Using the Agile SE Life Cycle Pattern to Plan and Manage Progress in Health Care Systems

3. System of Innovation (SOI)

Learning & Knowledge Manager for LC Managers of Target System

Life Cycle Manager of LC Managers

2. Target System (and Component) Life Cycle Domain System

Learning & Knowledge Manager for Target Systems

LC Manager of Target System

1. Target System

Target Environment

(Substantially all the ISO15288 processes are included in all four Manager roles)

Bill Schindel   schindel@ictt.com
INCOSE Agile Health Care Systems Conference,
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INCOSE
Healthcare Working Group

V1.2.4

Contents

- Health Care Systems Agility
- What is the INCOSE Agile Systems Engineering Life Cycle Model Discovery Project?
- What are Agile Systems, and why do they matter?
- How are Agile Systems related to MBSE?
- What is the Agile Systems Engineering Life Cycle Pattern?
- How do we apply the ASELCM Pattern to Health Care Systems Improvement?
- Break out: Test Drive and Hot Spot Data Collection
- Concluding Discussion
- References
- **Attachment**: Break Out Session Instrument

Health Care Systems Agility

- Viewed at almost any level—individuals, products, enterprises, market segments, or society--Health Care appears as a vast and complex system.
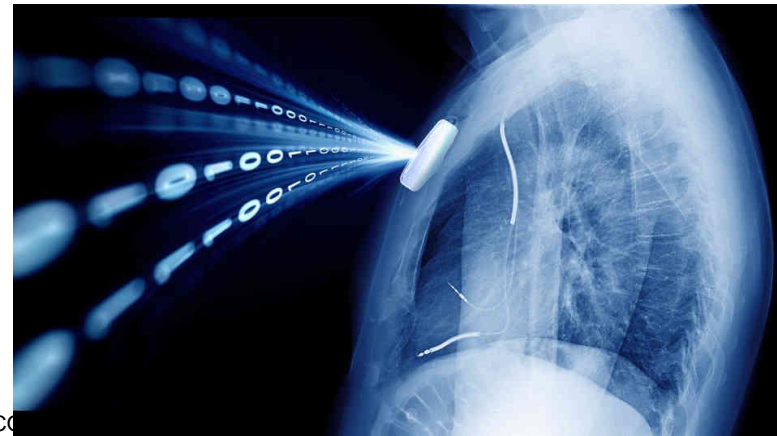
Health Care Systems Agility

- Since there are countless challenges and opportunities for progress, how can an enterprise, industry, society, or individual systematically plan and manage future progress and innovation?
  - Where can we best apply the principles and lessons of Systems Engineering, deeper Agility, or Lean Methods to make optimal progress today, tomorrow, and in the future?
  - Is there a systemic approach to map-making for planning this progress?

4

Health Care Systems Agility

- Roughly speaking, in referring to "agility", we mean ability to respond effectively to the challenges of uncertainty and rates of change in environment, stakeholders, competition, technologies, capacities, capabilities.

- Not just "going faster".

Health Care Systems Agility

- This session will include both an introduction to the INCOSE Agile Systems Engineering Life Cycle Model (ASELCM) being developed by the INCOSE ASELCM Discovery Project, . . .

- . . . and an opportunity to "test drive" it in a break-out team, to map challenging "hot spots" and opportunities for progress across the landscape of health care systems.

What is the INCOSE Agile Systems Engineering Life Cycle Model Discovery Project?

- During 2015-16, the INCOSE parent society is sponsoring the Agile Systems Engineering Life Cycle Model (ASELCM) Discovery Project, based on a series of workshop clinics being held at host example discovery sites across the U.S. and Europe.

- This project, now underway, will provide INCOSE inputs to a future version of ISO 15288, to improve explicit understanding of principles and practices of agility as applicable to systems engineering across different domains.

http://www.parshift.com/ASELCM/Home.html

What is the INCOSE Agile Systems Engineering Life Cycle Model Discovery Project?

- Announced at IW2015
- Built around a series of discovery clinics being conducted by example host sites during 2015-16
- Discovery clinics in 2015:
  - Navy SpaWar/MITRE, San Diego, CA,
  - Northrop Grumman, Vienna, VA,
  - Rockwell Collins, Cedar Rapids, IA,
  - Lockheed Martin, Ft. Worth, TX,
- You and your company can host or participate in 2016!
- Support from INCOSE Agile Systems WG and Patterns WG:
  - R. Dove, project lead, co-leads K.Forsberg, H. Lawson, J. Ring, G. Roedler, B. Schindel

What are Agile Systems? Why do they matter?

Longer history than just Agile Software Development Methods :

| Agile Enterprise Systems—Origins (c. 199x) | Agile Software Methods (c. 200x) | General Agile Systems Engineering (c. 201x) |
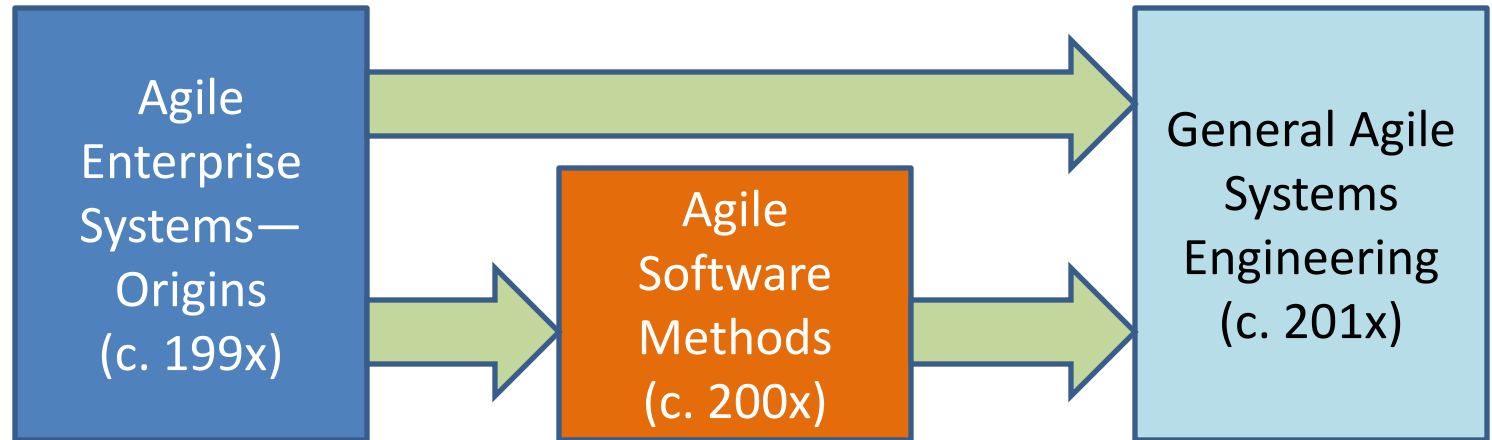
- For history and background, see Dove and LaBarge, 2014
- Agile software methods, by far better known, are related.
- General Agile Systems Engineering is the related broader subject of the INCOSE ASELCM Project.
- Problem space: Challenges of uncertainty and rates of change in environment, stakeholders, competition, technologies, capacities, capabilities. Not just "going faster".

Is this your tomorrow, or a distant vision?

From "The Hardware Renaissance Arrives: A New Dawn for Gadgets", *The Wall Street Journal*, March 23, 2015:

"Recently, as I gazed into the prototype of a smart breast pump, I had a vision of the future. I saw an age in which new products—actual, physical electronics products—will go from idea to store shelves in a matter of months. A future in which warehouses and distribution centers cease to exist, because factories produce finished goods from raw materials on demand, and they never stop moving through the supply chain. *Only it turns out all of this is possible today*. The "hardware renaissance" that began in Silicon Valley in just the last five years, born of rapid prototyping technologies, has become something much larger and more important. It has been a sea change in every stage of producing physical objects, from idea to manufacturing to selling at retail . . ."
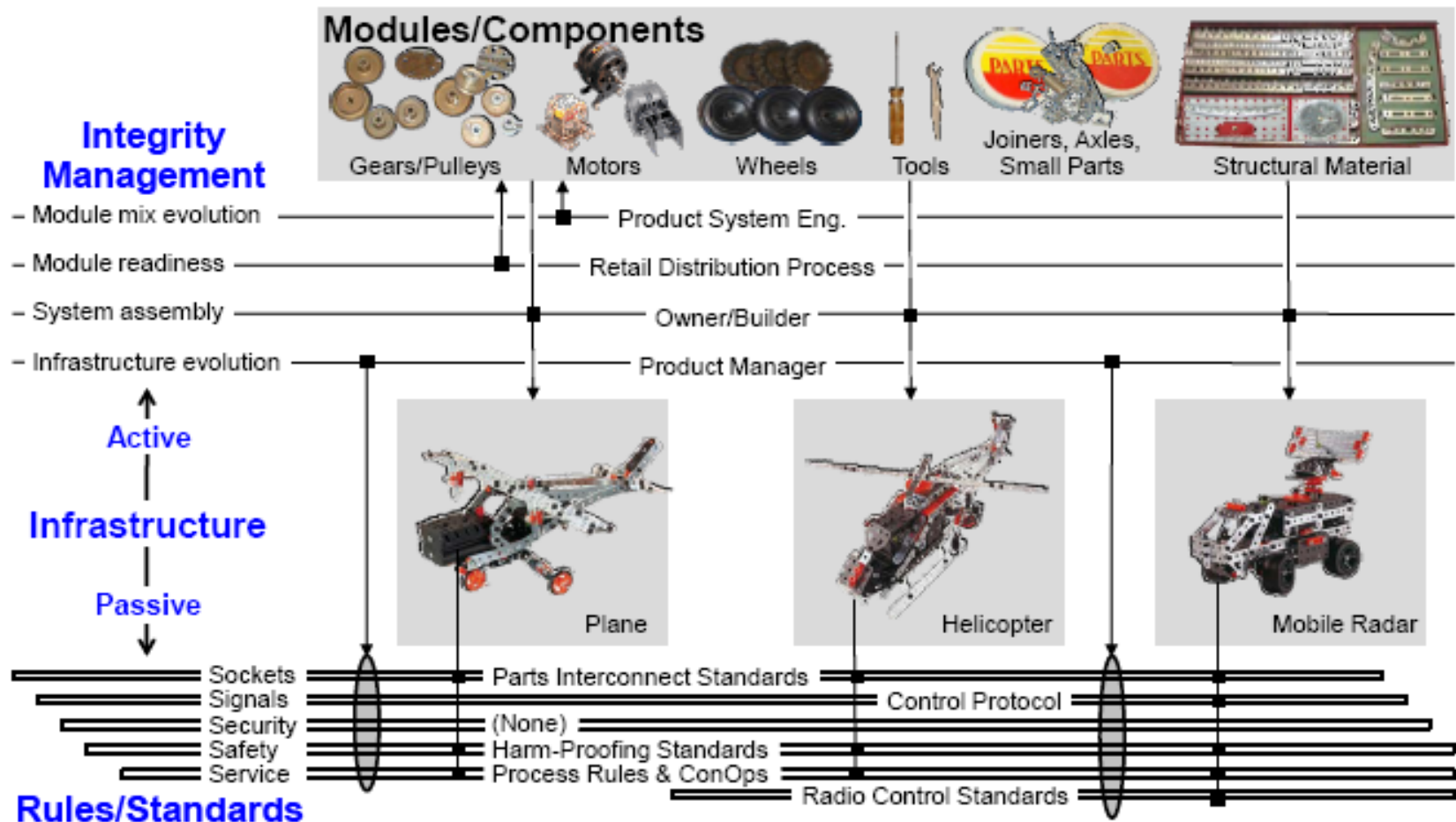
-- Christopher Mims, *The Wall Street Journal*, p B1,6, March 23, 2015
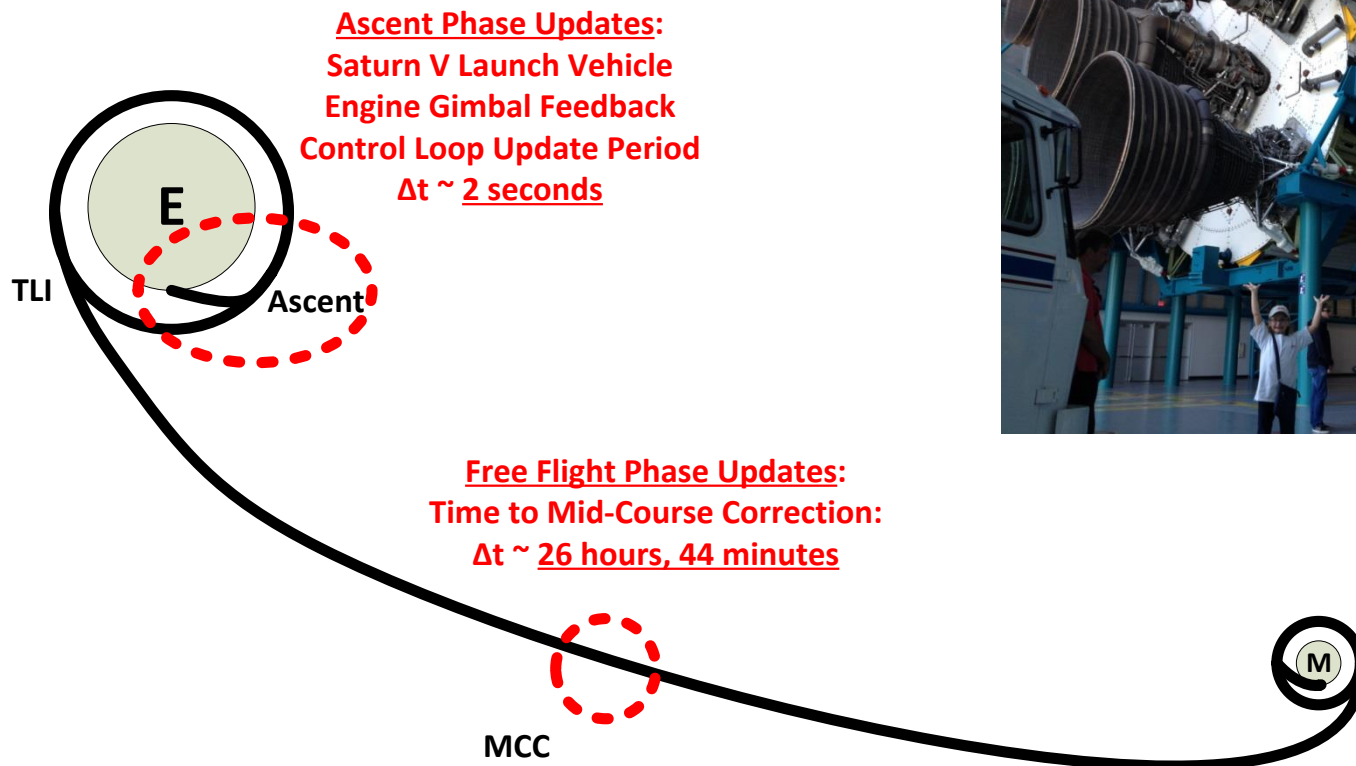-- emphasis added

Agile Systems Architecture Pattern (R. Dove)

