

Quality Assurance in SW Engineering for Telecommunication Systems

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Outline

- **Introduction**
 - What is Quality
 - The role of an Operation System
 - Quality Organisation
 - Quality Assurance
- **Quality Management**
 - Planning & Reporting
 - Management by Facts
- **Quality Control**
 - Why reviews?
 - Type of reviews
 - Preparation rate experience
- **Process Compliance**
 - Select your process with care
 - Check for compliance through audits and assessments
 - Type of findings
- **Preventive Quality Work**
 - Risk analyses and follow-up
 - Prediction of possible problem products
 - Root Cause Analyses
- **Quality is an Endless Journey**
 - The experience battery
 - A safe improvement journey

... and some noted experiences

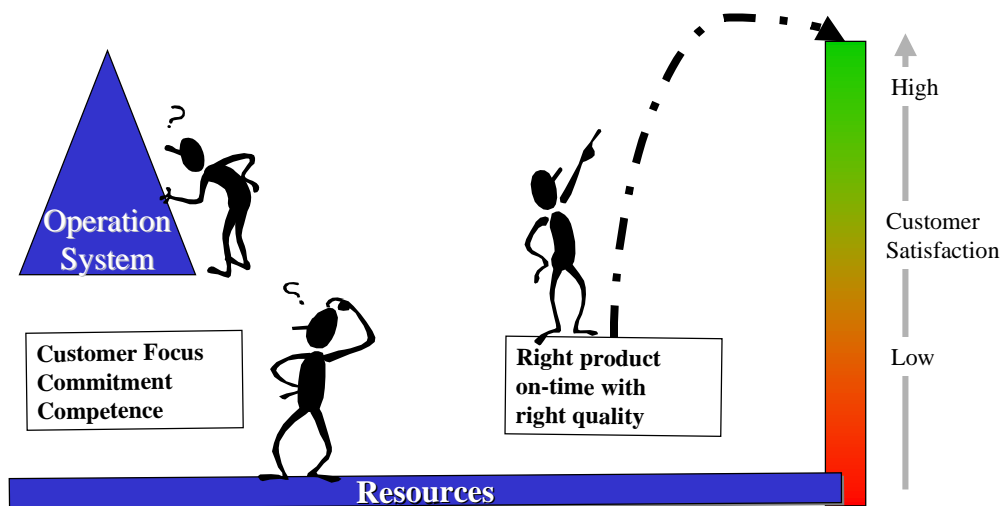


Quality is ...

