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INCOSE Webinar Series

Wednesday 16th September 2020 – Webinar 143

Agility as a System

Rick Dove

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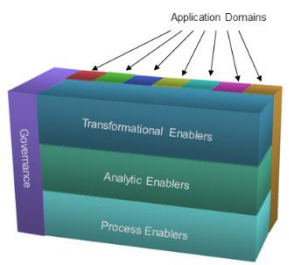

- To provide a forum for experts in the field of Systems Engineering to present information on the “State of the Art”
- To explain how INCOSE works, and how to make the most out of INCOSE membership

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Choreography

1. Andy Pickard (your host) will introduce the Webinar and the speaker
2. Rick will speak for about 40 to 45 minutes
3. During his talk, participants can write questions using the Webex Q&A window
4. After Rick completes his talk, he will spend 10 minutes answering questions that Andy selects from those submitted by the audience
5. Andy Pickard will provide information about upcoming Webinars and then end this session
6. This Webinar is being recorded and will be made available on the INCOSE website to members and employees of CAB organizations

Webinar

Agile SE Processes 203: Agility as a System

16-Sep-2020

Rick Dove

Anthem, AZ, dove@parshift.com, 575-770-7101
CEO/CTO, Paradigm Shift International
Adjunct Professor, Stevens Institute of Technology
Chair: INCOSE WG for Agile Systems & Systems Engineering

Agile 203 webinar slides: Agile SE Agility as a System
Agile 202 webinar slides: Agile SE Continuous Integration
Agile 201 webinar slides: Agile SE Problem Space Requirements
Agile 106 webinar slides: Agile System/Process as Risk Management
Agile 105 webinar slides: Agile System/Process Operational Awareness
Agile 104 webinar slides: Agile System/Process Engagement Quality
Agile 103 webinar slides: Agile System/Process Design Principles
Agile 102 webinar slides: Agile System/Process Design Requirements
Agile 101 webinar slides: Agile System/Process Architecture Pattern
(updated asynchronously from time-to-time)

Abstract

Systems engineering is codified as a collection of interrelated life cycle processes. Agility in systems engineering is accomplished by explicit capabilities in these processes for situational awareness, learning, and agile life cycle management. Collectively isolated these capabilities could be called the Agility System; but it is known formally as the System of Innovation, as it delivers improved stakeholder value.

In agile systems engineering the System of Innovation is embedded and distributed throughout the life cycle processes at relevant points. It functions as the learning and life cycle manager. Its core is the central Situational Awareness stage that triggers entry into all other stages in the Agile Systems Engineering Life Cycle Model. The Situational Awareness stage is also the stage that initiates a system project and initiates the selection or design of a suitable systems engineering approach.

All systems engineering processes have at least a tacit System of Innovation. Agile software development processes begin to get explicit with periodic retrospectives on both process and product work-in-process outcomes, and with incremental experiment and learning loops. For mixed-discipline SE projects we should identify what needs to be monitored and sensed to avoid undesirable outcomes, what response strategies are needed to address situational changes, and how coherent evolution in process and product will occur. And of course, where are these things done in the life cycle processes and by what agency?

This webinar will explore general concepts and strategies in the System of Innovation for tailored application appropriate to a project context.

Prelude:
Eight Principal Findings from the INCOSE ASELCM Project

(ASELCM: Agile Systems Engineering Life Cycle Model)

1. **Problem-Space Characterization – Agile 201**
2. **Response Requirements – Agile 201**
3. **Stakeholder Engagement – Agile 202**
4. **Continuous Integration Platform – Agile 202**
5. **Agile SE Life Cycle Framework**
6. **Managing Information Debt**
7. **ASELCM Operational Pattern**
8. **Operational Principles**

Prelude:
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6. **Managing Information Debt**
7. **ASELCM Operational Pattern – Agile 203**
8. **Operational Principles – Agile 203**

1. Problem Space Characterization

Internal and external environmental forces that impact process and product as systems

Caprice: unanticipated system-environment change
(randomness among unknowable possibilities)

Uncertainty: kinetic and potential forces present in the system
(randomness among known possibilities with unknowable probabilities)

Risk: relevance of current system-dynamics understanding
(randomness among known possibilities with knowable probabilities)

Variation: temporal excursions on existing behavior attractor
(randomness among knowable variables and knowable variance ranges)

Evolution: experimentation and natural selection at work
(relatively gradual successive developments)

2. General Response Strategies

Domain		Response Strategies
Proactive	Creation	•Threat and opportunity awareness •Response actions/options • Acculturated memory • Decisions to act
	Improvement	•Awareness/Sensing •Memory in culture, options, ConOps, SEMP • Action/option effectiveness
	Migration	•New fundamentally-different types of threats and opportunities
	Modification (Capability)	•Actions appropriate for needs •Personnel appropriate for actions
Reactive	Correction	•Insufficient awareness •Ineffective actions/options • Wrong decisions
	Variation	•Effectiveness of actions/options •Effectiveness of evaluation
	Expansion (Capacity)	•Capacity to handle 1-? actions simultaneously
	Reconfigu-ration	•Elements of an action •Response managers/engineers

3. Stake Holder Engagement

Developers	Subcontractors	Security Engineers
Operators	Producers	Maintainers
Customers	End Users	Management

Three typical forms of stakeholder engagement:

Integrated product team (IPT) is a multidisciplinary group of people who are collectively responsible for delivering a defined product or process. The emphasis of the IPT is on involvement of all stakeholders (users, customers, management, developers, contractors) in a collaborative forum. (Wikipedia)

Concurrent engineering (CE) is a work methodology emphasizing the parallelization of tasks (i.e. performing tasks concurrently), which is sometimes called simultaneous engineering or integrated product development (IPD) using an integrated product team approach. It refers to an approach used in product development in which functions of design engineering, manufacturing engineering, and other functions are integrated to reduce the time required to bring a new product to market. (Wikipedia)

DevOps is a set of software development practices that combine software development (*Dev*) and information-technology operations (*Ops*) to shorten the systems-development life cycle while delivering features, fixes, and updates frequently in close alignment with business objectives. (Wikipedia)

(Wikipedia access 11-Sep-2019)

