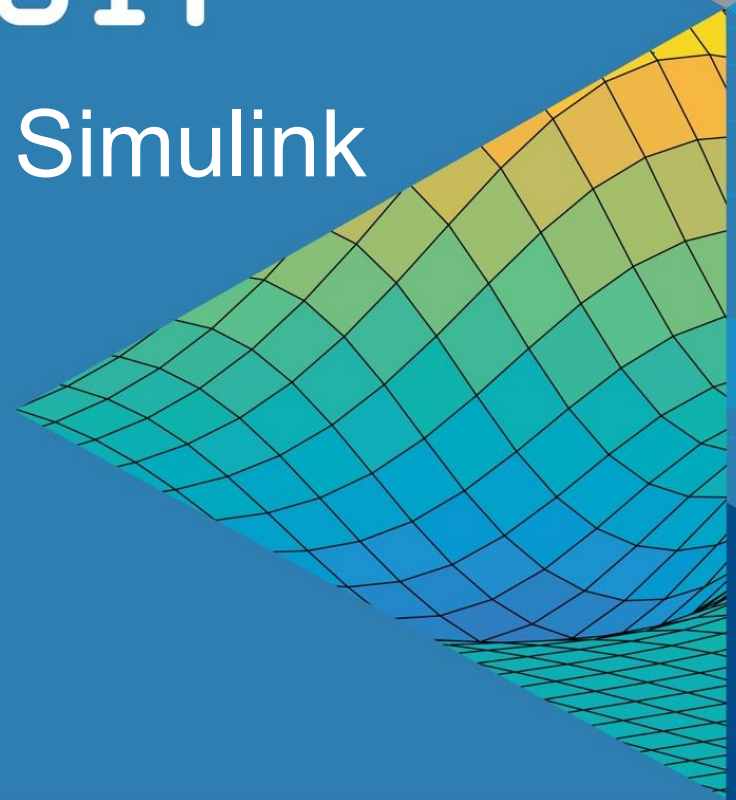
R2016b R2017a

MATLAB EXPO 2017

What's New in MATLAB and Simulink

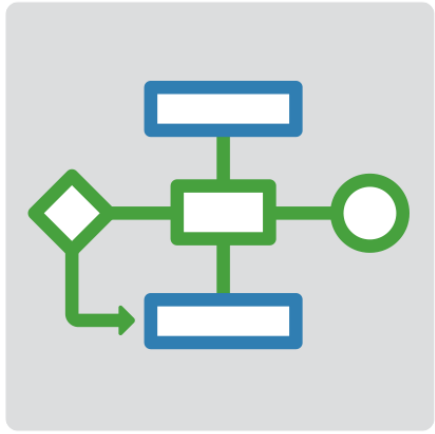
Paul Lambrechts & Paola Jaramillo



Platform Productivity

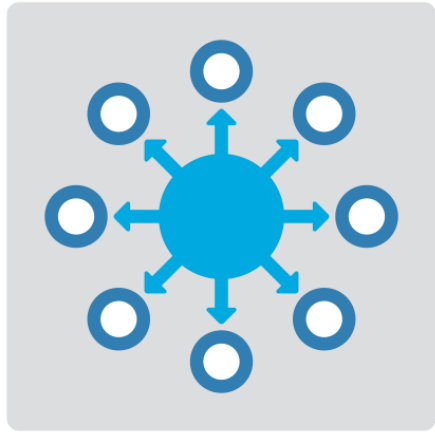
Getting your work done faster

Workflow Depth



Support for your entire workflow

Application Breadth



Products for the work you do

Platform Productivity

Getting your work done faster

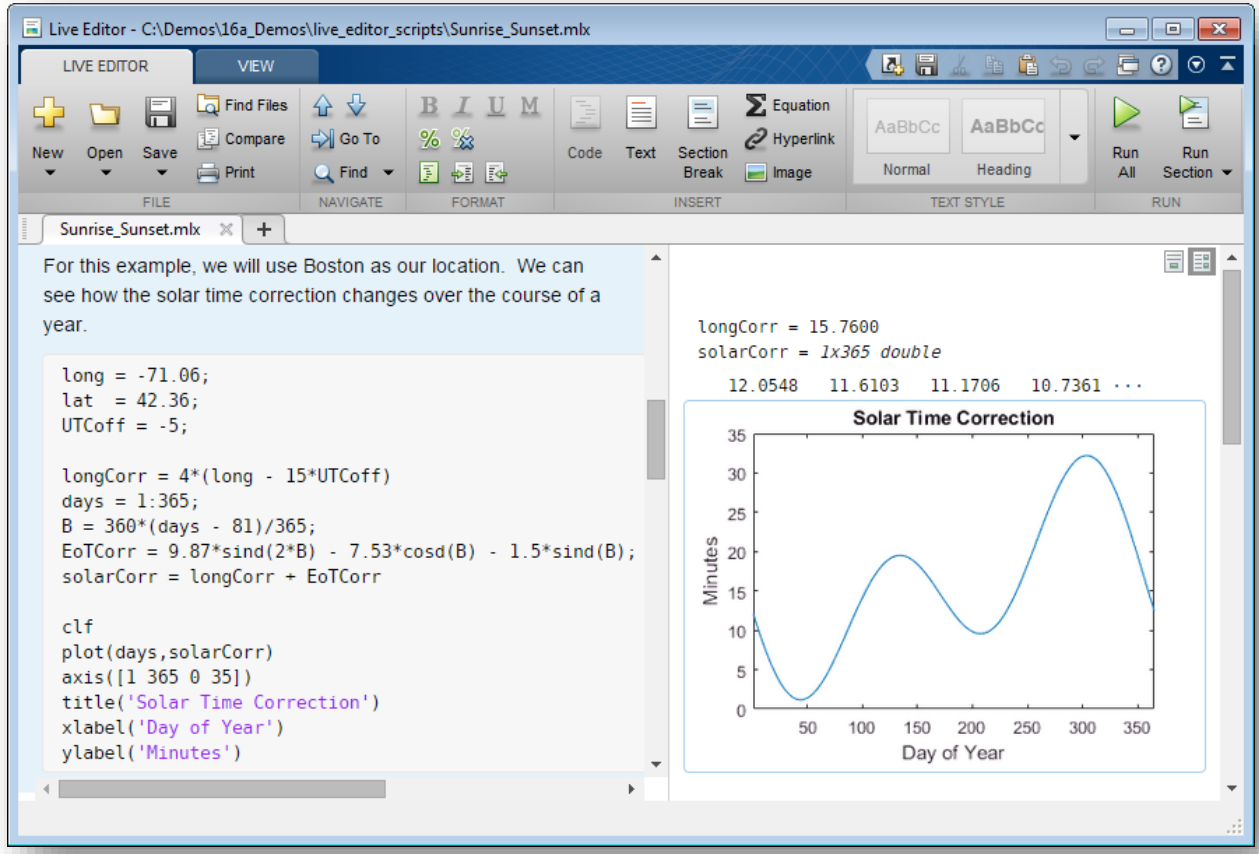
Change the Way You Work in MATLAB

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



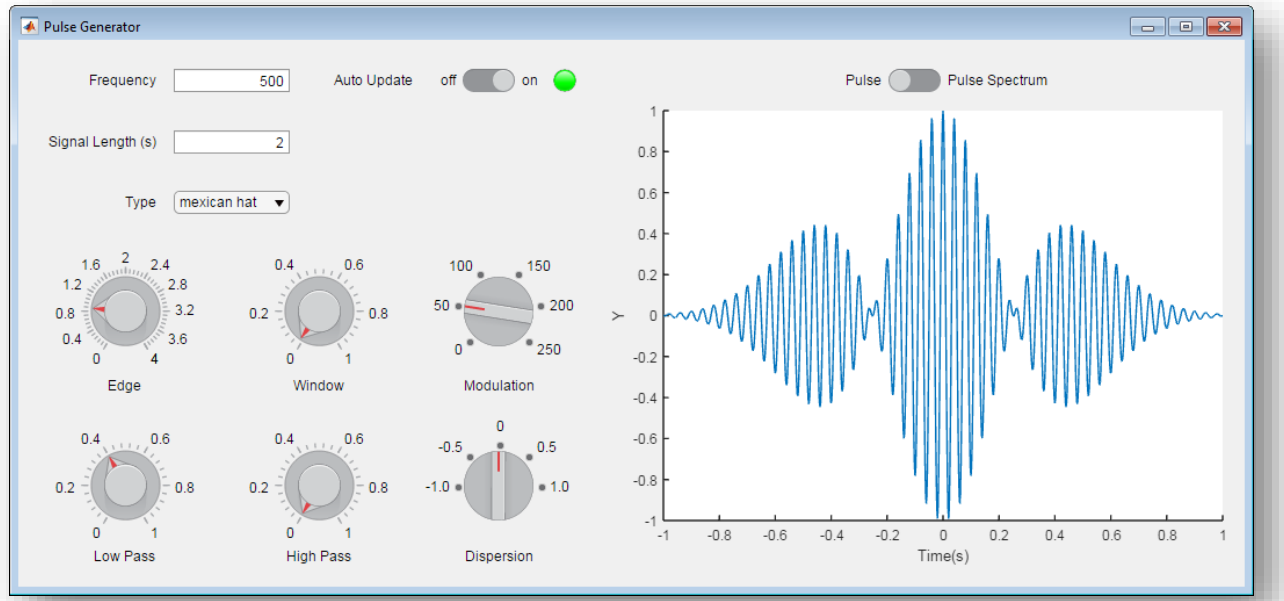
App Designer

R2016b R2017a

Environment for building MATLAB apps
(introduced in R2016a)

