



INCOSE Digital Engineering Information Exchange Working Group (DEIXWG)

Chairperson	Sean McGervey	Sean.MCGERVEY@3ds.com
Deputy Chairperson	Tamara Hambrick	Tamara.Hambrick@boeing.com
Co-Chair (DEIX-SF Lead)	Celia Tseng	Celia.TSENG@3ds.com
Co-Chair (DVM Lead)	Ken Zhang	LeqiKen.Zhang@L3Harris.com
Co-Chair (INCOSE Rep)	Frank Salvatore	Frank.Salvatore@saic.com
Co-Chair (NDIA Rep)	Chris Schreiber	chris.schreiber@lmco.com
Tech Lead	Terri Chan	terri.w.chan@boeing.com
Tech Lead	Wanda Eyre	wanda.j.eyre@boeing.com
Tech Lead	Risa Gorospe	Risa.GOROSPE@3ds.com

What is the DEIXWG?



- Collaboration between the International Council of Systems Engineers (INCOSE), National Defense Industrial Association (NDIA), and the Office of the Under Secretary of Defense for Research and Engineering (DoD OUSD(R&E))
- The DEIXWG supports the strategic objective of accelerating digital engineering transformation by characterizing the content and relationships involved in the exchange of digital artifacts between stakeholders of various disciplines throughout the engineering lifecycle



Use the authoritative source of truth to produce digital artifacts, support reviews, and inform decisions

As the technical baseline matures, preserving the knowledge across programs and lifecycle phases is essential. Technical reviews can be conducted from the authoritative source of truth on a continuous basis. Stakeholders will generate digital artifacts, representing multiple views and various perspectives from the authoritative source of truth. Digital artifacts provide visibility of appropriate information across functional domains, disciplines, and organizations.

--- DoD Digital Engineering Strategy, 2018

Background: Models, Metamodels, and Data Analysis

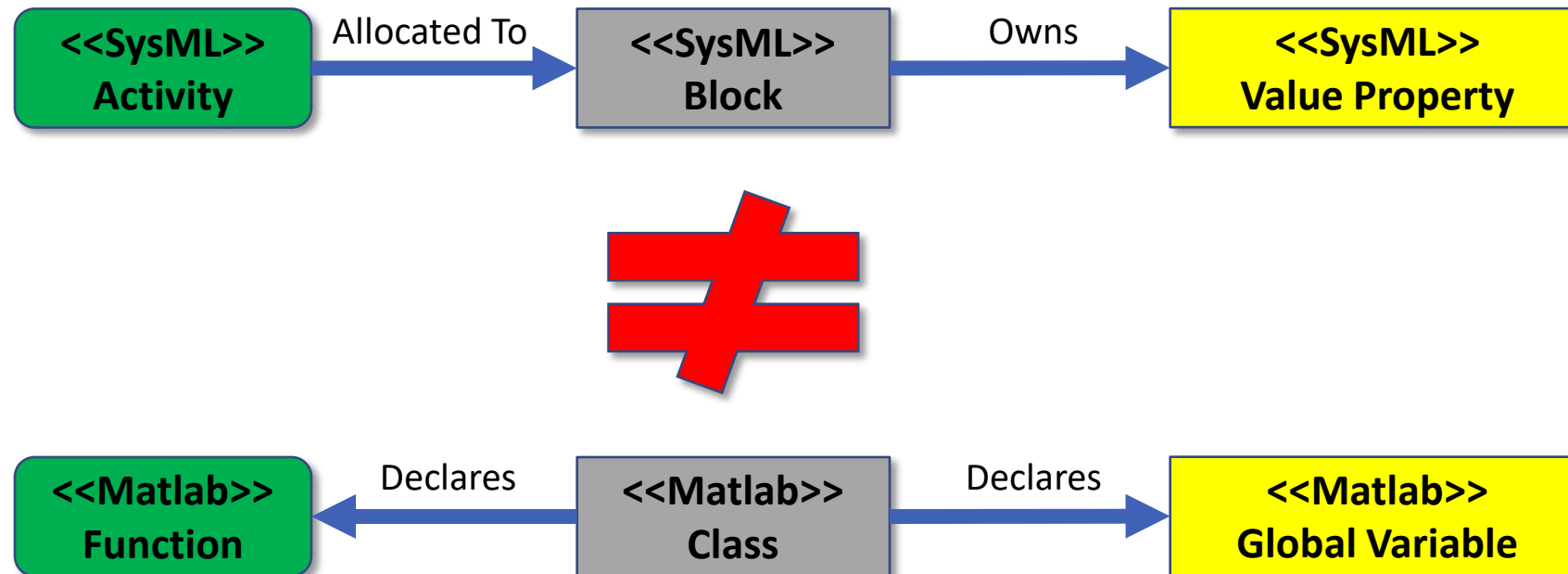
- Digital Engineering Information Exchange (DEIX) is difficult because it is fundamentally about **Data Analysis**: “a process of inspecting, cleansing, transforming, and modeling data with the goal of discovering useful information, informing conclusions, and supporting decision-making.” [1]
- For a single model, data analysis is made easier because the elements of the model are semantically related to each other via the rules established by the model’s governing metamodel, as exemplified below:



[1] "Transforming Unstructured Data into Useful Information", *Big Data, Mining, and Analytics*, Auerbach Publications, pp. 227–246, 2014-03-12, doi:10.1201/b16666-14, ISBN 978-0-429-09529-0, retrieved 2021-05-29

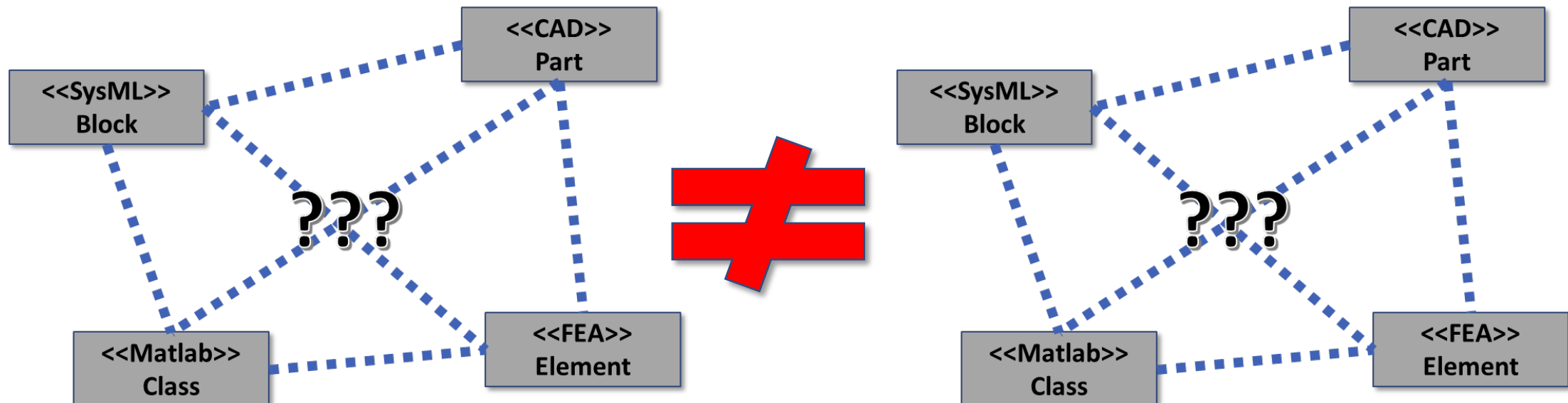
Background: Data Analysis Involving Different Metamodels

- But... how can we semantically relate elements between different models, when they each have their own metamodel and rules?



