Is Industrial Internet a Disruptive Innovation in IoT

Kai Hackbarth, ProSyst Software (Bosch Group)
Member of Board of Directors OSGi Alliance
Bosch acquired IoT middleware specialist ProSyst

**Gateway software for smart homes, connected mobility, and Industry 4.0**

**Bosch IoT strategy**

- Enabling connectivity in many areas of daily life and work
- Triad: sensor, software, service
- Systematically expand IoT software competencies
- Bosch electronic products are web-enabled to deliver fascinating new services
- Expand and foster IoT ecosystems
- Establish an open IoT platform with partners

**Reasons why**

- ProSyst is market leader in gateway software
- Provides the fastest & most efficient OSGi container in the market with backend connectivity
- Complements the Bosch IoT Suite
- ProSyst associates are highly experienced software developers for embedded and backend software

Gateway software serves as a link between connected devices and the backend. It is part of many IoT solutions.
Software components with strategic impact on IoT applications

❖ Technological, commercial, and user angles covered through Bosch

- Bosch IoT Cloud
- Bosch IoT Suite
- ProSyst mPRM
- ProSyst mBS middleware

Gateway software:
- Running on local gateways bundling and connecting also non-IP-ready devices
- Market leader in gateway software

Cloud & enterprise software:
- Basis for Bosch IoT solutions

Embedded software:
- The brain of an intelligent device or machine

End-user apps:
- Users experience IoT-enabled services via internet on mobile devices, TV sets, and more

Bosch is excelling in intelligent products of superior quality

Connecting users, devices, and business partners
The IoT technology and solution provider

We lead companies into the connected world

Market presence

Projects in many business areas

5.1m
connected devices using Bosch IoT Suite and ProSyst

150+
IoT international projects in the areas of manufacturing, mobility, energy, home & building, city, agriculture …

Know-how

Bosch early IoT visionary

700+
Started projects

2008
Bosch Software Innovations emerged out of the two earliest acquisitions in the IoT space

IoT experts around the world
In 2001 when I joined ProSyst

- ProSyst was one the few software vendors focusing on **Connected Home**

- The term „**Internet of Things**“ was only used in the scientific research community

- An **Open Platform** was really scary !!

- Everybody was on the hunt for the **Killer Application**
  - SMS being the prime example
  - Investments were not made due to missing business models

- Customers **canceled their product launches**

- We were **offering a solution for a problem that did not exist**
Today

- It's all about **Platforms & Ecosystems**
  - **360+ IoT Platforms** (Source: IoT Analystics)
  - Still growing amount of **communication protocols**
  - Witnessing first phase of **consolidation**

- **IoT Clouds** on the rise
  - Bosch, GE, Microsoft, Amazon, Salesforce
  - Let's not get started to talk about **Interoperability** among them

- The Industrial Internet will **fundamentally disrupt** the manufacturing industry
  - Cyber Physical Systems (CPS) change the **existing automation hierarchy**
  - **Increasing Operational Efficiency** by Managing Assets and Optimizing Processes
  - Reducing Downtimes with **Preventive Maintenance**

- Many **Proof of Concepts** but real adoption yet still to come
- The World Economic Forum expects IIoT to **disrupt business within the next 5 years**
OSGi Alliance

Background

Founded in 1999

Proven, Mature Software Architecture

Transparent Development Process

Strategic Partnerships/Collaboration

Global Ecosystem

Best Practices

Industry & End User Adoption
What is OSGi?

Modularity & Services

**Modular Software architecture**
- Execution environment, APIs, device abstraction
- Application development framework
- Common architecture is applicable to Cloud, Enterprise, M2M & IoT architecture
- Can run locally on one device, all the way through to distributed across 1,000's of servers

**Dynamic Service lifecycle enables:**
- True 24/7 remote maintenance
- Remote software updates
- Aftermarket sales of upgrades and extensions

**Portable and re-usable software modules enable**
- Faster time-to-market
- Increased agility and reduced development effort and project risk
- Reduction in maintenance costs
- Ecosystem based solutions
# OSGi Reference

## Industrial Internet

<table>
<thead>
<tr>
<th>SENSORS &amp; DEVICES</th>
<th>PROTOCOLS</th>
<th>GATEWAY</th>
<th>BACKEND</th>
</tr>
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<tbody>
<tr>
<td>Sensor 1</td>
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<td>Gateway</td>
<td>Backend 1</td>
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<tr>
<td>Sensor 3</td>
<td>Protocol 3</td>
<td>Gateway</td>
<td>Backend 3</td>
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</table>

**OSGi Framework**

- Java Virtual Machine (JVM)
- Operating System (Linux/Android/et al.)
- Home Gateway Hardware

**mBS SDK**

- Device Abstraction Layer
- OSGi Framework

**mPRM**

- Management Protocols
  - OMA-DM
  - OMA LWM2M
  - ETSI M2M
  - MQTT

**Backend Services**

- Device Management
- Software Management
- M2M Server
- Service Platform
- Operating System (Linux/Windows/Solaris/et al.)
- Server Hardware

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**ProSyst Bosch Group**
The IoT Expert Group was formally announced in September.

