CDRL / SDRL Digital Transformation & Standardization

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Agenda

- **Data eXchange Terms and Descriptions**

- **Data Item Current Methods**
  - **Individual project data item lists**
  - **Attributes are set up by each project**
  - **Program cross integration is limited**

- **Data Item Libraries and Standards**
  - **Relational attributes for Data item titles**
  - **Model based data items**
  - **Standard format, reuse and eXchange**

Model Based eXchange (MBX)

http://acqnotes.com/acqnote/careerfields/contract-data-requirements-list-cdrl

Terms and descriptions

- **CDRL - Customer Data Requirements List**

  From a Supplier view this is a list of contract data requirements that are required as part of a specific product order from the Customer. This list is made a part of the supplier contract for identifying deliverable data requirements needed to fulfill Customer product compliance.

- **SDRL - Supplier Data Requirements List**

  From a Supplier view is a list of contract data requirements that are required from a sub-tier supplier. This list is made a part of the sub-tier supplier contract for identifying deliverable data requirements needed to fulfill Original Equipment Manufacturer (OEM) product compliance.

- **DID - Data Item Description**

  A DID is a deliverable description that defines the data required of a supplier, many DIDs are collected to make up a CDRL or SDRL. The DID specifically defines the data content, format, and intended use. DIDs are organized by Title and number to help organize and group data content.

- **MBX - Model Based eXchange**

  MBX is a term used to describe the configuration control and eXchange of model based data as opposed to the eXchange of documents used in current data eXchange methods.

Data Item Descriptions

Department of Defense

CDRL

Original Equipment Manufacturer (OEM)

