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Bosch ConnectedWorld IoT conference in Berlin **Bosch combines “Industrie 4.0” platform and Industrial Internet Consortium standards for the first time** International breakthrough for connected industry

March 10, 2016
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- ▶ Werner Struth: “Only a truly global approach will allow Industry 4.0 to develop to its full potential”
- ▶ First combination of German RAMI4.0 and international IIRA industrial internet reference architecture models
- ▶ “Digital twin” of Bosch Homburg plant helps save electricity

Berlin and Stuttgart – Connected industry is now becoming an international reality. In a new project, Bosch is working together with partners to combine the technical standards of Germany’s “Industrie 4.0” platform and of the Industrial Internet Consortium (IIC) for the first time. This combination of the two approaches allows the exchange of data between central areas of connected industry.

“Industry 4.0 is not so much a national as an international issue. Only a truly global approach – without competing company standards or differing national regulations – will allow it to develop to its full potential,” said Dr. Werner Struth, a member of the Bosch management board, at the Bosch ConnectedWorld IoT conference in Berlin. To date, the lack of a common language has hindered the smooth international coordination of manufacturing, logistics, and building and energy management. “As we head towards connected industry, two worlds are now coming together. This is a major advance. A combination of these two standards paves the way for numerous new cross-border business opportunities for Industry 4.0 solutions, both for Bosch and for other international companies,” Struth said.

Cutting electricity costs with optimized production planning

The international industry conference in Berlin featured a presentation of the project, which brings the two reference architectures – RAMI4.0 and IIRA – together for the first time. In Bosch’s Homburg plant, a number of connectivity solutions are now combined to manage and optimize hydraulic valve manufacturing so that it avoids consuming electricity at particularly expensive peak times. “This prototype demonstrates for the first time how we can get the Industrie 4.0 platform standards and those of the IIC to work together effectively in connected manufacturing,” said Struth, whose responsibilities on the Bosch board of management include the Industrial Technology business sector and the Bosch Production System.

Common standards increase competitiveness

If all the energy-intensive machinery in Bosch’s Homburg plant runs at the same time, this can lead to very high electricity consumption at peak times. The resulting increase in electricity costs pushes up the cost of manufacturing the hydraulic valves. By using software to manage production and hence electricity consumption as effectively as possible, energy demand can be optimized and peak loads reduced by up to ten percent. This reduces manufacturing costs and increases competitiveness, while protecting the environment at the same time. All this is made possible by interaction between the production lines, which are based on the Industrie 4.0 platform, and the energy management system, which uses the IIC standard. The Homburg project involves not just Bosch but also, among others, SAP of Germany, Dassault Systèmes of France, and Tata Consultancy Services (TCS) of India.

Partnership is the key to success

The partners combine their expertise to optimize energy consumption at the plant. Bosch continuously collects data from all the machinery in the plant, generating a stream of information about the electricity consumed in the process of manufacturing the hydraulic valves for agricultural machinery. Dassault Systèmes, a 3D specialist, provides a multidimensional representation of all the plant’s machinery and functions, including heavy power users such as large machine tools and hydraulic test benches. The result is what is known as a “digital twin” of the plant, which visualizes not only production processes but also power consumption. SAP provides application services, the according database records all data and analyzes it in real time, Bosch provides energy management software, and TCS is applying its consultancy expertise to the integration of all these systems. The energy management solution is based on the IIC’s IIRA architecture; energy management connects to the production facilities via the Industrie 4.0 platform’s RAMI4.0 architecture. Because the RAMI and IIRA standards have now been aligned with each other and made compatible,

software-based data exchange between the production lines and the energy management system is now possible.

The IIC and Industrie 4.0 platform: helpful cooperation

Henning Banthien, the Industrie 4.0 platform's administrative director, said: "It's very good news that the two internationally leading initiatives in the field, the IIC and Industrie 4.0 platform, have agreed to cooperate closely in order to set up shared testbeds and work on common architectures and standards. The complementary nature of their approaches will greatly boost the development of connected industry and the internet of things." Dr. Richard Soley, executive director of the IIC, added: "The Industrial Internet Consortium and Industrie 4.0 platform have both been working for years to accelerate the adoption of the industrial internet of things, developing considerable expertise in the process. As we jointly announced recently, a number of important factors are coming together to make industrial IoT a reality. The IIC is delighted that this broad spectrum of industry expertise plans to propose its testbed to us, and we look forward to evaluating the proposal."

