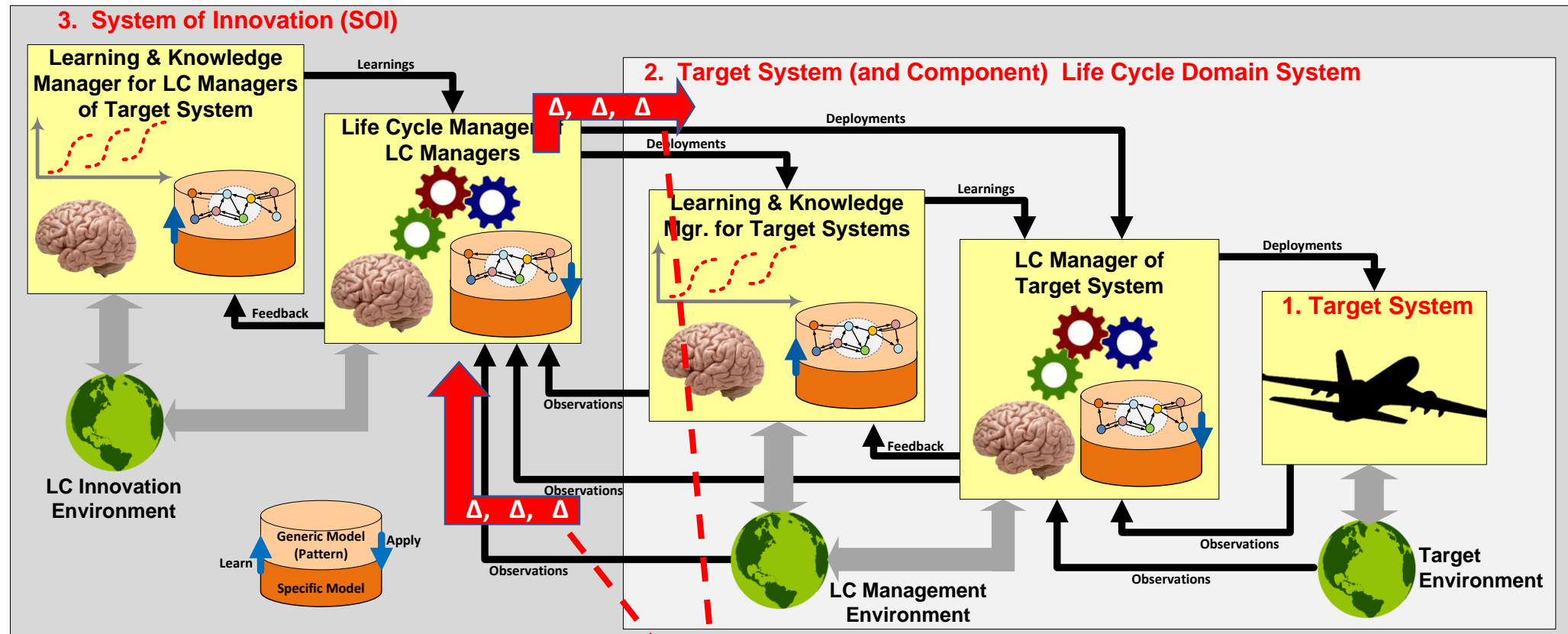


# Attachment I: Example Use of ASELCM Pattern for Analyzing Current State, Describing Future State, and Constructing Incremental Release Roadmap to Future

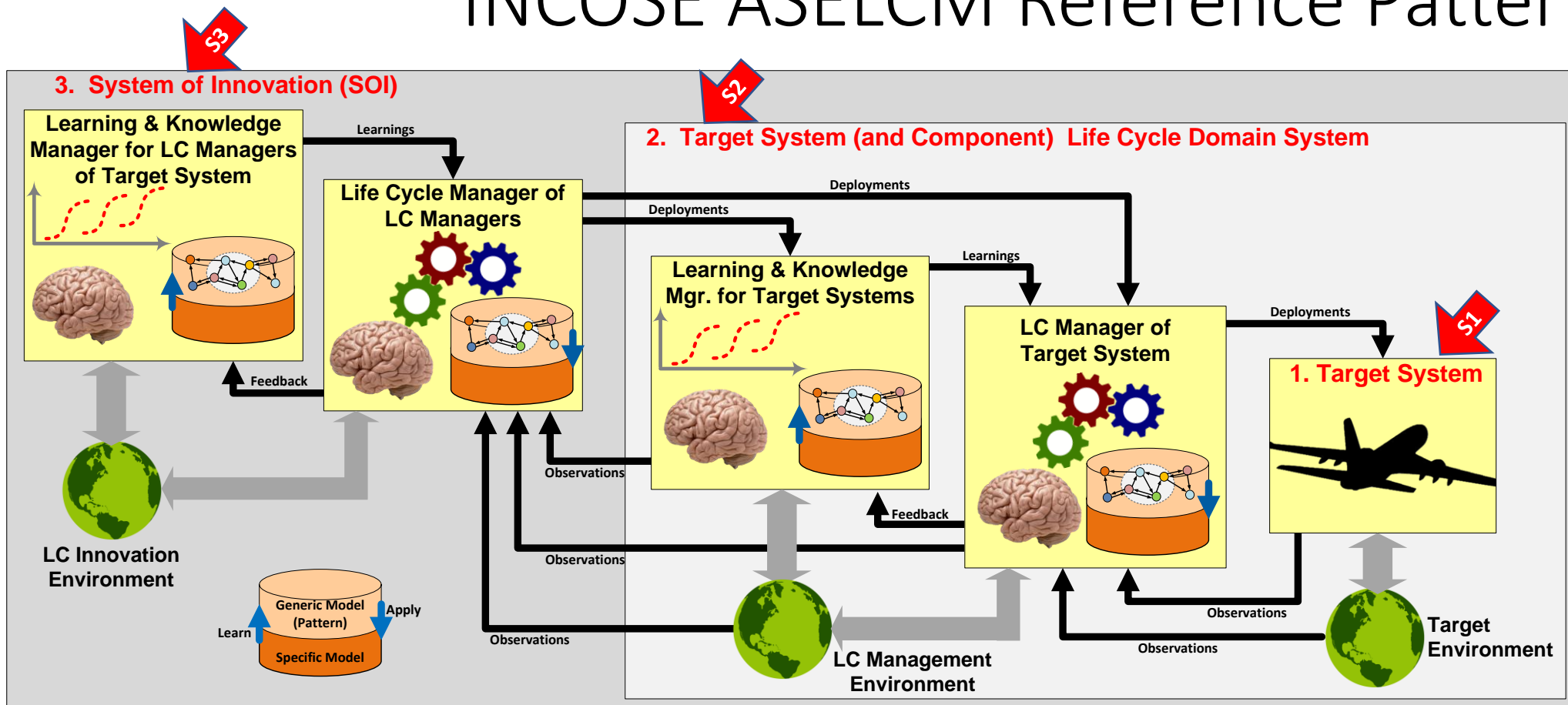


"Deltas"

# Purpose and scope

- The following material provides an example use of a neutral set of structures and forms for representing capabilities of systems of engineering, innovation, and life cycle management for system products and processes of all types.
- It is based on use of the INCOSE ASELCM (Agile Systems Engineering Life Cycle Management) Pattern, including in particular use of it to describe:
  - **Stakeholder Features** (Missions, Capabilities, Objectives, Performance Measures) of ASELCM Systems 2 and 3;
  - **Logical Roles** of ASELCM Systems 2 and 3, whose performance deliver the above Stakeholder Features;
  - **Physical Architecture and Design Components** of ASELCM Systems 2 and 3, which are allocated the responsibility of performance of those Logical Roles.
- To simplify analysis and planning of future **improvements** to Systems 2 and 3, this approach focuses of changes (“deltas”, shown as “ $\Delta$ ”, ) in the above entities.
- This example is limited to the high level planning that **integrates an otherwise disparate set of improvements into a single systemic plan that can readily be shared** across an organization and teams of individuals.

