
MATLAB
EXPO
POLSKA 2024

Oprogramowanie Naukowo-Techniczne sp. z o.o.

MATLAB EXPO

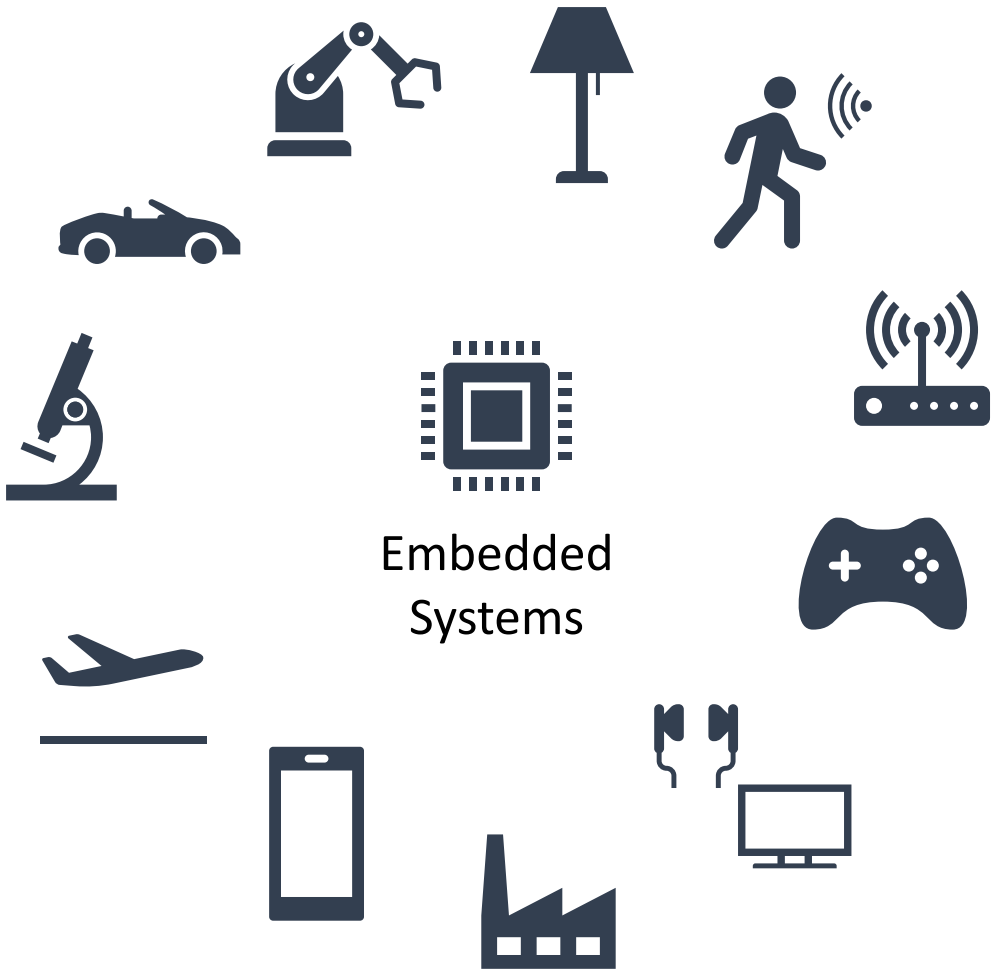
Warsaw, 04.06.2024 r.

