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AN ARCFIELD COMPANY

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A Flexible MBSE SysML Profile for Effective Test & Evaluation Planning and Integration

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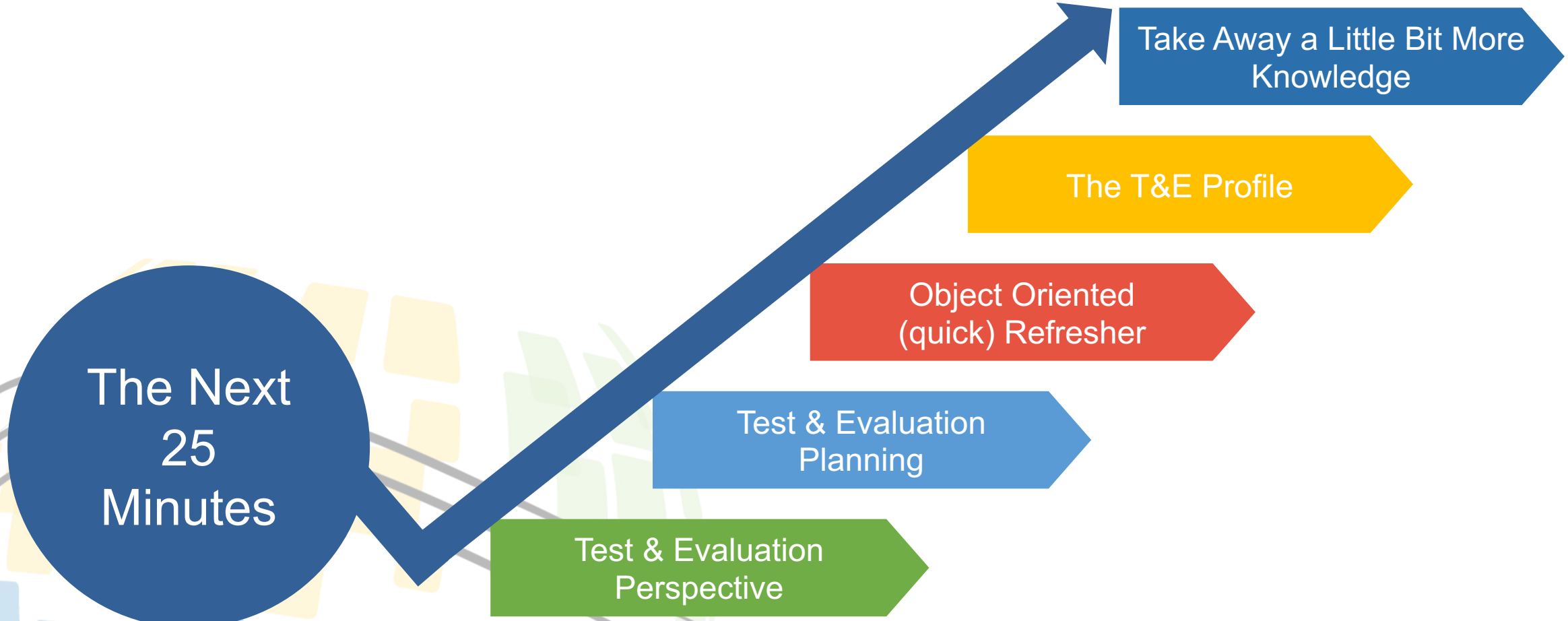
Path of this Presentation



Perspective

T&E

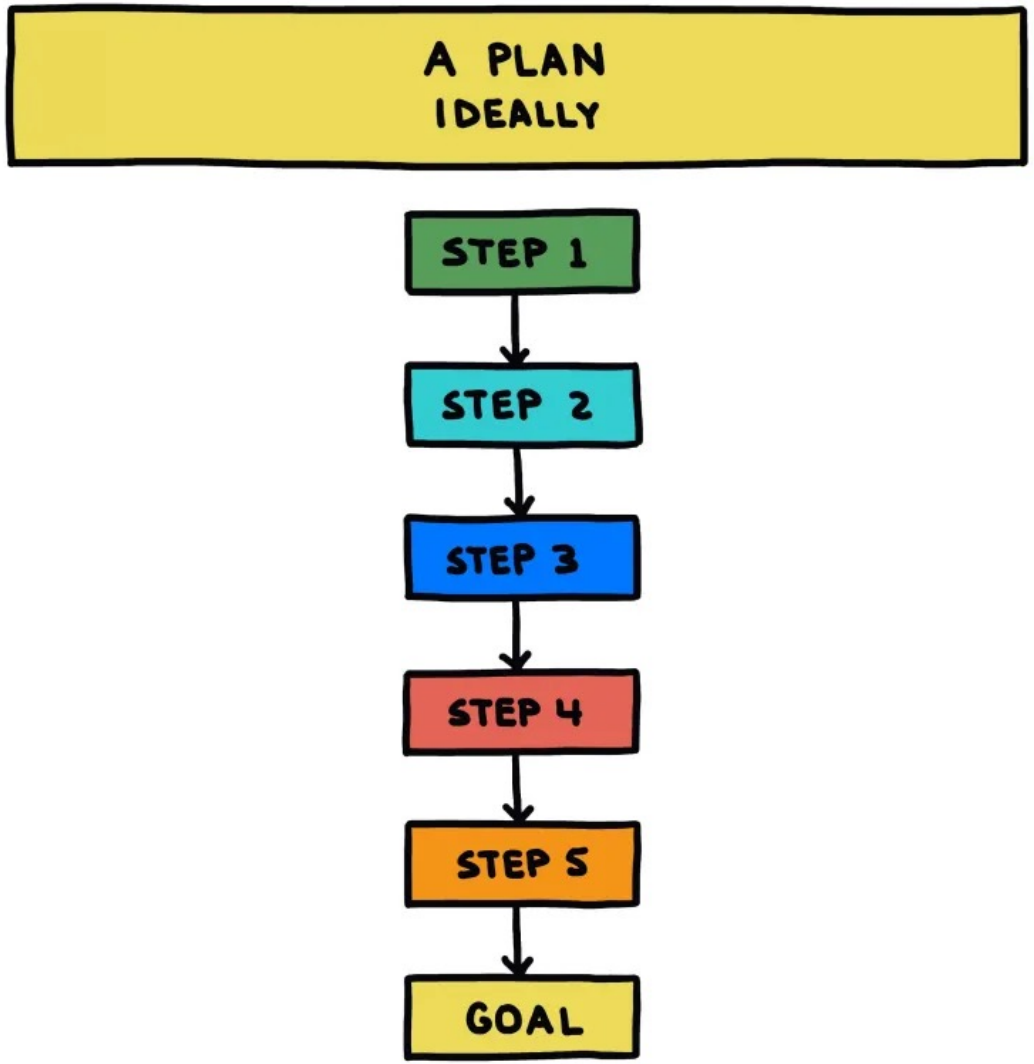
Test and Evaluation (DoD)

