

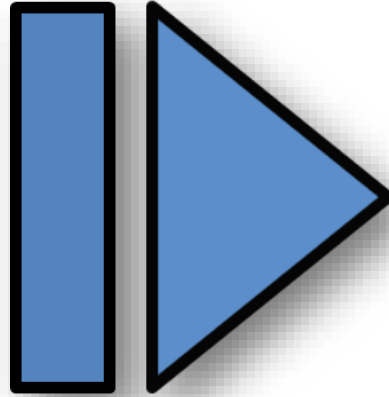
What's New in MATLAB and Simulink

Dr. Mohamed Anas
Manager, Applications Engineering Group
June 09, 2015

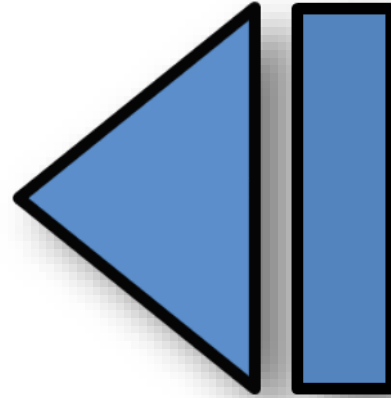
MATLAB
CONFERENCE **2015**



Imagine making your applications run
faster than you ever thought possible!



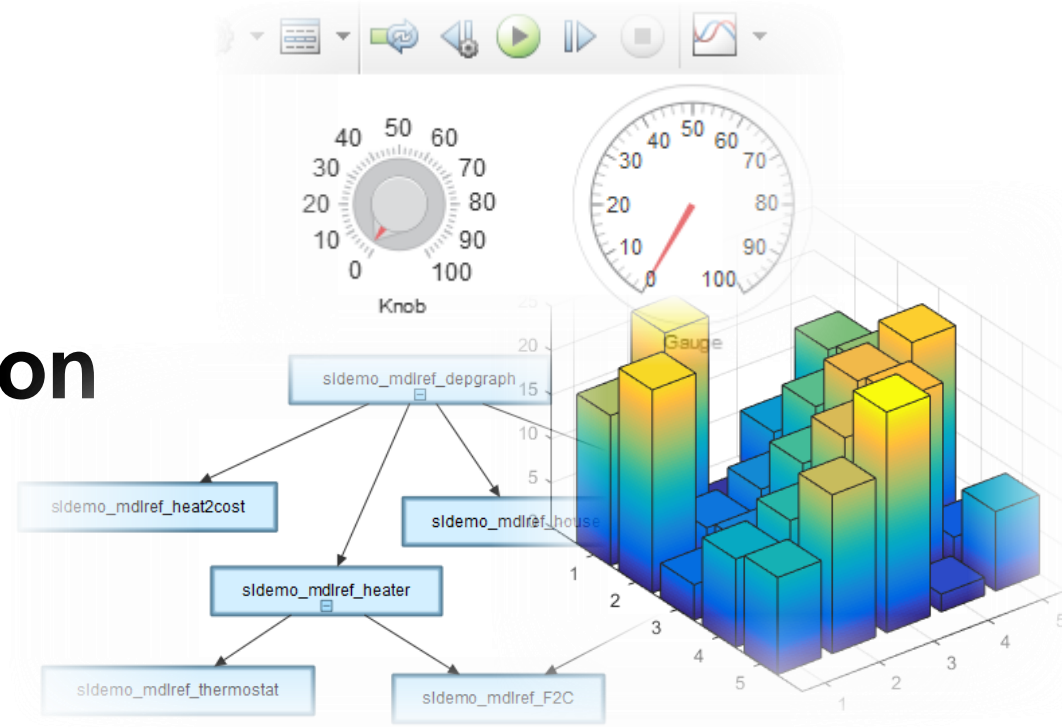
Imagine stepping **forward**
through a simulation



Imagine stepping forward
and back
through a simulation

Usability

Collaboration



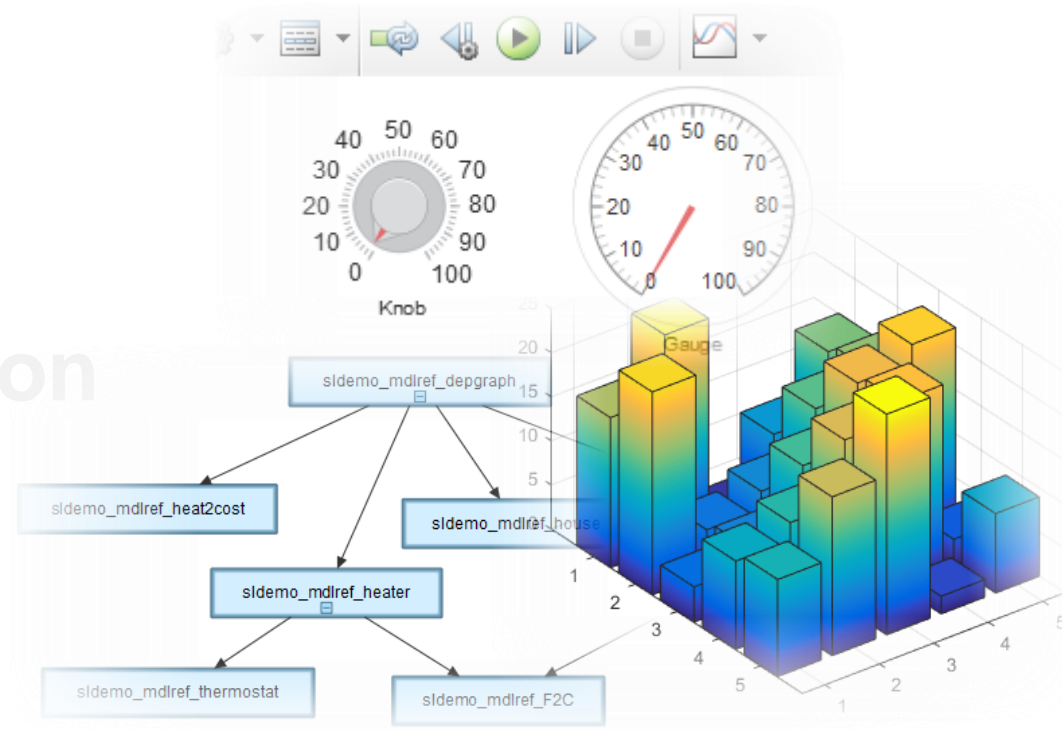
Visualization

Scalability

Usability

Collaboration

Visualization



Scalability

Where is MATLAB and Simulink Today?

The New MATLAB Desktop

See what you've
been missing.



TRY IT TODAY

visit mathworks.com/matlab-new-features

R2012b introduces a fresh new MATLAB® Desktop, making it easier to find what you need.

