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Case Study: Agile SE Process for Centralized SoS Sustainment at Northrop Grumman

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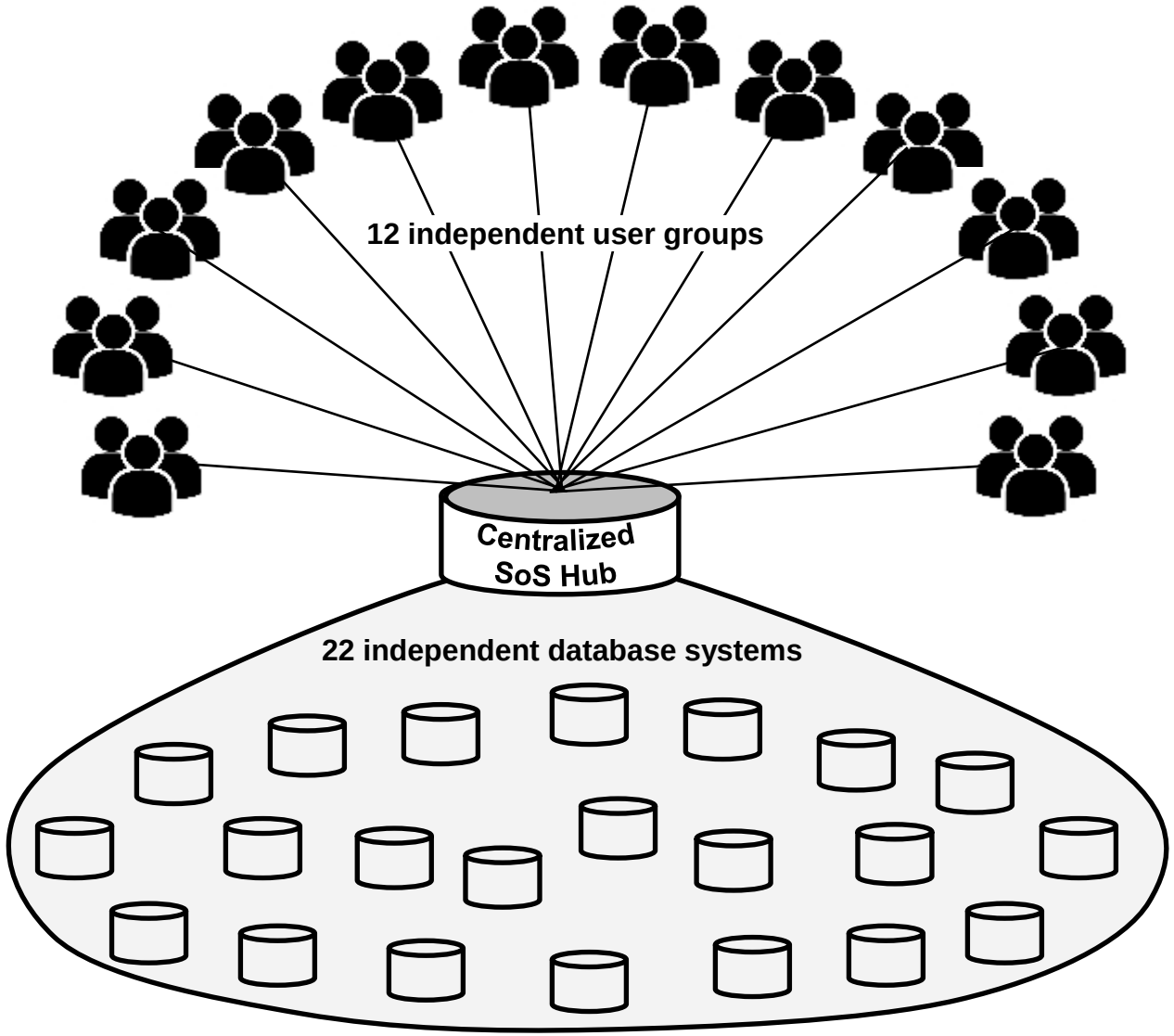
Military-critical centralized systems-of-systems web-hub

Case Study of Northrop Grumman's Global Combat Support System – Joint (GCSS-J) group in Herndon, Virginia.



Six years of effective employment and evolution, winning praise from GAO and users alike.

