

Driving Quality (IV&V, QA)

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Driving Quality

Quality – Built In, Not Tested In

Two Processes that Aid in Building Quality Into the System

- Quality Assurance (QA)
- Software Verification & Validation (V&V)

What are these Processes and How are they Different?

...and what happened to the “I” in front of “V&V?”



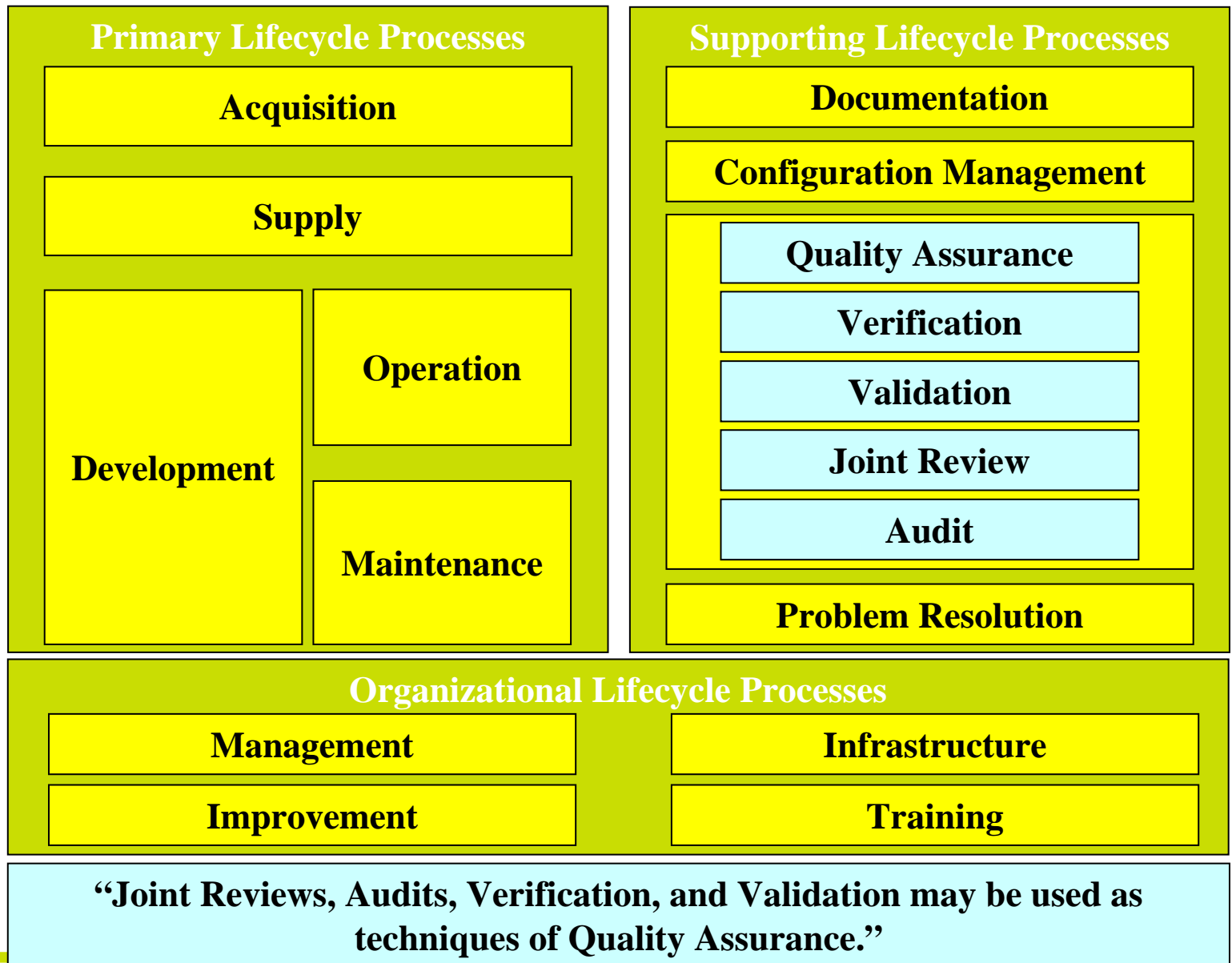
Definitions - *(From IEEE/EIA 12207.0-1996 Standard for Information Technology — Software life cycle processes)*

Quality Assurance - Process for Providing Assurance that the Software Products and Processes in the Project Life Cycle Conform to their Specified Requirements and Adhere to their Established Plans

Verification – Process for Determining whether the Software Products of an Activity Fulfill the Requirements or Conditions Imposed on them in the Previous Activities

Validation - Process for Determining whether the Requirements and the Final, As-Built System or Software Product Fulfills its Specific Intended Use

Context of QA and V&V within Lifecycle Processes (IEEE/EIA Std 12207.0)



As a Sound Bite ...