SDRL

Sub-Tier Supplier

Example DID items

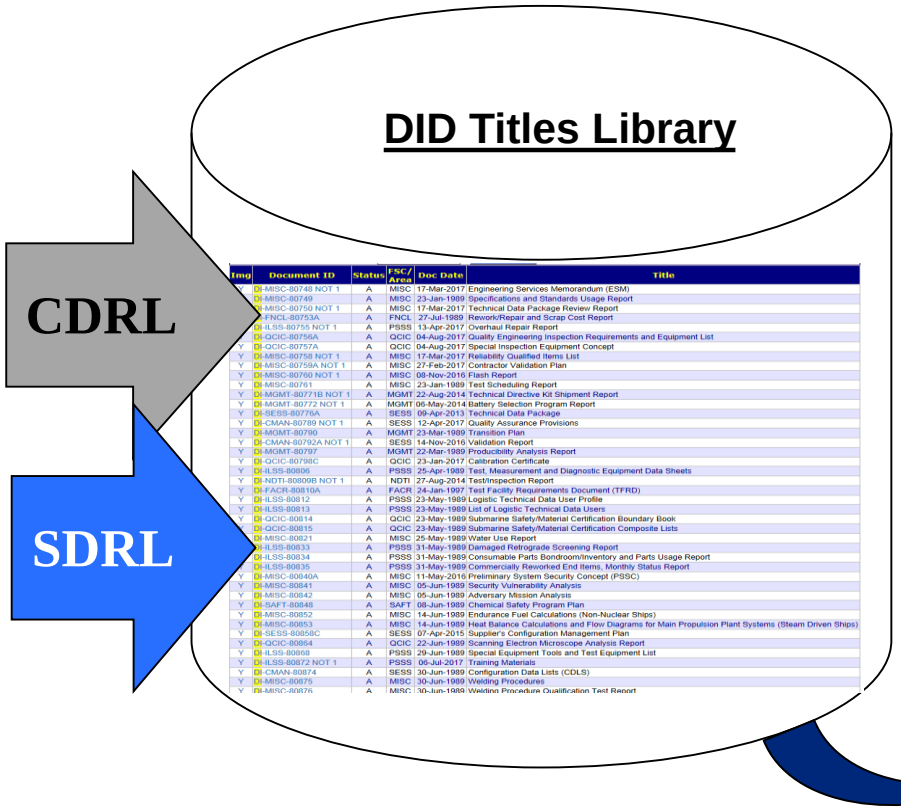
Img	Document ID	Status	FSC/ Area	Doc Date	Title
Y	DI-MISC-80748 NOT 1	A	MISC	17-Mar-2017	Engineering Services Memorandum (ESM)
Y	DI-MISC-80749	A	MISC	23-Jan-1989	Specifications and Standards Usage Report
Y	DI-MISC-80750 NOT 1	A	MISC	17-Mar-2017	Technical Data Package Review Report
Y	DI-FNCL-80753A	A	FNCL	27-Jul-1989	Rework/Repair and Scrap Cost Report
Y	DI-ILSS-80755 NOT 1	A	PSSS	13-Apr-2017	Overhaul Repair Report
Y	DI-QCIC-80756A	A	QCIC	04-Aug-2017	Quality Engineering Inspection Requirements and Equipment List
Y	DI-QCIC-80757A	A	QCIC	04-Aug-2017	Special Inspection Equipment Concept
Y	DI-MISC-80758 NOT 1	A	MISC	17-Mar-2017	Reliability Qualified Items List
Y	DI-MISC-80759A NOT 1	A	MISC	27-Feb-2017	Contractor Validation Plan
Y	DI-MISC-80760 NOT 1	A	MISC	08-Nov-2016	Flash Report
Y	DI-MISC-80761	A	MISC	23-Jan-1989	Test Scheduling Report
Y	DI-MGMT-80771B NOT 1	A	MGMT	22-Aug-2014	Technical Directive Kit Shipment Report
Y	DI-MGMT-80772 NOT 1	A	MGMT	06-May-2014	Battery Selection Program Report
Y	DI-SESS-80776A	A	SESS	09-Apr-2013	Technical Data Package
Y	DI-CMAN-80789 NOT 1	A	SESS	12-Apr-2017	Quality Assurance Provisions
Y	DI-MGMT-80790	A	MGMT	23-Mar-1989	Transition Plan
Y	DI-CMAN-80792A NOT 1	A	SESS	14-Nov-2016	Validation Report
Y	DI-MGMT-80797	A	MGMT	22-Mar-1989	Producibility Analysis Report
Y	DI-QCIC-80798C	A	QCIC	23-Jan-2017	Calibration Certificate
Y	DI-ILSS-80806	A	PSSS	25-Apr-1989	Test, Measurement and Diagnostic Equipment Data Sheets
Y	DI-NDTI-80809B NOT 1	A	NDTI	27-Aug-2014	Test/Inspection Report
Y	DI-FACR-80810A	A	FACR	24-Jan-1997	Test Facility Requirements Document (TFRD)
Y	DI-ILSS-80812	A	PSSS	23-May-1989	Logistic Technical Data User Profile
Y	DI-ILSS-80813	A	PSSS	23-May-1989	List of Logistic Technical Data Users
Y	DI-QCIC-80814	A	QCIC	23-May-1989	Submarine Safety/Material Certification Boundary Book
Y	DI-QCIC-80815	A	QCIC	23-May-1989	Submarine Safety/Material Certification Composite Lists
Y	DI-MISC-80821	A	MISC	25-May-1989	Water Use Report
Y	DI-ILSS-80833	A	PSSS	31-May-1989	Damaged Retrograde Screening Report
Y	DI-ILSS-80834	A	PSSS	31-May-1989	Consumable Parts Bondroom/Inventory and Parts Usage Report
Y	DI-ILSS-80835	A	PSSS	31-May-1989	Commercially Reworked End Items, Monthly Status Report
Y	DI-MISC-80840A	A	MISC	11-May-2016	Preliminary System Security Concept (PSSC)
Y	DI-MISC-80841	A	MISC	05-Jun-1989	Security Vulnerability Analysis
Y	DI-MISC-80842	A	MISC	05-Jun-1989	Adversary Mission Analysis
Y	DI-SAFT-80848	A	SAFT	08-Jun-1989	Chemical Safety Program Plan
Y	DI-MISC-80852	A	MISC	14-Jun-1989	Endurance Fuel Calculations (Non-Nuclear Ships)
Y	DI-MISC-80853	A	MISC	14-Jun-1989	Heat Balance Calculations and Flow Diagrams for Main Propulsion Plant Systems (Steam Driven Ships)
Y	DI-SESS-80858C	A	SESS	07-Apr-2015	Supplier's Configuration Management Plan
Y	DI-QCIC-80864	A	QCIC	22-Jun-1989	Scanning Electron Microscope Analysis Report
Y	DI-ILSS-80868	A	PSSS	29-Jun-1989	Special Equipment Tools and Test Equipment List
Y	DI-ILSS-80872 NOT 1	A	PSSS	06-Jul-2017	Training Materials
Y	DI-CMAN-80874	A	SESS	30-Jun-1989	Configuration Data Lists (CDLS)
Y	DI-MISC-80875	A	MISC	30-Jun-1989	Welding Procedures
Y	DI-MISC-80876	A	MISC	30-Jun-1989	Welding Procedure Qualification Test Report

