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Exchanging Digital Artifacts for the Engineering Life Cycle

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Abstract

As the Department of Defense (DoD) digital engineering effort has advanced, a need has emerged for a way to articulate the exchange of graphical and non-graphical digital artifacts among diverse stakeholders and digital technologies. The DoD Systems Engineering office proposes a construct, the Digital Engineering Information Exchange Model (DEIXM), that can form the foundation for an agreed-upon approach across the aerospace and defense sectors of government, industry, and academia. Fluid and seamless exchanges of digital artifacts enhances our ability to maintain a technological edge. As the U.S. Government collaborates with industry and academia on the realization of a DEIXM, we can enable parties to offer, request, and exchange digital artifacts. To achieve this end, we are broadening our initial DoD-focused development through collaboration with NDIA and INCOSE. The outcome of this initiative will be a DEIXM that establishes conventions on how the engineering of systems defines, creates, uses, and exchanges digital artifacts for the life cycle management of its systems and products. The desired benefits of a DEIXM result in full-spectrum solutions for digital engineering, private and public leaders innovating the way we do business, and technical practitioners improving their performance.

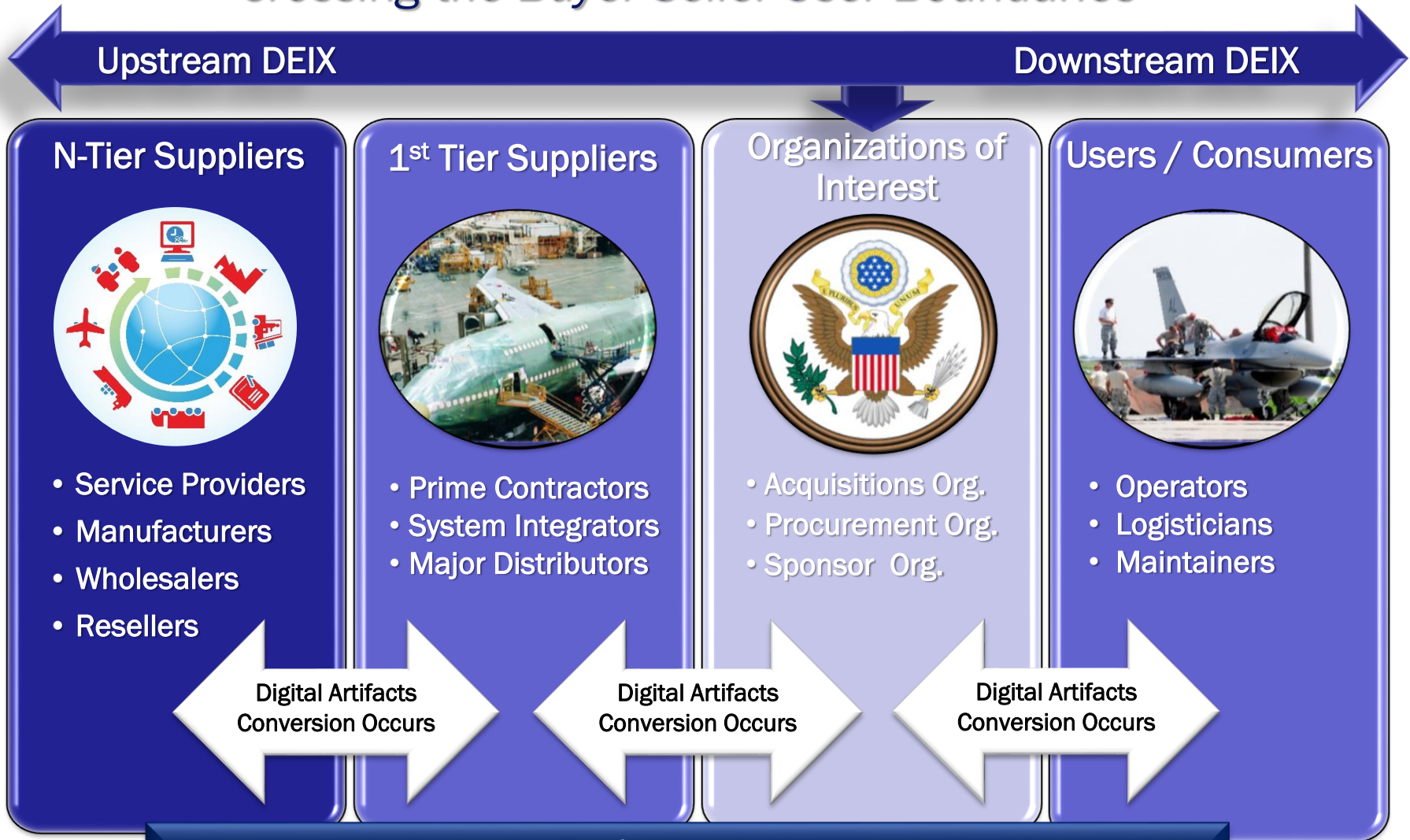


The Challenge

Why is it so hard to exchange engineering artifacts in a digital era?

