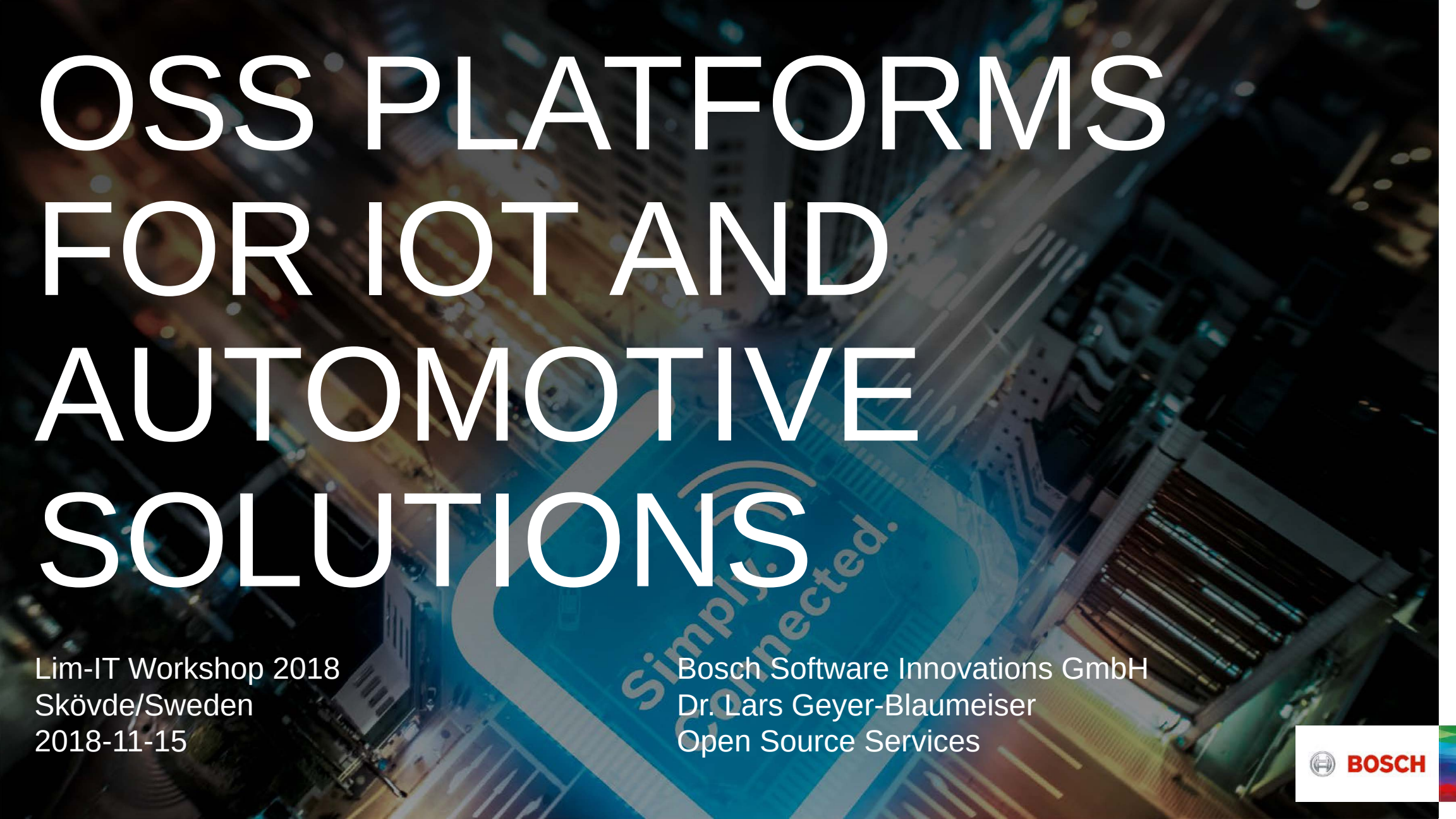
OSS PLATFORMS FOR IOT AND AUTOMOTIVE SOLUTIONS



Lim-IT Workshop 2018
Skövde/Sweden
2018-11-15

Bosch Software Innovations GmbH
Dr. Lars Geyer-Blaumeiser
Open Source Services

BOSCH

Bosch – a global network
Four business sectors

Mobility Solutions

Industrial Technology

Energy and Building Technology

Consumer Goods

Researchers and developers across the globe

45,700 associates in research and development

3,000 developers for the Internet of Things

15,000 software engineers

94 research and development locations in 25 countries

BOSCH

Bosch Software Innovations
Spearheading the Internet of Things

Market presence

6.2m

connected devices using Bosch IoT Suite

Know-how

800+

IoT experts around the world (Germany, Bulgaria, Singapore, China, Japan, USA)

Experience

250+

IoT international projects in the areas of manufacturing, mobility, energy, home & building, city, agriculture …

Mobility

Solutions for electro mobility, intermodal transporta-tion, and connected vehicles

