Managing Standards in a Digital Engineering Environment

Including Standards, Requirements, Risk, Design, and Test

Daniel Winton
Systems Engineering Division

June 14, 2022

Approved for public release. OTR 2022-00964.

DIGITAL ENGINEERING

HELP - 5¢

THE DOCTOR

IS IN

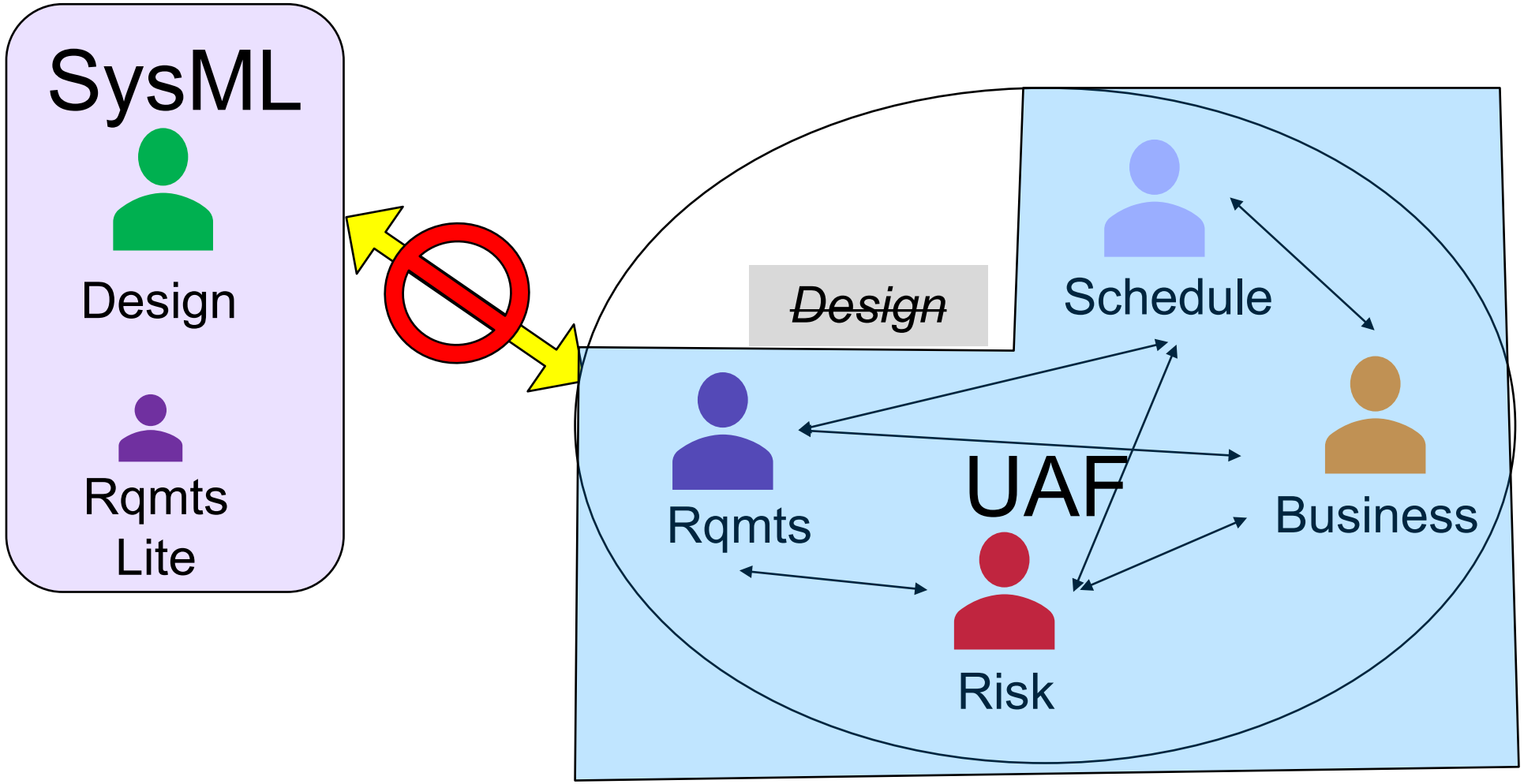
DR. D

DR. DIGITAL IS IN THE HOUSE

Digital Engineering using a Common Information Infrastructure (CII)

SysML and UAF

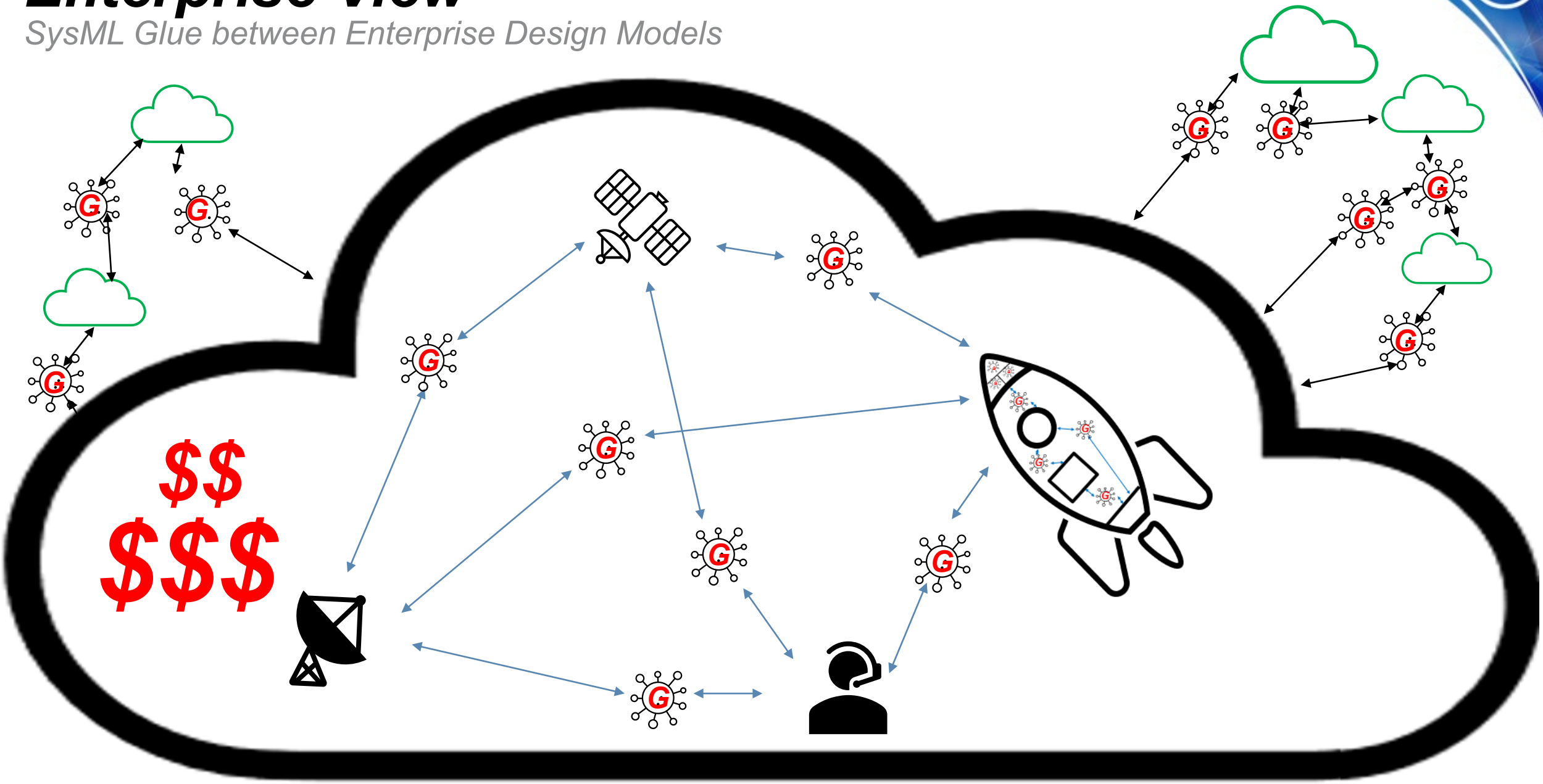
Limited connectivity between SysML and UAF



