



Managing Standards in a Digital Engineering Environment

Including Standards, Requirements, Risk, Design, and Test

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DIGITAL ENGINEERING

HELP - 5¢



THE DOCTOR
IS IN



***DR. DIGITAL
IS IN THE
HOUSE***

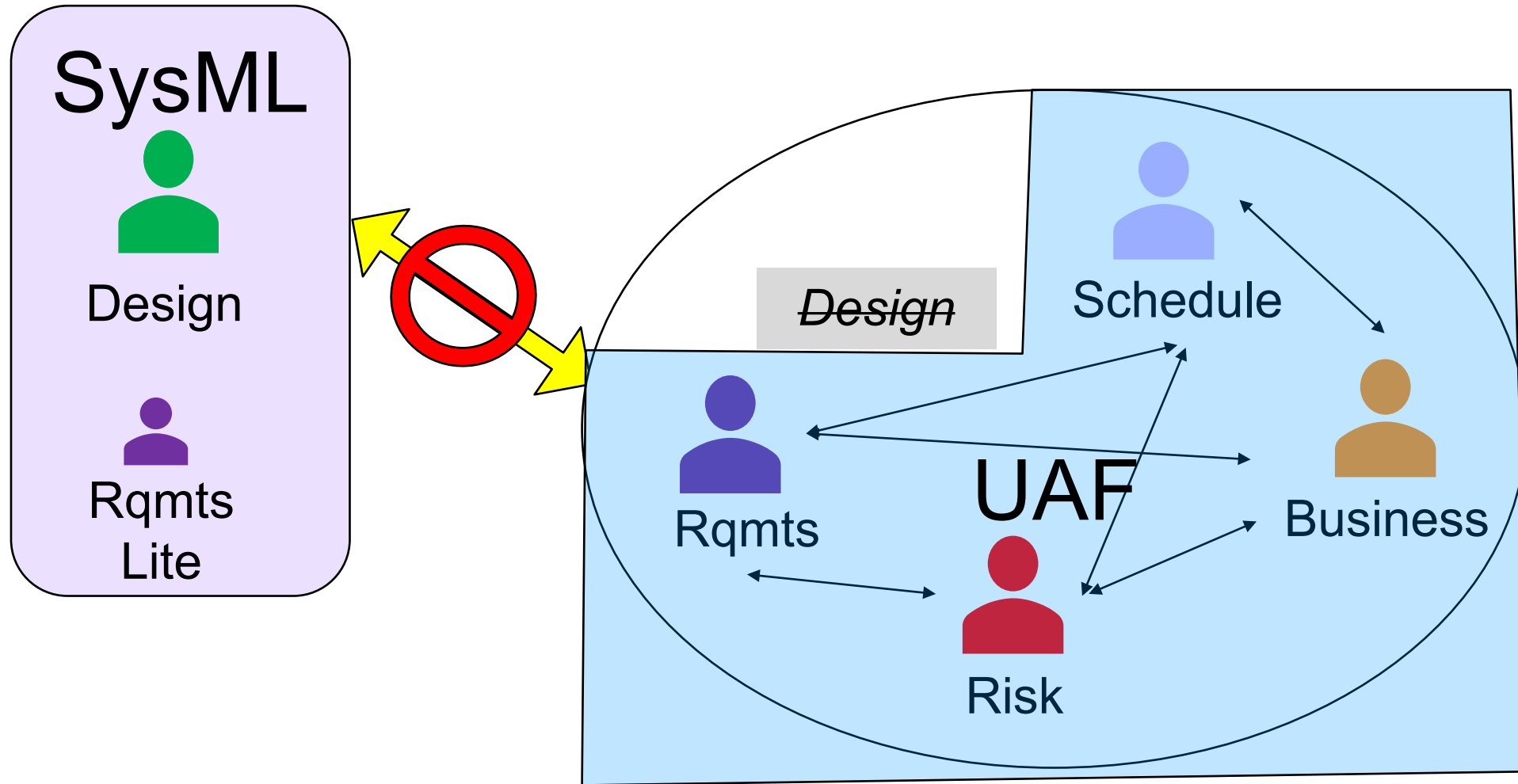




Digital Engineering using a Common Information Infrastructure (CII)

