MATLAB CONFERENCE 2017

What's New in MATLAB and Simulink

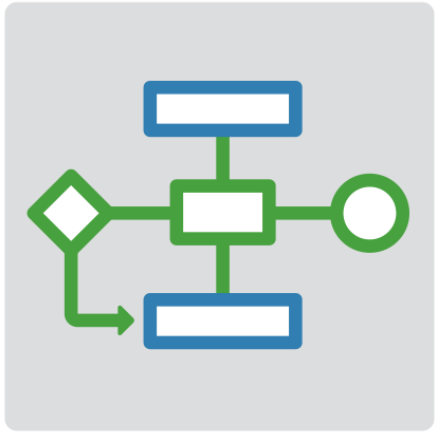
R2016b R2017a

Daryl Ning
Applications Engineer
MathWorks Australia

Platform Productivity

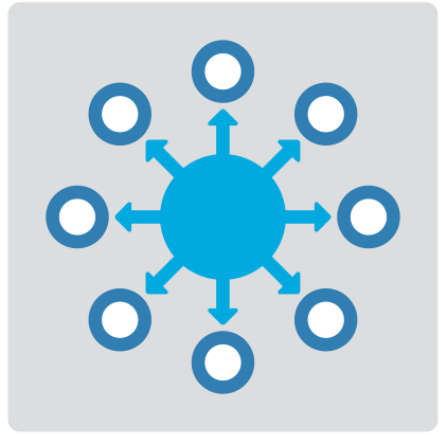
Getting your work done faster

Workflow Depth



Support for your entire workflow

Application Breadth



Products for the work you do

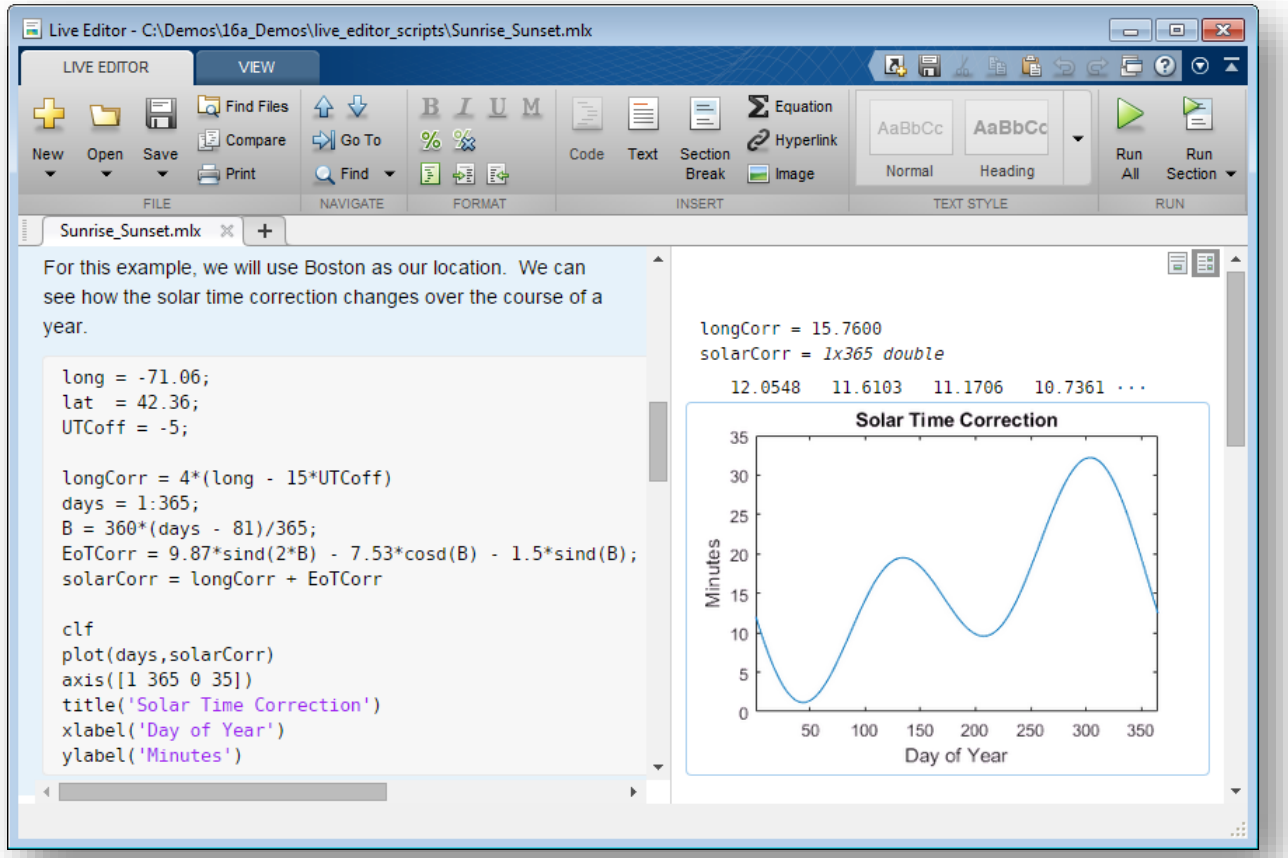
Change the Way You Work in MATLAB

R2016b R2017a

See results together with your MATLAB code in the Live Editor
(introduced in R2016a)

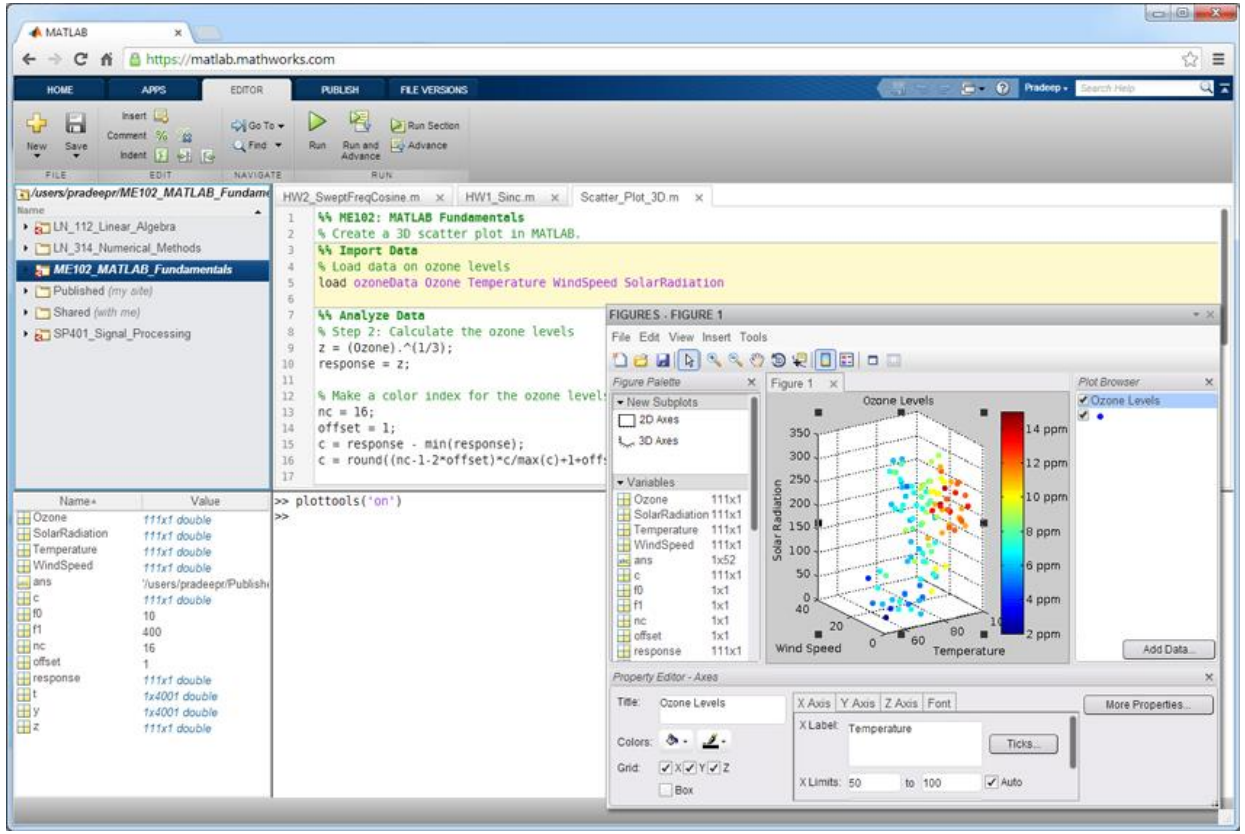
- Add equations, images, hyperlinks, and formatted text
- Present, share, and collaborate using interactive documents

- Interactive figure updates
  - Pan , zoom, and rotate axes
  - Interactive plot customization, with MATLAB code generation to automate work
- Interactive equation editor



MATLAB Online

- Provides access to MATLAB desktop and full MATLAB language support from any standard web browser
- No downloads or installs.
- Cloud Storage and synchronization via MATLAB Drive
- Log in here with your MathWorks Account: https://matlab.mathworks.com/



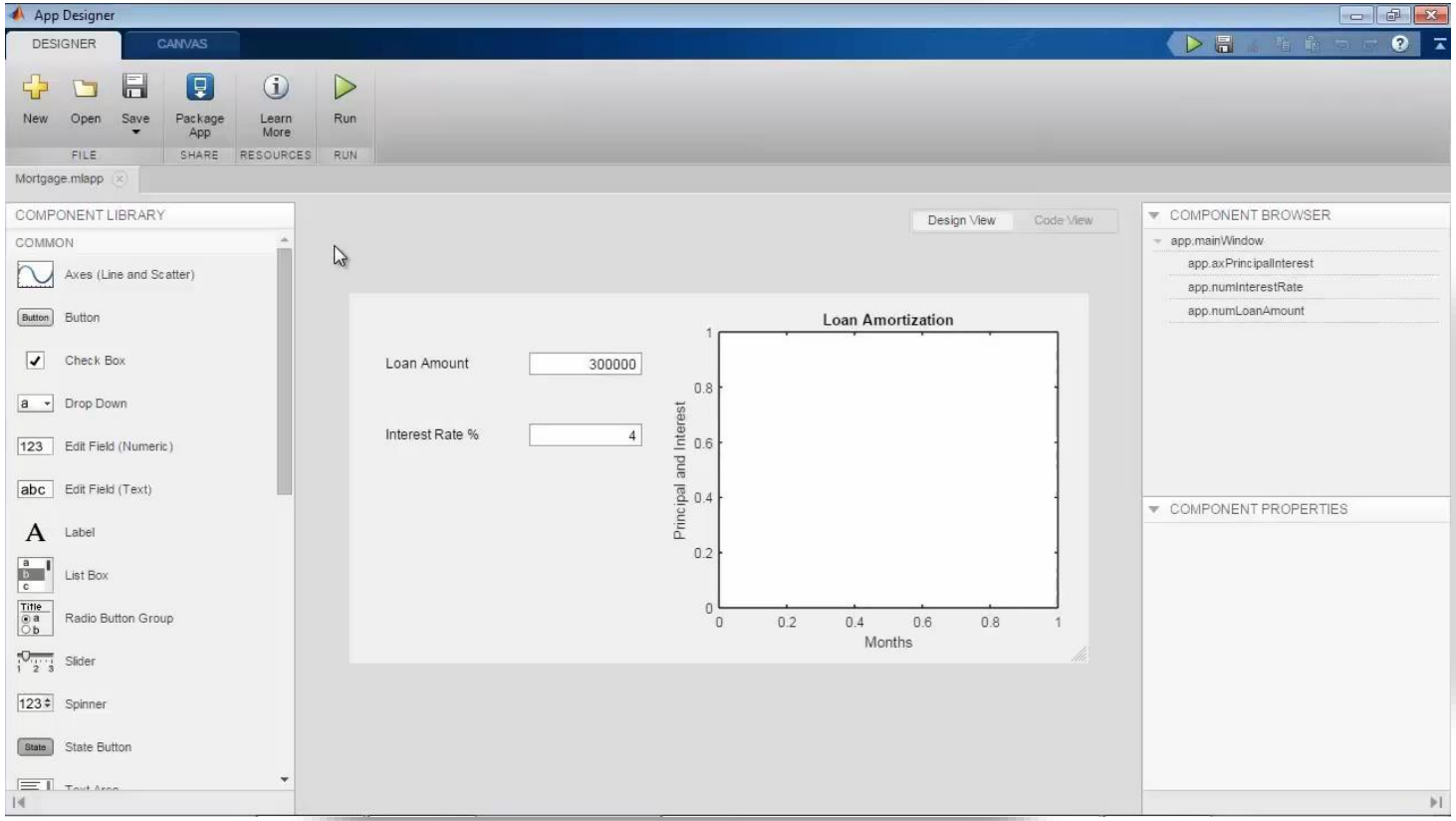
App Designer

R2016b R2017a

Environment for building MATLAB apps
(introduced in R2016a)

