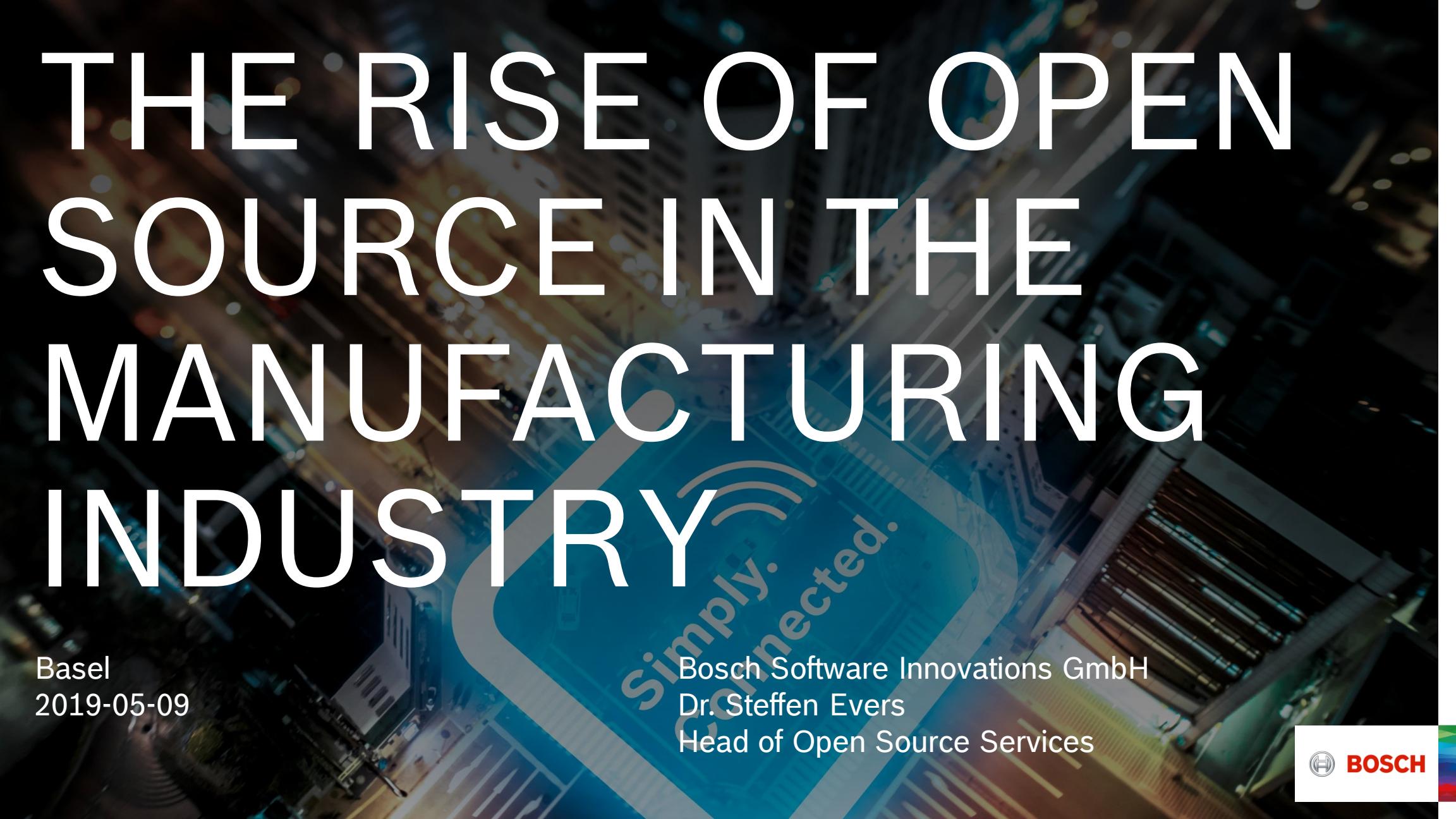


THE RISE OF OPEN SOURCE IN THE MANUFACTURING INDUSTRY



Basel
2019-05-09

Simply.
Connected.

Bosch Software Innovations GmbH
Dr. Steffen Evers
Head of Open Source Services



Bosch – a global network

Four business sectors - on the way into digital transformation

Mobility Solutions



Industrial Technology



Energy and Building Technology



Consumer Goods



Researchers and developers across the globe

45,700
associates in
research and
development



15,000
software
engineers



3,000
developers
for the Internet
of Things



94
research and
development
locations in
25 countries



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 electromobility, intermodal transportation, and connected vehicles



Industry

Solutions for connected manufacturing



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



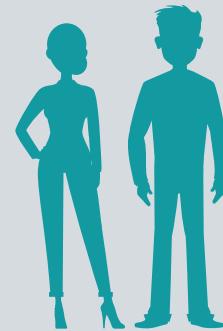
Bosch IoT Suite

SOFTWARE BUSINESS

“Software is eating the world”

[Marc Andreessen, 2011]

Facebook is the
world's biggest and
most up-to-date
registration office
–
**without legal
regulation.**



Airbnb is the world's
biggest hotel chain
–
**doesn't own a
single room.**



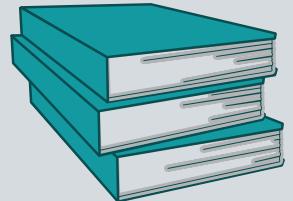
Amazon is the
biggest book store
–
**without a single
bookshelf.**



