

What's New in MATLAB and Simulink

R2015a

Kevin Cohan
Product Marketing, MATLAB

Michael Carone
Product Marketing, Simulink

What was new for Simulink in R2012b?

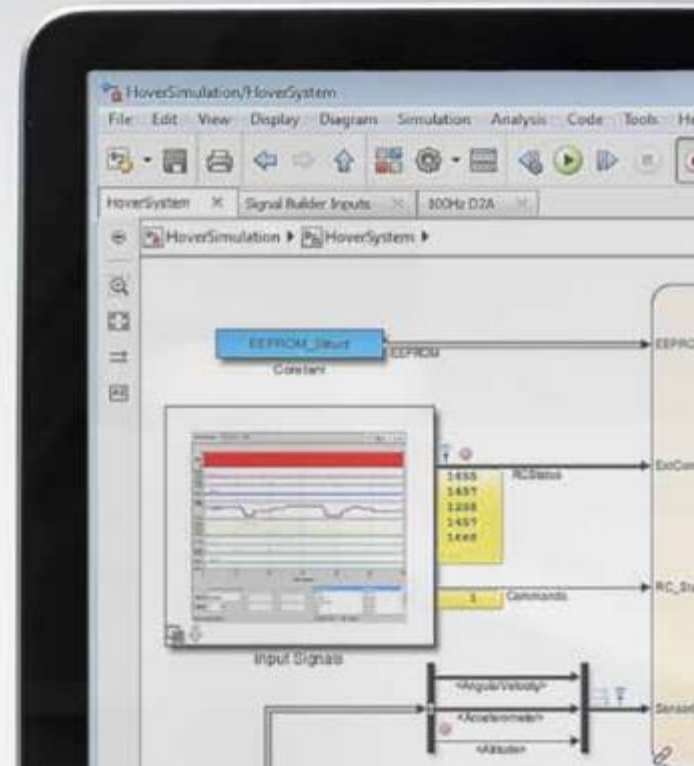
R2012b

DISCOVER THE NEW LOOK AND FEEL *of* Simulink

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

TRY IT TODAY
visit mathworks.com



What Was New for MATLAB in R2012b?

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

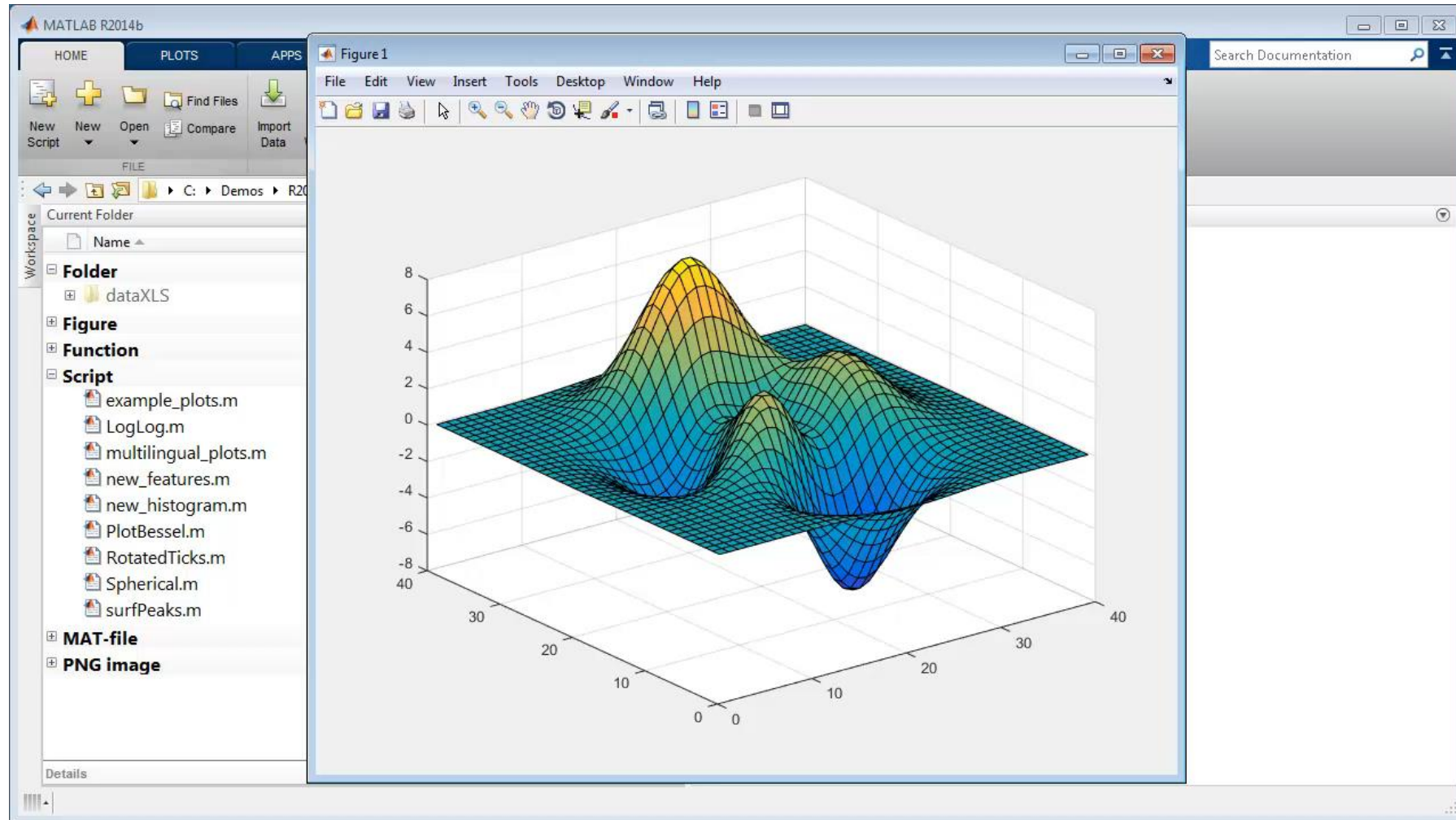
Displays in-product and
user-written apps

Online Documentation and Redesigned Help

Improves searching, browsing,
and filtering



New MATLAB Graphics System



Simulink – Tune and Monitor Your Simulations

New graphical controls and displays in Simulink

The image displays the Simulink R2015a interface, illustrating the integration of graphical controls and displays into simulation models.

Simulink Library Browser: Shows the 'Simulink/Dashboard' category, which includes various graphical components such as Dashboard Scope, Gauge, Half Gauge, Knob, Lamp, Linear Gauge, Quarter Gauge, Rocker Switch, Rotary Switch, Slider Switch, and Toggle Switch.

Simulink Model: The main workspace shows a Simulink model titled 'Dual_Clutch_Trans_dashboard'. The model includes a 'Dual Clutch Transmission' block, an 'Engine Generic' block, a 'Transmission Controller' block, and a 'Fuel' block. The model is connected to a 'Graphical Controls and Displays' block.