FPGA-based and embedded hardware support from MATLAB environment

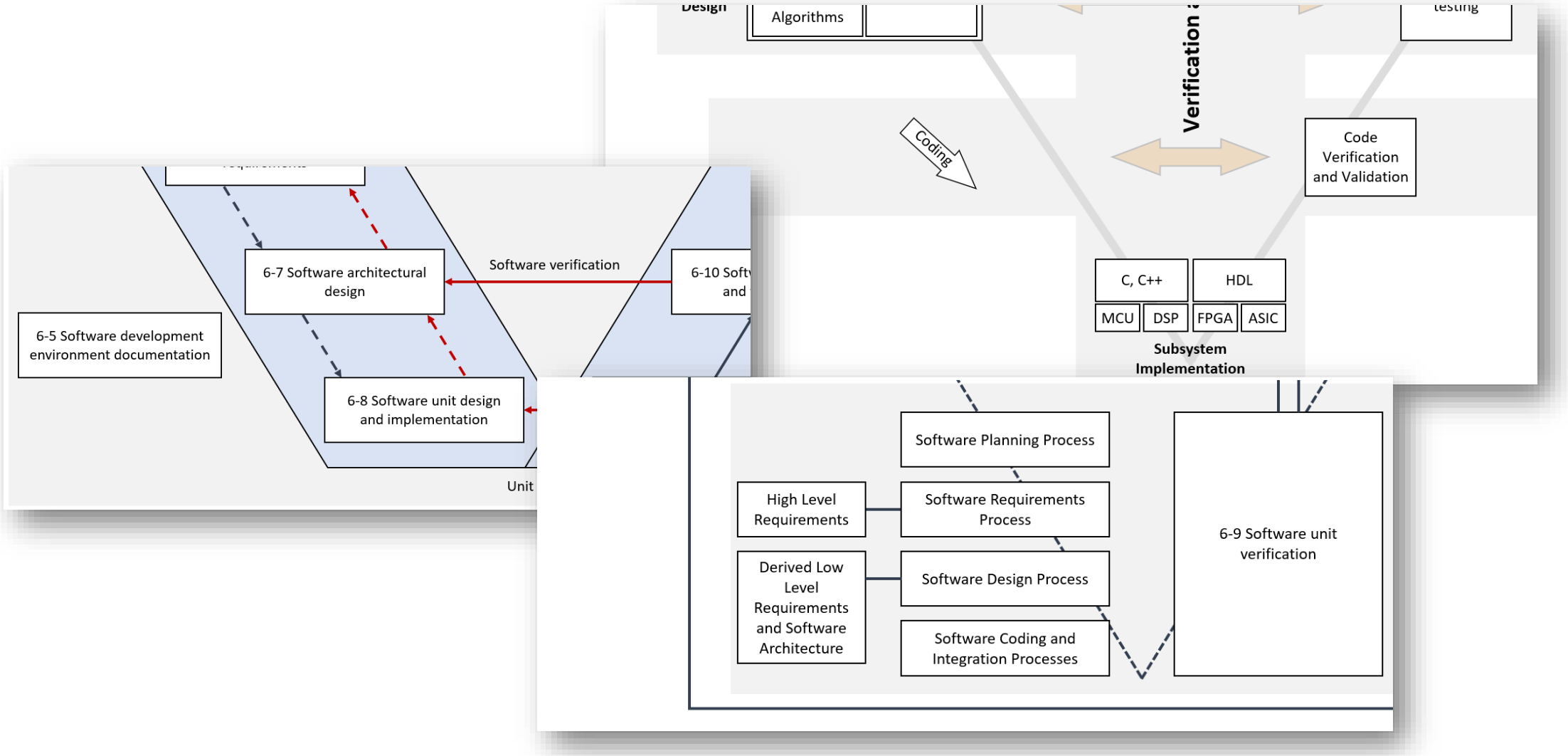
Konrad Kolski, ONT

MathWorks Authorized Reseller

Embedded Hardware

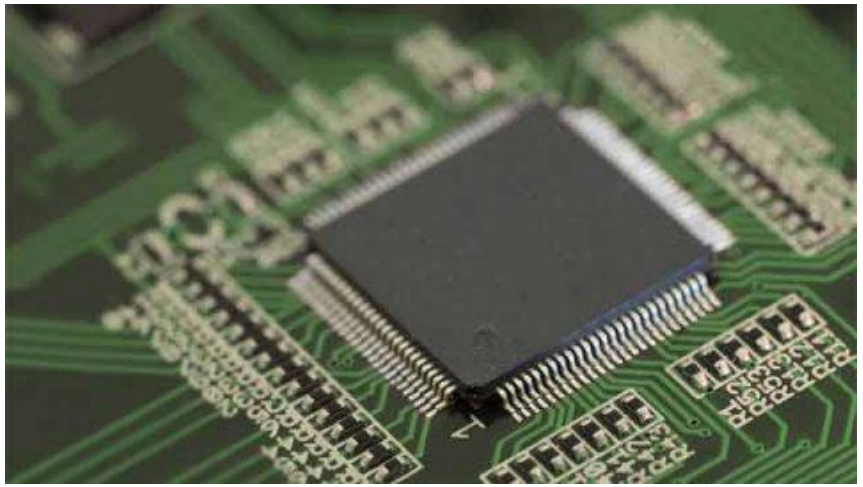

Embedded
Systems

Embedded Code in software workflows



Introduction – Embedded Coder

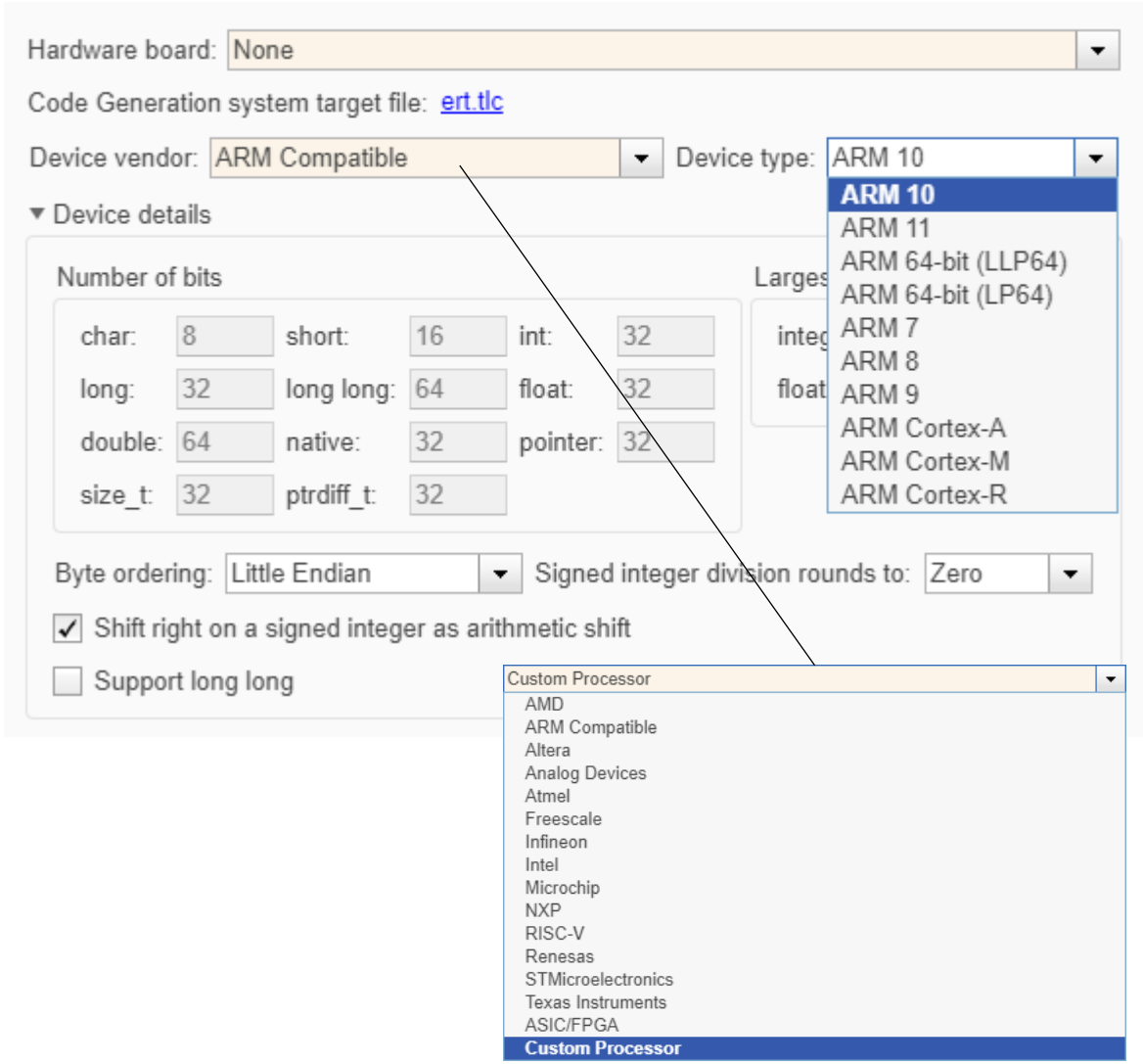
- Generate ANSI/ISO C, C++ and encapsulated C++ production code
  - optimized for specific procesor architecture
  - allows extensive customisation (data types, variables etc.
- Optimize code for your goals
  - efficency , traceability, debugging and safety considerations
  - control format of each generated file
- Provides verification mechanisms
  - generates main program, multirate/multitask execution
  - SIL/PIL testing with support for coverage analysis
- Code is NOT a „Black box”
  - comes with code report and full documentation/comments
  - editable, customisabe, full traceability to source