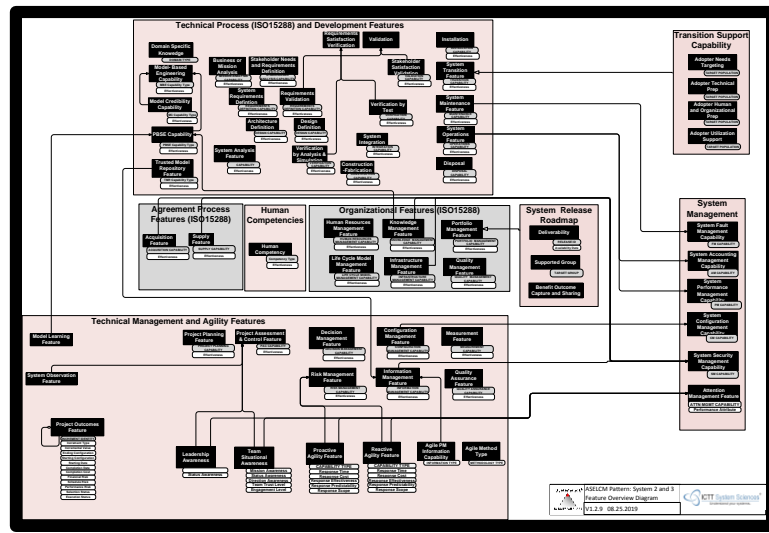
# INCOSE ASELCM Reference Pattern



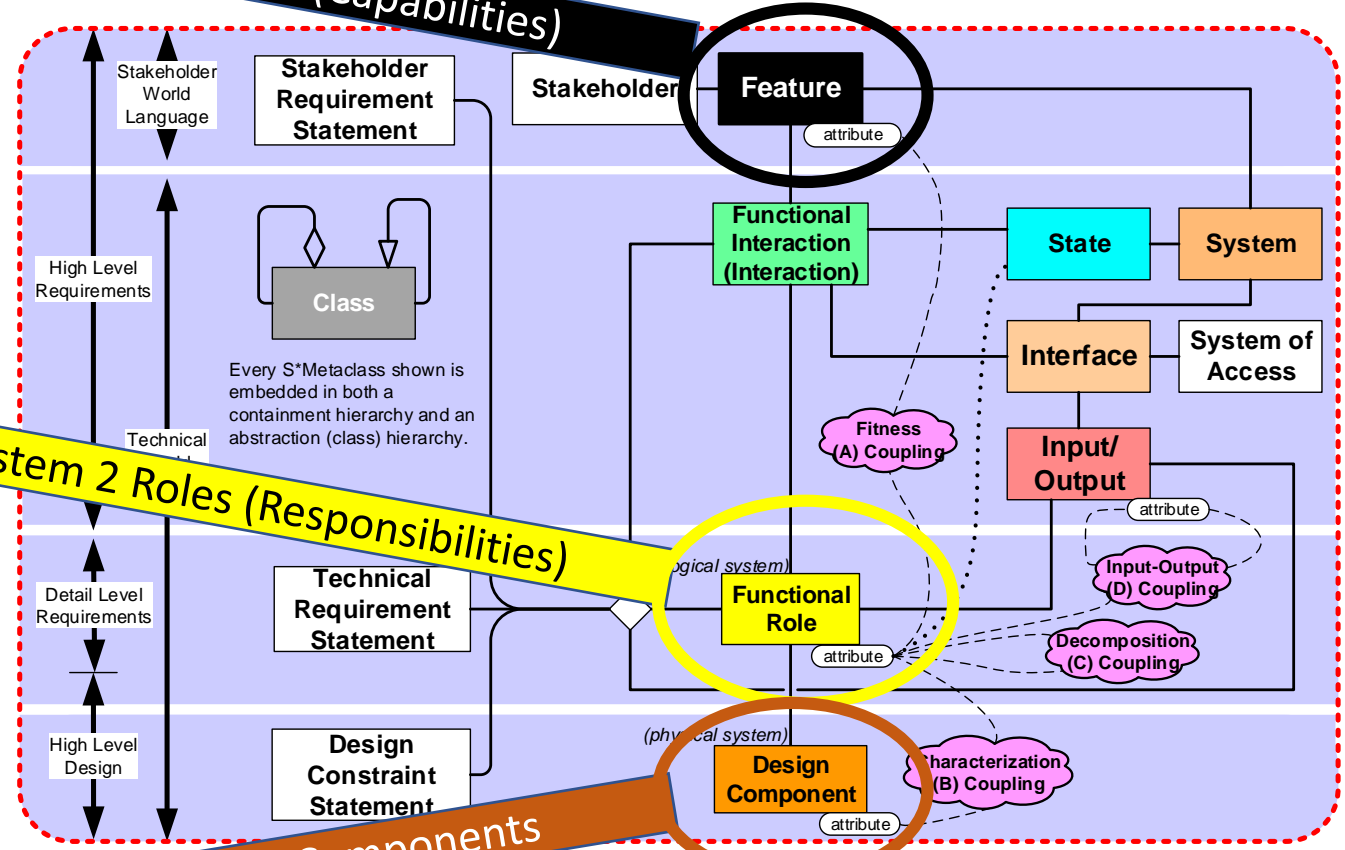
- **System 1 (S1)**: The engineered product.
- **System 2 (S2)**: The environment of S1, including the systems responsible for engineering and other life cycle management of S1; responsible for observing and learning about System 1.
- **System 3 (S3)**: The environment of S2, including the systems responsible for engineering and other life cycle management of S2; responsible for observing and learning about System 2.



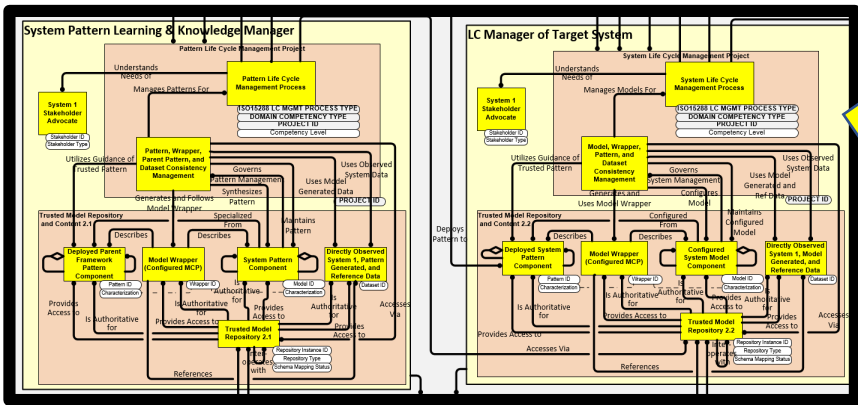
# System 2 is Modeled Using the S\* Metamodel



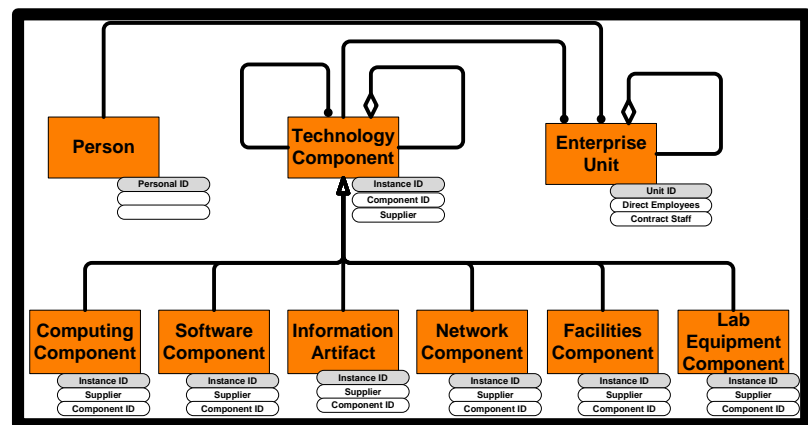
System 2 Features (Capabilities)



System 2 Roles (Responsibilities)

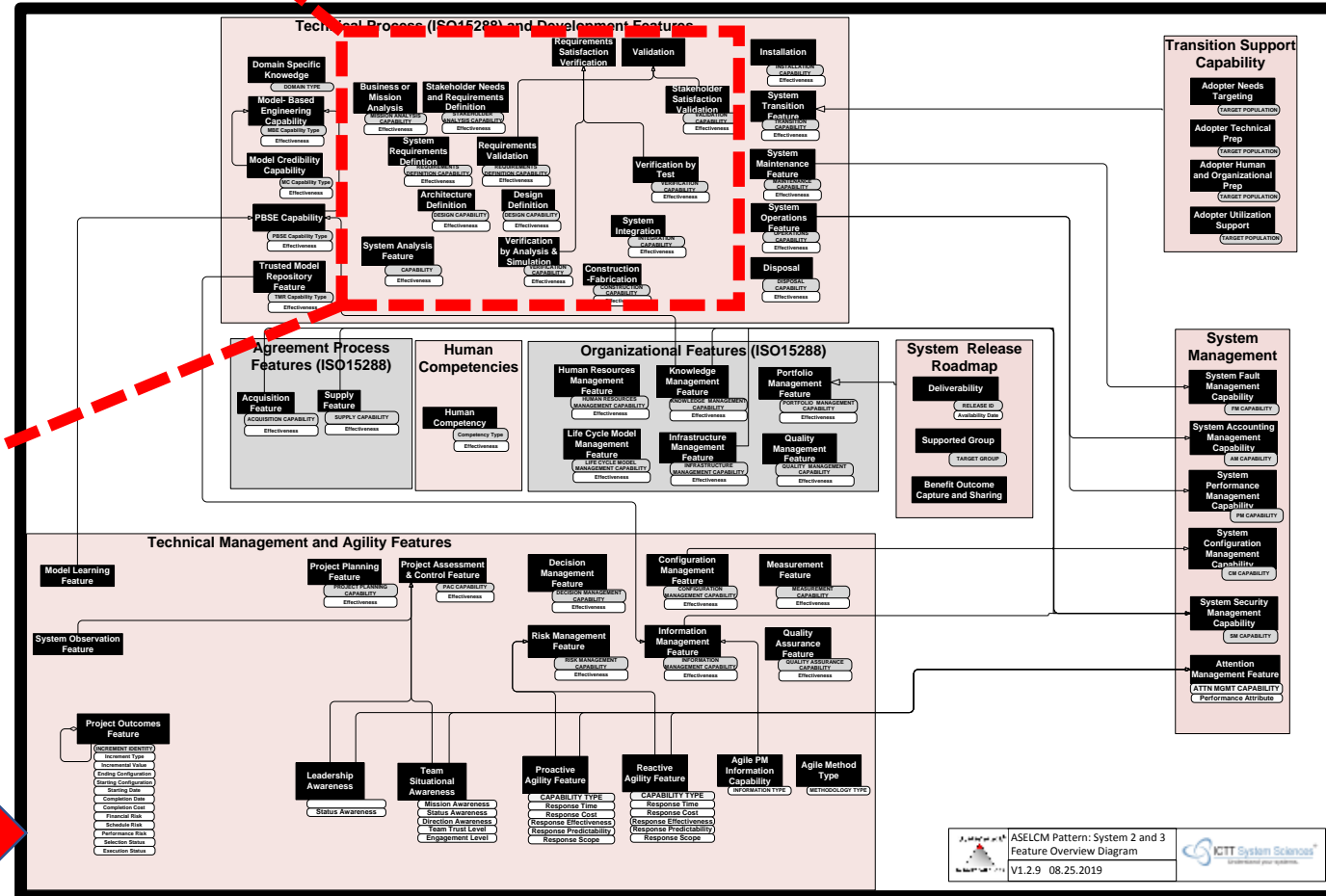
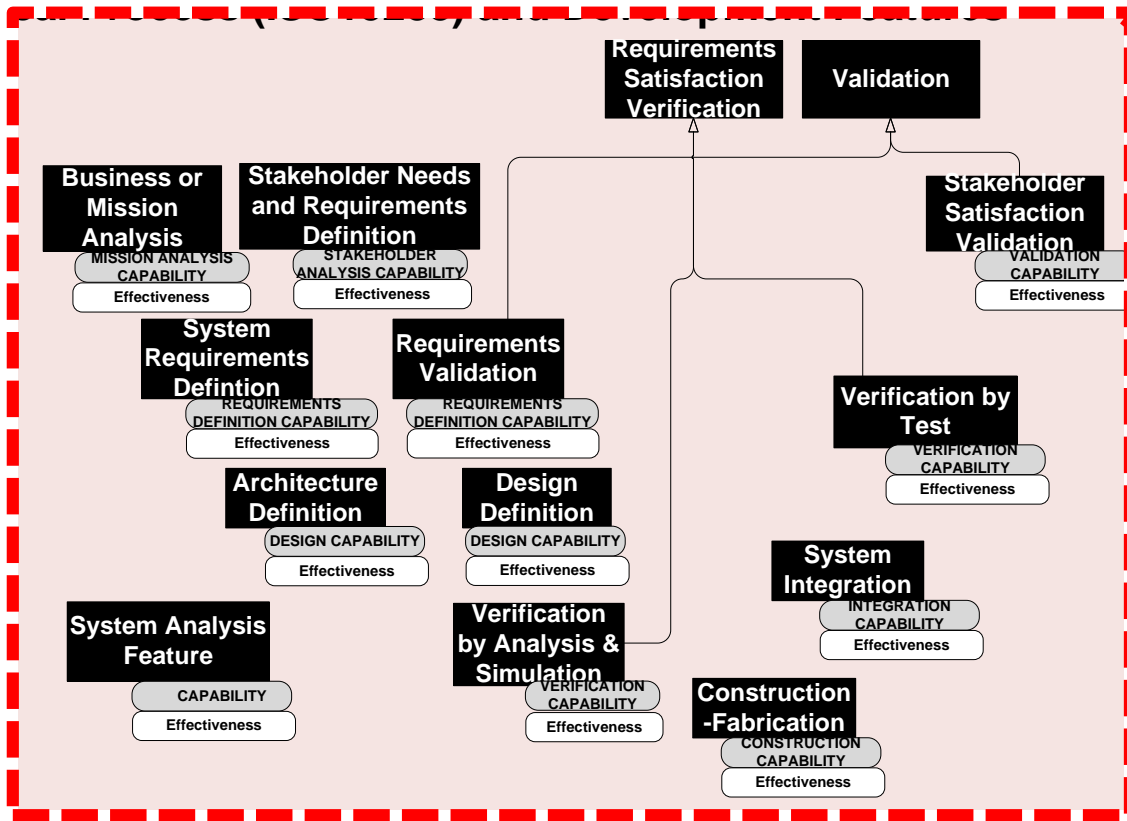


System 2 Design Components



Metamodel informal summary pedagogical diagram (formal S\*Metamodel includes additional details.)

