REQUIREMENTS ENGINEERING

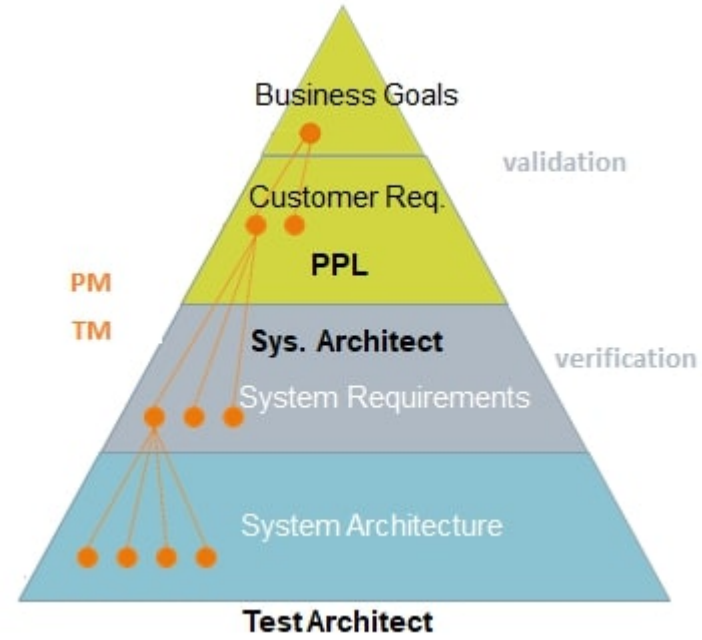
Sentence Template for System Requirements

Given When Then

Characteristics of Good Requirements

Quality Criteria	Business Goals	Customer Requirements	System Requirements
Individual Requirements			
Necessary	Mandatory	Mandatory	Mandatory
Implementation free	Mandatory	Mandatory	Mandatory
Unambiguous	Optional	Mandatory	Mandatory
Consistent	Mandatory	Mandatory	Mandatory
Complete	Optional	Optional	Mandatory
Singular	Mandatory	Optional	Mandatory
Feasible	Optional	Optional	Mandatory
Verifiable	Optional	Mandatory	Mandatory
Traceable	Mandatory	Mandatory	Mandatory
Set of Requirements			
Complete	Optional	Optional	Mandatory
Consistent	Mandatory	Mandatory	Mandatory
Affordable	Optional	Optional	Mandatory
Bounded	Optional	Optional	Mandatory