Industrie 4.0 platform and the IIC: two approaches, one goal

The Industrie 4.0 platform brings together numerous representatives from the industrial, political, and academic spheres to implement connected manufacturing in Germany. With its international outlook, the IIC takes an even wider approach, addressing industrial production in addition to mechanical and industrial engineering, and including the internet of things in the broader sense. The Industrie 4.0 platform set itself the objective of creating the technical framework for connected manufacturing. The IIC is focused on cross-sector connectivity on the internet of things, for instance in energy and building management. Both have developed their own reference architecture (RAMI4.0 in the case of the Industrie 4.0 platform, IIRA in the case of the IIC). As a global company, Bosch is a member of both organizations.

Internet:

About the "Industrie 4.0" platform

<http://bit.ly/1oVSG9J>

About the Industrial Internet Consortium (IIC):

<http://bit.ly/1nGj3z7>

About Tata Consultancy Services (TCS):

<http://on.tcs.com/1o5yEsF>

About SAP HANA:

<http://bit.ly/1KpELSV>

About Dassault Systèmes:

<http://bit.ly/1UwrIRO>

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Bosch is using Industry 4.0 to increase its competitiveness

More than 100 projects worldwide

- ▶ Data mining and RFID increase productivity in ABS/ESP braking-system manufacturing by one-quarter
- ▶ Data mining cuts hydraulic-valve testing time by 18 percent
- ▶ Inventory 97 percent shorter thanks to RFID

Berlin and Stuttgart – Bosch is making its manufacturing connected, with more than 100 projects already successfully running worldwide. Among other benefits, this increases the availability of its machinery – and hence also its productivity and competitiveness. Here are a few selected examples:

One production line, 200 different hydraulic modules

On its multi-product assembly line in Homburg, Germany, Bosch can manufacture 200 different hydraulic modules from more than 2,000 different components. Thanks to connectivity, these components are automatically ordered in time. The modules control the work and driving hydraulics in trucks or tractors, which help do things such as incline loading surfaces or lift a plow. The production line's nine stations are connected by a smart network. Thanks to an RFID chip attached to the workpiece, the stations know how the finished product has to be assembled and what steps are necessary. This facilitates efficient production, even for small batch sizes. That flexibility is important, since some modules are requested more often than others. What is more, Bosch can produce different types of module simultaneously on the multi-product line. This cuts tooling times on machinery, which increases productivity. The work plans required for assembling the hydraulics components are automatically called up and shown on the monitors as a photo or video. The display is customized to each associate's level of training, and shown in their native language. The aim is to offer associates the best possible support in their work. This is an example of how Bosch is successfully putting multiple core elements of Industry 4.0 into practice: distributed intelligence, rapid connectivity, contextualization in real time, and autonomous behavior. Details: <http://bit.ly/1TOCbsh>

Industry 4.0 boosts productivity in ABS/ESP braking-system manufacturing

Award-winning success: in less than one year, Bosch improved its productivity in the manufacture of ABS/ESP braking systems by nearly one-quarter by deploying Industry 4.0 solutions throughout its international manufacturing network. In recognition of this achievement, the Blaichach plant – which spearheaded the initiative – received the prestigious Industry 4.0 Award in 2015. One reason for this productivity increase is that Bosch collects data from the thousands of sensors that are installed along the plant's production lines. Sensors record the movement of cylinders, the cycle times of grippers, and the temperature and pressure levels in the manufacturing process. This wealth of information is entered into massive databases, with a clear structure. And thanks to RFID (radio frequency identification) technology, Blaichach can also digitally map its internal flows of goods. The result is a computer-generated virtual representation, or "digital twin," of the actual factory. This digital representation facilitates transparency across the entire value stream. And in turn, this transparency makes many more I4.0 solutions possible.

One of these solutions is applied in machinery maintenance: software analyzes machinery performance to spot deviations from the target state and indicate in good time when maintenance is necessary. The system helps associates detect and deal with errors by offering them instructions on how to carry out these repairs. On their tablets, for instance, associates can call up videos showing them how to replace parts. If they encounter a problem they cannot solve immediately, they can use a wireless video link to speak with experts who then assist in solving the problem remotely. All this reduces unplanned downtimes as well as increasing productivity and hence also competitiveness.

