Risk-Based Software V&V

Presented By: Linda Westfall

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Logistics

- Attendees are on mute
- Type your questions into the Question area
  - Cathy will ask questions between slides or at the end of the presentation
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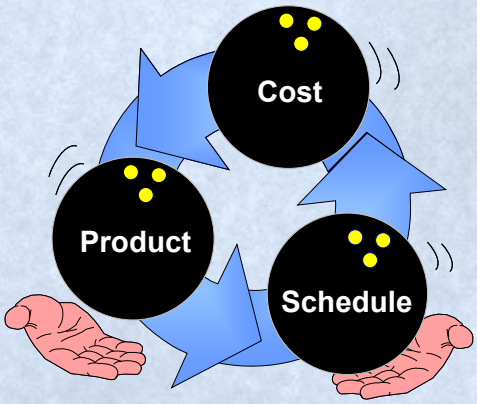
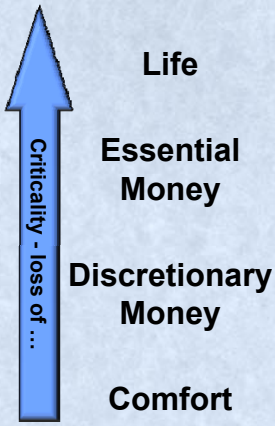
Risk-Based Trade-Offs



Made based on required product integrity & associated risk

Macro Level Risk Based V&V

The concept of good enough software recognizes the fact that not all software applications are created equal.



Grading Schema – V&V Example

Software	V&V Activity Grading by Integrity/Risk Level			
	4	3	2	1
Requirements peer review	Required	Required	Required	Tailorable
Design peer review	Required	Required	Tailorable	Not Required
Code peer review	Required	Tailorable	Tailorable	Not Required
Software unit testing	Required	Tailorable	Tailorable	Combined & Tailorable
Software integration testing	Required	Required	Tailorable	
Software system testing	Required	Required	Required	Tailorable
Software acceptance testing	Required	Required	Required	Tailorable

The level of "intensity & rigor applied to the V&V tasks vary according to the integrity level. Higher integrity levels require the application of greater intensity and rigor to the V&V task. Intensity includes a greater scope of analysis across all normal & abnormal system operating conditions. Rigor includes more formal techniques & recording procedures." [IEEE-1012]

Micro Level Risk-Based V&V

Micro level risk-based V&V is the activity of:

- Examining individual functions or components of the software & calculating risk based on the:
  - *probability that some feature or component in the software will fail*
  - *probable impact (cost) associated with the failure*

The greater the probability of an expensive failure, the greater the V&V resources allocated to that function or component to increase V&V intensity & rigor.

Risk Probability Indicators – Examples

Lower Probability		Higher Probability
Little change	Requirements Stability	Lots of change
Few defects	Past Quality	Lots of defects
Small/Simple	Size & Complexity	Large/Complex
Minimal	Quality Attributes	Constrained
Seldom used	Operational Profile	Used extensively
Experienced	Author Knowledge & Skill	Novice
Well known	Technology	Leading edge
High maturity	Processes	Low maturity

Risk Impact Indicators – Examples

Impact indicators:

- Failure costs
- Corrective action costs
- High maintenance costs
- Customer dissatisfaction
- Lost market opportunities
- Litigation
- Non-compliance with regulatory requirements
- Negative publicity
- etc.

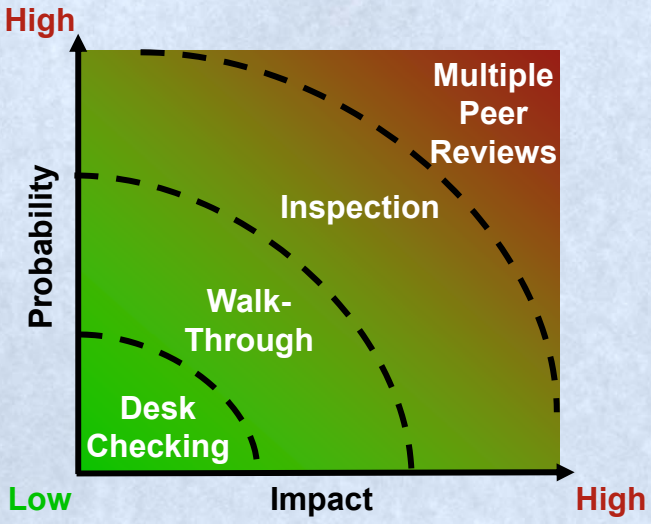
Risk-Based Analysis

Select the types of analysis performed based on risk:

