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Introducing Risk Based Testing to Organizations

Abridged Version

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Outline

Topics	Time (min)
Introduction	
Selecting where to introduce RBT	
Putting RBT into practice	
Incorporating RBT to agile methodology	
Measuring the effectiveness of RBT	
Sample “Pilot Project” Results	
Philosophical discussion – Testing Goals vs. a Risk approach	

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What is a risk?

- A risk is the likelihood of damage from a defect.
- The mission of software testing is to reduce the likelihood that escaped defects in the SUT will cause physical damage or financial impact.
- Different kinds of escaped defects have different probabilities and impacts for different stakeholders.
- Risk investigation may reveal potential defects in both the product and the process. (Process defects allow product defects to escape.)
- Risks are characterized by their:
  - *Identity:* Victim, defect, vulnerability, and threat.
  - *Magnitude:* Probability and cost.

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Software Risks

Risk Class	Explanation & Example
Project Risk	External dependencies – skill availability, constraints – fixed priced contracts
Process Risk	Internal: underestimating complexity, skill level, etc that can be handled by good planning, monitoring etc
Product Risk	Fault proneness of technology. Product definition, product complexity, failure to meet requirements. Testers concern.

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How many product risks are there?

- High level risks: 15-30 (most projects)
- Product risks: Could be 1000's of failure modes
- Present examples of risks: 40-80
  - Risks of most concern & test types in scope for planning purpose (high level test planning/test strategy)
  - While designing individual tests, investigate failure modes in more detail (e.g. exploratory testing)
  - As testing proceeds, more unanticipated problems will come to light. As new risks emerge, PM can change direction & emphasis of testing

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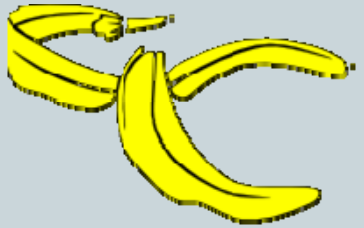
Anatomy of a well-identified risk

Is hurt when the SUT exhibits a

Which manifests when there is a

Which becomes dangerous when there is a



Victim

Defect

Vulnerability

Threat

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Risk Management (and its relation to RBT)

Steps

- Risk Identification
- Risk Projection
  - Developing a Risk Table
  - Assessing Risk Impact
- Risk Refinement
- Risk Mitigation, Monitoring & Management (Avoidance, Monitoring, Management & Contingency)

Exposure = Probability X Impact (or Cost)

Faster risk lowering is achieved by doing testing prioritization with risk in mind

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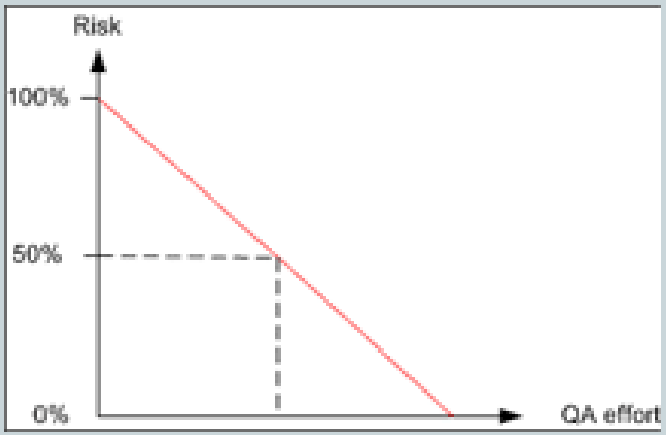

