ECLIPSE FOUNDATION

UNIVERSITY OF OULU

Mobility of the Future and Open Collaboration – A good idea?

Andy Riexinger | Robert Bosch GmbH
Business Development Manager Open Source

Eclipse SAAM Mobility 2021

Security | AI | Architecture | Modelling

Supported by: OULU AUTOMOTIVE CLUSTER

OULU | BusinessOulu

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Who am I?

Andy Riexinger

Robert Bosch GmbH

Cross-Domain Computing Solutions – Automated Driving

- Business Development Manager Open Source
- ~23 years at Bosch
- ~15 years experience in embedded software development
- Pushing Open Source development and business within Robert Bosch GmbH
- Interest in creating business with Open Source
- Interest in strengthen Open Source in automotive

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BOSCH

Contents

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The Bosch Group
Four business sectors

Mobility Solutions

- One of the world's largest suppliers of mobility solutions

Industrial Technology

- Leading in drive and control technology, packaging and process technology

Energy and Building Technology

- One of the leading manufacturers of security and communication technology
- Leading manufacturer of energy-efficient heating products and hot-water solutions

Consumer Goods

- Leading supplier of power tools and accessories
- Leading supplier of household appliances

Bosch Mobility Solutions is closely connected with all divisions.
Cooperation across the Bosch Group enables a valuable exchange of knowledge and synergies.

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The Bosch Group
Facts and figures

Sales in billions of euros
71.5

Associates
395,000

Associates in engineering
73,000

Manufacturing locations
235

Engineering locations
129

Business Sector Mobility Solutions

Sales in billions of euros
42.1

Associates
229,000

Associates in engineering
58,000

Manufacturing locations
126

Engineering locations
68

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Actively shaping global megatrends
With innovations for people, society, and the environment

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Actively shaping global megatrends
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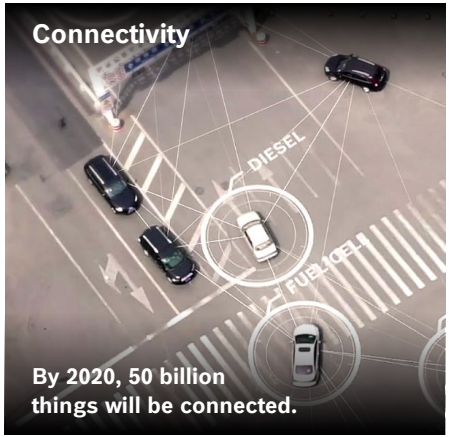

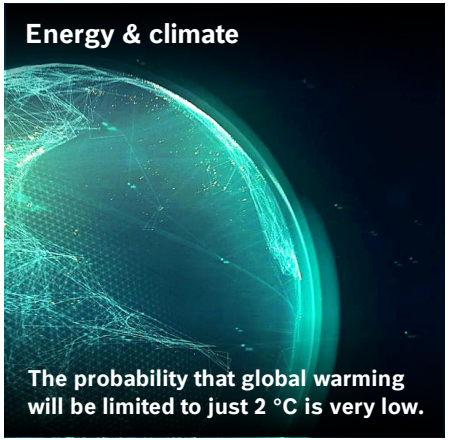

Urban mobility
Safety on the roads
Automated mobility
Automated parking
Rental vehicles
Charging infrastructure
Electromobility
Efficient powertrains
Connected services
Infotainment in the car
Convenient mobility
Hybrid powertrain systems
Driver assistance systems
HMI systems
Reduction of emissions
Alternative fuels
Internet of things
Connected mobility

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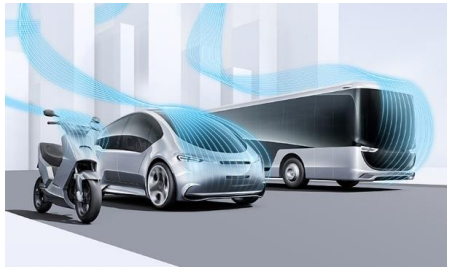
Bosch Mobility Solutions

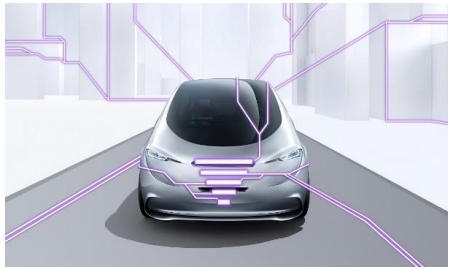
Integrated system solutions for maximum benefit

