Combat Training Center Objective Instrumentation System (CTC-OIS)

LTI Product Line Engineering

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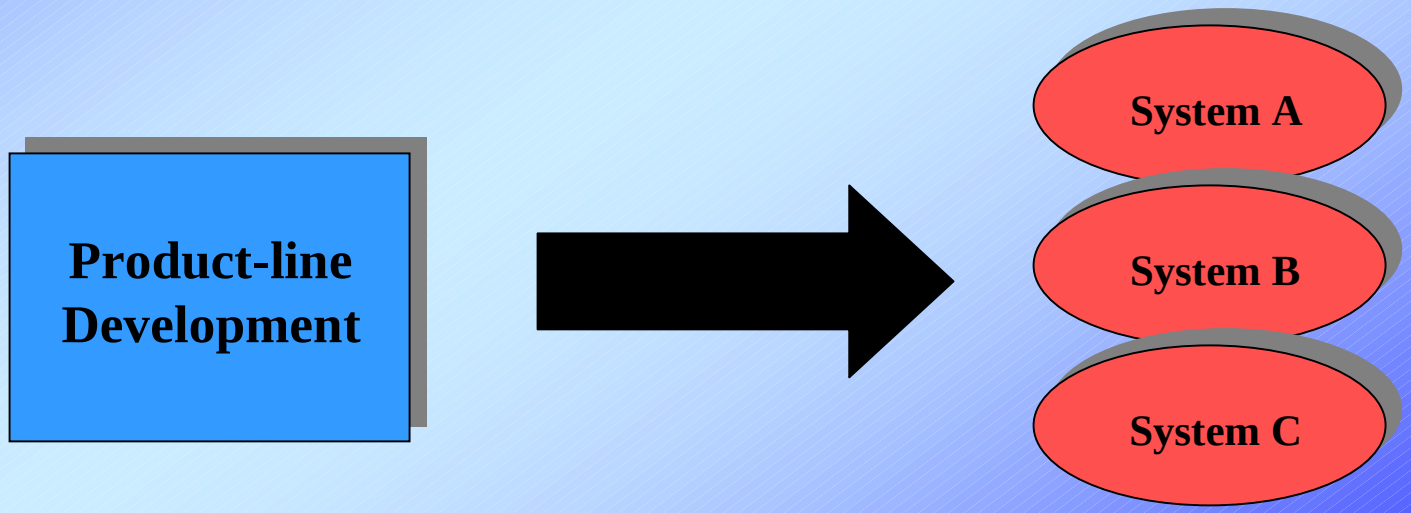
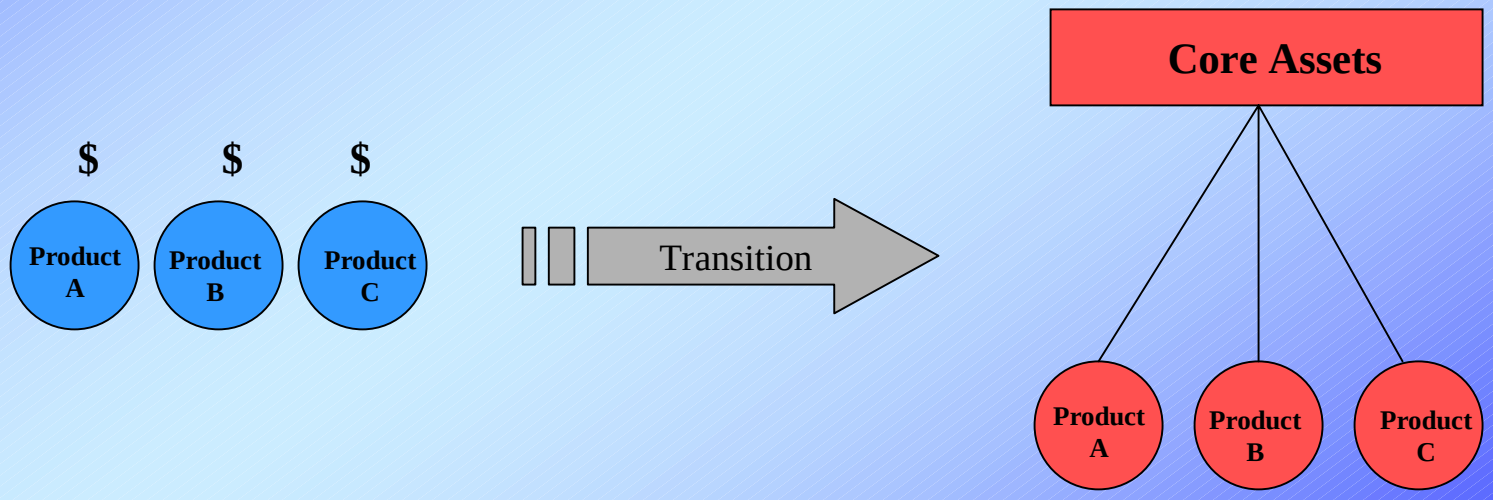
What is a Product-Line?