Toolstrip

Highlights commonly used functionality

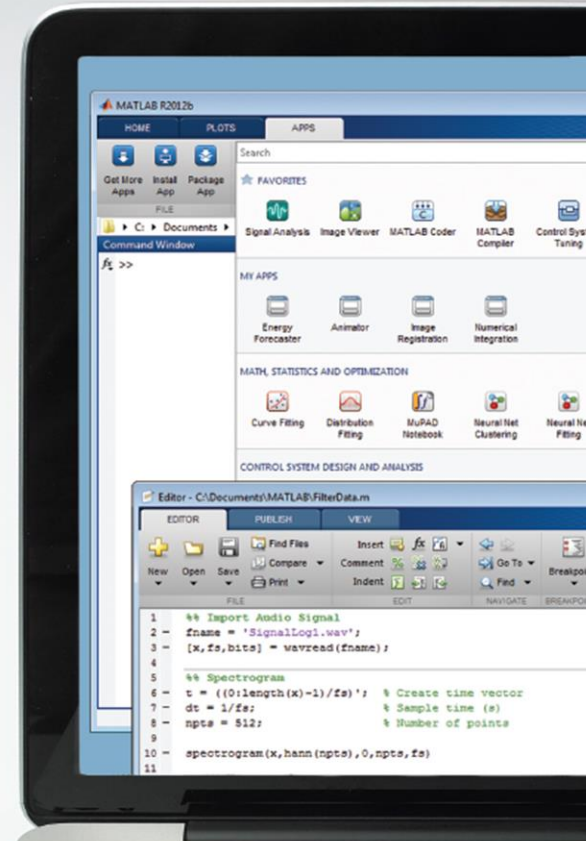
Apps Gallery

Displays in-product and user-written apps

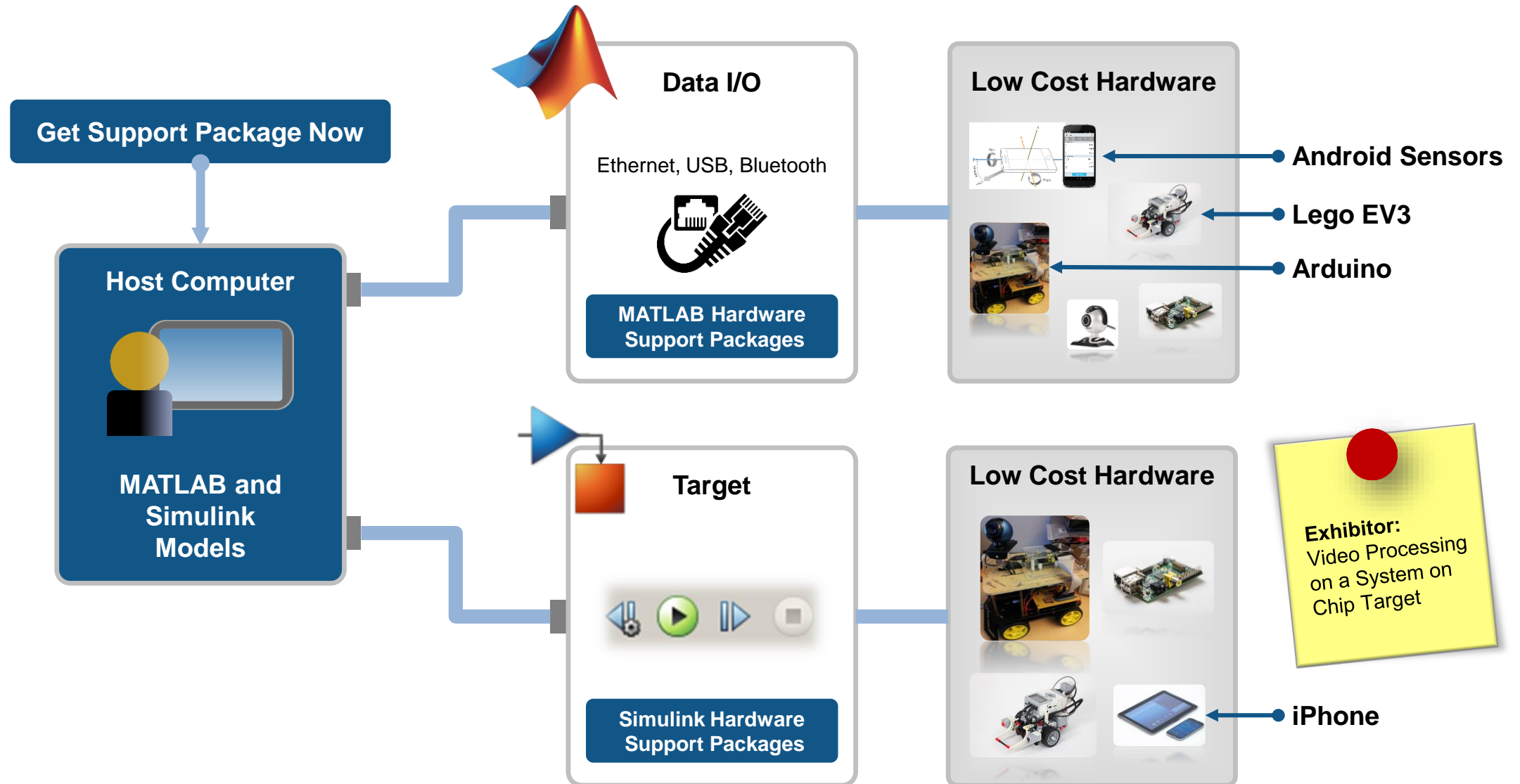
Online Documentation and Redesigned Help

Improves searching, browsing, and filtering

MATLAB
& SIMULINK



Connecting to and Targeting Hardware



MATLAB: Importing Data

- Import Tool
 - Interactive import of delimited and fixed-width text files
 - Provides improved handling of numbers, text, and dates
 - Automatically generate MATLAB code (scripts and functions) to automate the process
- Access online data (**webread**)
 - JSON, CSV, and image data
- Read and write data from network-connected devices (**tcpclient**)

	A	B	C	D	E	F	G
	FileName	Date	Time	Weather	Country	Website	Brand
NUMBER	NUMBER	NUMBER	TEXT	NUMBER	NUMBER	NUMBER	NUMBER
1	File Name	Date	Time	Weather	Country	Website	Brand
2	autodata2...	7/9/2010	8:29AM	Cloudy	Malaysia	Facebook.c...	Nike
3	No.	Row	Col	Status	Length	Brightness	x point

Read Image Data from Web Map Service (WMS) Server

Image data from a Web service is returned as a numeric matrix, in this case a 256-by-512-by-3 uint8 matrix. You can use `webread` to read image data from a WMS server.

```
url = 'http://neovms.sci.gsfc.nasa.gov/wms/wms';
RGB = webread(url, 'Service', 'WMS', 'Layers', 'BlueMarbleNG', ...
    'CRS', 'CRS:84', 'Format', 'image/jpeg', ...
    'Height', 256, 'Width', 512, ...
    'BBOX', '-180.0,-90.0,180.0,90.0', ...
    'Request', 'GetMap', 'Version', '1.3.0');
```

```
figure
imshow(RGB)
```



0.478103	0.96309
0.280294	0.904993
0.7427428	0.567636
0.552988	0.419628

MATLAB: New Fundamental Data Types

- **table**
 - For mixed-type tabular data
 - Supports flexible indexing
 - Built-in functionality (merge, sort, etc.)

- **categorical arrays**
 - For discrete non-numeric data
 - Values drawn from a finite set of possible values ("categories")
 - Can be compared using logical operators
 - Similar to numeric arrays

Variables - patients

patients

100x9 table

	1	2	3	4	5	6
	IDNumber	LastName	Sex	Age	Systolic	Diastolic
1	'YPL-320'	'Smith'	'Male'	38	124	93
2	'GLI-532'	'Johnson'	'Male'	43	109	77
3	'PNI-258'	'Williams'	'Female'	38	125	83
4	'MJJ-579'	'Jones'	'Female'	40	117	75
5	'XLK-030'	'Brown'	'Female'	49	122	80
6	'TFP-518'	'Davis'	'Female'	46	121	70
7	'LPD-746'	'Miller'	'Female'	33	130	88

Command Window

```
>> patients2.LastName(patients2.Health < 'Good')
ans =
    'Thomas'
    'Kelly'
    'Wood'
    'Foster'
    'Griffin'
    'Hayes'
```

patients

100x9 table

	7	8	9
	Height	Weight	Health
1	1.8000	80	Excellent
2	1.7500	74	Excellent
3	1.6300	59	Fair
4	1.7000	60	Good
5	1.6300	54	Poor

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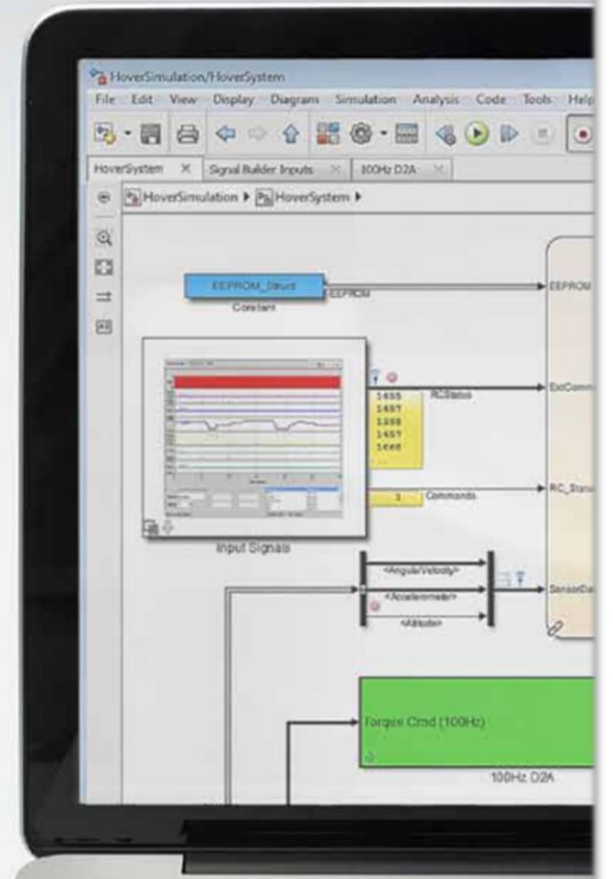
DISCOVER THE NEW LOOK AND FEEL of Simulink

