Data-Driven Test & Evaluation

October 18, 2023

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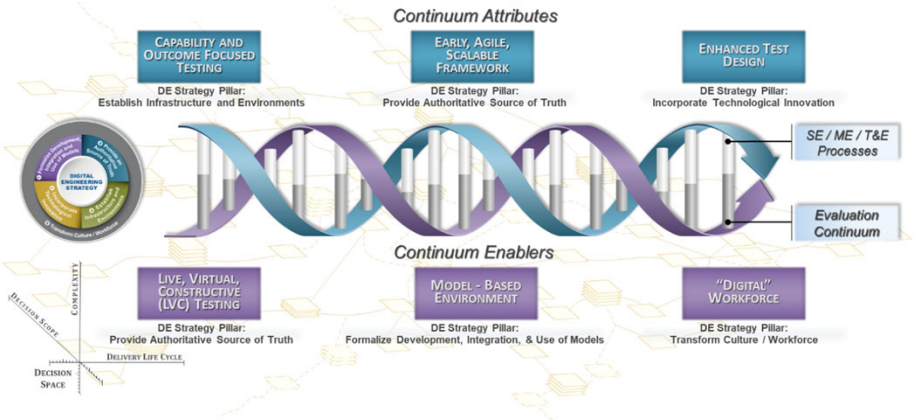
Agenda

- What is the T&E Continuum?
- Why is an ontology needed?
- Why choose LML?
- How does it aid in integrating T&E with digital engineering?
- How can we implement this language?
- How does this provide for the T&E continuum?

What is the Test and Evaluation as a Continuum Concept?

- Recently, Mr. Christopher Collins and Mr. Kenneth Senechal published an article in the ITEA Journal* that proposed:
  - "a critical change in how test and evaluation (T&E) support capability delivery."
- The new approach uses T&E continually throughout the lifecycle to inform development and fielding decisions



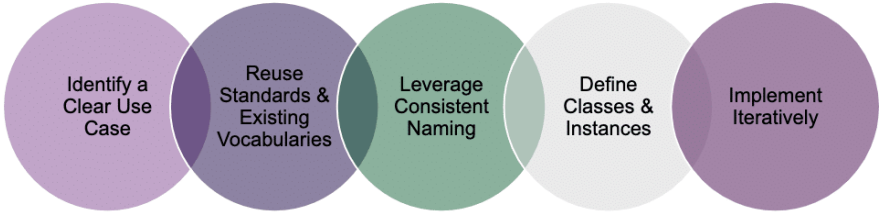
But how can we implement this concept?

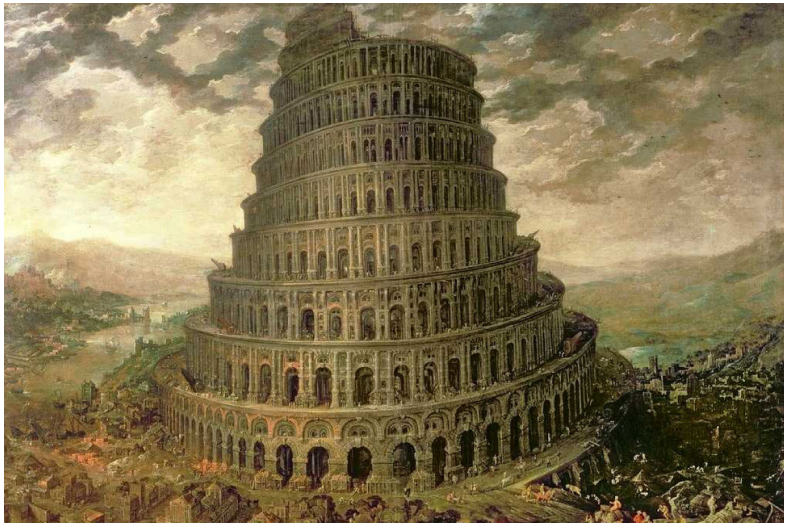
We need to understand how the data collected during T&E influences decisions early in the lifecycle … we need an ontology.

*https://itea.org/journals/volume-44-1/test-and-evaluation-as-a-continuum/

Why is an ontology needed?

