

Bosch and Veniam ensure seamless vehicle-to-everything connectivity

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- ▶ Dr. Dirk Hoheisel: “Bosch is taking a multi-standard approach when it comes to V2X.”
- ▶ All-in-one principle: Bosch connectivity unit communicates using all of the world’s popular transmission technologies.
- ▶ Smart connection management software from Veniam always selects the best communication standard.
- ▶ Bosch and Veniam have been selected as CES 2019 Innovation Award Honorees.

Hildesheim, Germany / Mountain View, USA – What is true for people is also true for cars: communication works best with a common language and a good connection. To enable connected and automated driving in the future, vehicles must be able to easily communicate with one another as well as with their surroundings. There is currently no globally standardized technical basis for this exchange of data, which is known as vehicle-to-everything communication, or V2X. Instead, vehicles will in future communicate using the wide variety of different standards implemented by countries and vehicle manufacturers around the world. “Bosch is taking a multi-standard approach when it comes to V2X. We have developed a universal connectivity unit capable of communicating using all of the transmission standards implemented in connected automobiles,” says Dr. Dirk Hoheisel, Member of the Board of Management at Robert Bosch GmbH. The neat thing here is that Bosch has combined connectivity units and telematics units, which – individually – are only capable of a single transmission technology, to create an all-in-one central control unit for V2X data communication. Cars can then use the Wi-Fi networks available in cities, while elsewhere they can communicate using, for instance, cellular networks. The complex task of managing these diverse communication options is handled by a software solution from the Silicon Valley-based start-up Veniam. It continuously searches for the best transmission technology that suits the particular requirements and switches automatically between the available alternatives. The software therefore

maintains continuous and seamless vehicle connectivity, ensuring cars can, for example, reliably alert one another to accidents and passengers can enjoy uninterrupted music streaming.

Bosch develops a connectivity unit for all standards

It is expected that the number of connected vehicles on the roads in Europe, the United States, and China alone will exceed 470 million by 2025 (source: PwC). Initially, most vehicles will connect directly to the cloud; but, thanks to V2X, increasing numbers of vehicles will in future also be able to communicate directly with one another as well as with traffic signals, road construction sites, pedestrian crossings, and buildings, etc. They will then be able to alert one another to potential hazards like the approaching tail end of a traffic jam, accidents, and icy conditions. Vehicles will also be able to take advantage of the green wave, because they will know when the next set of traffic lights is going to turn green. The vehicles can then adjust their speed accordingly. This ensures the traffic, particularly in cities, flows more smoothly. There is, however, no globally harmonized standard for V2X communication currently on the horizon. While China primarily uses Cellular-V2X technology (C-V2X), which is based on mobile communications, Europe and the United States are planning to additionally introduce transmission standards based on Wi-Fi (DSRC and ITS- G5) alongside C-V2X. A mishmash of standards is therefore emerging internationally, which may lead to vehicle communication issues. However, that will not be the case in the future when cars are equipped with the universal connectivity unit from Bosch. Equipped vehicles will be able to communicate with one another as well as with their surroundings regardless of the vehicle make or the country in which they are used. This will make V2X communication even more secure and reliable. “Thanks to Bosch’s all-in-one principle for connected vehicles, as many drivers as possible around the world can benefit from the added safety, comfort, and convenience provided by V2X,” says Dirk Hoheisel.

Software ensures the best connection

The software from Veniam is the connection enhancer for the connectivity unit from Bosch. As well as keeping an eye on which V2X communication technologies are currently available for use, the software also closely monitors the costs and data transmission latency of each alternative connection option, since not every technology is suitable in every situation. For example, when it comes to alerting a driver to another vehicle that is about to pull out in front of them from a side street, every millisecond counts. This kind of critical information must be communicated in real time using highly reliable technology that is always ready for use – even if that means the resulting data transmission costs are greater. Software updates from the cloud or a navigation system map update, on the other hand, can be put on hold in that sort of situation until a low-cost

stationary Wi-Fi network becomes available. Large volumes of data can be transmitted via Wi-Fi in a short space of time, though a downside is that public or home Wi-Fi hotspots are not always available. Veniam's software is familiar with the pros and cons of each of the communication types and always establishes the optimal connection. "The unique combination of Veniam's smart networking software and Bosch's connectivity unit boosts the vehicle's data-handling capacities dramatically, paving the way for innovative cloud services and much safer future mobility," says João Barros, founder and CEO of Veniam. On the occasion of the world's biggest consumer electronics trade show, CES 2019 in Las Vegas, Bosch and Veniam have been selected as CES 2019 Innovation Award Honorees in the "Vehicle Intelligence and Self-Driving Technology" category for their jointly developed solution.