The S*ASELCM Pattern captures (in a formal S*Model) the key ideas associated with the pre-MBSE Agile System Architecture:
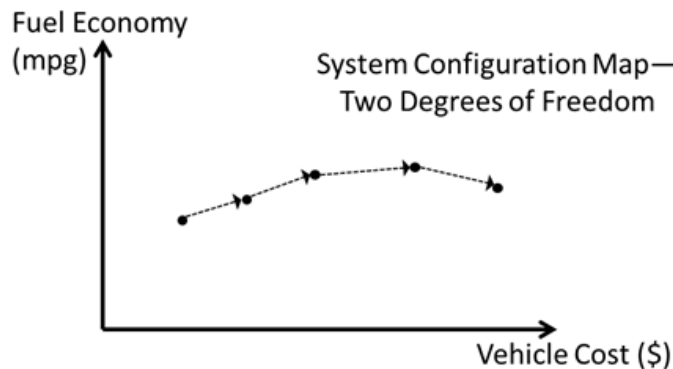
- As in (Dove and LaBarge, 2014)

Optimized Feedback & Correction Cycle Rate: A Hallmark of Agile Methods & Problem Space

An Apollo 11 Mission Question: Why was the Saturn V rocket engines' directional gimbals update cycle period throughout the Ascent Phase ~ 2 seconds, but the update cycle period of course direction during the Free Flight Phase was ~ 26 hours? [42,43]
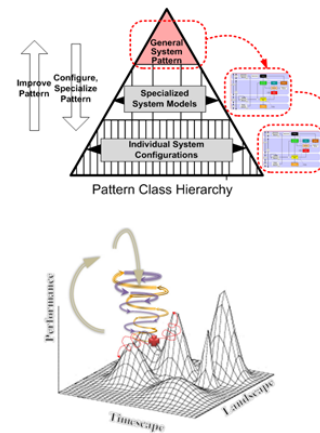

Ascent Phase Updates:
Saturn V Launch Vehicle
Engine Gimbal Feedback
Control Loop Update Period
Δt ~ 2 seconds

Free Flight Phase Updates:
Time to Mid-Course Correction:
Δt ~ 26 hours, 44 minutes

TLI

Ascent

E

MCC

M

System Life Cycle Trajectories in S*Space

- Configurations change over life cycles, during development and subsequently
- Trajectories (configuration paths) in S*Space
- Effective tracking of trajectories
- History of dynamical paths in science and math
- Differential path representation: compression, equations of motion
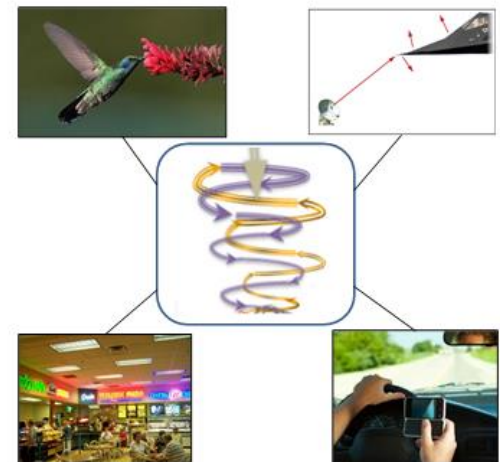

Evolving Systems Over Multiple Life Cycles

Fuel Economy (mpg)

System Configuration Map— Two Degrees of Freedom

Vehicle Cost ($)

Path as a series of system configurations, through iterations of the SE process

"Delta" Descriptions Further Compress Trajectory Representations

Co-Evolution of Interacting Systems

How are Agile Systems Related to MBSE?

1. **Basics**: Using <u>explicit models</u>, MBSE/PBSE <u>adds clarity</u> to pre-model descriptions of Agile Systems and Agile SE-- improves understanding of Agile Systems.

2. **More important**: MBSE/PBSE complements and improves the capability of Agile Systems and Agile Systems Engineering—

   • Agility requires persistent memory & learning—*being forgetful/not learning impacts agility*.

   • Patterns capture & retain learning, as persistent, re-usable, configurable, models, *updated as experience accumulates*.

   • S*Patterns are configurable, reusable S*Models.

"*PBSE as Agile MBSE*" emerges as essential when <u>competing on agility</u> becomes reality for competing, competent players:

– Improved: "Where are we?"
– Improved: "Where are we going?"   Vital for Scrum, other approaches
– Improved: "We've been here before."
– Improved: Understanding of response.
– Improved: Understanding of mission envelopes.   Vital for Response Situation Analysis (RSA)
– Improved: Ability to assess agility
– Improved: Ability to plan agility
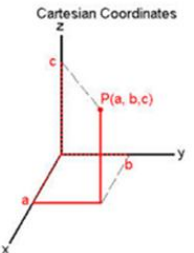
Maps *vs*. Itineraries -- SE Information *vs*. SE Process

Itinerary ≠ Map!
(What am I doing?)   (Where am I?)

When they eventually did emerge, maps represented a newer idea of the nature of "where".

- The SE Process consumes and produces <u>information</u>.
- But, SE historically emphasizes <u>process</u> over <u>information</u>. (Evidence: Ink & effort spent describing standard process versus standard information.)
- Ever happen?-- Junior staff completes all the process steps, all the boxes are checked, but outcome is not okay.
- Recent discoveries about ancient navigators: Maps <u>vs</u>. Itineraries.
- The geometrization of Algebra and Function spaces (Descartes, Hilbert)
- Knowing where you are, not just what you are doing.
- Knowing where you are going, not just what you are doing.
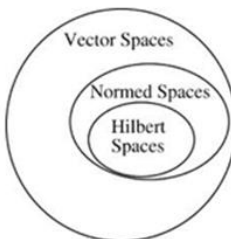- Distance metrics, inner products, projections, decompositions.

Rene Descartes
1596 - 1650

Geometrization of Algebra, by Rene Descartes

David Hilbert
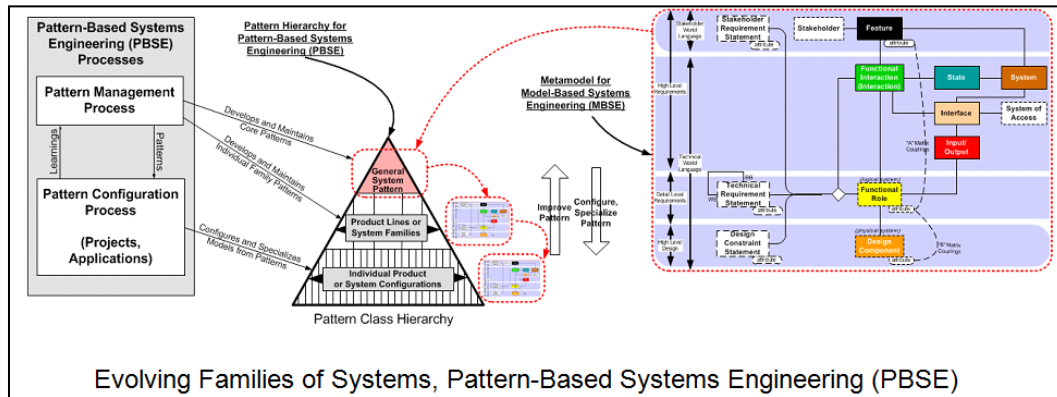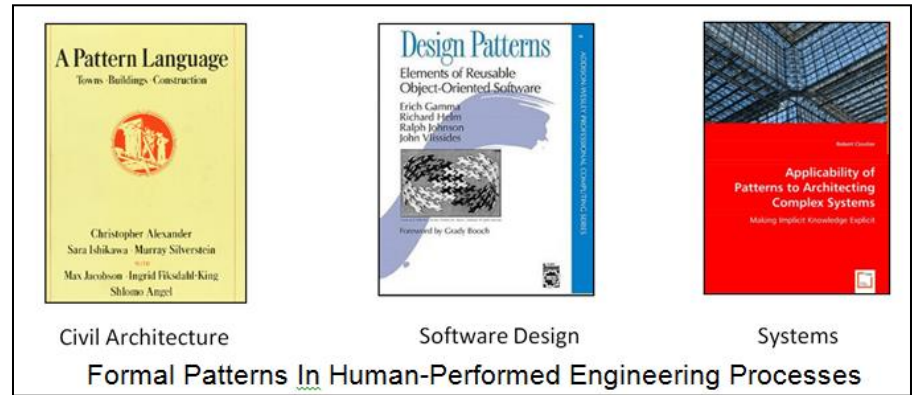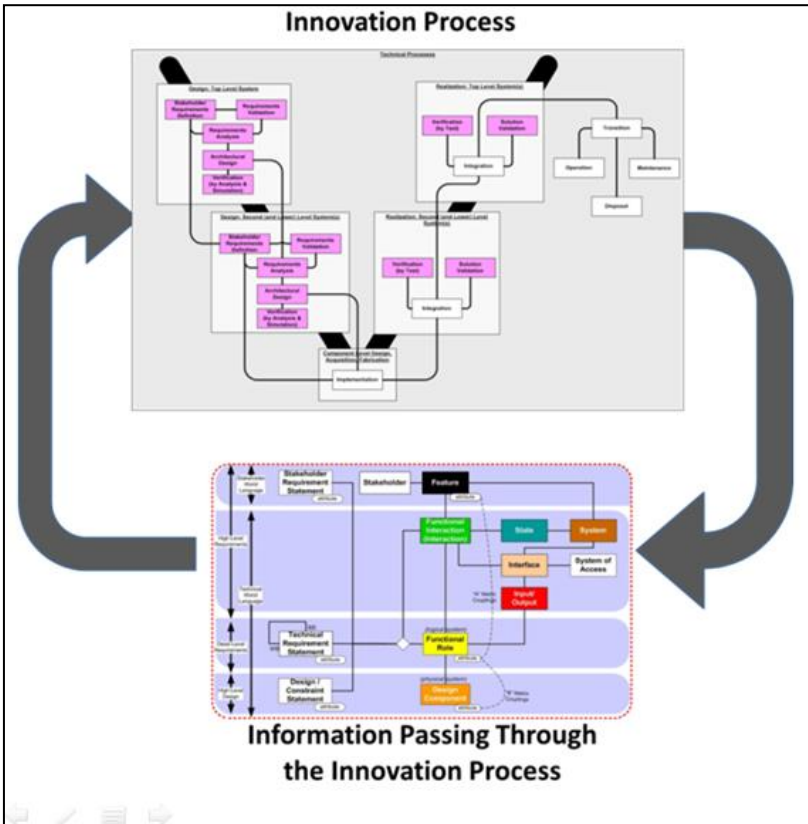1862 - 1943

Geometrization of Function Space, by David Hilbert

15

Maps *vs.* Itineraries -- SE Information *vs.* SE Process

Innovation Process

Information Passing Through the Innovation Process

Formal Patterns In Human-Performed Engineering Processes

Civil Architecture — Software Design — Systems

Evolving Families of Systems, Pattern-Based Systems Engineering (PBSE)

- Model-based Patterns in S*Space.
- Interactions as the basis of all laws of physical sciences.
- Relationships, not procedures, are the fruits of science used by engineers: Newton's laws, Maxwell's Equations.
- Immediate connection to Agility: knowing where you are--starting with better definition of what "where" means. There is a minimal "genome" (S*Metamodel) that provides a practical way to capture, record, and understand—the "smallest model of a system".
- Not giving up process: MBSE/PBSE version of ISO/IEC 15288.

16

What is the Agile Systems Engineering Life Cycle Pattern?

3. System of Innovation (SOI)

Learning & Knowledge Manager for LC Managers of Target System

Life Cycle Manager of LC Managers

2. Target System (and Component) Life Cycle Domain System

Learning & Knowledge Manager for Target Systems

LC Manager of Target System

1. Target System

Target Environment

(Substantially all the ISO15288 processes are included in all four Manager roles)
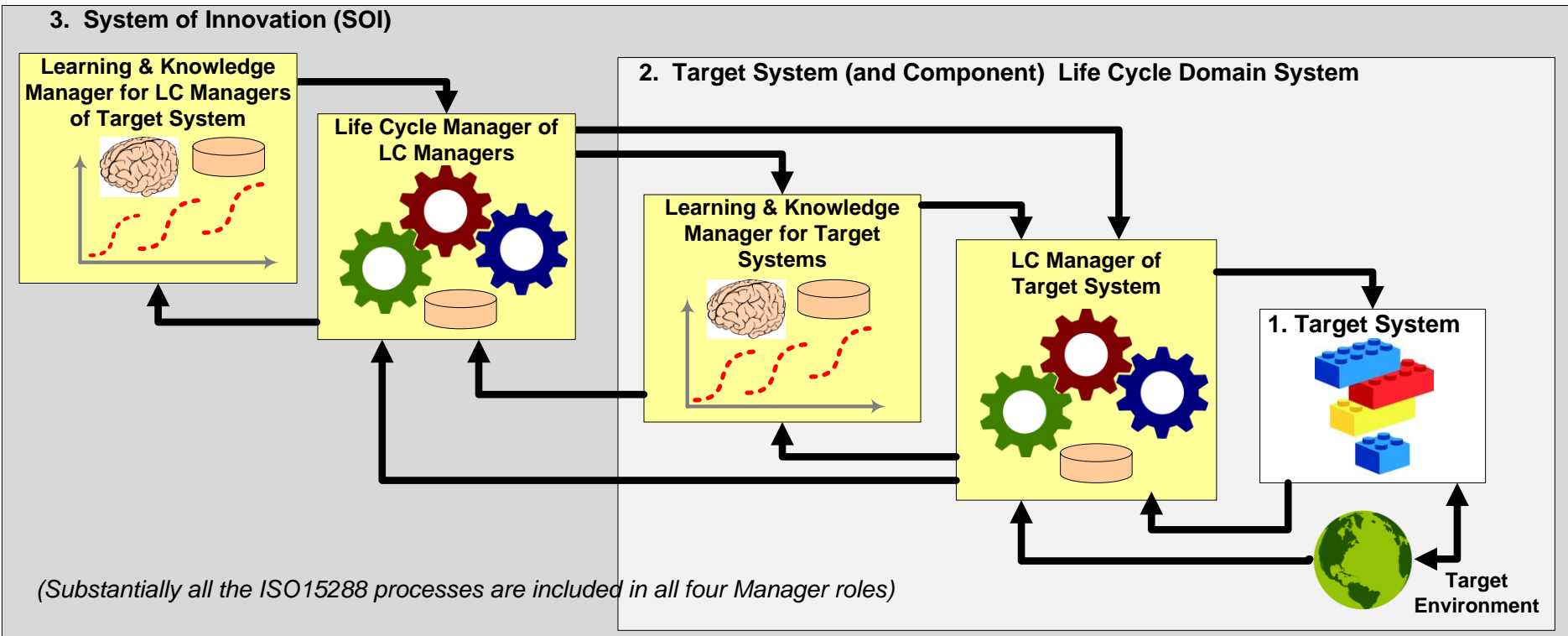
- A key subset of the ASELCM Pattern is--
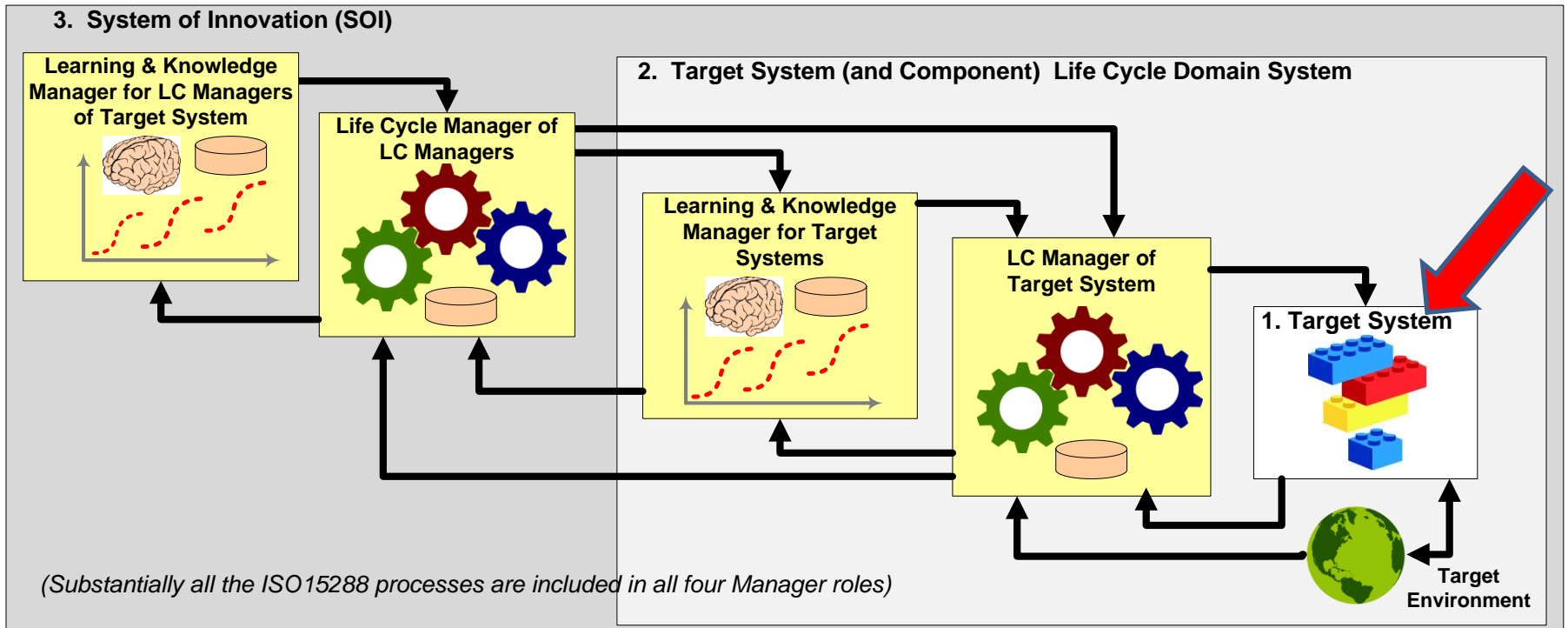 the system reference boundaries . . .