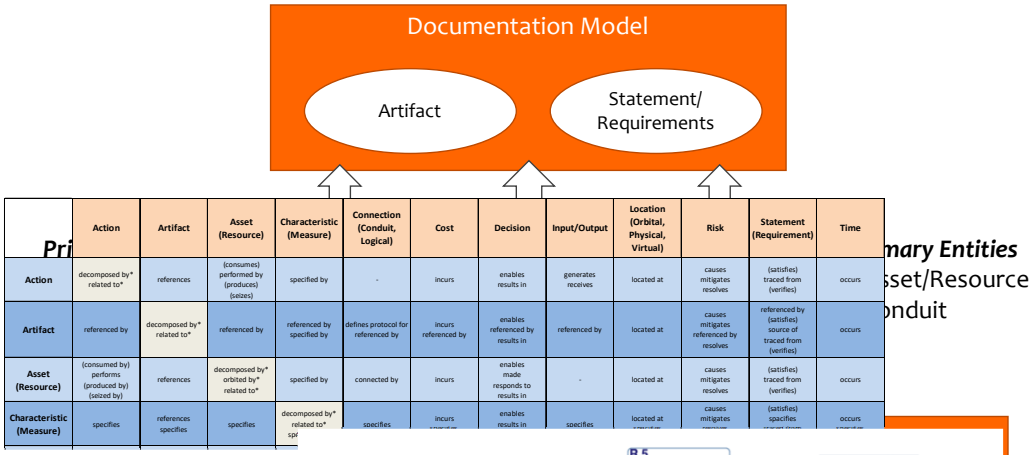
- An ontology (taxonomy + relationships) provides a language for communications
- Developing one is a lot of work, but important when you want people to work together
- Each discipline has its own language
- Having different languages can cause confusion

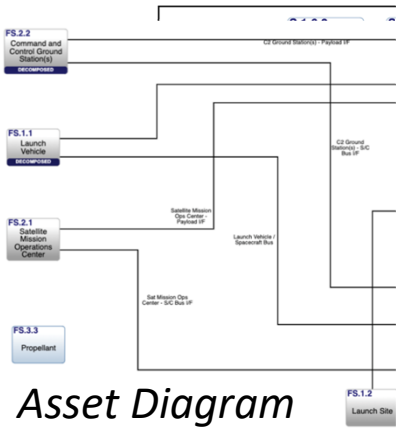


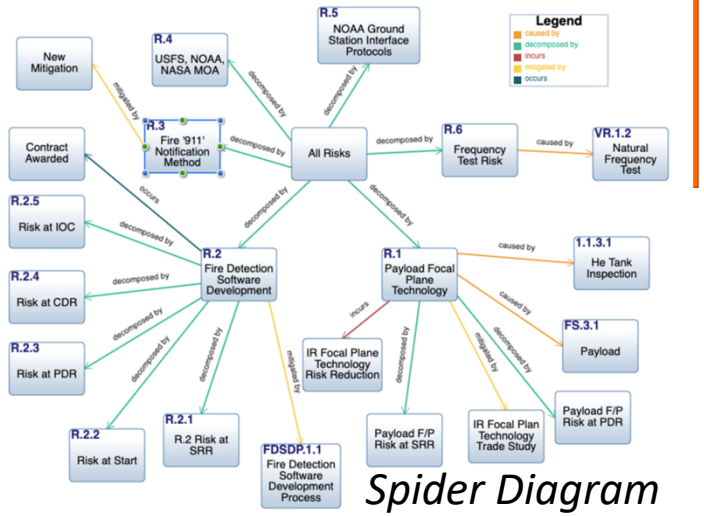


Why choose LML?