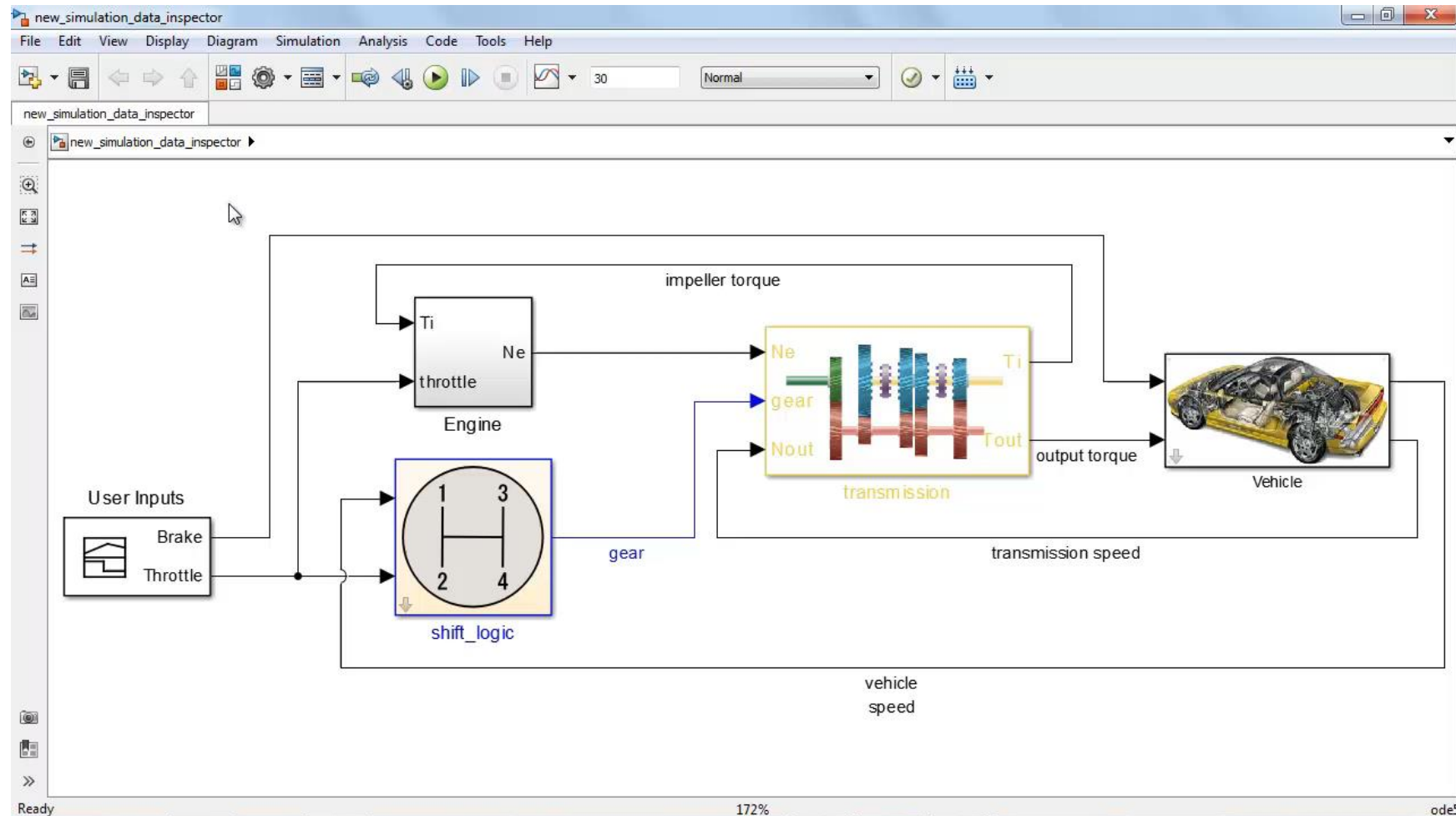
Graphical Controls and Displays Dashboard: The dashboard provides a visual representation of the simulation's state. It includes:

- Road incline:** A circular gauge with 'Downhill', 'Flat', and 'Uphill' indicators.
- Gear:** A linear gauge showing the current gear selection (0 to 20).
- Wind velocity:** A circular gauge showing wind speed (0 to 50).
- Fuel Economy:** A linear gauge showing fuel consumption (0 to 50).
- Engine RPM:** A circular gauge showing engine speed (0 to 8000).

The dashboard also features a 'View diagnostics' button and a status bar indicating 'Ready' and 'ode23t' solver.

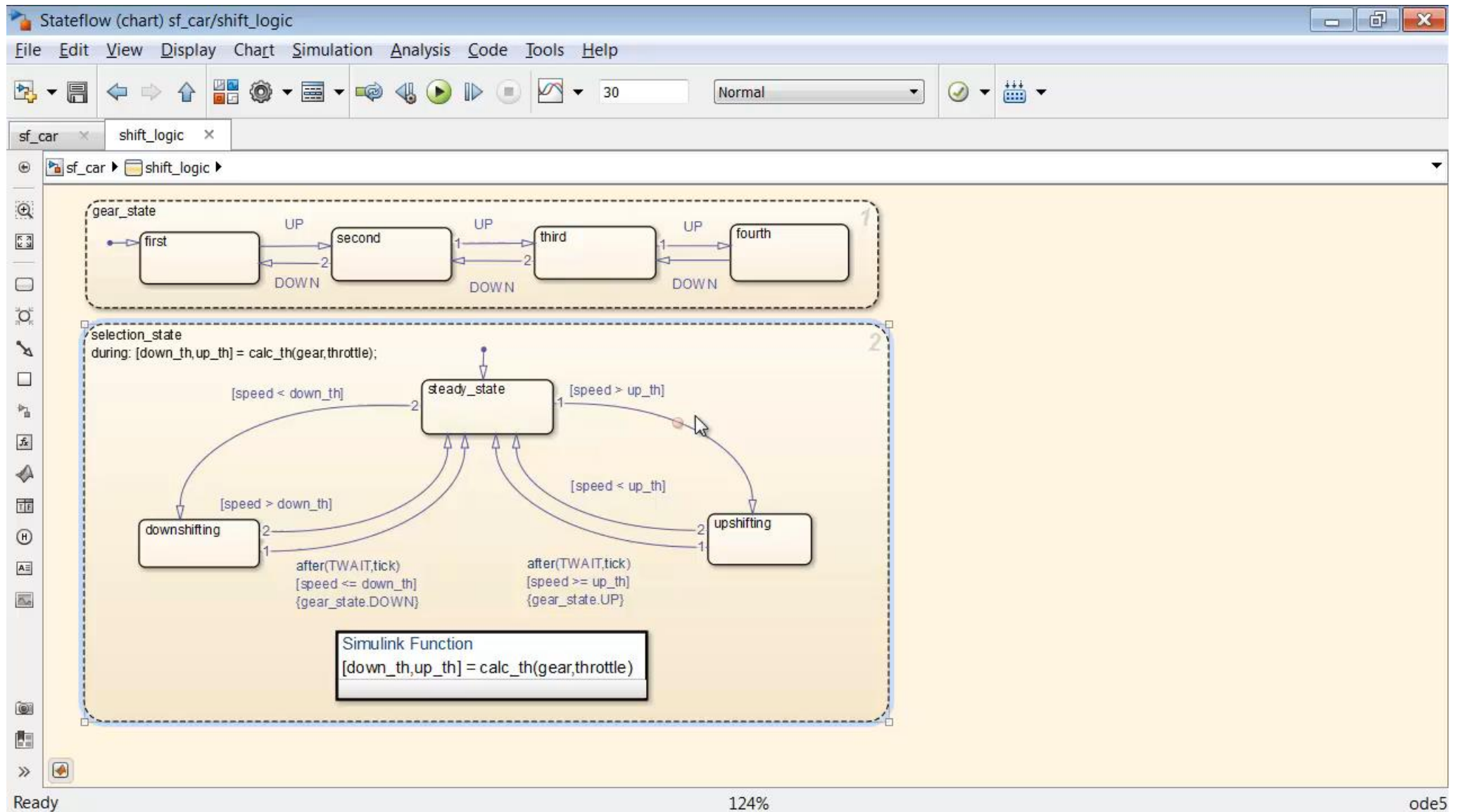
Simulink – Better Simulation Data Analysis

