Technical article, published in: elektro AUTOMATION (03-04/2020)

5G and co. optimise resources and material flow in the factory

More data transfer

Digitalisation and Industry 4.0 are changing the world of production. Shorter innovation cycles, a growing number of variants, lot size 1 and a more efficient use of production plants and resources are all forcing companies to use innovative technologies in their intralogistics. Of special significance in this context is the communication between the many sensors, actors and the IT infrastructure. In this interview about new trends, experts discuss the role played by wireless communication and its potential for creating new business models.

The questions were put by Andreas Gees, Assistant Editor-in-Chief of "elektro AUTOMATION"

elektro AUTOMATION: Digitalisation and Industry 4.0 are changing the world of production. Which trends can you identify, and which trends are impacting intralogistics?

Michael Braun (Unitronic): In the context of digitalisation within business processes, we can definitely identify a trend towards home office – in other words, wherever work is not location-specific, employees are able to control processes from home. This includes flexible working hours, which employers are also granting their staff. In the field of intralogistics, the use of robot technology is becoming ever more important. Consignment robots are increasingly taking on automated warehouse work, picking products from warehouse containers and placing them in consignment boxes. Despite the high degree of automation in production, we are also, however, observing a trend towards 'one man, one engine' processes. This philosophy, in which a single technician builds, for example, a complete engine, is strongly focused on the individual, not only ensuring quality, but also encouraging a high degree of employee identification with the product.

Eckard Eberle (Siemens): The current digital transformation is being driven by the necessity to react appropriately to the increasingly high volatility and continually growing number of different products, and in so doing to increase process quality. One answer to this is the use of digital systems which match various processes to a 'digital twin'. What is needed is a continual, flexible and safe alignment of real processes with IT systems and the cloud – something which we call digital connectivity. And since the current digital transformation concerns the entire value chain, intralogistics cannot ignore these demands either.

Dr. Anton Schäfer (Telekom): Many individual production processes have been standardised and digitalised. Their integration is highly complex. Artificial intelligence (AI), big data and data analytics are

steute Schaltgeräte GmbH & Co. KG
Brückenstr. 91
32584 Löhne, Germany
Phone: + 49 (0) 5731 745 0
Fax: + 49 (0) 5731 745 200
info@steute.com
www.steute.com

nexy facilitates the remote integration of sensors, actors and control devices. Data are transferred from Access Points to superordinate IT systems.

optimising the entire value chain. AI is transferring routine tasks to software robots in robotic process automation (RPA). Special machine and sensor networks, such as NB-IoT or LTE-M as part of 5G, are connecting sensors to the Internet of Things (IoT). In mobile communications networks exclusively for company sites, so-called campus networks, transport robots are integrated remotely. At the same time, data security demands are rising. Here blockchain can help with the uninterrupted documentation of processes. The focus in intralogistics is increasingly on topics such as track & trace, predictive maintenance, access control via digital keys and digital control systems.

Andreas Schenk (steute): The trend towards uninterrupted process automation is ongoing. Companies want to save time and to increase efficiency, but also to improve process reliability. In addition, more and more products are manufactured 'on demand' or as customised variants. Production and also logistics are thus becoming ever more complex. Software solutions such as ERP or MES systems have to reflect this, and frequently not only for certain jobs and lot sizes, but increasingly also for individual products. On the data side, this infrastructure ultimately corresponds to the 'digital twin' of the smart factory. In order to cope with

steute Schaltgeräte GmbH & Co. KG
Brückenstr. 91
32584 Löhne, Germany
Phone: + 49 (0) 5731 745 0
Fax: + 49 (0) 5731 745 200
info@steute.com
www.steute.com

these new tasks, ERP systems are increasing in their complexity and performance. Via standardised interfaces they now dock onto subsystems, such as our wireless network nexy.

