R&A CONTROLS ENGINEERING
VEHICLE CONTROLS & SYSTEM ENGINEERING

Converting Spreadsheet-Based Scenario Definitions to OpenSCENARIO Files

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Presentation Outline

Emily

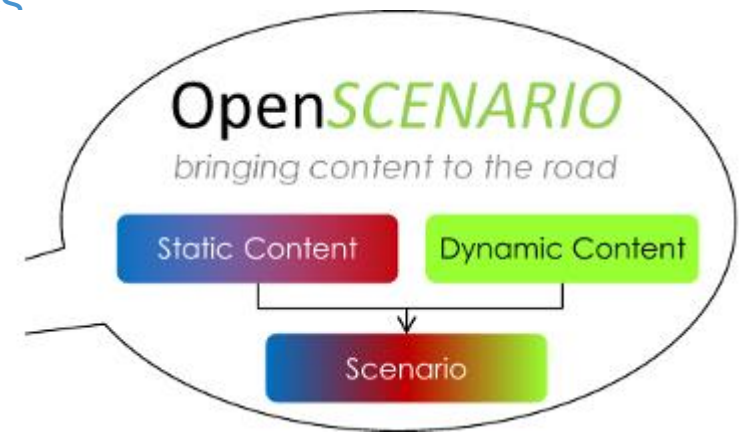
- Introduction
- What Is OpenSCENARIO
- Tool Methodology
- OpenSCENARIO Across Ford
- Demo 1
- Demo 2
- Summary
- Q&A

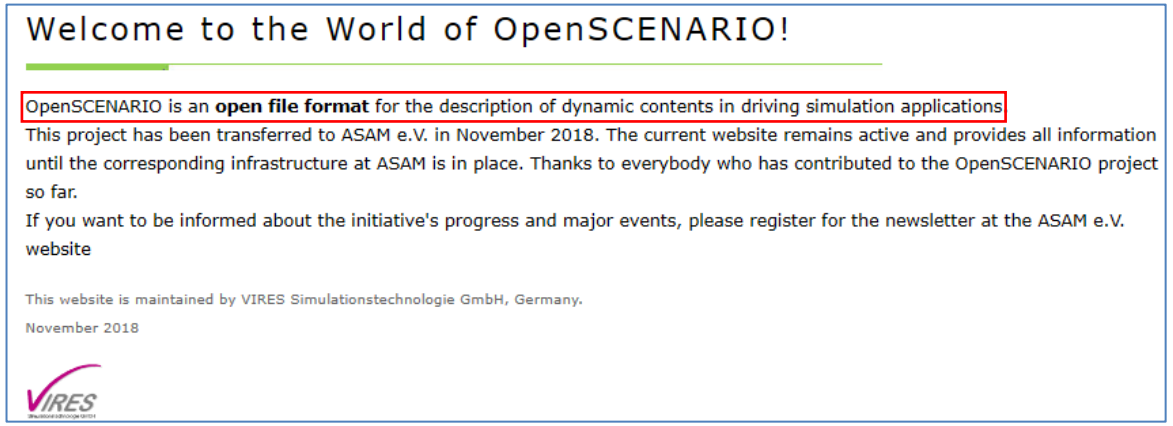
15 Min.

5 Min.

What Is OpenSCENARIO?

- Open file format to describe dynamic test cases
- Describes complex, synchronized maneuvers (e.g. pre-collision assist, cut-ins, lane centering assist, traffic jam assist)
- The standard describes the ways in which a vehicle moves using stories conditions, acts, and sequences.




Welcome to the World of OpenSCENARIO!

OpenSCENARIO is an **open file format** for the description of dynamic contents in driving simulation applications

This project has been transferred to ASAM e.V. in November 2018. The current website remains active and provides all information until the corresponding infrastructure at ASAM is in place. Thanks to everybody who has contributed to the OpenSCENARIO project so far.

If you want to be informed about the initiative's progress and major events, please register for the newsletter at the ASAM e.V. website

This website is maintained by VIRES Simulationstechnologie GmbH, Germany.