New Simulation Data Inspector



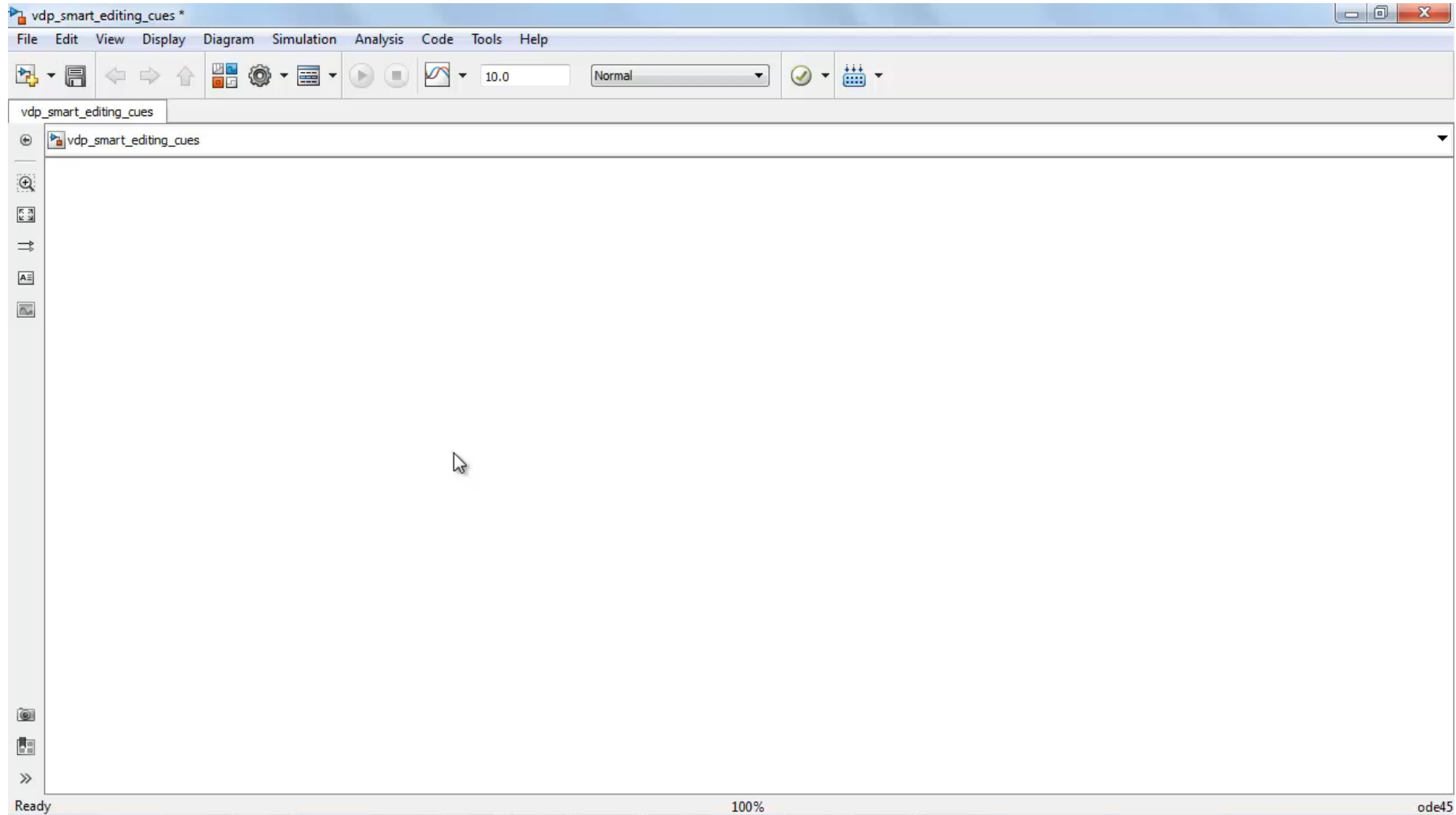
Stateflow – Watch Data

R2014b



Simulink – Accelerate Model Building

Smart Editing Cues

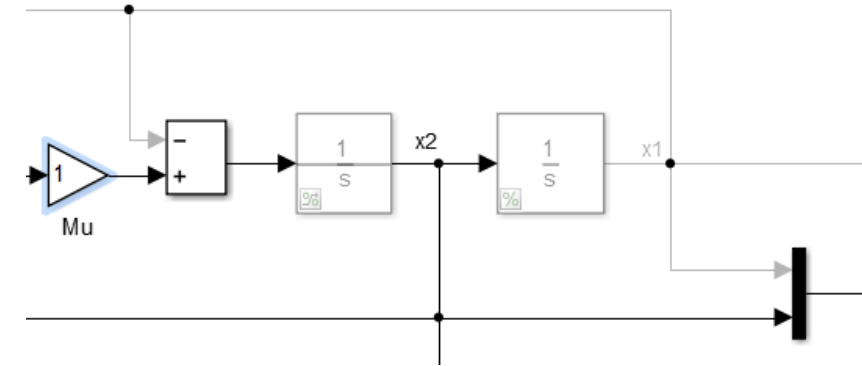


Simulink – Comment Out / Through

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

	Cut	Ctrl+X
	Copy	Ctrl+C
	Paste	Ctrl+V
	Comment Through	Ctrl+Shift+Y
	Comment Out	Ctrl+Shift+X
	Delete	Del



R2013b

Comment Through:

(block gray, badge)

(input → output)

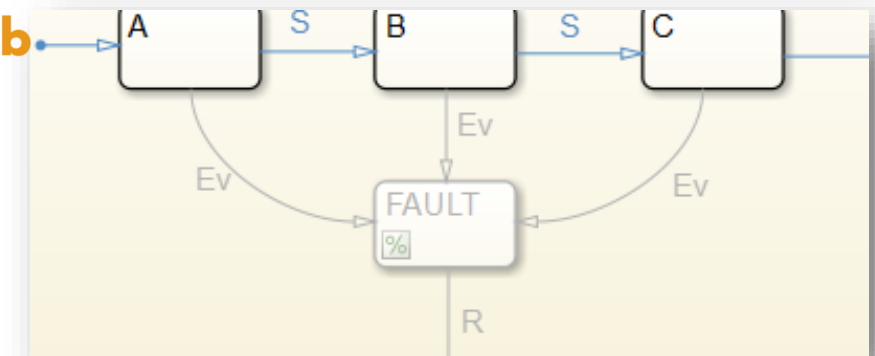
R2012b

Comment Out:

(block gray, badge)

(disconnected)

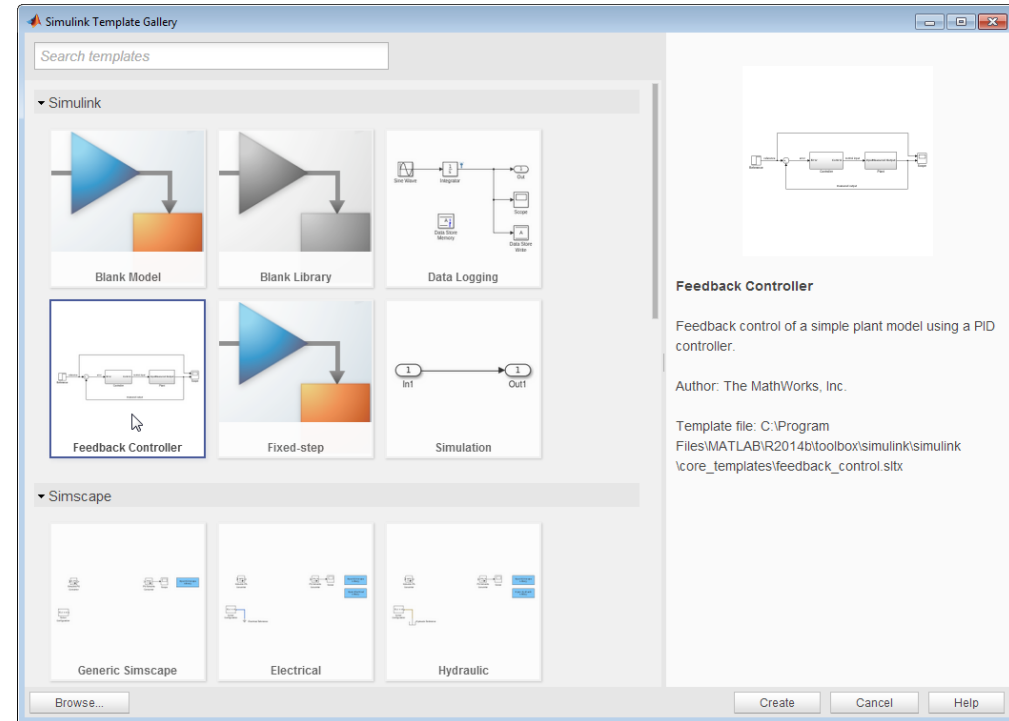
R2014b



Simulink – Model Templates

Build models using design patterns that serve as starting points to solve common problems

- Use shipped templates to get started with building models or create custom templates to from a Simulink model
- Avoid repetitive tasks when starting out to build a new model
- Enforce a standard process for building models for the entire team or organization



MATLAB

Tables

- `table` – new fundamental data type
- For mixed-type tabular data
 - Holds both data and metadata
- Supports flexible indexing
- Built-in functionality (merge, sort, etc.)