Data mining cuts the time needed to test hydraulic valves

By evaluating manufacturing data from its own facilities, the Bosch plant in Homburg, Germany, has managed to cut the time taken to inspect hydraulic valves by 18 percent. Given the frequently high level of optimization in modern manufacturing, such huge savings represent a major advance. Assuming an annual rate of production of 40,000 valves, the savings add up to 14 days per year. An analysis of the production data relating to 30,000 manufactured hydraulic valves showed that certain subsequent testing steps in the inspection process are unnecessary, provided the results of several earlier steps are positive. The outcome of those subsequent steps can be reliably predicted by analyzing the earlier steps. Pinpointing such correlations – which are generally much more complex than the example given here – saves time and money. When the number of parts runs into the millions, even savings of just a few seconds can soon add up to days, turning a few cents into millions of euros. The

search for new correlations (a process called data mining) requires that, over a long period of time, companies collect and appropriately evaluate the data they generate. Bosch has been doing this for many years.

Details: <http://bit.ly/21G5ZsG>

Predictive maintenance of machine tools

One of the items Bosch manufactures at its plants in Stuttgart-Feuerbach (Germany) and Jihlava (Czech Republic) is high-pressure pumps for injection systems. Part of the manufacturing process for the aluminum housing involves precise drilling of holes and milling of other parts. Large machine tools are deployed in the process, whose motorized drive units are referred to as “spindles.” Each spindle weighs some 50-70 kilograms and spins at a rate of 30,000 to 40,000 rpm. Sensors record vibrations in the operation of these spindles, and software stores and evaluates the data. Whenever the system registers that the intensity of vibrations exceeds a set limit, it sends a signal to the service associate in charge. The technician can then decide if and when to replace the spindle. Maintenance becomes easier to plan, machine availability improves, and productivity rises. Continuous monitoring of machine parts such as these spindles is also referred to as “condition monitoring.” Planned servicing is called “predictive maintenance.”

Ultrasound gloves for quality assurance

The Reutlingen plant is involved in electromobility, among other business areas. Manufacture of the necessary power electronics involves many manual activities. To support its associates in this work, Bosch introduced a system that records their hand movements. The system is based on special gloves worn by the associates. Ultrasound technology helps determine the position of these gloves. In turn, this indicates if associates have carried out a hand motion correctly, and which work step is being performed at any given moment. The entire work process is displayed step by step on a screen until it has been completed. This helps improve quality assurance.

Radio signals create transparency in the flow of goods

In many of Bosch’s more than 250 plants worldwide, the company has equipped plastic crates for the internal transport of parts and finished products with RFID (radio frequency identification) tags. RFID readers are positioned at all the doors to the manufacturing shops. When a transport cart goes from one shop to another, the reader registers its tag automatically and without any need for physical contact. The result is a digital map of the flows of goods in that particular plant. At any time, the company can determine when parts will most likely arrive on the production line, when and how many finished products have to be packaged, where a specific part is located, and what the inventory levels are.

The system also knows how many packaging boxes are required and can reorder these as needed. RFID technology ensures transparency in the flow of goods, as well as reducing manual effort and keeping inventory levels low. It simultaneously increases reaction speed and productivity. This is how Bosch achieves leaner logistics processes. Thanks to its use of RFID, Bosch was able to boost productivity in its Homburg plant's intralogistics by ten percent, and reduce storage in production by nearly one-third.

China: RFID cuts inventory time by 97 percent

In the Bosch plant located in the Chinese city of Suzhou, the yearly task of taking machine inventory used to be a major undertaking. Plant 1 has four manufacturing areas, each with up to 2,500 machines, test benches, and items of measuring equipment. For ABS manufacturing alone, the inventory process used to take up to a month in some cases. Sometimes associates printed out lists to help them manually record machine inventory. Now, thanks to smart connectivity, inventory takes just four hours. All the machines and equipment items have been fitted with RFID (radio frequency identification) transponders. This allows objects to be identified without physical contact. Now, associates push RFID trolleys fitted with a laptop and antennas through the manufacturing shop. As they move along, the trolleys use RFID technology to automatically identify machines and devices. It cuts the time needed for inventory by 97 percent, or 440 man-hours.