Background: Conceptually Relating Different Metamodels

- Additionally, even if one organization or business unit assembles a digital engineering ecosystem (DEE) that manages to conceptually relate its various authoritative sources of truth... How can it exchange its digital information with a different DEE that may have different concepts...?



Select Products of the DEIXWG



- DEIX Standards Framework (DEIX-SF): Framework for official standards related to DE information exchange
- Digital Viewpoint Model (DVM): Ontological model of concepts relating DE information, artifacts, and views
- DEIXPedia: Micropedia of digital engineering topics to explain relevant DEIX topics
- DEIX Primer: A narrative that describes the concepts and interrelationships between digital artifacts, enabling systems, and exchange transactions
- Digital Engineering Information Exchange Model (DEIXM): Model of DE information exchange in an engineering ecosystem

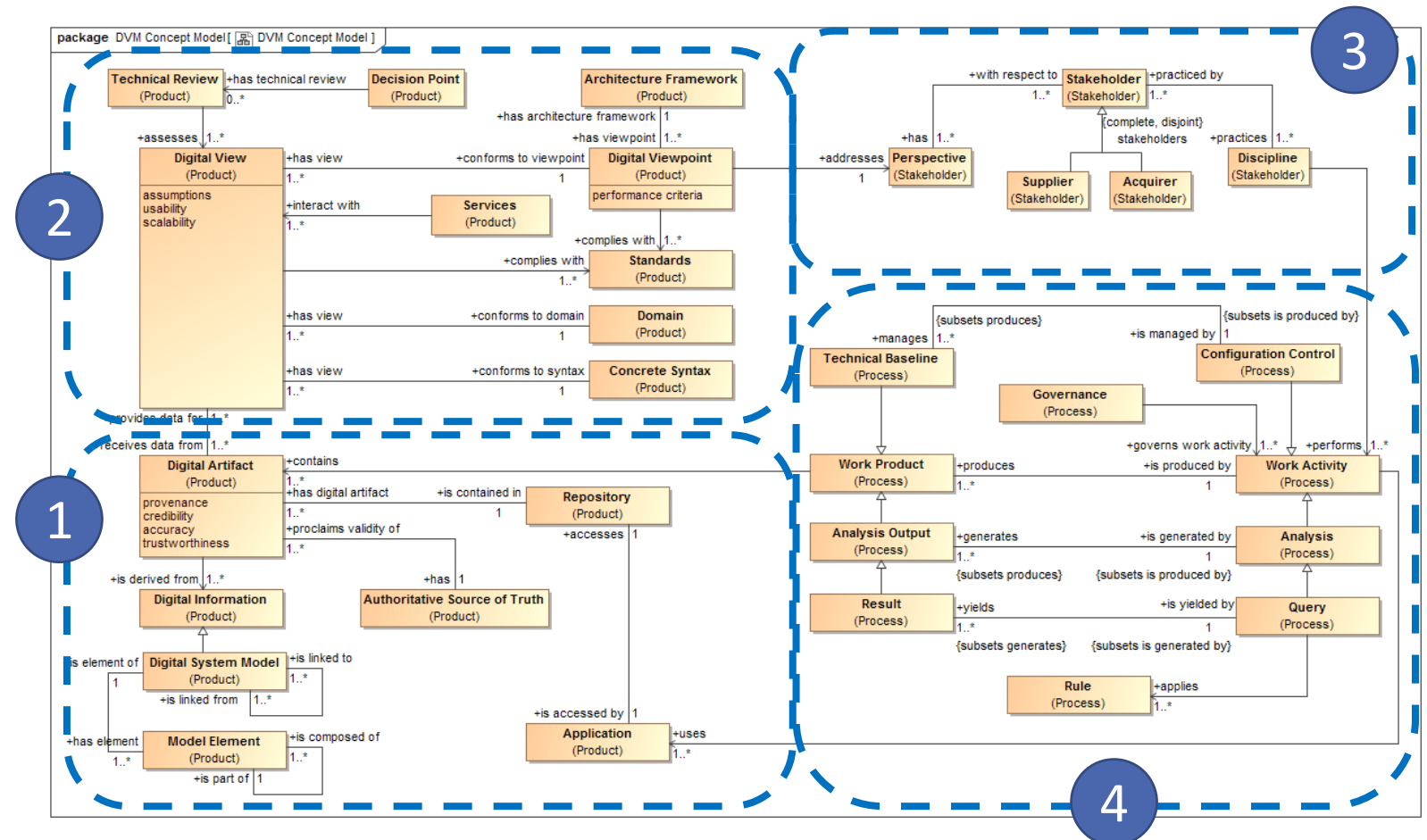
DEIX-SF (Lead: Celia Tseng)



