

**More safety, more energy efficiency, more convenience:
Bosch is investing in digital growth areas**

Presentation by Dr. Stefan Hartung,
member of the board of management of Robert Bosch GmbH,
at the press briefing for the
Bosch Energy and Building Technology business sector
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Ladies and gentlemen:

Welcome to our press briefing, whether you're here in person at Schillerhöhe or joining us by webcast. To those of you here in person, I would like to say welcome to our newly refurbished building. As you made your way to this auditorium, you may have noticed how it is above all the work environment itself that we have modernized, with a focus on collaborative work methods.

And whether making your way here today or to your office every day, you may also have passed by a solution or two from the Bosch business sector organizing today's event. Did you notice? Probably not. That's because energy and building technology is often behind the scenes; our solutions do not always immediately leap to the eye. But even with invisible solutions, we are helping to make people's everyday lives safer, more secure, more efficient, and more comfortable. That's what we want to talk about today, with a focus on three issues:

- **User experience** – involving customers early on in the development of products and services;
- **Connectivity and artificial intelligence** – applying sensors, software, and self-learning systems to make solutions smart; and

- **Partnerships, platforms, and interoperability** – opening up various providers' systems so they can work with each other.

These are crucial topics for us at Bosch as we systematically drive forward the internet of things, or IoT for short. And they are crucial not at some point in the distant future, but here and now. More than ever, we firmly believe that the IoT will fundamentally improve people's everyday lives. Smart energy and building technology enhances convenience and security, saves energy, reduces operating costs, and is good for the environment. Specifically, we offer products and services for efficiently generating, metering, managing, storing, and securing energy. I'm talking about connected heating, cooling, and ventilation systems in office buildings, about smart home applications for private homes, and of course about energy storage in industry.

What role do user experience, artificial intelligence, software platforms, and interoperability play in all this? They are decisive in leveraging the opportunities of the IoT.

But before we go into more detail about solutions and services in energy and building technology, I would like to take a moment to briefly review current trends, the market environment, and business developments over the past year.

Growth by saving – the market potential of efficient solutions

Experts predict that by 2050, there will be more than six billion people living in urban areas worldwide – twice as many as there are now, or 70 percent of the global population. Cities already account for some 75 percent of power consumption, with 40 percent going to buildings alone. By 2035, global energy consumption will have increased by a total of 30 percent, once again driving up CO₂ emissions. In light of these trends, smart – meaning connected – solutions for more efficient energy use are key to climate action. After all, they not only provide a pleasant indoor climate simply and automatically – they also reduce energy consumption and costs, and consequently also CO₂ emissions. Digitalizing buildings, then, has an ecological impact as well – and it is clearly becoming more popular. Experts predict that some 230 million homes worldwide – roughly 15 percent of all homes – will be intelligently connected by 2020. The research organization Gartner estimates that the global market for the internet of things will grow by 35 percent each year until 2020, reaching a value of 250 billion U.S. dollars. We at Bosch want to tap into this market potential, too. In 2017, Bosch sold 38 million web-enabled products. The Energy and Building Technology business sector shared in that as well, selling more than 13 million web-enabled devices, among them security cameras and heating systems.

The sector is growing – moderately so, but growing all the same. This year, its sales will rise from 5.4 to 5.5 billion euros, or by 2 percent.

The reported sales figure has above all been affected by the weakness of the U.S. dollar and the Turkish lira. If we adjust for such exchange-rate effects, we arrive at a growth figure of 6 percent. The number of associates in Energy and Building Technology will (likely) have grown from some 31,700 to 32,400 over the course of the year.

Ladies and gentlemen, the internet of things is and will remain the main driver of our business beyond the current year. Its growth is skyrocketing. Market researchers expect there to be more than 14 billion connected things around the world next year. By 2021, the figure will be 25 billion. This is not a case of connectivity for its own sake, but instead about using connected solutions to make people's everyday lives better. What are we at Bosch doing to achieve this goal?

Knowing what the customer wants – user experience

First off: products and services have to make sense from a technological perspective. But that's not enough: they also have to be fun to use! Our customers want products that are simple and intuitive to operate and that solve problems. In short, we have to know what users want and need – if possible, even before they themselves know or consciously formulate it.