OTR 2022-00660 The Case for a Common Information Infrastructure (CII)

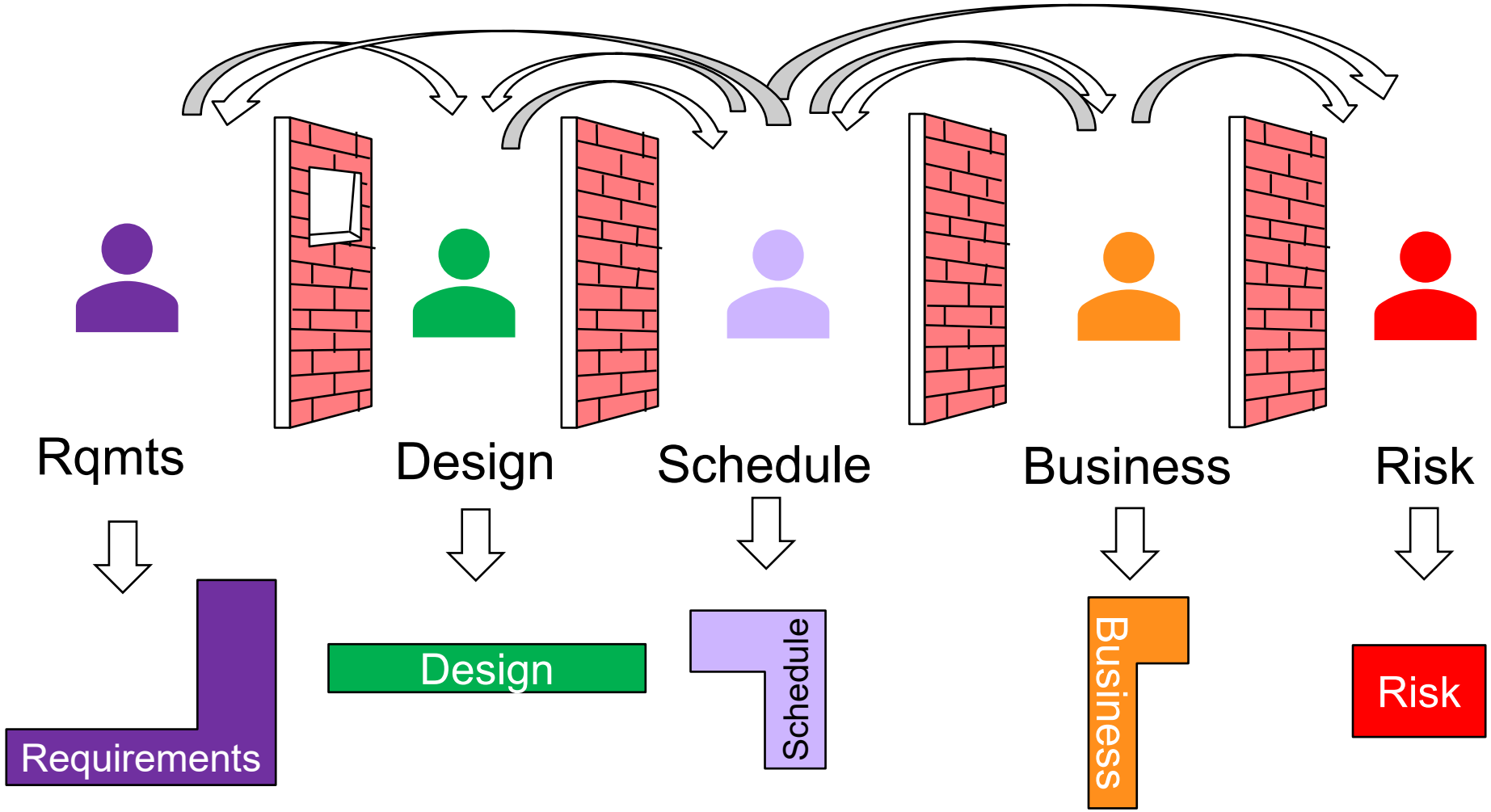
Enterprise View

SysML Glue between Enterprise Design Models



Subset of Multiple SMEs

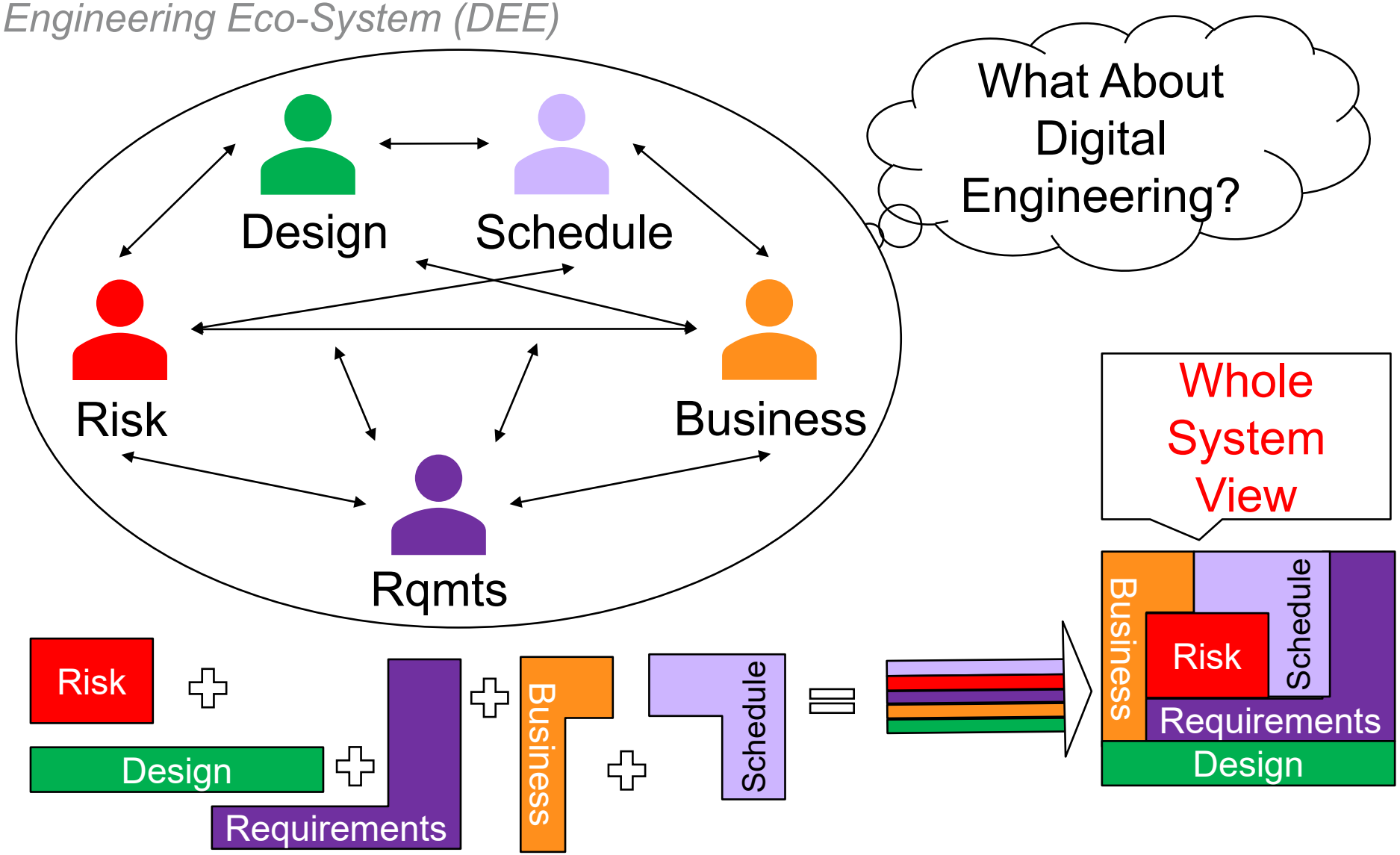
Legacy Process: Each has a separate viewpoint of the system