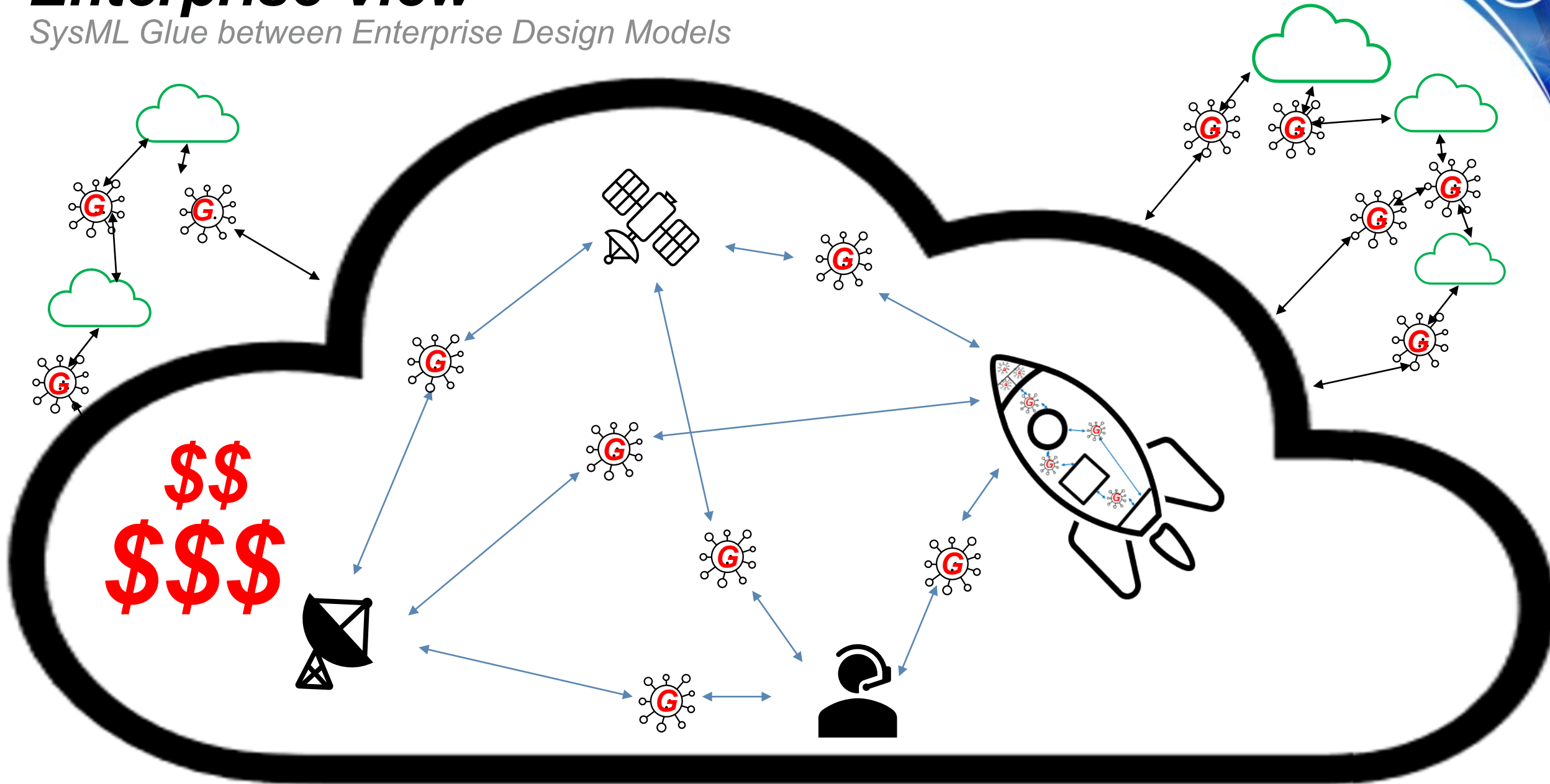
SysML and UAF

Limited connectivity between SysML and UAF



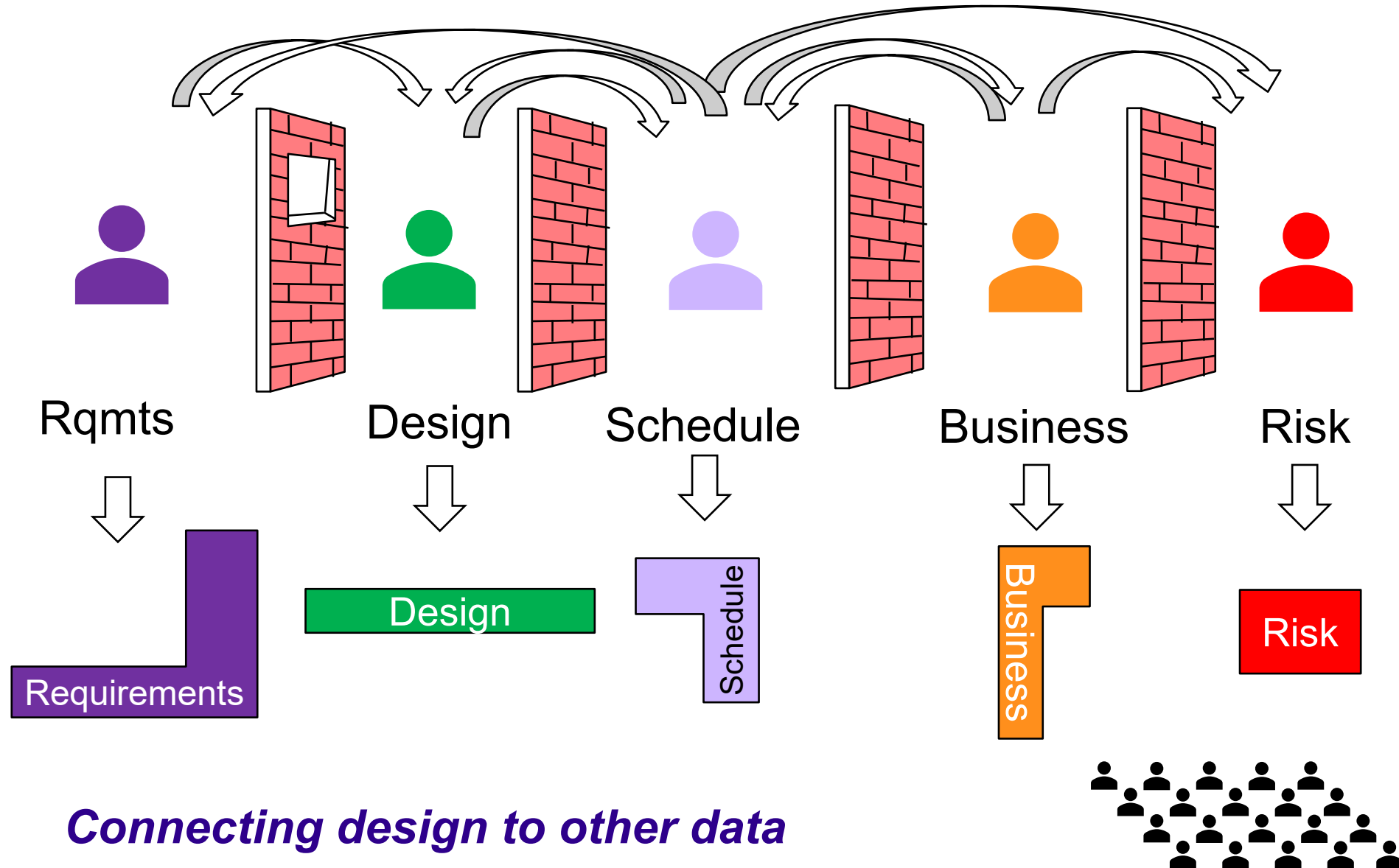
Enterprise View

SysML Glue between Enterprise Design Models



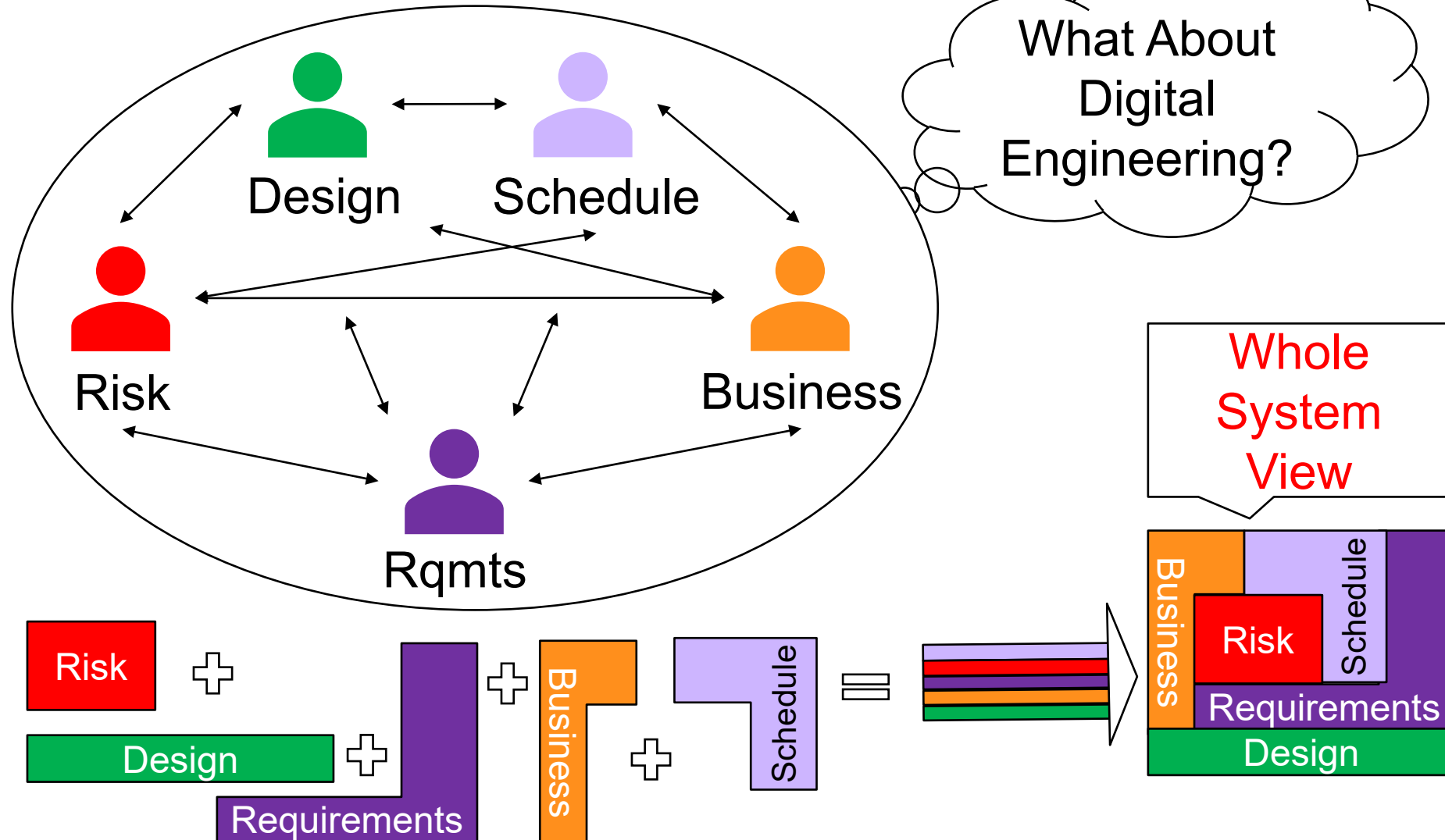
Subset of Multiple SMEs

Legacy Process: Each has a separate viewpoint of the system



Stakeholder Vision of the System

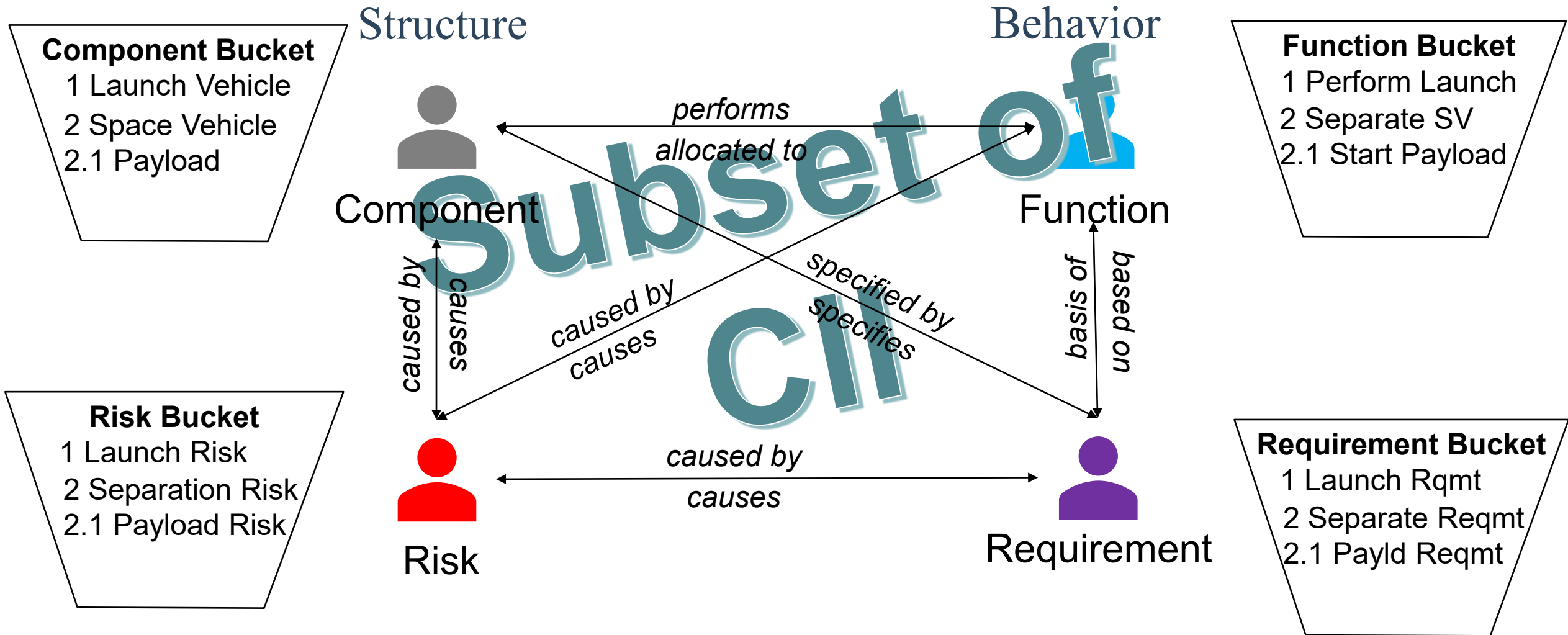