To do this, we have to systematically get closer to our users, their needs, and their expectations. And this is precisely what we're doing at Bosch with our user experience approach. Over the past six years, we've trained more than 13,000 associates in this approach. It has four key phases: observing users, analyzing the observations, rapid prototyping, and user tests. We repeat these phases until we are satisfied with the result and the product. As you can see, we involve our customers in the development of products and services right from the beginning. And we adapt function and design to the insights we gain in the process. This doesn't stop with the market launch: the product stays in the focus of our user experience team, even when it is in the hands of the user.

Let me give you an example. We already considered input from potential users when developing our **360° indoor camera**. But following the product launch of this security camera in mid-2017, our product engineers stayed in regular contact with our customers, evaluating 1,000 feedback reports and talking with many of the users. As a result, more than 20 new functions have been added since the market launch, including camera control with Alexa, detection of suspicious noises, and options for panning and zooming live video instead of just passively watching what happens at home. The expanded functions of the 360°

indoor camera demonstrate how we in effect turn users into developers, learning from them and their experiences.

The same approach informs our **DICENTIS conference system** for interpreters. Imagine EU representatives meeting for a European digital summit – politicians who have to reach joint decisions, despite speaking 24 different languages. They need interpreters who can concentrate fully on correctly translating what is being said, instead of worrying about technical problems. That is why we collaborated with them to develop a lectern that expands our DICENTIS system. We showed interpreters drawings, wooden models, and prototypes, and then improved the arrangement of the controls on the basis of their feedback. The lectern can be operated intuitively, so even interpreters with visual impairment can use it. In addition, we made installation easier: interpreters can store their settings in the system and call them up using a personal NFC (near-field communication) card. They simply hold their card in front of the lectern, and all individual configurations are immediately available. This is our conception of the user experience: focusing on people and their specific needs.

Connectivity and artificial intelligence go hand in hand

Making life easier for people, relieving them of routine tasks, and freeing up time for creative work or for recreation – all these are equally

what artificial intelligence, or AI, seeks to achieve. The whole world is talking about it – Bosch is making it happen. With the help of AI, machines can learn how to be smart and to anticipate; for example, by recognizing spoken language and images. This requires data evaluation and the connectivity of as many things as possible. Products first have to have connectivity before we can use AI to turn them into smart assistants. At all times, the aim is to make people’s everyday lives better.

Even now, the number of road deaths has fallen, factory downtimes have decreased, life-threatening diseases can be detected more quickly and accurately, and machines are using less energy – and life in our homes is getting easier. These positive developments are attributable to an increase in technical assistants: in traffic, in manufacturing, but also in the home. This trend is set to continue with connected sensors, software, and services – and of course also with AI. In ten years, all Bosch products will either utilize AI themselves or will have been developed and produced using AI.

Our spending also attests to our confidence in this approach. By 2021, the **Bosch Center for Artificial Intelligence**, or BCAI for short, will have spent some 300 million euros on AI research and development. We founded the BCAI in 2017, and it already has 170 experts around

the world – a figure we expect to climb to at least 400. They are currently working on some 80 development projects ranging from automated driving to applications in healthcare and manufacturing. Bosch has support here from its academic partners, the universities of Tübingen, Stuttgart, and Amsterdam. Right now I would like to provide you with some examples of services and systems from Energy and Building Technology – solutions that are connected via the internet of things and are moving in the direction of AI.

Today, more than 15 percent of interactions with **Bosch Service Solutions** customers are data-based. In other words, we're speaking about direct communication between things and machines with no human involvement. By 2021, we aim to increase this share of interactions facilitated by the internet of things to some 30 percent, and to as much as roughly 50 percent by 2025. Our Service Solutions division has also already piloted the use of AI. Specifically, we have used bots in customer communication, also known as **technical dialog systems**, which understand text input or even spoken language. They draw on background databases to find the right answer to each question. This process is more than a pure "if A, then B" logic based on predefined keywords. AI enables chatbots to determine the context and thus to properly classify misspelled or mispronounced words or those with multiple meanings. With this context-sensitive capability, bots can also

assume “concierge functions,” with which they can direct customers automatically to the appropriate contact person. Their software responds to customer behavior – this point alone makes bot solutions superior to pure search functions.

