Protocol writer
- Tester (with technical knowledge)
- Expert (with deep technical knowledge)
- Optional – quality assurer; usually focusses on formal aspects

One person can have multiple roles, e.g.:

Review organizer = moderator = protocol writer



Steps of the review planning

1. Select review object
 2. Select review method
 3. Select review participants
 4. Set time and date for the review meeting; send invitations
 5. Provide material to the participants and ask them to prepare themselves
 - Review object, check lists, review protocol, ...
-
- Give the participants enough time for preparation

Inspection

Systematic error detection in a software product.

- *Review team (3-6)*
 - Author, organizer, protocol writer, tester
- *Effort:*
2 hours at the maximum + preparation
- *Process:*
The inspector gets the software product first for proof-reading.
In a joint meeting a review protocol is created.

Walkthrough

Light-weight evaluation of a software product. Often used for the purpose of presentation.

- *Review team (2-7):*
 - Author, inspector (= protocol writer)
 - Optional audience
- *Effort:*
2 hours at the maximum
- *Process:*
The author describes the software-product candidate to be examined to the inspector. A protocol is created.

Quality status report

Purpose and properties

- Central document, in which the quality status in a project is documented and tracked; is used for
 - to communicate a company's quality status
 - to bring responsible persons into action
- Contains different views for different target groups
 - A detailed version for the project team
 - A summary for the management
 - An excerpt for customers



Quality status report

Is usually created at ...

- relevant project milestones
- regular points (monthly, half-yearly, ...)
- at special times (if severe problems in the project regarding time, costs, or quality arise)



Quality status report – content (1/3)

- What is the current quality status in the project?
 - Short summary of the project situation
- Which problems and deviations occurred in the last reporting period?
- What is the work-products' quality status?
 - Metrics regarding review or creation status of documents
 - Test metrics
 - Metrics regarding requirements engineering, source code, memory consumption, ...
 - Further project-specific metrics

Quality status report – content (2/3)

- What is the processes' quality status?
 - Results of the audits
- Which quality measures have the highest priority in the next project period?
- Open point list
 - With a sufficient description, with references to affected documents or the process table
 - Sortable regarding topics
 - Including responsible persons, status (open, in work, closed), and date

Quality status report – content (3/3)

Additional information

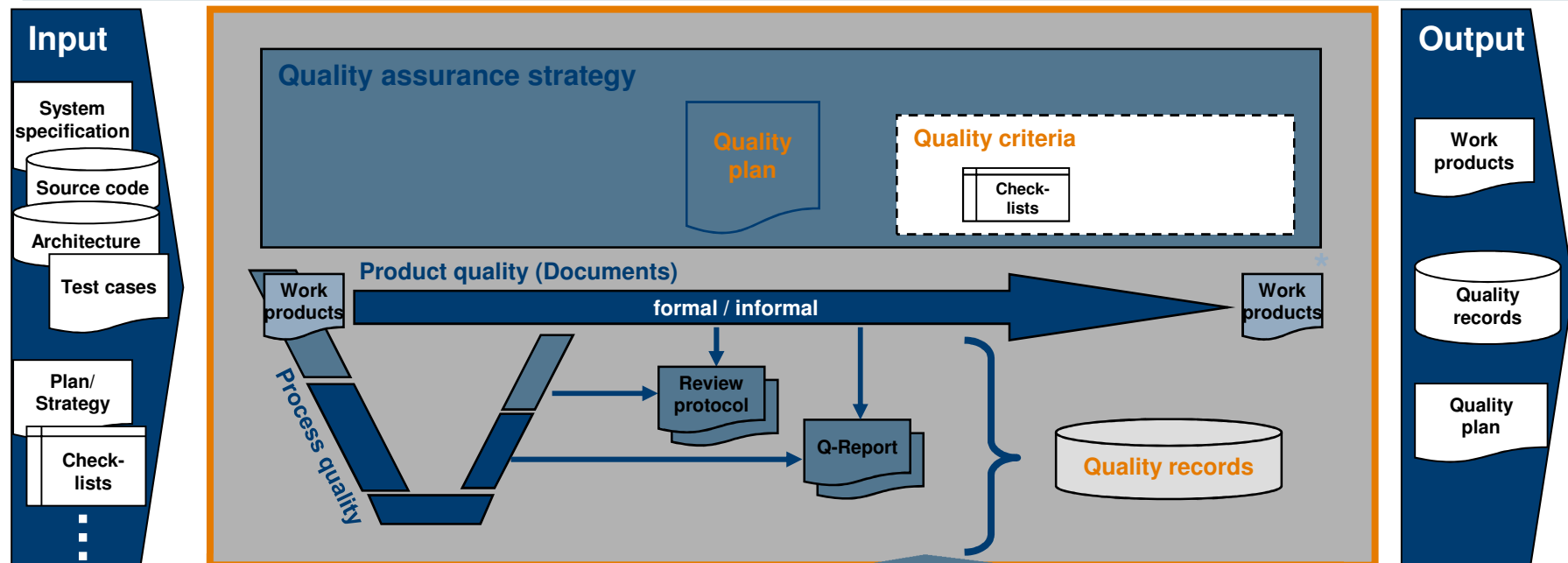
- Development of individual quality aspects in the project life time
 - Trends of quality results
- Feedback regarding customer satisfaction
- Preparation and make-up activities for audits and assessments