Requirements Traceability

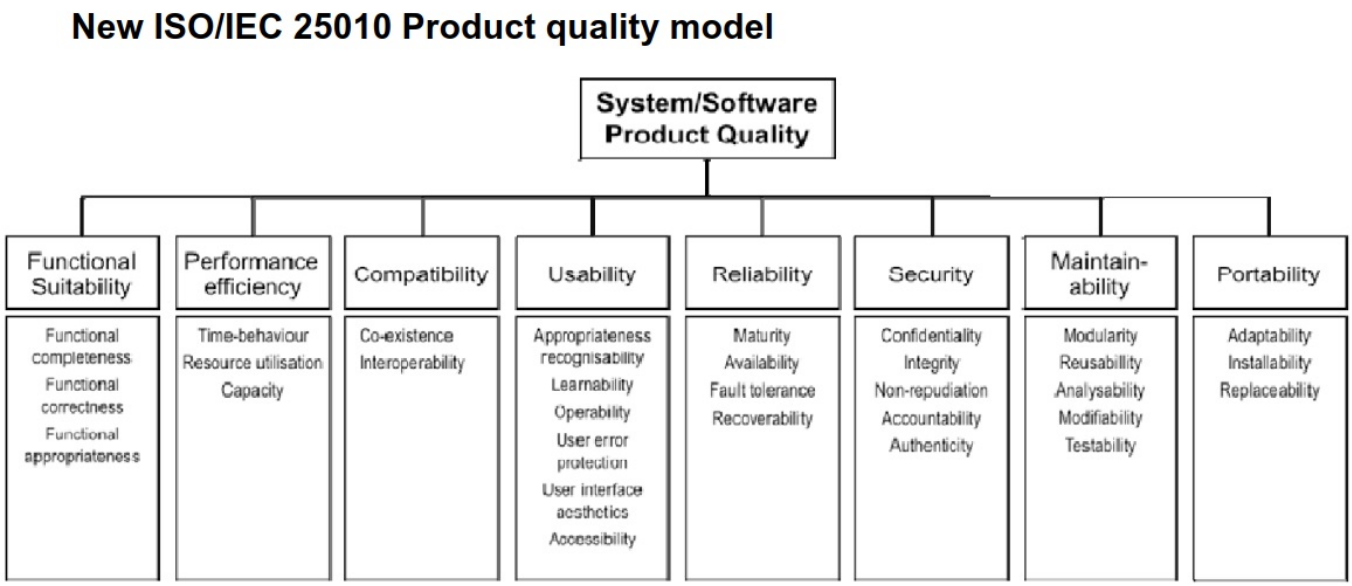


Tracing Usage:

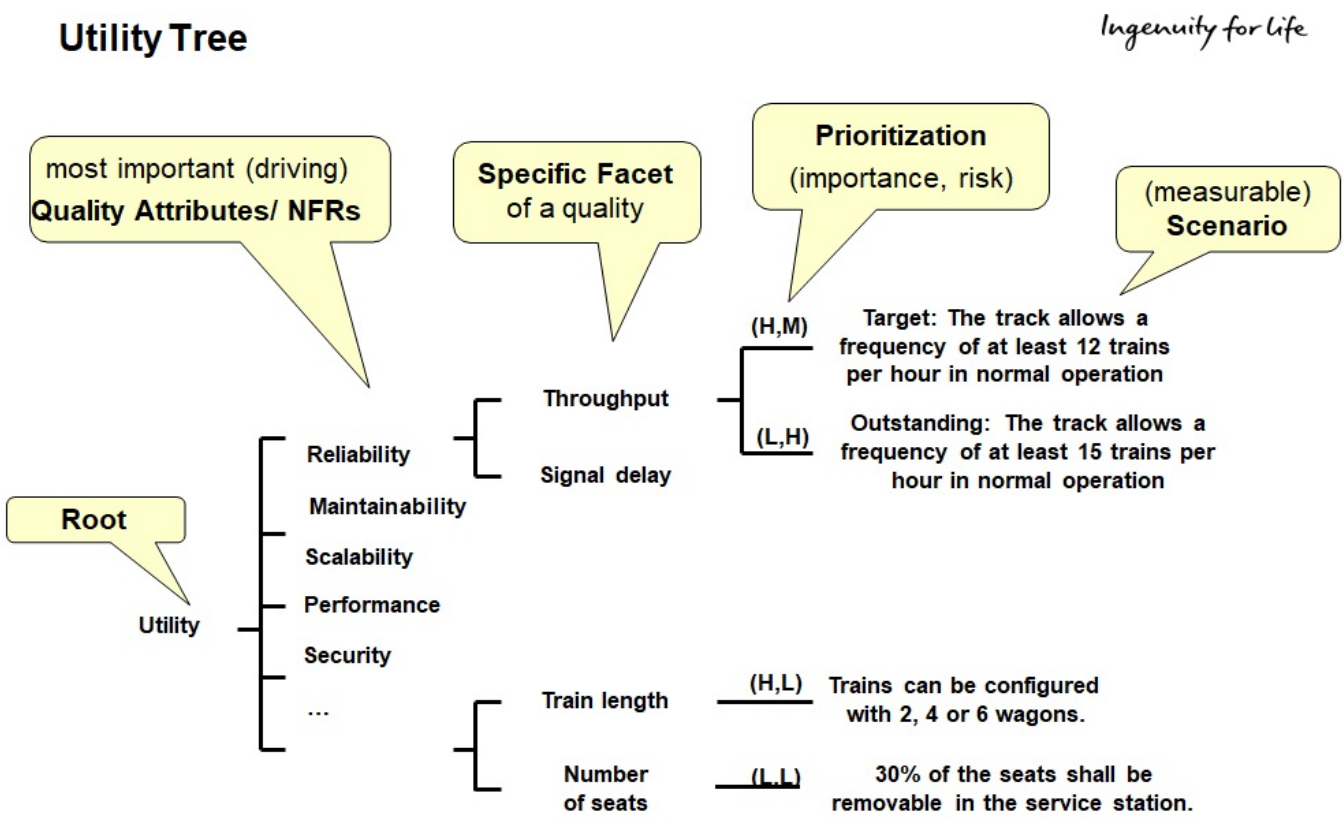
Analysis	Description	Process
Derivation	*Why is this here?*	cost-benefit analysis
Impact	*What if this changed?*	change management
Coverage	*Have I covered all reqs?*	management report

