NDIA Vendor Opportunity

1 NDIA Vendor Opportunity – Innoslate®

This document captures the responses to the specific questions are as part of the NDIA Vendor Opportunity at the 2018 NDIA Systems Engineering Division Conference in Tampa, FL. SPEC Innovations has been following the Digital Thread/Digital Twin initiative by DASD(SE) since its inception. The link below shows an Innoslate® project which captured the Digital Thread Posters presented at the AIAA SciTech Conference in January 2018. These posters has previously been shown at the 2017 NDIA SE Division Conference. We have been analyzing these posters to determine how best to implement this vision.

Hyperlink to Digital Thread Poster Database

2 SPEC Innovations and Innoslate Background

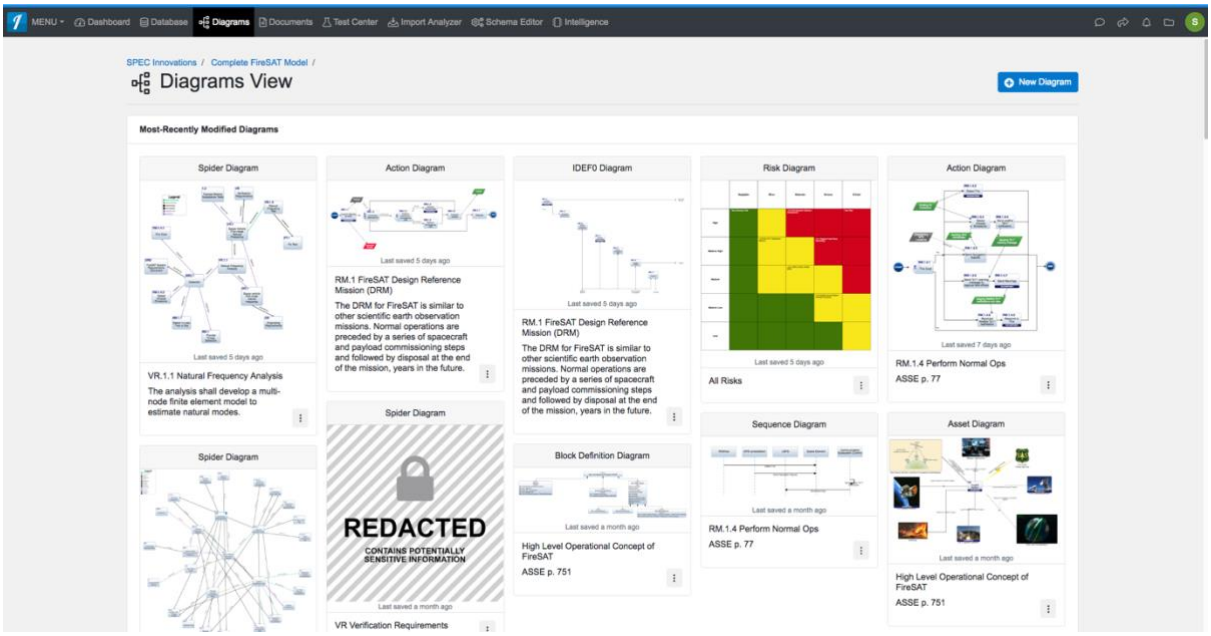
Systems and Proposal Engineering Company, dba SPEC Innovations, is a woman-owned small business, located in Manassas, VA (outside Washington, DC). It was founded in 1993. The company has worked on major architecture and systems engineering projects for the DoD, DOE, and other government and commercial organizations. Our website is www.specinnovations.com.

We began development of Innoslate in 2010, when we found it difficult to do the work we need to do with the limited tools available at the time. Innoslate was first released in 2012 and is currently in version 4.0 as a full lifecycle tool, with integrated Systems Engineering and Program Management capabilities. It uses the open standard, Lifecycle Modeling Language (LML), as it's open ontology. It currently supports users around the world. Innoslate is also available on NIPRNET, SIPRNET, and C2S, as well as behind your own firewalls. You can learn more about Innoslate by going to our website www.innoslate.com.

3 Demonstrate how the tool supports Digital Engineering. How does the tool:

3.1 Support the development, integration, and/or curation of models?

Innoslate provides modeling capabilities across many languages/frameworks, including SysML, LML, some UML, and some IDEF. It also provides the capability to create documents, with diagrams from the tool embedded in the document and updated as those diagrams are updated.



