Introduction to Quality Engineering



SE 350 Software Processes & Product Quality

Quality: Two Views

- Conformance to requirements (absence of defects).
 - Narrow definition (sometimes referred to as q).
- Fitness for use (relative to needs).
 - Broader definition (referred to as Q).
 - Relative to actual needs, not just written requirements.
 - Includes other attributes (product quality, project business objectives, organizational objectives).



Quality Engineering

- "Optimize" quality (not maximize)
 - Preferred tradeoff among multiple objectives
 - For example: Achieve desired quality levels within cost bounds
- Aim is to design systems and systematic approaches that continually work towards this optimum.



Limitations of Quality Engineering

- Quality frameworks define what to do and how to do it, and measure the outcomes.
- They can identify and eliminate problems.
- But their effectiveness depends on the people who do the activities involved.
- Frameworks cannot deliver excellence. Only people can deliver excellence.



Processes

- (Systematic) steps for accomplishing a task
 - "Structured" approach to getting things done.
- The best process for a task is that which accomplishes the task most effectively, that is, optimizes across task objectives.



More Process vs. Best Process

- Processes maximize probability of successful task accomplishment, that is, prevent problems.
 - "More process" (more formality and ceremony) improves probability of success, but runs counter to other objectives (such as cost, flexibility).
 - "Best" process optimizes across task objectives, hence more process is not always good.



Process Design

- Designing good processes requires:
 - Understanding the various task objectives.
 - Understanding the impact of the steps involved (process design decisions) on all the different objectives.
 - Creatively identifying different possible approaches (process designs) and picking the best.
 - A typical engineering design problem!



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Limitations of Process

- Processes are designed to prevent problems ("reduce variance of output").
- Process is not free there is a cost in time and effort, as well as in flexibility.
- Processes incorporate assumptions about the nature of the task and about the objectives – but every situation is a little different. The more the difference, the less effective the process.
- Process customization (tailoring) is not free!



Metrics

- The purpose of metrics is to provide evaluation and feedback
 - Try walking to the door with your eyes closed.
- They can provide an "objective" view to complement the subjective view of the people doing the job.
- When skillfully used, metrics can reveal longer-term trends that are harder to spot otherwise
 - Filter out random variation



Metrics Interpretation

- Metrics tell us something, but to make sure that the numbers don't mislead us, we need to do a lot of additional work "behind the scenes"
- Doing this requires:
 - Metrics understanding
 - Domain understanding
 - Familiarity with the specifics of the situation



Metrics Interpretation...

- Any chart should be accompanied by comments that point out what lies behind the numbers.
- This is the real value added by the quality engineer!



Famous Lines About Metrics

- "There are three kinds of lies: lies, damned lies and statistics"
- "What statistics reveal is interesting, but what they conceal is vital"



Another Famous Line

- "If you can't measure it, you can't control it"
 - (The idea is that measurement helps to close the feedback loop, which is necessary)
- Flip side:
 - "If you manage purely by the numbers, all you manage is the numbers"
 - (Objectives that are not measured will not be met, and some of them may be the most important ones. And as we have seen, numbers don't reveal the entire truth)
 - To ponder: Is the goal to "control" the outcomes, or to facilitate achievement of better outcomes?



Conclusion

- Quality engineering is about effective ways to achieve project objectives.
- Processes and metrics are enablers to achieve these objectives.
- Defining good processes and selecting good metrics is a challenging design problem.
- Metrics interpretation is critical. If not done well, all work collecting data etc. is useless.



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