An Elastic Approach to Digital Engineering

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Agenda


Digital Engineering
Optimizing Digital Engineering
fleX-engineering™ Approach
Future Work

What is Digital Engineering? [1]

- Digital Engineering (DE) is defined as ‘‘an integrated digital approach that uses authoritative sources of systems’ data and models as a continuum across disciplines to support lifecycle activities from concept through disposal”
- DE combines model-based techniques, digital practices, and computing infrastructure to enable delivery of high pay-off solutions to the end users at the speed of relevance.
- DE modernizes how the scientists and engineers conceive, design, operate, and sustain capabilities to outpace adversaries.
- DE incorporates technological innovation into an integrated digital model-based approach to transform the state of engineering practice in support lifecycle activities.

DE Accelerates Missions – It is Not, Itself, the End Goal

Applying DE Capability for Customers is Complex… (but let's look closer here)

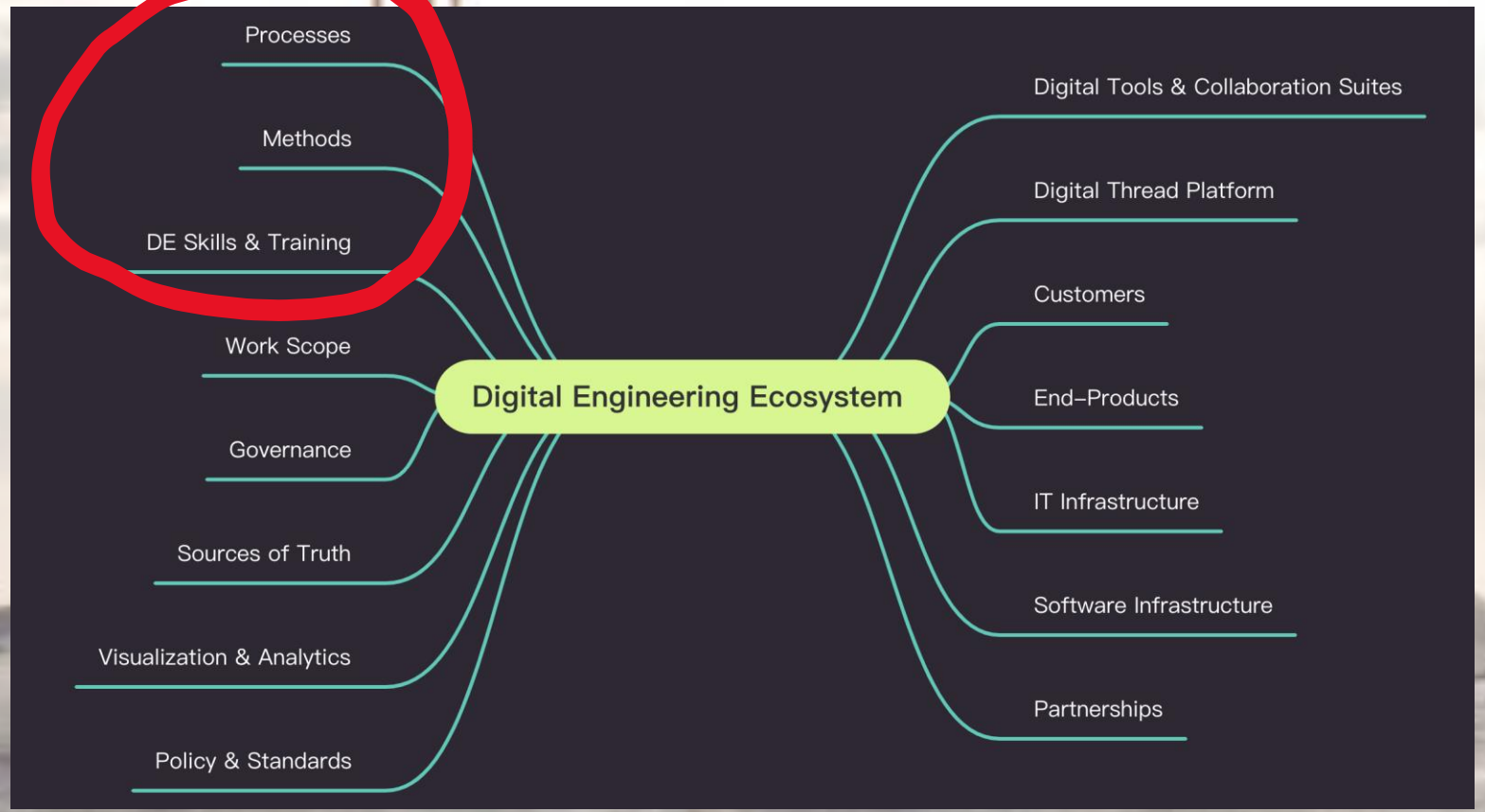
Challenges

- Methods and processes in use by orgs typically not 'born digital'
- Orgs possess varying mix of DE competency

Our Approach

flex-engineering™

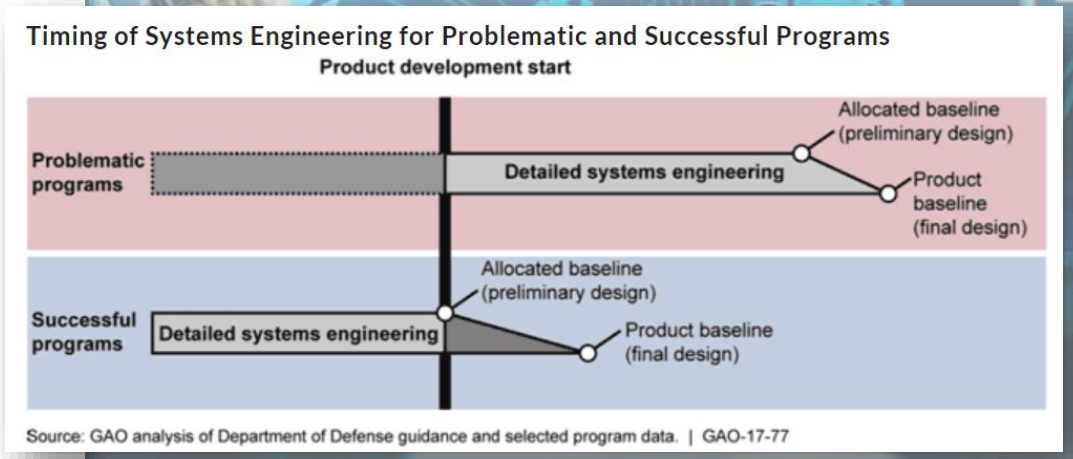
ManTech UNIVERSITY



Analogy: Optimizing Size of SE Effort

Return on Investment (ROI) and sizing Systems Engineering effort is a well-studied problem:

- http://www.hcode.com/seroi/ (SE ROI)
- INCOSE SE Handbook[2], Section 2.8.1
- GAO-17-77[3]
- GAO-15-469[4]



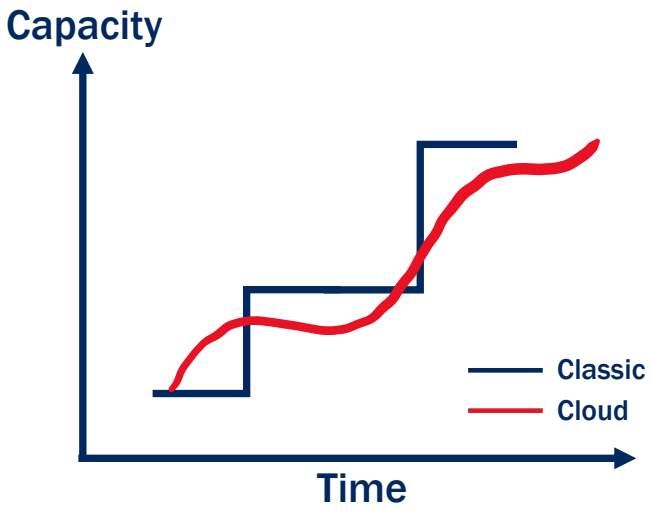
There Are Also 'Right Amounts' and 'Right Times' for DE Effort… It's Different for Every Project.

Analogy: Elasticity in Cloud Computing

Acquire resources as you need them, and release resources when you no longer need them. In the cloud you want to do this automatically, and dynamically.