Nonetheless, this automated approach is especially well suited for answering simple and frequently asked questions, such as those about delivery times or tourist destinations. This frees up customer advisors so they can devote more time to complex or sensitive problems. We firmly believe that people will remain irreplaceable in service solutions. Take for example a serious road accident: in situations like this, a human voice is absolutely vital, in the truest sense of the word. Bosch will continue to rely on this element wherever empathy is required – for instance, in the eCall emergency call service, where specially qualified experts will be free to focus on exerting a calming influence on those involved in an accident. In the future, AI will be able to lend a hand as well. The analysis of sensor data, whether from tires, car seats, belt tensioners, or even external weather services, will deliver further key insights into the accident. It is conceivable that AI will provide emergency services with important initial information – not just about snow or black ice at the scene, but also about the probable severity of the injuries. Quick and comprehensive information can save lives.

Our **monitoring services** also improve safety and, more than ever, they are doing so over the internet of things. For example, we are connecting crucial areas and infrastructure in buildings. In Germany alone, some 40,000 elevators are connected to the Bosch Service Solutions control center. Such connectivity makes it possible to quickly free any people trapped inside one of them in an emergency.

In the logistics sector as well, we are employing sensor-based services. The demand for web-based monitoring services is continually rising – on the road, on water, and in the air. They help keep track of the condition and location of urgent deliveries of plasma, rare vaccines, easily perishable foods, or expensive smartphones. If a condition or location deviates from the norm, the control center is automatically notified right away. This benefits people by increasing security and convenience – and reducing waste.

Critical situations that could literally flare up call for **video-based fire detection** systems from Bosch Building Technologies. We plan to further expand this business area, which is one where we have high expectations of artificial intelligence. Special AI-based Aviotec cameras use intelligent image analysis to detect fires. Cameras pointed directly at potential problem spots detect flames or smoke within seconds. This is even faster than conventional smoke detector systems, in which the smoke has to first reach the detectors. If a fire starts on the floor of a

hall with high ceilings, it can take minutes before the smoke reaches the actual detector. In contrast, the new intelligent cameras can detect smoke and flames right at the source – this resulting head start is decisive in limiting damage and perhaps even saving lives.

Beyond safety, our **smart home solutions** also help ensure the desired interior climate, comfort, and energy efficiency. This business is constantly growing. According to a study by Arthur D. Little and eco, the German market alone will be worth 4.3 billion euros by 2022, which means average annual growth of 26.4 percent. By way of comparison, the figure was just 1.3 billion euros in 2017. Connected solutions are becoming more and more popular in Germany's private homes, which the industry association Bitkom attributes in no small part to the spread of digital voice assistants. Straightforward voice control helps allay people's concerns about the technology. This year, Bosch integrated Alexa into its smart home system. This is AI based on connectivity and intelligent speech recognition. A security system that uses facial recognition to deactivate itself when an authorized user enters, or a window that closes itself based on a forecast of bad weather – this is what we see as the future of the smart home. To turn such ideas for homes into business opportunities, we need to spark occupants' enthusiasm for them.

One way in which we do so is with our **scenario manager**, one of the highlights at the IFA in Berlin this year. This is an app that lets users control all devices connected with the Bosch smart home system. It allows residents to quickly and conveniently take care of everyday tasks, such as turning off lights, heating, and electrical appliances when leaving the house. They can select one of the preset scenarios or program their own. Two of the preset scenarios are “Leaving the house” and “Coming home.” Another is the “Good morning” scenario: running it raises the window blinds, turns on the hall light, and signals the heating system to adjust to the desired temperature in the bathroom. Meanwhile, in the kitchen, the kettle can start boiling water for a morning cup of tea thanks to its plug adapter. What enables the scenario manager to handle all this is the connectivity of as many devices as possible.

In the future, AI will take on a larger role in smart homes as well. The home will learn from specific behavior patterns of its occupants and be able to adjust itself to best meet their needs. Algorithms will detect if something does not fit an established pattern – such as a smart heating valve that registers unusually high energy consumption in the middle of the night. The valve reports the unusual event not only to the user, but to the heating system as well – which can then turn itself off to avoid water damage, sparing the customer high costs. We firmly believe that the benefits of AI will be so obvious that this will win over other home-

owners to the smart-home idea. That is precisely why we are already working on artificial intelligence in the home, collaborating with partners inside and outside of Bosch.

Helping devices understand each other – platforms and interoperability

Ladies and gentlemen, “together” is the keyword for a further strategic aspect that is important to us at Bosch: partnerships, platforms, and interoperability. The connected world is one in which many devices and services are in use, made by different manufacturers. We have to find a way to get these devices and services to become friends. They have to understand each other and be interoperable if they are to generate benefits for people.