The Digital Engineering Eco-System (DEE)



Sharing information in a traceable common information infrastructure

Implementing the Stakeholder Vision with a CII

Element Types as Buckets and Relations Between Them as Strings

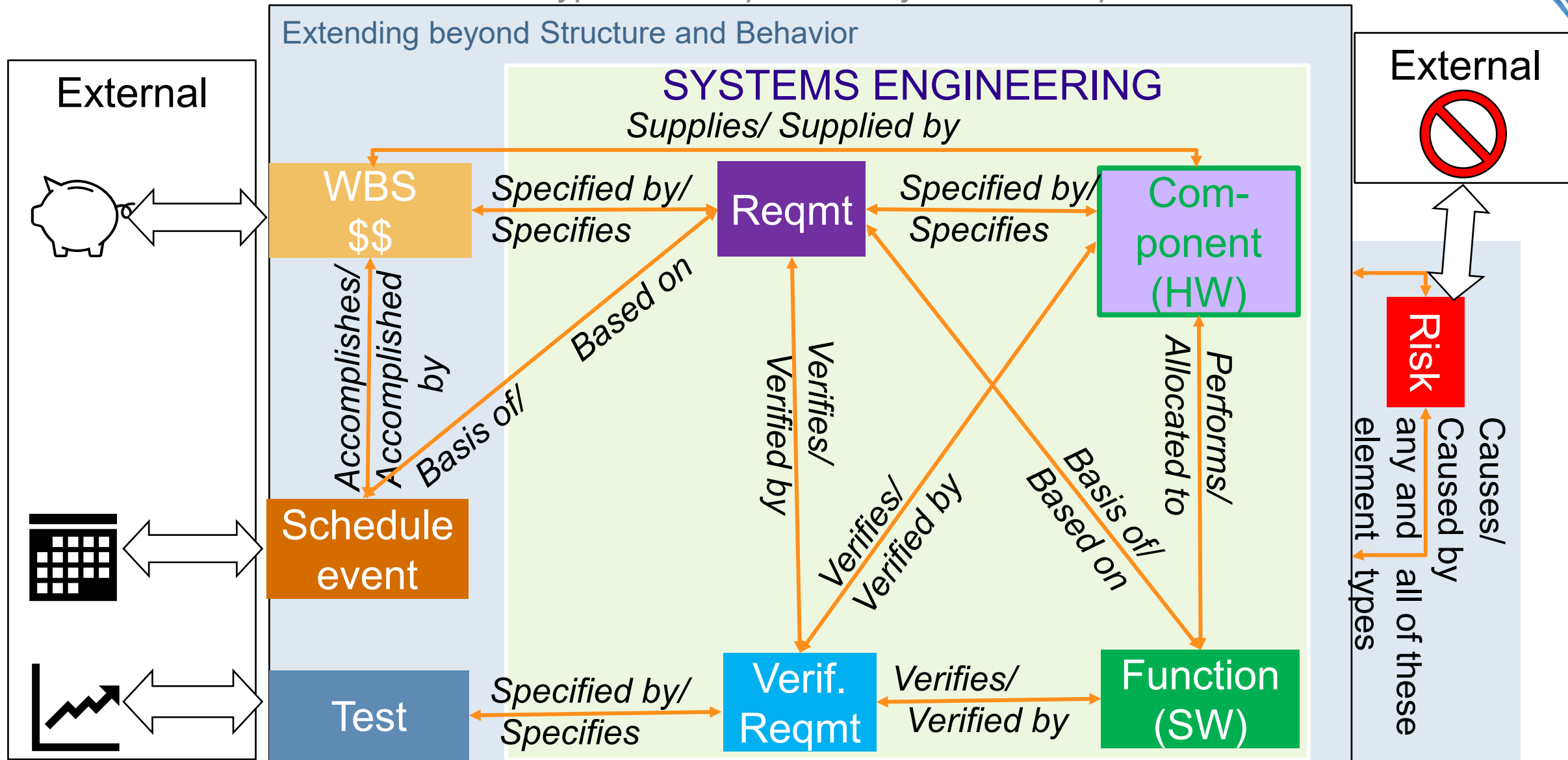


CII groups similar elements and uses pre-defined relations to tie them together



Common Information Infrastructure (CII)

