

MATLAB EXPO 2017

What's New in MATLAB and Simulink

R2017a **R2016b**

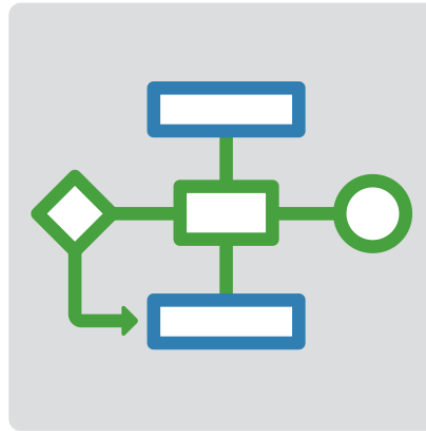
Dr. Marc Segelken

Platform Productivity



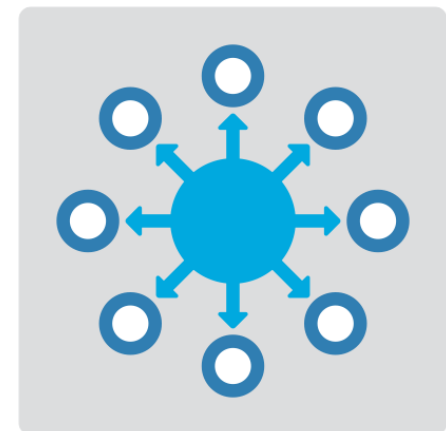
**Getting your work
done faster**

Workflow Depth



**Support for your
entire workflow**

Application Breadth



**Products for the
work you do**

Platform Productivity



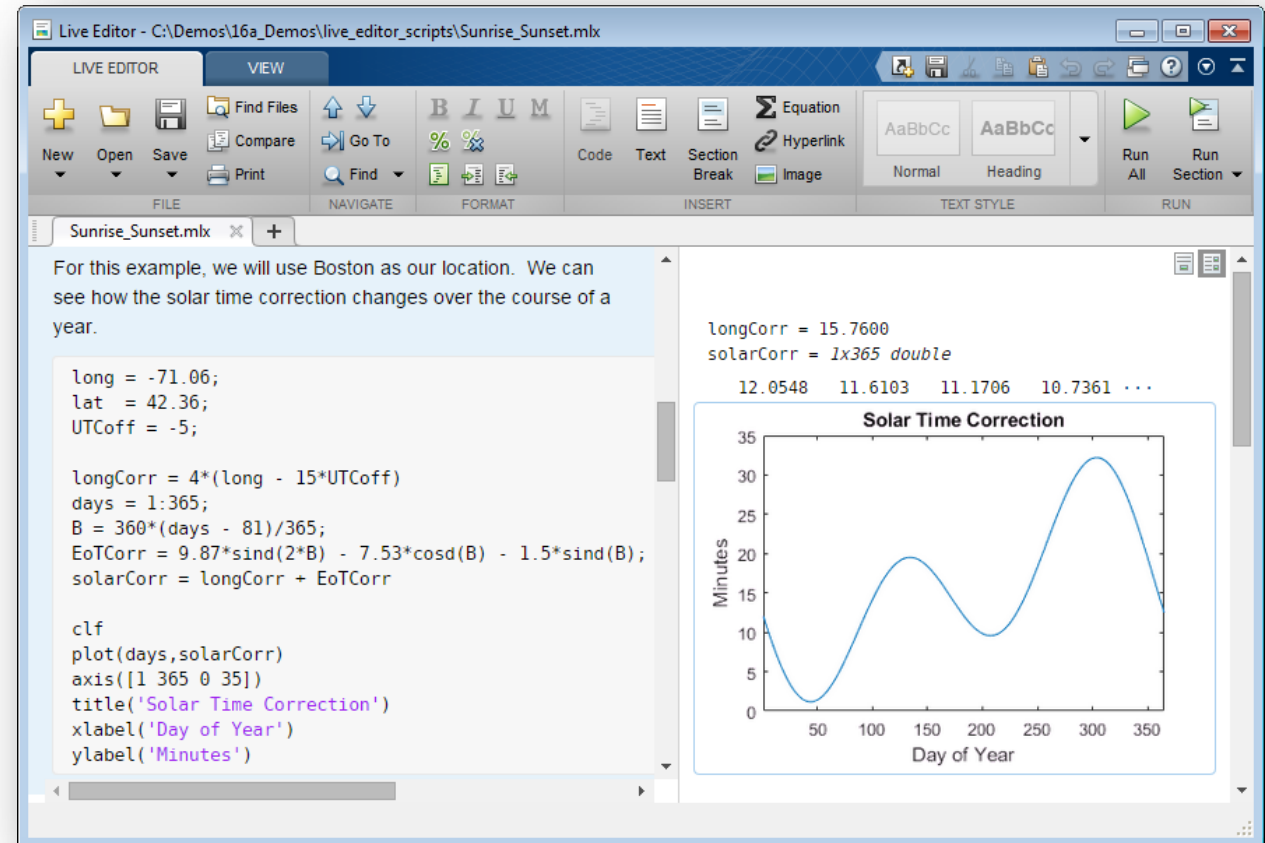
**Getting your work
done faster**

Change the Way You Work in MATLAB

R2016b **R2017a**

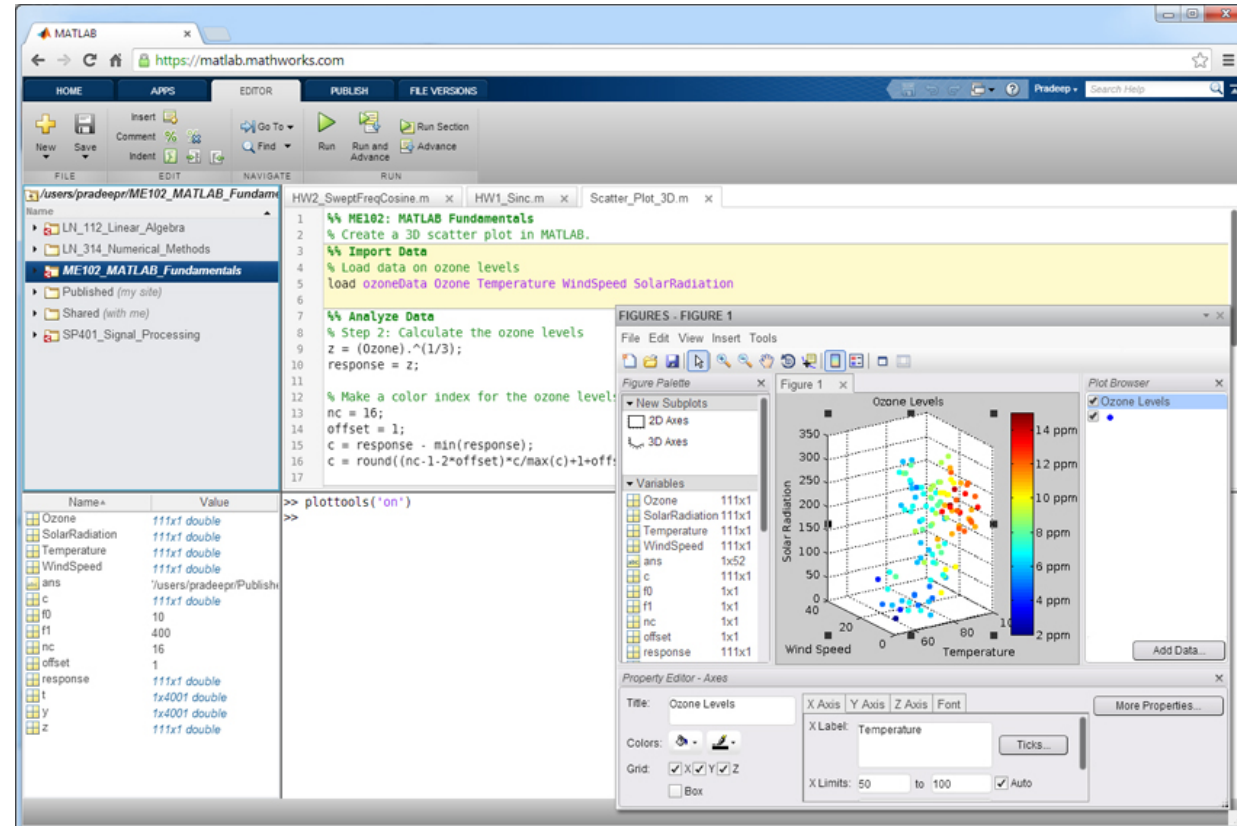
See results together with your MATLAB code in the Live Editor (introduced in R2016a)