- Full set of standard user interface components, as well as gauges, knobs, switches, and lamps
- Rich design environment for laying out apps
- Object-based code format for easily sharing data between parts of the app

- Enhancements include:
  - Majority of 2-D plots supported
  - Embed tabular displays using `uitable`
  - Zoom and pan plots in apps

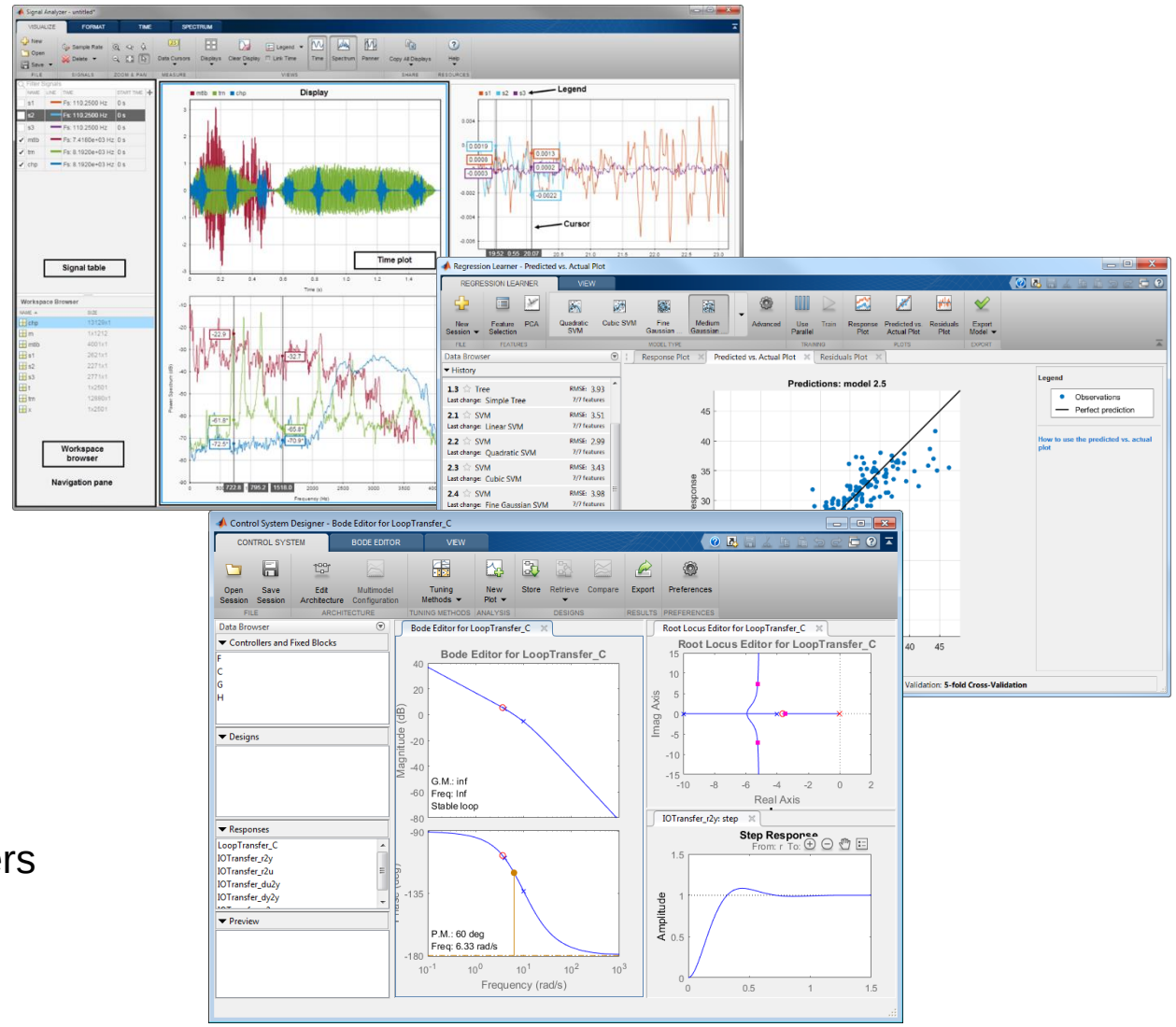


Apps Simplify Modeling and Simulation

R2016a R2016b R2017a

These interactive applications automate common technical computing tasks

- Signal Analyzer app
  - Perform time- and frequency-domain analysis of multiple time series
- Regression Learner app
  - Train regression models using supervised machine learning
- Control System Designer app
  - Design single-input, single-output (SISO) controllers



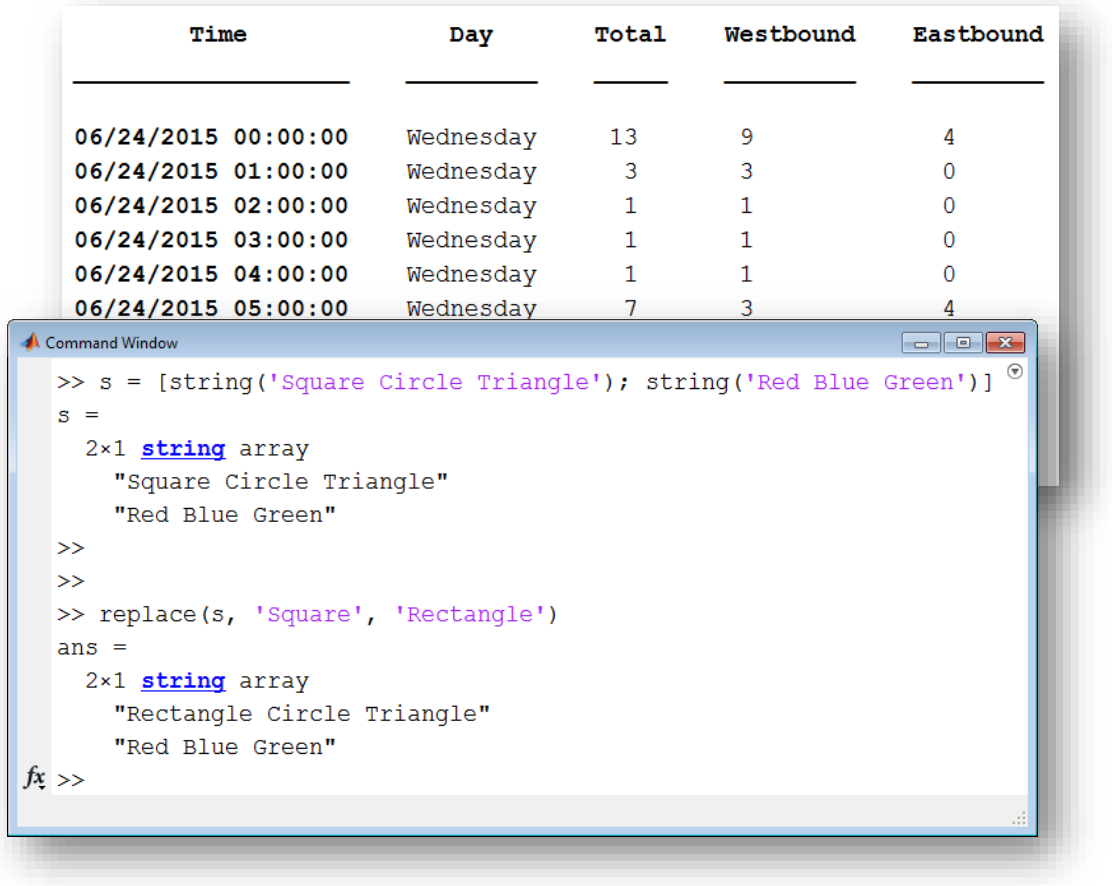
Signal Processing Toolbox
Statistics and Machine Learning Toolbox
Control System Toolbox

Working with Data Just Got Easier

R2016b R2017a

New data types and functionality for more efficient storage and managing of data

- `timetable` data container *(introduced in R2016b)*
  - Store time-stamped tabular data
  - Reorganize, evenly space, and align data
- `string` arrays *(introduced in R2016b)*
  - Memory efficient, faster string operations
  - New functions for common string manipulation
- New capabilities for **preprocessing** data
  - Find, fill, and remove missing data
  - Detect and replace outliers
  - Smooth noisy data

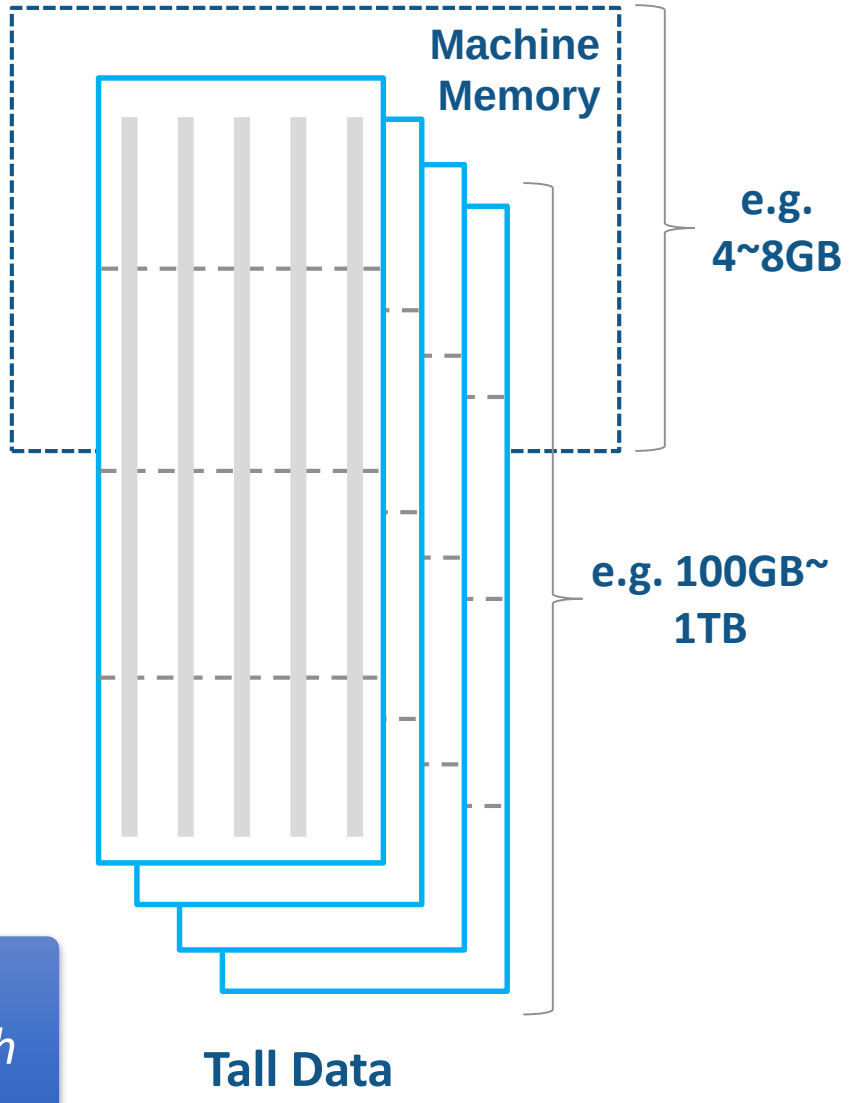


Working with Big Data Just Got Easier

R2016b R2017a

Use tall arrays to manipulate and analyze data that is too big to fit in memory

- Tall arrays let you use familiar MATLAB functions and syntax to work with big datasets, even if they don't fit in memory
- Support for hundreds of functions in MATLAB and Statistics and Machine Learning Toolbox
- Works with Spark + Hadoop Clusters