Bosch tests V2X in Europe, the United States, and China

In the biggest European field trial to date (simTD, Safe Intelligent Mobility – Test Field Germany), V2X communication has proven its suitability for daily use under everyday conditions and in lab simulations. Bosch has played a significant role in this joint project. Since February 2017, Bosch and Vodafone have been performing trials of the V2X communication with the first 5G test modules – the first companies in Europe to do so. The A9 freeway in Bavaria north of Munich is the location for the field tests, which focus on [real-time warning systems](#) during lane changing maneuvers on the freeway or in case the vehicle in front brakes suddenly. V2X will also be able to make driver assistance functions even more comfortable, like [adaptive cruise control \(ACC\)](#). In the summer of 2018, Bosch tested secure, direct communication between vehicles and roadside infrastructure, cameras, and sensors in Detroit. The test showcased Wi-Fi- based DSRC technology, where equipped vehicles were provided with in-vehicle notifications about the status of traffic signals ahead and pedestrians crossing the street – functions designed to enhance safety in city traffic. ESCRYP, a subsidiary in the Bosch Group, provided the cybersecurity technologies behind these V2X demonstrations. In China, Bosch is testing ad hoc communication using Wi-Fi as well as cellular technology. The tests are focusing on alerts that help the driver when overtaking or negotiating complex intersections.

Press photos: #1713652, #1714739, #1714740, #1713653, #1714753, #1714754

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Bosch at CES 2019

- **PRESS CONFERENCE: Monday, January 7, 2019, 9:00 a.m. – 9:45 a.m.**
(local time) in the Mandalay Bay Hotel, **South Convention Center, Level 2**; Mandalay Bay Ballrooms B, C, and D
- **TRADE SHOW BOOTH: Tuesday to Friday, January 8 – 11, 2019** in the Central Hall, booth #14020
- **FOLLOW** the Bosch CES 2019 highlights on Twitter: **#BoschCES**

About Bosch:

Mobility Solutions is the largest Bosch Group business sector. In 2017, its sales came to 47.4 billion euros, or 61 percent of total group sales. This makes the Bosch Group one of the leading automotive suppliers. The Mobility Solutions business sector pursues a vision of mobility that is accident-free, emissions-free, and stress-free, and combines the group's expertise in the domains of automation, electrification, and connectivity. For its customers, the outcome is integrated mobility solutions. The business sector's main areas of activity are injection technology and powertrain peripherals for internal-combustion engines, diverse solutions for powertrain electrification, vehicle safety systems, driver-assistance and automated functions, technology for user-friendly infotainment as well as vehicle-to-vehicle and vehicle-to-infrastructure communication, repair-shop concepts, and technology and services for the automotive aftermarket. Bosch is synonymous with important automotive innovations, such as electronic engine management, the ESP anti-skid system, and common-rail diesel technology.

The Bosch Group is a leading global supplier of technology and services. It employs roughly 402,000 associates worldwide (as of December 31, 2017). The company generated sales of 78.1 billion euros in 2017. Its operations are divided into four business sectors: Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology. As a leading IoT company, Bosch offers innovative solutions for smart homes, smart cities, connected mobility, and connected manufacturing. It uses its expertise in sensor technology, software, and services, as well as its own IoT cloud, to offer its customers connected, cross-domain solutions from a single source. 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." The Bosch Group comprises Robert Bosch GmbH and its roughly 440 subsidiary and regional companies in 60 countries. Including sales and service partners, Bosch's global manufacturing, engineering, and sales network covers nearly every country in the world. The basis for the company's future growth is its innovative strength. At 125 locations across the globe, Bosch employs some 64,500 associates in research and development.

To learn more, please visit www.bosch.com, iot.bosch.com, www.bosch-presse.de, twitter.com/BoschPresse.

About Veniam:

Veniam is accelerating future mobility by delivering intelligent networking software for connected cars and autonomous vehicles. With an IP portfolio of more than 160 patents, Veniam's data networking platform makes the most out of all available networks to improve quality of service and reduce the costs of moving massive amounts of data between vehicles and the cloud. Working closely with the world's largest Auto OEMs and Tier 1 suppliers, Veniam aims to improve the lives of millions of people by securely managing the data flows of a new and emerging mobility ecosystem – the Internet of Moving Things – where vehicles move people and goods efficiently but also expand Internet coverage, deliver new human experiences and gather valuable data for smart city applications.

Named by CNBC and NASDAQ as one of the 50 most disruptive companies in the world, Veniam is a global company with its headquarters in Mountain View, California, Engineering Center in Porto, Portugal and sales offices in Detroit, Munich and Tokyo.