CURVE Environment

(That requires an agile SE process)

Caprice

- External data sources change their services at will
- COTS (Common Off The Shelf) software upgrades deprecate existing interfaces

Uncertainty

- Software and/or hardware may go end-of-life at any point

Risk

- May not be able to meet 15-day schedule for delivery of security fixes

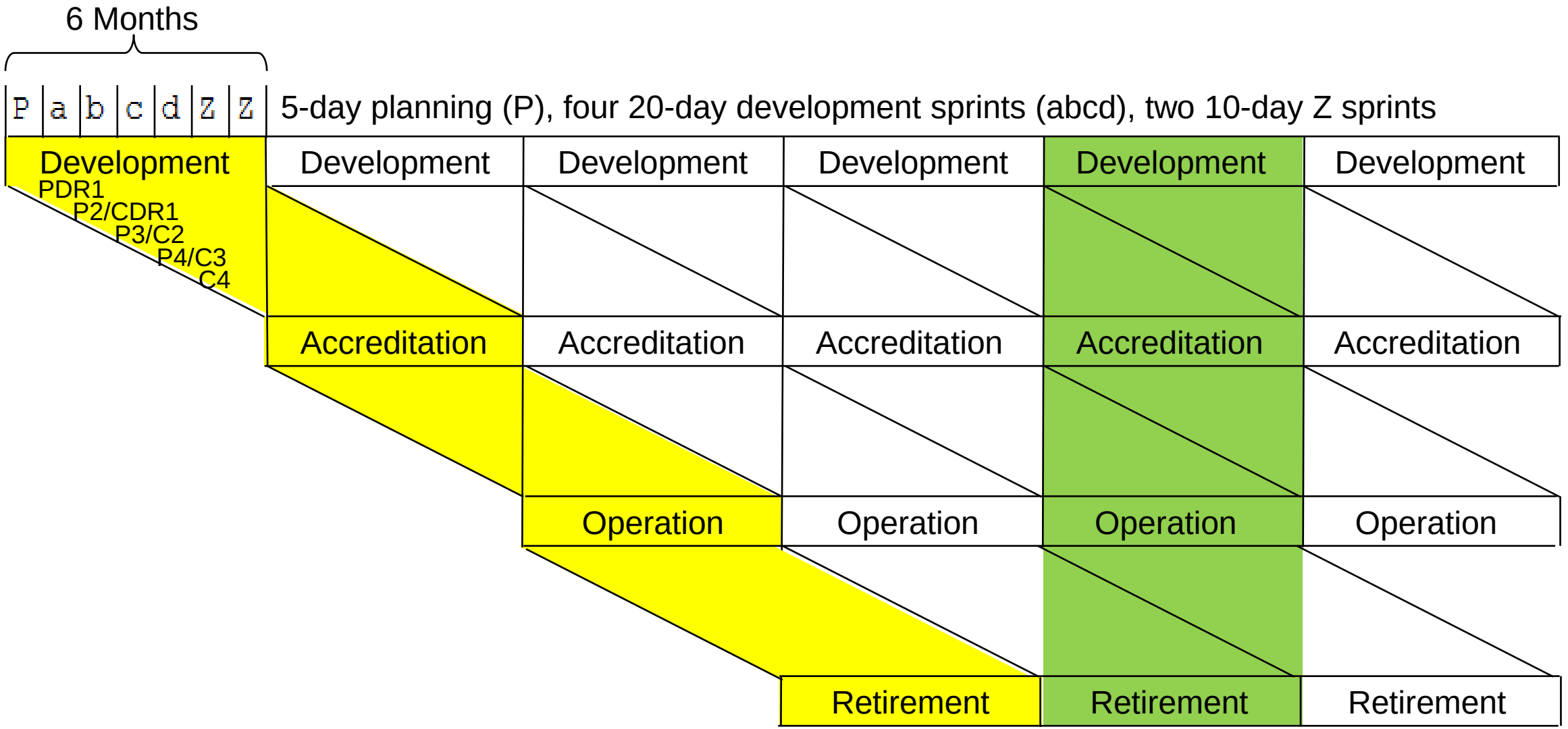
Variation

- Number of security vulnerabilities to address varies greatly week-to-week
- Development man-hours available for capability evolution in competition with higher priority patches and security updates

