

Proposal for new standard on “ATML-compatible representation in SysML of test requirements information for electronic systems”

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The Need

- With the proliferation of digital transformation initiatives, product **design data** is becoming widely available in SysML
- At the moment, product **topology data** from SysML (blocks, parts , ports, connections) are being successfully translated and imported into diagnostic models, for example to perform testability analysis and diagnostic strategy optimization
- There is interest within industry and government in implementing a similar capability for product **test data**. The following use cases have been proposed:
 - Automatic translation and import into *test models* (i.e., ATML), in support of test requirements analysis, automatic generation of test code, etc.
 - Automatic translation and import into *diagnostic models*, in addition to the topology data, to eliminate duplication of manual input
 - Transition to “Electronic TRDs” (Test Requirements Documents)

The Problem

- Currently there is no standard format for describing in SysML test information for hardware systems
 - The existing OMG standard “UML Testing Profile” supports the testing of software
- A similar situation exists for system topology information (blocks, parts, ports, connectors)
 - Due to the flexibility of SysML as a modeling language, the modeling style varies greatly from organization to organization and from project to project.
 - This requires the development of custom data translators, leading to duplicate work and increased cost and risk for digital transformation projects.
 - Avoiding this situation for test information will benefit SysML producers, consumers, and software tool vendors.