Pixar has won
16 Oscars
–
**never employed
an actor.**

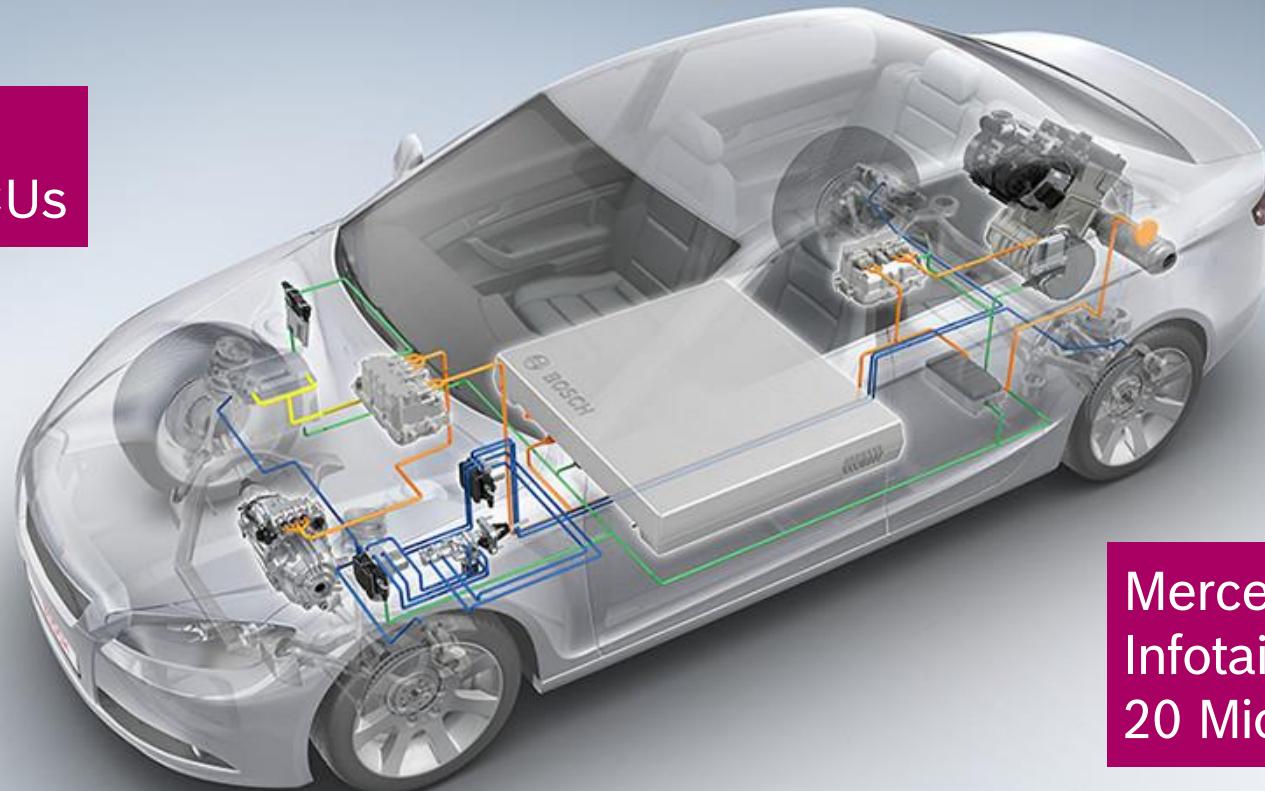


Uber is the biggest
cab operator
–
**doesn't operate a
single car.**



Realized by software 90% of automotive innovations

50 – 100
networked ECUs



Mercedes S-Class
Infotainment subsystem
20 Mio. LOC

Service-based products are promising

Smart devices, websites, apps, and clouds



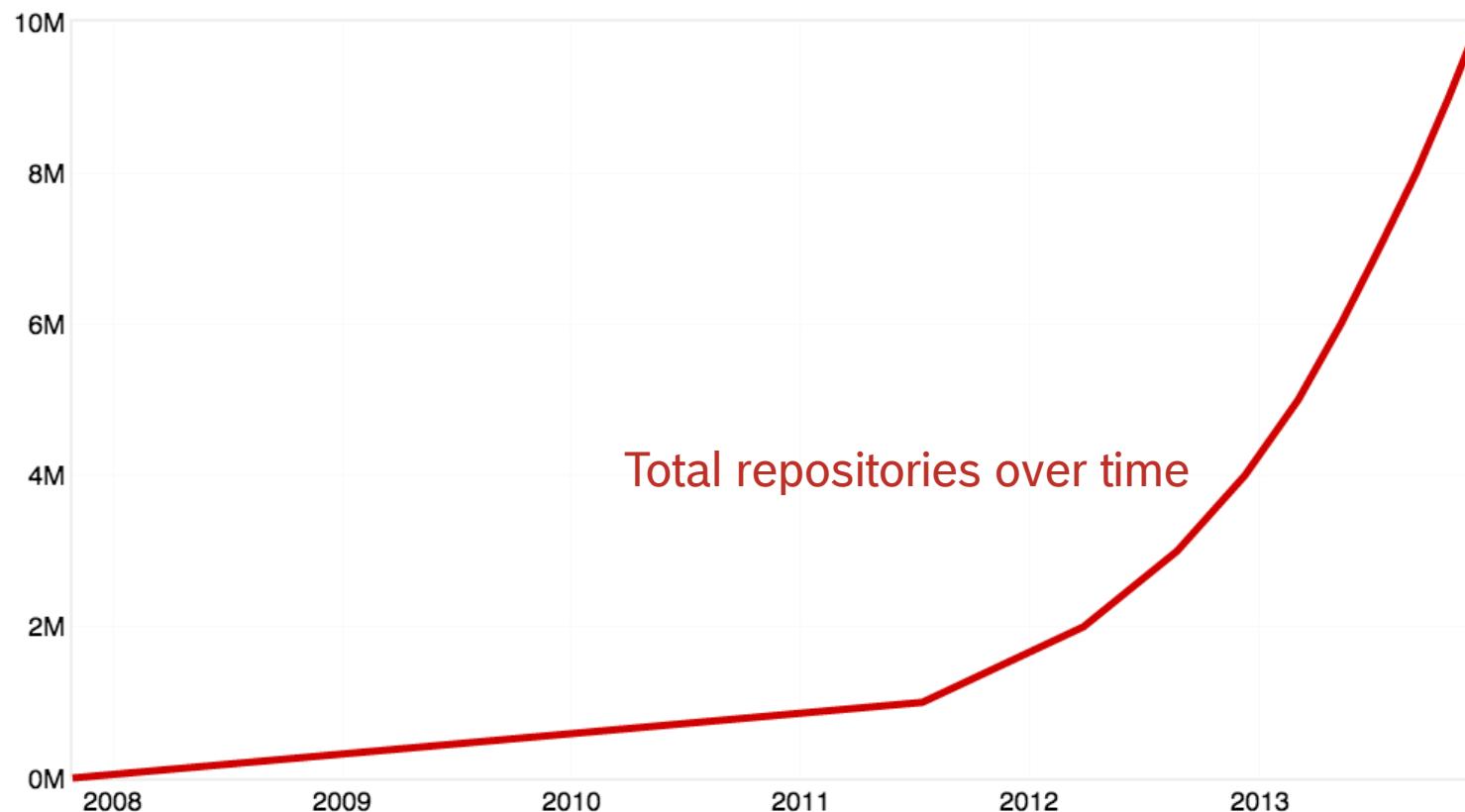
Software as a product business models
are getting out of fashion.

Service based products are on the rise.

GETTING THE SOFTWARE FOR YOUR SERVICE

Github: Leading open source hoster

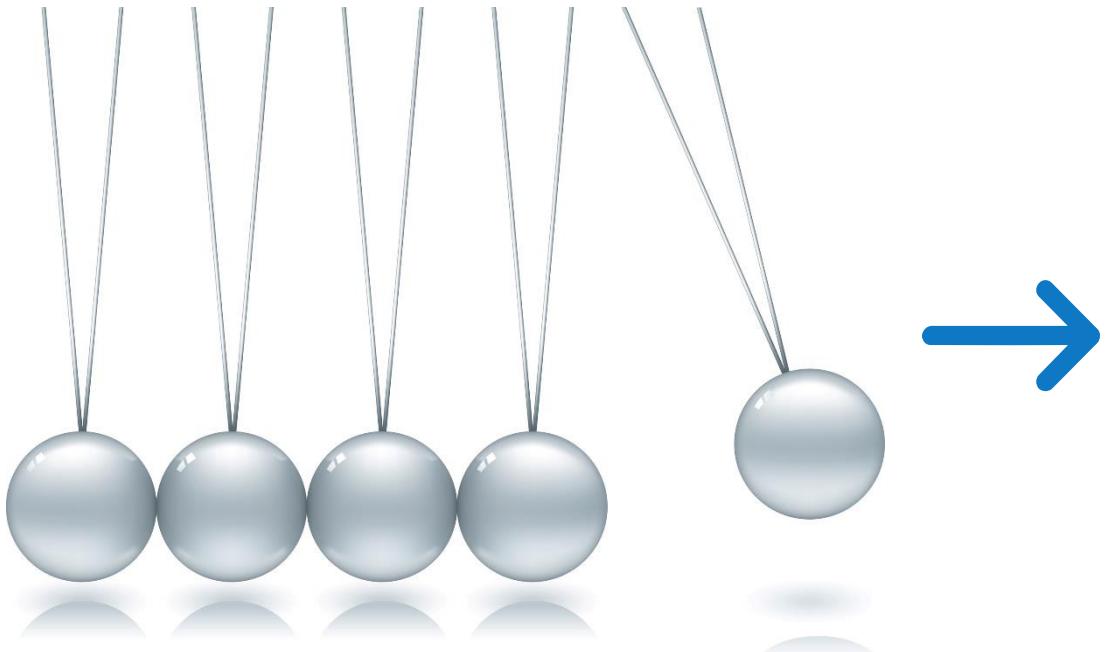
Software already there?