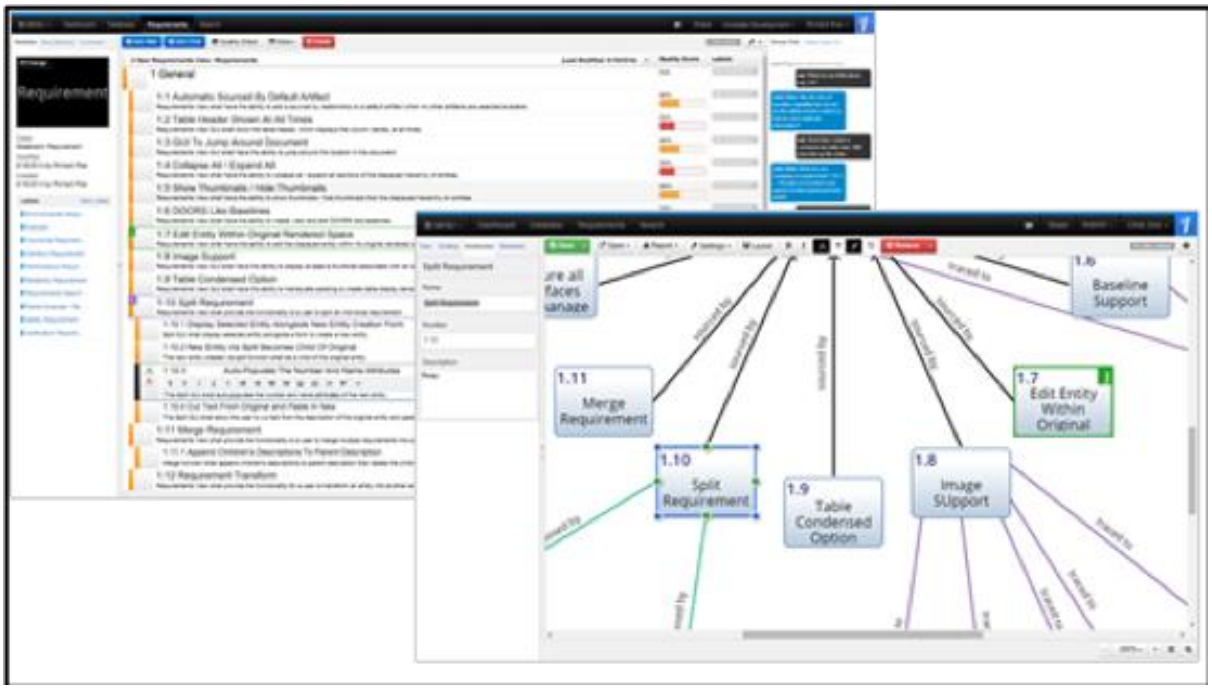
The modeling is done in one or many projects. Models between projects can be shared using the cross-project relationships available within the tool. Import/export of XML is also available.

Curation can be accomplished using Artifacts, Baselining documents, and export of models via XML (which can in turn be uploaded as Artifacts within the database). The information can be tagged using labels and searched for using the complex search capability.

3.2 Support the use of models to communicate, collaborate, and perform model-driven lifecycle activities?

Innoslate® provides a means to author models in one language, such as SysML, and then display the information in other forms (e.g., LML, IDEF, etc.). The use of a common ontology (LML) that has been mapped to other languages (SysML) and Frameworks (DoDAF/DM2, IDEF0), enables this capability. Thus information can be communicated in a form that any stakeholder can understand and assimilate.

Innoslate® was designed as a collaboration tool. All users of a project see the same database at the same time. Real-time indicators show who is looking at what information independent of their view of that information. If an item is changed, a refresh indicator will appear. A built-in Chat (private and group) capability is also available to enable communications between users.



Innoslate's real-time indicators and chat enable collaboration around the world

LML and Innoslate® support the entire lifecycle from concept development through disposal. It contains the capability to conduct program and test planning, CONOPS development, requirements analysis and management, modeling and simulation (discrete event and Monte Carlo), and verification through the Test Center. It also supports program management functions, such as Risk and Issue tracking, WBS development, capturing of decisions, and cost and schedule generation from business processes. Resource modeling and other constraints are also available via the tool. It has been used in every phase of the lifecycle.

3.3 Implement the authoritative source of truth concept?

Since the tool generates the diagrams and other views of the information from the database, it acts as a single source of "truth." Since this database can be virtualized, it can grow as large as the hardware and SQL Server will allow. With cross project relationships and permissions, we can also compartment information as needed.