- 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



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/>

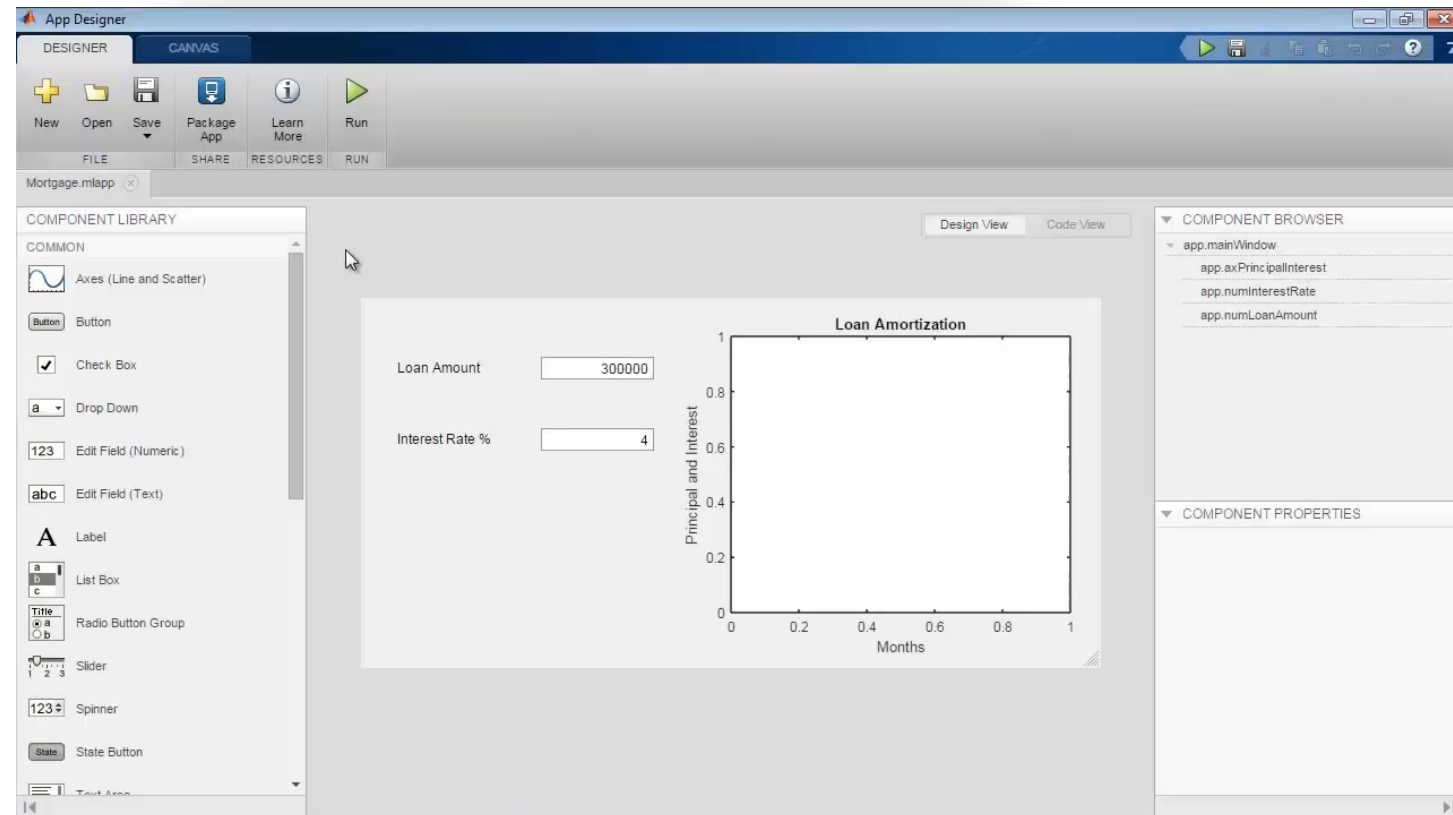


App Designer

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

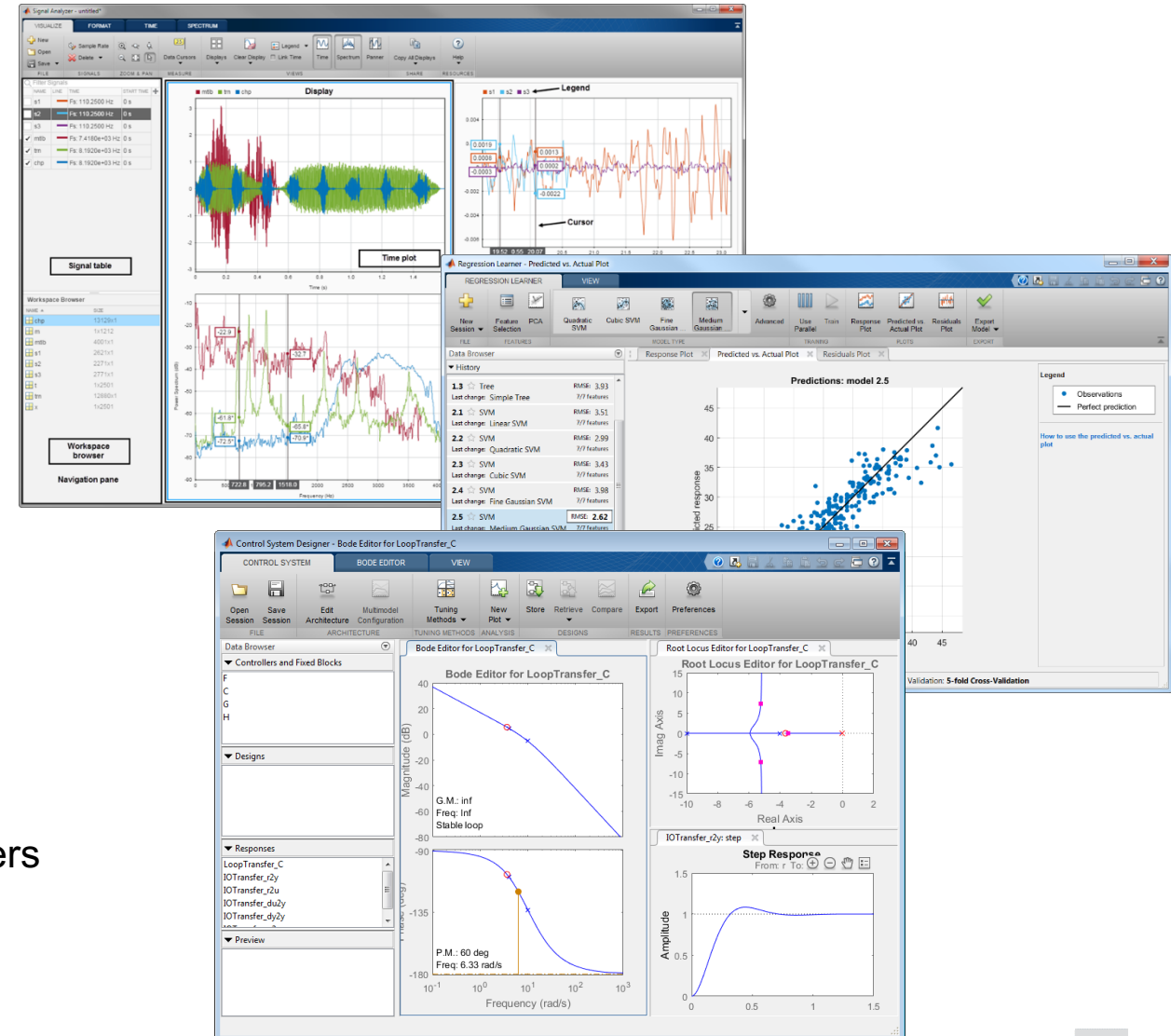


Apps Simplify Modeling and Simulation

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

Time	Day	Total	Westbound	Eastbound
06/24/2015 00:00:00	Wednesday	13	9	4
06/24/2015 01:00:00	Wednesday	3	3	0
06/24/2015 02:00:00	Wednesday	1	1	0
06/24/2015 03:00:00	Wednesday	1	1	0
06/24/2015 04:00:00	Wednesday	1	1	0
06/24/2015 05:00:00	Wednesday	7	3	4

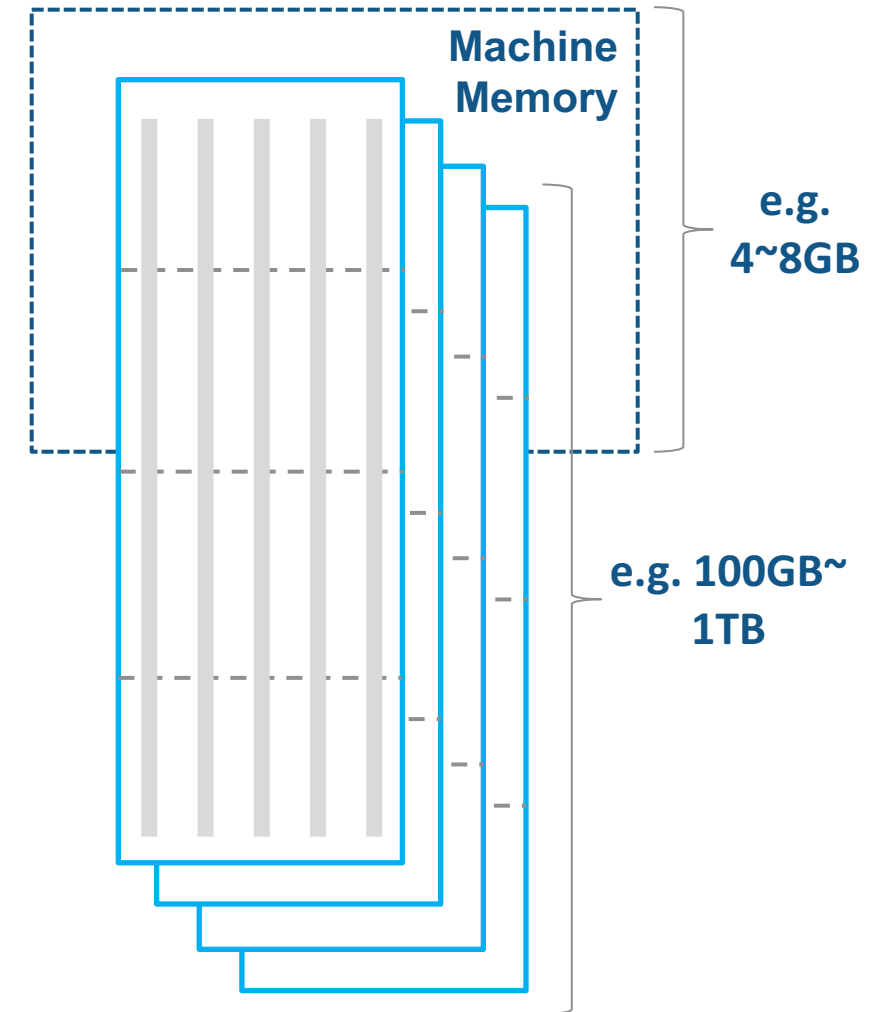
```
Command Window
>> s = [string('Square Circle Triangle'); string('Red Blue Green')]
s =
    2x1 string array
    "Square Circle Triangle"
    "Red Blue Green"
>>
>>
>> replace(s, 'Square', 'Rectangle')
ans =
    2x1 string array
    "Rectangle Circle Triangle"
    "Red Blue Green"
fx >>
```