November 2018

VIRES

OpenSCENARIO
bringing content to the road

Benefits and Pain Points

- Temporary Pain Points
  - Validation of the standard
  - Utilization of the standard
  - Unprecise written definition of the standard

- Long Term Benefits
  - Universally used
  - Shortens scenario generation time e.g. no learning curve or conversion
  - Keeping up with industry
  - Enables the exchange and usability of scenarios agnostic to supplier
  - Large numbers of critical situations can be run across various simulators

DoubleLaneChanger.xosc

C: > Users > kmcgarri > Documents > MATLAB > Consulting > Ford > OpenSCENARIO > Examples > DoubleLaneChanger.xosc

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dSPACE IPG AUTOMOTIVE esmini OpenSCENARIO player foretellix CARLA Mechanical Simulation carSIM truckSIM bikeSIM

Ford-MathWorks Tool Methodology

1.) Investigate OpenSCENARIO constructs and capabilities → Will OpenSCENARIO suffice?

2.) Create a methodology to build up automated scenarios using MATLAB/Simulink → What tests will benefit from standardization?

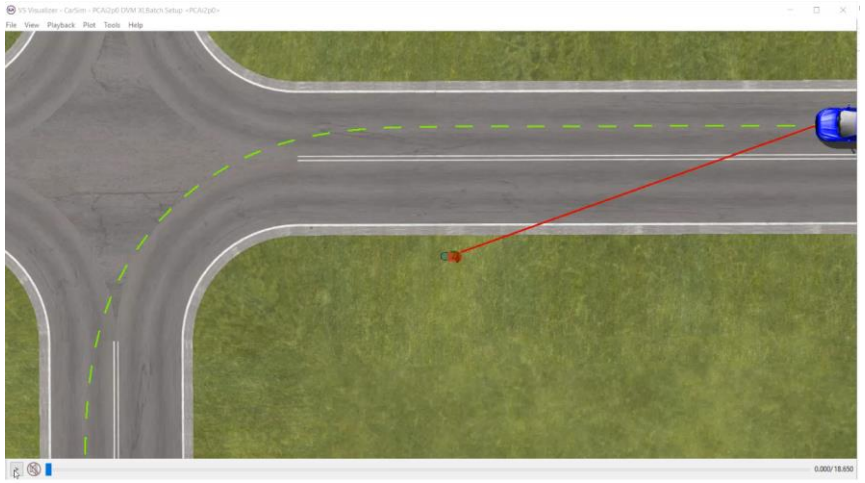
3.) Determine method(s) to represent scenario in MATLAB → .mat files, apps, Driving Scenario Designer?

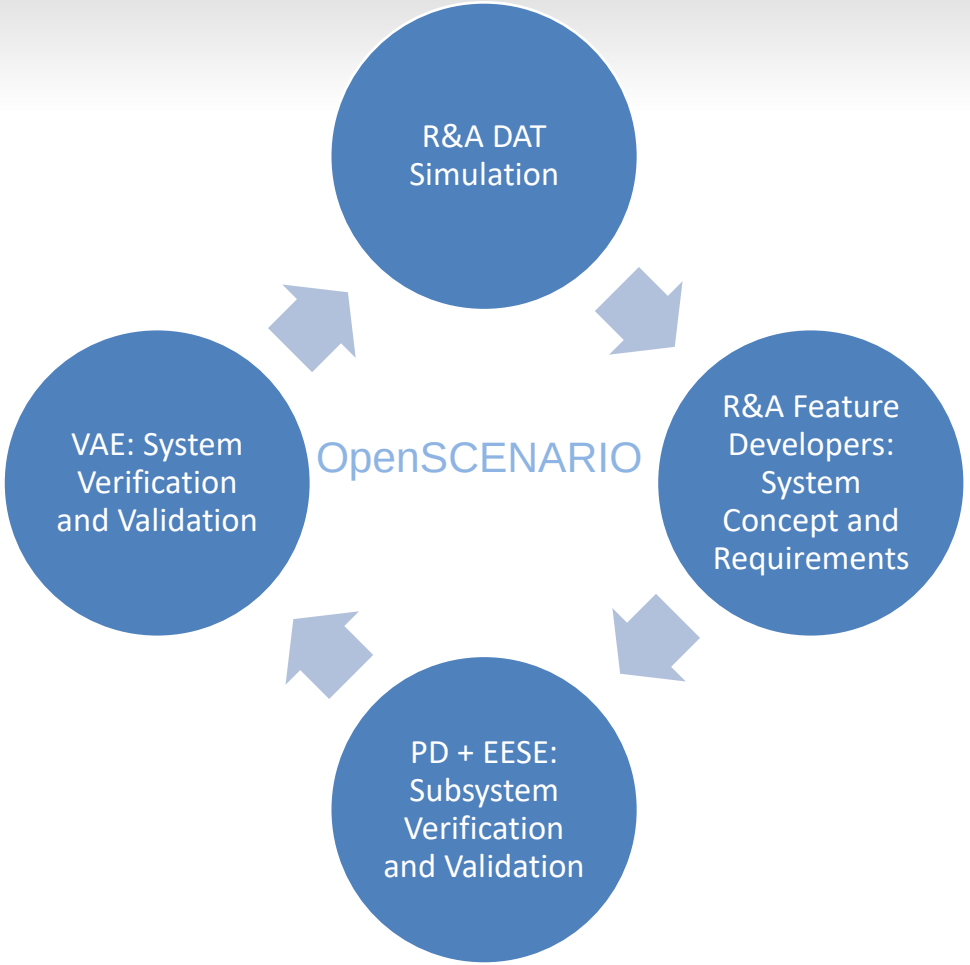
4.) Create a tool to enter scenario information → How can we automate the process?