3.4 Support the use of the authoritative source of truth to produce digital artifacts, support reviews, and inform decisions?

All artifacts (diagrams, reports, exports) come from the single database, thus all artifacts produced from the tool will represent the state of the information at their time of production.

Model-Based Reviews (MBRs) can be accomplished using the tool's commenting feature (available at the object level and accessible from any diagram or view). MBRs have been performed using the tool for

all the NASA milestone reviews. This capability was demonstrated to the NDIA M&S Committee in February 2014.

A Decision entity class is available within the tool to facilitate the decision process, but all facets of the tool help inform decisions, particularly the Requirements Quality Checker and Intelligence Views, which use NLP technology to evaluate the quality of the modeling. The simulators also aid in verifying the processes.

3.5 Support the infusion of technological innovations to enable the end-to-end digital enterprise?

Innoslate® was designed for the application of new technologies and innovations for the digital enterprise. It was one of the first systems engineering tools to use cloud computing and a web front-end. Currently, Innoslate® has applied Natural Language Processing (NLP) technology to check the quality of requirements, identify modeling issues (Intelligence View), and assist in the traceability of entities (Traceability Assist and Suspect Assist). With the use of the JavaScript interface, the simulator can use API calls to other web services and bring that information into the simulation. Also the Java SDK and REST APIs enable greater integration of new technologies into Innoslate® by third parties.

3.6 Advance human machine interactions?

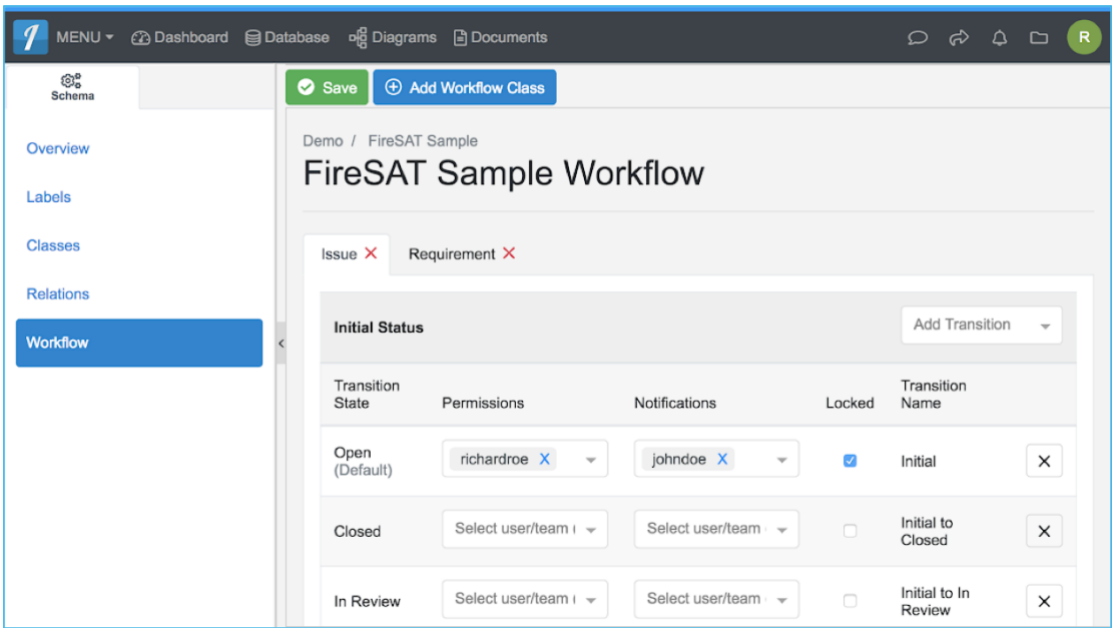
Using a web interface, makes the human-machine interface easier and more intuitive, plus it takes advantage of built-in browser tools, such as spelling and grammar checking. The underlying language (LML) provides explicit decision points that can be allocated to either the human or the machine, thus making the modeling of these HAI processes more clear and complete. The Java SDK and REST APIs also offer third parties the capability to design and experiment with different user interfaces. We call this "Architecture to Operations," a paper which was presented at the 2017 NDIA conference.