- Safety/hazard analysis
- Security analysis
- Control flow analysis
- Data flow analysis
- Database analysis
- Interface analysis
- Traceability analysis
- Algorithm analysis
- Criticality analysis
- Feasibility analysis
- Testability analysis
- Performance analysis
- Usability analysis
- Reliability analysis

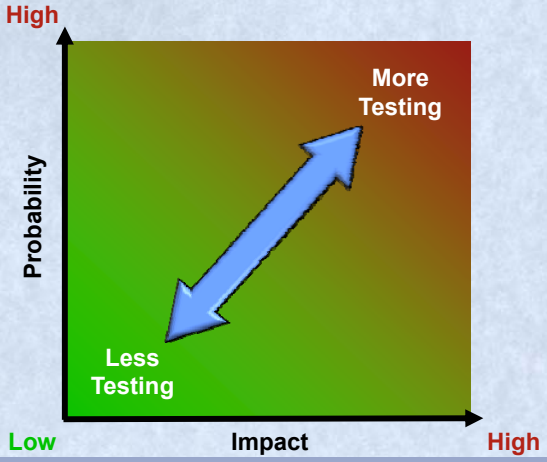
Risk-Based Peer Review

Selecting the type of peer review based on risk:



Risk-Based Testing

Focus testing effort on targeted areas of the software that have a high probability of containing yet undiscovered defects that will cause high-impact field failures



Implementing Risk-Based Testing

Strategies for implementing risk-based testing, include:

- White-box:
  - More extensive code coverage
  - More fault insertion
- Gray-box:
  - Select top-down or bottom-up integration strategy based on position of risky components
  - Test paths through the calling tree after integration
  - More extensive negative testing using checklist

Implementing Risk-Based Testing (cont.)

- Black-box:
  - Collaborative test case design
  - Broader sampling of input/output domains
  - More extensive negative testing using checklists
  - Exploratory testing of higher risk functions
  - Time-boxed testing
- Retesting & regression testing:
  - More rigorous regression analysis
  - Broader retesting & regression testing (automation)
  - More frequent regression testing (automation)

Implementing Risk-Based Testing (cont.)

Expanded expertise in & broader testing of quality attributes:

- Performance
- Internationalization
- Accuracy
- Accessibility
- Efficiency
- Flexibility
- Interoperability
- Robustness (fault-tolerance)
- Installability
- Maintainability
- Portability
- Reusability
- Supportability
- Reliability
- Availability
- Usability
- Security
- Safety

Implementing Risk-Based Testing (cont.)

Expanded use of various testing techniques:

Specification-based:

- Equivalence partitioning
- Boundary value testing
- State transition testing
- Decision table testing
- Cause & effect graphing
- Syntax testing
- All pairs testing
- Scenario testing

Structure-based:

- Statement testing
- Decision testing
- Condition testing
- Multiple condition testing
- Data flow testing

Experience-based:

- Error guessing
- Exploratory testing

Risk-Based V&V Sufficiency

- **Probability of undiscovered defects**
- **Impact associated with the defects**
- **Cost of continued V&V activities**
- **Benefits of more V&V**

Reminders

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Linda Westfall

More than 40 years in software:

- President of The Westfall Team
- Sr. Manager of Quality Metrics & Analysis, Manager of Production Software, software process engineer, software engineer & systems analyst

Active professionally:

- ASQ Software Division past chair, ASQ Certification Board, PMBOK® contributor & P.E. exam development
- P.E. Software Engineering, ASQ Fellow, CSQE, CMQ/OE, CQA & CBA, PMP, Certified Scrum Master & Product Owner, SAFe Certified Consultant, Lean Six-Sigma Master Black Belt, ISTQB Certified Tester
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