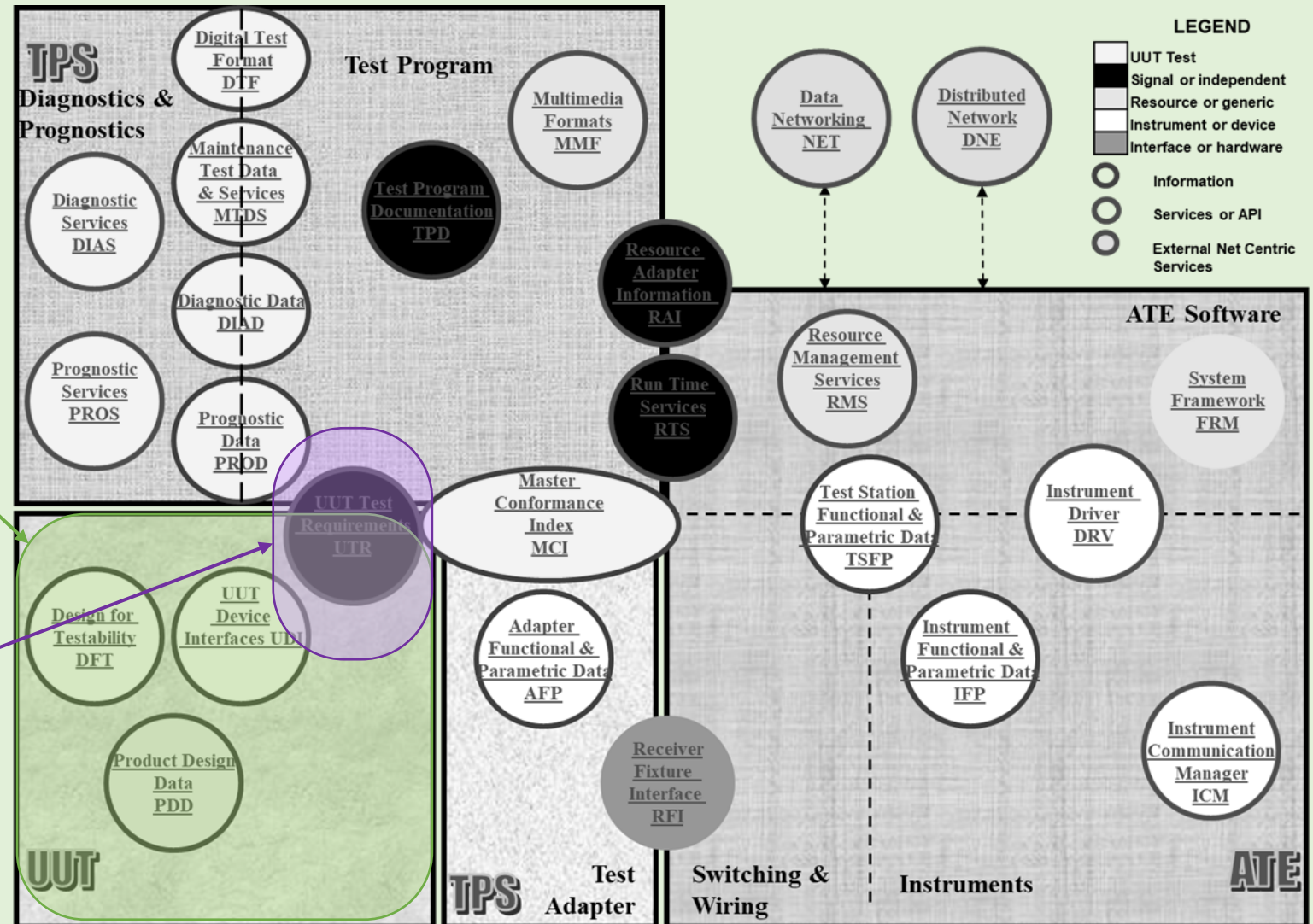
Relationship to the ATML Standards

- Test requirements can already be described in ATML UUT & Test Description. What are the benefits of describing this information in SysML?
 - Capture of test requirements *directly from the product designers*, within the design environments they *already use*
 - Mapping test requirements to product requirements
 - This is applicable primarily to developmental testing
 - Capture of relationships between test data and *UUT design data* that are *already described* in SysML models:
 - Design verification test design information
 - Mapping test stimuli and measurements to UUT ports
 - Integration of testing with UUT state management (ex. controlled through serial bus commands)
 - Mapping tests to UUT components (test coverage)
 - Mapping tests to component failure modes, when specified in SysML (ex. using the FMEA profile or similar)
 - Standardization will bring to SysML the well-defined syntax and semantics of ATML, along with the domain-specific terminology established within SCC20
- The intent is not to create an alternative to the ATML standards, but to enhance ATML interoperability with the software environments used for product design

Relationship to the ATML Standards...

- Compatibility with the ATML Standards is essential
 - Facilitates the mapping between SysML test requirements and ATML
 - Builds on an existing standard that has been validated in applications at TRL 8 ... 9. This means a shorter timeline for standard development and lower risk
- Which ATML components?
 - ATML Test Description: object of this proposal
 - ATML UUT Description:
 - A new standard profile is not needed, because SysML already defines classes equivalent to UUT Description elements (part, port, interface, flow, connector)
 - An informative clause could recommend a mapping
 - ATML Test Station / Instrument Description: possible, but not part of this proposal
 - ATML Test Adapter: possible, but not part of this proposal