A group of products sharing a common, managed set of features that satisfy specific needs of a selected market or mission.



Why Product-lines?

Developing multiple software products one product at a time is no longer economically viable if a multi-project business case exist

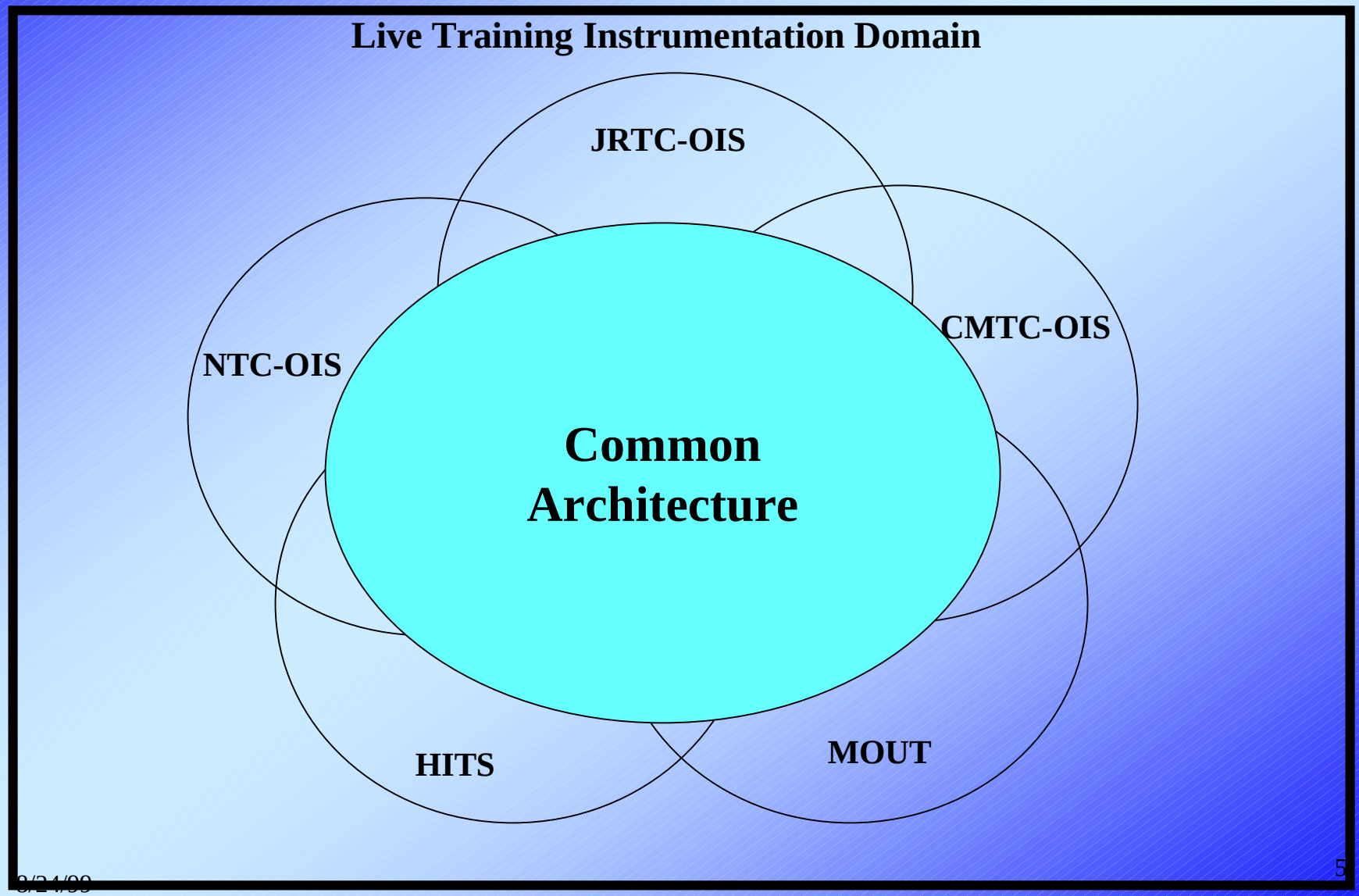


Why an LTI Product-Line?

"Faster, Cheaper, Better"

- Decrease the cost of follow-on training systems
- Decrease the cost of supportability, maintenance and other life-cycle cost
- Shorten the time to market systems
- Reduce technical risk
- Improve trainer system quality

