SUMMARY

MEMBER

Industry: Global supplier of technology and services for four business sectors: Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology.

Location: Headquartered in Stuttgart, Germany, with roughly 460 subsidiaries and regional companies in 60 countries

Employees: 410,000 (2018)

Revenues: 78.5 billion euros (2018)

CHALLENGE

Bosch realized that an Internet of Things (IoT) platform would be needed to connect the millions of IoT devices with existing operational technology and enterprise IT systems. They realized there were three options: build their own proprietary IoT platform, OEM an IoT platform from a third party, or adopt an open source IoT platform.

APPROACH

Bosch decided they would pursue an open source software (OSS) strategy for implementing an IoT platform for themselves and their customers. In 2015, Bosch increased its membership level in the Eclipse Foundation to become a strategic member and joined the Eclipse IoT Working Group.

OUTCOMES

Bosch's leadership in Eclipse IoT has also helped position the company as a leader in the IoT industry. Many of the Bosch IoT Suite commercial cloud services are based on Eclipse IoT projects. Bosch has more than 60 developers working on Eclipse IoT projects, and has contributed around 1.5 million lines of code to Eclipse IoT projects.

BOSCH

BOSCH PURSUES AN OPEN STRATEGY TO TRANSFORM IOT

The Bosch Group is a leading global supplier of technology and services for connected industries. It employs roughly 410,000 associates worldwide and has revenues of over 78 billion euros per year. As a leading IoT company, Bosch offers innovative solutions that connect homes, buildings, vehicles, cities, factories, agriculture, retail, and more. It uses its expertise in sensor technology, software, and services to offer its customers connected, cross-domain solutions from a single source.

Bosch.IO, a Bosch Group subsidiary, is spearheading the development of innovative digital and IoT software solutions, based on Bosch IoT Suite, to connect things that can transform how business operate and disrupt existing industries. The company has also been a pioneer in creating open source software communities that provide the core technology building blocks required for all IoT solutions.

WHY OPEN SOURCE?

Bosch was an early innovator in IoT. Bosch's strong ties to the manufacturing, automotive, and consumer products industries provided insight into the new software required to improve the productivity of connected factories, connected vehicles, and indeed any connected device. Bosch quickly realized that a new category of software, called an IoT platform, would be needed to connect the millions of IoT devices with existing operational technology (OT) and enterprise IT systems.

To be a leader in IoT, Bosch made a strategic decision to adopt an IoT platform. After an assessment, they realized there were three options:

1) build their own proprietary IoT platform,

2) OEM an IoT platform from a third party, or

3) adopt an open source IoT platform.

Bosch did not want to risk a strategic investment that relied upon a licensing agreement with a third party, so an OEM option was rejected. Bosch also saw the dominance of open source software across many software infrastructure categories and realized an open source IoT platform would probably be one of the dominant IoT platforms in the next 5 to 7 years.

For these reasons, Bosch decided they would pursue an open source software (OSS) strategy for implementing an IoT platform for themselves and their customers. An OSS strategy would allow Bosch to create a modern open platform that would better compete with the proprietary IoT platforms that were beginning to come onto the market. An open platform would also allow Bosch to collaborate with other companies in the IoT ecosystem and enable them to provide a more complete solution to their IoT customers.

> *"Open source is the way we chose to compete with proprietary vendors"*

"Open source is the way we chose to compete with proprietary vendors," says Dimitar Valtchev, Chief Product Owner of the Bosch IoT Suite. "It provides the basis for a viable and vital ecosystem where we can engage with customers, collaborators, and competitors in a completely new and open way."

An open source strategy also fits well into Bosch.IO's mandate to introduce new perspectives and processes that transform how the Bosch Group develops innovative software solutions. Internally, the acceptance of the OSS strategy was reviewed by key Bosch stakeholders, including legal, marketing, and product owners. Initial concerns about legal issues, potential loss of IP, and transparency of code were addressed by senior management. The result was the development of a set of best practices for open source management. In fact, Bosch has been so successful with their open source management that they have now started their own consulting practice to help other companies begin an open source journey.

LEADERS IN IOT AND OPEN SOURCE: BOSCH AND ECLIPSE IOT

An important part of Bosch's open source strategy was to join a community that was dedicated to building IoT open source technology. For this reason, in 2015 Bosch increased its membership level in the Eclipse Foundation to become a strategic member and joined the Eclipse IoT Working Group. With over 35 different projects and 40 participating member companies, Eclipse IoT is the leading open source community focused on IoT.

Since joining the Eclipse IoT community, Bosch has created six different IoT open source projects and contributes to many other Eclipse IoT projects. The Bosch projects started with source code contributions from existing Bosch commercial projects. The open development process used by the Eclipse projects has been adopted by the Bosch.IO product development teams. Many of the Bosch IoT Suite commercial cloud services are now based on Eclipse IoT projects. Using an open development model allows Bosch customers to benefit from a more transparent and collaborative development process while at the same time relying upon the quality and service level Bosch provides for their commercial products.