Industry

Solutions for connected manufactu-ring

Agriculture

Solutions to support the sustainable intensification of food production

Energy

Solutions for smart and simple energy management

Smart Home & Building

Solutions for connected homes and commercial buildings

Smart City

Connected solutions for urbanites to make life easy and efficient

Bosch IoT Suite

INST-CSS/BSV-OS | 15.11.2018

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SOFTWARE BUSINESS

Service-based products are promising
Smart devices, websites, apps, and clouds

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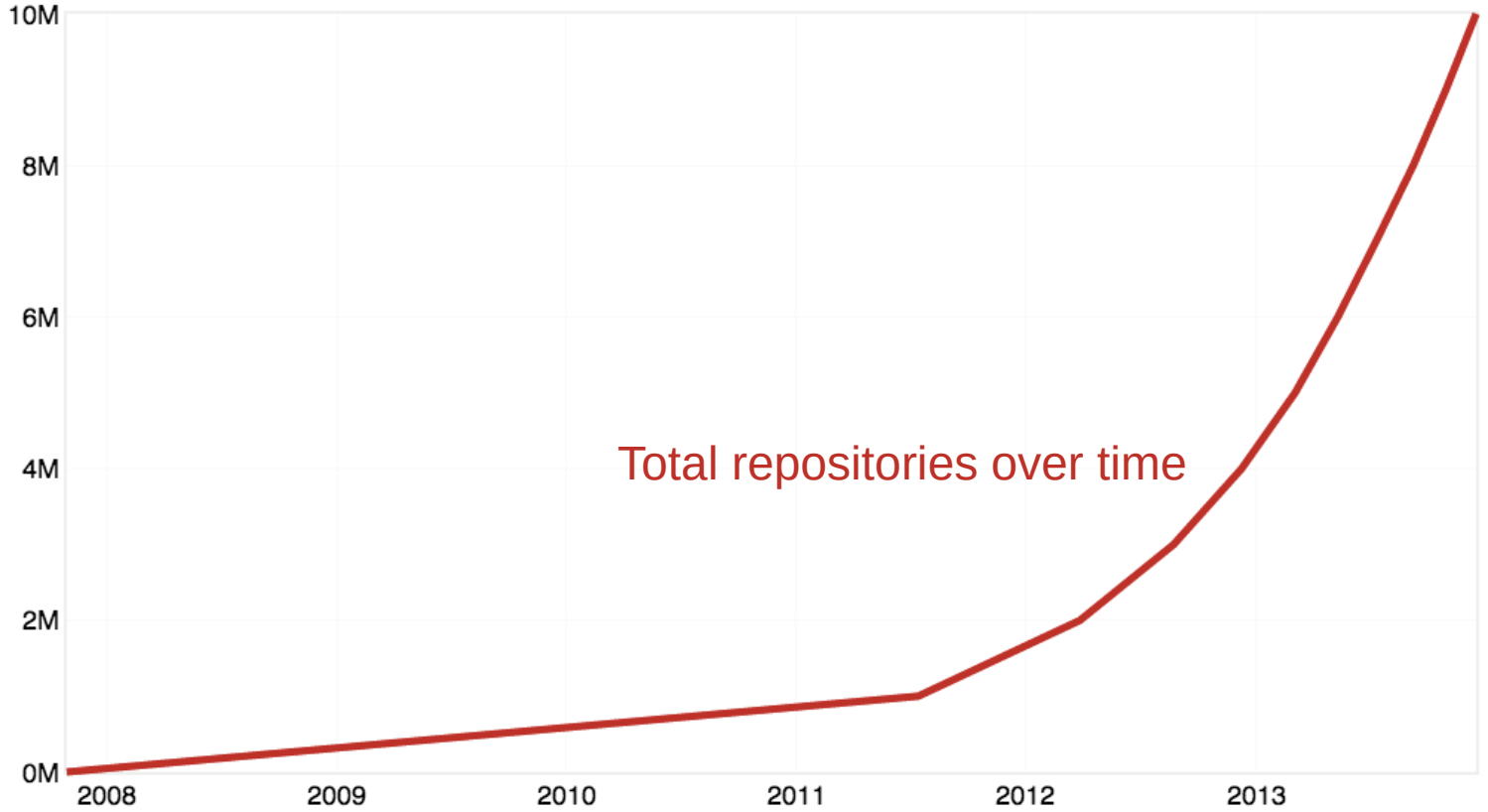
Software as a product business models are getting out of fashion.

Service based products are on the rise.

GETTING THE SOFTWARE FOR YOUR SERVICE

BOSCH

Github: Leading open source hoster
Software already there?



- 20M total users, (5.8M+ active)
- 57M total repositories (19.4M+ active)
- 10.7M+ active issues
- 331k+ active organizations
- 100M pull requests

Open source: A tool to reach business goals

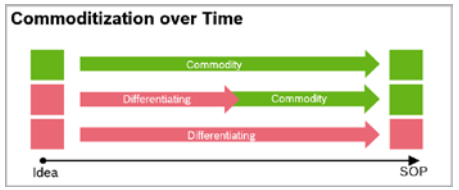
How OSS works for companies

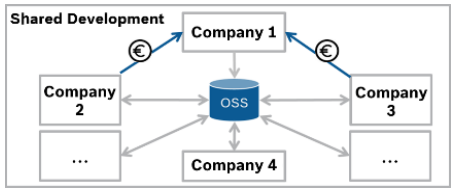
Partition into differentiating and commodity SW

Identify commodity for relevant point in time

Shared development

Shared commodity is competitive advantage





What they gain from OSS

Efficient technology development

- **Agile Collaboration**
- **Increase Quality**
- **Gain Speed**
- **Share Risks**
- **Reduce Costs**

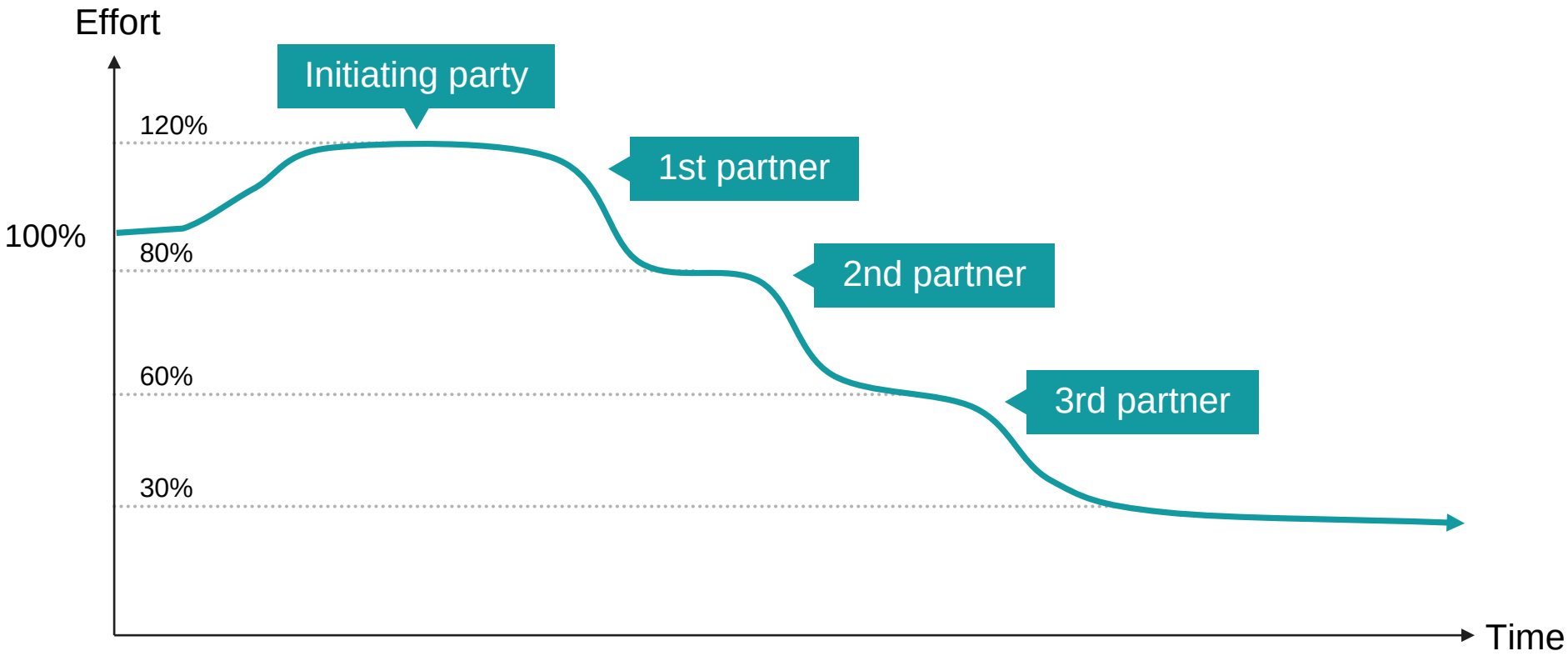
Higher independence

- **Minimize dependency** on Suppliers
- Break/prevent a **proprietary monopoly**

Accelerated market penetration

- **Viral marketing**
- **Establish a new market** in technology
- **Standardization**

Effort for strategic open source development



IOT PLATFORMS: NO-ONE CAN DO I(O)T ALONE.