Aurelius Wosylus (Sigfox): With the availability of 0G networks like Sigfox, digitalisation is also finding its way into the basics. Our network was developed to include small and low-price things which were not previously integrated because this would have been too expensive or too high-energy. In logistics this currently refers to load carriers of all types – from large special load carriers down to the many different small load carriers (SLC) in the factory. Thanks to their IoT connection, users always know where they are, and long search times are replaced by short identification times. Users also know when a load carrier is moving and when it arrives at its destination inside the production hall or even its destination worldwide. And they know when something unplanned happens, such as theft. Users enjoy full process transparency in real time. They are thus able to simplify and optimise management of their load carriers, both inside the factory from incoming goods to warehouse to production to dispatch, and in transport logistics en route to the customer and even the customer's customer. Load carrier management also means that stocks can be digitalised in real time, making 0G networks suitable for Kanban digitalisation, automated order triggerng and vendor-managed inventory strategies. Further application fields are automated delivery recording, anti-theft protection and inventory management.

elektro AUTOMATION: Which changes in intralogistics are necessary in order to be able to react to the growing demands?

Eberle: What intralogistics has to deliver is greater flexibility in conjunction with lower costs and fewer errors. The basic task remains the same: to have the right components in the right place at the right time. In detail this also means faster and automated orders, uninterrupted recording of all movements of goods (also for automated bookings), as well as dynamic and intelligent reaction to all modifications.

Dr. Schäfer: Logistics networks and supply chains are becoming more complex – and at the same time data quantitites are increasing. While the demand for flexibility is growing in every phase of the process. The only thing which can help is transparency, with an uncompromising changeover from paper-based to digital processes. With the 'digital freight paper', for example, an electronic display with a GPS module shows which papers are required. The global electronic data interchange standard for exchanging business data simplifies the processing of track & trace notifications and blockchain-based processes. The right technological equipment and a suitable IT infrastructure are crucial for integrating terminal devices and applications. They take care of connectivity and short latency periods in conjunction with the best possible IT security. The motto is be brave – decision-makers must see digital transformation as a chance to grow.

Schenk: When data processing accompanies every single product as it moves through production, assembly and

steute Schaltgeräte GmbH & Co. KG
Brückenstr. 91
32584 Löhne, Germany
Phone: + 49 (0) 5731 745 0
Fax: + 49 (0) 5731 745 200
info@steute.com
www.steute.com

consignment – and that is clearly the trend – high-performance IT solutions and communication networks are required to keep pace with the sheer volume of data. This is a highly complex branch of industry which is currently experiencing a monumental shift. In some areas we can also observe a strong trend towards flexibility. The automotive industry, for example, is eliminating the production lines which dominated its production for exactly 100 years, while research institutes are testing concepts such as matrix production, enabling, for example, car wheels to be produced one day and cooking pots the next. This all means: more data transfer.

Wosylus: I would like to turn our focus in another direction. Requirements are simpler using 0G-based digitalisation. Scanners and gates are no longer required. Users simply record data from all things on a regular basis and are thus always informed. Sigfox is a network which is already available. It does not have to be installed or maintained. And thanks to low-energy 0G wireless technology, the sensors have battery lifetimes of several years. In transport logistics, sometimes lifetimes of 7+ years are already guaranteed. Research projects at the TU Deggendorf are addressing energy harvesting, leading us to expect even longer lifetimes in the future. Freedom from maintenance is what makes many digitalisation projects possible which otherwise would not be financially viable.

elektro AUTOMATION: Wireless communication is playing an increasingly important role. Which benefits, which applications are there for campus networks in intralogistics?

Braun: Campus networks are tailored to suit individual user needs and meet future demands from the Industry 4.0 environment. Typical features of such campus networks are closed wireless networks, high data security, fast data transfer with low latency periods, guaranteed availability of high bandwiths with a defined data throughput, as well as very high reliability in conjunction with low energy requirements. Of course, campus networks on the basis of Office Wi-Fi or the slightly more robust industrial WiFi already exist. If, however, the number of integrated machines and applications within a company increases, higher-performance mobile wireless networks become necessary. In addition, Wi-Fi is not suitable for mobile scenarios, for example automated guided vehicles (AGV) in logistics.

Eberle: Precisely because intralogistics is concerned with moving objects (goods and vehicles), wireless technologies are a must. 5G – and in particular the version Industrial 5G with local frequencies and its focus on short latency periods – is viewed for example as the ideal communication technology when it comes to the management and coordination of AGV and mobile robots. But there are other mobile technologies which seem to be equally important. One example: real-time locating systems (RTLS) make it possible to monitor and control materials and goods within a factory at all times. And when the RTLS transponders – such as Simatic RTLS – have a dynamic display at their disposal, then whole new forms of interaction with

steute Schaltgeräte GmbH & Co. KG
Brückenstr. 91
32584 Löhne, Germany
Phone: + 49 (0) 5731 745 0
Fax: + 49 (0) 5731 745 200
info@steute.com
www.steute.com

employees can be created. For example, a materials box can automatically display what is inside it and where it needs to be brought next.