4. Continuous Integration Platform
Live Virtual Constructive

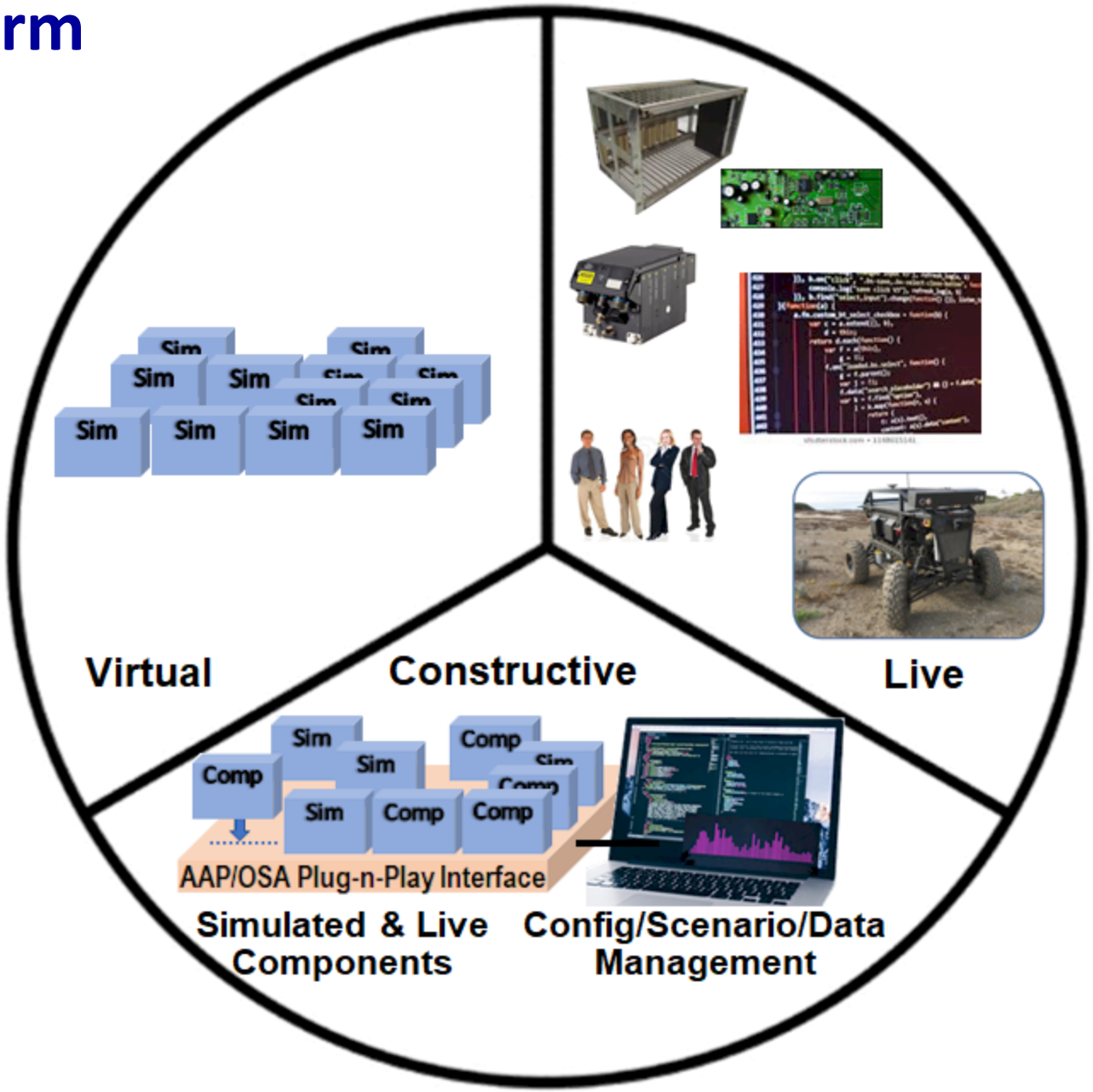
Live components
(people, things)
Virtual components
(component simulations)
Constructive capabilities
(component mix, scenario simulation, and performance monitoring/recording)

L&V components are functional system elements; configured, challenged and monitored by C elements for performance and anomalies.

Demonstration/test/experimental events can occur at any time with the latest instantiation of simulations & components.

Caveat: LVC internet search is dominated by military training applications.

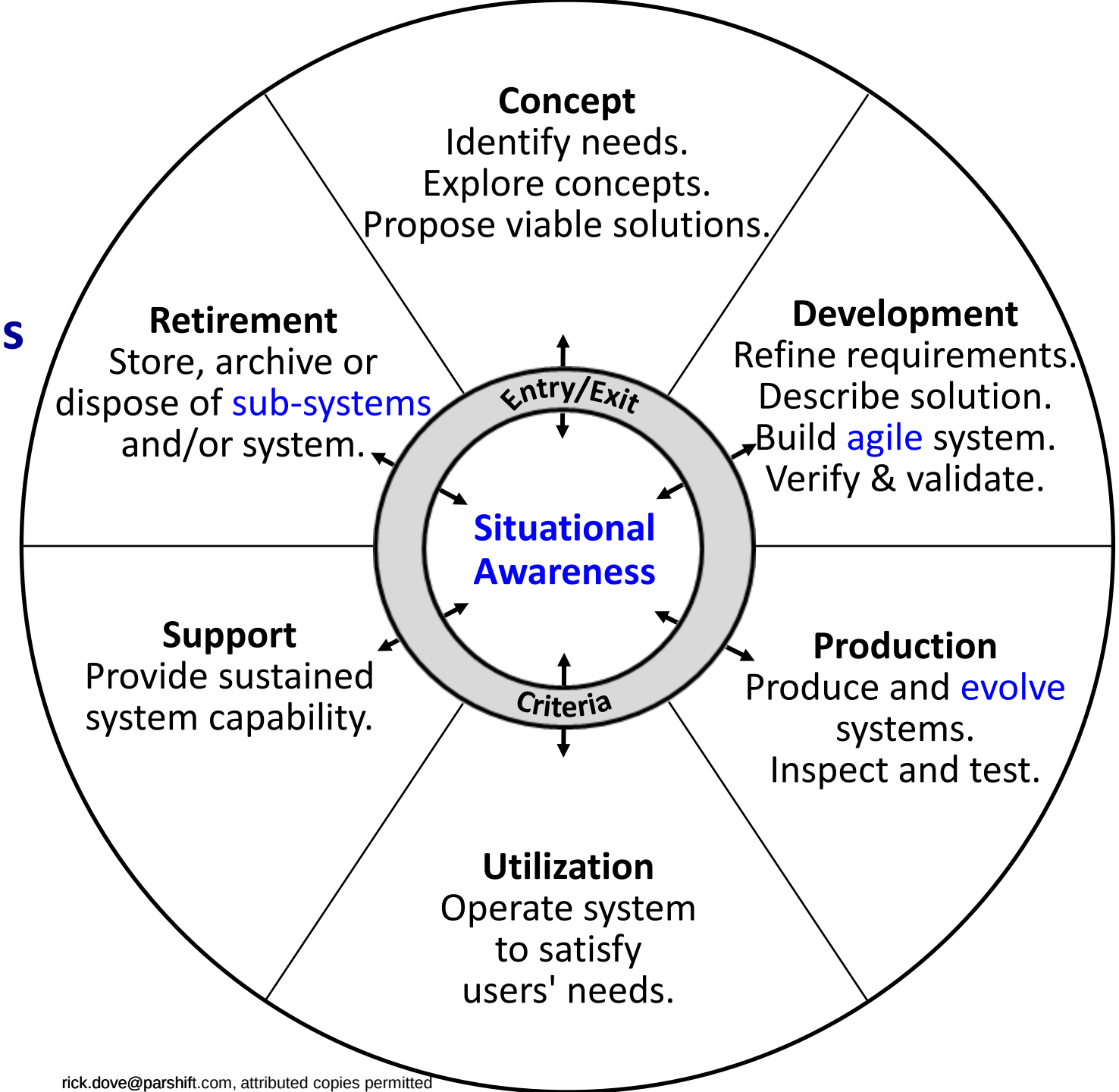
AAP: Agile Architecture Pattern
OSA: Open Systems Architecture