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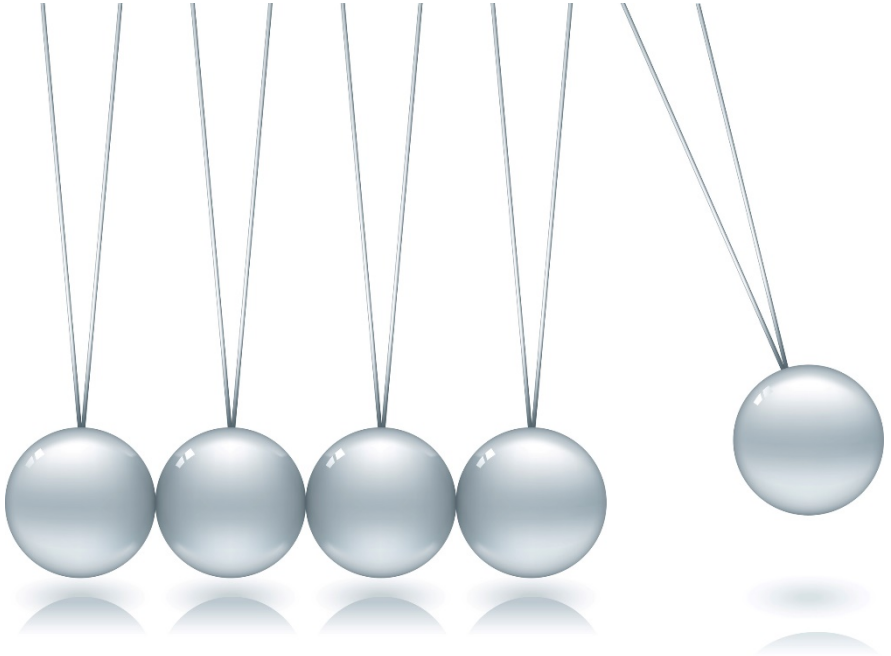
Major changes in doing business
for established industries

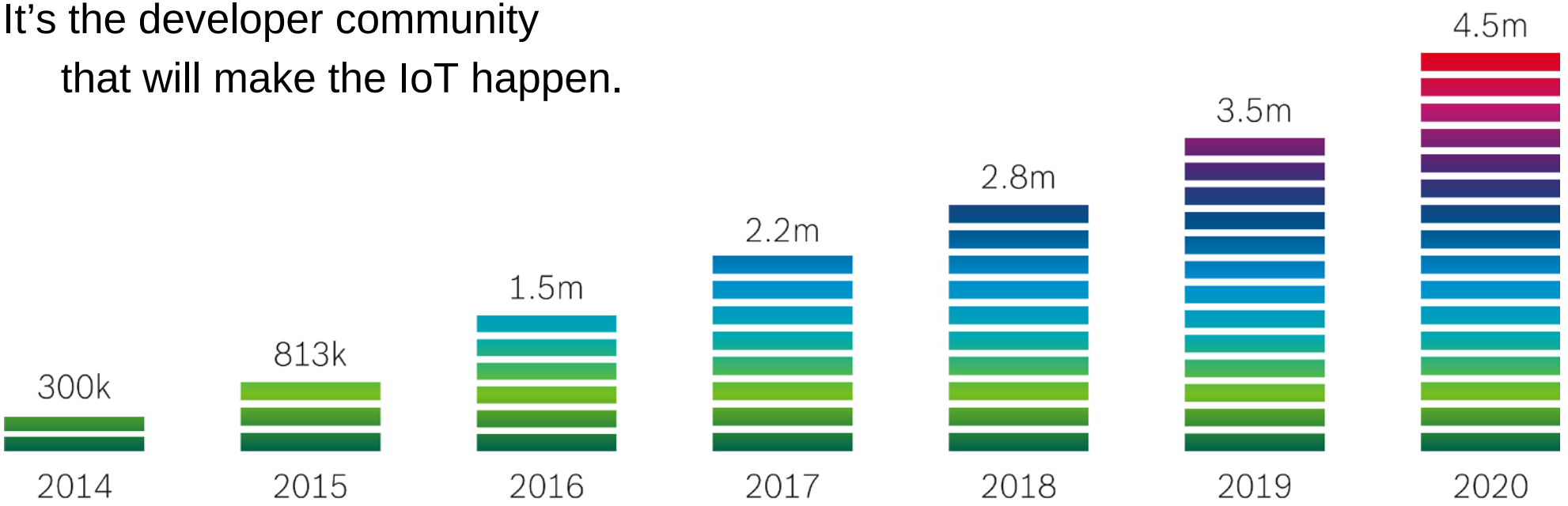


Value chain

Business ecosystem

Technology adoption is strategic

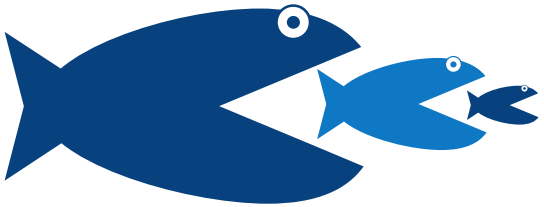
It’s the developer community
that will make the IoT happen.



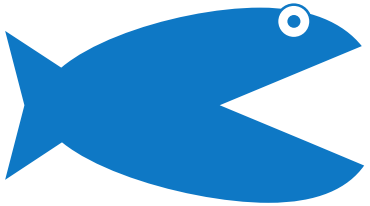
Source: Report: IoT: Breaking Free From Internet And Things | vmob.me/IoT
©Vision Mobile | June 2014 | Licensed under BY ND

