National Defense Industrial Association Systems and Mission Engineering Conference

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Digital Engineering (DE) Tool Selection Criteria

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Agenda

- Purpose & Scope
- Approach
- POAM
- Initial Criteria
- Criteria Crosswalk
- Sample Criteria
- Digital Engineering Body of Knowledge (DEBoK)
- Next Steps

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Purpose & Scope

- Purpose: Provide guidance to DE architects, planners and implementers focused around making tool decisions to align engineering with enterprise goals for digital transformation.
- What it is not? - Policy, list of tools or vendors, trade study tool, "single point solution/one size fits all"
- Scope: Establish DE tool agnostic selection criteria aligned with
  - DoD DE strategy, DE fundamentals, DE ecosystem requirements
  - DoD Defense Industrial Base lessons learned and best practice
  - Provide reference products in the DEBoK
- So what?
  - Improved vendor tool interoperability
  - Shared collaborative environment
  - Expanded commonality across enterprise solutions
  - Increase in automation

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Approach

Define Purpose

Define Scope and Plan
- Define product boundaries
- Establish initial guidance

Define and Organize Criteria
- Brainstorm
- Alignment
- Crosswalk criteria against: strategy, requirements, fundamentals
- Aggregate into organized list of questions

Gain Acceptance
- Internal review
- DEM&S CoP
- NDIA SME conference
- INCOSE IW

Develop Usage Guidance
- Finalize criteria
- Use cases
- User guidance

Release, Promote and Adoption
- Publicly available on the DEBoK
- Include in info share briefs
- Training
- Acceptance
- Command media

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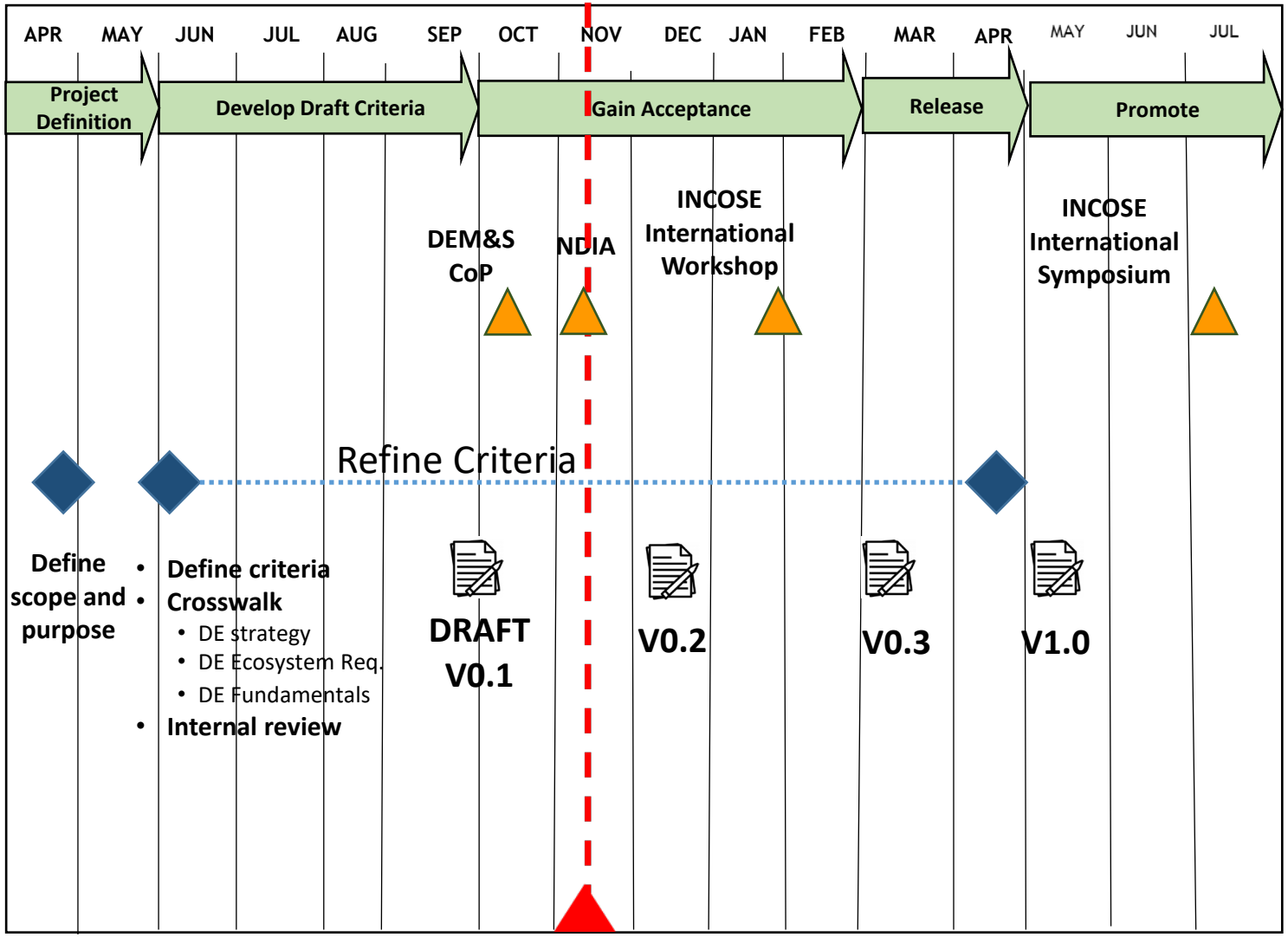
DE Tool Selection Criteria POAM



