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The INCOSE Innovation Ecosystem (ASELCM) Pattern

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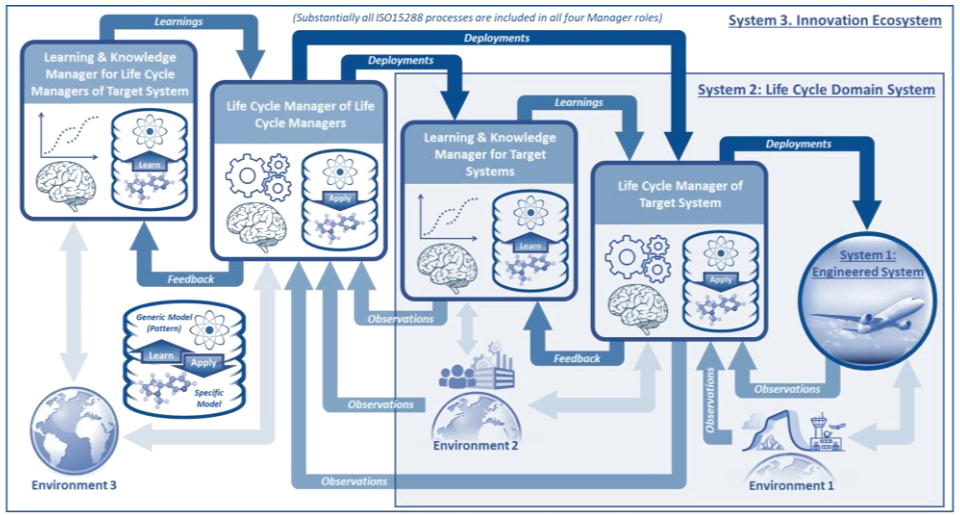
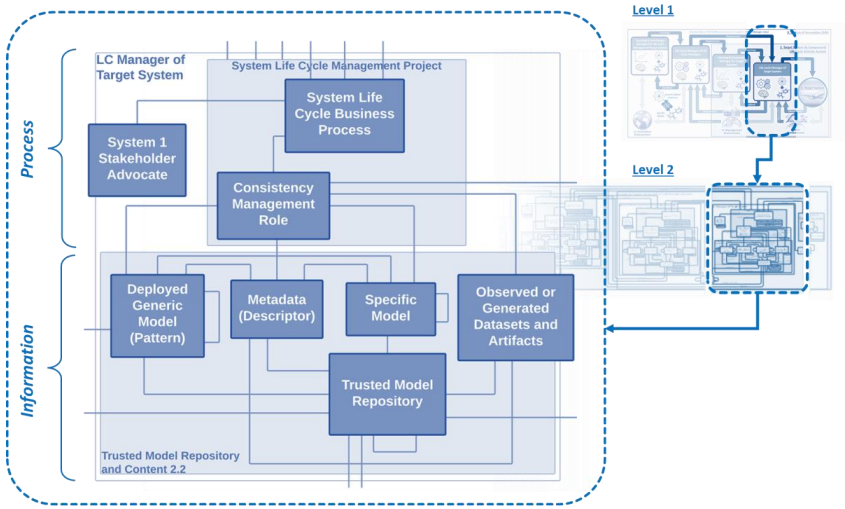