Connecting design to other data

Stakeholder Vision of the System

The Digital Engineering Eco-System (DEE)

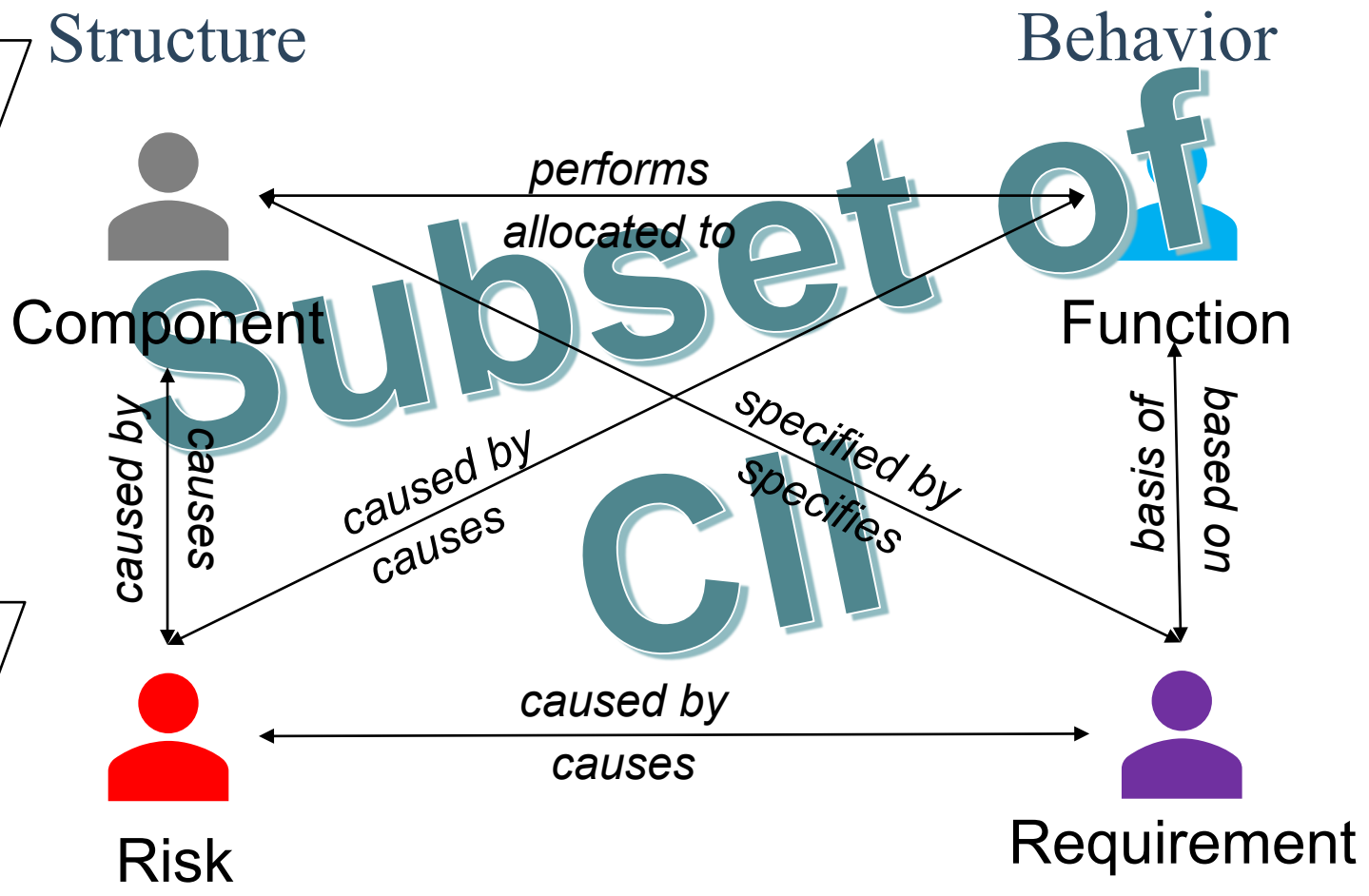


Sharing information in a traceable common information infrastructure

Implementing the Stakeholder Vision with a CII

Element Types as Buckets and Relations Between Them as Strings

Component Bucket
1 Launch Vehicle
2 Space Vehicle
2.1 Payload



Subset of CII

Function Bucket
1 Perform Launch
2 Separate SV
2.1 Start Payload

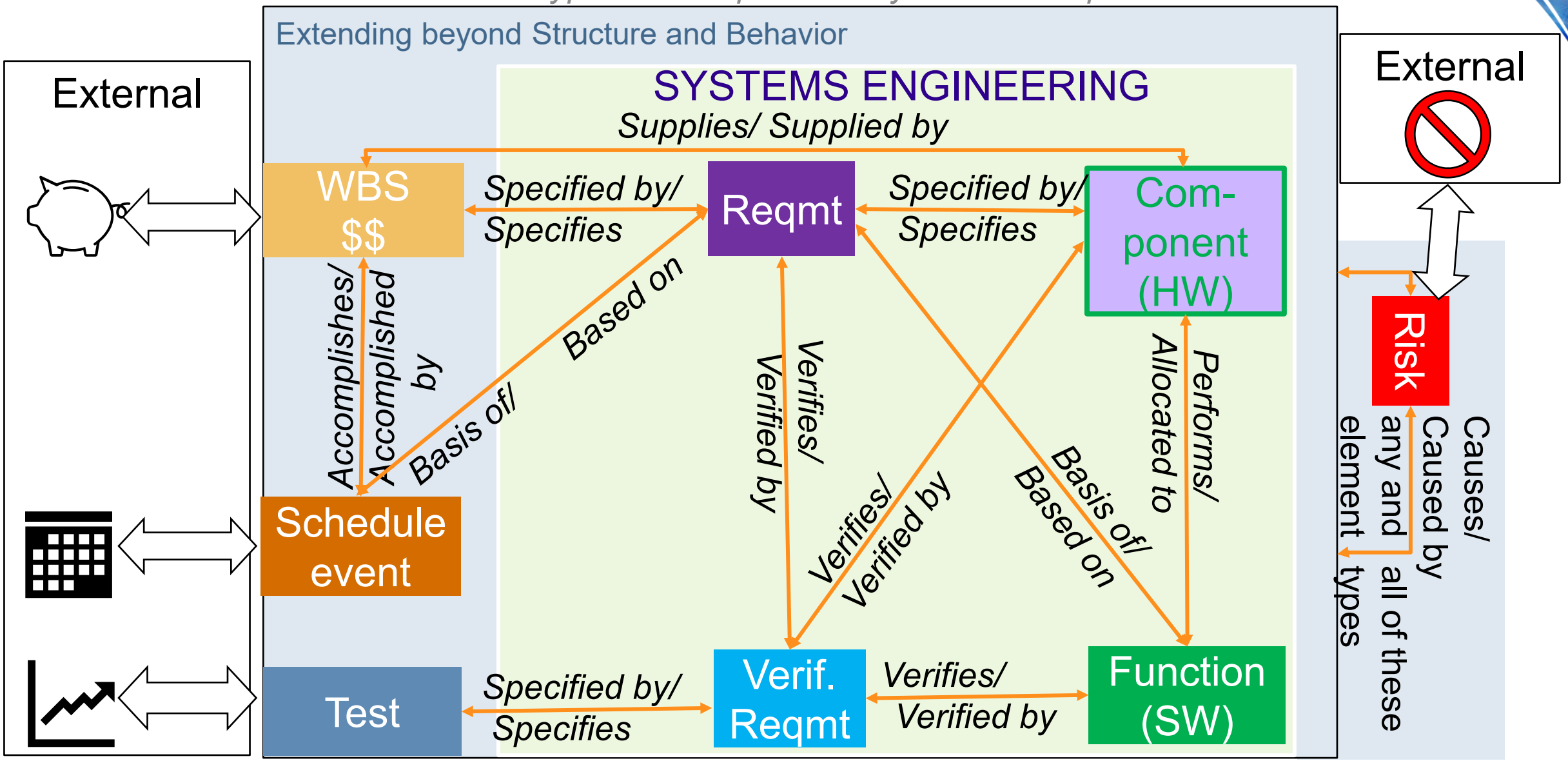
Risk Bucket
1 Launch Risk
2 Separation Risk
2.1 Payload Risk