NFRs / Quality Attributes

Software Quality Characteristics pdf

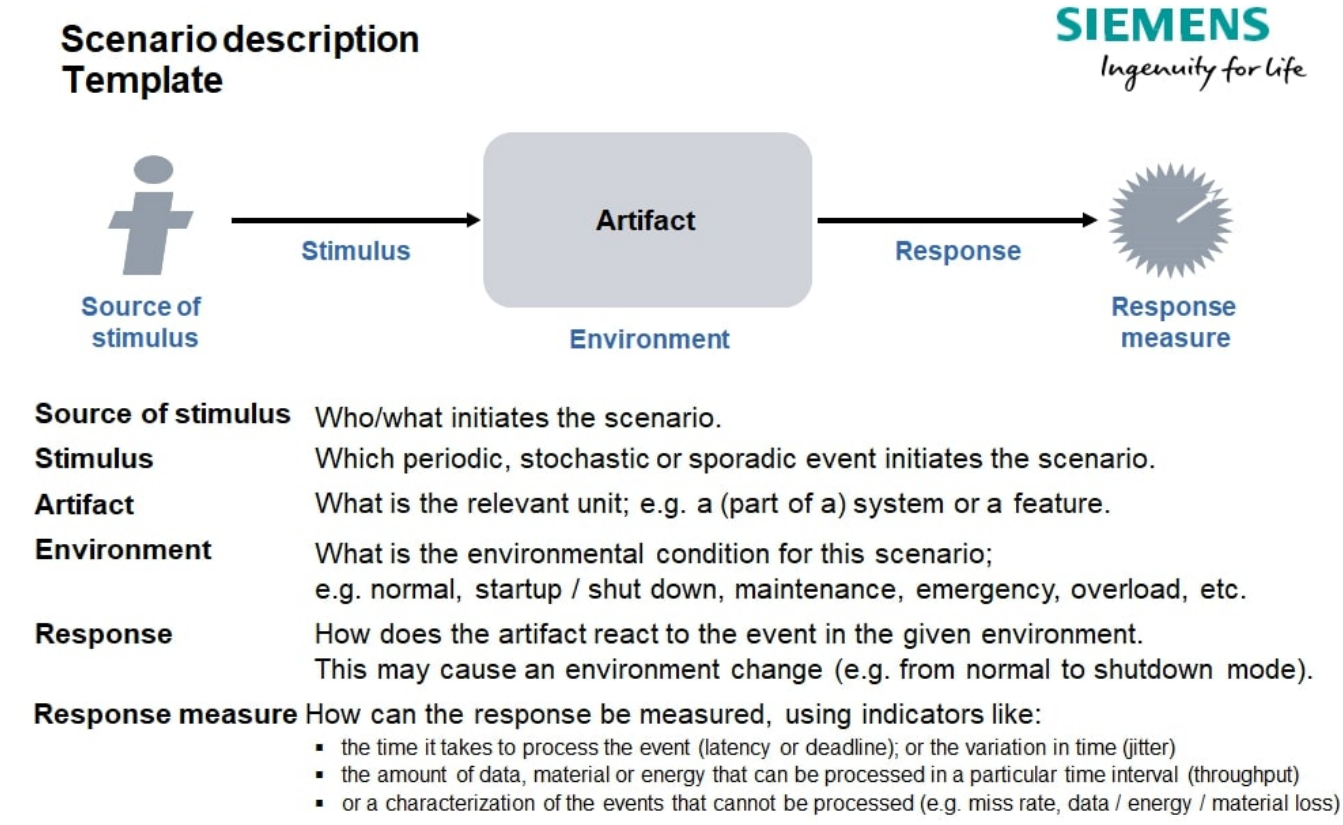


Step 1: Utility Tree



Step 2: Scenario Description Template / Workflows

To reduce ambiguity and increase testability, each measurable scenario in the Utility Tree gets described with this template.