Defined Element Types & Complementary Relationships



Subset of CII (not built into SysML)



Standards Management Within Digital Engineering

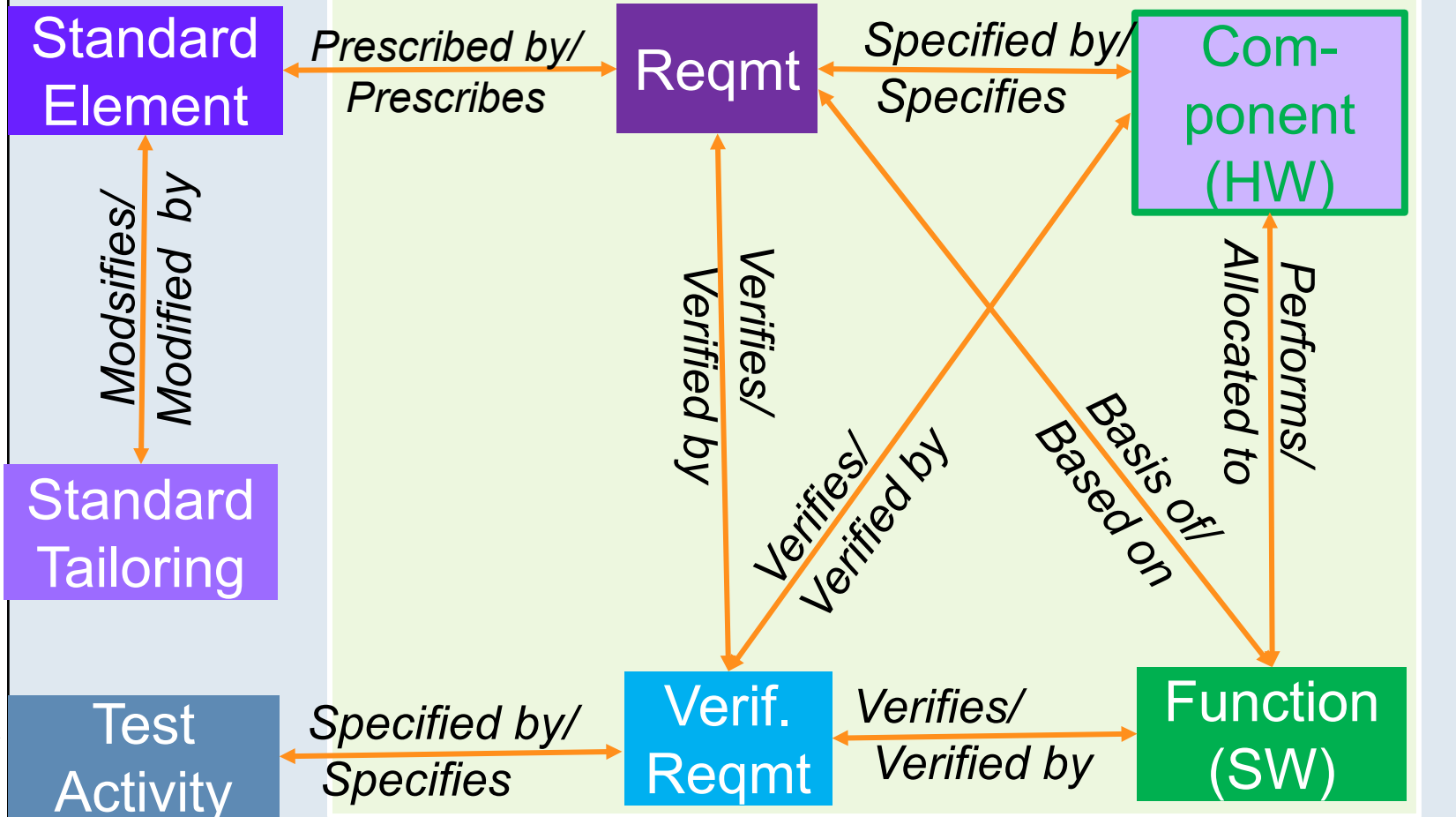
Including Standards, Requirements, Design and Test

Common Information Infrastructure (CII)