5.) Create XML export functionality that matches that of OpenSCENARIO Spec

OpenSCENARIO Across Ford Continued

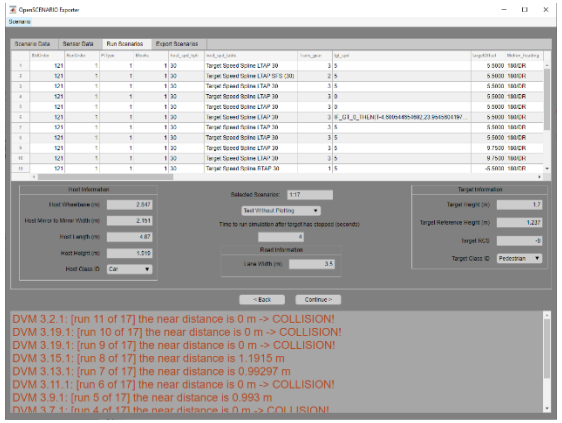
- Reading and writing back out scenario files for both Open Scenario and Open Drive for CarSim use case
- Agent based traffic scenario testing
- Creating scenes from Lidar and camera data, validating the scene
- App that reads in Test Runs , Road, and Vehicle files from Carmaker and builds up a scenario in driving scenario
- Validation of ADAS feature
- Scenario Creation from L2/L3 road data