- Lifecycle Modeling Language, first published in 2013, provides a simple ontology that covers systems engineering and program management
- The current version, v1.4, was released October 20, 2022
- Each version includes extensions, in the form of Appendices including extensions for DoDAF and SysML
- LML v1.5 will provide a mapping to SysML v2 and BPMN







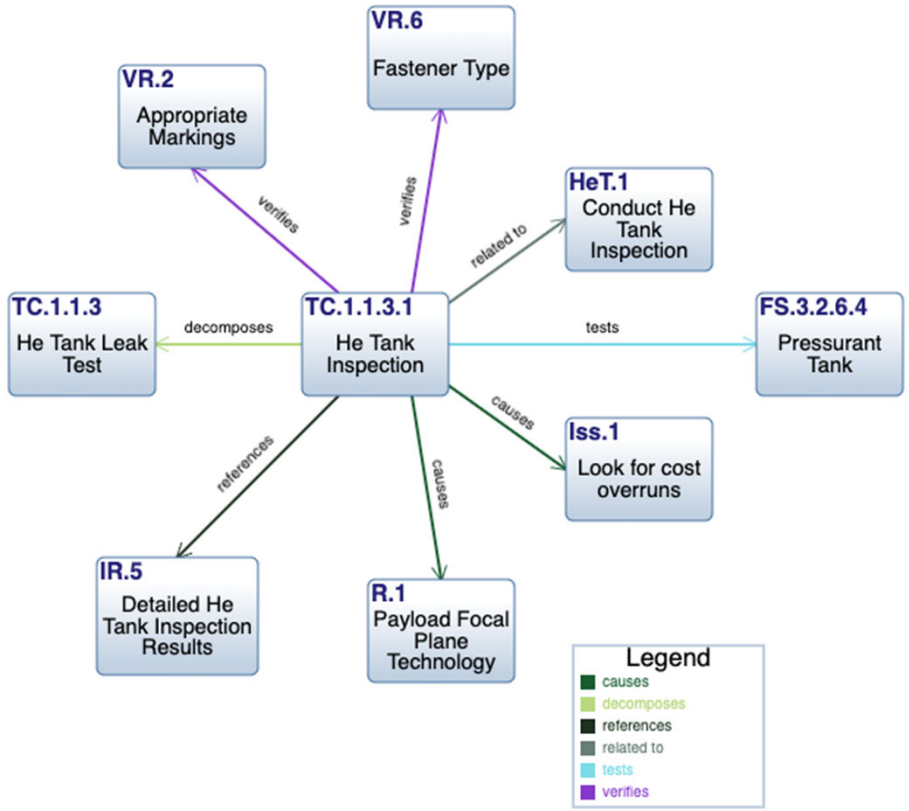
Why choose LML?

- In March 2022, version 1.2 was released and included an extension for V&V
- This extension came from users of the language proving it out on a number of programs over many years
- Test Suites act as containers for Test Cases, which are V&V tasks

Class	Parent	Description
Test Case (Verification Event)	Action	A Test Case entity specifies a verification/validation task, as well as its expected and actual results.
Test Suite	Artifact	A Test Suite entity specifies a container for Test Cases.
Verification Requirement	Statement	A Verification Requirement entity specifies what is required to confirm that a requirement is satisfied

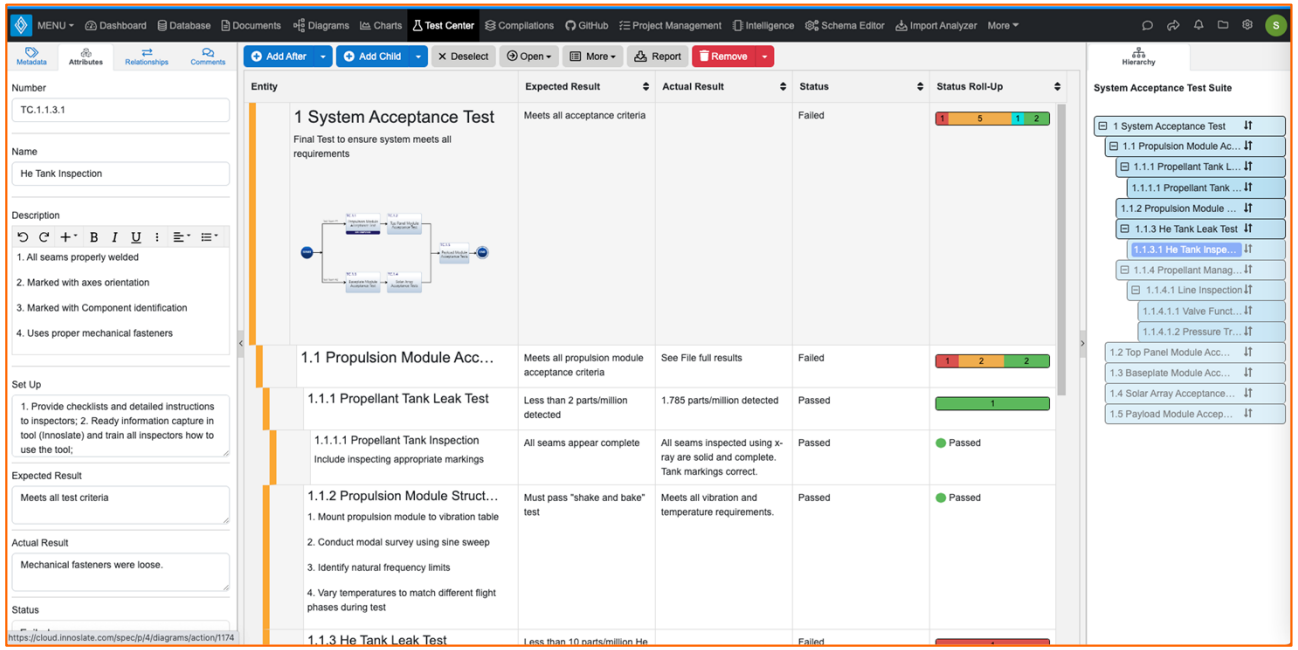
How does it aid in integrating T&E with digital engineering?