Standards Focus

Extending beyond Structure and Behavior

SYSTEMS ENGINEERING



External



Risk

Causes/
Caused by
any and
all of these
element types

External

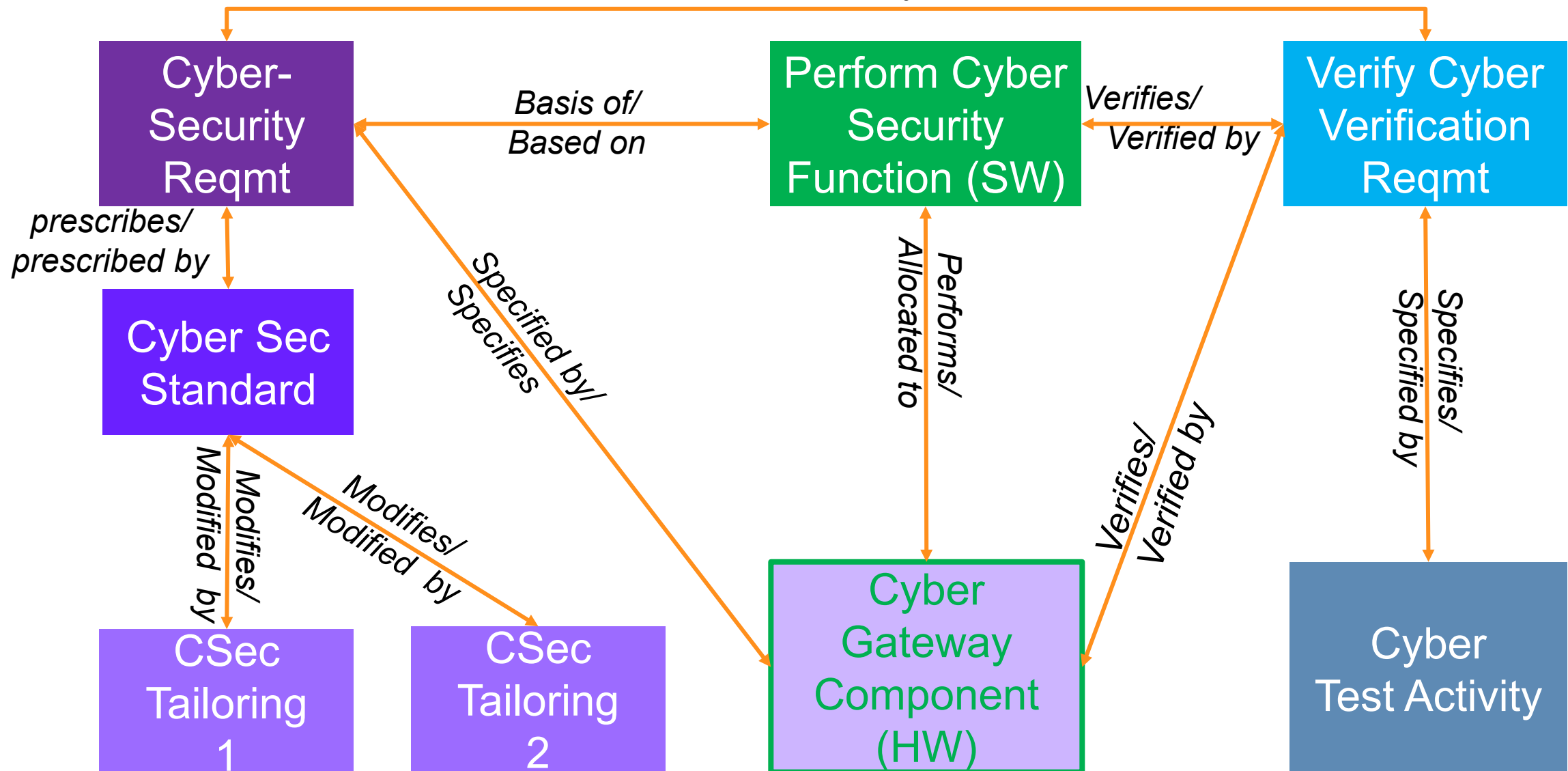


Subset of CII (not built into SysML)

Common Information Infrastructure (CII)

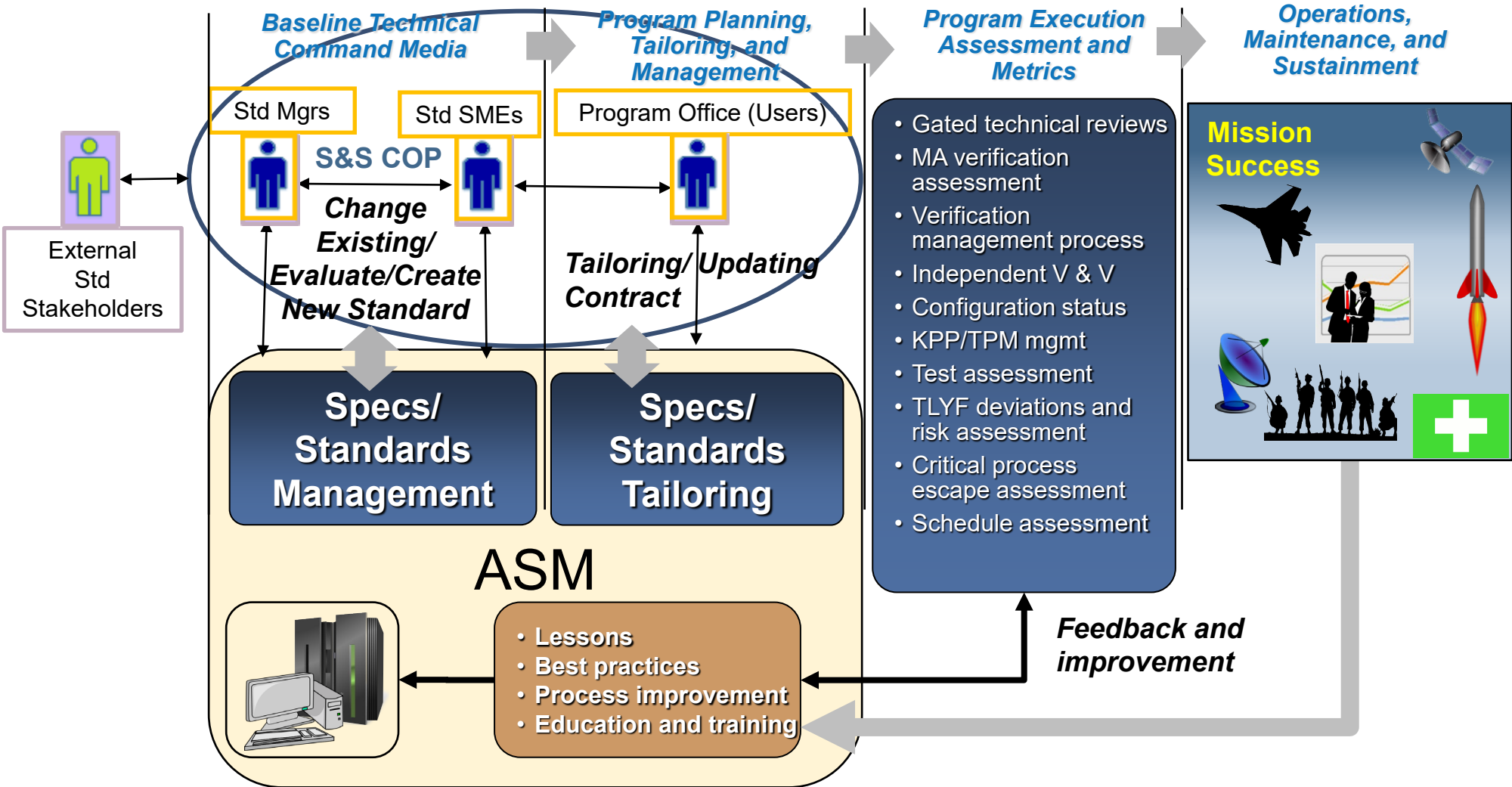
Standards Focus

Verifies/ Verified by



Aerospace Specs & Standards Model (ASM)

Updates based on well-defined use cases



ASM Operational View (OV)-1 Living Document

Manage Tailorings of Standards using Web



Working Program:

Path: ASM 0.0 PO AAA - UI / StdElementTailoring / Test1 / TOR-2005(8583)-3 Systems Engineering 15 April 2005 tailored for Test1 / 0.CoverTOR-2005(8583)-3 line 03 tailored for Test1

Project

- ASM 0.0 PO AAA - UI
 - Document
 - ProgramElement
 - StdElementTailoring
 - GPSIII
 - Test1
 - TOR-2005(8583)-3 Systems Engineering 15 April 2005 tailored for Test1
 - IEEE.15288.2015 Systems Engineering tailored for Test1
 - TOR-2005(8583)-3 Systems Engineering 15 April 2005 tailored for Test1
 - 0.CoverTOR-2005(8583)-3 line 03 tailored for Test1
- ASM 0.0 Program Execution; Systems Engineering UI New
 - StandardElement
 - Systems Engineering
 - IEEE.15288.1.2015 amending of IEEE 15288.2015
 - IEEE 15288.2015 Systems Engineering