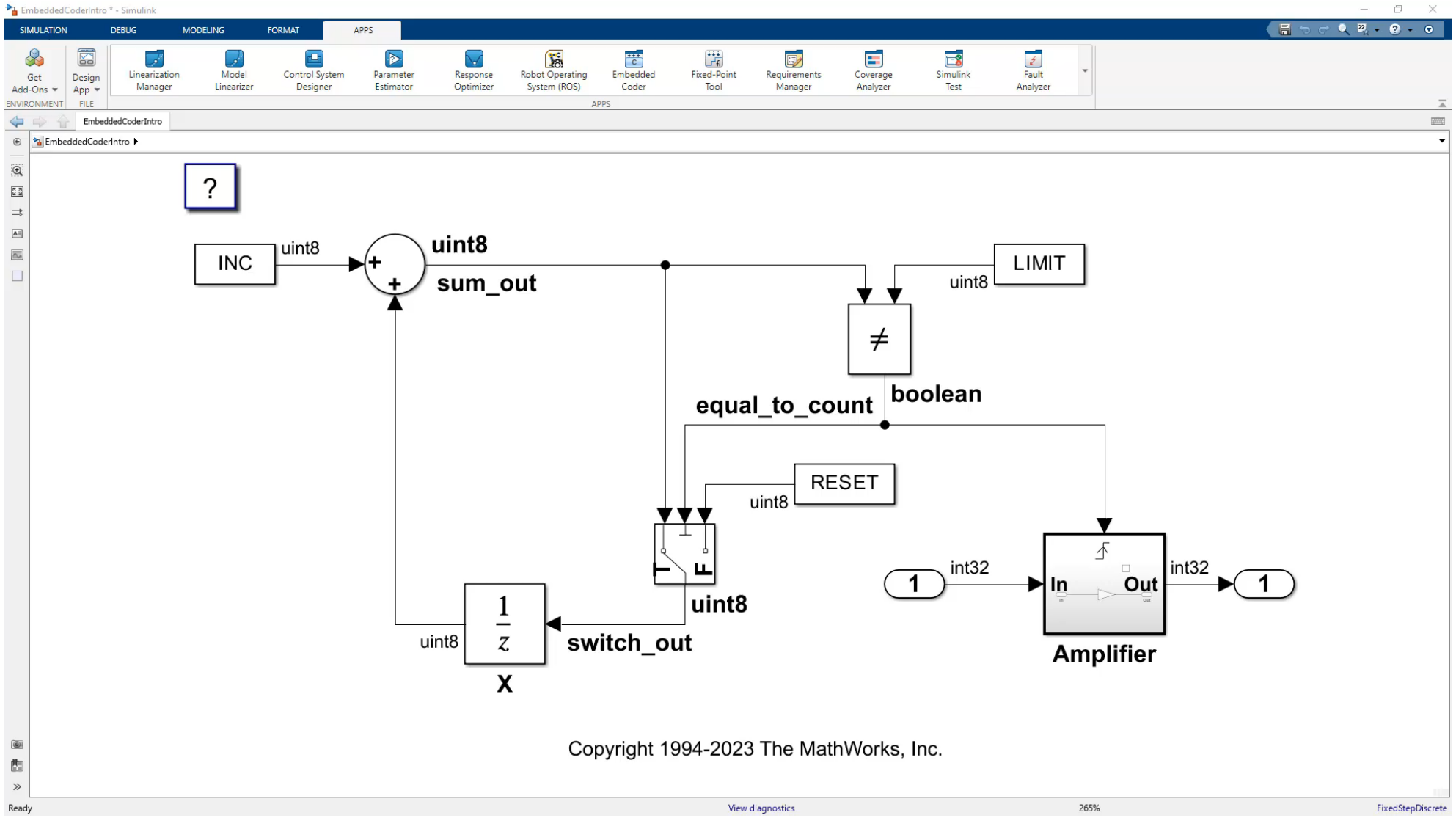


Code Generation – Target Hadware

Vendor optimized C/C++ production code

- Code generation presets for most popular Embedded Hardware vendors
- Applies vendor derived configurations to code generation settings
- Supports custom device definitions
- Allows to generate production code for external IDE integration




