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Maturing MBSE Tool Interoperability at Sandia National Laboratories

Alex Bencoe, Max Danik, and Marissa Conroy

Integrate22 Digital Engineering Symposium

San Antonio, TX

June 6th - 9th

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integrate22™

The Digital Engineering Symposium

Maturing MBSE Tool Interoperability at Sandia National Laboratories

Alex Bencoe, Max Danik, and Marissa Conroy

R&D, Systems Engineers

Vitech
A Zuken Company

Agenda and Purpose

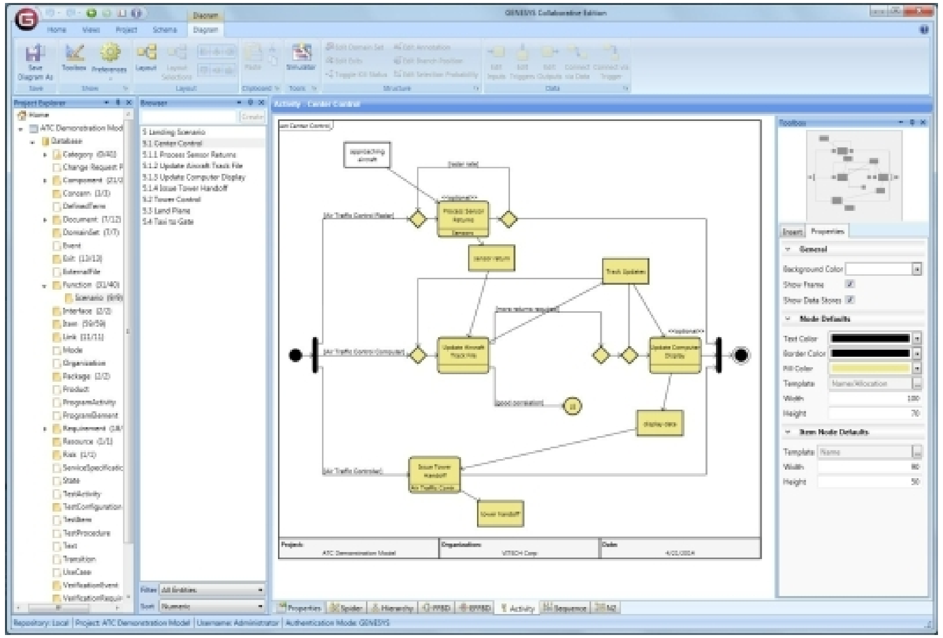
- MBSE Maturation at Sandia National Labs
- Assessing MBSE Maturation
- Three Demonstrators
  - Nuclear Deterrence Schema
  - Enabling a Digital Build-Cycle
  - Enabling a Digital Thread through SE2MCAD

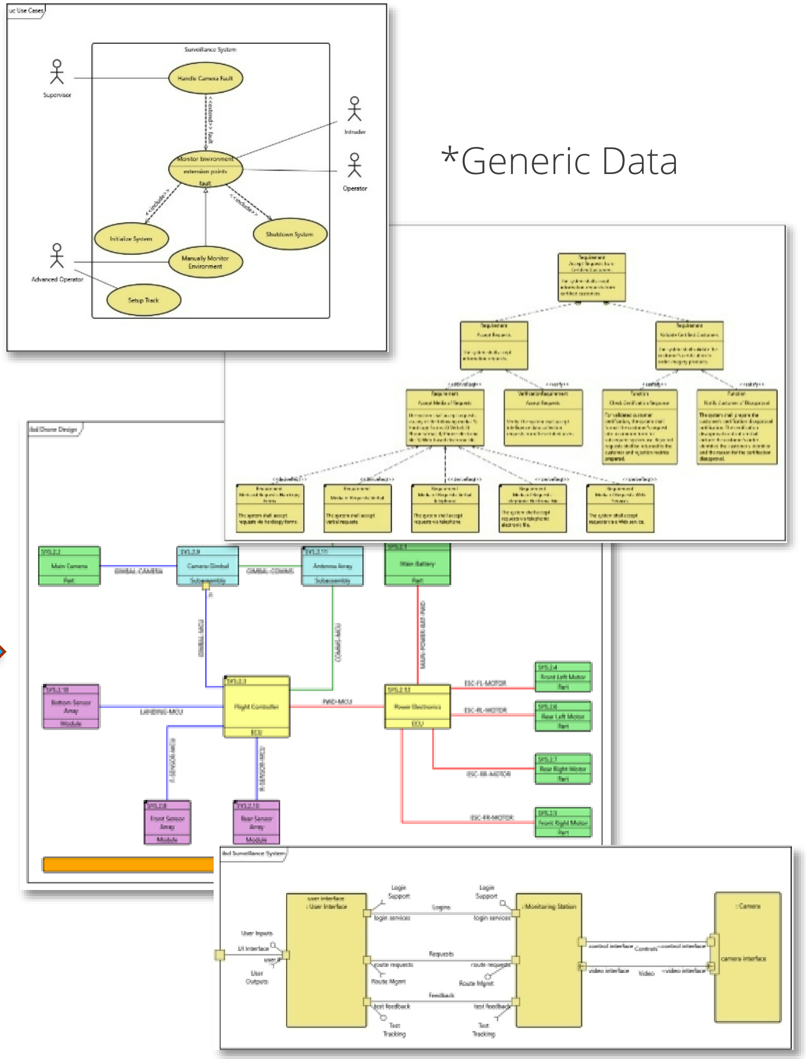
*DRAFT Digital Engineering Maturation Path

SNL has developed an MBSE assessment tool that enables consistent and methodical MBSE maturation

Model Based Systems Engineering Vision

- *Model* Based Systems Engineering is just how we do Systems Engineering at Sandia
- GENESYS is a common tool in the SE's toolbox





*Generic Data

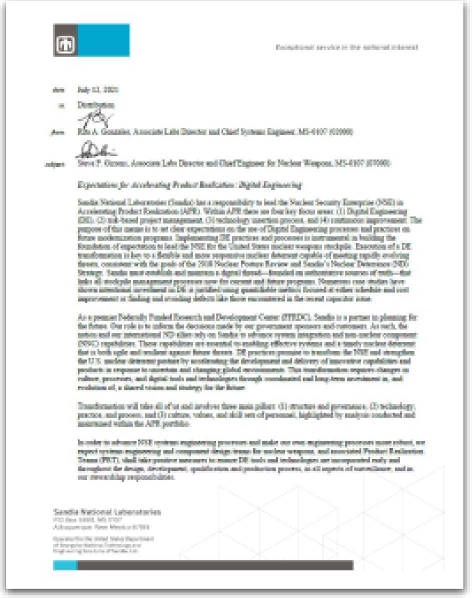
If we want to lead in the field of Systems Engineering in the future, we must transform now and move on from document based Systems Engineering practices of the past

Nuclear Deterrence MBSE Strategy

Transformation requires change in culture, processes, and digital tools and technologies through coordinated long-term investment in and evolution of a shared vision for the future

Expectations for Accelerating Product Realization: Digital Engineering

July 12th, 2021



Organizational Culture and People

- Accessibility & Training
- MBSE communities
- Leaders and Partnerships

Business Practices

- DE expectations for each program and coordination with 2490
- Implementation framework from the WEC
- MBSE Maturity Matrix