Content

☒ Original ☒ Gov ☐ Ktr ☐ Final

GovApprv

Government Rationale

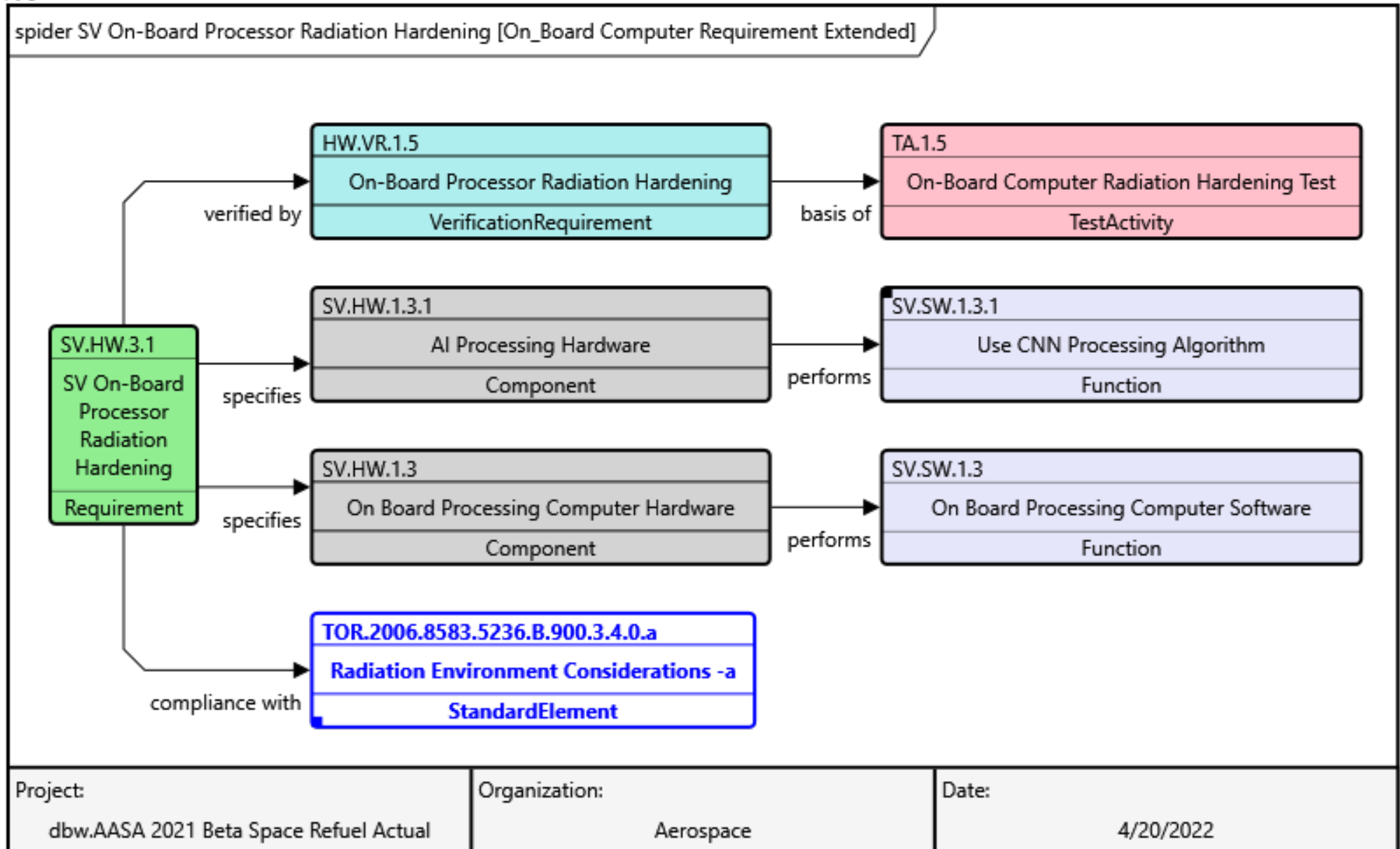
GovPropTrng

number	0.Cover
name	TOR-2005(8583)-3 line 03
description	This TOR contains a new draft version of Military Standard 499, Systems Engineering. It incorporates suggested revisions to the MIL-STD-499 and the "R" revision to that document, which was

[Update](#)

Requirements to Test, Design, & Standards

As CII elements





M&S Parameters Connecting M&S, Requirements and other DE

Requirement Parametrics

Objective	Minimum	Maximum	Units	Observed	Precision	
Acc 0	10.00000000	0.0	100.00000000	cm	250.00000000	

Source Binding: [Position Accuracy Standard](#) ... X

Dependent Bindings:

- [CMP Space Vehicle](#)
- [FCN SV Position Algorithm Augmented](#)
- [FCN SV Position Algorithm Simple](#)
- [PA Perform Simulation](#)
- [PE Space Vehicle](#)
- [RSK Position Missing Semantic Fidelity](#)
- [VR Position Accuracy](#)

Other Elements

Observed flows from Verification Requirement

VR Test Data source is External M&S

Verification Requirement Dependency

Objective	Minimum	Maximum	Units	Observed	Precision	
Acc 0	10.00000000	0.0	100.00000000	cm	250.00000000	

Source Binding: [REQ SV DT Position Accuracy](#) ... X

Dependent Bindings:

- [TACT Sim Position A...](#)
- [REQ SV DT Position Accur](#)

Acronyms for Bindings to Parameters of Elements from Previous Page							
CMP	Component	PA	Program Activity (Schedule)	RSK	Risk	TACT	Test Activity
FCN	Function	PE	Program Element (WBS)	REQ	Requirement	VR	Verification Requirement



Modeling and Sim Impact to System Choice

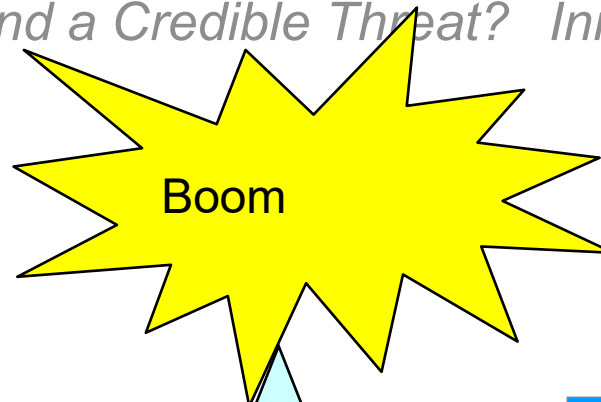
***From Dr. Ric Roca
Software Implementation & Integration***

August 15, 2022

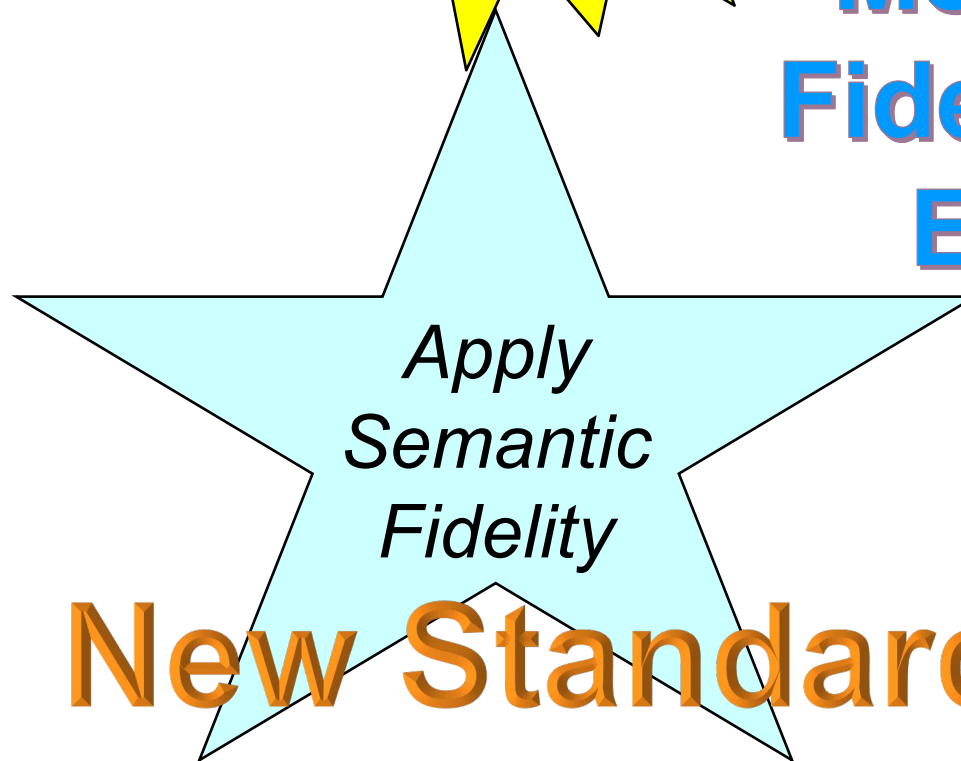
Digital Twin External M&S of Risk

Is intercepting the Satellite from the ground a Credible Threat? Initially No.