EmbeddedCoderIntro * - Simulink
SIMULATION
DEBUG
MODELING
FORMAT
APPS
Get Add-Ons
Design App
ENVIRONMENT
FILE
Linearization Manager
Model Linearizer
Control System Designer
Parameter Estimator
Response Optimizer
Robot Operating System (ROS)
Embedded Coder
Fixed-Point Tool
Requirements Manager
Coverage Analyzer
Simulink Test
Fault Analyzer
APPS
EmbeddedCoderIntro
?
INC
uint8
uint8
sum_out
LIMIT
uint8
≠
equal_to_count
boolean
RESET
uint8
uint8
switch_out
1/z
uint8
X
1
int32
In
Out
int32
1
Amplifier
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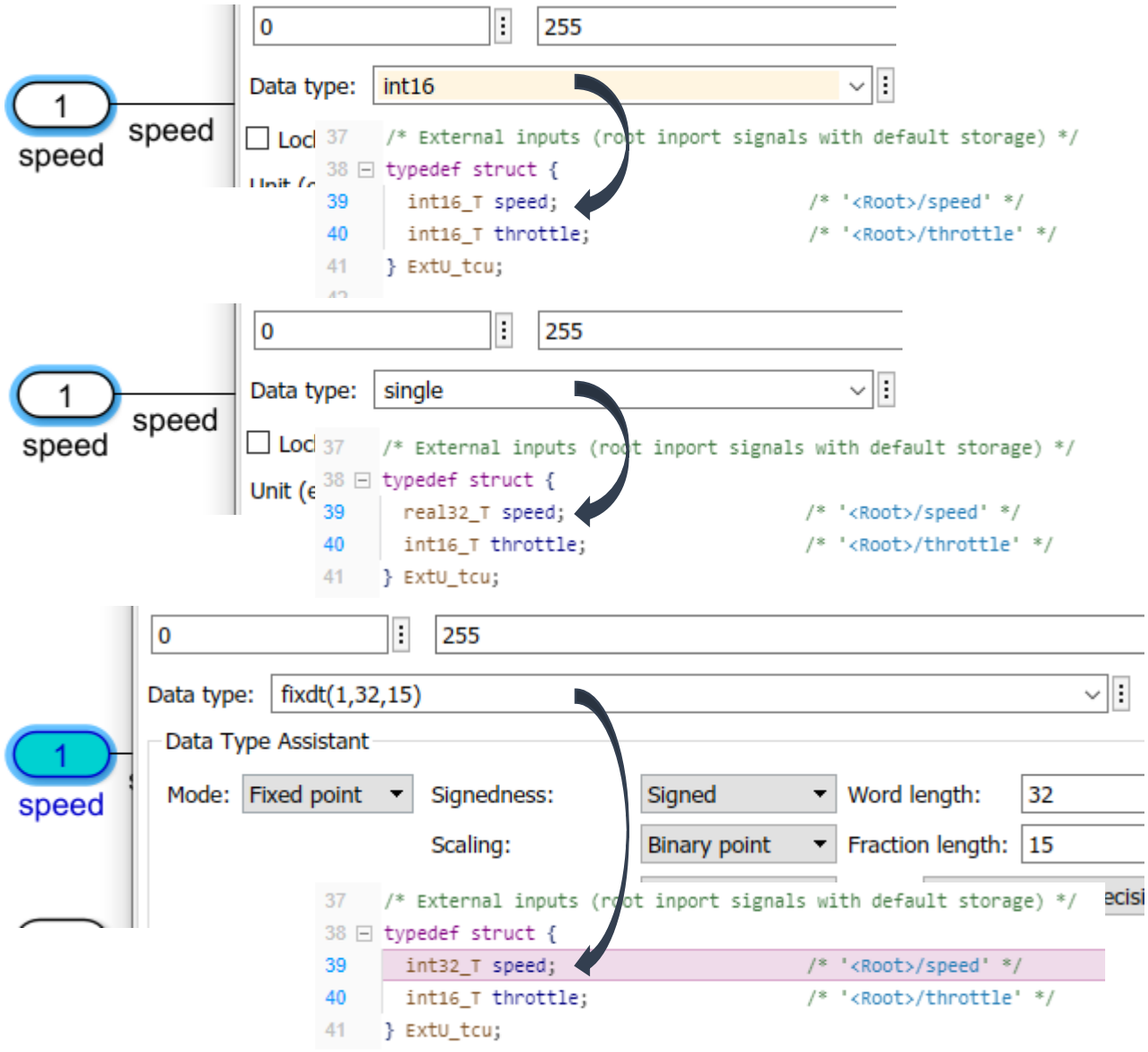
Ready
View diagnostics
265%
FixedStepDiscrete