Document Based Data Gaps

Current Methods – Document Based exchange

- **Requirements Management focused, verification methods and deliverables have a weak association to requirements**
- **MSWord, Adobe PDF, Drawings, Associated Files**
- **Separately managed activities for validation, allocation and verification**
- **Documents released to requirements author for approval**
- **Reuse consists of uncontrolled copy paste**
- **Metrics almost non-existent**
- **Metrics are focused on performance to schedule**

DID Model Based eXchange Transition



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Key Transition Elements:

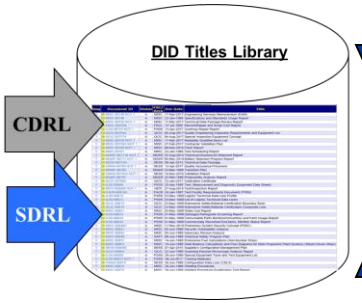
- Standard DID Titles
- DID numbers isolated and relational to DID Titles
- DID indicator for format of data file(s)
- Standard format for model based DIDs

The future Model Based eXchange

Future Model Based eXchange

- **Web enabled data base infrastructure necessary**
  - **Object Oriented Requirements and Data Nodes**
  - **Relational Model Based eXchange files**
  - **Metrics can be focused to benefit user role and model based engineering**
  - **OEM and supplier are accessing the same data source concurrently**
- **Data conforms to standards**
  - **Titles**
  - **Content**
  - **Format**
- **Requirement Verification is relational to the model based data**

DID Attribute Elements aligned support MBSE



Number

Title

Format

Document based data

Model based design

Modeling Standards

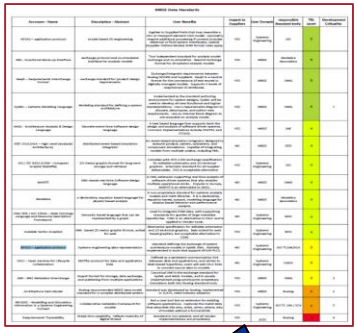
Examples of Typical Document format:

- PDF
- Word
- Excel
- JPG
- TIFF

Model Based Functional Data Standard

Model Based Logical Data Standard

Model Based Physical Data Standard AP242

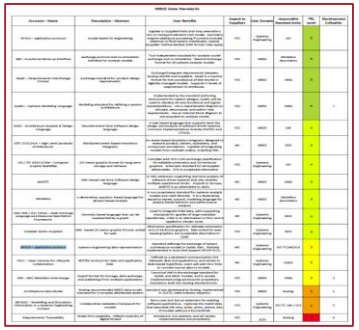


Design is Relational to the Data

MODEL BASED ENGINEERING (MBE)