17

The Agile System Domain Model

- We will particularly refer to **three major system boundaries**:

  – To avoid a confusion bog of loaded terms, we could have just named them "System 1", "System 2", and "System 3" and proceeded to define them behaviorally.

  – The definitions are <u>behavioral</u> because these are <u>logical</u> systems, performing defined <u>roles</u>.

  – However, we will also give them more specific names — but make sure you understand the <u>definitions</u> of these systems, which are more important than their names . . .

The Agile System Domain Model

System 1: The **Target System (and Components):** (Definition) The logical system of interest, which results from, or is subject to, innovation.
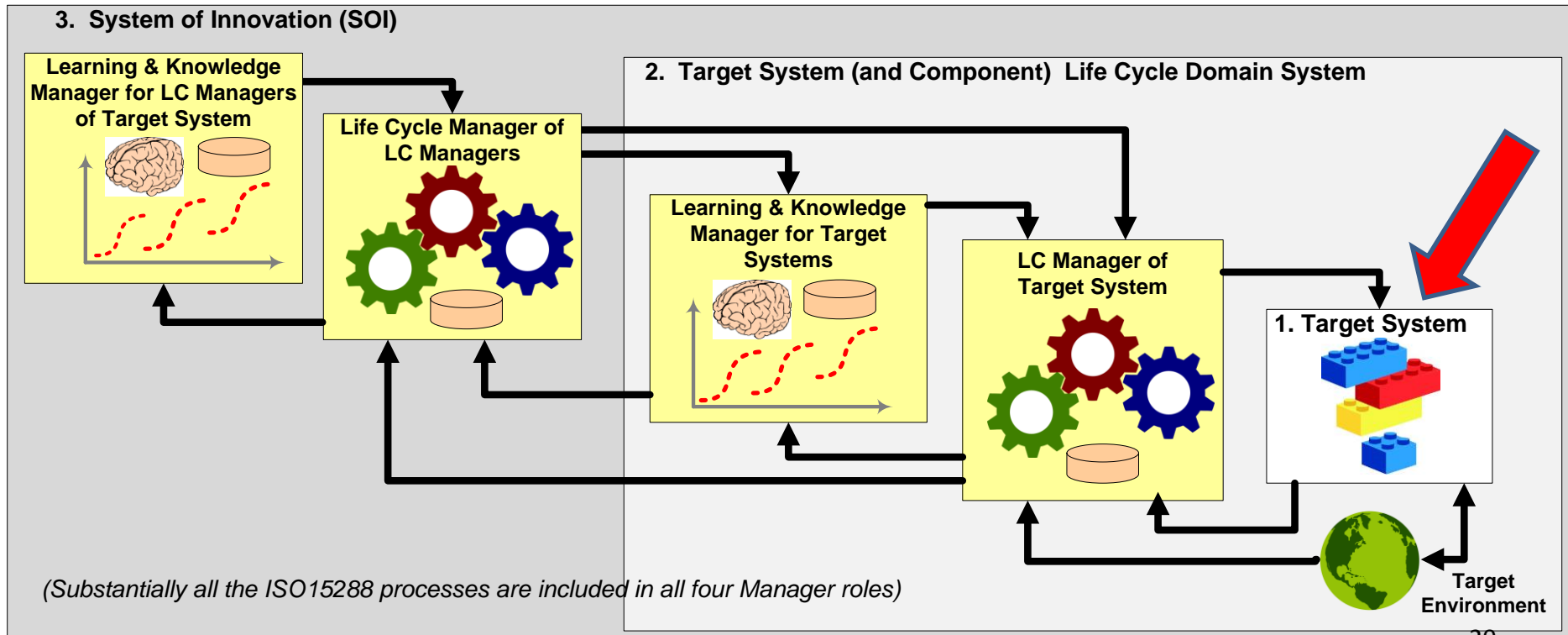
- Its behavior, characteristics, or performance are targets of the innovation (change, adaptation) process we'll introduce later.
- It is potentially agile. (Assertion: for SE to be fully agile, so must its target)
- Examples potentially include aircraft, automobiles, satellites, the human population, software, restaurants.

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19

The Agile System Domain Model

System 1: The **Target System (and Components):** (Definition) The logical system of interest, which results from, or is subject to, innovation.

- The Components maintained for integration into a Target System, but not yet integrated, are included in this domain.
- Notice that this idea can apply at multiple additional levels (e.g., System of Systems, System, Subsystem, Component, etc.)


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The Agile System Domain Model

System 2: The **Target System (and Component) Life Cycle Domain System:** (Definition) The logical system within which the Target System will exist during its life cycle, when "in service" or otherwise. This domain includes *all actors with which the Target System will directly interact during its life cycle*:

– This includes (among others) any system that directly manages the life cycle of an instance of a Target System (or a Component)—production and integration systems, maintenance, support, and operations systems, and others.

3. System of Innovation (SOI)
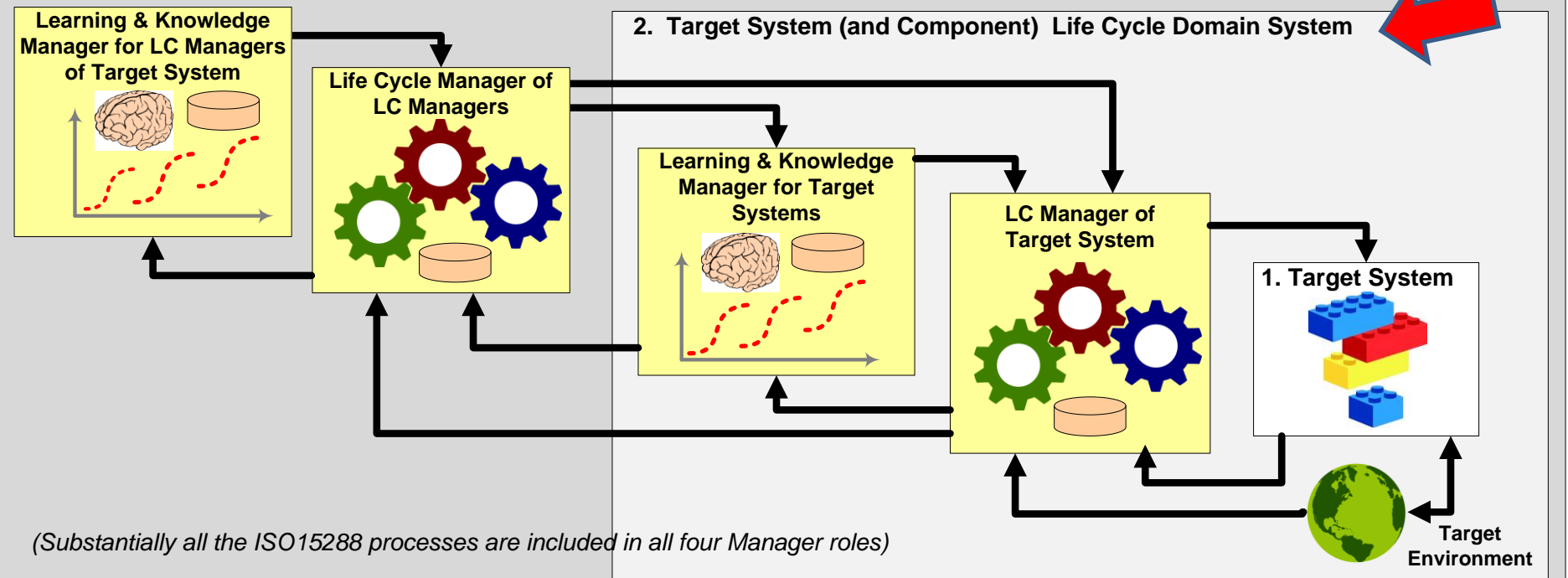
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21

The Agile System Domain Model

The System 2 model recognizes three systems besides the Target System:
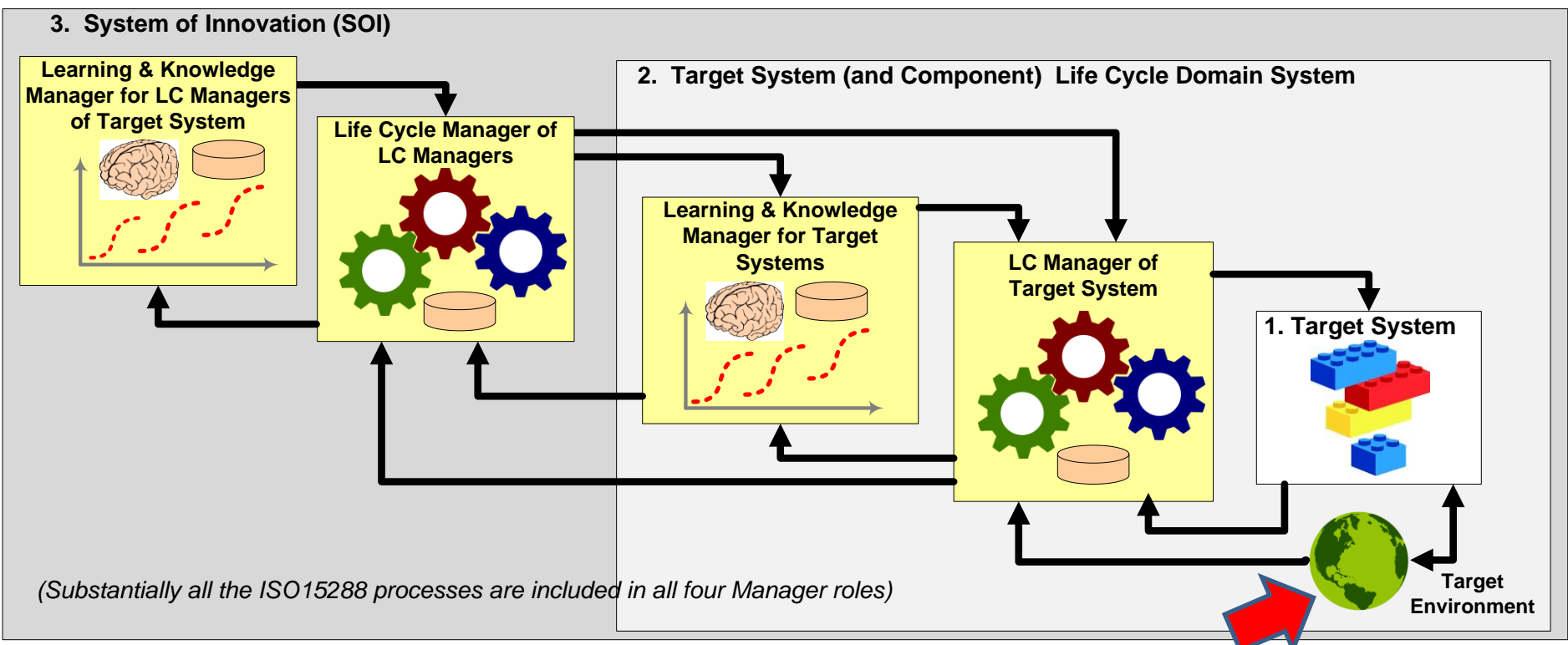
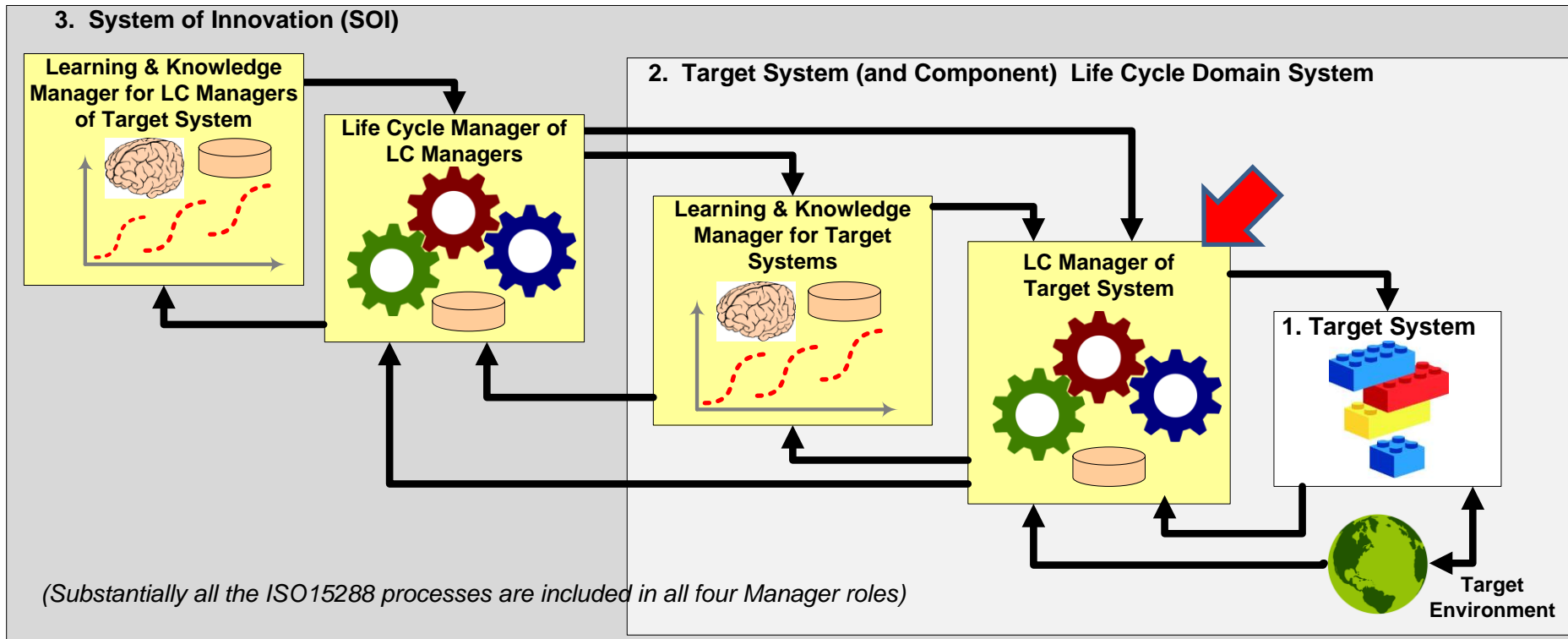- Target Environment: Target System Life Cycle Domain Actors
- LC Manager of Target System (also manages Target System Components)
- Learning & Knowledge Managers for Target System (and Components)
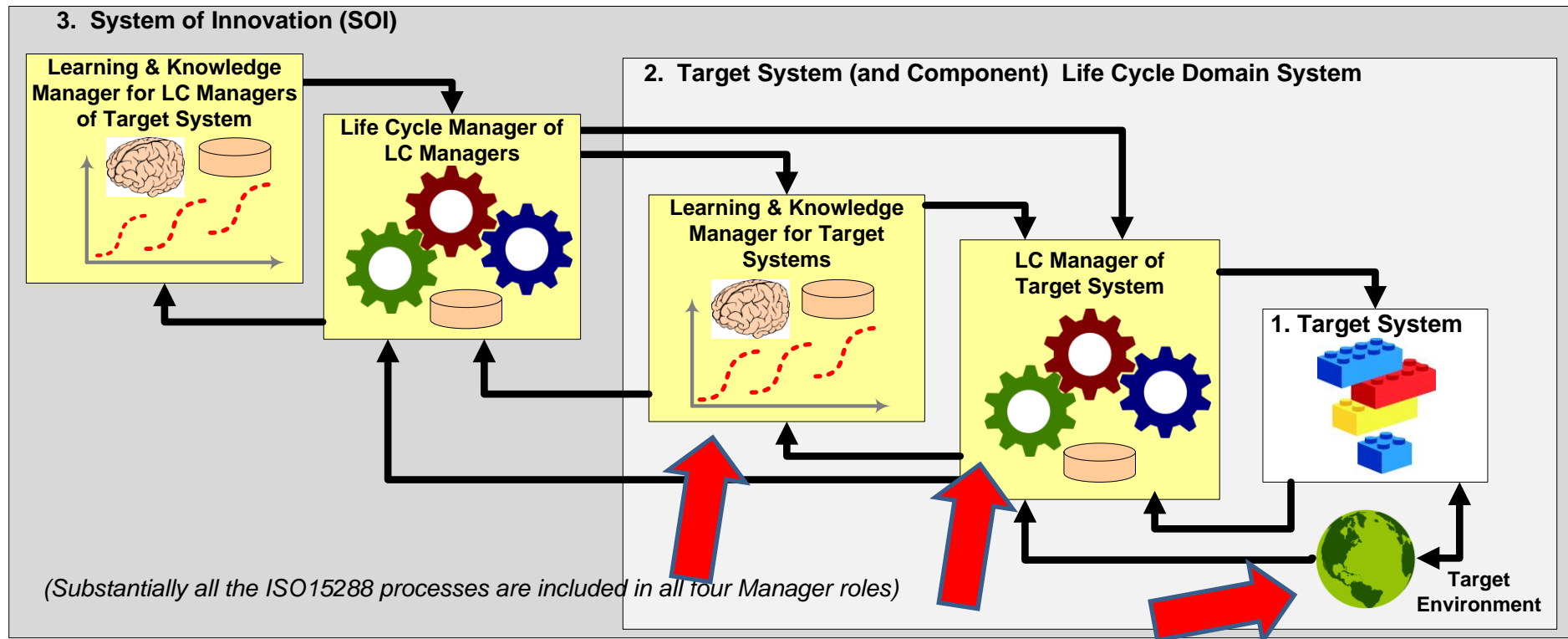
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*(Substantially all the ISO15288 processes are included in all four Manager roles)*