INCOSE ASELCM Level 1 Reference Model



INCOSE ASELCM Level 2 Reference Model

Contents

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- The ASELCM Pattern in SysML
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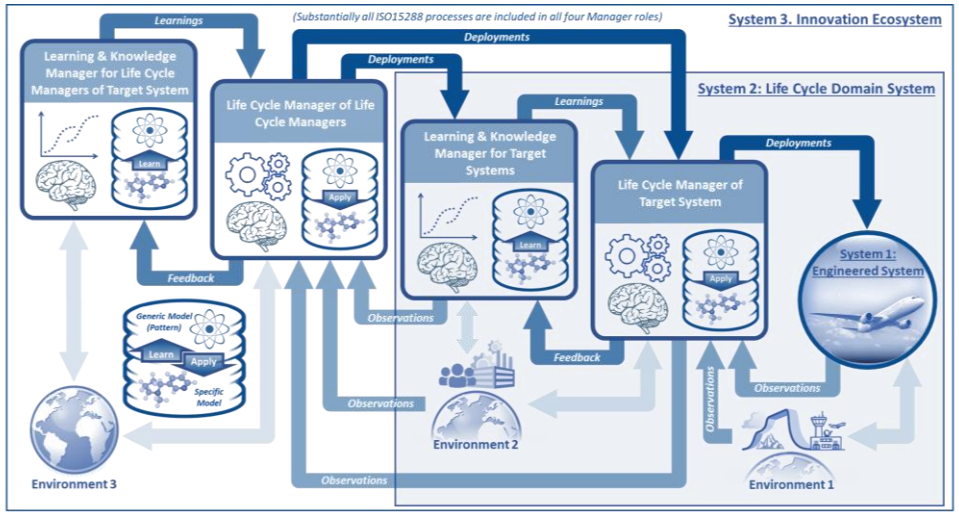
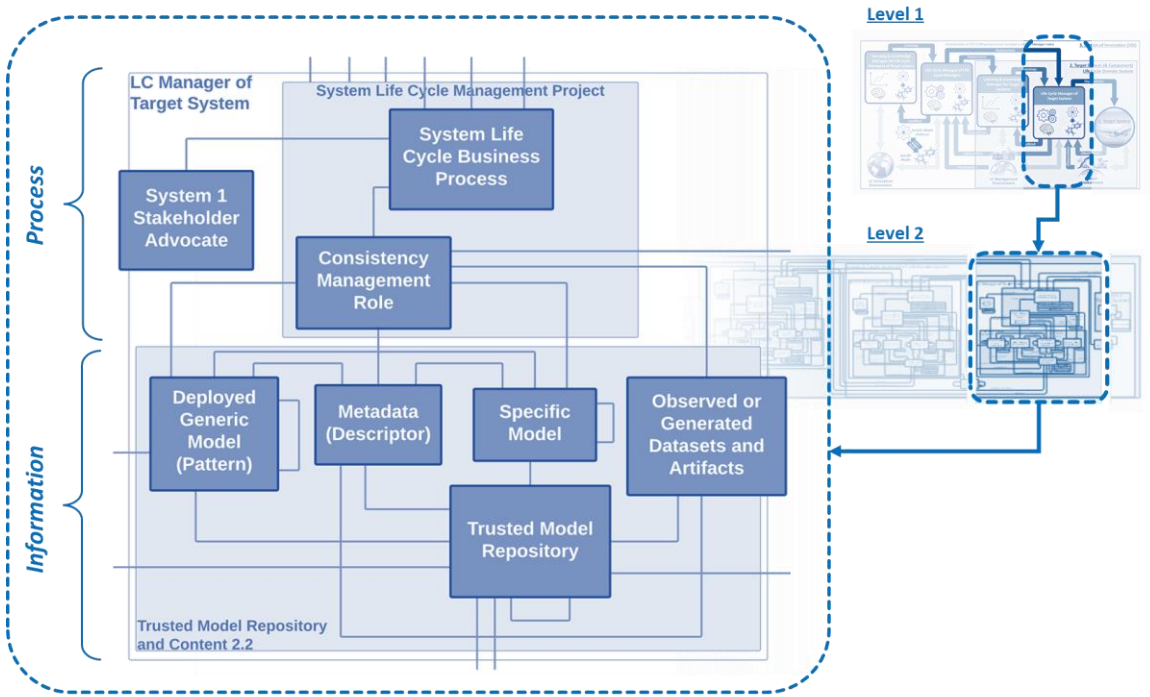
- Discussion
- How to find out more: References

INCOSE Innovation Ecosystem (ASELCM) Pattern

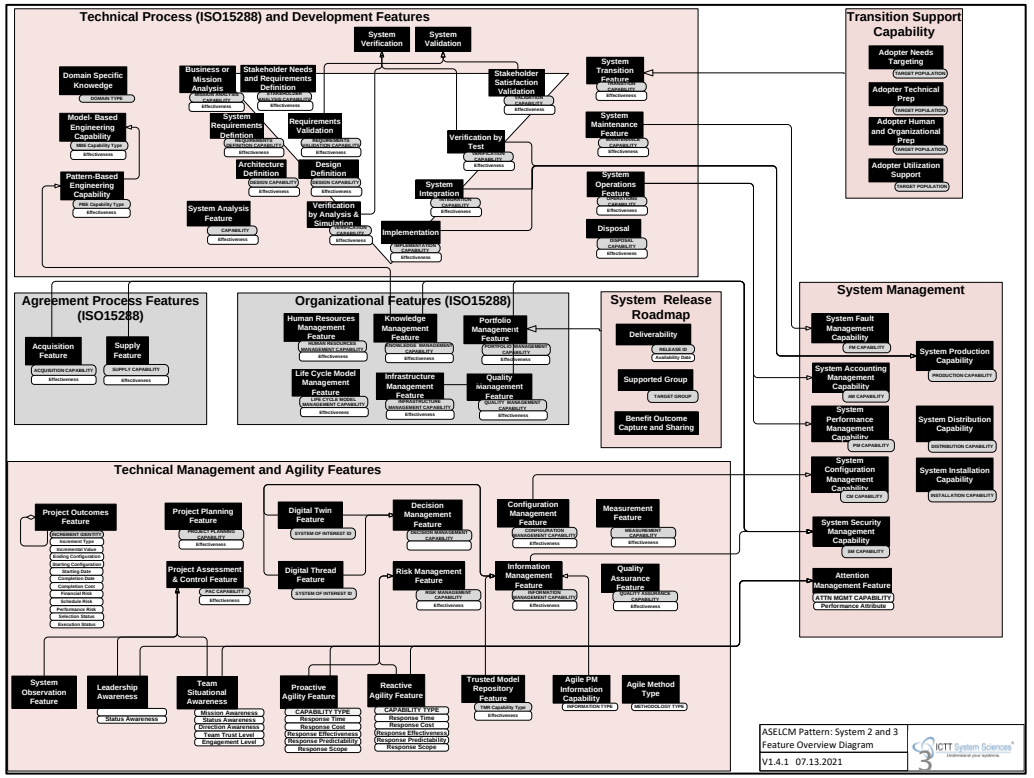


INCOSE ASELCM Level 1 Reference Model

- Innovation (delivery of new or rearranged value).
- Whether human-engineered, natural (e.g., biological), or hybrid.
- Analyze any system of innovation--descriptive, not prescriptive; whether innovation is effective or flawed, any methodology.
- Emphasis on group learning, uncertainty, information.
- Diverse applications and theory insights, listed in part below.
- Related INCOSE publications began in 2014, more nearly every year.