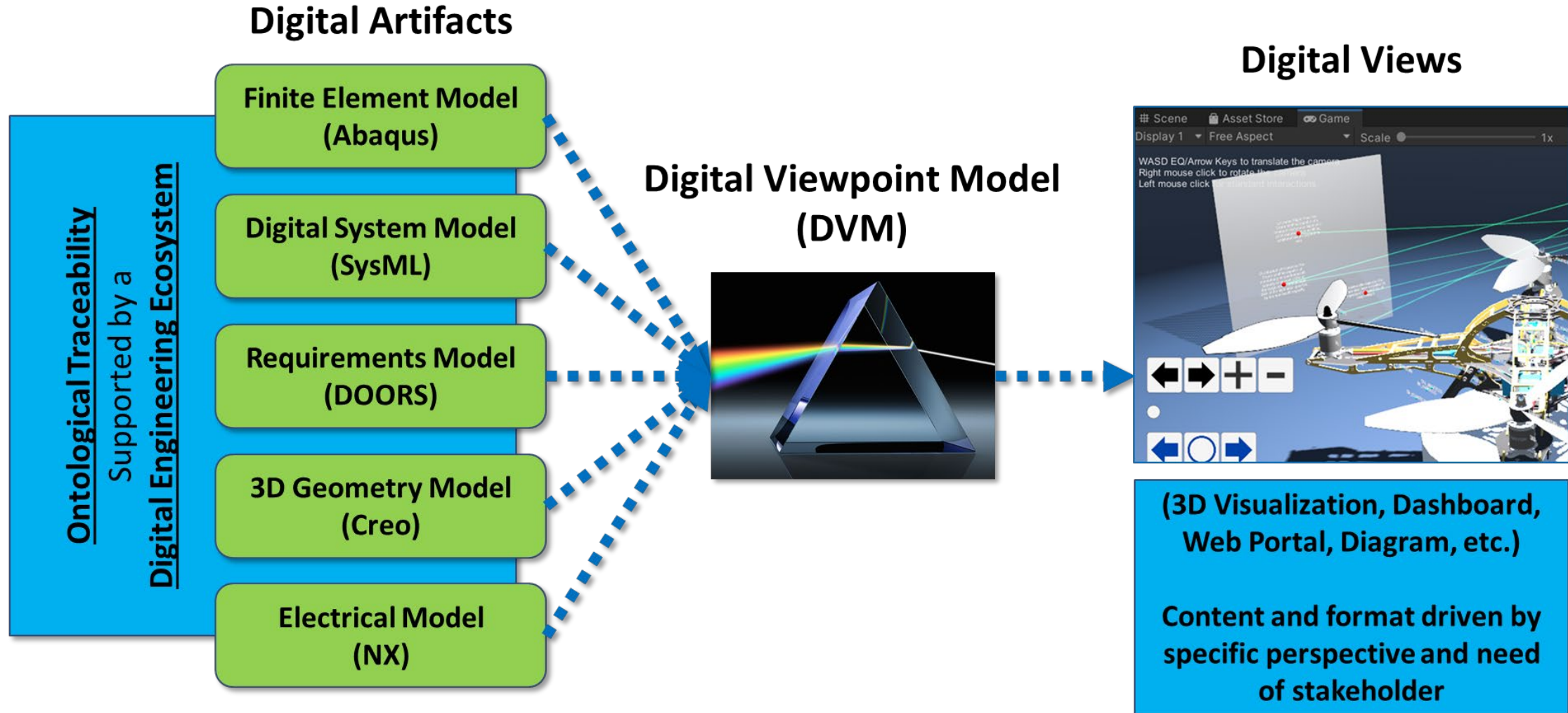
- Goal: Establish a framework for official standards related to model-centric information exchange
- Actions:
 - Identify needs for standards to facilitate seamless exchanges of model-centric digital artifacts
 - Review and analyze existing standards for content for relevance to needs for standards.
 - Create a standards hierarchical framework and references to acceptable standards
 - Recommend to the INCOSE Standards Committee proposed modifications or new standards to fill gaps or meet needs
 - Lead ongoing collaboration with ISO/IEC to develop standard lexicon and concepts related to Digital Engineering