LTI Product-line



Product-line Engineering

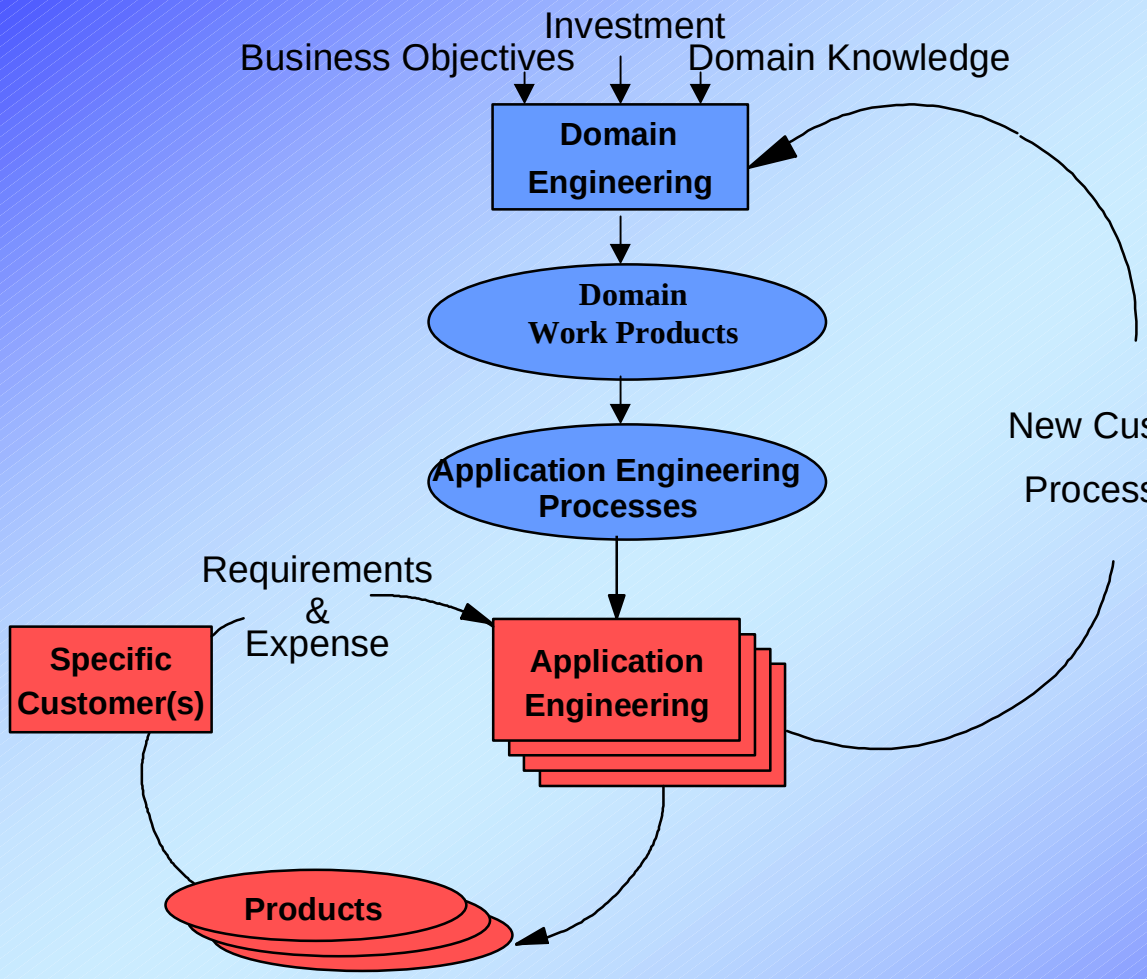
Domain Engineering

An iterative process for the design and development of (1) a product family, and (2) an application engineering process for producing members of the family.

Application Engineering