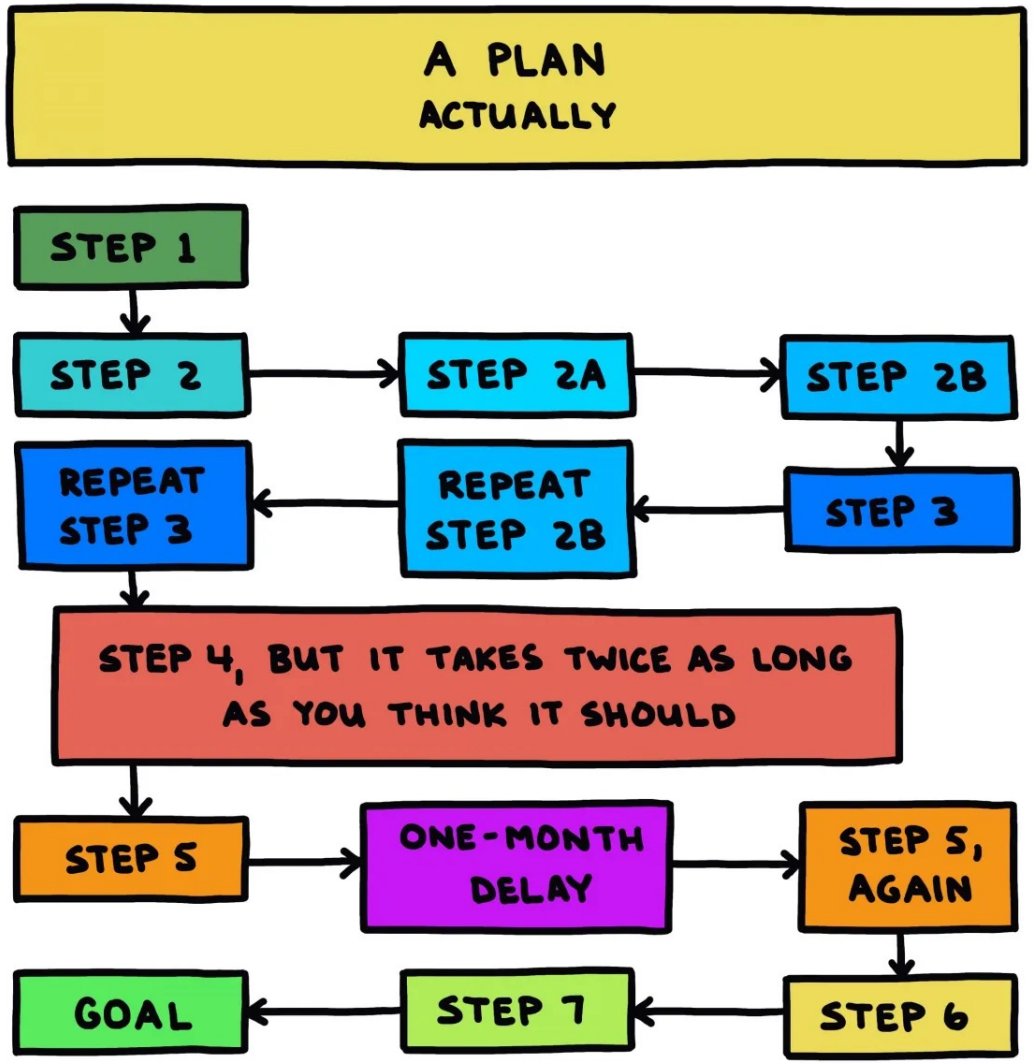
"T&E is a critical part of the DoD acquisition process. T&E professionals develop, optimize, execute and evaluate the testing of system performance, interoperability, reliability, maintainability and cybersecurity. They offer unbiased information to support and inform design improvements, production and fielding decisions."

~ Defense Acquisition University

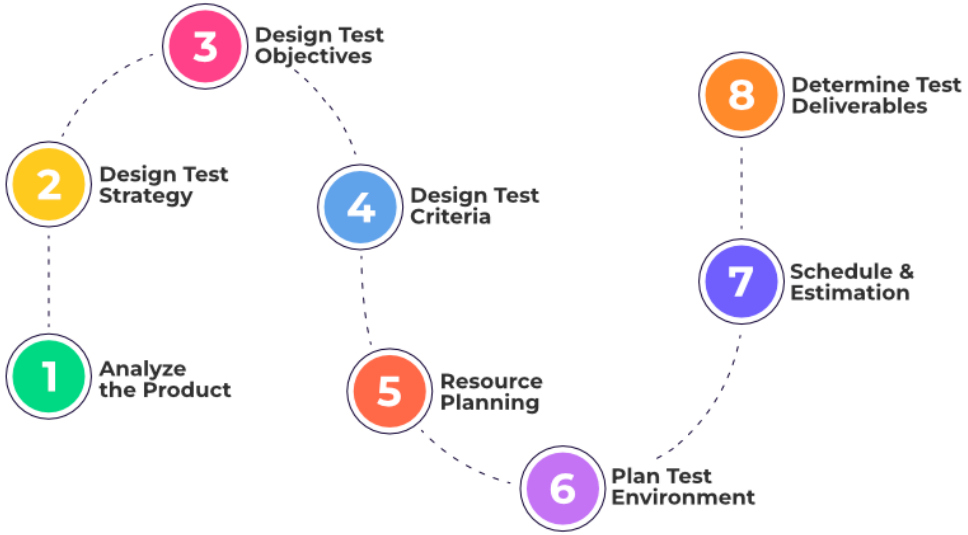
Planning

T&E

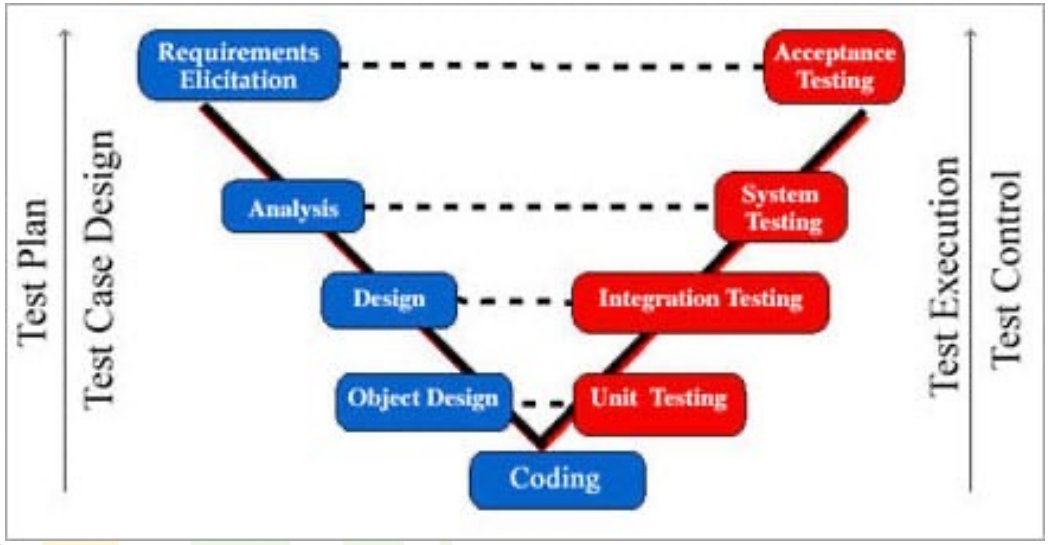

A PLAN
IDEALLY
STEP 1
STEP 2
STEP 3
STEP 4
STEP 5
GOAL


A PLAN
ACTUALLY
STEP 1
STEP 2
STEP 2A
STEP 2B
REPEAT STEP 3
REPEAT STEP 2B
STEP 3
STEP 4, BUT IT TAKES TWICE AS LONG AS YOU THINK IT SHOULD
STEP 5
ONE-MONTH DELAY
STEP 5, AGAIN
GOAL
STEP 7
STEP 6

Test Planning Activities & Attributes



Test Planning Activities & Attributes



T&E Planning Benefits from This Approach

- An appropriately robust T&E approach is dependent on many factors
- T&E Planning can be seen as system architecture where Test is the System
- A Systems approach using a set of relevant stereotypes in SysML will capture the T&E planning architecture
- **More Effective T&E**

Refresher

Object Oriented

Four Key OO Relationships

- Class or Interface
- *Apple **is a** fruit; Ferrari **is a** car*

- Instance variables are references to objects
- Entities are interdependent
- Engine is ***part of*** car; Lungs are ***part of*** body

IS-A relationship

Inheritance

Composition

PART-OF relationship

HAS-A relationship

Association

Aggregation

(special) ***HAS-A*** relationship

- Between two classes through their objects
- One to one/many, many to one/many
- Entities share objects for work
- Can exist without each others dependency
- Both have their own life time

- One entity as owner
- Entities meet for work and then separate
- One-way association