Figure 1: Random testing will lower risk

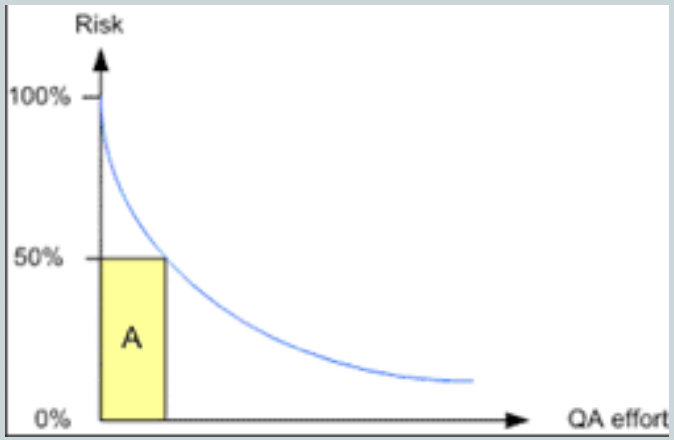

Figure 2: Using test strategy to reduce risk

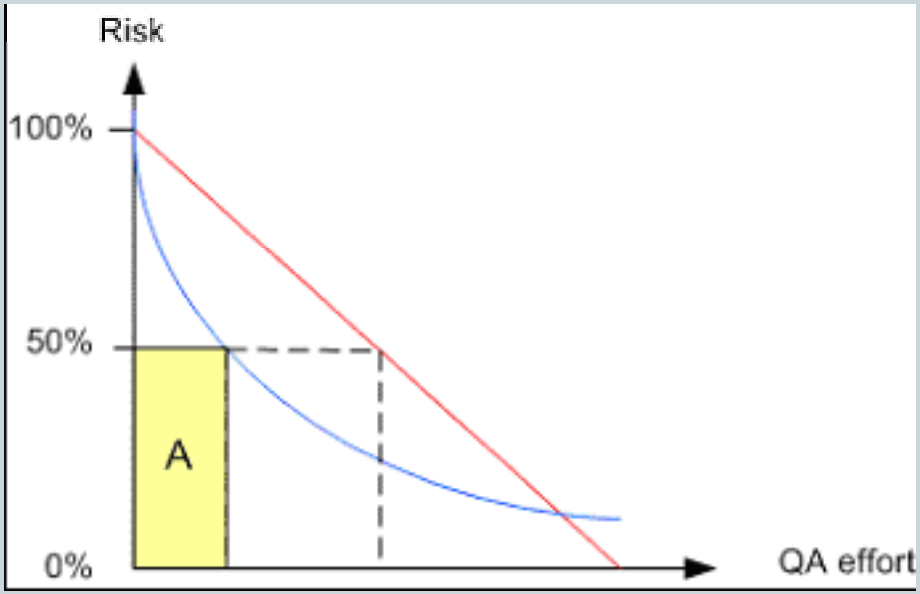

Figure 3: Optimal QA strategy: minimum testing effort invested to maximize risk reduction.

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RBT Method

RBT is based on well-established methods, that are adapted to testing

- Generic risk management techniques
  - Risk identification
  - Risk analysis
- Failure Mode and Effects Analysis (FMEA)
  - Risk response with focus on testing
- Test planning and testing techniques
  - Test scope
  - Test planning and allocation

RBT builds the foundation for an efficient test strategy

Test strategy and test management

- Test focus on most critical aspects
- Effective allocation of limited test resources

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History of RBT

- James Bach (1995), "father" of RBT
  - Original idea: "The Challenge of Good Enough Software", 10/1995
  - Heuristic approach with 2 treatments for risk identification. Assessment and control of factors are not trivial needing SME.
- Amland (1999)
  - Developed metrics set for risk analysis to support test activities.
  - Defines cost and quality indicators for faults (a challenge)
- Chen (2002)
  - Execution strategy for component level regression testing
  - Select test cases not requirements

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History of RBT

- Jorgensen (2004)
  - Support tool prototype for RBT risk analysis and test plan creattion
- Besson (2007)
  - Link test activity for risk reduction using the principle: 20% of the functionalities allows user to accomplish 80% of the tasks
- Others
  - Paul Gerrard & Neil Thompson (Risk-based E-business Testing),
  - Hans Schaefer
  - Cem Kaner (co-author with James Bach).

Example: Two approaches to analysis – inside out and outside in

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- Heuristic analysis:
  - Finding a solution that doesn't always work.
  - Performed through a checklist of open-ended questions, suggestions, or guidewords
- Inside – Out
  - Begin with details about the situation & identify risks associated with them
  - For each part of the product, ask
    - Vulnerabilities – weakness/possible failures in this component"
    - Threats: inputs/situations can arise that may exploit a vulnerability and trigger a failure in this component
    - Victims: who/what is impacted & how bad, from a failure
  - "What can go wrong here" – ask repeatedly

Example: Two approaches to analysis – inside out and outside in

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- Outside In
  - Begin with a set of potential risks and match to the details of the situation
  - Easier than inside out. Check predefined lists (3 from below) and match applicability

- Quality Criteria Categories
  - CRUPIC STeMPL
  - Capability, Reliability, etc .