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Initial Criteria Focus, Not Comprehensive

- Integration with existing tools
- Data: Continuity, authoritative, curation and shared
- Full traceability of tool execution, product and legacy (digital thread, cross domain, etc.)
- Tool product credibility: Automated verification and validation
- Data management adherence (Configuration Management (CM), Data Management (DM), logistics, quality, etc.)
- Long-term archival/retrieval (obsolescence, tool supportability)
- Standards adherence
- Automation – reporting, notification, handoffs, etc.
- Licensing: Enterprise-wide, creative licensing strategies
- Collaboration and sharing (Intellectual Property (IP), data rights, access control, etc.)

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Criteria Alignment – Strategy, Fundamentals & Requirements

OUSD(R&E)

DE Ecosystem Generic Requirements

OUSD(R&E)

DE Fundamentals

DE Tools Criteria

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DE Strategy: What, Not How

Describes an integrated digital approach that uses authoritative sources of systems' data and models as a continuum across disciplines to support life cycle activities from concept through disposal

DE Strategy Link

1. Formalize the **development, integration and use of models** to inform enterprise and program decision making
2. Provide an enduring **authoritative source of truth**
3. Incorporate **technological innovation** to link digital models of the actual system with the physical system in the real world
4. Establish supporting **infrastructure and environments** to perform activities, collaborate, and communicate across stakeholders
5. Transform a **culture and workforce** that adopts and supports Digital Engineering across the lifecycle

Combine standard representations of a system (s), with computers, additional computational techniques as a continuous, complete and evolving ecosystem to provide data for data-informed decisions and interactive visualizations to a continuum of questions

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DE Strategy Crosswalk

DE Strategy

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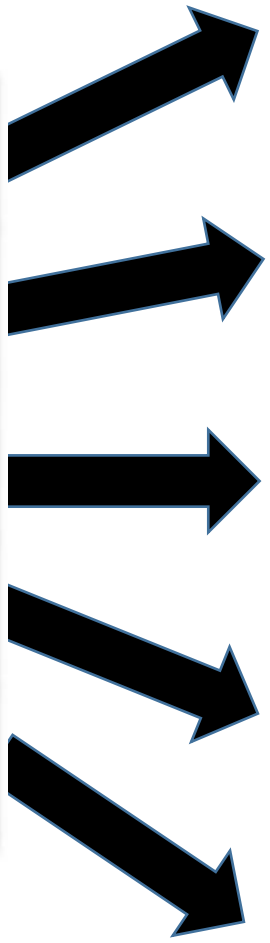

Sample DE Tool Criteria

- Supports the development of models
- Support interoperability with other models (management, design, manufacturing, system, business, product support)
- Supports establishing access and controls.
- Supports the management of models as the authoritative source of truth
- Provides AI/ML capabilities
- Supports advanced human machine interfaces
- Support enterprise and flexible licensing agreements with minimal constraints on data exchange/sharing.
- Supports change management activities
- Supports Enterprise level reporting and communications