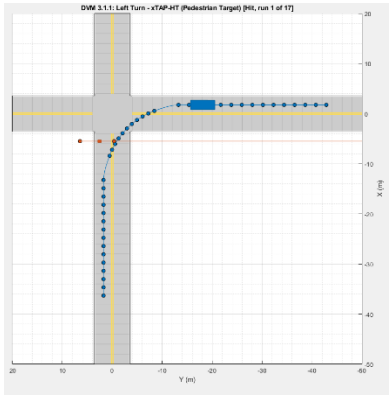




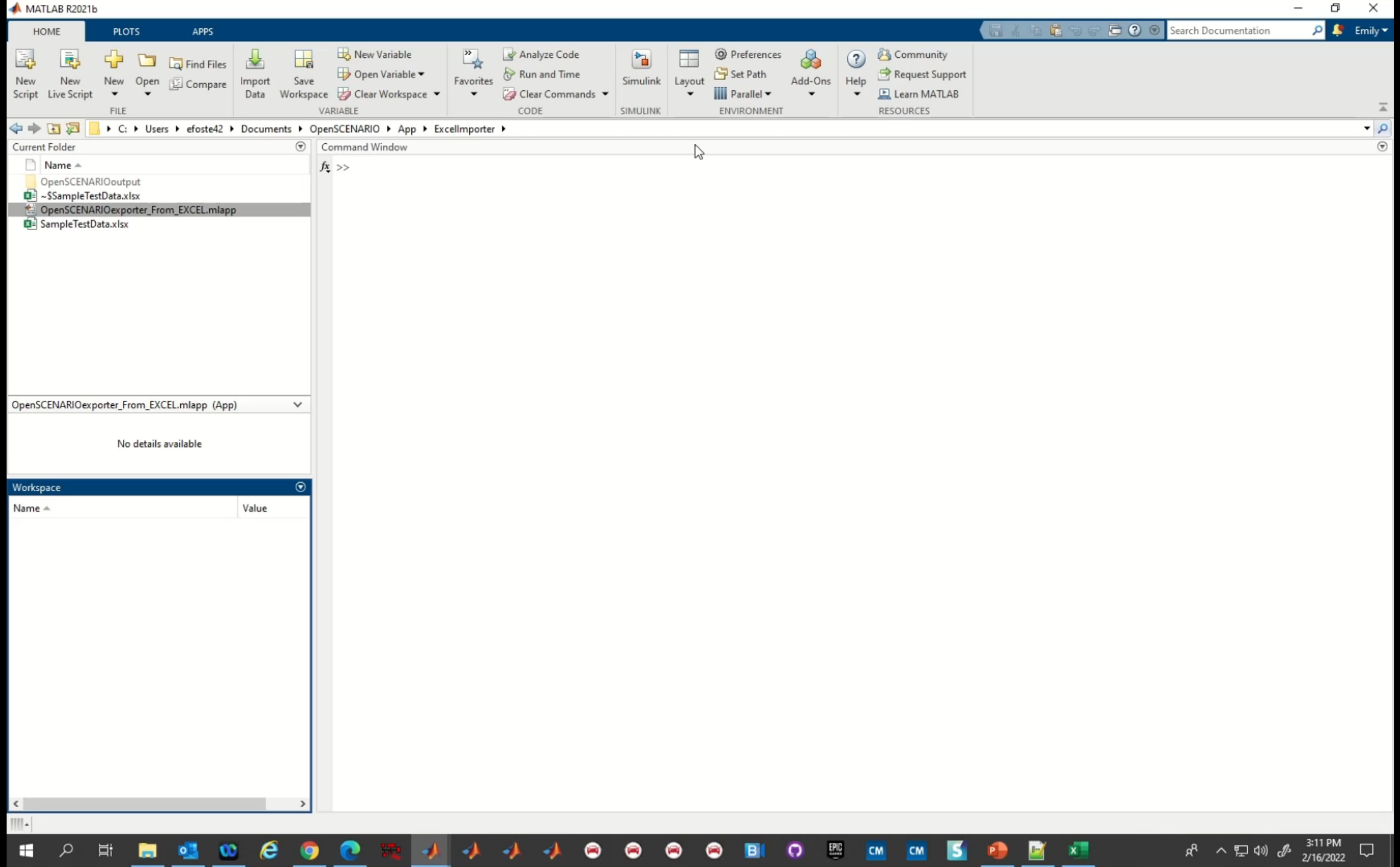
Excel to OpenSCENARIO App-1

- MathWorks has created two tools to aid the creation of OpenSCENARIO files
  - Proof of concept
  - Automated conversion of the CarSim to OpenSCENARIO 0.9.1
    - Thousands of variants per test
    - Most difficult feature scenarios to ensure versatility