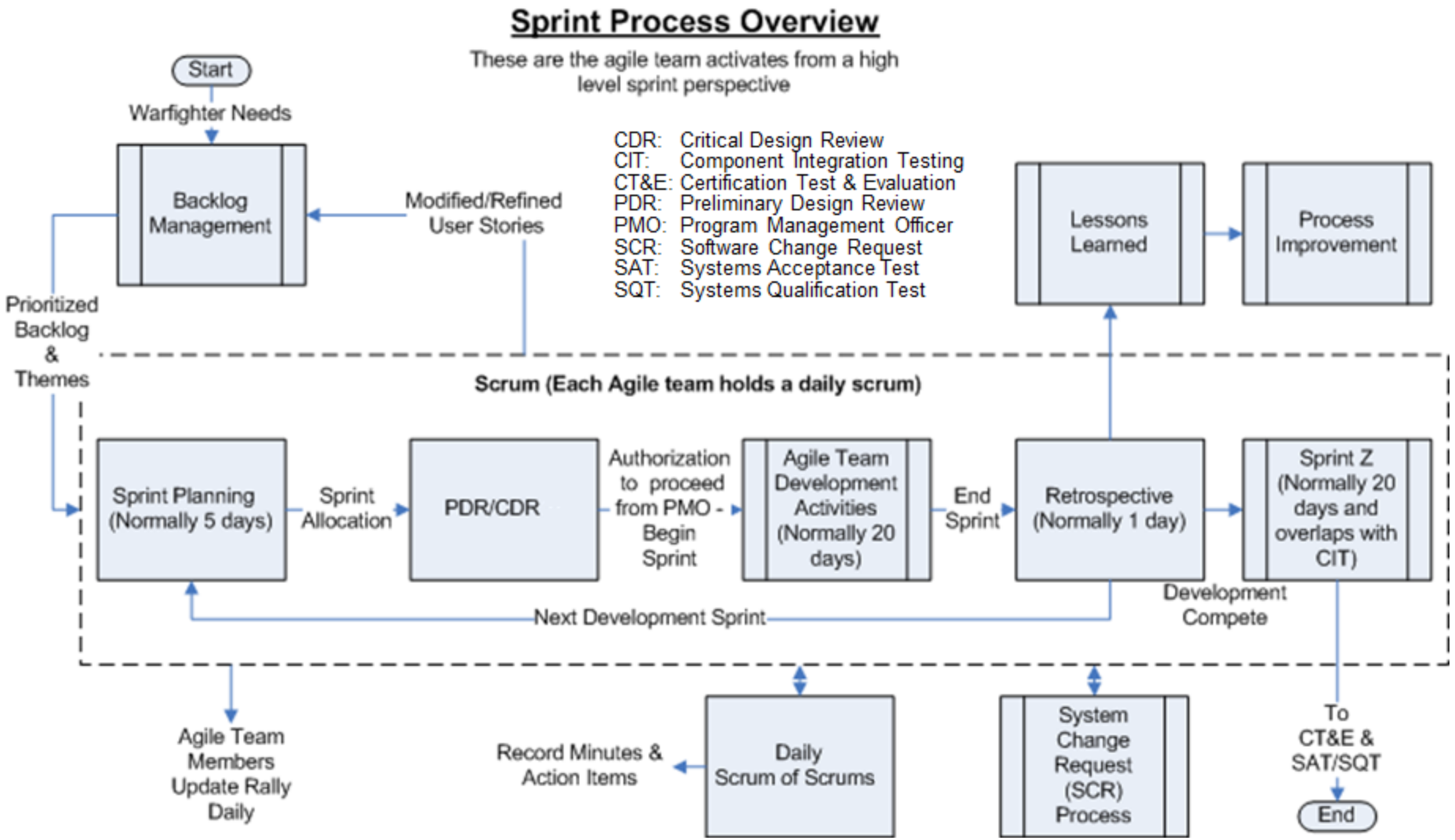
Evolution

- As technology changes, the program must port existing capability to new technology