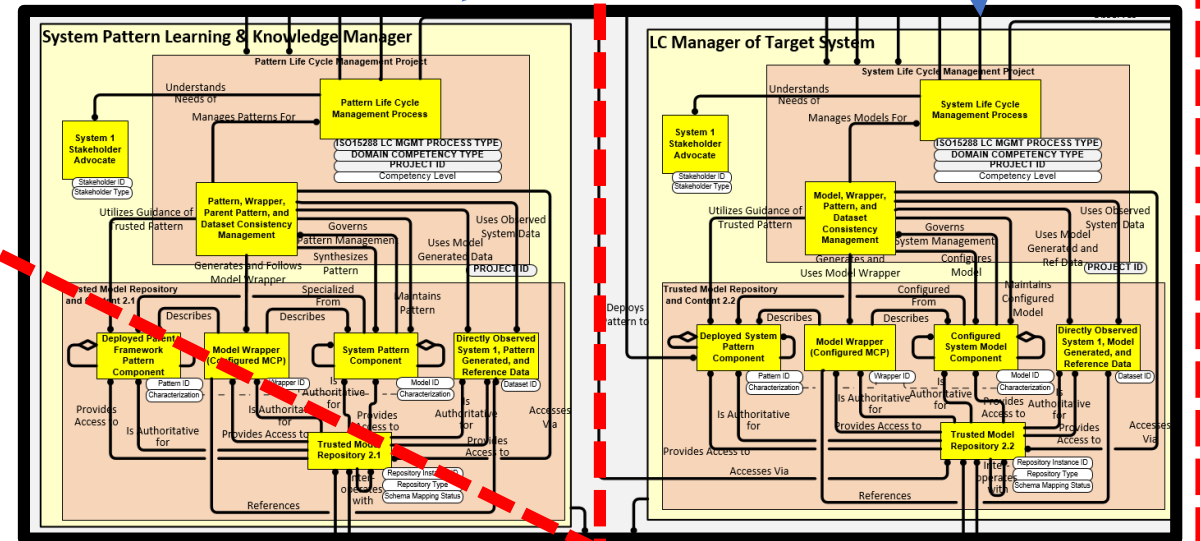
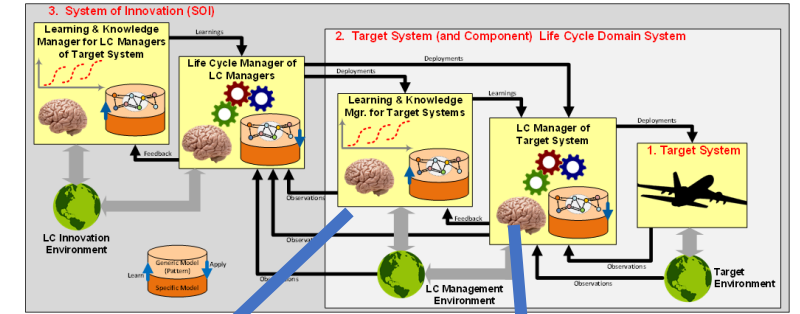
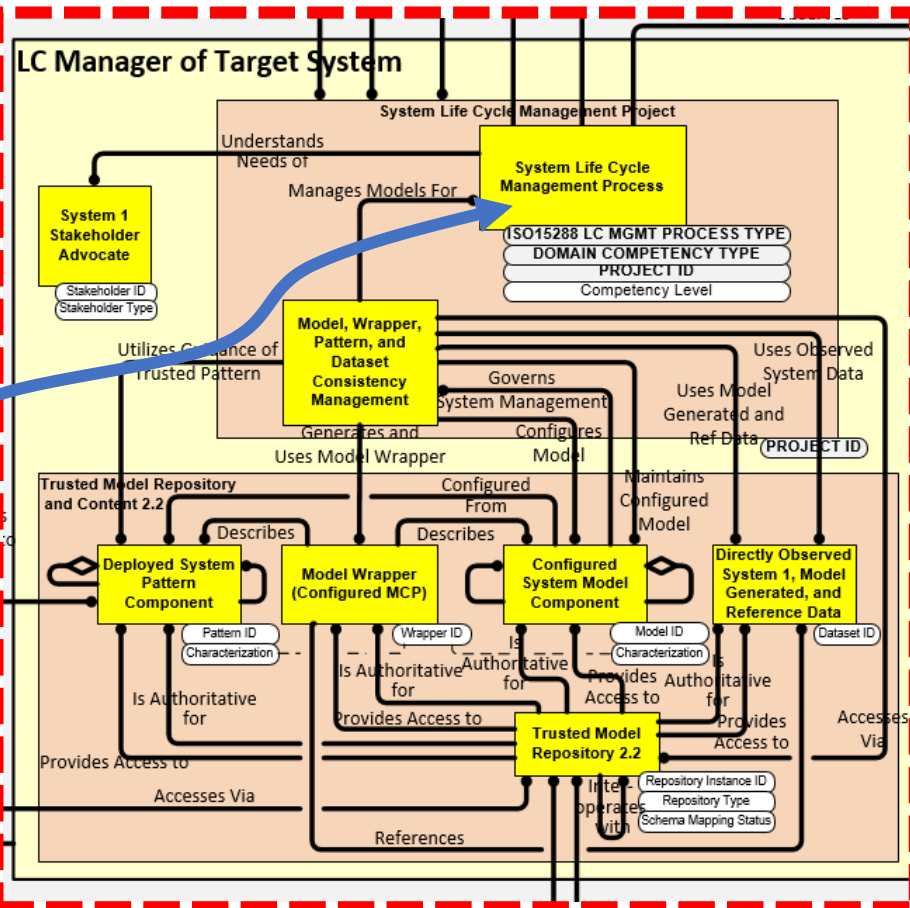
# The planning artifacts: System 2 Features (Capabilities) in Features Overview Diagram



The ASELCM Ecosystem Reference Pattern provides a standard set of System 2 Features consistent with ISO 15288 and other generic references:

- You can use these or supply others if you wish—but they are usually enough.

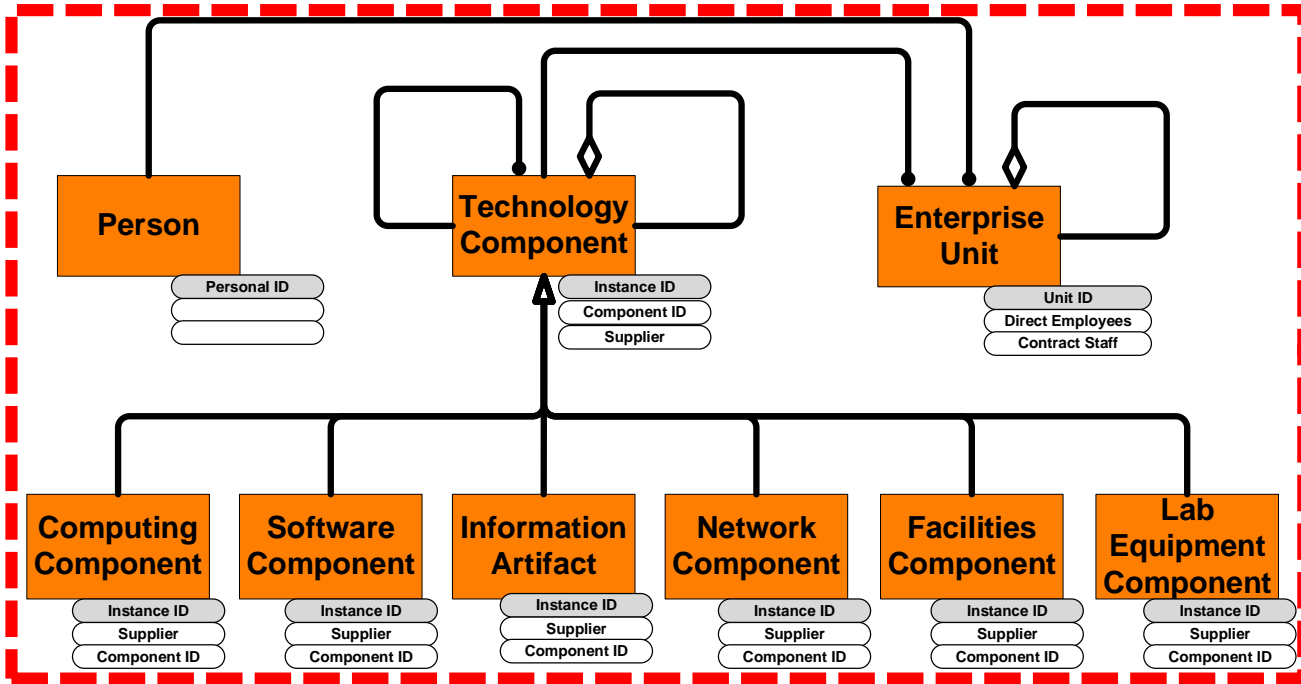
# The planning artifacts: System 2 Roles (Responsibilities) in Logical Architecture Diagram



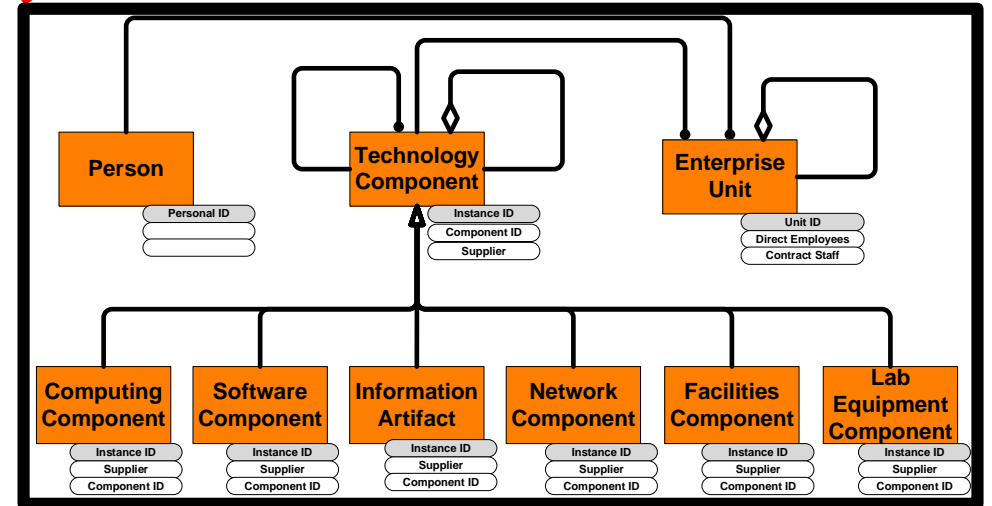
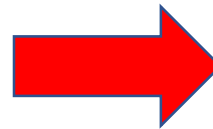
The ASELCM Ecosystem Reference Pattern provides a standard set of System 2 Roles decomposing the top level ASELCM Model:

- Instances of a key block in this diagram map directly to each of the business processes of the ISO15288 Vee Model, or the Rolls-Royce "O" Model.

# The planning artifacts: System 2 Design Components in Physical Architecture Diagram



The ASELCM Ecosystem Reference Pattern provides a standard set of System 2 Design Components consistent with the human and facilities components used to realize a System 2.



