FOSS PLATFORM FOR CLOUD BASED IOT SOLUTIONS

Bosch Software Innovations GmbH
Dr. Steffen Evers
Head of Open Source Services
Eclipse Kuksa Demo
Open Source
Connected Car Platform

In-Vehicle Platform

Cloud Platform

Development Environment

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IOT PLATFORMS: NO-ONE CAN DO I(O)T ALONE.
Service-based products are promising
Smart devices, websites, apps, and clouds
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
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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

IoT solution A

IoT solution B

IoT solution C

IoT solution D

IoT solution E

Device type A

Device type B

Device type C

Device type D

Device type E

a1

a2

a3

b1

b2

b3

c1

c2

c3

d1

d2

d3

e1

e2

e3

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)
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 IoT working group

**Major components to create such an IoT platform**

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Eclipse Ditto</strong></td>
<td>... where IoT devices and the state of their digital twins get together</td>
</tr>
<tr>
<td><strong>Eclipse Leshan</strong></td>
<td>A Java library for implementing Lightweight M2M servers and clients</td>
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<tr>
<td><strong>Eclipse hawkBit</strong></td>
<td>A domain-independent, back-end solution for managing software rollouts in IoT</td>
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<tr>
<td><strong>Eclipse Vorto</strong></td>
<td>A smart, open approach to the interoperability of IoT products</td>
</tr>
<tr>
<td><strong>Eclipse Hono</strong></td>
<td>Enabling device-related communication between connected devices and IoT applications in the cloud</td>
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GOAL

De-facto standard for IoT cloud platforms: ready-to-deploy, micro-service-based
Example setup for IoT cloud scenario
Eclipse Ditto

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

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.

https://eclipse.org/ditto/
Eclipse Ditto – Digital Twins

Conceptual Model

Deployment Model

Digital Twin for Thing 123

Policy X

Function Block Definition C

∅ (freeform)

Feature D Microservice

Feature C Microservice

Business Application

Digital Twin API

Eclipse Ditto

Eclipse Hono

Feature B Device Driver

Twin states

F-A  B  C  D

Attributes
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, Project Lead
MOVING INTO THE DOMAINS
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)

- Integrate **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](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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EVOLUTION OF TECHNOLOGICAL CONTEXT
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
ROS @ AD
Open Source for Automated Driving

- Robot Operating System (ROS) is...
  - An advanced environment to develop advanced robotic systems
  - A big community with many ideas

- Automated Driving (AD) is...
  - A mega trend in the automotive world
  - Safety critical & complex
  - An attractive challenge for software developers and engineers

- ROS @ Bosch Automated Driving
  - An advanced environment for automated driving
  - Combination of automotive grade software and prototypical development

Join and find more information here: [http://www.ros.org/](http://www.ros.org/)
Cloud native computing uses an open source software stack to:
- segment applications into microservices,
- package each part into its own container
- and dynamically orchestrate those containers to optimize resource utilization
This landscape is intended as a map through the previously uncharted terrain of cloud native technologies. There are many routes to deploying a cloud native application, with CNCF Projects representing a particularly well-traveled path.
Add authentication to applications and secure services with minimum fuss. No need to deal with storing users or authenticating users. It's all available out of the box.

You'll even get advanced features such as User Federation, Identity Brokering and Social Login.
Make the IoT happen at the hackathon

Berlin, February 21-22

Celebrate with us the Internet of Things!

- 30 Hours of hacking
- 700+ Developers
- 5 Hack challenges
- 80+ Things to hack with
TU Darmstadt Racing Team e.V. (DART)
Formula Student Driverless Team @ BCX
THANK YOU

We are hiring. Contact us.

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