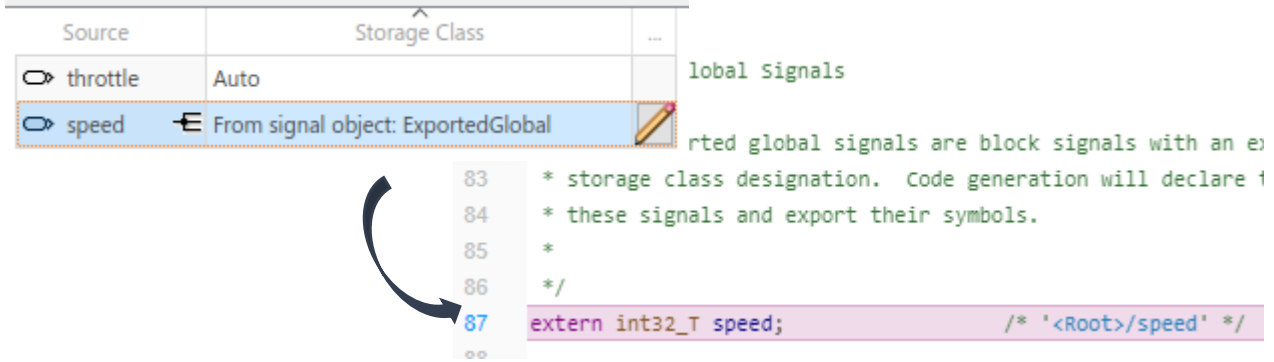
Code Customization

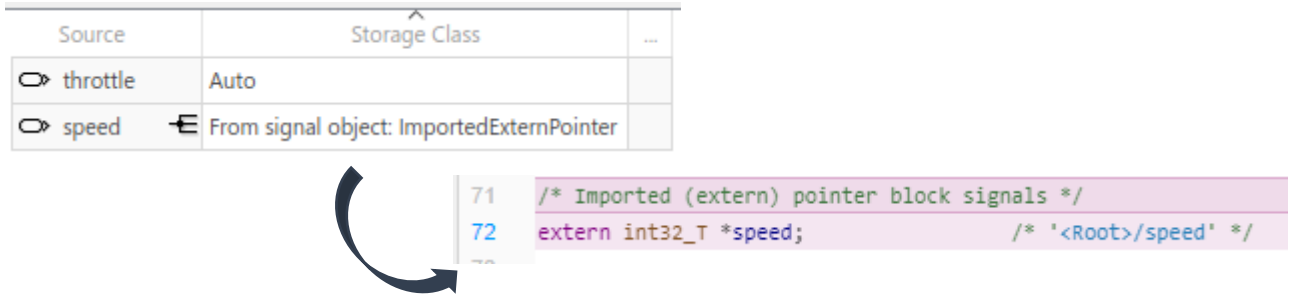
- Control Data Types of signals, ports and parametes and their apperance in source code
  - Model Simulates on same data types that code will run on
- Supports float and integer datatypes
  - (u)int8/16/32/64, half, single, double, boolean, enum, string
- Fixed-point data type support and code generation (with Fixed-Point Designer)

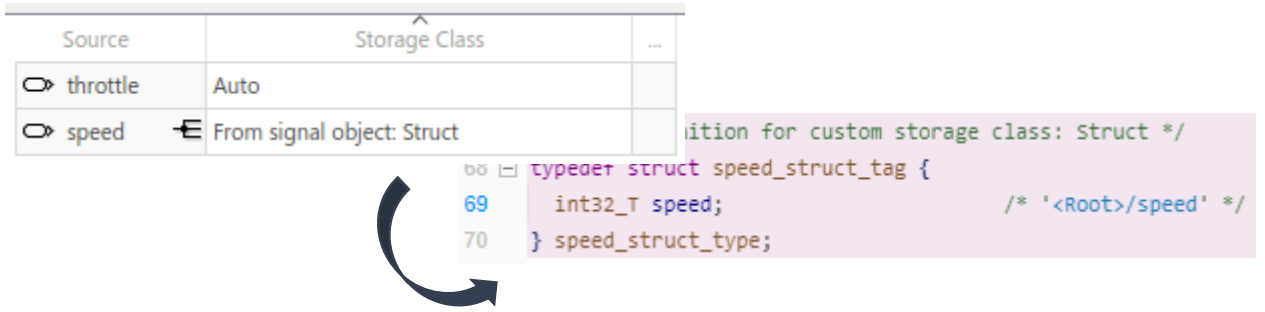


Code Customization

- Precise control ever data representation in source code
- Supports standard ISO/ANSI C/C++ data constructs i.e.
  - structures, pointers, global/local variables, bitfields
  - const, define, volatile and function accessed variables