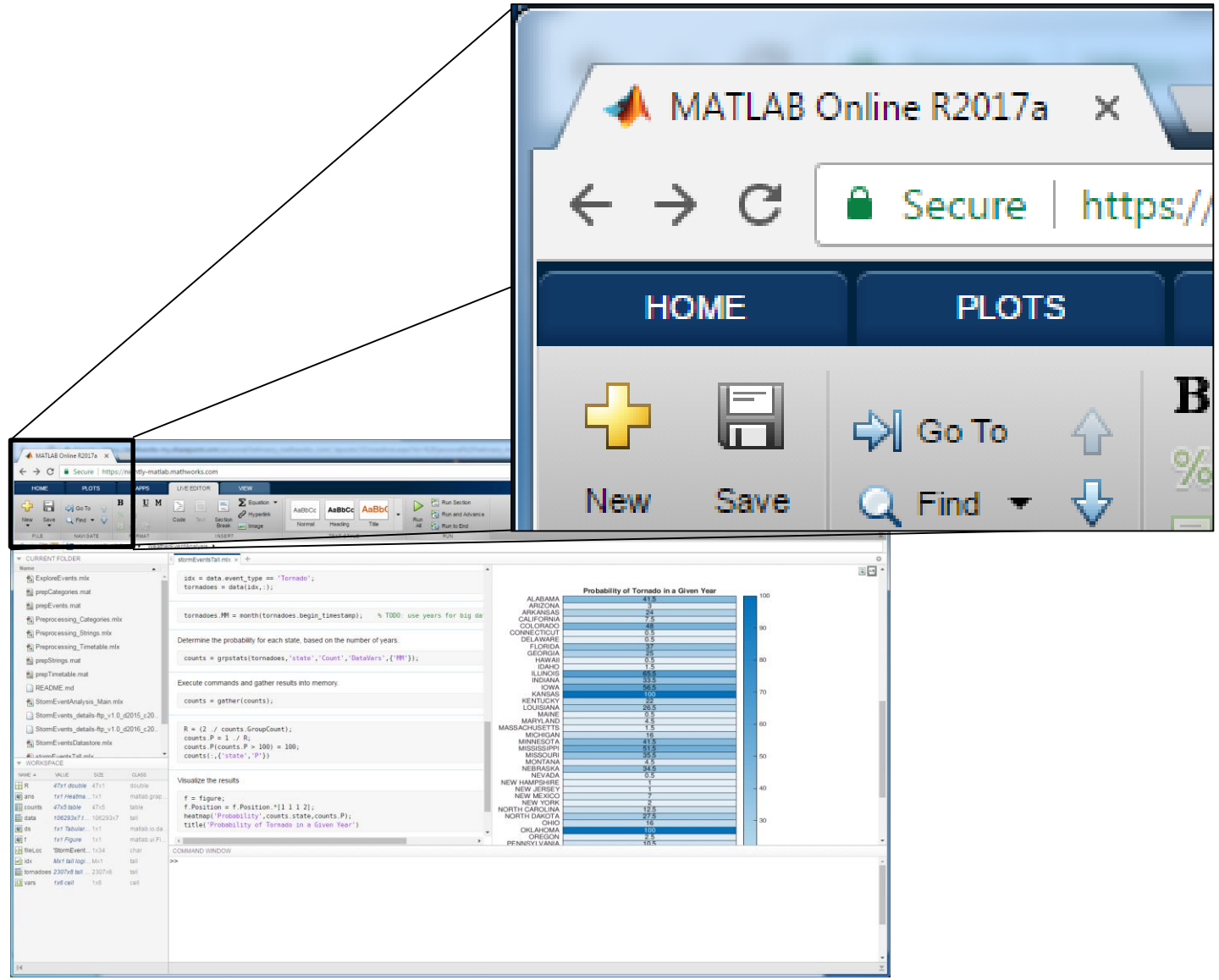
- Full set of standard user interface components, as well as gauges, knobs, switches, and lamps
- Rich design environment for laying out apps
- Object-based code format for easily sharing data between parts of the app