  (Usability, Performance, Installability, Compatibility, Supportability, Testability, Maintainability, Portability, Localizability)
- Generic Risk Lists
  - E.g. Complex, New, Changed, Upstream dependency, etc

- Risk Catalogs
  - E.g. Wrong files installed, install process is too slow, etc

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Phases of RBT

- Risk identification
  - Gathering possible risks
- RBT planning:
  - Risk estimation/analysis
    - Well-understood catalog of risks and exposures
  - Risk mitigation/response
    - Mitigation measures
  - Test scoping
    - Scope tests and mitigation measures
  - Test process update
- RBT execution

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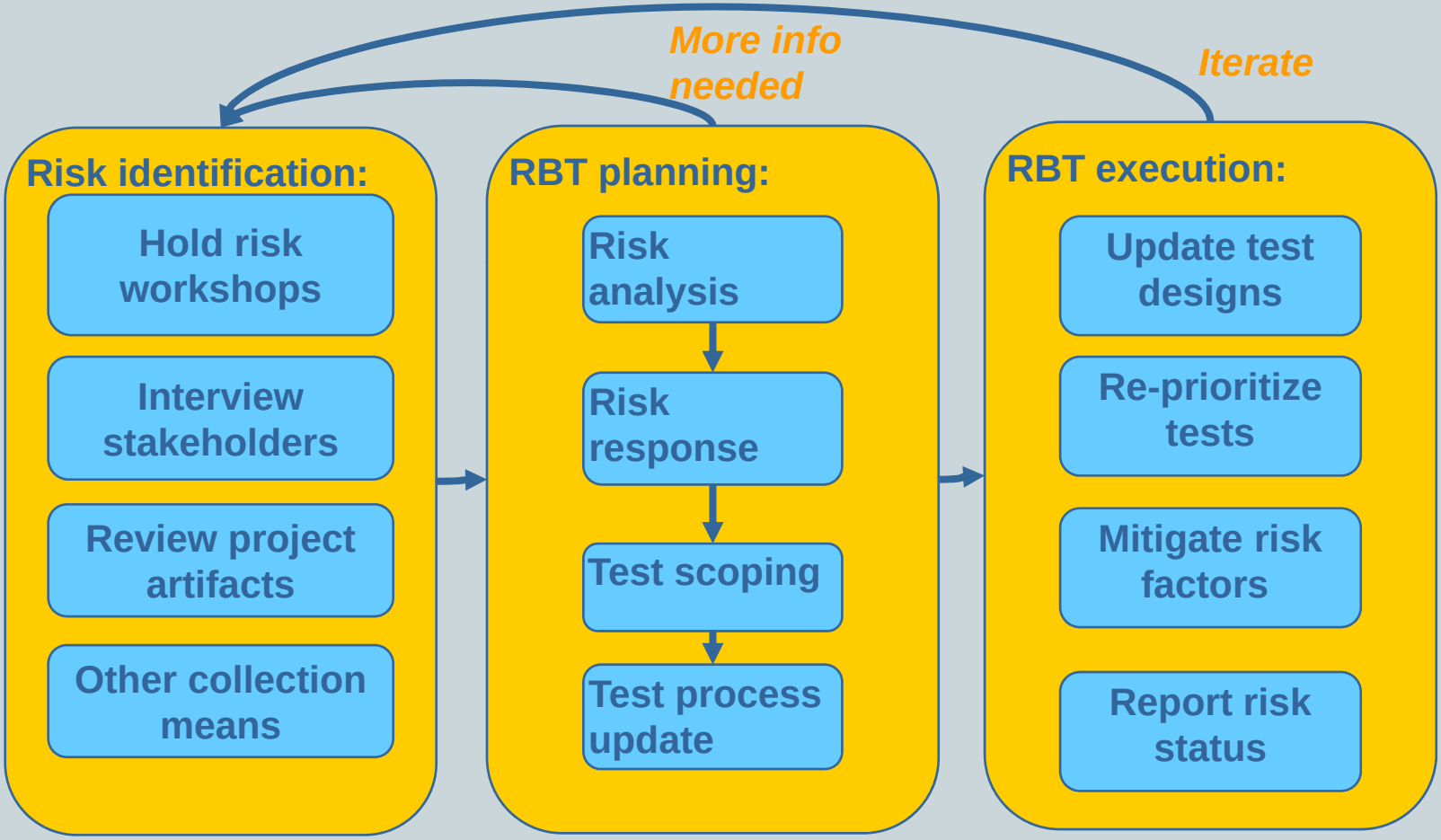
Overview of RBT methodology