Requirement Bucket
1 Launch Rqmt
2 Separate Reqmt
2.1 Payld Reqmt

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

Common Information Infrastructure (CII)

Defined Element Types & Complementary Relationships



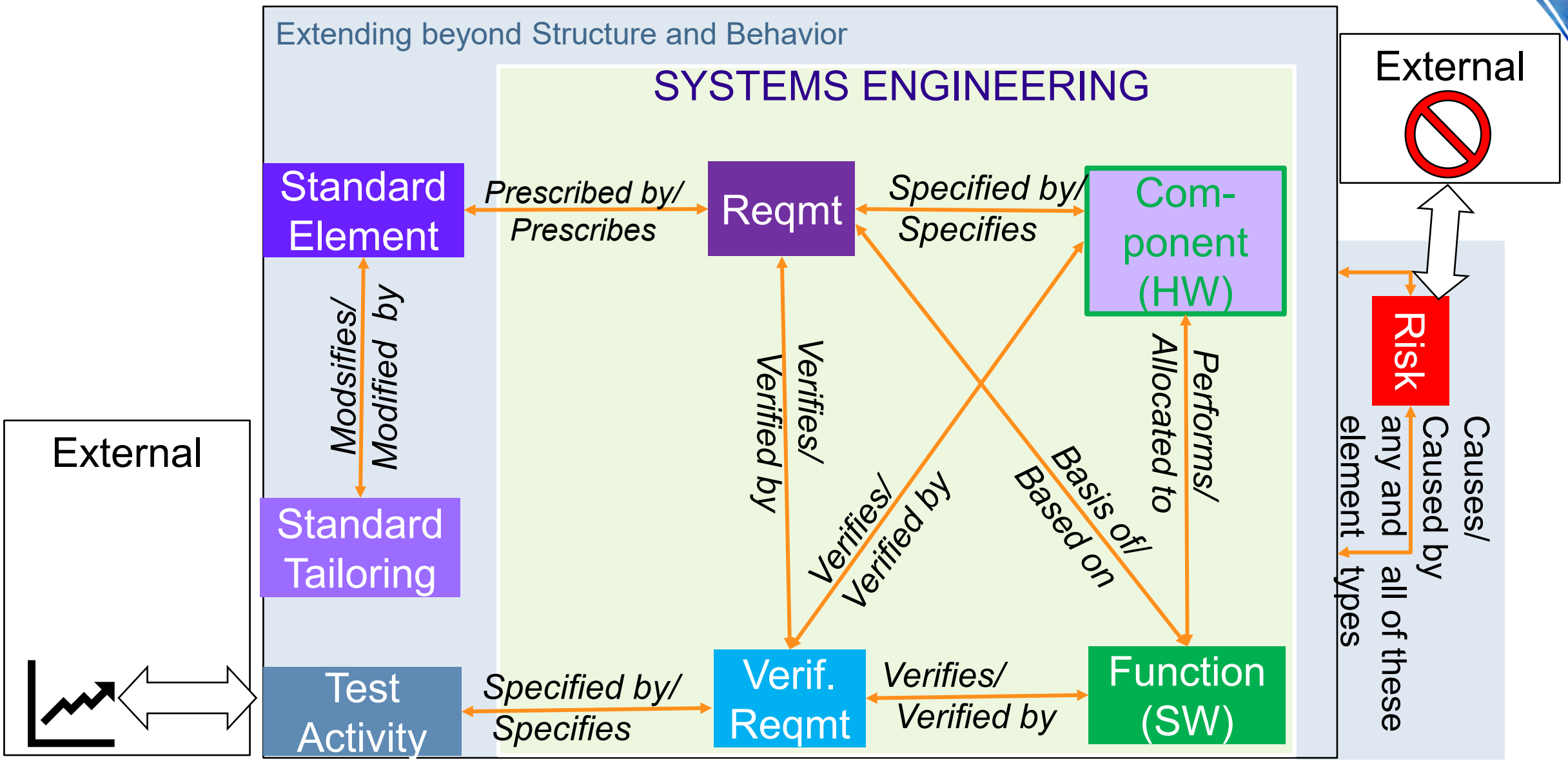
Subset of CII (not built into SysML)

Standards Management Within Digital Engineering

Including Standards, Requirements, Design and Test

Common Information Infrastructure (CII)