Excel to OpenSCENARIO App-1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New Variable
Open Variable
Clear Workspace
VARIABLE
Favorites
Analyze Code
Run and Time
Clear Commands
CODE
Simulink
SIMULINK
Layout
Preferences
Set Path
Parallel
ENVIRONMENT
Add-Ons
Help
Community
Request Support
Learn MATLAB
RESOURCES
C: ▸ Users ▸ efoste42 ▸ Documents ▸ OpenSCENARIO ▸ App ▸ ExcelImporter ▸
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Name
OpenSCENARIOoutput
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SampleTestData.xlsx
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Workspace
Name
Value
Command Window
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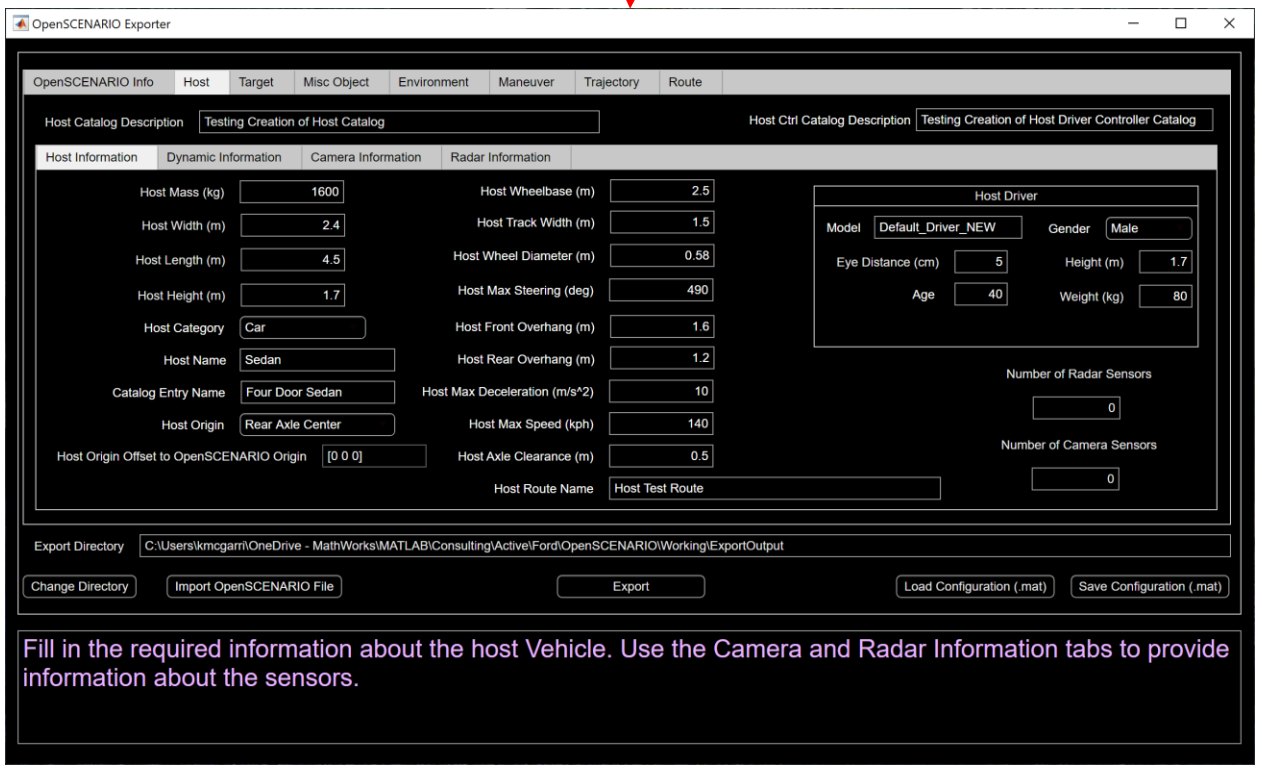
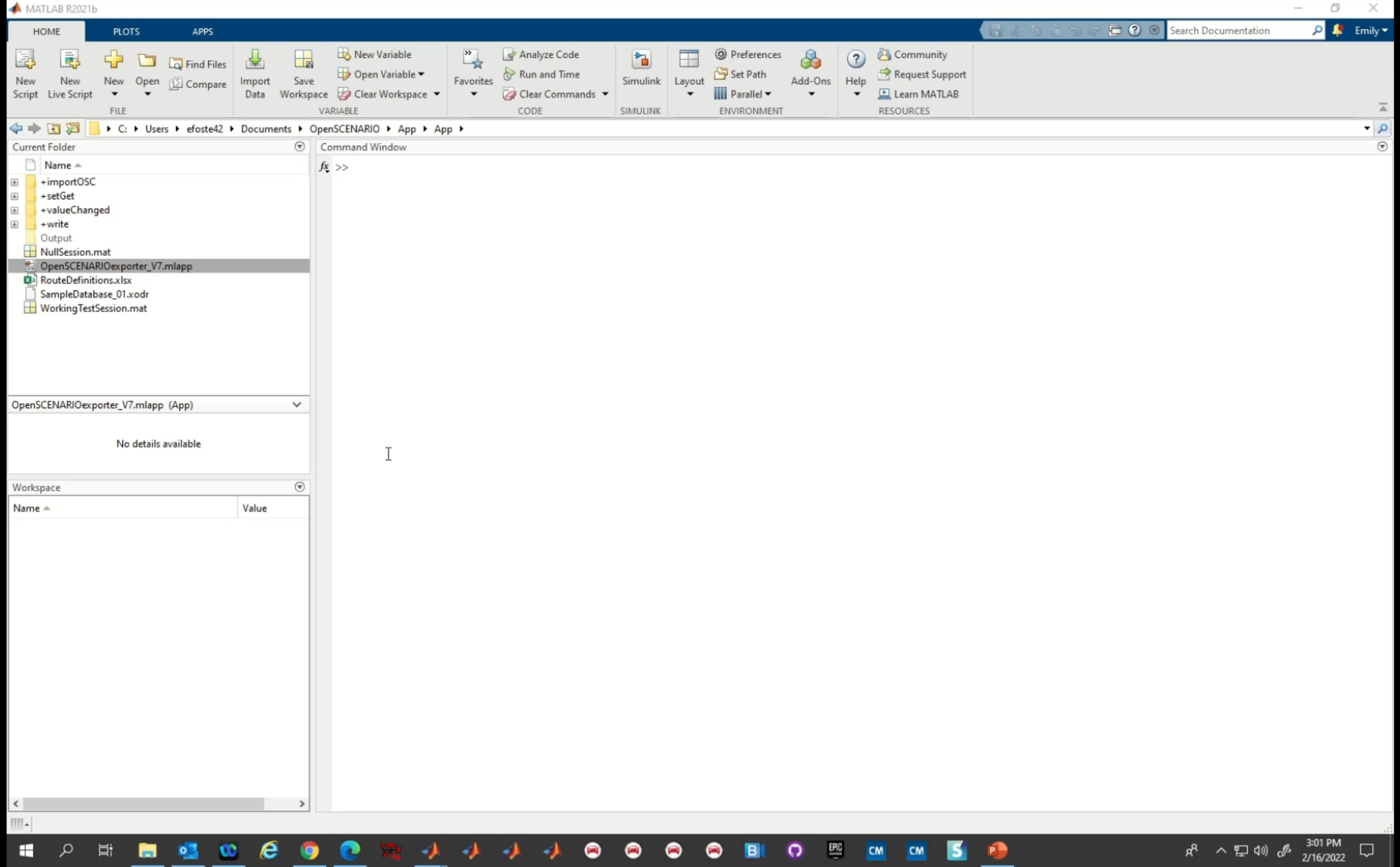
3:11 PM
2/16/2022

