Effective Team Collaboration with Simulink

A MathWorks Master Class: 15:45–16:45

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Overview

- **Focus**: New features of Simulink that make working in teams even easier
- **Covering**
  - Creating and sharing work in a team using Simulink Projects
  - Automation: a foundation for team efficiency
  - **Case Study**: Refactoring an existing model
  - Understanding what data is used in your design
  - Exporting your designs to colleagues, suppliers, customers
- **Wrap-up, possible next steps**
- **Heavily demo based**
Who is Using Simulink in a Team?
Simulink in Teams

A new, more integrated workflow

- Teams are constantly interacting using the model as a reference
- Interactions are inherently bi-directional
- Errors and mistakes much more likely to be discovered early in the lifecycle
Simulink in Teams

Sample statistics from recent customer conversations:

Q: “How big are your projects?”

“Around 600 models plus data files”

“Probably around 100 models (libraries), 200 MATLAB files for data”

“100 model references, 20 libraries, twice as many scripts”

“More than 100 models; might get to 1,000 in the future”
Simulink in Teams

Sample statistics from recent customer conversations:

Q: “How big are your projects?”

“Too big for a single person to know everything about the project”
Introduction to Simulink Projects
Simulink Projects Overview

Integrate with Source Control

Place to build, store & share best-practice

Understand structure of your design

Simulink Projects

MATLAB API to help automate common, uncommon & repetitive tasks

Support for peer-review of changes

Create & standardize team environment

Simulink 8.0
+ YourLib v1.3
+ Microsoft® Visual C++ 2010
+...
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Simulink Projects Manages the Files in Your Design

- Simulink Projects tool finds, manages, and shares all the required files of your project.

Demo: >> sldemo_slproject_airframe
Demo
Simulink Projects Shortcuts

- Make it easy for *any* engineer (not just engineer who created the project) to:
  - Find important files
  - Find & execute important or common operations
    - Make the top-level model in the project a shortcut
  - All debuggable

- Optionally set shortcuts to run at project startup or shutdown
  - Provides formal mechanism for running initialization scripts
  - Makes it easier to ensure the symmetric shutdown scripts are called
Using Simulink Projects to Create a Consistent Cross-Team Environment

- We saw Project Shortcuts being used to
  - Check MATLAB version, compiler version, etc.
  - Set (and re-set) the MATLAB path
  - Make available (the right version of) company utilities
  - Load data
  - Highlight entry points into the Project

- Benefits:
  - Everyone on the team has the same environment
  - New team members can get started more quickly
  - Less wasted time debugging discrepancies
Using MATLAB & Simulink Project to Automate Tasks
Why Automate?

- **Automated Processes Get Done**
  - Regularly (if needed)
  - Repeatably
  - Can be done by anyone

- **Corollaries**
  - Manual processes are often infrequently done
  - Can be subject to variation
  - Perhaps only one person can do them
Why Automate?

“Our model uses some S-Functions. We’re struggling to try some new ideas out on our Linux cluster because we can’t rebuild those S-Functions…”

Why can’t they be rebuilt?

1. We can’t find the source code
2. No one can remember the magic command to rebuild them (compiler, version, flags, etc.)
3. (Variation on the above) The engineer who used to do this has left and now… (1. &/or 2.)
How can Automation in Simulink Project help?

**SOLUTION:**

1. Put the source in the project & hence under source control
   
   (This is the obvious bit)

2. Whenever someone does something that no one else knows how to do:
   - Convert it into a MATLAB script, & …
   - Make it a Project Shortcut

   (This is the nice Simulink Project bit)

**BENEFITS:**

In the project
- Under source control
- Shared across the team

Automation via MATLAB & Simulink Project API
- Shortcuts make things discoverable
- Anyone can do it
- Everyone can find it
- Project API aids portability
How can Automation in Simulink Project help?