Relationship to the DoD ATS Framework



SysML supports **PDD**, **UDI**, and possibly **DFT**

The proposed standard will

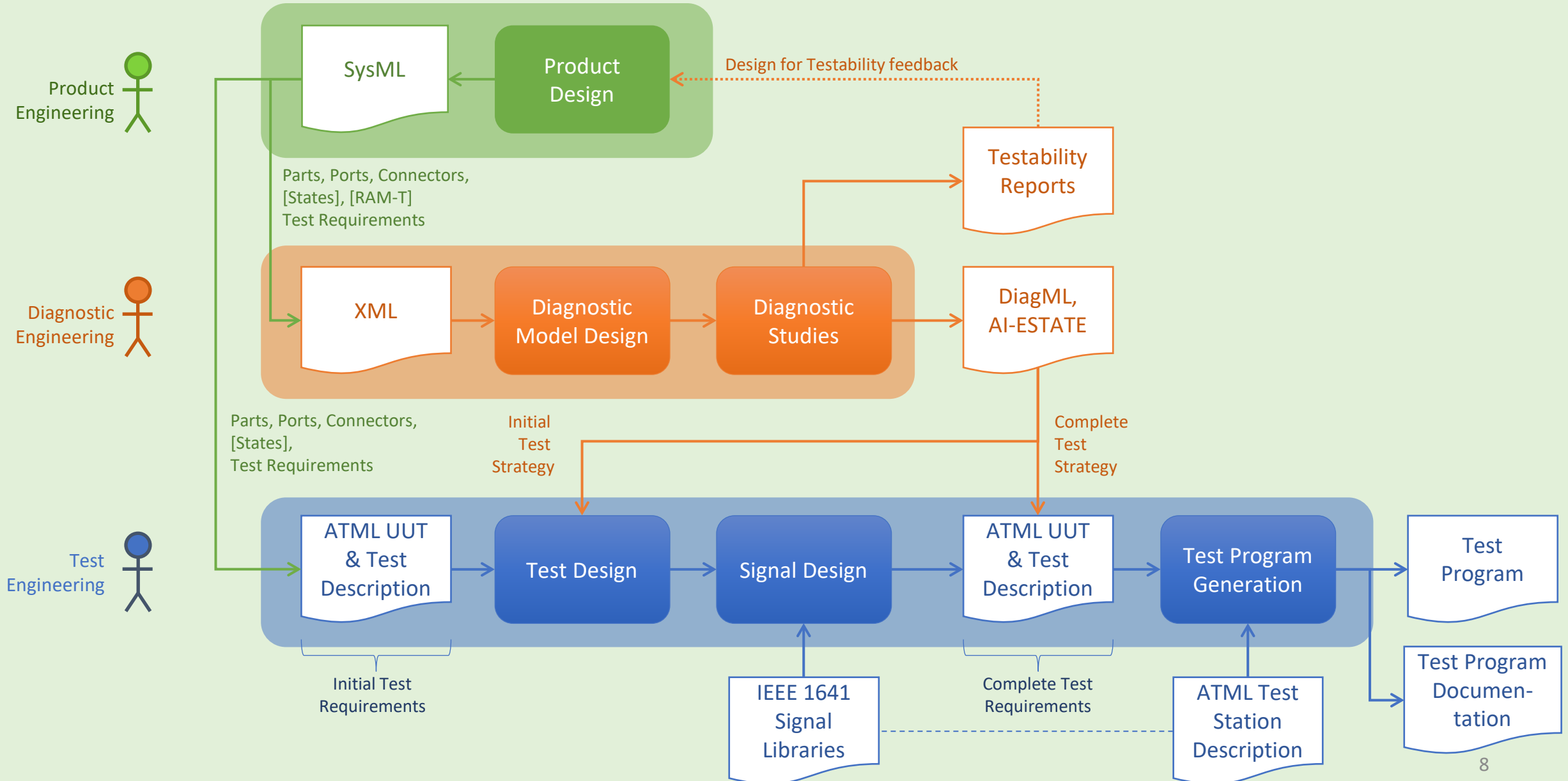
- Add support for **UTR** data in SysML
- Facilitate the transfer of **UTR** data from the UUT domain to the TPS domain
- Facilitate the derivation of **DIAD** and **PROD** from **PDD**