**When the customer is happy
Everyone's job**



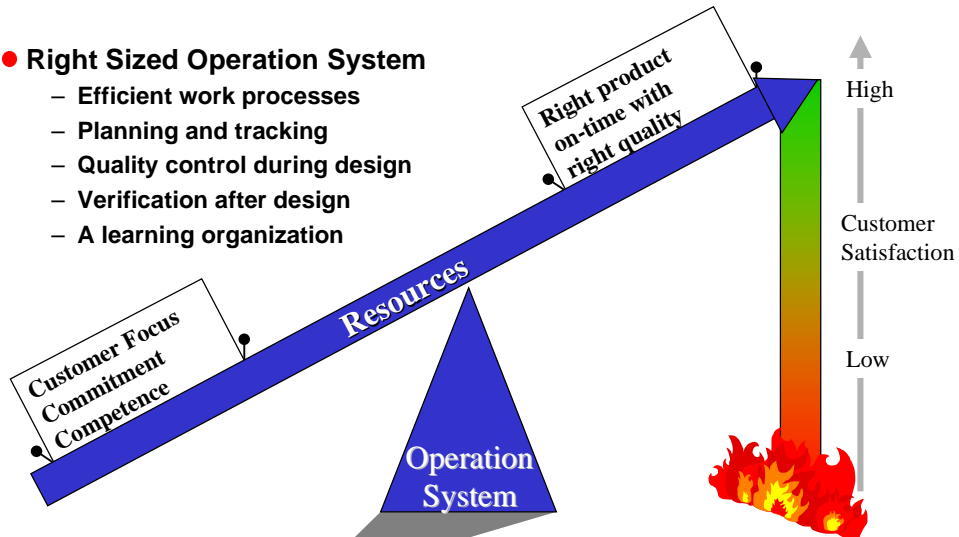
Challenge: How to Get Happy Customers



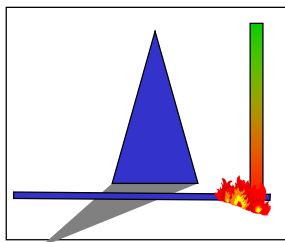
Operation System - Base for Customer Satisfaction

• Right Sized Operation System

- Efficient work processes
- Planning and tracking
- Quality control during design
- Verification after design
- A learning organization

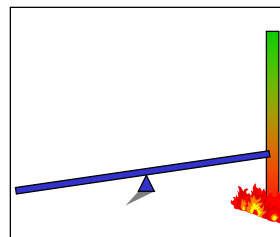


Operation Systems Can Be Misused (= Not Used)



• Too much:

- bureaucracy
- police function
- statistics, statistics
- long and boring documents



• Too little:

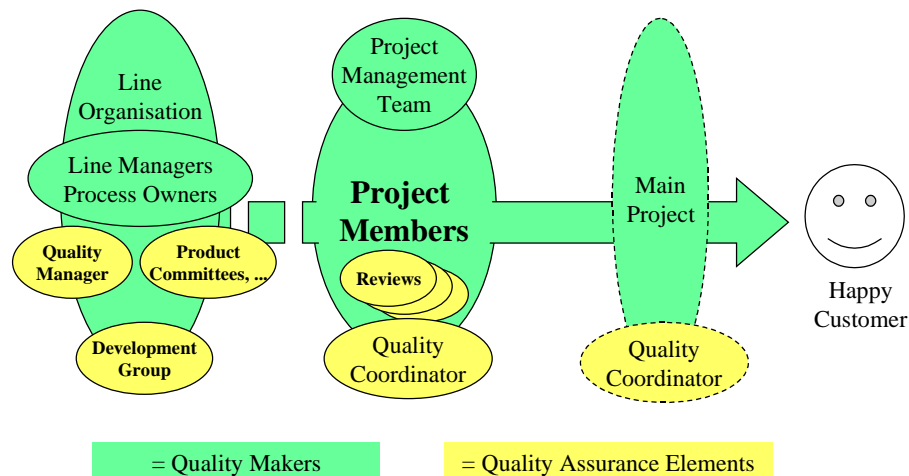
- no planning, only fire fighting
- unnecessary work
- re-inventing the wheels
- unclear tasks
- lack of information flow

Our Operation System (= Quality System)

- Available on Intranet (WWW), includes for example
 - Responsibilities & Authorities
 - Operational Plans
 - Improvement Programs
 - Performance Follow-up
 - Process Management and Process Environment
 - Project Management
 - Competence Management
 - **Quality Assurance**
- ISO 9001 Certified
 - Preliminary ISO 9001:2000 used internally



Quality Organisation = Quality is Everyone's Job



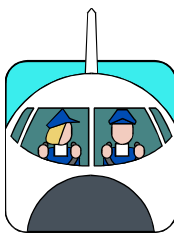


No quality in, no quality out

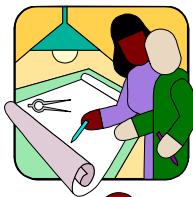
- **Miracles with respect to quality usually not happen in SW design**
 - if the input is of low quality, so is the output
- **“Miracles” can happen from time aspect**
 - overtime and deviations from agreed work flow
 - might result in employee dissatisfaction
 - it is a relief to get ready, not an accomplishment
- **What do we do?**
 - Focus on requirement capturing and impact analyses
 - Develop the work flow towards an incremental approach: start when you can, control total project and changes
 - Cross functional teams: requirement, system, code and test aspects from beginning to the end