Transporters with swarm intelligence

Engineers in Bosch's Nuremberg plant have developed and successfully tested an AutoBod – a driverless, self-navigating transport system equipped with swarm intelligence. The two-wheeler AutoBod, which is equipped with four additional stabilizer wheels, knows when to pick up production materials that have previously been automatically ordered. It then takes these materials to the production line. Using a laser sensor, the system navigates by following a map drawn up during its first drive. It recognizes and evades obstacles, then wirelessly transmits information about them to the other AutoBods. This collective behavior relies on data about the location, electric drive charge level, and maintenance status of the various transporters. This means requests are routed to the AutoBod that is closest to the pick-up point, that is not already busy with another request, and that has enough battery charge. This kind of intelligence sets the AutoBod apart from other driverless transport systems, which are incapable of deviating from their programmed route. In contrast to conventional driverless transport systems, AutoBods do not require the installation of expensive in-plant infrastructure. The deployment of AutoBods reduces the time and effort spent on transport, frees up space, and considerably decreases inventory.

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Bosch ConnectedWorld IoT conference in Berlin **The internet of things from a single source: Bosch launches cloud for its IoT services** Computing center located in Germany

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- ▶ Bosch CEO Denner: “The Bosch IoT Cloud is a major milestone”
- ▶ Key features are privacy and data security
- ▶ Bosch IoT Cloud improves Germany’s innovative strength
- ▶ Software expertise and IT infrastructure are significant competitive advantages

Berlin and Stuttgart – Bosch is launching its own cloud for web-based services. In the Bosch IoT Cloud, the international supplier of technology services runs various applications for its connected mobility, connected industries, and connected buildings businesses. The first cloud is located in Germany. “As of today, we offer all the ace cards for the connected world from a single source. The Bosch IoT Cloud is the final piece of the puzzle that completes our software expertise. We are now a full service provider for connectivity and the internet of things,” said Bosch CEO Volkmar Denner at the Bosch ConnectedWorld conference in Berlin on Wednesday. Bosch is the only company worldwide that is active on all three levels of the internet of things. The Bosch Group offers key technologies that enable connectivity such as [sensors](#) and software, and is also developing new services on this basis. “A major factor in the success of connected solutions is their scalability. Business models must be able to grow quickly when necessary. The Bosch IoT Cloud means Bosch now has the relevant infrastructure. We see this as a major milestone for Bosch,” said Denner, who is also responsible for research and advance engineering on the Bosch board of management. The Bosch IoT Cloud comprises technical infrastructure as well as platform and software offerings. To begin with, the supplier of technology and services will use it for in-house solutions. From 2017, it will also be made available as a service to other companies.

Cloud located in Germany

Denner stressed that it was a conscious decision to locate the cloud in Germany. “Many companies and consumers state that security concerns keep them from using cloud technologies and connectivity solutions. The Bosch IoT Cloud is the answer to those concerns.” Bosch operates its IoT cloud in its own computing center near Stuttgart. As Denner explained, “Consumers want to know whether their data are protected and secure. For this reason, the security we offer our customers is always state of the art.” The fundamental legal framework for this is German and European data-security regulations. As Denner explained, “The fact that the Bosch IoT Cloud is located in Germany gives it a competitive edge. Our cloud is a competitive advantage for Germany’s status as a seat of innovation.”

The brain of the connected world: the Bosch IoT Suite

The software core of the Bosch IoT Cloud is the company’s own IoT Suite. It identifies any objects that are web-enabled, orchestrates the exchange of data, and enables a multitude of services and business models. Big data management allows enormous amounts of data to be analyzed. “The Bosch IoT Suite is the brain of the connected world. It offers all the functions necessary to connect devices, users, and companies,” Denner said. Rules for automatic decisions can be stored in the Bosch IoT Suite – such as when patterns of wear and tear should be reported and preventive action taken to service machinery. Bosch and its customers already operate many solutions and projects that are based on this platform. The Bosch IoT Cloud currently connects more than five million devices and machines.

Bosch IoT competence for the connected world

Speaking to the conference’s 1,000 delegates, Denner stressed that this digital transformation should not be understood as a threat. “Digital transformation and increasing connectivity are huge opportunities for us.” In particular, it offers those companies with a strong industrial base and outstanding hardware expertise the potential not only to develop their traditional businesses but also to enter completely new fields. “The key prerequisite for this is to have in-house software and IT expertise. Bosch has been building these capabilities for many years.”

A wide variety of possibilities and business models

The company has already launched numerous products and solutions for the connected world. The Bosch Smart Home System, for instance, can tell users the current temperature in their home and let them change the setting while they are still on the road. Another solution running in the Bosch IoT Cloud is designed for heating service technicians. It gives them remote access to authorized Bosch heating systems so they can troubleshoot problems in the event of a breakdown.

