Lecture 4: System Life cycle

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Case study:
Lifecycle of a Soda Can

https://prezi.com/zcm6mwrmlx2z/product-lifecycle-soda-can/

System Verification and Validation

- Engineering of the system
  - Conversion of users vision to an operable system
- System integrity
  - Confidence in the performance of the system
- Reproducibility of the system

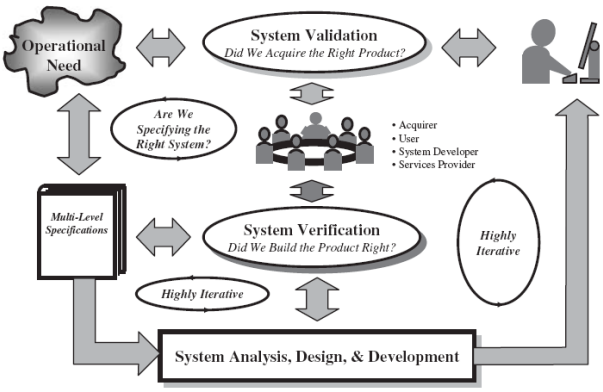

Figure 6.2 Verification & Validation (V&V) Concept Overview

Guiding Principles

Principle 1 System acceptability is determined user satisfaction; user satisfaction is determined by five User criteria:

1. Provide value—meaning *operational utility*.
2. Fit within the user's system and mission applications—meaning *operational suitability*.
3. Be available to conduct missions—meaning *operational availability*.
4. Accomplish performance objectives—meaning *operational effectiveness*.
5. Be affordable—meaning *cost effectiveness*.

Principle 6.2 Despite the most technically *innovative* and *elegant* SE design solutions, Users' *perceptions* of a system, product, or service constitute *reality*.

Stages in a System's Life

- *conceptualized*,
- *planned*,
- *organized*,
- *scheduled*,
- *estimated*,
- *procured*,
- *deployed*,
- *operated & supported*, and
- *disposed*

* = If applicable

Figure 7.1 The System/Product Life Cycle

System Life Cycle

- System Definition Phase
  1) mission opportunities, 2) threats, or 3) projected system capability and performance “gaps” or deficiencies.
- System Procurement Phase
- System Development Phase
- System Production Phase
- System Operations and Support (O&S) Phase
- System Disposal Phase

System Definition

1) mission opportunities,
2) threats, or
3) projected system capability
and performance “gaps” or deficiencies.

System Procurement Phase

1. Qualifying capable system, product, or service vendors.
2. Soliciting proposals from qualified vendors (offerors).
3. Selecting a preferred vendor (offeror).
4. Contracting with the vendor to develop the system, product, or service.

System development Phase

1. System Engineering Design
2. Component Procurement and Development
3. System Integration, Test, and Evaluation (SITE)
4. Authenticate System Baselines
5. Operational Test and Evaluation (OT&E)
Each stage has an *Entry and Exit* criteria

Developmental Configuration
System Verification test
System Performance test

System Operations and Support (O&S) Phase

- *Initial Operational Capability* (IOC)
- *Full Operational Capability* (FOC)
- *operational service life*
- Disposal

Multi-level Life Cycles

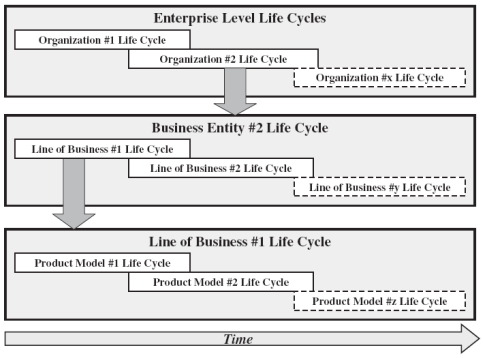

Figure 7.2 System Life Cycles within Life Cycles

Importance of a System Life Cycle to an SE

1. LOB the User is engaged in.
2. *Opportunities*, *problems*, or *issues* the User is chartered to address as part of its LOB. → *opportunity space*; specific targets as *targets of opportunity (TOO)*.
3. Missions the User performs to support the LOB. → *solution space*.
4. Capabilities are required to support *solution space* missions now and in the future.
5. Existing systems, products, or services the User employs to provide those capabilities.
6. Deficiencies or opportunities - exist in the current system, product, or service and how you and your organization can cost effectively eliminate those deficiencies with new technologies, systems, products, or services.

SE's role as a *problem solver-solution developer* becomes crucial.
The challenge is how do SEs work with Users and Acquirers to:
1. *Collaboratively* identify and partition the *opportunity space* into one or more *solution spaces*,
2. Technically *bound and specify* the *solution space* in terms of capability and performance requirements that are legally sufficient to procure systems, products, and services,
3. *Verify* that the new system complies with those requirements,
4. *Validate* that the system developed satisfies the User's original operational needs?

System Interfaces

- **Objective 1:** Physically link or bind two or more system elements or entities.
- **Objective 2:** Adapt one or more incompatible system elements or entities.
- **Objective 3:** Buffer the effects of incompatible system elements.
- **Objective 4:** Leverage human capabilities.
- **Objective 5:** Restrain system element or its usage.

Interoperability—The Ultimate Interface Challenge

Types of Interfaces

- Active Interfaces
- Passive Interfaces
- Combined Passive/Active Interfaces

- Logical
- Physical – Mech, Elect, Optical, Acoustic, Natural, Chemical, Biological, etc

- **Caution**: Engineers have a strong tendency to jump to defining the *physical interface* BEFORE anyone has decided WHAT the interface is to accomplish.

Understanding Interfaces

- **What Constitutes an Interface Failure?**
- **Consequences of an Interface Failure**
- **Interface Failures**
  - 1) *disruption*, 2) *intrusion*, 3) *stress loading*, and 4) *physical destruction*.
- **Interface Vulnerabilities**
- **Interface Latency**
- **Interface Failure Mitigation and Prevention**