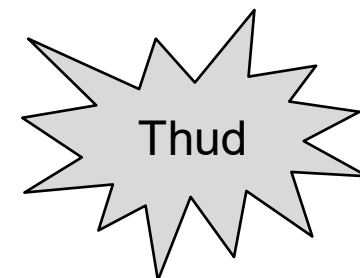
But Wait!
Two Simulators with
Differing Semantic
Definitions
(Ground and Space)



**M&S Semantic
Fidelity Changes
Everything!**



New Standard?

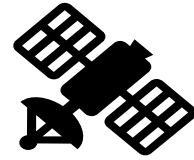


Two Simulators without Semantic Fidelity provide inaccurate results

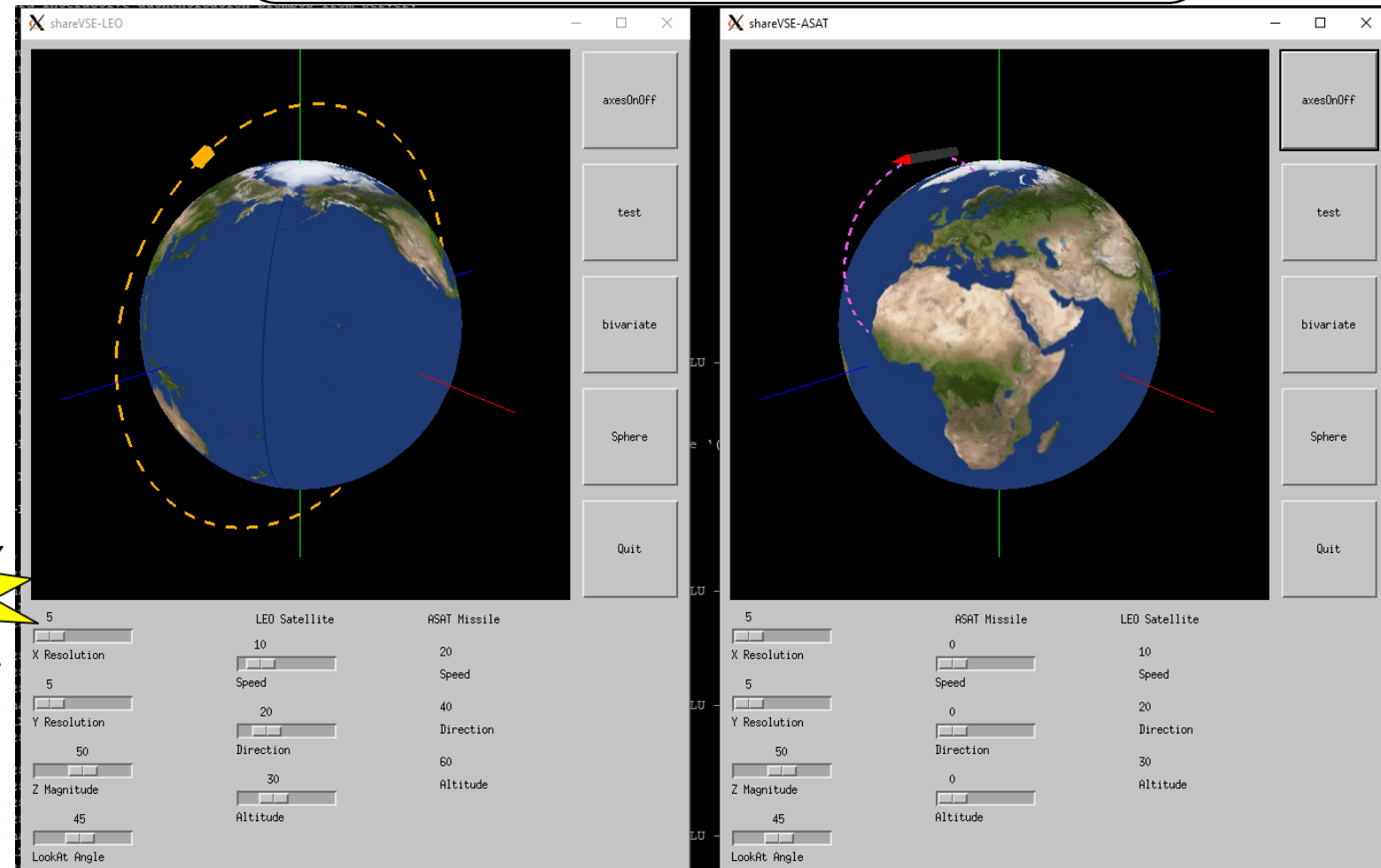
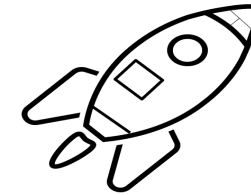
Semantic Fidelity Implemented