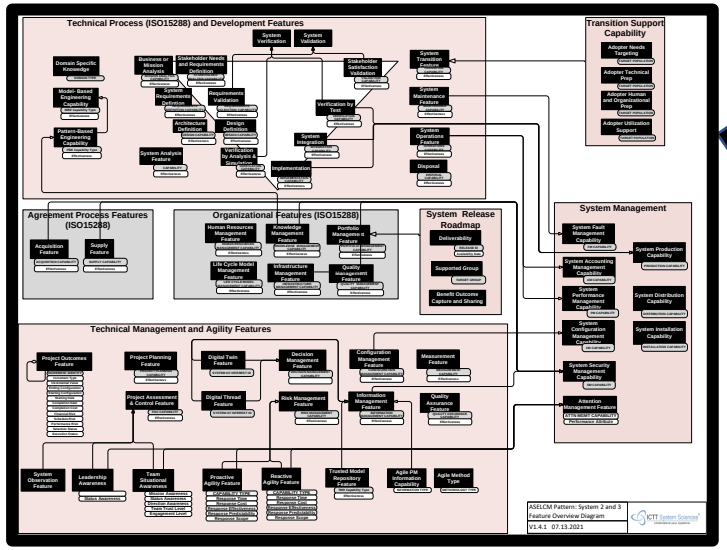
INCOSE ASELCM Level 2 Reference Model

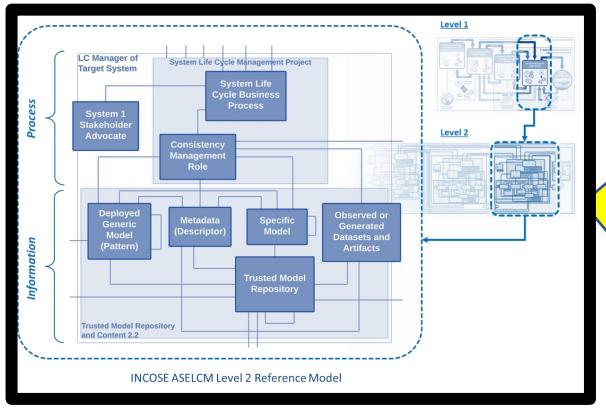


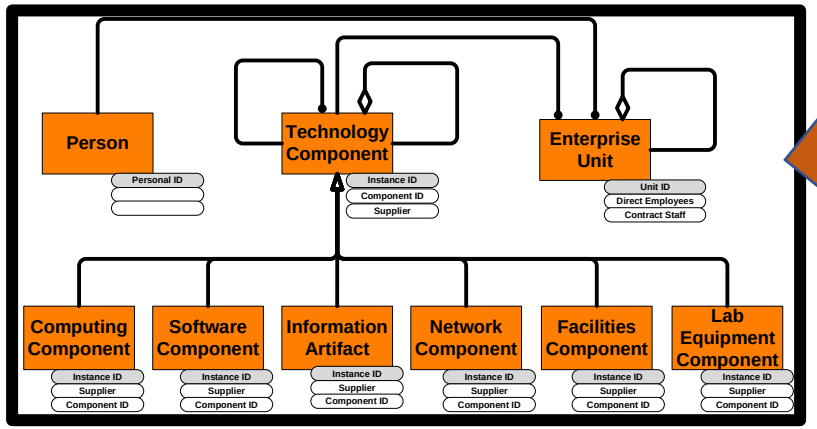
Stakeholder Features

Top down and bottom up

S*Model Components of the S*Pattern