22

The Agile System Domain Model

The System 2 model recognizes three systems besides the Target System:

- Target System Life Cycle Domain Actors: All actors with which the Target System will directly interact during its life cycle—those in its operational domain as well as all other direct actors.

- The next system is a special case of those actors . . .

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23

The Agile System Domain Model

The System 2 model recognizes three systems besides the Target System:

- LC Manager of Target System: Manages all life cycle aspects of the Target System, as recognized by ISO 15288. Note that this is more than just development or systems engineering—it includes manufacturing or acquisition, operations, maintenance, configuration management, and all the ISO System Management Functional Areas.
    - However, it addresses only "already known" aspects of System 1 and Domain Actors—it does not include responsibility of learning new things about them . . .

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Target Environment

(Substantially all the ISO15288 processes are included in all four Manager roles)

The Agile System Domain Model

The System 2 model recognizes three systems besides the Target System:

- <u>Learning & Knowledge Manager for Target System (and Components)</u>: Responsible for learning new things about the Target System, its Components, and its Environment. This may include extraction of patterns or other knowledge from observations, planning experiments and extracting conclusions from their results, and other forms of learning. It also includes responsibility for accumulation and persistent memory of those learnings, and for providing the resulting knowledge for use by the LC Managers of the Target System.
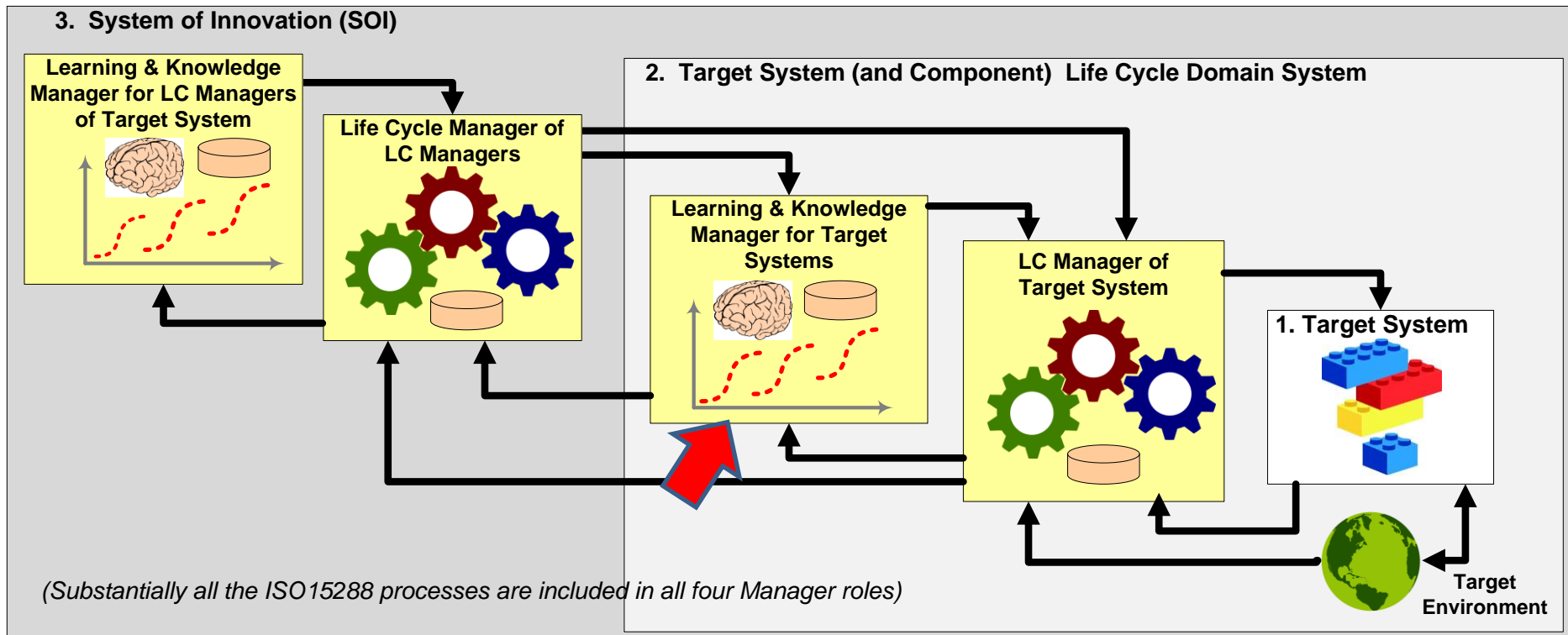
- Again, remember that these are <u>logical</u> (behavioral) roles. In realized systems, a single <u>physical</u> system may behave as both a Target System and a system that produces, modifies, reconfigures, or otherwise manages a Target System, by having roles from each allocated to it.
- For purposes of this logical roles description, they have been identified separately.
- We introduce the physical components into the model later.

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Target Environment

26
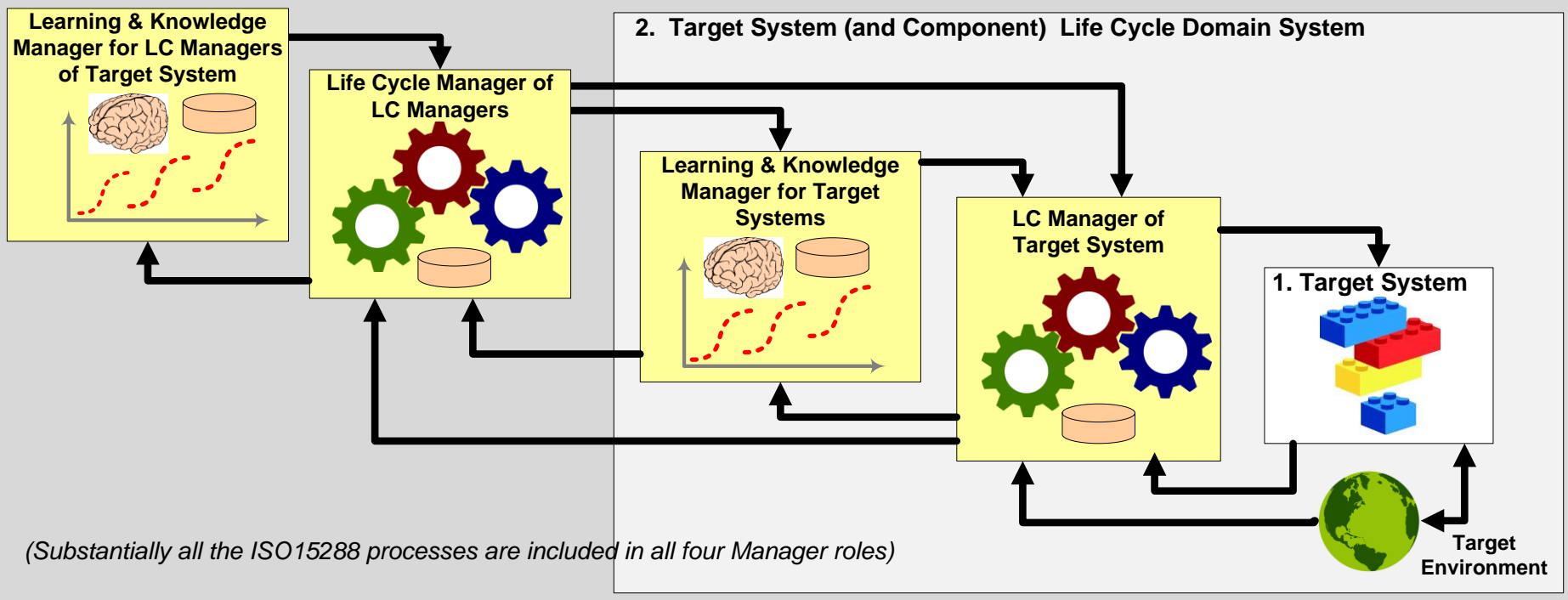
System 3: The **System of Innovation:** (Definition) The logical system responsible for managing the life cycles of instances of any (System 2) Target System LC Manager.

- (Recall that those System 2 Target System LC Managers include Target System development, production, integration, maintenance, operations, and other management systems.)
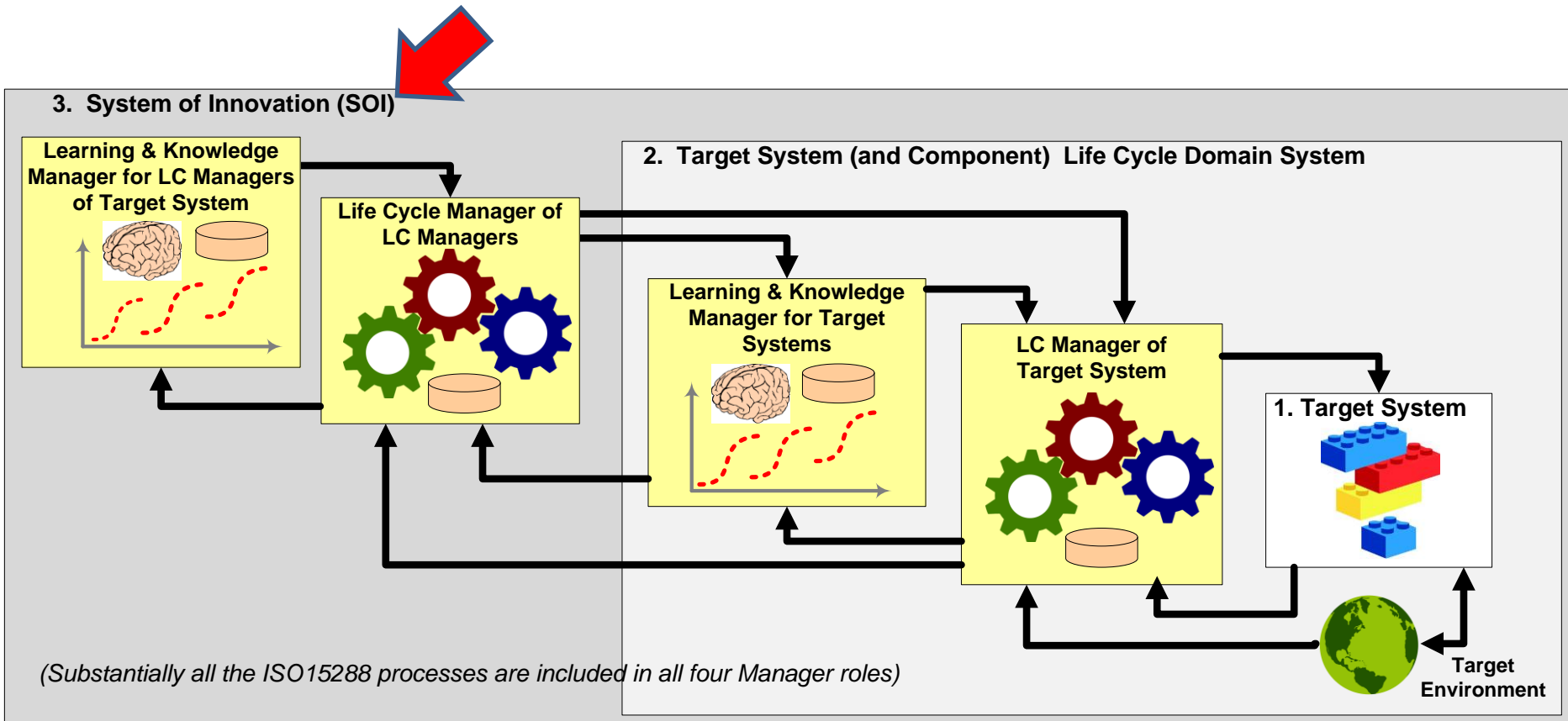
The Agile System Domain Model