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



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/



Working with Data Just Got Easier

Numeric

double, single, …

logical

R2013b

categorical

datetime

duration

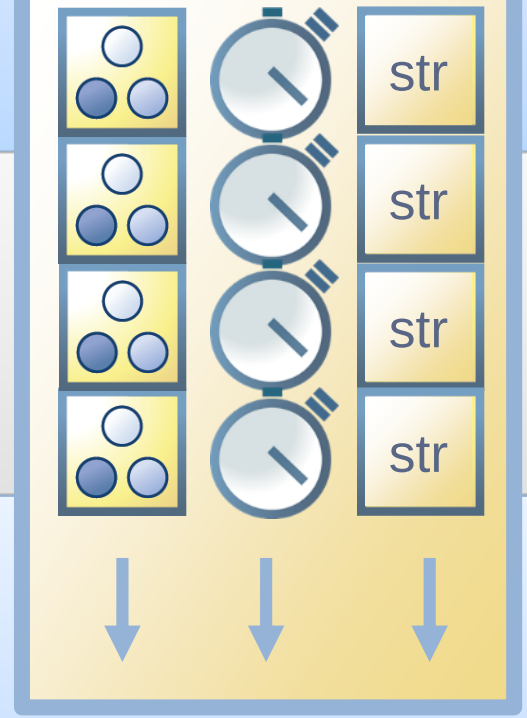
R2014b

calendarDuration

R2016b

timetable

R2016b



tall

Heterogeneous

structure

cell

R2013b

table

Text

char

cell string

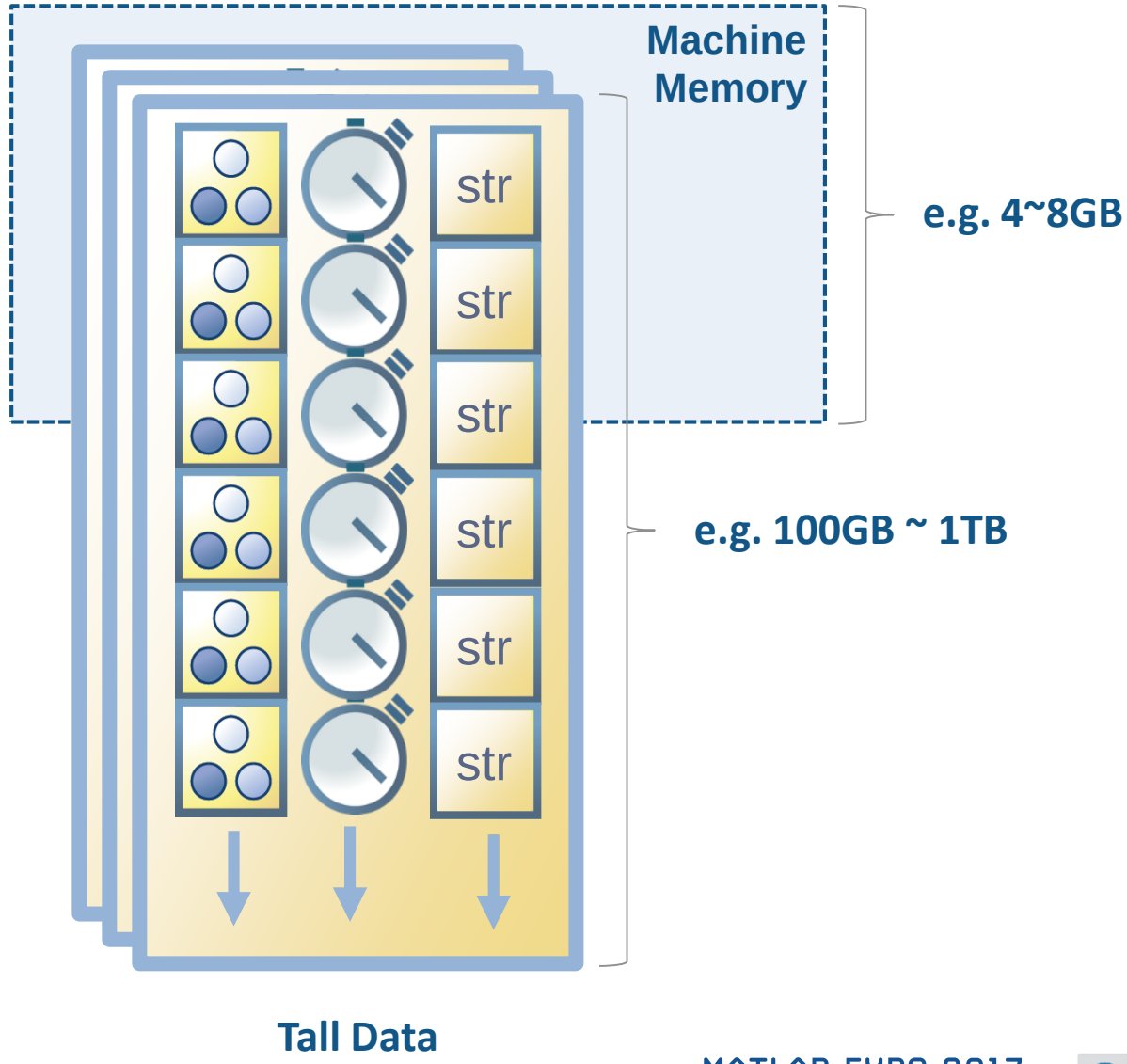
R2016b

string

Working with Big Data Just Got Easier

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

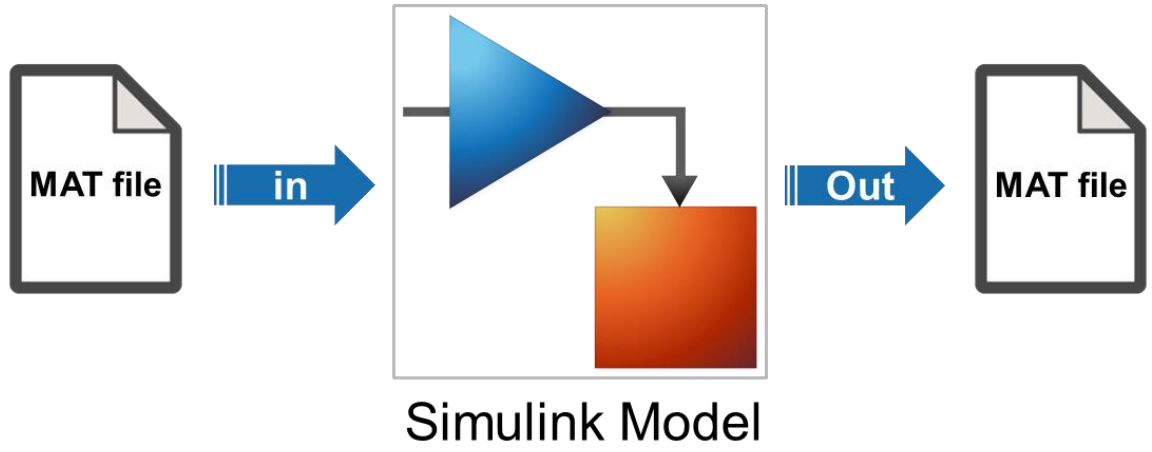


Working with Big Data Just Got Easier in Simulink Too

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

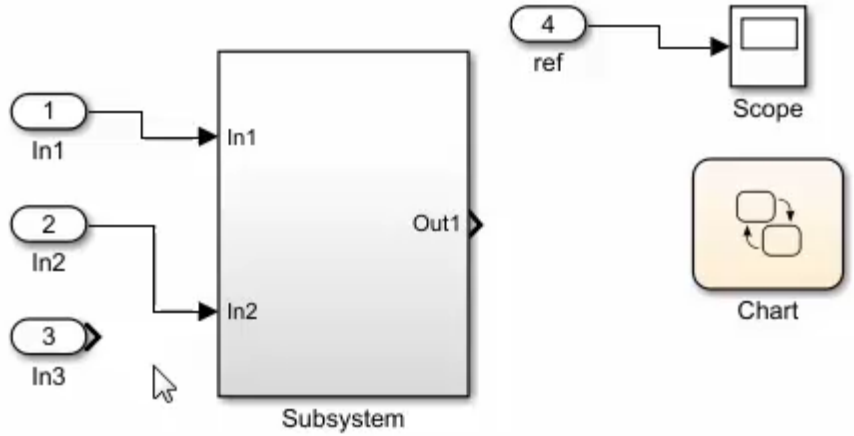


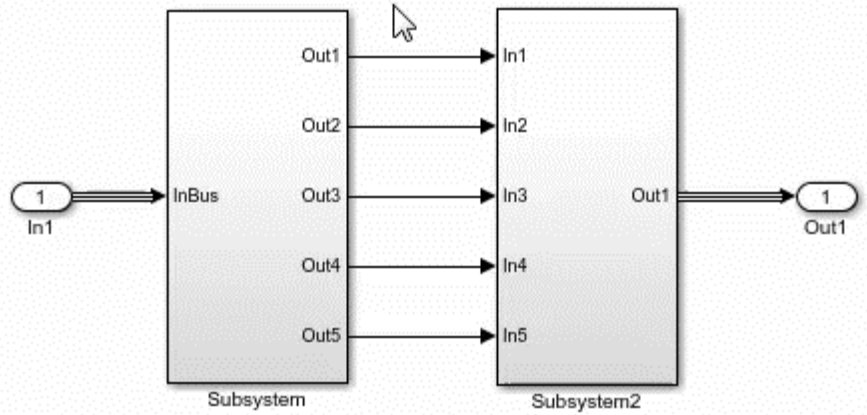
Create Your Models Faster

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

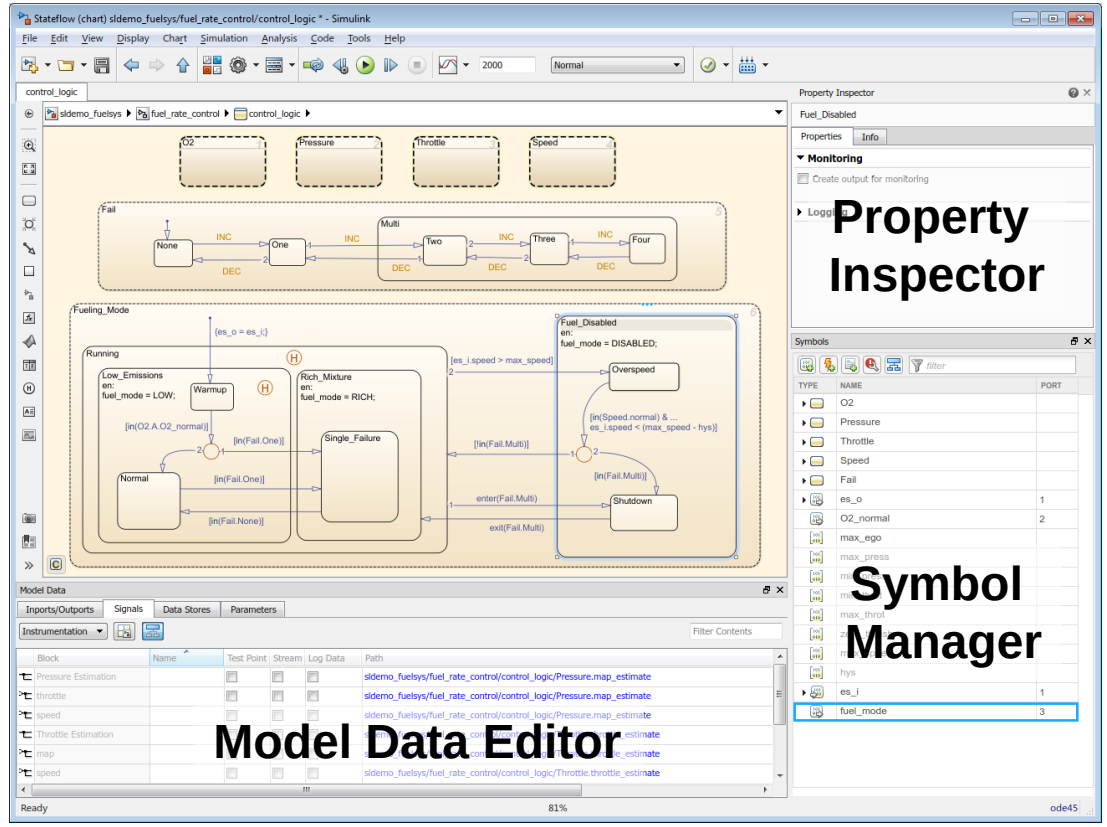




Define your Data Faster

Reduces the need to open separate dialog boxes

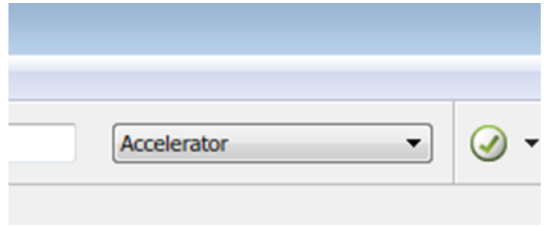
- Model and block parameter data is now accessible within the main editor window
- Accessing and defining Stateflow data is also much easier