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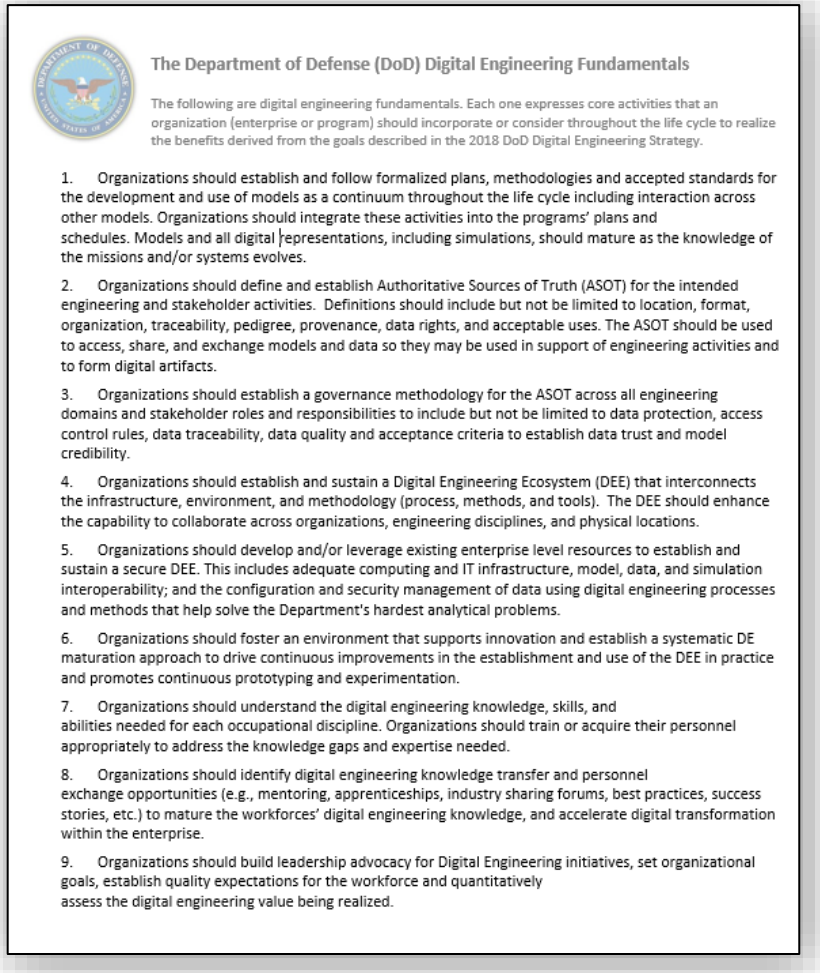
DE Fundamentals



The Department of Defense (DoD) Digital Engineering Fundamentals

The following are digital engineering fundamentals. Each one expresses core activities that an organization (enterprise or program) should incorporate or consider throughout the life cycle to realize the benefits derived from the goals described in the 2018 DoD Digital Engineering Strategy.

1. Organizations should establish and follow formalized plans, methodologies and accepted standards for the development and use of models as a continuum throughout the life cycle including interaction across other models. Organizations should integrate these activities into the programs' plans and schedules. Models and all digital representations, including simulations, should mature as the knowledge of the missions and/or systems evolves.

2. Organizations should define and establish Authoritative Sources of Truth (ASOT) for the intended engineering and stakeholder activities. Definitions should include but not be limited to location, format, organization, traceability, pedigree, provenance, data rights, and acceptable uses. The ASOT should be used to access, share, and exchange models and data so they may be used in support of engineering activities and to form digital artifacts.

3. Organizations should establish a governance methodology for the ASOT across all engineering domains and stakeholder roles and responsibilities to include but not be limited to data protection, access control rules, data traceability, data quality and acceptance criteria to establish data trust and model credibility.

4. Organizations should establish and sustain a Digital Engineering Ecosystem (DEE) that interconnects the infrastructure, environment, and methodology (process, methods, and tools). The DEE should enhance the capability to collaborate across organizations, engineering disciplines, and physical locations.

5. Organizations should develop and/or leverage existing enterprise level resources to establish and sustain a secure DEE. This includes adequate computing and IT infrastructure, model, data, and simulation interoperability; and the configuration and security management of data using digital engineering processes and methods that help solve the Department's hardest analytical problems.