Technical Capabilities

- MBSE as a capability
- MBSE integration into the Digital Engineering Ecosystem

Assessing MBSE Adoption at SNL

MBSE Category / Topic / Facet / (Context)	Description: How the organization . . .	Transition: As maturity increases, the organization's . . .	Document-Centric Systems (L0)	Model-Centric Systems (L1)	Verified Model-Centric Systems (L2)	Formalized Model-Based Systems (L3)	Validated Model-Based Systems (L4)	Integrated Model-Based Systems (L5)	Extended Model-Based Enterprise (L6)	AS-IS Level: Capability (Tool)	AS-IS Level: Readiness (Process)	AS-IS Level: Adoption (ND Use)	TO-BE Level: Target
Assessment Identifier (AID): [organizationally unique identifier]	Organization under assessment (OUA):		Description of Environment:					Assessor:		Assessment Date:		Target Date/Event: [when implemented]	
DRAFT MBSE Maturity Matrix 05/2022										AS-IS Level (Reset)			TO-BE Level
Maturity Level Name			Document-Centric Systems	Model-Centric Systems	Verified Model-Centric Systems	Formalized Model-Based Systems	Validated Model-Based Systems	Integrated Model-Based Systems	Extended Model-Based Enterprise	Capability: Tools are Available?	Readiness: Processes are Ready?	ND Adoption: People are Using?	Target Adoption
Categories (e.g., C1) └Topics (e.g., T3) └Facets (e.g., F2) / Level #	Description: How the organization . . .	Transition: As maturity increases, the organization's . . .	L0	L1	L2	L3	L4	L5	L6	N/A	N/A	N/A	N/A
C1: Model Based Systems Engineering (MBSE)	Uses models to define all aspects of system requirements, behavior, hardware, and V&V	utilization of a system model to drive digital engineering	Documents used for all SE activities	Descriptive model used to aid some SE activities	Select areas of descriptive model content are reviewed and authorized	Defined processes support descriptive model usage for SE activities	Descriptive model permissions, confidence in modelers, and peer review	Descriptive model utilizes relationships between architectures and other models	Descriptive model institutionalized and accessible across the enterprise	N/A	N/A	N/A	N/A
C2: Systems Engineering Data Sharing	Shares enterprise systems engineering data	Recreation of systems engineering data is removed maturing towards authoritative information	Recreation of models based on released static documents	Getting data directly from Systems Engineering tools	Standard method developed and implemented	Defined site specific and federal processes support systems engineering data sharing between sites	Model based processes used to ensure systems engineering data was imported into requirements management correctly	Systems engineering data tools are integrated communicating consistent information	Authorized single source of systems engineering data across the enterprise	N/A	N/A	N/A	N/A
C3: Production Integration and Testing	Uses digital engineering data to manufacture, test and V&V product definition requirements	Utilization of digital engineering data informs decisions and drives increased lifecycle efficiencies	Documents used for all Production and Testing activities	Digtial engineering data used to aid some Production and Testing activities	Select digitial engineering data content is reviewed and authorized into business datastreams	Defined processes support digital engineering data usage for Production and Testing activities	Confidence in digital engineering data format, outputs, and usage	Digital engineering data utilizes relationships with other softwares for a connected digital thread	Digital engineering data is institutionalized and accessible across the enterprise	N/A	N/A	N/A	N/A

Maturity matrix allows for assessment at the project, program, corporate, capability, and enterprise levels

Intent of MBSE Maturity Matrix

Need

- An MBSE assessment tool to be used by non-MBSE practitioners

References

- Sandia Model Based Design (MBD) Maturity Matrix
- INCOSE, NASA, Northrop Grumman, etc.

Role Based Matrix Area	Model-Based Capability Name	Stage 0	Stage 1	Stage 2	Stage 3	Stage 4
1. Workforce/culture	MBSE Use Strategy	No documented MBSE use strategy, or the strategy is described for ad hoc efforts. Each MBSE effort is stand-alone to address specific concerns.	Organization MBSE use strategy is documented as part of its overall organizational strategy at the system level. The strategy is related to the overall risk strategy.	Organization MBSE use strategy is documented as part of the organization's overall strategy at the system level. The strategy is related to the overall risk strategy. Modeling results used to inform systems engineers across system engineering phases and for all disciplines.	Organization MBSE use strategy is documented as part of the organization's overall strategy at the enterprise level. The strategy is related to the overall risk strategy. Modeling is integrated with business information tools and results used to inform systems engineers, program management, and all staff across the enterprise.	Organization MBSE use strategy is documented as part of the organization's overall strategy at the enterprise level. The strategy is related to the overall risk strategy. Modeling is integrated with business information tools and results are used to inform systems engineers, program management, and all staff across the enterprise. It manages a full range of business concerns.
1. Workforce/culture	Common DE and MBSE Terminology	Appropriate terminology defined for the project or program.	Common Glossary/Data Dictionary.	Top Tier terminology is defined for the enterprise.	Discipline and engineering specialty terminology is added to cover lower level models.	Common, tiered taxonomies are defined and consistent across enterprises and consistent with accepted community standards.
1. Workforce/culture	Modeling Roles and Responsibilities	Modeling roles and responsibilities are not identified.	Modeling roles and responsibilities are identified.	Modeling roles and responsibilities are characterized by model-based Knowledge, Skills, and Abilities (KSAs).	Modeling roles are provided the permissions necessary to perform their responsibilities.	People who need to be active are identified and involved. Sufficient staffing and staffing plan ensures all roles are fulfilled.
1. Workforce/culture	Modeling Development Skills	Model-based Knowledge, Skills, and Abilities (KSAs) are undefined and unknown. None, or ad hoc for all staff.	Model-based Knowledge, Skills, and Abilities (KSAs) are defined for modelers. Modeling of components of the Enterprise or System.	Model-based Knowledge, Skills, and Abilities (KSAs) are defined for roles involved with modeling; Enterprise Architect, SE, PM, IT, modelers, etc.... Novice Modelers on full Enterprise or System-subsystem models.	Model-based Knowledge, Skills, and Abilities (KSAs) are defined for roles involved with enterprise management. Expert model development lead with experience practicing modeling on at least 1 project that successfully completed at least 3 major technical reviews that used models in support of the review.	Expert model development lead that sets modeling standards and evaluates the model product quality of other modelers.

The INCOSE and other partners' maturity matrices were explored, but not suited for our intended audience of non-MBSE practitioners