Step 3: Refine Scenarios

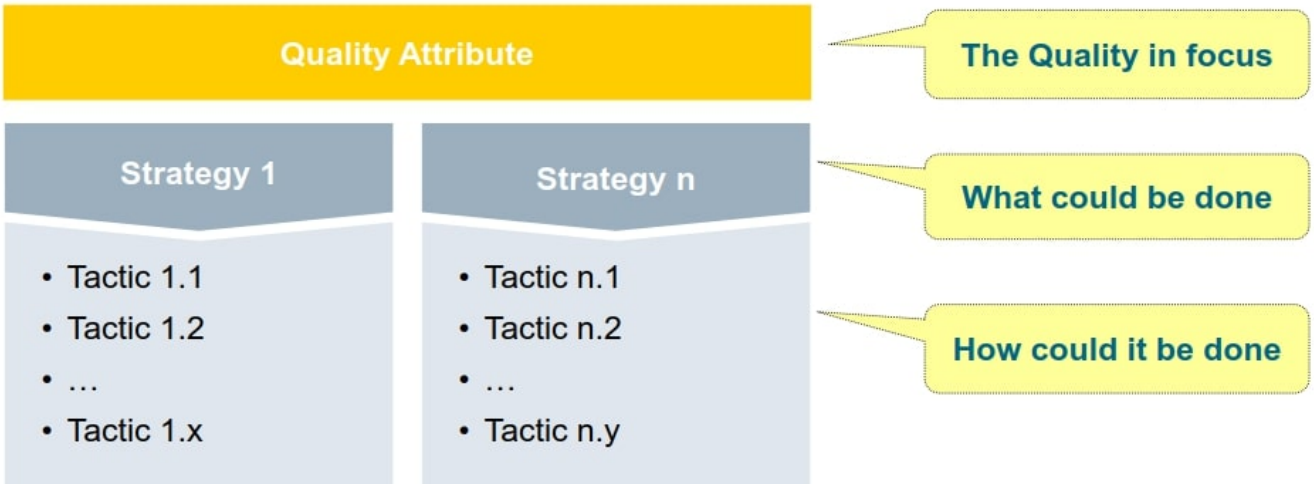
Scenario refinement table
Example from SEI Quality Attribute Workshop (QAW)

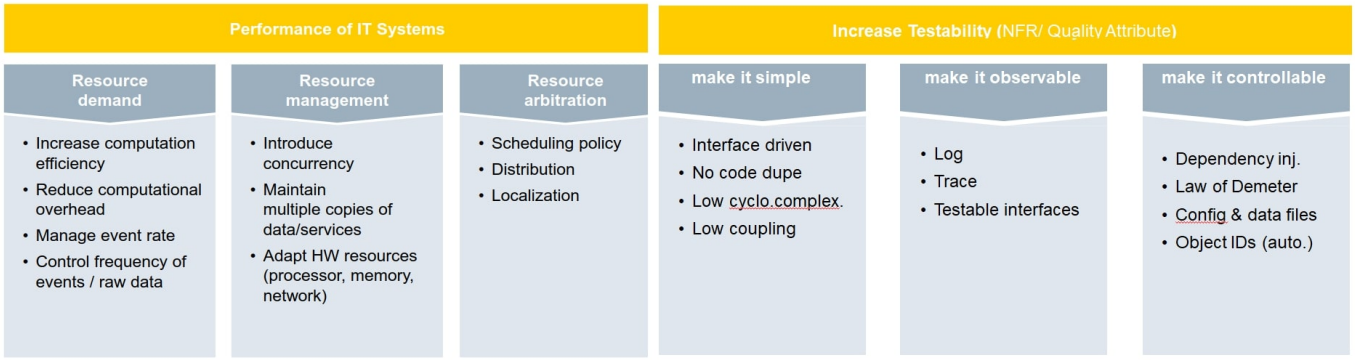
Scenario Refinement for Scenario N		
Scenario(s):		When a garage door opener senses an object in the door's path, it stops the door in less than one millisecond.
Business Goals:		safest system; feature-rich product
Relevant Quality Attributes:		safety, performance
Scenario Components	**Stimulus:**	An object is in the path of a garage door.
	Stimulus Source:	object external to system, such as a bicycle
	Environment:	The garage door is in the process of closing.
	Artifact (If Known):	system's motion sensor, motion-control software component
	Response:	The garage door stops moving.
	Response Measure:	one millisecond
Questions:		How large must an object be before it is detected by the system's sensor?
Issues:		May need to train installers to prevent malfunctions and avoid potential legal issues.