Personalized mobility



Automated mobility

Connected mobility



Powertrain systems and electrified mobility

fun and **fascinating**

safe and **comfortable**

efficient and **economical**

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PERSONALIZED MOBILITY

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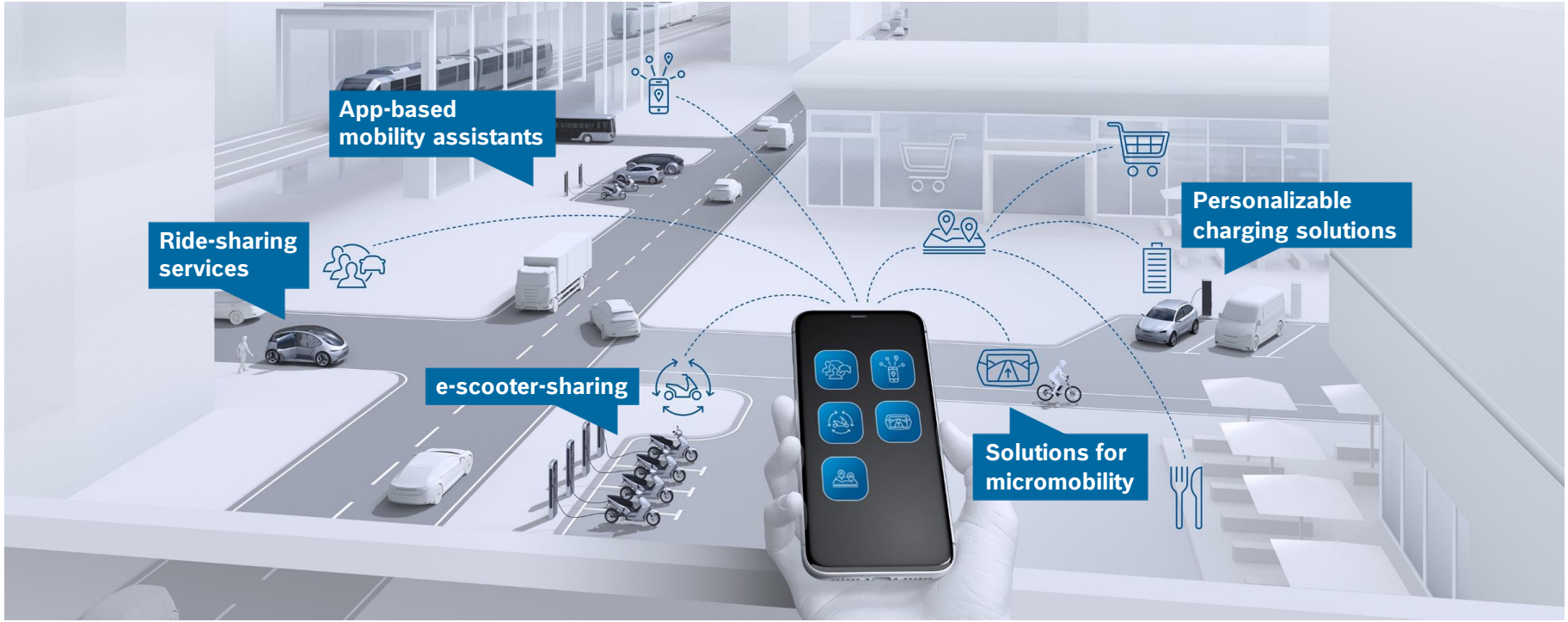
Personalized mobility
Bosch customizes your mobility experience