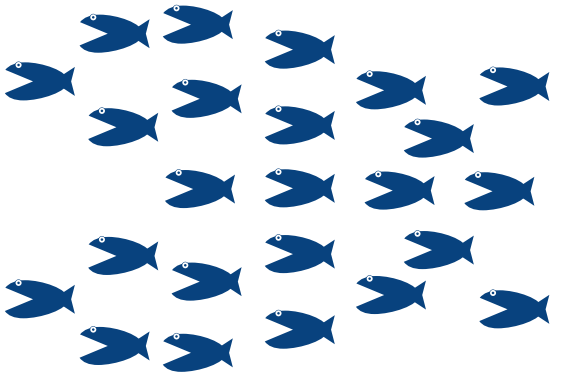
Playing the platform game
... and win

Big fish eat small fishes



… but small fishes
can build swarms





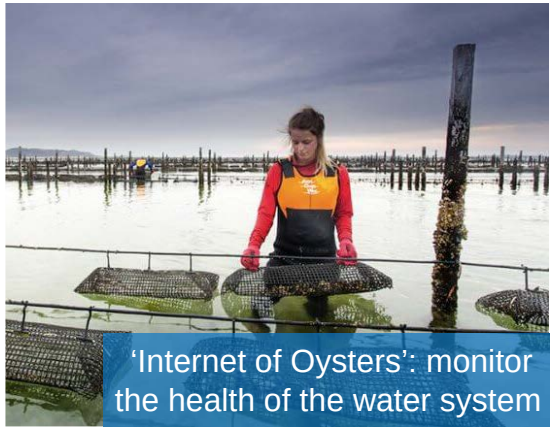
We connect every thing

Bosch IoT Suite

Device management for connected filters

Smart heating: intelligent networking of heating systems


IoT Gateway: easy connection to Industry 4.0 environments


‘Internet of Oysters’: monitor the health of the water system


TrackMyTools: a smart inventory management system


Indego Connect: intelligent device management


Connected asset intelligence system for rail freight


Firmware and software updates over the air

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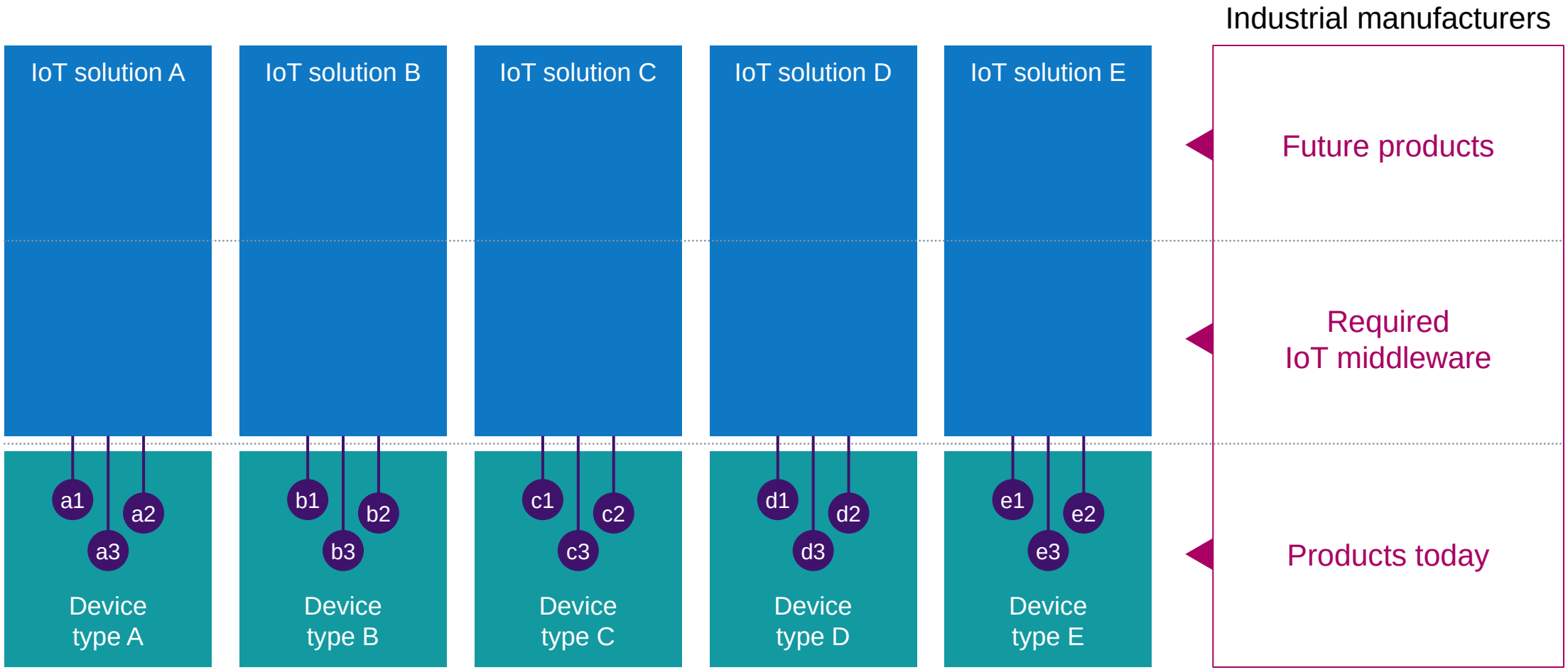
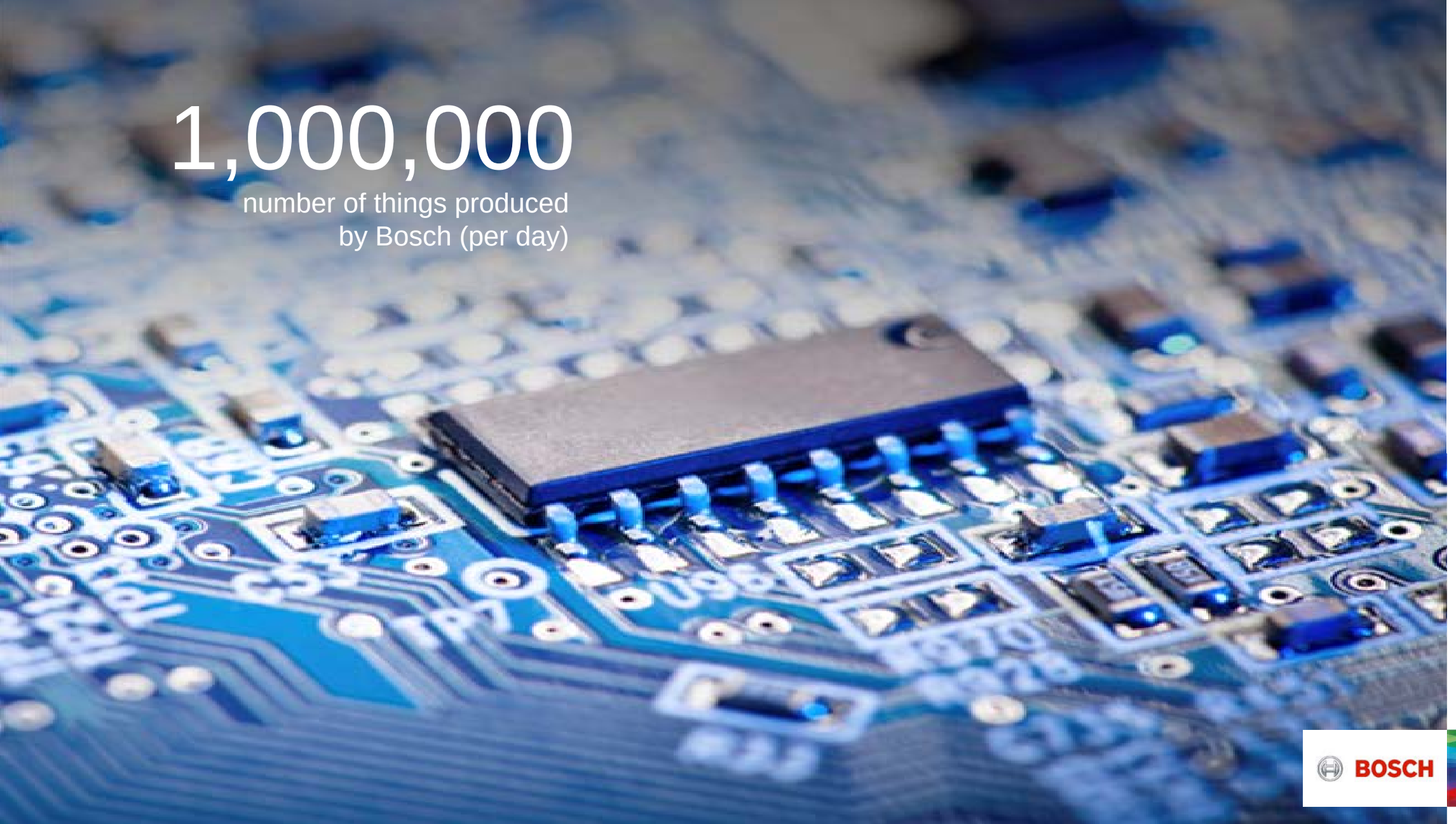
Current IoT
Isolated solutions