The DE approach should be optimally sized for the needs of the project at each point in time. You also want to do this dynamically; predicting it all at project inception is difficult:

- The project evolves
- Technology evolves
- DE capabilities mature and evolve



DE is Not 'Set, and Forget'…
Inspect the DE Approach, Expand/Contract as Needed.

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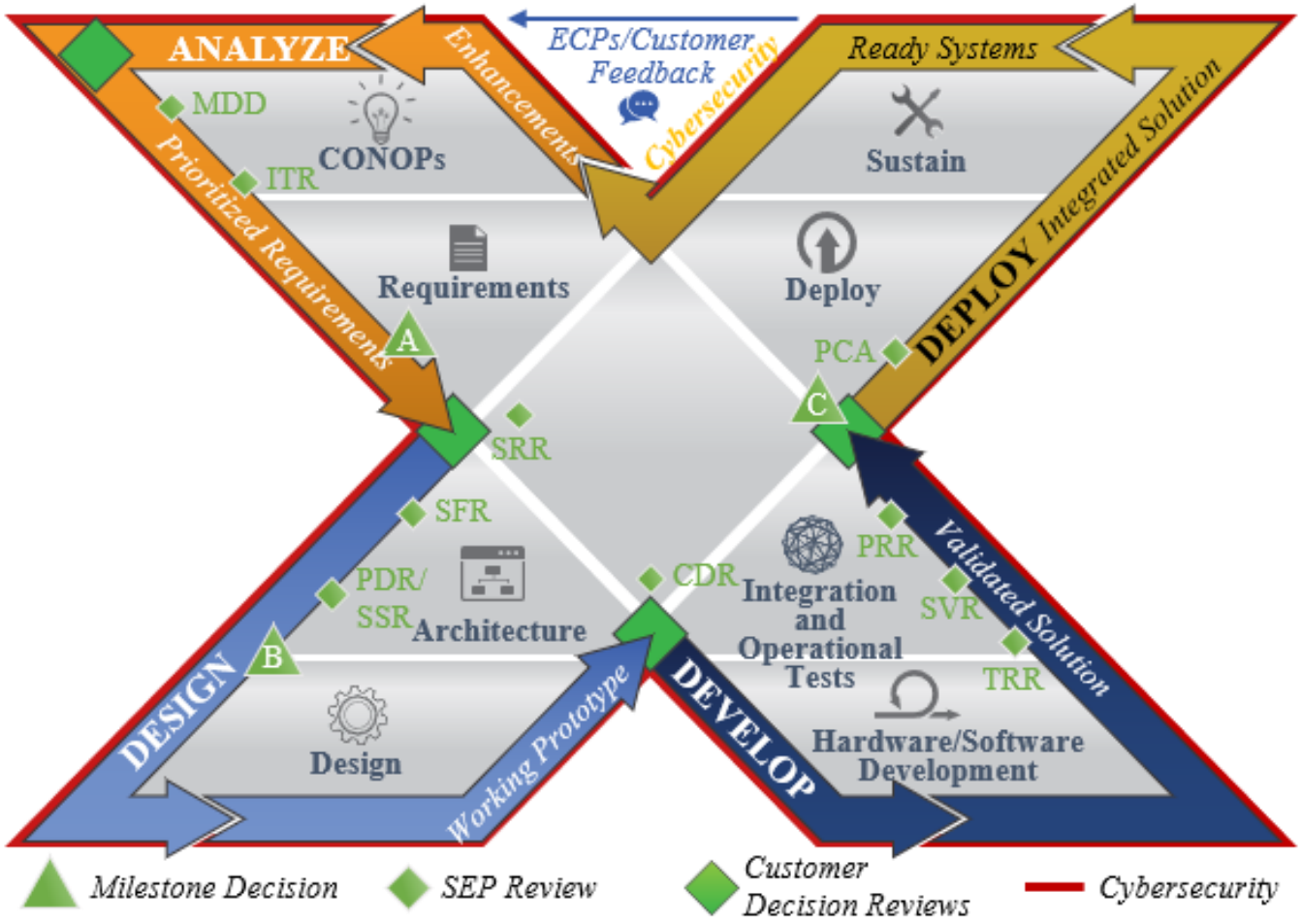
fleX-engineering™ Approach



ISO/IEC/IEEE 15288 Technical Processes Mapped by X 'leg'