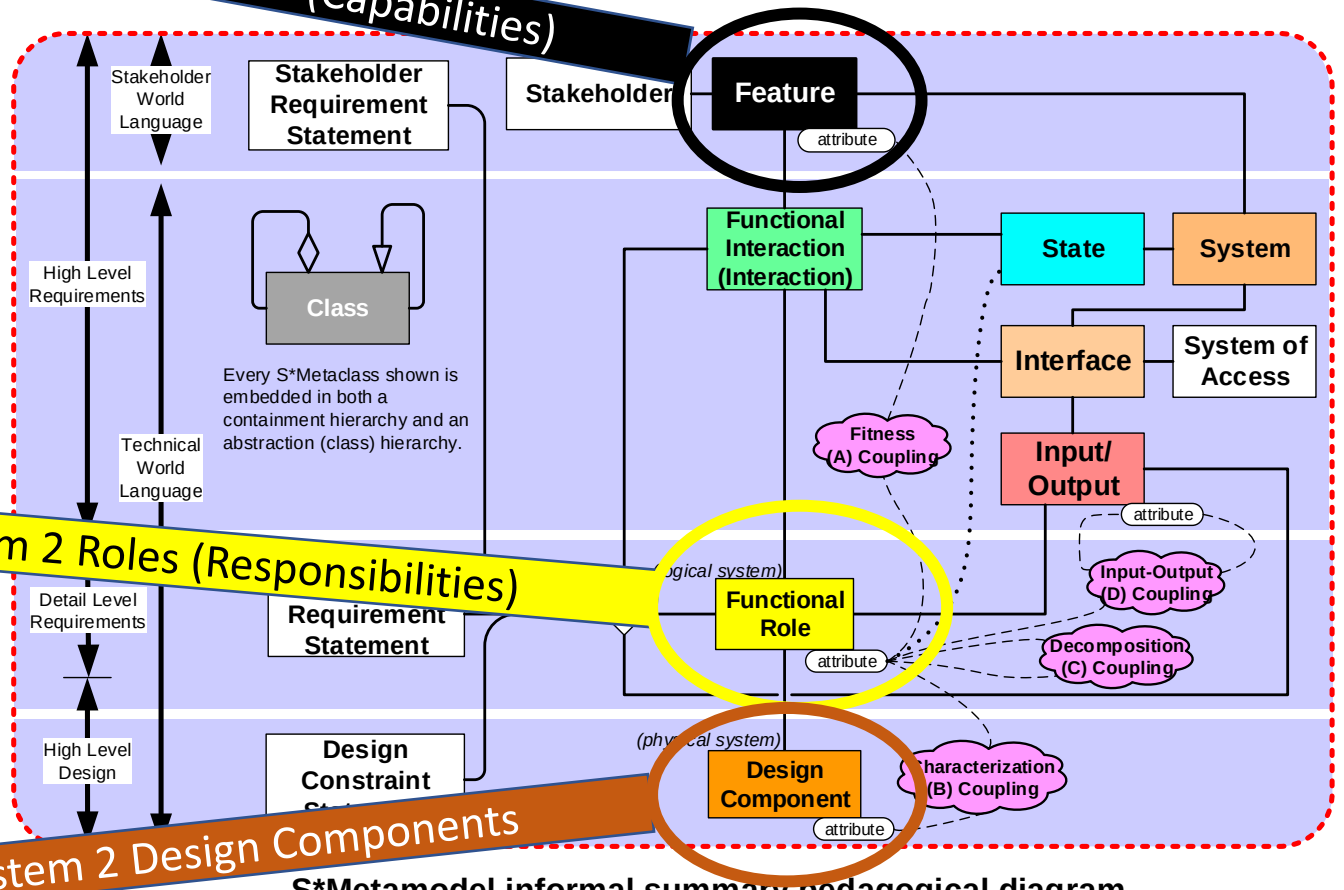




System 2 Features (Capabilities)

System 2 Roles (Responsibilities)

System 2 Design Components

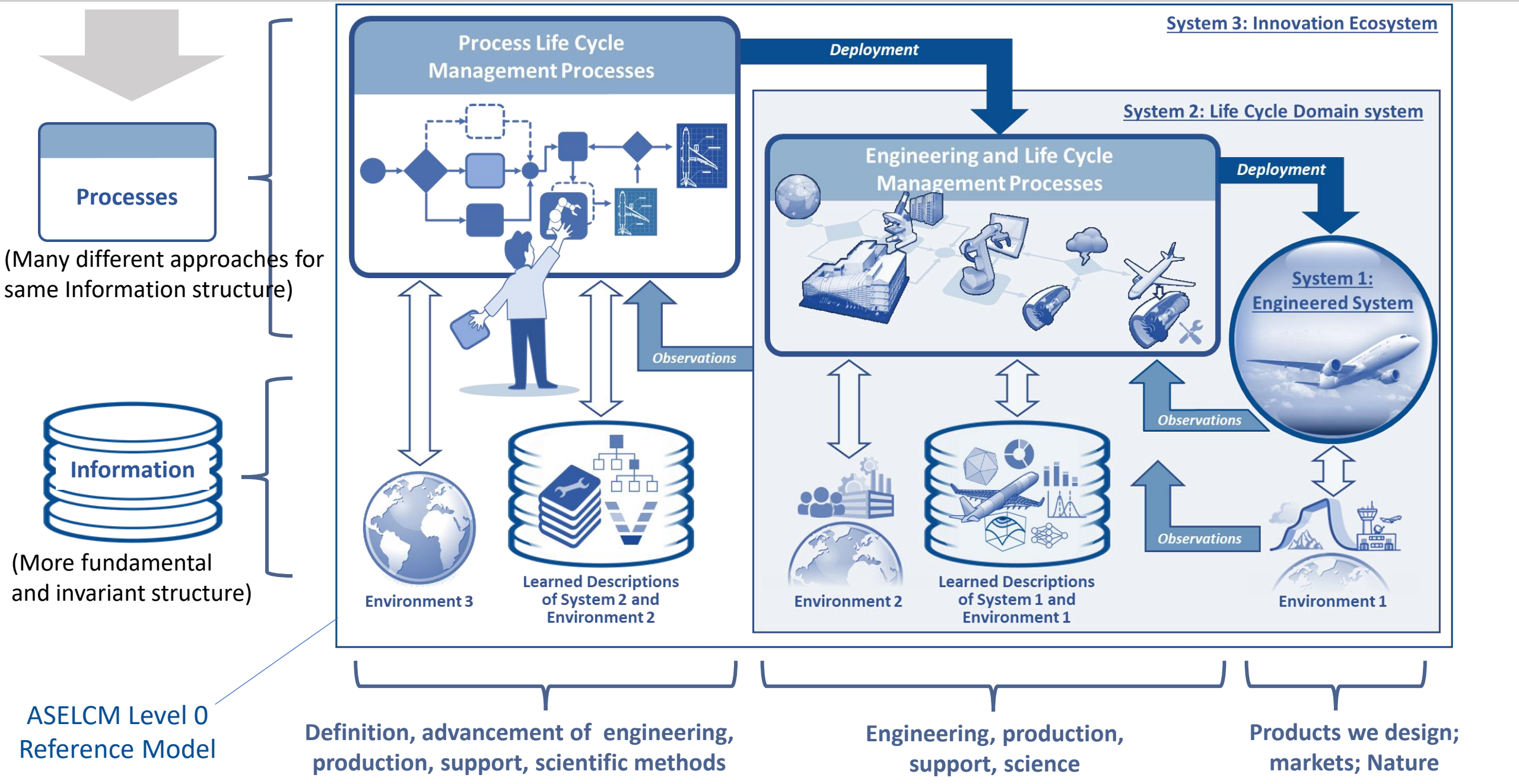


S*Metamodel informal summary pedagogical diagram

(formal S*Metamodel includes additional details.)