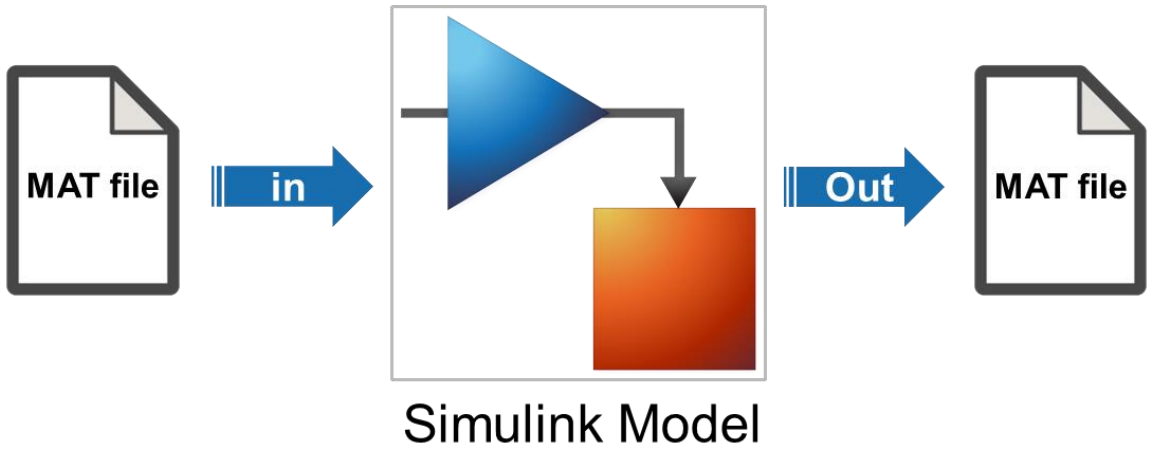
Learn more at this session:
Gaining Business Insights with MATLAB and Big Data

Working with Big Data Just Got Easier in Simulink Too

R2017a

Stream large input signals from MAT-files without loading the data into memory

- Provides a big data workflow for Simulink simulations
- Use big data in Simulink logging and loading
- Especially useful when running many simulations where data retrieved is too large to fit into memory



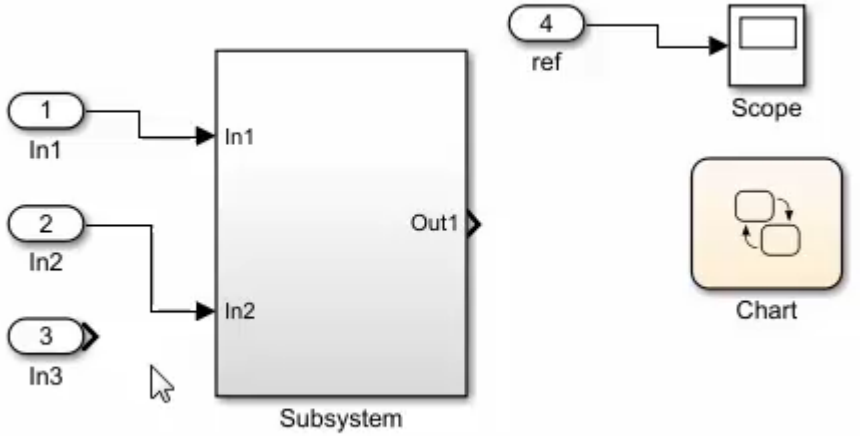
Learn more at this session:
Simulink as Your Enterprise Simulation Platform

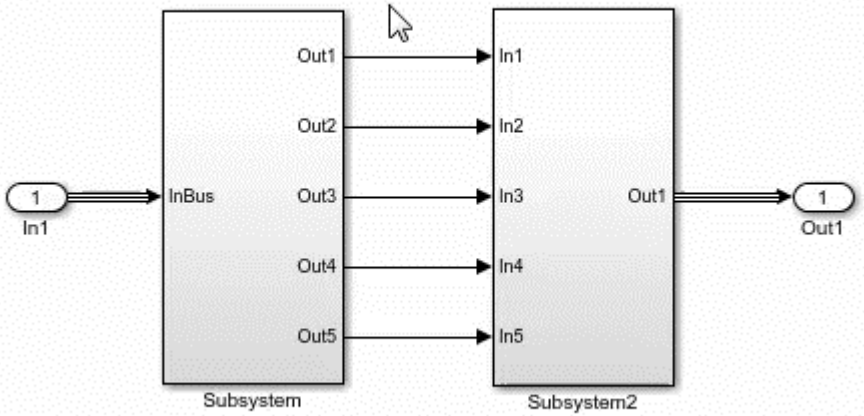
Create Your Models Faster

R2017a

Use automatic port creation and reduced bus wiring

- Add inports and outports to blocks when routing signals
- Quickly group signals as buses and automatically create bus element ports for fewer signal lines

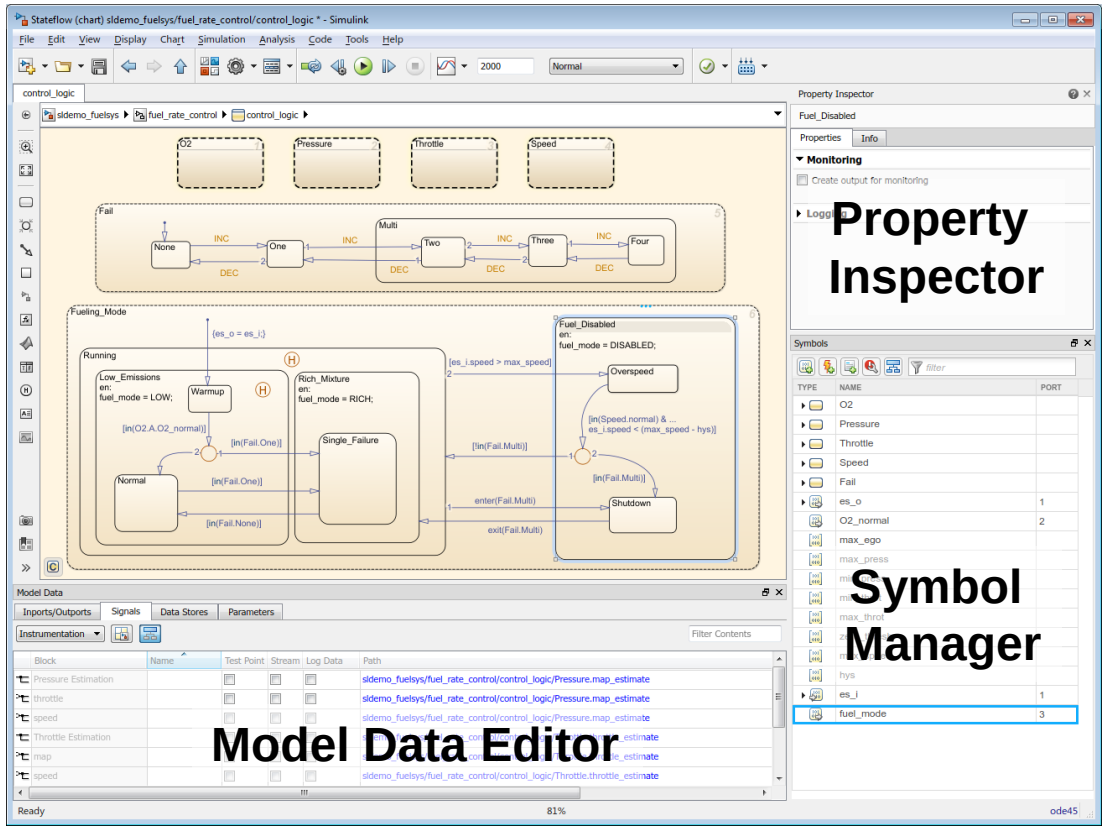




Define your Data Faster

Reduces the need to open separate dialog boxes

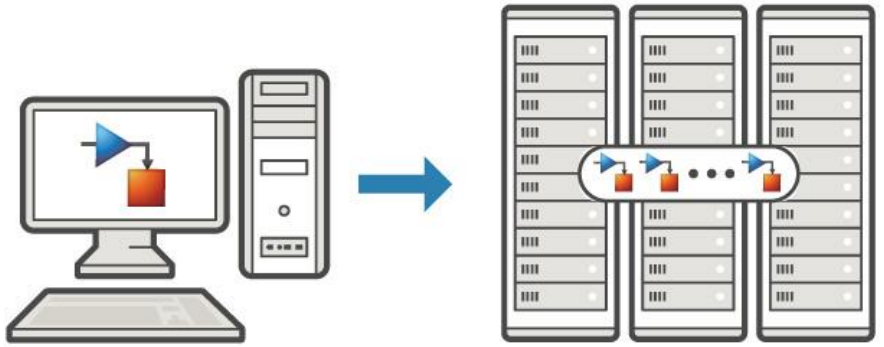
- Model and block parameter data is now accessible within the main editor window
- Accessing and defining Stateflow data is also much easier



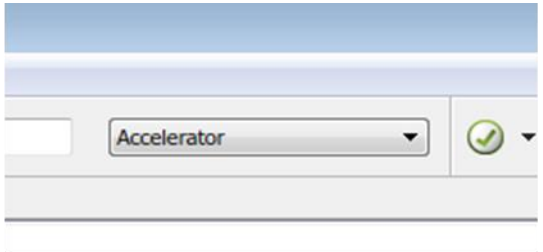
Simulate your Model Faster

R2017a

Use the new `parsim` command and JIT acceleration to speed up your simulations

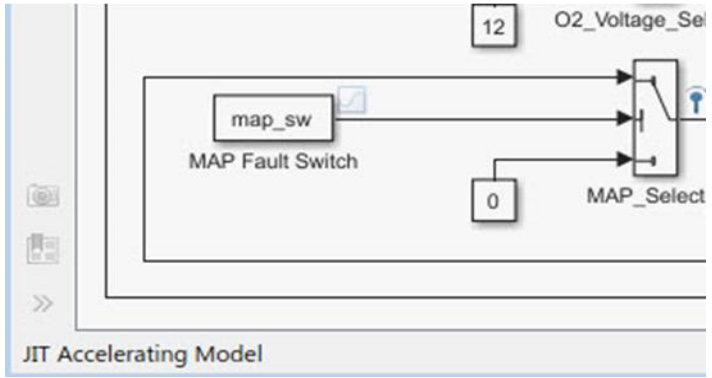


- Directly run multiple parallel simulations from the `parsim` command



- Quickly build the top-level model for improved performance when running simulations in Accelerator mode

