Testing to improve requirements – is it mission impossible?

Prepared and presented by

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Contents

Relationship of requirements and testing
Myths and misconceptions
How to improve requirements through testing

conference theme: understanding the stakeholders’ desires and needs

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Waterfall model

- Business requirements
- System specification
- Design specification
- Coding
- Testing

 interessant stuff

V-Model

- Business requirements
- Acceptance testing
- System specification
- System testing
- Design specification
- Integration testing
- Coding
- Component (unit) testing
Early test design and defects

- test design finds defects
- defects found early are cheaper to fix
- most significant defects found first
- defects prevented, not built in
- no additional effort, re-schedule test design
- changing requirements caused by test design

Early test design helps to build quality, stops defect multiplication
Experience report: Phase 1

Phase 1: Plan

<table>
<thead>
<tr>
<th>2 mo</th>
<th>2 mo</th>
</tr>
</thead>
<tbody>
<tr>
<td>dev</td>
<td>test</td>
</tr>
</tbody>
</table>

Actual

fraught, lots of dev overtime

“has to go in” but didn’t work

Quality:

Test 150 faults
1st month 50 faults

users not happy

Experience report: Phase 2

Phase 2: Plan

<table>
<thead>
<tr>
<th>2 mo</th>
<th>6 wks</th>
</tr>
</thead>
<tbody>
<tr>
<td>dev</td>
<td>test</td>
</tr>
</tbody>
</table>

Actual

smooth, not much for dev to do

on time

acc test: full week (vs half day)

Quality:

Test 50 faults
1st month no faults

happy users!

Source: Simon Barlow & Alan Veitch, Scottish Widows
Iterative development

Each increment includes
- Requirements analysis
- Design
- Coding
- Testing

Good testing within a lifecycle model

Test objectives for each test level
- test analysis and design begins early,
  testers review development documentation

Mindsets

- **requirements engineer**
  - what is needed / wanted?
  - what will help the business?
  - want it to be useful

- **designer / developer**
  - how can I make it work?
  - what’s the best way to implement this?
  - want it to be good quality

- **tester**
  - what could go wrong?
  - what exactly does this mean?
  - what if it isn’t?
  - what’s missing?
  - how could I break it?
  - anti-patterns
  - what would a user do?
  - want it to be useful and good quality
  - if you look for bugs, you are more likely to find them!

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**Testing and Requirements**

**Contents**

- Relationship of requirements and testing
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Myth 1: Testing starts at the end

- **requirements come first**
  - “We don’t need to think about testing yet – let’s just concentrate on requirements”
  - testing is at the end, we’re at the start
- **what’s wrong with this?**
  - testing can start right at the start
  - thinking about testing early improves requirement specifications early
  - don’t have to wait to get benefits of a tester view

Myth 2: Can’t test till it’s there

- **testing the system needs to have the system**
  - “We can’t do any testing because nothing has been built yet.”
  - “Testers just play with the system and see what happens”
  - “Anyway, you can’t test a piece of paper!”
- **what’s wrong with this?**
  - testing is more than testing, and starts before testing
  - misconception: testing = test execution
Example requirements

- facilities are required to enable the treasurer to update the account information such as when members pay their subscription fees.
- the system will be required to produce reports giving information about who has paid membership fees, etc.
- the system must be fast. Many people must be able to access the website concurrently.

How would you test this spec?

- a computer program plays chess with one user. It displays the board and the pieces on the screen. Moves are made by dragging pieces.
What is testing?

<table>
<thead>
<tr>
<th>Policy and strategies</th>
<th>Test planning</th>
<th>Test control</th>
<th>Test improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process improvement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Review test basis docs</td>
<td>Identify conditions</td>
<td>Test process</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Design test cases</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Build tests</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Execute (run) tests</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check results</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check exit criteria, Test Report</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test closure activities</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Myth 3: Requirements to test is a one-way street

- **testing uses requirements, not vice versa**
  - “You don’t test requirements, you test FROM requirements”

- **what's wrong with this?**
  - thinking about testing raises questions on the requirements
  - test design can lead to improved requirements
    - boundary value analysis
    - decision tables (example ->)
Example requirement

- Sue has a number of jobs to do on a Saturday but this is dependent on various circumstances.
- if she wakes up early and the weather is sunny she needs to cut the grass. However if she sleeps late and it is sunny then she hangs the washing out.
- if she wakes up early and the weather is not so good and she has some cash in the bank then she will need to go shopping.

**what if she sleeps in, it's raining, and she has cash in the bank?**

Clearer requirement

<table>
<thead>
<tr>
<th>Condition/cause</th>
<th>T</th>
<th>T</th>
<th>T</th>
<th>T</th>
<th>F</th>
<th>F</th>
<th>F</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up early</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>Sunny weather</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>Cash in the bank</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>Action/effect</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cut the grass</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F?</td>
<td>F</td>
<td>F</td>
<td>F?</td>
<td>F?</td>
</tr>
<tr>
<td>Hang washing out</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F?</td>
<td>T</td>
<td>T</td>
<td>F?</td>
<td>F?</td>
</tr>
<tr>
<td>Go shopping</td>
<td>F?</td>
<td>F</td>
<td>T</td>
<td>F?</td>
<td>F</td>
<td>F</td>
<td>F?</td>
<td>F?</td>
</tr>
</tbody>
</table>

Tags: A B C D E F G H

“spec” covered only 5 out of 8 combinations!