Relational Connection to Verification Artifacts

Modeling Standards



Model based design

Model Based Functional Data Standard

Model Based Logical Data Standard

Model Based Physical Data Standard AP242

Design is Relational to the Data

MBSE Data Standards

Acronym - Name	Description - Abstract	User Benefits	impact to Suppliers	User Domain	responsible Standard body	TRL Level	Development Criticality
AP242 – application protocol	model based 3D engineering	Applies to Supplied Parts that may resemble a LRU or transport element CAD model. Geometry require additional processing if content includes electrical or fluid system interface(s). Special (Supplier Outline Model) SOM format rules apply.	YES	Systems Engineering	ISO	5	
FMI - Functional Mock-up interface	exchange protocol and co-si interface for analysis mo	Tool independent standard for analysis model format for all systems analysis models	YES	MBSE	Modelica Association	5	
ReqIF – Requirements Interchange Format	exchange standard for product design requirements	Exchange/integrate requirements between Boeing DOORS and Suppliers. ReqIF is a neutral format for the conveyance of text stored in digitally managed models. Supports 3 levels of requirement ID attributes.	YES	MBSE	OMG	5	
SysML – Systems Modeling Language	Modeling standard for defining a system architecture	Implemented as the standard authoring environment for system designs, SysML will be used to develop all new functional and logical representations. Use a requirements diagram to allocate, decompose, and author new requirements. Use an internal block diagram to pre-populate an analysis model.	YES	MBSE	OMG	5	1

TRL rating *is based on Industry Level Adoption*

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Design is Relational to the Data

MBSE Data Standards

Acronym - Name	Description - Abstract	User Benefits	impact to Suppliers	User Domain	responsible Standard body	TRL Level	Development Criticality
AADL - Architecture Analysis & Design Language	Discrete-event-time Software design language	A text based language that supports both the design and analysis of software driven systems. Common implementations include OSATE2 and STOOD.	YES	MBSE	SAE	4	
IEEE 1516 [HLA – High Level (analysis) Architecture]	distributed event-based simulation integrator	An event-based simulation integrator designed to execute product, system, subsystem, and component simulations. Capable of integrating models from multiple codecs, including FMI.	NO	MBSE	IEEE	4	
ISO / IEC 8632 (CGM - Computer Graphic Metafile)	2D Vector graphic format for long term storage and retrieval	Complies with ATA 2100 exchange specification for editable schematics and 2D technical graphics. Schematic standard for all Supplier deliverables. SVG is acceptable alternative	YES	Systems Engineering	ISO	4	
MARTE	UML-based real time Software design language	A UML extension supporting real time analysis of software driven systems that also enables multiple operational clocks. Popular in Europe, MARTE is an alternative to AADL.	NO	MBSE	OMG	4	
Modelica	a declarative, equation based language for physics based analysis	A non-proprietary standard for systems analysis models and math libraries. It is a declarative, equation based, acausal, modeling language for physics based behavior and performance analysis.	NO	MBSE	Modelica Association	4	
OWL RDF / ISO 15926 – Web Ontology Language and Resource Description Framework	Semantic based language that can be represented by a graph	Used to integrate PDM data, with supporting standards for queries of large metadata repositories. OWL is an alternative to OSLC and is applied to Vendor tools.	NO	Systems Engineering	W3C	4	
Scalable Vector Graphics	XML based 2D vector graphic format, suited for web	Alternative specification for editable schematics and 2D technical graphics. Best suited for web based graphics, but acceptable alternative to CGM.	YES	Systems Engineering	W3C	4	