Quality Assurance - Assurance that the software products and processes are in conformance

Verification – Assurance that the software is built correctly

Validation – Assurance that the correct software is built

As an Analogy...

Quality Assurance is analogous to a code inspection during house construction

V&V is analogous to the owner hiring an independent inspector during construction



The “I” Before “V&V”

The IEEE standards allow for V&V activities to be performed by anyone, but describe a concept of independence

IEEE/EIA 12207.0-1996 Standard for Information Technology — Software life cycle processes

- This process may be executed with varying degrees of independence. The degree of independence may range from the same person or different person in the same organization to a person in a different organization with varying degrees of separation. In the case where the process is executed by an organization independent of the supplier, developer, operator, or maintainer, it is called Independent Verification Process.

IEEE Std 1012-2004 Software Verification and Validation

- Independent verification and validation (IV&V): V&V performed by an organization that is technically, managerially, and financially independent of the development organization.
- Standard requires the specification of the degree of independence required, but does not mandate any specific degree.

Who Performs QA Activities?

IEEE Std 730 Software Quality Assurance Plans requires that the QA Plan identify the specific organizational element that is responsible for performing each task

The SQAP standard does not impose any restrictions on who may perform a given task

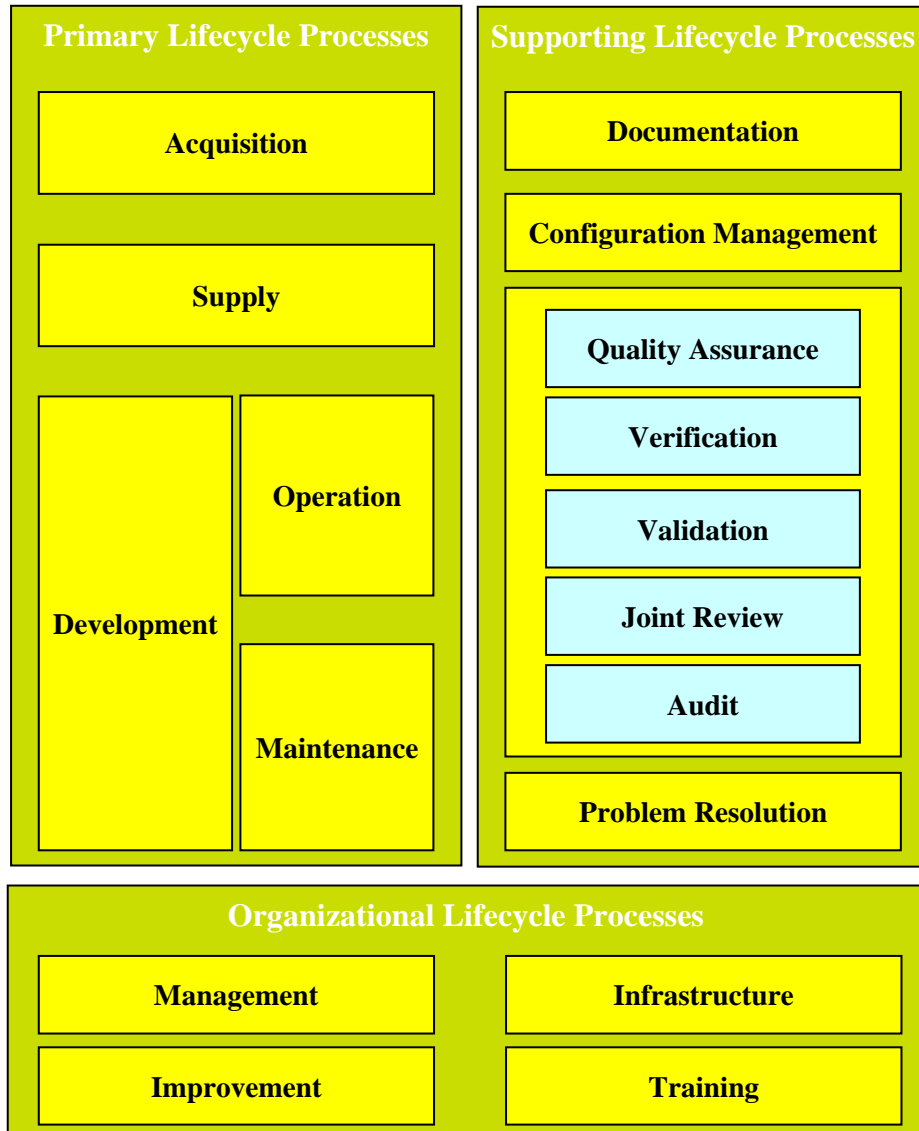
- “The amount of organizational freedom and objectivity to evaluate and monitor the quality of the software, and to verify problem resolutions, shall be clearly described and documented.”