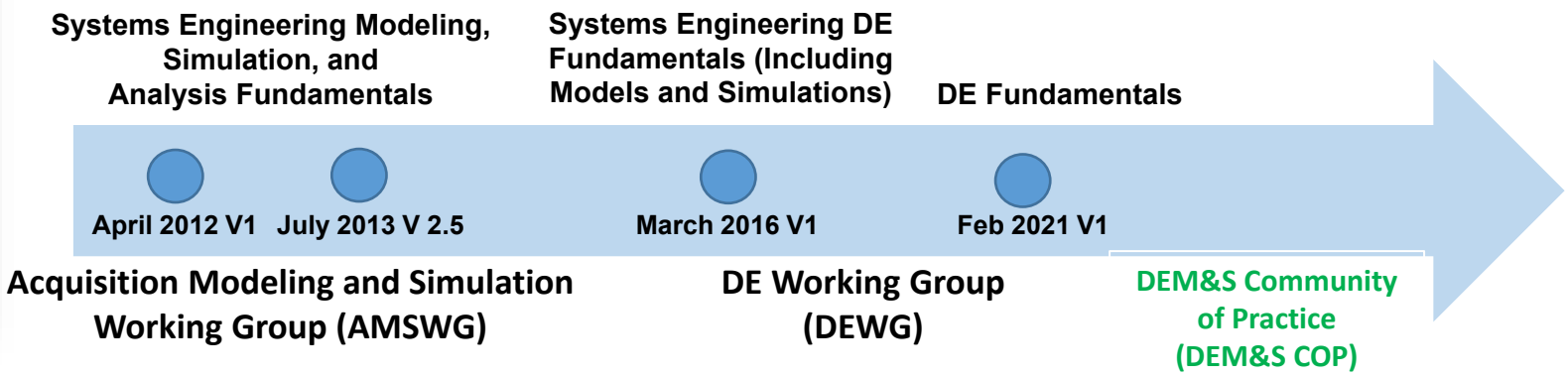
6. Organizations should foster an environment that supports innovation and establish a systematic DE maturation approach to drive continuous improvements in the establishment and use of the DEE in practice and promotes continuous prototyping and experimentation.

7. Organizations should understand the digital engineering knowledge, skills, and abilities needed for each occupational discipline. Organizations should train or acquire their personnel appropriately to address the knowledge gaps and expertise needed.

8. Organizations should identify digital engineering knowledge transfer and personnel exchange opportunities (e.g., mentoring, apprenticeships, industry sharing forums, best practices, success stories, etc.) to mature the workforces' digital engineering knowledge, and accelerate digital transformation within the enterprise.

9. Organizations should build leadership advocacy for Digital Engineering initiatives, set organizational goals, establish quality expectations for the workforce and quantitatively assess the digital engineering value being realized.

- The DE Fundamentals are a one-page reference that expresses core activities that an organization (enterprise or program) should incorporate or consider throughout the life cycle to realize the benefits derived from the DoD DE Strategy.
- Where can you find it?
  - Public access: https://ac.cto.mil/wp-content/uploads/2022/03/DE-Fundamentals-2022.pdf
- Product Heritage and Pedigree



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DE Fundamentals

DE Fundamentals Snapshot

Organizations should establish and sustain a Digital Engineering Ecosystem (DEE) that interconnects the infrastructure, environment, and methodology (process, methods, and tools).

The DEE should enhance the capability to collaborate across organizations, engineering disciplines, and physical locations.

Organizations should develop and/or leverage existing enterprise level resources to establish and sustain a secure DEE.

DRAFT Sample DE Tool Criteria

- Facilitate data formats/standards to include pedigree and provenance, meta-data, or appropriate traceability needed.
- Tools need to be compatible with the organizations existing infrastructure and environment.
- Tools should support continuous validation includes self-checking to enforce adherence to semantics and syntax. Supports error checking
- Tool supports automated notification of changes and discussion or activity happening within it.
- Tools should support planning and scheduling of modeling, simulation, and digital engineering activities.