TRL rating *is based on Industry Level Adoption*

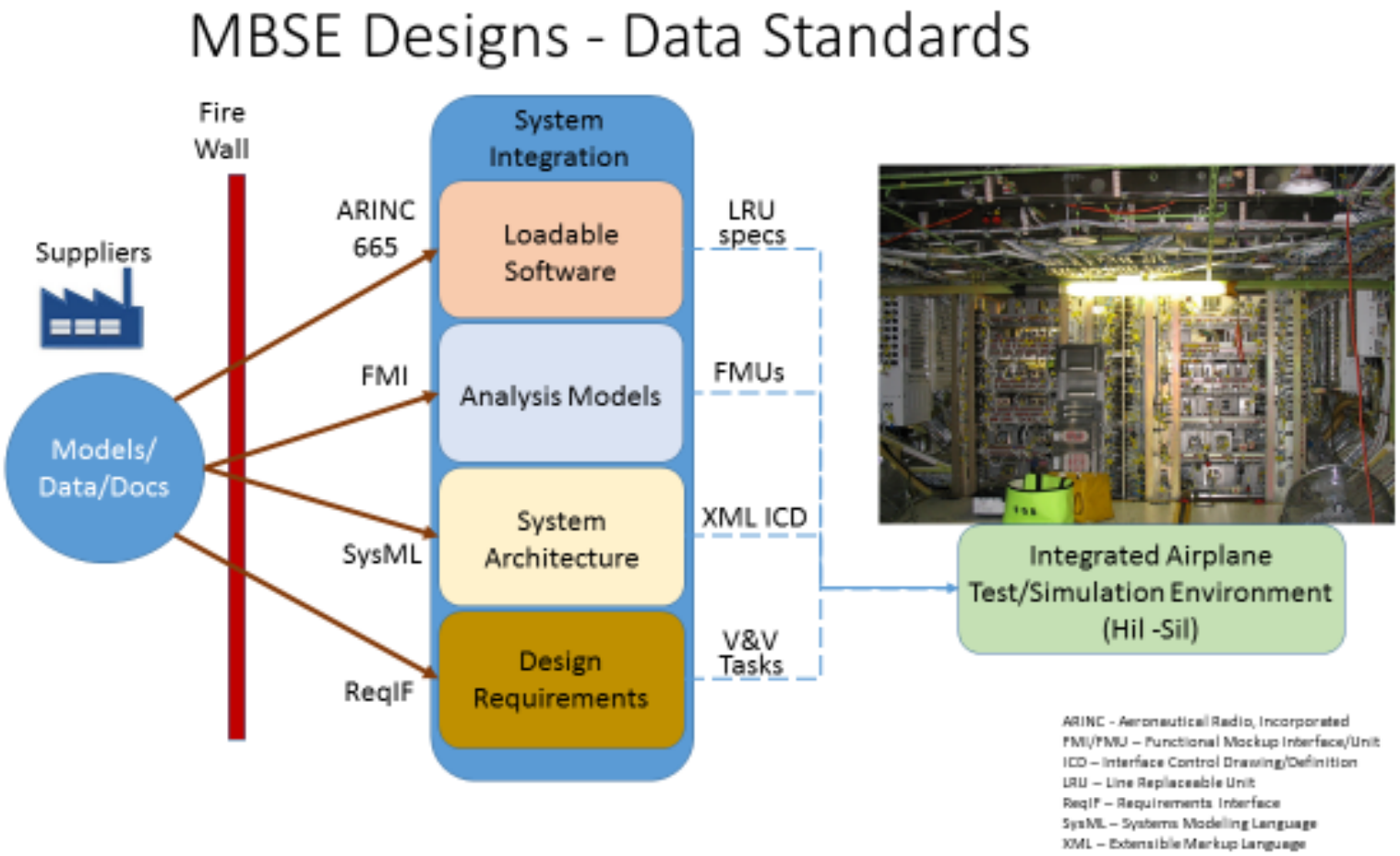
Design is Relational to the Data

MBSE Data Standards

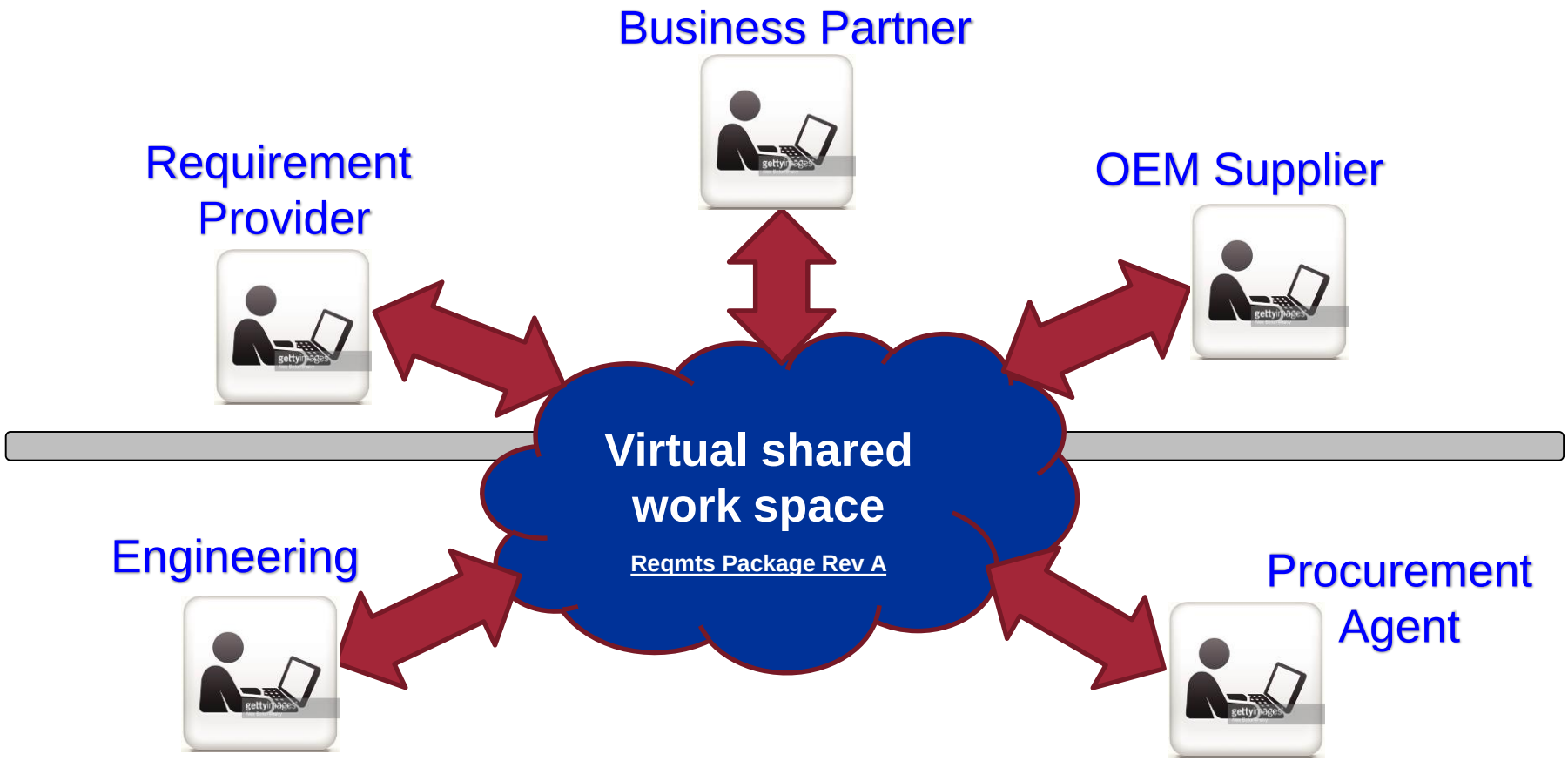
Acronym - Name	Description - Abstract	User Benefits	impact to Suppliers	User Domain	responsible Standard body	TRL Level	Development Criticality
AP233 – application protocol	Systems engineering data representation	Standard defining the exchange of system architecture models in SysML XML. Partially implemented in tools that support AP239 PLCS.	NO	Systems Engineering	ISO TC184/SC4	3	
OSLC - Open Services for Lifecycle Collaboration	RESTful protocol for data and application links	Defined as a persistent communication link between data and applications, and similar to Web-based hyperlinks, users will add OSLC links to connect source data to models.	NO	Systems Engineering	OASIS	3	
XMI - XML Metadata Interchange	Export format for storage, data exchange, and publishing from multiple applications	Canonical XMI is the exchange standard for SysML and AADL models, and is usually implemented using point2point proprietary translators built into Boeing standard tools.	YES	MBSE	OMG	3	3
Architecture Data Model	Boeing recommended MBSE data model standard for a complex distributed system	standard was developed by Boeing, implemented in SLATE, need industry adoption	YES	MBSE	Boeing	2	2
MOSSEC - Modelling and Simulation information in a Systems Engineering Context	Collaborative metadata Framework for models	Not a user tool but an extension for existing software applications. Captures the metat data that describes the who, what, when, where, why of models without a formal BOM.	YES	Systems Engineering	ISO TC 184 / SC4	2	5
Requirements Traceability	Break-thru capability, reflects maturity of digital thread	standard is non-existent, and all Vendor implementations are proprietary	YES	2CES	Boeing	1	4