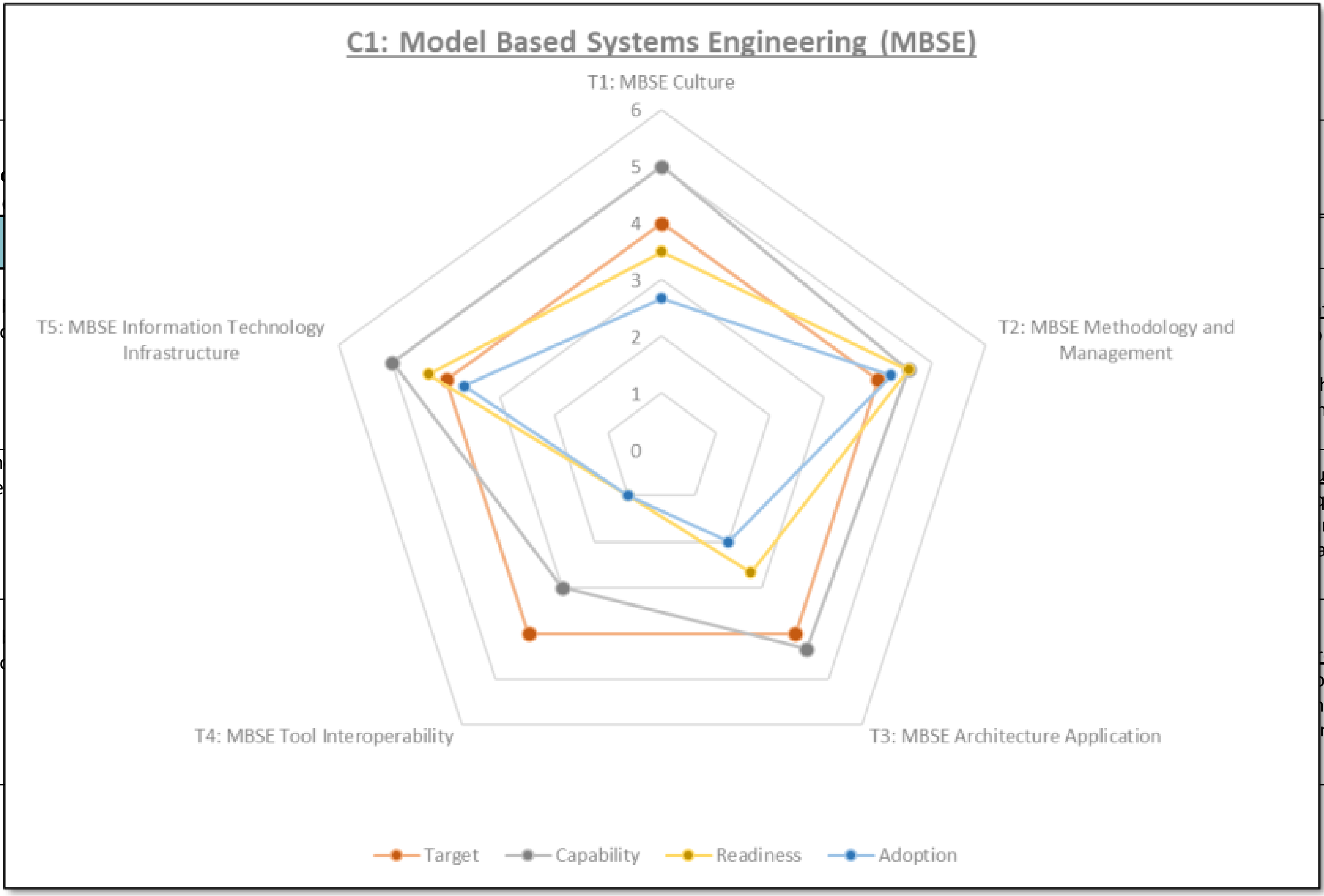
Maturity Matrix Summary

- Maturity Matrix Is broken up into 3 categories
  - MBSE (Highest level of development)
  - System Engineering Data Sharing
  - Production Integration and Testing
    - MBSE Category contains 5 topics
      - MBSE Culture
      - MBSE Methodology and Management
      - MBSE Architecture Application
      - **MBSE Tool Interoperability**
      - MBSE Information Technology Infrastructure
      - Each topic contains 6-9 Facets
    - Actively working the remaining categories with our Production Agency Partners to created an enterprise rubric for MBSE Maturity

Maturity Level Name / Categories (e.g., C1) └Topics (e.g., T3) └Facets (e.g., F2) / Level #	Description: How the organization . . .	Transition: As maturity increases, the organization's . . .	Document-Centric Systems L0	Model-Centric Systems L1	Verified Model-Centric Systems L2	Formalized Model-Based Systems L3	Validated Model-Based Systems L4	Integrated Model-Based Systems L5	Extended Model-Based Enterprise L6
C1: Model Based Systems Engineering (MBSE)	Uses models to define all aspects of system requirements, behavior, hardware, and V&V	utilization of a system model to drive digital engineering	Documents used for all SE activities	Descriptive model used to aid some SE activities	Select areas of descriptive model content are reviewed and authorized	Defined processes support descriptive model usage for SE activities	Descriptive model permissions, confidence in modelers, and peer review	Descriptive model utilizes relationships between architectures and other models	Descriptive model institutionalized and accessible across the enterprise
T1: MBSE Culture									
F1: MBSE Institutional Adoption	Uniformly adopts MBSE across the organization	Support, usage, and benefits of MBSE increase	No MBSE use	Pilot projects funded to demonstrate the MBSE methodology and benefits	MBSE adopted by systems engineering departments and incorporated into projects	MBSE best practices and approach established and used to meet program specific needs. Consistent MBSE tool coverage and usage	Consistent MBSE approach across projects using the same ontology driven by policy, practices and methods	System and subsystem MBSE models are linked allowing for full system integration	Consistent MBSE approach, tool, and policies across the enterprise
F2: MBSE Model Methodology	Develops and implements an MBSE modeling methodology	MBSE best practices, processes, and standards allow for enterprise wide SE model interconnectivity	No MBSE use	Descriptive model is developed for limited use and scope with an independent approach	Best practices are developed and documented	Best practices are formalized into an MBSE process document	Descriptive models follow a process document to promote consistency	Best practices for connecting descriptive models to external engineering tools are developed	Enterprise wide use of documented descriptive model methodology
F3: MBSE Influence	Uses the descriptive model and its artifacts to influence activities and decisions	Use of the descriptive model is further institutionalized into program level deliverables/knowledge	No MBSE use	Subset of artifacts derived from system pilot model	Descriptive model used to influence system decisions, breadth expands from a pilot	Program engineers directly use model as their primary tool to generate artifacts	Model used in design reviews, onboarding, etc. as the primary content	Communication with other engineering tools established to inform design across disciplines	MBSE model connected across enterprise to establish a system of systems descriptive model
F4: MBSE Authoritative Source of Truth (ASOT) Contribution	Manages and stores data necessary for system lifecycle sustainment	Develops and uses descriptive models of the system of interest to provide source, rationale, and traceability throughout the lifecycle	ASOT is maintained in released documents	Data and Information included in the ASOT are discoverable from descriptive models	The descriptive model drives exports that contribute to ASOT	Portions of the descriptive model are identified as the ASOT for design details	The descriptive model provides the ASOT for architectural information with pointers to other ASOT sources	The descriptive model provides ASOT for architectural information with links to and from model elements with other ASOT sources	The descriptive model contributes to the ASOT framework that provides details to other ASOT sources
F5: MBSE Training	Develops and implements multi-level MBSE training	MBSE user base grows, becomes more proficient in the tool/ methodologies, and role specific training options	No MBSE training	Tool familiarity training completed. MBSE modeler and model consumer are able to read and understand model artifacts	Modeler and model consumer share a common approach to MBSE modeling (e.g. language and methodology)	Consistent training approach to utilize MBSE, demonstrating organizational approach to descriptive modeling	Descriptive modeling permissions based on completed training	Organization wide training program for MBSE and other connected engineering toolsets	Consistent enterprise wide architecture training program
F6: MBSE Roles and Responsibilities	Manages descriptive model permission and authority	MBSE skillset is defined and recognized at organization and enterprise levels	Descriptive modeling roles and responsibilities are not identified	Program specific descriptive modeling roles and responsibilities are identified	Descriptive modeling roles and responsibilities are identified by MBSE specific Knowledge, Skills, and Abilities (KSAs)	Descriptive modeling roles and responsibilities are managed via permissions within the tool	Processes in place to manage and authenticate descriptive model permissions	Descriptive modeling roles and responsibilities are implemented across interconnected projects	Descriptive modeling roles and responsibilities are shared across the enterprise

How the Maturity Matrix is Used as an Assessment Tool

MBSE Category / Topic / Facet / (Context)	**Descripti How the**	**Comment**
T3: MBSE Architecture Application		
F1: Requirement Architecture Development	States the definition specificati	<u>ture than process</u>: rocess to mature to lv 3 horitative source will mature the to lv 4.
F2: Requirement Architecture Traceability	Derives an requireme	<u>re than adoption</u>: quirements management team needs ments to modeling requirement ationships to other architectures to
F3: Functional Architecture Development	States the definition specificati	<u>e than the tool</u>: l is barrier to maturity. Assess tool er tools to advance maturity to nl architecture



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Maturity Matrix – MBSE Tool Interoperability Topic Deep Dive

- MBSE Tool Interoperability Contains 7 Facets
  - Model Reuse
  - Model Visualization
  - **Schema**
  - MBSE Tool Interoperability
  - Descriptive Model to Requirement Management Tool
  - **Descriptive Model to Analytical Model**
  - **Descriptive Model to Product Structure**