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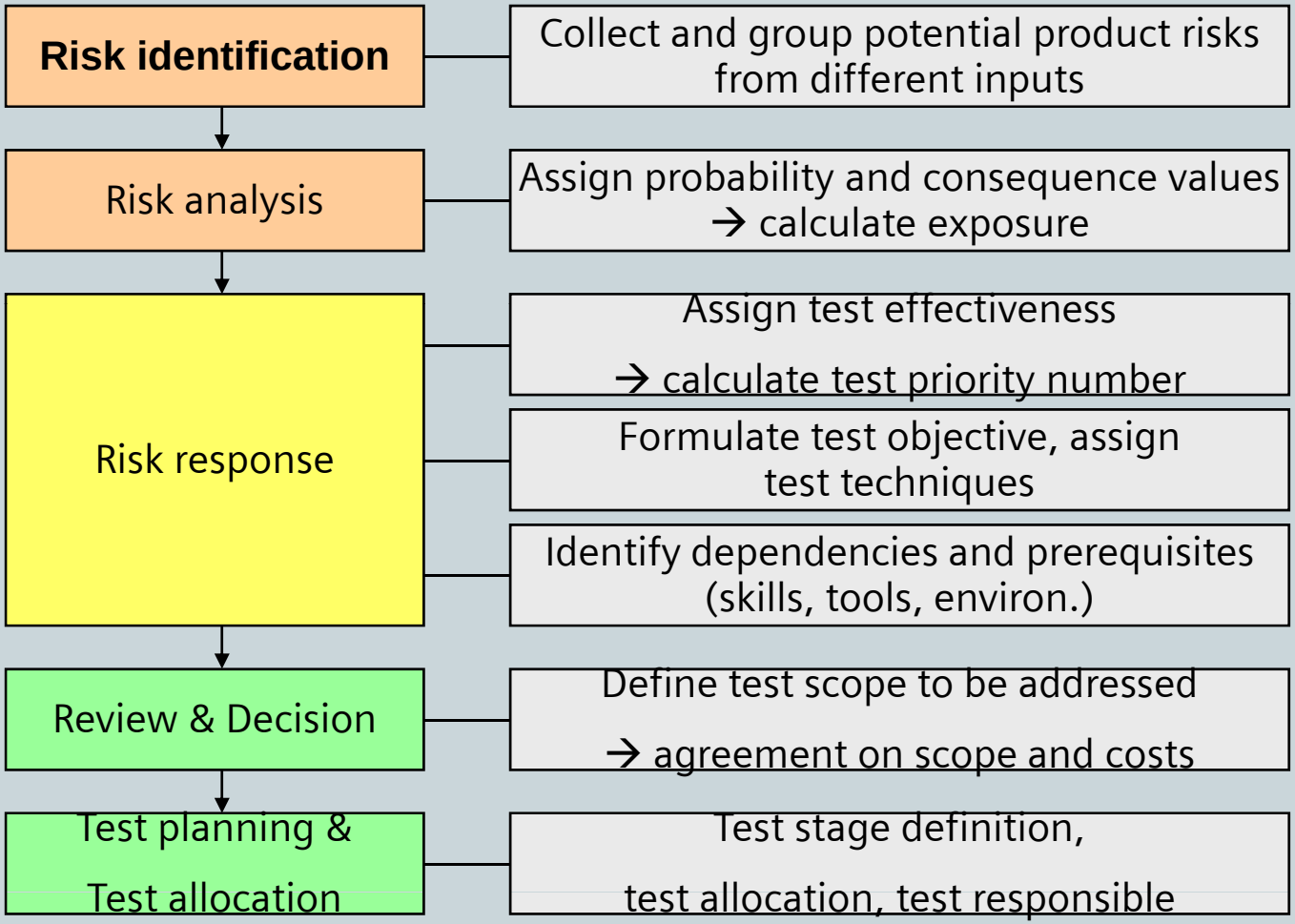
Risk-Based Testing Steps



Adapted from: P.Gerrard, N.Thompson: *Risk-Based E-Business Testing*

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Risk Workshops - Identification

- Pre-Workshop: Review candidate risks
- Workshop
  - Summarize concerns regarding modes in which final system may fail
  - Brainstorming session after people have thought over specific risks (candidate risks)
    - Aim: Add to candidate risks; Remove risks not of concern; Identify risk in more detail
  - Tools/Worksheets
    - Checklists of common risks to trigger ideas
    - Generic risks lists- areas of complexity, past error areas, changes to code
    - Quality criteria: reliability, usability, performance etc

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Risk Workshops – Estimation (Analysis)

- Testing can help address uncertainty
  - Testing may prove that the original concerns were justified because many faults were exposed
  - Testing may show that the concerns were less founded if few faults were detected
- Assessing cost: Use scores

Critical	business objectives cant be accomplished	5
High	business objectives are undermined	4
Moderate	business objectives are affected	3
Low	business will be affected slightly	2
Negligible	No noticeable effect	1