Python External File

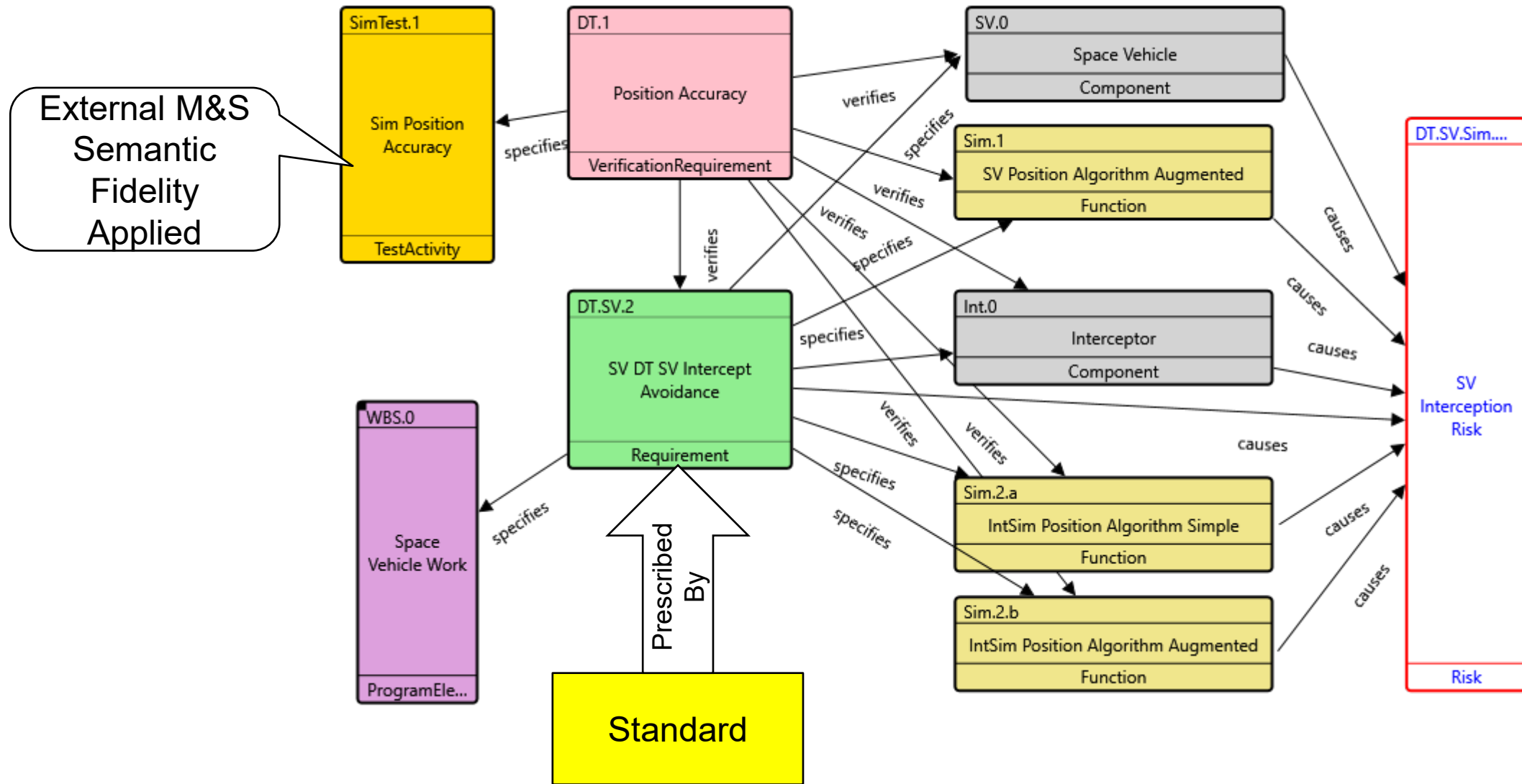
- Two Simulators
 - Built Separately
- Data from each has different parameterization
 - models give inaccurate results
 - SV has semantic fidelity
 - Includes atmospheric drag
 - Interceptor Circular
- Applied Semantic Fidelity to Interceptor
- Accurate Results



Digital Twins



Modeling and Sim Impact to System Choice



Using the CII to tie M&S to Standards, Design, Requirements, Risk, and Programmatics

Questions?



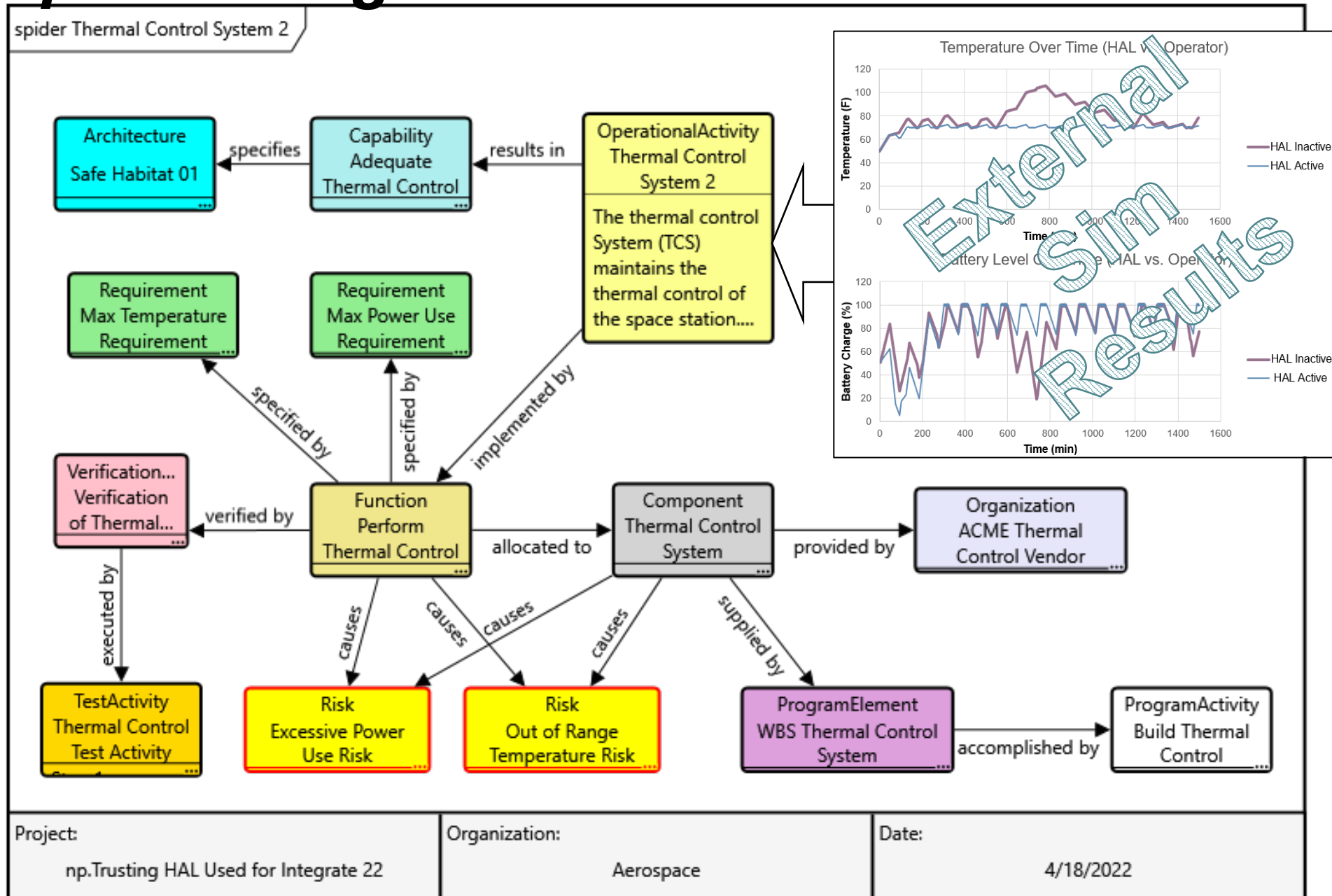
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Backup

Exemplar: Using the CII for DE



Modeling for Enterprise Systems Engineering

Some not covered here due to time constraints



Attributes	SysML	UAF	CII
Design (Structure, Behavior)	Yes	No	Yes
Architecture	No	Yes	Yes
Addresses requirements	limited internal	Yes	Yes
Built-in element types for cost, schedule, risk	No	No	Yes
Disciplined Systems Engineering Approach	No	Yes	Yes
Pre-defined element types and relations	No	Yes	Yes
Understandability	Ad hoc development & requires understanding of Software Engineering	Requires Understanding of Software Engineering & expert knowledge of UAF	Easier learning curve.
Easy to find information	No	No	Yes
Easy to get information out	Yes	Complex	Yes
Semantically Precise	No	Yes	Yes
Syntactically Precise	No	Yes	Yes
Complementary Relations (easy to read both ways)	No	No	Yes
Defined information infrastructure	No	Yes	Yes
One Element view builds all other views	No	No	Yes
Easy Multi-Domain Information Discovery	No	No	Yes