The System 3 model recognizes two sub-systems of System 3:

- Life Cycle Manager of LC Managers

- Learning & Knowledge Managers for LC Managers of Target Systems
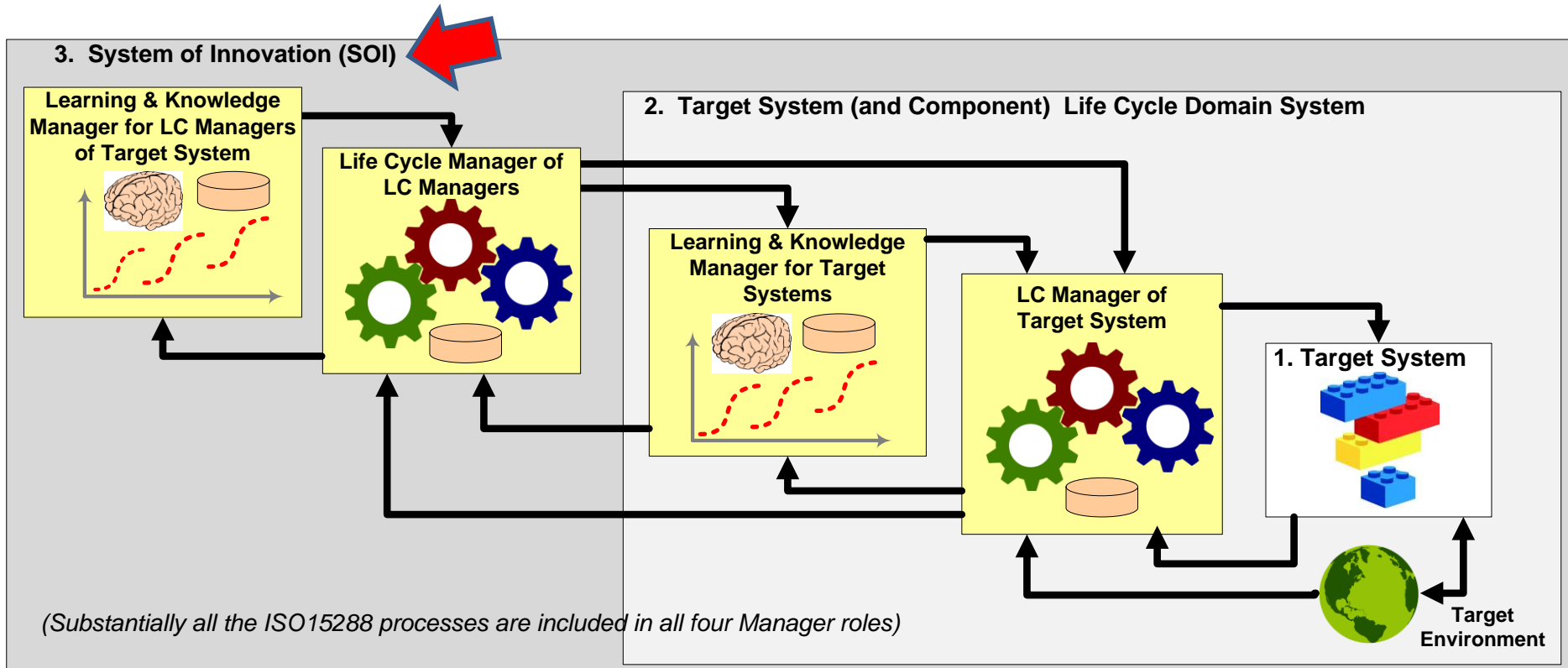
28

The Agile System Domain Model

The System 3 model recognizes two sub-systems of System 3:

- Life Cycle Manager of LC Managers: Manages all life cycle aspects of the LC Managers of Target Systems, as recognized by ISO 15288. Note that this is more than just development or systems engineering—it includes their design or acquisition, maintenance, configuration management, and all the ISO System Management Functional Areas.

    - However, it addresses only "already known" aspects of the LC Managers in System 2—it does not include responsibility of learning new things about them . . .

(Substantially all the ISO15288 processes are included in all four Manager roles)

29
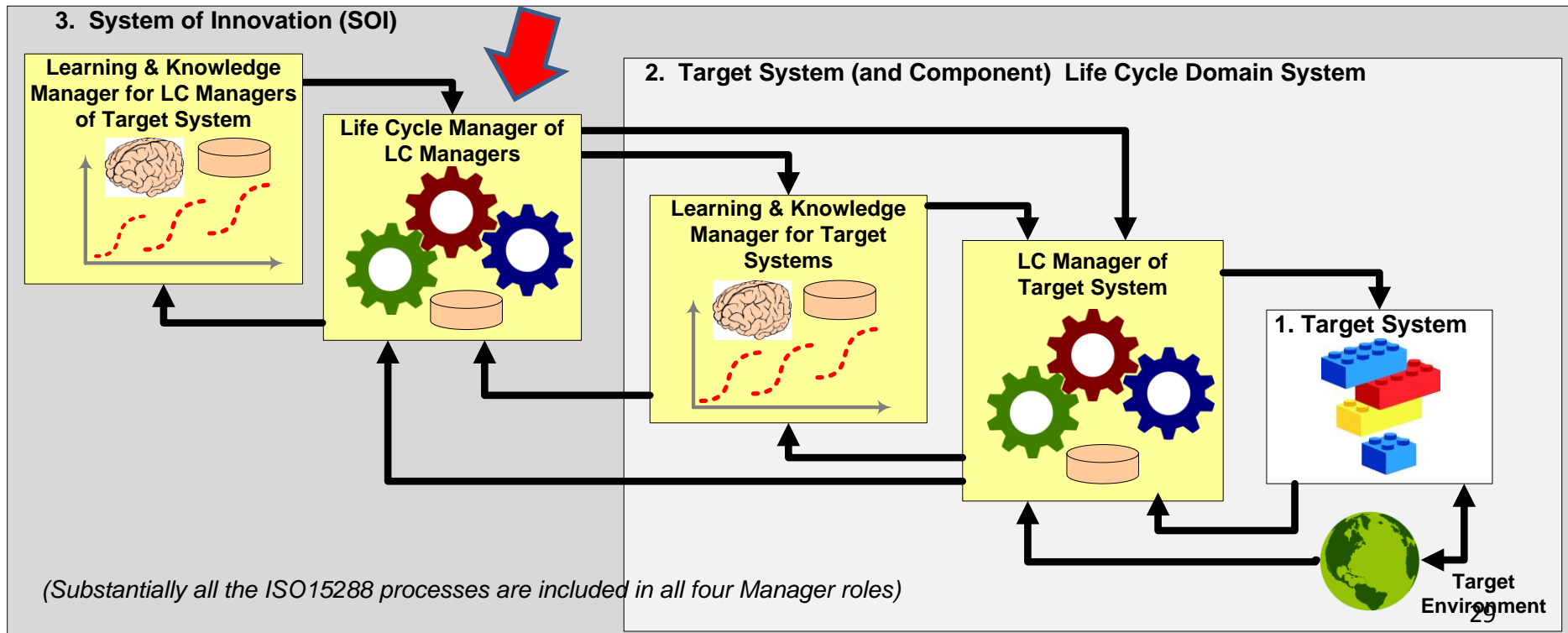
The Agile System Domain Model

The System 3 model recognizes two sub-systems of System 3:

- <u>Learning & Knowledge Managers for LC Managers of Target Systems</u>: Responsible for learning new things about the LC Managers in System 2. This may include extraction of patterns or other knowledge from observations, planning experiments and extracting conclusions from their results, and other forms of learning. It also includes responsibility for accumulation and persistent memory of those learnings, and for providing the resulting knowledge for use by the Life Cycle Manager of the LC Managers.
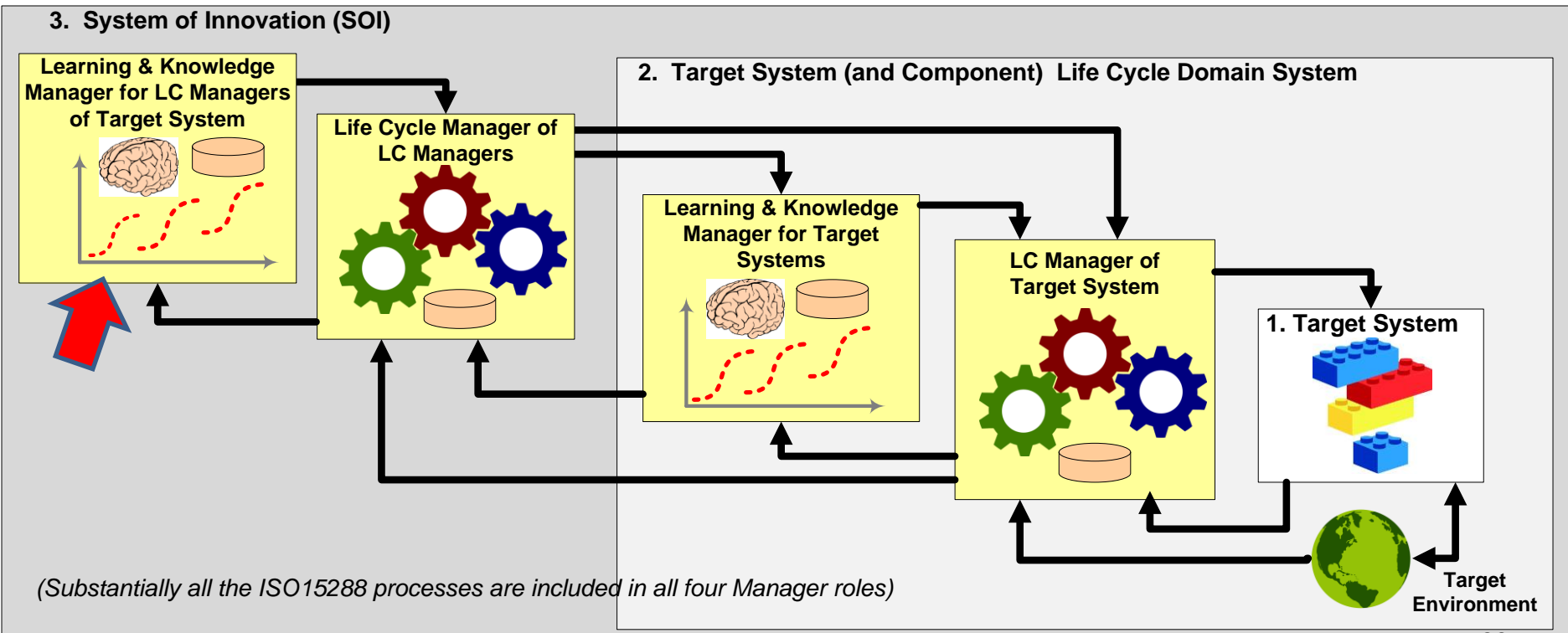
- Summary so far:
  - System 2, the Target System Life Cycle Domain System produces and modifies instances of System 1, the Target Systems (and Components), and also learns new things about System 1 and its environment.
  - System 3, the System of Innovation, produces and modifies instances of System 2, the Target LC Managers, and also learns new System 2 things.

31

Behind the "iconic" diagram, there is a formal MBSE model that describes the ASELCM Pattern

3. System of Innovation (SOI)

Learning & Knowledge Manager for LC Managers of Target System
(substantially all ISO15288 processes)

Pattern Repository, Describing **Knowledge of Families** of:

LC Managers of Target System
(all ISO15288 processes)

Provides Knowledge to

Life Cycle Manager of LC Managers
(substantially all ISO15288 processes)

Configured Models Repository, Describing **Configured Instances** of:

LC Managers of Target System
(all ISO15288 processes)

Provides Observations to

Observes

Observes

2. Target System (and Component) Life Cycle Domain System

Manages Life Cycle of

Manages Life Cycle of

Learning & Knowledge Manager for Target Systems (and Components)
(substantially all ISO15288 processes)

Provides Knowledge to

Pattern Repository, Describing **Knowledge of Families** of:

Target System

Target System Life Cycle Domain Actor

Target System Component

LC Manager of Target System (and Components)
(substantially all ISO15288 processes)

Configured Models Repository, Describing **Configured Instances** of:

Target System

Target System Life Cycle Domain Actor

Target System Component

Provides Observations to

Manages Life Cycle of

1. Target System

Target System

Target System Component

Observes

Observes

Target System Life Cycle Domain Actor

Some of these life cycle management roles may be assigned to the same physical system as the Target System

32

Example: Health care domain, top level

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(Substantially all the ISO15288 processes are included in all four Manager roles)

Target Environment

Example: Health care domain, top level

3. Health Care System of Innovation (SOI)

Learning & Knowledge Manager for Health Care Delivery Systems

Pattern Repository, Describing **Knowledge of Families** of:
- Health Care Delivery System

Provides Knowledge to

Life Cycle Manager of Health Care Delivery System

Configured Models Repository, Describing **Configured Instances** of:
- Health Care Delivery System

Provides Observations to

2. Patient Health Life Cycle Domain System

Manages Life Cycle of

Manages Life Cycle of

Learning & Knowledge Manager for Target Systems (and Components)

(substantially all ISO15288 processes)

Pattern Repository, Describing **Knowledge of Families** of:
- Patient
- Patient Environment
- Patient Component

Provides Knowledge to

Health Care Delivery System

(Health Care equivalents of Agile (extended) ISO15288 Model, including HC equivalents of Performance, Fault, Configuration, Accounting, and Security Management Processes)

Configured Models Repository, Describing **Configured Instances** of:
- Patient
- Patient Environment
- Patient Component

Manages Life Cycle of

1. Target System

Patient

Patient Subsystem

Observes

Observes

Observes

Patient Environment

Observes

Observes

Provides Observations to

- Pharma Molecule Database
- Health Care Research Web Site
- Crowd-Sourced Health Care Web Site
- Health Care Expert

- Best Medical Practices Database
- Evidence-Based Medicine Repository
- Contract Research Organization (CRO)

- Practice Management System Supplier
- Medical School
- Nursing School
- Teaching Hospital
- Health Care Organizational Change Consultant
- Medical Practice Consultant
- Health Care Delivery Holding Company
- Health Care Systems Engineering, Fabrication, Construction & Installation
- Provider Insurer
- Health Care Certification Agent

- Health Care Delivery Investor
- Pharmaceutical Supplier
- Medical Devices and Equipment Supplier
- Orthopedics Manufacturer
- Medical Information Technologies Supplier
- Contractual Medical Trials Business
- Contractual Medical Products Developer
- Contract Medical Manufacturer
- Health Care Systems Maintenance & Support
- Health Care Regulator
- Health Care Licenser
- Medical Products Marketing

- Life Scientist
- Medical Journal
- Life Sciences Textbook

- Genetics Database
- Life Sciences Repository

- Caregiver
- HC Education Service
- Health Care Payer
- Insuring Employer
- Insuring Family
- Business Office
- Facilities and Infrastructure
- HR Role
- Health Services Marketing
- Safety, Quality Assurance

- Health Care Organization
- Health Care Practitioner
- Medical Records System
- Diagnostic Service System
- Care Plan Development
- Therapeutic Service System
- Pharmacy
- Transcription Service System
- Coding Process
- Health Care Equipment
- Medical Device

- Hospital
- Private Practice
- Clinic

- Home Environment
- Occupational Environment
- School Environment
- Extracurricular Environment

Health Care Domain Reference Boundaries:
Agile System Life Cycle Management Perspective

INCOSE Patterns Working Group
V1.3.1   10.28.2015

34

How do we apply the ASELCM Pattern to Health Care Systems Improvement?