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AUTOMATED MOBILITY

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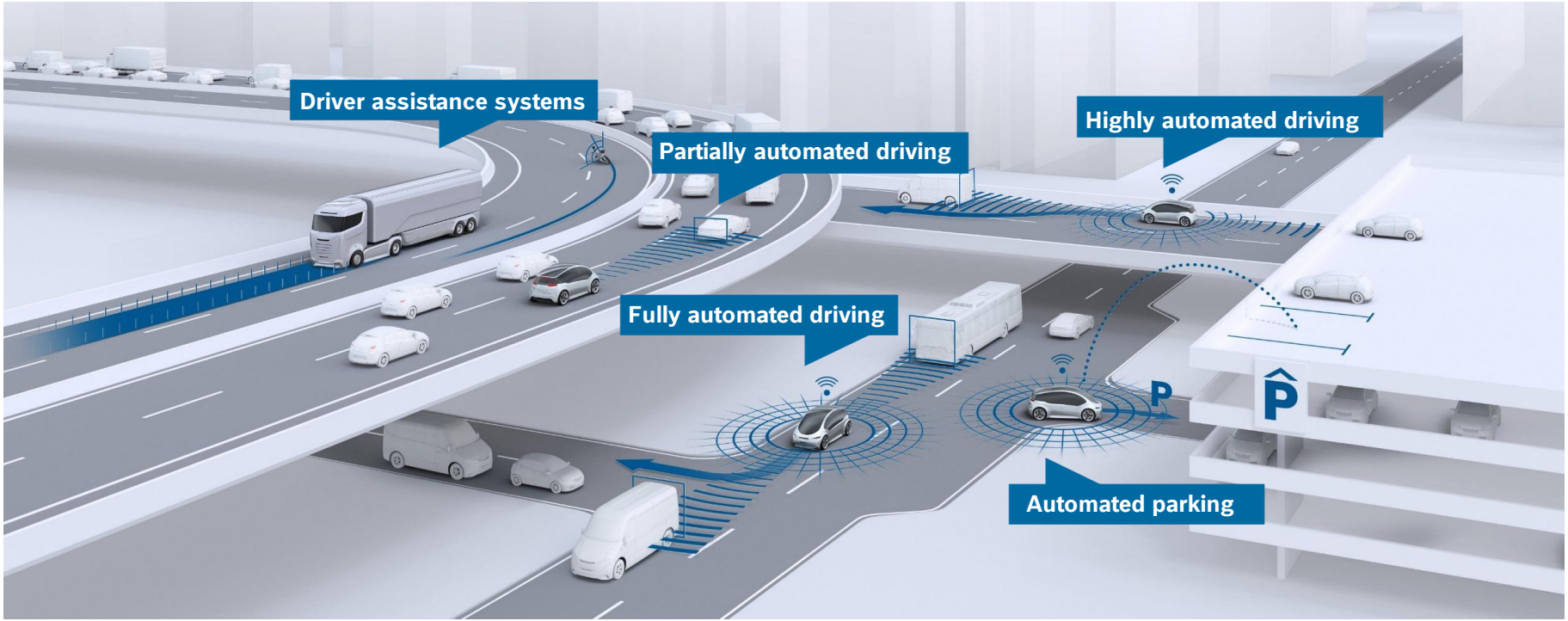
Automated mobility
Bosch is teaching the vehicle how to drive