The image displays three MATLAB windows illustrating the use of tables:

- Workspace:** Shows a variable named `patients` of type `100x9 table` with a size of `100x9`.
- Variables - patients:** Shows a detailed view of the `patients` table with 6 columns: IDNumber, LastName, Sex, Age, Systolic, and Diastolic. The first five rows are visible:

	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	'MIJ-579'	'Jones'	'Female'	40	117	75
5	'XLK-030'	'Brown'	'Female'	49	122	80

- Command Window:** Shows the command `patients(1:5, {'LastName', 'Age', 'Health'})` being executed, resulting in the following output:

```
ans =  
    LastName    Age    Health  
    _____    ___    _____  
    'Smith'      38    'Excellent'  
    'Johnson'   43    'Fair'  
    'Williams'  38    'Good'  
    'Jones'     40    'Fair'  
    'Brown'    49    'Good'
```

MATLAB

Categorical Arrays

- **categorical** – new fundamental data type
- For discrete non-numeric data
 - Values drawn from a finite set of possible values ("categories")
- More memory efficient than a cell array of strings
- Can be compared using logical operators
 - Similar to numeric arrays

The image displays the MATLAB interface with three windows illustrating categorical arrays. The 'Variables - patients' window shows a table with columns for Height, Weight, and Health. The 'Health' column contains categorical values: Excellent, Excellent, Fair, Good, and Poor. The 'Command Window' shows the command `patients.Health(1:5)` resulting in a categorical array: `ans = Excellent Fair Good Fair Good`. Another 'Command Window' shows the command `patients2.LastName(patients2.Health < 'Good')` resulting in a cell array of strings: `ans = 'Thomas' 'Kelly' 'Wood' 'Foster' 'Griffin' 'Hayes'`.

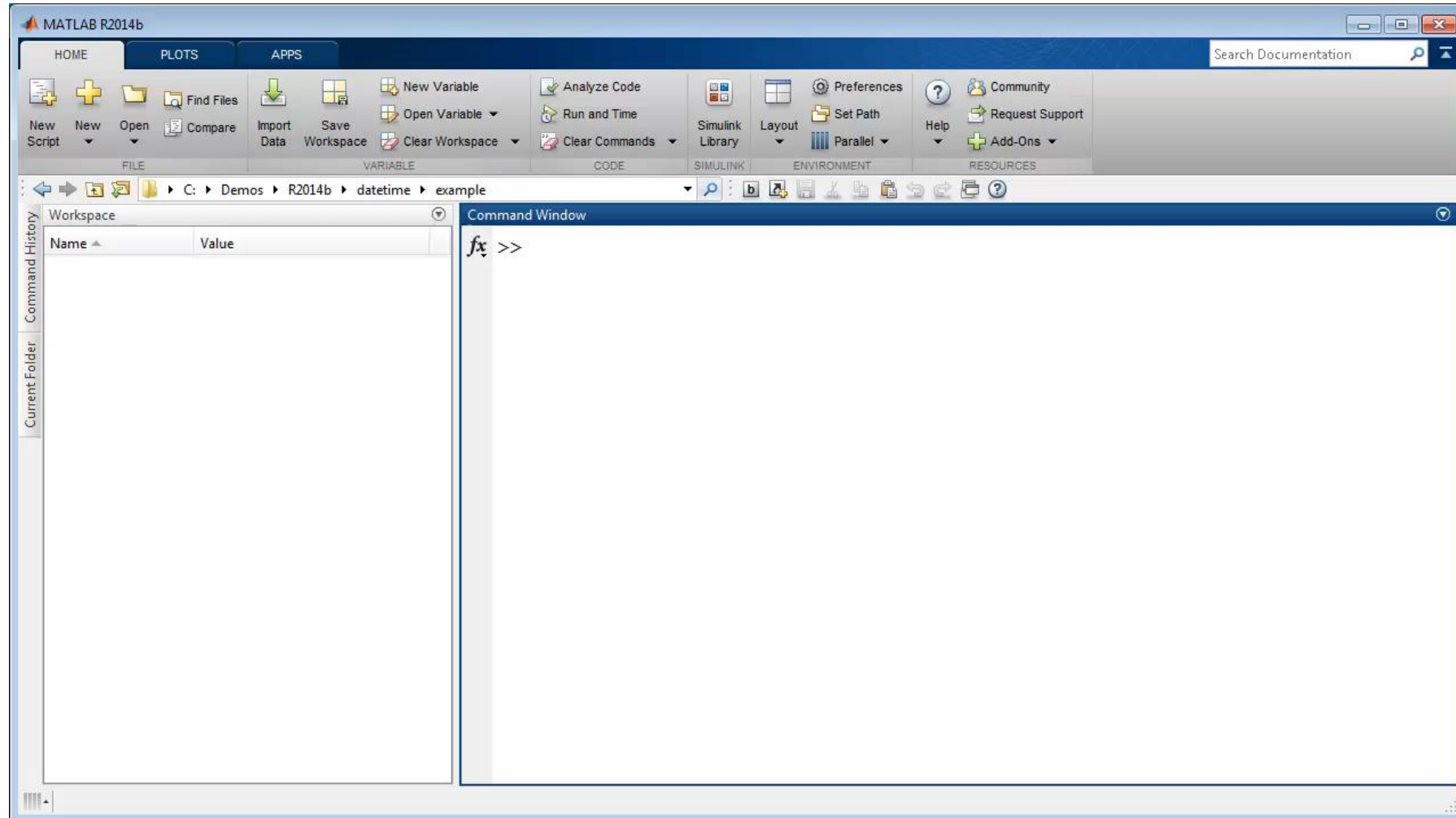
	7	8	9
	Height	Weight	Health
1	1.8000	80	Excellent
2	1.7500	74	Excellent
3	1.6300	59	Fair
4	1.7000	60	Good
5	1.6300	54	Poor

```
>> patients.Health(1:5)
ans =
    Excellent
    Fair
    Good
    Fair
    Good

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

MATLAB

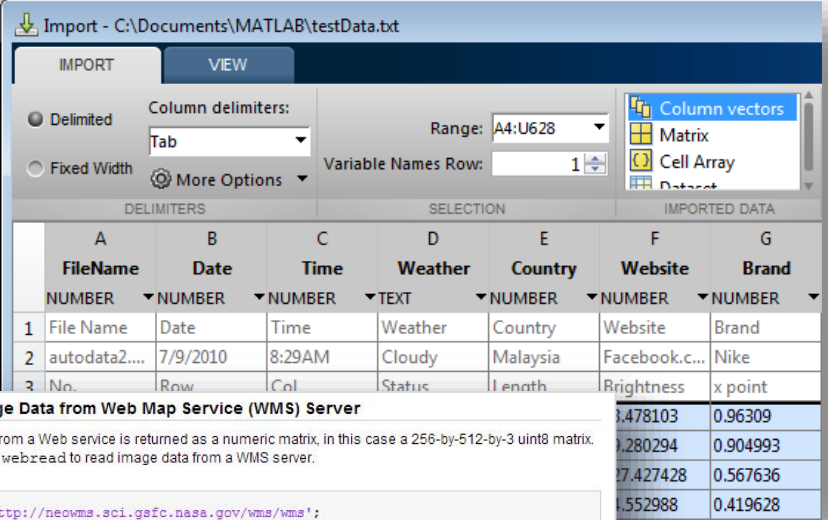
Date and Time Arrays



MATLAB

Importing Data

- Import Tool **R2012b**
 - 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**) **R2014b**
 - JSON, CSV, and image data
- Read and write data from network-connected devices (**tcpclient**) **R2014b**



Import - C:\Documents\MATLAB\testData.txt

IMPORT VIEW

Delimited Column delimiters: Tab Range: A4:U628

Fixed Width More Options Variable Names Row: 1

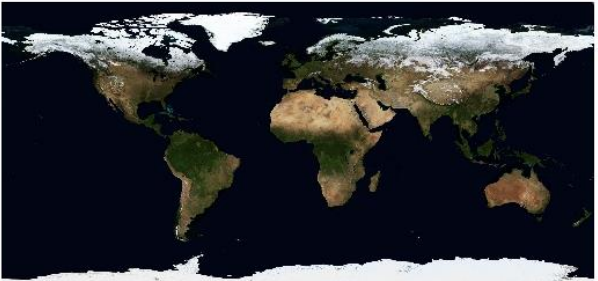
DELIMITERS SELECTION IMPORTED DATA

	A	B	C	D	E	F	G
	File Name	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
						0.478103	0.96309
						0.280294	0.904993
						0.7427428	0.567636
						0.552988	0.419628

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.

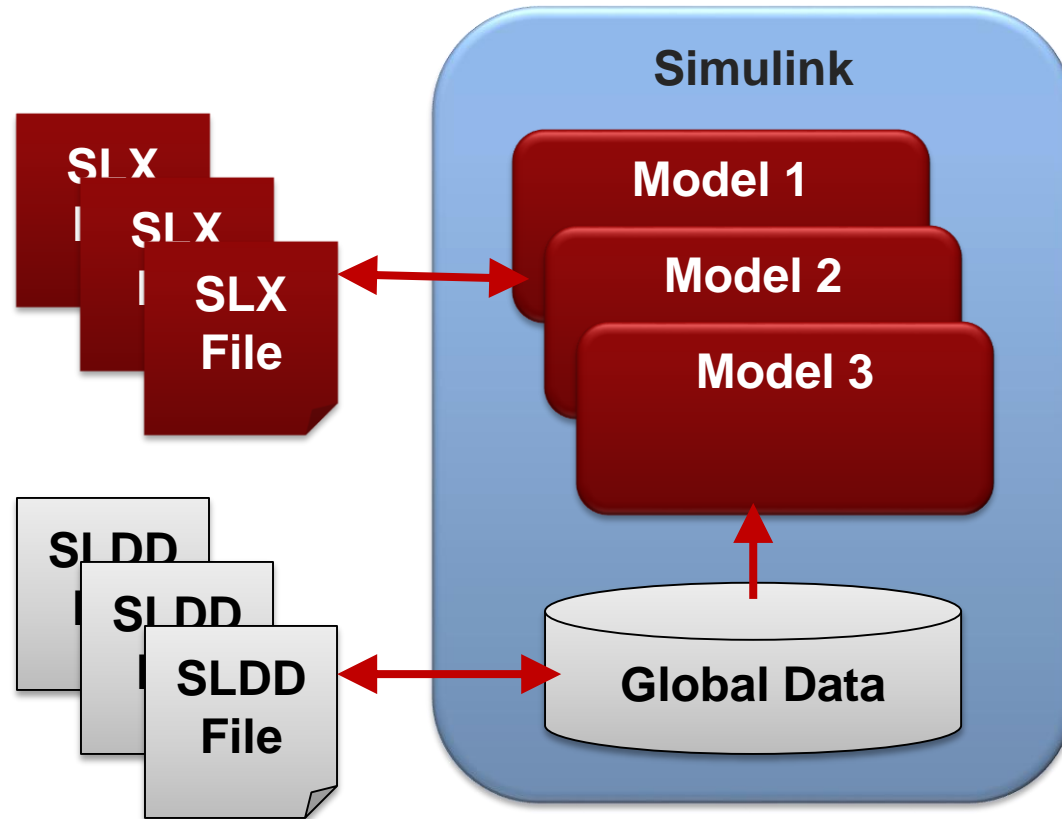
```
url = 'http://neovms.sci.gsfc.nasa.gov/wms/wms';
RGB = webread(url, 'Service', 'WMS', 'Layers', 'BlueMarbleNG', ...
    'CRS', 'CRS:84', 'Format', 'image/jpeg', ...
    'Height', 256, 'Width', 512, ...
    'BBOX', '-180.0,-90.0,180.0,90.0', ...
    'Request', 'GetMap', 'Version', '1.3.0');
figure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