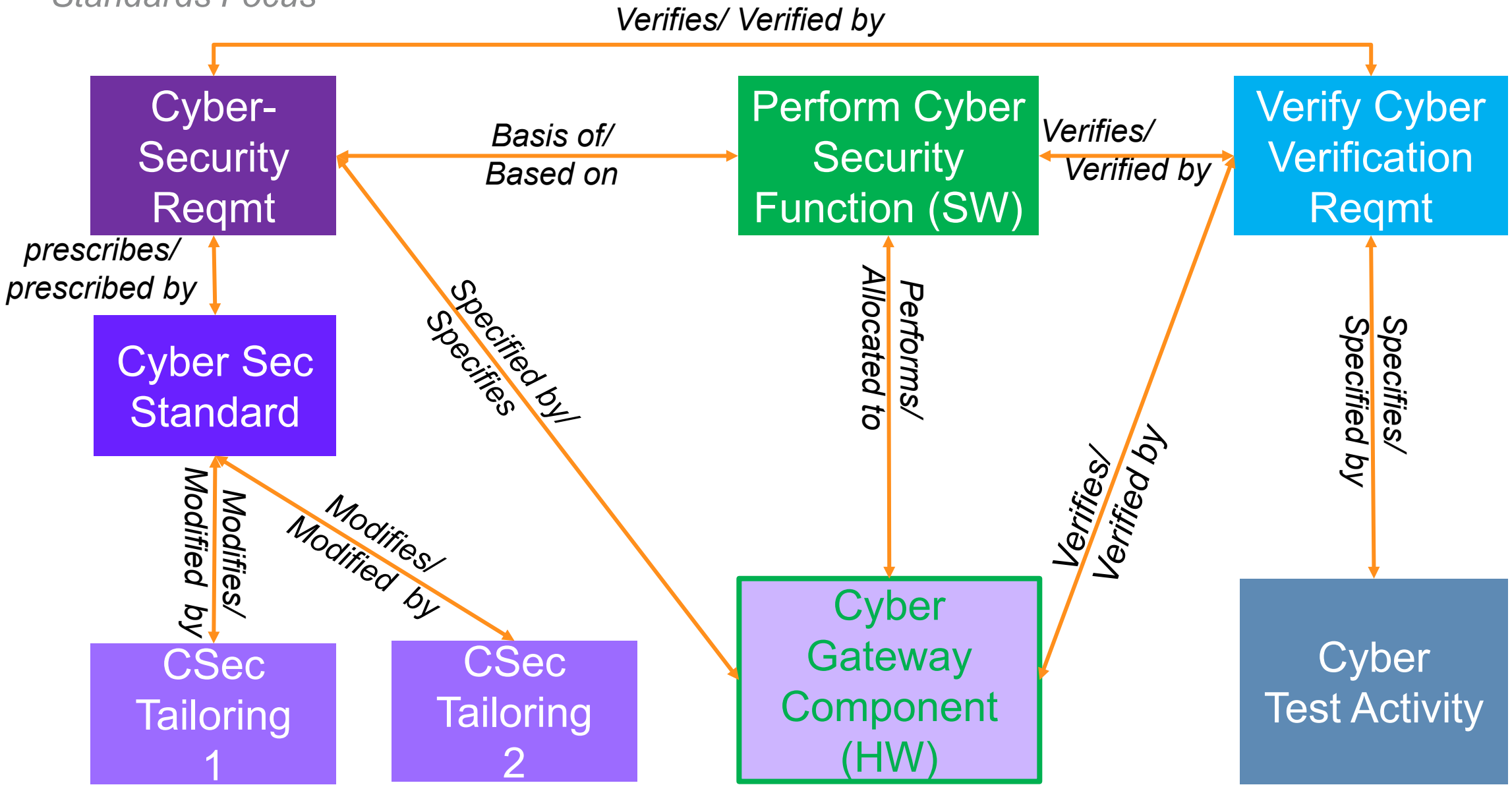
Standards Focus



Subset of CII (not built into SysML)

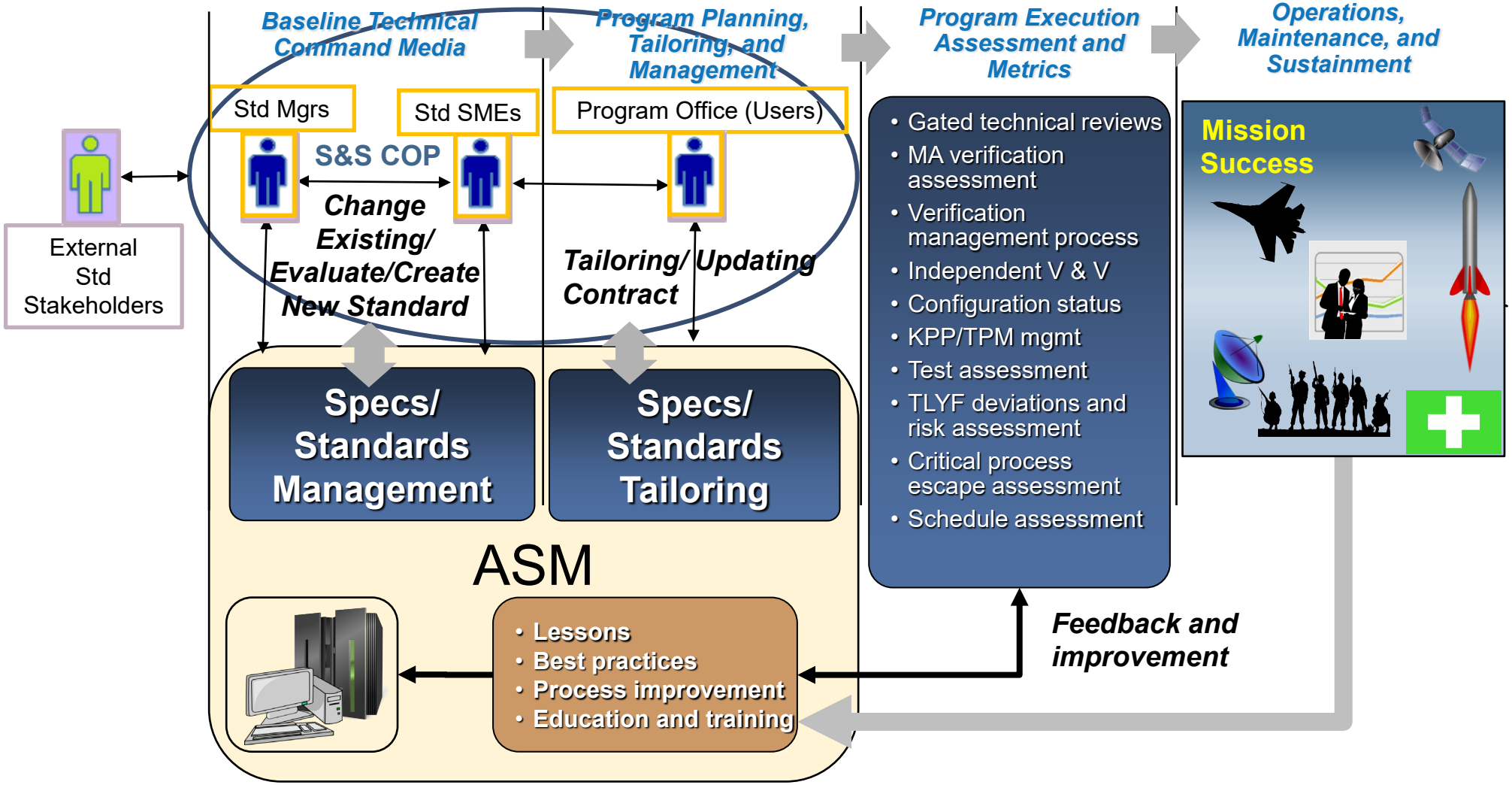
Common Information Infrastructure (CII)