SysML Profile

T&E

Building a T&E Approach

TEMP

Building a T&E Approach

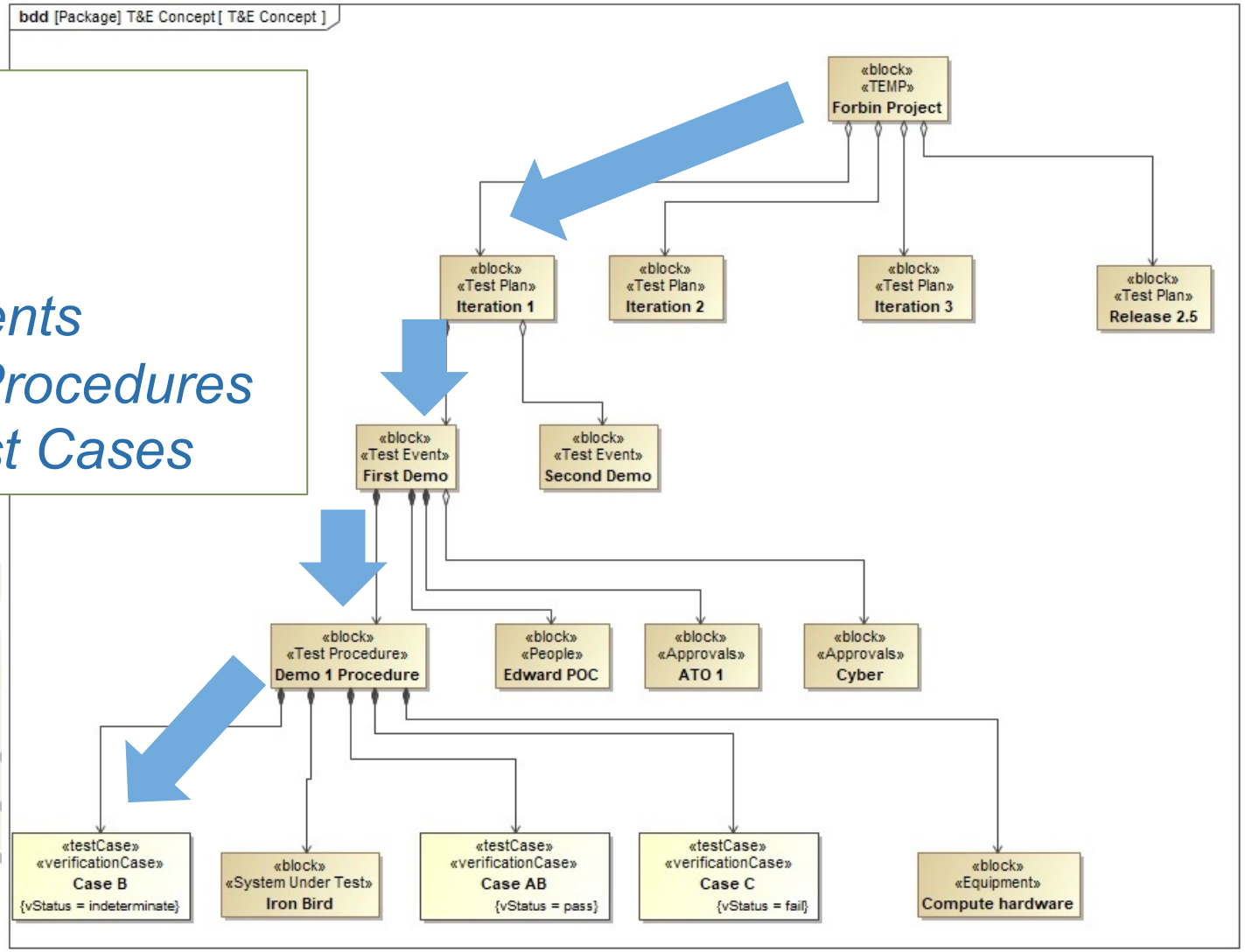
TEMP

Has *Test Plans*

Which include *Test Events*

Which have *Test Procedures*

That have *Test Cases*

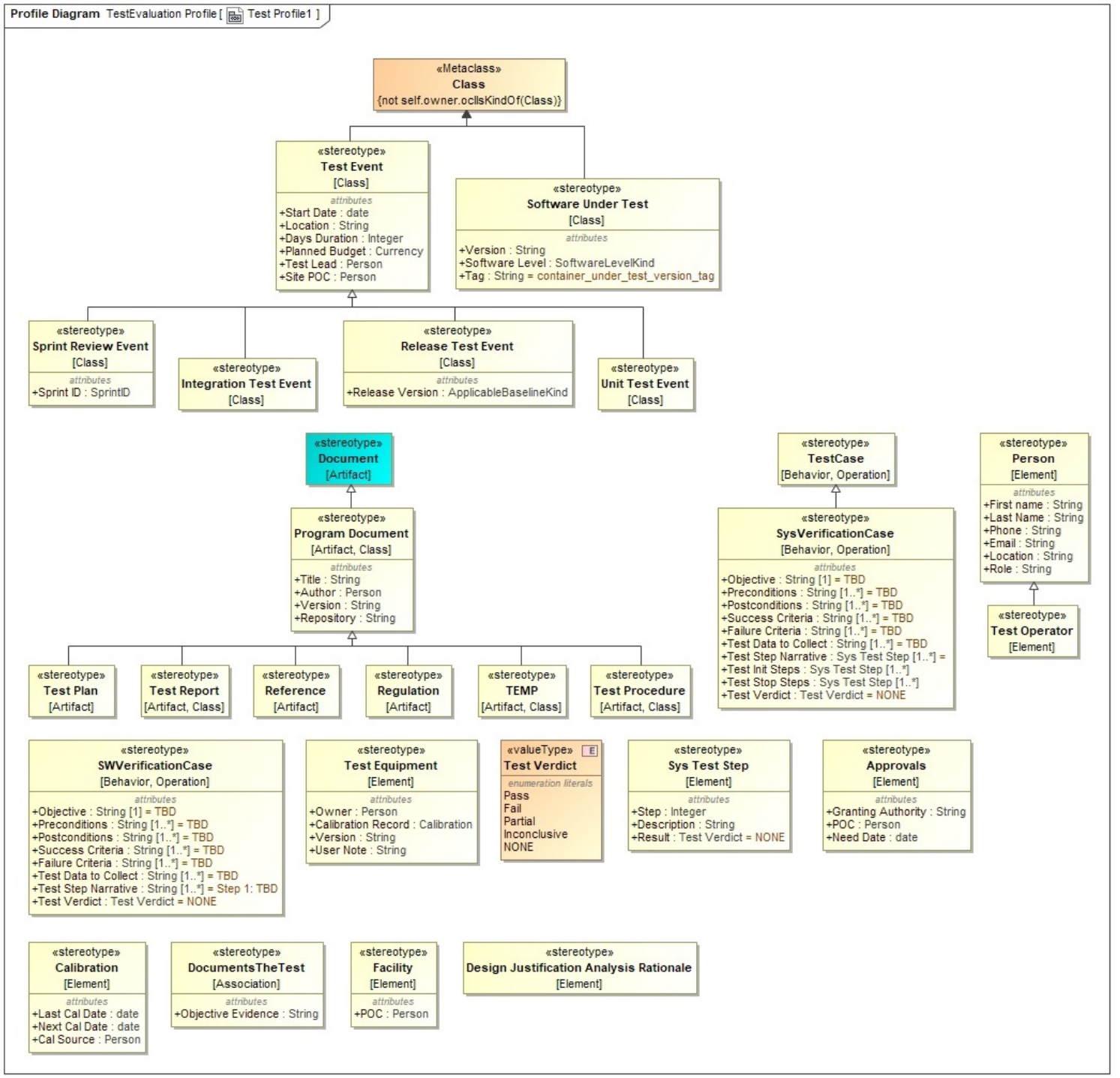


The Profile

Structured SysML Profile

- Events
- People
- Equipment & Facilities
- Other Necessities

This is *One* example. *You* will define the elements that comprise *Your* T&E approach