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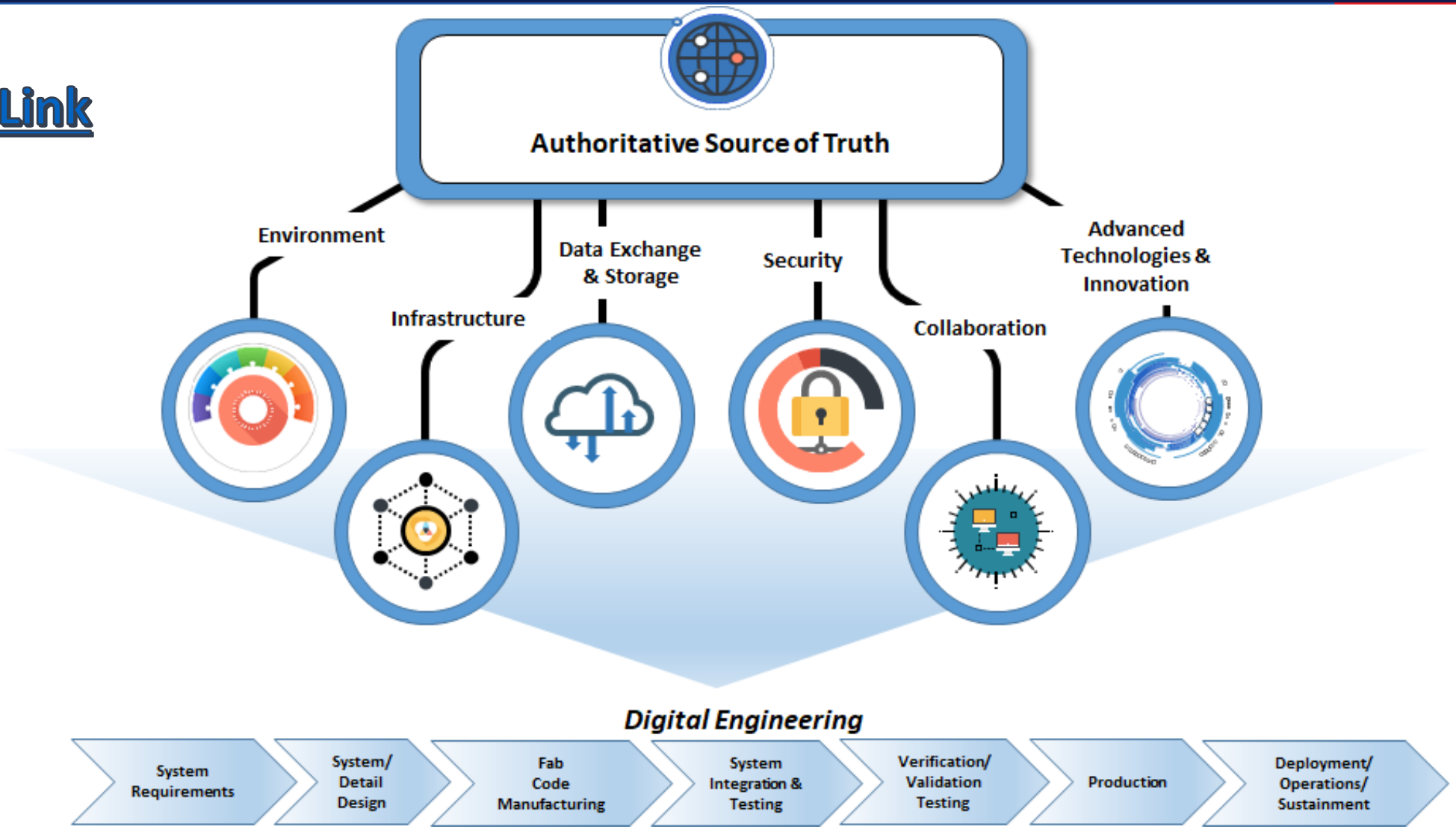
DE Ecosystem Requirements

DEBoK Link



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DE Ecosystem Requirements

DE Ecosystem baseline requirements	
Category	**Sub-Category**
Adv Tech & Processes	Processes
Adv Tech & Processes	Technologies
Collaboration	Resources
Collaboration	Users
Data	Curation
Data	Exchange
Data	Storage
Environment	Licensing
Environment	Portability
Environment	Support
Environment	Visualization
Infrastructure	Hardware/Computing
Infrastructure	Networks
Infrastructure	Software
Security	Access Control
Security	Classification
Security	Cybersecurity

Sample DE Tool Criteria

Capable of cross platform capabilities, tool to tool interaction, integration.

Enable automation of data exchange between users.

Interface capabilities to export data easily in varying different formats

Supports DoD Data Strategy VAULTIS goals

Support legacy and new technology- part of extensibility

Supports automated data tagging, metadata entry for curation of resulting work products. This will aid in configuration management and curation of work products.

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Sample Criteria - As Factors in Your Decision Making

- **Does your tool have a governance process?**
  - Does the tool support version control with a controlled process?
  - Is the tool vendor committed to long term sustainability?
  - Is the tool compatible with the organization's existing tools?
- **Does your tool support integration of models?**
  - Does the modeling environment support integration of modeling tools?
  - Does the modeling tool support interfacing and integration with other models ?
  - Can the models be used on other operating systems?
- **Does your tool support access control?**
  - Does the tool only allow authorized users to edit?
  - Does the tool support "read-only" capabilities?
  - Does your tool have user group access control?
  - Is there controls on access down to the attribute level?
- **Does your tool provide cross tool /platform integration?**
  - Does the tool support API/ interfacing (standard plug-ins) for tool-to-tool interaction?
  - Can the tool be used on multiple platforms and operating systems?
  - Does the tool support forward and backwards capabilities?