MBSE Category / Topic / Facet / (Context)	Description: How the organization . . .	Transition: As maturity increases, the organization's . . .	Document-Centric Systems (L0)	Model-Centric Systems (L1)	Verified Model-Centric Systems (L2)	Formalized Model-Based Systems (L3)	Validated Model-Based Systems (L4)	Integrated Model-Based Systems (L5)	Extended Model-Based Enterprise (L6)
T4: MBSE Tool Interoperability									
F1: Model Reuse			No system or component model reuse implemented	Project specific model libraries are created for select entities	Descriptive models of entities are archived after being quality reviewed and available for reuse	Descriptive model archives are formally managed by staff who maintain and control access	Descriptive model archive could be accessed to provide framework for new projects	Descriptive model archives contains connected models	Descriptive model archives are available across the extended enterprise
F2: Model Visualization			TBD	TBD	TBD	TBD	TBD	TBD	TBD
F3: Schema	Manages the structure and meaning of the descriptive model entities	Consistent descriptive modeling structure and meaning spans organizational areas of interest	No descriptive model schema exists	Project specific schema is created for general architectures	Descriptive model schemas span project specific focus areas	Schema changes are formalized and captured	Descriptive model schemas implemented to provide framework for new projects	Schemas are common across connected descriptive models	Schemas are available across the extended enterprise
F4: MBSE Tool interoperability	Shares information between differing MBSE tools	Ability to implement MBSE methodologies using any MBSE tool	No descriptive models used	Descriptive modeling tools used but non-connected (e.g. siloed efforts).	Manually recreate necessary descriptive model content in each MBSE modeling tool	MBSE tools may be different, but methodology consistency allows for import/export sharing of static content	Process for sharing information between descriptive model tools utilizes a trusted process (e.g. API related)	Changes/Updates are propagated to all linked tools and users are notified to validate applicable relationships	Descriptive models are fully integrated across enterprise barriers, even if differing tools are used
F5: Descriptive Model to Requirement Management Tool Interoperability	Shares information from the descriptive model to other requirements management centric tools	Ability to leverage a federated set of cross-linked descriptive models increases	No descriptive models used	MBSE tools used to support requirements architecture, but not connected to requirement management tool	Manually recreate requirement architecture between MBSE and requirement management tools	Semi-automatic process used to import/export static requirement content between MBSE and requirement management tools	Automatic process for sharing information between descriptive modeling tools utilizes a trusted process (e.g. API related)	Changes/updates are propagated to all linked tools concomitantly and associated entities are flagged for users	MBSE and requirement management tools are integrated across enterprise barriers
F6: Descriptive to Analytical Model Interoperability	Shares information from the descriptive model to analytical engineering tools	Ability to leverage a federated set of cross-linked descriptive models increases	No descriptive models used	MBSE and analytical tools used but not connected (e.g. siloed efforts)	Manually recreate necessary model content between MBSE and analytical tools	Semi-automatic process used to import/export static model content between MBSE and analytical tools	Automatic process for sharing information between descriptive modeling tools utilizes a trusted process (e.g. API related)	Changes/Updates are propagated to all linked tools concomitantly and associated entities are flagged for users	MBSE and analytical tools are integrated across enterprise barriers
F7: Descriptive to Product Structure Model Interoperability	Shares information from the descriptive MBSE model to enable component design and production	Ability to leverage a federated set of cross-linked models increases	No descriptive models used	MBSE and product structure tools used but not connected (e.g. siloed efforts)	Manually recreate physical architecture between MBSE and product structure tools	Semi-automatic process used to import/export static model content between MBSE and Product Structure tools	Automatic process for sharing information between descriptive modeling tools utilizes a trusted process	Changes/Updates are propagated to all linked tools concomitantly and associated entities are flagged for users	MBSE and product structure tools are integrated across enterprise barriers

Demonstrator 1 – Common Nuclear Deterrence (ND) Schema

- Nuclear Deterrence has unique safety, environmental, and qualification constraints with respect to MBSE Architecture and System Engineering
- GENESYS schema modification have helped address the need
- As MBSE adoption matures at SNL, a common ND Schema is needed for smoother tool interoperability
  - Does each project use the GENESYS schema in the same way?
  - Does each project employ custom attribute, parameters, relations… etc
  - Are schema decisions documented?

Categories (e.g., C1) └Topics (e.g., T3) └Facets (e.g., F2) / Level #	Description: How the organization . . .	Transition: As maturity increases, the organization's . . .	L0	L1	L2	L3	L4	L5	L6
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F3: Schema	Manages the structure and meaning of the descriptive model entities	Consistent descriptive modeling structure and meaning spans organizational areas of interest	No descriptive model schema exists	Project specific schema is created for general architectures	Descriptive model schemas span project specific focus areas	Schema changes are formalized and captured	Descriptive model schemas implemented to provide framework for new projects	Schemas are common across connected descriptive models	Schemas are available across the extended enterprise

Demonstrator 1 - ND Schema

Custom schema modifications across programs and projects have benefits and detriments

Benefits of Customization:

- Enables creativity between SE Team and ownership of the model
- Capture unique customer needs
- Creation of organization specific wants for possible reuse among programs

Detriments of Customization:

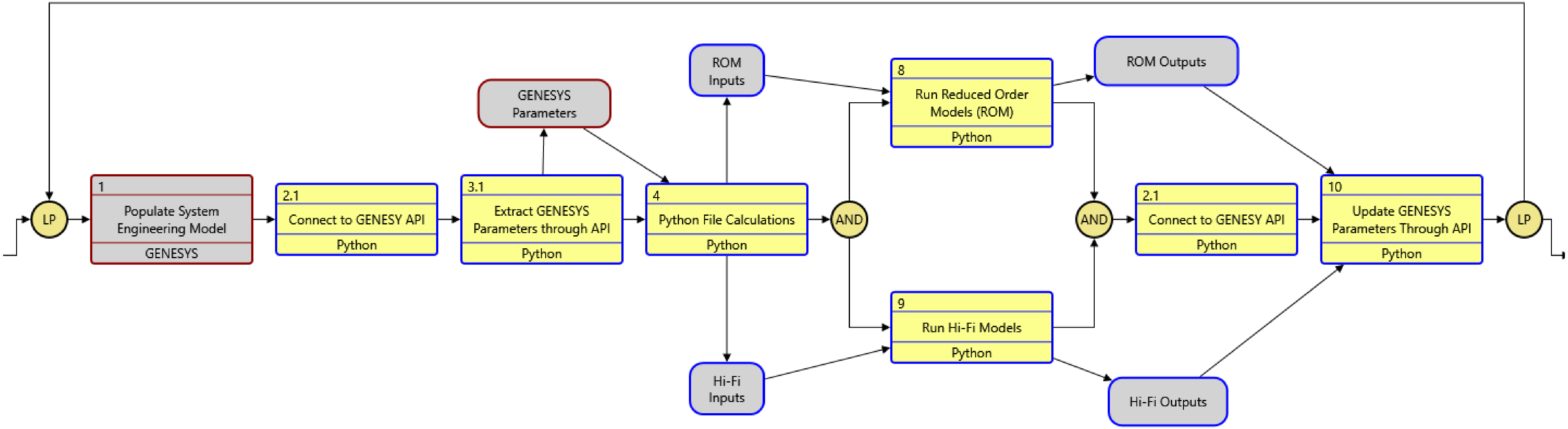
- Increase complexity when migrating projects
- Unintended consequences when relating new classes to existing classes
- Lack of documentation can lead to further confusion defeating the purpose

Demonstrator 2 – Tool Interoperability with Python

- Digital Twin project had a need to connect system engineering Model data to analytical tool calculations performed with Python
- No tool interoperability capability existed to transfer requirement parameters from MBSE Tool → analytical model → MBSE Tool
- Open Source Library Pythonnet allowed for connecting analytical model to GENESYS database through GENESYS API
- Established a digital thread
- Using GENESYS API enables external tools to access all SE architectures in safe and reliable manner

C1: Model Based Systems Engineering (MBSE)	Uses models to define all aspects of system requirements, behavior, hardware, and V&V	utilization of a system model to drive digital engineering	Documents used for all SE activities	Descriptive model used to aid some SE activities	Select areas of descriptive model content are reviewed and authorized	Defined processes support descriptive model usage for SE activities	Descriptive model permissions, confidence in modelers, and peer review	Descriptive model utilizes relationships between architectures and other models	Descriptive model institutionalized and accessible across the enterprise
T4: MBSE Tool Interoperability									
F6: Descriptive to Analytical Model Interoperability	Shares information from the descriptive model to analytical engineering tools	Ability to leverage a federated set of cross-linked descriptive models increases	No descriptive models used	MBSE and analytical tools used but not connected (e.g. siloed efforts)	Manually recreate necessary model content between MBSE and analytical tools	Semi-automatic process used to import/export static model content between MBSE and analytical tools	Automatic process for sharing information between descriptive modeling tools utilizes a trusted process (e.g. API related)	Changes/Updates are propagated to all linked tools concomitantly and associated entities are flagged for users	MBSE and analytical tools are integrated across enterprise barriers

