



THE ROLE OF IV&V IN THE SOFTWARE DEVELOPMENT LIFE CYCLE

by:

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for:

ASQ Section 509

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INTRODUCTION

- Overview
- Phase-Related IV&V Activities
- IV&V Implementation
- Summary
- The IV&V Plan
- Recommendation(s)

OVERVIEW

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OVERVIEW

IV&V activities provide information that determines (for senior management) whether development products of a particular activity conform to the requirements of that activity, and whether the software satisfies both its intended use and user needs.

OVERVIEW - continued

Department of Defense, NASA, FBI, and National Archives are among the Federal agencies that have used, or are currently using IV&V for critical programs. IV&V does not replace Quality Assurance or Test. **Rather IV&V exists parallel alongside both. IV&V may do the same task but with a different filter.**

OVERVIEW - continued

- IV&V provides
 - Objective assessment of software products and processes throughout the development life cycle
 - Objective assessment that requirements (system and software) are correct, complete, accurate, consistent, and testable

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Note these points:

1. Objective Assessment - means evidence has to be present
2. IV&V looks at products and processes
3. IV&V is involved throughout the development life cycle
4. Recognition that the final product starts with the requirements.

OVERVIEW - continued

- IV&V provides
 - Early detection and correction of software errors
 - Management insight into process and product risk(s)
 - Objective evidence of compliance (or non-compliance) with program performance, schedule and budget requirements

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Note these points:

1. Early rather than later
2. Risk may be technical, financial, or schedule.

OVERVIEW - continued

- IV&V may be implemented at any level
 - Project
 - Program
 - Division or Enterprise
 - Corporation or Agency

PHASE-RELATED ACTIVITIES

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All Phases

- Management of IV&V
 - IV&V Plan generation
 - Baseline change assessment
 - Management review of IV&V
 - Management and technical reviews support
 - Interface with organizational and supporting processes

Acquisition Phase

- IV&V Activities -
 - Scope IV&V effort
 - Plan IV&V: supplier interface
 - Review system requirements

Supply Phase

- IV&V Activities –
 - Re-plan IV&V: Supplier interface
 - Verify contract(s)
 - Perform criticality analysis

Concept Phase

- IV&V Activities –
 - Evaluate concept documentation
 - Analyze requirements allocation
 - Analyze traceability
 - Perform criticality analysis
 - Perform hazard analysis

Criticality Analysis

▪ The Integrity Level

This is a value that represents system complexity, criticality, risk, safety, security, desired performance, reliability or other project unique characteristic that describes the importance of the software to the user (IEEE Std 1012-2004). The process of identifying the

Integrity Level is called Criticality Analysis.

Example A: Levels 1 - 4

- Level 1: potential minor impact or loss
- Level 4: potential risk to life, mission, financial

Example B: High, Medium, Low

- High: critical to life or mission
- Low: minor impact on life or mission

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Assessment of criticality determines which activities need to be undertaken

Requirements Phase

- IV&V Activities –
 - Analyze traceability
 - Evaluate software requirements
 - Analyze interfaces
 - Perform criticality analysis
 - Perform hazard analysis
 - Perform risk analysis

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Requirements Phase - continued

- IV&V Activities –
 - Verify developer's system test plan
(levels 1-2)
 - Verify developer's acceptance test plan
(levels 1-2)
 - Generate/verify IV&V system test plan
(levels 3-4)
 - Generate/verify IV&V acceptance test plan
(levels 3-4)

Design Phase

- IV&V Activities –
 - Analyze traceability
 - Evaluate software design
 - Analyze interfaces
 - Perform criticality analysis
 - Verify developer's Component test plan (levels 1- 2)
 - Verify developer's Component test design (levels 1-2)

Design Phase

- IV&V Activities –
 - Generate/verify IV&V Component test plan
(levels 3-4)
 - Generate/verify IV&V Integration test plan
(levels 3-4)
 - Generate/verify IV&V Component &
Integration test designs
(levels 3-4)

Implementation Phase

- IV&V Activities –
 - Analyze traceability
 - Analyze interfaces
 - Perform criticality analysis
 - Evaluate source code and source code documentation
 - Perform hazard analysis
 - Perform risk analysis

Implementation Phase - continued

- IV&V Activities -
 - Verify developer's test cases
(levels 1-2)
 - Verify developer's test procedures
(levels 1-2)
 - Validate developer's component test results
(level 2)
 - Witness developer's testing (if required)

Implementation Phase - continued

- IV&V Activities - (cont'd)
 - Generate/verify IV&V test cases
(levels 3-4)
 - Generate/verify IV&V test procedures
(levels 3-4)
 - Execute/verify IV&V component tests
(levels 3-4)

Test Phase

- IV&V Activities -
 - Analyze traceability
 - Verify developer's acceptance test procedures
(level 2 only)
 - Validate developer's system test results
(levels 1-2)
 - Validate developer's acceptance test results
(level 2 only)

Test Phase

- IV&V Activities –
 - Perform risk analysis
 - Generate/verify IV&V acceptance test procedures (levels 3-4)
 - Verify IV&V integration test execution (levels 3-4)
 - Verify IV&V system test execution (levels 3-4)

Test Phase - continued

- IV&V Activities -
 - Verify IV&V system test execution
(levels 3-4)
 - Verify IV&V acceptance test execution
(levels 3-4)

Installation/Checkout Phase

- IV&V Activities –
 - Perform installation configuration audit
 - Perform installation checkout
 - Perform hazard analysis
 - Generate IV&V Final Report

Operation Phase

- IV&V Activities -
 - Evaluate new constraints
 - Assess proposed changes
 - Evaluate operating procedures
 - Perform hazard analysis
 - Perform risk analysis

Maintenance Phase

- IV&V Activities -
 - Revise IV&V Plan
 - Assess proposed changes
 - Evaluate anomalies
 - Perform criticality analysis
 - Perform migration assessment
 - Perform hazard analysis
 - Perform risk analysis

THE IV&V PLAN

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THE IV&V PLAN

- The IV&V Plan (IEEE Std-1012-2004)
 - Section 1: Purpose
 - Section 2: Referenced Documents
 - Section 3: Definitions
 - Section 4: IV&V Overview
 - Section 5: IV&V Processes
 - Section 6: IV&V Reporting Requirements
 - Section 7: IV&V Administrative Requirements
 - Section 8: IV&V Test Documentation Requirements

IMPLEMENT IV&V

- Perform Criticality Analysis (as needed)
- Generate the IV&V Plan (to document planning)
- Execute the IV&V Plan
- Provide feedback on IV&V results

SUMMARY

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SUMMARY

- Determine the integrity level
- Identify the minimum required tasks (IEEE 1012)
- Identify optional tasks
- Plan the IV&V effort and required interfaces
- Document (IV&V Plan) the IV&V effort
- Execute the IV&V Plan

FOLLOW UP

- **QUESTIONS ?**
- **COMMENTS ?**

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Independence

- **Independence Criteria:**
- Technical independence
- Managerial independence
- Financial independence

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Technical Independence--

utilizes personnel who are not involved in development, formulates own understanding of the problem and how the proposed system is solving the problem, develops own set of test and analysis tools

Managerial Independence--

places IV&V in a separate organization from the development organization

Financial Independence--

requires control of the IV&V budget be vested in an organization that is independent of the development organization