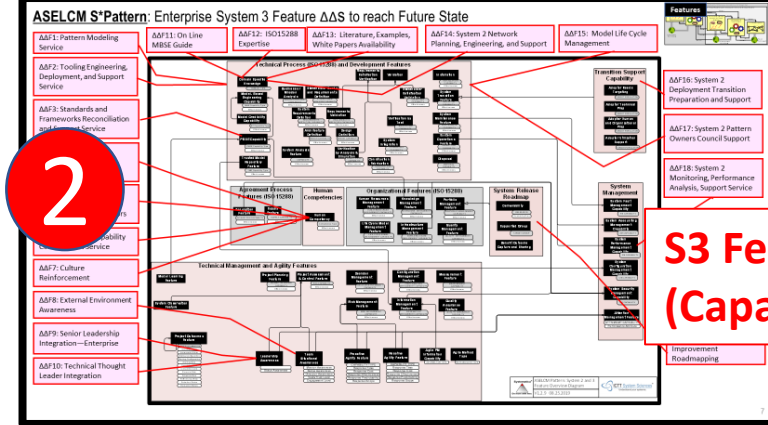


Analysis and planning procedure illustrated by this example (numbered red circles later pages)

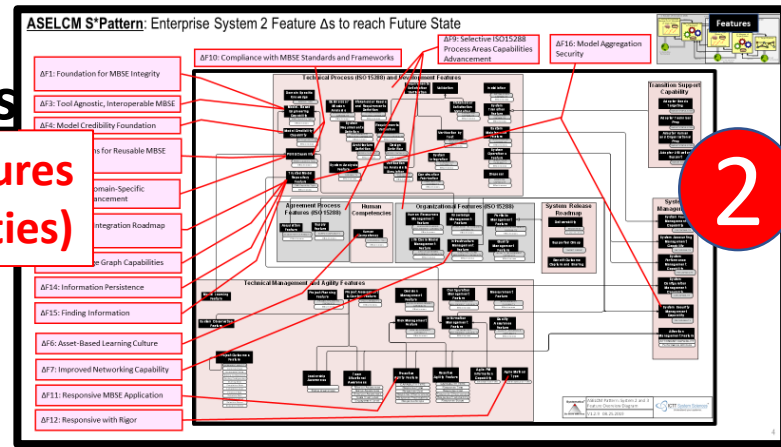


1. Learn about the ASELCM Pattern (see the above reference to start); refer to: [https://www.omgwiki.org/MBSE/doku.php?id=mbse:patterns:agile\\_systems\\_engineering\\_life\\_cycle\\_management\\_asebcm\\_discovery\\_project\\_with\\_ase\\_wg](https://www.omgwiki.org/MBSE/doku.php?id=mbse:patterns:agile_systems_engineering_life_cycle_management_asebcm_discovery_project_with_ase_wg)
2. Mark up the ASELCM Stakeholder Features to represent desired shift(s) (deltas) in the current **capabilities** of an existing organization;
3. Mark up the ASELCM Roles to represent implied deltas to those **roles** necessary to deliver the deltas to the ASELCM Features;
4. Mark up the ASELCM Physical Architecture/**Design Components** necessary to deliver the performance deltas of the ASELCM Roles;
5. Allocate the deltas identified above to a series of **capability releases over calendar time**, as the basis of planning and implementation. (This is very similar to an Agile Release Train.)
6. Perform 2-4 first for System 2. If System 3 is not already capable of causing those changes to System 2, then perform 2-4 to identify deltas to System 3.
7. In the following pages, the examples of “delta mark ups” listed above as shown as red overlays of boxes and lines, on top of the related ASELCM diagrams of Features, Roles, and Design Components. Your project may require different deltas!

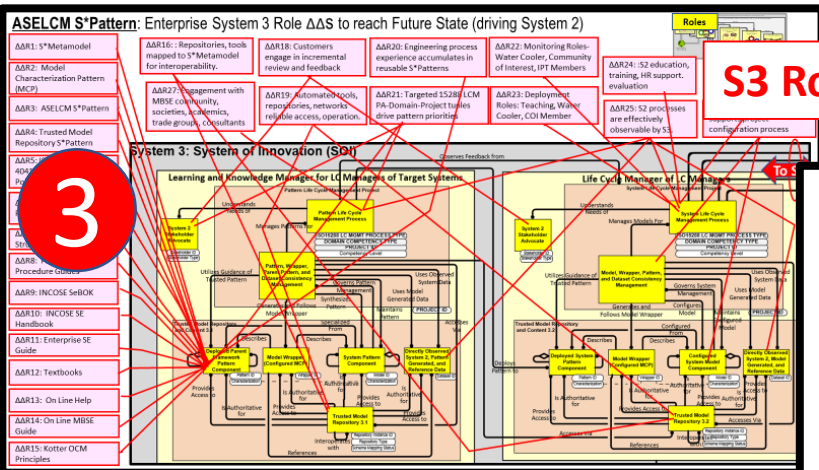
# Examples of "Mark Ups" Showing Intended "Deltas" on Three Artifacts



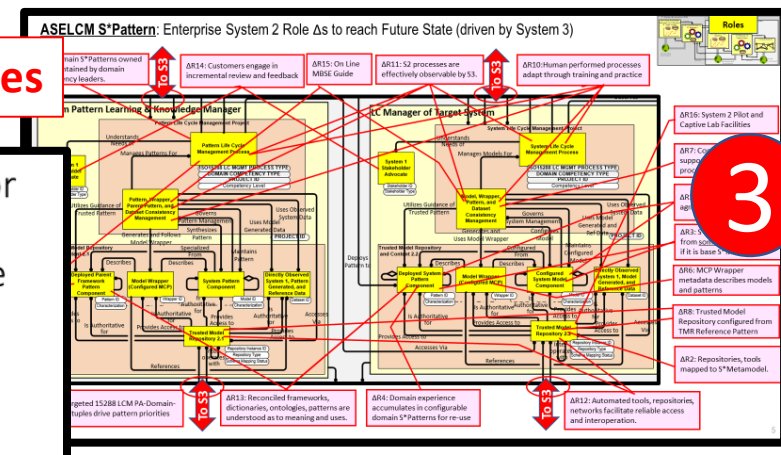
**S3 Features (Capabilities)**



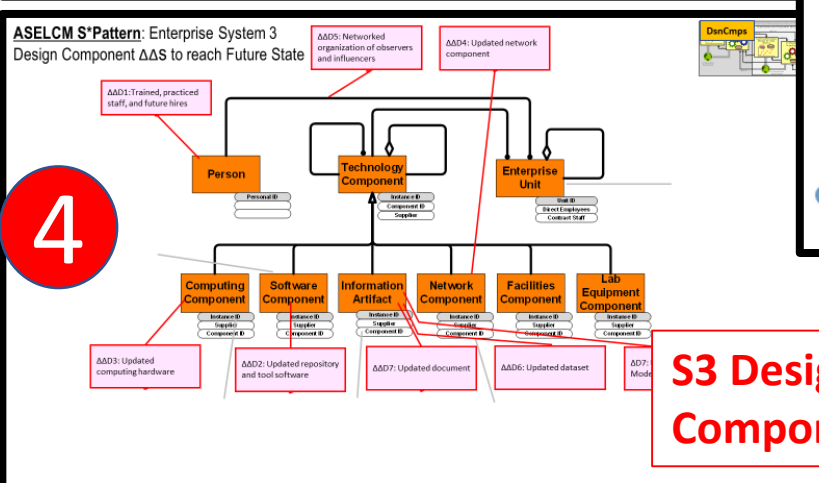
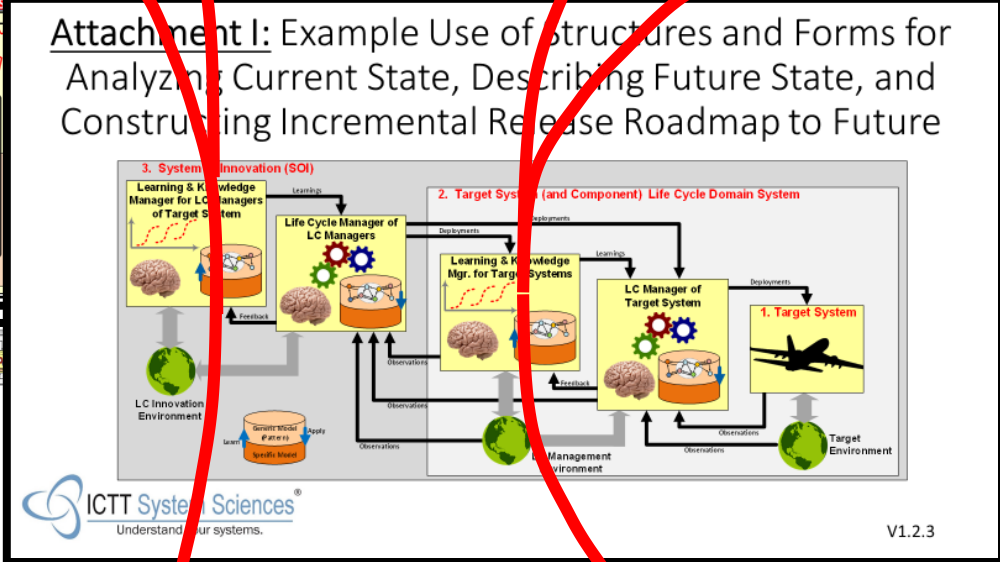
**S2 Features (Capabilities)**