- HC Systems Trajectories: Managing Opportunity Risk
- Refer to the supplemental hand-out for break out session
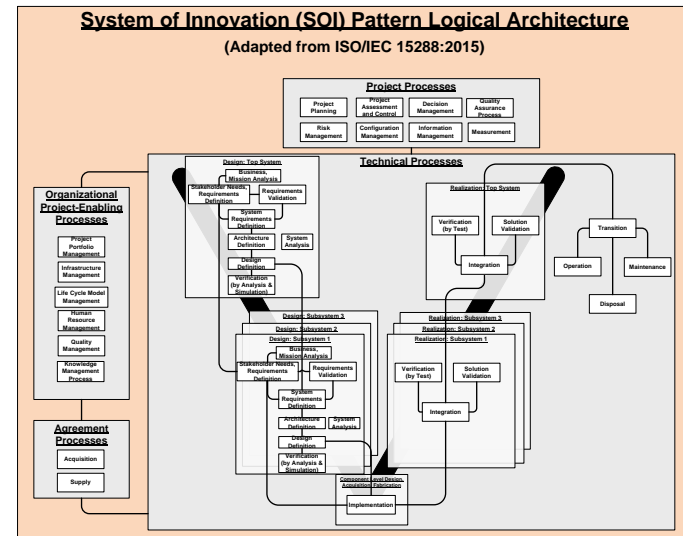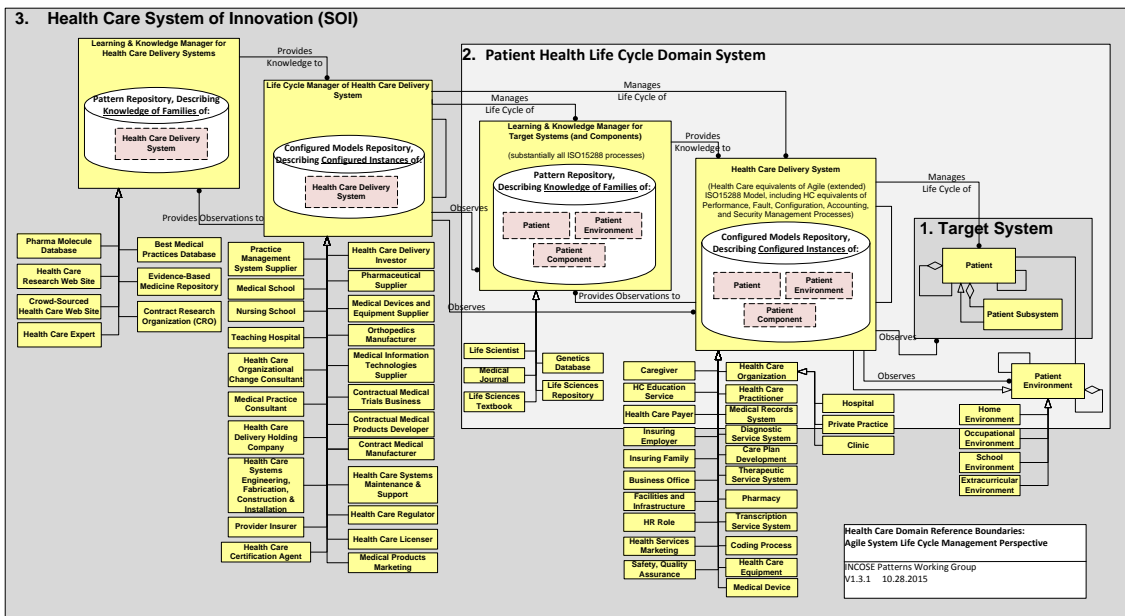
Break out: Test Drive and Hot Spot Data Collection

- Directions:
  - Break into teams and discuss the following, then . . .
  - In the domain model, identify the 5 highest cases of:

Sticky Dots

🔴 <u>Needs</u> for improved future agility (even if most difficult)

🟡 <u>Opportunities</u> for improved future agility (low-hanging fruit)

🟢 <u>Already accomplished</u> examples of improved agility progress (e.g., defense theater medicine, device software, etc.)

Sticky note In the domain model, identify potential corrections or improvements to the model

Concluding Discussion

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37

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7. J. Bradley, M. Hughes, and W. Schindel, "Optimizing Delivery of Global Pharmaceutical Packaging Solutions, Using Systems Engineering Patterns" Proceedings of the INCOSE 2010 International Symposium (2010).

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13. "A World in Motion: Systems Engineering Vision 2025", INCOSE, 2014.

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39

Back Up

Session Presentation :
Introduction to the Agile Systems Pattern

An MBSE-Based System Pattern,
with Implications for Agile Modeling

Bill Schindel, ICTT System Sciences
schindel@ictt.com

Attachment 1

Sample Extracts
from ASELCM Pattern

Bill Schindel, ICTT System Sciences
schindel@ictt.com

See --

http://www.omgwiki.org/MBSE/doku.php?id=mbse:incose_mbse_iw_2015:breakout_out_session_agile_modeling

What is the INCOSE MBSE Patterns Working Group?

http://www.omgwiki.org/MBSE/doku.php?id=mbse:patterns:patterns

MBSE Patterns Working Group's PBSE Methodology Summary for INCOSE includes overview and many references:

"Pattern-Based Systems Engineering (PBSE), Based On S*MBSE Models", INCOSE Patterns Challenge Team, 2015.

Introduction to
INCOSE MBSE Patterns Working Group

- Started in 2014, meeting several times a year, membership across domains.
- Team Co-chairs: Bill Schindel, Troy Peterson
- Six accepted IS2015 Challenge Team member papers.
- Re-usable, configurable, MBSE models ("Patterns").
- Based on S*Metamodel.
- Language and tool independent—frequently in SysML.
- Methodology practiced across domains ~ 20 years.
- For more information . . .

   http://www.omgwiki.org/MBSE/doku.php?id=mbse:patterns:patterns

Cooperative cross-team/working group projects

- The Patterns Challenge Team has been reaching out to other INCOSE and industry working groups:
  - Joint projects of interest.
- Example: We are jointly supporting, with the INCOSE Agile Systems Working Group (Rick Dove, chair), the Agile Systems Engineering Life Cycle Model Project
  - Sponsored by INCOSE
  - During 2015-16
  - Announced at IW2015

S*Models, S*Patterns

S*Pattern Hierarchy for Pattern-Based Systems Engineering (PBSE)

S*Metamodel for Model-Based Systems Engineering (MBSE)

System Pattern Class Hierarchy
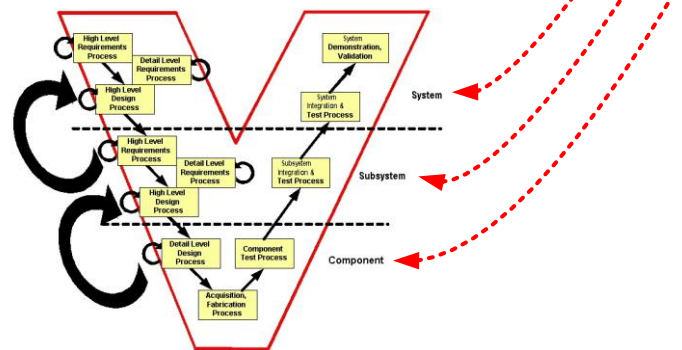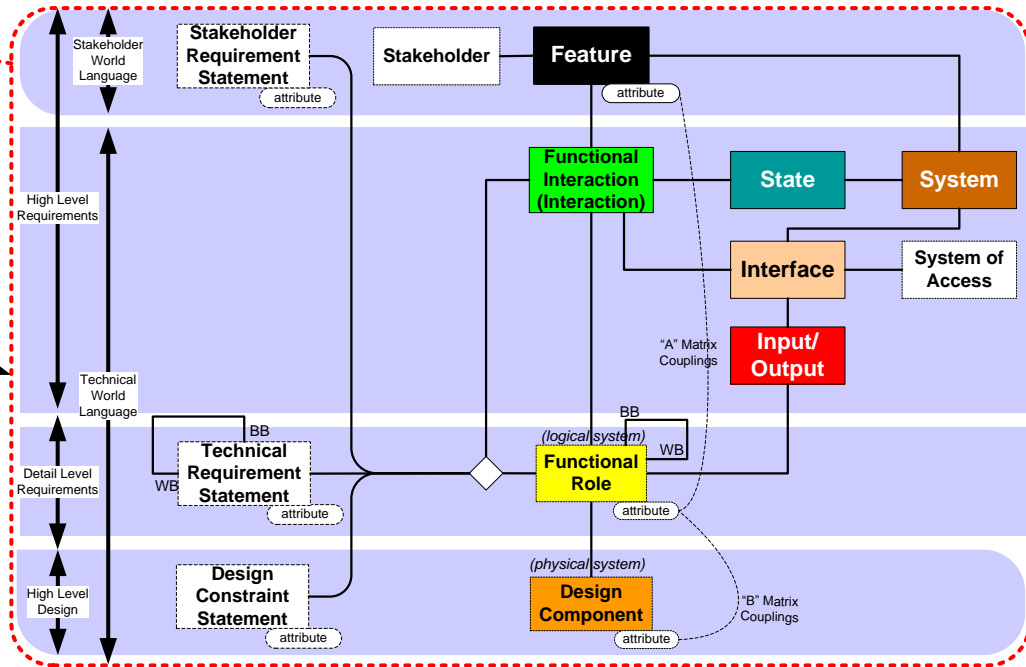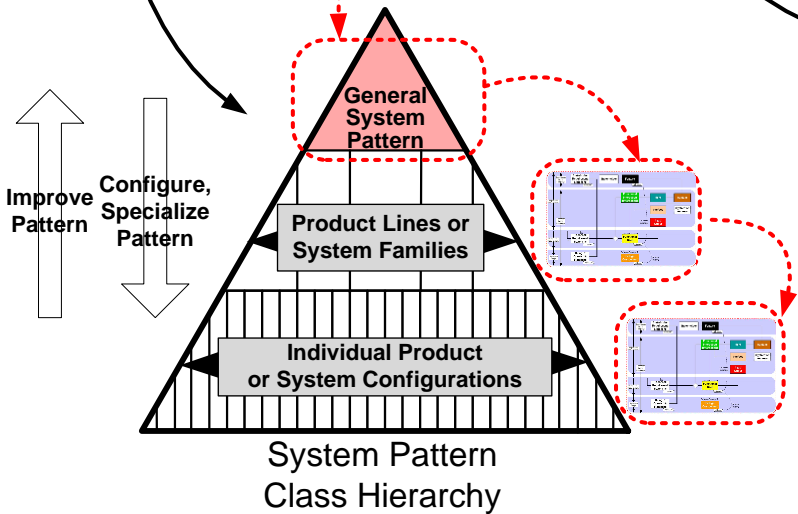
System Containment Hierarchy

44
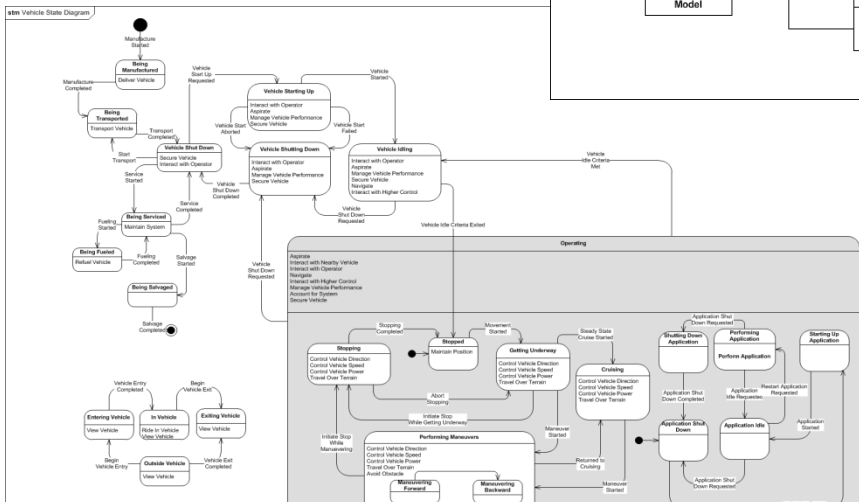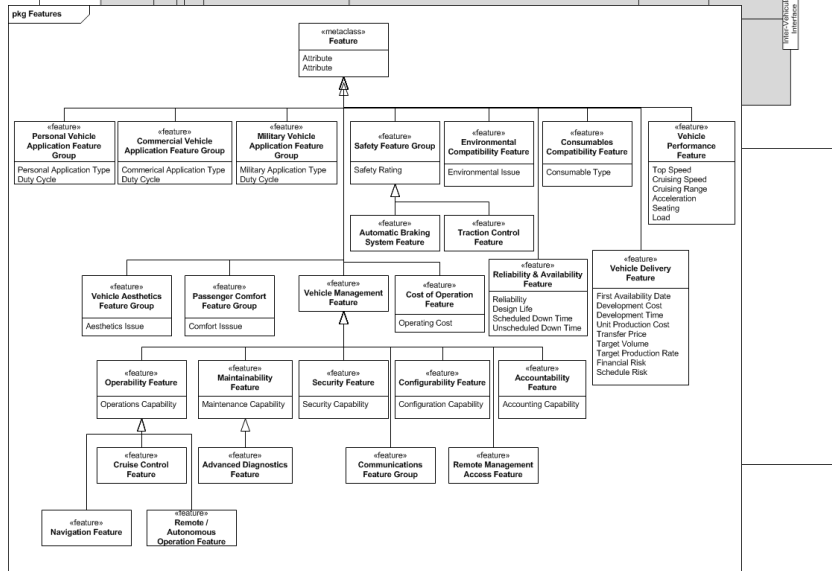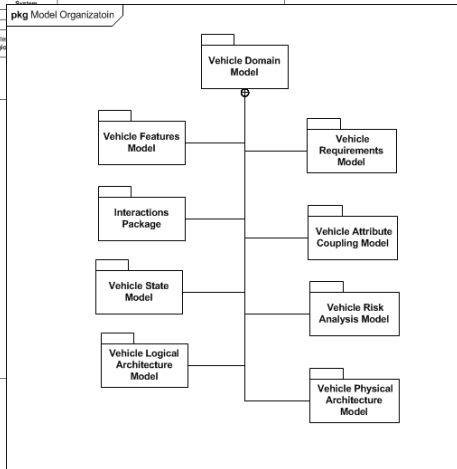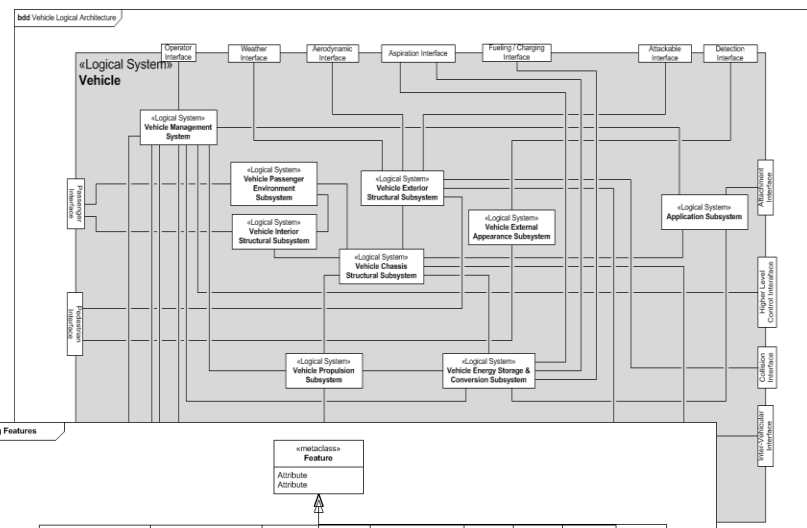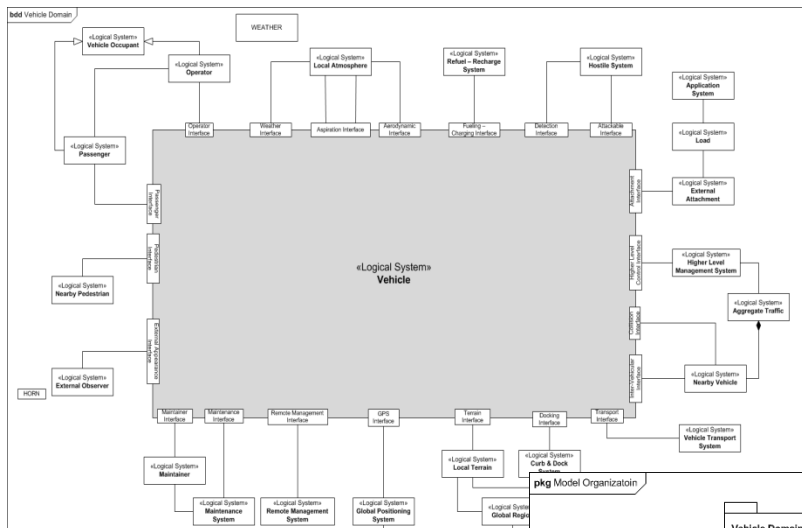
Extracts from Vehicle Pattern in 2013 INCOSE PBSE Tutorial 45

Relating Scrum and ISO 15288 Process Models

- More Than One Representation (Model View) of the Same Underlying (Process) Reality . . .