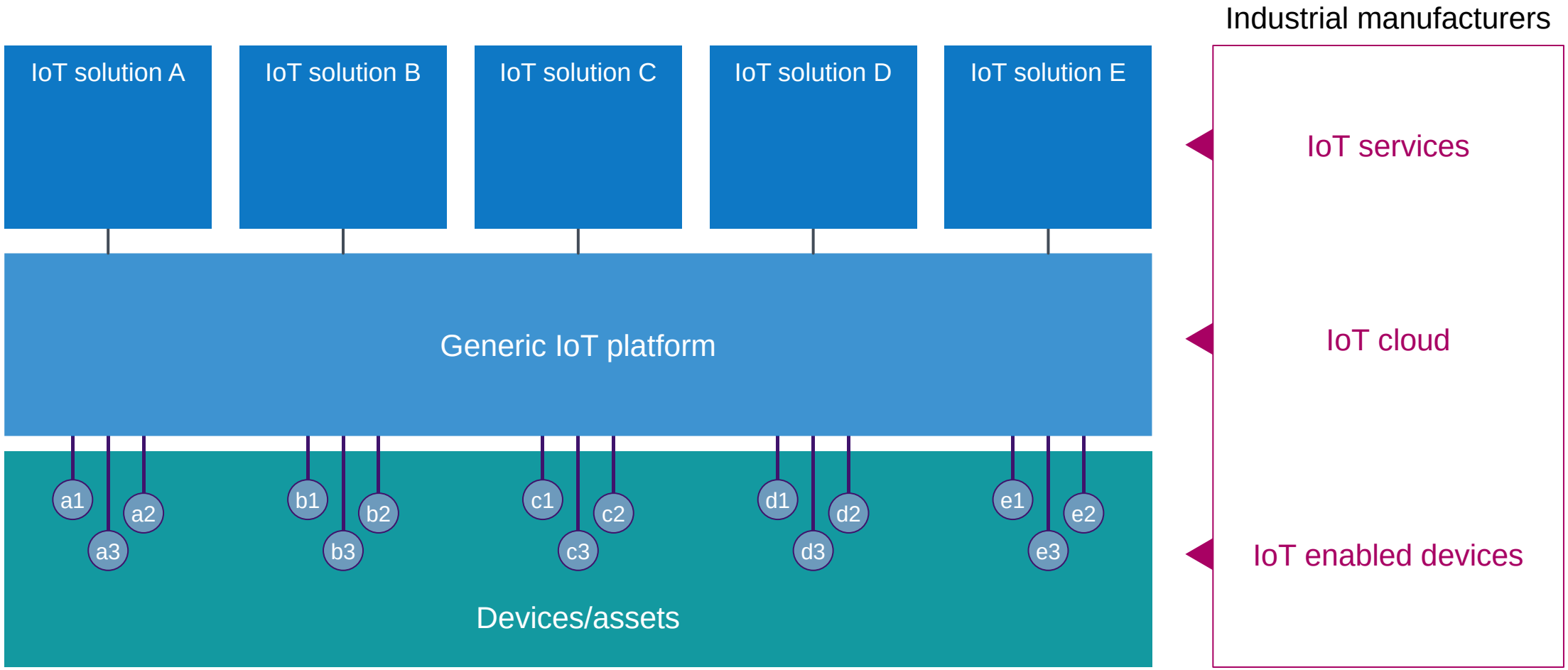
“In a few years, every electronic product will be internet-capable. The question is no longer if, but when.”

Dr. Volkmar Denner

Chairman, Board of Management
Robert Bosch GmbH


1,000,000
number of things produced
by Bosch (per day)
BOSCH

IoT Vision: Cross vendor, cross domain



Open IoT Platform with OSS

Overall Goal

- Business success for Bosch Group in IoT with products and services in the verticals Mobility, Industry, Energy, Building
- Interconnections and interoperability of devices/ services (therefore Bosch should “bet on the right (platform) horse”)

Assumption

- 2-5 major IoT platforms (in next 5-7 years)
- At least one of them will be Open source
- Big industrial manufacturers not able to position proprietary platforms among top 5 and customers/partners would not accept it
- No risk/dependency on proprietary 3rd party platform

Conclusion

Open platform strategy with OSS

Eclipse Foundation: strategic membership
Actively engaged within the Eclipse IoT Working Group

Eclipse Ditto
… where IoT devices and the state of their digital twins get together

Eclipse Leshan
A Java library for implementing Lightweight M2M servers and clients

Eclipse hawkBit
A domain-independent, back-end solution for managing software rollouts in IoT

Eclipse Vorto
A smart, open approach to the interoperability of IoT products

Eclipse Hono
Enabling device-related communication between connected devices and IoT applications in the cloud

BOSCH

GOAL

De-facto standard for IoT cloud platforms:

ready-to-deploy, micro-service-based

BOSCH

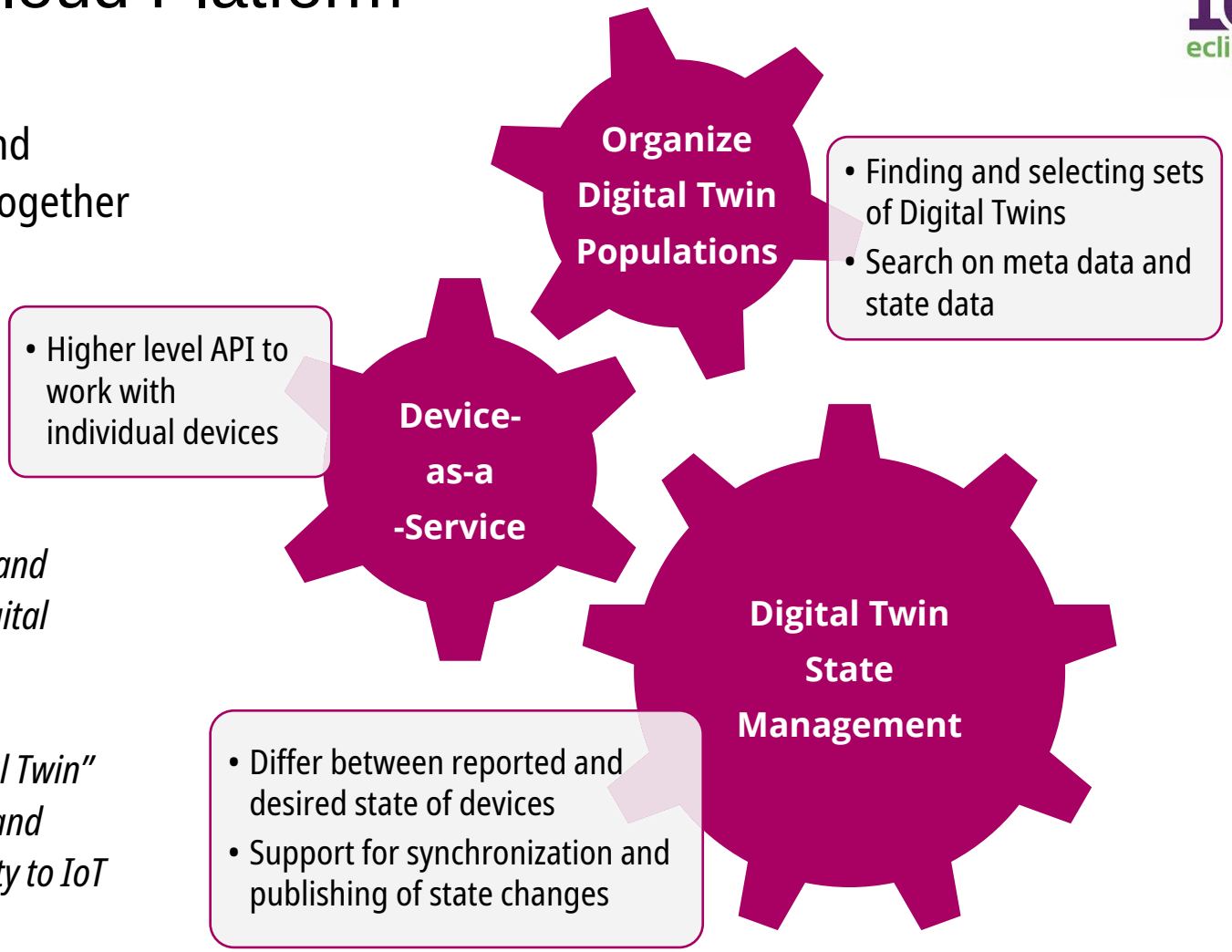
An Open Source IoT Cloud Platform
Eclipse Ditto

... where IoT devices and their digital twins get together

https://eclipse.org/ditto/

Digital Twin ... is a holistic view of all capabilities and aspects of a device/product asset including its digital representation.

Eclipse Ditto addresses core aspects of the "Digital Twin" metaphor to understand and manage industrial and consumer IoT scenarios by bringing back simplicity to IoT developers.



An Open Source IoT Cloud Platform
Eclipse Hono

Telemetry data
Hono can ingest and forward sensor readings from millions of devices with low latency.

Transparent device access
Applications can send messages to devices using a unique address provided by Hono.

Privacy
Sensor data is neither stored nor processed by Hono. Only metadata is used for making routing decisions.

Standard Interfaces
Hono exposes its API using AMQP 1.0 (an OASIS standard) and REST.

Flexibility
Hono can be extended with protocol adapters supporting arbitrary device communication protocols.

“Eclipse Hono is all about connecting the T (things) of the IoT to the I (internet). We’re not talking about just a few Raspberry Pis. We’re talking about cloud scale with millions of devices reporting billions of sensor readings.”

Kai Hudalla, Project Lead

An Open Source IoT Cloud Platform
Eclipse hawkBit

- Software provisioning to constrained edge devices & more powerful controllers and gateways:
  - Device and Software Repository
  - Artifact Content Delivery
  - Software Update and Rollout Management
- Direct and indirect device integration available.
- Cloud-ready, powered by Spring Boot.
- Includes a management API as well as a graphical user interface.

“Software updates for the Internet of Things have never been easier with an open source platform.”

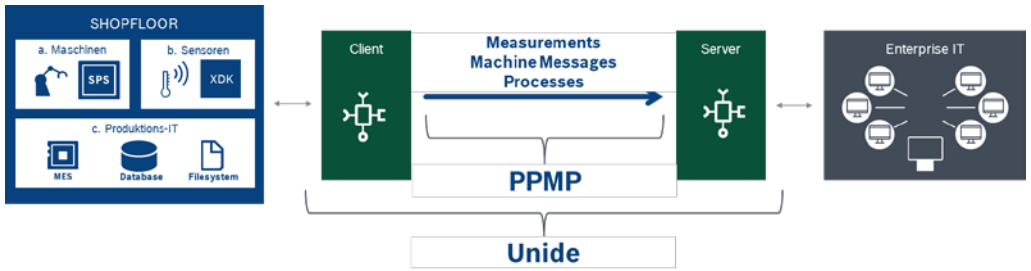
Kai Zimmermann, former Project Lead

Eclipse Unide – understand industry devices

The ecosystem of PPMP

- **Production Performance Management Protocol (PPMP)**
  Standardized lightweight structure for receiving data of production machines
- **Message types**
  - Machine events (e.g. “cooling water low”)
  - Sensor measurements (e.g. temperature 37°)
  - Process data (e.g. Tightening process curve)
- Integrates **manufacturing characteristics** like part ids, part types, machine status
- Does not impose constraints on transport (**rest, amqp, mqtt etc.**)

- **Unide** provides
  - PPMP bindings in different languages (java, python)
  - A server for
    - validating messages
    - Persisting data (to influxdb)
    - Visualizing the data (using grafana)
  - Platform for further evolution of the protocol