5. Agile SE Life Cycle Framework

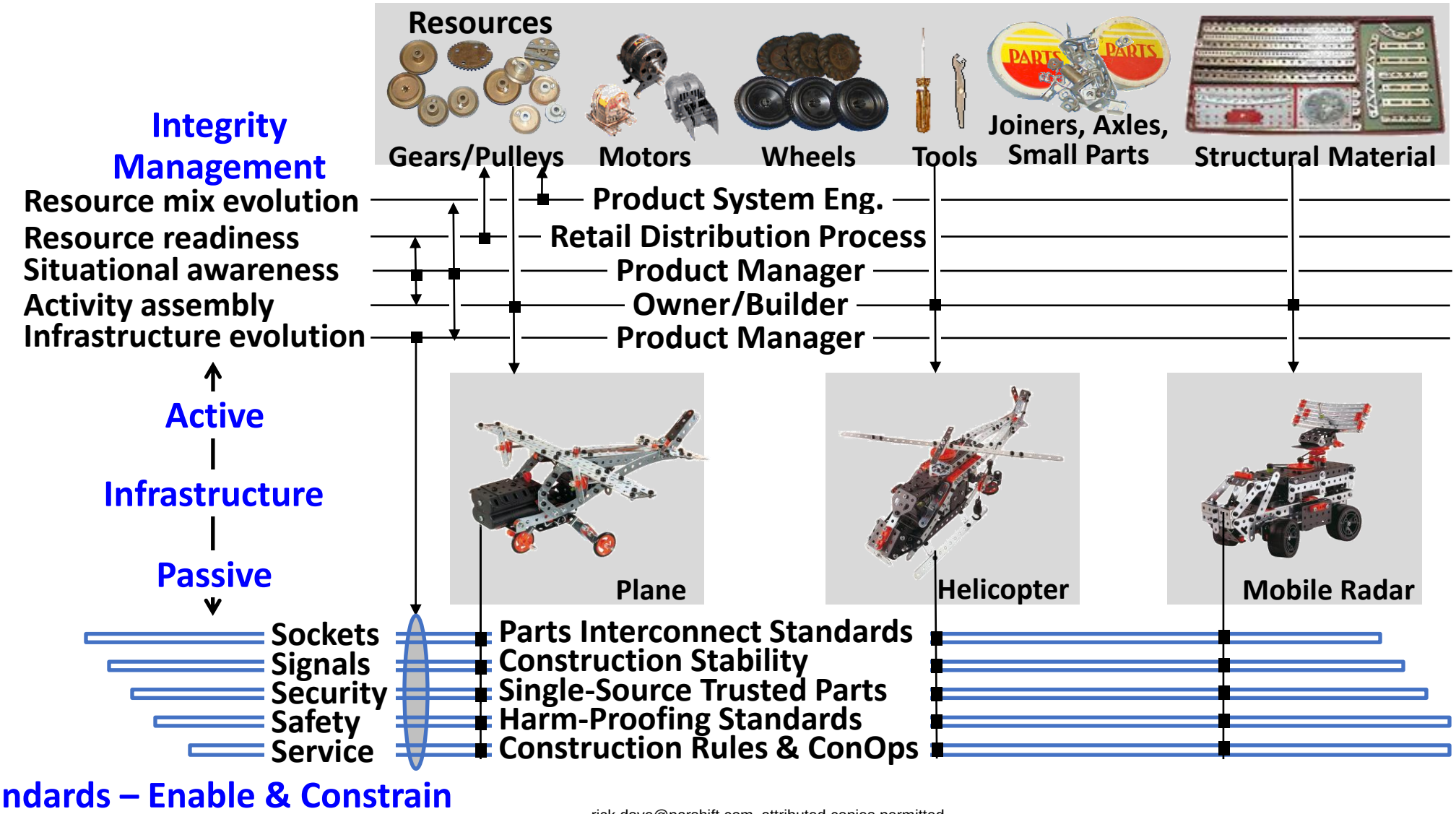
Situational Awareness Engages Other Stages and Tasks Asynchronously Concurrently Experimentally Incrementally Iteratively

Consistent with ISO/IEC/IEEE 24748-1:2018

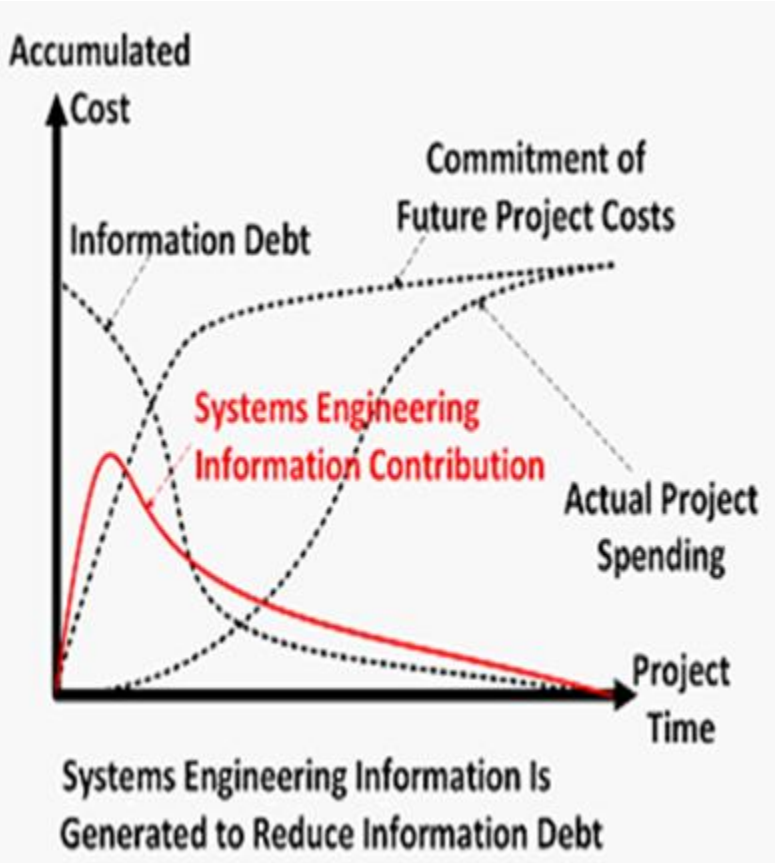


Agile Architecture Pattern (AAP) – Enables Agility
Notional Concept: System Construction/Augmentation Kit

Details in www.parshift.com/s/140630IS14-AgileSystemsEngineering-Part1&2.pdf



6. Managing Information Debt



Knowledge Management for:

- **Team member attrition and replacement cost**
- **Production and maintenance cost**
- **Other-party sustainment and evolution**
- **Upgrades when original developers are gone**
- **Evolving situational awareness**
- **Reusable knowledge for other projects**

Timely SE information must be generated (e.g., reqs, architectures, risk assessments, etc.) early enough in the project.