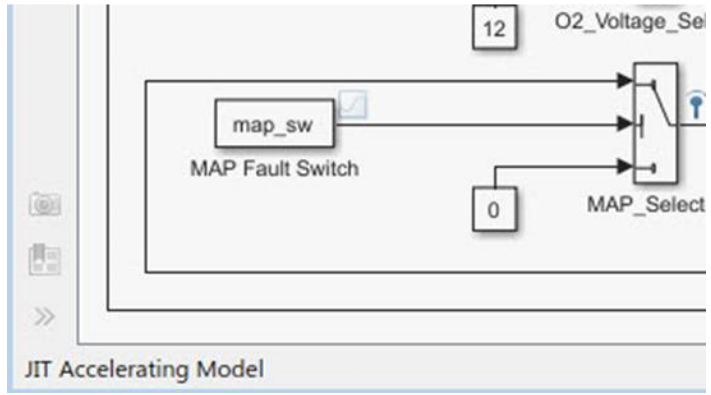


Simulate your Model Faster

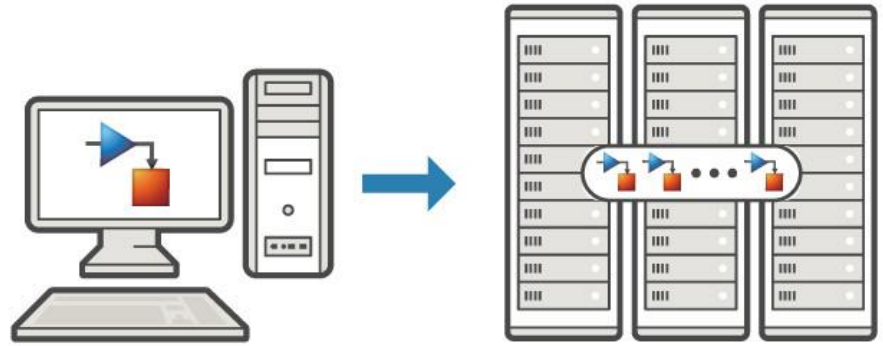
R2017a

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





- Quickly build the top-level model for improved performance when running simulations in Accelerator mode
- Directly run multiple parallel simulations from the `parsim` command
- Especially use for Monte Carlo simulations and Design of Experiments

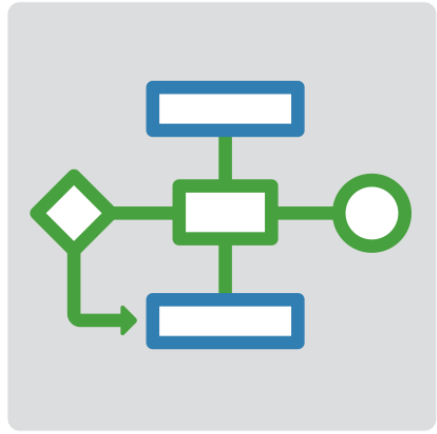


Parallel Computing Toolbox
MATLAB Distributed Computing Server

Platform Productivity

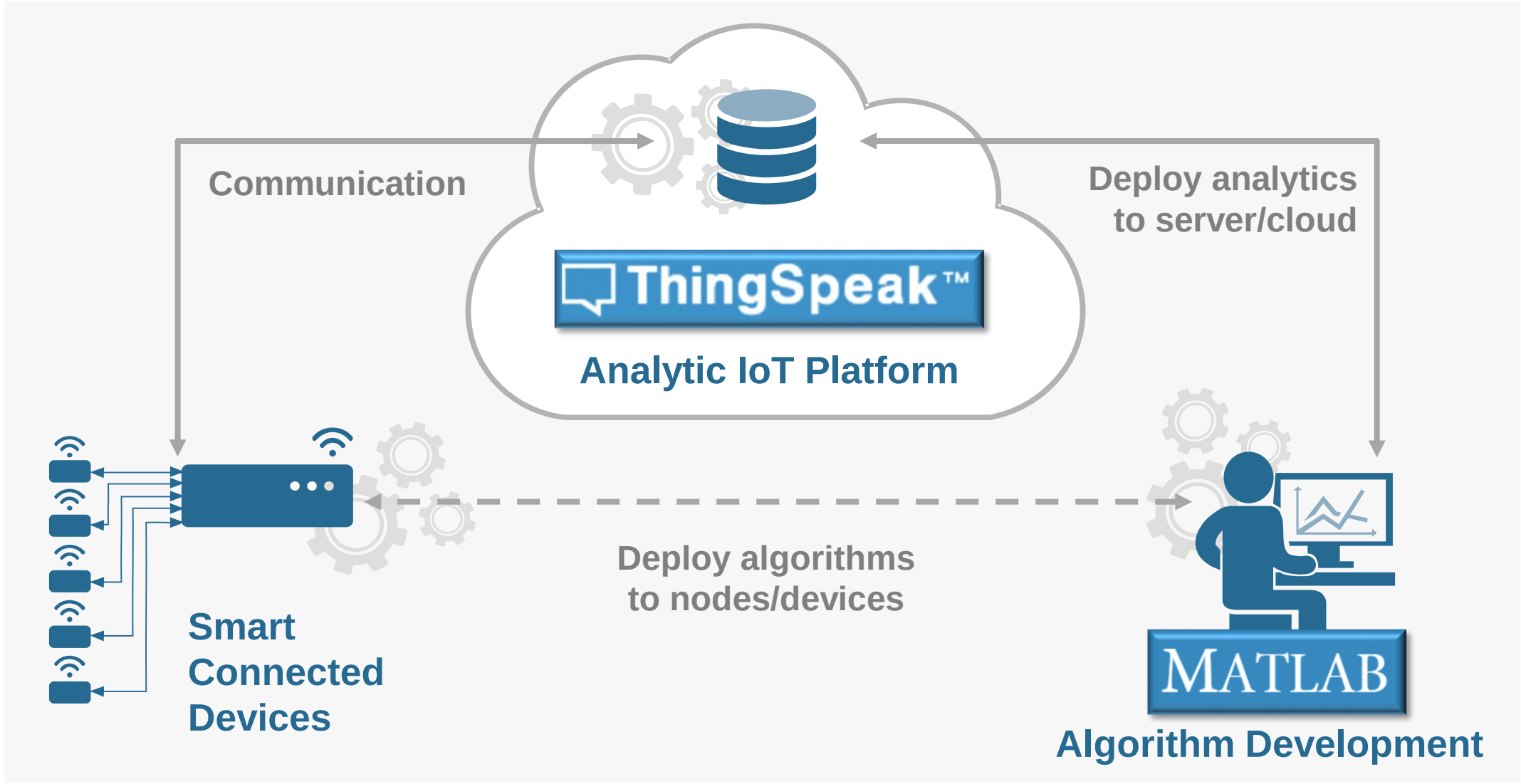
Getting your work done faster

Workflow Depth



Support for your entire workflow

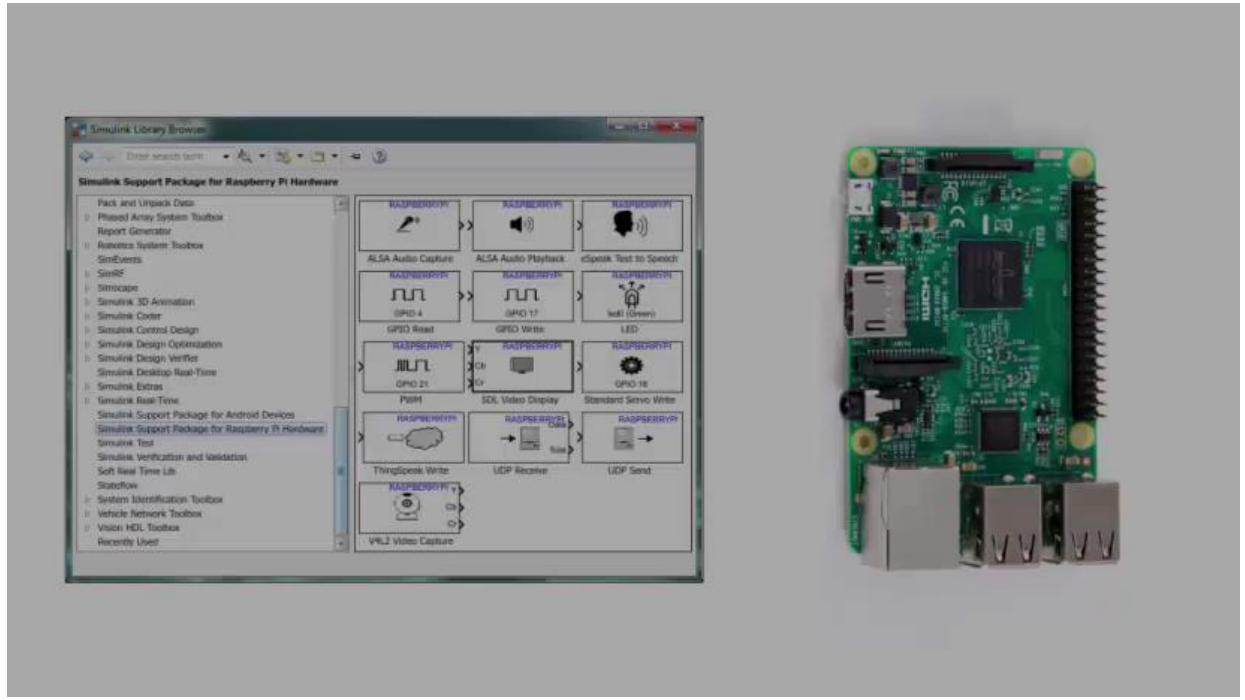
Connecting MATLAB Analytics to IoT Systems