3.7 Support the development, maturation, and/or use of digital engineering IT infrastructures?

Being cloud based and on all the major commercial cloud environments (Amazon AWS, Google AppEngine, and Microsoft Azure), as well as classified clouds, such as NSERC and C2S, enables Innoslate® to fit into the modern IT infrastructures that will have to be used for digital engineering. Innoslate® was also designed with scalability in mind. Digital engineering will require the capturing and management of Exobytes of data. Scalability will become critical to that environment.

3.8 Support the development, maturation, and/or use of digital engineering methodologies?

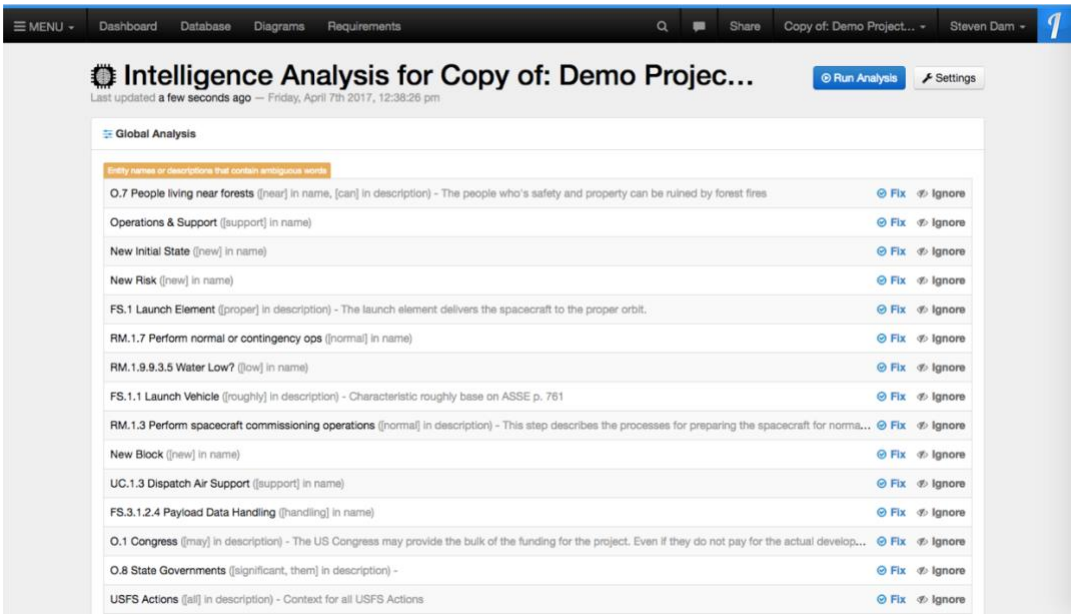
Innoslate® can support any methodology and be used to model processes and other aspects of those methodologies. Workflow can also be used to enforce processes.



Innoslate's workflow capability can be applied to any enumerated attribute of any class