TRY IT TODAY
visit mathworks.com

Exhibitor:
Model-Based Control Design and Rapid Prototyping of a Motion System

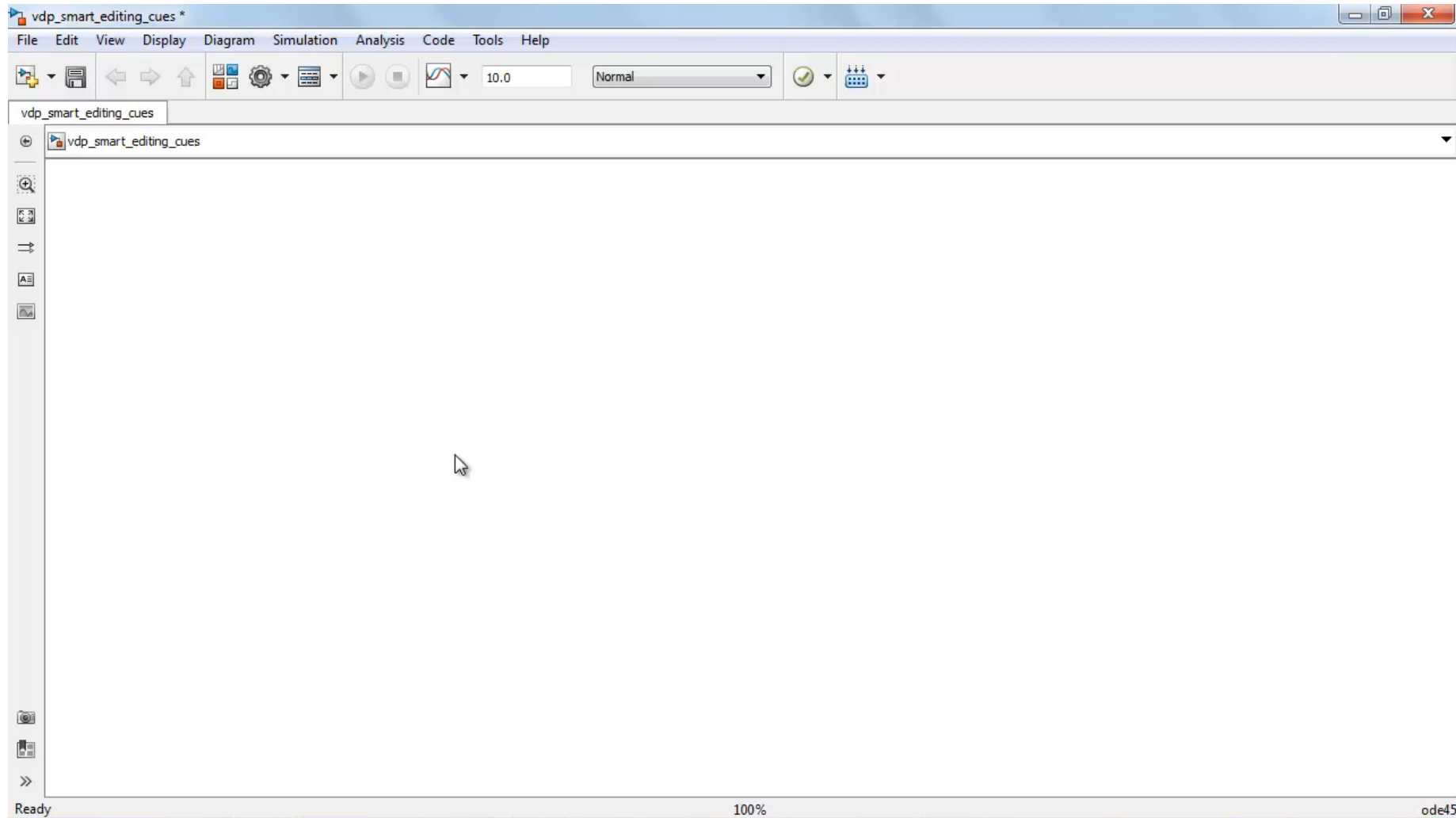
With Simulink® Release 2012b, it's even easier to build, manage, and navigate your Simulink and Stateflow® models:

- Smart line routing
- Tabbed model windows
- Simulation rewind
- Signal breakpoints
- Explorer bar
- Subsystem and signal badges
- Project management



Simulink: Accelerate Model Building

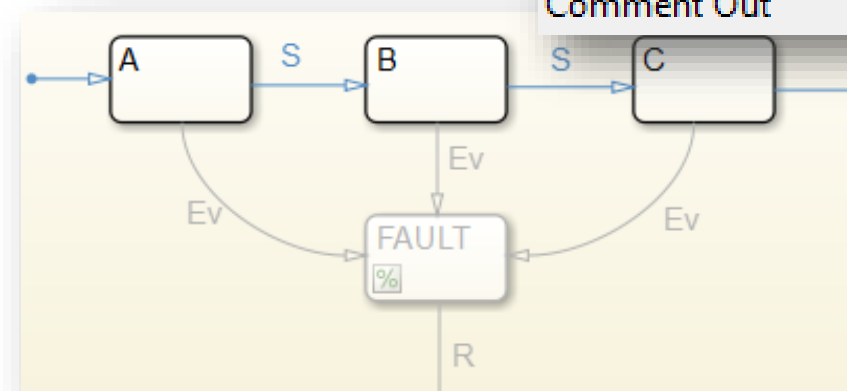
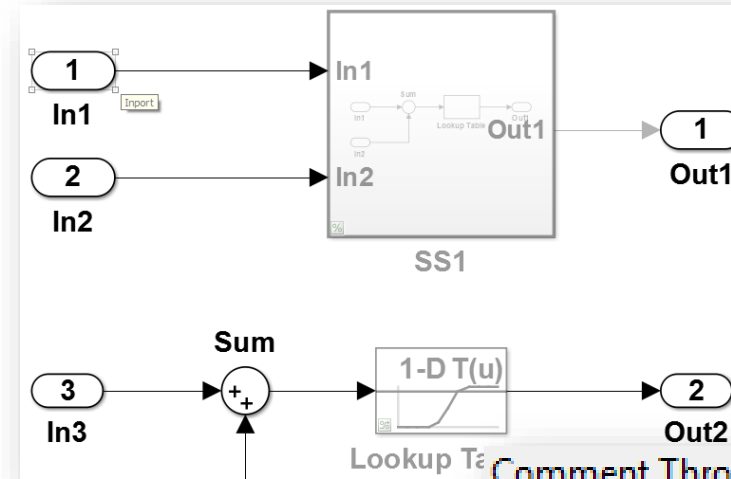
Smart Editing Cues



Simulink: Comment Out and Comment Through

Comment a block so that the output equals the input

- Signal passes through the block during simulation
- Comment out option remains available
- Works on blocks with the same number of inputs and outputs