Demonstrator 2 – Example Work Flow



Significant reduction in human error while increases efficiency of data transfer between models

Demonstrator 3 – Systems Engineering to Mechanical CAD (SE2MCAD)

- Enable a digital thread from system requirements and functional behavior to design, manufacturing, and quality acceptance.
- Enable better, model-based communication between systems engineering and design – tracking requirement changes and concerns
- Historically requirements were buried in complex documents and mechanical envelopes

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T4: MBSE Tool Interoperability									
F7: Descriptive to Product Structure Model Interoperability	Shares information from the descriptive MBSE model to enable component design and production	Ability to leverage a federated set of cross-linked models increases	No descriptive models used	MBSE and product structure tools used but not connected (e.g. siloed efforts)	Manually recreate physical architecture between MBSE and product structure tools	Semi-automatic process used to import/export static model content between MBSE and Product Structure tools	Automatic process for sharing information between descriptive modeling tools utilizes a trusted process	Changes/Updates are propagated to all linked tools concomitantly and associated entities are flagged for users	MBSE and product structure tools are integrated across enterprise barriers

Our User Story: SE2MCAD

As a Systems Engineer, I want to transfer data from my SE2MCAD Systems model (in GENESYS) to provide constraint parameters to the Spar component in the MAPR-4D top-level mechanical design model (in PDMLink), so that designers have access to the latest requirement needs influencing their design.

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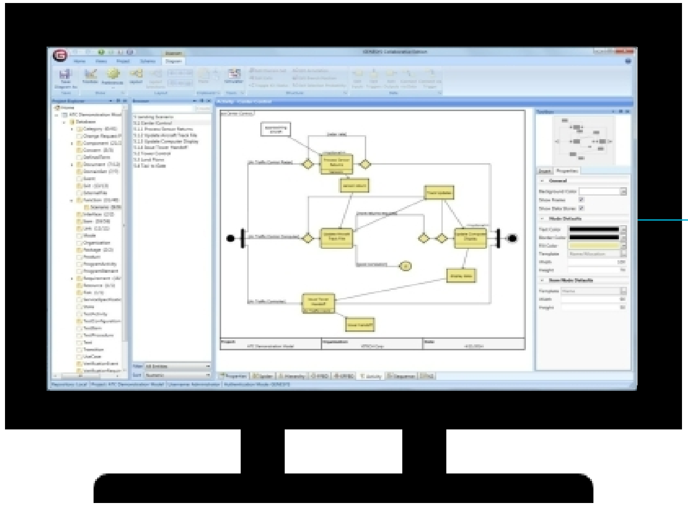

Parameter(s) ->

Canonical Model

Parameter(s)->

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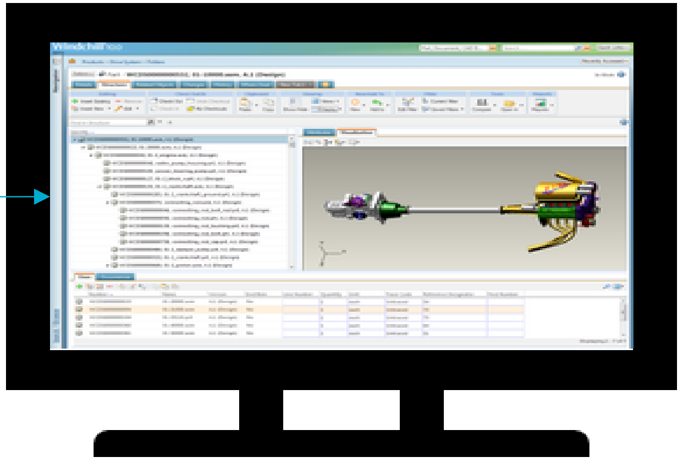


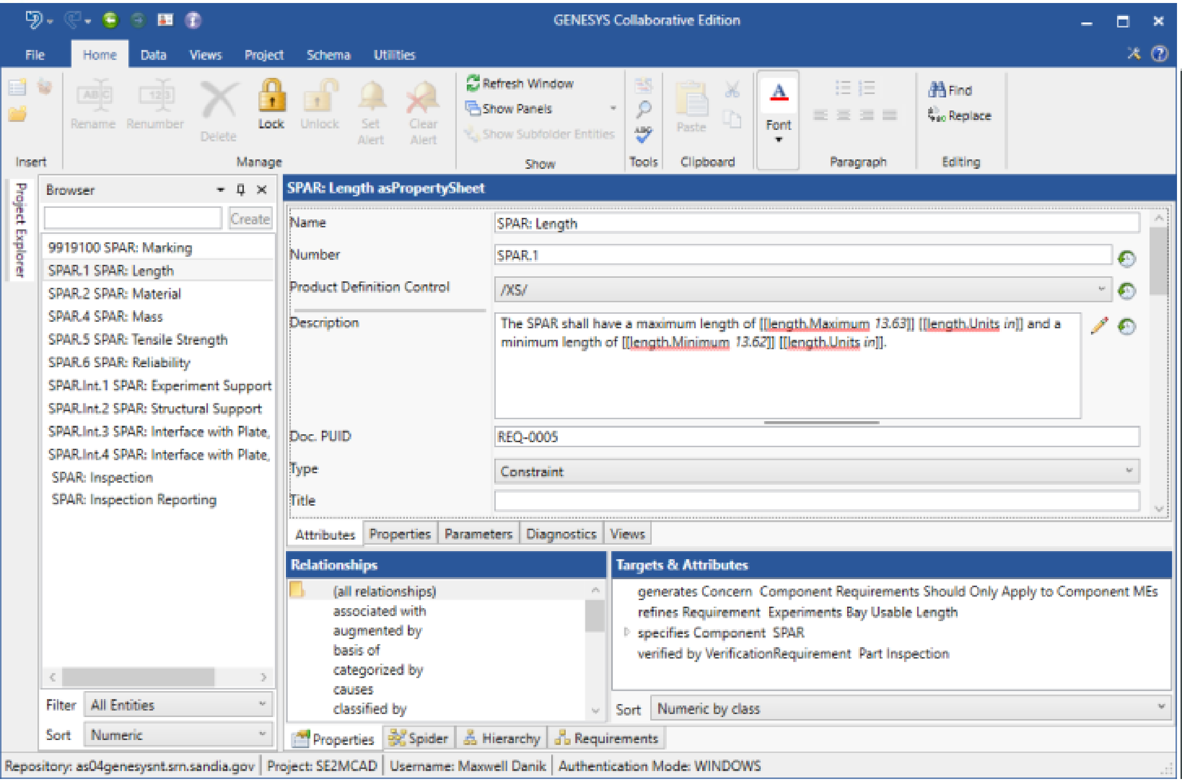
Systems Engineer defines parameter data in GENESYS, sends to MCAD