"Eclipse IoT is a great platform for collaboration," states Valtchev. "Our developers enjoy working closely with this community. We also find the open source development model is very attractive to recruit new developers who might want to join our company. Developers are keen and eager to work on open source, and are honored to be a part of it."

Bosch now has more than 60 developers working on Eclipse IoT projects, and has contributed around 1.5 million lines of code to the open source projects. Dr. Steffen Evers, director of open source services at Bosch.IO, a member of the Eclipse Foundation

Board of Directors, and Caroline Buck, a member of the Eclipse IoT Working Group Steering Committee, join forces to provide strategic direction to the open source IoT community. Bosch's participation has helped to make Eclipse IoT an important source of IoT technology for the industry. Bosch's leadership in Eclipse IoT has also helped position the company as a leader in the IoT industry.

BENEFITS OF OPEN SOURCE

Bosch is clearly seeing the benefits of their open source strategy and participation in the Eclipse community. Moving to an open development model and using open source technology has increased its attractiveness for software engineers, significantly improved their software quality, and incorporated the knowledge of the industry's best talents for Bosch's commercial solutions without the need to have them all on the Bosch payroll. The Bosch developers benefit from the community feedback, testing, and code contributions made to the Eclipse IoT projects. Bosch has improved the efficiency of their development teams by reusing other open source projects in their commercial products.

> *"If you are planning to do open source IoT, then Eclipse IoT is THE community we recommend!"*

Commercial customers of Bosch IoT Suite are providing positive feedback to Bosch's open source strategy. Companies who are looking to use an IoT platform view Bosch's reliance on open source as a way to provide them with more freedom of choice. Customers can benefit from using Bosch IoT Suite while at the same time having an opportunity to contribute to the open source projects used by Bosch. This allows customers to gain influence over future releases and participate in a more transparent development process of the commercial product.

Open source has allowed Bosch to increase their pace of innovation by collaborating with other leaders in the IoT industry. The Eclipse IoT Working Group has made it easier for Bosch to collaborate with companies, such as Red Hat, Sierra Wireless, Cloudera, and others. The Eclipse Foundation's clear rules for IP sharing and decision making makes it easy to quickly start open collaborations with other organizations.

Bosch also sees significant value in the services provided by the Eclipse Foundation. The Eclipse Foundation's legal and intellectual property processes enable Bosch to fully comply with antitrust laws, and provide Bosch with the legal assurance that they can successfully embed open source technology into their commercial products. The Eclipse development process is a set of best practices that have guided Bosch developers during the process of starting open source projects. Finally, the Eclipse IoT Working Group has been very successful in promoting the open source projects and attracting new developers and users to the IoT technology. This helps Bosch gain adoption of their projects, which in turn helps with promoting their commercial products.

A BRIGHT FUTURE FOR OPEN SOURCE AND IOT

Bosch sees a bright future for open source and IoT. Their initial strategy of using open source to create an IoT platform is paying off. The plan is to continue to participate in the open source community and create innovative solutions that will benefit their customers and the industry.

"We have accomplished so much since we began our open source strategy at Bosch," concludes Caroline Buck. "Open source development has enabled us to transform how we build software internally and it is making our organization a better product company. Any company that is serious about IoT should consider an "open source first" strategy. If you are planning to do open source IoT, then Eclipse IoT is THE community we recommend."

BOSCH PROJECTS AT ECLIPSE IOT

Eclipse Ditto is a framework for creating and managing digital twins. Bosch IoT Things is the commercial product based on Ditto.

Eclipse Hono provides remote service interfaces for connecting large numbers of IoT devices to a back end and interacting with them in a uniform way regardless of the device communication protocol. Bosch IoT Hub is the commercial product based on Hono.

Eclipse IoT Packages project provides deployment instructions and scripts for deploying packages of Eclipse IoT projects to Kubernetes based platforms using Helm charts.

Eclipse hawkBit is used to roll out software updates to constrained edge devices, controllers, and gateways. Bosch IoT Rollouts is the commercial product based on hawkBit.

Eclipse Vorto allows device manufacturers to easily describe device functionality and characteristics as device information models and manage them in a central repository. Vorto provides convenient tools for IoT device developers to convert device information models to source code that runs on the device or gateway, easing the integration with IoT platforms, such as the Bosch IoT Suite. This enables IoT solution developers to easily integrate devices into their IoT solutions.

Eclipse Mita is a programming language for the embedded IoT.

Eclipse Unide is an implementation of the Production Performance Management Protocol (PPMP).