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

BUILDING ECOSYSTEMS

Major changes in doing business for established industries



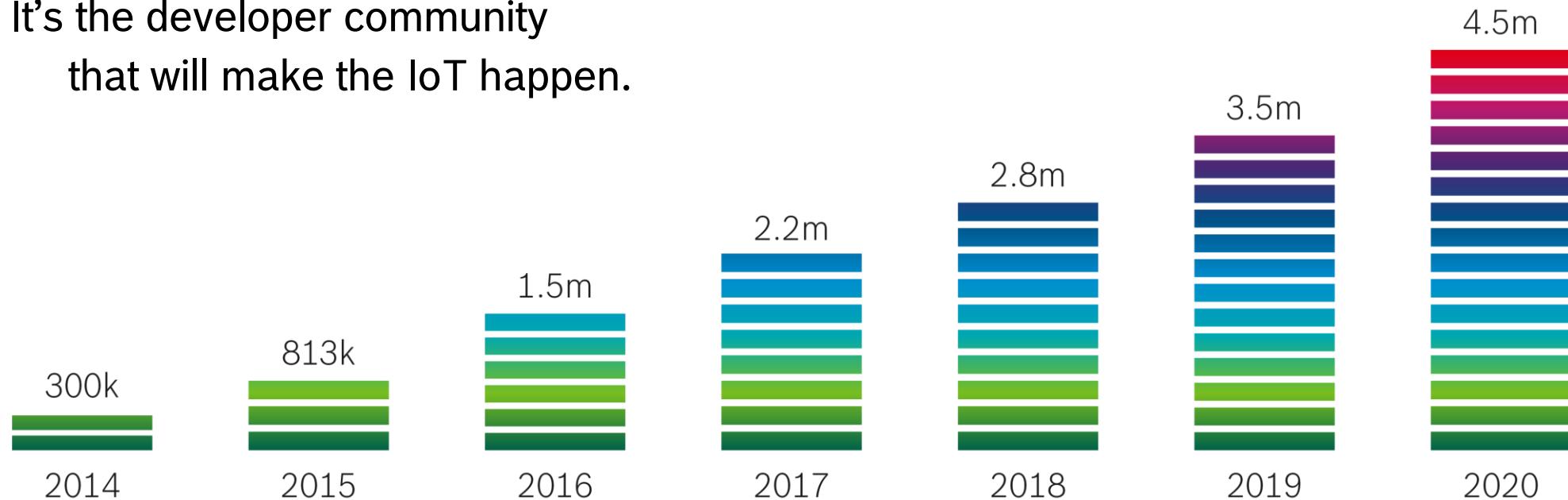
Value chain



Business ecosystem

Technology adoption is strategic

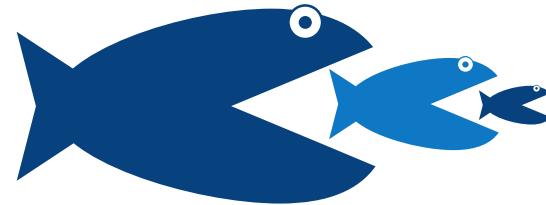
It's the developer community
that will make the IoT happen.



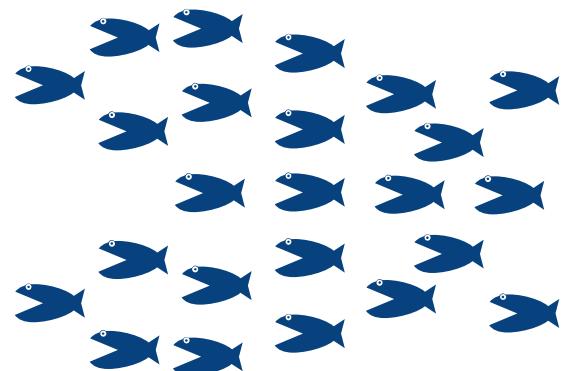
Source: Report: IoT: Breaking Free From Internet And Things | vmb.me/iot
©Vision Mobile | June 2014 | Licensed under BY ND

Playing the platform game ... and win

Big fish eat small fishes



... but small fishes
can build swarms



Resulting in platform ecosystem battles

Linux and AWS

Aug 27th 2016

Cloud chronicles

The
Economist

How open-source software and cloud computing have set up the IT industry for a once-in-a-generation battle

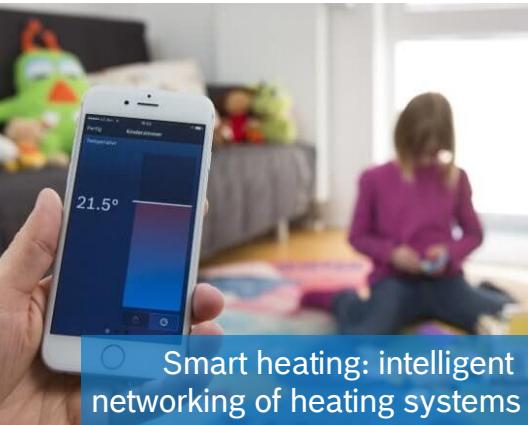


IOT PLATFORMS: NO-ONE CAN DO I(O)T ALONE.

We connect every thing



Device management for connected filters



Smart heating: intelligent networking of heating systems



IoT Gateway: easy connection to Industry 4.0 environments



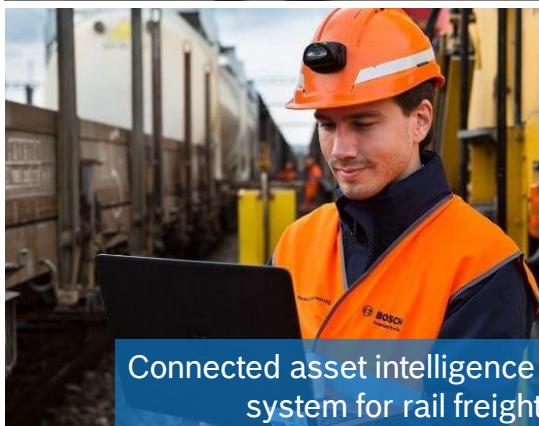
'Internet of Oysters': monitor the health of the water system