An interactive process for the development of a product that satisfies specified customer requirements within the bounds of the domain

Two Life-Cycle Model

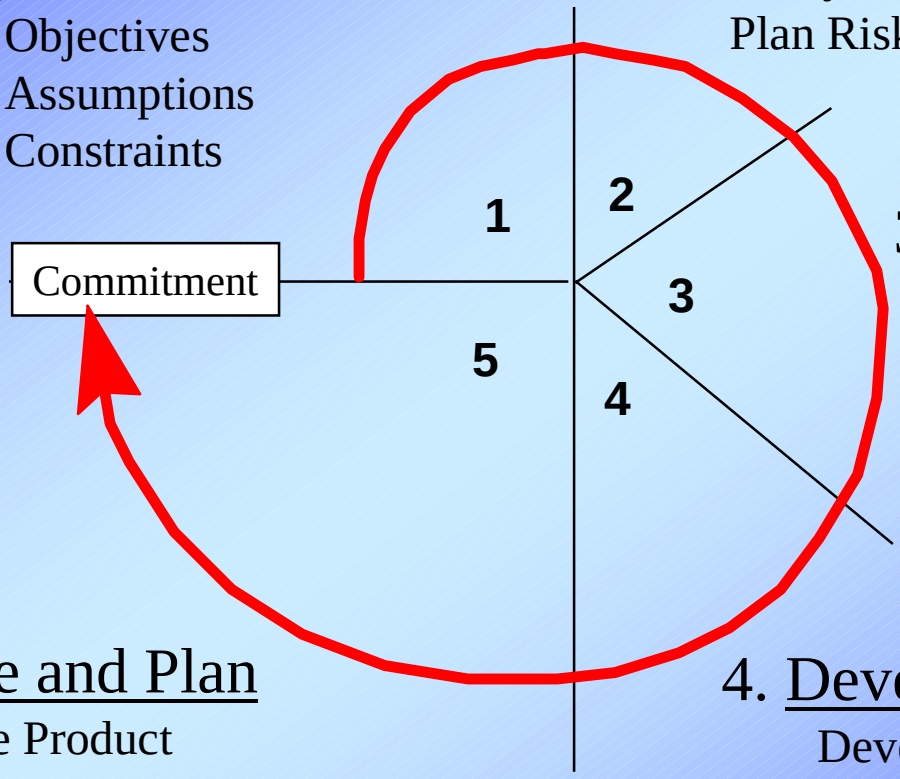


- Process driven
- Allows for partial or intermediate solutions
- Cyclic in nature
- Focus on quality of both process and product