This means they can bring along any required replacement parts to their first – and now only – service visit. Customers benefit from lower service costs.

Sensor data from asparagus fields makes its way into the Bosch IoT Cloud, too. Farmers can improve their harvest and their yield if they know the exact temperature of the ground. The Bosch IoT Cloud also generates an online map of available park-and-ride spaces throughout Stuttgart's commuter train network. Sensors detect which parking spaces are unoccupied and send this information to the cloud, where it is added to a real-time map that users can call up on their smartphone. Another example is the book-and-park service for truck drivers. Whenever they are looking for a rest area to park in, their truck sends its location data to the Bosch IoT Cloud. This then reserves an available parking space nearby and informs the driver. "These examples show that intelligently connected devices, complemented by services from our IoT Cloud, are the basis of successful IoT business models. Connected solutions improve people's quality of life and conserve natural resources," Denner said.

Background:

Cloud computing

In cloud computing, data and programs are no longer hosted on computers in homes or offices, but in a cloud computing center instead. The center's operator is responsible for security and operations, makes the required computing capacity available, and provides the necessary programs, data security, and backups. This relieves customers of many costly and time-consuming tasks. Cloud technology and cloud platforms form the basis for fast, simple scalability of applications.

Bosch ConnectedWorld – where industries meet to discuss implementation

The Bosch ConnectedWorld event is an annual conference on the subject of the internet of things. This year, some 1,000 international experts are meeting in Berlin to talk about current areas of application and new business models. By showcasing successful examples, the conference demonstrates how the vision of the internet of things has become a reality.

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Bosch ConnectedWorld IoT conference in Berlin **Connectivity helps drivers find parking, optimizes servicing work, and improves asparagus yields** Bosch IoT Suite is the basis for new applications

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- ▶ Solutions for connected mobility
- ▶ Solutions for connected industry
- ▶ Solutions for the connected home

Berlin and Stuttgart – Bosch has launched its own cloud for its services on the internet of things (IoT) at a computing center of its own in Germany. These IoT applications are created using the Bosch IoT Suite. The suite offers all the functions necessary to connect devices, users, and companies. More than five million devices and machines are currently connected via the IoT Suite. Here are some examples of new Bosch solutions and products for the connected world:

1. Solutions for connected mobility

Sensors detect available park-and-ride spaces

Where is the nearest free parking space? A new Bosch system offers an answer to this usually urgent question. Sensors fitted in 15 park-and-ride facilities along Stuttgart's S2 and S3 commuter train lines can detect whether parking spaces are available or occupied. This data is sent over the web to the Bosch IoT Cloud and fed into an up-to-the-minute map of available parking spaces. This information will be made available through an app and the website of the VVS, Stuttgart's transportation authority. The system's main benefit is that it saves people time. If drivers know they can find a free park-and-ride space, they will be more willing to use public transportation, which in turn will reduce traffic jams. The smallest parking area in this pilot project offers 49 spaces, the largest over 520 spaces. Installation of the sensors will begin in 2016 and the project will run through June 2018. Details: <http://bit.ly/1RDx6QI>

Parking spaces for tired truckers

Rest areas for truckers along freeways are often hopelessly overfilled. This is especially true at night, which is also when the risk of theft increases. Bosch offers logistics companies, fleet operators, and independent truckers a book-and-

park service called “Secure Truck Parking”. This provides secure parking spaces that truck drivers can book in advance. Whenever they are looking to park, their truck sends its location data and a parking request to the system. The system then finds a nearby parking space and sends the details directly to the truck’s navigation system. Booking and billing are automatic and cashless. This system will be running in the Bosch IoT Cloud starting in summer 2016.

Rebates for careful drivers

A large German insurer is giving drivers who are careful and responsible a rebate on their insurance premium. Bosch’s Automotive Aftermarket division offers the technology to enable this, in the form of its connectivity control unit (CCU). Once installed in the vehicle, the CCU connects to the car’s OBD interface to gather data on acceleration, maximum speed, and cornering speeds. The CCU encrypts this information and sends it to a computer system via the cellular network using its built-in SIM card. The insurer can generate driver profiles based on this information and offer particularly careful drivers a rebate.