Standards Focus



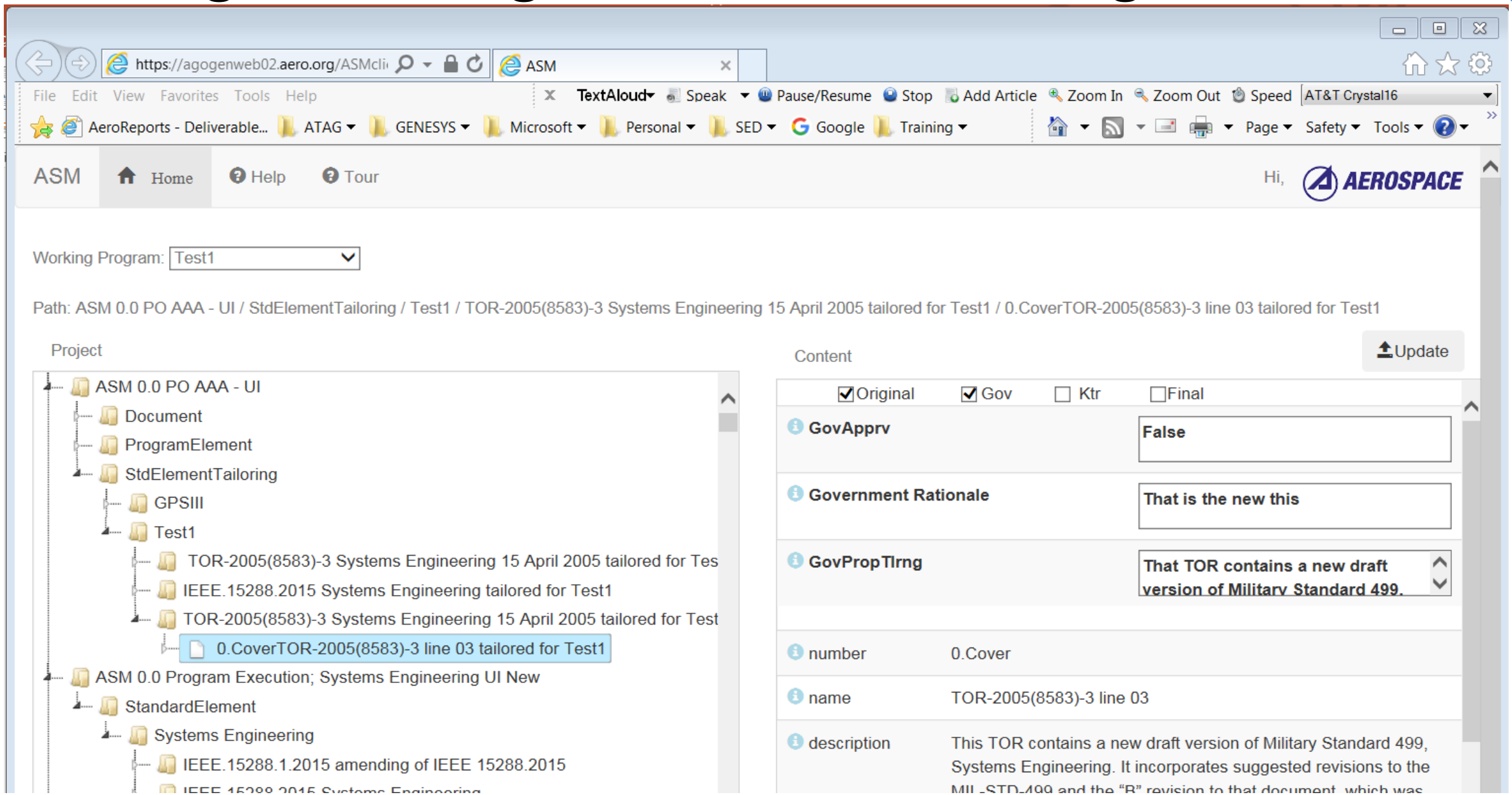
Aerospace Specs & Standards Model (ASM)

Updates based on well-defined use cases



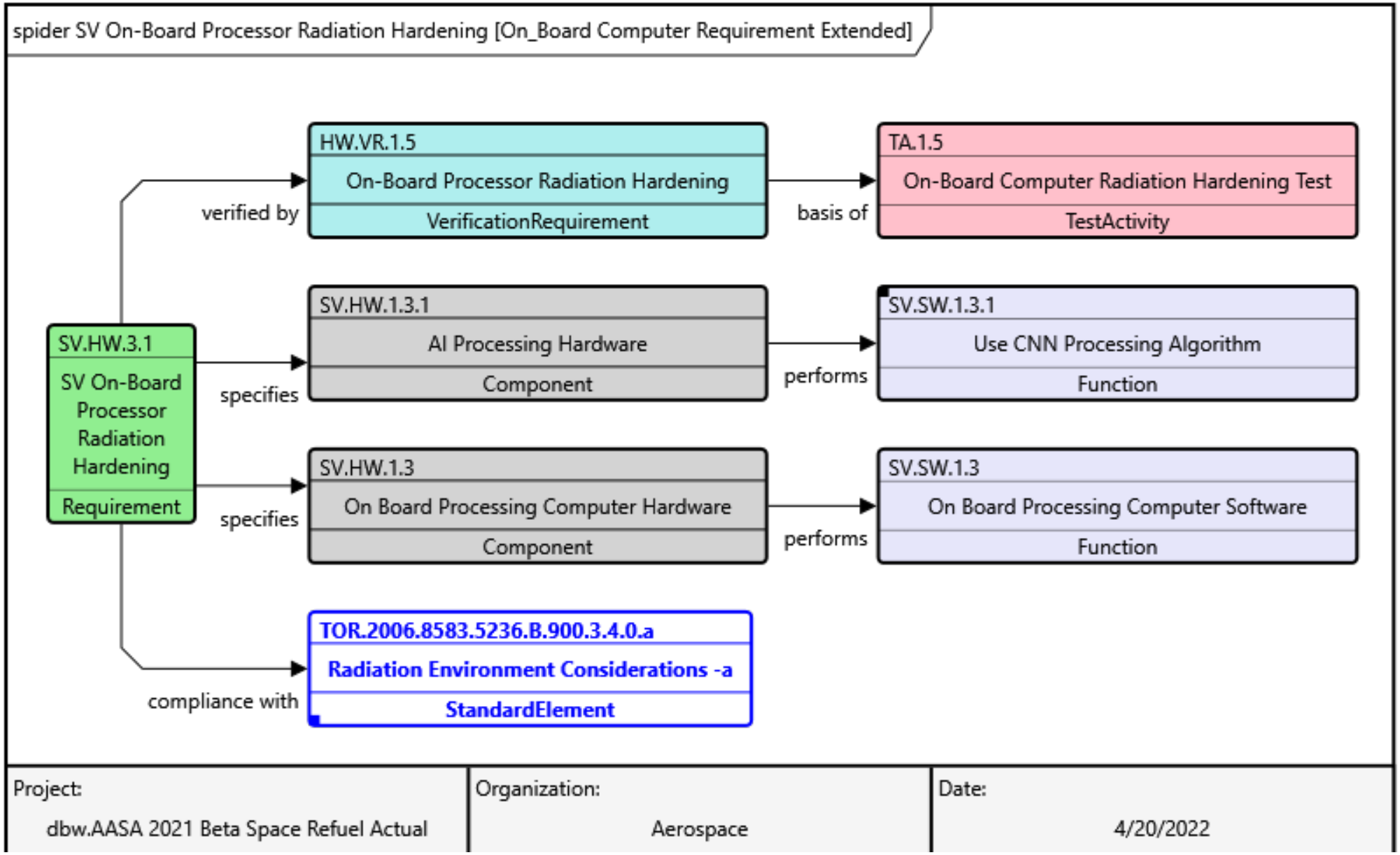
ASM Operational View (OV)-1 Living Document