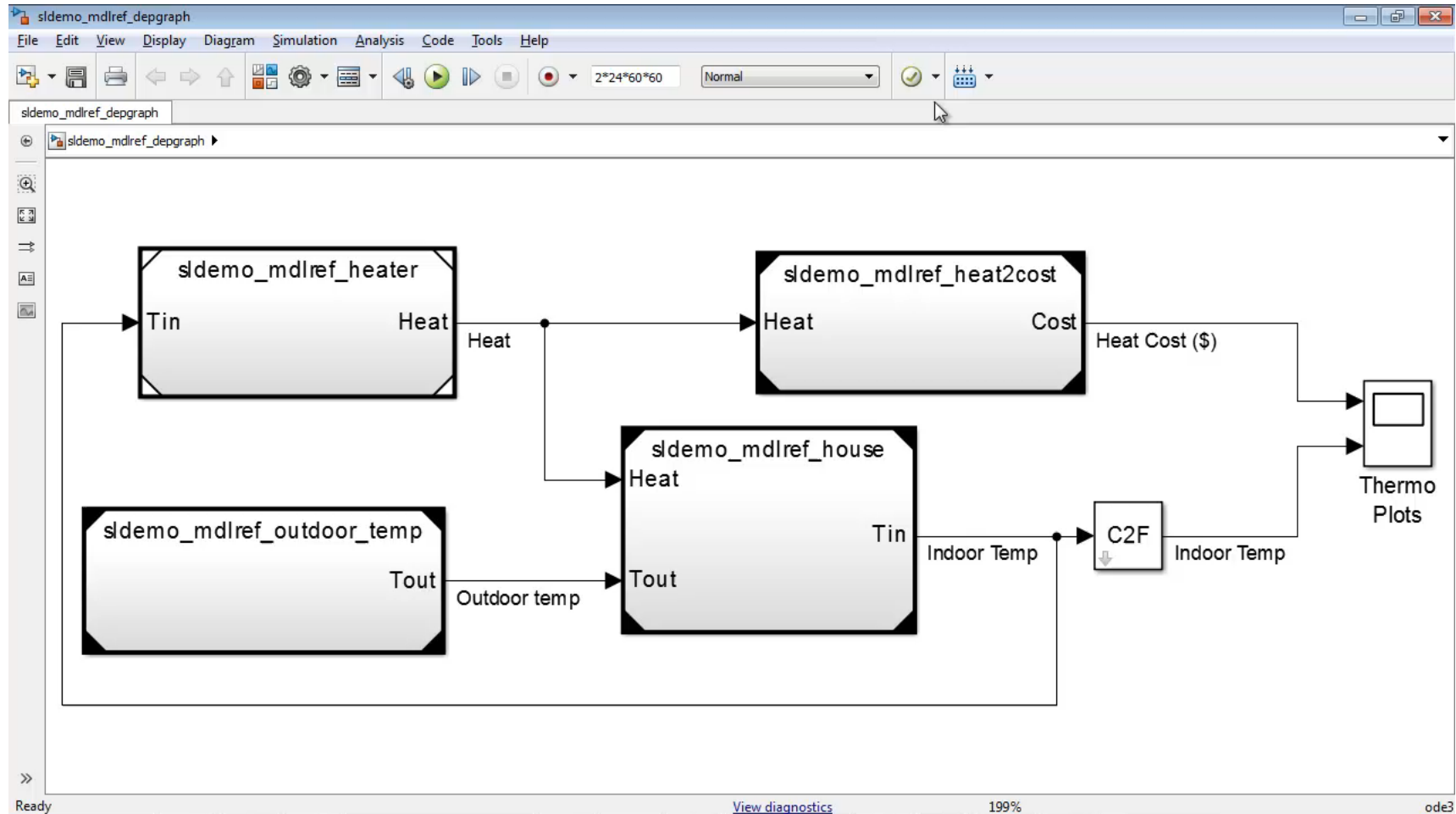
Simulink – Data Dictionary

Store, edit and access design data using the data dictionary

- Change tracking and differencing
- Defined relationship with SLDD file
- Componentization
- Integration with Simulink Projects
- Scalability and performance