The Digital Exchange Context

Crossing the Buyer-Seller-User Boundaries

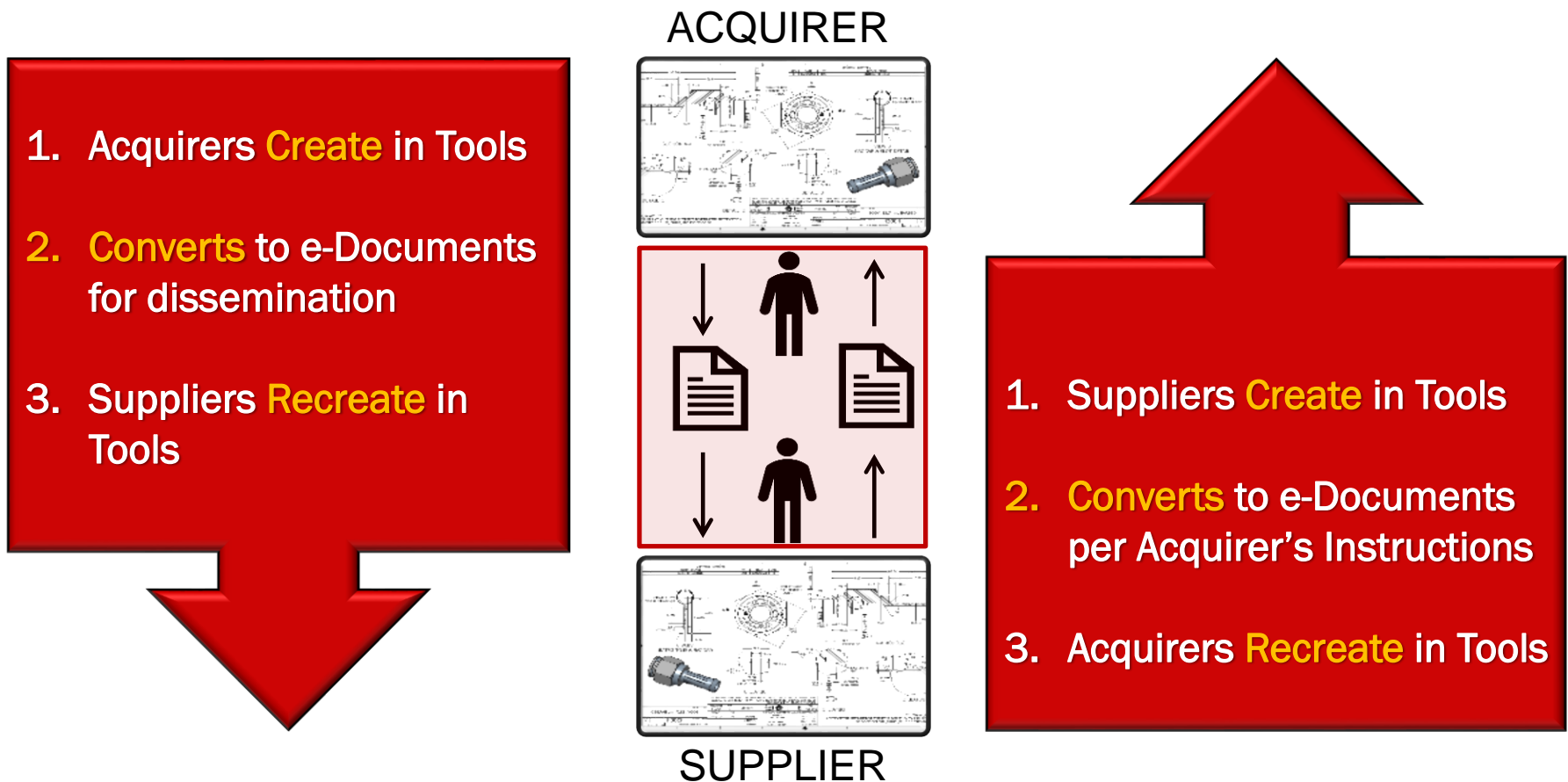


How do we exchange digital artifacts using historical contracting-language from a document-based tradition?