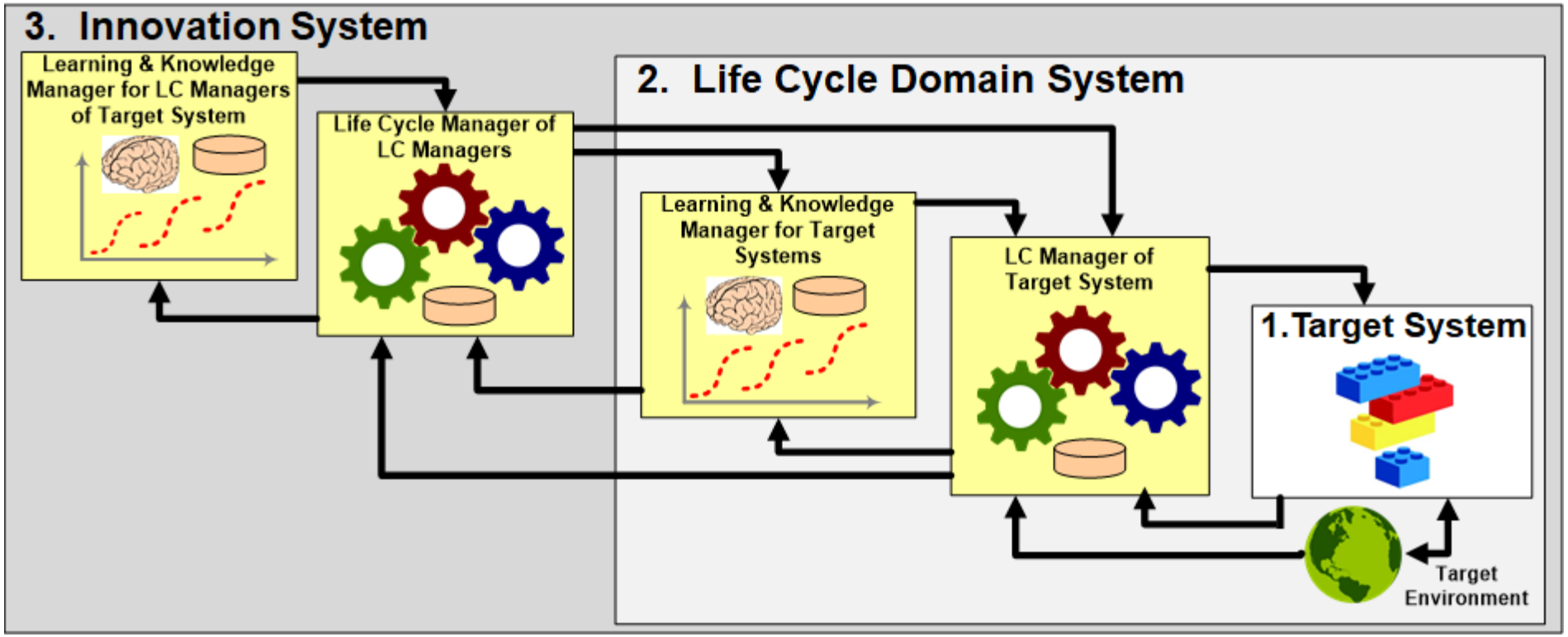
Will development end with outstanding information debt – a "working system" with impaired sustainment and evolution agility?

Here We Focus on Two Findings

7. ASELCM Operational Pattern

8. Operational Principles

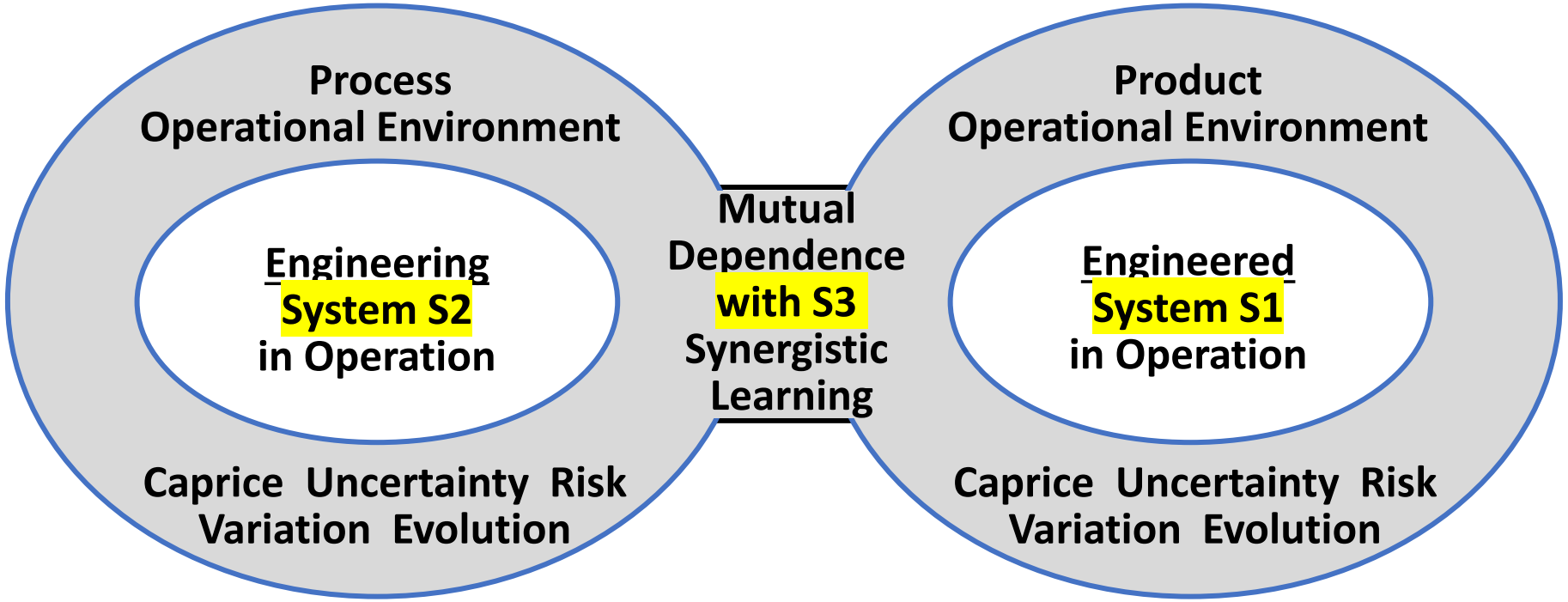
7. ASELCM Operational Pattern – Three Concurrent Systems



- System-1 is the target system under development.
- System-2 includes the basic systems engineering development and maintenance processes, and their operational domains that produces System-1.
- System-3 is the process improvement system, called the system of innovation that learns, configures, and matures System-2.

System 3 is responsible for situational awareness, evolution, and knowledge management, the provider of operational agility. Intent is continuous, not episodic, information flow.