Step 4: Implement Design Strategies to support the NFRs

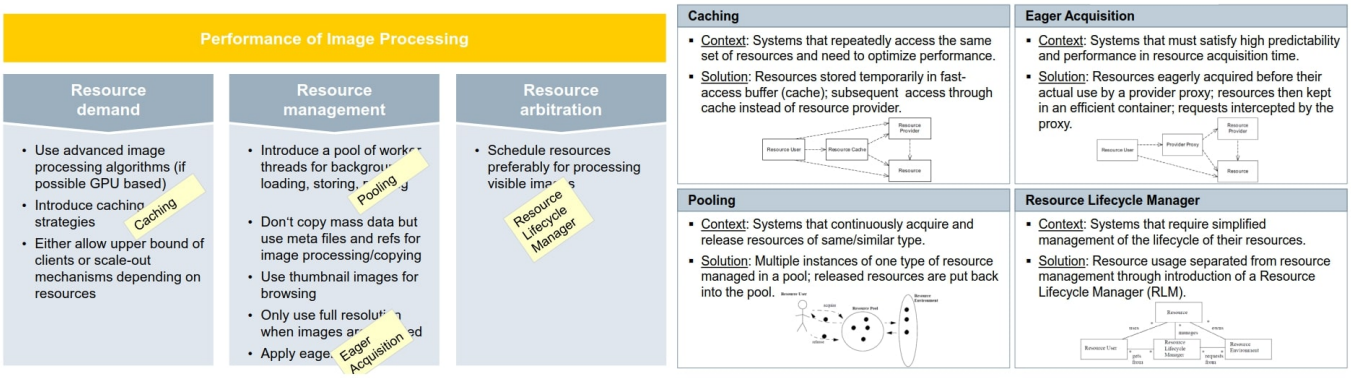
.. and use Design patterns when needed...