TrackMyTools: a smart inventory management system



Indego Connect: intelligent device management

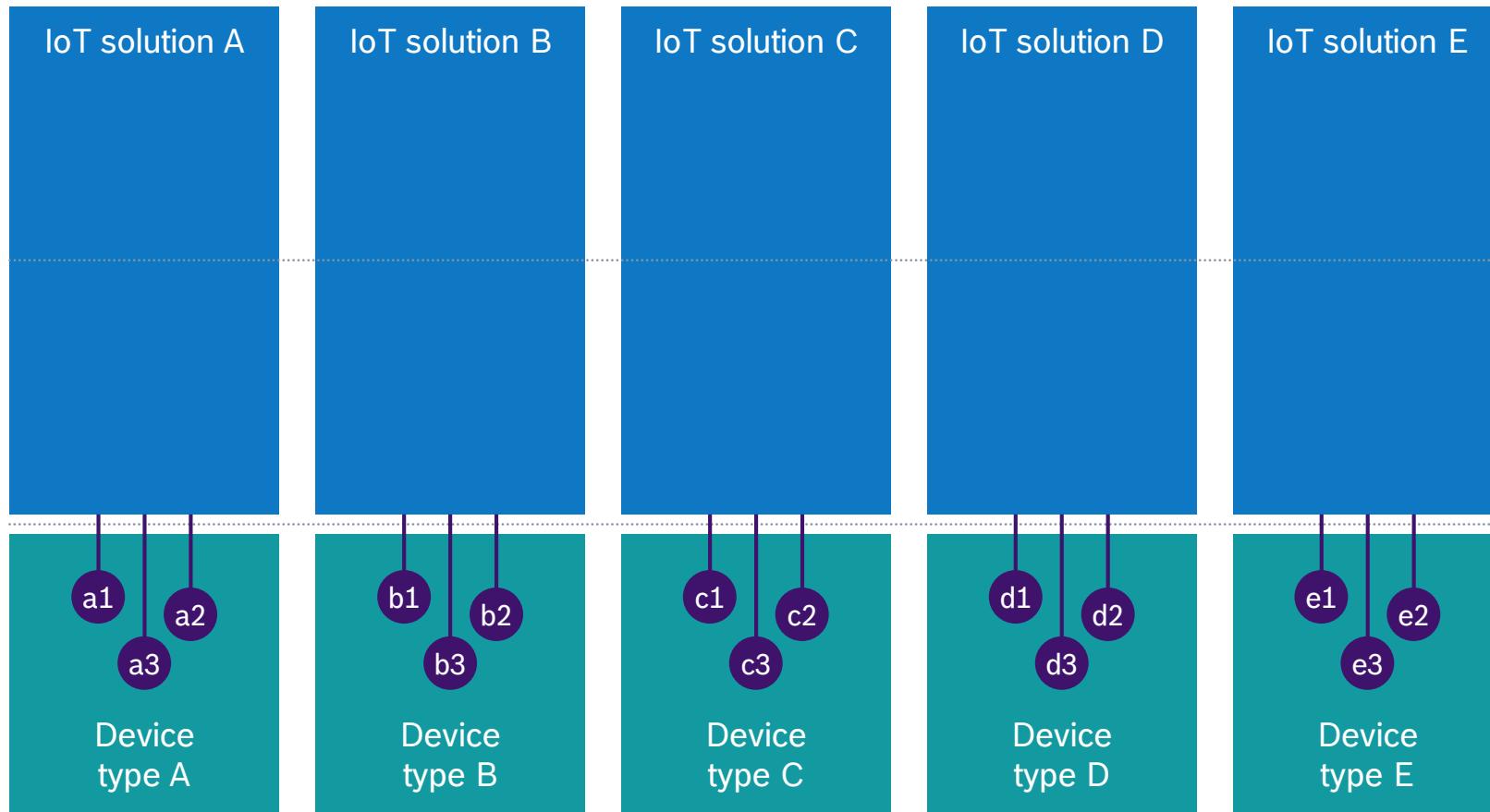


Connected asset intelligence system for rail freight



Firmware and software updates over the air

Current IoT Isolated solutions



Industrial manufacturers

Future products

Required
IoT middleware

Products today

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

Dr. Volkmar Denner

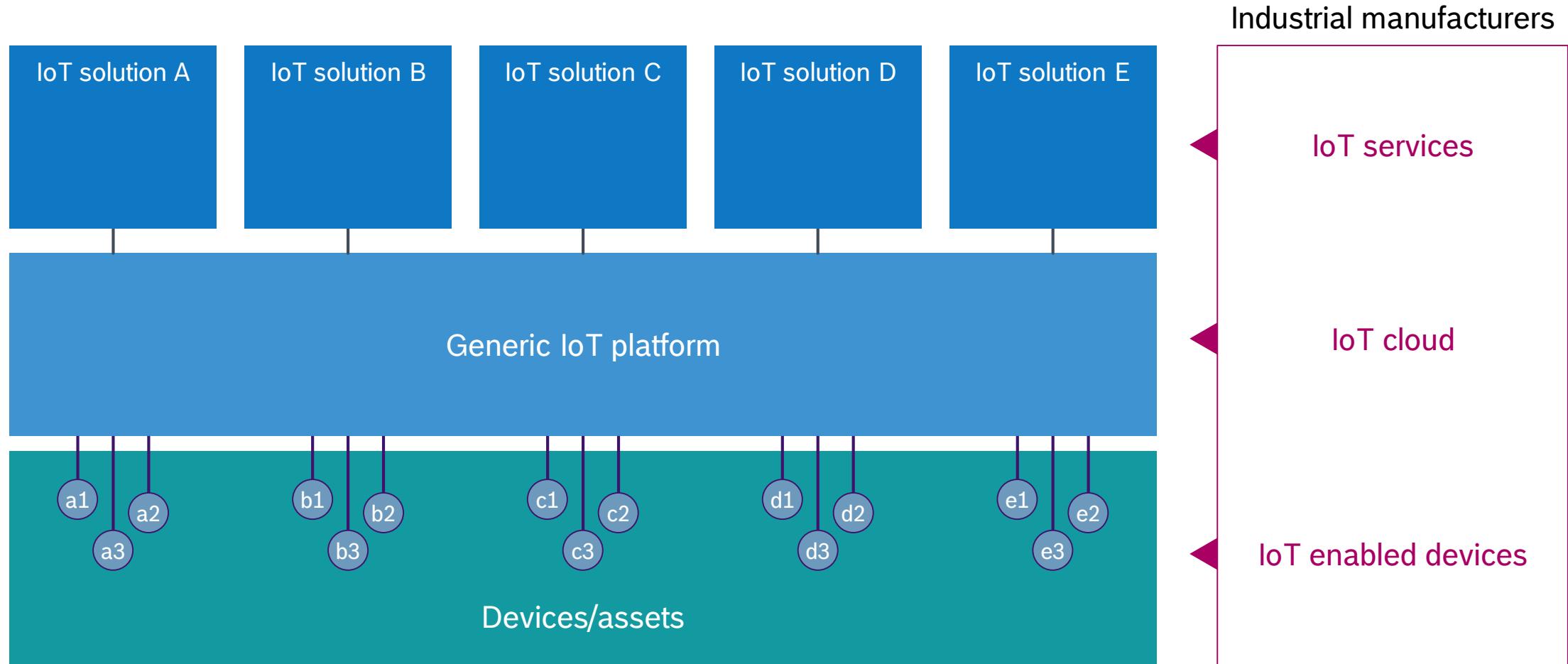
Chairman, Board of Management
Robert Bosch GmbH



1,000,000

number of things produced
by Bosch (per day)

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

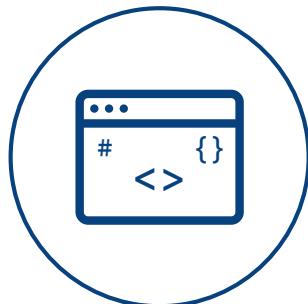


Eclipse Hono

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



Eclipse IoT community Numbers



2.5M

lines of code



30¹

projects



290+

developers



1.5M

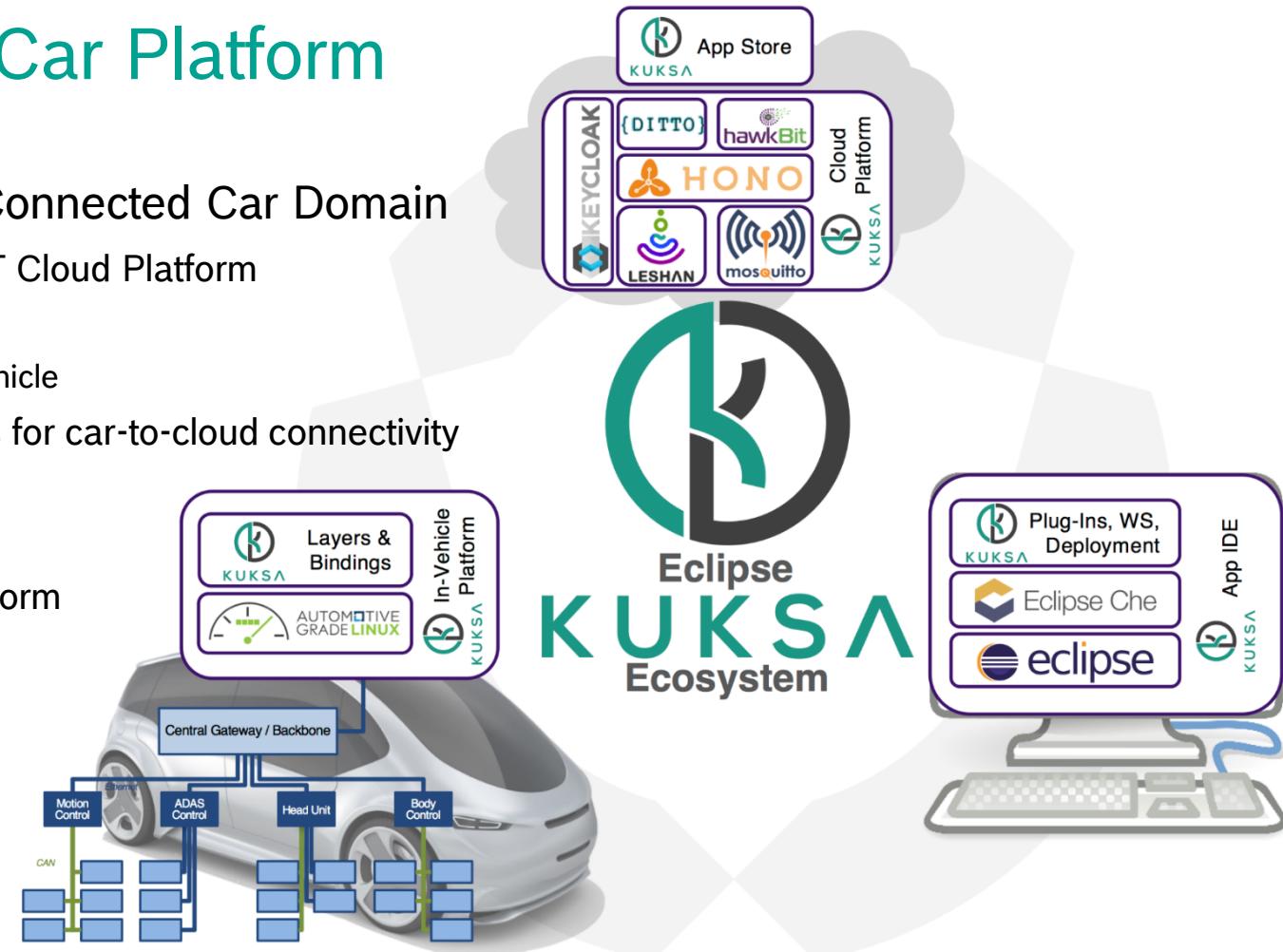
annual visitors

1) and counting!

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>

© 'Kuksa' and 'Eclipse' are trademarks of Eclipse Foundation, Inc.