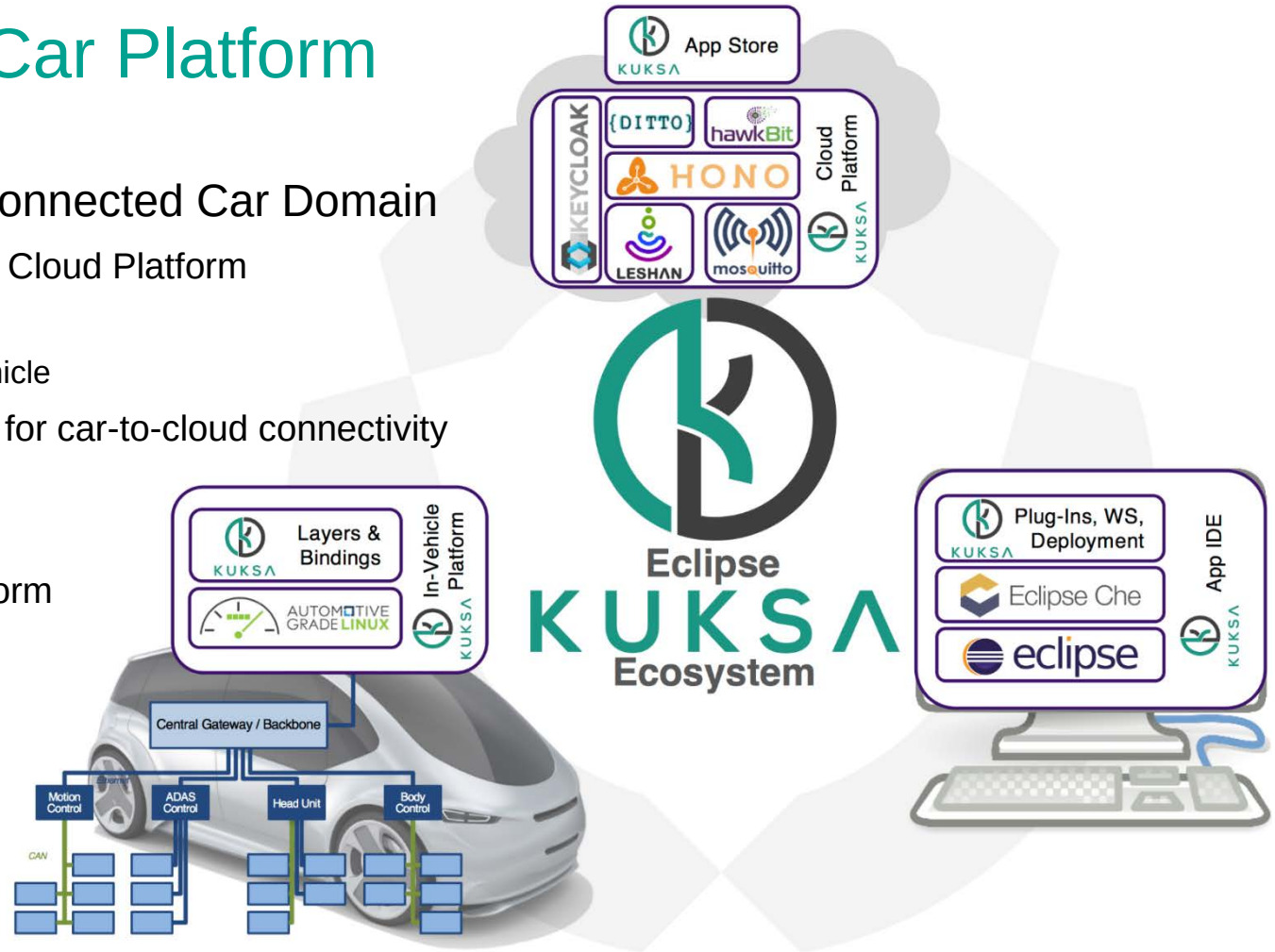


Join and find more information here: http://unide.eclipse.org

Eclipse Kuksa
Open Source Connected Car Platform

Objective: Provide Technology for the Connected Car Domain

- Development of an open source automotive IoT Cloud Platform
  - Architectural considerations for the cloud platform
  - Establishment of standardized interfaces to the vehicle
- Definition and development of Service enablers for car-to-cloud connectivity
  - Network infrastructure considerations
  - Next generation mobile networks
- Development of an open source in-vehicle platform
  - Safe and secure gateway to the cloud
  - In-vehicle data access mechanism and application platform



Join and find out more:

https://projects.eclipse.org/proposals/eclipse-kuksa

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AUTONOMOUS DRIVING: NO ONE CAN DO IT ALONE ☺

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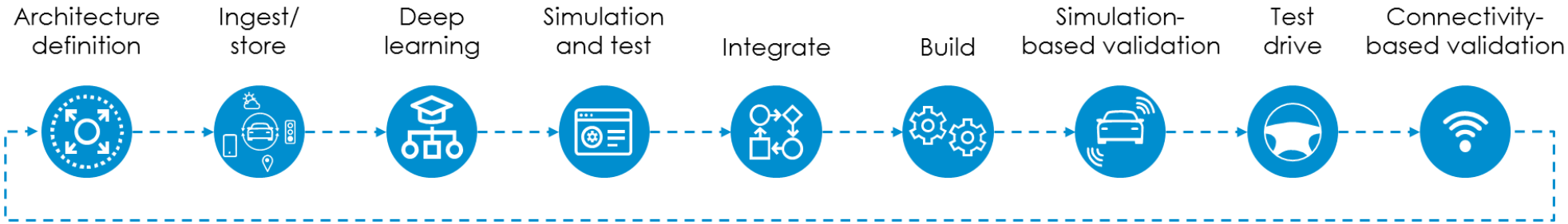
Eclipse OpenADx - xcelerate your AD development
Tool Chain for Automated Driving Systems

- **Automated Driving (AD) is clustered into three equally important technology areas:**
  1. In-vehicle technology
  2. Cloud technology (backend)
  3. Design, development, test and validation tools (tool chain)

- **OpenADx is focused on the AD tool chain**
  The goal is to accelerate AD development through open collaboration and open source.
- **OpenADx' vision** is to ensure transparency and make the complex AD tool landscape more easily accessible for its users.



Join and find more information here: https://wiki.eclipse.org/OpenADx

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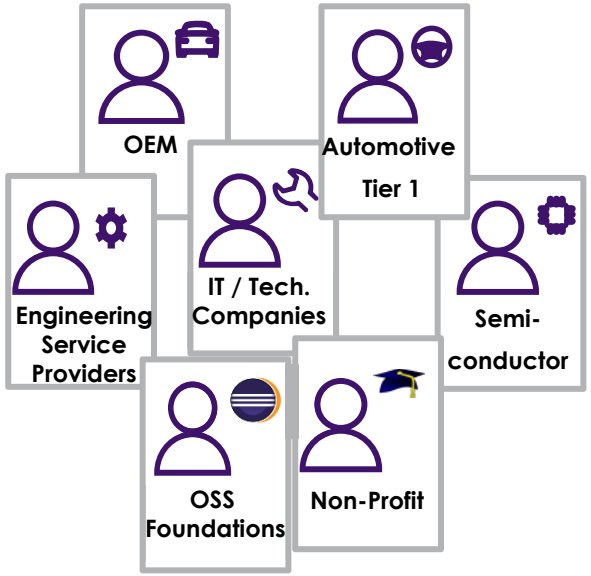
Eclipse OpenADx - xcelerate your AD development

Identify target partners to initiate ecosystem



AVL, Bosch, CEA, Dassault Systemes (3DS), Elektrobit, German Aerospace Center (DLR), IPG Automotive GmbH, itemis, MathWorks, Microsoft, Renesas, Samsung, TESIS DYNAware GmbH, ZF Friedrichshafen AG, Vattenfall AB

Common open activities to establish cooperation

Bosch CONNECTED EXPERIENCE 2018
LEARNING / SHARING / MAKING / HACKING
BERLIN FEBRUARY 20-22

Testbeds

- Simulation Framework
- Massive Data Ingest

Open source activities by ecosystem partners

ROS.org

- ROS2
- RVIZ2
- ROSBAG for ROS2

Microsoft AirSim Simulator Platform

#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

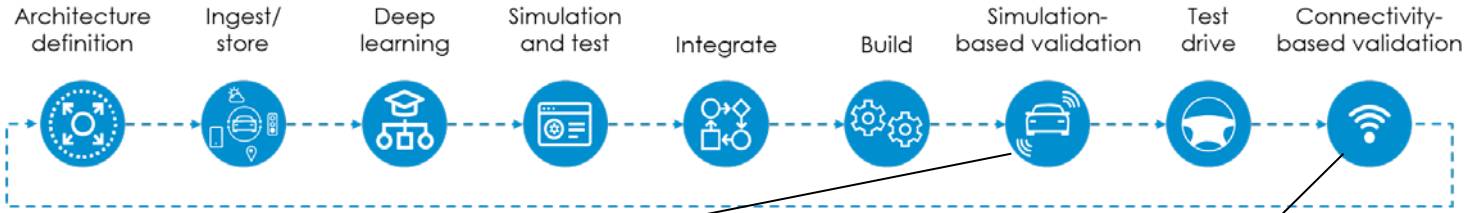
- Controlled experimentation environment
- Validation of customer requirements and technical feasibility
- Focus on AD toolchain integration aspects
- Can lead to longer term open source project