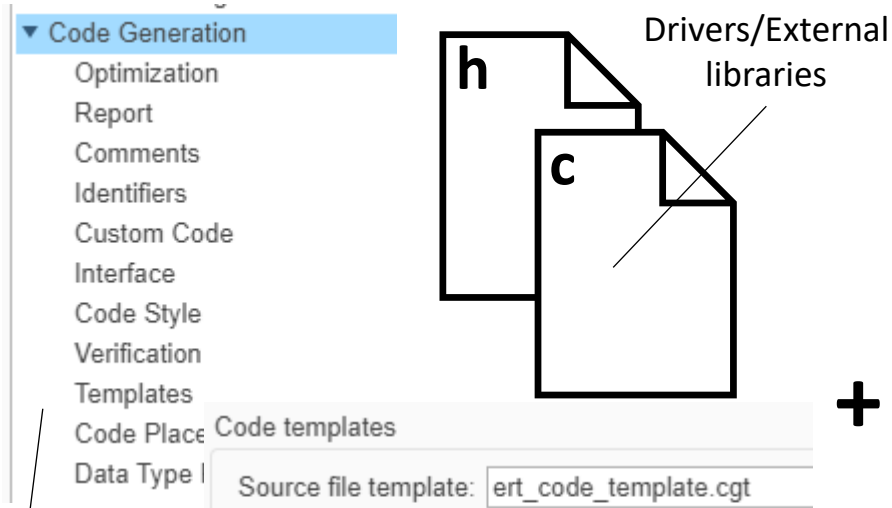






Code Generation – Target Hadware

Custom Hardware Target

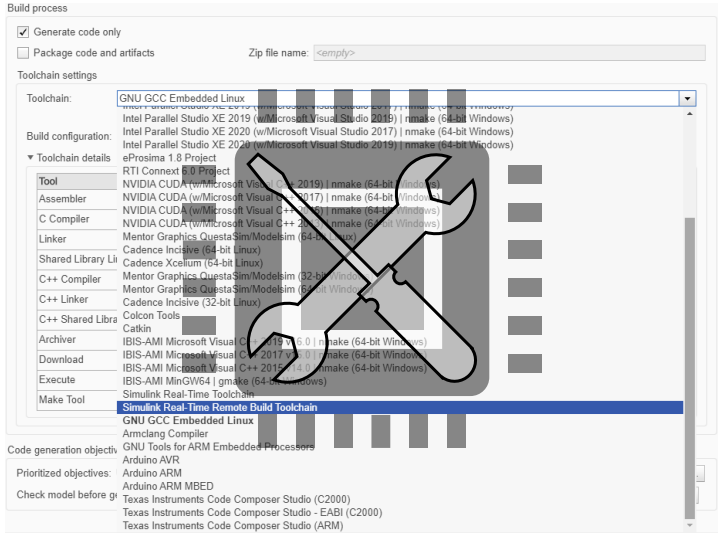


Code generation setting presets and custom parameters

Drivers/External libraries

+

3rd party tools (compiler, linker, programmer etc.)