Problem Statement: **Digital Artifact Conversion Occurs**

The World of Data Item Descriptions (DID) & Contract Data Requirements List (CDRL)
“The Cycle of Create and Recreate”





A Conceptual Approach

**A New Way of Thinking about Exchanging
Digital Engineering Information**

The Computer-Aided Conversion: From Digital Artifact to Stakeholder Wisdom

Digital Artifacts

Model Elements

Data Records

A	B	C	
1	College Enrollment 2007 - 2008		Each row of data in a table is a "record"
2			
3	Student ID	Last Name	Initial
4	ST348-245	Walton	L
5	ST348-246	Wilson	R
6	ST348-247	Thompson	Q
7	ST348-248	James	L
8	ST348-249	Peterson	M
9	ST348-250	Graham	J
10	ST348-251	Smith	F
11	ST348-252	Nash	S
12	ST348-253	Russell	W
13	ST348-254	Robballe	L

Geometric Primitives

Video Frames

Software Enabled Digital Viewpoint

OMG SYSTEMS MODELING LANGUAGE (SysML)

OpenGL

Data Queries

Stakeholders' Information Requirements

Interactive Digital View



Retrieve or Reference


Assembling Digital Artifacts

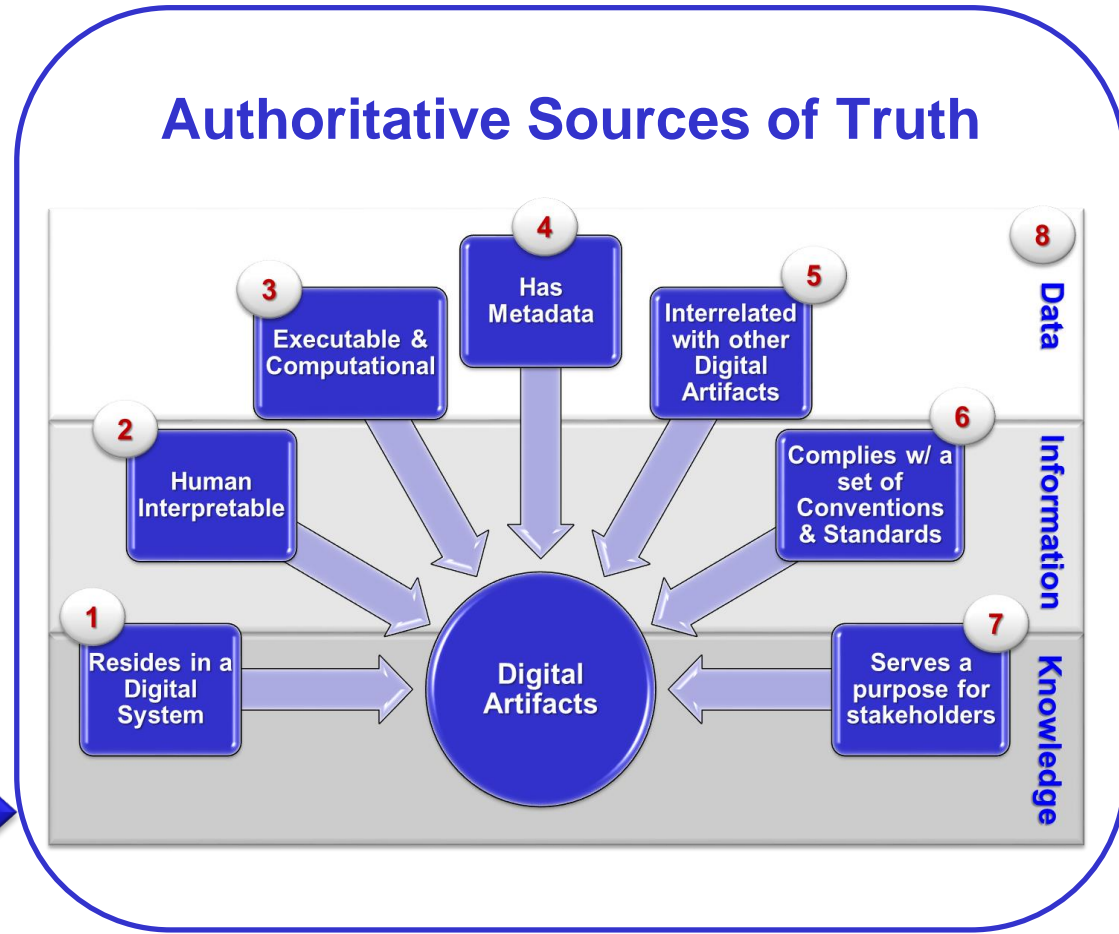
Access, Exchange, or Synchronize

Digital Viewpoint as Digital Artifact

Digital View as Digital Artifact

An Evolved Concept of Digital Artifact

- Any digital object produced with digital technology
- It represent concepts, items, or phenomena.
- Contains following Characteristics: 