Comment Through

Ctrl+Shift+Y

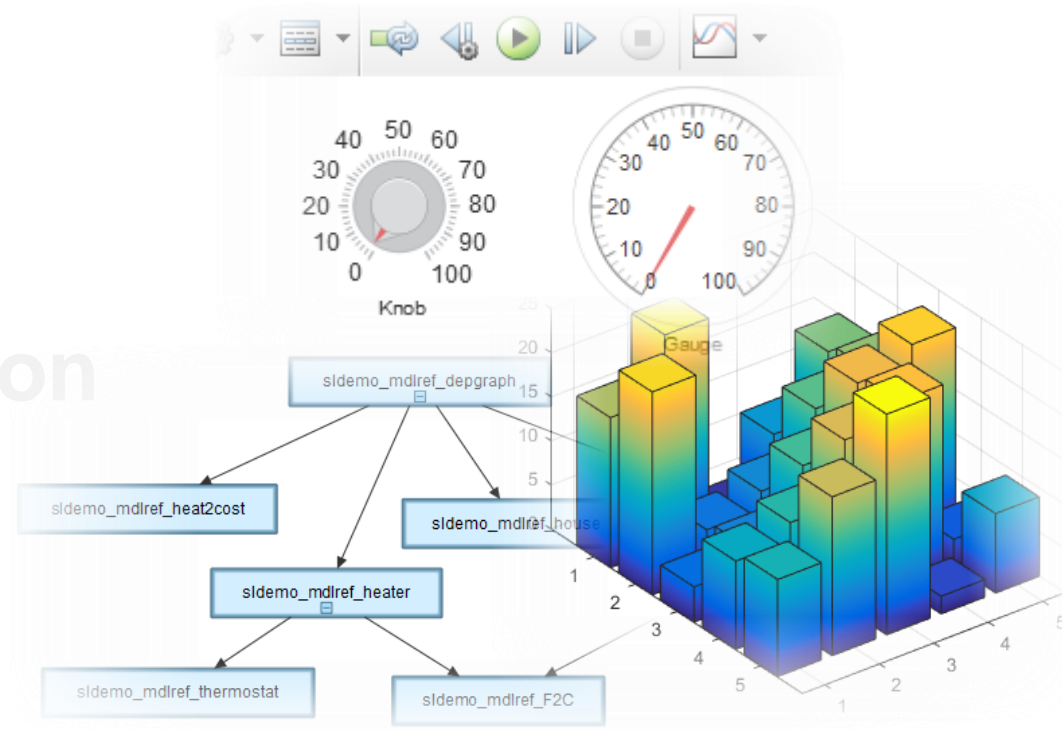
Comment Out

Ctrl+Shift+X

Usability

Collaboration

Visualization



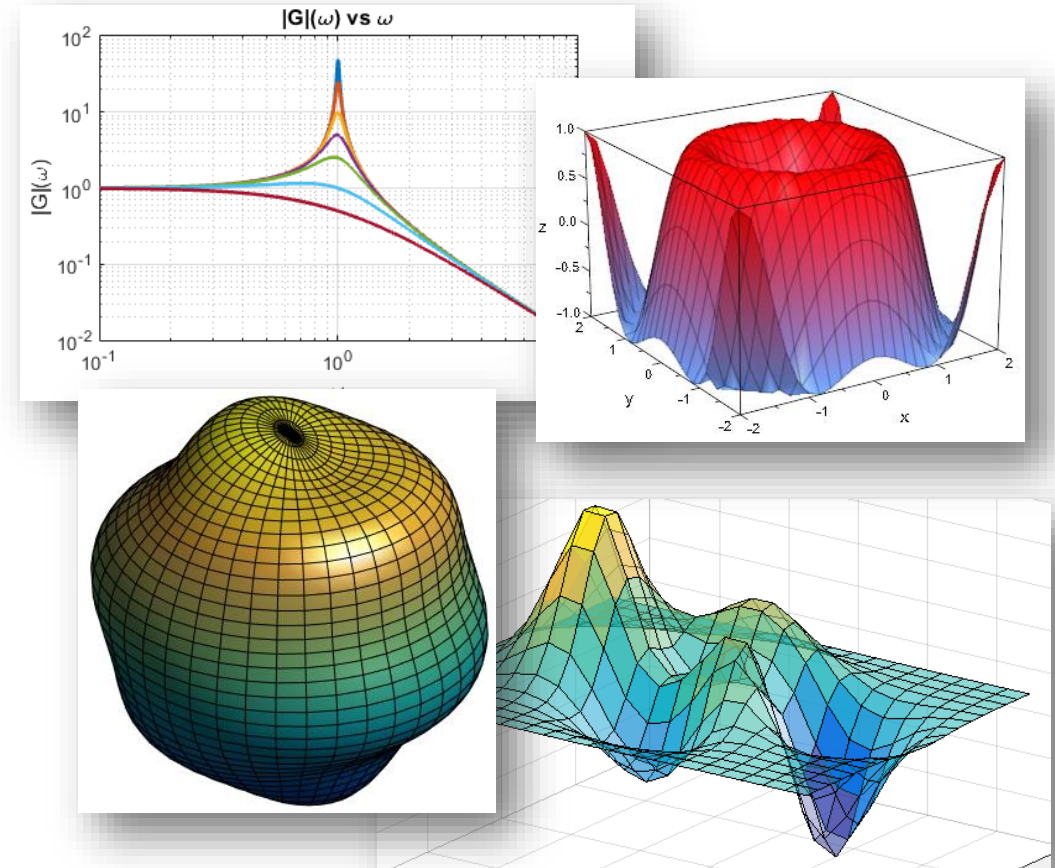
Scalability

New Graphics System Overview

- New look
 - New default colormap and line colors
 - Anti-aliased fonts and lines
 - Subtler grid lines

Data easier to interpret

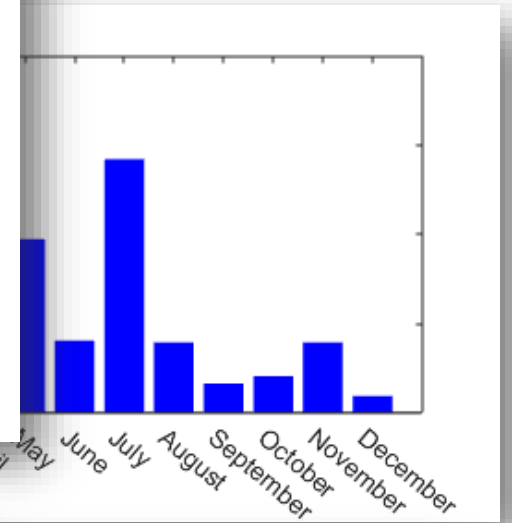
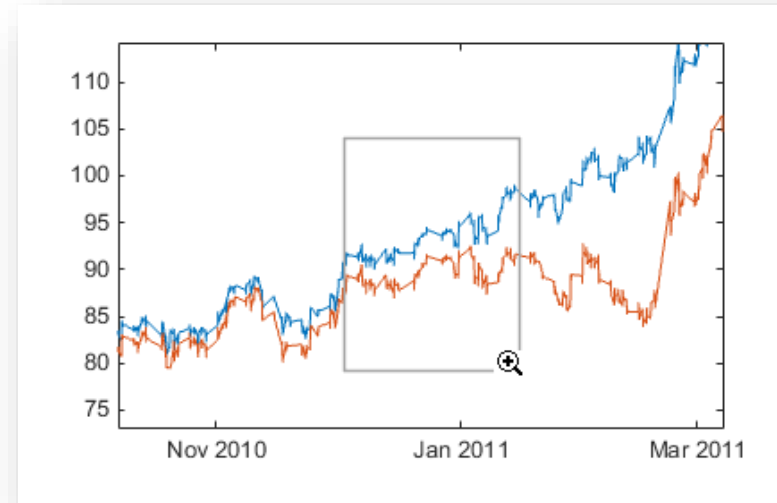
- Easier to customize
 - Graphics objects now behave like other MATLAB objects
 - Support dot-notation to access and change properties



```
>> p = plot(x,y);  
>> p.Color = 'red';
```

New Graphics System

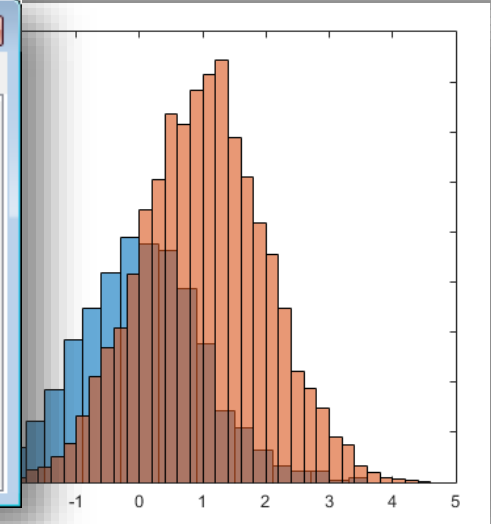
- Multilingual text and symbols
- Automatic updating of `datetime` tick labels
- New visualization functions
 - `histogram`
 - `animatedline`
- Multiple colormaps per figure
- Rotatable tick labels
- User interfaces with tab panels



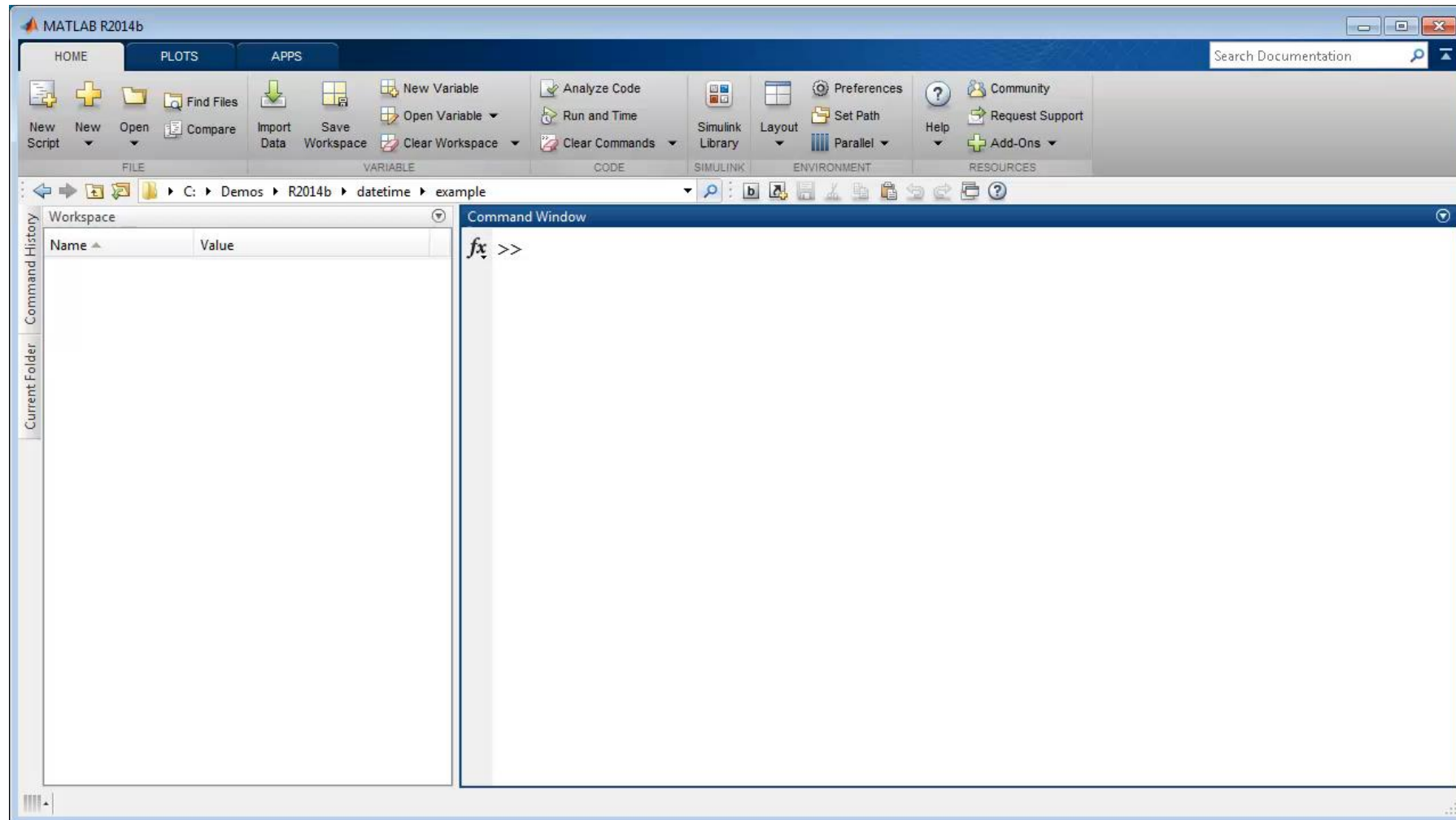
User Interfaces with Tab Panels

Loan Data | Amortization Table | Principal/Interest Plot

Loan Amount	<input type="text" value="400000"/>
Down Payment %	<input type="text" value="5"/>
Interest Rate %	<input type="text" value="4.5"/>
Load Period (years)	<input type="text" value="20"/>