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)

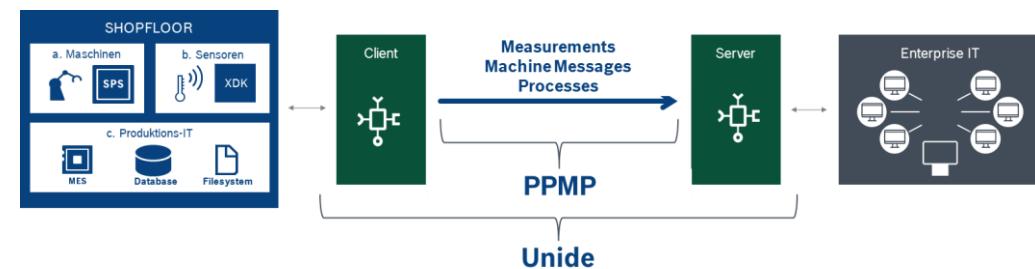
► Integrates manufacturing characteristics

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>

OPEN SOURCE @ AUTOMOTIVE

Eclipse OpenADx - xcelerate your AD development

Tool Chain for Automated Driving Systems

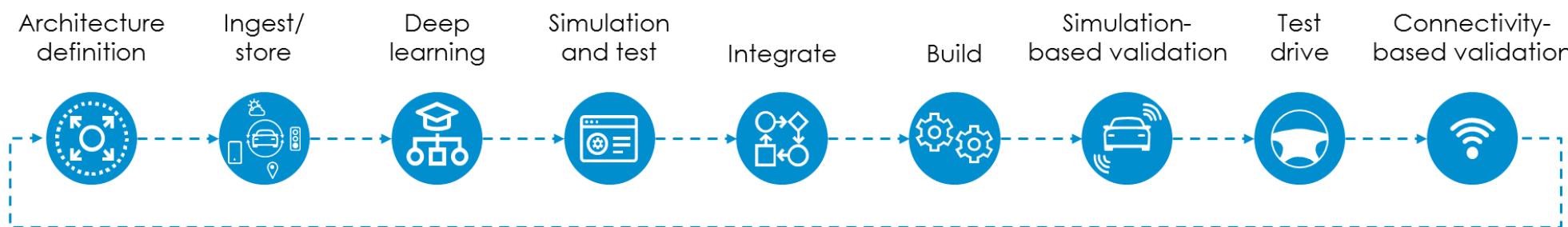
- **Automated Driving (AD) is clustered into three equally important technology areas:**

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.

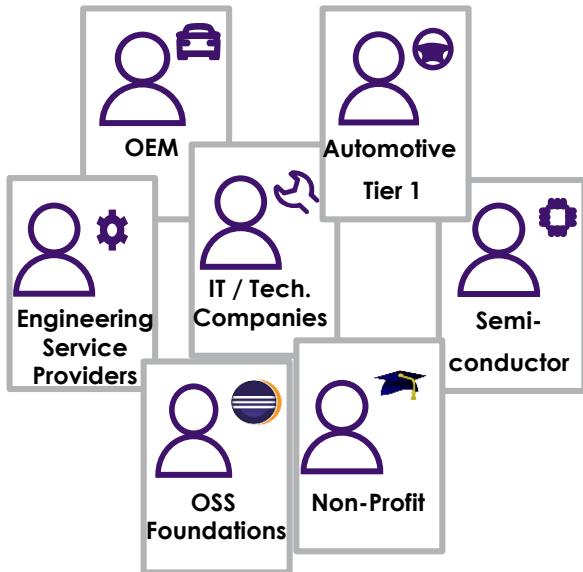
- **OpenADx' vision** is to ensure transparency and make the complex AD tool landscape more easily accessible for its users.



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

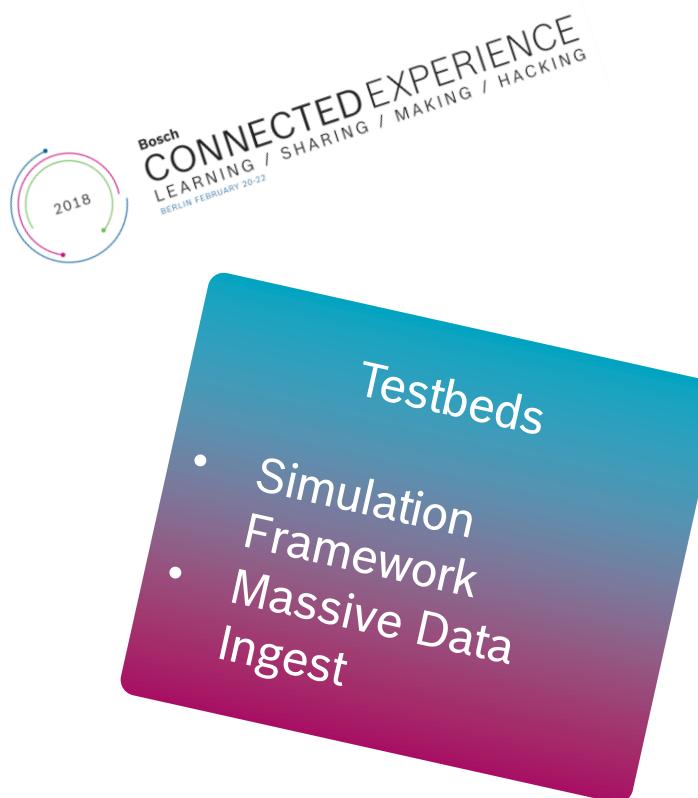
Eclipse OpenADx - xcelerate your AD development

Identify target partners to initiate ecosystem



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

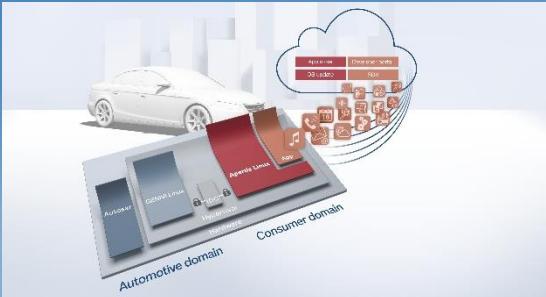
Common open activities to establish cooperation



Open source activities by ecosystem partners



Bosch Car Multimedia – Connected Information Solutions APERTIS



<https://www.apertis.org>



a derivate of



- 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

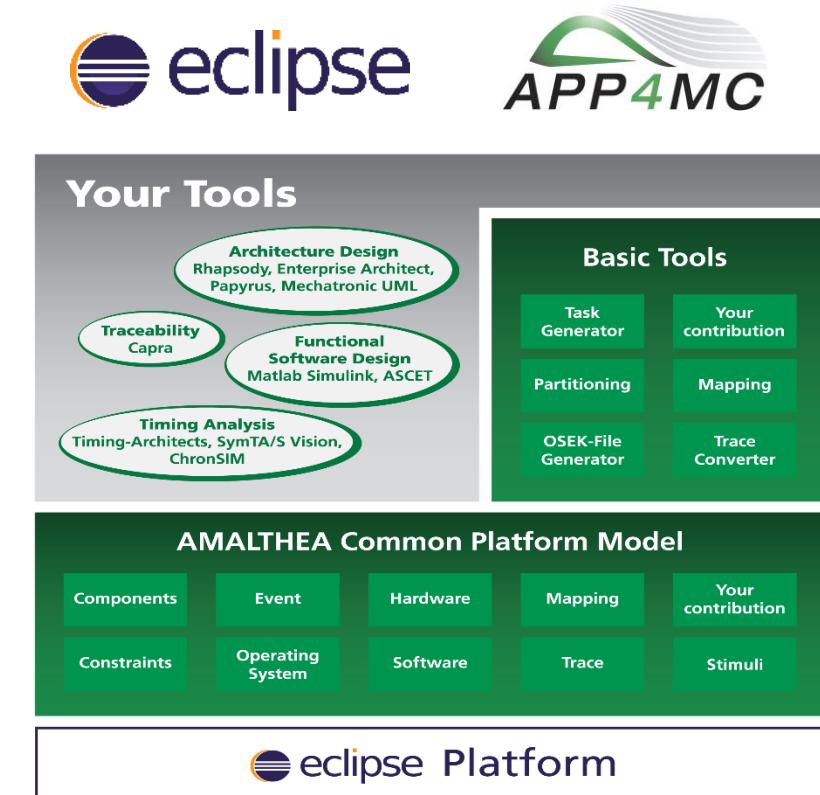
Eclipse APP4MC – ApplicationPlatformProject4MultiCore

Platform for engineering embedded multicore software systems

- Eclipse APP4MC is a platform for engineering embedded multi- and many-core software systems. The platform enables the creation and management of complex tool chains including simulation and validation. It supports interoperability and extensibility and unifies data exchange in cross-organizational projects.