Quality Assurance Means ...

to know and
show where
we are going
(Quality Management)



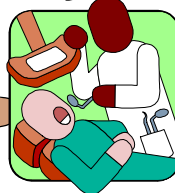
to control
what will
be delivered
(Quality Control)



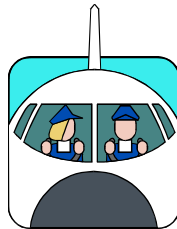
to maintain
law and order
(Process Compliance)



to avoid
problems and
learn from
mistakes
(Preventive Quality Work)

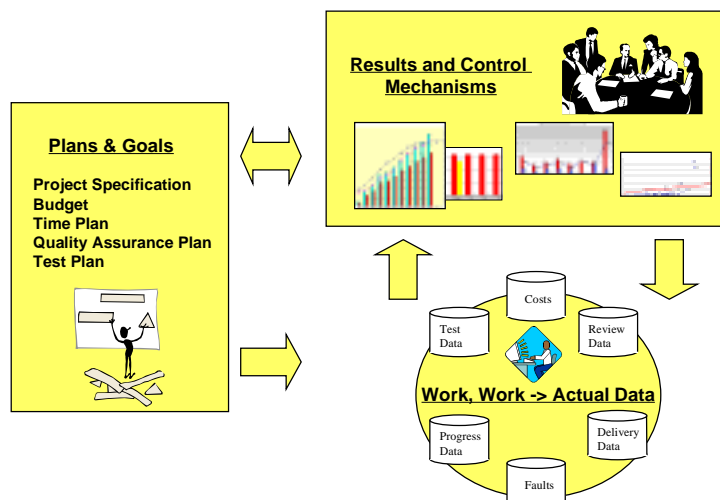


Quality Management



to know and
show where
we are going

Project Management by Facts



Quality Planning

- Annual goals for the line organisation
- Strategies and actions how to achieve the goals
- Improvement programs established

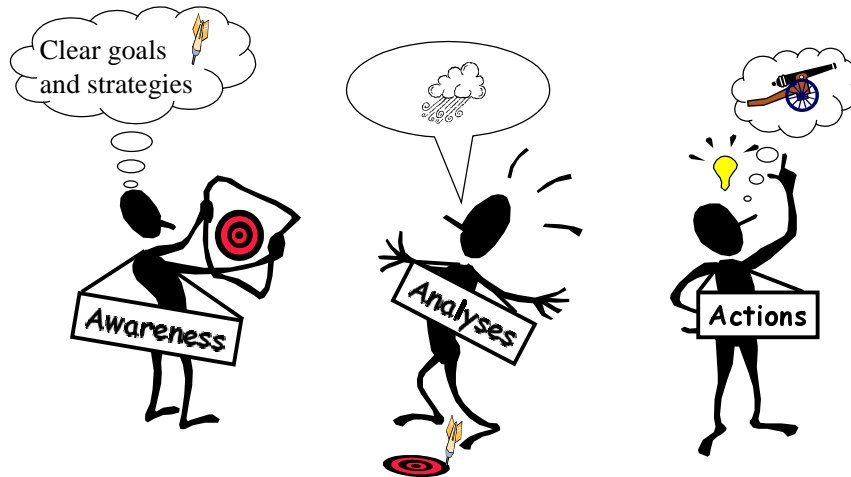
- Project specific goals and strategies are based on
 - line organisation visions and goals and
 - project sponsor's goals
- Priorities are defined per project
 - Quality <-> Cost <-> Functionality <-> Time

- A Quality Assurance Plan deploys the Quality Assurance practices to the project

Project Quality Reporting

- Monthly Quality Reports by Quality Coordinator
 - Summary
 - Goals and Results
 - Events in Quality Assurance:
 - Process Compliance
 - Preventive Quality Work
 - Quality Control
 - Proposals for Quality Improvements
- Info shots and seminars for project members
 - Audit findings, review statistics, instructions, ...