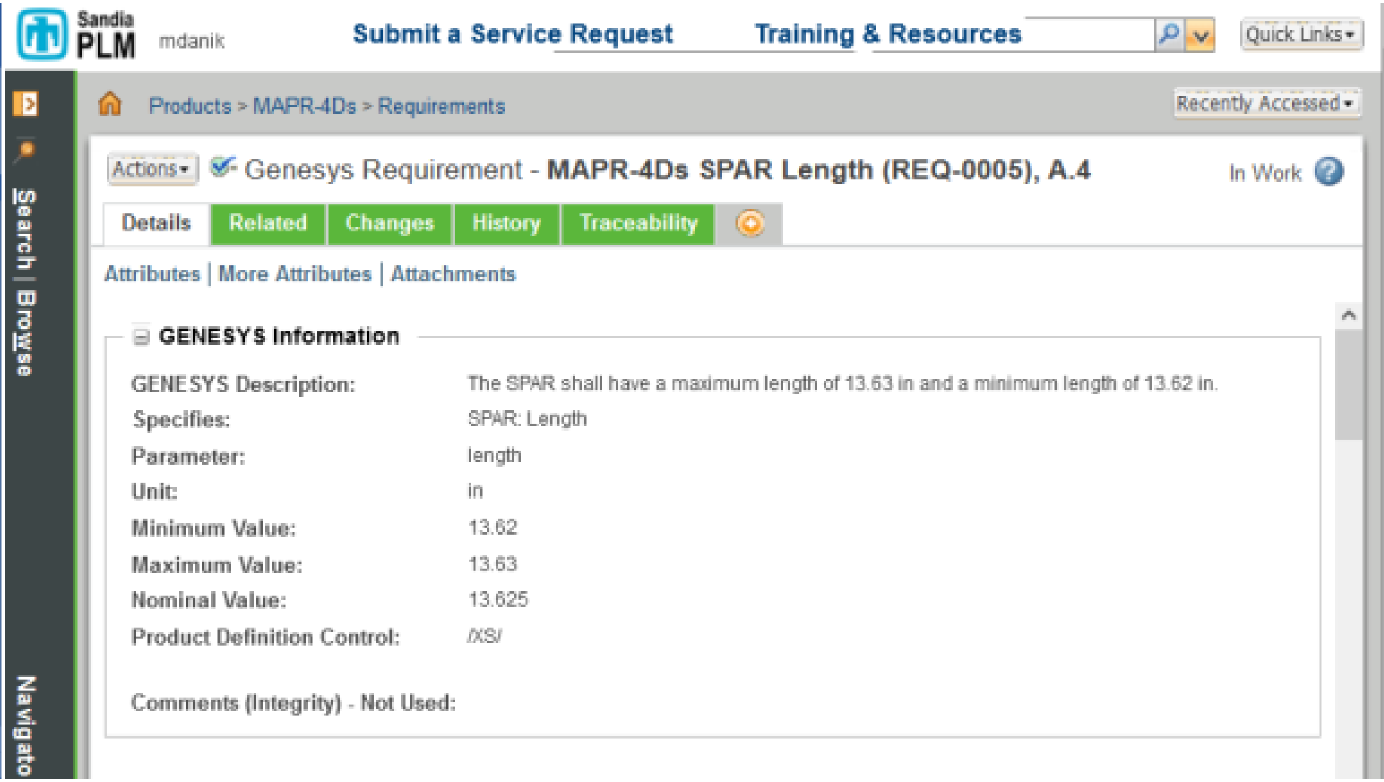
Mechanical Engineer receives parameter in PDMLink and associate them to a part

Video Demo Showing Export of Parameterized Requirements

Video will be sent through Programmatic R&A prior to Conference

Comparing Requirement Information Between Tools





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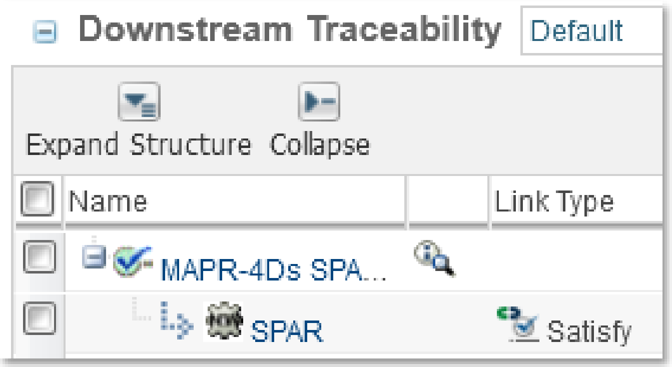
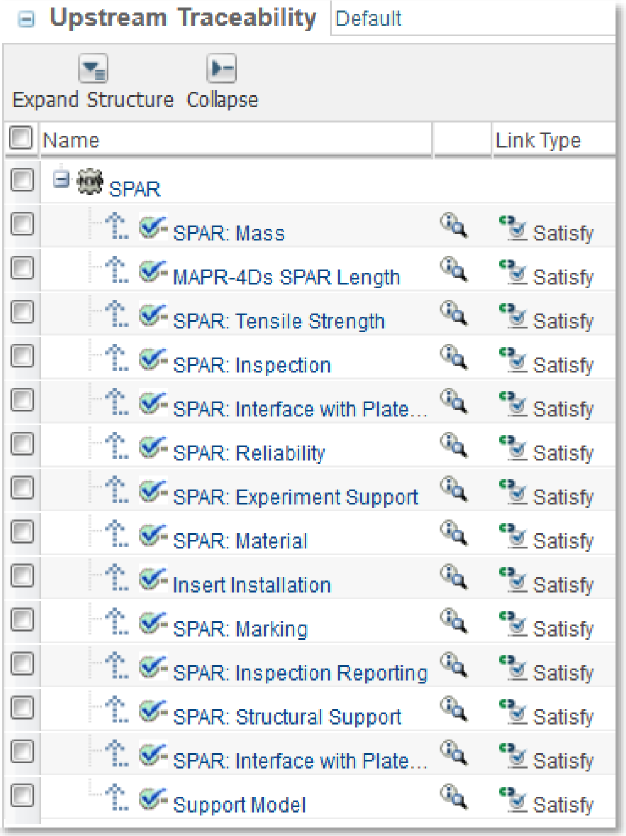
PDMLink Attributes and Relationships Configuration Managed