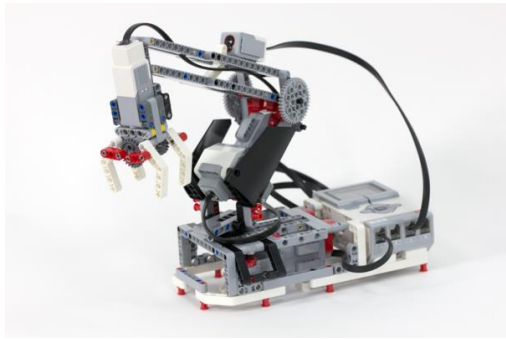
New Hardware Support

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



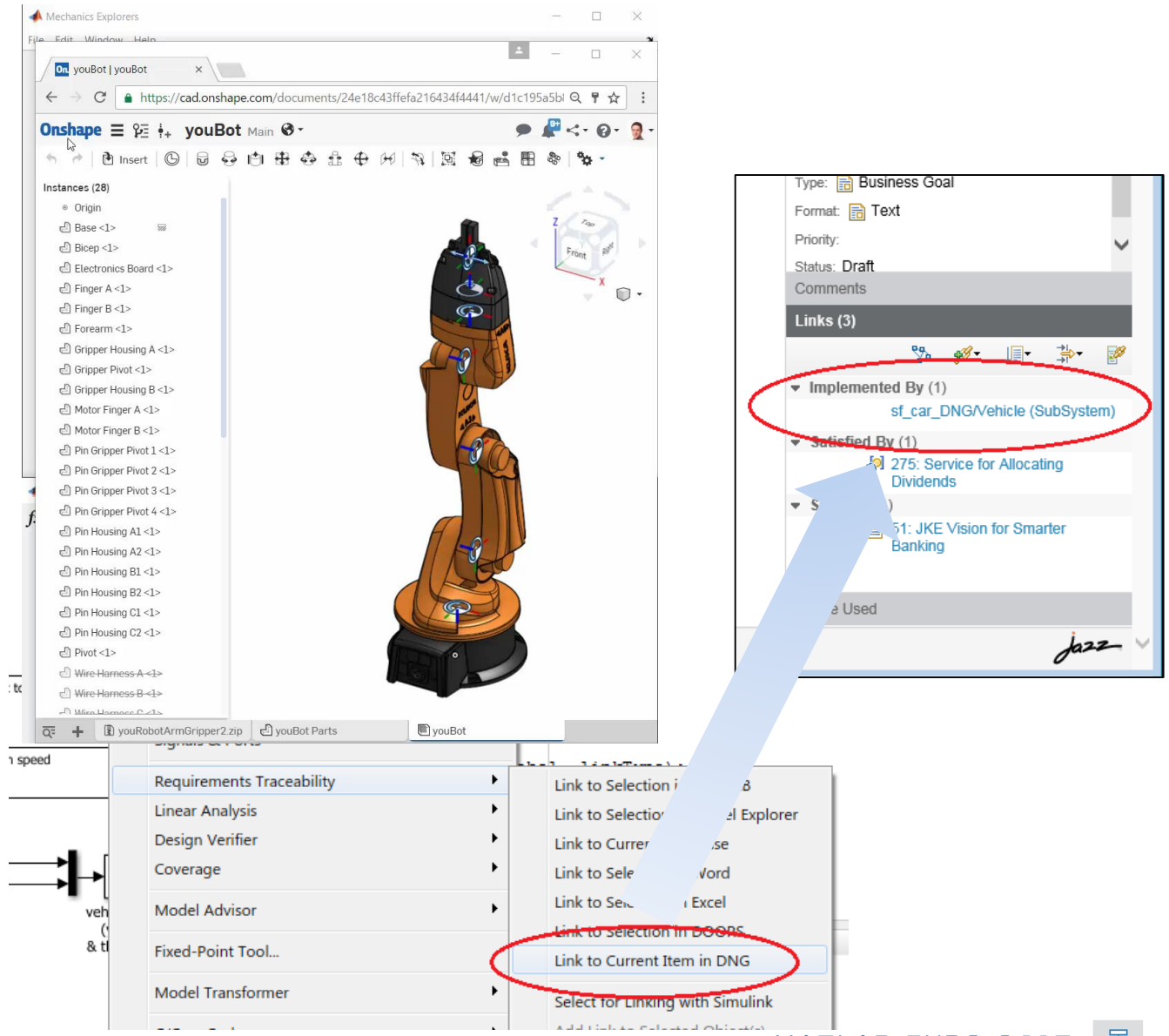


More Connections to 3rd Party Tools

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



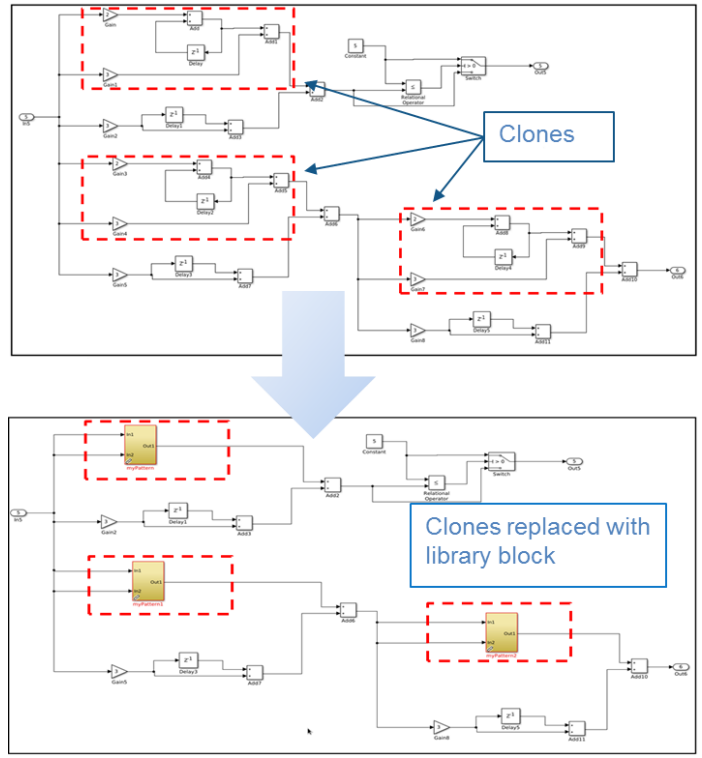
Simscape Multibody
Simulink Verification and Validation