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



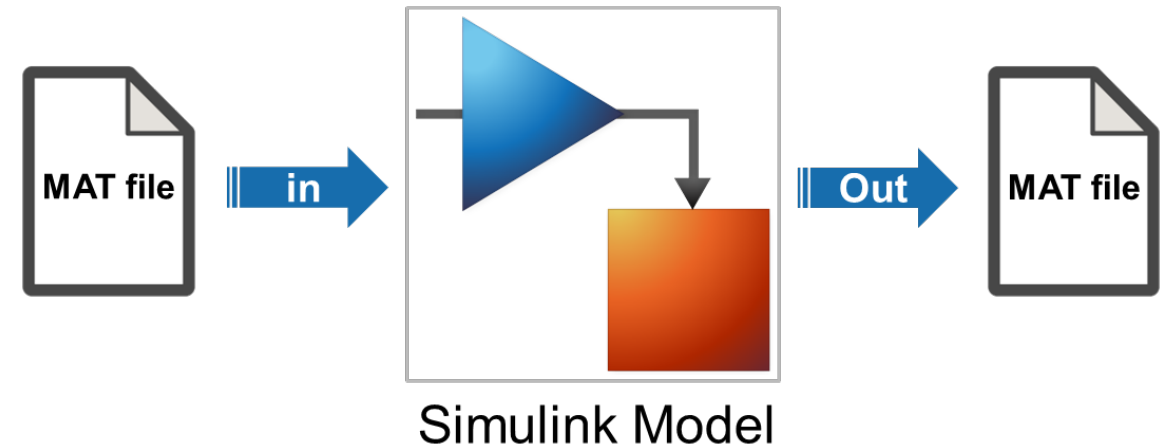
Learn more at this session:
Big Data and Machine Learning

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

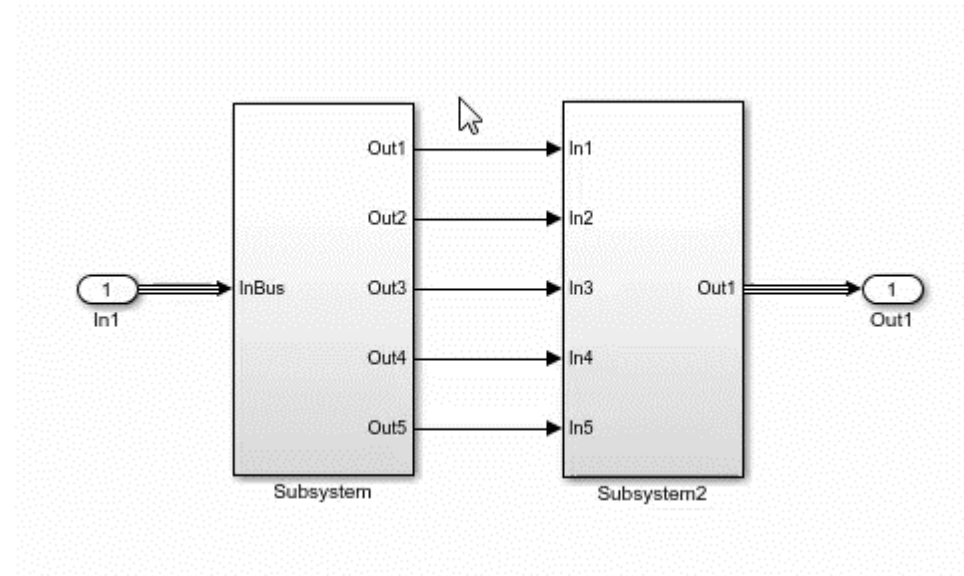
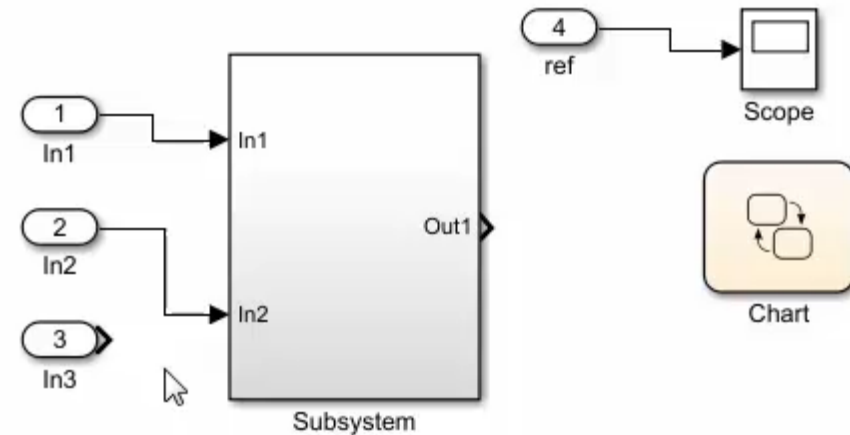


Learn more at this session:
*Simulink as Your Enterprise
Simulation Platform*

Create Your Models Faster

Use automatic port creation and reduced bus wiring

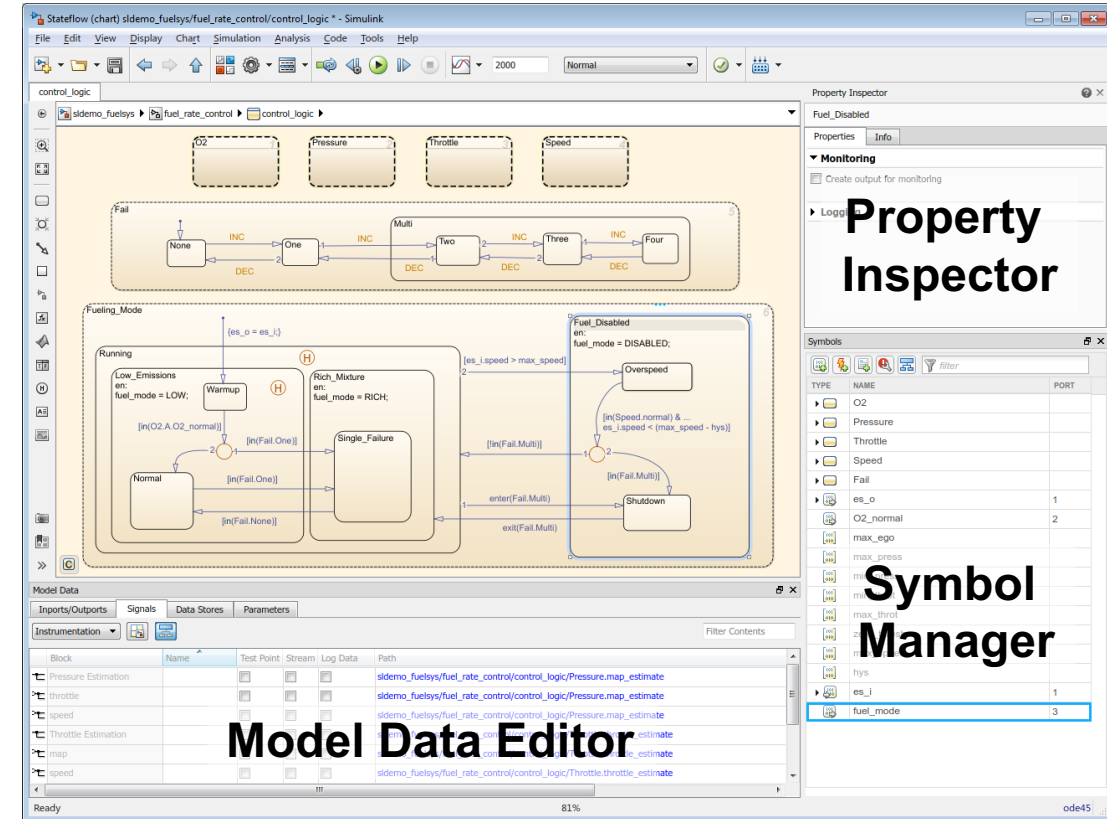
- Add inports and outports to blocks when routing signals
- Quickly group signals as buses and automatically create bus element ports for fewer signal lines



Define your Data Faster

Reduces the need to open separate dialog boxes

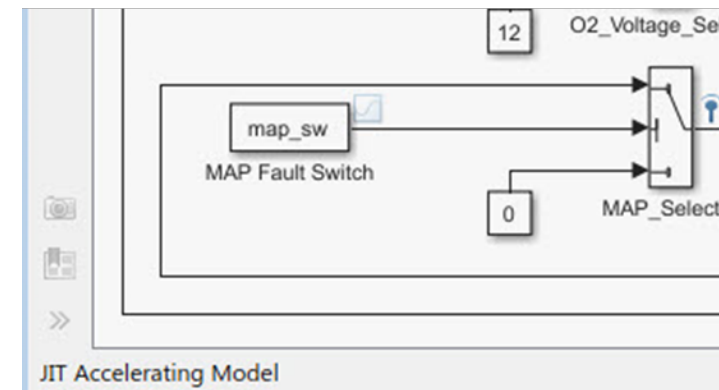
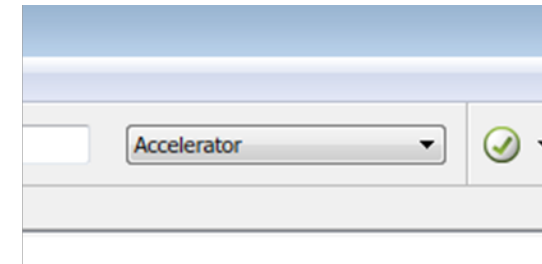
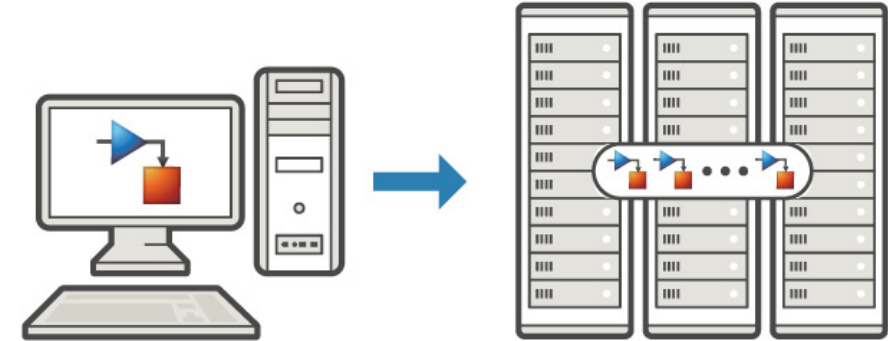
- Model and block parameter data is now accessible within the main editor window
- Accessing and defining Stateflow data is also much easier