- Especially use for Monte Carlo simulations and Design of Experiments



Parallel Computing Toolbox
MATLAB Distributed Computing Server

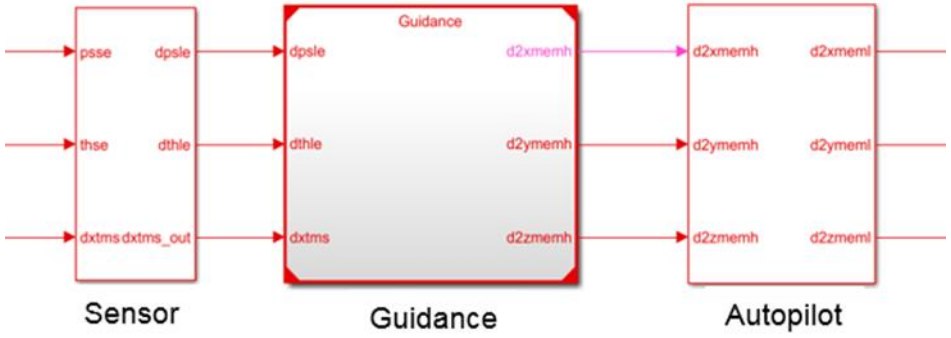
Cross-Release Code Integration

R2016b

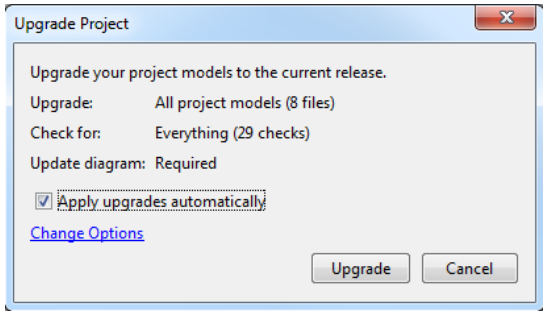
Reuse code generated from previous releases

- Reuse code that you generated from previous releases (R2010a and later)
- Avoid reverification cost due to the reuse of unmodified code

```
void AutonomousSystem_step(void)
{
Sensor_SFcn( ... )     /* R2015b */
Guidance( ... )        /* R2016b */
Autopilot_SFcn( ... ) /* R2013a */
}
```

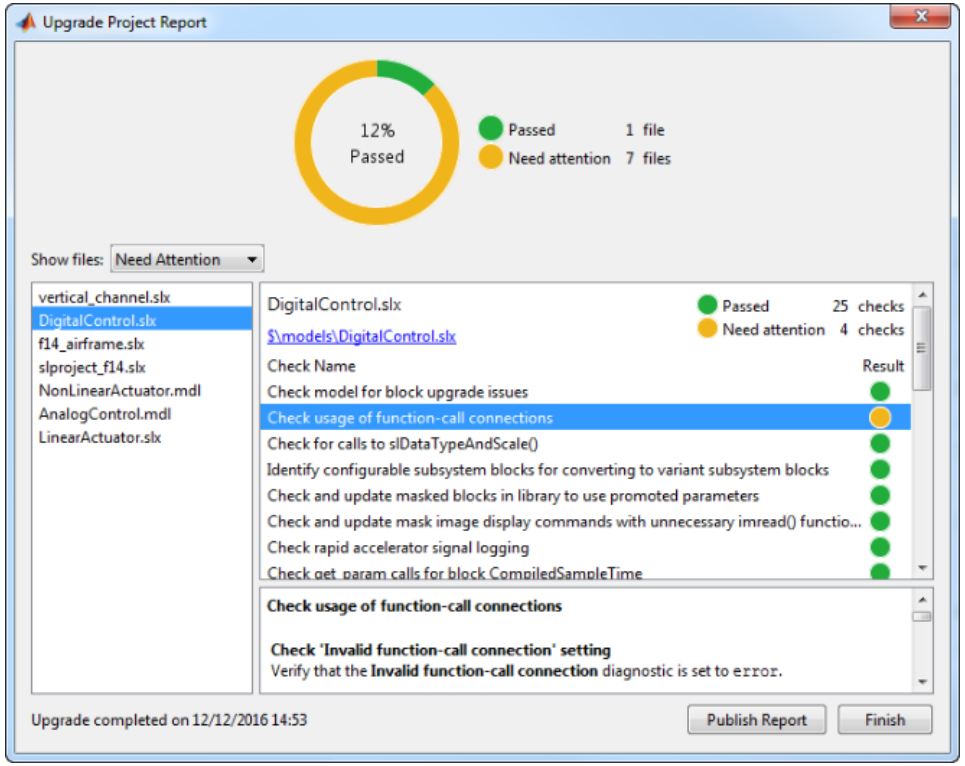


Simulink Project Upgrade



Easily update all the models in your Simulink Project to the latest release

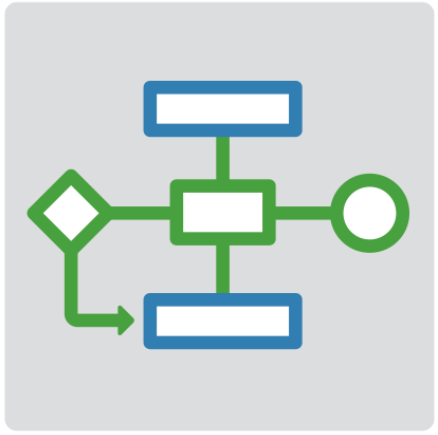
- Avoid the manual process of upgrading one model at a time
- Simulink Project upgrade is an easy to use UI to automate the upgrade process of all the models in a Simulink project
- Fixes are automatically applied and a report gets generated



Platform Productivity

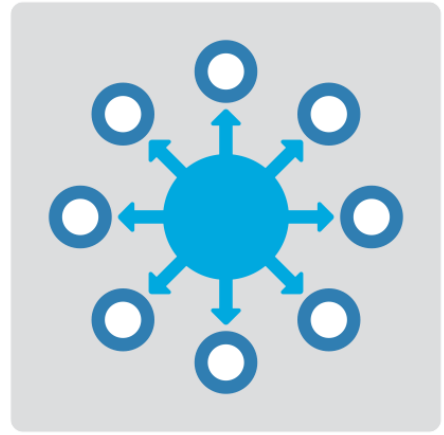
Getting your work done faster

Workflow Depth



Support for your entire workflow

Application Breadth

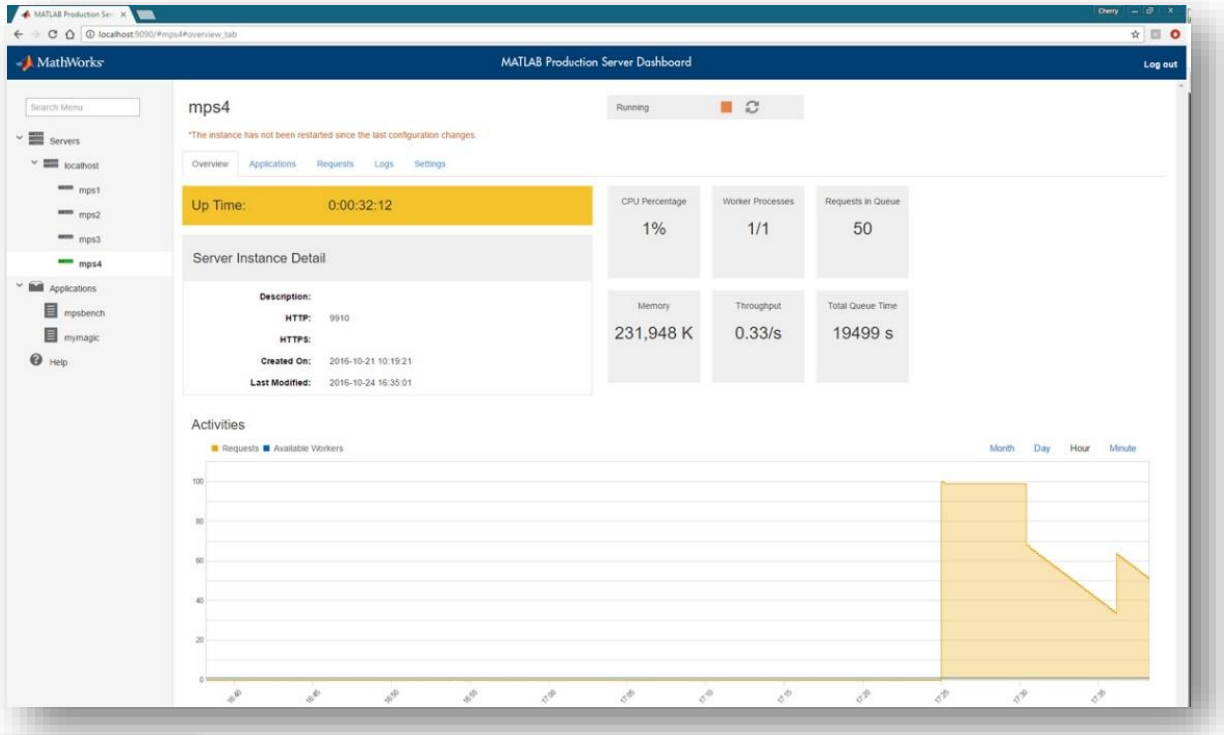


Products for the work you do

Integrate MATLAB Analytics into Enterprise Applications

Deploy MATLAB algorithms without recoding or creating custom infrastructure

- Develop clients for MATLAB Production Server in any programming language that supports HTTP using RESTful API and JSON — R2016a
- Configure and manage multiple server instances using a web-based interface — R2017a



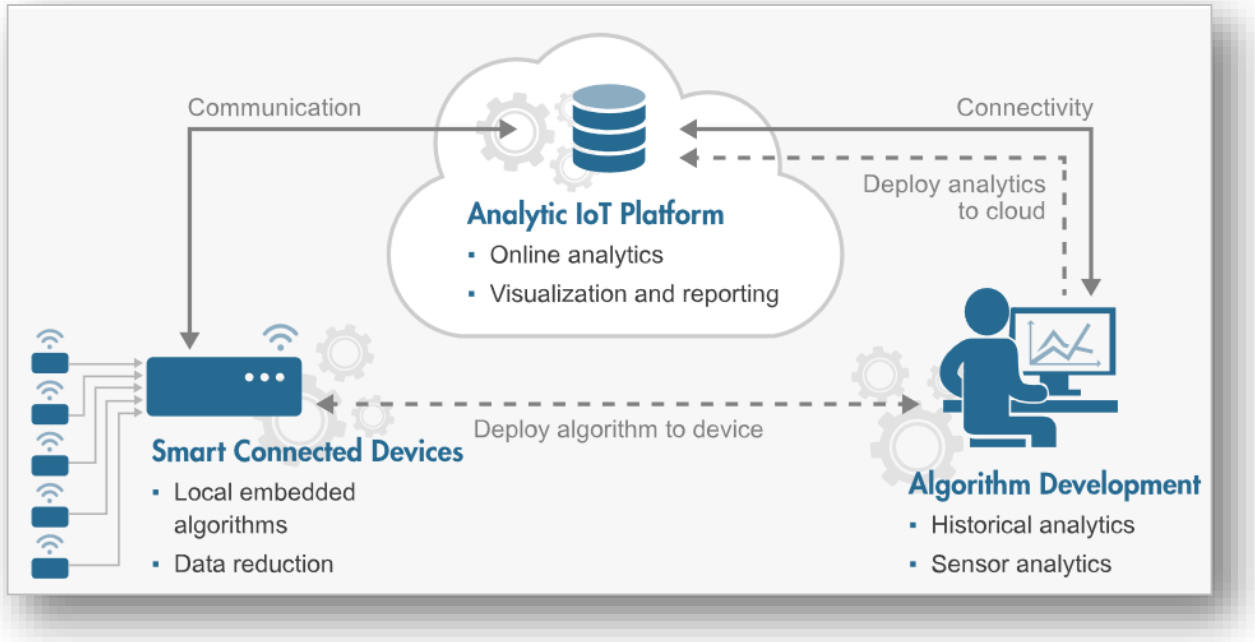
Learn more at this session:
Integrating MATLAB Analytics into Enterprise Applications