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CONNECTED MOBILITY

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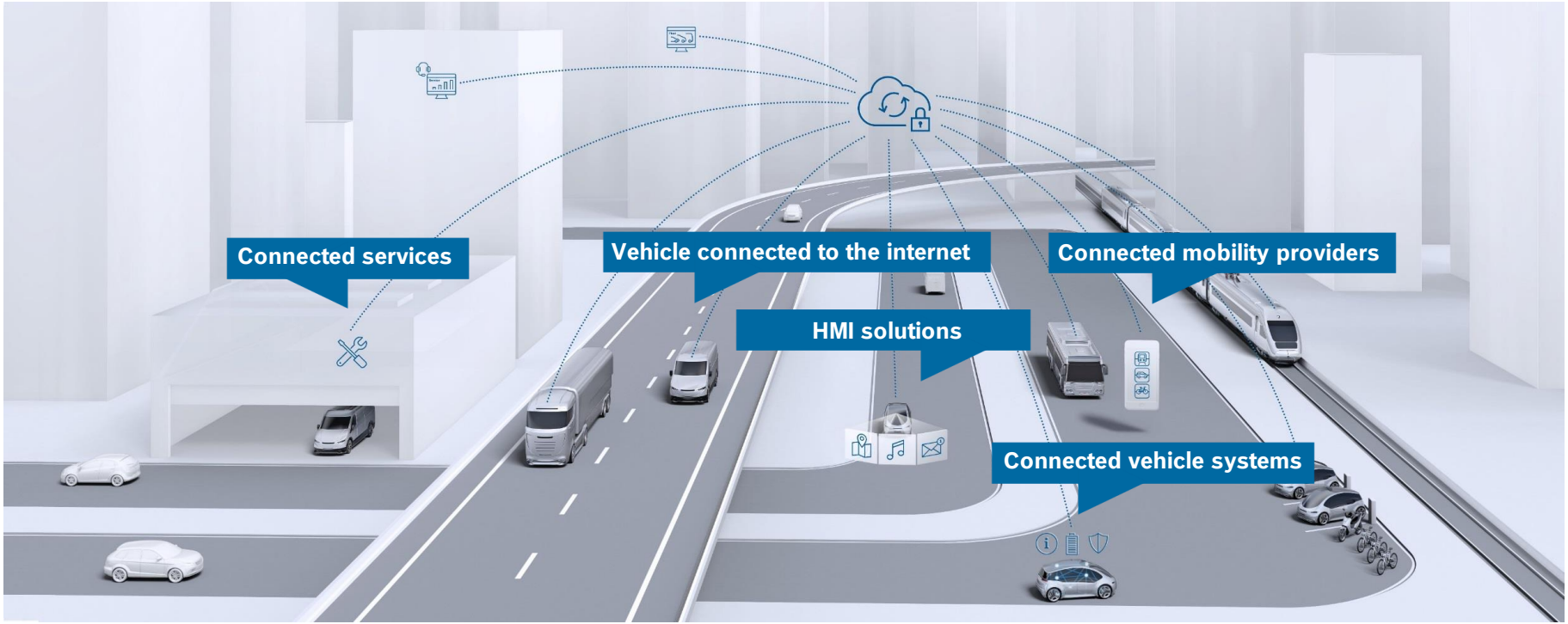
Connected mobility
Bosch is seamlessly connecting mobility



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ELECTRIFIED MOBILITY

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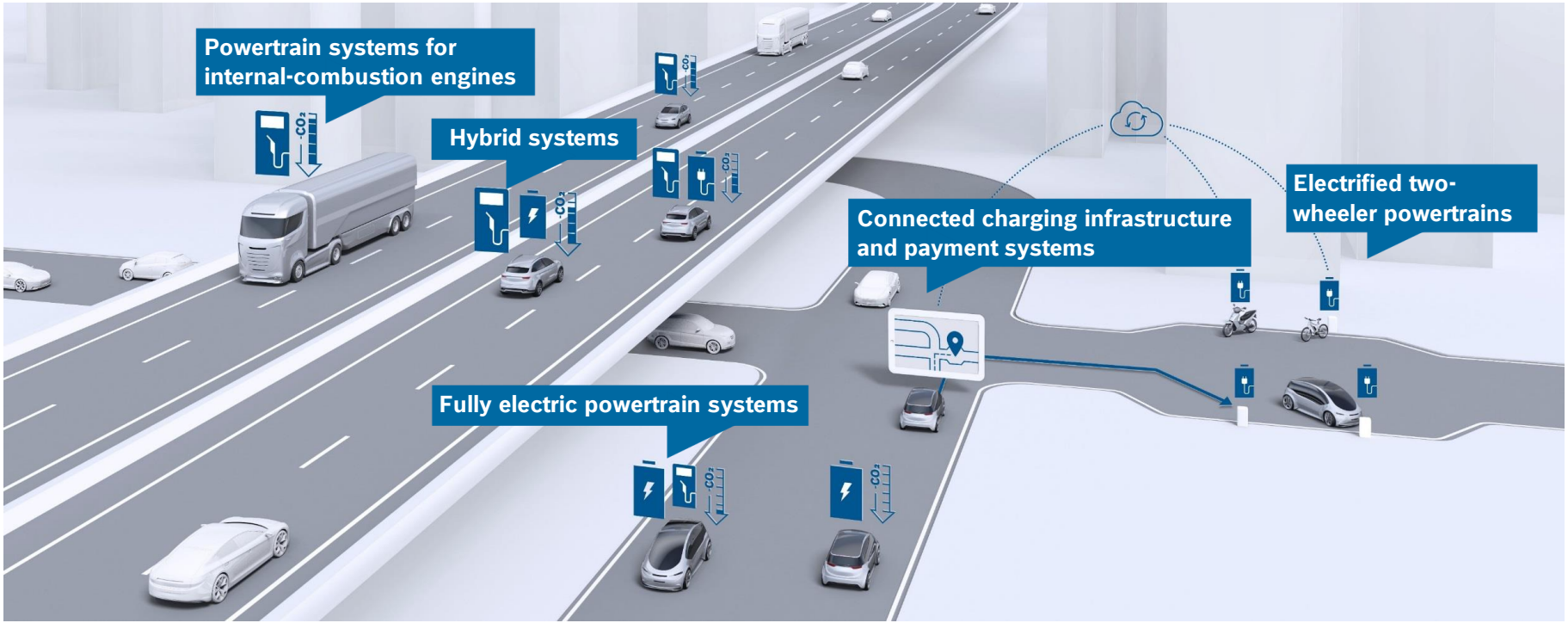
Electrified mobility
Bosch is energizing the powertrain