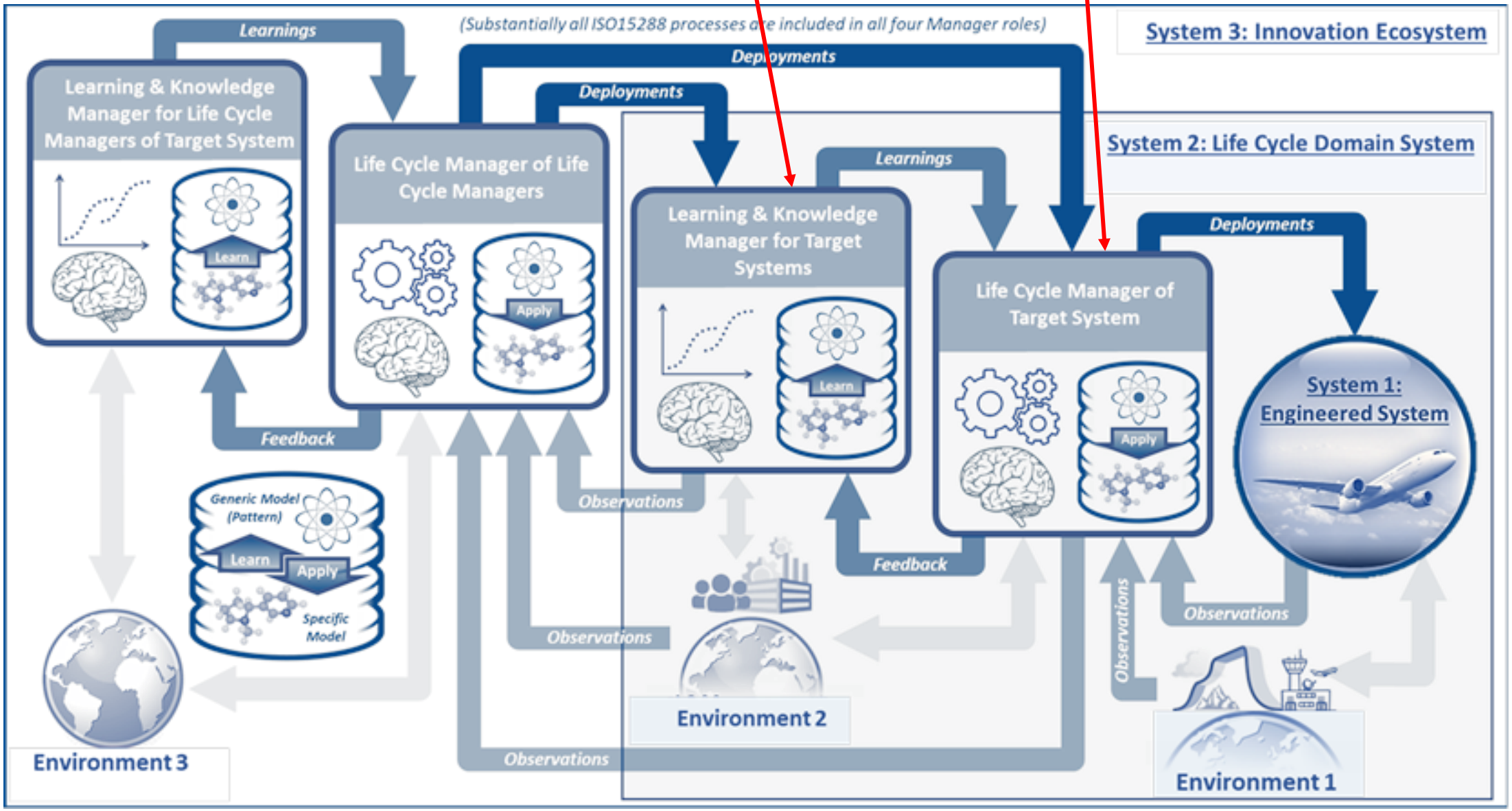
Does not assume the Ecosystem players make any use of S*Models, or even MBSE!