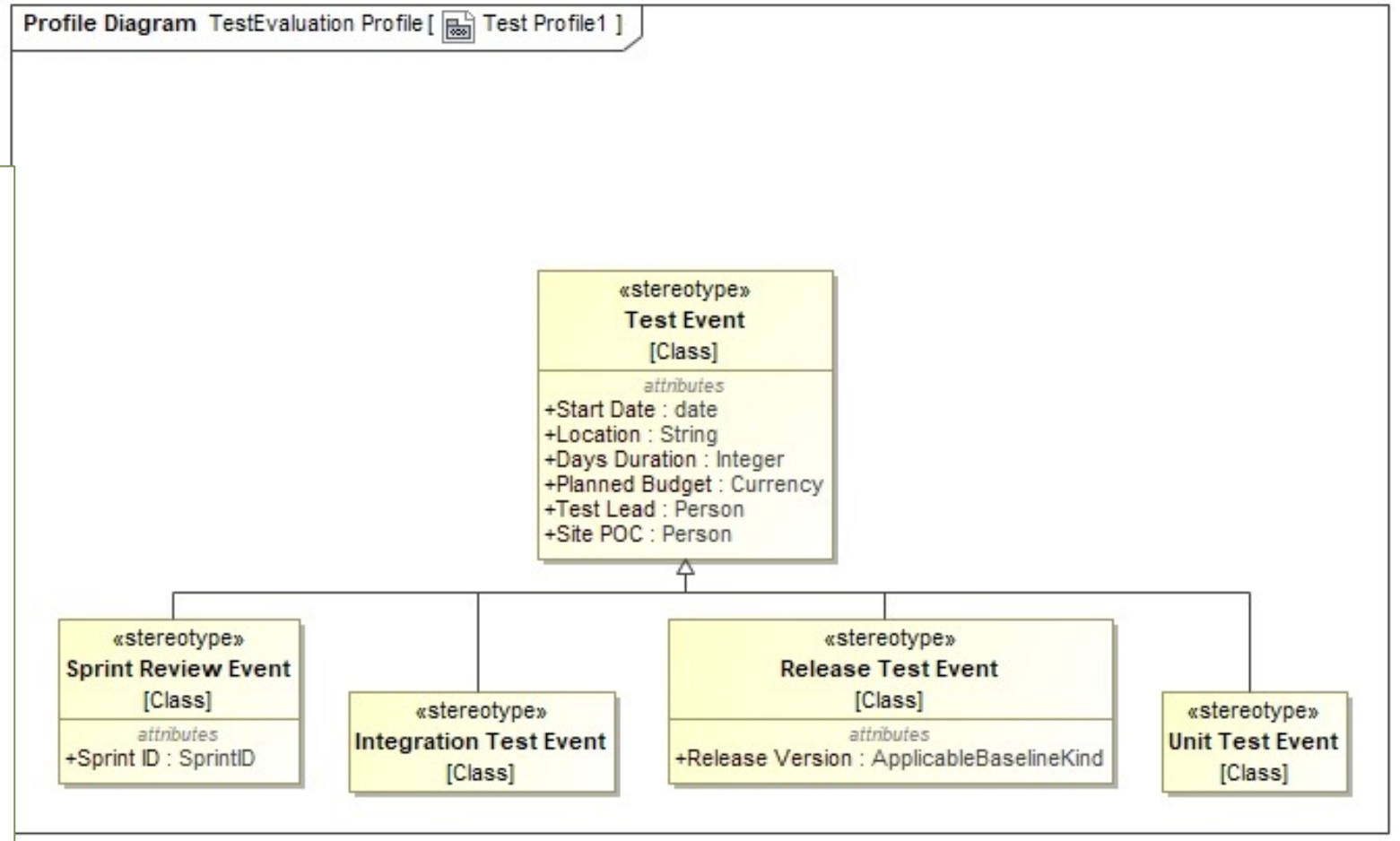


Events

Test Event Stereotype

- Date
- Location
- Duration
- Budget
- People

Other Event stereotypes further refine, as necessary.

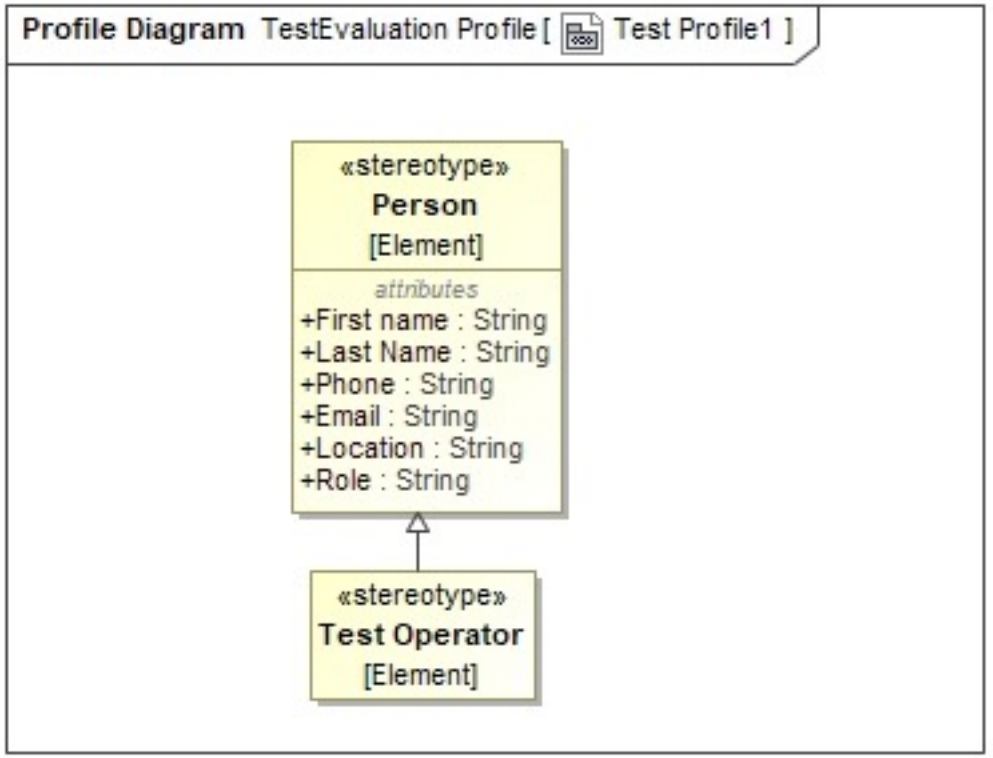


People

Person Stereotype

- Basic Info

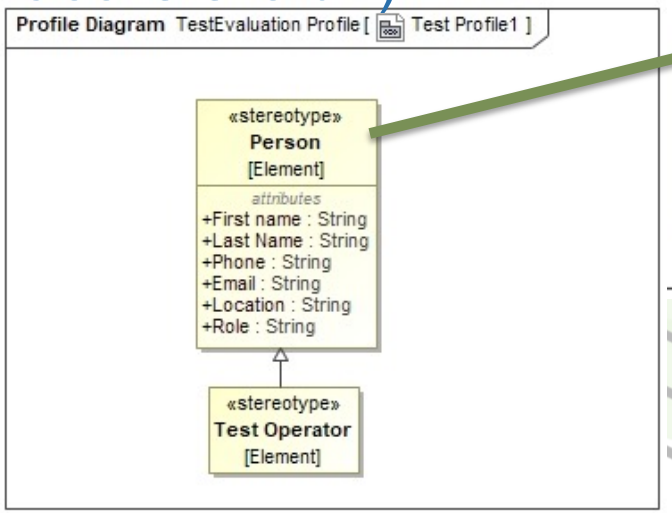
Other stereotypes further refine, as necessary.