ISO15288 Reference Processes
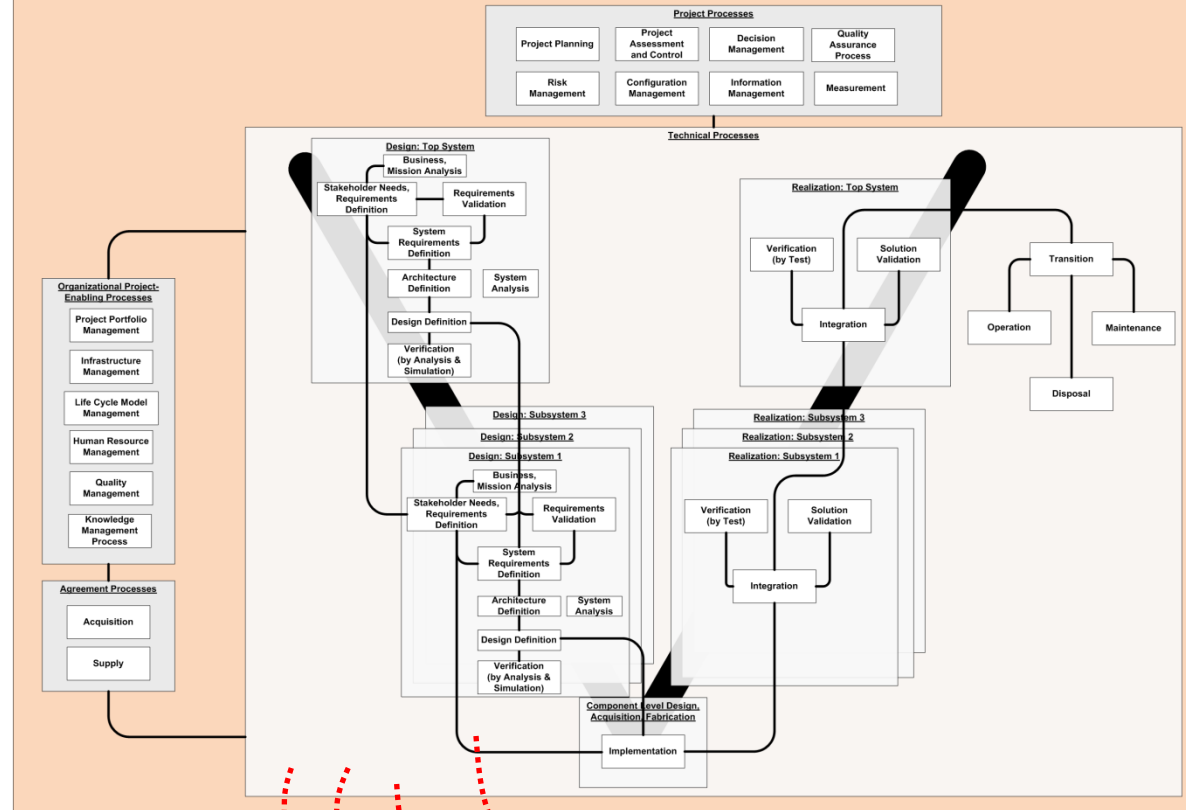
ISO15288 Technical Processes appear in System 2 (for target) and System 3 (for LC managers), as (potentially concurrent) "Vee" processes, and learning sources.

47

ASELCM Pattern: System 1 (Target System) agility, driven by System 2 (Life Cycle Management) and System 3 (System of Innovation).

Performs most of these ISO processes, to manage what is being learned about S1 space.

Manages Target System Family Patterns

Performs most of these ISO processes, to manage S1 instances, using S1 patterns

Manages LC Management System Family Patterns

Performs most of these ISO processes, to manage S2 instances, using S2 patterns

Performs most of these ISO processes, to manage what is being learned about S2 space.

System 2

System 3

48

Agile Scrum Model
(See IW2015 MBSE Workshop Attachment I for more.)

Traditional Scrum Sprint Perspective
(Summary State Machine)
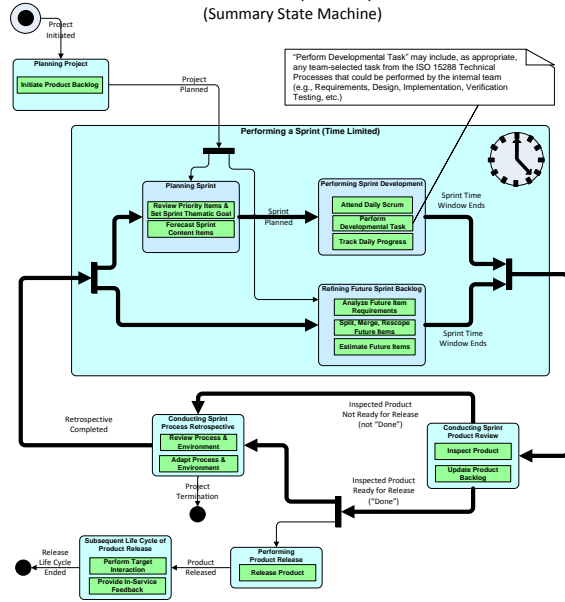
Traditional Scrum Sprint Perspective
(Simplified Model of Managed Information)
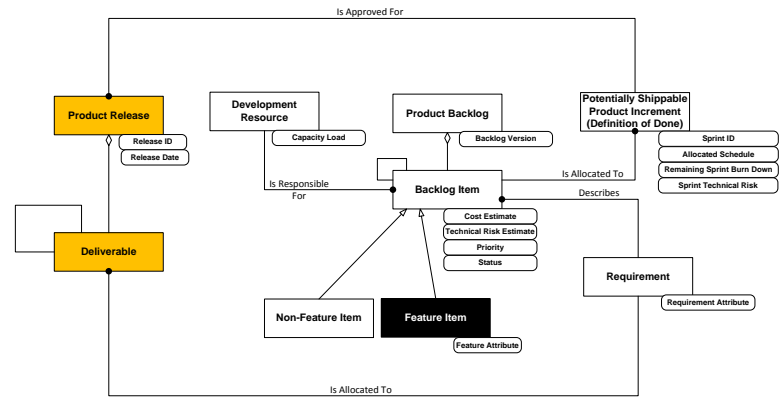
Copyright 2015, ICTT System Sciences

Traditional Scrum Sprint Perspective
(Activity Diagram, with Swim Lane Roles)
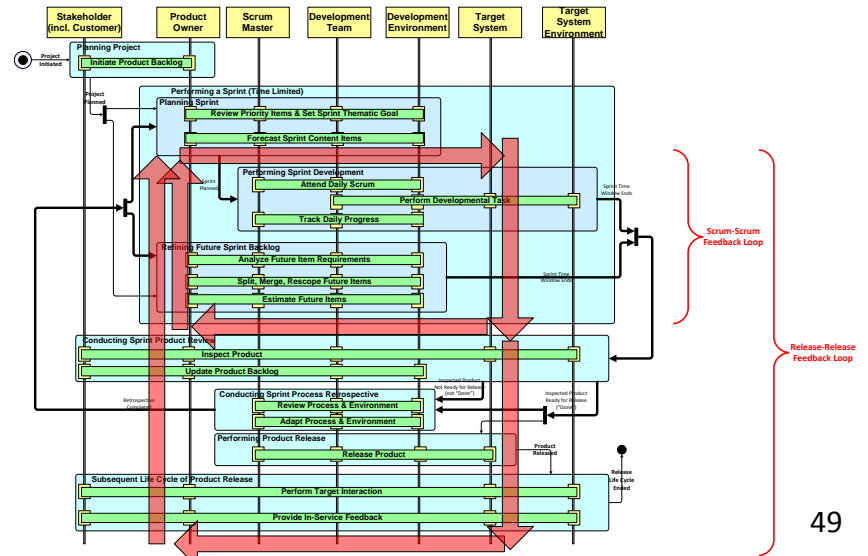
49

More Than One Representation
(Model View) of the Same Underlying Reality

We are dealing with four different representations of the same underlying reality:

1. The Scrum Pattern: Emphasizes time-bound outputs and feedback, focusing on processes for _learning from produced outputs, and management of risk_

2. The ISO15288 Pattern: Emphasizes types of processes, focusing on _management of processes_

3. The Agile Systems Engineering Life Cycle Pattern : Shows how (1) and (2) above may be seen as one

4. The S*Metamodel: Emphasizes the information flowing through all three of them: (1), (2), and (3)

Scrum Pattern
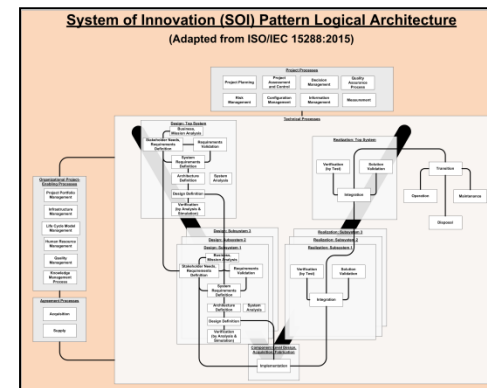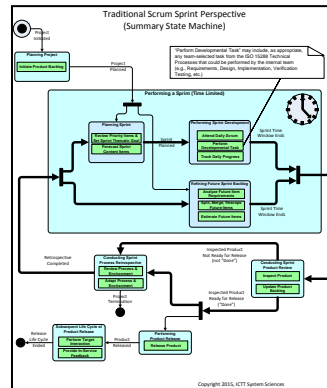
ISO15288 Pattern

ASELC Pattern
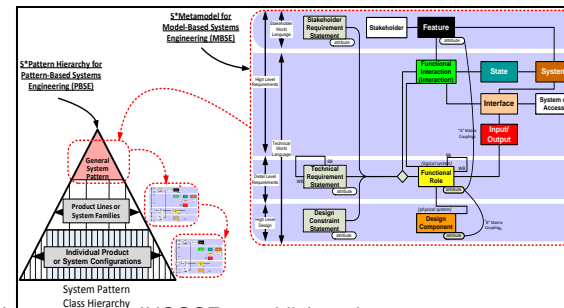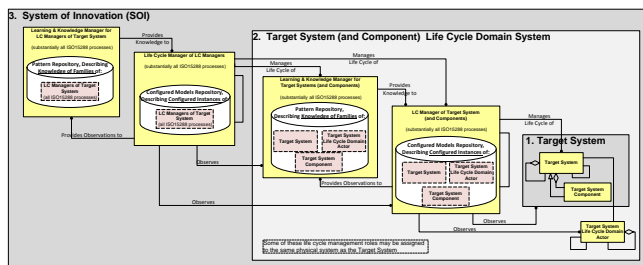
S*Metamodel

More Than One Representation (Model View) of the Same Underlying Reality

- The Scrum Model is actually an abstraction of the more complex-<u>looking</u> multiple Processes of the ISO15288 System Life Cycle reference model:
  - As indicated in the Agile literature, nothing about the Scrum Model is intended to prevent things like Requirements Analysis, Verification (Test), or even aspects of Project Management, . . .
  - But those activities are shared by the small team members who play many individual roles, and the simpler-looking Scrum model "gives us permission" to "do what is needed" in a given situation, in an "agile way".

Scrum Pattern
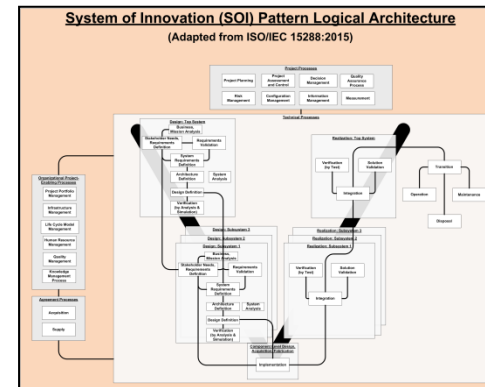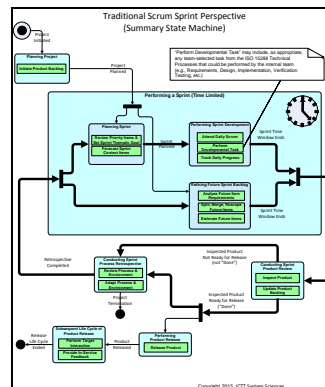
ISO15288 Pattern

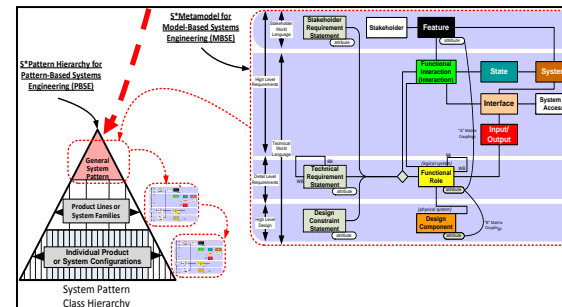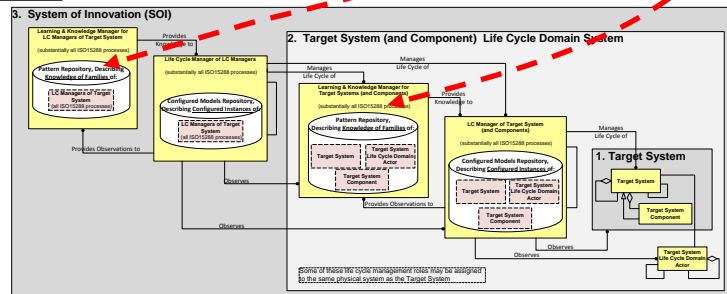# More Than One Representation (Model View) of the Same Underlying Reality

- The Scrum Model also abstracts complex <u>learning</u> behavior, into simple-looking form—but it is still strongly expected to occur as part of the Agile Process, and is more <u>explicitly</u> represented in the ASELC Pattern, as capture of Pattern information—not assumed to be only in human minds.