TRL rating *is based on Industry Level Adoption*

Design is Relational to the Data

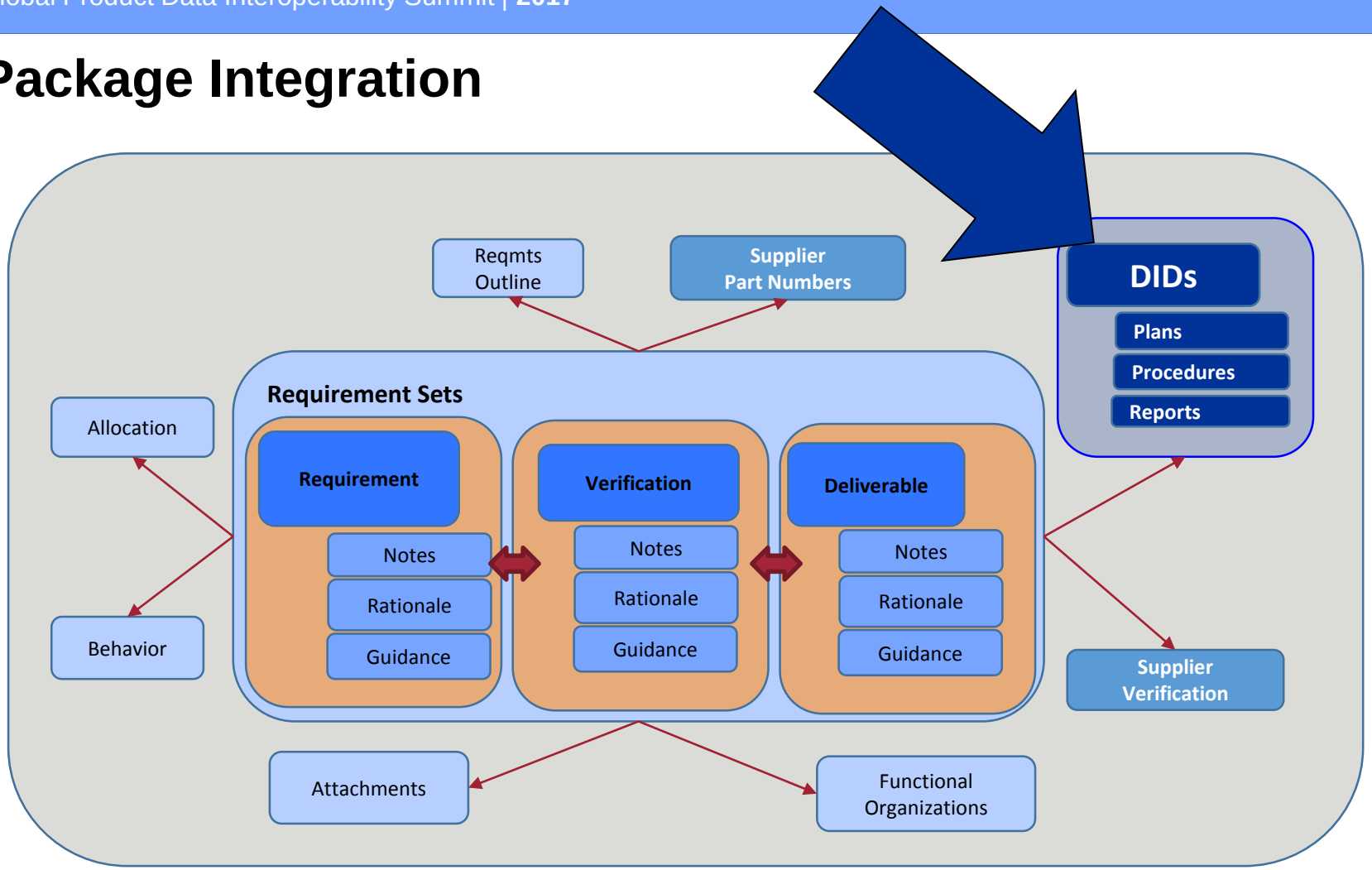


Model Based eXchange – Requirements and Data



MBX integration

Package Integration



The future of Requirements Exchange

Opportunities presented with a Web based integration of Model Based eXchange

- **Reuse**
  - **Improves Data Quality**
  - **Reduces effort for creation and review**
  - **Takes advantage of previous work**
  - **Provides consistency for compliance**