3.9 Capture and share best practices within the tool?

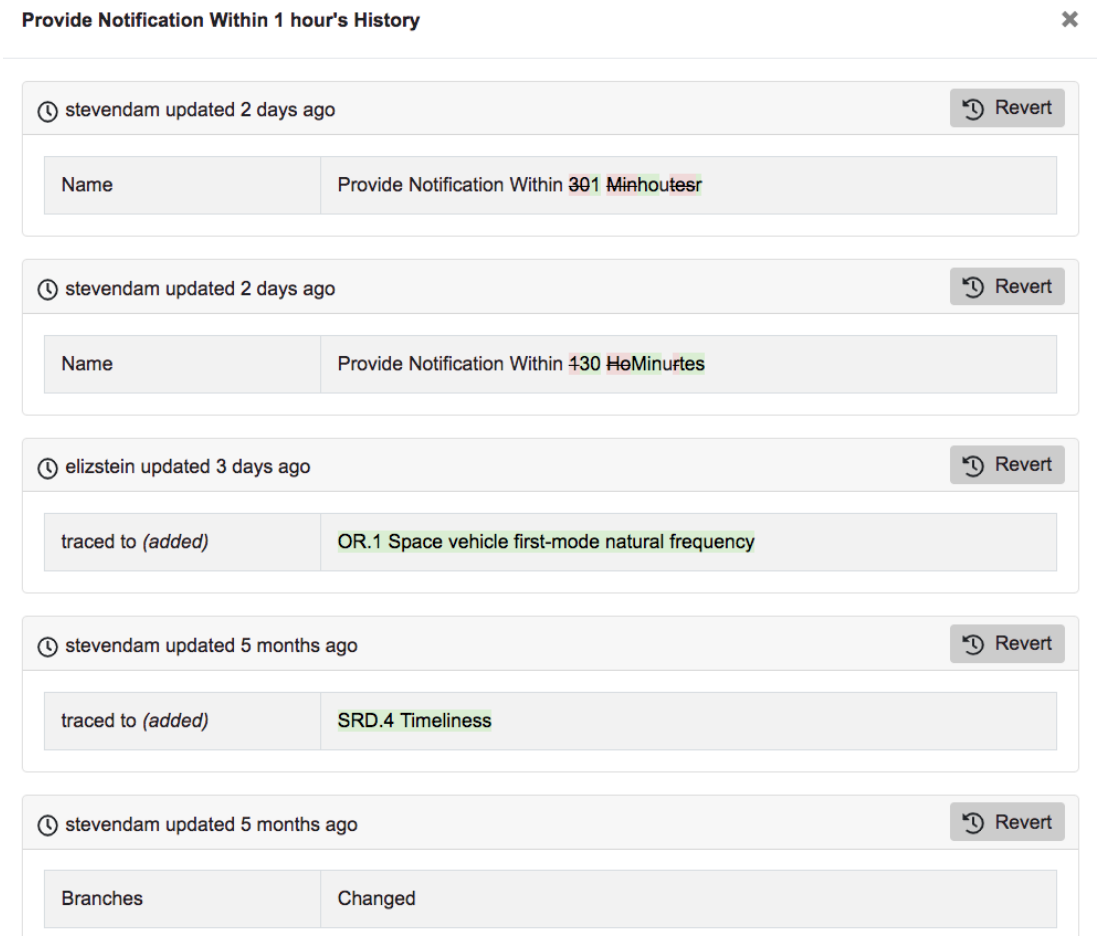
Innoslate® currently uses best practices identified by work done though the Naval Postgraduate School and Stevens Institute of Technology as the basis for the heuristics used in Intelligence View. Additional best practices can be captured as a document in Documents View for sharing with other projects in the organization.



Intelligence View enforces best practices in digital engineering modeling

3.10 Support accountability to measure and facilitate improvement of tangible results?

Since Innoslate® automatically captures all change information, these History files can be mined to identify ways to improve the digital engineering practices. The Activity Feed on the dashboard also allows managers to see who is change what. Workflow provides a means to control the changes in status of requirements, issues, and any other entity class in the tool.



Innoslate tracks the change history of every entity

4 Demonstrate how the tool supports MOSA. How does the tool:

4.1 Visualize modularity of the system?

Figure 1. shows a SysML Internal Block Diagram (IBD) for the the Innoslate modular architecture. Plugins are viewpoints of the Innoslate database. Plugin features include:

- Not a standalone application (requires Innoslate Core)
- All authentication is through Innoslate Core with the options for:
  - Single-Sign-On CAC (Default)
  - Native Email/Password (Optional)
  - LDAP (Optional)

- All data is stored in the U.S. Government or commercial managed MSSQL database using Innoslate Core
- Innoslate REST API facilitates plugin data exchange