- The V&V extension for LML has relationships to requirements and other aspects of the lifecycle model
- You can add your own relationships as well to aid in searching or reporting



How can we implement this language?

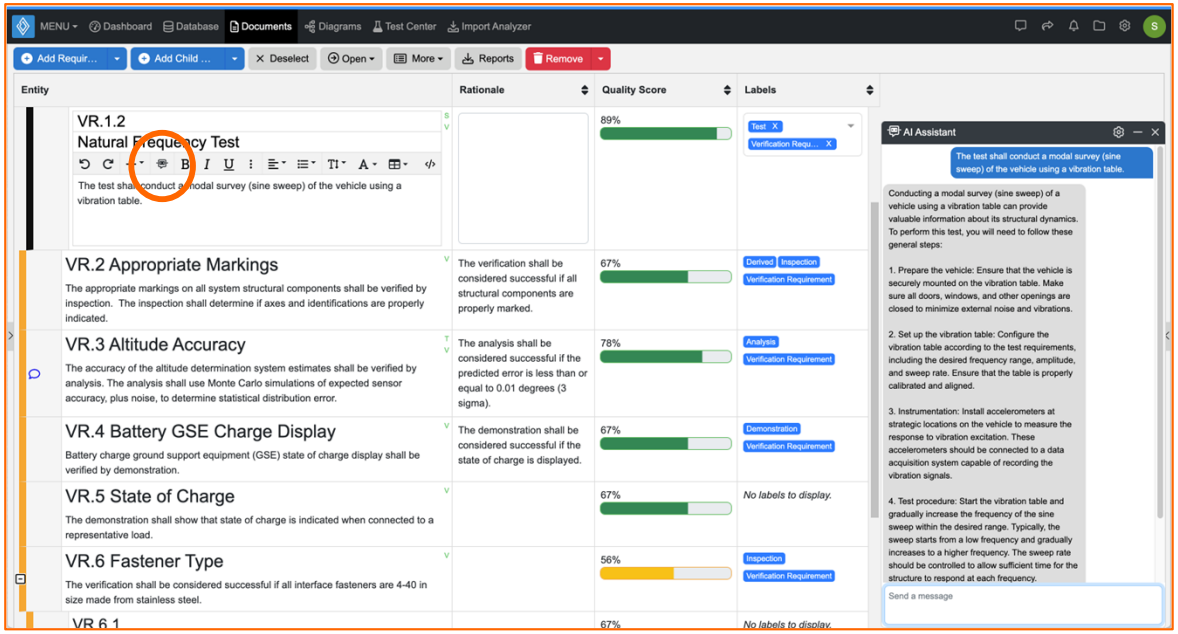
- Innoslate® uses LML as it's primary language
- Innoslate® acts as a test bed for the language and research tool for digital and systems engineering
- Innoslate ®'s Test Center provides a dashboard to roll up results



But building test cases early in the lifecycle costs money!