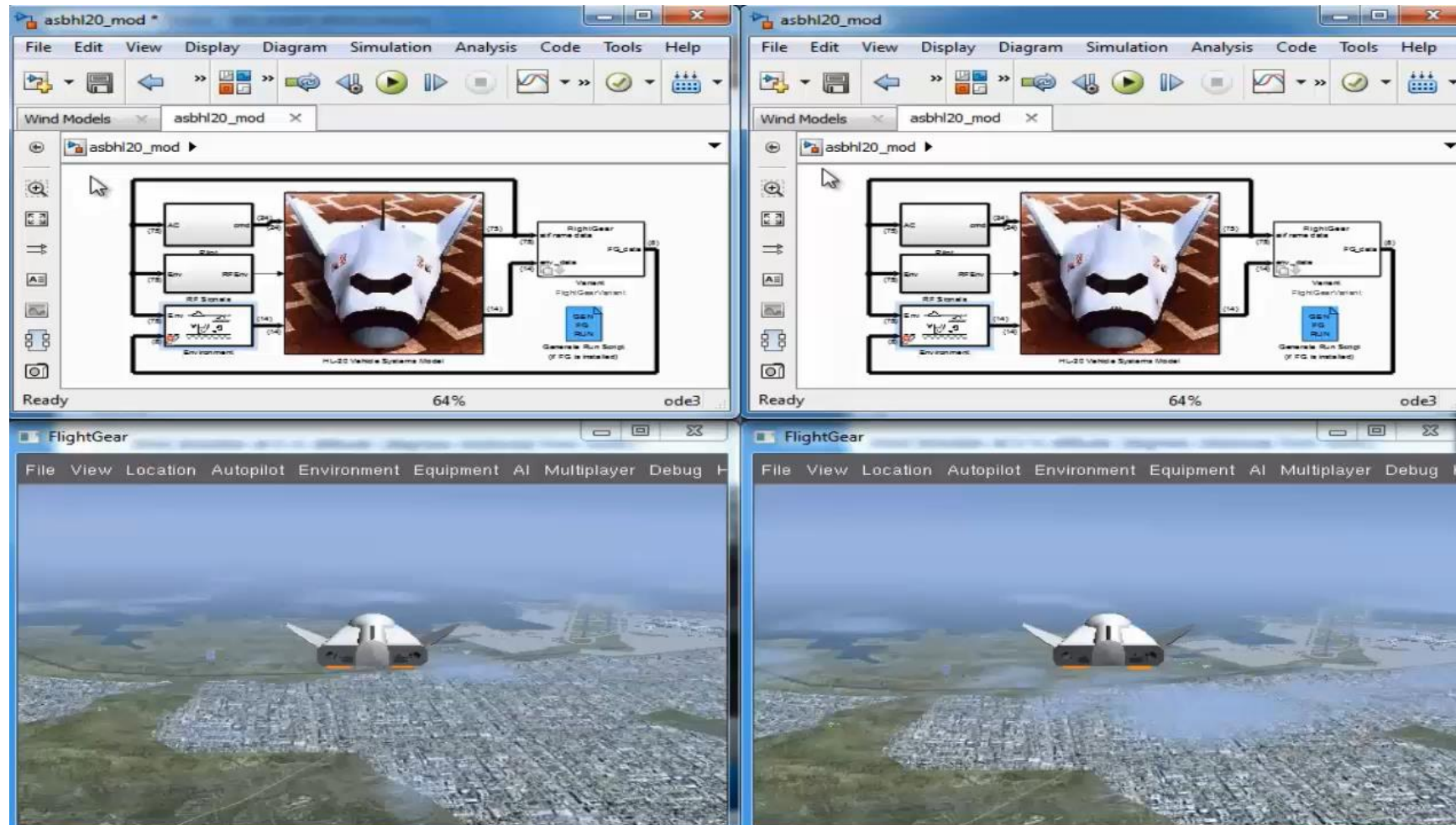
Simulink – Performance Advisor



Simulink – Faster Consecutive Simulations

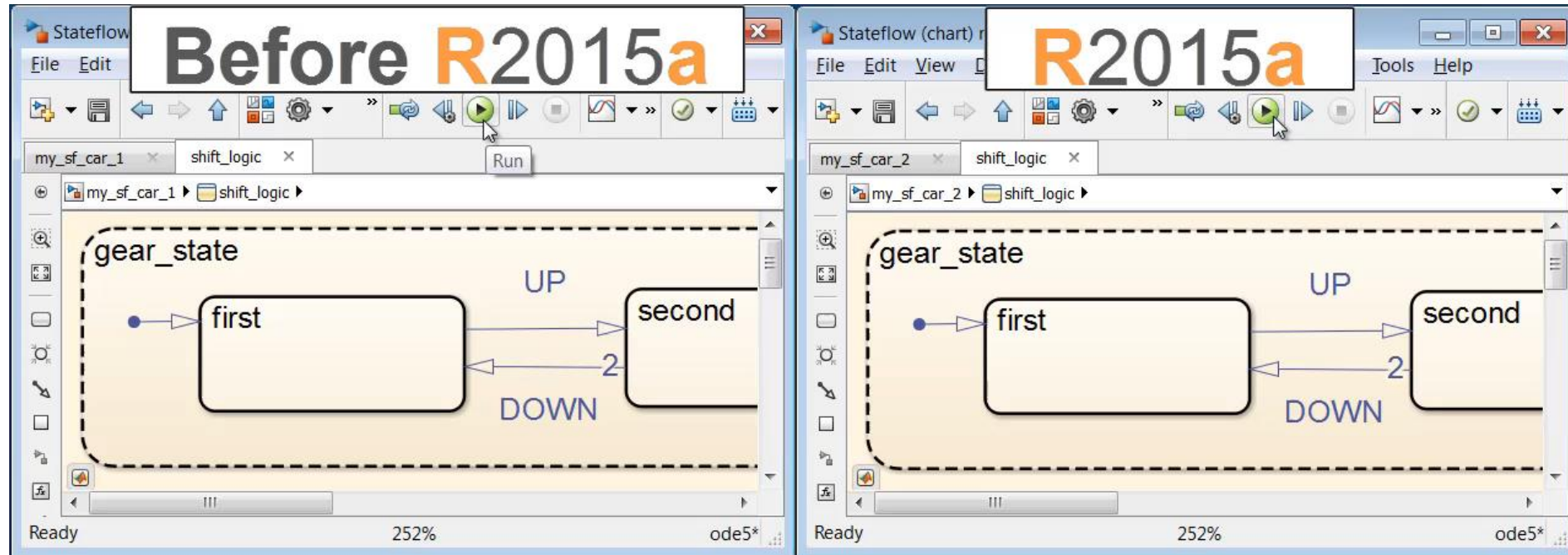
Fast Restart

R2014b



Stateflow – Start Simulation Faster

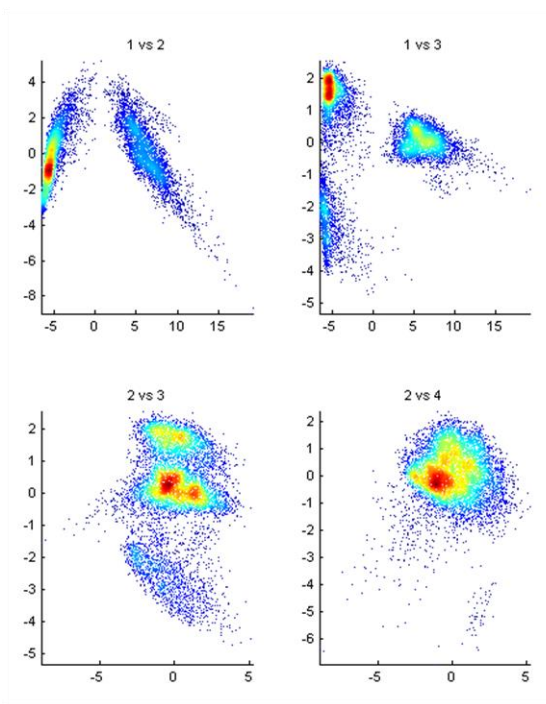
Just-In-Time Compilation



MATLAB – Big Data Capabilities

Memory and Data Access

- 64-bit processors
- Memory Mapped Variables
- Disk Variables
- Databases
- **Datastores R2014b**