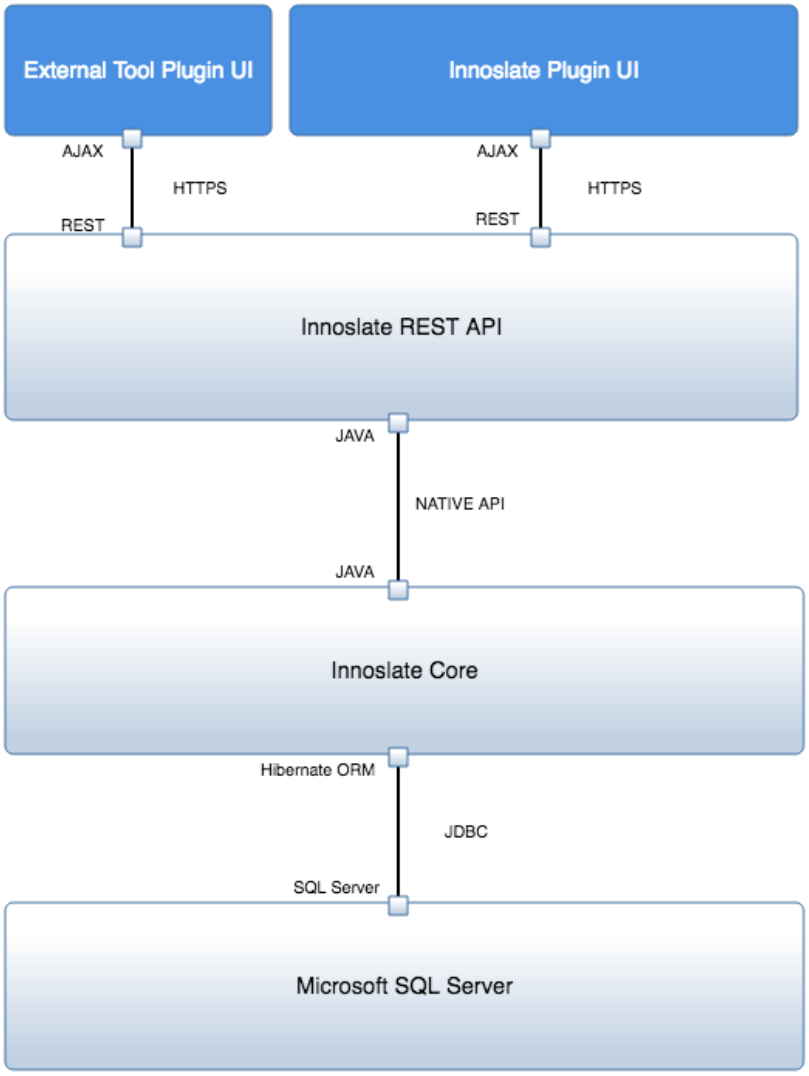
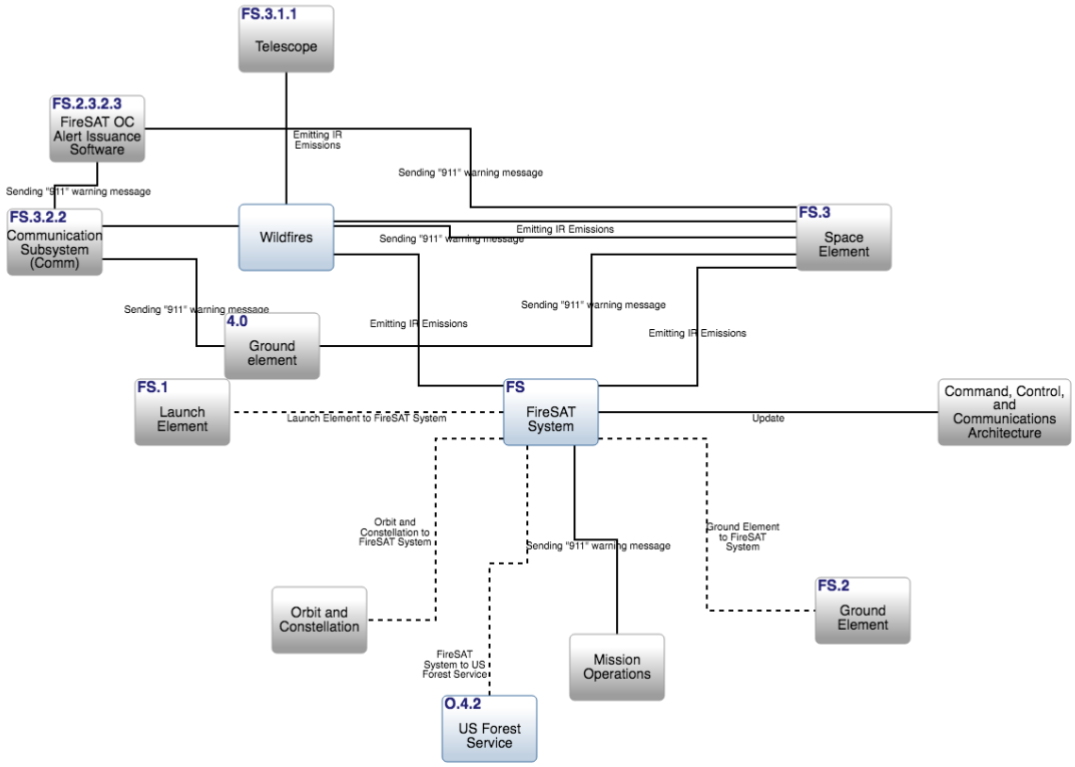


Figure 1. Innoslate Modularity

4.2 Identify and visualize system components and interfaces (i.e., software, hardware, electrical, mechanical)?

Innoslate® provides many different diagrams to visualize the systems components and interfaces, including the Asset Diagram (LML), Internal Block Diagram (SysML), and N2 Chart. All these diagrams use

the same ontological elements: Assets for the components and Conduits for the interfaces. Data flows (Input/Output entities) can be allocated to the Conduits. These data flows have “size” (which can be a distribution) and the Conduits have “capacity” and “latency” attributes as well. These attributes are used in the simulators to constrain the functional model, thus affecting the overall system performance.



