Why Does Software Quality (Still) Suck?

The Ongoing Frustration with Lousy Software

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Introduction

- Software quality is abysmal, and has been ever since software was created
- Software is everywhere, and so are software bugs
- These bugs costs millions of dollars and sometimes kill people
- Why do we put up with this situation?
- Manufacturing achieves six sigma levels of quality
- Shouldn’t software quality be better?
- Let’s look at some of the barriers to quality software, and also acknowledge some of our mistakes

Six Sigma Levels of Quality

- Manufacturing can achieve six sigma quality
  - 1 sigma = 31% yield
  - 3 sigma = 93%
  - 4 sigma 99%
  - 6 sigma 99.9997%
- Roughly, 3 defects per million items

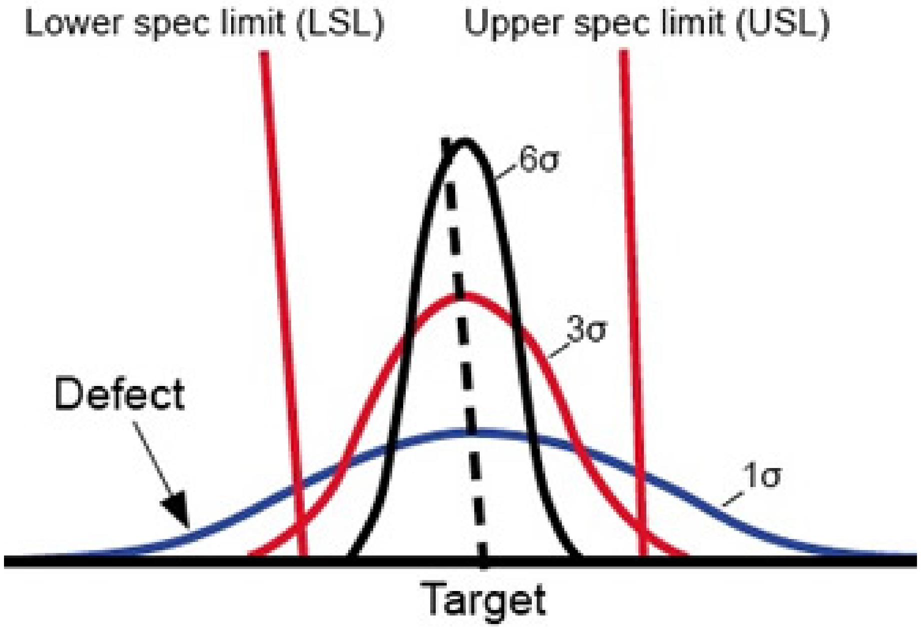


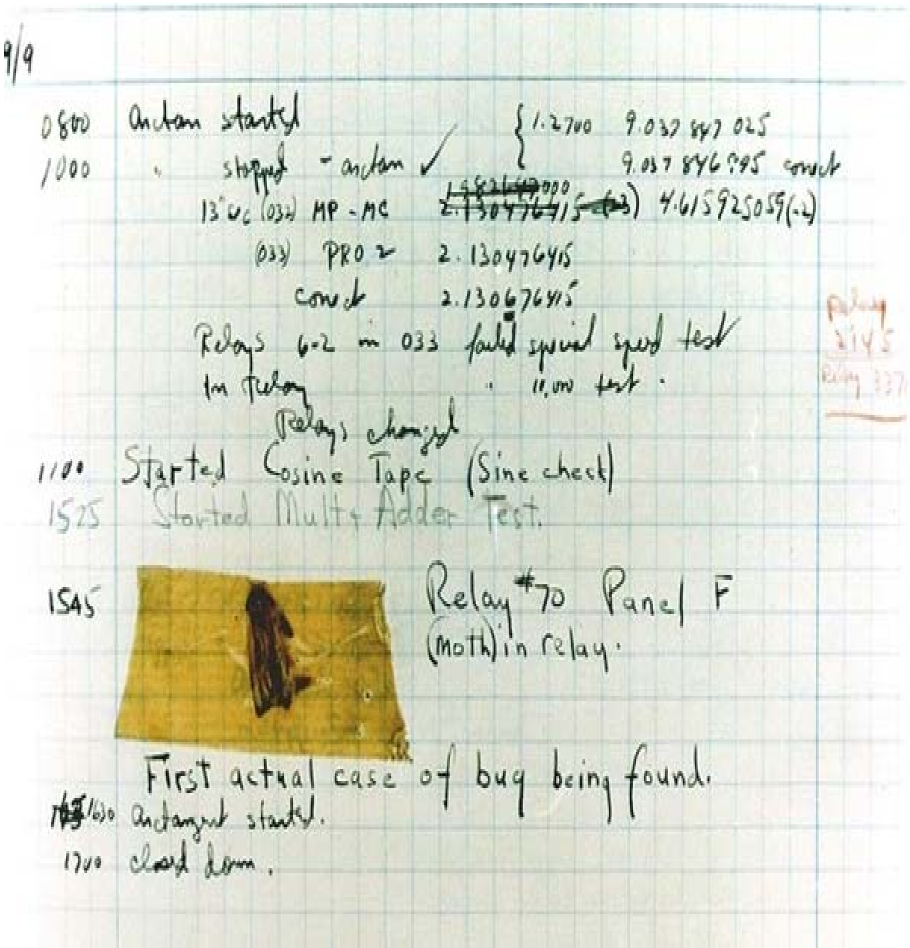
Figure from APO-Tokyo.org

How About Software?