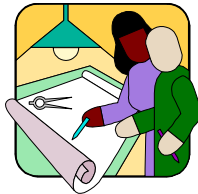
Success Factors



Good news, bad news and statistics

- It is easy to gather a lot of data, the tough thing is to use it
- What do we do?
 - Provide the users of statistics with analyses of the data, not only the data
 - Connect the measurements to higher level strategies and visualise it, for example through a Balanced Scorecard approach

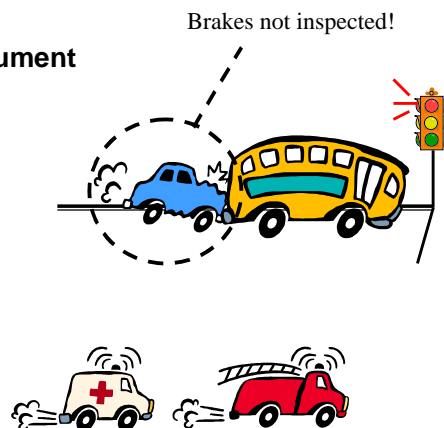
Quality Control



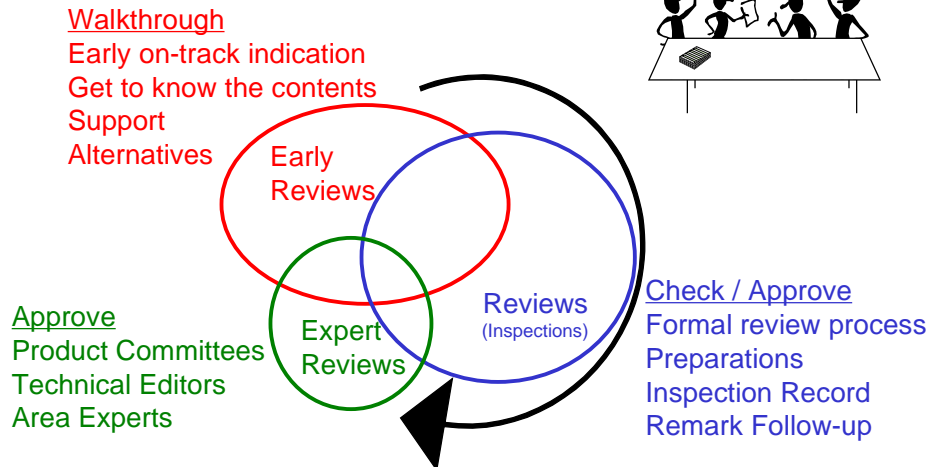
to control
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be delivered

Why reviews?

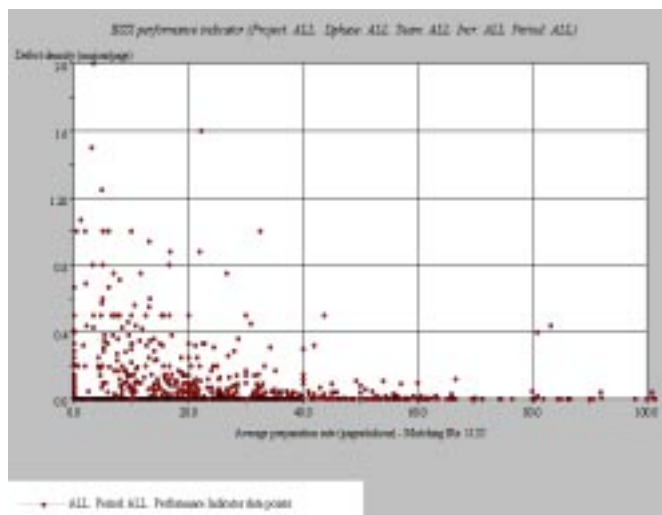
- Would you like to drive in a city where no one care about the brakes?
- An inspected and approved document makes life easier for everyone
- Hints on the road
 - Plan the reviews
 - Assign viewpoints, everyone does not need to read everything
 - Prepare, focus on major remarks
 - Require and use the feedback



Type of Reviews



Defects per Inspected Page vrs Preparation Rate



- There is a strong correlation between
 - the used preparation rate (pages read per hour during preparation) and
 - the number of major defects found per page.
- More defects per page will be found if the preparation rate is kept low.
- Optimum preparation rate seem to be at 3-5 pages per hour.