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SOFTWARE

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“Software is eating the car”
Software defined car

- Simplified and accelerated development and deployment of vehicle software in accordance with automotive quality standards
- Comprehensive software platform to connect the vehicle with the cloud will reduce the complexity of the software development and the vehicle system integration.

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Software defined car
What is a “Software defined car”?

- The term “Software defined car” describes a car, containing features and functionalities, which are enabled by software, transforming a hardware-based car to a software-centric computing center on wheels.

- Vehicles today can already have
  - More than 100 electronic control units (ECUs)
  - A growing array of sensors, cameras, radar and light detection and ranging (lidar) devices
  - Up to 150 million lines of software code

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Software defined car
Benefits of a “Software defined car”

- unlocking new safety, comfort and convenience features
- receive over-the-air (OTA) updates (security patches, infotainment improvements, monitoring and tuning of core functional capabilities of the vehicle)
- send and receive vast amounts of data to and from sensors and actuators, getting an insight into every aspect of a vehicle, its performance and its place in the connected ecosystem.
- This will result in new Business Models by buying packages from the OEM store e.g.,
  - Extra power for a track day
  - Heated seats for a skiing day
  - Extra range for longer trips

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Software defined car
Software Development for a “Software defined car”

- To build software functionalities, an efficient Software development is needed with shorter development and deployment cycles

- 3 typical options for software development
  1. Develop software in-house across most / all domains
  2. Develop software in-house for one or two differentiating domains and specify, outsource development
  3. Outsource software development and keep feature specification, integration and validation in-house

Open Source can help in ALL software development options and …

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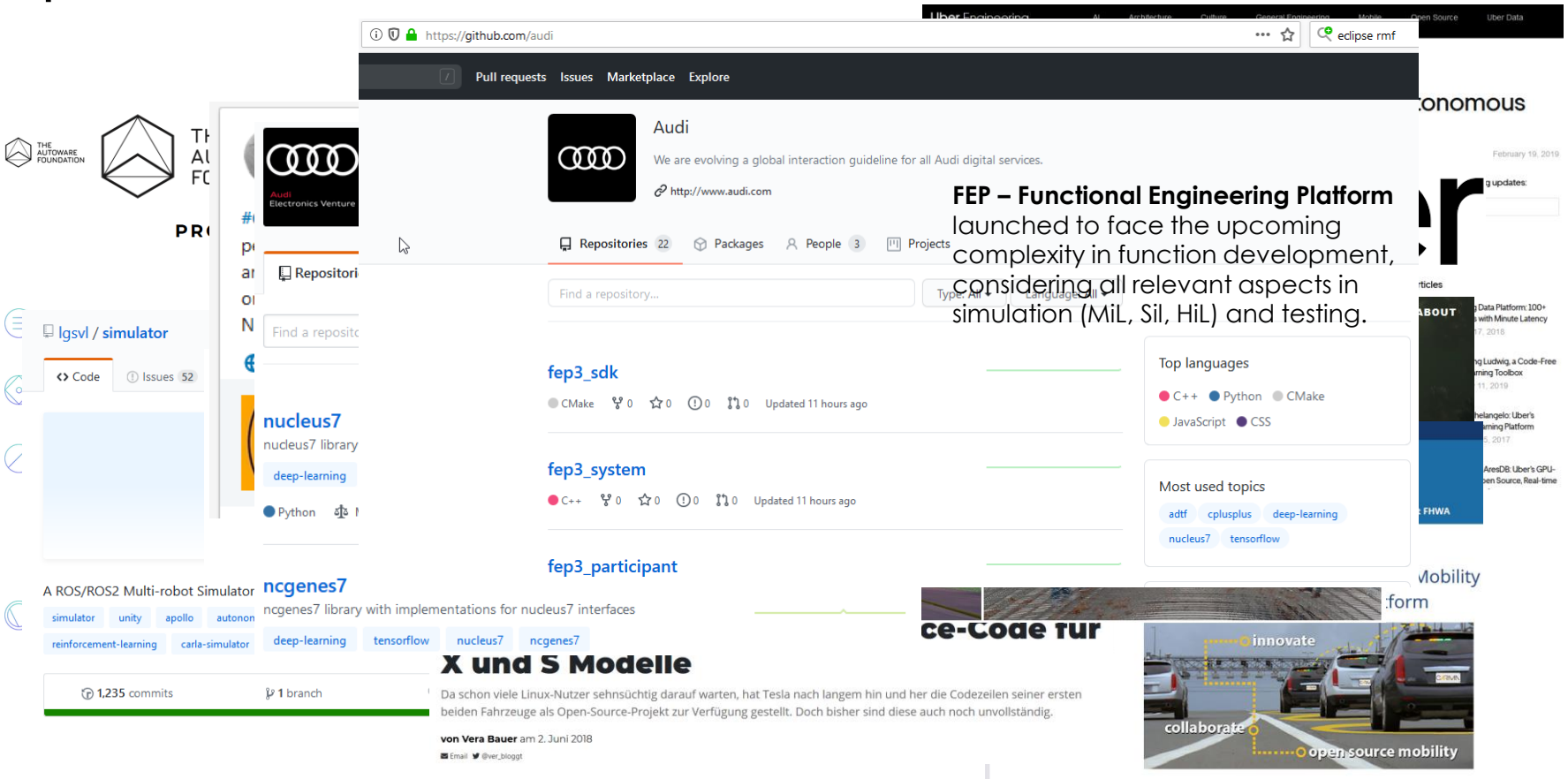
… Open Source Software has arrived in Automotive