Connecting MATLAB Analytics to IoT Systems

R2016b

Develop analytics and deploy IoT systems

- ThingSpeak is a MathWorks web service for IoT.
- Quickly collect and analyze IoT data with ThingSpeak and MATLAB
- Analytics algorithms developed using MATLAB can run directly on ThingSpeak



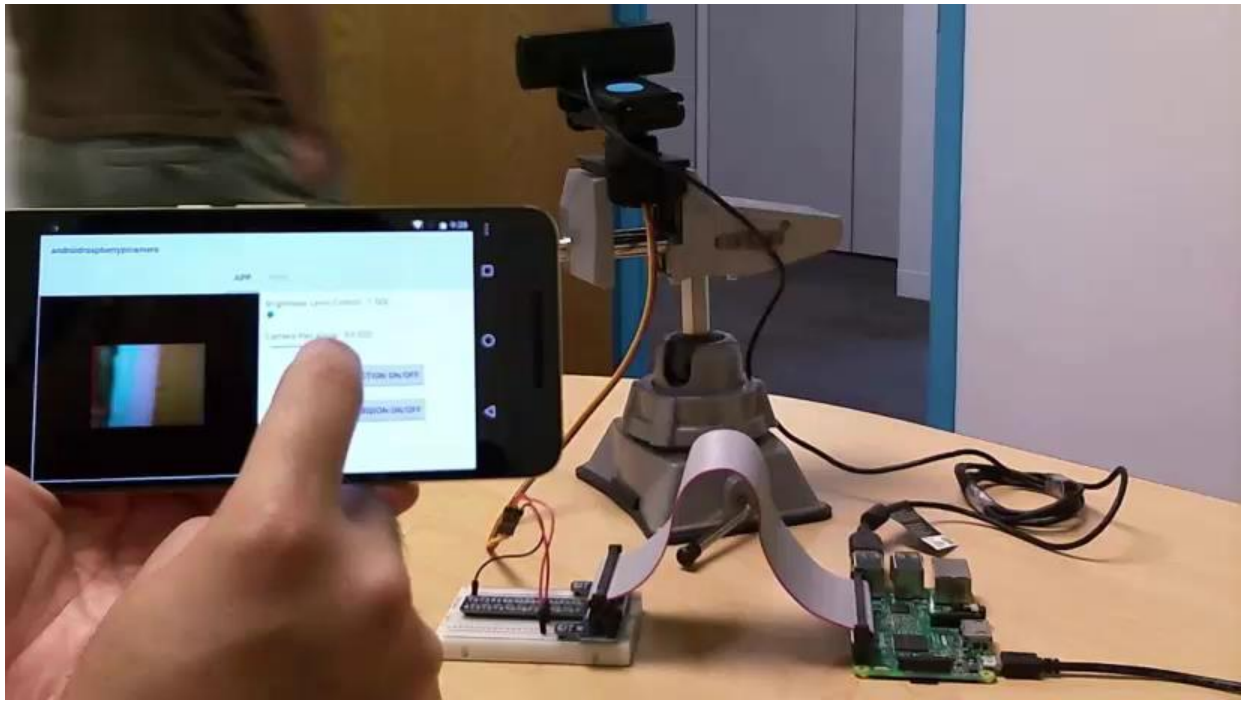
Learn more at this session:
Developing and Deploying Analytics for IoT Systems

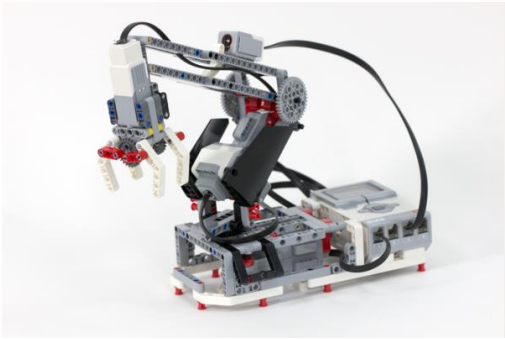
New Hardware Support

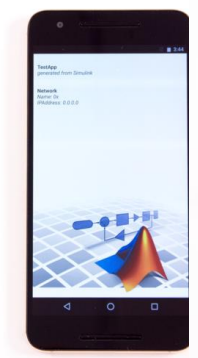
R2016b

Run Simulink models on low-cost hardware devices

- Run Simulink models on Raspberry Pi 3 and Google Nexus devices
- Adds to existing hardware support, including LEGO, Arduino, iPhone, and Android devices





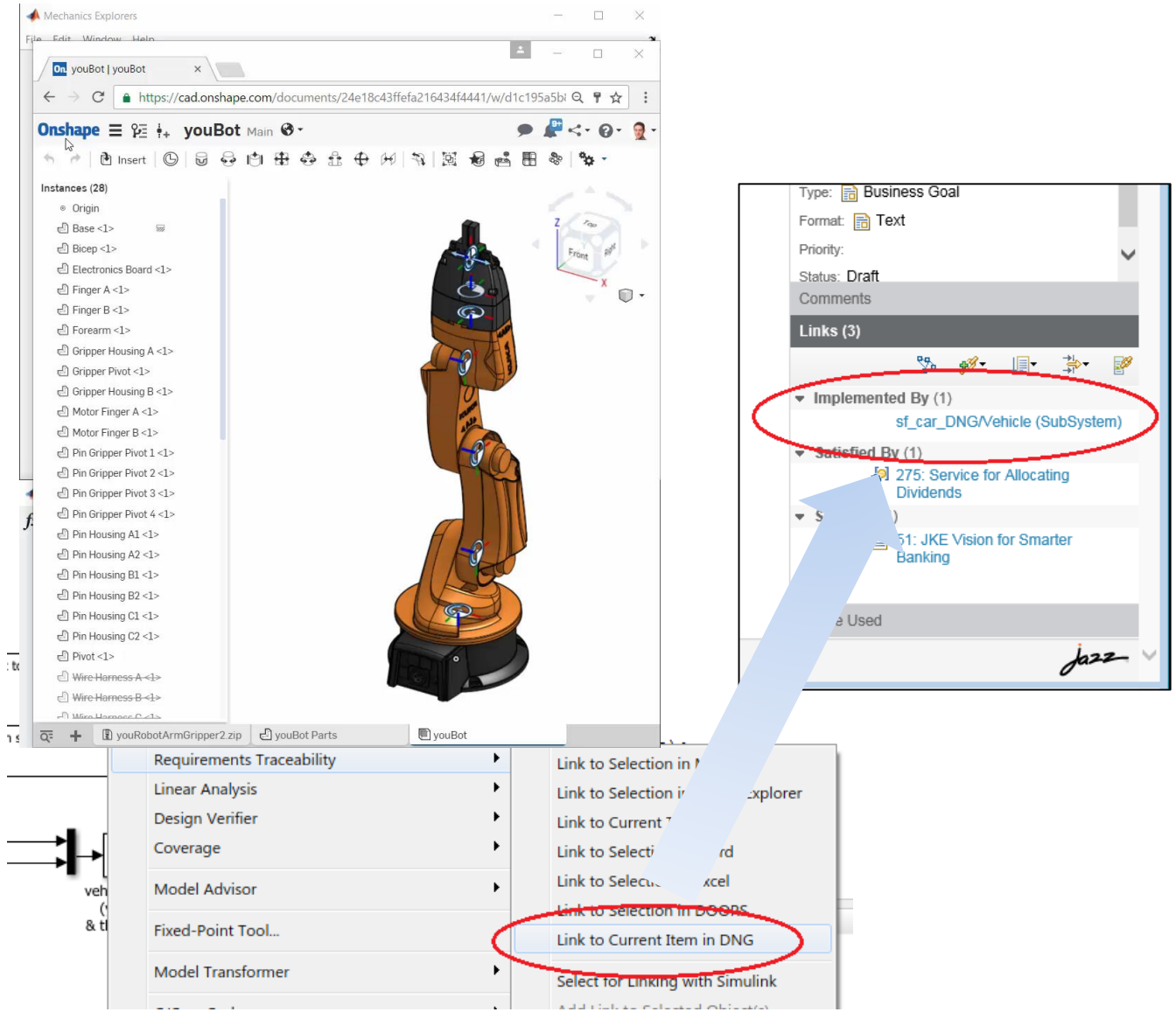


More Connections to 3rd Party Tools

R2017a

Connect your models to Onshape and DOORS Next Generation

- Convert an Onshape CAD assembly into a Simscape Multibody model
- Link and trace model elements to requirements in DOORS Next Generation



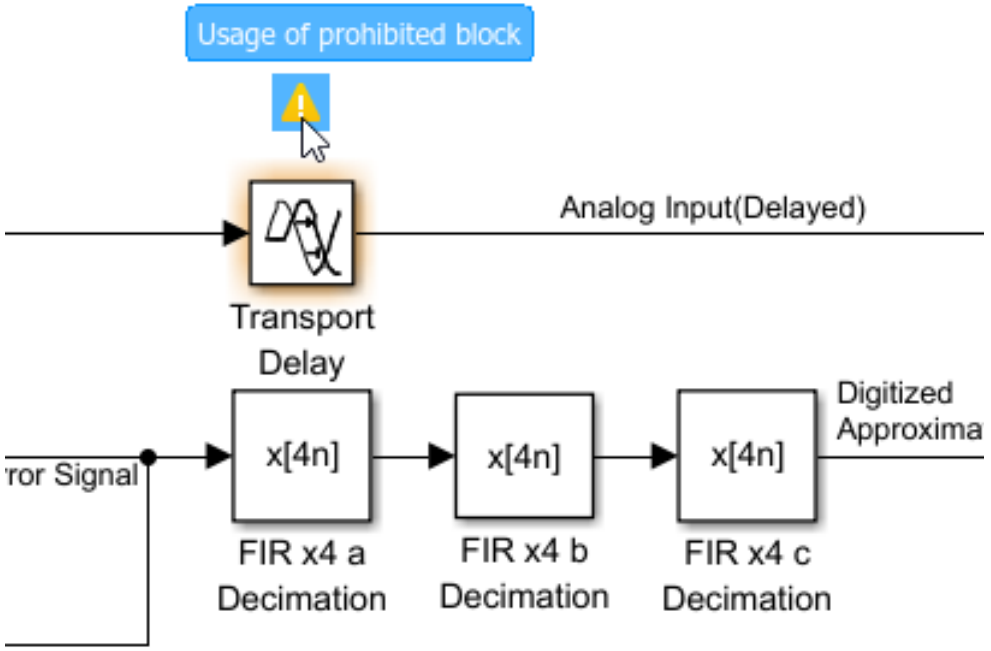
Simscape Multibody
Simulink Verification and Validation