► APP4MC focuses on:

1. Multi- and Many-Core Development Process Support
2. Common Data Exchange and Simulation
3. Event Tracing
4. Customizable Workflow



Join and find more information here: <https://www.eclipse.org/app4mc/>

THE ART OF OPEN SOURCE

Open Source Services @ Bosch

Maturity levels

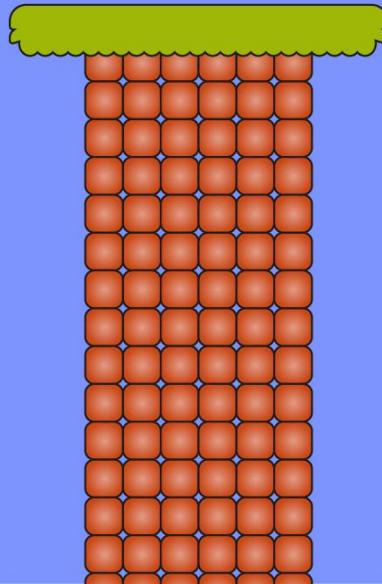
Level 4

Understand how
to use it



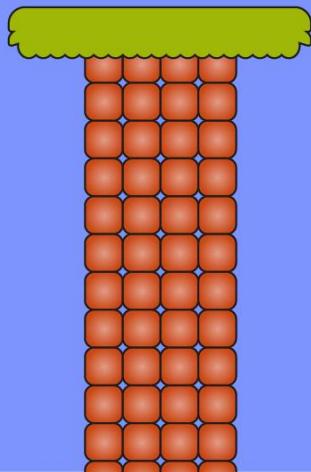
Level 3

Understand
how to do



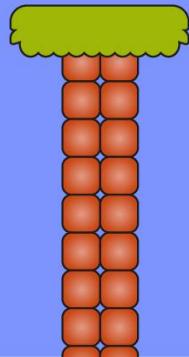
Level 2

Understand
what to do



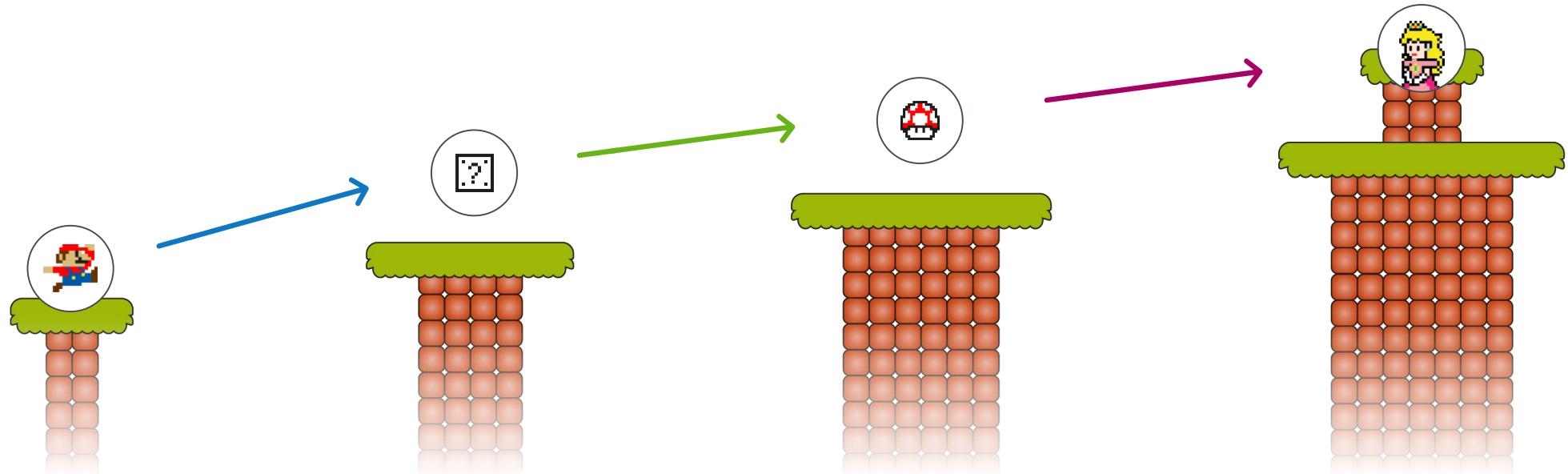
Level 1

Understand the
importance of
Open Source



Open Source Services @ Bosch

Getting Ready for the Open Source Arena



1. OSS Awareness

Strategic options are limited by the Open Source 'Fitness' of the company

2. OSS Business Considerations

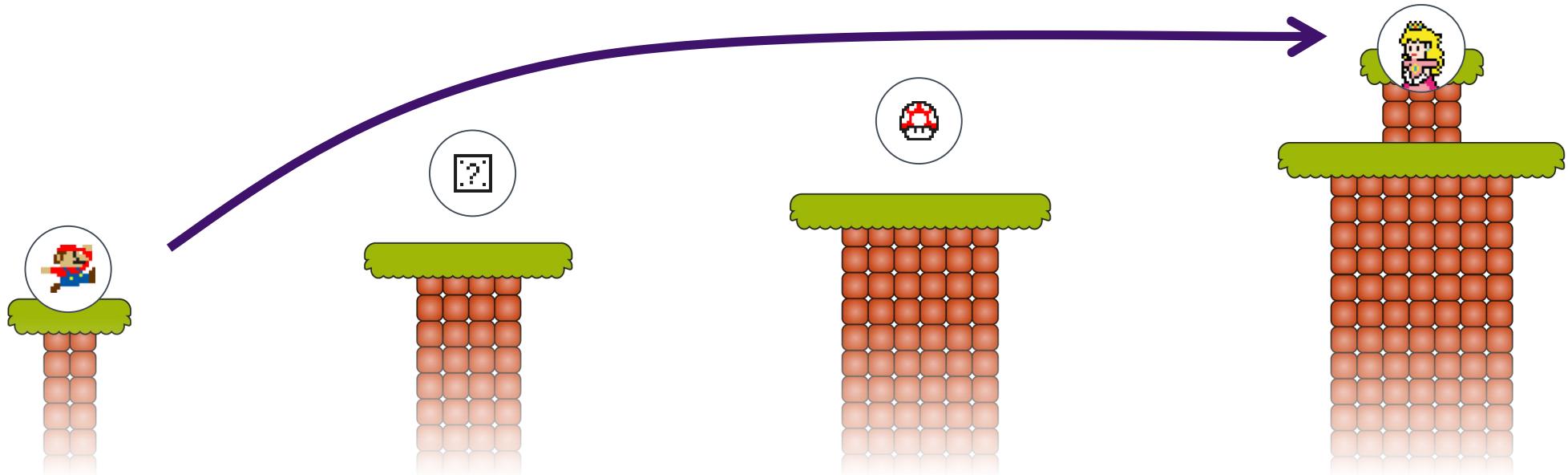
- 3. OSS Compliance & QM
- 4. Tooling for OSS Approach
- 5. OSS Development