Simulate your Model Faster

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

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

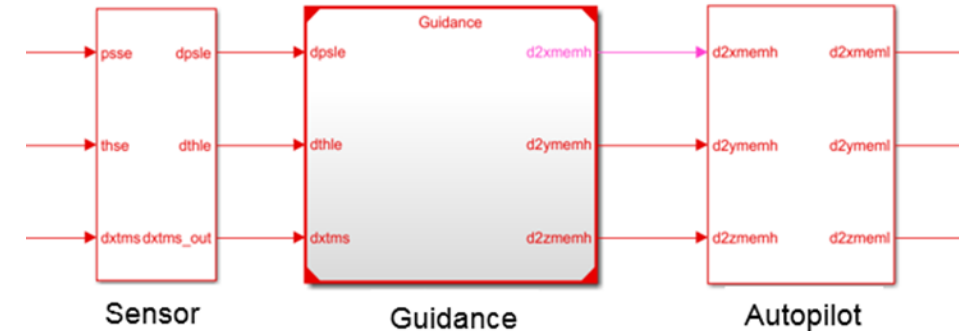


Cross-Release Code Integration

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

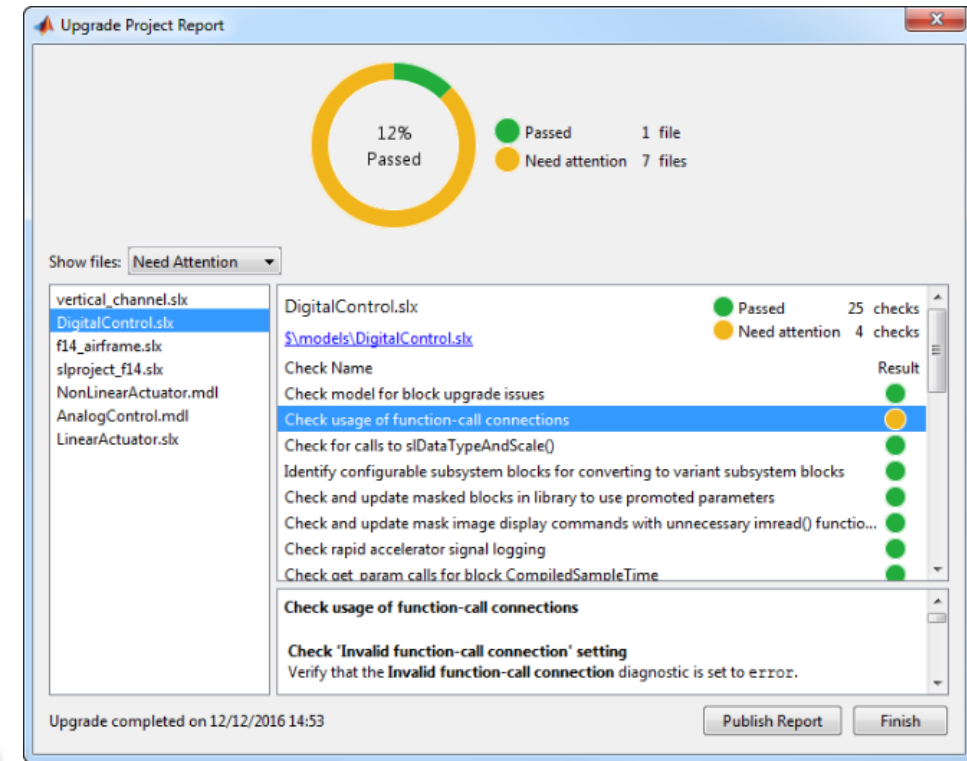
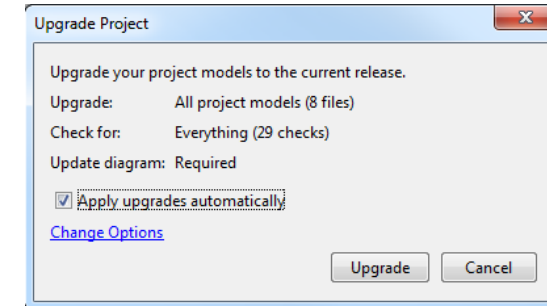
```
void AutonomousSystem_step(void)
{
    Sensor_SFcn( ... )    /* R2015b */
    Guidance( ... )       /* R2016b */
    Autopilot_SFcn( ... ) /* R2013a */
}
```



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



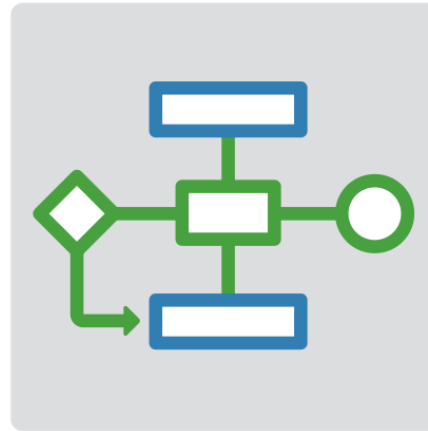
Learn more at this session:
*Simulink as Your Enterprise
Simulation Platform*

Platform Productivity



**Getting your work
done faster**

Workflow Depth



**Support for your
entire workflow**

Integrate MATLAB Analytics into Enterprise Applications

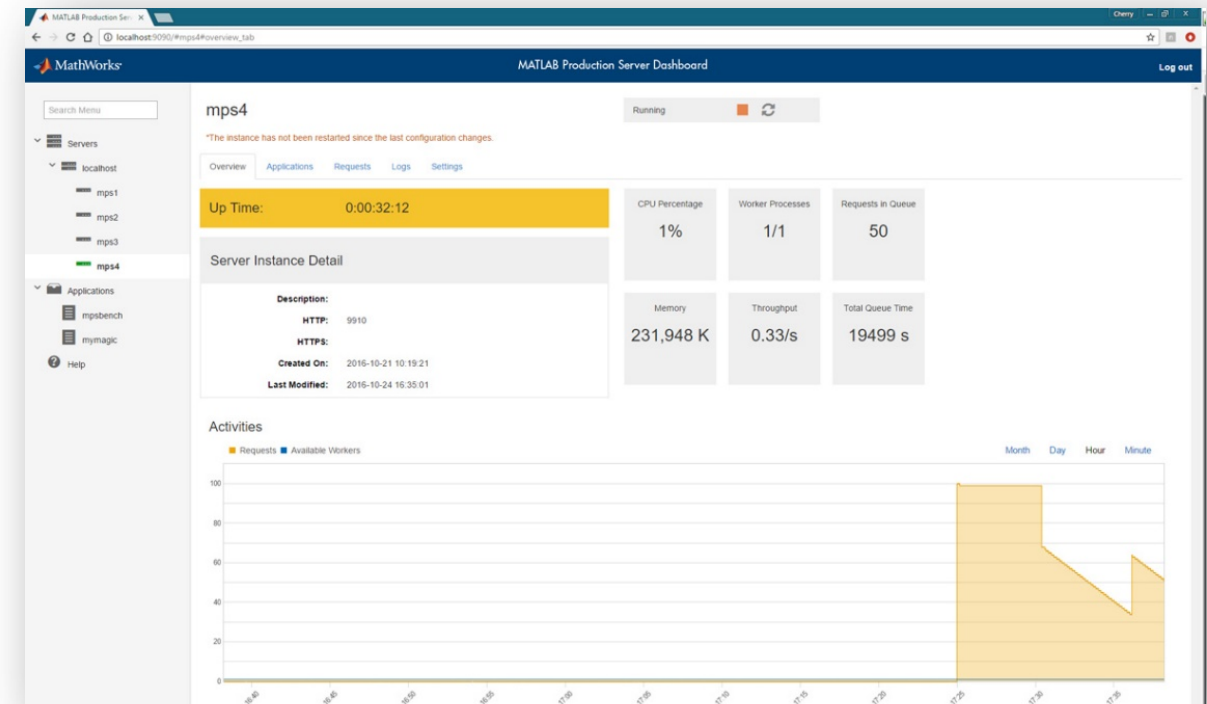
Deploy MATLAB algorithms without recoding or creating custom infrastructure

- 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



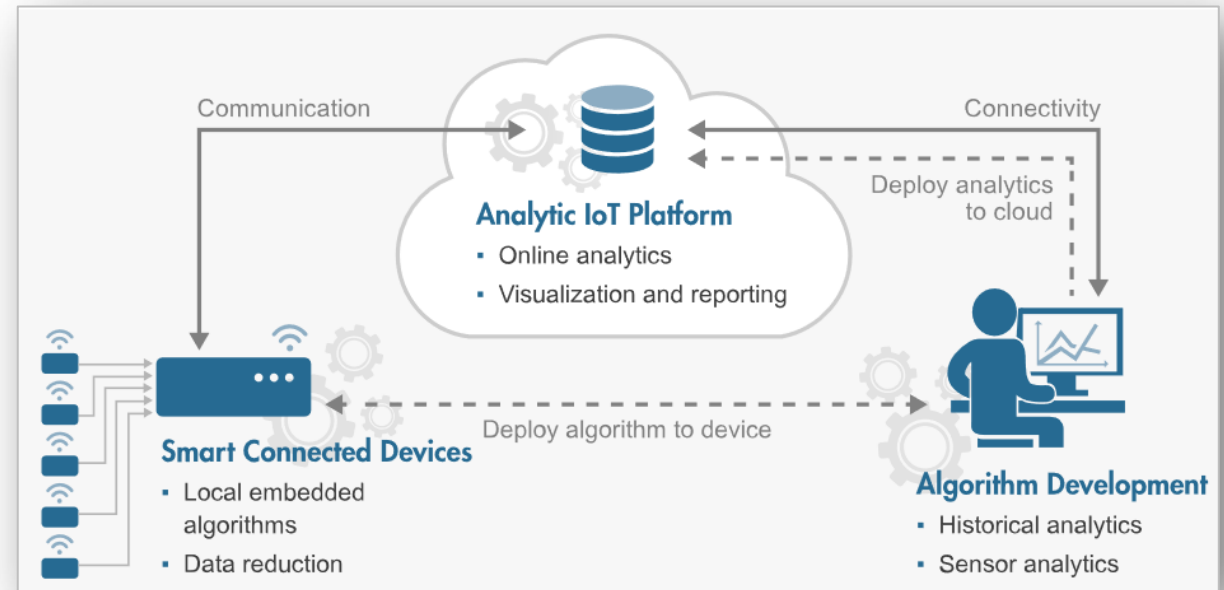
Learn more at this session:

Integrate MATLAB analytics into enterprise applications

Connecting MATLAB Analytics to IoT Systems

Develop analytics and deploy IoT systems

- Quickly collect and analyze IoT data with ThingSpeak and MATLAB
- Develop analytics algorithms using MATLAB and toolboxes
- Deploy on smart devices using code generation and embedded target support
- Deploy at scale on cloud using ThingSpeak and MATLAB Production Server