Complying with Safety-Critical Standards

R2016b

Detect and fix standards compliance issues at design time with edit-time checking

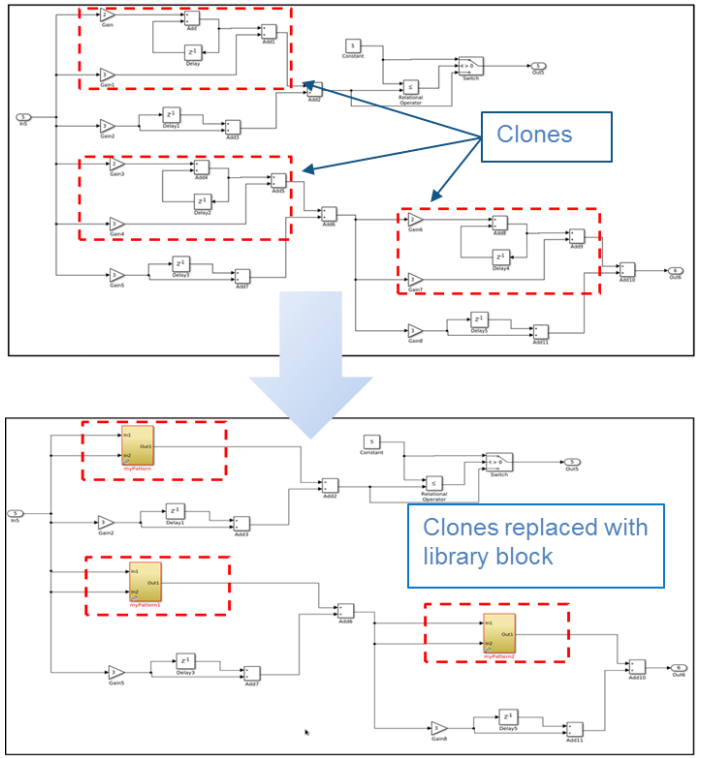
- Quickly address compliance and modeling standards issues before running the model
- For example, check for prohibited blocks or block names
- Especially useful for applications that require compliance to standards such as DO-178, ISO 26262, IEC 62304



Efficient Code Generation

Improve code quality with clone detection and dynamic memory allocation

- Refactor repeating library patterns and subsystem clones
  - Reduces redundancy
  - Improves reusability
- Generate C code that uses dynamic memory allocation from MATLAB Function blocks
  - Allocate memory as needed at runtime




```
118     /* MATLAB Function: '<Root>/MATLAB Function' */
119     /* MATLAB Function 'MATLAB Function': '<S1>:1' */
120     if (!mymdl_DW.p_not_empty) {
121       /* '<S1>:1:4' */
122       /* '<S1>:1:5' */
123       k = mymdl_DW.p->size[0] * mymdl_DW.p->size[1];
124       mymdl_DW.p->size[0] = 1;
125       mymdl_DW.p->size[1] = 0;
126       mymdl_emxEnsureCapacity((emxArray__common_mymdl_T *)mymdl_DW.p, k, (int
127         sizeof(real_T));
128       mymdl_DW.p_not_empty = false;
129     }
```

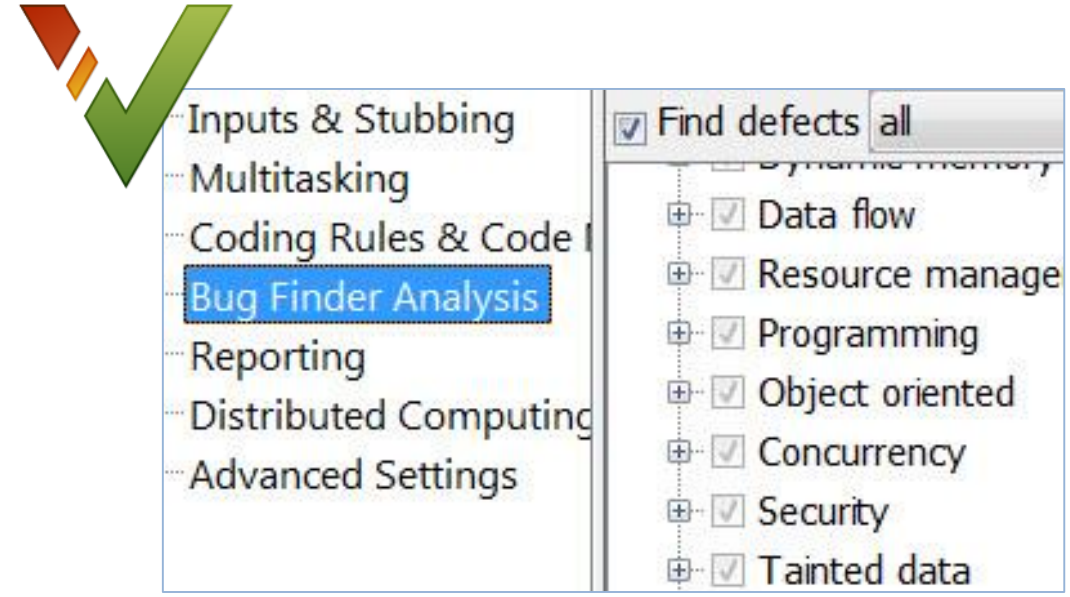
Simulink Verification and Validation
Simulink Coder

Code Verification

R2016b

Detect and prove the absence of run-time errors in your source code using static analysis

- Identify CERT C violations using defect checkers and coding rules
- Detect security vulnerabilities highlighted by the CERT C standard
- Addresses growing concern over software security with the rise in system connectivity




```
if (output_v7 >= 0) {
    saved_values[output_v7] = s8_ret;
    return s8_ret
}
return reset_temp
```

Assignment to element of static array (int 16): [-32 .. 112]
array size: 127
array index value: [0 .. 555]

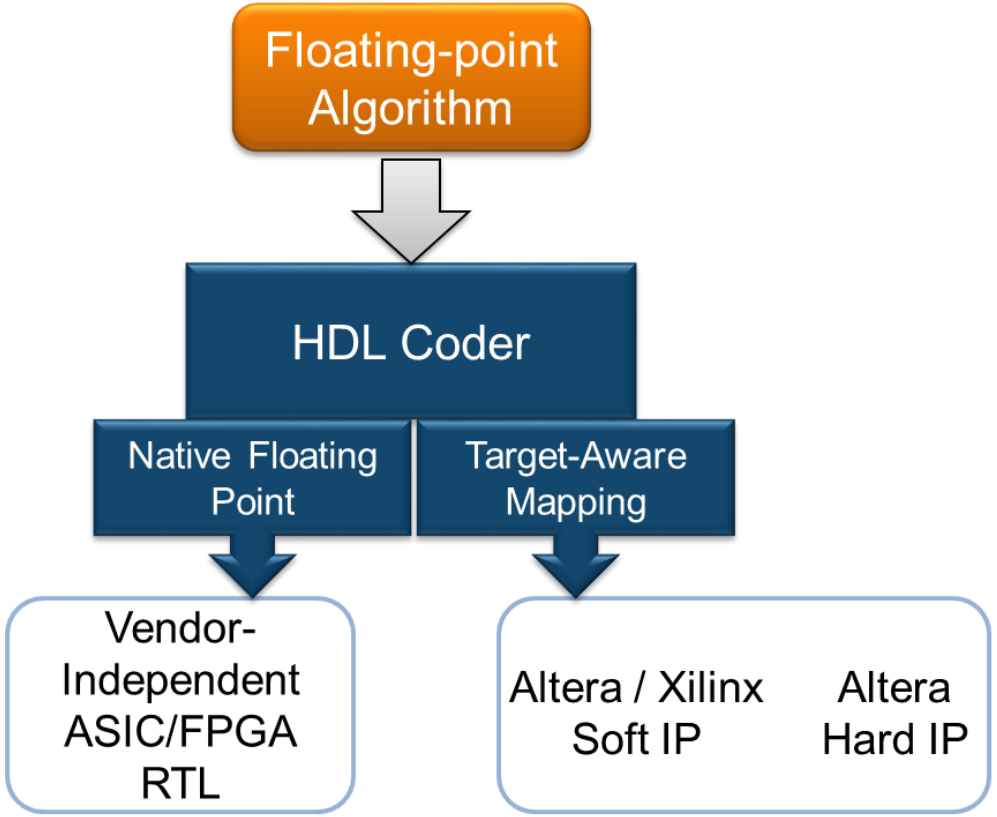
CERT C	Description	Polyspace Code Prover
ARR30-C	Do not form or use out-of-bounds pointers or array subscripts	Array access out of bounds

Floating Point HDL Code Generation

R2017a

Generate HDL code directly from single-precision floating point Simulink models

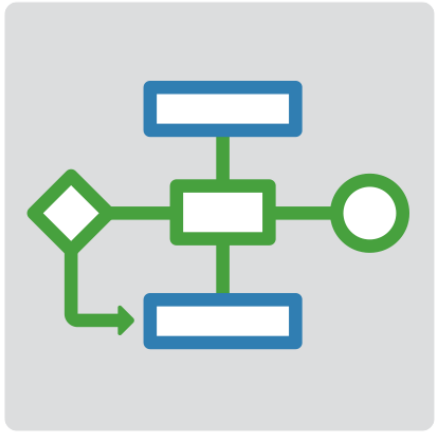
- Generates native floating-point arithmetic HDL code complying to IEEE-754 standard
- Balance numerical accuracy versus hardware resource usage by mixing integer, fixed-point, and floating point operations.