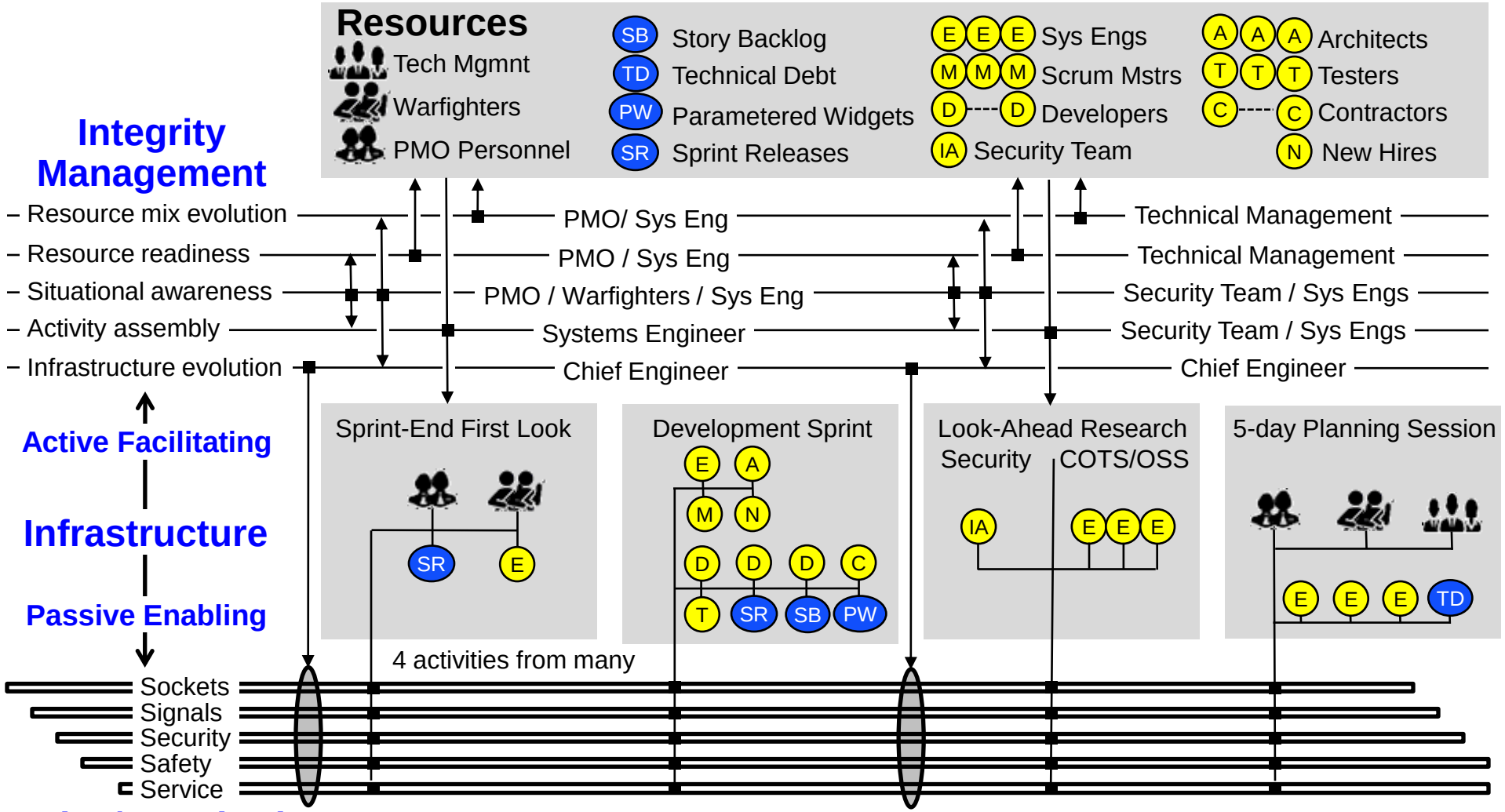
Scrum-Based Software Development Process in Decoupled Wave-Like Waterfall