Efficient Code Generation

R2017a

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



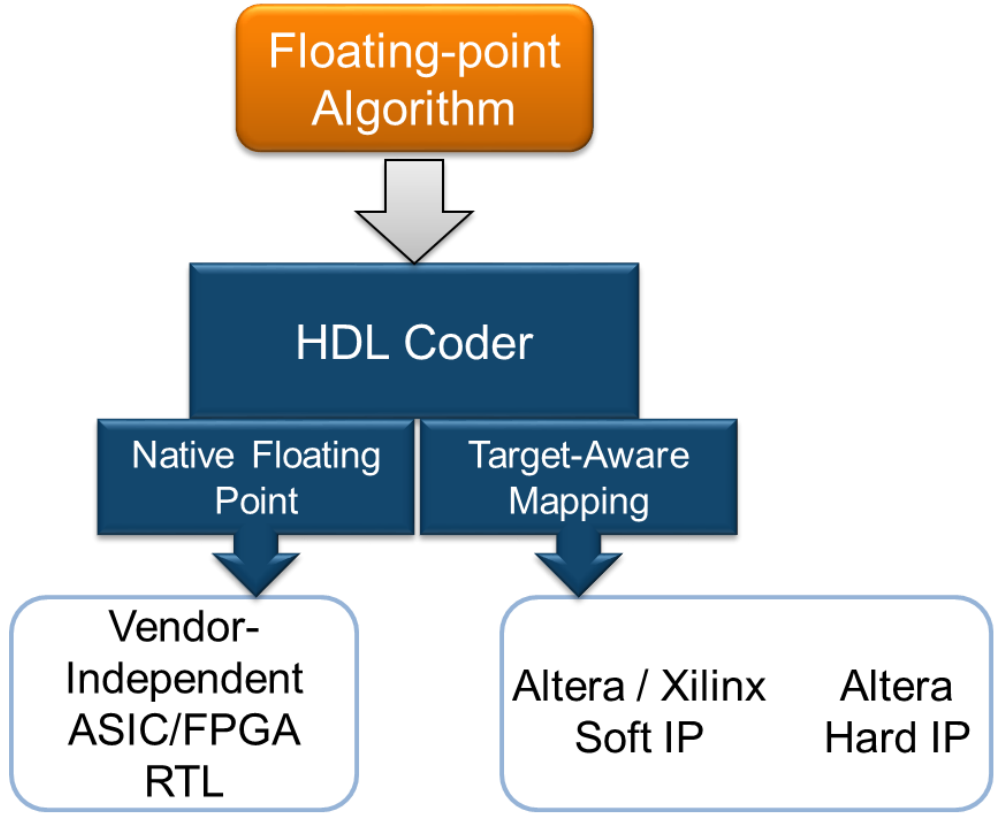

```
118    /* MATLAB Function: '<Root>/MATLAB Function' */
119    /* MATLAB Function 'MATLAB Function': '<S1>:1' */
120    if (!mymdl_DW.p_not_empty) {
121      /* '<S1>:1:4' */
122      /* '<S1>:1:5' */
123      k = mymdl_DW.p->size[0] * mymdl_DW.p->size[1];
124      mymdl_DW.p->size[0] = 1;
125      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    }
```

Floating Point HDL Code Generation

R2016b

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

- Generates native floating-point arithmetic HDL code complying to IEEE-754 standard
- Optimize for speed versus area using custom block-level settings
- Balance numerical accuracy versus hardware resource usage by mixing integer, fixed-point, and floating point operations.