2. Solutions for connected industry

How to monitor transport crates

While product quality can be almost seamlessly monitored during manufacturing, what happens at later stages of the supply chain is often shrouded in mystery. “TraQ” (tracking and quality) is Bosch’s Industry 4.0 solution designed to address this. It allows product quality to be tracked along the entire supply chain – all the way to the customer. Sensors installed in the transport packaging or even in the product itself record information relevant for quality, including temperature, vibration, light, and humidity levels, and send these to the cloud. Software in the cloud compares the readings with permitted levels. If one of these levels is exceeded, an alert is sent in real time to customers, suppliers, and service providers. The sensors also transmit information on position, which allows expected arrival times to be calculated and thus transport management to be optimized. There are considerable benefits for participating companies: real-time notification means that in case of damage to goods, action can be taken quickly, thus minimizing things like production stoppages and their ensuing costs. Sensors integrated into the product itself help to identify the causes of damage – both during transport and while in use by the end customer. TraQ is a key component in a range of solutions that Bosch is currently working on to enable the intelligent and cost-effective management of the digital supply chain. The sensor solution is expected to have its market launch in 2017.

Wireless sensors for high-quality asparagus

Bosch is improving commercial asparagus yields with connected radio sensors. Asparagus grows especially well between 18 and 22 degrees Celsius. One way farmers maintain this temperature is by covering the mounds with strips of two-sided foil: one side is black, the other white. To heat the soil with the help of sunlight, the foil is laid with the black side facing up. To cool the soil when it gets too warm, the foil is laid with the white side facing up. To assist them in maintaining the correct temperature, the Bosch start-up Deepfield Robotics has developed a solution that consists of several sensors embedded at various depths in the ground to measure the temperature. Cables send the temperature readings to a small box, which transmits the data via radio to the Bosch IoT Cloud. From there the data is routed to an app on the farmer's smartphone. Farmers can use this data to track the temperature changes of their asparagus crop in detail, which means they can act quickly to optimize the growing conditions for the asparagus. Details: <http://bit.ly/1UGSLq4>

3. Solutions for the connected home

Safety and comfort in smart homes

The Bosch Smart Home System lets users connect their home's heating, lighting, smoke alarms, and appliances via a single platform and then operate them simply using a smartphone or tablet. At the heart of the system is the controller. This central control unit for the house connects the components mentioned above with each other and with the internet. Other elements of the system include a smart radiator thermostat and a sensor-based window contact. All data generated by the smart home are stored in the smart home controller, meaning customers retain control over their own data. Only when users who are on the road call up the temperature at home on their smartphone are any data sent via the internet. These data are encrypted before transmission over the IoT Cloud. In future versions of the product, the system will also send a message to the smartphone whenever a window or door is opened. The benefit is increased comfort and security with no need for a separate alarm system.

Details: <http://bit.ly/1ORATbJ>

The heating technician only rings once: HomeCom Pro

The Bosch HomeCom Pro online portal connects service technicians directly with their customers' heating systems. The portal shows technicians the status of the heating system at a glance – together with any servicing work that has already been carried out. In the event of a breakdown, the system allows technicians to troubleshoot problems and suggests repairs. To this end, it sends all the key heating system information to the service company's PC, laptop, or tablet. That way, the heating experts know which steps to take, which means they can generally bring along the right replacement parts on their first visit. This solution runs in the Bosch IoT Cloud.

TrackMyTools: Where did I leave my drill?

Workers need never again search for their cordless screwdriver – thanks to Bosch's TrackMyTools, they know where their tools are at all times. The result is a smoother workflow, time saved, and increased productivity. TrackMyTools works by affixing a small Bluetooth module to the tools. Every eight seconds, this module transmits a signal that can be picked up within a radius of 30 meters by smartphones or tablets running the TrackMyTools app. The mobile device then transmits this information to the cloud, together with details of the time, the user, and the most recent location data for the equipment in question. Another benefit is that owners of drills or cordless screwdrivers can access the data over the web at any time to know where their tools are and how they are being used. They can also flexibly assign individual tools and equipment to workers. Launched in 2015, the system will be migrated to the Bosch IoT Cloud in 2016.

Details: <http://bit.ly/1QpiUlr>

Press photos: 1-BBM-21502_1, 1-BBE-21804, 1-BBE-21802_1, 1-BBE-21871, 1-CR-21570_1, 1-RB-22032-e

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The Bosch Group is a leading global supplier of technology and services. It employs roughly 375,000 associates worldwide (as of December 31, 2015). According to preliminary figures, the company generated sales of more than 70 billion euros in 2015. Its operations are divided into four business sectors: Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology. The Bosch Group comprises Robert Bosch GmbH and its roughly 440 subsidiaries and regional companies in some 60 countries. If its sales and service partners are included, then Bosch is represented in roughly 150 countries. This worldwide development, manufacturing, and sales network is the foundation for further growth. In 2015, Bosch applied for some 5,400 patents worldwide. The Bosch Group's strategic objective is to deliver innovations for a connected life. Bosch improves quality of life worldwide with products and services that are innovative and spark enthusiasm. In short, Bosch creates technology that is "Invented for life."

