Requirements-Driven Workflows in Implementation and Test

MATLAB EXPO 2018
Requirements – why we care

1. Because it is in our interests to care

2. Because we have to care
Requirements – why we care

The cost of the mission was $327.6 million
The hardest single part of building a software system is deciding precisely what to build. No other part of the conceptual work is as difficult as establishing the detailed technical requirements... No other part of the work so cripples the resulting system if done wrong. No other part is as difficult to rectify later.

(Brooks, No Silver Bullet – Essence and Accident in Software Engineering, 1987)
Requirements & Model-Based Design

Requirements Models
Simulink Requirements

Models
Simulink Test
Tests
REQ 3.5 TARGET SPEED INCREMENT
While the cruise control mode is activated, the driver can increase the target speed by pushing the Set+ button.

Is this implemented?

What is the impact of this requirement changing?

What verification coverage of my requirements do I have?

How is it being tested?

What is the test result?

Why is this block required?
New Verification and Validation Products

- Simulink Requirements – requirements authoring, editing, trace, management
Simulink Requirements
Work with requirements without leaving Simulink

- Author or import requirements
- Trace to design, code and test
- Identify gaps in design or test
- Respond to requirement changes
Agenda

- Importing requirements
- Tracing requirements to implementation
- Tracing requirements to tests
- Requirement change
- Reporting
- Programmatic interface
Agenda

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- API
Ability to Modify Custom Attributes

Existing custom attributes can be modified.

- Custom attribute name and description is editable.
- New entries for Combobox can be added.
- Attributes value will be kept.

Documentation: Custom Attributes of Requirement Sets
Requirements Import with ReqIF Standard

 Allows you to work with requirements from third party tools in Simulink

- Import requirements from third party tools using ReqIF standard (Requirements Interexchange Format)

- Import wizard supports mapping custom attributes

- Tools that support ReqIF standard:
  - IBM DOORS / DOORS Next Generation
  - Siemens Polarion
  - PTC Integrity

Documentation: Import Requirements from ReqIF Files
Agenda

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Link requirements to model (implementation)
**Properties**

**Type:** Functional

**Index:** 2.3.1

**Custom ID:** SRD-CONTROL-10

**Summary:** when in power generation mode the rotor speed shall be % of the [RotorNominalSpeed]

**Keywords:**

**Revision information:**

**Custom Attributes**

**Definitions:** [RotorNominalSpeed] shall be

**Last Modified By:** francis

**Last Modified On:** 05 September 2018

**Verification:** by system level simulation

**Links**

No links

**Comments**


Link requirements to data (implementation)
The yaw rate magnitude shall be less than 0.5 deg/s

The commanded yaw torque per actuator shall be less than 250 Nm
Simulink Requirements

New File Extensions

1) `.slreqx`
   File containing imported or authored requirements

2) `.slmx`
   Where links are stored
Managing Large Sets of Requirements

- Project may have thousands of requirements

- Simulink Requirements provides features to make it easier to find and navigate the requirements

- Customize browser view to only see relevant data
  - Sort by column
  - Select columns to display

- Keywords – add tags to requirements to categorize and search

- Search – filter and locate requirements by search term
Agenda

- Importing requirements
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Link requirements to test (verification)
Test Execution Support

Invoke linked tests to verify requirements

- Run all tests which are linked to selected hierarchy of requirements
- Right-click on Requirement or Requirement Set for option to run tests

» See: Review Requirement Verification Status Metrics Data

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Agenda

- Importing requirements
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- Reporting
- Programmatic interface
Link Set Comparison support

Track changes to requirements links by comparing Link Set files

- View added / removed / modified links compared to previous revision.
- Improved change tracking by leveraging Simulink Project and SCM integration
- Use `visdiff` for invoking from command-line.

Documentation: Compare Link Sets
Agenda

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# Programmatic interface

## Requirements Definition

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>slreq.RedSet</td>
<td>Work with Requirements sets</td>
</tr>
<tr>
<td>slreq.Reference</td>
<td>Work with external requirement proxy objects</td>
</tr>
<tr>
<td>slreq.Requirement</td>
<td>Work with Requirement objects</td>
</tr>
<tr>
<td>slreq.clear</td>
<td>Clear requirements and links from memory</td>
</tr>
<tr>
<td>slreq.convertAnnotation</td>
<td>Convert annotations to requirement objects</td>
</tr>
<tr>
<td>slreq.editor</td>
<td>Open Requirements Editor</td>
</tr>
<tr>
<td>slreq.find</td>
<td>Find requirement reference and link set artifacts</td>
</tr>
<tr>
<td>slreq.import</td>
<td>Import requirements from external documents</td>
</tr>
<tr>
<td>slreq.load</td>
<td>Load requirements/link set</td>
</tr>
<tr>
<td>slreq.new</td>
<td>Create requirements set</td>
</tr>
<tr>
<td>slreq.open</td>
<td>Open requirements set</td>
</tr>
</tbody>
</table>

## Requirements Traceability and Consistency

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>slreq.LinkSet</td>
<td>Work with link sets</td>
</tr>
<tr>
<td>slreq.link</td>
<td>Work with link objects</td>
</tr>
<tr>
<td>slreq.clear</td>
<td>Clear requirements and links from memory</td>
</tr>
<tr>
<td>slreq.createLink</td>
<td>Create traceable links</td>
</tr>
<tr>
<td>slreq.find</td>
<td>Find requirement reference and link set artifacts</td>
</tr>
<tr>
<td>slreq.load</td>
<td>Load requirements/link set</td>
</tr>
</tbody>
</table>

## Requirements Verification

<table>
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<th>Description</th>
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<tbody>
<tr>
<td>slreq.justification</td>
<td>Work with slreq.justification objects</td>
</tr>
</tbody>
</table>

## Requirements Comparison and Change Tracking

<table>
<thead>
<tr>
<th>Function</th>
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<tbody>
<tr>
<td>slreq.generateReport</td>
<td>Generate report for requirements set</td>
</tr>
<tr>
<td>slreq.getReportOptions</td>
<td>Get default report generation options</td>
</tr>
<tr>
<td>slreq.refreshLinkDependencies</td>
<td>Refresh requirement link dependencies</td>
</tr>
</tbody>
</table>
function tableOfReqs = tableOfRequirements

% PURPOSE:
% Create a summary MATLAB table of requirements

home

>> tableOfReqs = tableOfRequirements
Conclusions
Simulink Requirements
Work with requirements and design together

- Author, edit and organize requirements
- View and link requirements within the Simulink graphical editor
- Track status and manage requirement changes
What next…

More information:

mathworks.com/products/simulink-requirements.html

Feedback:

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