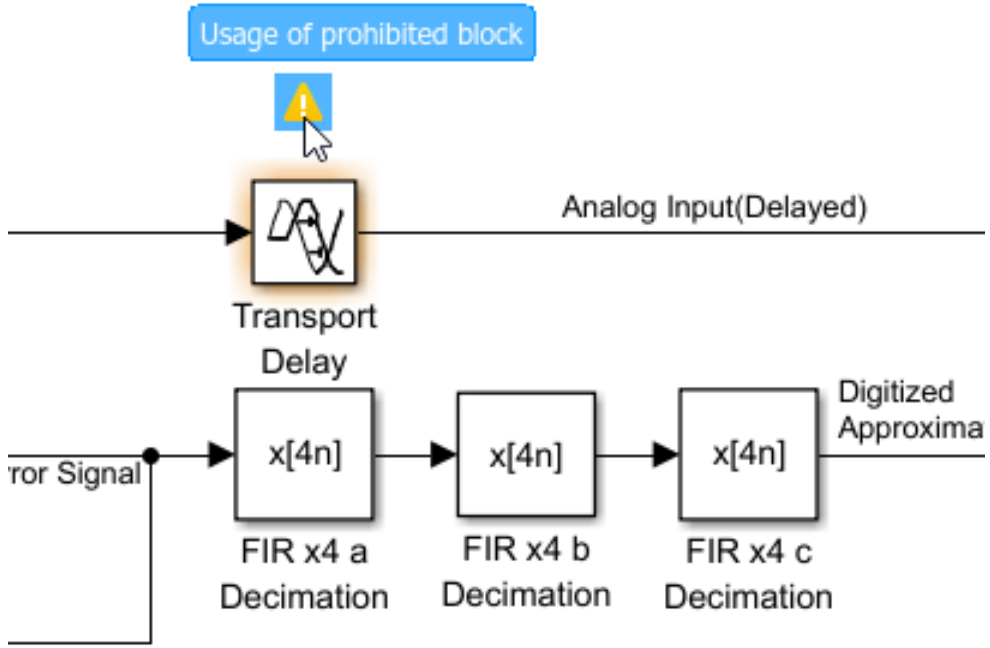


Complying with Safety-Critical Standards

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

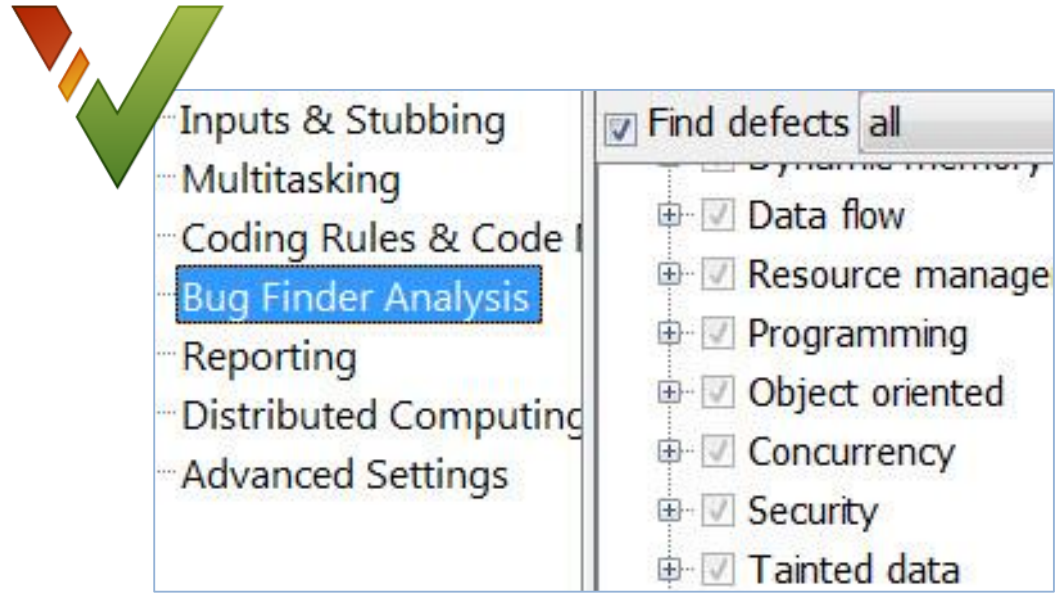


Code Verification

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
```

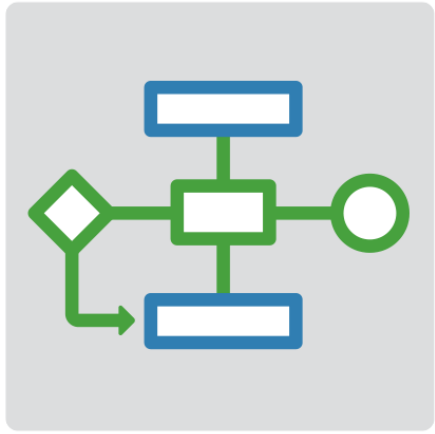
Assignment to element of static array (int 16): [-32 .. 112]
array size: 127
array index value: [0 .. 555]

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

Platform Productivity

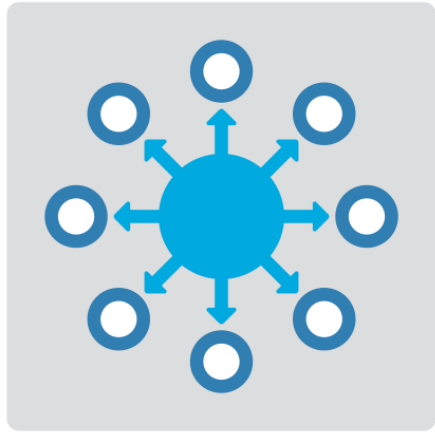
Getting your work done faster

Workflow Depth



Support for your entire workflow

Application Breadth



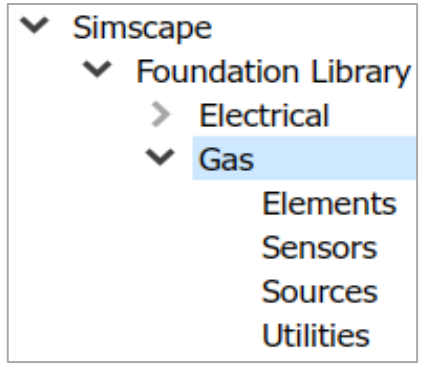
Products for the work you do

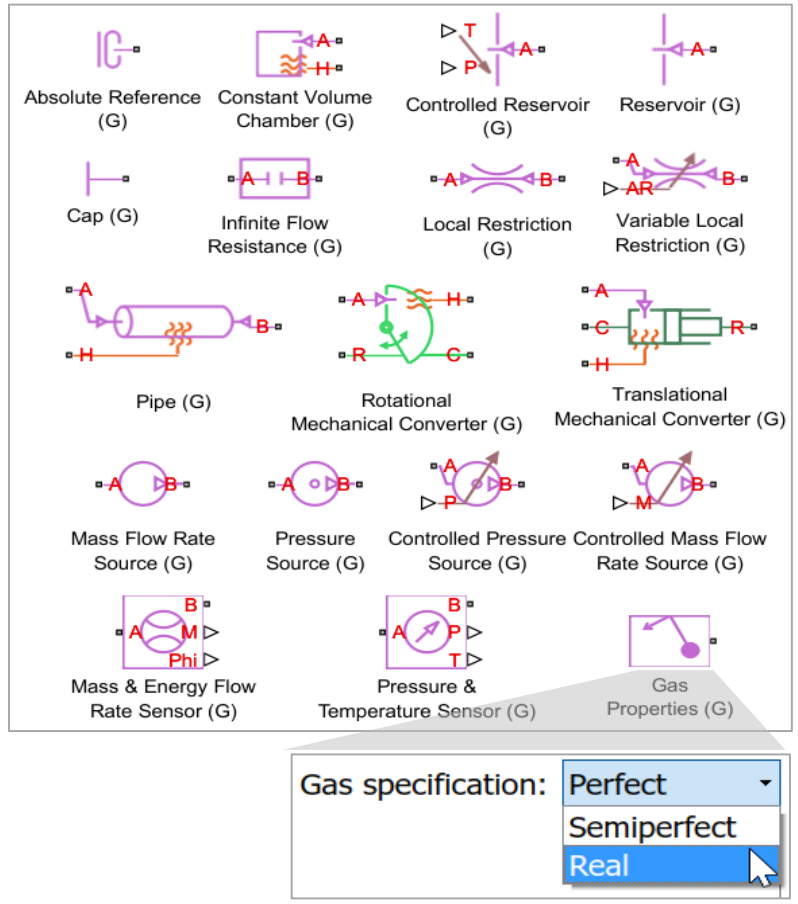
Gas Domain and Block Library

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



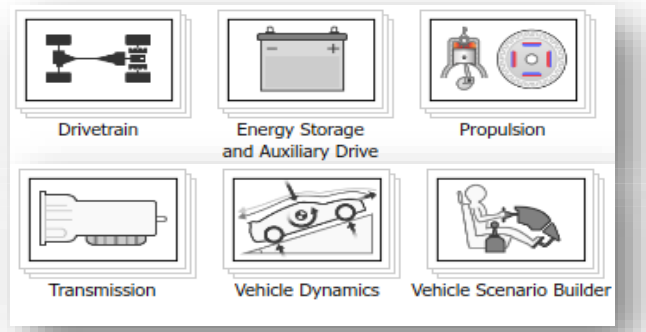


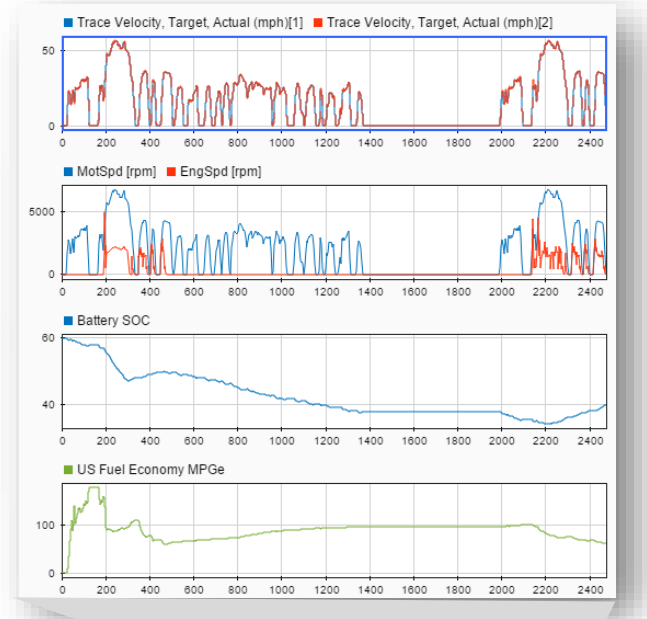
Model and simulate automotive powertrain systems

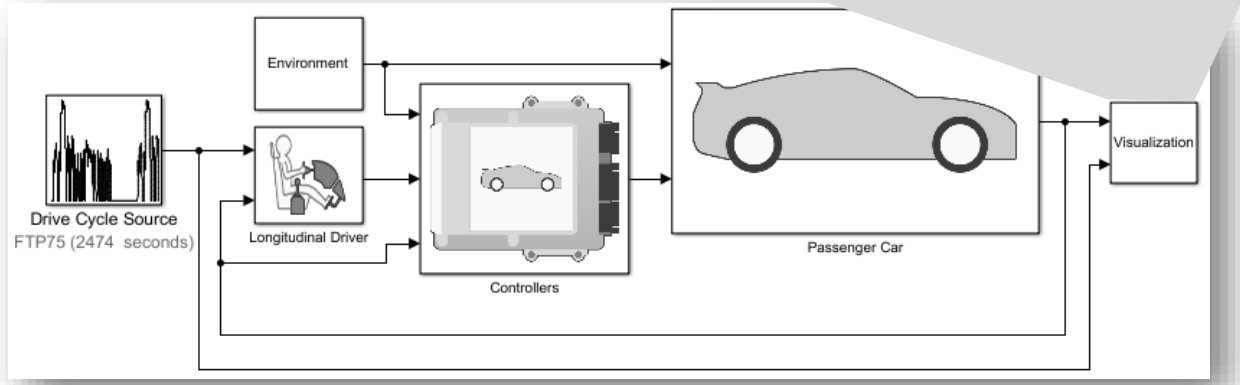
R2017a

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
- Connect to 3rd party engine models for specific components of the system







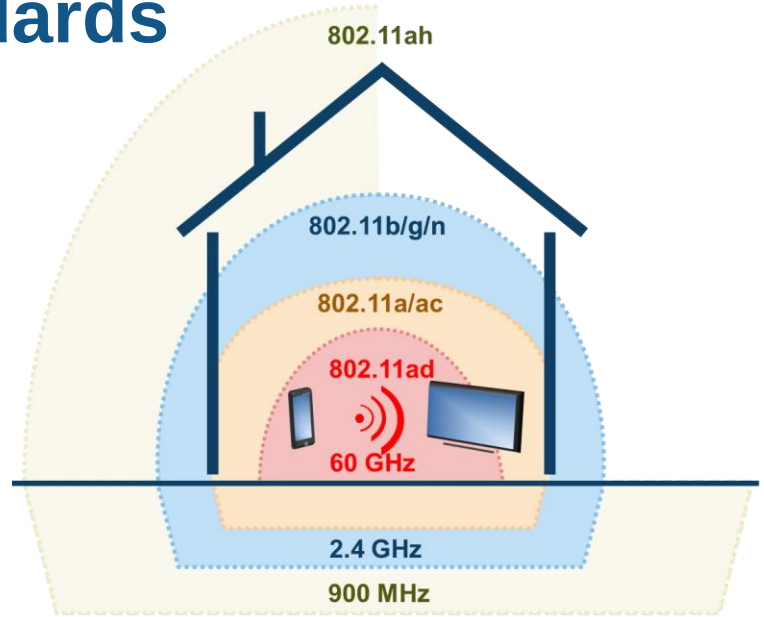
Powertrain Blockset

Support for the Latest Wireless Standards

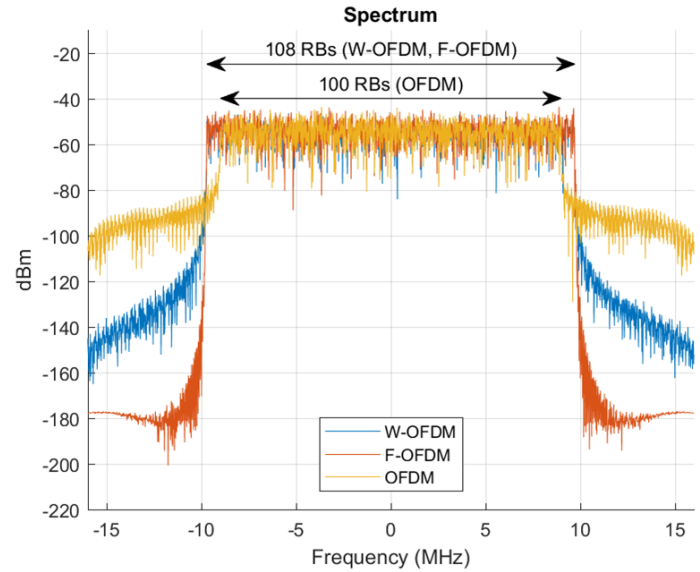
R2017a

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



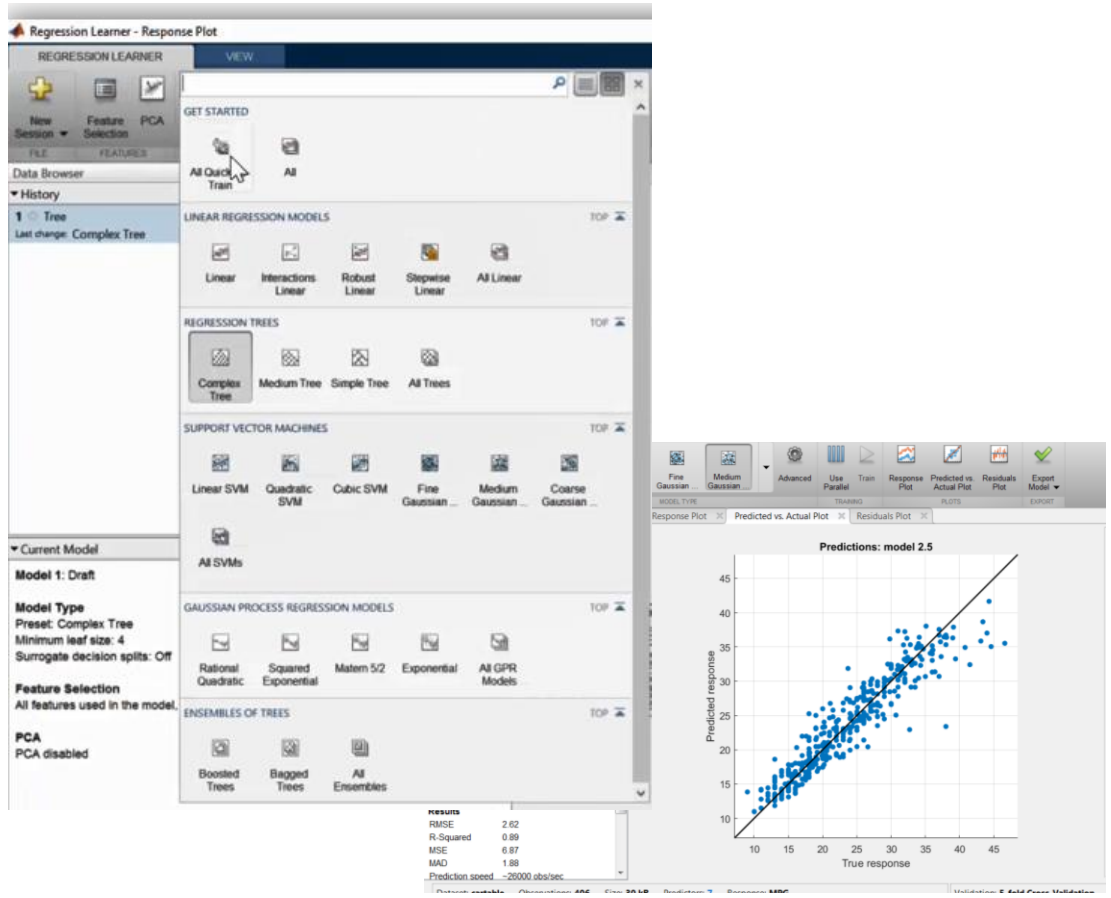
WLAN System Toolbox
LTE System Toolbox

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

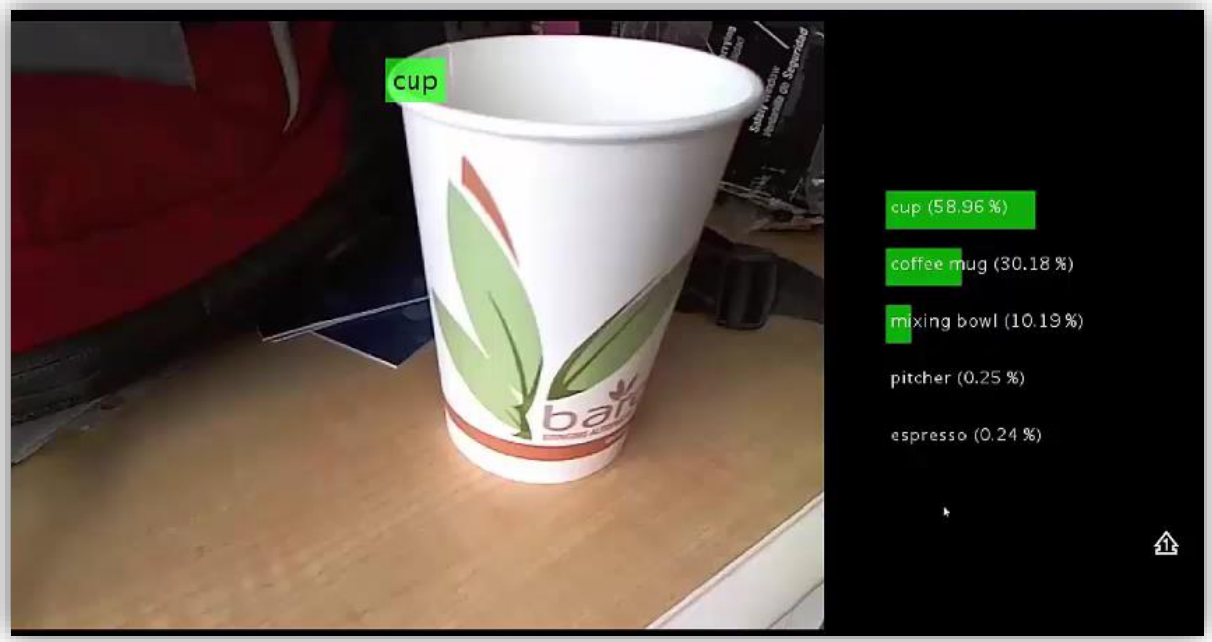


Deep Learning

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)



Neural Network Toolbox
Computer Vision System Toolbox