Manage Tailorings of Standards using Web

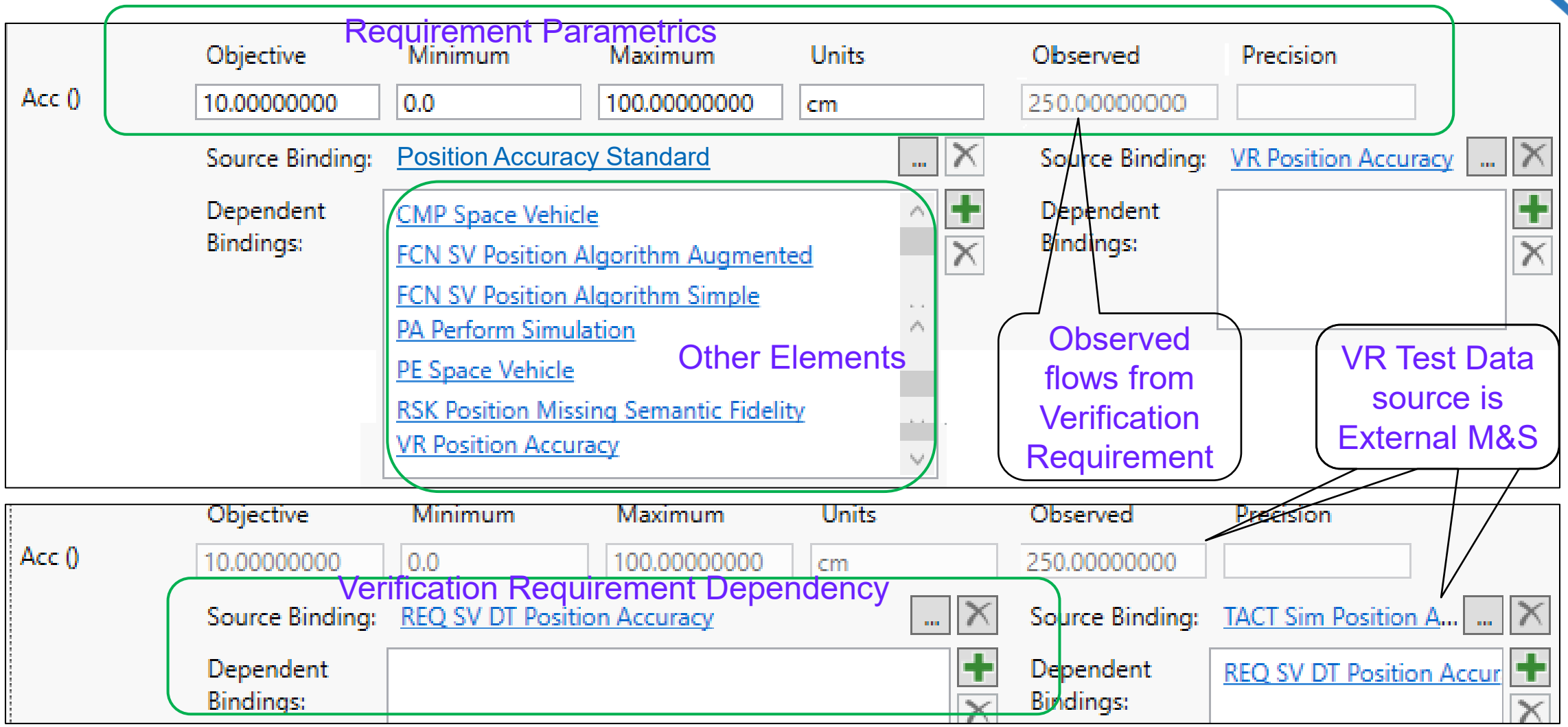


Requirements to Test, Design, & Standards

As CII elements



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



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.

Boom

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

M&S Semantic Fidelity Changes Everything!

Apply Semantic Fidelity

New Standard?

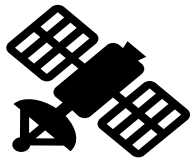
Thud

Two Simulators without Semantic Fidelity provide inaccurate results

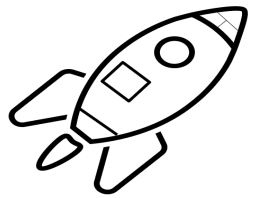
Semantic Fidelity Implemented

Python External File

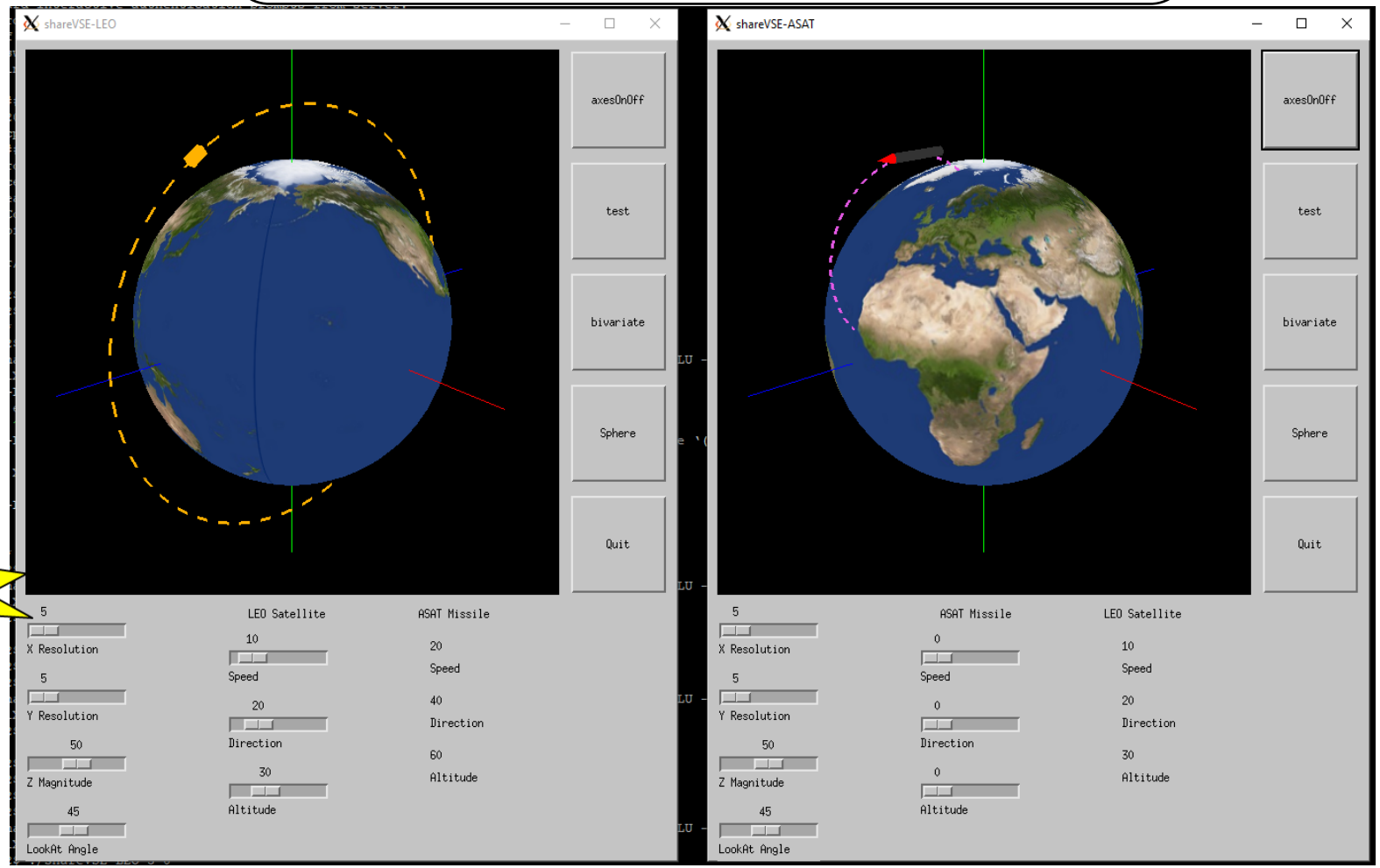
- Two Simulators
  - *Built Separately*
- Data from each has different parameterization
  - *models give inaccurate results*
  - *SV has semantic fidelity*
    - Includes atmospheric drag
  - *Interceptor Circular*
- Applied Semantic Fidelity to Interceptor
- Accurate Results