"Minor applications will continue to communicate via simpler, yet equally reliable wireless networks."

Andreas Schenk, Product Manager Wireless at steute Technologies in Löhne

Dr. Schäfer: Campus networks make this leap into the future possible, the exclusive wireless integration of defined production halls through the expansion of a local mobile infrastructure. They provide uninterrupted wireless availability inside buildings and on site – a must for track & trace solutions and digital control systems. Centrally controlled vehicles autonomously transport materials from one part of the site to another, production machines send notifications when they require maintenance. 5G technology offers many of the features necessary for this, such as a high bandwith, short latency periods and improved availability and reliability – with low energy consumption. The closed wireless network offers high data security, yet is connected to the normal mobile wireless network for communication with partners or suppliers. The costs are much lower than for cabled solutions: no extra cables have to be laid on site.

Schenk: Since intralogistics objects are not static, but moving through the factory, the flow of information can only be wireless, controlled remotely. The pioneers of such applications, e.g. in the automotive industry, have to date used WiFi solutions, but in practice they often come up against their limits – for example when managing AGV fleets. Here the latency periods are often high, sometimes too high. This is where 5G is perfect – a high-performance and reliable network which can be used for dozens of applications and in which each individual package and each individual load carrier can be precisely localised and controlled. 5G will come. Many devices today are not yet 5G-compatible, but that will change.

Wosylus: A classic 3G/4G or 5G mobile wireless connection is no good for the integration of simple things for lengthy periods without having to recharge a battery. As the name 0G, pronounced zero-G, suggests, our Sigfox 0G network stands apart from these classic mobile wireless technologies. Small amounts of data, 140 messages per day and extremely low-energy data transfer make it possible to integrate load carriers efficently. The only thing the technologies have in common is that 0G also provides a public network, like the 3G/4G or 5G mobile wireless connections. Campus networks on the basis of Sigfox 0G are not currently available. But they are also not necessary since we can guarantee

steute Schaltgeräte GmbH & Co. KG
Brückenstr. 91
32584 Löhne, Germany
Phone: + 49 (0) 5731 745 0
Fax: + 49 (0) 5731 745 200
info@steute.com
www.steute.com

customers complete network coverage with just a few public base stations. This is not the case with 5G base stations: when devices call up the full bandwidth, significantly fewer devices can be connected than with the Sigfox 0G network, which is able to manage millions of devices per base station.

elektro AUTOMATION: With the so-called 5G networks, as well as reinforced WiFi for industrial applications, etc., additional options are on the table. What do these solutions offer?

Braun: These new solutions offer considerably higher data rates of up to 10 Gbit/s, as well as lower latency periods of below 1 ms. In addition, data transmission takes place in real time. Also, users have approximately 1,000 times more network capacity than with the 4G-LTE standard. We are convinced that 5G will be the key technology used in IoT applications in the future.

Eberle: Different technologies usually pursue different goals, making it almost impossible to generalise. What is clear, however, is that 5G is not the answer to all questions. In addition to the technical parameters, any analysis must include suitability for certain use cases, the investment and operation costs, availability in certain regions and countries, and much much more. For this reason, Siemens will continue to support different wireless technologies in the future, such as Industrial 5G or Wi-Fi 6; at the same time, we are thoroughly checking all new technologies to see if they really do represent added value for our customers.

Dr. Schäfer: Deutsche Telekom has strategically opted for the machine and sensor networks NB-IoT and LTE-M as part of 5G. In comparison to NB-IoT, LTE-M offers higher data rates and shorter latency periods. Coverage inside buildings considerably exceeds that of standard GSM technology, and the expected battery lifetime is almost as good as that of NB-IoT. Further plus points are integrated mobility (i.e. the ability to transfer data between cells without loss) and SMS compatibility. The global standardisation initiative 3rd Generation Partnership Project has agreed to further development of NB-IoT and LTE-M within the framework of 5G specifications, making their existence guaranteed in the long term. Both network technologies qualify for various applications, for example within building monitoring analytics. Digitally recorded parameters, such as temperature, humidity and CO2 levels or open doors, provide a more precise understanding of how the building is used and where the costs occur.