How can we implement this language? (continued)

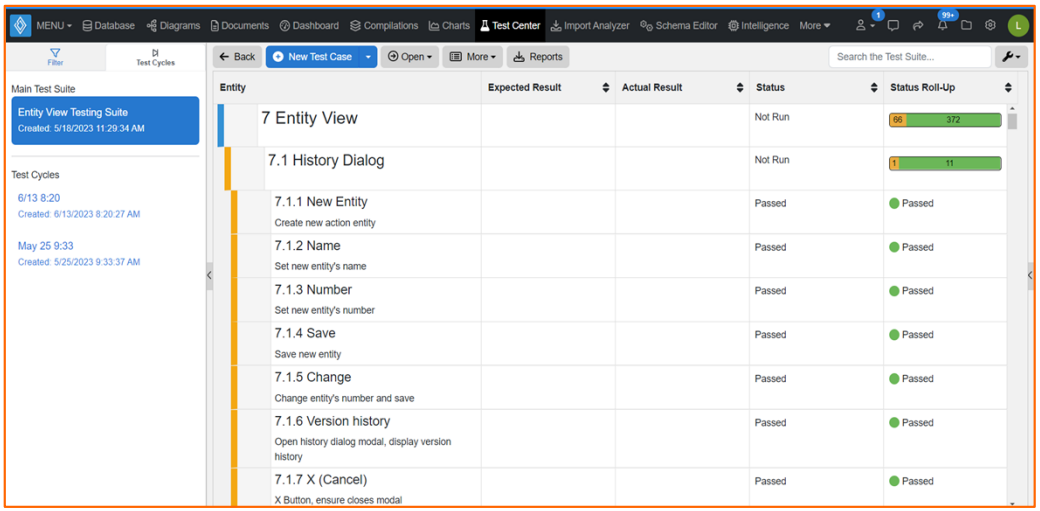
- To create test cases from requirements has always been a difficult task to perform early in the lifecycle because it adds more time (and cost)
- Recently, ChatGPT was added to Innoslate and may provide a means to speed up the test case development from requirements
- Providing a verifiable requirement to ChatGPT can result in a suggested test case



With this application, we are just scratching the surface of what Generative AI might be able to do for us.

How does this provide for the T&E continuum?

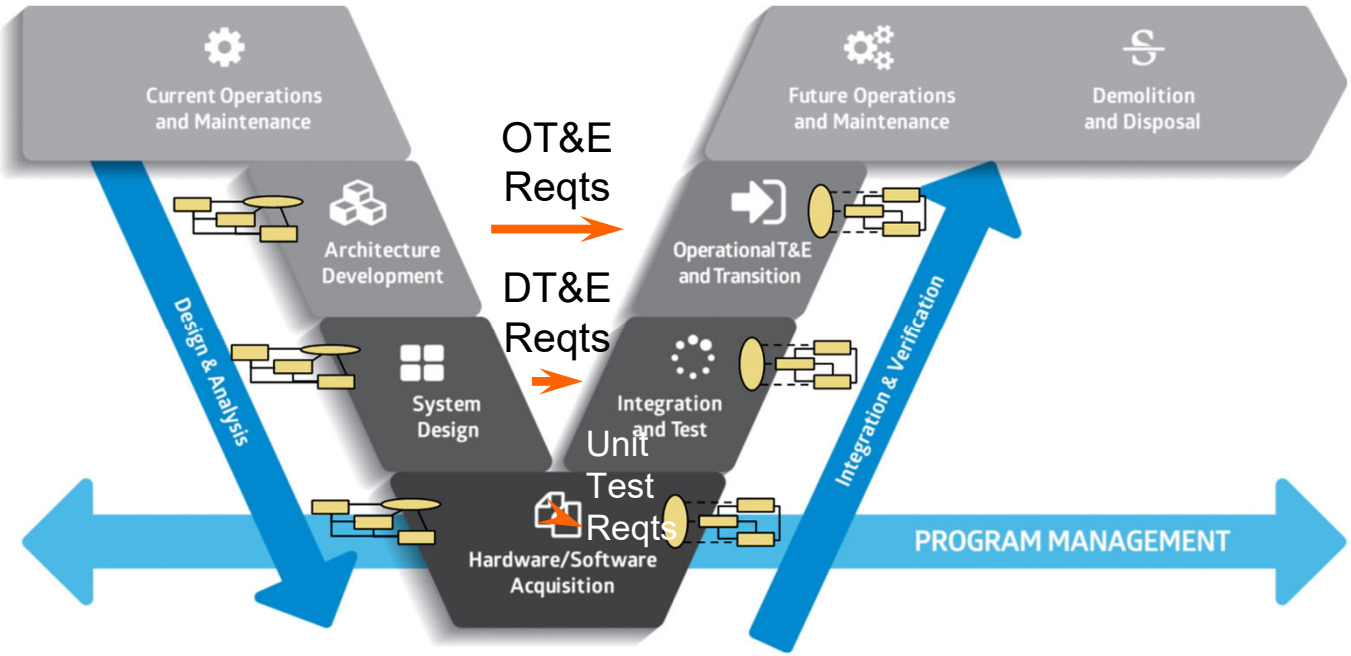
- Customers have interfaced Innoslate® with LabView® for dynamic hardware-in-the-loop testing
- SPEC Innovations has recently interfaced Innoslate® with Selenium® for software test tracking
  - Uses Innoslate's Java SDK to make changes to entities (editing, creating, deleting, etc.)