ANALYZE
- 6.4.1 Business or mission analysis process
- 6.4.2 Stakeholder needs and requirements definition process
- 6.4.3 System requirements definition process

DESIGN
- 6.4.4 Architecture definition process
- 6.4.5 Design definition process
- 6.4.6 System analysis process

DEVELOP
- 6.4.7 Implementation process
- 6.4.8 Integration process
- 6.4.9 Verification process

DEPLOY
- 6.4.10 Transition process
- 6.4.11 Validation process
- 6.4.12 Operation process
- 6.4.13 Maintenance process
- 6.4.14 Disposal process

fleX-engineering™

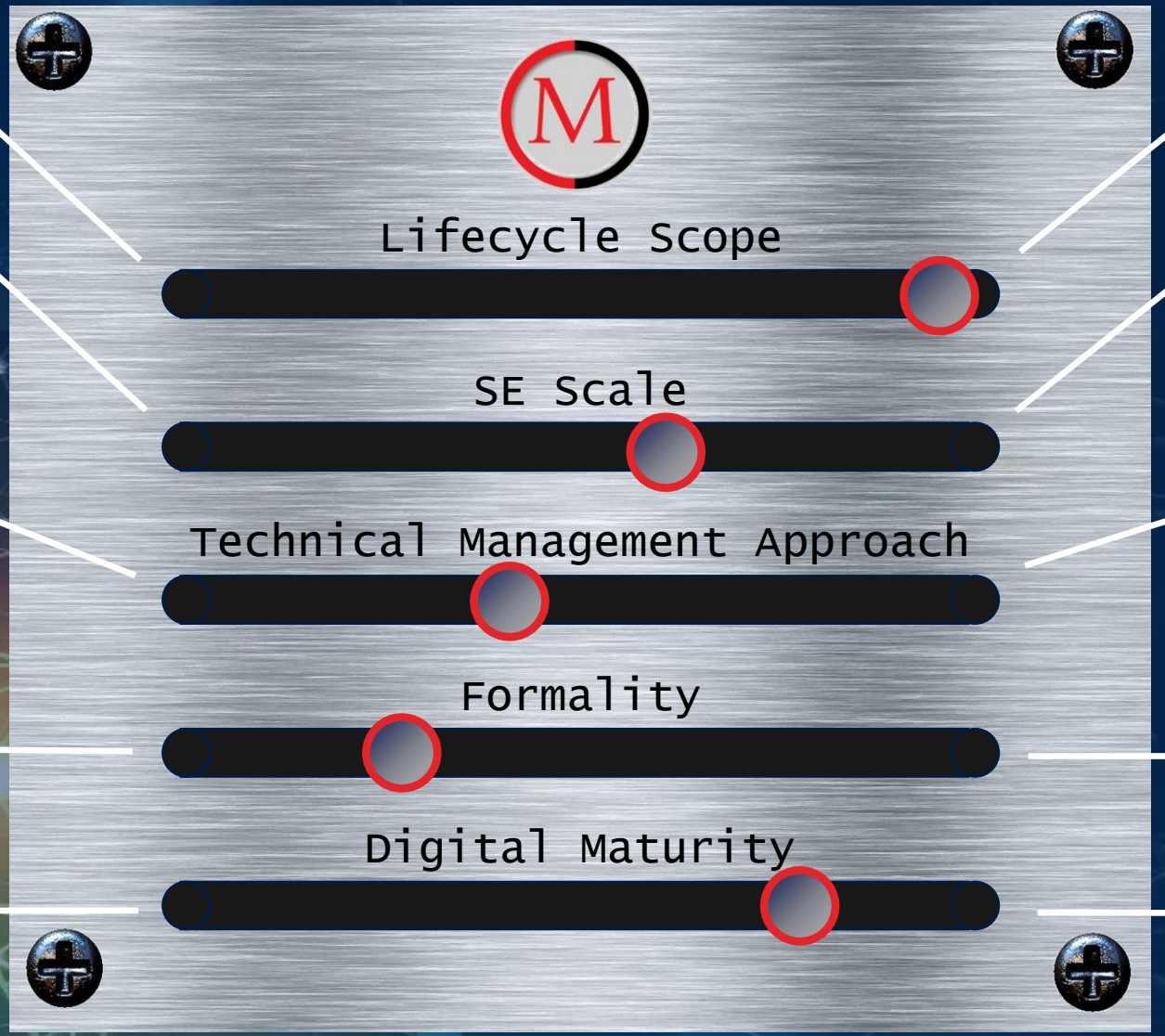
Single SE Process
- One 15288 outcome
- Partial fleX “X”