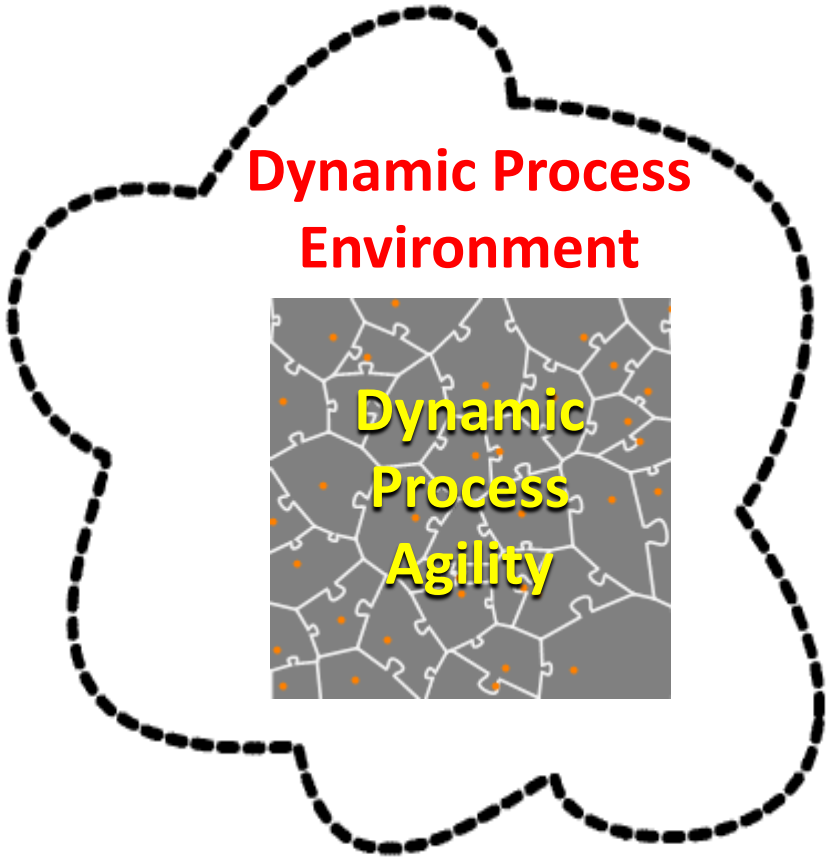
Synergistic Dependencies



You can't have
an agile engineering process
if it doesn't engineer an agile product
(and vice versa)

Dynamic Process Must Fit with Dynamic Environment

Agile systems engineering is responsive to the dynamic environments in which it operates. Attentive awareness of the evolving environments is necessary.



Agility Innovation System

Concept Development Emerging from FuSE Agility Project

Problem	Insufficient breadth and depth of learning activity; barriers to learning application.
Need	Situational awareness and learning embedded in life cycle processes; timely/affordable learning-application enabled; knowledge management.
Barriers	Not clear what to do or where to do it beyond learning ceremonies and contract obligation satisfaction.
Intent	A focus on the why and what that can guide the how appropriate for any operational agility need.
Value	Less rework (cost/time); higher customer/user satisfaction.
Metrics	Relevance of what was learned; impact of applied learning.
Refs	Schindel and Dove 2016; Schindel 2017; Dove and Schindel 2019.

8. Operational Principles

3 principles, 9 strategies

Sensing (observe, orient)

- **External awareness (proactive alertness)**
- **Internal awareness (proactive alertness)**
- **Evaluation (learning: outcome of sensing, process of sensing)**

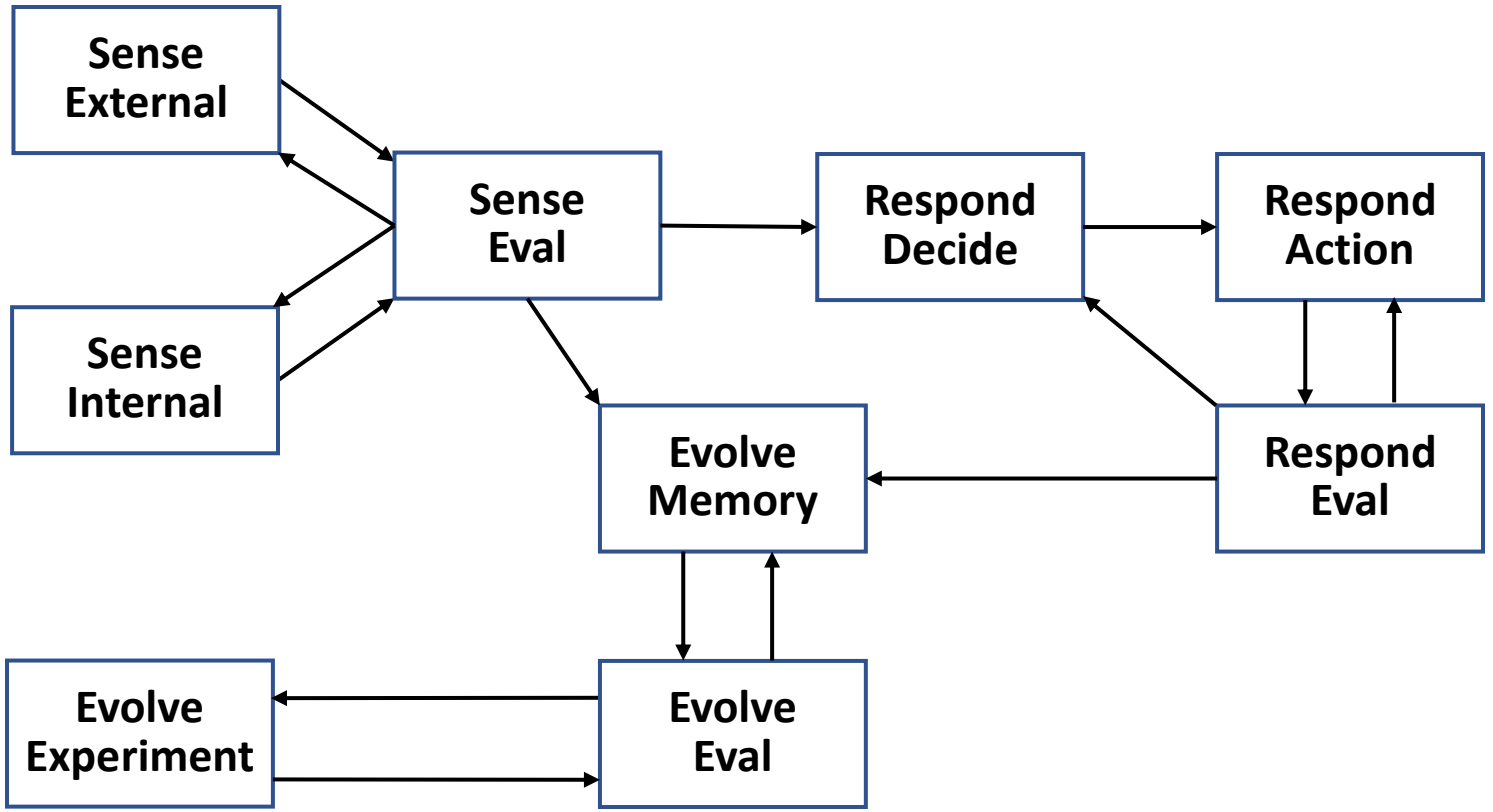
Responding (decide, act)

- **Decision making (timely, informed)**
- **Action making (reconfigure process & product to fit the situation)**
- **Evaluation (learning: outcome of responding, process of responding)**

Evolving (improve above with learned knowledge and capability)

- **Experimentation (variations on process and product)**
- **Evaluation (learning: outcome of evolution, process of evolution)**
- **Memory (culture, capabilities, ConOps/OpsCon, knowledge management)**

Agility Innovation System



This is the WHAT

Conceptual architecture for tailoring-to-context in a system model

The goal of agile systems engineering is S2 and S1 compatibility with their CURVEd environments.