- 12 OSGi member companies are actively contributing.

The IoT Expert Group RFP pipeline is starting to fill up.

- RFP 175 - Improvements to the Device Access Specification
- RFP 176 - A Bundle security testing platform
- RFP 177 - Constrained Application Protocol support
- RFP 180 - MQTT integration

OSGi Community Event IoT Demo

- A live IoT demo involving LEGO® Trains
- Very popular among attendees
- Numerous competition entries providing train managers
The Three Challenges of IoT Solution Development

1. **Rapid application development for IoT:**
   - Quickly and efficiently building user interfaces and applications for IoT use cases that require cost efficiency and fast time to market.

2. **Managing heterogeneity and diversity:**
   - Handling large numbers of heterogeneous, constantly evolving assets and devices in the IoT.

3. **Building customizable IoT solutions:**
   - Supporting IoT solution vendors in creating solutions that can be easily customized for different use cases.
Factory integration at multiple levels

- Handheld industrial power tools automatically do what needs to be done

Tools send information about their position as well as measuring data to a central database. Software is then used to analyze this data. This analysis helps ensure manufacturing quality.

Depending on the specific location of each tool, the appropriate program for the task at hand is automatically deployed on the tool.

There is no other solution like this out there; I am convinced that it harbors major potential for industry as a whole.

Dr. Richard M. Soley,
Executive Director of the Industrial Internet Consortium

Source: Bosch

Tools

- MES
- Workstations
- ERP
- PLM
Highest quality and efficiency standards in connected manufacturing

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<tr>
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<th>Open standards and interfaces mastering heterogeneity</th>
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<tbody>
<tr>
<td>2</td>
<td>Indoor localization accuracy</td>
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<td>3</td>
<td>Factory integration at multiple levels</td>
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<td>4</td>
<td>Joint solution architecture</td>
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<tr>
<td>5</td>
<td>Ecosystem of collaborating partners</td>
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</table>
Heterogeneous environments in IoT require a new, very open approach

- Many different product categories
- Many different product variants
- Many different product versions

Bosch IoT Suite
- Reliable device connection and control
- Operating a secure, flexible and transparent infrastructure for distributed devices

Eclipse Vorto
- Open source tool initiated by Bosch Software Innovations
- Developed by Eclipse IoT
- Enables creation and management of information models for integration into different platforms
Bosch Software Innovation & PTC ThingWorx

Joint Architecture

IoT application: Mining

IoT application: Track & Trace

ThingWorx Mashup Builder

Bosch IoT Remote Manager

Production Rules Configurator

Vorto Information Model Repository

ProSyst mBS

IoT gateways

IoT devices and sensors
Example for a Nutrunner Mashup

Select a Tightening [Last 30 minutes shown]

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Torque And Angle [For selected tightening]
Towards a global IoT standard

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<th>Gateway (“Frontend”)</th>
<th>Information models (“Backend”)</th>
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</thead>
<tbody>
<tr>
<td>OSGi is a Java framework for developing and deploying modular software programs and libraries of two main elements:</td>
<td>Vorto (“the word” in Esperanto) allows to create and manage technology agnostic, abstract physical device descriptions (“information models”) used within IoT applications.</td>
</tr>
<tr>
<td>- a specification for modular components (“bundles” or “plug-ins”)</td>
<td>Eclipse Vorto supports use cases of</td>
</tr>
<tr>
<td>- a Java Virtual Machine service registry that allows bundles to publish, discover and bind to services (SOA).</td>
<td>- device manufacturers</td>
</tr>
<tr>
<td>Developed since 1999</td>
<td>- vendors of IoT platforms</td>
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<td></td>
<td>- solution developers</td>
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IoT standardization will happen in open source. Now is the time to shape open source communities.
Thank you for your attention!

Kai Hackbarth
+49 221 6604-410
k.hackbarth@prosyst.com

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