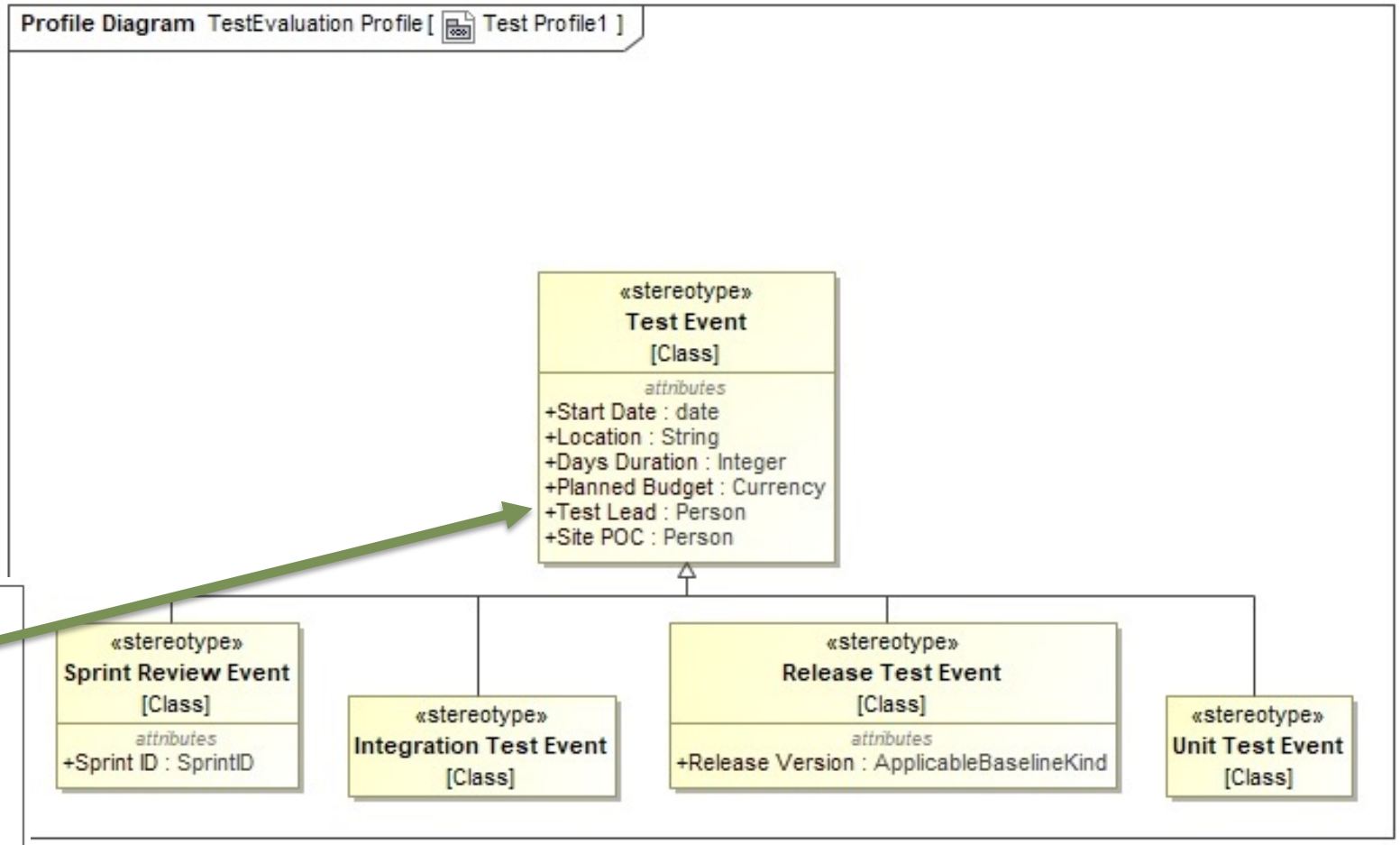


Event Person

Person Stereotype used in *Event* stereotype

Leverage the Profile to build *other* stereotypes in the Profile (Class OO stuff)

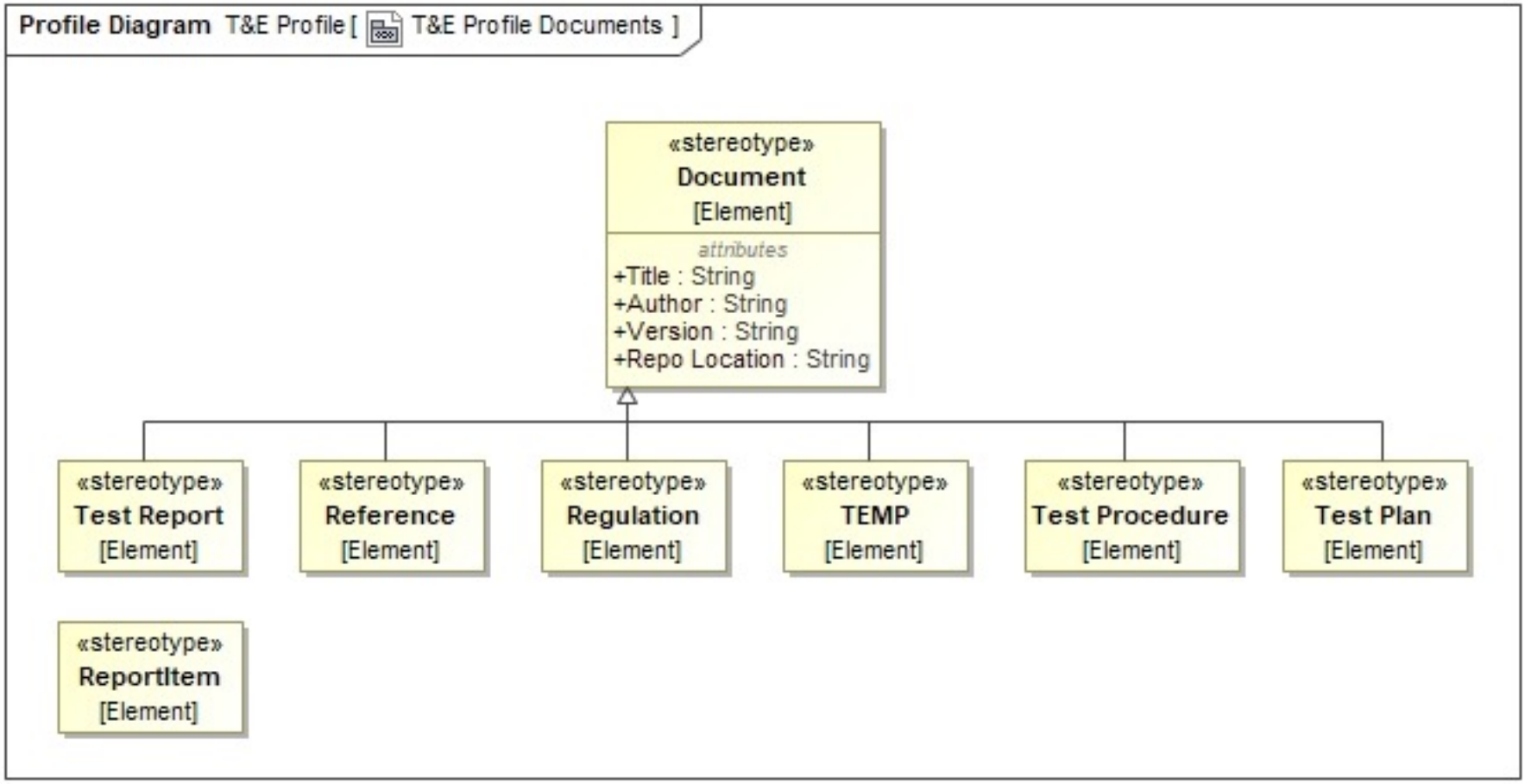




Documents

Where Documents are still necessary in your organization.