This goal is the purpose of S3.

The general SE CURVE shown here is applicable to S3, S2, and S1.

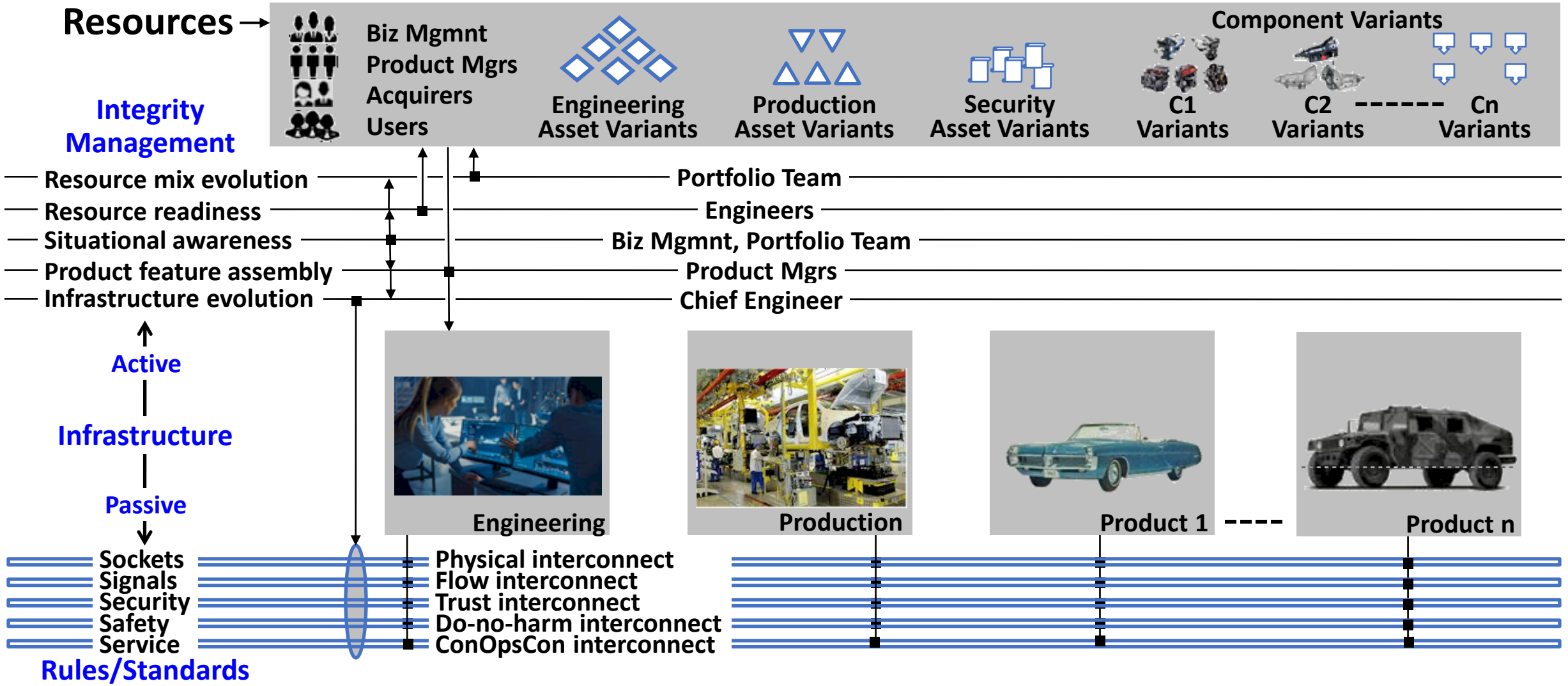
S3, S2, and S1 have cyber-physical-social dimensions.

General SE CURVE
Caprice
• Survivability (i.e., current order compatibility) • Occurrence and nature of emergent behavior • Game-changing technologies • Availability of symbiotic social relationships
Uncertainty
• Relevance (i.e, appropriate to current desires) • Cohesion in the greater SoSs (multiple) • Integrity and symbiosis of social relationships
Risk
• Viability (i.e., capable of working successfully) • Cohesion among constituent parts
Variation
• Operational environments • Social compatibility
Evolution
• Toward more operating environment complexity • Toward more SoI complexity • Toward shorter SoI static viability • Toward new technology options • Toward new malevolent threats to viability • Toward greater social involvement

This is the WHY

General SE CURVE	General Agility Innovation System CURVE
Caprice	**Caprice**
• Survivability (i.e., current order compatibility) • Occurrence and nature of emergent behavior • Game-changing technologies • Availability of symbiotic social relationships	• Adequacy of awareness breadth • Knowledge conflicts • AI-assisted awareness sensing • Timeliness and depth of stakeholder engagement
Uncertainty	**Uncertainty**
• Relevance (i.e, appropriate to current desires) • Cohesion in systems and SoSs • Integrity and symbiosis of social relationships.	• Cost vs. value evaluations • Response decision and action consensus • SME availability for evaluating what was sensed
Risk	**Risk**
• Viability (i.e., capable of working successfully) • Cohesion among constituent parts	• Response decision and action efficacy • Insufficiently-shared learned knowledge
Variation	**Variation**
• Operational environments • Social compatibility • Human resource loading	• Nature of optimal agility system for project type • Cooperation • Sufficiency of awareness attention
Evolution	**Evolution**
• Toward more operating environment complexity • Toward more SoI complexity • Toward shorter SoI static viability • Toward new technology options • Toward new malevolent threats to viability • Toward greater social involvement	• Increasing external sources of potential impact • Increasing internal sources of potential impact • Decreasing life of knowledge relevance • Increasing frequency of innovative technology • increasing manipulation with fake news • Increasing assimilation of relevant knowledge