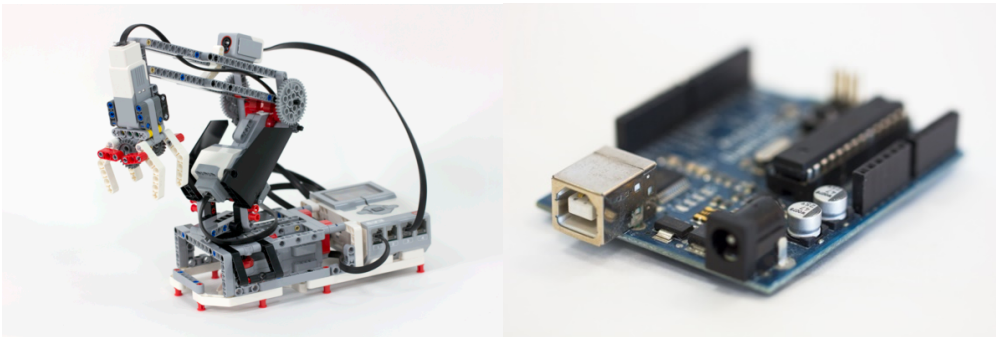
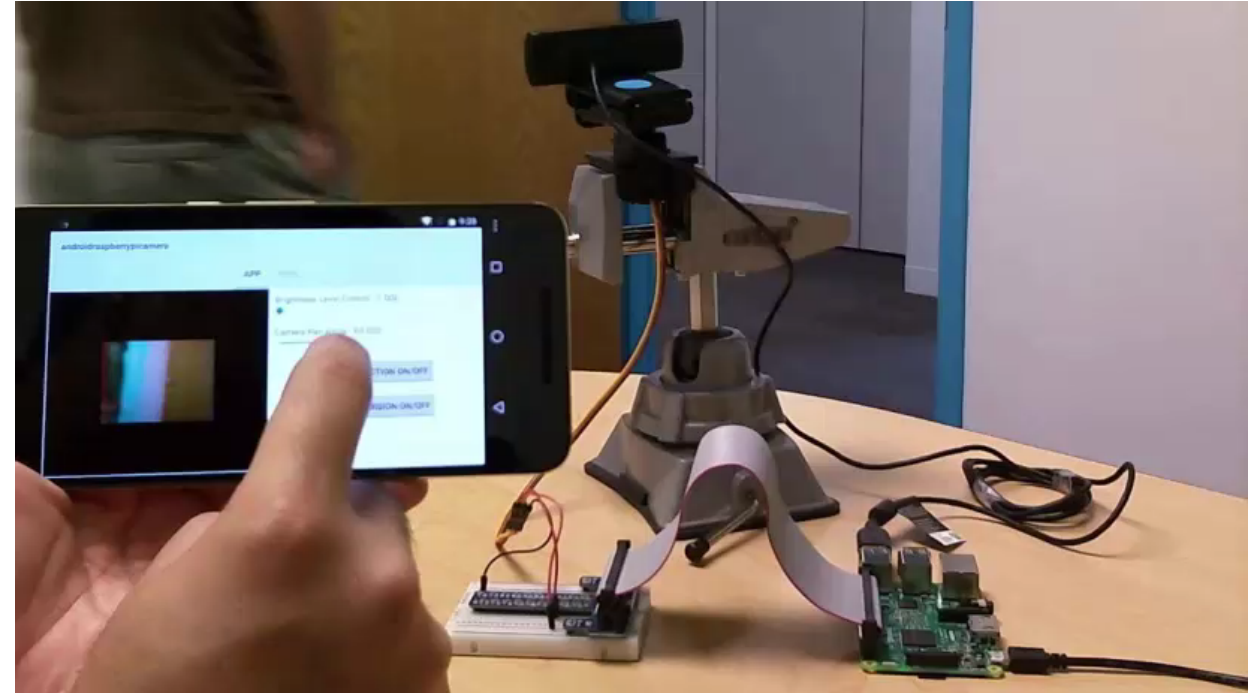


Learn more at this session:
*Developing Analytics and
Deploying IoT Systems*

New Hardware Support

Run Simulink models on low-cost hardware devices

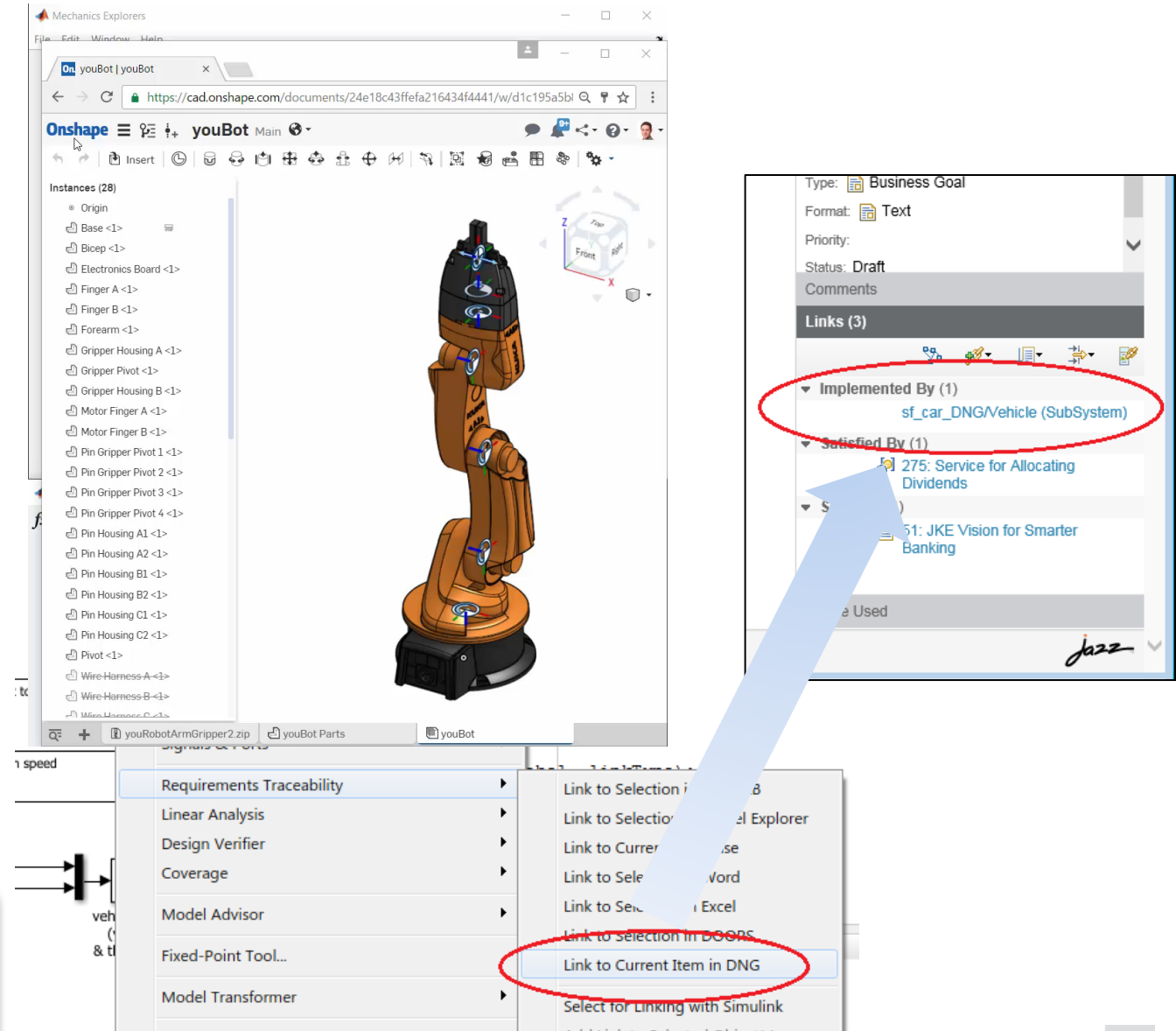
- Run Simulink models on Raspberry Pi 3 and Google Nexus devices
- Adds to existing hardware support, including LEGO, Arduino, iPhone, and Android devices



More Connections to 3rd Party Tools

Connect your models to Onshape and DOORS Next Generation

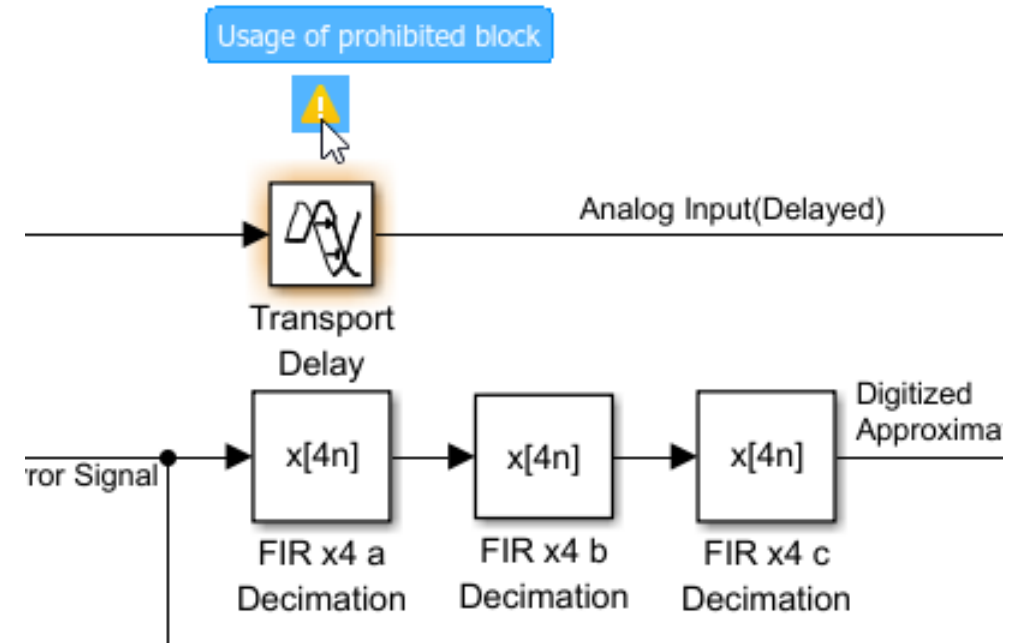
- Convert an Onshape CAD assembly into a Simscape Multibody model
- Link and trace model elements to requirements in DOORS Next Generation