*Generic Data

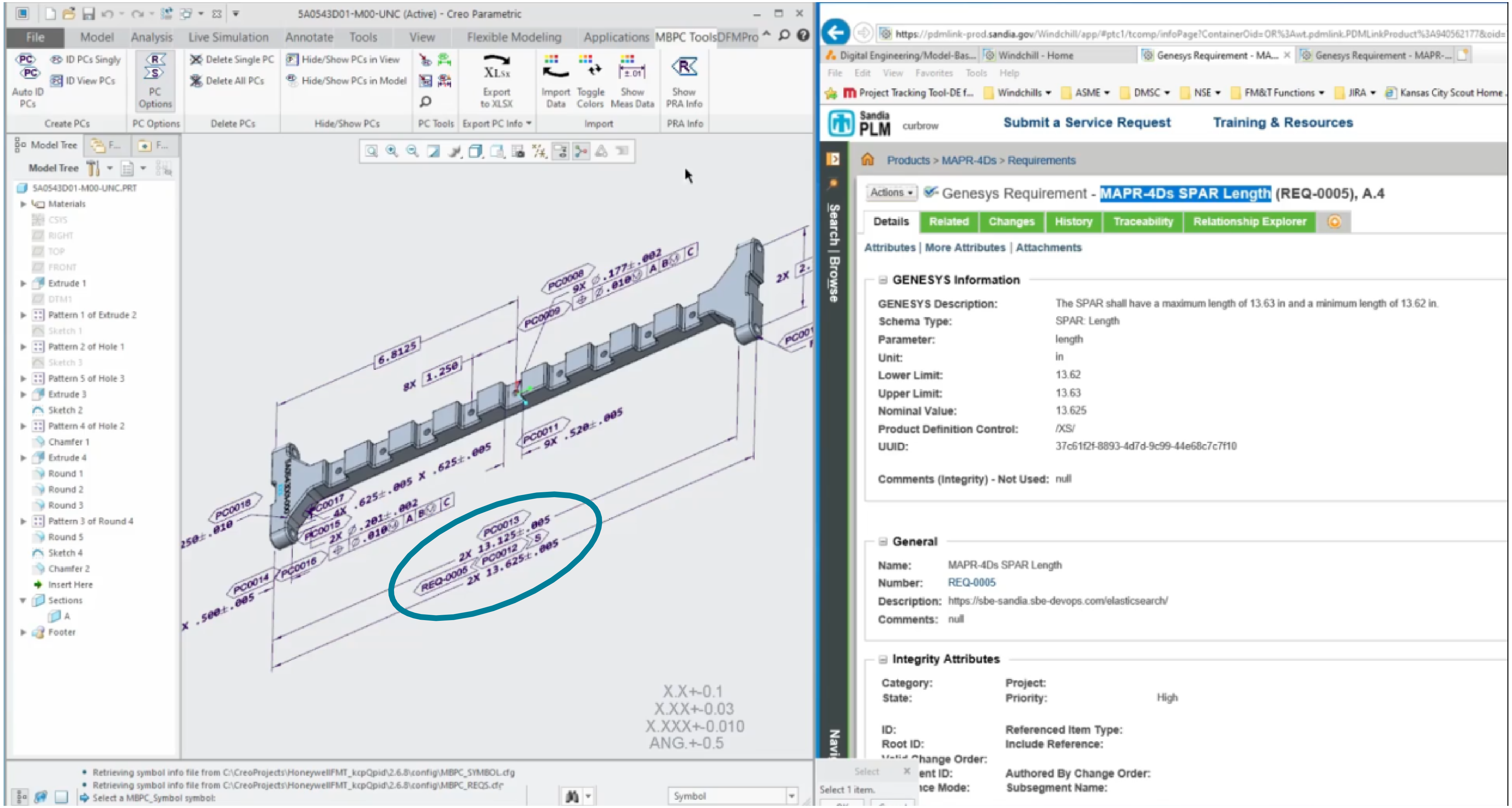
Attributes

MAPR-4Ds SPAR Length (REQ-0005), A.0		MAPR-4Ds SPAR Length (REQ-0005), A.1		MAPR-4Ds SPAR Length (REQ-0005), A.2		MAPR-4Ds SPAR Length (REQ-0005), A.3		MAPR-4Ds SPAR Length (REQ-0005), A.4	
Modified By	Benjamin Morey (bmorey: SNL)	Modified By	Ung Tae Jeong (ujeong: SNL)	Modified By	Ung Tae Jeong (ujeong: SNL)	Modified By	Ung Tae Jeong (ujeong: SNL)	Modified By	Sarah Elizabeth Hale (sshield: SNL)
MBE Annotation ID	--	MBE Annotation ID	adfasdfadf	MBE Annotation ID	adfasdfadf	MBE Annotation ID	adfasdfadf	MBE Annotation ID	37c81f2f-8893-4d7d-9c89-44e68c7c7f10
Version	A.0	Version	A.1	Version	A.2	Version	A.3	Version	A.4
GENESYS Description	The SPAR shall have a maximum length of 13.63in and a minimum length of 13.62in.	GENESYS Description	The SPAR shall have a maximum length of 13.63in and a minimum length of 13.62in.	GENESYS Description	The SPAR shall have a maximum length of 13.63in and a minimum length of 13.62in.	GENESYS Description	The SPAR shall have a maximum length of 13.63 in and a minimum length of 13.62 in.	GENESYS Description	The SPAR shall have a maximum length of 13.63 in and a minimum length of 13.62 in.
Parameter	Length	Parameter	Length	Parameter	Length	Parameter	length	Parameter	length
Nominal Value		Nominal Value		Nominal Value		Nominal Value	13.625	Nominal Value	13.625
Product Definition Control	--	Product Definition Control	--	Product Definition Control	test	Product Definition Control	/XS/	Product Definition Control	/XS/
Specifies	SPAR	Specifies	SPAR	Specifies	SPAR	Specifies	SPAR: Length	Specifies	SPAR: Length
Checkin Comments	--	Checkin Comments	Updated UUID	Checkin Comments	Updated product definition control	Checkin Comments	Updated per GENESYS integration	Checkin Comments	Updated UUID



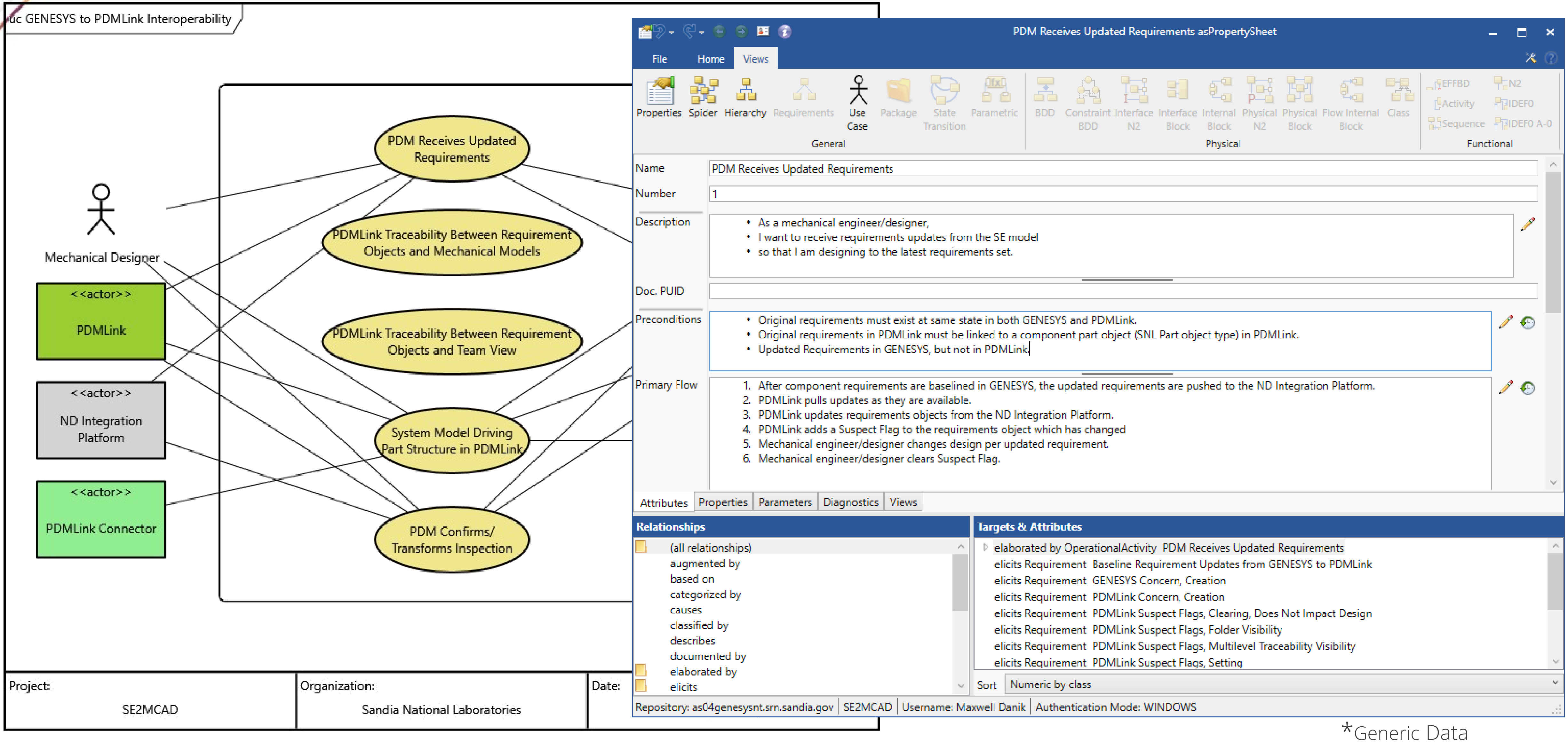


Mapping Requirement Object to 3D Interactive Viewable (3DIV)