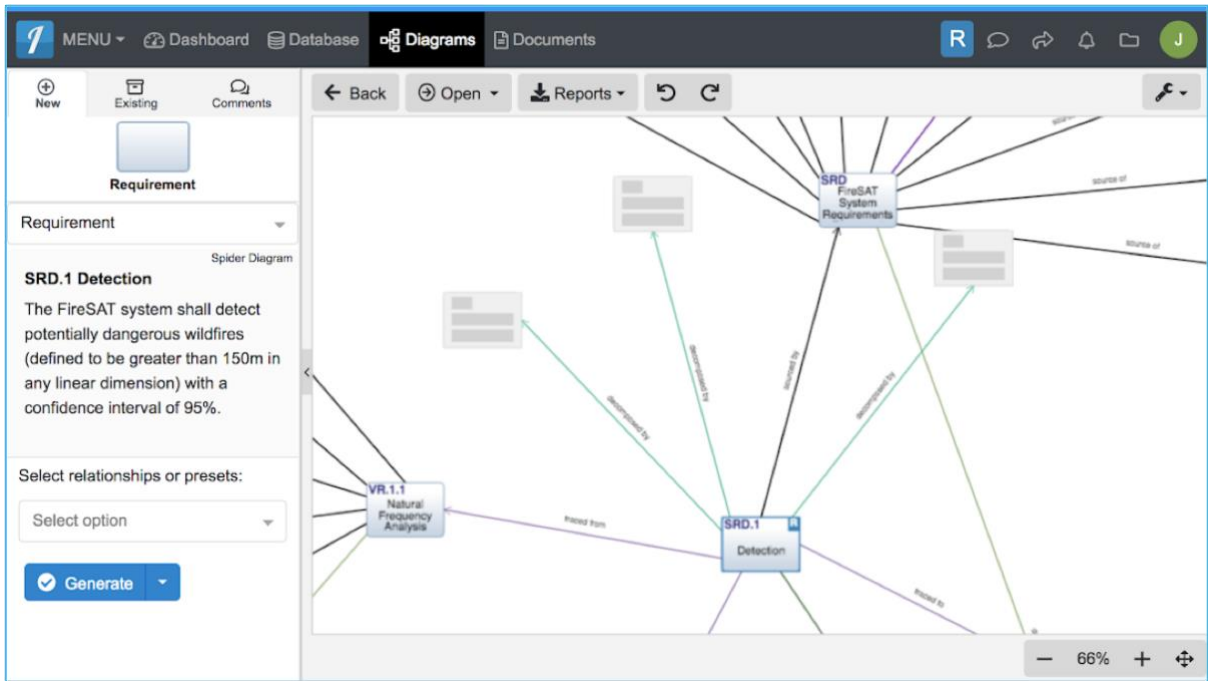
Innoslate's unique Physical I/O Diagram shows Assets, Conduits, and I/Os in one chart

In addition, Innoslate® provides a CAD Viewer to view .stl or .obj files, which are standard output formats from CAD tools. If the ,obj file is used, the objects in the file can be translated into Innoslate Asset entities and linked back to the drawing.

4.3 Visualize modularity at different levels in the system (i.e., theater level, mission scenarios, sequence/behavior views, system model view, requirements view)?

The underlying language (LML) provides an ontology where all classes of information are decomposable. This capability enables the modeling to be performed at any and all levels necessary. Innoslate® also supports cross-project relationships, so that each level can be modeled separately, if desired, and then shared with other models. This modularity will become critical when concerned with the sharing of proprietary information. Users who do not have permission to see information from a particular project

will not see that information if it is included in another project using the cross-project relationships. A redaction bar shows up in its place.



Innoslate permissions and cross project relationships enable using information from other projects while protecting that information

4.4 Visualize the impacts of interfaces with other systems?

This visualization occurs with any of the physical diagrams. Again, if cross-project relationships are used, you can see those specific interfaces. Another visualization tool is the Spider Diagram. Since Innoslate® uses relationships to capture the interfaces, the Spider Diagram shows those related elements as well.

