AHMED YOUSIF
VIRTUAL VALIDATION AND VERIFICATION
INTRODUCTION

ELECTRICITY MAY BE THE DRIVER. One day your car may speed along an electric super-highway, its speed and steering automatically controlled by electronic devices embedded in the road. Travel will be more enjoyable. Highways will be made safe—by electricity! No traffic jams... no collisions... no driver fatigue.

POWER COMPANIES BUILD FOR YOUR NEW ELECTRIC LIVING

Your air conditioner, television and other appliances are just the beginning of a new electric age. Your food will cook in seconds instead of hours. Electricity will allow your children at their play to see and hear the world, this will be achieved under automatic control. Electricity will make your home a safer place to live. It will also make your home a more efficient place to live. You will save and have much more electricity than you have today. Right now, America’s more than 100 independent electric light and power companies are planning and building to have twice as much electricity as we had in 1959. These companies may sell this power only when you need it because they don’t have to make up an act of Congress or pay a rate of tax money to build the plants.

The experience, imagination and ingenuity that identified the nature of a single lifetime on the world shaping your electric future. That’s why the plans to come... in the past... will handle most when you are served by independent companies like the one bringing you this message—America’s Electric Light and Power Companies. ©
AGENDA

• Validation and Verification Challenges
• Facing the Challenge
• Deployment
SOFTWARE TESTING CHALLENGES
SOFTWARE TESTING CHALLENGES

10 million miles and counting

Disengagements 2017

Kilometers

WAYMO
GM Cruise
Zoox
Nissan
Baidu
Tesla
Delphi/Aptiv
Valeo
Bosch
Mercedes-Benz

2.07
SOFTWARE TESTING CHALLENGES

Relative cost to fix bugs, based on time of detection

- Requirements / Architecture
- Coding
- Integration / Component Testing
- System / Acceptance Testing
- Production / Post-release
SOFTWARE TESTING CHALLENGES
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SOFTWARE TESTING CHALLENGES

Tesla crashes and driver claims he couldn’t...er, drive. 

Waymo’s self-driving car... ignored woman it struck. 

Uber vehicle reportedly saw but... front of you.

The next time you see one these AI vehicles, pretend it is a vehicle with a driver under the influence. Let it get in front of you.
SOFTWARE TESTING CHALLENGES
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AGENDA

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FACING THE CHALLENGE/ SENSOR MODEL

Scenario Run and Replay [Simulation]

Perfect Pointcoud [Simulation]

Realistic Pointcoud [Simulation]

\[ f(r, m, i) \]

\[ f(f(r, m, i)) \]

\[ f(r, m, i) \]

\[ f(r) \]

\[ f(m) \]
FACING THE CHALLENGE/ SENSOR MODEL
FACING THE CHALLENGE/ SENSOR MODEL

- Distance
- Position
- Material ID
- Normal Vector
- Time Stamp

- Radial distance
- Intensity
FACING THE CHALLENGE/ SENSOR MODEL
FACING THE CHALLENGE/ GROUNDTRUTH

Simulation Traffic Information
Simulation Objects Information
Simulation timestamp

Generated Groundtruth (*.xml)
SMQs main objective is to evaluate sensor models based on predefined deterministic scenarios and compare its behavior with the real sensors using a set of KPIs and visualize the results in an interactive way.

Can be used as the targeted results in Test Driven Development methods.

Can be used as a reference for developers to enhance their sensor models for other products lines.

When it reaches full maturity, it can be used as a generic acceptance test for sensor models as part of the tool qualification process.
FACING THE CHALLENGE/ SENSOR MODEL QUALIFICATION
FACING THE CHALLENGE / SENSOR MODEL QUALIFICATION
Vehicle in the loop, Database
DEPLOYMENT

- Scenario Run and Replay [Simulation]
- Trace Generator [Python]
- Ground Truth Generator [C++]
- Auto Annotation Neural Network

Virtual Environment
SDC – Stacked Dilated Convolution: A Unified Descriptor Network for Dense Matching Tasks