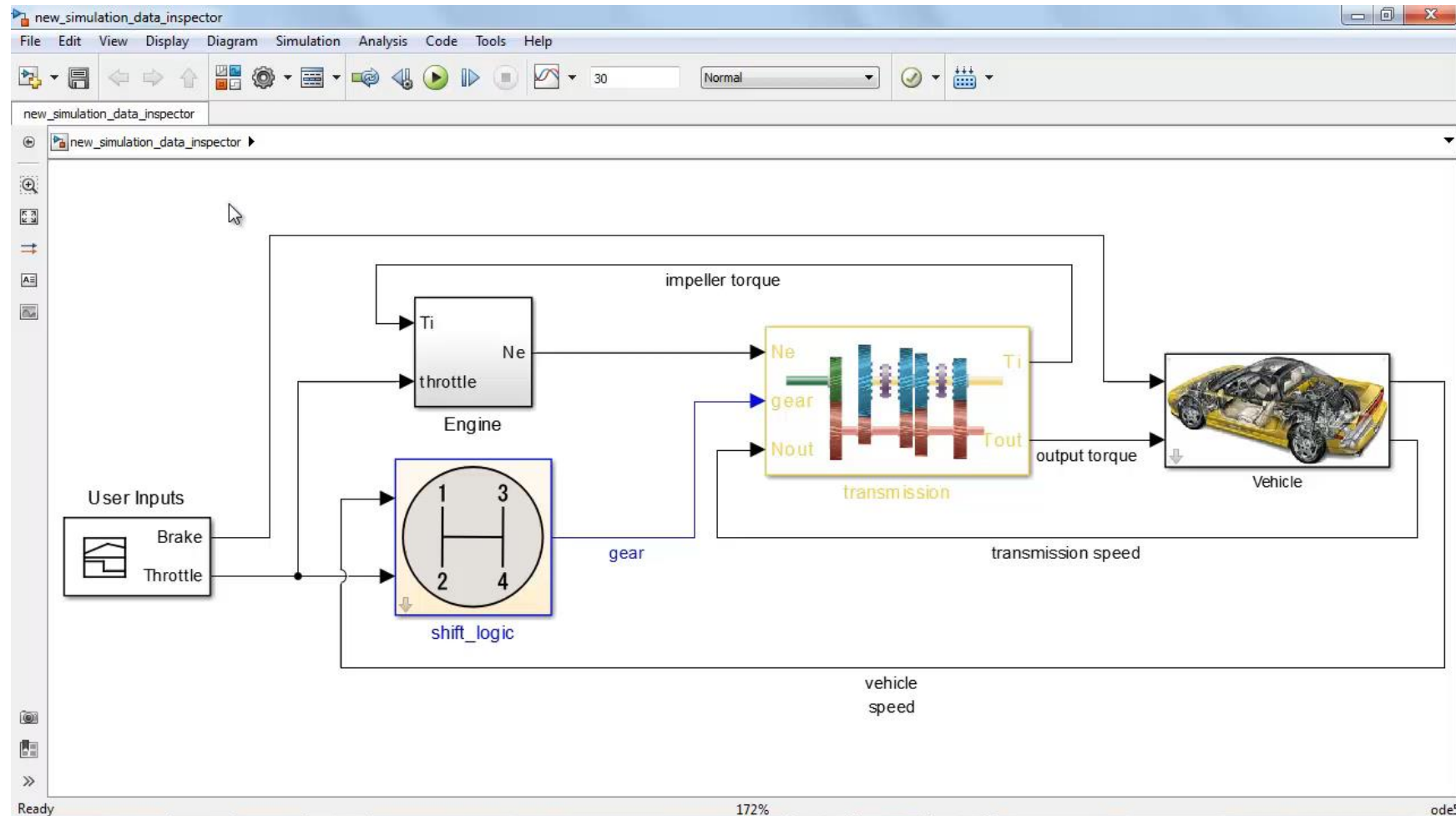


MATLAB: Date and Time Arrays



Simulink: Better Simulation Data Analysis

New Simulation Data Inspector



Simulink: Tune and Monitor Your Simulations

New graphical controls and displays

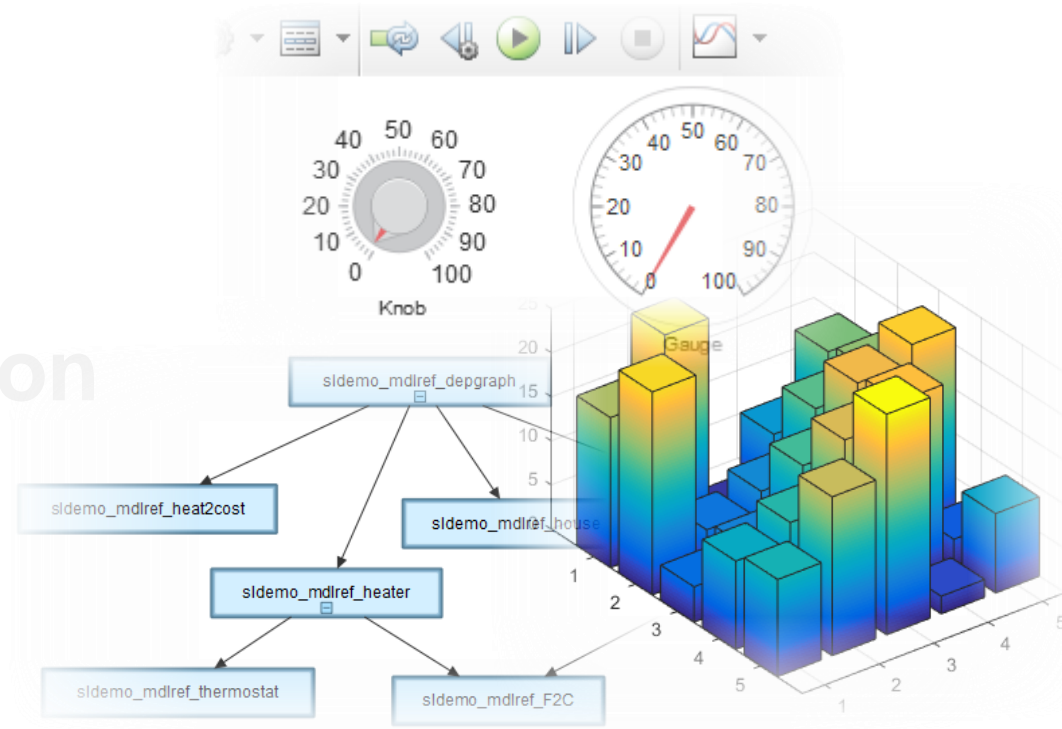
The image displays the Simulink environment for a Dual Clutch Transmission (DCT) simulation. It is divided into three main sections:

- Simulink Library Browser (Top Left):** Shows a tree view of Simulink blocks under the 'Simulink/Dashboard' category. The 'Graphical Controls and Displays' sub-category is expanded, showing various UI elements like Dashboard Scope, Gauge, Half Gauge, Knob, Lamp, Linear Gauge, Quarter Gauge, Rocker Switch, Rotary Switch, Slider Switch, and Toggle Switch.
- Main Simulation Window (Bottom Left):** Displays the Simulink block diagram for the 'Dual Clutch Transmission' model. Key blocks include 'Speed Demand', 'Transmission Controller', 'Engine Generic', and 'Dual Clutch Transmission Detailed'. The diagram shows the flow of signals between these components, including gear selection and speed feedback loops.
- Graphical Controls and Displays Panel (Right):** Provides a real-time visualization of simulation data. It features several instruments:
 - Road Incline:** A circular gauge with 'Downhill', 'Flat', and 'Uphill' positions.
 - Gear:** A linear scale from 0 to 20.
 - Wind velocity:** A circular gauge with a scale from 0 to 50.
 - Fuel Economy:** A linear scale from 0 to 50.
 - Engine RPM:** A circular gauge with a scale from 0 to 8000.