Platform Productivity

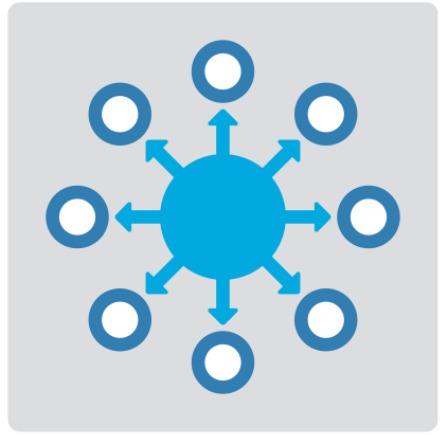
Getting your work done faster

Workflow Depth



Support for your entire workflow

Application Breadth



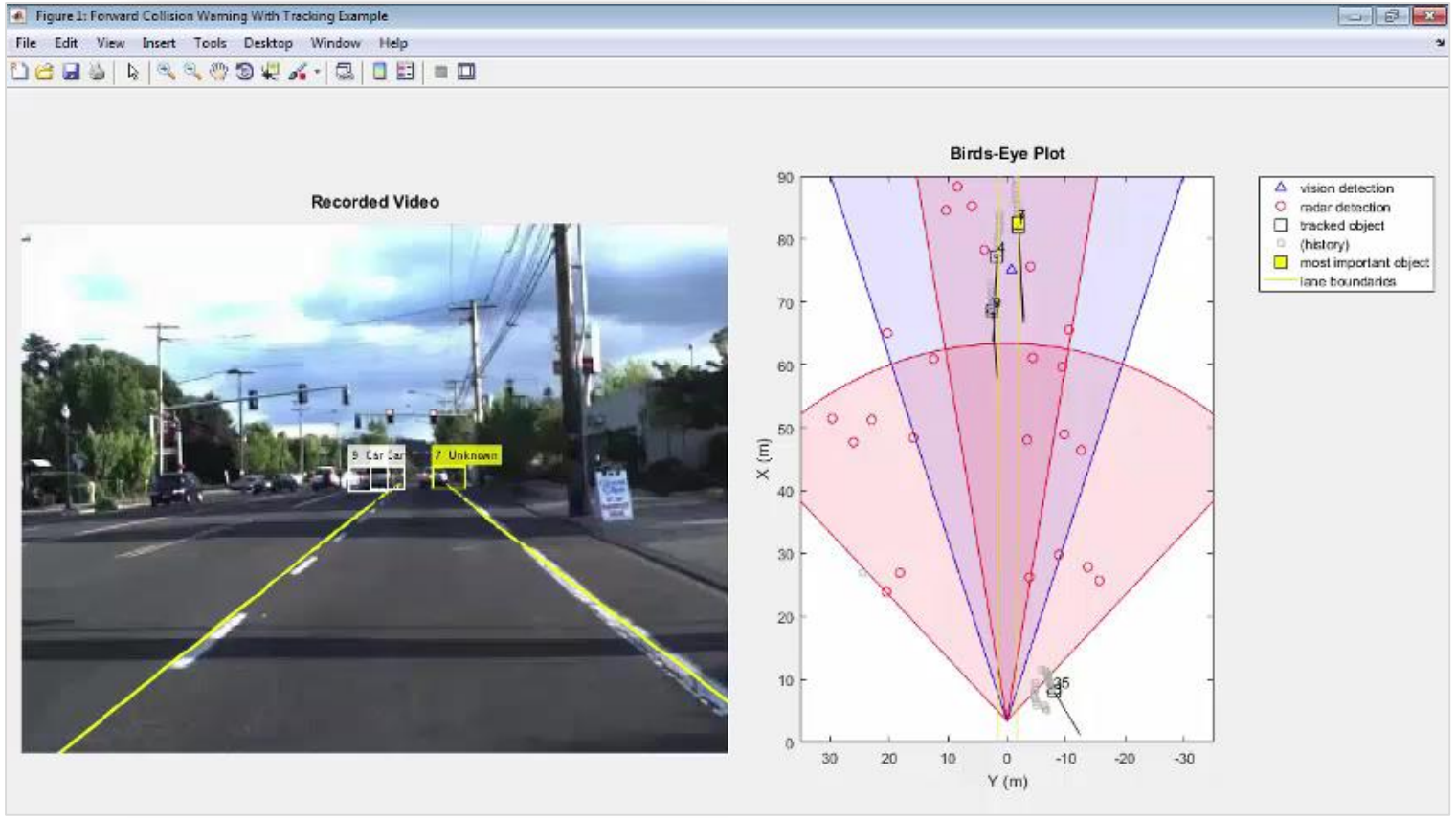
Products for the work you do

Autonomous Driving Systems

R2017a

Design, simulate, and test ADAS and autonomous driving systems

- Algorithm development
  - Sensor Fusion
  - Computer Vision
  - Deep learning
- Visualization tools
- Testing and verification
  - Ground Truth Labeling App
  - Traffic scenario generation

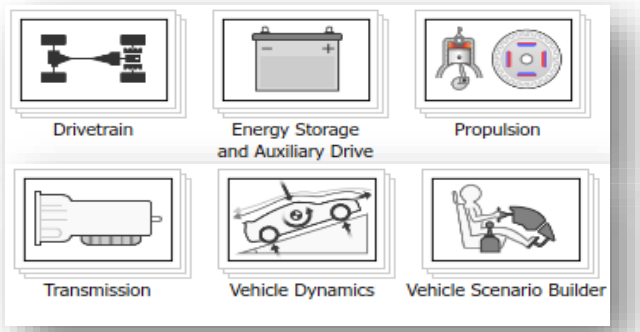


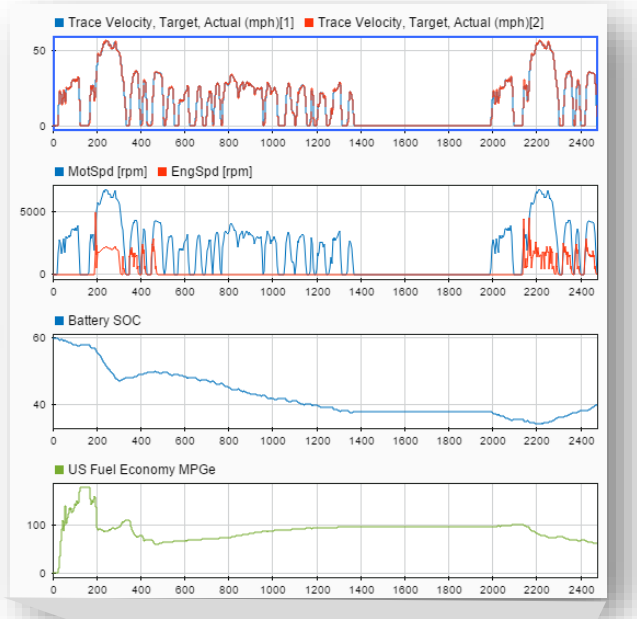
Model and Simulate Automotive Powertrain Systems

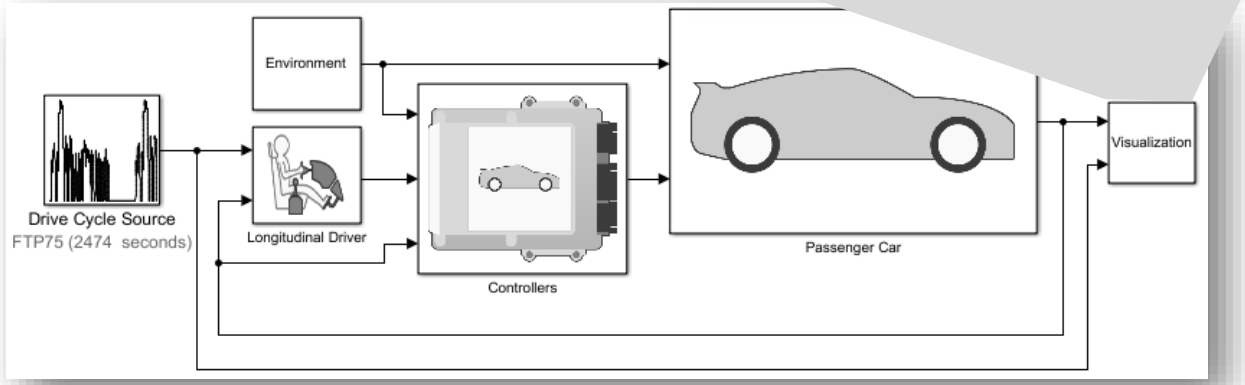
R2017a

Accelerate your powertrain controls development process

- Simulate engine and controller subsystems, transmission assemblies, battery packs
- Use pre-built conventional, EV, and HEV vehicle models that can be parameterized and customized
- Run fuel economy and performance simulations
- Deploy fast-running models onto HIL systems







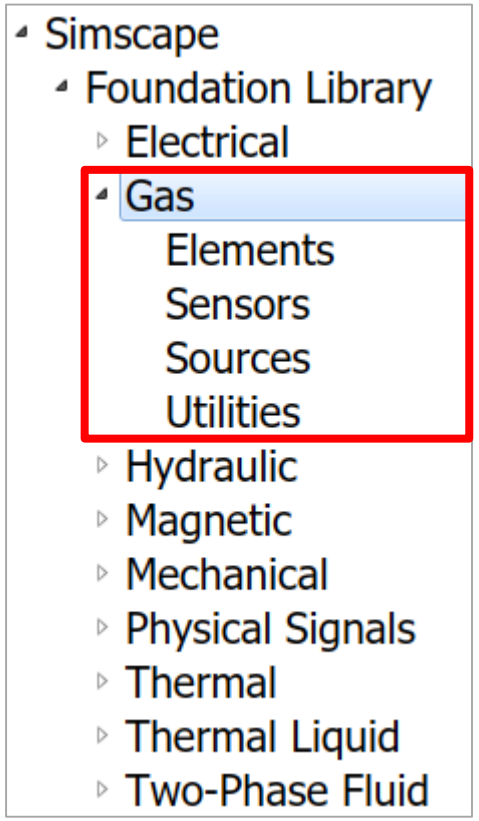
Powertrain Blockset

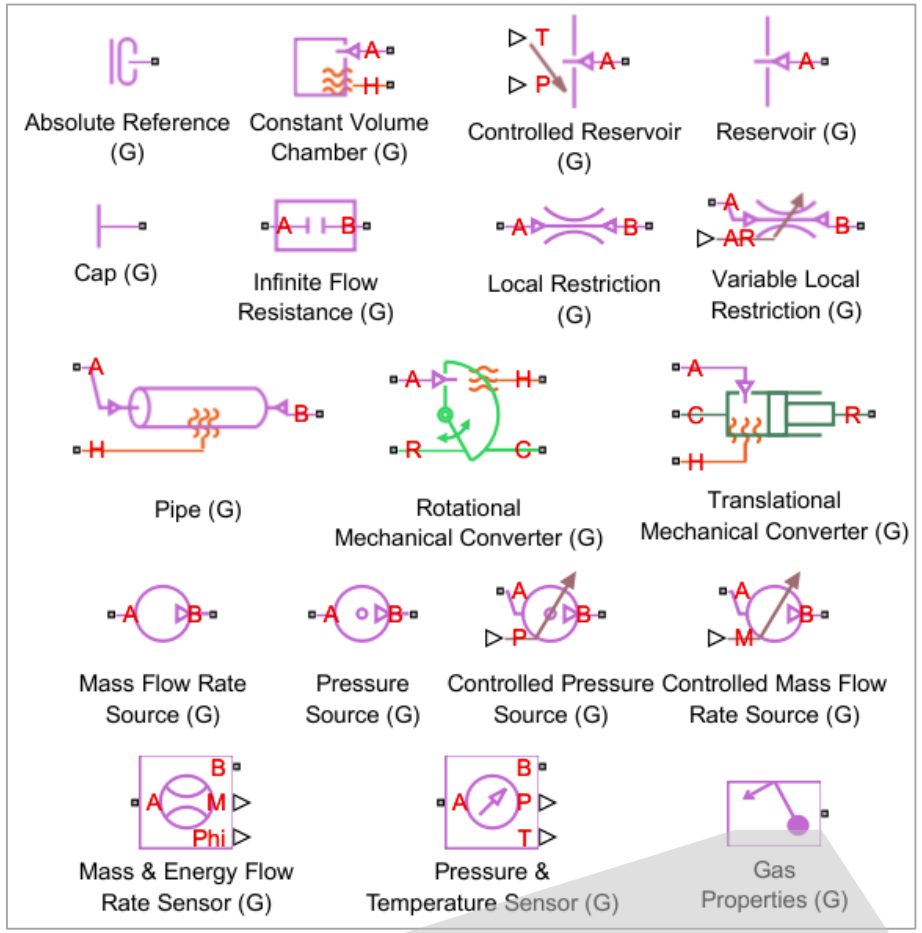
Gas Domain and Block Library in SimScape