Scrum Pattern
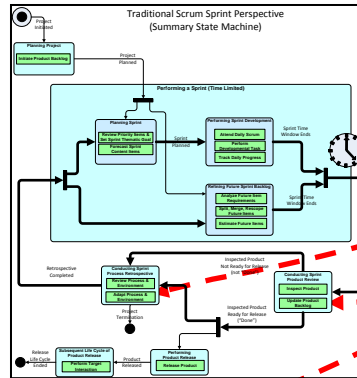
ASELC Pattern

S*Metamodel

Learning

<u>Learning often in upper-most S1,2,3 Pattern, but can also be in specializations and configurations below it.</u>

52

More Than One Representation (Model View) of the Same Underlying Reality

- Notice that the division of the System 2&3 learning roles in the ASELCM Pattern corresponds to the Scrum division of (review and learning about target system) versus (review and learning about development process):
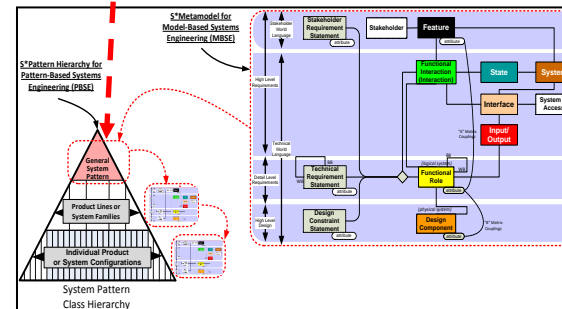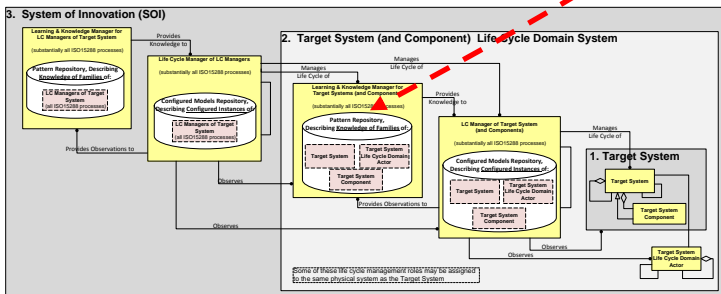
Scrum Pattern
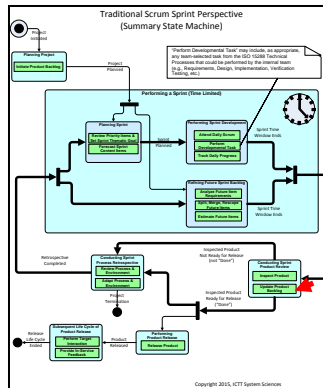
ASELC Pattern

Pattern: Learnings about Target System (Product & Its Environment)

Pattern: Learnings about Development / Fielding System & Its Environment
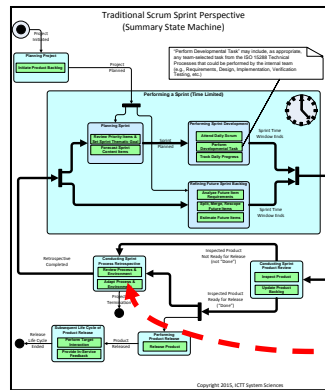
S*Metamodel

More Than One Representation (Model View) of the Same Underlying Reality

- Notice that the division of the System 2&3 learning roles in the ASELCM Pattern corresponds to the Scrum division of (review and learning about target system) versus (review and learning about development process):
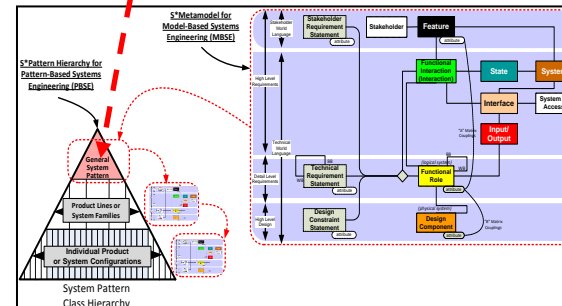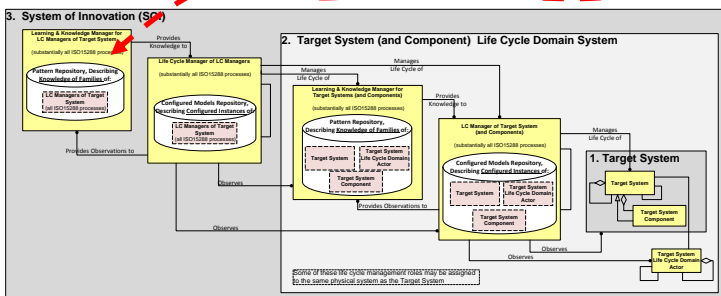
Pattern: Learnings about Target System (Product & Its Environment)

Scrum Pattern

Pattern: Learnings about Development / Fielding LC Management System(s) & Its Environment
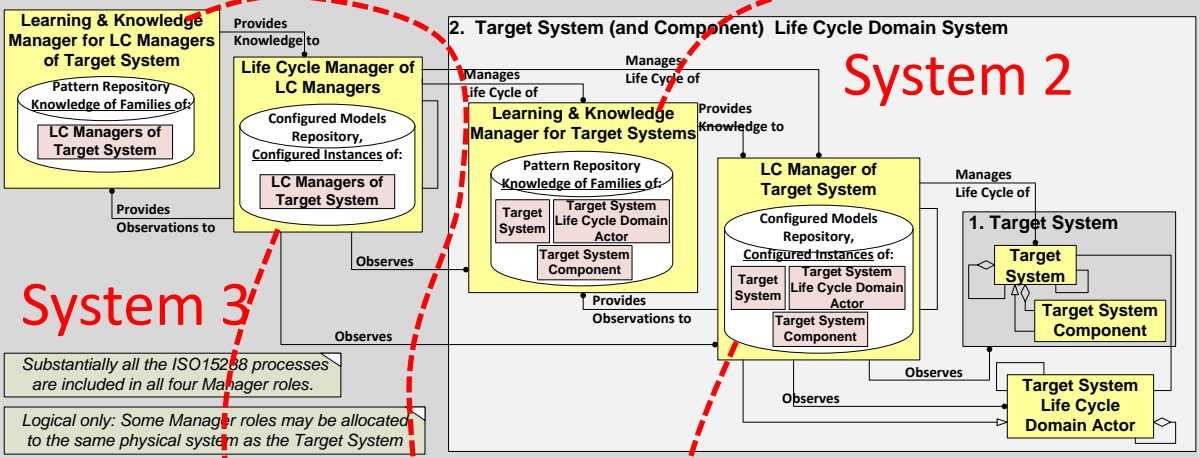
ASELC Pattern

S*Metamodel

3. System of Innovation (SOI)

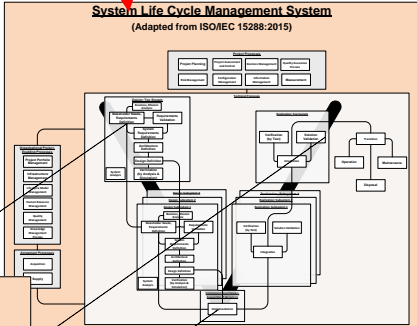Learning & Knowledge Manager for LC Managers of Target System
- Pattern Repository Knowledge of Families of:
  - LC Managers of Target System

Provides Knowledge to

Life Cycle Manager of LC Managers
- Configured Models Repository, Configured Instances of:
  - LC Managers of Target System
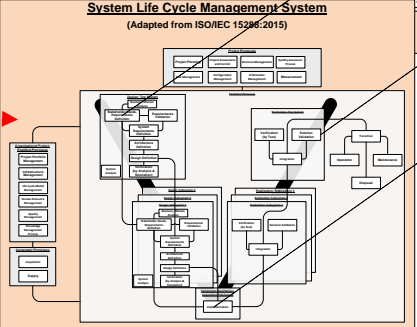
Provides Observations to

System 3

Observes

Substantially all the ISO15288 processes are included in all four Manager roles.

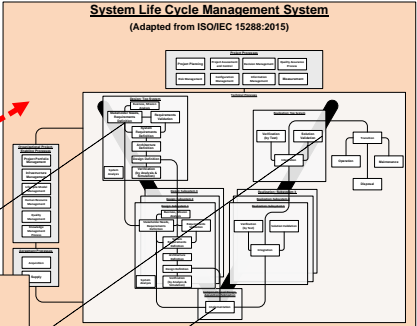*Logical only: Some Manager roles may be allocated to the same physical system as the Target System*

Observes

2. Target System (and Component) Life Cycle Domain System

System 2

Manages Life Cycle of

Learning & Knowledge Manager for Target Systems
- Pattern Repository Knowledge of Families of:
  - Target System
  - Target System Life Cycle Domain Actor
  - Target System Component

Provides Knowledge to

Manages Life Cycle of

LC Manager of Target System
- Configured Models Repository, Configured Instances of:
  - Target System
  - Target System Life Cycle Domain Actor
  - Target System Component

Manages Life Cycle of

Provides Observations to

Observes

1. Target System
- Target System
- Target System Component

Observes

Target System Life Cycle Domain Actor

Performs most of these ISO processes, to manage what is being learned about S1 space.

System Life Cycle Management System (Adapted from ISO/IEC 15288:2015)

Manages Target System Family Patterns

Performs most of these ISO processes, to manage S1 instances , using S1 patterns

System Life Cycle Management System (Adapted from ISO/IEC 15288:2015)

Manages LC Management System Family Patterns

System Life Cycle Management System (Adapted from ISO/IEC 15288:2015)

Performs most of these ISO processes, to manage S2 instances , using S2 patterns

System Life Cycle Management System (Adapted from ISO/IEC 15288:2015)

ASELCM Pattern: System 1 (Target System) agility, driven by System 2 (Life Cycle Management) and System 3 (System of Innovation).
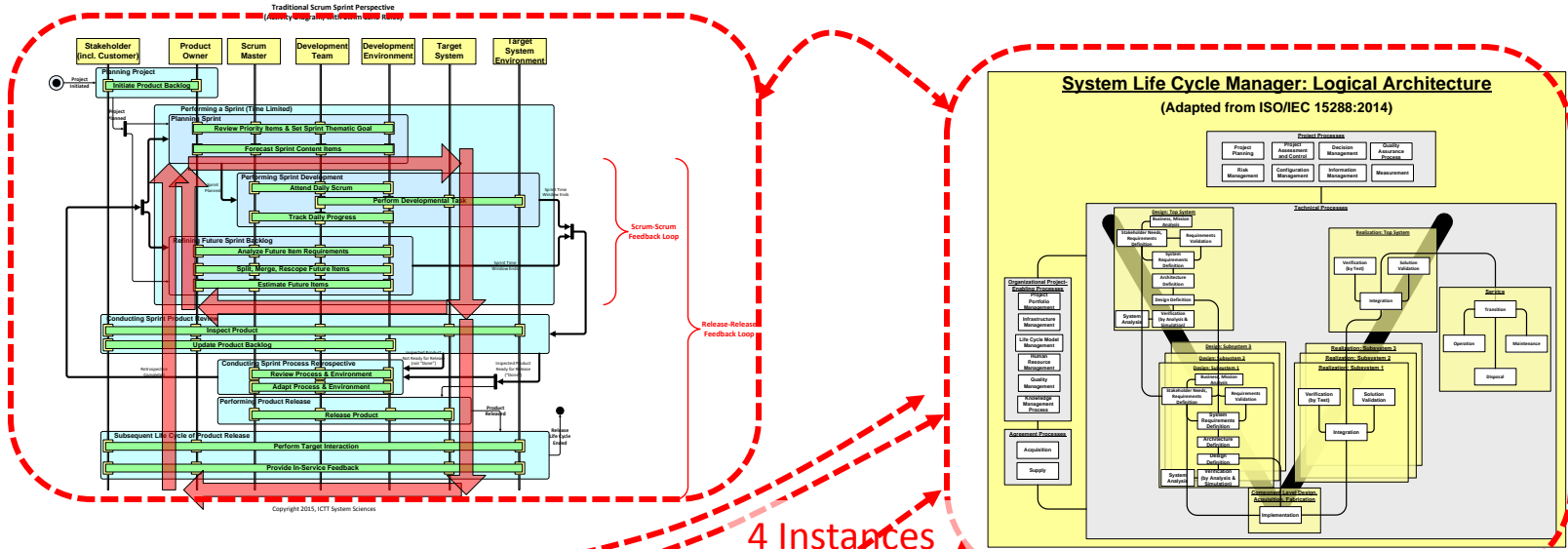
Performs most of these ISO processes, to manage what is being learned about S2 space.

55

Traditional Scrum Sprint Perspective
(Simplified Model of Managed Information)

Is Approved For

Product Release
- Release ID
- Release Date

Development Resource
- Capacity Load

Product Backlog
- Backlog Version

Potentially Shippable Product Increment (Definition of Done)
- Sprint ID
- Allocated Schedule
- Remaining Sprint Burn Down
- Sprint Technical Risk

Is Responsible For

Backlog Item
- Cost Estimate
- Technical Risk Estimate
- Priority
- Status

Is Allocated To

Describes

Deliverable

Non-Feature Item

Feature Item
- Feature Attribute

Requirement
- Requirement Attribute
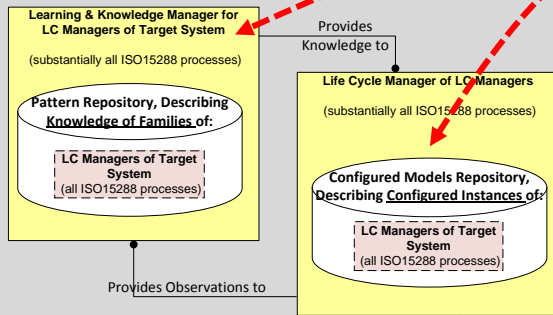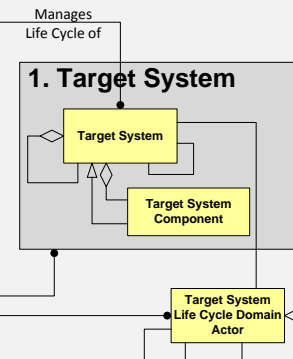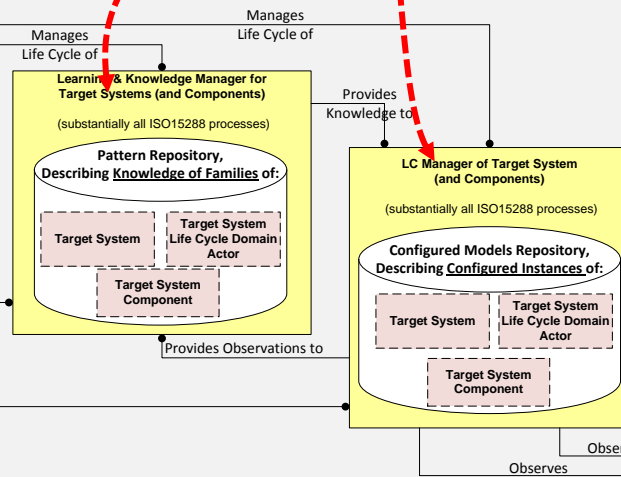
Is Allocated To

56

Agile Scrum Specialization of the ASELCM Pattern

4 Instances

3. System of Innovation (SOI)

2. Target System (and Component) Life Cycle Domain System

1. Target System