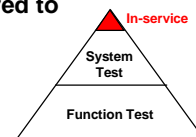
Hey, there is no time^w for review^s!

- Time is constant, the problems could be
 - delays to settle requirements, delays in previous phase
 - it is hard to say NO! to changes in requirements
 - effort estimations are faulty or incomplete
 - pressure and progress are very closely related
 - delay of code delivery is more visible than delay of specifications
- What do we do?
 - Team work and frequent (weekly) reviews of documents and code
 - requires investments like team building,
 - Controlled freedom to teams -> commitment
 - Increased understanding of benefits with reviews



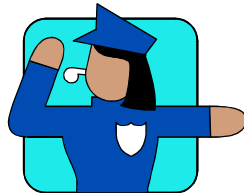
But no problem, we have the testing...

- Ratio of faults (x %) slipping through tests to a live network is rather constant
 - the more faults we introduce, the more faults are delivered to customer (and vice versa!)
- Faults should be eliminated as close to introduction as possible - invest early or suffer later



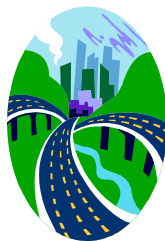
High quality is achieved in design, testing makes it excellent

Process Compliance



to maintain
law and order

We shall choose proper way of working

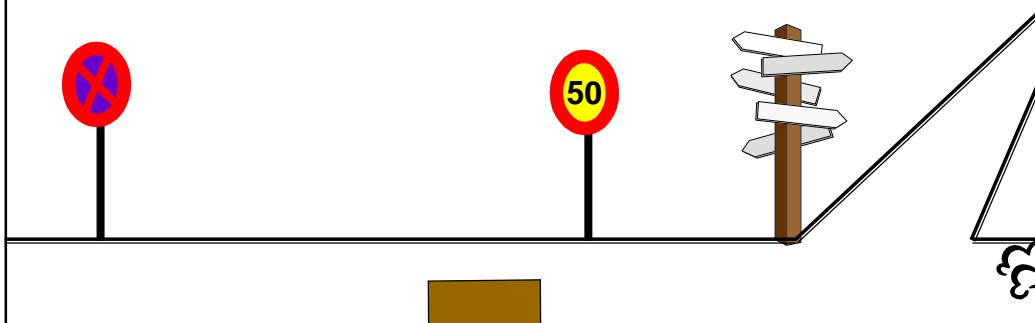


The chosen way will be checked for compliance

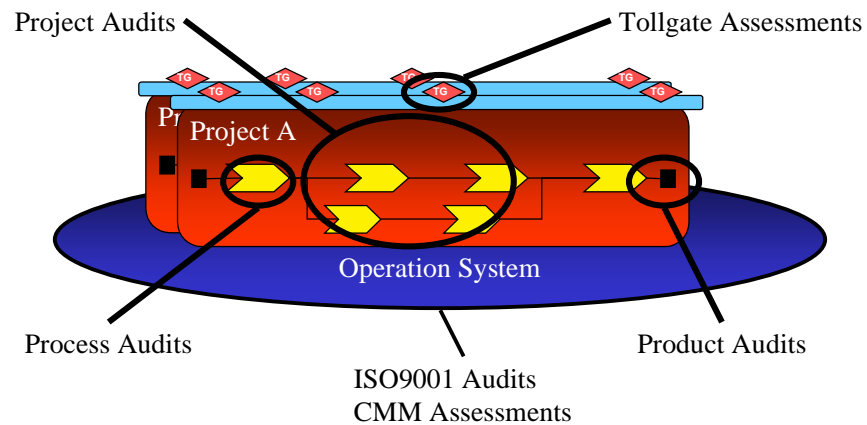
- The chosen way is base for
 - Estimations
 - Schedules and resource needs
 - Goal setting
 - Expectations and interfaces to associated processes
- Known deviations shall be agreed on from start