Categories of Tests

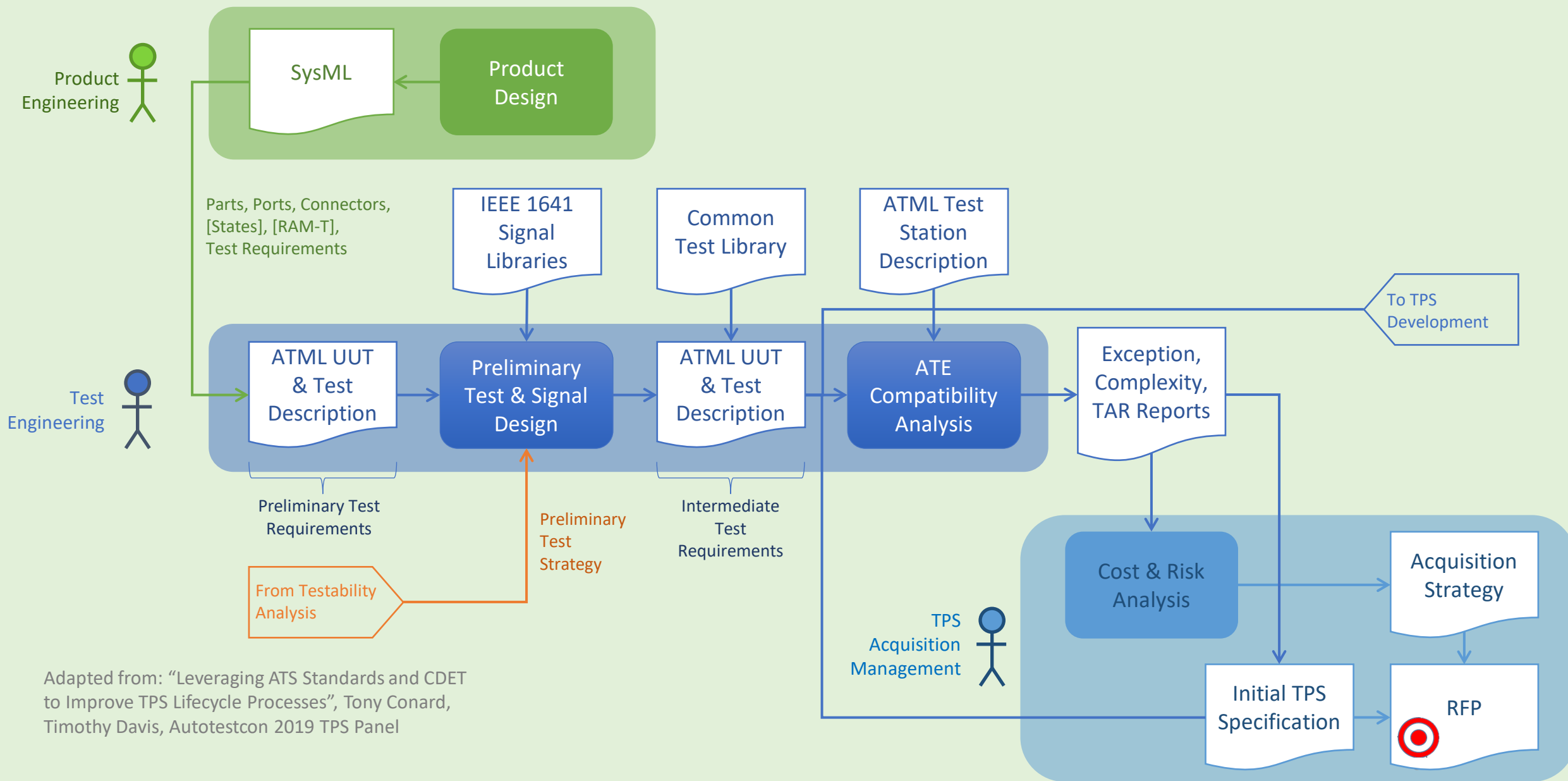
- Developmental Testing
 - ✓ Verifies design requirements
- Production Testing
 - ✓ Verifies correct manufacturing
- Sustainment Testing
 - ✓ Verifies nominal operation (RFI)
 - ❖ Detects and isolates failures that can occur in operation



Use Case: Sustainment Testing, Testability Analysis and Test Program Development



Use Case: Sustainment Testing, TPS Acquisition



Relationship to the OMG SysML Standard

- SysML is standardized by the Object Management Group® (OMG) Standards Development Organization (SDO)
 - Most recent “formal version” is 1.6
 - Version 1.7 is in Beta
 - Version 1.4 was adopted as ISO/IEC 19514:2017
- SysML 2.0
 - Currently in Beta
 - A significant departure from SysML 1.x; not backwards compatible.
 - Not yet supported by mainstream software tools
 - Virtually all existing models use versions 1.x. The upgrade path appears to be difficult.
 - Introduces a text-based modeling language that should simplify data translation, compared to SysML XMI
- Proposal:
 - Target version 1.6 initially
 - Continue evaluating support for version 2.0 throughout development, tracking on OMG approval and support in SysML software tools

Related Standards

- Standards identified so far:
 - ATML
 - UML Testing Profile 2 - <https://www.omg.org/spec/UTP2>
 - OMG Risk Analysis and Assessment Modeling Language (RAAML) - <https://www.omg.org/spec/RAAML>
 - FMEA profile
 - FTA Profile
- Are these being used? Need input from end users.