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for the company to plan over the long term and to undertake significant up-front investments in the safeguarding of its future. Ninety-two percent of the share capital of Robert Bosch GmbH is held by Robert Bosch Stiftung GmbH, a charitable foundation. The majority of voting rights are held by Robert Bosch Industrietreuhand KG, an industrial trust. The entrepreneurial ownership functions are carried out by the trust. The remaining shares are held by the Bosch family and by Robert Bosch GmbH.

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Connected solutions as a driver of job growth **Bosch to hire 14,000 university graduates** Career opportunities for graduates as well as people with professional experience

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- ▶ Internet of things changing personnel requirements in many business fields
- ▶ “Let’s be remarkable” – a new look for the company’s image as employer
- ▶ Christoph Kübel: “Software expertise is the key to the connected world”

Stuttgart, Germany – To stay on its growth course, Bosch plans to recruit some 14,000 university graduates worldwide this year. In the future, increasing numbers of software specialists will find jobs at the global supplier of technology and services. “Connectivity through the internet of things is changing Bosch’s business – and consequently our personnel requirements – more than ever before,” says Christoph Kübel, member of the board of management and director of industrial relations of Robert Bosch GmbH. “Bosch is now a popular employer for specialists from the software and IT industries,” he adds. Almost every second vacancy at Bosch is related to IT or software. In particular, the need for software engineers for IT systems (e.g. web applications) and for embedded systems (e.g. sensor systems) is growing. A large number of Bosch associates are developing solutions for a connected world. “Software expertise is the key to the connected world,” Kübel says, announcing the staffing needs in the run-up to the IT expo CeBIT. At a regional level, the focus of new hires is on Asia Pacific. In India, Bosch plans to recruit 3,500 university graduates, followed by 2,500 new hires in China and 2,100 new hires in Germany. With a new look for HR marketing, Bosch hopes to attract future specialists with and without professional experience.

Digital transformation: interdisciplinary study in vogue

Bosch’s strategic objective is to create solutions for connected mobility, connected industry, connected energy systems, and connected buildings. For some years now, Bosch has been expanding its software expertise. As a result, new job profiles are being created, and cross-domain professional qualifications are

becoming more important. The company currently employs more than 15,000 software engineers, and the numbers are set to grow. “Today’s Bosch is also a software company,” Kübel says. “University graduates with a degree in electrical engineering, mechanical engineering, and industrial engineering and who possess software expertise have excellent chances to start a career with us.” He adds that people with the reverse profile – namely business information technology experts and software engineers with expertise in the automotive or industrial technology sectors – are also sought-after. This is because solutions for things such as connected industry call for a synthesis of different kinds of expertise for creative problem-solving. But Bosch still requires specialists, both with and without a degree, in its traditional business fields as well.

Software expertise: shaping the connected world

At Bosch, associates such as the 45-year-old Dr. Lutz Bürkle are playing a significant role in shaping the connected world. Together with his colleagues, he is working on driver assistance systems that help prevent collisions with pedestrians. “With my work, I can contribute to greater road safety. My software knowledge helps me develop the necessary algorithms,” says Bürkle, who works as a project manager at the Bosch research campus in Renningen. His colleague Jayalakshmi Kedariseti also sees the importance of software expertise in everyday working life. The 33-year-old engineer from India is conducting research on power electronics for electric vehicles. Power electronics convert the direct current provided by the battery into alternating current to drive the electric car’s motor. “Besides my electrical engineering expertise, I also need programming knowledge for my job in order to optimize power electronic components through simulation,” Kedariseti explains. “It helps that I took courses in programming languages early on in my studies,” she adds.