- Now anyone can rebuild the S-Functions
  - (or run the tests; generate code; publish the reports; import & validate test data; …)
  - Even at 8:34pm on a Friday night; on a testing trip; …
Automation Options in Simulink Projects

- Build-in “best practice” support
  - Project Checks
  - Growing list of our own “gotchas”
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- Startup & Shut Down shortcuts
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- Startup & Shut Down shortcuts

- Command-line API used to manage files

- Batch-running functionality from the UI
Batch Operations on Project Files

Execute project-wide operations authored in MATLAB on batches of files

- Execute a MATLAB function on some or all of the files in a project from the GUI for automation tasks
- Filtering supports selection of files
- Results are displayed in the Batch Job View

» sldemo_slproject_batchjobs
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Componentization, Data Management & Work Sharing
Case Study: Typical industry workflow

Change Request:

Tasks:
1. Refactor powertrain calibration project to create new component.
2. Analyse for unused data.
3. Apply fuel type labels appropriately

Repository: svn://repo/projects
Project: powertrain
Branch: trunk
Demo
Simulation Data Inspector
Managing Data

- Analyse data dependencies for models
- Find dead/unused data
- Supports partitioning large designs

Find Referenced Variables

Export to File
Protected Mode Available as a Clickable Option

Protect models you share with just two clicks

- Create the protected model reference file with two clicks
- Share model functionality without exposing underlying implementation
- Requires Simulink Coder to create
  - Just Simulink to simulate

» sldemo_mdlref_bus
Compare XML Files Exported from Simulink Models

Quickly determine what changed between two designs

- Use XML comparison tool to:
  - Export Simulink model to an XML text file
  - Compare XML text files using a change detection algorithm (Chawathe)
  - Identify and review differences between two versions of files
  - View changes highlighted in the original models
  - Create and save a printable report

- Compatible with configuration management systems

Demos: >> slxml_sfcar, slxml_truthtables, slxml_eml_radar

* Requires Simulink Report Generator 3.9
Merge Simulink Models Based on XML Comparison Differences

Merge Simulink models from within XML comparison report

- Merge models within the tool by merging changes from left to right:
  - Left model is the base
  - Right model is the one edited
- Merge individual parameters, blocks, or entire subsystems

```plaintext
» slxml_sfcar
```

Requires Simulink Report Generator
Using Labels in a Simulink Project

- Define metadata to associate with project files
- Use for sorting, grouping
  - Application information
  - Project status
  - Ownership
  - Etc.
- Persistent and shareable
- Available through Project API

Extensible set of metadata categories

Categories contain your metadata names

Metadata names appear in Project UI (sort, group by)

Metadata panel provides detailed info
Enhanced Dependency Graph

Intuitive interface helps users understand associations and missing files

- Improved file dependency graph
- Highlight by:
  - Dependencies
  - File type
  - Reference type
  - Label
- For example:
  - Highlight all files that have label “to review”
  - Highlight all Simulink models
Simulink Projects for Sharing Work
Project Templates

- Make it easy to ensure that new projects
  - Use the company standard environment
  - Have access to the company standard tools such as company Model Advisor checks

- Project Templates
  - Easy to create from an existing project
  - **Reuse** on subsequent new Simulink Projects

- Use **to apply company standards**:
  - Add libraries & utilities to path
  - Start up and shutdown scripts
  - Code generation procedure
  - Folder structure
  - Model architecture
  - CM tool

**Set up standard environment**

**Expert-created utilities easily available**

**Pre-populated metadata**

**Standard folder structure**
Archived Projects

Share projects outside the source control system

- Export the current project as a zip archive (R2012a)
  - Preserves project files, structure, labels, shortcuts, etc.
  - Does not include CM information
- Send zipped archive to customers, suppliers, or colleagues who do not have access to CM repository
- Recipient can create a new project from that zip archive (R2012b)
Sharing Work through Source Control Integration
Source Control Integration

Integrate with 3rd party source control tools

- Out of the box
  - Integration with Subversion (SVN) from R2012a onwards; web download for R2011b
  - Lightweight local version control tool for single user (supports evaluations, R2011b onwards)

- SDK for integrating with other source control tools
  - Open, minimal API
  - Documentation & SDK ship with Simulink
  - MathWorks Consulting

- Simulink Projects is source control agnostic
  - Workflows same regardless of source control backend
Wrap Up; Next Steps
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Next Steps

- Try it out..!
  - Simulink Projects shipped in R2011b
  - Search documentation for “Simulink Projects”
  - Demo: sldemo_slproject_airframe (and others)

- Focus on automation, short-cuts, batch-jobs, dependency analysis, labels, creating a team environment
  - Using SVN? Built-in support will just work
  - Using something else? Trial using SVN, build-in local CM or use Simulink Projects & your source control tool in parallel
  - Talk to your account manager about Consulting support
Thank You!

Questions?