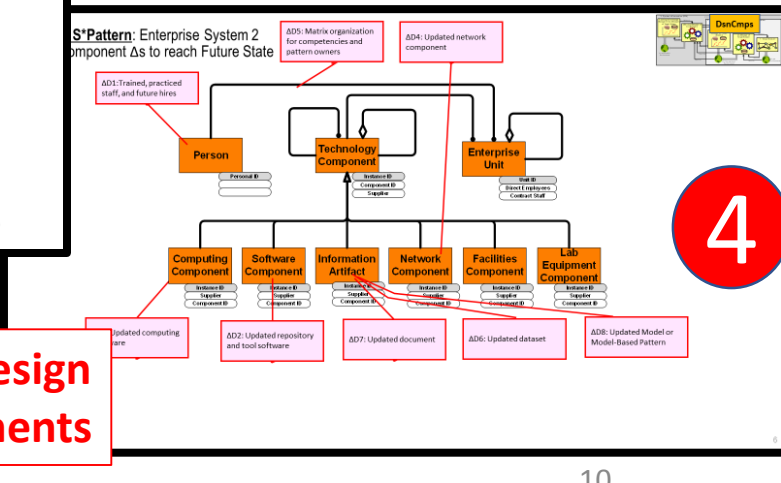
**S3 Roles**



**S2 Roles**

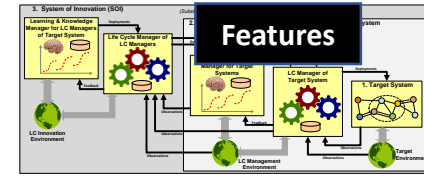


**S3 Design Components**



**S2 Design Components**

# ASELCM S\*Pattern: Enterprise System 2 Feature Δs to reach Future State

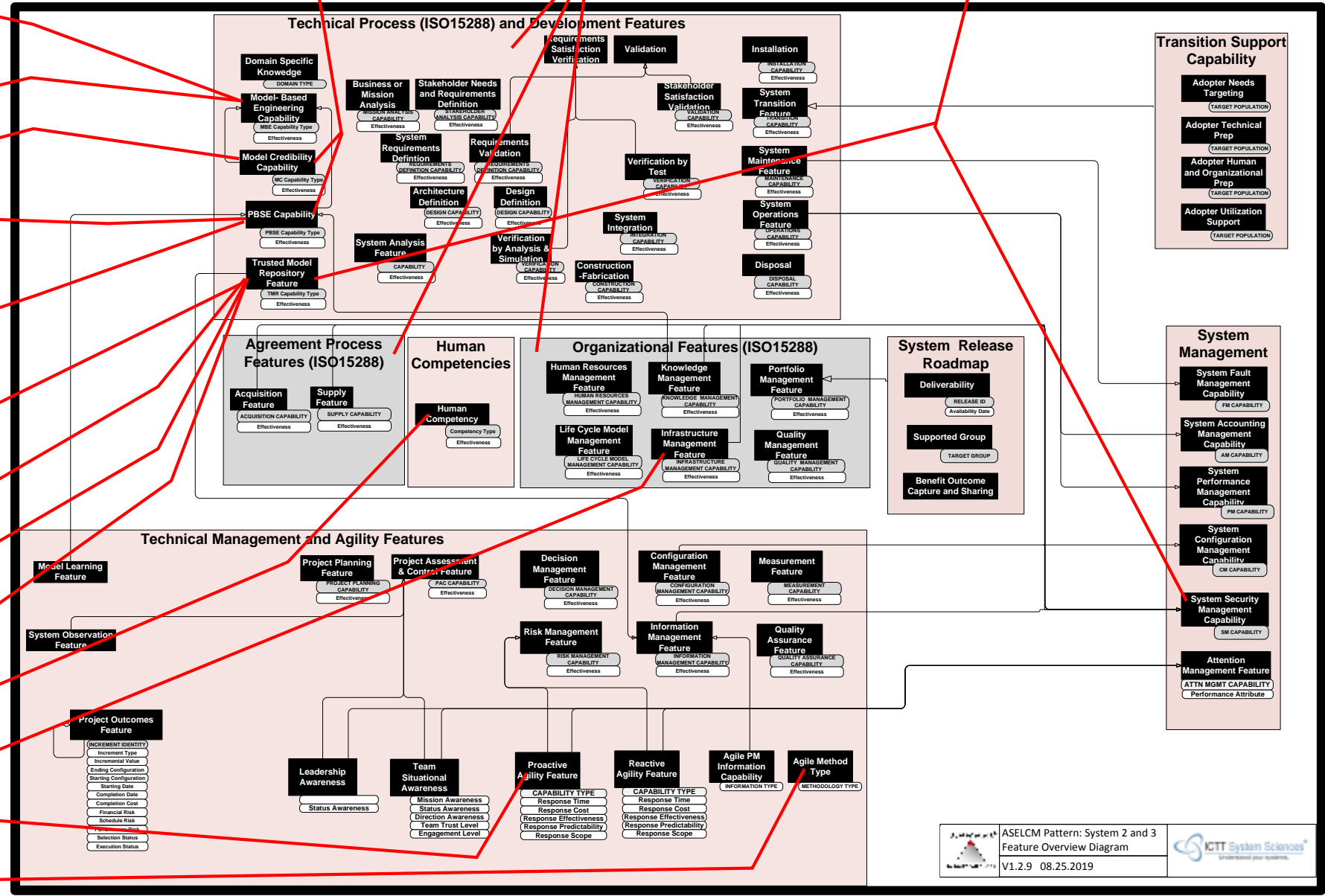


- ΔF1: Foundation for MBSE Integrity
- ΔF3: Tool Agnostic, Interoperable MBSE
- ΔF4: Model Credibility Foundation
- ΔF2: Foundations for Reusable MBSE Patterns
- ΔF8: Selective Domain-Specific Capabilities Advancement
- ΔF5: Toolchain Integration Roadmap Sequence
- ΔF13: Knowledge Graph Capabilities
- ΔF14: Information Persistence
- ΔF15: Finding Information
- ΔF6: Asset-Based Learning Culture
- ΔF7: Improved Networking Capability
- ΔF11: Responsive MBSE Application
- ΔF12: Responsive with Rigor

ΔF10: Compliance with MBSE Standards and Frameworks

ΔF9: Selective ISO15288 Process Areas Capabilities Advancement

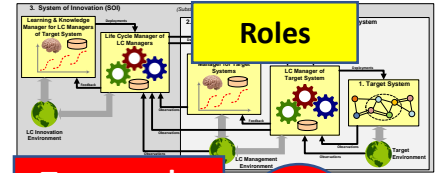
ΔF16: Model Aggregation Security



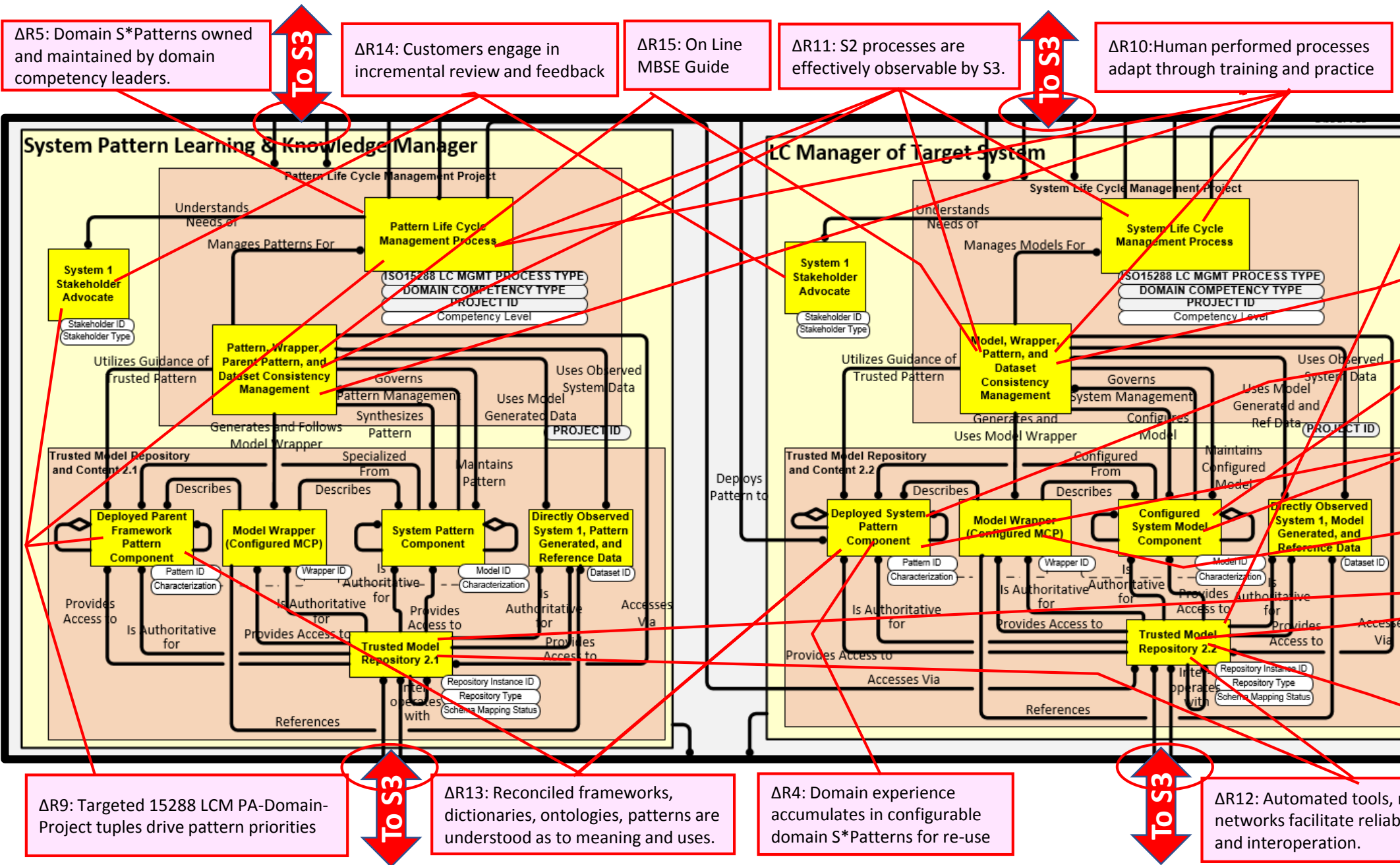
2

Example Mark Up

# ASELCM S\*Pattern: Enterprise System 2 Role $\Delta$ s to reach Future State (driven by System 3)



Example Mark Up **3**



$\Delta$ R5: Domain S\*Patterns owned and maintained by domain competency leaders.

To S3

$\Delta$ R14: Customers engage in incremental review and feedback

$\Delta$ R15: On Line MBSE Guide

$\Delta$ R11: S2 processes are effectively observable by S3.

To S3

$\Delta$ R10: Human performed processes adapt through training and practice

$\Delta$ R16: System 2 Pilot and Captive Lab Facilities

$\Delta$ R7: Configuration agent supports configuration process

$\Delta$ R1: Models based on tool agnostic S\*Metamodel

$\Delta$ R3: S\*Models always start from some S\*Pattern, even if it is base S\*Metamodel.

$\Delta$ R6: MCP Wrapper metadata describes models and patterns

$\Delta$ R8: Trusted Model Repository configured from TMR Reference Pattern

$\Delta$ R2: Repositories, tools mapped to S\*Metamodel.

$\Delta$ R9: Targeted 15288 LCM PA-Domain-Project tuples drive pattern priorities

To S3

$\Delta$ R13: Reconciled frameworks, dictionaries, ontologies, patterns are understood as to meaning and uses.

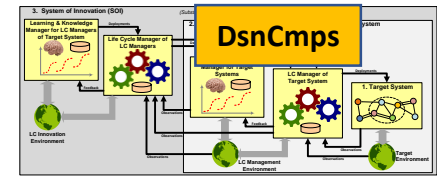
$\Delta$ R4: Domain experience accumulates in configurable domain S\*Patterns for re-use

To S3

$\Delta$ R12: Automated tools, repositories, networks facilitate reliable access and interoperation.