Deviations Lead to Problems



Process Compliance Checkpoints



Types of Audit Findings and Examples

- **Deviations**
 - Reviews not done as agreed
- **Shortcuts**
 - Parallel working without endangering project goals
- **Opportunities for Improvements**
 - Introduce a known good practice to decrease lead time
- **Need for Information**
 - Not aware of all needed input documents for a design phase
- **Faults in Processes or Work Instructions**
 - Inconsistency with associated process

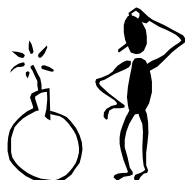
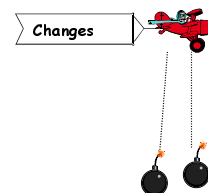
Preventive Quality Work



to avoid
problems and
learn from
mistakes

Risk Analyses and Follow-up

- Risk analysis is held at start of project
- Followed-up during the project
- New risks added as needed



Analyse risks,
decide actions



Follow-up &
close risks



Add new risks
and actions

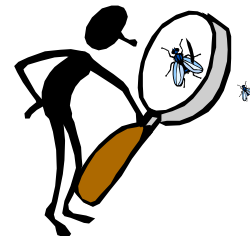
Prediction of Potential Problem Products

- **Based on facts / feelings regarding**
 - impacts on single SW units
 - design base quality of modified SW units
 - stability of requirements
 - SW unit complexity
 - interface complexity
- **Actions initiated as needed**
 - expert support, actions to settle requirements, review plan focus, ...
- **Status is followed-up during project, for example by amount of faults in tests.**



Root Cause Analyses of Faults

- **Fault Description**
 - How it was found and the visual consequences
 - The actual fault (in SW, in interactions, ...)
- **Root Causes**
 - When introduced and why
 - Where should it have been found before testing
 - Why not found in testing
- **Counter Measures**
 - Concrete and clear suggestions how similar faults could be avoided in the future.

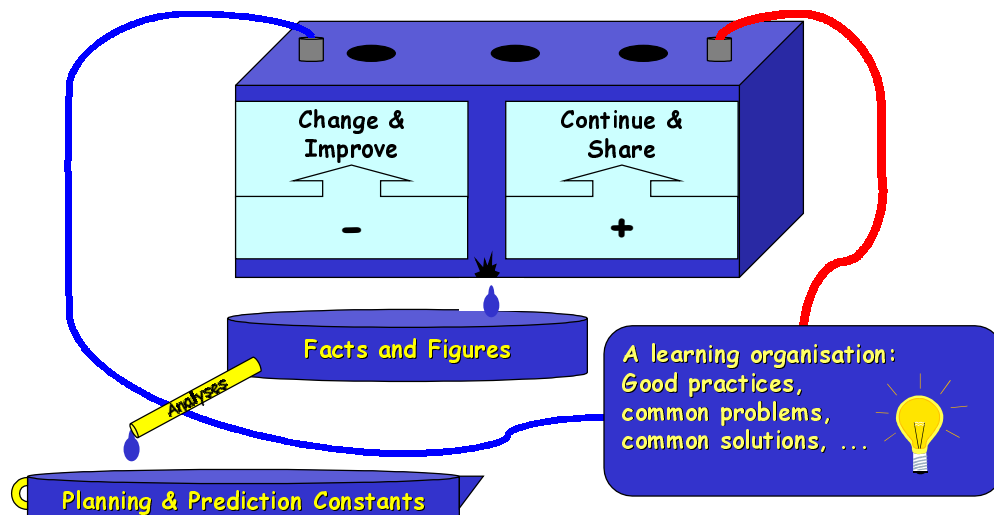


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The Experience Battery



A “Safe” Improvement Journey