6. OSS Program Office

- 7. OSS Management System
- 8. Open Source Strategy
- 9. OSS DevOps Team

Open Source Services @ Bosch

Shortcut for Open Source: Pay Others



10. FOSS Development

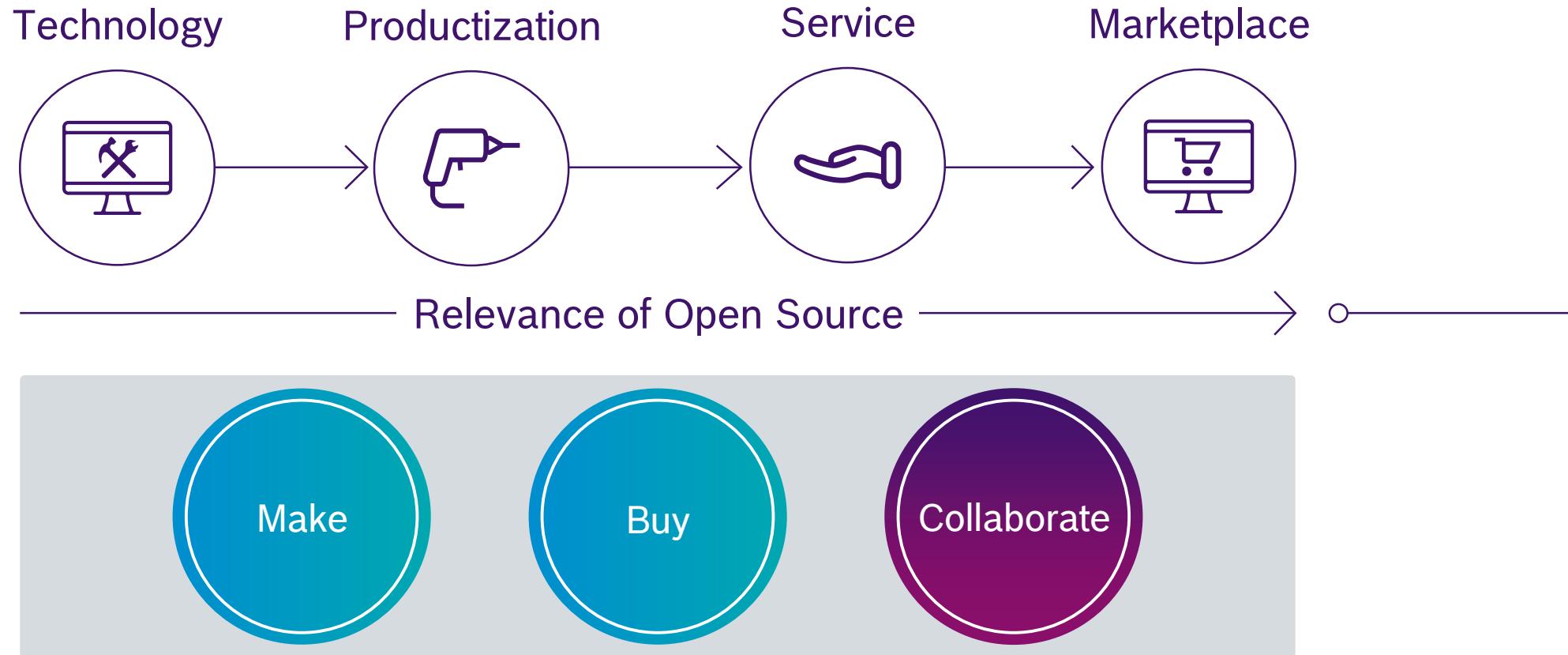
Strategic FOSS Project Participation (Contributor, Committer and Project Lead)