Work in progress, preparation for INCOSE International Workshop

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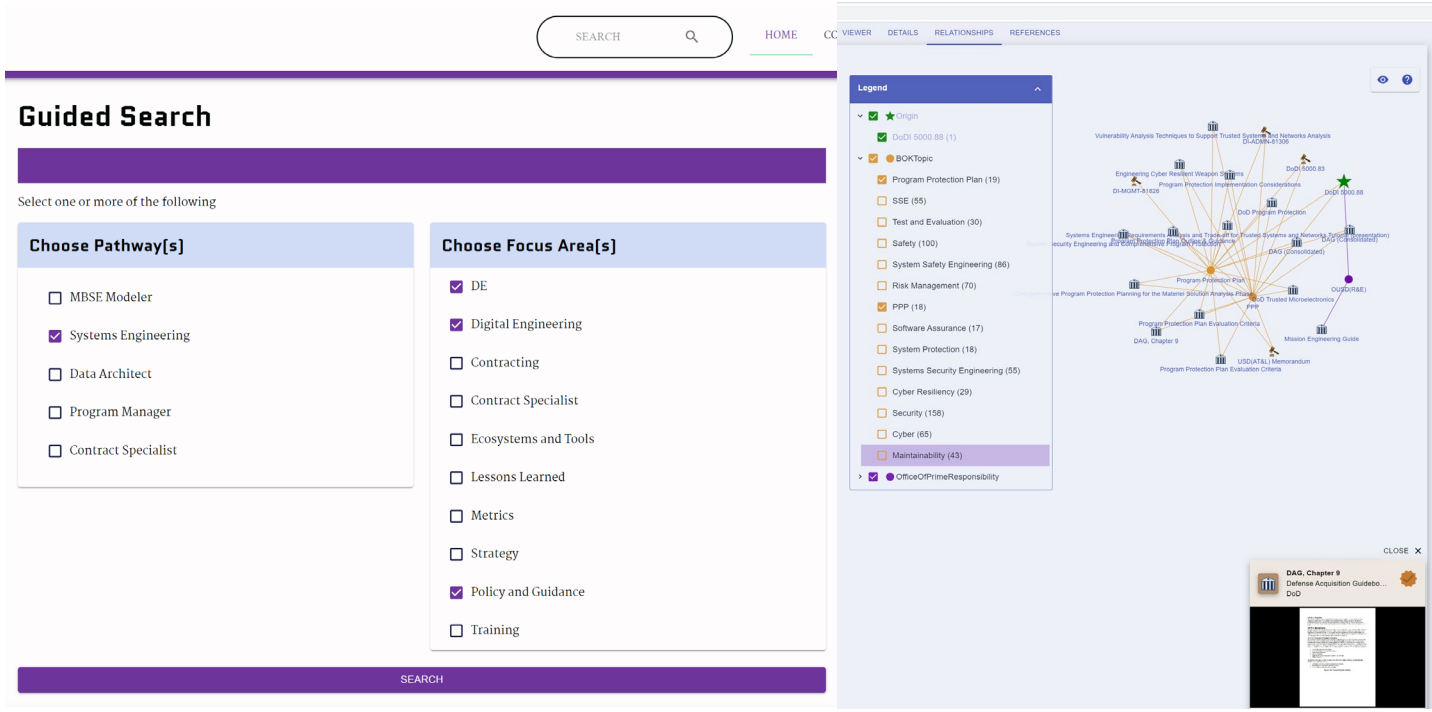
DEBoK

- Tools selection criteria will be available on the DEBoK
  - The DEBoK is a public-facing platform for authoritative DE referential resources
  - Provides collaboration for the DE community
- Please visit us at: de-bok.org

DEBoK
Digital Engineering Body of Knowledge



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Next Steps and Request for Input/Feedback

We are looking for your feedback, support & guidance:

- Comments, Recommendations
- Similar activities
- Similar artifacts
- Established baseline set of tool criteria

Next Steps:

- Derive preliminary criteria guidance (ongoing)
- Complete draft criteria guidance OSD internal review
- INCOSE IW collaboration
- Public release

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Questions, Outreach for Collaboration

- Provide us your feedback and any input you might have
- Provide your recommendations with supporting rationale for consideration in future revisions
- If you have artifacts, please send them to:

osd.mc-alex.ousd-r-e.mbx.deboksupport@mail.mil

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Contact

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