Process vs. Information: Rebalancing the Historical *Process* Emphasis



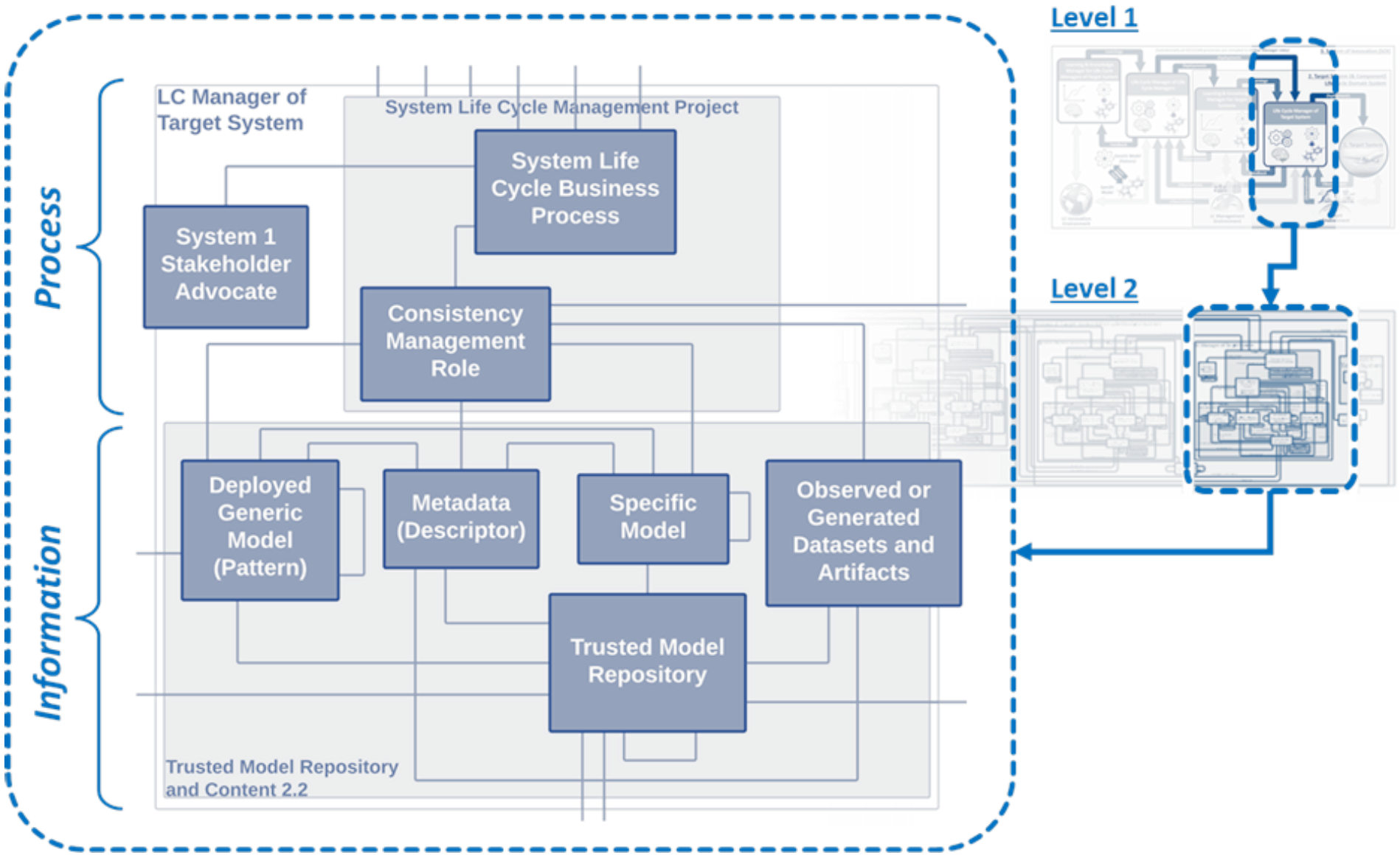
INCOSE ASELCM Level 1 Reference Model

(Separation of ***learning new information*** from ***acting on what is already known***.)