Complying with Safety-Critical Standards

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

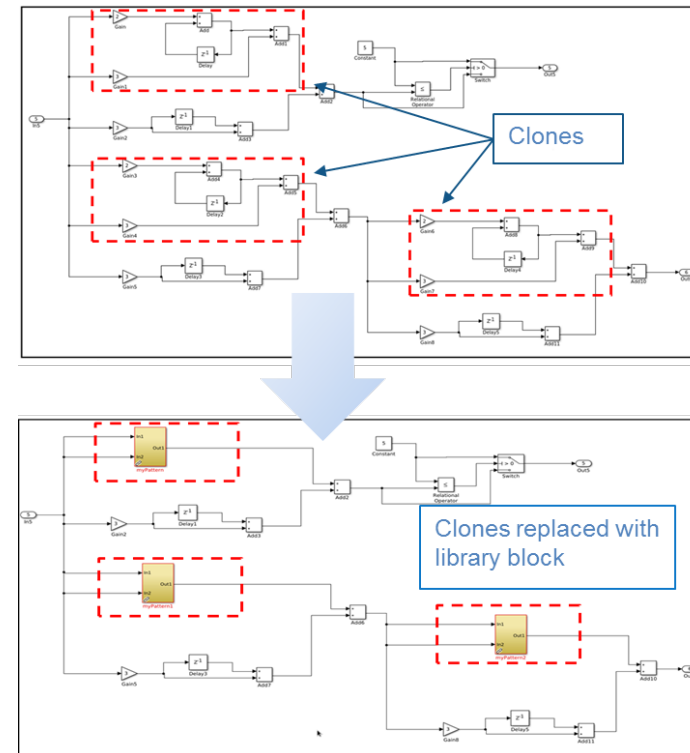


Learn more at this session:
*Verification, Validation and
Test in Model Based Design*