Programming Constructs

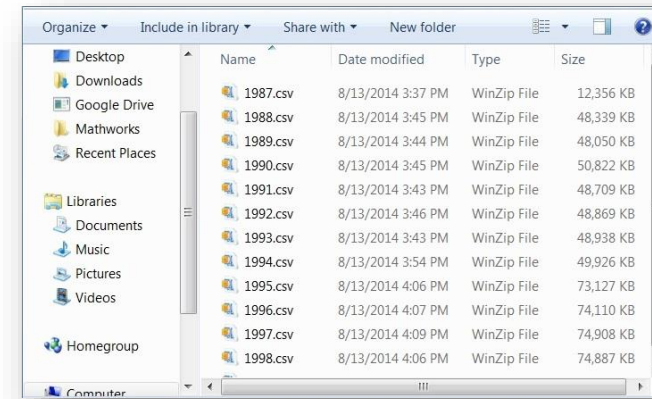
- Streaming
- Block Processing
- Parallel-for loops
- GPU Arrays
- SPMD and Distributed Arrays
- **MapReduce R2014b**

Platforms

- Desktop (Multicore, GPU)
- Clusters
- Cloud Computing (MDCS on EC2)
- **Hadoop R2014b**

MATLAB – Access Big Data datastore

- Easily specify data set
 - Single text file or collection of text files
 - Database (using Database Toolbox)
 - Data stored on HDFS
- Preview data structure and format
- Select data to import using column names
- Incrementally read subsets of the data



```
>> preview(ds)
ans =
   Year   Month  DayofMonth  DayOfWeek
-----
 1987    10      21           3
 1987    10      26           1
 1987    10      23           5
 1987    10      23           5
```

```
airdata = datastore('*.csv');
airdata.SelectedVariables = {'Distance', 'ArrDelay'};

data = read(airdata);
```

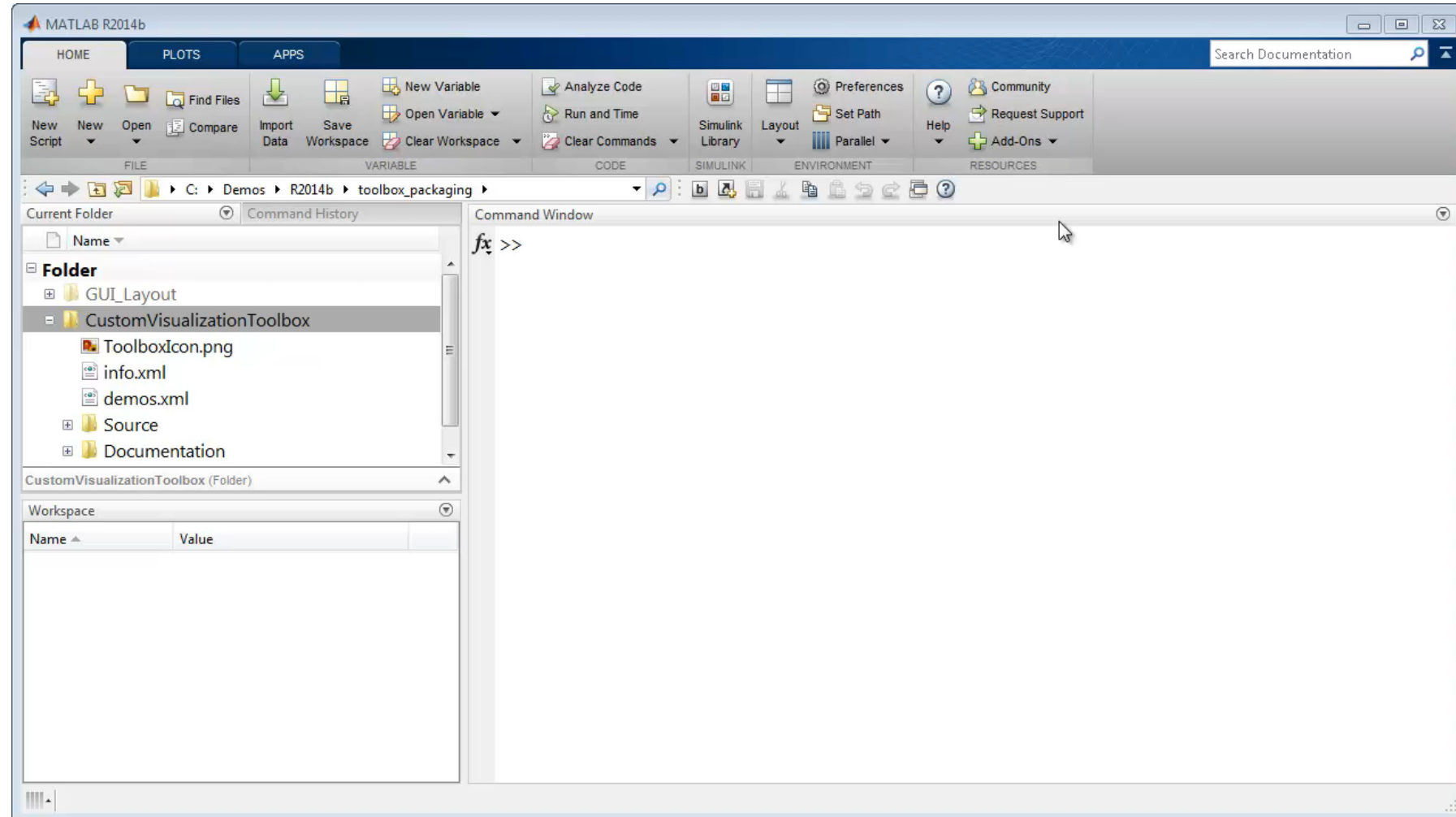
MATLAB – Analyze Big Data

mapreduce

- Use the powerful MapReduce programming technique to analyze big data
 - **mapreduce** uses a **datastore** to process data in small chunks that individually fit into memory
 - Useful for problems with complex grouping, or when intermediate results do not fit in memory
- **mapreduce** on the desktop
 - Increase compute capacity (Parallel Computing Toolbox)
 - Analyze big database tables (Database Toolbox)
 - Access data on HDFS to develop algorithms for use on Hadoop
- **mapreduce** on a cluster
 - Run on cluster or Hadoop using MATLAB Distributed Computing Server
 - Deploy applications and libraries for Hadoop using MATLAB Compiler

```
*****  
*           MAPREDUCE PROGRESS           *  
*****  
Map 0%           Reduce 0%  
Map 20%          Reduce 0%  
Map 40%          Reduce 0%  
Map 60%          Reduce 0%  
Map 80%          Reduce 0%  
Map 100%         Reduce 25%  
Map 100%         Reduce 50%  
Map 100%         Reduce 75%  
Map 100%         Reduce 100%
```