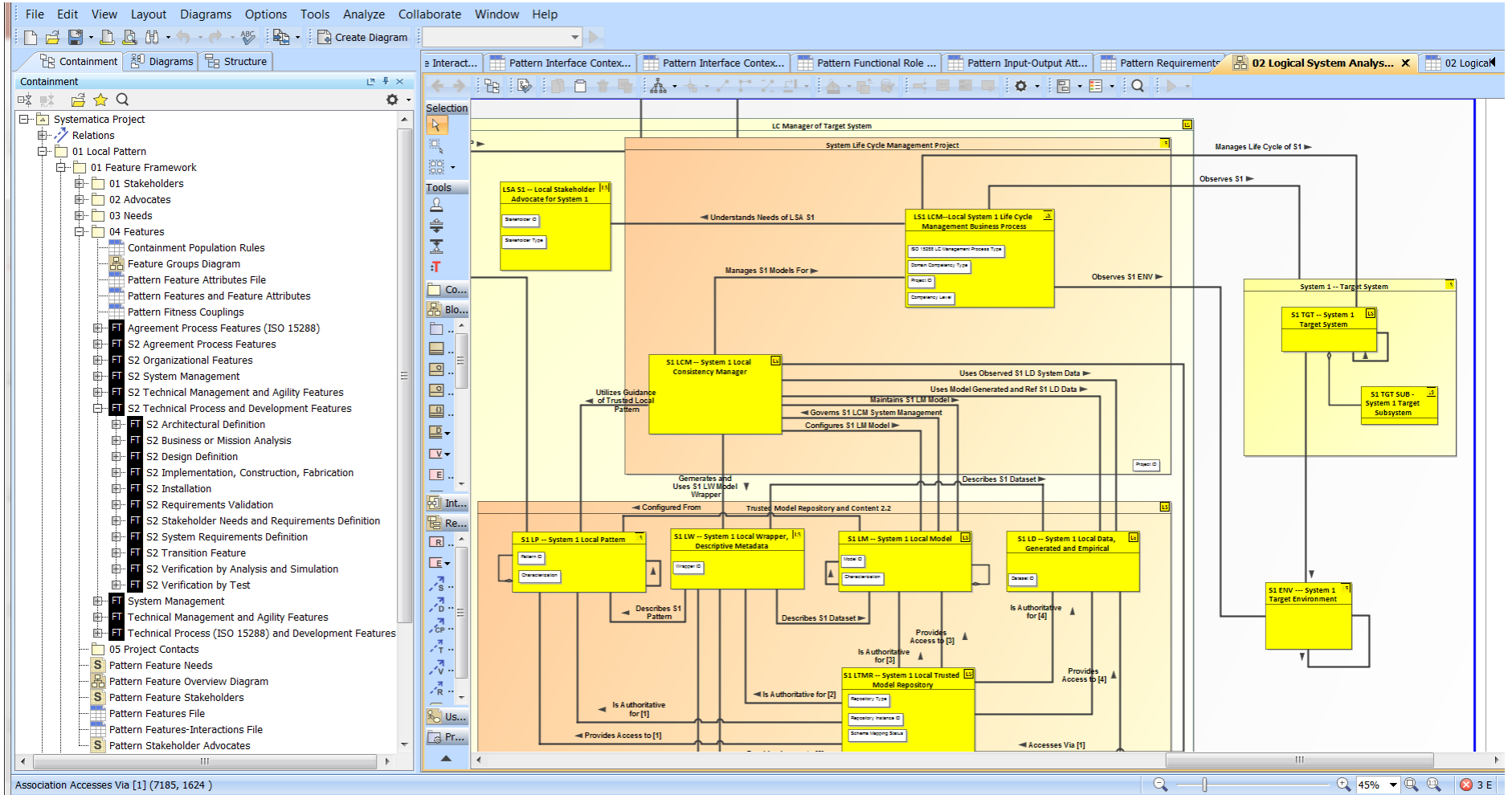
INCOSE ASELCM Level 2 Reference Model

(Segment for Application of “Already Learned” Information)