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  }

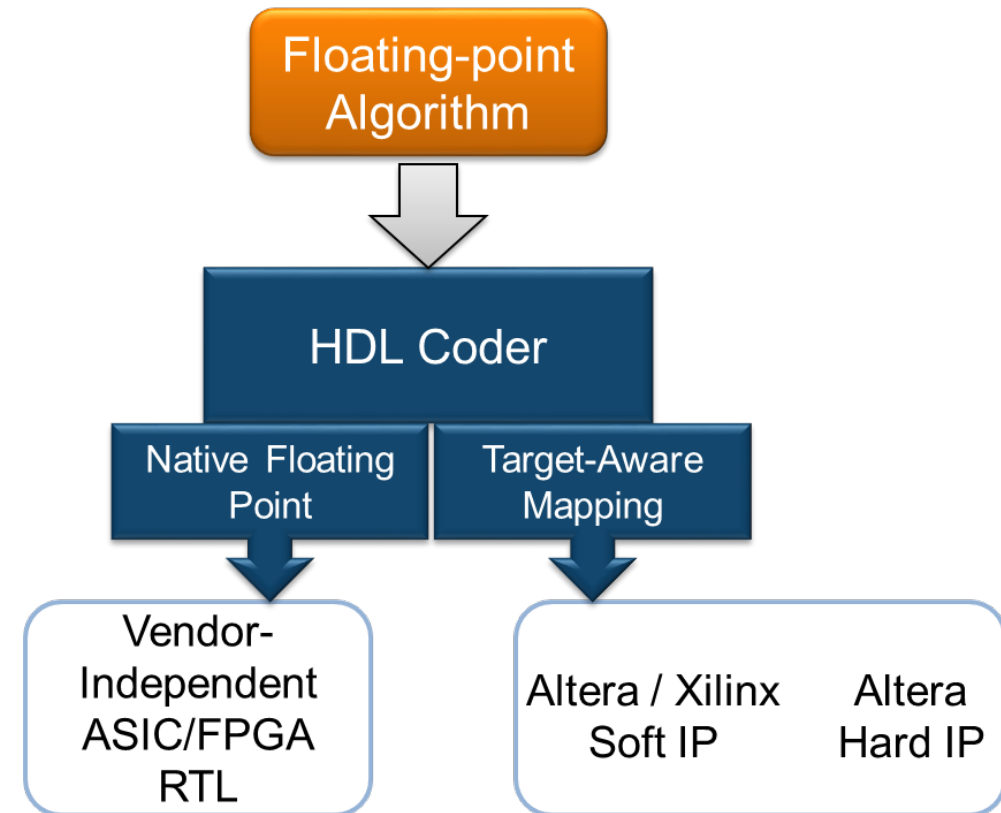
```

Learn more at this session:
*Generating Optimized Code for Embedded
 Microcontroller Algorithms*

Floating Point HDL Code Generation

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.

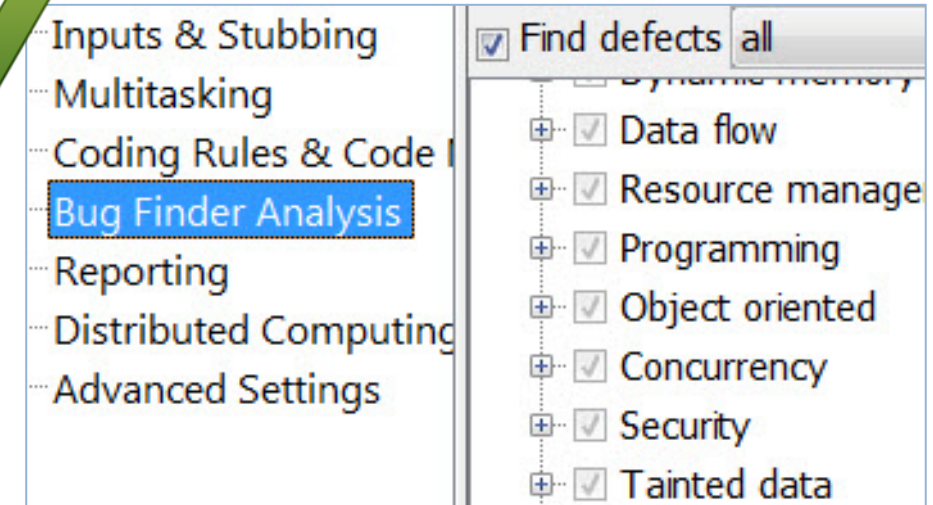


Learn more at this session:
*Designing and Implementing Real-Time
Signal Processing Systems*

Code Verification

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]

Learn more at this session:

Prove the Quality and Achieve MISRA compliance with Formal Methods Based Technique for High Integrity applications

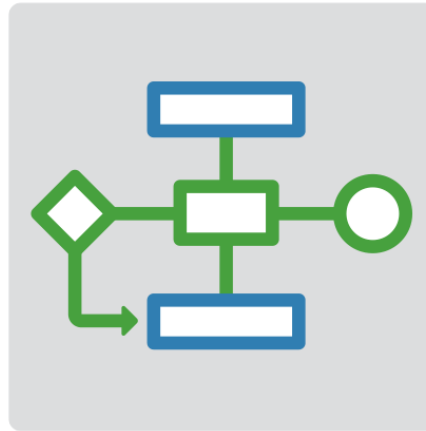
CERT C	Description	Polyspace Code Prover
ARR30-C	Do not form or use out-of-bounds pointers or array subscripts	Array access out of bounds

Platform Productivity



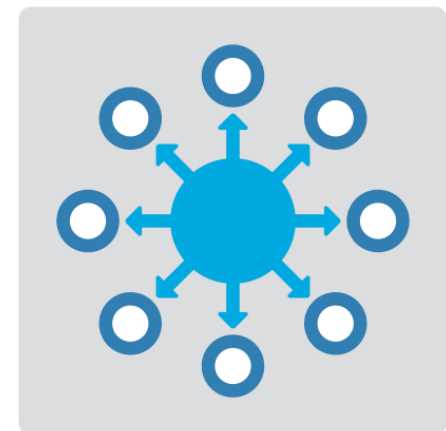
**Getting your work
done faster**

Workflow Depth



**Support for your
entire workflow**

Application Breadth



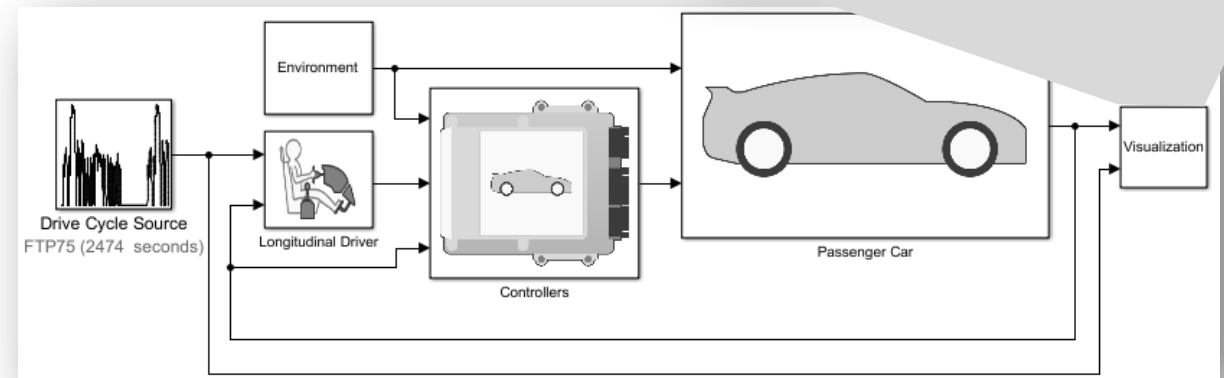
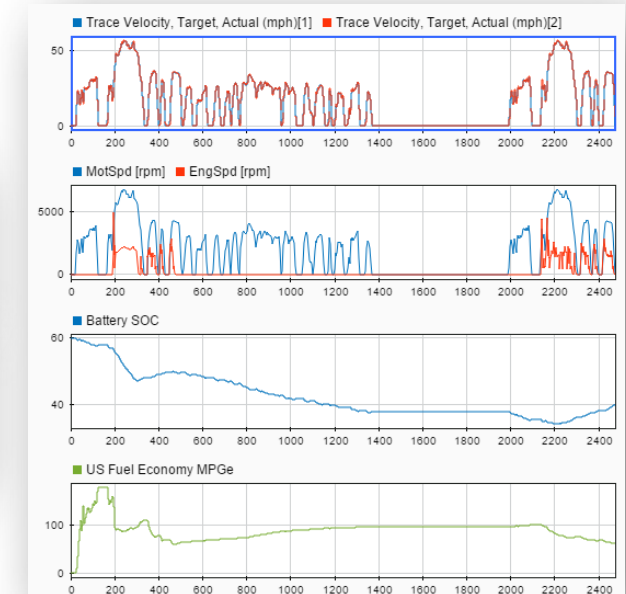
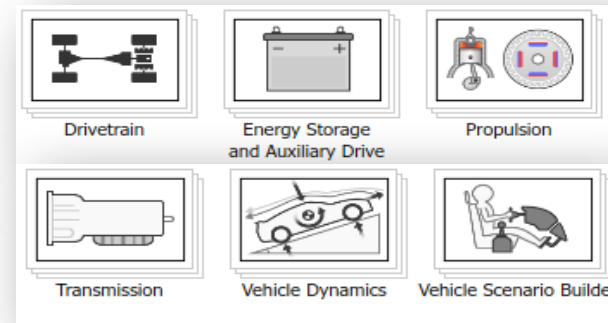
**Products for the
work you do**

Model and simulate automotive powertrain systems

R2017a

Accelerate your powertrain controls development process

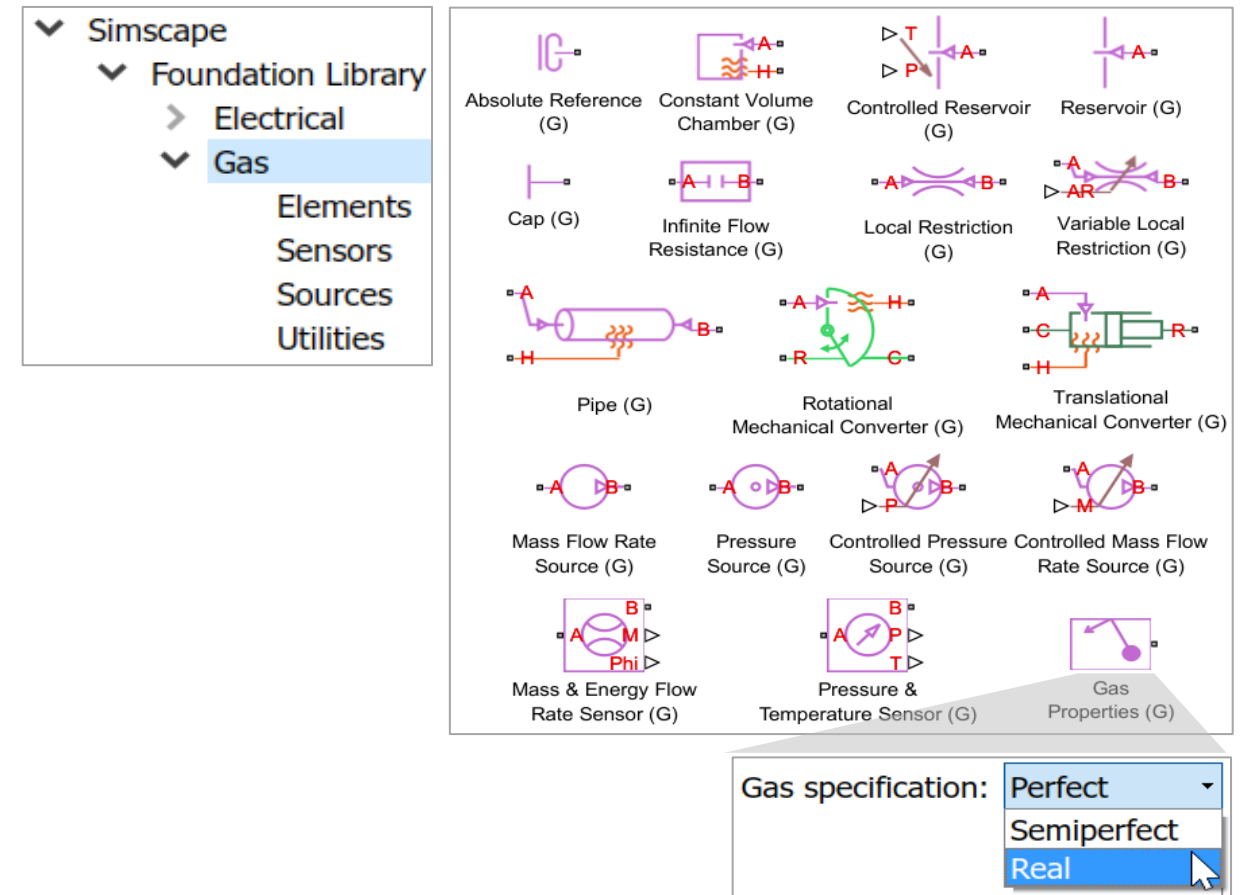
- Simulate engine and controller subsystems, transmission assemblies, battery packs
- Use pre-built conventional, EV, and HEV vehicle models that can be parameterized and customized
- Run fuel economy and performance simulations
- Deploy fast-running models onto HIL systems
- Connect to 3rd party engine models for specific components of the system



Gas Domain and Block Library

Model gas systems with various levels of idealization

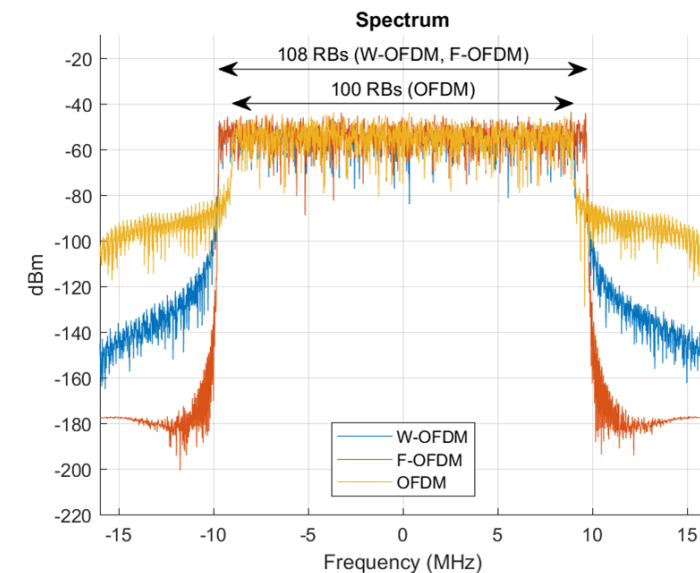
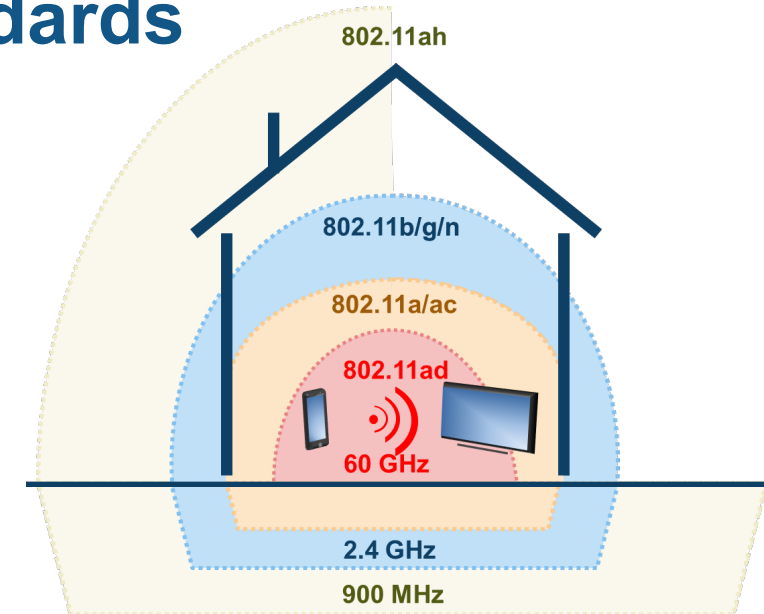
- Pneumatic actuation
- Gas transport in pipe networks
- Gas turbines for power generation
- Air cooling of thermal components
- Perfect gas, semiperfect gas, or real gas



Support for the Latest Wireless Standards

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

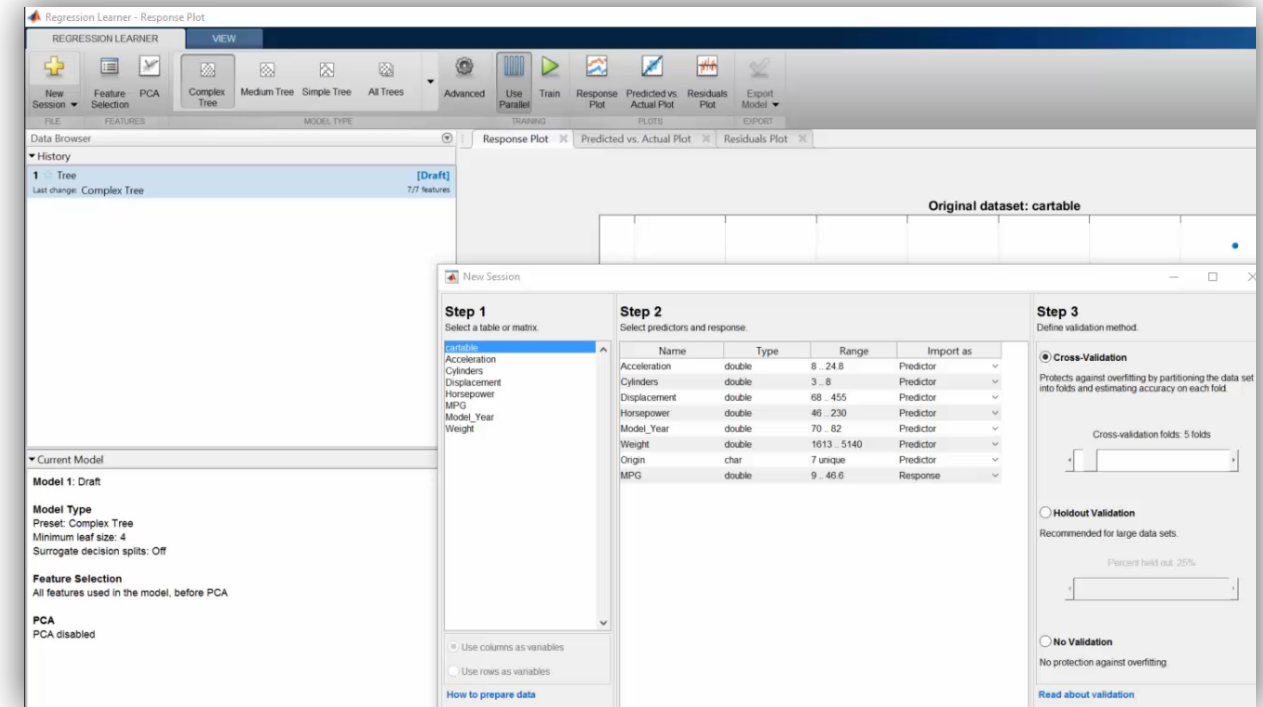
- IEEE 802.11ad is a new Wi-Fi standard intended for high data rate short range communication
 - e.g., streaming video between a phone and a TV