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Risk Workshops – Estimation

- Assessing probability: use scores & bug databases

80-100%	Almost certain – highly likely	5
60-80%	Probably, likely, we believe	4
40-60%	We doubt	3
20-40%	Unlikely, probably not	2
1-20%	Highly unlikely	1

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Test Priority Evaluation

Frequency

Frequent (4)	0	16	32	48	64	Excellent (4)
Probable (3)	0	9	18	27	36	High (3)
Remote (2)	0	4	8	12	16	Good (2)
Theoretical (1)	0	1	2	3	4	Fair (1)
None (0)	0	0	0	0	0	None (0)
	None (0)	Negligable (1)	Minor (2)	Major (3)	Critical (4)	

Test Effectiveness

Severity

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Test Priority Chart

Categories of Test Priority		TPN	Testing Recommended
Top Priority	Exposure and test effectiveness strongly warrant mitigation by testing	28 and above	Strongly
High Priority	Exposure and test effectiveness definitely warrant mitigation by testing	18 through 27	Yes
Medium Priority	Exposure and test effectiveness may warrant mitigation by testing	12 through 17	If risk exposure high and no other mitigation strategy is possible
Low Priority	Low exposure or testing will not mitigate the risk (or both)	0 through 11	No

Risk Workshops – Mitigation

Response planning

- Pre-emptive: reduce probability of the risk materializing
  - Information buying, process model, risk influencing, contractual transfer
- Reactive: reduce impact when risk occurs
  - Contingency plans, Insurance

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Risk Activity – Monitoring & Management

- Risks assigned to owners for monitoring and repeated assessment
- Data summary from previous cycle shown at start of Risk Identification Workshop II & III

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Summary: Stages in RBT Pilot Process

- Risk identification
  - Workshop: Gather risk candidates
  - Vetting: Investigate where needed; approve, eliminate, or clarify risk candidates
- Risk analysis
  - Workshop: Workshop: Gather estimates of probability and consequence of each risk
  - Vetting: Investigate where needed; resolve differences of opinion
- Risk mitigation
  - Estimate test effectiveness and effort to implement mitigation by testing; identify test phase, objectives, and techniques
  - Vetting: Resolve differences of opinion; finalize decision on mitigation; identify existing, modified, and additional test cases

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Sample Project Summary

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Business Benefits of RBT

- RBT can provide qualitative and quantitative information about:
  - What business priorities are being risked
  - The total magnitude of the risk
  - How to anticipate and avoid problems in the product
- The business leadership's priorities for mitigation include schedule, budget, and customer acceptance (escaped defects.)

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Warning & Benefits of a Risk based approach

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Risk with Risk Analysis

- Less than perfect decision making
- Lead to culture of blame

Benefits

- Reduce customer defects
- Test Early
- Risks visible to PM so they know they are squeezing testing

When to stop testing?

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- Decision to stop testing is made with the clear knowledge of outstanding risks of release

RBT addresses

- How much testing is enough
- When (and why) should we stop testing
- When is the product good enough for release
- How good is our testing anyway

How much testing is enough?

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- As the developer how many bugs he has put. Or project management which has decided anyway
- Testing is a sampling activity, the most important pinch of sand from the beach
- No upper limit
- So as human procrastinates to limit time to …

When & Why should we (& stop) testing

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- All tests planned have been run
- All incidents raised have been resolved
- All faults found here have been fixed and retested
- All regression tests run without failure

Do you really meet such an acceptance criteria !!

Are these criteria useful .. So what?

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- Perfection
- Strike a balance
- Can demonstrate coverage of risks
- Unexpected stops
- What are the risks of stopping testing now?
- What are the benefits of testing now

- By recording risks to be addressed for each test, we can identify those risks covered and those outstanding. Easier to count cost than number of tests remaining → to make a positive release decision

To be released, good enough = ??

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- Sufficient benefits
- No critical problems
- Benefits sufficiently outweigh non critical problems
- Present situation, all things considered, delaying its release to improve it further would cause more harm than good

Testing fits by determining

- Have sufficient benefits been delivered?
- Are there any critical problems
- Is our testing adequate to support the decision

How good is your testing?

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- Fault Detection Percentage = T/T+P

Where T = fault found in testing, P = faults found in production

For testers, FDP cant be calculated. How do you find P?

Hence, coverage is an indirect measure of thoroughness

Definition of Good Testing

Alternate definition for good (or good enough) testing

- Provides sufficient evidence of benefits delivered
- Provides sufficient evidence of current risks of release
- Accomplishes these tasks at an acceptable cost and time frame

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Questions?