Design Strategy Template for Quality Attributes

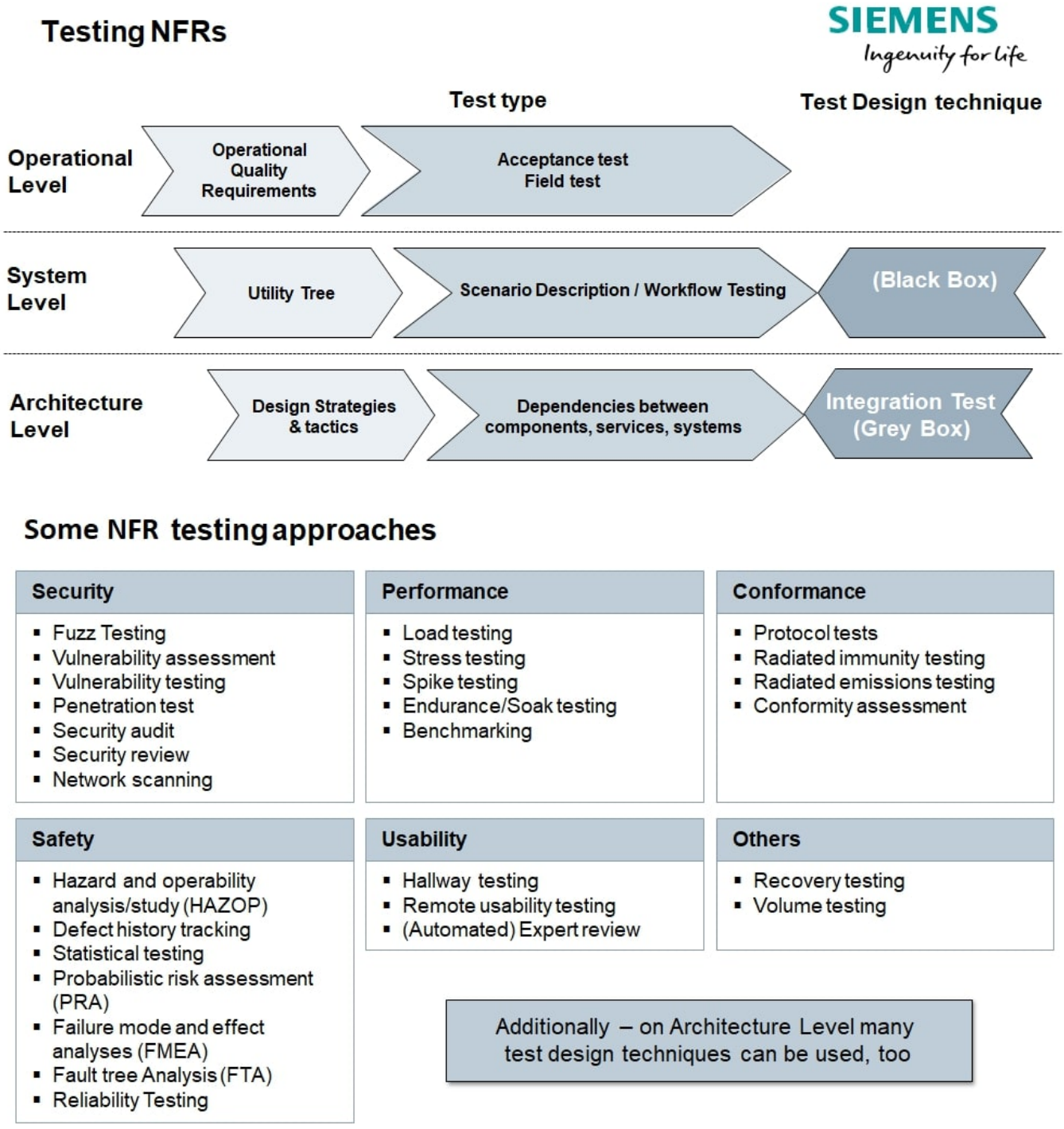




Design Pattern example
"Performance of Image Processing"



Testing NFRs



Some NFR testing approaches

Security
- Fuzz Testing
- Vulnerability assessment
- Vulnerability testing
- Penetration test
- Security audit
- Security review
- Network scanning

Performance
- Load testing
- Stress testing
- Spike testing
- Endurance/Soak testing
- Benchmarking

Conformance
- Protocol tests
- Radiated immunity testing
- Radiated emissions testing
- Conformity assessment

Safety
- Hazard and operability analysis/study (HAZOP)
- Defect history tracking
- Statistical testing
- Probabilistic risk assessment (PRA)
- Failure mode and effect analyses (FMEA)
- Fault tree Analysis (FTA)
- Reliability Testing

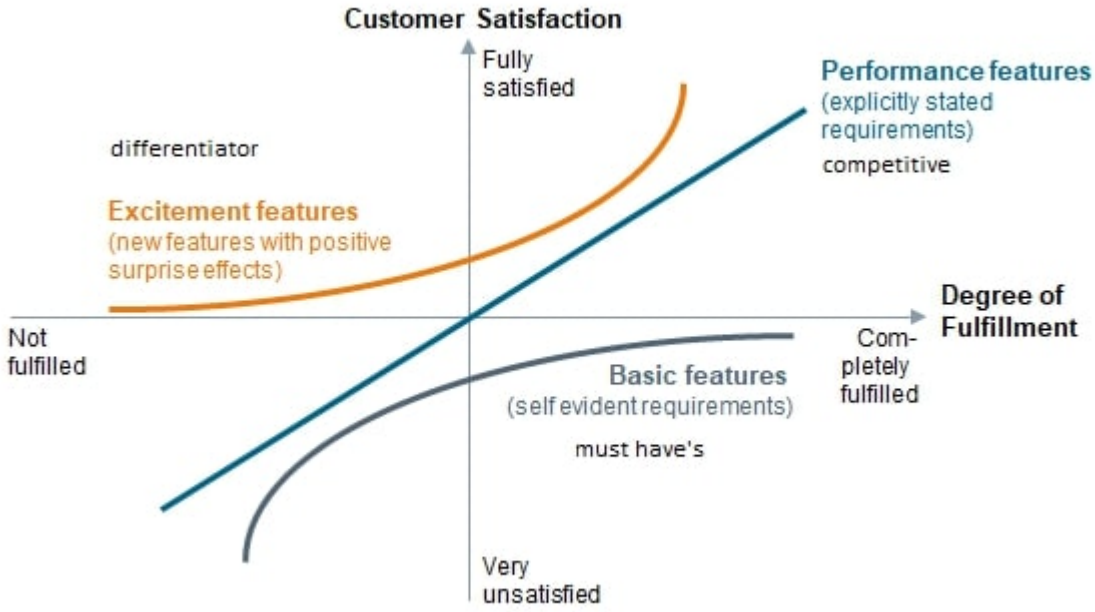
Usability
- Hallway testing
- Remote usability testing
- (Automated) Expert review

Others
- Recovery testing
- Volume testing

Additionally – on Architecture Level many test design techniques can be used, too