Sprint Process Overview



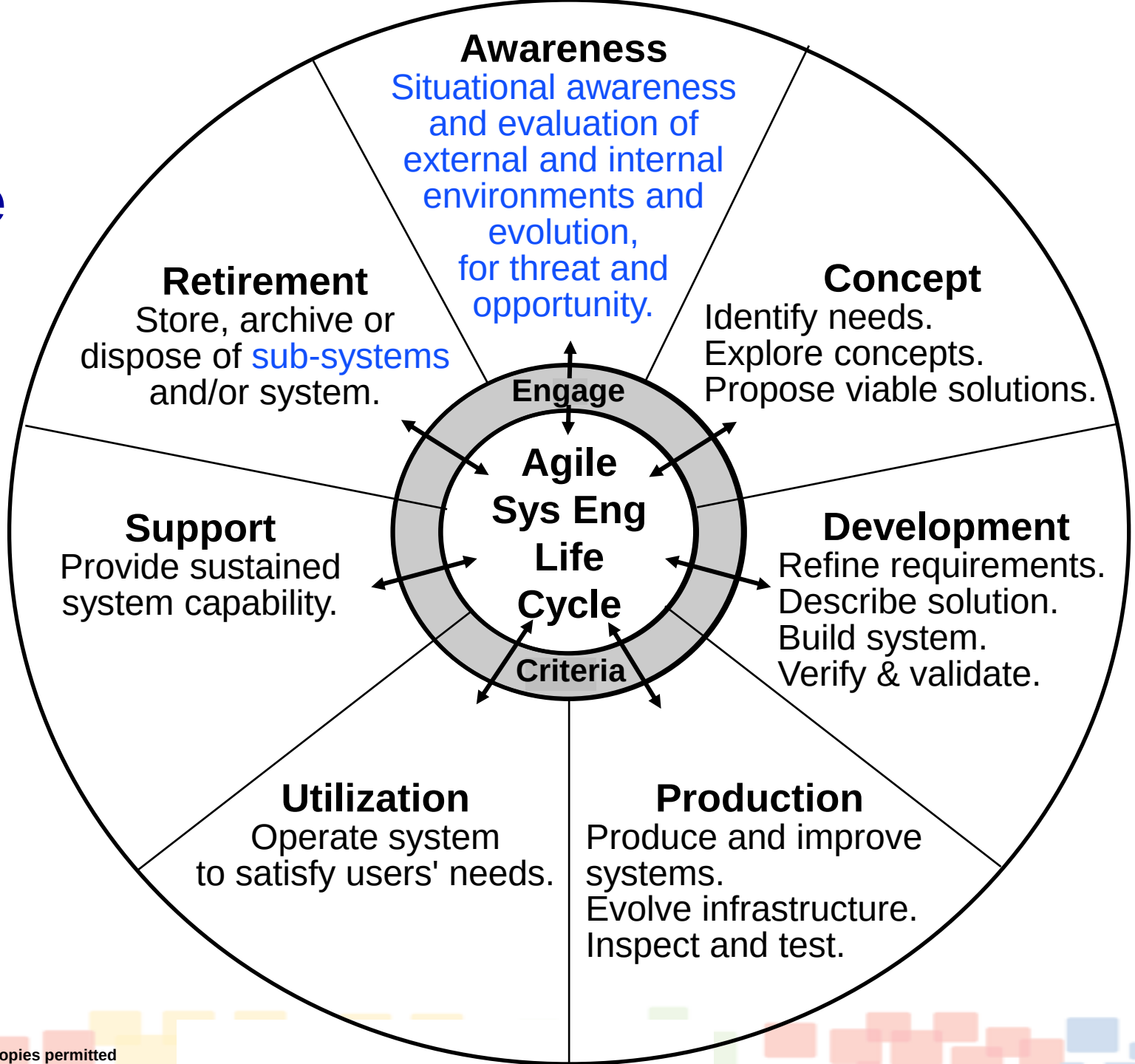
SoS Web-Portal Evolution Process



Rules/Standards

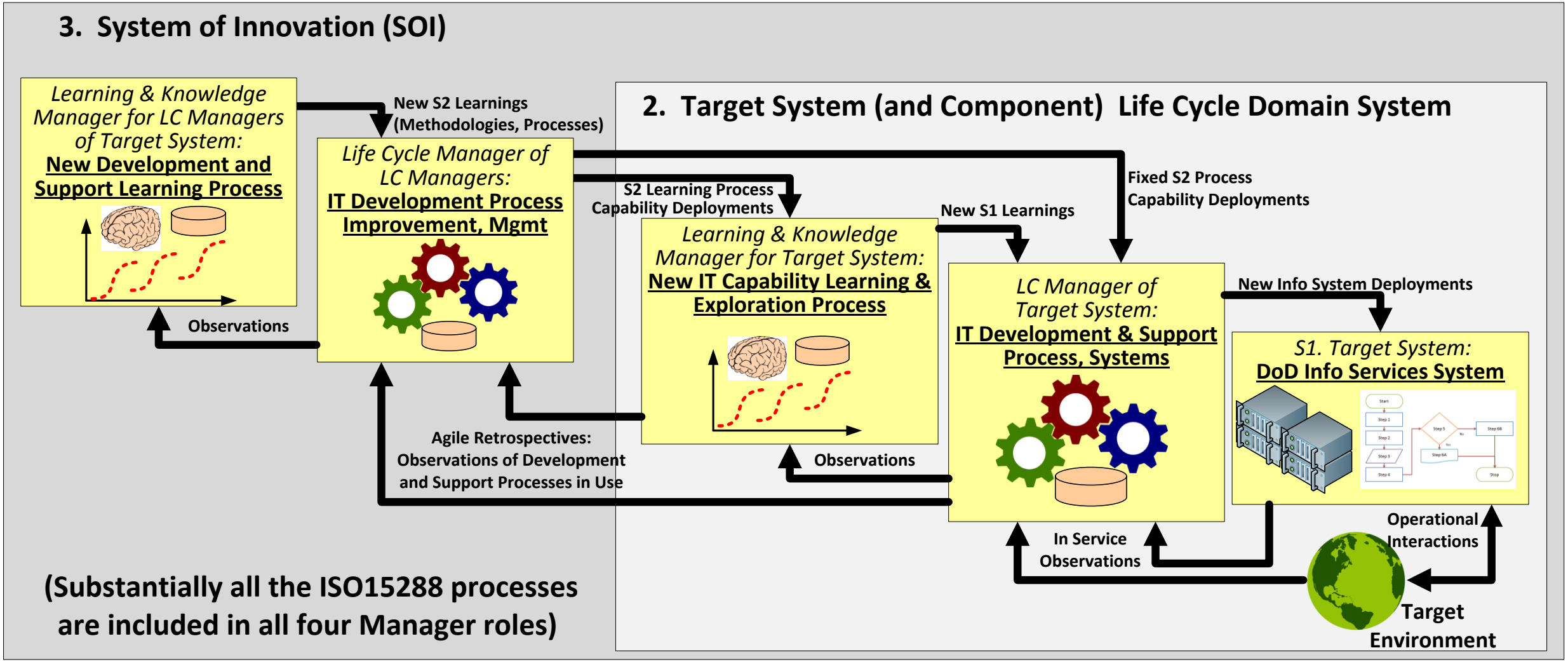
Sockets: Meeting formats, Sys-1 modular architecture, Automated build environment, User story acceptance criteria, Roles, Culture
Signals: Vision/Intent, Release themes, Spikes, User stories, Wireframes, Code, SCR, Process status/metrics, Deliverables, Behavior
Security: Governance, Leadership, Cultural oversight, QA, Metrics, CMMI level 5 oversight, Configuration management
Safety: Open-process visibility, Open no-penalty communication, On-boarding, Team user-story estimation, 40-hour work load
Service Documented accessible ConOps, Embedded environment awareness, Continuous DevOps integration, AAP for Systems 1&2