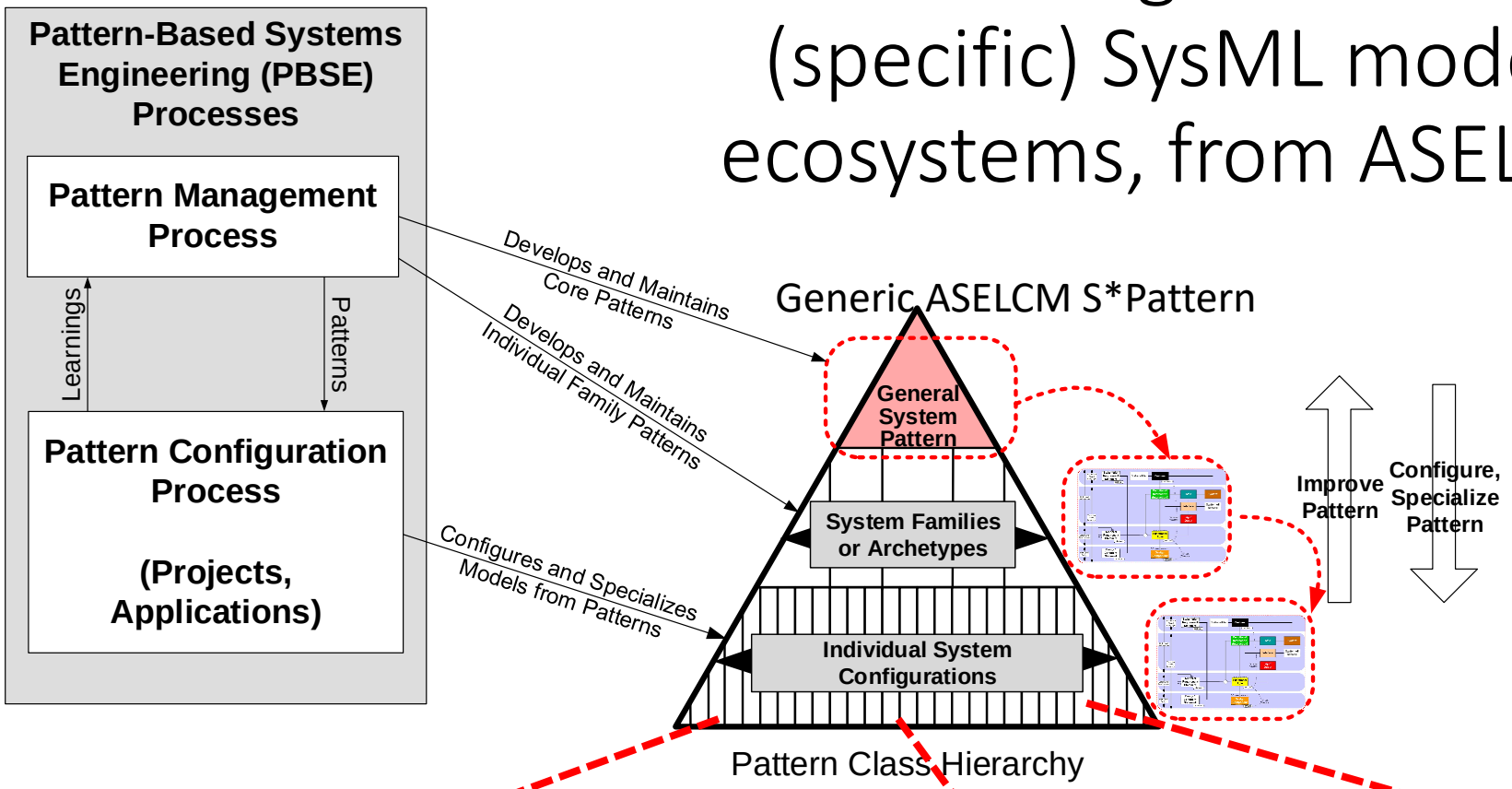


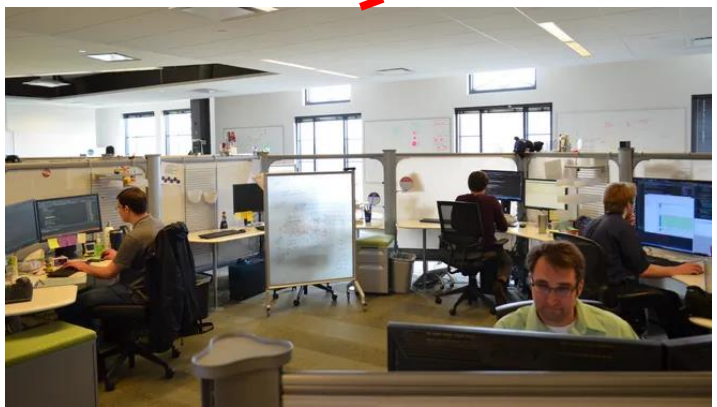
The ASELCM Ecosystem Pattern in OMG SysML

- Migrated to SysML in early 2021, currently in test, for release through the Patterns Working Group web site.
- Creative Commons CC BY SA license.



Automated generation of configured (specific) SysML models of diverse ecosystems, from ASELCM S*Pattern





Practice: Applications we have addressed with ASELCM Pattern

- Analyzing agility in enterprise systems of innovation
- AIAA's reference model for aerospace Digital Threads
- AIAA's reference model for aerospace Digital Twins
- Improved engineering-manufacturing integration
- Analyzing and planning enterprise ecosystems
- Supply chains in commercial and defense settings
- Introduction/propagation of MBSE & PBSE in engineering ecosystems
- Metadata as a "gasket" for improved interoperability
- Planning and analyzing cybersecurity in the innovation ecosystem
- Applying semantic technologies to validation of model consistency

(AIAA = American Institute for Aeronautics and Astronautics)

Theory: What we have been learning from the ASELCM Pattern

- Selection model of generalized value landscape
- Group learning model of innovation, with uncertainty management
- Balancing urgency-uncertainty risk
- Hysteresis effects, information balance, saturation effects
- Consistency management model of dynamics, threads, information
- Decision model founded in consistency resolution
- Energy model of ecosystem—what drives and impedes innovation
- Basic: Innovation as a boundary value problem
- Advanced: Innovation as an evolutionary game theory problem
- Innovation pathologies and opportunities
- Information debt and capitalized IP assets

Discussion, Q&A.

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Introductory Grouped ASELCM References

A. Introductory materials on ASELCM Ecosystem Reference Pattern:

- https://www.omgwiki.org/MBSE/lib/exe/fetch.php?media=mbse:patterns:realizing_the_vision_of_digital_engineering_is2022_v1.3.4.pdf
- https://www.omgwiki.org/MBSE/lib/exe/fetch.php?media=mbse:patterns:is2016_intro_to_the_aselcm_pattern_v1.4.8.pdf
- https://www.omgwiki.org/MBSE/lib/exe/fetch.php?media=mbse:patterns:aselcm_pattern_--_consistency_management_as_a_digital_life_cycle_management_paradigm_v1.2.2.pdf
- https://www.omgwiki.org/MBSE/lib/exe/fetch.php?media=mbse:patterns:configuration_stages_v1.3.8.pdf

B. American Inst. of Aeronautics and Astronautics digital thread & digital twin reference models, based on INCOSE ASELCM Pattern:

- https://www.aiaa.org/news/news/2023/06/12/aiaa-releases-white-paper-advocating-for-use-of-digital-threads-in-aerospace
- https://www.aiaa.org/news/news/2023/01/26/aiaa-releases-implementation-paper-on-digital-twins-in-aerospace

C. Introductory summary to some uses of it in analyzing and planning the ecosystem and its progress over time:

- https://www.omgwiki.org/MBSE/lib/exe/fetch.php?media=mbse:patterns:example_evolutionary_roadmap_v1.3.3a.pdf
- https://www.omgwiki.org/MBSE/lib/exe/fetch.php?media=mbse:patterns:risk_and_agility_as_optimal_control_and_estimation_v1.7.2.pdf
- https://www.omgwiki.org/MBSE/lib/exe/fetch.php?media=mbse:patterns:model_based_maturitiy_planning_asme_incose_may_2017.pdf

D. INCOSE case studies specific to agility, using aspects of the ecosystem pattern, joint with INCOSE Agile SE Working Group:

- is2016_--_autonomous_vehicle_development_navy_spawar.pdf
- is2017--northrup_grumman_case_study_dove_and_schindel_bp.pdf
- is2018_-_aselcm_lmc_case_study.pdf
- pap170424syscon-casestudyrc.pdf

E. Summary of a recent "digital thread with learning" demonstration project, via collaborating large OEM and supply chain small to medium manufacturers:

- https://www.omgwiki.org/MBSE/lib/exe/fetch.php?media=mbse:patterns:team_top_gun_idn_presentation_06.09.2021_v2.1.1.pdf

F. Not about the ASELCM pattern specifically, but rather about all S*Patterns, and related S*Pattern-based methods:

- https://www.omgwiki.org/MBSE/lib/exe/fetch.php?media=mbse:patterns:pbse_extension_of_mbse--methodology_summary_v1.6.1.pdf
- https://www.omgwiki.org/MBSE/lib/exe/fetch.php?media=mbse:patterns:pbse_tutorial_glrc_2016_v1.7.4.pdf