

The Impact of a Requirements Specification on Software Defects and Other Quality Indicators

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Agenda

- Premise
- Background: Gen 1 vs. Gen 2
- Software Defect Potential Analysis
- Gen 2 Project Requirements Details
- Validation (QA) Results
- Conclusions
- Questions & Answers

Premise

Is there any correlation between a **well-written, properly reviewed requirements specification** and software defect levels and other quality indicators?

Background: Gen 1 vs. Gen 2

- First Generation Software (Gen 1):
 - No formal requirements specification (emails, design documents, web sites, etc.) or RM tool
 - No reviews of requirements by requirements subject matter expert
 - Runs on older Intel processor and motherboard
- Second Generation Software (Gen 2):
 - Requirements Specification stored in a RM tool
 - All specification revisions reviewed by requirements subject matter expert
 - Runs on newer Intel processor and motherboard

Software Defect Potential Analysis

Factor	Gen 1	Gen 2
Team Maturity	High	High
# of New Features	N/A	> 50
Complexity of New Features	N/A	Moderate
Stability of Code Base	Stable	Merge with Gen 1 & other group
Hardware Changes	Older generation Intel Processor	Newer generation Intel Processor
Development Practices	Waterfall	Waterfall


Defect Potential Should Be *Higher* for Gen 2 vs. Gen 1

Gen 2 Project Requirements Details

- Requirements Subject Matter Expert (SME) assigned to work with requirements author
- Author trained on writing requirements
- SME mentored requirements author through all revisions of the requirements specification
- Six revisions of the requirements specification:
 - Revision 0.3 requirements defect density: **> 10 defects/page**
 - Revision 1.0 requirements defect density: **< 1 defect/page**
- All downstream work products based on requirements specification

Validation (QA) Results


Total Number of Software Defects (by type)

Defect Type	Gen 1	Gen 2	Delta
Critical	21	3	-86%
High	137	69	-50%
Medium	111	62	-44%
Low	24	6	-75%
Totals:	293	140	 -52%

Total # of SW Defects *Decreased* by over 50%

Validation (QA) Results

Requirements Volatility at Major Milestones

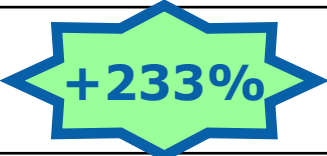
Milestone	Gen 1	Gen 2	Delta
Alpha	0.4	0.4	0%
Beta	1.2	0.7	-42%
Release	1.7	0.9	 -47%

Requirements Volatility *Decreased* by almost 50%

Volatility = (#of added requirements + # of changed requirements + # of deleted requirements) / Total # requirements

Validation (QA) Results

Feature Variance at Major Milestones


Milestone	Gen 1	Gen 2	Delta
Alpha	0.05	0.15	+300%
Beta	0.15	0.25	+167%
Release	0.15	0.35	 +233%

Feature Variance More Than *Doubled*

Feature Variance = $((\text{Current \# Features}) - (\text{\# Planned Features})) / (\text{\# Planned Features})$

Validation (QA) Results

SW Defect Closure Efficiency at Release

Milestone	Gen 1	Gen 2	Delta
Release	69%	87%	 +26%

SW Defect Closure Efficiency *Improved* by over 25%

software defect closure efficiency = (cumulative SW defects closed / cumulative SW defects submitted)

Conclusions

Possible factors positively impacting SW quality indicators:

1. Applying lessons learned from Gen 1 development effort
2. Augmented developer experience and maturity
3. Improved unit testing prior to validation
4. Formalized and reviewed requirements

Recall that the software defect potential for Gen 2 should have been *higher* than that of Gen 1.

In actual testing, software defects were *dramatically lower* and other quality indicators *improved significantly for Gen 2*.

Conclusions

While factors 1-3 had some impact on requirements quality indicators for Gen 2, their impact should have been *minimal* given the added complexity of Gen 2.

Clearly, a **well-written, properly reviewed requirements specification** was the *major* contributing factor to these improvements in software defect levels and other quality indicators on Gen 2.

Question & Answer

Contact Information

Thank You!

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