Very Small Entity
- Lightweight process & work products reflect ISO 29110 – Entry profile

Waterfall
- Sequential, planning focused, full system scope advanced linearly

Low Ceremony
- Continuous or informal review, focused meetings & artifacts

Document-based
- Documentation-centric, ad-hoc threading of info



All SE Processes
- All 15288 outcomes
- Full flex “X”

Large Organization
- Heavyweight process & work products reflect full ISO/IEC/IEEE 15288

Iterative
- Continuous planning & adjustment, system scope advanced via threads

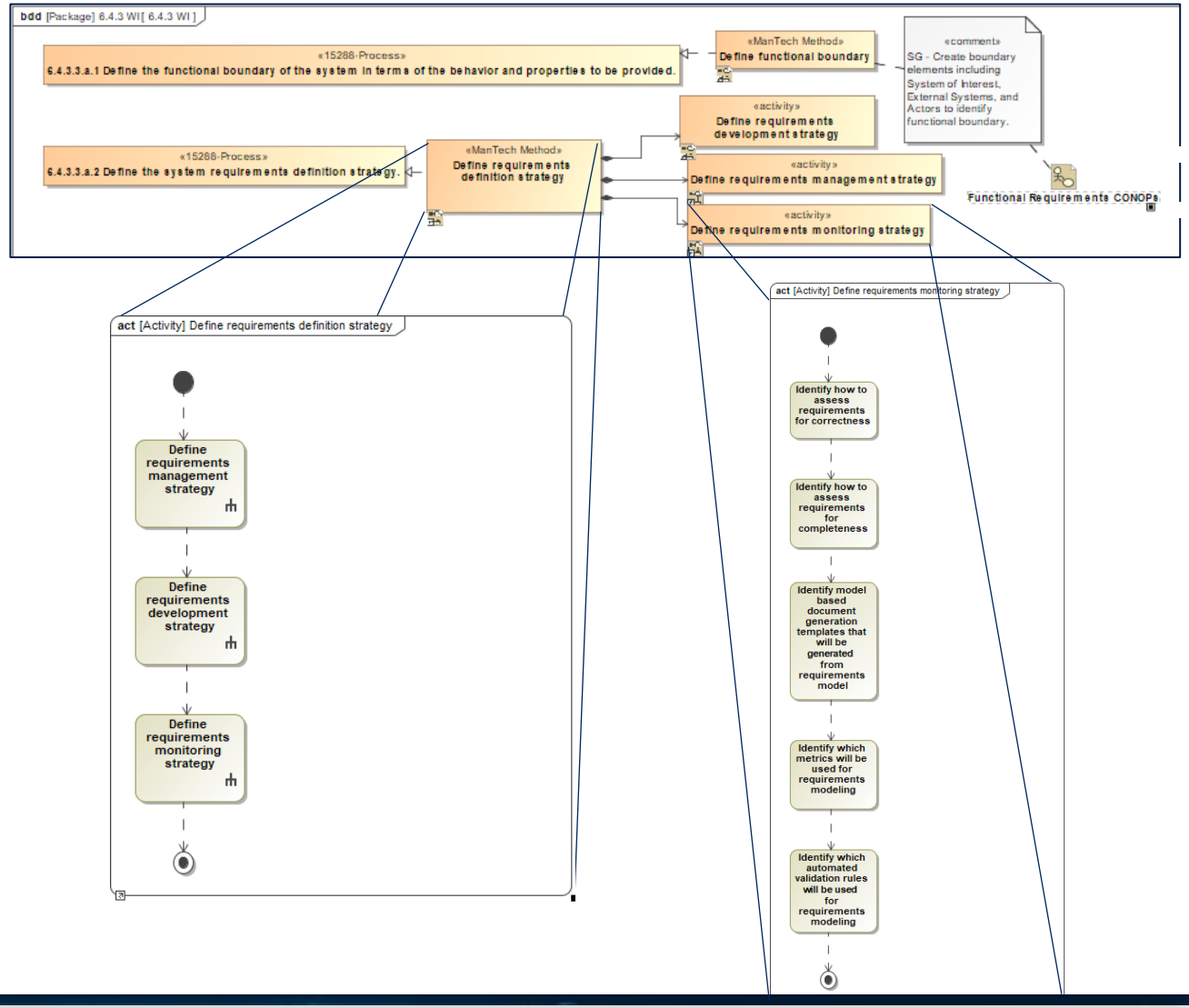
High Ceremony
- Stage-gate reviews, high meetings, high artifacts

