SIEMENS

Background information

On the path to a new era: How 5G will change industry

A factory site in 2025: Goods, spare parts, and finished products are being transported between delivery bays, production facilities, and warehouses by a fleet of autonomous vehicles which is precisely coordinated with the manufacturing schedule. Countless devices are networked with each other in production and transfer data from the entire production line in a matter of milliseconds. Cameras on a conveyor belt can, for example, identify a foreign body and bring a robot to rest instantly. The field engineer is able to carry out remote maintenance and service tasks easily and effectively using augmented reality without having to leave the site. All this is possible due to the 5G communication standard which has been introduced in Germany. According to the Mobile Economy 2019 Report (GSMA), 15 percent of the world's mobile communications will run on 5G as early as 2025. "The opportunities for industry are immense," says Sander Rotmensen, Head of Product Management for Industrial Wireless Communication at Siemens. "We are talking about a wireless network which can combine many things thanks to its bandwidth: From automated racking systems, and production robots, to air conditioning systems, and control panels. An all-encompassing network which allows an industrial plant to be controlled wirelessly – reliable, super-quick, or equipped with very high bandwidth." Siemens has therefore committed itself to this new communication standard from the outset and is supporting standardization and industrial implementation.

Added value for users and industry

Looking back on the development of mobile networks over the last 40 years shows that they have always generated added value for users and industry alike. Even the first commercial mobile network, in retrospect, the first-generation network (1G), allowed us to talk to each other while on the move, in other words, mobile telecommunication. 2G networks heralded the arrival of text messages, 3G put the Internet into people's hands, and 4G did the same for music and video streaming.

However, for industry, 1G applications might as well not have existed due to high costs, the restriction to analog voice transmission, and limited network coverage. The next generation, 2G, brought text messages and later even simple data transmission for industrial telecontrol applications. 3G allowed long-distance actions and remote access, for example, in teleservice where users could interact with remotely installed applications. 4G finally provided high-performance mobile remote access – and that is not the end of it. 5G wireless mobile communications will bring further improvements, focusing on increased bandwidth, greater reliability, lower latency, and more connected devices.

A vision with three key scenarios

The “3rd Generation Partnership Project (3GPP)” is responsible for the global standardization of mobile networks, including the 5th generation. The 5G vision was established in an early phase of the development of the most recent standard. This consists of three key scenarios or use cases which are envisaged for fifth generation mobile networks.

The first key scenario, Enhanced Mobile Broadband (eMBB), encompasses improvements with respect to 4G. The main objective is the realization of data-driven applications which require high data rates with global, large-scale network coverage. A typical example is the growing need for HD high-quality streaming of music and videos on mobile devices such as smartphones. It is also possible to envisage augmented-reality applications for industry which would support field engineers.

The second scenario, Ultra-Reliable Low-Latency Communication (URLLC), includes demands for high reliability and low latency in challenging industrial applications. Typically, this includes mobile robots, autonomous logistics, automated guided vehicles (AGVs), or safety applications.

The third scenario, massive Machine-Type Communication (mMTC), focuses on connecting a large number of devices in a small space. In practice, this frequently means applications for the Industrial Internet of Things (IIoT) where a unit area typically has a high device density. The devices send or receive data continuously at longer intervals so that only the smallest possible bandwidth is used. Another example could be the process industry where many sensors are installed (e.g. for temperature, pressure, flow) to support process monitoring in a plant.

Actual implementation and its limits

In spite of the many potential advantages of 5G, we should bear in mind that not all functionalities will be available from the start and that, in most cases, they cannot be combined. A series of capabilities were defined which 5G had to have in order to satisfy the stated objectives from the three key scenarios. This includes downlinks with peak data rates of 20 Gbits/s and a maximum latency of 1 millisecond, as well as specifications with respect to mobility, density, energy efficiency, spectrum efficiency, and area network capacity.

5G has a phased release schedule to allow for these commitments and the prescribed timeline for the new standard. Release 15 has been released this year with a focus on the eMBB (enhanced Mobile Broadband) scenario. Releases 16 and 17 will support the two remaining scenarios and have more relevance for industrial applications.

Public vs. private network

One of the most important variables when building a 5G network is the subject of ‘public vs. private network’. Operating public networks is covered with the first release of 5G while private networks with URLLC (Ultra-Reliable Low-Latency Communication) will be part of the imminent Release 16 which is planned to start in the middle of 2020.

The mobile networks we know today are public. They are operated by a mobile network operator and all transmitted data flow through the operator’s network. This poses a data protection risk for the user as the data leave the user’s jurisdiction. A private network, on the other hand, is similar to WLAN (wireless LAN) network. The data remain in the network and do not leave the private domain. The data are therefore more secure.

Spectrum as a key factor

The provision of 5G has a higher spectrum requirement than previous generations of mobile communications. The spectrum is owned by governments. Some of it is royalty-free (ISM bands, Industrial Scientific and Medical) but for mobile networks, governments auction off the frequencies to mobile network operators as they are building national public networks. These public networks are typically focused on

eMBB applications in order to provide users with the highest possible data rate and bandwidth.
However, industrial 5G allows the network to be ‘tailored’ to each application. For example, URLLC and mMTC could be more beneficial than eMBB for different industries. In private networks, the end user can determine which parameters are set and operate the network in the way which is best for the specific application. However, sufficient spectrum must be available to industry for these types of private networks.
In Germany, the Bundesnetzagentur (Federal Network Agency - BNetzA) has decided to reserve 100 MHz from 3,7 GHz to 3,8 GHz for local industrial use. This provides German companies with the opportunity to lease a spectrum for an annual payment for exclusive use in their own operating facilities and therefore to ensure optimum data protection.

Summary

5th generation networks undoubtedly offer industry enormous potential. The unprecedented reliability and very low latencies as well as the comprehensive IIoT connectivity of Industrial 5G all make it much easier to create future-oriented applications in industry. These include mobile robots in production as well as autonomous vehicles in the transport and logistics industries, IIoT, augmented reality applications for service and maintenance engineers, and virtual reality applications. As the leading company in automation and digitalization, Siemens is also grasping this opportunity and is already developing solutions which allow industrial companies to increase their efficiency, flexibility, and productivity, and to future-proof their plants with the new 5G technology.