Bosch: working at a software company

Specialists from internet and software companies are finding attractive fields of work at Bosch, as Bosch is the only company worldwide that is active on all three levels of the internet of things. The Bosch Group offers key technologies, such as sensors and software for connectivity, and at the same time develops new services based on these technological innovations. “In the end, every Bosch electronic product should be web-enabled,” the 35-year-old Lan Guo says, getting to the heart of the matter. Just last year, Lan Guo left her assignment as section head in quality management in Reutlingen to return to China, where she works at the Suzhou location. There, she and her teams are responsible for things such as rolling out production of the electronic control units that are used for automotive near-range cameras. “It opens up a lot of professional development opportunities for me, whether in hardware or software. In the medium to long term, I can even switch to another industry without leaving the company,”

she says. In addition to the opportunity to change function or industry, the company supports different career paths. Associates can climb the career ladder moving within and between specialist, project, and leadership career paths.

Working like a start-up: creative freedom in a large company

The working environment is also an important consideration for many young professionals when choosing an employer. “For me, flat hierarchies are important, as is the opportunity to have a hand in shaping something new,” Dr. Kai Häussermann says. The 34-year-old senior software developer works on intelligent smart-home solutions at Bosch in Stuttgart-Vaihingen. The company announced just a few weeks ago that it is entering the smart-home market, and has established a subsidiary for this purpose. “The combination of the advantages of a large company and a start-up is the right mix for me. On the one hand, I have access to the expertise and processes of the parent company, while on the other I can make the most of the creative freedom the job offers,” Häussermann adds.

Workplace design: telecommuting and social media

Bosch most recently began the process of expanding its 240,000 computer workstations with modern office software. The objective is to facilitate telecommuting with familiar social media applications that associates use in their personal lives. A flexible and family-friendly working culture also plays a key role in the working environment at Bosch. The company supports more than 100 working-time models and gives equal recognition to private and professional commitments. “I don’t spend my free time at work,” says Sule Dogan, section head in the Information Systems & Services corporate sector. The 36-year-old computer science engineer and mother of a small daughter works at the company’s location in Stuttgart-Feuerbach. “Depending on the project, there can be a lot to do, but even in such cases, I try to make it a point to honor the end of the work day. Ensuring a work-life balance is simply important,” she says.

“Let’s be remarkable”: a new look for Bosch as an employer

Over the course of the year, Bosch will be presenting a new image of itself as an employer. In keeping with the guiding principle “Let’s be remarkable,” ad motifs boasting a fresh design will appear in print and online media, ad materials, and at trade show booths. The new image aims to use words and visual elements to place focus on the meaningful tasks at Bosch. “Anyone who wants to improve quality of life will find the right job at Bosch,” says Daniela Huber, who is responsible for international HR marketing. “The thing that links all Bosch associates is their desire to leave their mark on the world with products that spark enthusiasm. This is what our new image conveys.” As a financially independent employer, the company is known for its values and long-term focus. “Our meaningful tasks will therefore be the best form of HR marketing in the future as well,” Huber adds.

Internet:

Bosch at the CeBIT job and career fair: <http://bit.ly/1QAKWQk>
Bosch as an employer: http://bit.ly/bosch_vacancies_worldwide
Diversity at Bosch: <http://bit.ly/1SsbSrC>
Guidelines for a flexible working culture at Bosch: <http://bit.ly/ZRVR5Z>
Work-life balance at Bosch: http://bit.ly/bosch_work_life_balance_en
Conference Bosch Connected World 2016: <http://bit.ly/1nlvJeH>

Videos:

Bosch sensor solutions enable wearable devices: <http://bit.ly/1QIL6LE>
Data mining at Bosch: <http://bit.ly/1LlyP2f>
Connected data for rail freight: <http://bit.ly/1QIJSQK>
The connected car becomes a personal assistant: <http://bit.ly/1SYrWld>
Active parking lot management: <http://bit.ly/1oL5T5a>
Connected products portal: <http://bit.ly/24s2DvD>
Connected Industry 4.0: <http://bit.ly/21kofrv>
Working conditions and office scenes: <http://bit.ly/1TBKyGg>
Renningen research campus: <http://bit.ly/1p9XJmN>

Press photos: 1-PE-22024, 1-CR-21647, 1-CR-21645, 1-CR-21712,
1-CR-21714, 1-PE-22016, 1-PE-22017, 1-PE-22018, 1-PE-22019, 1-PE-22020,
1-PE-22021, 1-PE-22022, 1-PE-22023, 1-PE-19234, 1-PE-21759, 1-PE-21679,
1-PE-21681, 1-BBE-21802, 1-BBM-21371, 1-RB-21067, 1-RB-21102,
1-RB-21096, 1-PE-22030, 1-PE-22031

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