DVM (Lead: Ken Zhang)

- Ontological model of concepts relating DE information, artifacts, and views
- Divided into four different ontologies:
 1. Digital Artifact
 2. Digital View
 3. Stakeholder
 4. Process



DVM (Lead: Ken Zhang)



Other DVM-Related Products



- Initial set of User Stories for a typical CDR were identified
 - Based on Systems Engineering Standards (ISO/IEC/IEEE 15288, IEEE 15288.1, and IEEE 15288.2) on Contracts for Department of Defense Acquisition Programs
- Broader set of User Stories now being gathered and refined
- Some example User Stories include:
 - Ensure key interfaces and resources are identified for developmental and operational test
 - Review testability and diagnostic capability
 - Assess software detailed design baseline
 - Assess product support and life cycle management strategies
 - Assess compliance to certification or legal requirements
- Extensions to the DVM resulting from analysis of the User Stories

Summary and Path Forward



- The INCOSE DEIXWG has been working steadily to understand the needs of the DE user community, both acquirers and their suppliers, by surveying current standards and “crowdsourcing” needs through DEIX Challenges and Workshops
- In 2021:
 - DEIXWG Panel Session at the 2021 INCOSE International Symposium
 - Unveiling of a new-and-improved DEIX Challenge at INCOSE IS
 - Working with ISO/IEC SC7/AHG6 to develop Digital Engineering standards
 - Celia Tseng presented an initial whitepaper to the December ISO Plenary
 - Celia and Wanda Eyre created the whitepaper in consultation with ISO and INCOSE
- In 2022:
 - Working sessions to build-upon the Digital Viewpoint Model at the INCOSE International Workshop
 - Follow-up on DE standards with ISO/IEC SC7/AHG6 in June and again in late August
 - DEIX Meeting at the INCOSE International Symposium in June
 - Multiple presentations at the NDIA SME Conference in November



Questions...?

And thank you for your attention!



Glossary and References

Glossary of Terms



Term	Definition
Digital Artifact	A digital artifact is any combination of professional data, information, knowledge, and wisdom (DIKW) expressed in digital form (Digital Information) and exchanged within a digital ecosystem (see DEIXPedia).
Digital View	A digital view is a visual presentation on an electronic display device of one or more processed digital artifacts, enabling the consumption of digital artifact content according to stakeholders' unique activities at any phase or step in the system life cycle (see DEIXPedia).
Digital Viewpoint	A design of a digital view that uses conventions, formalisms and standards to define the systematic procedures to select, compile, layout, and present digital artifacts in a digital ecosystem such that it meets stakeholders' unique needs (see DEIXPedia).

References



Reference	Description
Glossary of Key DEIX Terms	DEIX Topical Encyclopedia Entries (DEIXPedia)
Digital Engineering	Digital Engineering References on the OMG MBSE Wiki Page
DEIXWG on OMG MBSE Wiki	OMG Wiki Page for DEIXWG
INCOSE DEIXWG Page	INCOSE WG Page for DEIXWG