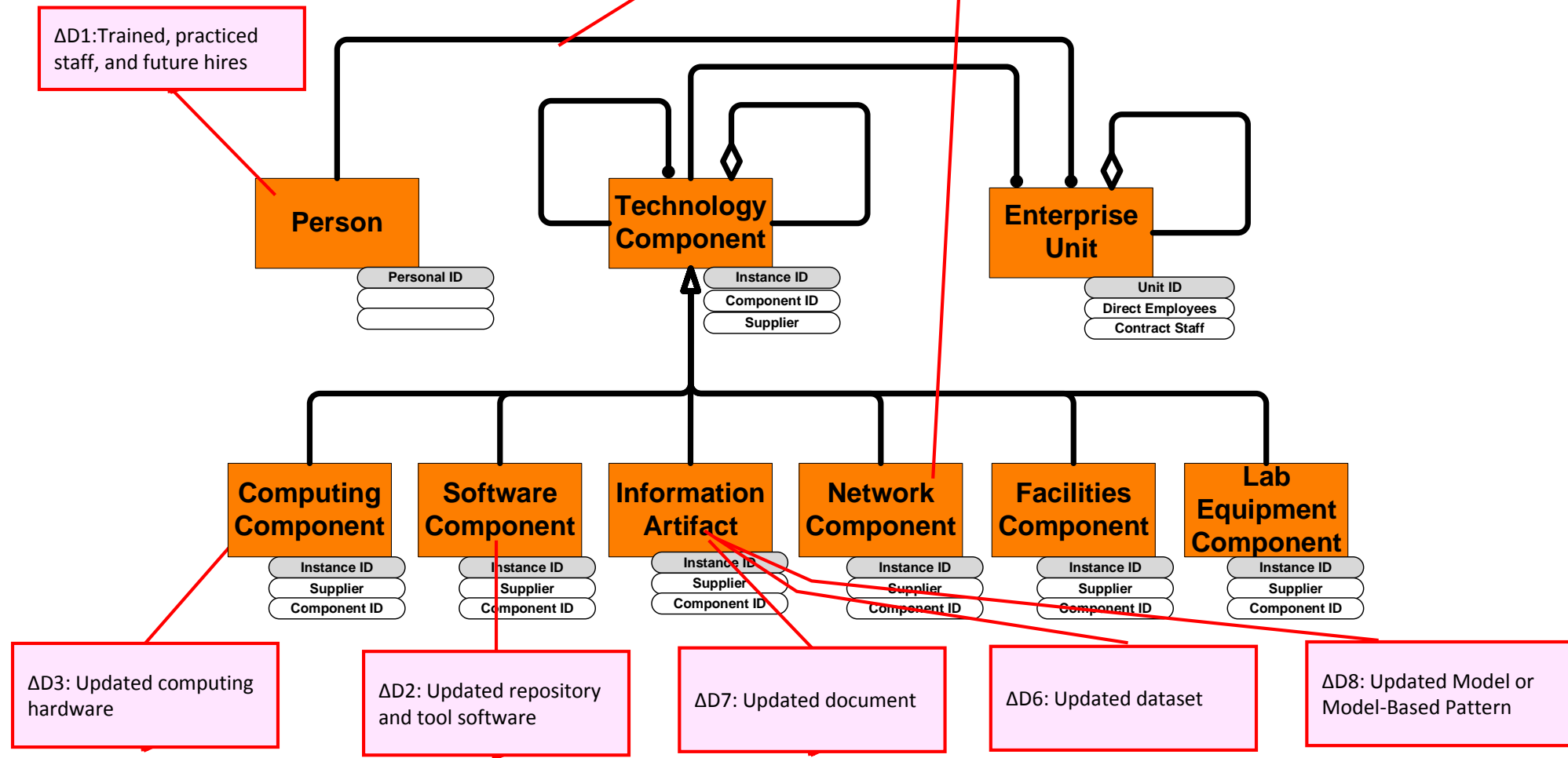
# ASELCM S\*Pattern: Enterprise System 2

## Design Component $\Delta$ s to reach Future State

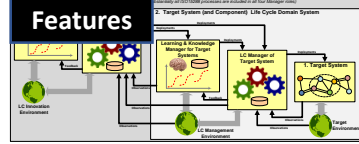


4

Example Mark Up



# ASELCM S\*Pattern: Enterprise System 3 Feature ΔΔS to reach Future State



- ΔΔF1: Pattern Modeling Service
- ΔΔF2: Tooling Engineering, Deployment, and Support Service
- ΔΔF3: Standards and Frameworks Reconciliation and Support Service
- ΔΔF4: Basic S\*MBSE Training and Coaching Service, for Model Users and Authors
- ΔΔF5: PBSE Training and Coaching Service—for Pattern Users and Authors
- ΔΔF6: System 2 Capability Certifications Service
- ΔΔF7: Culture Reinforcement
- ΔΔF8: External Environment Awareness
- ΔΔF9: Senior Leadership Integration—Enterprise
- ΔΔF10: Technical Thought Leader Integration