IEEE/EIA 12207.0-1996 Standard for Information Technology - Software life cycle processes requires QA to “to have organizational freedom and authority from persons directly responsible for developing the software product or executing the process”

QA activities may be performed by project personnel, staff personnel outside the project or by contracted personnel

A project may have staff dedicated to performing QA or QA activities may be performed by staff members who have additional duties

Coverage of Lifecycle Processes by QA and V&V



	Conformance	Correctness
Primary Processes	QA	
Primary Products	QA	V&V
Supporting Processes	QA	
Supporting Products	QA	V&V (Partial)
Organizational Processes	QA	
Organizational Products	QA	V&V (Partial)

QA is Directed at the Project
V&V is Directed at the System

Coverage across the System Development Life Cycle

- 1) Process implementation
- 2) System requirements analysis
- 3) System architectural design
- 4) Software requirements analysis
- 5) Software architectural design
- 6) Software detailed design
- 7) Software coding and testing
- 8) Software integration
- 9) Software qualification testing
- 10) System integration

QA and V&V are applied across all phases of the SDLC

V&V (particularly IV&V) may also perform testing in addition to that performed by the developing organization

Level of effort and skills required will vary for both QA and V&V over the course of the life cycle

11) System qualification testing

A major goal of both QA and V&V is to identify problems and potential improvements early, when the cost of change is lower. Don't wait until the end of the project to try to improve the quality!

What about the Processes and Products Not Covered?

The combination of standards-based QA and V&V still leaves a gap in assurance for correctness:

- Primary Processes
- Supporting Processes
- Organizational Processes
- Supporting Products
 - Some coverage of documentation, requirements configuration management, audits
- Organizational Products
 - Some coverage of training



This coverage gap (or parts of it) is often requested under solicitation titles such as IV&V, QA, or General IT Support

If the acquiring organization wants to acquire services to cover these gaps, the services should be clearly defined in the solicitation (i.e., imposing the IEEE QA and Software V&V Standards is not sufficient)

DHHS ACF OCSE “Independent Verification & Validation Options”

The Office of Child Support Enforcement in DHHS ACF provides guidance on IV&V of CSE systems in a document entitled Independent Verification and Validation Options (see <http://www.acf.dhhs.gov/>

[programs/cse/stsys/dsts_ivv_overview.html](http://www.acf.dhhs.gov/programs/cse/stsys/dsts_ivv_overview.html)).

“Options” refers to areas that might be evaluated, and the areas are organized into three Parts:

- Part I – Planning and Management
 - Evaluation of project management issues and activities
 - Examples: Project Initiation, Business Process Reengineering, Project Planning and Reporting
- Part II – Project-Wide Process
 - Evaluation of activities that have project-wide scope
 - Examples: Training and Documentation, QA, Configuration Management
- Part III - Environments, Phases, and Products
 - Evaluations of a specific phase, environment or product of the development process
 - Examples: Systems Engineering, Operating Environment, Database Management

Comparison of IEEE 1012 to OCSE IV&V Options

IEEE Std 1012-2004	OCSE IV&V Options
Review of primary products	Review of primary, supporting and organizational products and processes
Focus on system as it will be in operation	Includes both system development and system as it will be in operation
Tasks to be performed determined by Software Integrity Levels identified in Criticality Analysis *	Tasks to be performed determined by Areas and Tasks identified in IV&V Assessment performed by OCSE *
Usually performed on continuing basis	Typically performed using audits at specified intervals

* Under IEEE Std 1012-2004, the V&V tasks to be performed are not usually known at the time that V&V services are acquired, while the IV&V tasks are known at the time of acquisition using the OCSE IV&V Options approach.