In that vein, today I'd like to tell you about the latest addition to our IoT ecosystem, the startup [SAST](#). SAST stands for Security and Safety Things GmbH. Established just a few weeks ago in Munich, the company is still small, but it has big plans. The startup is a wholly owned Bosch subsidiary, currently with 80 associates, that aims to shake up the market with software for security cameras. Its objective is to develop the world's first open IoT platform for security camera applications. The new app store should be online by mid-2019.

Security cameras have become indispensable in areas with large crowds of people. They improve the safety of train stations, airports, stores, and office buildings. Cameras have also long served to help detect dangers early by supporting the analysis of movement patterns – another area where AI was put to use early on. Still, there’s one challenge: as their software gets older, the cameras are getting “dumber.” Even when new software is released, it is often incompatible with their specific hardware. Security cameras would thus be capable of much more if we regularly updated them with compatible software packages.

And this is where the new startup comes in. SAST provides the first operating system that can be used for programming and controlling different security cameras. That means no more multiple update versions for multiple software programs – one is enough. With this open and standardized operating system, SAST has achieved nothing less than the creation of a global marketplace for security camera applications. For new cameras, this means old software out, new software in: remotely, with no further adjustments, with no great fuss, and whenever necessary – throughout the camera’s service life.

The new solution is being launched in a market that has been steadily expanding for years. In Germany alone, according to BHE, customers spent more than half a billion euros on security video technology in 2017, a 7 percent increase over the previous year. Manufacturers will

deliver some 130 million security cameras around the world in 2018; compare that to 2006, when it was just 10 million (source: IHS Markit). It is for this growing market that we are creating the first uniform software development platform, which is sure to deliver benefits for all stakeholders.

Ladies and gentlemen, this news about our SAST project brings me to my closing remarks. It is an especially clear example of our strategy of investing in digital growth areas, and encouraging the emergence of new platforms in the process.

Finally, I'd like to announce a changeover in the leadership of the Energy and Building Technology business sector. From January 1, I will be passing the baton to Dr. Christian Fischer, and it is to him that I would now like to hand over.



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**Digital transformation –
a new mountain to climb**

Dr. Christian Fischer,
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speaking at the Energy and Building Technology
business sector press event,
on December 7, 2018

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Thank you, Mr. Hartung...

... for your kind words of introduction. So, I'm the new guy here – so new, in fact, that it would be too early for me to make any definite, agenda-setting predictions about the future of the Bosch Energy and Building Technology business sector .

And as a native of the maritime city of Hamburg, I However, as someone with a passion for mountain hiking, I would also say that we're in the middle of digital transformation, a task that's like climbing a mountain for the first time. It demands that we seek out new and untested tracks and routes. This will call for a clear view, good equipment, a solid walk, and some bold moves last but not least, a strong support team. Having the right women and men in the team is essential.

Staying briefly with this image it certainly applies to the present situation. What Bosch brings along to an expedition like this is a deep and di-verse knowledge of the world of things. Bosch has a wide-ranging expertise that spans different domains and connects many different areas, such as cars with homes.

I am always amazed by this company's 130-year history of innovation. As a new member of the board of management, I hope to be able to help roll out new developments in the years to come. The vision we all follow is embedded in our strategic imperative "Invented for life."

Here, at Bosch Energy and Building Technology, this is a pledge that we are now starting to fulfill. Mr. Hartung has just described the products and solutions that will enable us to do this. As a believer in credible visions, I will continue to work very hard in this direction. Bosch was visionary enough to focus on digital transformation at a very early stage. . It is more than ten years ago since Bosch began exploring the opportunities, offered by the internet of things. And the benefits of this technological head start are starting to show:

- a host of connected products and devices
- our own IoT platform, and
- a range of applications in the field of artificial intelligence.

As Mr. Hartung has just explained, these applications are not just a vague possibility, but are emerging right now in the present. But none of this can be realized without skilled and motivated colleagues. That may sound like trite management-speak. But for me, as the new guy, it is reassuring to know that there are so many excellent people working together at Bosch Energy and Building Technology.

These are good conditions on which to build when I take over the helm from Mr. Hartung. I'm excited to have the opportunity to shape the future of a company as strong as Bosch. For me, there's no doubt that Bosch is extremely well positioned to take on the challenges of digital transformation. You may well know that I used to be head of a TecDAX company – and that I have also experience in the consulting business, from my time at Roland Berger. I know all too well how difficult restructuring can be. This is why I'm very much in favor of proactive transformation – and this is exactly what I see happening at Bosch.

We are now happy to answer your questions