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#DEVELOPER #MOBILITY

Bosch ConnectedWorld 2018

Autonomous driving accelerator “OpenADx” launched

FEB 21, 2018 0

Today at the Bosch ConnectedWorld conference in Berlin, a new open source autonomous driving accelerator was introduced. OpenADx focuses on the software development toolchain for autonomous driving, an enabling component in the landscape of highly autonomous driving.

BOSCH CONNECTED WORLD 2018
ADDRESSING THE TOOLCHAIN COMPLEXITY

Development ▸ Lab Test ▸ Test Fleets ▸ Validation ▸ Manufacturing ▸ Operations

OpenADx
Accelerate AD development through open collaboration and open source

OpenADx Testbeds
- Controlled experimentation environment
- Validation of customer requirements and technical feasibility
- Focus on AD toolchain integration aspects
- Can lead to longer term open source project

Use Case:		Toolchain:
Sense	Slow car ahead	
Think	Overtake trajectory	
Act	Inputs for vehicle control	

Testbed

OpenADx –
xcelerate your Autonomous Driving development

The OpenADx community provides a platform which …

… leverages open source to increase efficiency and create standards

Reason Why

AD requires a multifaceted process incorporating a variety of software tools

But none of these tools were ever designed to work together

This costs the industry time and money

We are mitigating this problem by creating the leading automated driving ecosystem ➢ ***OpenADx***

RB launched OpenADx at BCW 2018 …

… and established an Eclipse hosted community

- 30 entities
- 60+ active contributors
- Initial projects:
  - Cloe (simulation kit for testing AD software components)
  - Standardized AI labeling
  - SiL standardization