So what do I get for all these letters, and how are they different?



V&V

QA

IV&V

Skills Needed for Performance

QA

- QA Process (including Measurement to support Improvement Process)
- Management Methodology
- Development Methodology

V&V

- V&V Processes
- Technical Solution

Extended V&V (V&V plus coverage of the “gaps”)

- V&V Process
- Management Methodology, Development Methodology and Technical Solution

IV&V provides increased assurance through activities accomplished by an unbiased performer

Comparison Summary

	Assurance	Target	Focus	Periodicity	Tailoring	Performer
QA	Conformance to standards and plans	Primary Products & Processes, Supporting Products and Processes, Organizational Processes and Products	Development Effort	Continuous	None	Organizationally independent of persons directly responsible for developing the software product or executing the process
V&V	Correctness to requirements of previous activities and to intended use	Primary Products	Operational System	Continuous	By Software Integrity Levels Determined in Criticality Analysis	Anyone (IV&V requires financial, management and technical independence)
Extended V&V	Correctness to requirements of previous activities and to intended use	Primary Products & Processes, Supporting Products and Processes, Organizational Processes and Products	Development Effort & Operational System	OCSE IV&V Options: typically audits at specified intervals	OCSE IV&V Options: By Areas and Tasks Identified in IV&V Assessment	OCSE IV&V Options: Financial, management and technical independence

Questions/Comments?





IV&V and QA – Observations from Experience

Maureen Finmand

EDS

What Is It?

Not always easy to understand & often used interchangeably, but bottom line intended to determine if “my requirements were met”

IEEE/EIA 12207.0-1996 Standard for Information definitions:

- Technology Quality Assurance – process for providing assurance that the software products and processes **conform to specified requirements** and adhere to established plans
- Verification – process for determining whether the software **products** of an activity **fulfill the requirements or conditions** imposed on them in the previous activities
- Validation - process for determining whether the requirements and the final, system or software product **fulfills its specific intended use**

Other definitions include:

- “conformance to user requirements”
- “achieving excellent levels of fitness for use”
- “market-driven quality” which is based on achieving total customer satisfaction

Why Do It?

- Ensure project success
 - Identify software and project process issues early and take corrective action
 - Protect investments - getting what you paid for
 - Decrease delays and cost overruns
- Meet funding source requirements
 - State legislatures and executives are requiring QA and IV&V as part of approving large-scale projects – expect an independent view on what is happening
 - Federal funding sources specify that there must be independent oversight as part of approving matching funds

Who Is Doing What?

QA

State

SI

IV&V



State

The State agency has a quality role and responsibility

Provides quality through:

- Executive sponsorship and oversight
- Project management
- Deliverable review and approval
- Targeted quality assurance reviews

Limitations

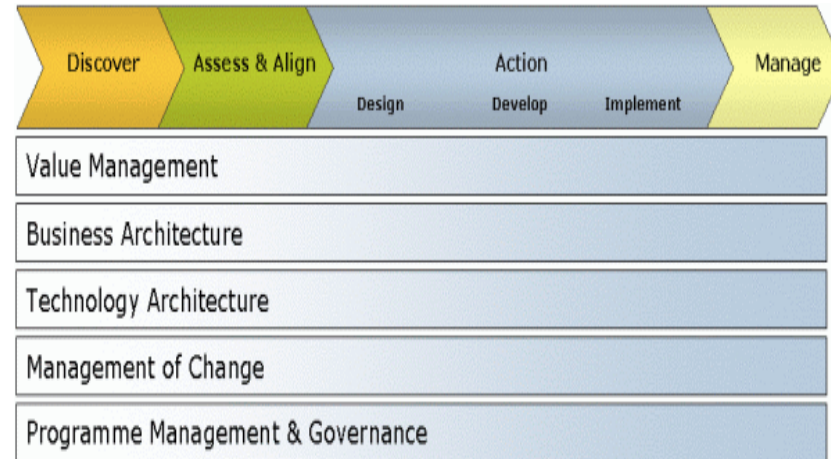
- May fail to assume or minimize “quality” role since it has been “purchased”
- Difficult to find and dedicate sufficient qualified staff
- Not fully independent
- Focus may be limited to just a few specific deliverables
- Assigned staff may not have positional authority to look critically at the agency’s performance