KANO Model

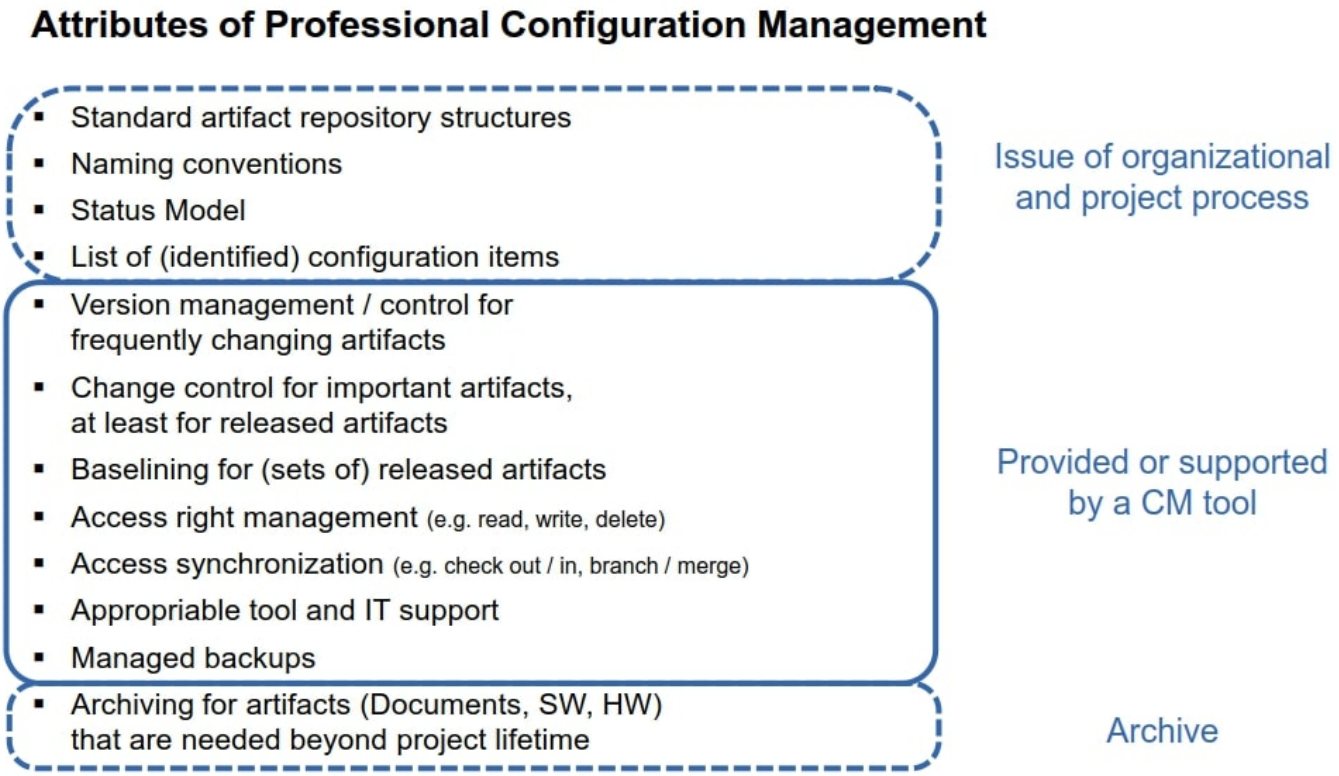
For the Product Manager KANO is a tool to find the right mix between the different feature types. For the Test Architect KANO helps to identify risks.



Configuration Management

Source Control, configurations, environment...

Devops: continious integration, deployment, testing...



Change Request Management

Change Request: any issue that cannot go in a patch or point rev, has to go into the product asap.

Change Management: because requirements are incomplete, erroneous. ambiguous.

Defect Management: because tests reveal defects that need correction.

Tool -> Feature -> trace & Test

CCB:

Change Request Management: Evaluate and Decide on Change

SIEMENS
Ingenuity for life

Understand impact on the system and all disciplines or sub-systems.

Decision by Change Control Board (CCB)

A group of persons with assigned responsibility and authority to make decisions on the change.

Typically includes

- Product Manager
- Project Manager
- (System) Architect

Impact Analysis

- Rough initial evaluation by the CCB to decide on further action
- Deep analysis by experts
  - on architecture, cost, schedule
  - all affected disciplines
  - all relevant sub-systems
- Propose further proceeding (accept / defer / reject)