ΔΔF11: On Line MBSE Guide

ΔΔF12: ISO15288 Expertise

ΔΔF13: Literature, Examples, White Papers Availability

ΔΔF14: System 2 Network Planning, Engineering, and Support

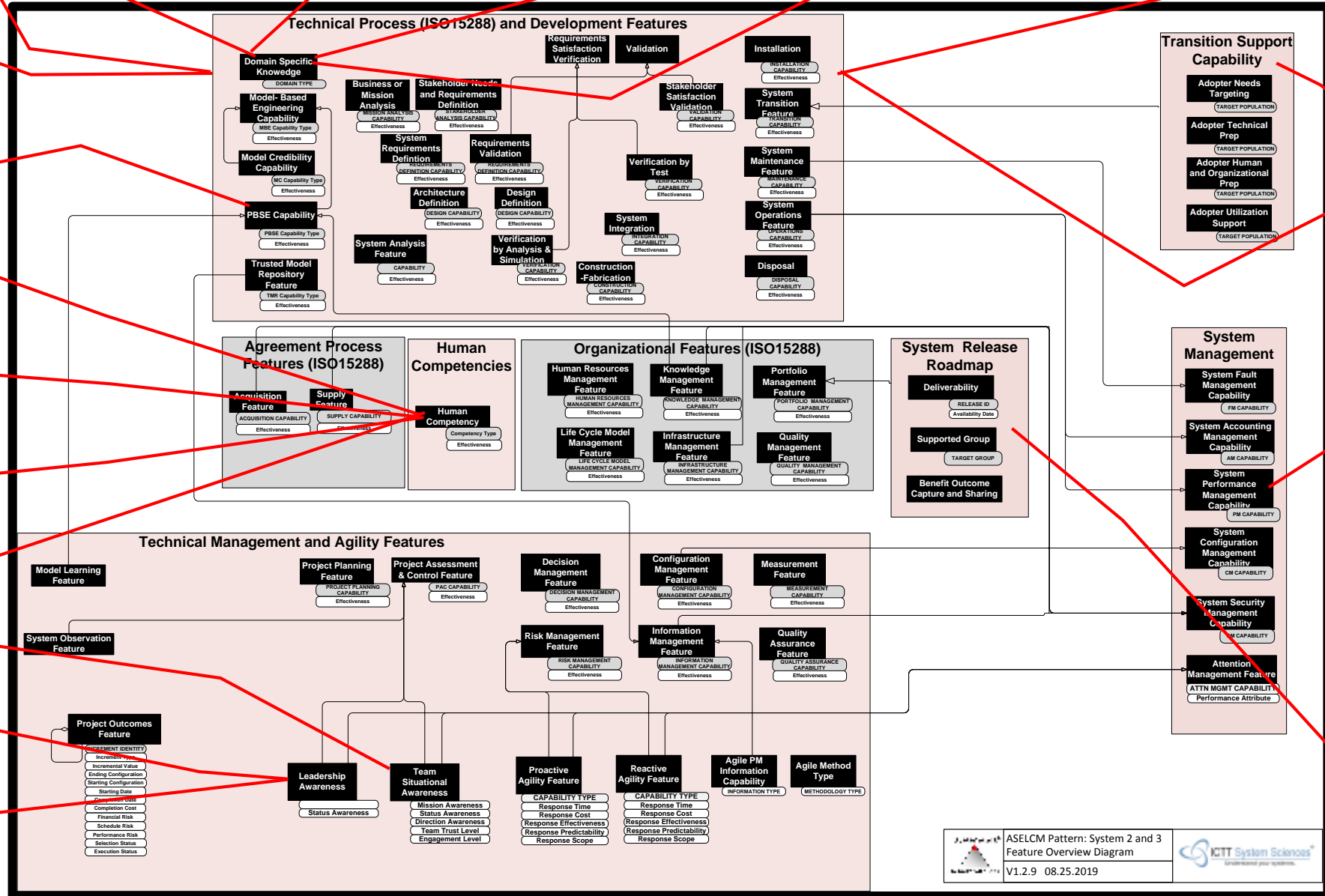
ΔΔF15: Model Life Cycle Management

ΔΔF16: System 2 Deployment Transition Preparation and Support

ΔΔF17: System 2 Pattern Owners Council Support

ΔΔF18: System 2 Monitoring, Performance Analysis, Support Service

ΔΔF19: System 2 Improvement Roadmapping



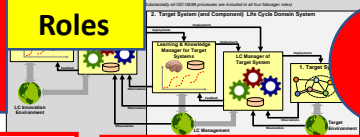
2

Example Mark Up

# ASELCM S\*Pattern: Enterprise System 3 Role $\Delta S$ to reach Future State (driving System 2)

**Example Mark Up**

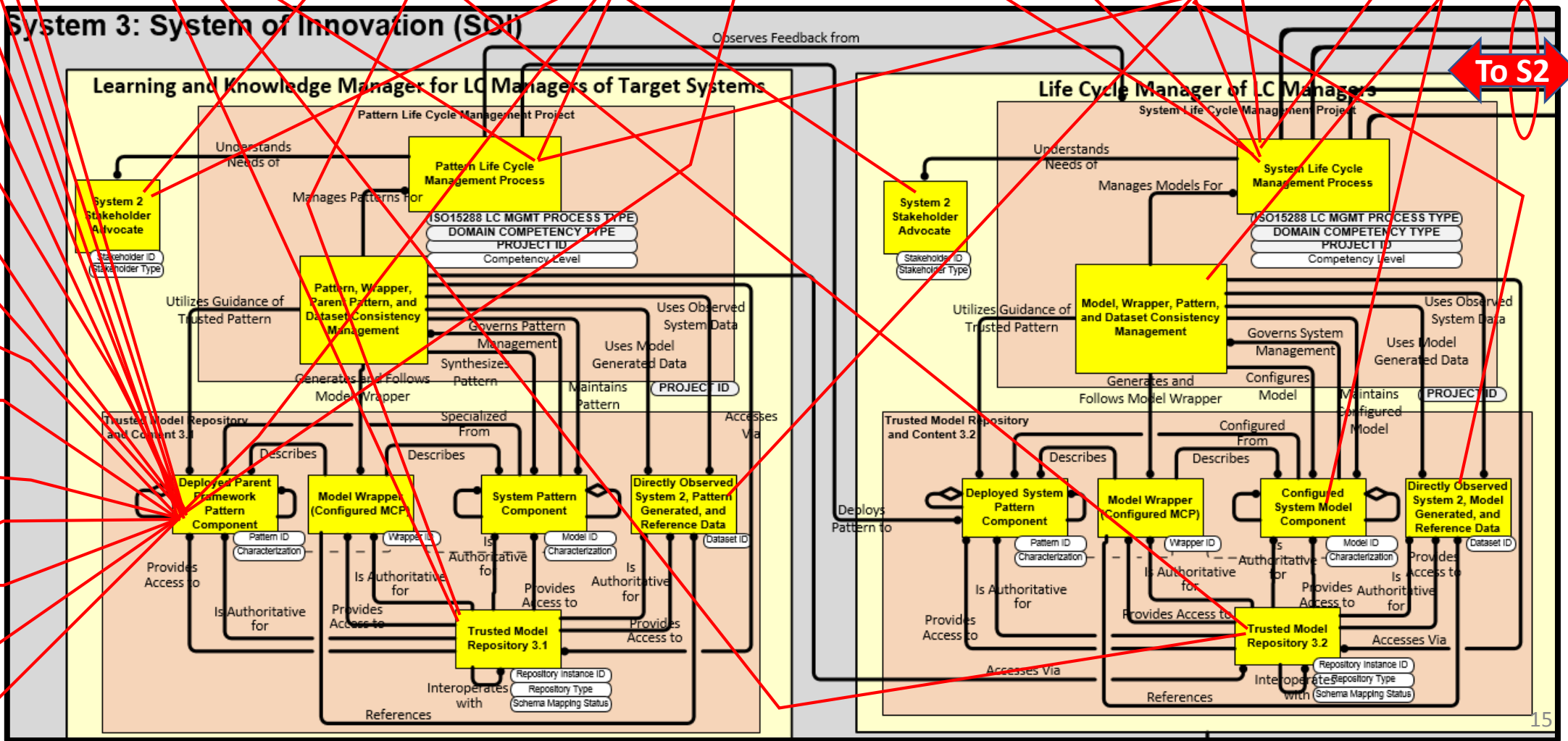
**Roles**



**3**

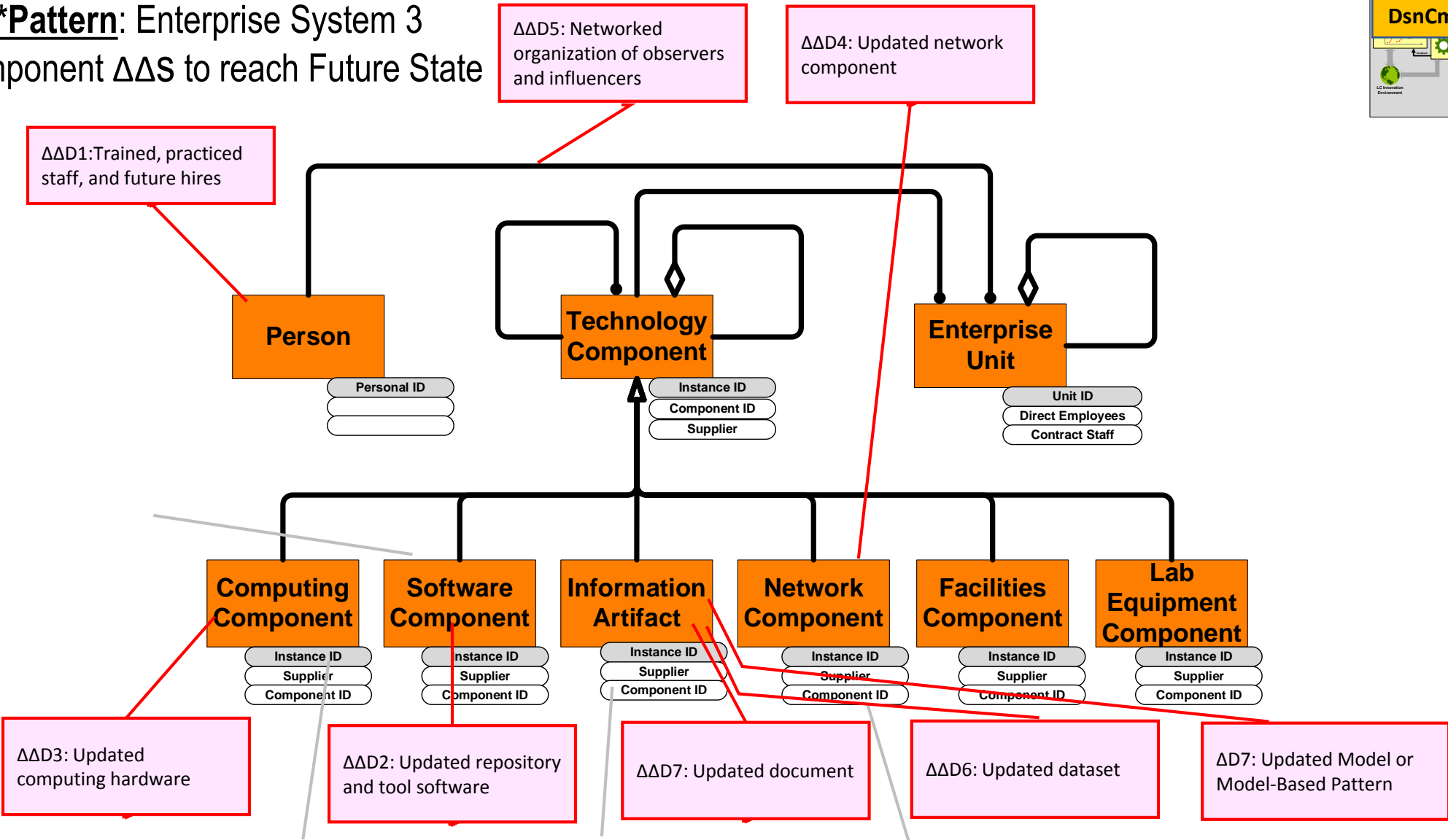
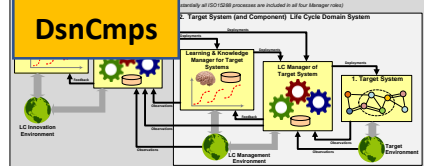
- $\Delta R1$ : S\*Metamodel
- $\Delta R2$ : Model Characterization Pattern (MCP)
- $\Delta R3$ : ASELCM S\*Pattern
- $\Delta R4$ : Trusted Model Repository S\*Pattern
- $\Delta R5$ : ISO 15288, ISO 40410, ISO 15289, Corp. Policy
- $\Delta R6$ : Enterprise Schema, Frameworks, Dictionaries
- $\Delta R7$ : Organizational Structure Guides
- $\Delta R8$ : Process and Procedure Guides
- $\Delta R9$ : INCOSE SeBOK
- $\Delta R10$ : INCOSE SE Handbook
- $\Delta R11$ : Enterprise SE Guide
- $\Delta R12$ : Textbooks
- $\Delta R13$ : On Line Help
- $\Delta R14$ : On Line MBSE Guide
- $\Delta R15$ : Kotter OCM Principles

- $\Delta R16$ : : Repositories, tools mapped to S\*Metamodel for interoperability.
- $\Delta R17$ : Configuration agent supports project configuration process
- $\Delta R18$ : Customers engage in incremental review and feedback
- $\Delta R19$ : Automated tools, repositories, networks reliable access, operation.
- $\Delta R20$ : Engineering process experience accumulates in reusable S\*Patterns
- $\Delta R21$ : Targeted 15288 LCM PA-Domain-Project tuples drive pattern priorities
- $\Delta R22$ : Monitoring Roles-Water Cooler, Community of Interest, IPT Members
- $\Delta R23$ : Deployment Roles: Teaching, Water Cooler, COI Member
- $\Delta R24$ : :S2 education, training, HR support. evaluation
- $\Delta R25$ : S2 processes are effectively observable by S3.
- $\Delta R26$ : Human performed processes adapt by training, practice, feedback



# ASELCM S\*Pattern: Enterprise System 3

## Design Component $\Delta\Delta S$ to reach Future State

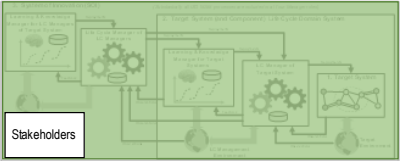


4

Example Mark Up



# ASELCM Pattern: System 2 and 3 Stakeholders



**Delivered System  
Operational  
Beneficiary**

Instance ID  
Type

**Delivered System  
Installer**

Instance ID  
Type

**Adapting Party**

Instance ID  
Type

**Delivered System  
Operator**

Instance ID  
Type

**Delivered System  
Maintainer**

Instance ID  
Type

**Party at Safety  
Risk**

Instance ID  
Type

**Delivered System  
Supplier**

Instance ID  
Type

**Delivered System  
Funder**

Instance ID  
Type

**Party at Security  
Risk**

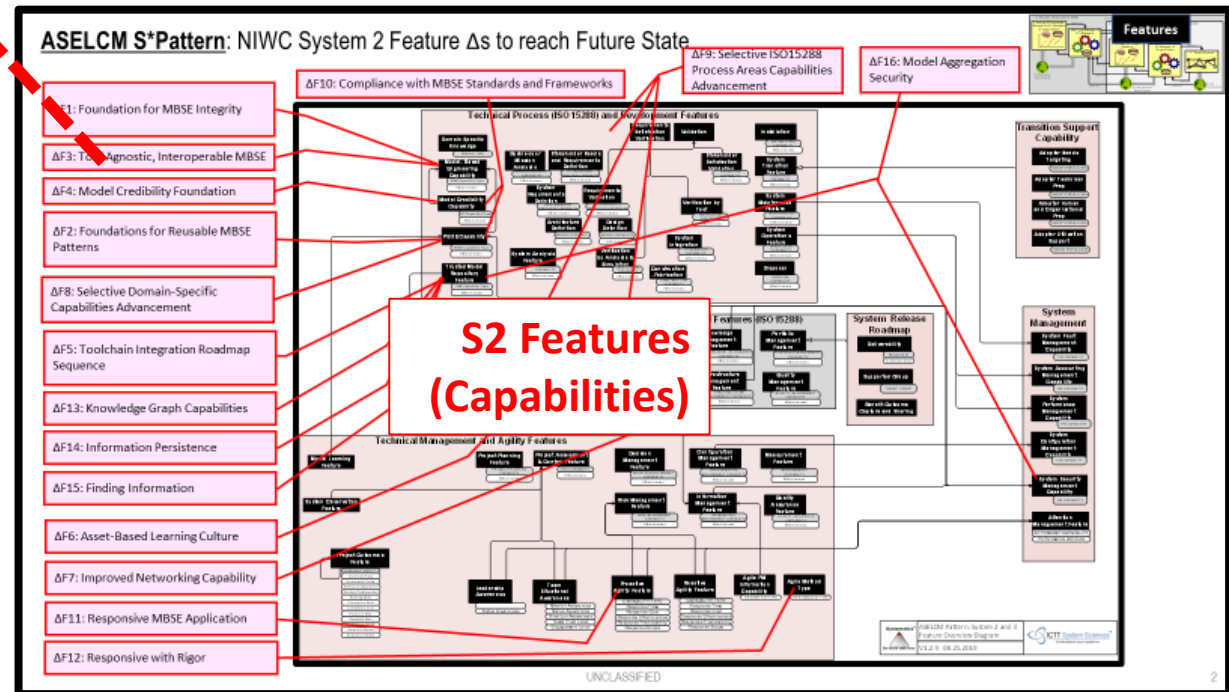
Instance ID  
Type

# Deltas to S2 Features, Roles, Design Component

Diagram Ref	Short Name	Impacted S2 Ftrs	Description of Enterprise S2 Feature Delta
ΔF1	Foundations for MBSE Integrity	Model-Based Engineering Capability	Adoption of S'Metamodel foundation and related methods for MBSE.
ΔF2	Foundations for Reusable MBSE Patterns	PBSE Capability	Adoption of S'PBSE information framework for reusable, configurable MBSE S'Patterns, and related methods for rapid configuration of S'Models from S'Patterns.
ΔF3	Tool Agnostic, Interoperable MBSE	Model-Based Engineering Capability	Establish S'Metamodel mappings for related tools and language schemas. S'Models and S'Patterns are tool agnostic by virtue of minimality of S'Metamodel, and its mapping into each system modeling tool's schema. Models are therefore semantically compatible if transported, imported, and interpreted consistent with the related mapping and
	Model Credibility	Model Credibility	Utilize Model Characterization Pattern (MCP) configured for each model, along with related