Autonomous Driving Systems

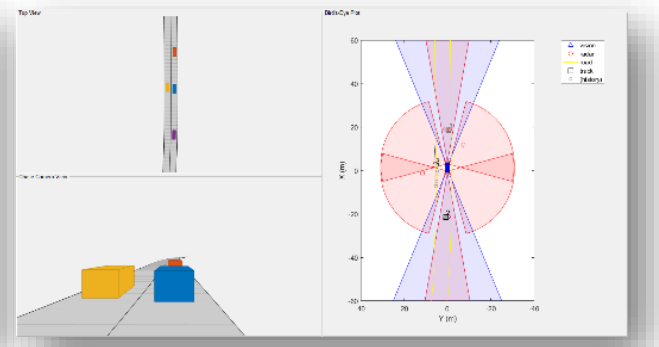
Design, simulate, and test ADAS and autonomous driving systems

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

Sensor Fusion

Computer Vision & Deep Learning

Ground truth labeling



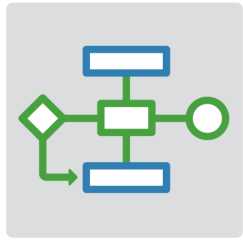
Scenario Generation

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

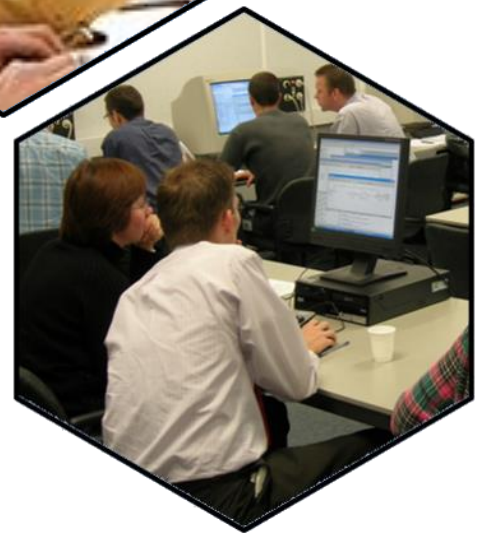
Application Breadth

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

What's new in Training

Public

On-Site



MATLAB®

Data Analytics
Data Processing and Visualization
Statistics
Machine Learning
Optimization Techniques
Parallel Computing

Application Development
Programming Techniques
Building Interactive Applications
Object-Oriented Programming

Code Generation
MATLAB Coder
Interfacing with C-code

Application-Specific
Control System Design
Signal Processing
Communication Systems
LTE Systems

Computational Finance
Risk Management
Time-Series Modelling

Signal Processing
Using MATLAB
Using Simulink

Image and Video Processing
Image Processing
Computer Vision

SIMULINK®

Model-Based Design
Implementing MBD Workflow
Model Management and Architecture
Verification and Validation

STATEFLOW®
Event-Based Modeling

Simscape™
General Simscape™
Simscape Multibody™
Simscape Drivelime™
Simscape Fluids™
Simscape Power Systems™

Code Generation
Rapid Prototyping and HIL-Simulation
Embedded Systems
FPGA Design
Generating HDL Code
Xilinx Zynq SoCs
AUTOSAR

Code Integration
Integrating C and MATLAB

Polyspace©
Polyspace Code Prover™

https://nl.mathworks.com/services/training.html

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Thank You