With this integration, we have created a seamless interface between systems engineering and software engineering!

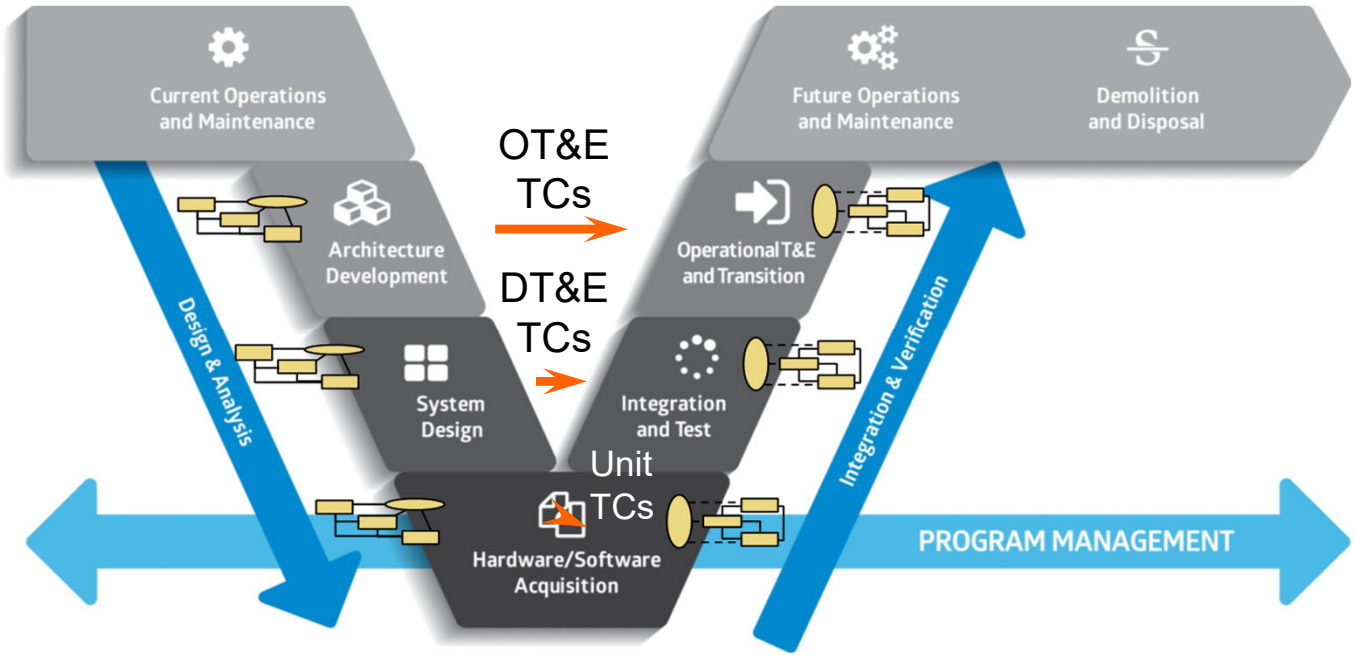
How does this provide for the T&E continuum?