Model-based
- Architecture-centric, self-documenting models, digital threading of info

Model-Based Work Instruction

- Work instructions architected in Cameo help with the creation of a Systems Engineering Management Plan
- Work Instructions accompanied with style guides and validation rules to provide quality control of artifacts and methodology described
- ManTech methods and associated activities are ‘micro-processes’ that are tailored in or out at higher levels

Example SysML Work Instruction in Cameo



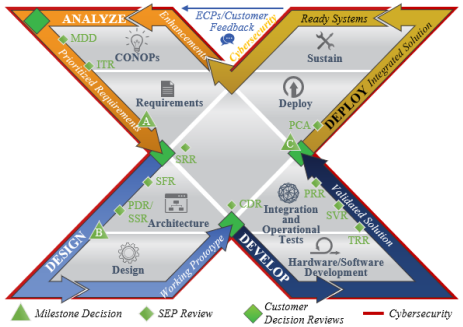
Flexibility with Discipline (Process Owner)

fleX-engineering™ Users

methodpark by UL stages

DASSAULT SYSTEMES
Teamwork Cloud
CAMEO COLLABORATOR

Process Owners



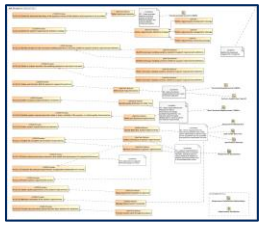
What

- Value Streams
- Workflows & Activities
- Phases & Milestones
- Work Products
- Guidance
- Roles

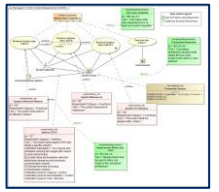
- Establish & maintain processes
- Control and view versioning
- Structure tailoring
- Compliance/Reference tracing

Links To

How



Work Instructions



Style Guide Validation

Training Videos

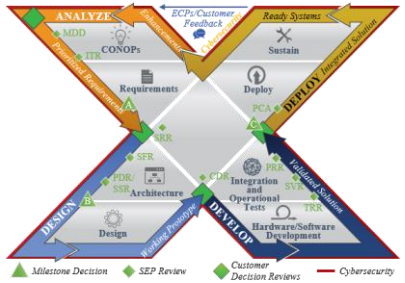
Flexibility with Discipline (Process Customer)

fleX-engineering™ Users

methodpark by UL stages

DASSAULT SYSTEMES Teamwork Cloud CAMEO COLLABORATOR

Program A



Program B

Tailoring

Value Streams
Workflows & Activities
Phases & Milestones
Work Products
Guidance
Roles

Program-specific

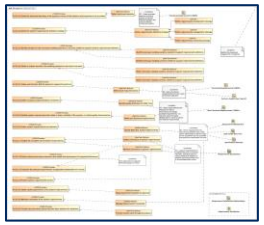
Tailoring

Value Streams
Workflows & Activities
Phases & Milestones
Work Products
Guidance
Roles

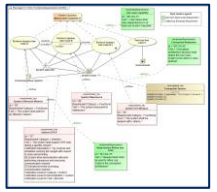
Program-specific

Links To

Links To



Work Instructions



Style Guide Validation

Training Videos

Final Thoughts

- DE approaches should be elastic in nature and adapt to the work at hand.
- Work to enable speed and flexibility, with discipline.
- Connect information to eliminate process islands, support DE knowledge management in the enterprise.

Future Work

- Mature and evolve process, work instruction, style guide models.
- Incorporate recent work on governance of models into processes and methods
- Evaluate fleX-engineering™ approaches against DE competency[5,6], maturity frameworks, customer efforts[7].
- Explore synching modeled process and modeled work instruction.

References

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Thank you

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