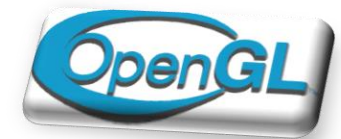


Converting Digital Artifacts to Digital Views

Digital Viewpoint

Examples Digital Viewpoint Conventions

- An information model or design
- Selects, compiles, and displays digital artifacts
- Software enabled conversions
- Catalyst for digital artifact exchange



Query Languages



User Experience Design (UXD) / User Interface Design (UID)



Converting Digital Views to Stakeholder Wisdom

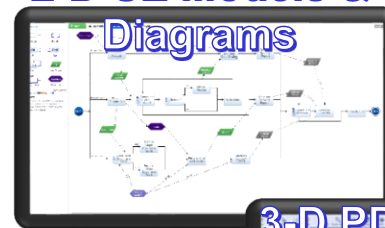
The Digital View



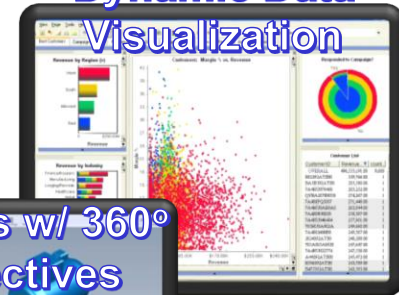
Examples of Digital Views

- An interactive view on a digital display device
- It includes one or more assembled digital artifacts
- It enables stakeholders' unique activities
- It conforms to its digital viewpoint

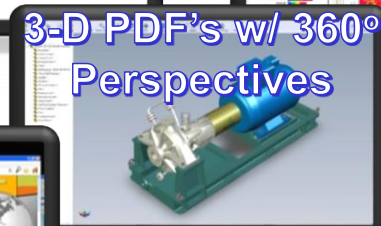
2-D SE Models & Diagrams



Dynamic Data Visualization



3-D PDF's w/ 360° Perspectives



Dynamic Multimedia / Hypermedia Content



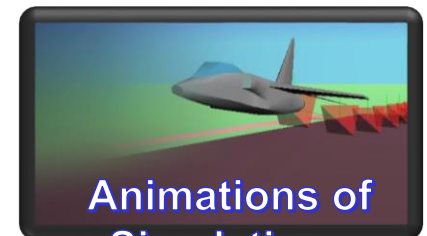
Videos of Tests



Decision Meeting Audio Recordings



Animations of Simulations





The Payoff

**Leverage the power of
digital automation and
multimedia displays**



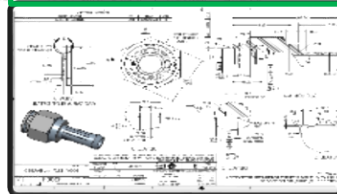
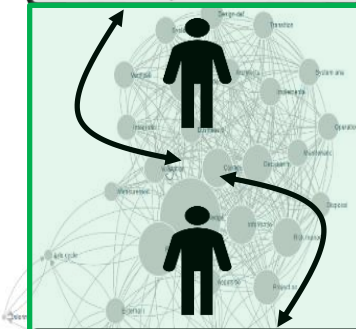
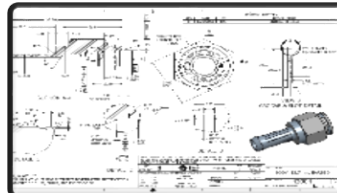
Opportunity Statement: **Automated, Synchronized, & Interactive Digital Artifacts**

The World of Digital Engineering Information Exchange

“Seamless Exchanges in a Digital Ecosystem”

1. Acquirer **Creates** Digital Artifacts
 2. **Software Enables** Digital Viewpoints
 3. Acquirer **Grants** Access to Digital Views
- And / Or
4. Acquirer **exchanges or synchronizes** Digital Artifacts

ACQUIRER



SUPPLIER

1. Supplier **Creates** Digital Artifacts in tools
 2. **Software Enables** Digital Viewpoints
 3. Supplier **Grants** Acquirer Access to Digital Views
- And / Or
4. Supplier **exchanges or synchronizes** Digital Artifacts



How You Can Help:

Digital Engineering Information Exchange Working Group (DEIX WG)

- **Primary Goal of DEIX WG:**
 - To identify conventional ways to define, request, offer, and exchange graphical and non-graphical digital artifacts between stakeholders across the systems life cycle.
- **Need Volunteers for Products:**
 - Digital Artifacts List (DAL): **Systems engineers** to define digital artifacts required for ISO/IEEE/IEC 15288 audits & reviews
 - DEIX Model: **Modelers** to define & model aspects of the DE information exchange concepts
 - DEIX Encyclopedia/Wikipedia: **Writers** to write encyclopedia entries on relevant concepts
 - DEIX Framework of Standards: **Researchers** to research, catalog, and perform gap analysis of existing and emerging standards

**For more Information go to OMG MBSE Wiki:
<http://www.omgwiki.org/MBSE/doku.php>**

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