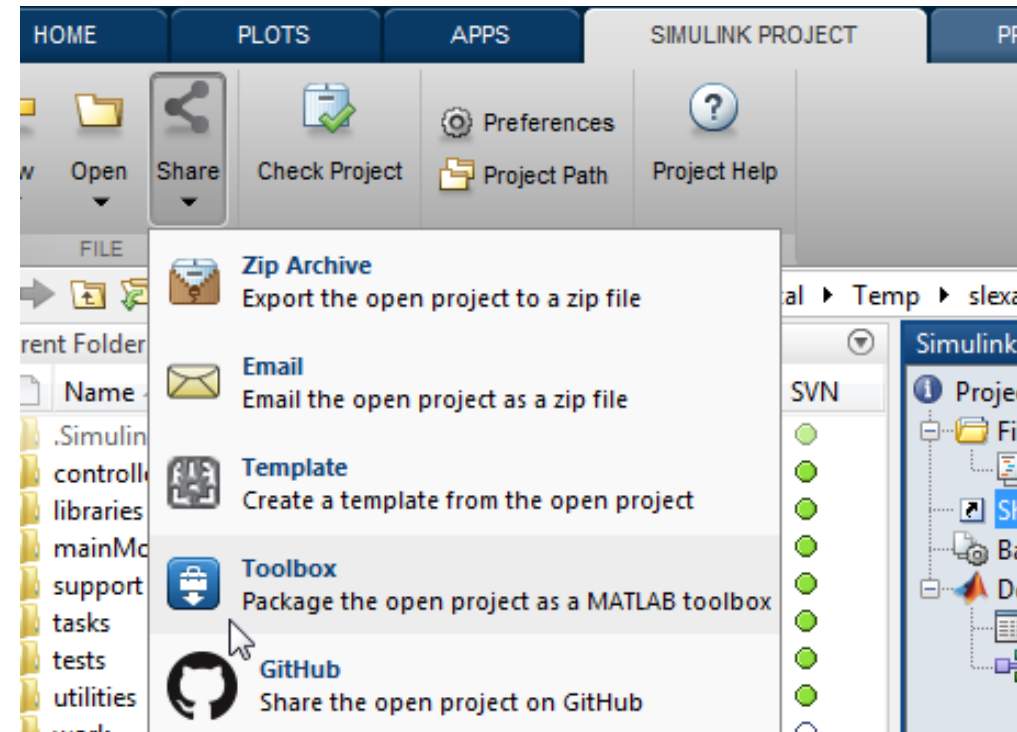
MATLAB – Toolbox Packaging



Simulink – Sharing Projects

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

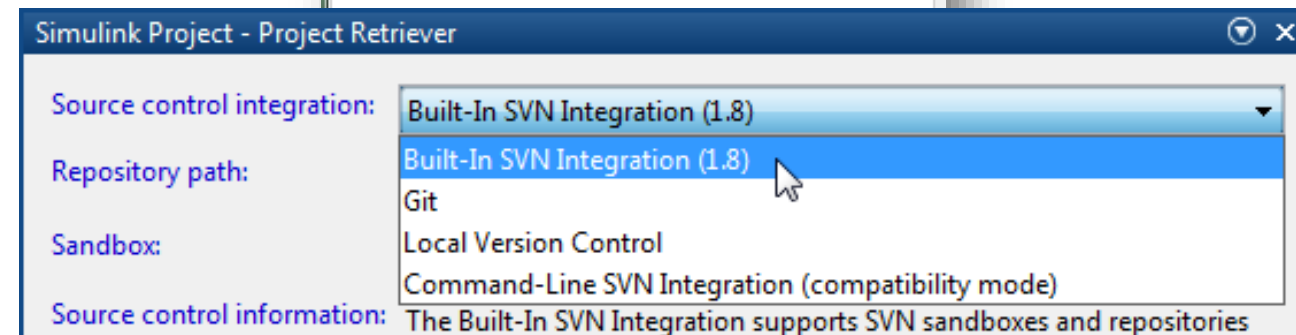
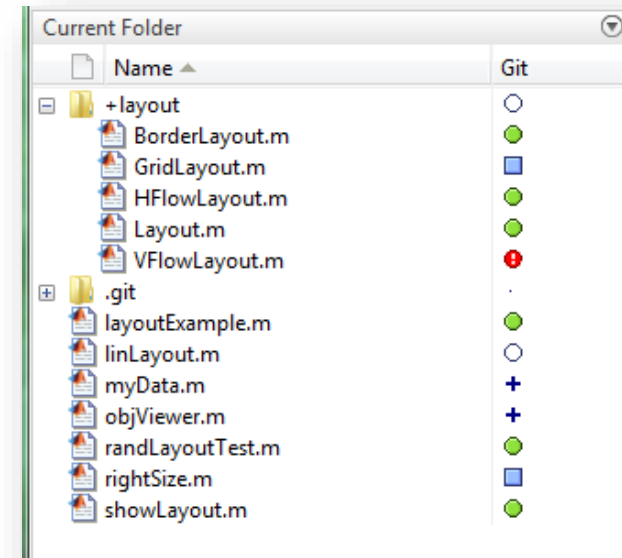
- Make your project publicly available on GitHub.
- Share your project via email.
- Package your project as a MATLAB toolbox



MATLAB and Simulink – Managing Code and Models

Source Control Integration

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



Learn More

www.mathworks.com/products/matlab/whatsnew.html

R2015a Release Highlights



[Release Notes](#)
[License-Related Changes](#)
[System Requirements](#)
[Previous Releases](#)

MATLAB Product Family

- MATLAB**
- Integration of documentation for custom toolboxes into the MATLAB® Help Browser
 - Scale mapreduce algorithms to MATLAB Distributed Computing Server™ for data-intensive applications
 - Support for Arduino Leonardo and other Arduino boards

Simulink Product Family

- Simulink**
- In-canvas dials, gauges, and scopes for tuning, testing, and visualizing simulations
 - Fast model update using just-in-time (JIT) compilation for MATLAB Function blocks and Stateflow® charts
 - Hardware Support Package targeting Apple iOS devices for creating apps that run Simulink® models and algorithms
 - Share projects via GitHub®, email, or as a packaged custom toolbox

MATLAB The Language of Technical Computing

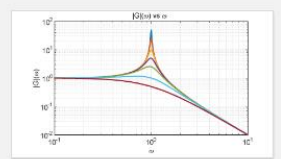
Overview Features Videos Code Examples **Latest Release** Product Trial Contact Sales

New graphics. Big data. Source control integration. And more...

New Features By Release

R2015a (Version 8.5) - Released 5 Mar 2015

Many new features included in MATLAB R2015a build off of capabilities introduced in R2014b, including hardware support, and integrated documentation for custom toolboxes. Explore the features below:



MATLAB Graphics

See the new MATLAB graphics system, with an updated look and many enhancements and new features (R2014b).

```
ds = datastore('airline.csv', 'readAsMatrix', 'delimiter','\t');
ds.SelectVariableNames = {'ArrDelay'};
mapreduce(ds, @maxArrivalDelay, @maxArrivalDelayReducer);
readall(maxDelay)
```

Big Data Capabilities

Analyze big data on your desktop, then scale to Hadoop with mapreduce (R2014b, R2015a).

R2015a

SIMULINK

Overview Features Model Examples Videos Webinars **New Features** Product Trial

New Features By Release

R2015a (Version 8.5) - Released 5 Mar 2015

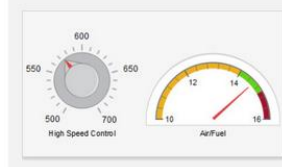
Explore performance improvements to the Simulink® product family.

R2015a

- Renew Software Maintenance Service
- Get Trial Software
- Buy Online

[Download this release](#)

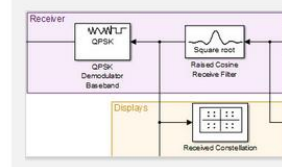
» See release highlights for all products



Dashboard Block Library

Tune and test simulations with graphical controls and displays.

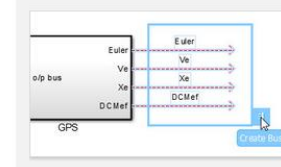
[Watch video 2:26](#)



Area Annotations

Call out and separate regions of interest in model.

[Watch video 0:44](#)



Bus Smart Editing Cue

Automatically create a bus from a set of signals.

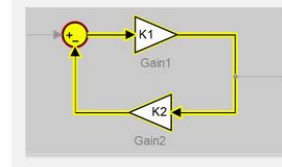
[Watch video 0:37](#)

```
% Create the data dictionary
dictionaryObj = Simulink.data.dictionary...
% Import to the dictionary the model vari...
workspace, and clear the variables from...
[importSuccess,importFailure] = importFrom...
'varList',varNames,'clearWorkspaceVar...
% Link the dictionary to the model
set_param(modelName,'DataDictionary',dict...
```

Data Dictionary API

Automate the creation and editing of data dictionaries with MATLAB scripts.

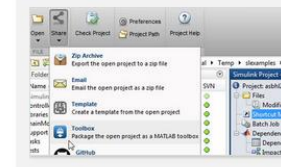
[Watch video 1:43](#)



Algebraic Loop Highlighting

Find and remove algebraic loops in the model to boost simulation speed.

[Watch video 1:11](#)



Simulink Project Sharing

Share a project using GitHub, email, or a MATLAB toolbox.

http://www.mathworks.com/products/new_products/latest_features.html

www.mathworks.com/products/simulink/whatsnew.html

