Software Product Maturity in SIS Source Selection

Thomas Cole, The Voyage of Life, 1842, National Gallery of Art, Washington, DC

Richard Turner, **OUSD(AT&L)/DS/SIS (George Washington University)**

Acquisition of SIS Conference, January 28, 2004

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The Requirement

- **Section 804 of the '3 Defense Authorization Act requires that OSD**

  "assist MILDEPs by ensuring criteria applicable to selection of sources provides added emphasis on
  - ***Past performance of potential sources***
  - ***<u>Maturity of software products</u> offered by potential sources"***

Defining SW Product Maturity

- No standard definitions/scales
- Not Software Technology Readiness Levels (TRL)
  - Maturity addresses a specific product
  - TRL addresses underlying technology
- Highly dependent on environment and application context
- Many dimensions of maturity

The Approach

- Gathered a group of experts to:
- Review existing approaches
- Develop characteristics and information sources
- Develop guidance for source selection
- Develop RFQ/RFP language

Focus on Source Selection

- General maturity problem is extremely difficult
  - Limited time and resources
  - Need for significant effort to work on development-based maturity
  - Some promising work (MDA, AF) but untried
- Source selection was the Congressional emphasis
- Source selection bounds the problem to measuring existing, working software (e.g. COTS, GOTS, legacy)

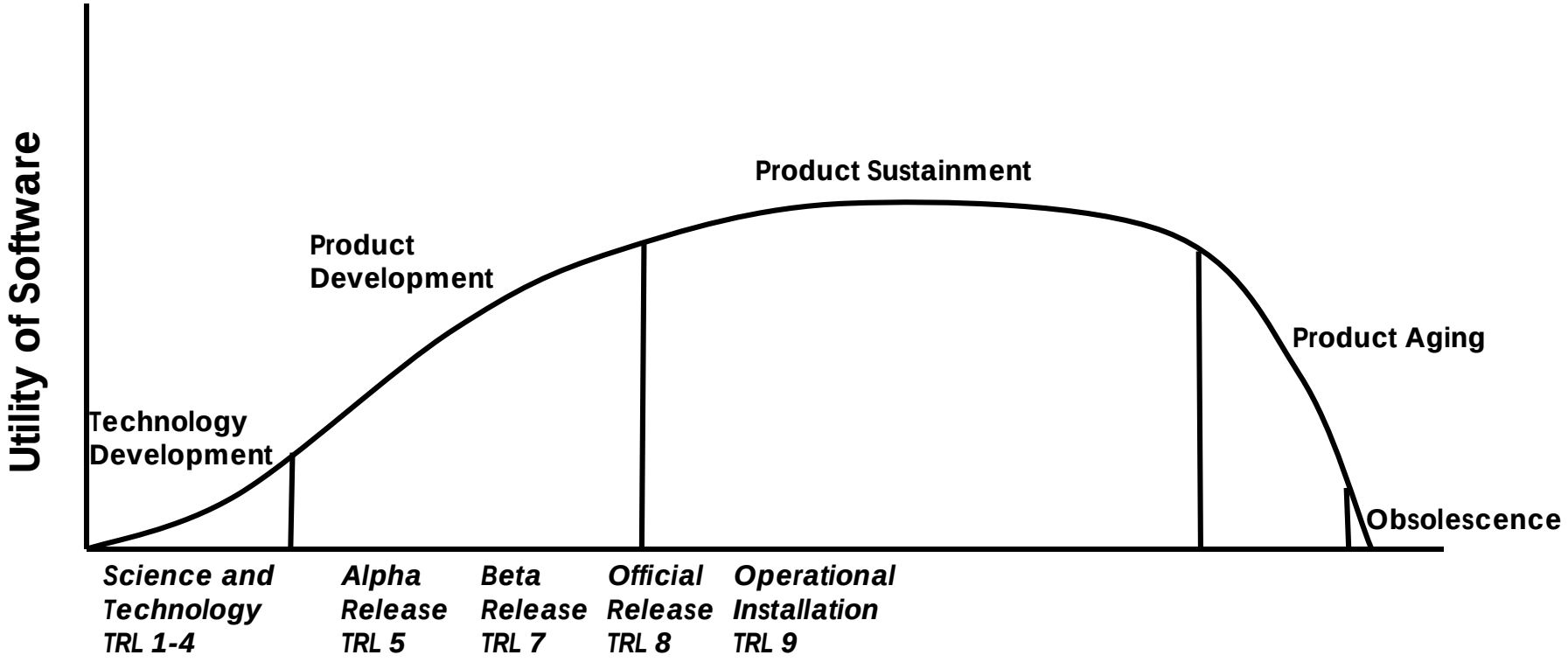
Software in Source Selection

- Many different kinds of source selections
  - Greenfield vs. Upgrade
  - Traditional business-process IT system implementation vs. Command and Control or embedded software
- Different kinds of software in programs
  - Only software that exists has determinable maturity
  - Aggregations of existent and non-existent software are common
- Software doesn't exist (Not measurable)
  - Developmental software
- Software exists (Measurable)
  - COTS
  - GOTS
  - Prototype
  - NDI/Legacy
  - Experimental