This becomes more important later…

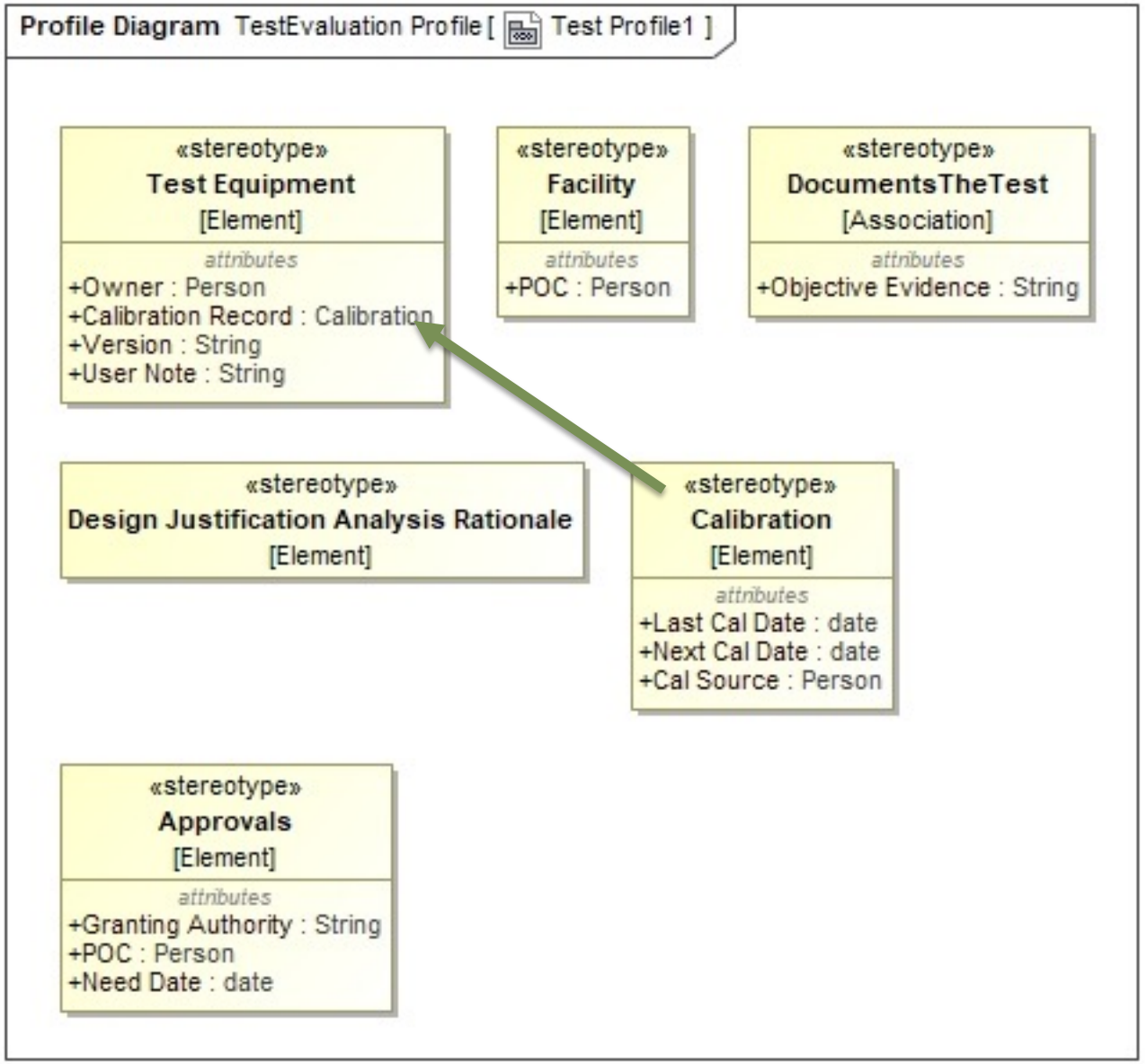


Other Items

Single Stereotypes

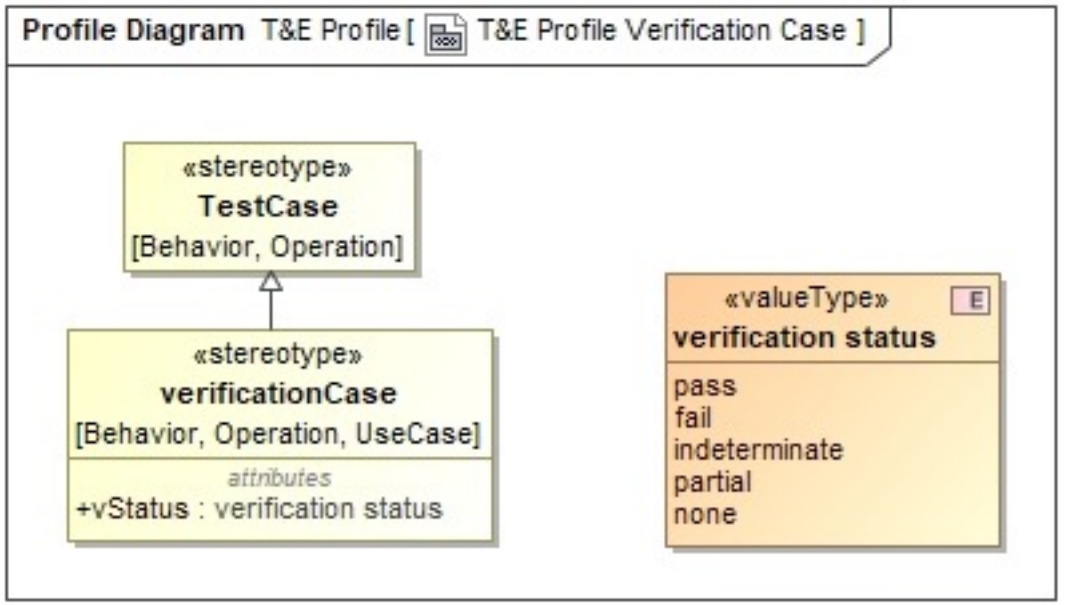
- Equipment
- Calibration
- Approvals
- Facilities