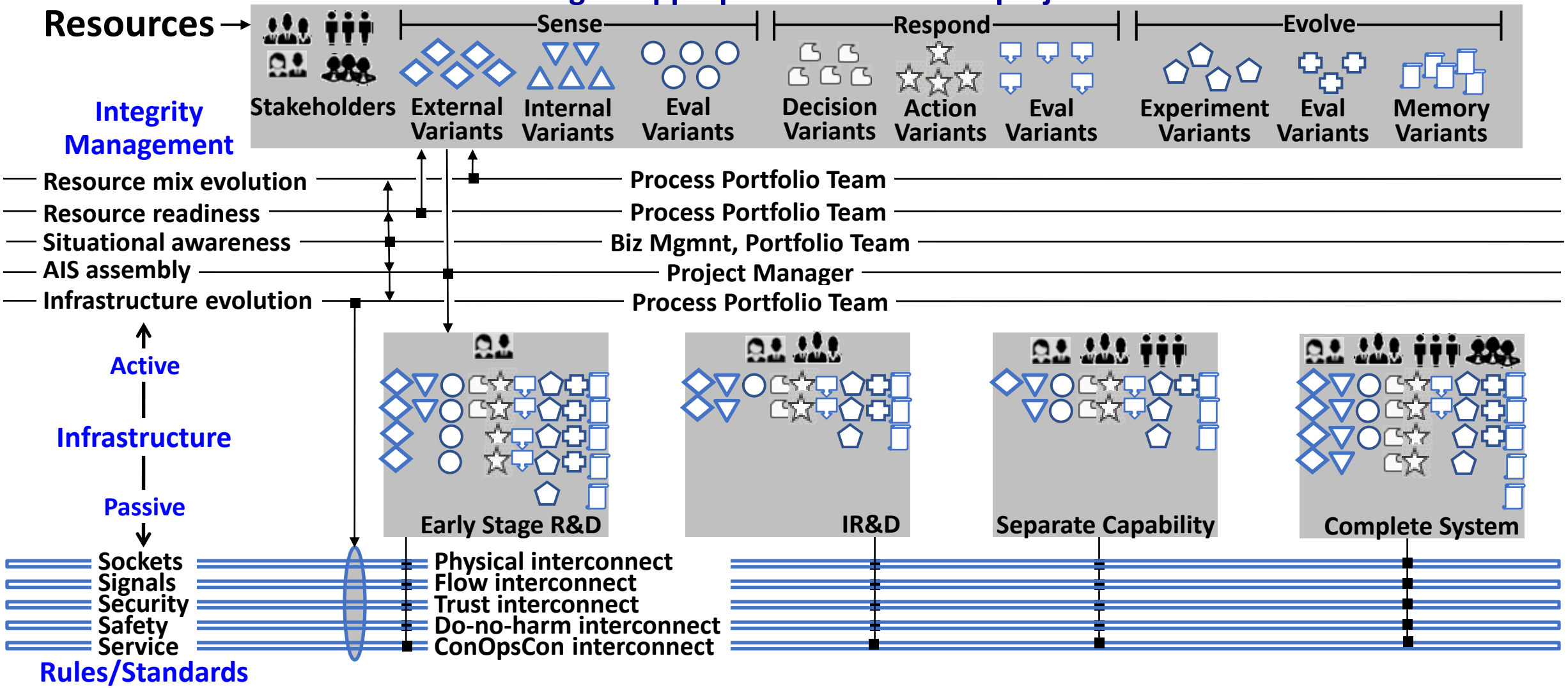
Notional AAP Concept: Product Line Engineering Process



Dove, R. 2010. "Security Issue Detection and Mitigation Patterns for Product Line Resource Variation." INSIGHT, International Council on Systems Engineering. August.

Agility Innovation System AAP – Notional

Concept: Product Line Engineering Architecture and Resource Management for instantiating an appropriate AIS fit to the project context



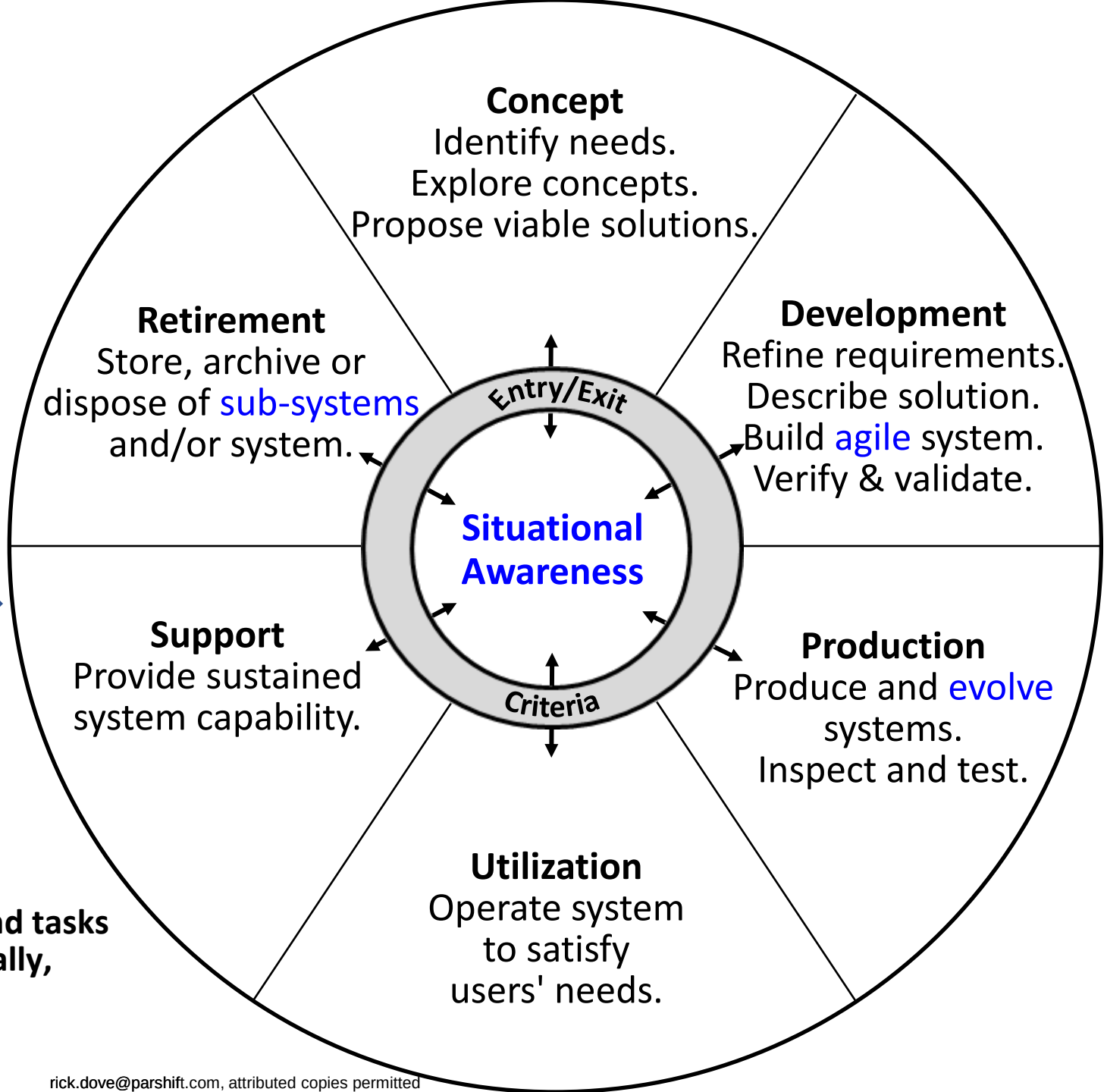
Depicted is a mature system – which starts with a shallow set of variants for the first instantiation, subsequent projects increase the variant population accordingly.