11 .FOSS Community Management

Partner Recruiting and FOSS Foundation Management

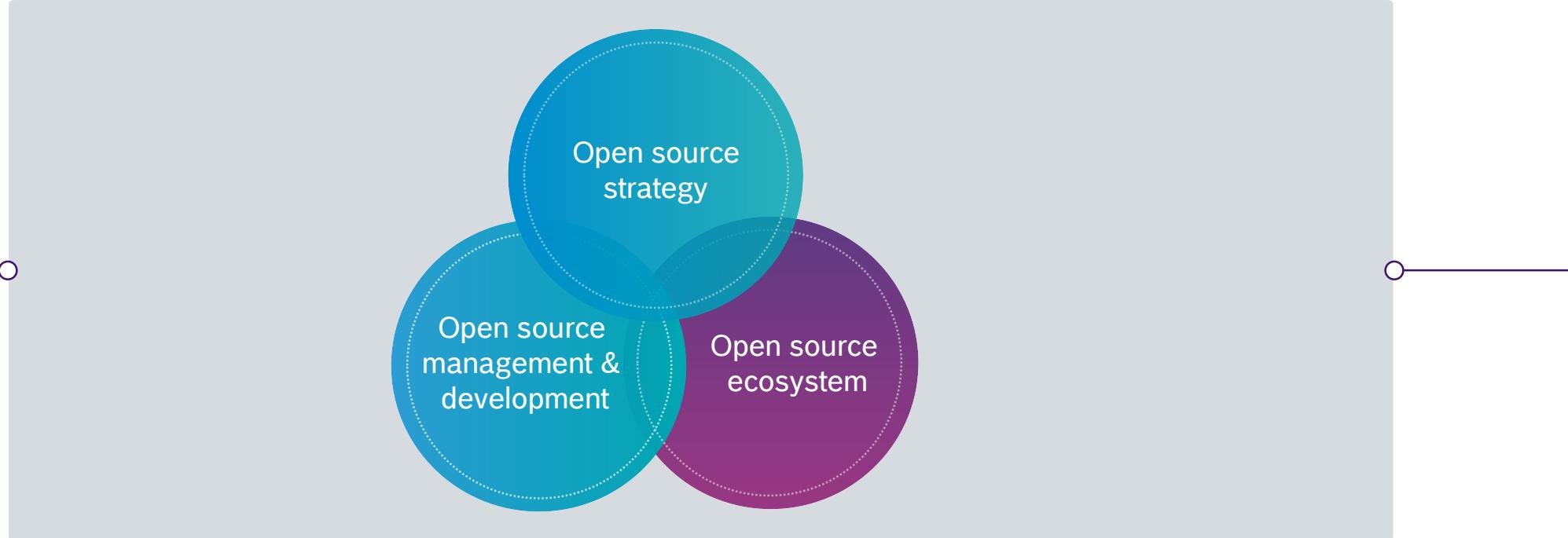
Open source

Shifting your business focus



Open source

Using open source as a strategic tool



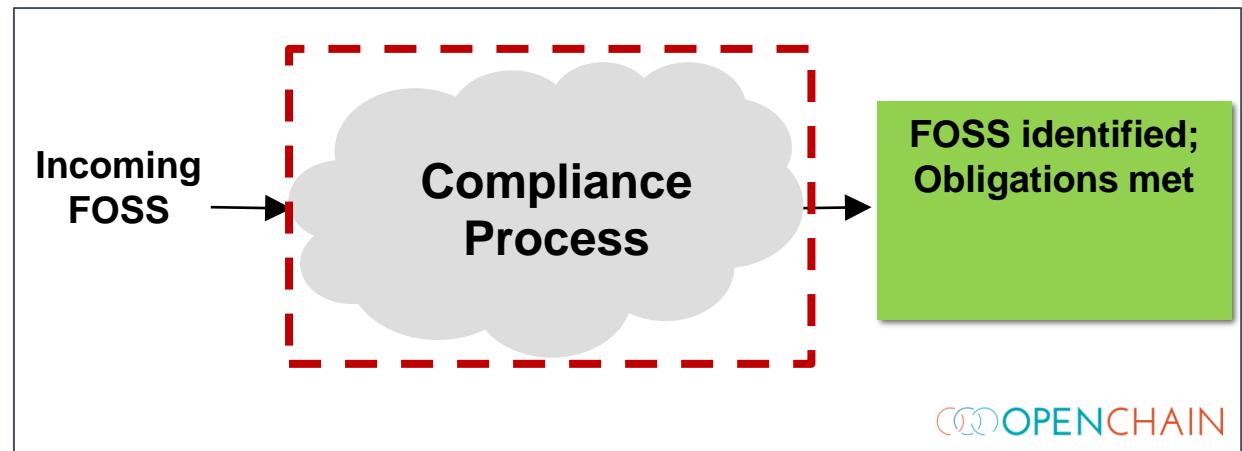
OPEN SOURCE@ OPEN SOURCE MANAGEMENT

End-to-end compliance

Introduction

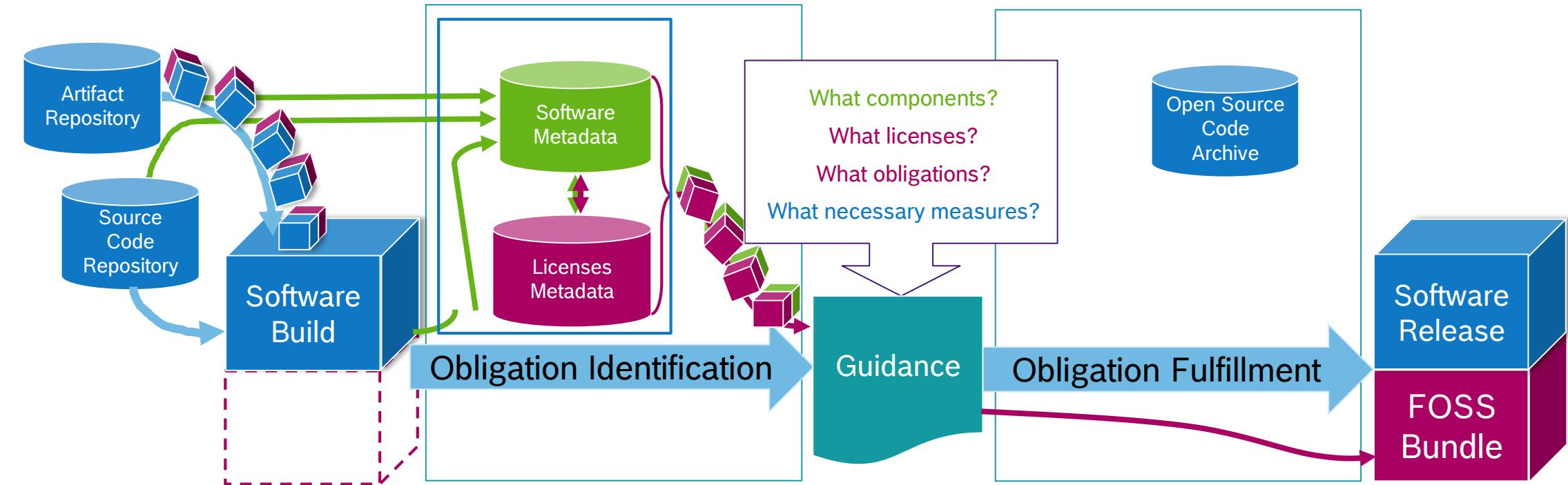
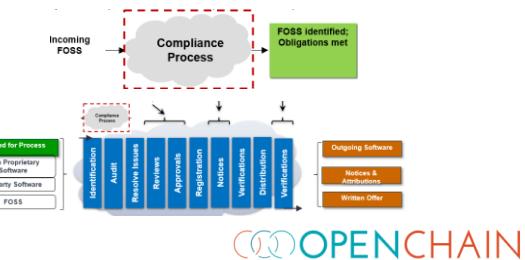
Theory
What?

- Compliance management is a set of actions that manages OSS components used in products. Companies may have similar processes in place for proprietary components. FOSS components are called "Supplied Software" in the OpenChain specification.
- Such actions often include:
 - Identifying all the FOSS components used in Supplied Software
 - Identifying and tracking all obligations created by those components
 - Ensuring that all obligations have been or will be met
 - Small companies may use a simple checklist and enterprises a detailed process.



Generic Open Source Management System

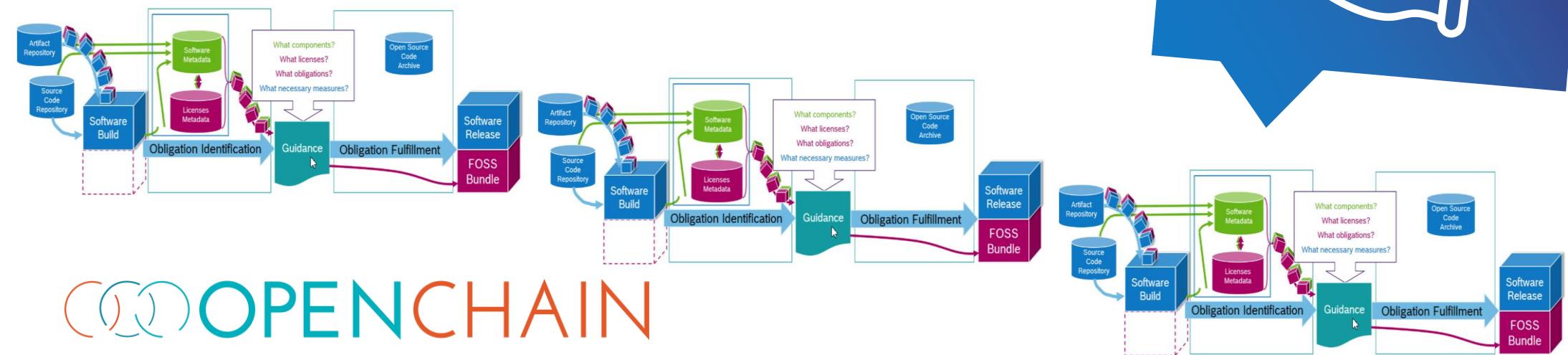
Key elements



Open Chain

Basic OSM-maturity through the supply chain

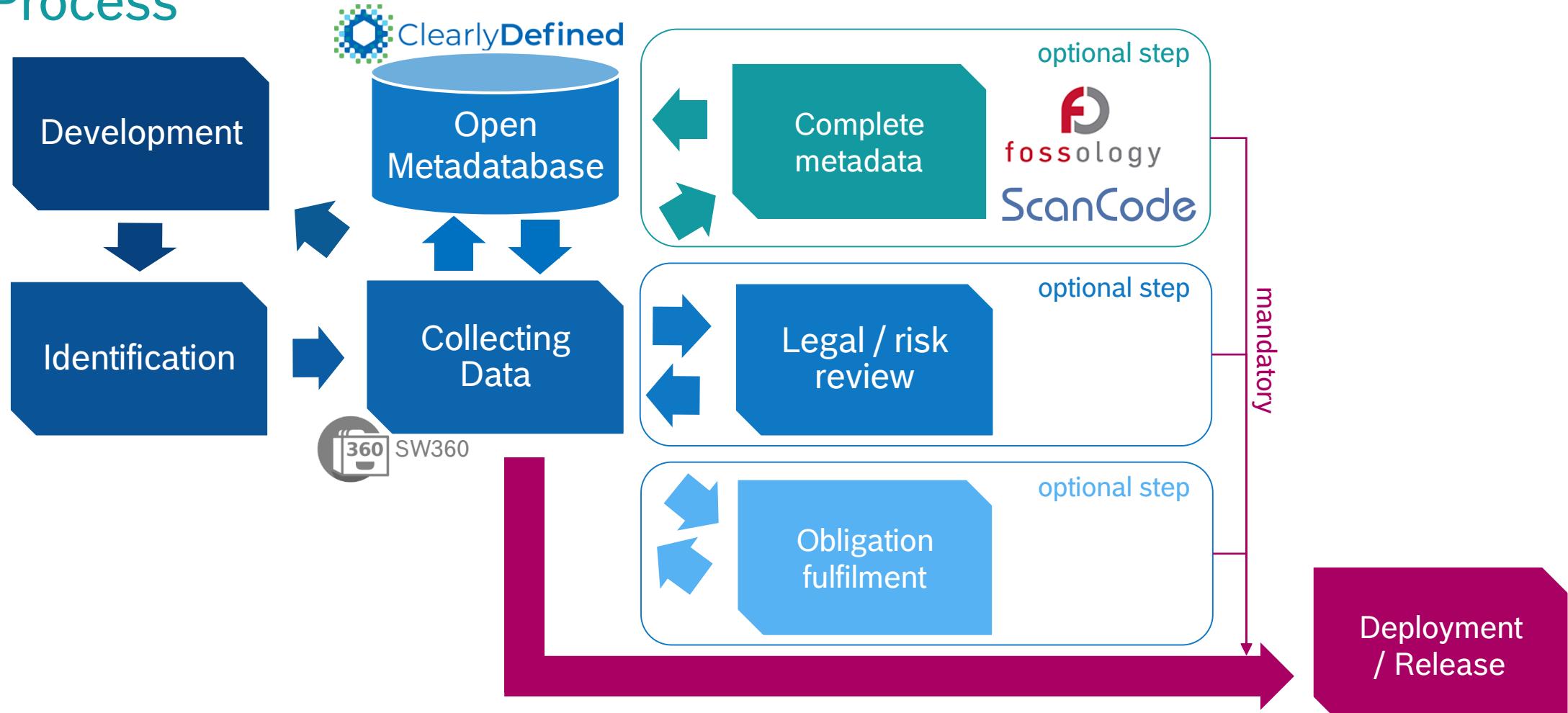
- ▶ Value the work of the open source communities by establishing and maintaining a professional Open Source Management
- ▶ Share good practices with suppliers and partners
- ▶ Spread the good practices to increase the overall OSM-maturity in the business
- ▶ Continuous delivery needs automated processes!



 **OPENCHAIN**

COLLABORATION IN THE FIELD OF OSM

Generic Open Source Management Process



Alignment efforts across the industry

Collaborative projects



Processes



Source Code



Data



Standards



Tooling



Development
Integration

Bosch participation currently under investigation

THANK YOU

Dr. Steffen Evers

Head of Open Source Services

steffen.evers@bosch-si.com

Bosch Software Innovations

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