Hints

- All statements regarding the project quality have to be verifiable with (provable) facts
- The evaluation process has to be described in detail in the quality-assurance plan.
 - e.g., 0-15% result in status "red"
- The quality evaluation of the results should be transparent for all persons in the project

SUP.1: Quality Assurance

Purpose is to provide independent assurance that work products and processes comply with predefined provisions and plans.

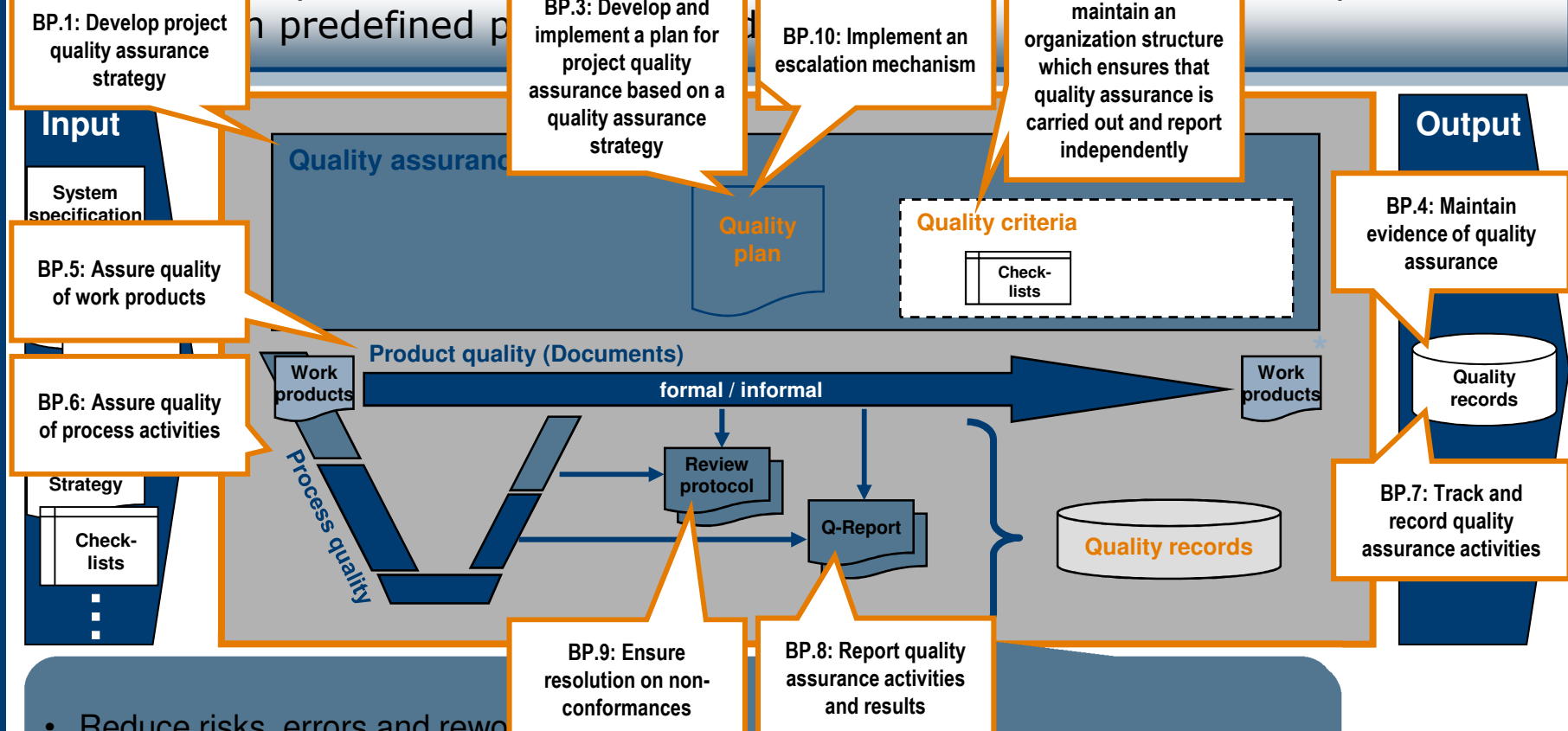


- Reduce risks, errors and rework
- Invest resources (time and money) to save resources
- Make the customer come back – not the product!

Overview of SUP.1

SUP.1: Quality Assurance

Purpose is to provide independent assurance that work products and processes



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