Evolutionary Approach

1. Understand Context
- Identify Stake Holders
- Define Objectives
- Define Assumptions
- Define Constraints

2. Analyze Risks
- Identify Risks
- Analyze Impact
- Plan Risk Avoidance



3. Plan Development
- Avert Risks
- Select Development Strategy
- Plan Development

4. Develop Product
- Develop
- Monitor
- Verify and Validate

5. Manage and Plan
- Baseline Product
- Review Progress
- Update Plans and Process

Domain Engineering

- **Domain Management**
- **Domain Definition**
- **Domain Analysis**
- **Domain Design**
- **Domain Implementation**
- **Domain V&V**

Domain Engineering Processes

- DSSA Engineering Process Guidelines
- Domain Analysis Design Process (DADP)
- Feature-Oriented Domain Analysis (FODA)
- Reuse-driven Software Process (RSP)
- Organizational Domain Modeling

Domain Management

- Owner of the Domain Management Plan (DMP)
  - defines the domain objectives (business-case objectives)
  - scopes the domain
  - defines the organizational structure
  - identifies the resources necessary to achieve the objectives
- Monitors the progress throughout the domain engineering process

Domain Definition

- Refines the scope of the domain
- Identifies the commonalities and variabilities within the domain
- Identifies the interactions with external domains
- Determines whether the planned development is economically viable

Domain Analysis

- The process of identifying, collecting, organizing and representing the relevant information in a domain
- A domain model is the work product of the process
- Evaluation of legacy system assets

Domain Design

- Specifies the design for the product family
- Focuses on “how” the functionality will operate
- A Domain Specific Software Architecture (DSSA) is the work product of the process

DSSA Specification

- DSSA is the software structure used to build systems within a product line
  - representation of software components within the domain
  - relationships between the components
  - externally visible properties
  - guideline for the use and evolution of the DSSA

Desirable Attributes of a DSSA

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- Understandability
- Usability
- Complexity
- Adaptability
- Configurability
- Extensibility
- Composability
- Interoperability
- Scalability
- Compatibility
- Predictability
- Quality
- Saleability

1. Domain Specific Software Architecture Engineering Process Guidelines, ADAGE-IBM-92-02B, Will Tracz

Domain Implementation

- The creation of an application engineering process
- The creation of reusable assets and reuse of software assets
  - reuse can be opportunistic or highly systematic

Domain Implementation
(Reuse types)

- Requirements
- Designs
- Code
- Data
- Test cases
- Documentation
- Processes
- COTS

Motives for Reuse [1]