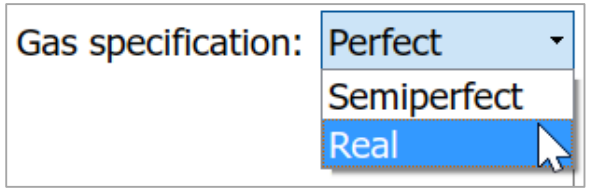
R2016b

Model gas systems with various levels of idealization

- Pneumatic actuation
- Gas transport in pipe networks
- Gas turbines for power generation
- Air cooling of thermal components
- Perfect gas, semiperfect gas, or real gas

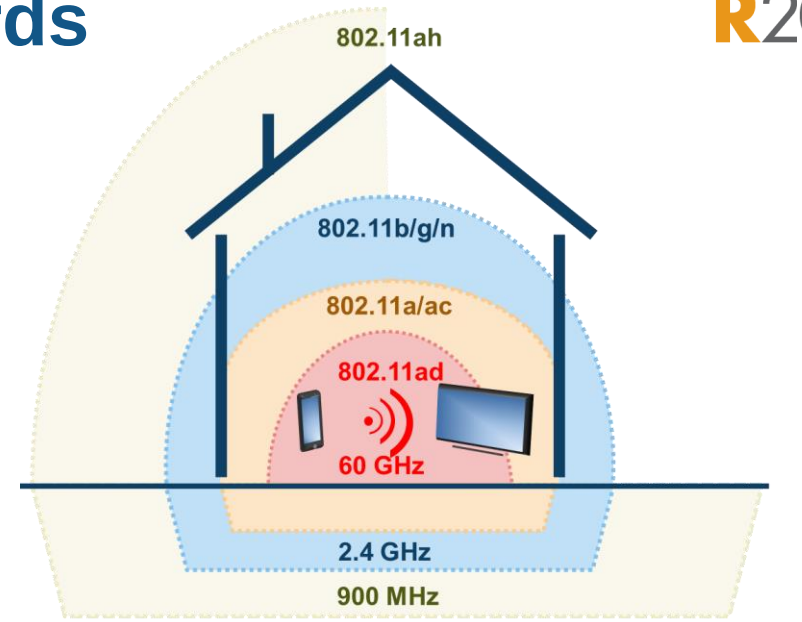






Support for the Latest Wireless Standards

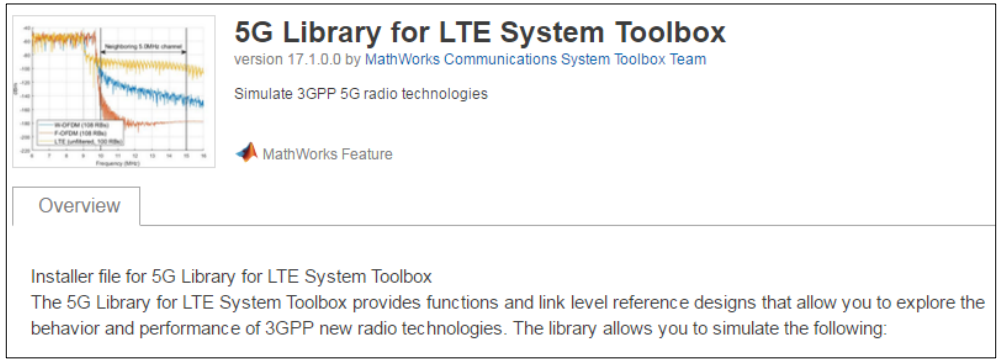
R2017a

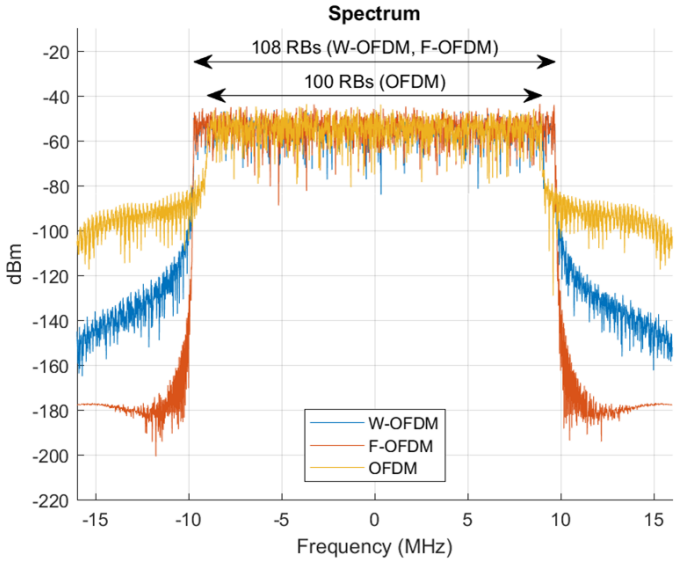


Generate IEEE 802.11ad compliant waveforms and simulate 3GPP 5G radio technologies

- **IEEE 802.11ad** is a new Wi-Fi standard intended for high data rate short range communication
  - e.g., streaming video between a phone and a TV

- A **new 5G library** is available to explore the behavior and performance of new proposed 5G radio technologies





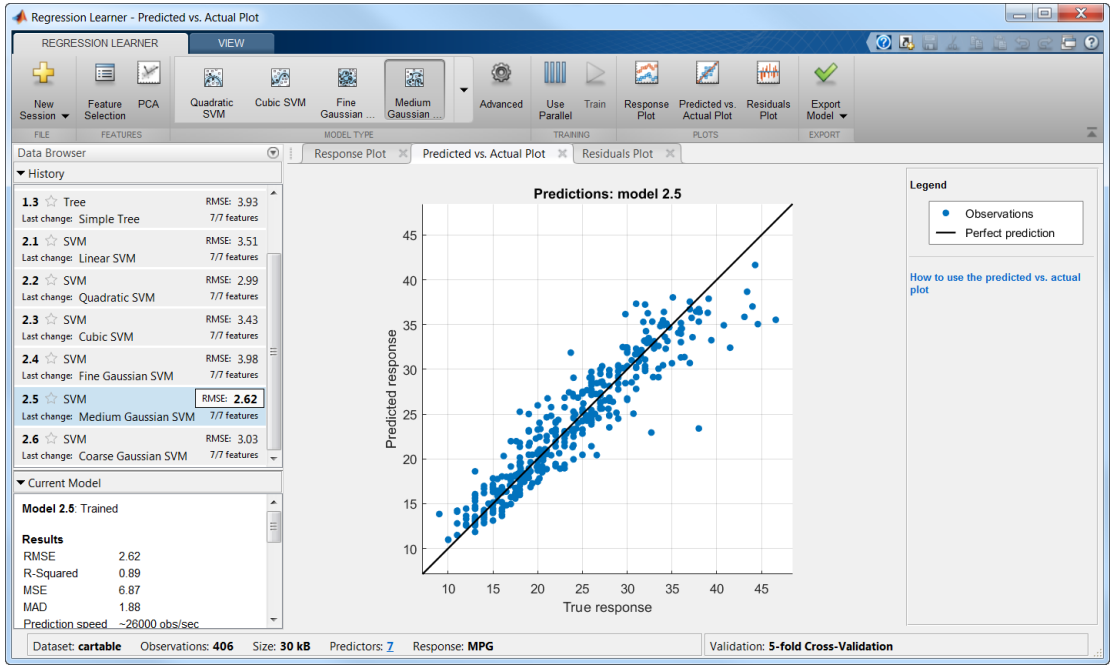
WLAN System Toolbox
LTE System Toolbox

Machine Learning

R2017a

“Learn" information directly from data without assuming a predetermined equation as a model

- Regression Learner app
  - Choose from multiple algorithms
  - Train and validate multiple models
  - Assess model performance, compare results, and choose the best model
- Code generation
  - Generate C code for predictive models that can be deployed directly to hardware devices

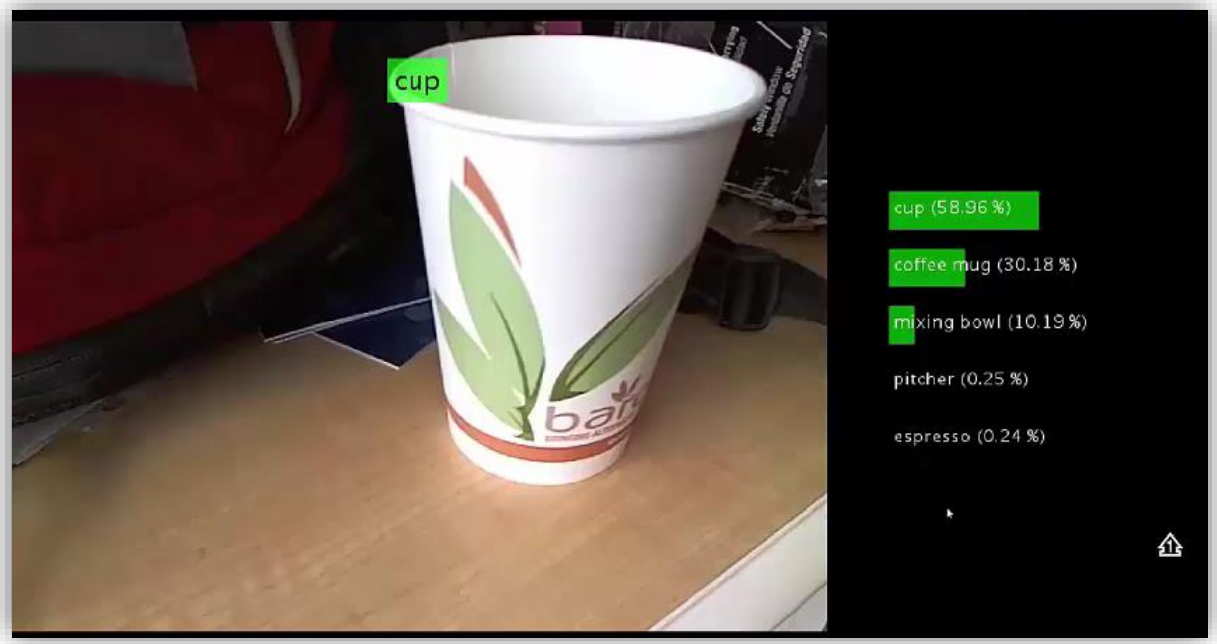


Deep Learning

R2016b R2017a

Apply deep learning to computer vision problems

- Configure and train models using object detection algorithms
  (R-CNN, Fast R-CNN, Faster R-CNN)
- Leverage pretrained models for transfer learning
  (AlexNet, VGG-16, VGG-19)
- Import models from Caffe
- Train networks using multiple GPUs
  (including on Amazon EC2)



Learn more at this session:
Developing Deep Learning Algorithms Using MATLAB

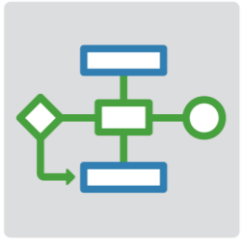
Neural Network Toolbox
Computer Vision System Toolbox

What's New in MATLAB and Simulink?

Platform Productivity

- Live Editor
- MATLAB Apps
- New (big) data types
- Modeling enhancements
- Release adoption

Workflow Depth



- Enterprise applications
- IoT systems
- 3rd party tool integration
- Standards compliance
- Code generation and verification

Application Breadth

- Powertrain systems
- New wireless standards
- Machine learning
- Deep learning
- Autonomous driving

© 2017 The MathWorks, Inc. MATLAB and Simulink are registered trademarks of The MathWorks, Inc. See www.mathworks.com/trademarks for a list of additional trademarks. Other product or brand names may be trademarks or registered trademarks of their respective holders.

© 2017 The MathWorks, Inc.