? = assumption

how easy is it to answer the question?
Myth 4: Tests are for testers only

- **writing good tests is purely a testing concern**
  - “The testers seem to have problems writing tests from our requirements -
  - maybe we should get some better testers!”

- **what’s wrong with this?**
  - ambiguous specifications – not testable
  - non-functional quality attributes
    - e.g. “user friendly”, “very reliable”
  - if you don’t know how to test it, how can you know how to build it?

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**Non-functional testing**

- **testing of software product characteristics**
  - “how” the system works
  - quantified on a varying scale (e.g. response time)

- **performed at all test levels**

- **including the following types:**
  - performance - maintainability
  - load - reliability
  - stress - portability
  - interoperability - usability

ISO 9126: Software Engineering: Software Product Quality
Which of the following are testable?
- all help messages are meaningful to the users ☑️
- context sensitive help available on all fields ☑️
- all users must like all aspects of the system including reports and screens ☐️
- the system must be user-friendly ☐️
- the system must be intuitive ☐️
- navigation must be consistent across all applications ☑️
- exit/escape keys must be clearly labelled ☑️
- entering a new record must be achieved in less than 20 keystrokes ☑️

Tom Gilb, Principles of Software Engineering Management, 1988, or gilb.com

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Myth 5: Minor changes are minor

- **minor requirements changes don’t matter (much)**
  - “Just add a couple more spaces to this input field. There’s plenty of room on the screen.”
  - “It’s only a minor change; it won’t need testing”

- **what’s wrong with this?**
  - impact on implementation (e.g. database, checking)
  - impact on testing
    - what unexpected side-effects?
  - size of change NOT = size of testing
Small change ≠ small testing

Regression testing

More tests here?

Enhancement (new feature)

Impact analysis

Confirmation tests

More here?

Confirmation vs. regression testing

Regression tests look for unexpected side-effects (but may not find all of them)

Fix introduces or uncovers new defects

Depth tests

Breadth tests

Test finds defect

Confirmation test to check fix
Myth 6: Testers don’t need requirements

- **requirements are nice to have but not essential**
  - “We know the requirements aren’t great [there], but just test it anyway as best you can.”
  - “Just see what the system does.”
- **what’s wrong with this?**
  - we still need to test somehow
  - what is the test oracle?
  - test that the system does what the system does?
    * not a test! test against what the system SHOULD do

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A test

A Program:

- Read A
- IF (A = 8) THEN
  - PRINT (“10”)
- ELSE
  - PRINT (2*A)

Source: Carsten Jorgensen, Delta, Denmark
Myth 7: Can’t test without requirements

- testers MUST HAVE requirements
  - “We can’t test until we have decent requirements”
  - the tester’s excuse?
- what’s wrong with this?
  - yes, a test oracle is needed
  - not an excuse to avoid testing
  - more responsibility on the tester
  - exploratory testing is designed for severe time pressure and poor or non-existent requirements

Myth 8: Follow the elephant

- mainstream is more important
  - “We need to specify what the users do in their normal work.”
  - “Of course, there will be exceptions, but these don’t happen often, so they’re not important
- what’s wrong with this?
  - yes, normal use is important
  - but exceptions must also work correctly
User Acceptance testing

Acceptance testing distributed over this line

20% of what users do done by 80% of code

80% of what users do done by 20% of code

System testing distributed over this line

Acceptance testing is unfair!

<table>
<thead>
<tr>
<th>purchasers / users</th>
<th>suppliers / developers</th>
</tr>
</thead>
<tbody>
<tr>
<td>no requirement changes</td>
<td>changing requirements</td>
</tr>
<tr>
<td>decision pressure</td>
<td>exception details</td>
</tr>
<tr>
<td>business needs</td>
<td>psychic specification</td>
</tr>
<tr>
<td>technical jargon</td>
<td>no technical understanding</td>
</tr>
<tr>
<td>timescales and budgets</td>
<td>delays and overruns</td>
</tr>
<tr>
<td>screens still have errors</td>
<td>screen formats</td>
</tr>
<tr>
<td>-&gt; acceptance to retaliate</td>
<td>-&gt; acceptance nit-picking</td>
</tr>
</tbody>
</table>
Testing motto

If you don't have patience to test the system
the system will surely test your patience

Testing and Requirements

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Improved requirements through testing

- get testers involved early
  - start test activities at the beginning
  - invite testers to requirements reviews
- use the tester perspective / mindset
  - with every requirement, ask:
    - what could go wrong? what if it isn’t?
  - ask for (and appreciate) feedback from testers
- technical aspects
  - include examples, business scenarios, use cases
  - non-functional requirements: measurable & testable
- communicate with testers: common goals

Summary: key points

Improving requirements through testing is not only “mission possible” – it’s “mission critical”

to understand stakeholders’ desires and needs

Good requirements engineering produces better tests;

good test analysis produces better requirements
Shameless commercial plug

download IEEE Software article, Sep/Oct 2002 from www.grove.co.uk (downloads – “paper on requirements”)
copy of slides: DorothyRGraham@aol.com or USB stick