Usability

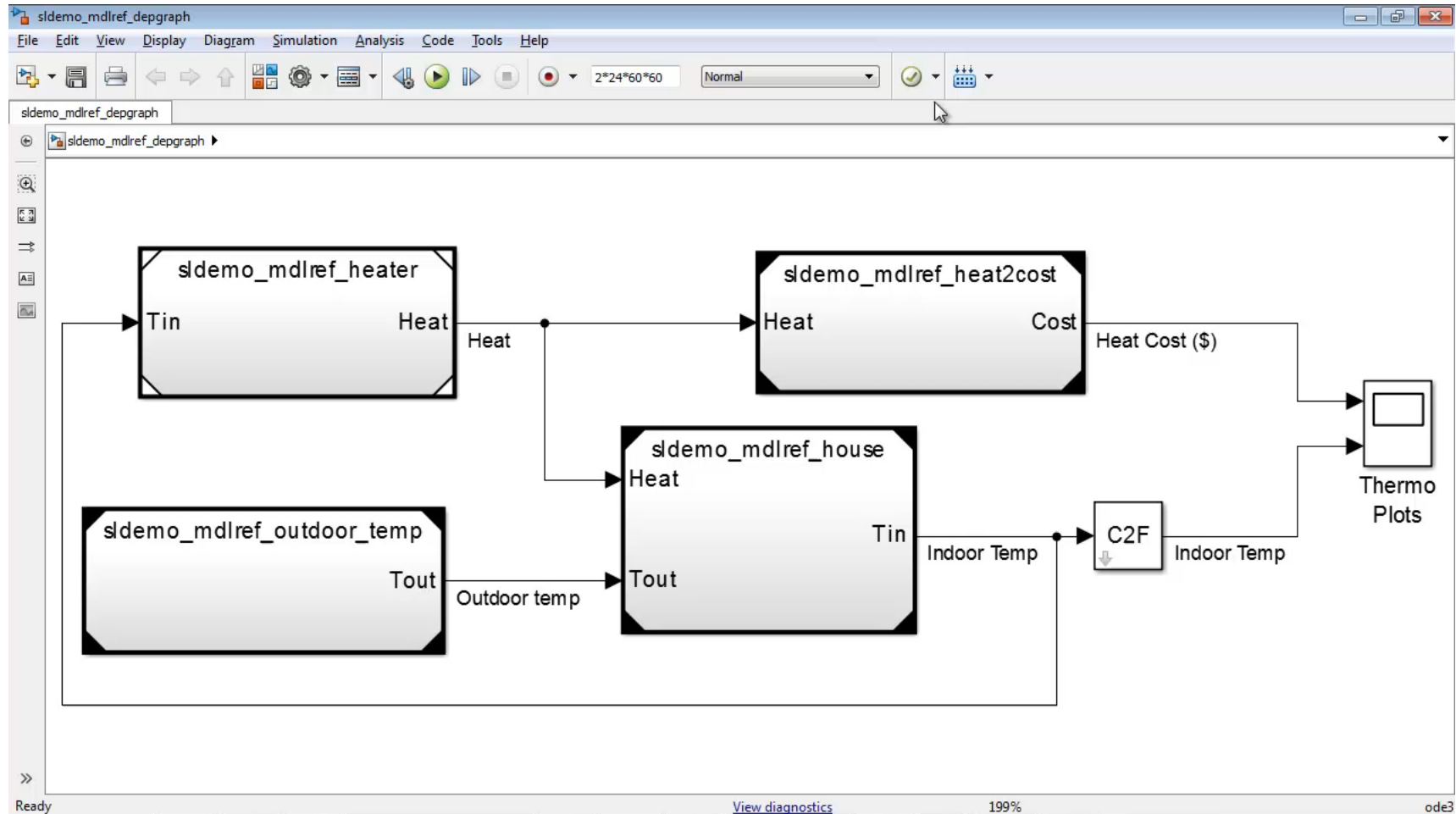
Collaboration

Visualization



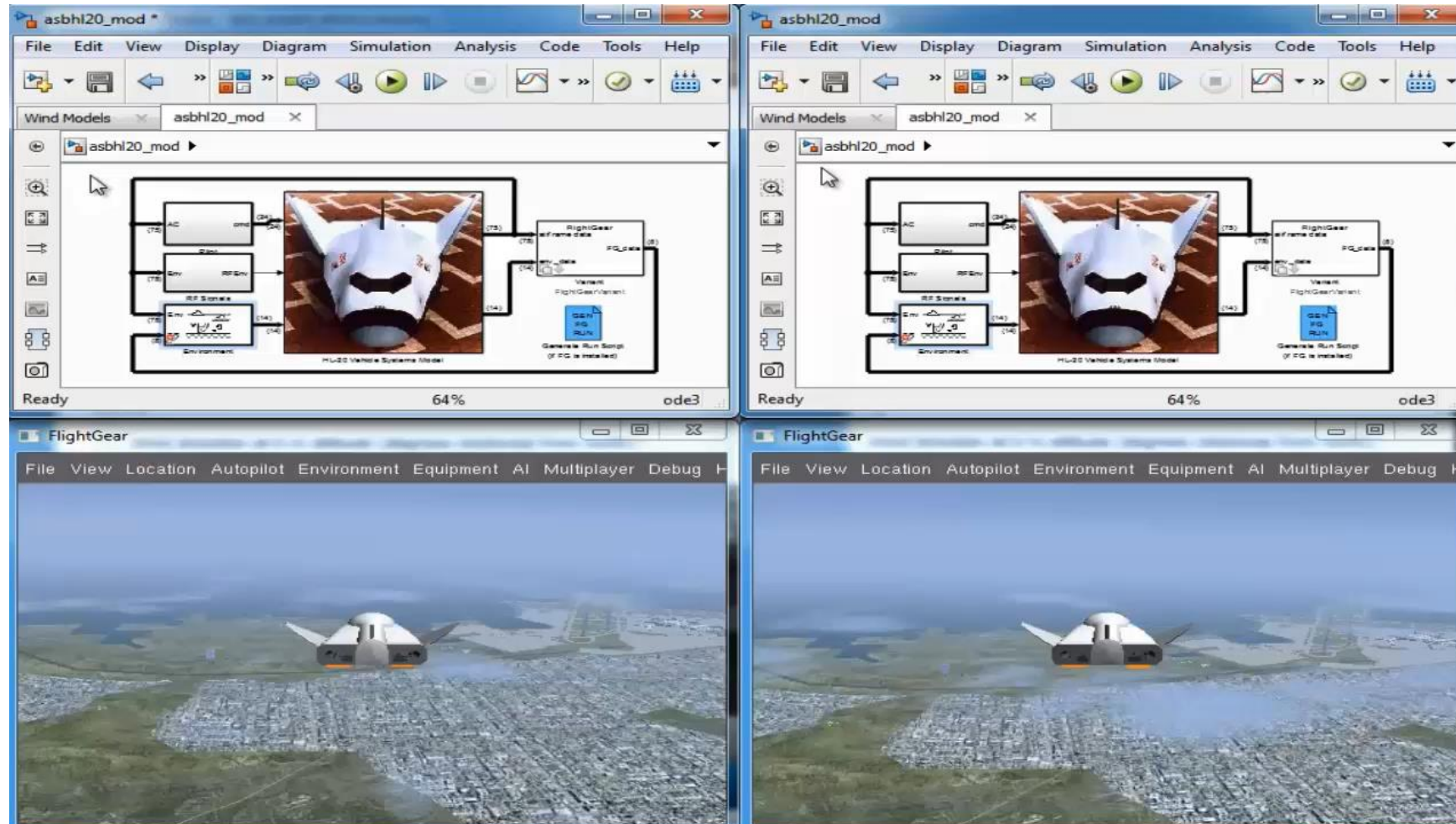
Scalability

Simulink: Performance Advisor



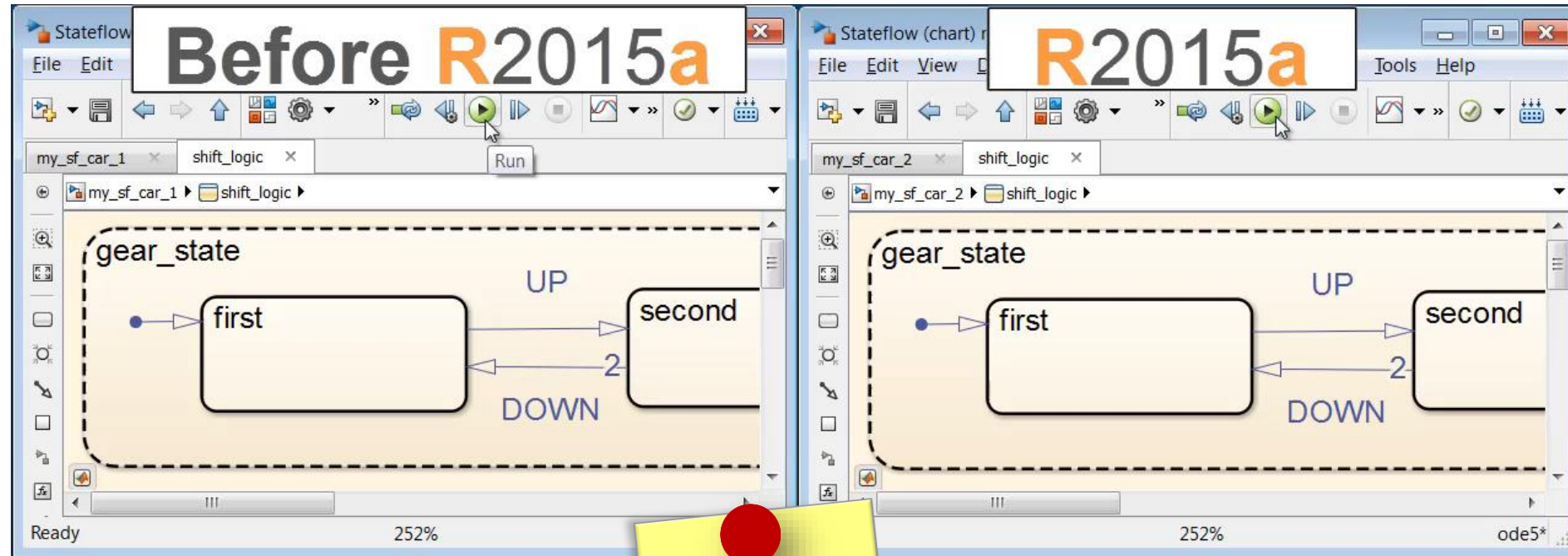
Simulink: Faster Consecutive Simulations