Wrap Up

Life Cycle Model Framework

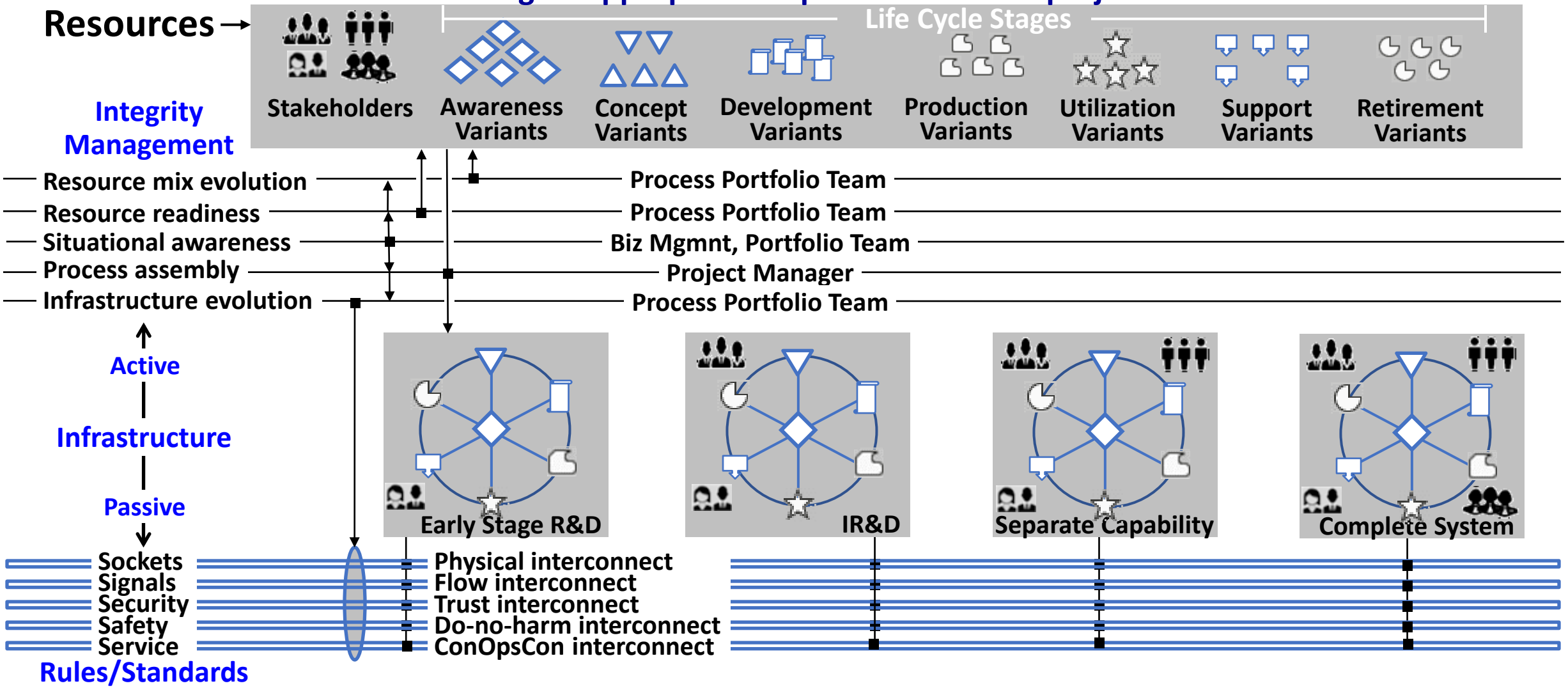
1. Problem-Space Characterization
2. Response Requirements
3. Stakeholder Engagement
4. Continuous Integration Platform
5. Agile SE Life Cycle Framework
6. Managing Information Debt
7. ASELCM Operational Pattern
8. Operational Principles

Situational Awareness engages other stages and tasks asynchronously, concurrently, experimentally, Incrementally, and iteratively



System Engineering Agility-Process Portfolio AAP – Notional

Concept: Product Line Engineering Architecture and Resource Management for instantiating an appropriate SE process fit to the project context



Different types of SE projects have all Life Cycle stages, but with different stakeholder and stage variations.
A concept under early exploration

rick.dove@parshift.com, attributed copies permitted

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Full Series

Agile 203 webinar slides: Agile SE Agility as a System
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Agile 106 webinar slides: Agile System/Process Risk Management & Mitigation
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Webinar ID: Webinar 131 Dove 18 September 2019 Agile SE Processes 202
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Webinar ID: Webinar 104 Dove 20 September 2017 Agile Systems & Processes 106
Webinar ID: Webinar 092 Dove 28 September 2016 Agile Systems & Processes 105
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Webinar ID: Webinar 056 Dove 18 September 2013 Agile Systems & Processes 102
Webinar ID: Webinar 045 Dove 19 September 2012 Agile Systems & Processes 101

Upcoming Webinars (tentative schedule)

Who	What	When
René Oosthuizen	A Comprehensive Guide on Tailoring the INCOSE Guide for Writing Requirements	Wednesday 21st October 2020 at 11am EDT
Jose Fernandez and Carlos Hernandez	ISE&PPOOA a MBSE Methodology from System to Software Architecture	Wednesday 18th November 2020 at 11am EST

Invitations will be emailed in advance and informational updates will be placed on www.incose.org

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Information on the webinars is now being posted in INCOSE Connect, in the INCOSE Library area, at https://connect.incose.org/Library/Webinars/Pages/INCOSE-Webinars.aspx . Joining instructions will added around two weeks before the webinar is scheduled to take place.

Save the Dates

HSI WG – IW2020

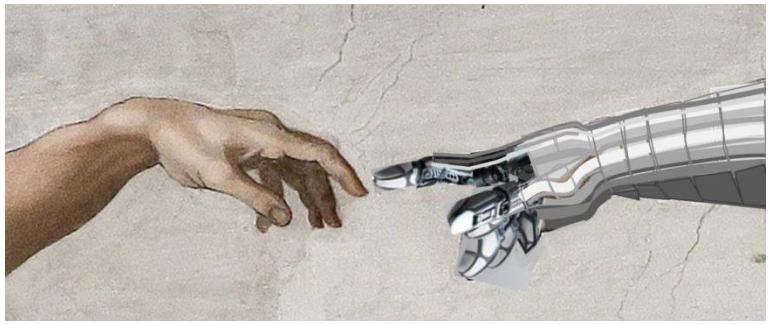
Tuesday-Thursday, 27-29.10.2020

International Workshop:

Human System Integration in the Era of Global Crises Challenges and Opportunities.

You are invited to take part in Developing and Advancing the HSI Awareness and Practices in the Systems Engineering Community.

Join us to reinforce the HSI community and inspire to persistent dialogue on HSI.



Virtual event for about 4 hours a day.

13:15 UTC/GMT on 27.10 and 13:55 UTC/GMT on 28, 29.10.

Free Registration. Pre-registration is required.

Details will be soon published.

HSI WG– 2020

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