Observations

- **Software product maturity is value-neutral**
  - **Mature software not better than immature software in some instances; must be interpreted in light of risk**
    - ***Web-pages***
    - ***Proofs of concept***
- **Software can become senile**
  - **Collective impact of changes overwhelm the architecture**
  - **Environment changes**
  - **Utility degrades**
- **Level of understanding of context directly impacts risk and interpretation of maturity**
  - **Poorly understood application environment or target makes risk assessment difficult**

Notional SW Maturity Lifecycle



Candidate Characteristics

- Represent areas/dimensions affecting product maturity
- Must be considered both separately and as a group
- Weight of each characteristic may differ in any particular situation
- Must be evaluated against intended purpose

Candidate Characteristics

- Understanding of the potential for latent defects within the product
- Understanding of the domain of product applicability
- Predictability of product behavior (within well-defined parameters)
- Product stability
- Product supportability
- Product pedigree

Potential for Latent Defects

- Addresses the risk of undetected bugs
- Possible measures or information sources
  - Test regimen
  - Test coverage
  - History and trends of types/frequency of faults
  - Certifications and test packages

Domain of Product Applicability

- **Addresses risk of suitability of the product to the intended task**
- **Possible measures or information sources**
  - **Compatibility measures**
  - **Robustness (adaptability, scalability, portability, security, safety, integrity, etc.)**
  - **Availability and quality of design and maintenance documents**
  - **Certifications and test packages**
  - **Specific operational environment(s)**
  - **Limitations on product use**

Predictability of Product Behavior

- Addresses the risks associated with suitability of operational and functional quality
- Possible measures or information sources
  - Test regimen
  - Test coverage
  - History and trends of types/frequency of faults
  - MTBF
  - Availability
  - Recovery from faults
  - Compatibility measures
  - Accuracy
  - Completeness of features/functions definition

Product Stability

- **Addresses the risks associated with historic volatility that could re-emerge**
- **Possible measures or information sources**
  - **Release history and frequency**
  - **History and trends of types/frequency of faults**
  - **Obsolescence potential**
  - **Software aging characteristics**

Product Supportability

- **Addresses the risks associated with continuing suitability of the product**
- **Possible measures or information sources**
  - **Availability of training**
  - **Availability of vendor/developer/consultant support**
  - **Recovery from faults**
  - **Mean time between failure**
  - **Availability and quality of design/maintenance documents**
  - **Dependency on events out of product control**
  - **Life expectancy**
    - ***First shipment date***
    - ***End-of-life plans***
    - ***Market share***
    - ***Market trend***
    - ***Rights granted on discontinuation of product***

Product Pedigree

- Addresses the risks associated with the developers/sources for the product
- Possible measures or information sources
  - Installed base
  - Market share
  - Market trend
  - Maturity of underlying software technology(ies)
  - Customer references
  - Confidence in adherence to standards
  - History of upward compatibility

Additional Factors

- **Control over configuration/evolution**
  - **Does the acquisition need to determine when or how the product will change and the type of features that may be added or dropped?**
- **Predictability of evolution and obsolescence**
  - **Does the acquisition have a clear understanding of the direction and speed of product evolution and the time remaining in the product's likely supported life?**
- **Schedule**
  - **Does the acquisition understand when the product will be available or updated (such as availability of NDI or required product functionality)?**
- **Costs**
  - **Does the acquisition understand the full costs associated with the product, such as licensing, refresh, maintenance**

Additional Factors - 2

- **Architecture**
  - **Will the product require significant changes to an existing software architecture?**
- **Operational Context**
  - **Will the product fit the current or envisioned modes of operation, operational environment (e.g. platform) and process context?**
- **Fitness for use**
  - **Do the product characteristics meet the needs of the envisioned use (such as security, availability, and scalability)?**
- **Modification of product**
  - **Will there need to be modifications to the product that will prevent normal developer/vendor refresh?**

Additional Factors - 3

- **Release synchronization**
  - **Will the vendor release schedule impact operations?**
- **Pedigree of product developer**
  - **Does the acquisition have confidence in the developer/vendor (including disclosure of subcontractors)?**

Context Impacts Risk

Summary

- **Maturity can only be measured on existing software**
  - **For source selection this means COTS, GOTS, NDI, prototype, experimental**
- **Initial set of software product maturity characteristics defined**
- **Maturity evaluation complex - dependent on context and related factors**
- **Next steps**
  - **Complete draft language for OSD Guidebook**
  - **Refine characteristics and measures**
  - **Continue to evaluate development maturity concepts**

Questions?

- **Contact Information**
  - **Rich.turner.ctr@osd.mil**
  - **703.602.0851 x 124**