General Format to OpenSCENARIO App-2

- 2nd app solves the problem of diverse test file formats
  - Benefited general formats (Excel, Word, MagicDraw, ECU-TEST) with ambiguous structure
  - Addressed need for multiple exported catalogs with OpenDRIVE

General Format to OpenSCENARIO App-2




MATLAB R2021b
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Emily
New Script
New Live Script
New
Open
Find Files
Compare
FILE
Import Data
Save Workspace
New Variable
Open Variable
Clear Workspace
VARIABLE
Favorites
Analyze Code
Run and Time
Clear Commands
CODE
Simulink
SIMULINK
Layout
Preferences
Set Path
Parallel
ENVIRONMENT
Add-Ons
Help
Community
Request Support
Learn MATLAB
RESOURCES
C: ▸ Users ▸ efoste42 ▸ Documents ▸ OpenSCENARIO ▸ App ▸ App ▸
Current Folder
Name
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+setGet
+valueChanged
+write
Output
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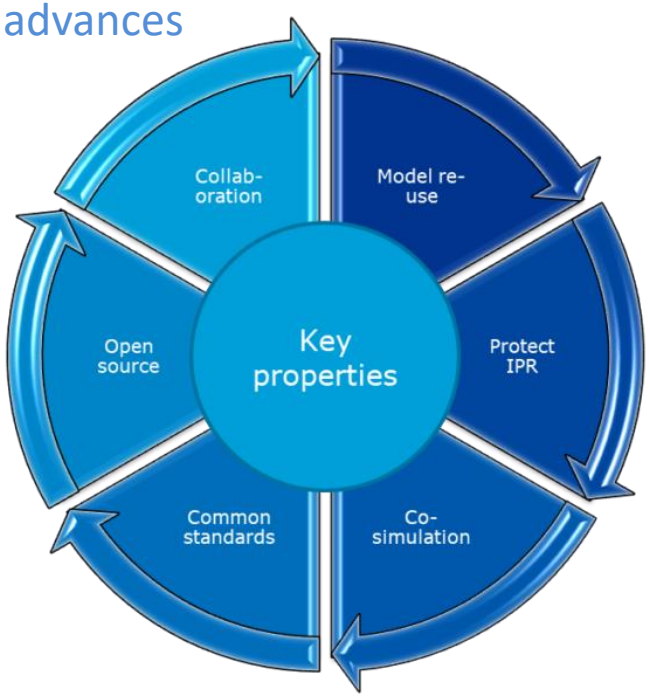
Results/Benefits

- Through standardization the tool allowed for scenario reuse regardless of the simulation tool and test case format
  - 1st app both showed the resulting scenario in the MathWorks drivingScenario tool as well as exported OpenSCENARIO 0.9.1 files
  - 2nd allowed users to enter information required by OpenSCENARIO by hand to build up scenarios from other documentation
- Unique opportunity to collaborate
- The resulting standard files are stored in GitHub (Ford only)

Future Work

- Next steps are to make the files accessible, searchable, findable by groups that didn't create them but want to use them
- MathWorks tools have advanced since the creation of the final version of the app. drivingScenario Designer now exports OpenSCENARIO
- Keep up to date on ASAM OpenSCENARIO advances
- Utilize advancements in current workflow



Thank You!

Q&A