4.5 Determine interoperability?

Since interoperability requires interfaces at many levels, Innoslate® provides the means to identify those interfaces at every level. The fact that all the drawings are generated from the data will allow the analyst to see how the information connects. Further research in this area is also feasible and may be yet another place where graph theory and NLP technologies can be used to provide more automated heuristics.

4.6 Capture linkages between hardware and software?

Innoslate® provides the means to identify any interfaces between hardware and software as well. They are both (along with people) considered “Assets” in the ontology. Assets can have Conduits or Logical Connections between each other. So, if the modeler does not want to use the Conduit, they could use the Logical connection for this purpose. And, of course, other relationships can be provided using the Schema Editor.

4.7 Provide application programming interfaces (APIs/plug-ins) to use custom applications?

Innoslate® comes with a complete set of APIs, including Java, REST, and for Enterprise users, JavaScript. These APIs are used by Innoslate® developers as well, so they are rarely deprecated. We have developed completely new user interfaces for Innoslate® to mimic legacy tools using these APIs.

4.8 Enable transfer of data from one model construct to another?

The APIs provide a means to "put" or "get" information and can provide this function. Other data transfer mechanisms of models include the XML and XMI importers, along with Word, CSV, and Plain Text import capabilities.

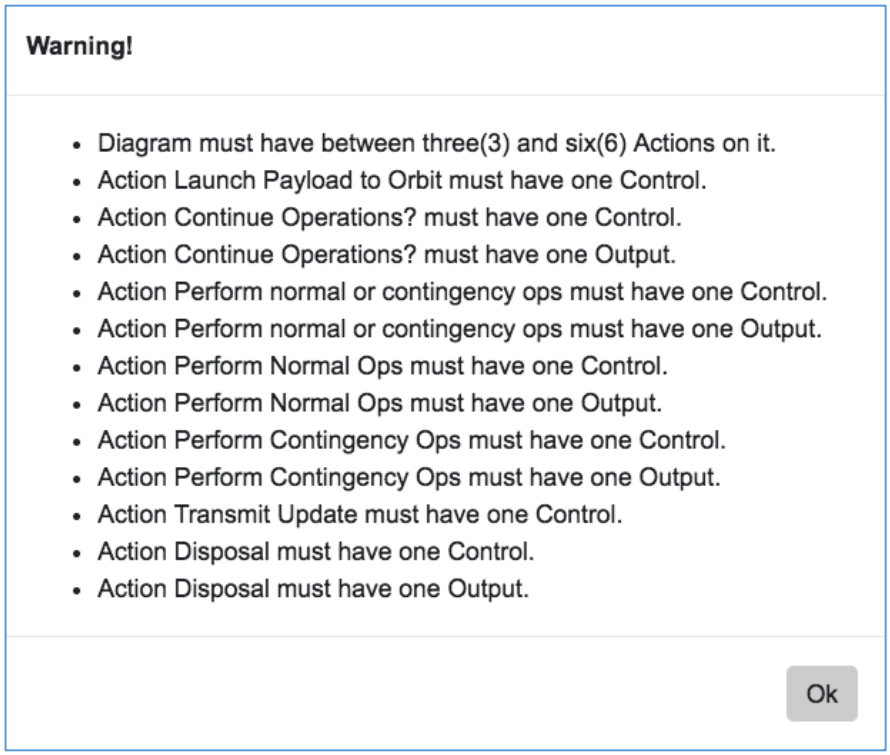
4.9 Capture standards information for system interfaces and components?

Standards can be captured as Artifacts and decomposed into Statements and Requirements. Those standards can then be easily related to any other information in the database, including interfaces (Conduits) and components (Assets).

4.10 Test for standards compliance?

Innoslate® provides the Traceability Assistant as part of the Traceability Matrix. This matrix and assistant can be used with the standards trace to interfaces and components to help identify that the standards are being met.

In addition, when rules are available, Innoslate diagrams, such as the IDEF0, and has tools to indicate when errors occur.



Innoslate rule checking aids the modeler in meeting requirements

Intelligence View checks the entire model for best practices, using 68 tailorable heuristics, developed from work by US Naval Postgraduate School.

4.11 Test and verify modularity and openness?

These criteria can be captured as part of the Test Center's Test Cases and results. If criteria can be developed for these, SPEC would be interested in using those criteria as part of its Intelligence View, as well.