## Deltas to S2 Features, Roles, Design Component

Diagram Ref	Short Name	Impacted S2 Ftrs	Description of Enterprise S2 Feature Delta
ΔF1	Foundations for MBSE Integrity	Model-Based Engineering Capability	Adoption of S'Metamodel foundation and related methods for MBSE.
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ΔF4	Model Credibility Foundation	Model Credibility Capability	Utilize Model Characterization Pattern (MCP) configured for each model, along with related model VVUQ process, so that configured MCP establishes the provenance of the model as the basis for trust.
ΔF5	Toolchain Integration Roadmap Sequence	Trusted Model Repository Feature	Trust in a shared model requires trust in its provenance, which is in part dependent on trust in the repository(ies) in which it resides or from which it was obtained. Plans for that should include a roadmap plan for integration of the related tool chain.
ΔF6	Asset-Based Learning Culture	Human Competency	S'Patterns are information assets representing the collective learning of the organization, and also provide a foundation for individual learning from those same patterns. Required and optional learning for individual competencies about domains is reflected by the contents of the related S'Patterns, planned and constructed as learning assets.
ΔF7	Improved Networking Capability	Infrastructure Management Feature	Network connectivity, security, performance, and reliability should be planned, engineered, and supported consistent with internal and external information sharing and access
ΔF8	Selective Domain Specific Capabilities Advancement	PBSE Capability	Priority application domains (e.g., flight, communications, undersea, op centers, etc.) are selected as justifying capture of application domain knowledge in the form of system patterns of values, requirements, design, test, or other aspects, based on considerations such as frequency of use, changes in future staff, evolution of the domain, need for
ΔF9	Selective ISO15288 Process Areas Capabilities Advancement	Selective ISO15288 Process Areas Capabilities Advancement	Priority ISO 15288 systems management domains (e.g., Requirements, Design, Verification, etc.) are selected as justifying capture of related domain knowledge in the form of system patterns of key information types, views and artifacts, processes, stakeholders, sources and uses of information, or other aspects, based on considerations such as frequency of
ΔF10	Compliance with MBSE Standards and Frameworks	PBSE Capability, Model Credibility	Careful selection standards, frameworks, or portions of them, and compliance with them on a selective basis, is based on criteria to improve speed, quality, group learning, or other aspects of performance, and administrative efficiency, in the absence of other



e Δs (S2 Capability Improvements)

## Deltas to S2 Features, Roles, Design Component

**(S2 Capability Improvements)**

Diagram Ref	Δ Short Name	Impacted S2 Ftrs	Description of Enterprise S2 Feature Delta
ΔF1	Foundations for MBSE Integrity	Model-Based Engineering Capability	Adoption of S*Metamodel foundation and related methods for MBSE.
ΔF2	Foundations for Reusable MBSE Patterns	PBSE Capability	Adoption of S*PBSE information framework for reusable, configurable MBSE S*Patterns, and related methods for rapid configuration of S*Models from S*Patterns.
ΔF3	Tool Agnostic, Interoperable MBSE	Model-Based Engineering Capability	Establish S*Metamodel mappings for related tools and language schemas. S*Models and S*Patterns are tool agnostic by virtue of minimality of S*Metamodel, and its mapping into each system modeling tool's schema. Models are therefore semantically compatible if transported, imported, and interpreted consistent with the related mapping and
ΔF4	Model Credibility Foundation	Model Credibility Capability	Utilize Model Characterization Pattern (MCP) configured for each model, along with related model VVUQ process, so that configured MCP establishes the provenance of the model as the basis for trust.
ΔF5	Toolchain Integration Roadmap Sequence	Trusted Model Repository Feature	Trust in a shared model requires trust in its provenance, which is in part dependent on trust in the repository(ies) in which it resides or from which it was obtained. Plans for that should include a roadmap plan for integration of the related tool chain.
ΔF6	Asset-Based Learning Culture	Human Competency	S*Patterns are information assets representing the collective learning of the organization, and also provide a foundation for individual learning from those same patterns. Required and optional learning for individual competencies about domains is reflected by the contents of the related S*Patterns, planned and constructed as learning assets.
ΔF7	Improved Networking Capability	Infrastructure Management Feature	Network connectivity, security, performance, and reliability should be planned, engineered, and supported consistent with internal and external information sharing and access
ΔF8	Selective Domain Specific Capabilities Advancement	PBSE Capability	Priority application domains (e.g., flight, communications, undersea, op centers, etc.) are selected as justifying capture of application domain knowledge in the form of system patterns of values, requirements, design, test, or other aspects, based on considerations such as frequency of use, changes in future staff, evolution of the domain, need for
ΔF9	Selective ISO15288 Process Areas Capabilities Advancement	Selective ISO15288 Process Areas Capabilities	Priority ISO 15288 systems management domains (e.g., Requirements, Design, Verification, etc.) are selected as justifying capture of related domain knowledge in the form of system patterns of key information types, views and artifacts, processes, stakeholders, sources

# Time-based Roadmap of Capability Releases: Equivalent to an “Agile Release Train”, as in SAFe Agile Methodology

	4Q2019	1Q2020	2Q2020	3Q2020	4Q2020	1Q2021	2Q2021	3Q2021	4Q2021

				Deltas to S2 Features, Roles, Design Components									
Diagram Ref	Short Name	Impacted S2 Ftrs	Description of Enterprise S2 Feature Delta	4Q2019	1Q2020	2Q2020	3Q2020	4Q2020	1Q2021	2Q2021	3Q2021	4Q2021	
ΔF1	Foundations for MBSE Integrity	Model-Based Engineering Capability	Adoption of S'Metamodel foundation and related methods for MBSE.										
ΔF2	Foundations for Reusable MBSE Patterns	PBSE Capability	Adoption of S'PBSE information framework for reusable, configurable MBSE S'Patterns, and related methods for rapid configuration of S'Models from S'Patterns.										
ΔF3	Tool Agnostic, Interoperable MBSE	Model-Based Engineering Capability	Establish S'Metamodel mappings for related tools and language schemas. S'Models and S'Patterns are tool agnostic by virtue of minimality of S'Metamodel, and its mapping into each system modeling tool's schema. Models are therefore semantically compatible if transported, imported, and interpreted consistent with the related mapping and										
ΔF4	Model Credibility Foundation	Model Credibility Capability	Utilize Model Characterization Pattern (MCP) configured for each model, along with related model VYUQ process, so that configured MCP establishes the provenance of the model as the basis for trust.										
ΔF5	Toolchain Integration Roadmap Sequence	Trusted Model Repository Feature	Trust in a shared model requires trust in its provenance, which is in part dependent on trust in the repository(ies) in which it resides or from which it was obtained. Plans for that should include a roadmap plan for integration of the related tool chain.										
ΔF6	Asset-Based Learning Culture	Human Competency	S'Patterns are information assets representing the collective learning of the organization, and also provide a foundation for individual learning from those same patterns. Required and optional learning for individual competencies about domains is reflected by the contents of the related S'Patterns, planned and constructed as learning assets.										
ΔF7	Improved Networking Capability	Infrastructure Management Feature	Network connectivity, security, performance, and reliability should be planned, engineered, and supported consistent with internal and external information sharing and access										
ΔF8	Selective Domain Specific Capabilities Advancement	PBSE Capability	Priority application domains (e.g., flight, communications, undersea, op centers, etc.) are selected as justifying capture of application domain knowledge in the form of system patterns of values, requirements, design, test, or other aspects, based on considerations such as frequency of use, changes in future staff, evolution of the domain, need for										
ΔF9	Selective ISO15288 Process Areas Capabilities Advancement	Selective ISO15288 Process Areas Capabilities Advancement	Priority ISO 15288 systems management domains (e.g., Requirements, Design, Verification, etc.) are selected as justifying capture of related domain knowledge in the form of system patterns of key information types, views and artifacts, processes, stakeholders, sources and uses of information, or other aspects, based on considerations such as frequency of										
ΔF10	Compliance with MBSE Standards and Frameworks	PBSE Capability, Model Credibility Capability	Careful selection standards, frameworks, or portions of them, and compliance with them on a selective basis, is based on criteria to improve speed, quality, group learning, or other aspects of performance, and minimizing blind adherence in the absence of rationale and										
ΔF11	Responsive MBSE Application	Proactive Agility Feature	MBSE is applied in targeted areas (application domains and process areas) selected in advance for the ability of MBSE to improve effective responsiveness.										
ΔF12	Responsive with Rigor	Agile Methodology Type	MBSE is applied with rigorous enough model content to assure that rapid response does not unduly sacrifice appropriate technical rigor for risks at hand.										
ΔF13	Knowledge Graph Capabilities	Trusted Model Repository Feature	Tooling makes effective use of graph-based technologies to improve systems engineering performance associated with recognizing and exploiting knowledge relationships.										
ΔF14	Information Persistence	Trusted Model Repository Feature	Confidence in the persistence of key data is improved.										

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Organizational learning is not flipping a switch



					Deltas to S2 Features, Roles, Design Components							
Diagram Ref	Short Name	Impacted S2 Ftrs	Description of Enterprise S2 Feature Delta	4Q2019	1Q2020	2Q2020	3Q2020	4Q2020	1Q2021	2Q2021	3Q2021	4Q2021
ΔF1	Foundations for MBSE Integrity	Model-Based Engineering Capability	Adoption of S*Metamodel foundation and related methods for MBSE.									
ΔF2	Foundations for Reusable MBSE Patterns	PBSE Capability	Adoption of S*PBSE information framework for reusable, configurable MBSE S*Patterns, and related methods for rapid configuration of S*Models from S*Patterns.									
ΔF3	Tool Agnostic, Interoperable MBSE	Model-Based Engineering Capability	Establish S*Metamodel mappings for related tools and language schemas. S*Models and S*Patterns are tool agnostic by virtue of minimality of S*Metamodel, and its mapping into each system modeling tool's schema. Models are therefore semantically compatible if transported, imported, and interpreted consistent with the related mapping and									
ΔF4	Model Credibility Foundation	Model Credibility Capability	Utilize Model Characterization Pattern (MCP) configured for each model, along with related model VVUQ process, so that configured MCP establishes the provenance of the model as the basis for trust.									
ΔF5	Toolchain Integration Roadmap Sequence	Trusted Model Repository Feature	Trust in a shared model requires trust in its provenance, which is in part dependent on trust in the repository(ies) in which it resides or from which it was obtained. Plans for that should include a roadmap plan for integration of the related tool chain.									
ΔF6	Asset-Based Learning Culture	Human Competency	S*Patterns are information assets representing the collective learning of the organization, and also provide a foundation for individual learning from those same patterns. Required and optional learning for individual competencies about domains is reflected by the contents of the related S*Patterns, planned and constructed as learning assets.									
ΔF7	Improved Networking Capability	Infrastructure Management Feature	Network connectivity, security, performance, and reliability should be planned, engineered, and supported consistent with internal and external information sharing and access									
	Selective Domain Specific	PBSE Capability	Priority application domains (e.g., flight, communications, undersea, op centers, etc.) are									

Capability Improvements)

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