Systems Integrator

Are required to have internal quality assurance

Provides quality through:

- Project Management
 - Risk and issue identification and mediation
 - Change control procedures and administration
 - Check points at key milestones; tasks incorporated into the project plan
- Best Practices and Methodologies
 - Executive oversight of project team
 - Government Business Change Lifecycle
 - System Development Lifecycle
- Formal Quality Assurance Reviews
 - Reviews to determine if methodologies were followed
 - Review of all deliverables prior to submission
 - Quality Assurance



Limitations

- Not an external third party

Who Is Doing What?, continued

QA or IV&V vendor ... quality is their only responsibility and can include a wide range of quality management processes...

Software Quality Assurance

- SQA processes provide assurance that the software products and processes in the project life cycle conform to their specified requirements by planning, enacting, and performing a set of activities to provide adequate confidence that quality is being built into the software.

Software Verification & Validation

- A disciplined approach to assessing software products throughout the product life cycle.
- Strives to ensure that quality is built into the software and that the software satisfies user requirements

QA and IV&V

QA and IV&V vendor quality management processes...

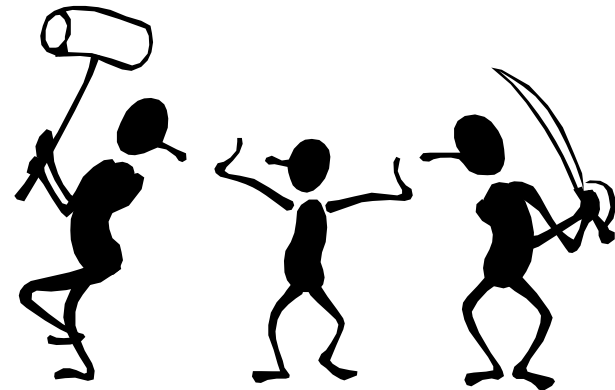
Reviews and Audits

- Management Reviews - to monitor progress, determine the status of plans and schedules, confirm requirements and their system allocation, or evaluate the effectiveness of management approaches used to achieve fitness for purpose
- Technical Reviews - is to evaluate a software product to determine its suitability for its intended use
- Inspections - to detect and identify software product anomalies
- Walk-through - to evaluate a software product. A walk-through may be conducted for the purpose of educating an audience regarding a software product.
- Audits - provide an independent evaluation of the conformance of software products and processes to applicable regulations, standards, guidelines, plans, and procedures

Factors that Contribute to Project Failures

Contributing Factors:

- Lack of senior management involvement and commitment
- Lack of governance and role definition
- Poor project management
- Unclear contracts and weak contract management
- Underestimation of resources needed – buyer and vendor
- Failure to define and document requirements (functional and non-functional)
- Failure to define expected deliverables including targets for quality review



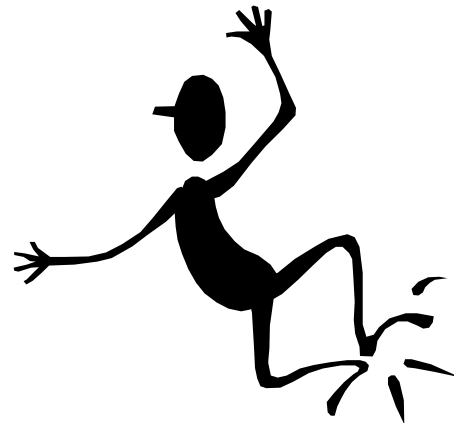
Achieving Success

Develop a strategy early in the Planning Cycle

- Roles and responsibilities
 - Identify primary targets for review – product and/or project processes
 - Define expected quality management processes to be used; e.g., verification, validation, audits, etc
- Experience
 - Completed projects of similar scope and size
 - Performed the same types of reviews
 - Provide key staff with the “right” skills and experience
 - Adept with proven methodologies, tools and techniques
- Incentives
 - Contribute to project success

Achieving Success Once Project Starts...

- Governance Model
 - Establish reporting line to high level executive not to the PMO
 - Maintain independence of this team
- Project planning
 - Allocate time and resource into the schedule
 - Align verification and Validation at appropriate intervals
- Shared goals and outcomes



Questions/Comments?