Asynchronous/ Simultaneous Agile Life-Cycle Framework

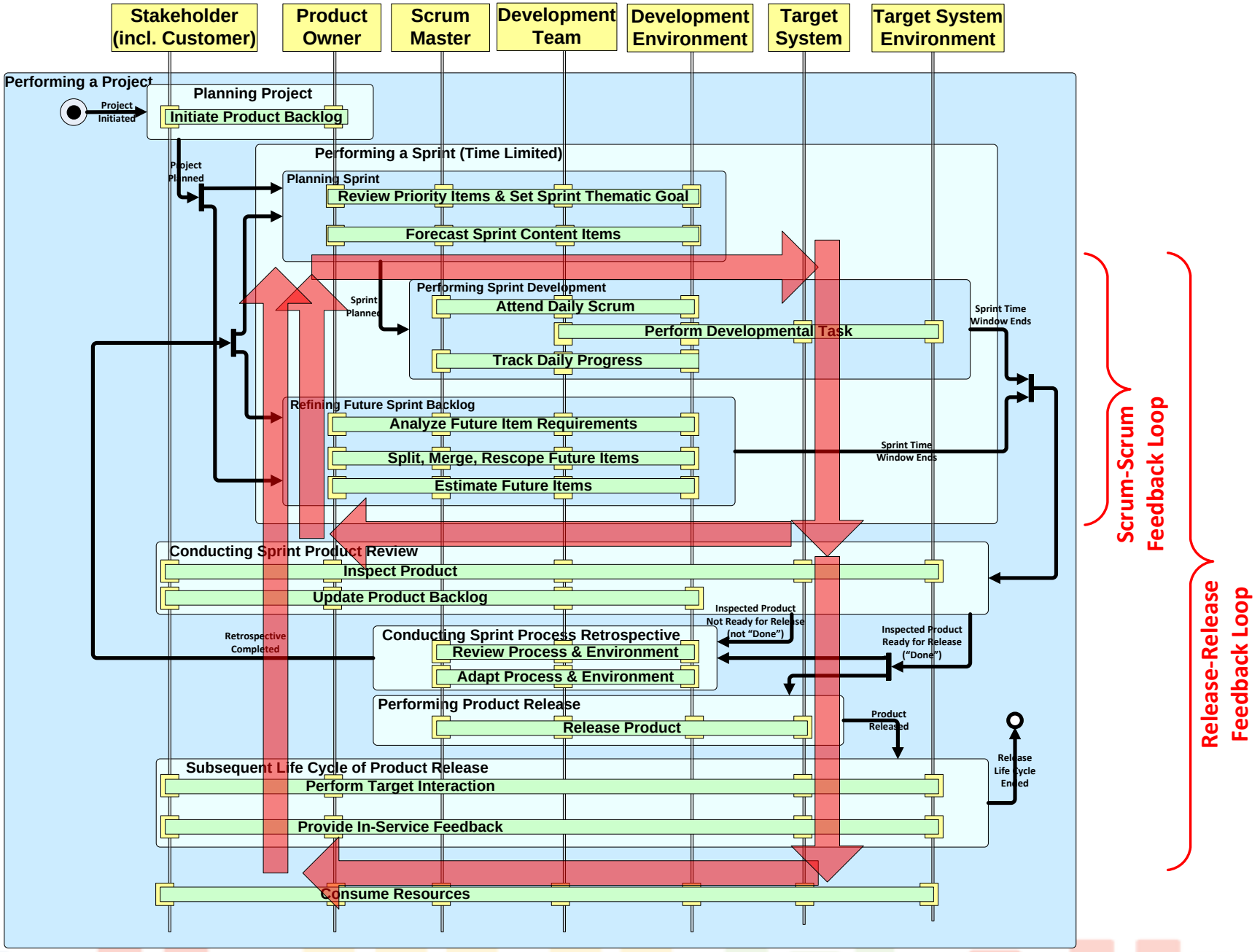


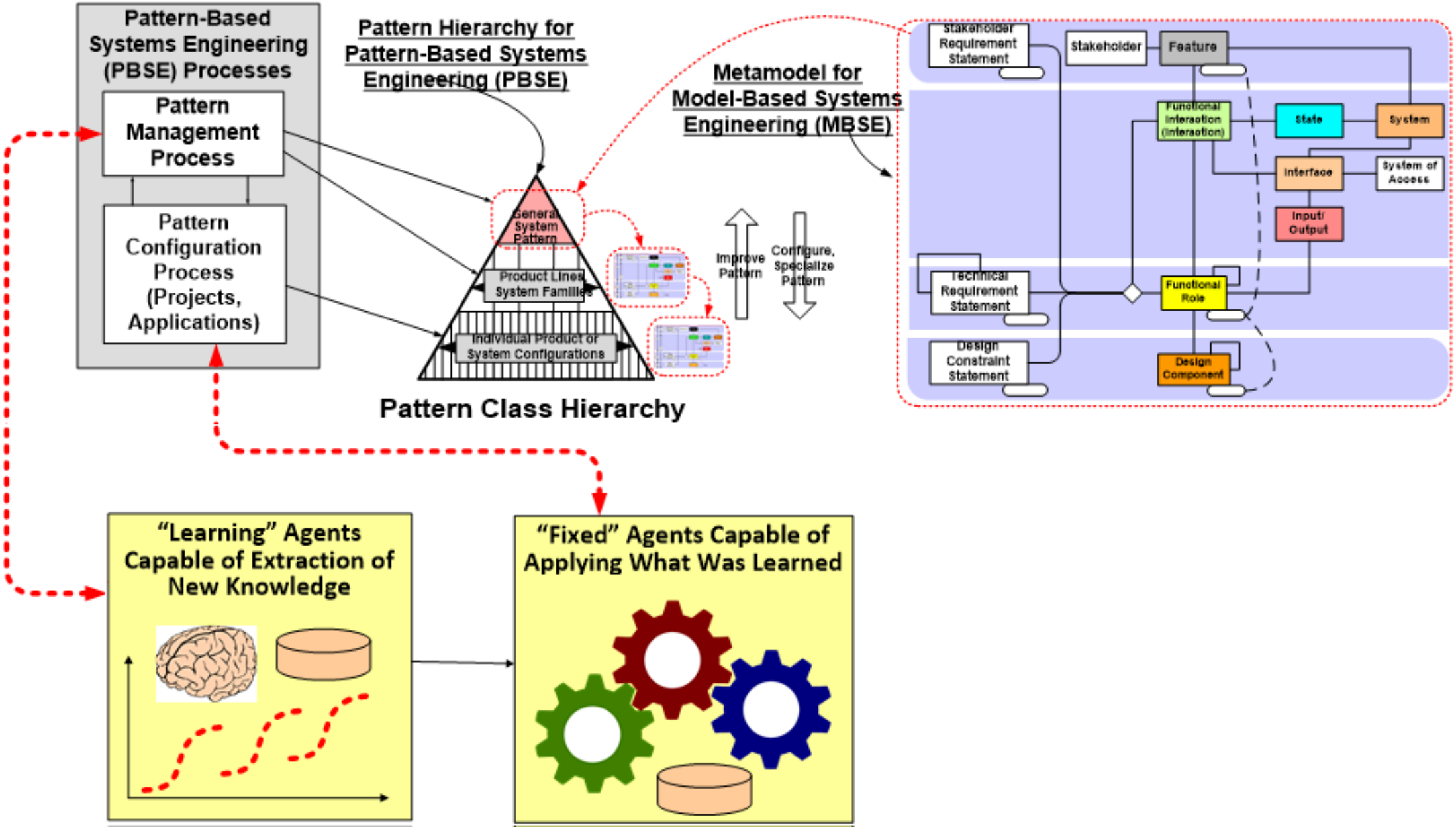
Awareness Stage is Critical Driver of Agility