Productivity
▲ 14%-68%

Schedule
▼ 25%

Quality
▲ 20%-35%

Integration time
▼ 50%

Customer complaints
▼ 20%

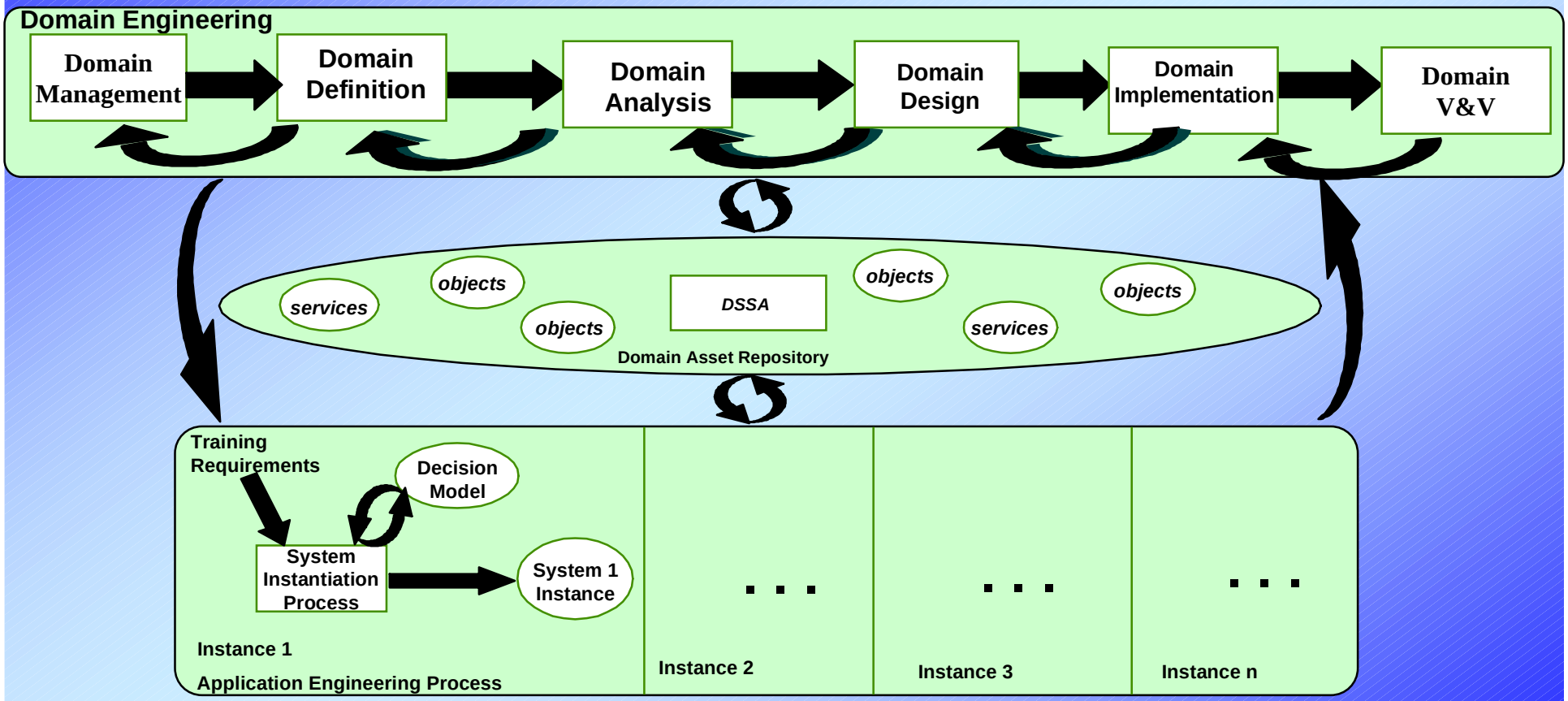
ROI
400%

1. Statistics compiled from multiple studies at 1993 Reuse Education Workshop, West Virginia University

Domain V&V

- Validation and Verification that the work products of domain are correct

Two Life-Cycle Model



Challenges to Product-line Engineering

- **Reform of the current trainer acquisition process**
  - Change the development focus from a single product to a family of products
- **Roles and responsibilities of a two life-cycle organization do not match that of a single life-cycle organization**
  - Need to manage both horizontally and vertically
- **Government organizations typically use a near-term "cost reduction" approach instead of a long-term "cost avoidance" approach**
  - Establish a clearly defined funding model
- **Development and management of a viable domain requires that the owners of the domain invest resources and commit to its success**
  - Demonstrate incremental success throughout the process

STRICOM's Domain Objectives

- **Reduced cost of follow-on systems within the Live Training Instrumentation domain**
- **Reduce maintenance and other life-cycle cost**
- **Improve interoperability**

"An architecture centric approach is the essential for the achievement of these objectives"

Conclusion

STRICOM will pursue a product-line approach to developing LTI!

but ...

- **The Government needs to finalize the scope of the domain**
- **The Government needs to define the domain objectives**
- **The Government must invest in the domain**
- **The Government must own and manage the domain**
- **The Government needs to work closely with the domain developer in order to achieve our objectives**