- A new 5G library is available to explore the behavior and performance of new proposed 5G radio technologies



Machine Learning

“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



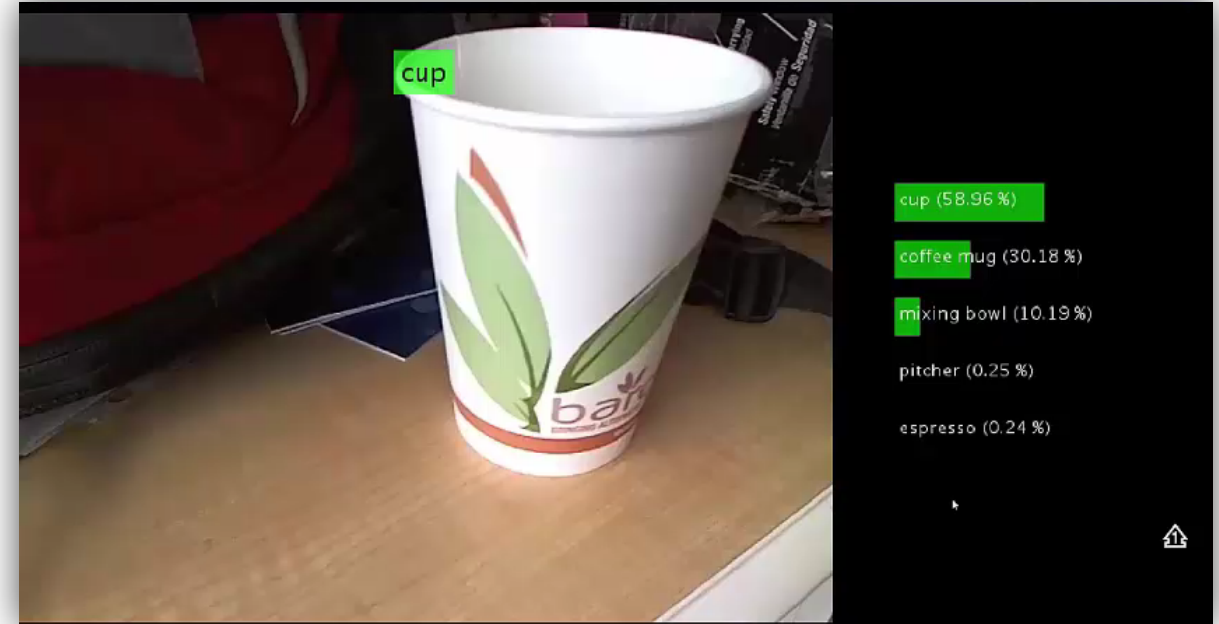
Learn more at this session:
Big Data and Machine Learning

Deep Learning

R2016b R2017a

Apply deep learning to computer vision problems

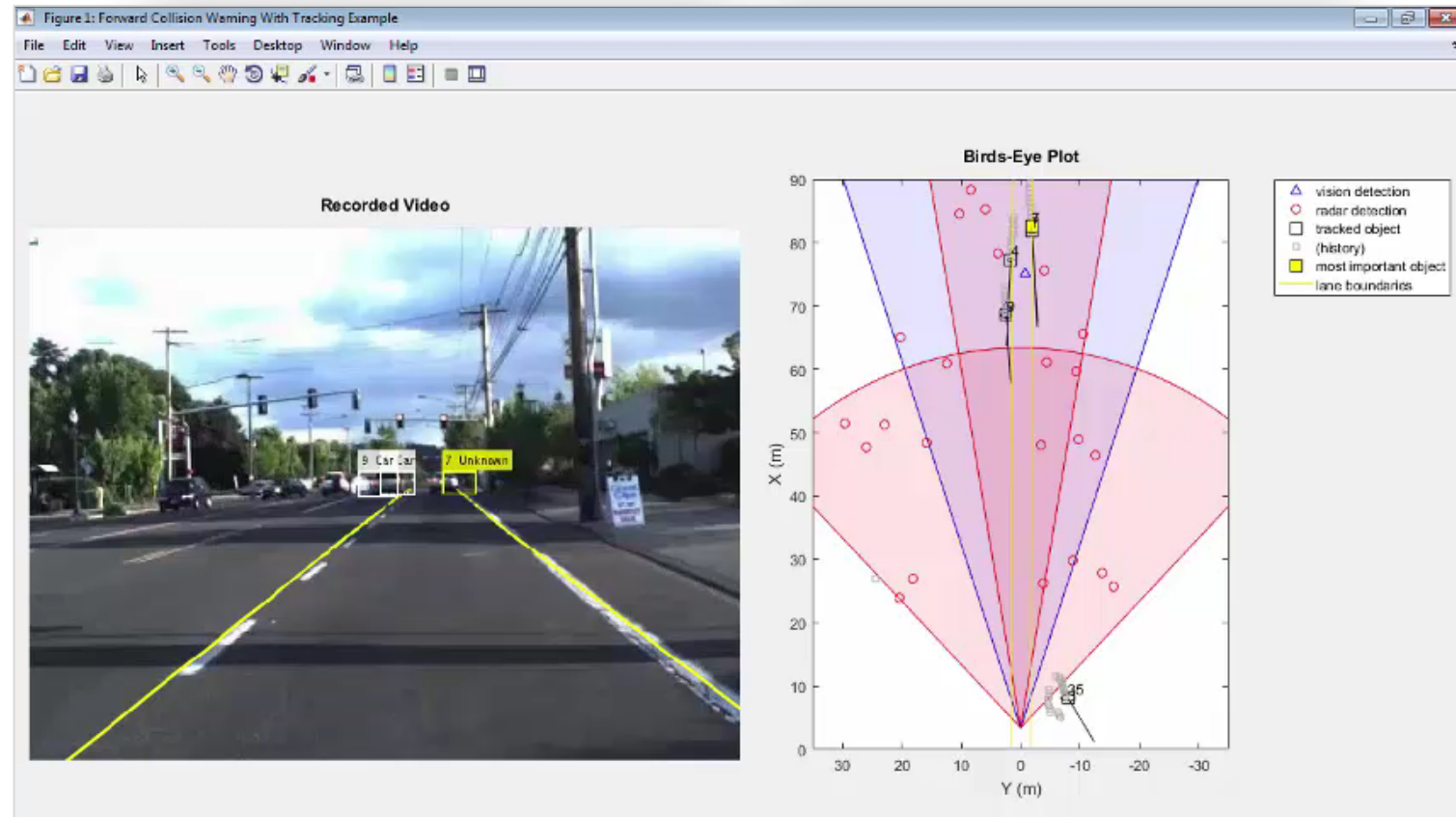
- Configure and train models using object detection algorithms (*R-CNN, Fast R-CNN, Faster R-CNN*)
- Leverage pretrained models for transfer learning (*AlexNet, VGG-16, VGG-19*)
- Import models from Caffe
- Train networks using multiple GPUs (*including on Amazon EC2*)



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



Learn more at this session:

Developing and Validating Perception Systems for ADAS & Automated Driving

Explore. Enroll. Excel.

New Training Courses

Code Generation for AUTOSAR Software Components

Testing Generated Code in Simulink

Accelerating and Parallelizing MATLAB Code

Communications System Design with MATLAB

SimEvents for Discrete-Event System Modeling

Software-Defined Radio with Zync using Simulink

New Training Modules

Object Oriented Design with MATLAB

Modeling RF Systems using MathWorks Tools

Modeling Radar Systems using Phased Array Systems Toolbox

Modeling Wireless Communication Systems using Phased Array Systems Toolbox

Real-Time Testing with Simulink Real-Time and Speedgoat Hardware

Self-Paced Online Training Offerings

MATLAB Onramp (Free)

MATLAB Fundamentals

MATLAB Programming Techniques

MATLAB for Data Processing and Visualization

Machine Learning with MATLAB

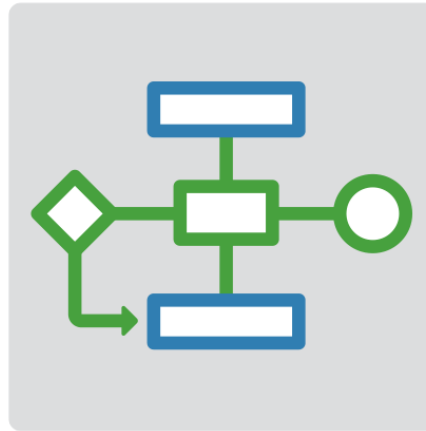
MATLAB for Financial Applications

Platform Productivity



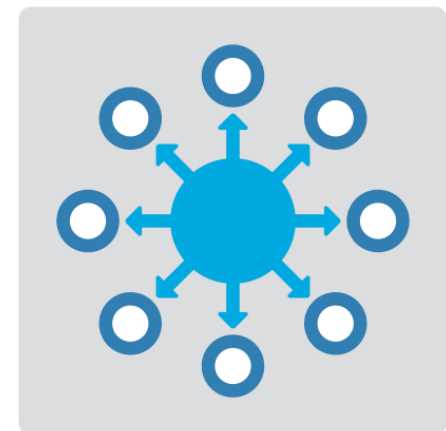
**Getting your work
done faster**

Workflow Depth



**Support for your
entire workflow**

Application Breadth



**Products for the
work you do**

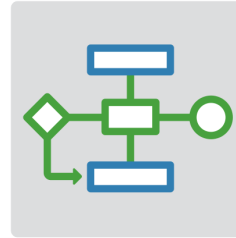
What's New in MATLAB and Simulink?

Platform Productivity



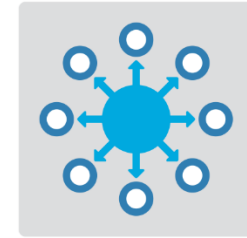
- Live Editor
- MATLAB Apps
- New (big) data types
- Modeling enhancements
- Release adoption

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

MATLAB EXPO 2017

Thank You