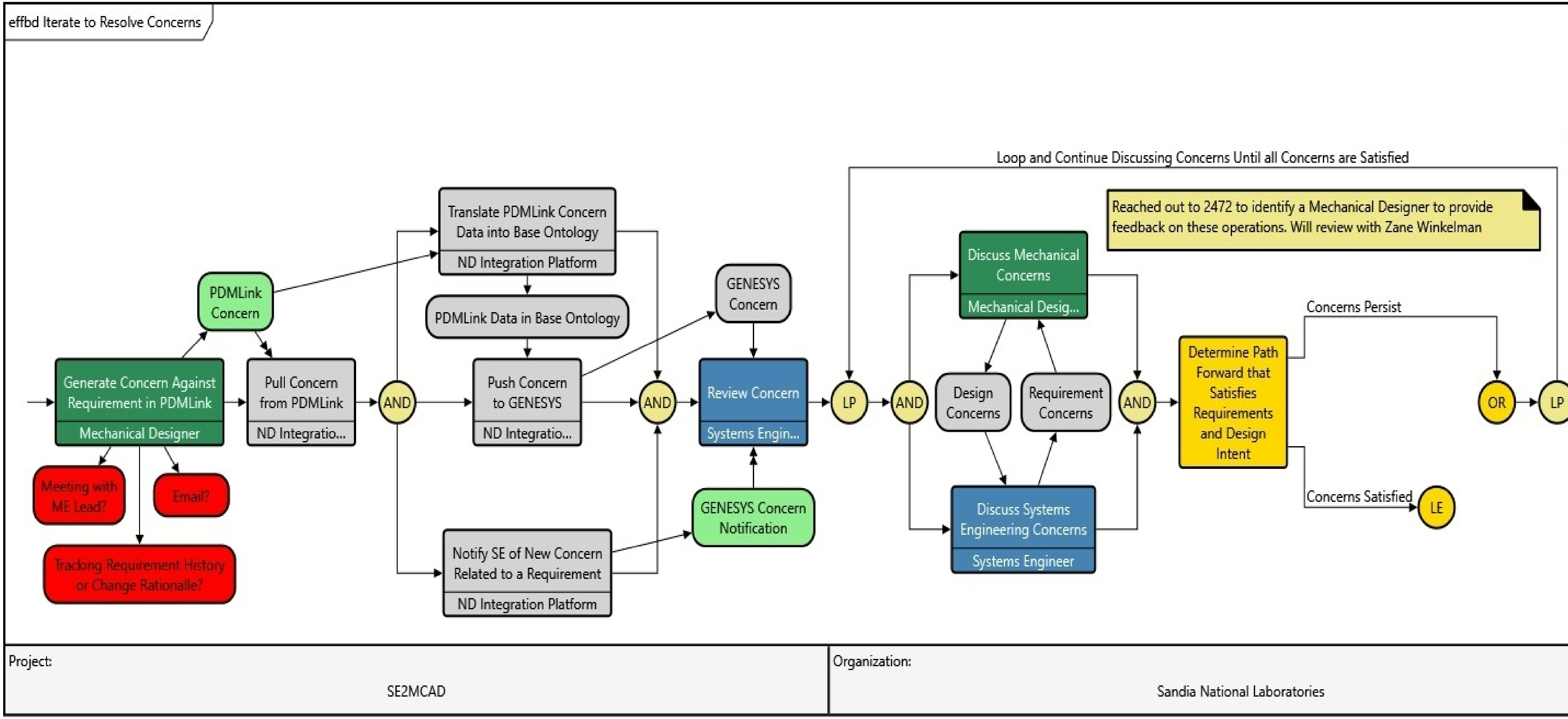
*Generic Data

SE2MCAD (GENESYS ⇔ PDMLink) Requirements Update Use-Case



*Generic Data

SE2MCAD (GENESYS ⇔ PDMLink) Requirements Update Use-Case



*Generic Data

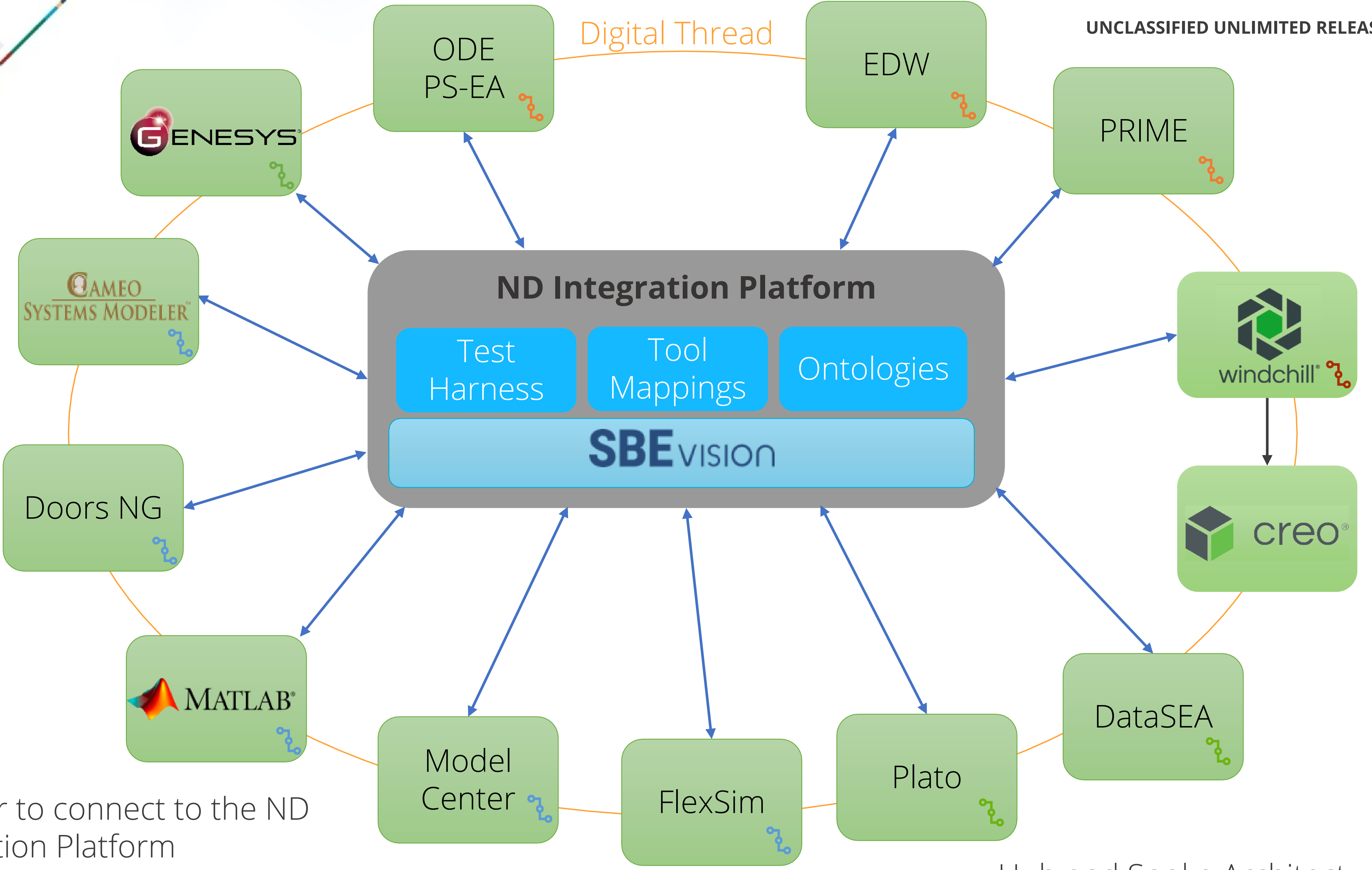
SE2MCAD (GENESYS ⇔ PDMLink) Requirements Update Use-Case

Additional SE2MCAD Use-Cases Planned for FY22 and Beyond

- **System Model Creates Part Structure in PDMLink Mechanical Model.**
- **System Model Creates Requirements in PDMLink Mechanical Model.**
- **Auto-Create "Satisfy" Relationships between Requirements Objects and Mechanical Models in PDMLink.**
  - Driven by Specifies relationship between Component Requirement and Component in SE Model.
  - *This is currently a manual process in PDMLink.*

SIM2MCAD (MBA) Use-Case

- **Simulation Model Provides Component Verification Analysis Data to Mechanical Model**
  - 3D STEP File from CAD to Sim Model.
  - Sim Model Results Package to Package Object in PDMLink, then Associated to Part Object of Component of Interest in PDM.



Adaptor to connect to the ND Integration Platform

SBE Vision Vitech Custom

- Hub and Spoke Architecture
- No point-to-point integrations

Questions?

integrate22™