Agile Systems Engineering Life Cycle Pattern Encompassing Systems 1, 2, and 3



- System-1 is the target system under development.
- System-2 is the SE process life cycle that produces System-1.
- System-3 is the process improvement system, that learns, configures, and matures System-2.





Some Notable Process Concepts

- ❑ Intimate stakeholder involvement in the SE process.
- ❑ Asynchronous and simultaneous life cycle stage activity, in never-ending system growth and evolution.
- ❑ Hybrid Scrum/Waterfall/Wave process-model integration, in contract conformance.
- ❑ CMMI level 5 procedure discipline, providing seamless new-release operational stability.
- ❑ Awareness and mitigation of external environment evolution.
- ❑ Real-time optimal process-control model, for re-prioritizing development-increment activity and acting on feedback.

Four Key Findings Emerging from ASELCM Project:

1. **Life Cycle Model Framework**
2. **ASELCM 3-System Pattern**
3. **CURVE problem-space characterization**
4. **MME behavior principles**

Details in: Agility in Systems Engineering – Findings from Recent Studies.
Working Paper, 15-April-2017
www.parshift.com/s/ASELCM170415-AgilityInSE-Findings.pdf

Characterizing the Problem-Space

CURVE

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

Capriciousness: Unknowable situations.
Unanticipated system-environment change.

Uncertainty: Randomness with unknowable probabilities.
Kinetic and potential forces present in the system

Risk: Randomness with knowable probabilities.
Relevance of current system-dynamics understanding.

Variation: Knowable variables and associated variance ranges.
Temporal excursions on existing behavior attractor.

Evolution: Gradual successive developments.
Experimentation and natural selection at work.

Emerging Fundamental Principles

All case studies enable and facilitate (in core, but different methods):

- Project situational sensing and response.
- Team-members' engagement sensing and response.
- Development-issue sensing and response.
- Integration-issue sensing and response.
- Assimilated shared-culture and evolution.
- Process and procedure evolution.
- Product evolution.

Three Categories of Fundamental Principles Emerge:

- Sense/Monitor – awareness is the driver of agility
- Respond/Mitigate – action is the expression of agility
- Evolve – applied learning is the sustainer of agility

Agility-Facilitating Operational Principles

Monitoring (observe, orient)

- External awareness (proactive alertness)
- Internal awareness (proactive alertness)
- Sense making (risk & opportunity analysis, trade space analysis)

Mitigating (decide, act)

- Decision making (timely, informed)
- Action making (invoke/configure process activity for the situation)
- Action evaluation (validation & verification)

Evolving (improve above with more knowledge and better capability)

- Experimentation (variations on process ConOps)
- Evaluation (internal and external judgement)
- Memory (evolving process ConOps)

Relevant References

Agile Systems Engineering Life Cycle Fundamentals Project, Documents at: https://connect.incose.org/ProgramsProjects/aselcm/Pages/Home.aspx, alternatively at www.parshift.com/ASELCM/Home.html

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