Leverage the structure built in the Profile



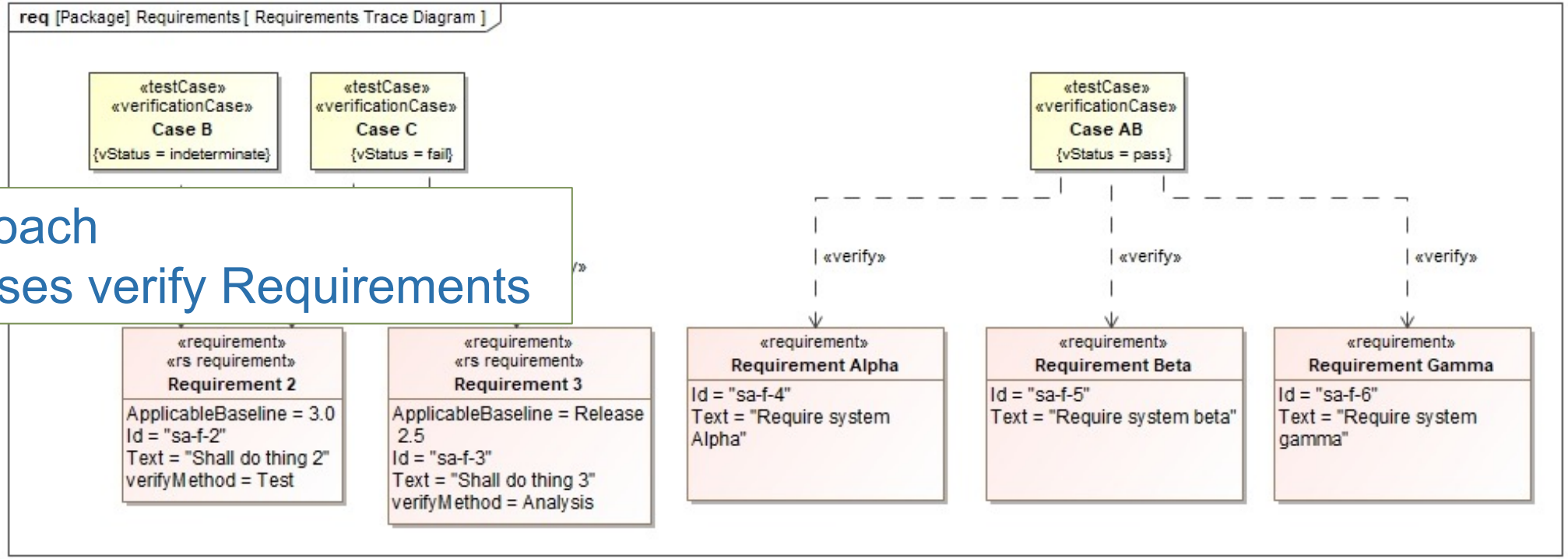
Building a T&E Approach

Verification Case extends TestCase



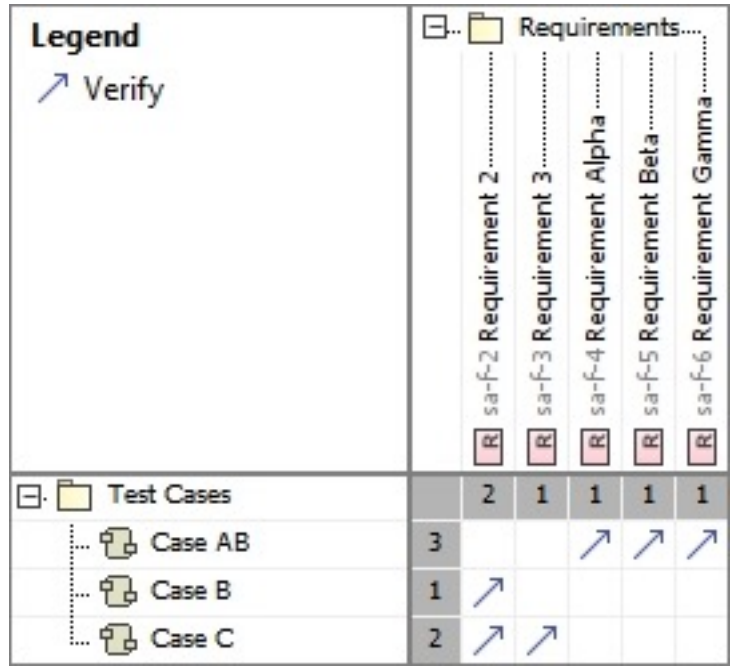
Building a T&E Approach

Standard approach
Verification Cases verify Requirements



Using The Traceability

Standard Verify Matrix
Standard Requirement Table
Standard Verifies Table



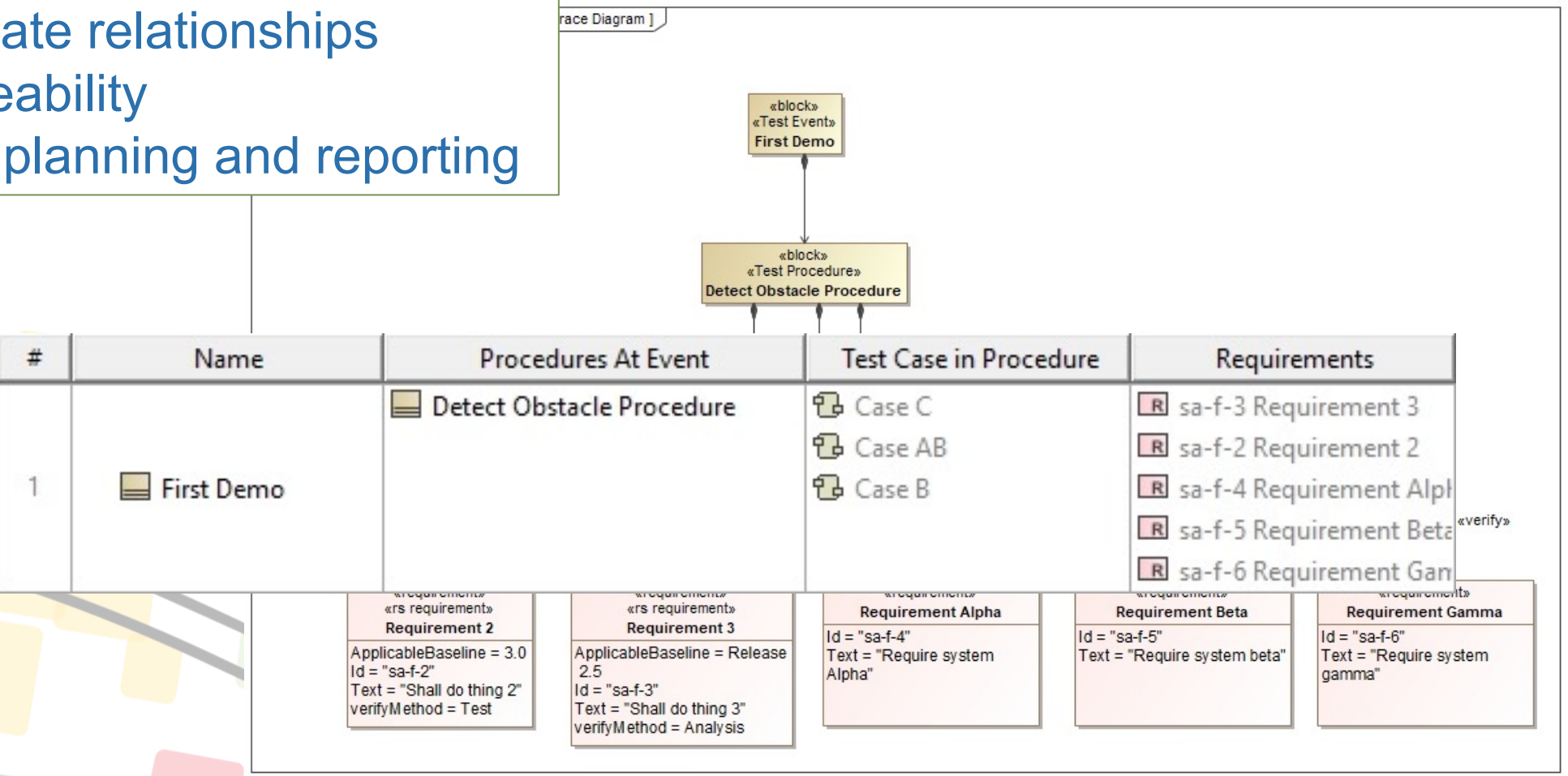
Legend	Requirements				
Verify	sa-f-2 Requirement 2	sa-f-3 Requirement 3	sa-f-4 Requirement Alpha	sa-f-5 Requirement Beta	sa-f-6 Requirement Gamma
Test Cases	2	1	1	1	1
3 Case AB			↗	↗	↗
1 Case B	↗				
2 Case C	↗	↗			

#	Name	Text
1	sa-f-2 Requirement 2	Shall do thing 2
2	sa-f-3 Requirement 3	Shall do thing 3
3	sa-f-4 Requirement Alpha	Require system Alpha
		uire system beta
		uire system gamma

#	Name	Verifies
1	Case AB	sa-f-4 Requirement Alpha sa-f-5 Requirement Beta sa-f-6 Requirement Gamma
2	Case B	sa-f-2 Requirement 2
3	Case C	sa-f-3 Requirement 3 sa-f-2 Requirement 2