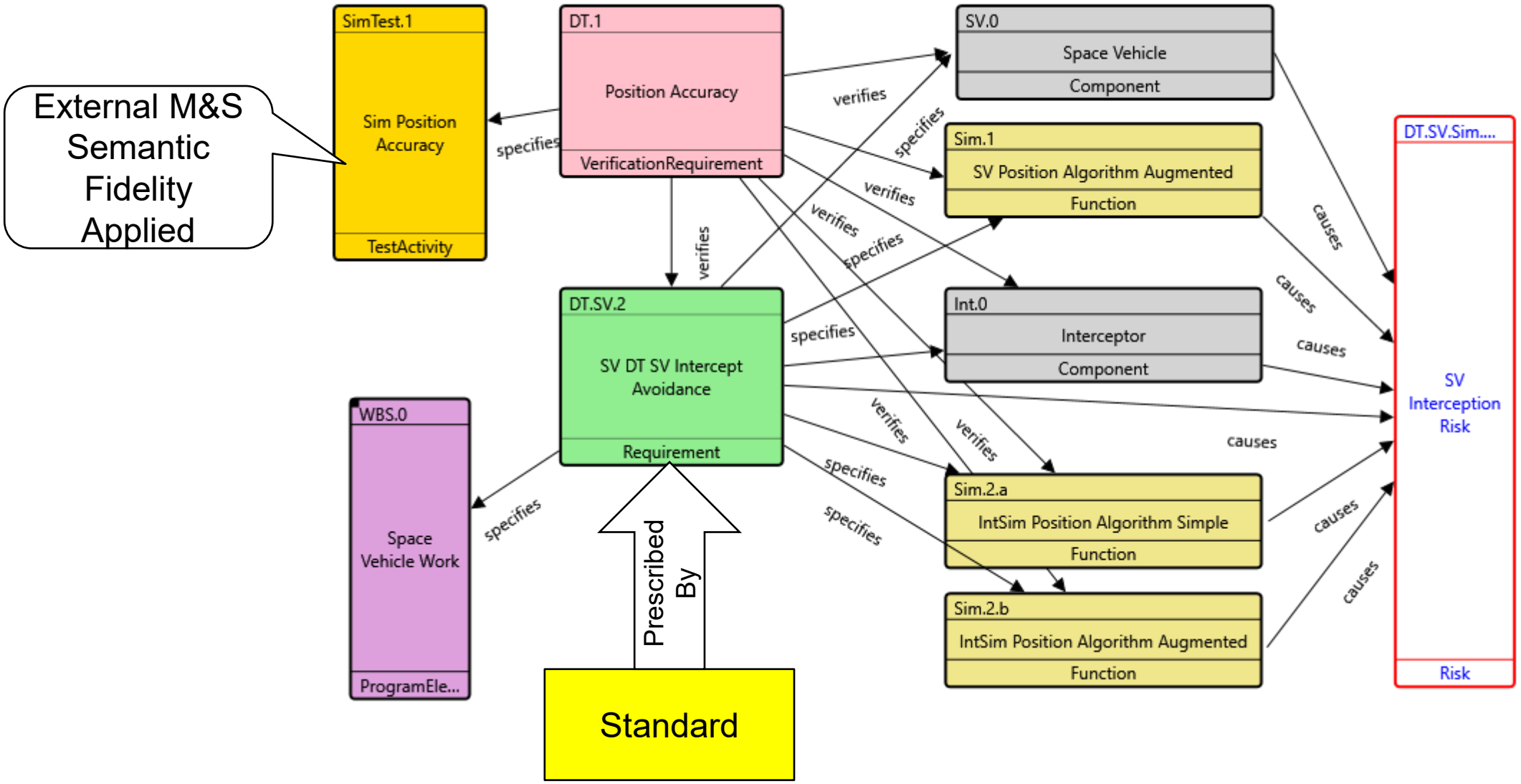
Digital Twins



Boom



Modeling and Sim Impact to System Choice



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

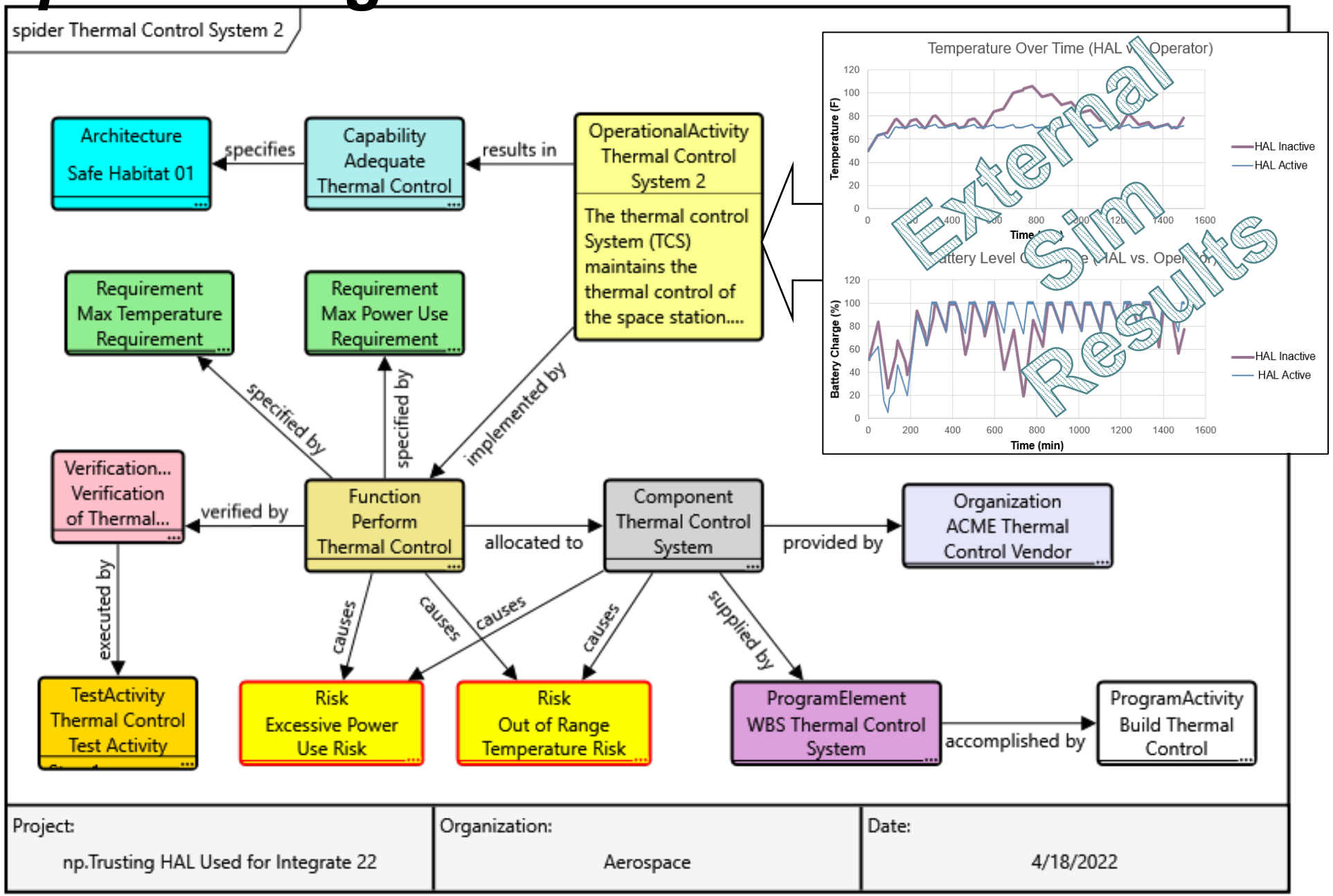
Questions?

DR. DIGITAL IS IN THE HOUSE

21

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