- In software, according to Capers Jones' studies, we release over 13,000 defects in a typical million-line C++ program following typical development practices
- Usually, only 85% of defects are detected (DDE) and removed
- Even RBCS clients that achieve 99% DDE will still release close to 1,000 defects in similar-sized software
- It's even worse: every copy of a software app contains all the bugs, so in fact we have 0% yield!
- Ultimately, software quality must increase dramatically

Bugs, With Us Since the Start

- Sept 9, 1947, Grace Hopper files first bug report to include a real bug!
- Ada Lovelace discussed possibility of bugs in 1843, regarding Babbage's proposed analytical engine
- Assuming about 10MM apps in use, there are trillions of bugs in the wild!
- What can we do?



9/9

0800 Antan started
1000 " stopped - antan ✓ {1.2700 9.037 847 025
9.037 846 995 correct
13" UC (032) MP-MC ~~1.982147000~~ ~~2.130476415~~ (-3) 4.615925059(-2)
(033) PRO 2 2.130476415
correct 2.130676415
Relays 6-2 in 033 failed special speed test
In relay " 11,000 test .
Relays changed
1100 Started Cosine Tape (Sine check)
1525 Started Multy Adder Test.
1545 Relay #70 Panel F
(moth) in relay.
First actual case of bug being found.
1630 Antangent started.
1700 closed down.

Relay 2145
Relay 3370

What To Do

- Main problem: software engineering has not matured to true engineering yet
- Think of how bridges or aircraft are designed and built
- Now compare how we design and build software
- As Frank Lloyd Wright said, “You can use an eraser on the drawing board or a sledgehammer on the construction site”
- This saying applies to software, too
- While software bugs can often be easily fixed, the consequences of software failures cannot
- So, given the current state of the practice, what mistakes do we make that exacerbate the situation?

Failure to Follow Best Practices

- As Jones' figures show, following best practices leads to an order of magnitude fewer bugs
- The state of development practice lags best practices by at least 25 years
- Software testing is even worse, with few testers using techniques known for 40+ years
- If we applied best practices of software development and testing, software would suck a lot less
- So why don't we?

Bowing to Schedule Pressure

- One major cause of bug-breeding sloppiness is schedule pressure
- Unrealistic schedules (or excessive content in agile) are common
- Long-standing problem: Fred Brooks wrote of "20 pounds in a 10 pound bucket"
- Management imposes unrealistic schedules and then punishes failure to achieve them
- Since testing and other software quality activities are infinitely compressible, they often suffer disproportionately

Underfunding Quality Activities

- This problem compounds the previous one
- Not only are schedules tight, but there’s usually not enough money
- Test professionals don’t always make a good business case for testing and quality
- The need for development is clear, but testing and other quality activities seem less so
- Most software professionals are “vaguely religious” about software testing and quality activities
- Most quality professionals are not very effective proselytizers

Poor Measures of Quality and Its Impact

- Further, we don’t have good tools to measure quality and the impact of not having it
- Defect density (which I used earlier) is actually a weak indicator of quality
- Quality is fitness for use, which is not necessarily directly correlated with defect density
- What measures of quality we do have, we aren’t always able to present realistically and meaningfully
- Sometimes we are encouraged to or rewarded for toning down our findings when they are inconvenient
- Similarly, productivity measures are weak
- These measurement problems combine to result in dysfunctional choices about staffing
- We need to develop and standardize good ways to measure and categorize defects, failures, productivity, and quality costs

Underqualified Software Professionals

- To build a bridge, licensed professional engineers are required
  - To *develop* software?
  - To *test* software?
- Widespread failure to follow best practices makes it hard to say what "qualified" means
- Lack of good quality and productivity measures makes it hard to measure the qualifications of a team
- This has contributed to the race to the bottom with outsourcing
- Certifications are a start, especially if we can make them omnipresent
- It's important, though, that these certifications be credible and valuable, and be seen as credible and valuable

Transfer of Costs of External Failure

- Perhaps most toxic, software companies can transfer the costs of bugs *onto their users and customers*
- Most enterprise software companies make more money from support than from new software
- Thus, they are financially incented to release software that meets minimal quality standards
- Software as a service is often a way that the industry has (very successfully) put lipstick on this pig
- "Fast failure" is a Silicon Valley motto: easy to say when your company doesn't bear the costs
- We need an implied warranty of fitness, as with almost all other products
- We also need better quality measures to those warranties that are given can be enforced

Conclusions

- Software quality problems have plagued our industry from the start
- In the long-term, we need to make software a true form of engineering
- In the short-term, we are making many avoidable mistakes
- Some of these mistakes are the result of bad incentives
- We can and should fix these problems, given the omnipresence (and increasing criticality) of software

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