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

Testbed

OpenADx launched at BCW18

Software in the loop

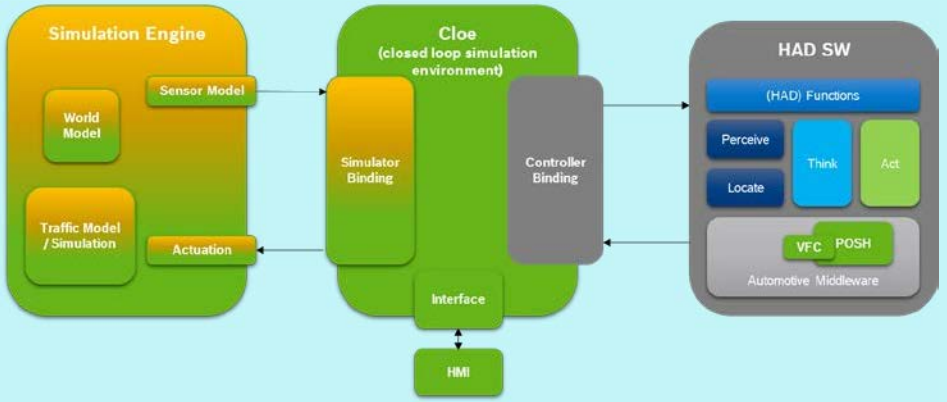


Software in the loop (SiL) Test Environment

Models and Data Interface

Simulation Middleware

System under test



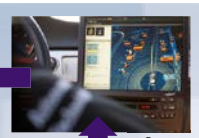
Open-Context-Scenarios

Test cases

Test report

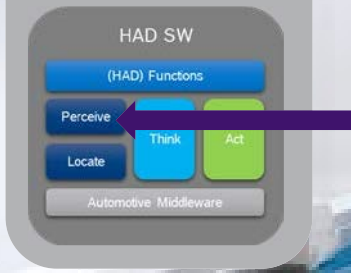
Ok or nok

unknown scenarios



observe

Domain Controller



perceive

Field-based or Connectivity-based validation

V&V

Verification in a virtual environment

Validation in real-world environment

Iterative and seamless

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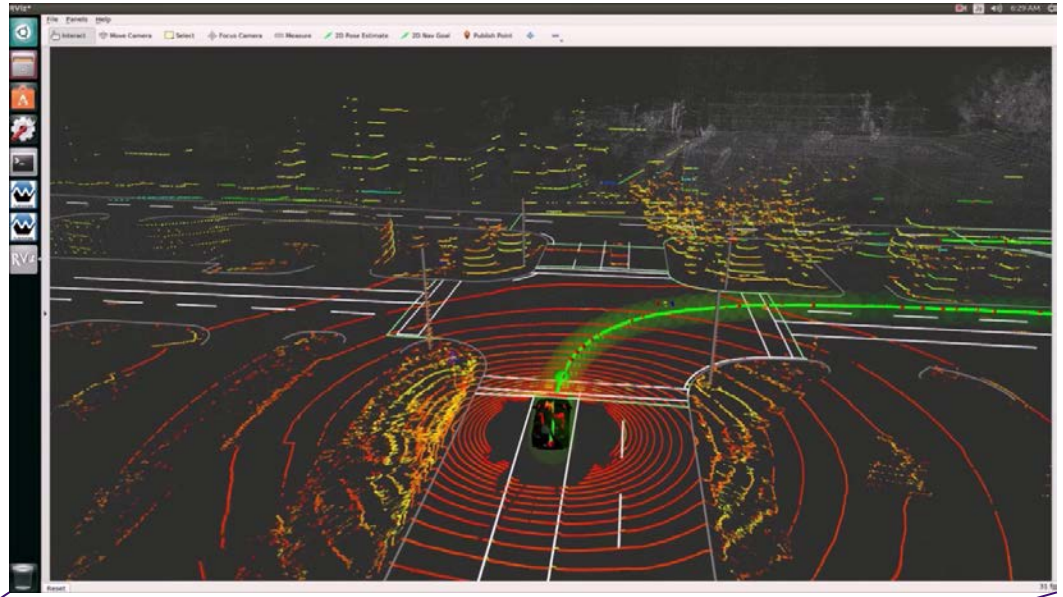
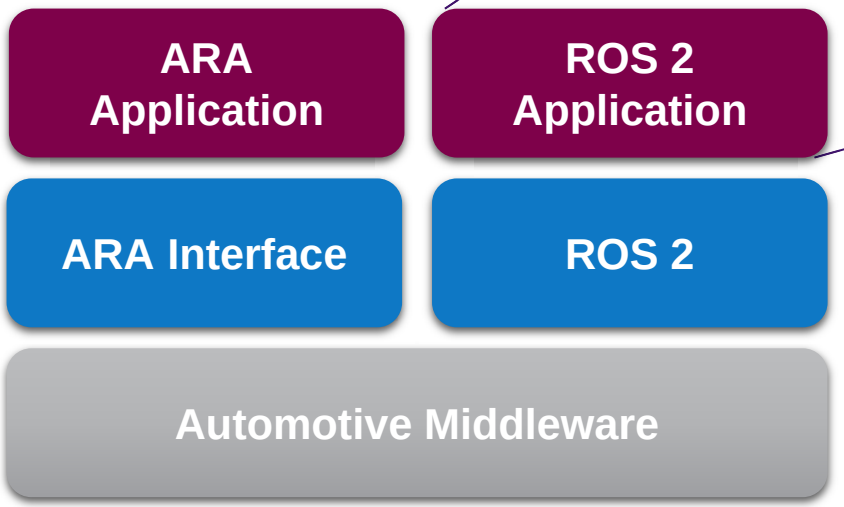
Automotive ROS

- Use Cases:
  - Post Simulation
  - Simulation (artificial data)
  - Visualisation while Simulation
  - In Car Visualisation
  - Introspection (ros topic echo etc)





ARA –**A**utosa**R** **A**daptive

Bosch Car Multimedia – Connected Information Solutions
APERTIS

https://www.apertis.org

APERTIS

a derivate of

debian

- A versatile infrastructure, fully based on open source
- Tailored to the automotive needs and fit for a wide variety of electronic devices
- Sustainable security and flexibility are two of its primary strengths
- Maintain up-to-dateness efficiently over long product lifetime
- Grants discretion of data ownership
- Efficient, modular, resilient as also scalable & customizable

APERTIS enables secure connected mobility and supports maintaining flexibility

BOSCH

OSS@BOSCH ...
MORE TO COME

BOSCH

THANK YOU

Dr. Lars Geyer-Blaumeiser

Open Source Services

lars.geyer-blaumeiser@bosch-si.com

Bosch Software Innovations

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