Targets

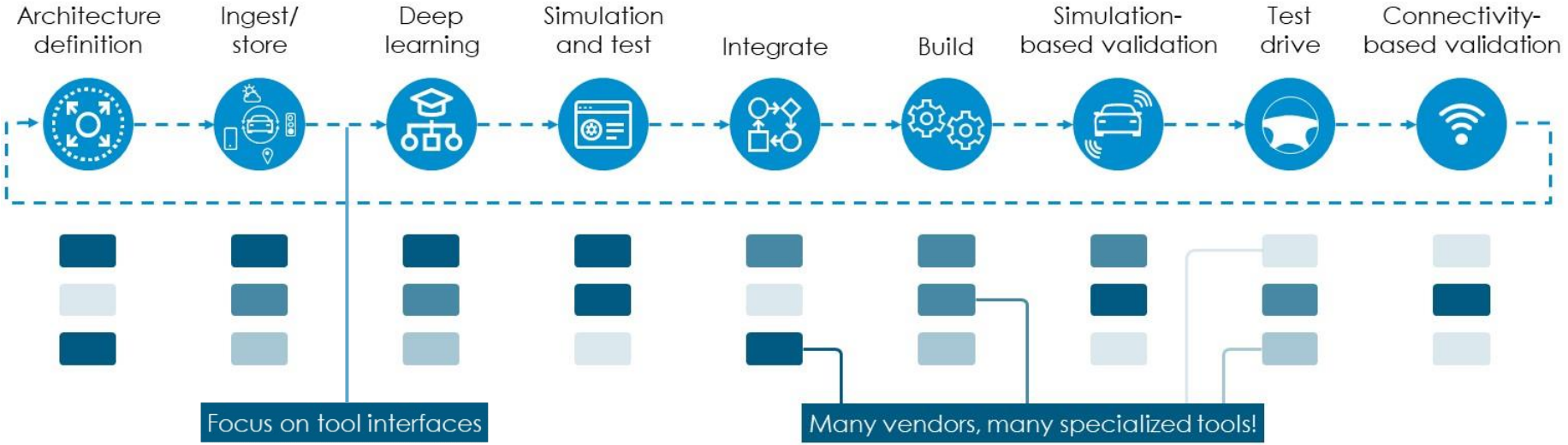
- Accelerate time to market
- Share costs
- Free up resources to focus on customers

Approach

- Define Industry-wide AD toolchain
- Ensure high interoperability
- Provide easy access
- Establish basis for reference arch.

OpenADx targets reference architecture and …

a wide ranging interoperable toolchain for PoV* and commercial applications



GOALS

- Industry-wide accepted definition of the AD toolchain
- Tool interface standardization
- Ensure efficient implementation and interoperability
- Foundation for reference architecture

Make a complex tool landscape more accessible for enterprise users

*PoV – privately owned veicle

OpenADx: Leading to holistic functional approaches

Use Case: Leverage OpenADx to develop end-to-end solutions (with the community)

Summary

- **Open source software…**
  - Is gaining traction in the automotive industry
  - Minimizes dependency on suppliers
  - Increases quality through broad testing reviews, skilled attention, broad expertise
  - Enables risk sharing and cost reduction
  - Will be essential to the success of partnerships and consortia

The future of mobility will be software defined!

Open Technologies and Open Source helps to Collaborate in a Changing Automotive Market!

We invite you!

Thank you!

Andreas Riexinger
Andreas.Riexinger@de.bosch.com

Find out more and join us

https://openadx.eclipse.org/

https://wiki.eclipse.org/OpenADx

Useful Links

- OpenADx
  - Whitepaper: https://openadx.eclipse.org/resources/OpenADx-Manifesto-v07-2020.pdf
  - Website: https://openadx.eclipse.org/
  - Wiki: https://wiki.eclipse.org/OpenADx
  - Mailing List: https://accounts.eclipse.org/mailing-list/openadx
  - OpenADx in Blogs: https://blog.bosch-si.com/developer/5-things-you-should-know-about-openadx
  - Eclipse iceoryx
    - https://github.com/eclipse-iceoryx/iceoryx
    - https://projects.eclipse.org/projects/technology.iceoryx
  - Eclipse Cloe:
    - https://github.com/eclipse/cloe
    - https://projects.eclipse.org/projects/technology.cloe
  - Eclipse OpenMCX: https://projects.eclipse.org/proposals/eclipse-openmcx
  - Eclipse APP4MC: https://www.eclipse.org/app4mc/
  - Eclipse Cyclone DDS: https://projects.eclipse.org/projects/iot.cyclonedds
  - Eclipse Zenoh: http://zenoh.io/
  - Eclipse Kuksa: https://www.eclipse.org/kuksa/
  - Panorama: https://panorama-research.org/
- openMDM: https://www.openmdm.org/
- openPASS: https://wiki.eclipse.org/OpenPASS-WG
- openMobility: https://openmobility.eclipse.org/
- openGENESIS: https://wiki.eclipse.org/OpenGENESIS_WG

White Papers

OpenADx Manifesto

DOWNLOAD