The primary purpose of the “V” model was to remind systems engineers that they have a responsibility to create the verification requirements for the V&V activities



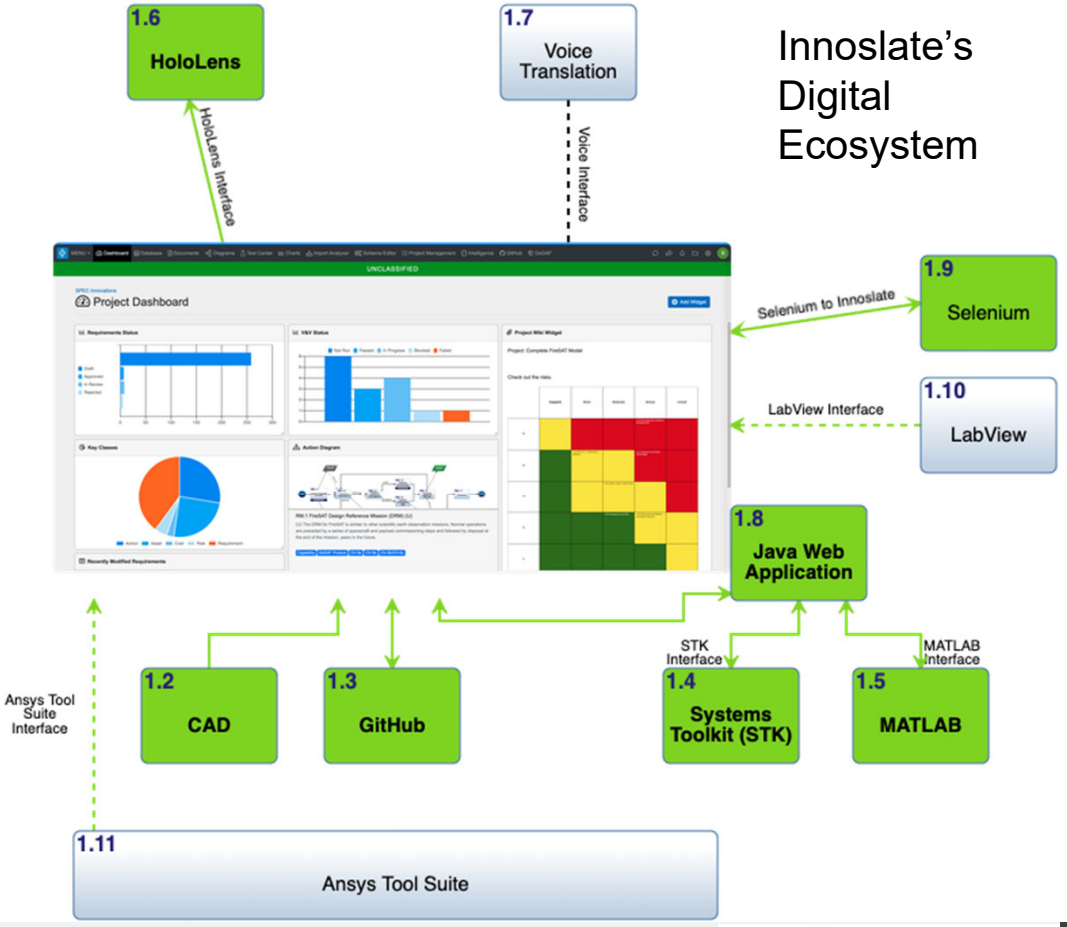
How does this provide for the T&E continuum?

- Now with Test Center we can (should?) create the test cases directly
  - Reduces time of developing separate VRs
  - Provides detailed test plans early in the lifecycle
- Will follow current software engineering best practice



How does this provide for the T&E continuum?