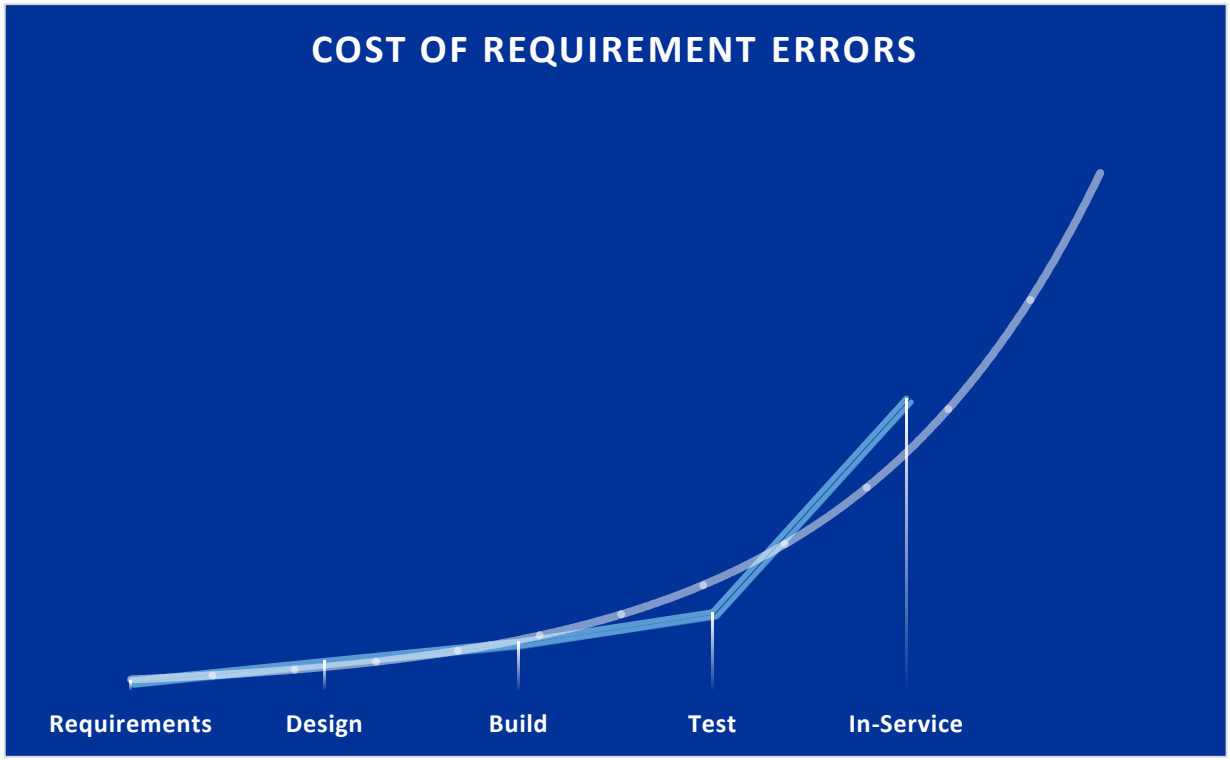
- **Advanced Analytics Available**
  - **Ability to use metrics to assist the user in creating quality Data relationships to requirements**
  - **Availability of customized group and program metrics and reporting**

- **Product Reliability & Maintainability**

- **Expanded capability for integration of requirements and data**

MBX Builds in Cost Avoidance

- **Cost Avoidance**
  - **Requirements and Data integrated delivering at a much higher quality avoiding costly errors found later**



MBX Transition

- **Questions and Discussion**