Fast Restart



Stateflow: Start Simulation Faster

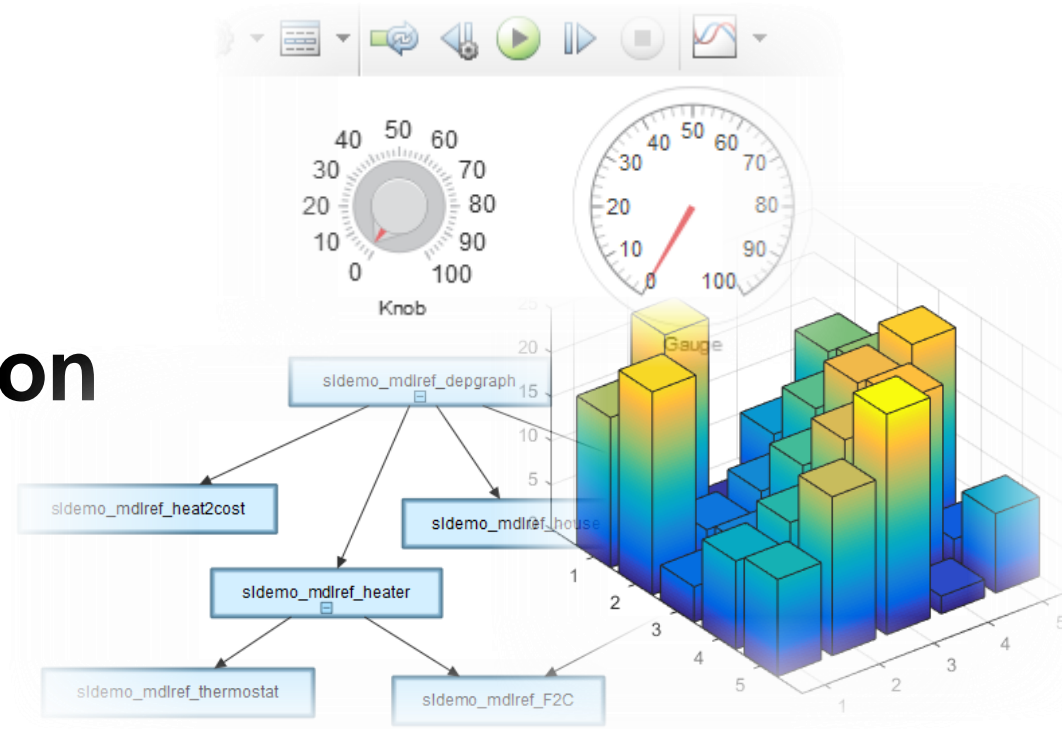
Just-In-Time Compilation



Presentation:
Verify, Validate,
and Document
Models and
Code

Usability

Collaboration



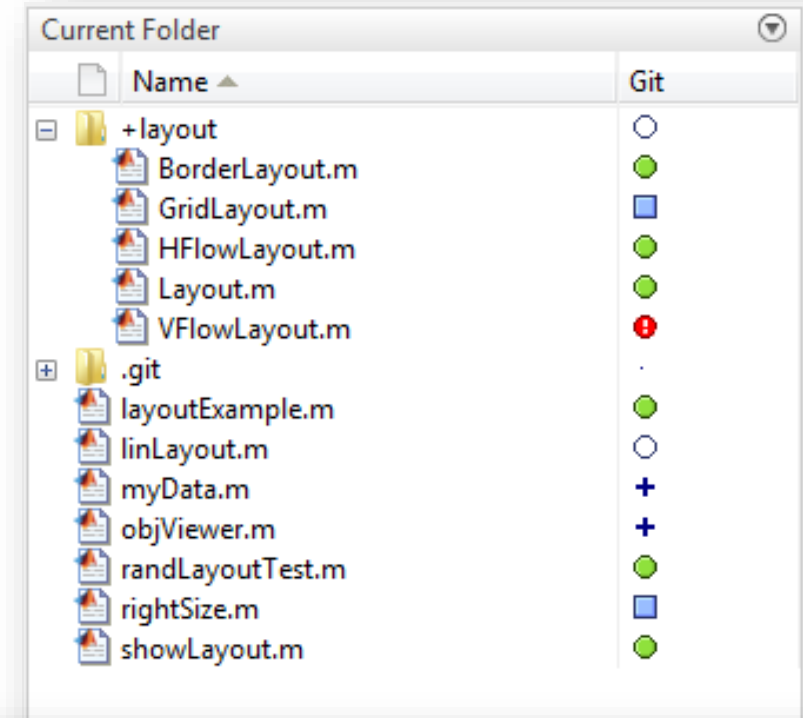
Visualization

Scalability

MATLAB and Simulink: Managing Code and Models

Source Control Integration

- Manage code from MATLAB Desktop and Simulink Projects
- Leverage source control capabilities
 - Git and Subversion integration in Current Folder browser
- Use Comparison Tool to view and merge changes between revisions



Simulink Project - Project Retriever

Source control integration:

Built-In SVN Integration (1.8)

Repository path:

Built-In SVN Integration (1.8)

Sandbox:

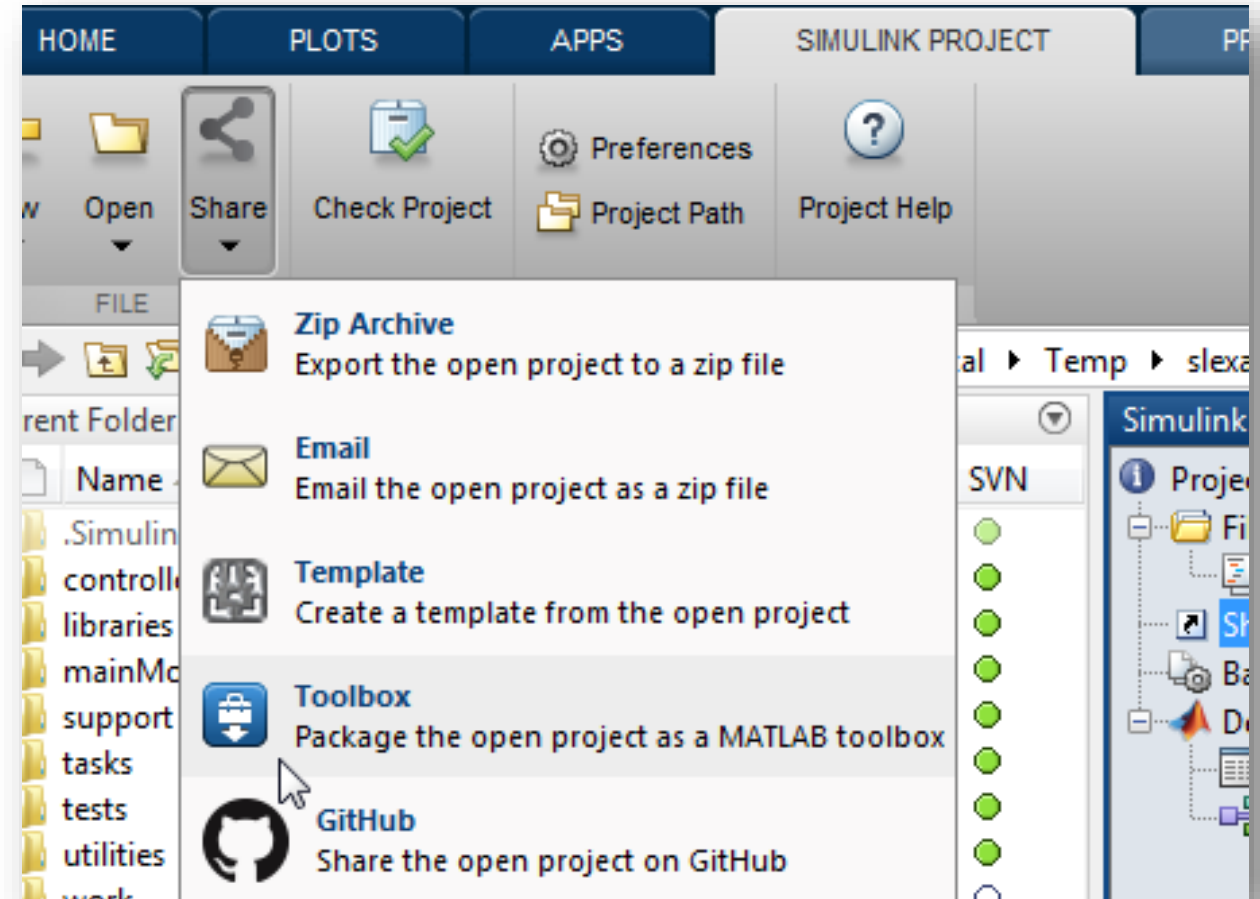
Git

Local Version Control

Simulink: Sharing Projects

Share a project on GitHub® via e-mail or as a MATLAB Toolbox

- Make project publicly available on GitHub
- Share your project via email
- Package project as a MATLAB toolbox



App and Toolbox Packaging

- Package your app or toolbox as a single installer file
 - Contains all of the code, data, apps, documentation, and examples
 - Checks for dependent files and automatically includes them
 - Documents required products
- Included folders and files automatically appear on path when installed
- View details and uninstall toolboxes with Manage Custom Toolboxes dialog box

Presentation:
MATLAB as a
Collaboration
Platform

The screenshot shows the MATLAB 'Package a Toolbox' dialog box for a 'Custom Visualization Toolbox'. The dialog has a 'PACKAGER' tab with 'New Project', 'Open Project', and 'Save Project' buttons. The 'TOOLBOX FOLDER' field contains 'CustomVisualizationToolbox'. A 'Package' button with a green checkmark is visible. Below the dialog, the 'Toolbox Information' window is open, displaying a heatmap visualization and the following details:

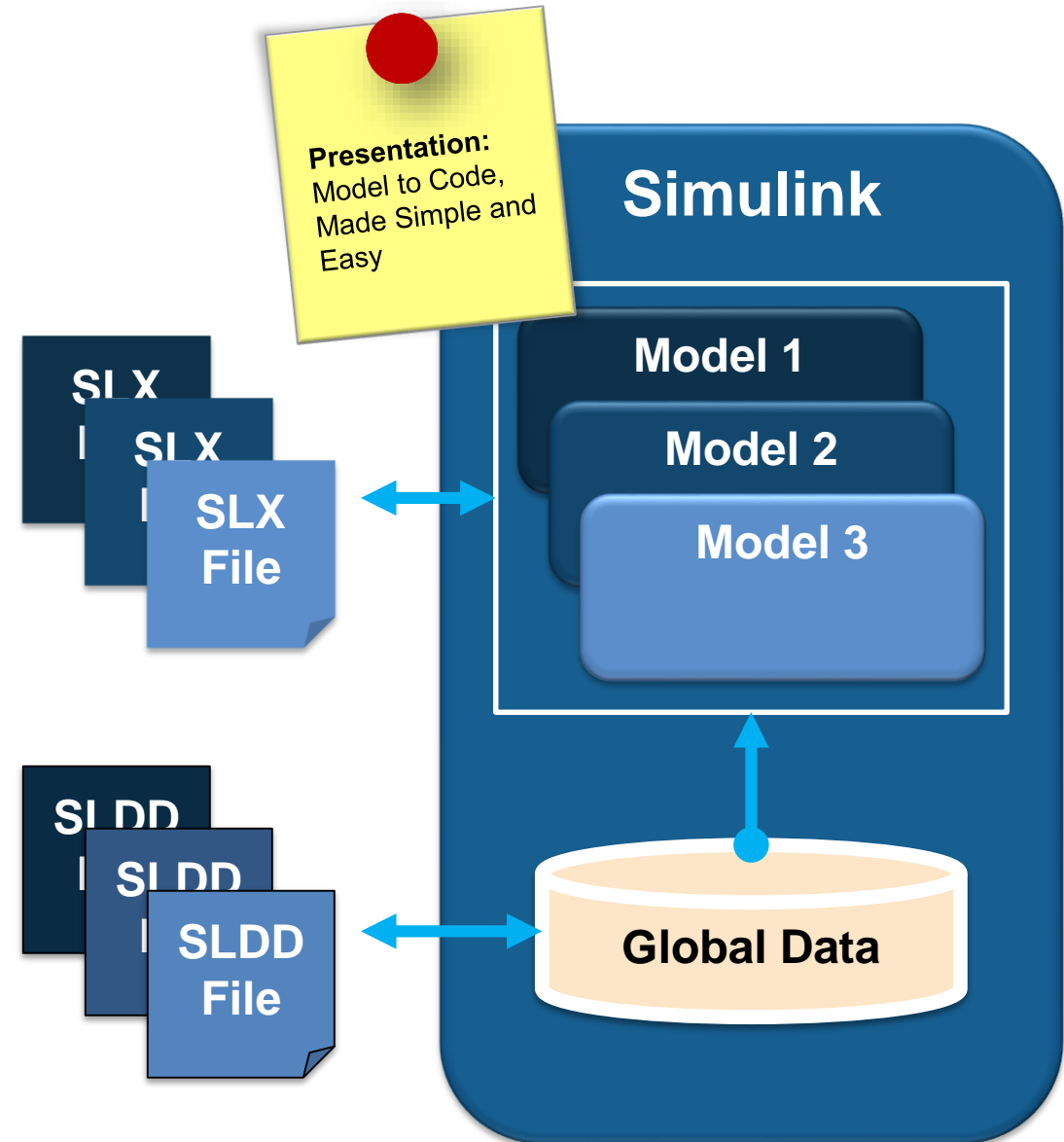
- Custom Visualization Toolbox
- Ameya Deoras, Adam Fillion
- Email
- MathWorks

The 'ENVIRONMENT' menu is open, showing options like 'Preferences', 'Set Path', 'Parallel', 'Help', 'Community', 'Request Support', and 'Add-Ons'. A 'Toolbox installed' notification window is also visible, showing the heatmap and the text 'Custom Visualization Toolbox'. The Command Window at the bottom shows the prompt 'fx >>'.

Simulink Data Dictionary

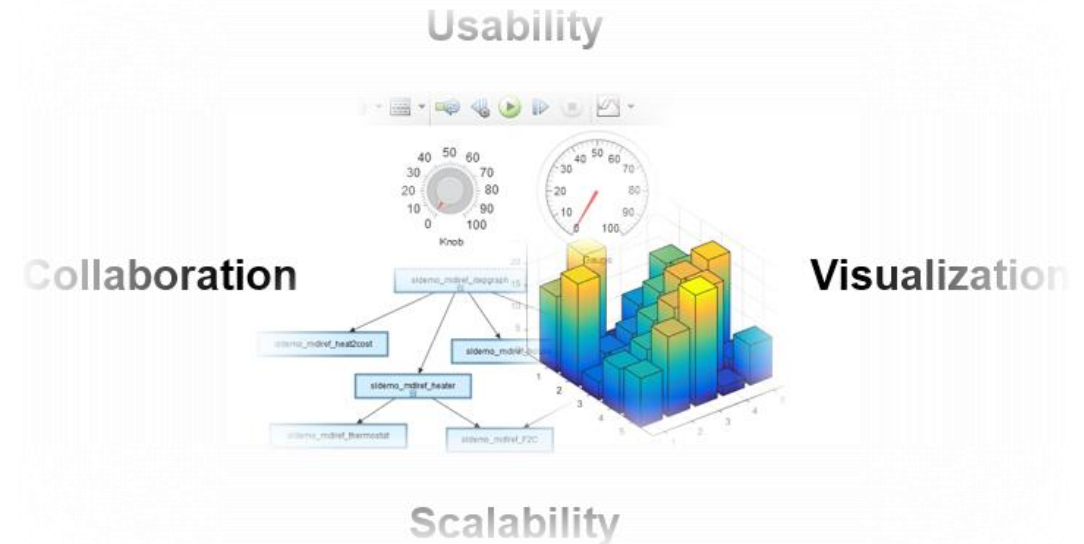
Store, edit and access design data using the data dictionary

- Componentization
- Scalability and performance
- Requirements linking
- Change tracking and differencing
- Defined model-data relationship
- Integration with Simulink Projects



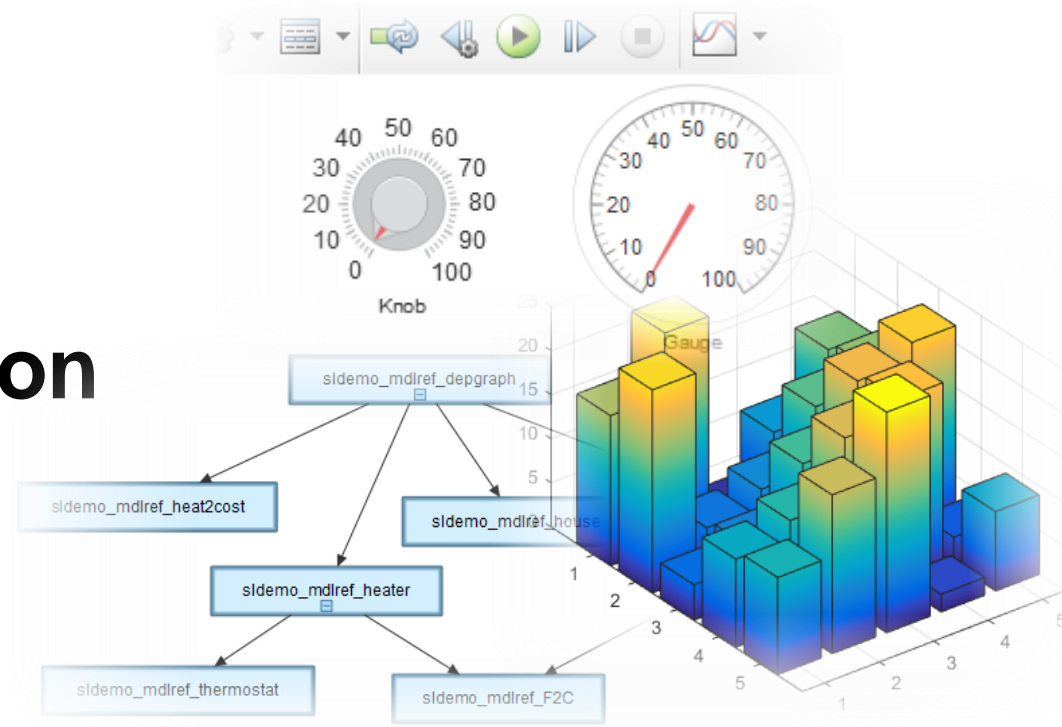
Concluding Remarks

- Methods for improving **ease-of-use** during the design process
- Convey information in a universal manner and make it **simple to share**
- “**Scale up**” and “**Scale out**”
- Work together to a common purpose to achieve **business benefits**



Usability

Collaboration



Visualization

Scalability