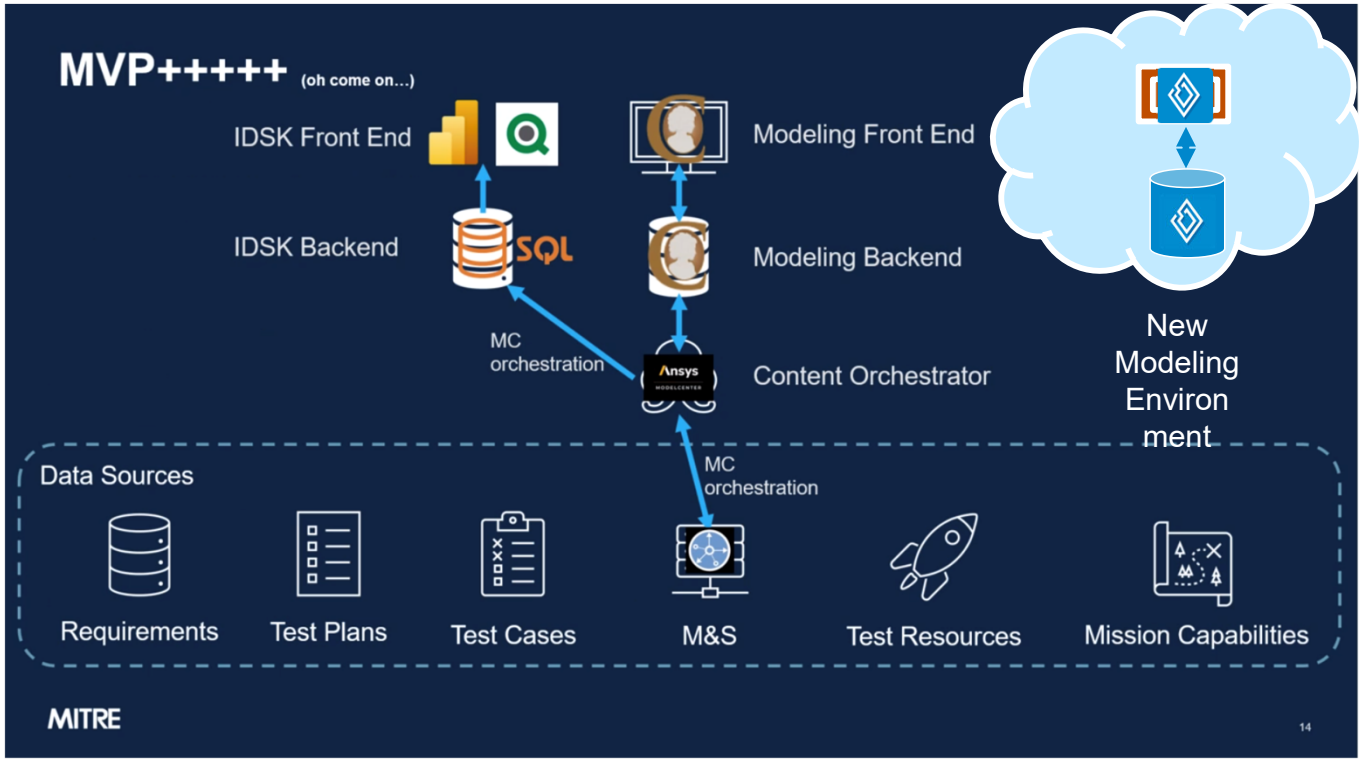
- Another thing we can do earlier in the process is conduct simulation to predict test results
- The use of simulation for this purpose is not new, but the modern tools provide the capability to conduct modeling and simulation together



How does this provide for the T&E continuum?

- Reduces “vendor lock” for the modeling environment by adding another tool
- Cloud-native and USA owned and developed
  - provides a perfect alternative modeling environment
- Adding this path to the Hack-a-Thon only requires that Innoslate integrate with Ansys ModelCenter

Proposed Addition to next Integrated Decision Support Key (IDSK) Hack-a-thon



Summary

- LML provides an ontology that connects the dots between systems engineering and test and evaluation today
- It has been tested by numerous organizations inside and outside DoD
- The language can be implemented by any tool with an open database schema
- It's time to move beyond diagrams and focus on the data … that's where true interoperability can be attained