Using Quality Factors and Measures to Focus on Customer Satisfaction

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Why Force Developers to Think About Quality Factors?

- Defining quality factors helps develop understanding of customer needs.

- Attending to quality factors results in capturing quality requirements and design goals in the Software Management Plan (e.g., 2167A Software Development Plan) and in the Software Requirements Document.

- Using measures for quality factors supports follow up (getting quality engineered into products).
  - Where are we now? Where do we want to go? Are we getting there?

This presentation reports the experiences of 2 teams.
Team Backgrounds

- **Team A**
  - Participants included Software Manager, Lead Engineers, Software Product Assurance, and SEPG member
  - Project characteristics
    - Onboard software for robotic spaceflight mission with many instruments and many critical events

- **Team B**
  - Participants included Manager, System Engineer, Test Engineer, Configuration Manager, Software Quality Engineer, SEPG members
  - Project characteristics
    - Ground data system software supporting many missions
    - Large inheritance, multiple platforms over history
    - Greater portability is needed along with new capabilities
Quality Goals of Each Team

• The Team A goal was to pre-rank the quality factors so that the lead engineers could then use the ranked quality factors as criteria in making design trade-off decisions.

• Team B goals were to
  • Improve quality within their budget and schedule
  • Measure current quality
  • Determine how to allocate resources based on current quality
  • Give rewards based on quality factor improvements
Generic Process

- Assemble the team members with all areas and disciplines represented

- Rank the quality factors

- Propose candidate measures

- Determine cost and values of the supporting measures

- Select the measures
  - Collect, analyze, and refine the measures
  - Improve the process
  - Collect, analyze, and refine the measures based on their costs and values
Rank the \textit{Quality Factors}

- Determine the definitions for your customer
  - Discuss the book definitions (e.g., Deutsch and Willis)
  - Customize those definitions
  - Add other quality factors or delete those irrelevant to the customer

- Each individual ranks the quality factors
  - Sometimes team members bring consensus from their areas back to team
  - Skipping this step can incline group to follow the leader

- Display the range of votes
  - Look at the minimum, the maximum, the median, and the modes
Team B -- Ranking Summary

Correctness *

Reliability *

Usability

Verifiability *

integrity *

Interoperability *

Portability *

Flexibility

Maintainability

Reusability

Test Efficiency

Efficiency

Solid bars and dotted lines represent medians. * indicates required quality factor.
Diverse Students -- No Discussion

Correctness

Reliability

Efficiency

Verifiability

Maintainability

Usability

Flexibility

Expandability

Survivability

Portability

Manageability

Integrity

Solid bars and dotted lines represent medians. * indicates required quality factor,
Use Patterns to Focus Discussion

- Arrange counts for each quality factor by decreasing medians to see patterns

  Is apparent agreement real? (e.g., Correctness)

  Why did people hold split views? (e.g., Usability)
    - Are different people using different definitions?

- Why were views so distributed? (e.g., Maintainability)
  - Is same definition applied differently by different people to the project?

- Do close “averages” mean equally important factors?
  
  0 1234 5678 9101112
  - Are some quality factors requirements and others are design goals?
Propose Candidate Measures: Some Examples

- \#Errs. In. Interface.Test = Number of errors found during interface testing

- \#Errs.by.Phase.Found = Number of errors by phase found

- \#Extrnl.Interfcs.to. Test = Number of external interfaces to test

- \#Failure. Reports = Number of failure reports (FRs) per time period (e.g., month or delivery)

- \#FRs.Call.Cockpit.Errs = Number of failure reports called cockpit errors

- \#Unt.W/NStd.Lang.Feat = Number of units using non-standard language features
Example Scales for Determining Cost and Value

‘cost
  o LOW if it is something we already have or do
  o MEDIUM if is something not done now, but easy and well understood
  o HIGH if it is something new or something hard to do

• Value scales roughly with the strength of the correlation between the quality factor and the measure
  o HIGH if the measure is directly related to the quality factor
  o MEDIUM if it is one degree removed from the quality factor (e.g., Complexity correlates with Reliability)
  o LOW if it is more than one degree removed from the quality factor
Determine Costs and Values

- Assess COSTS before VALUES
  - is easier and gives an established scale work against

- Pre-Assess VALUES
  - Discuss the meanings of the values with whole team
  - Two people each make an initial assessment of the values, then discuss the values with each other
  - Adjust the values and record differences of opinion (e.g., HIGH/MED)

- Re-Assess VALUES
  - Present preliminary values and their reasons to the group
  - Discuss and modify the pre-assessed values
  - Iterate as many times as it takes to reach consensus
### Some Costs and Values According to Team B

#### Values Corresponding to Quality Factors

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For Cost: ■ (HIGH), ☐ (Meal), or ☐ (low) represents the cost of obtaining the measurement.

For Value: ■ (HIGH), ☐ (Meal), or ☐ (low) indicates the value of how strongly the measure supports the quality factor.

"." indicates no recommended value of measure. "/'" shows range. "**" indicates selected measures.
In Conclusion

- Defining quality factors and measures helped the teams understand their customers' needs and make better trade-off decisions

"You Can't Achieve ξuality ... Unless You Specify It!"

--Michael Deutsch and Ronald Willis in "Software Quality Engineering", Pg. 8
References