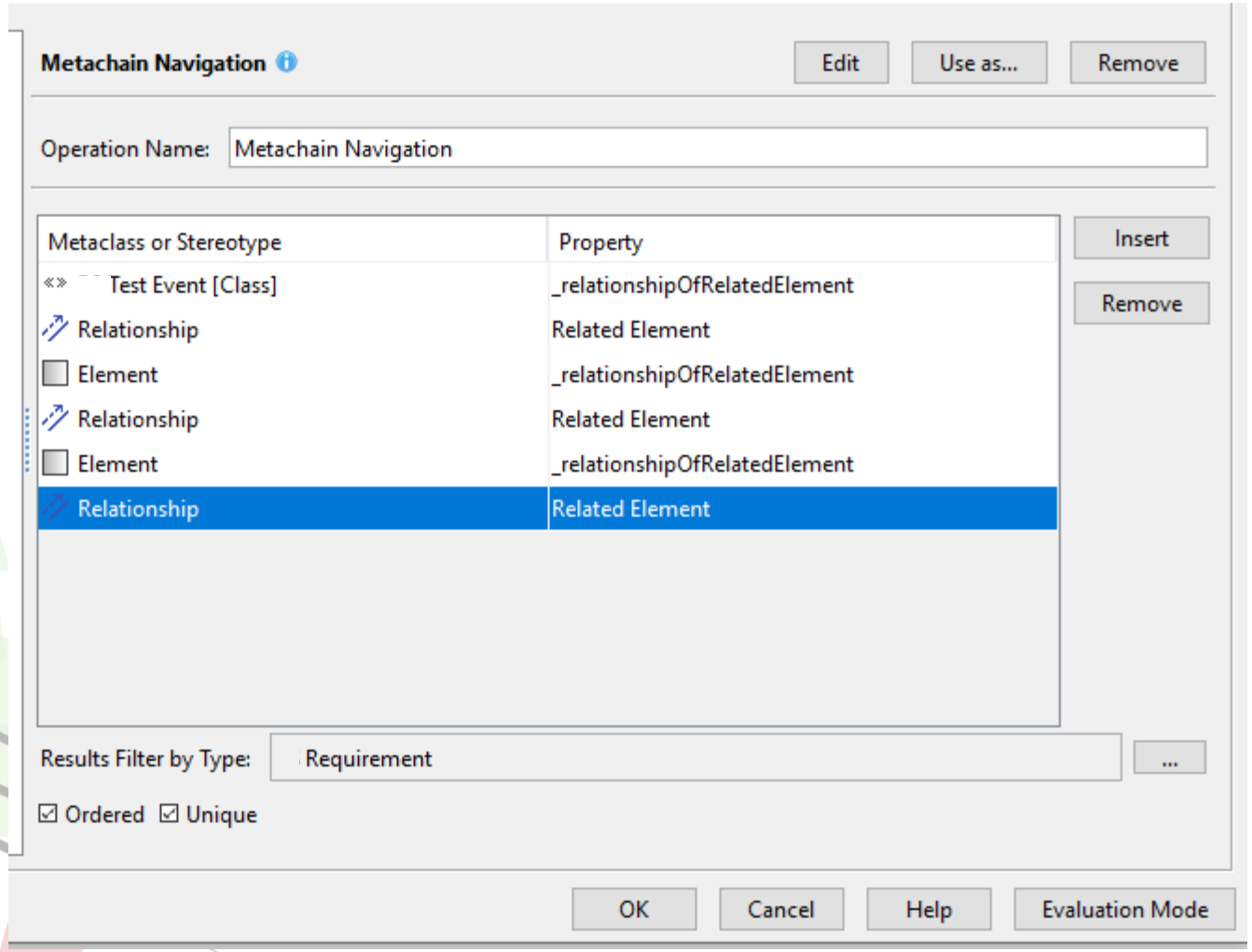
Events-Contain-Procedures-Contain-Cases

Creating appropriate relationships
enables traceability
enables planning and reporting



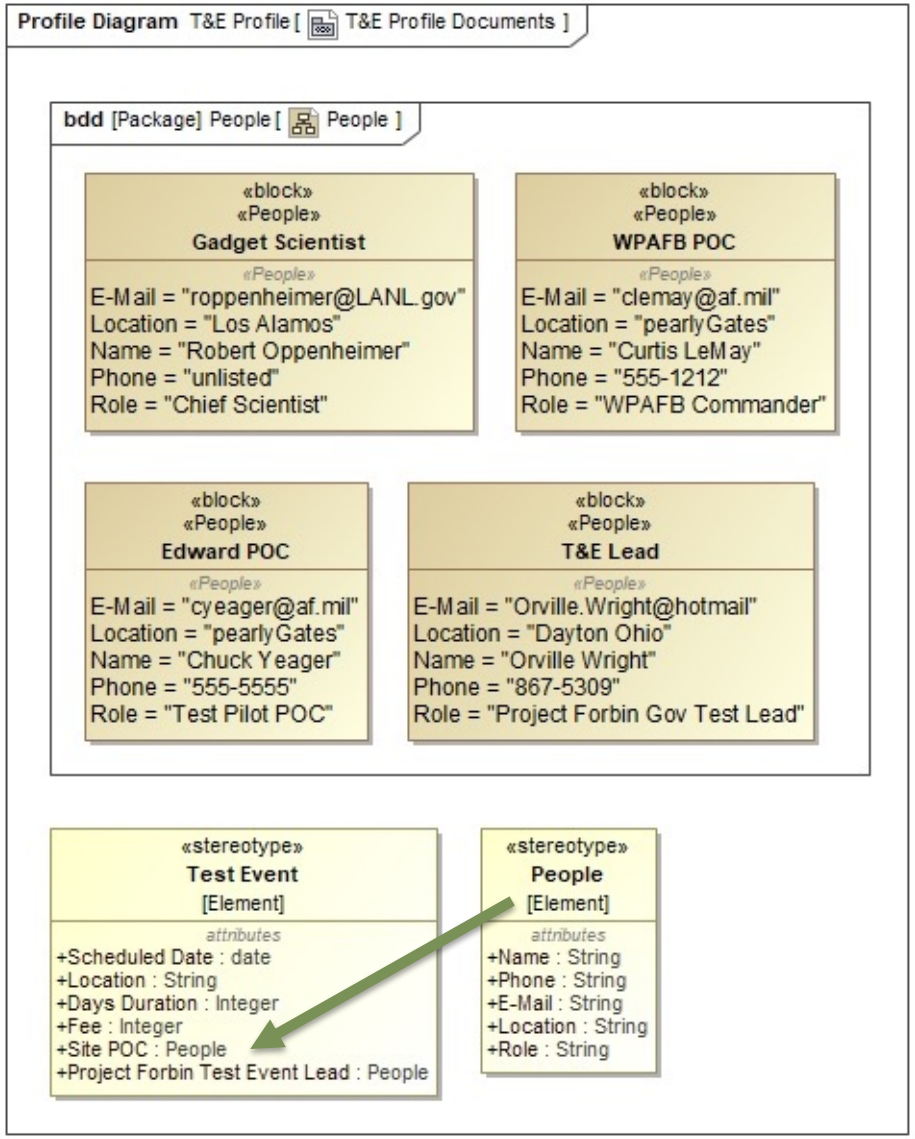
Fun with Metachain Navigation…

Cameo Example
- Uses Stereotypes
- Leverages Relationships



Other Metadata

- Flexible
- Define *your* test approach
- Leverage Stereotypes
- Manage Metadata



Other Metadata

Tables, Diagrams, Reports…

Architect the Test
Architect the Test Data
Architect the Test Metadata

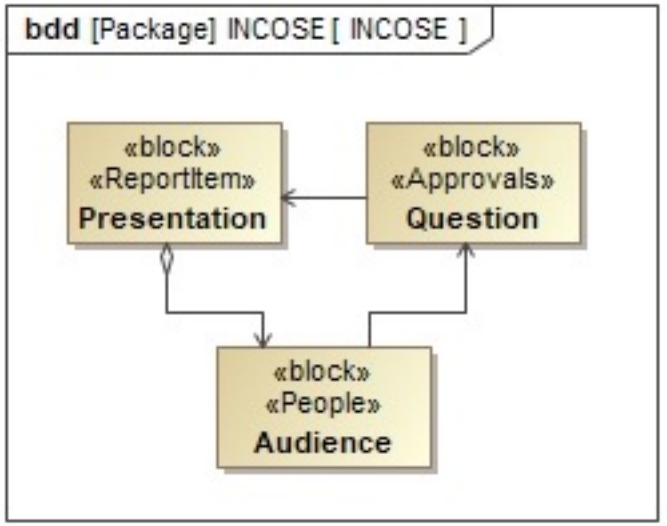
#	Name	Event Information
1	First Demo	Scheduled Date = "3/14/24" Location = "Edwards AFB" Fee = 0 Days Duration = 8 E-Mail = "cyeager@af.mil" Location = "pearlyGates" Name = "Chuck Yeager" Phone = "555-5555" Role = "Test Pilot POC"
2	Second Demo	Days Duration = 3 Fee = 0 Location = "WPAFB" Scheduled Date = "6/21/24"

Take Away

Take Away

- Apply MBSE/SysML SE Architecture Concepts to Plan T&E
- Flexible Approach
- Effective
- Extensible

It's thinking about System Architecture, where the *System* is the T&E approach.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Questions?

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