Source File templates

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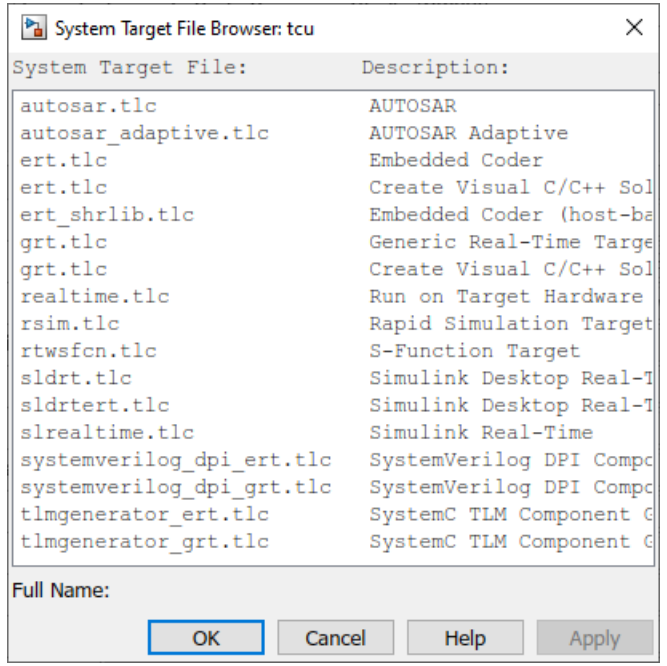
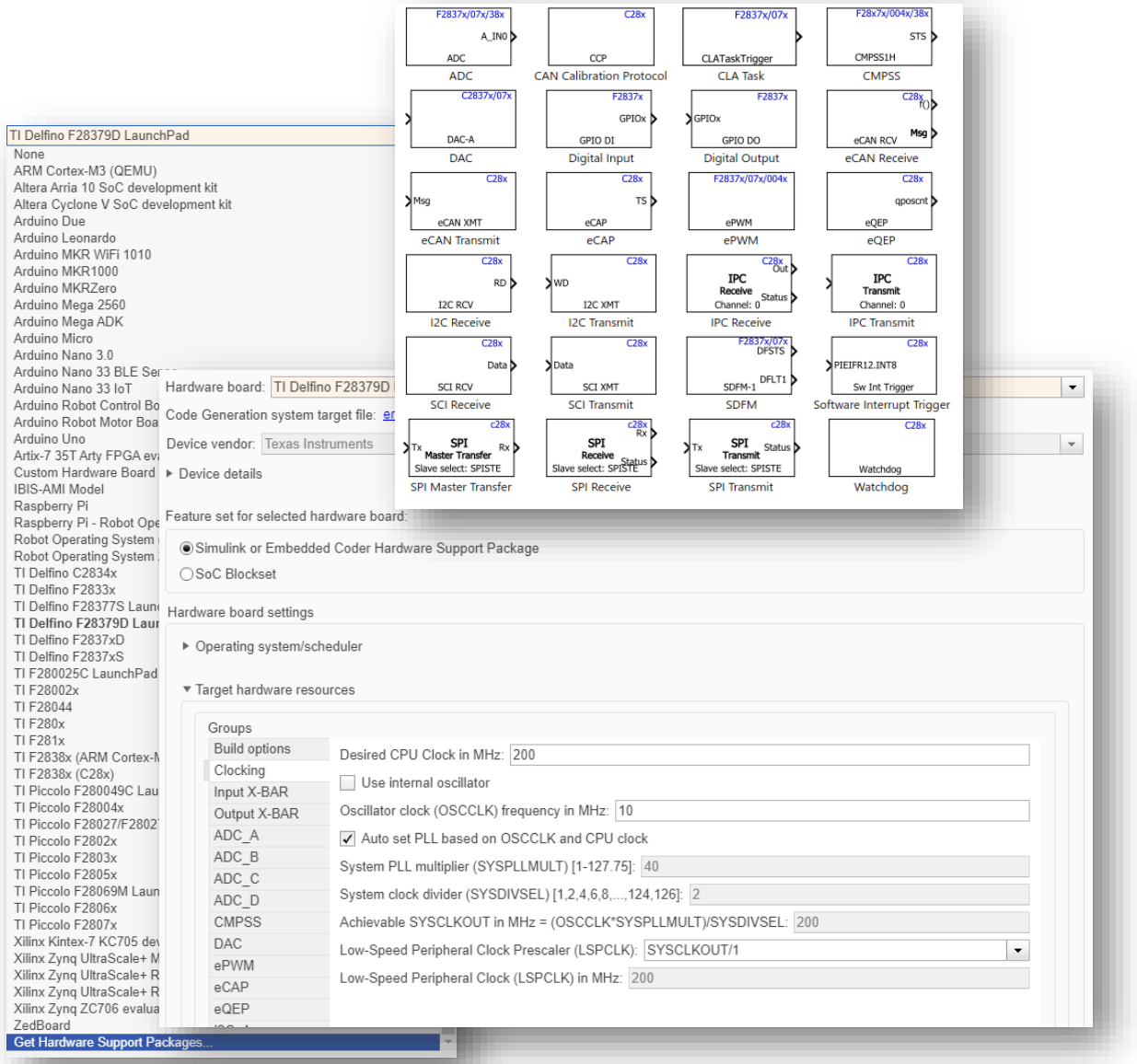
Custom System Target File



Code Generation – Target Hadware

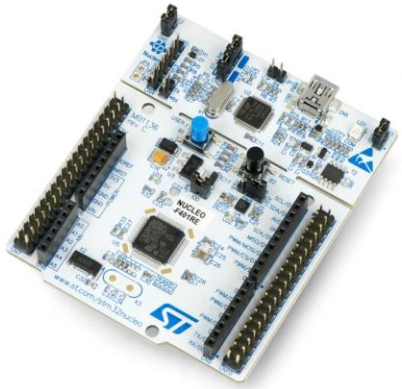
Hardware Support Packages

- Applies hardware specific configurations and features to code generation settings
  - hardware interrupts, timers, communication interfaces etc.
- Provides I/O drivers as MATLAB Functions/Simulink blocks











» http://www.mathworks.com/hardware-support/

Benefits of automated code generation

- Quality
  - Directly related to quality of templates and tool used to generate code
- Consistency
  - Variable, function, method and class names built in the same way in all of the output code
- Productivity
  - Running code generator iteratively seamlessly updates the output code with every change
- Abstraction
  - Code is being build based on abstract model of target code which becomes source for the code generator

- Quality of templates/tool increases quality of the whole codebase
- Easy to understand, use and layer more functionality
- Ability to seamlessly update code based on changing requirements
- Code generator can be retargeted to build code for different platform while source model remains the same

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Warszawa | 4.06.2024

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