Schenk: For 'major' applications with high data volumes, such as a complete materials management system, it is fairly clear that 5G will be used. But it should be questioned from both a technical and an economic standpoint whether each sensor monitoring the occupancy of a rack slot or the stock in a Kanban shelf needs to have its own IP address – especially when hundreds of sensors are integrated, e.g. in eKanban systems. We believe that such applications will continue to communicate via simpler, yet equally reliable wireless networks. Some of these networks – for example our nexy system – offer particular benefits, such as extremely low-energy operation, and an infrastructure facilitating

steute Schaltgeräte GmbH & Co. KG
Brückenstr. 91
32584 Löhne, Germany
Phone: + 49 (0) 5731 745 0
Fax: + 49 (0) 5731 745 200
info@steute.com
www.steute.com

the simultaneous operation of multiple applications.

Wosylus: As the provider of 0G networks, our applications for transport logistics are currently bringing us as far as the gates of the ever more digitalised factory. We are now knocking on those gates in order to localise digitalised load carriers inside the production hall, or at the customer's factory gates, to trigger the parameter-based signature of a delivery note. In addition, we are safeguarding assets through constant monitoring in real time and by notifying the factory foreman if, for example, an expensive machine should suddenly and unexpectedly decide to leave a production hall. Embedded in machines and devices, our system also provides OEM with all the information needed for new business models and predictive maintenance. With corresponding Edge logistics embedded in all the more complex devices, only a few notifications per day are required.

elektro AUTOMATION: Do you see mobile communication leading to new products/services (pay per use, mobile robots for picking, route calculations, augmented workers, etc.) in intralogistics?

Braun: New serverless computing services, such as Google's Cloud Run will become established. This service is all about the complete administration of an infrastructure environment, relieving the customer of all management tasks. Using Cloud Run, containers can be rolled out as part of logistics processes fast and easily. The short latency period of a 5G infrastructure additionally means efficient monitoring and control of automated guided machines, as well as remote control within critical infrastructures. Medical procedures, as well as real-time translations, will also profit from 5G.

Eberle: I certainly do. It is always interesting when external providers can solve certain things better than a company can by itself. A good example is the supply of C-category materials. A company can either purchase such materials itself, in the worst case scenario using manual Kanban cards or similar. Or it uses the services of a company like Würth Industrie Service, which uses Siemens technology to record material consumption in real time and trigger replenishment material deliveries as required – increasing the quality of supply at a low cost.

Dr. Schäfer: In the logistics branch, track & trace solutions have particularly high potential, from dynamic route optimisation to port logistics, with dynamic appointment management for deliveries. Indoor tracking simplifies automatic localisation of expensive load carriers within the warehouse. Outdoor tracking ensures, for example, that containers do not get lost en route. The 'digital freight paper' will replace the paper label through a telematics module with a low-energy display, temperature and shock sensors, GPS and mobile wireless connection to the cloud of things. The status and position of goods can be tracked along the entire route and make transport simpler, cheaper and more reliable.

Schenk: Definitely. New products like mobile robots are already appearing in pilot factories. As outfitters of factories, we also have to rethink. We no longer supply just hardware, but also software to control the

steute Schaltgeräte GmbH & Co. KG
Brückenstr. 91
32584 Löhne, Germany
Phone: + 49 (0) 5731 745 0
Fax: + 49 (0) 5731 745 200
info@steute.com
www.steute.com

material flow. Our Sensor Bridge is connected 'live' to the user's ERP system. Which means we also have to provide support like a software house, and we have to offer licences and maintenance contracts. And the development and installation of new interfaces and updates is a continual demand. This is an exciting and dynamic business which allows us to develop ourselves and our skills further. It is also a business which can lead to success faster than classic production software. In the latter case, solutions must be tested – to put it in layman's terms – at least 110% before acquisition. In intralogistics, e.g. with eKanban, customers are more likely to say: we are convinced, we will take it. In the past this enabled us to acquire our first use cases very early on, and today nexy is already established in the factories of multiple car manufacturers.

Wosylus: Absolutely. The 0G network is perfect for logistics. It functions indoors and outdoors and thus in both intralogistics and transport logistics. Just taking the track & trace business model, Sigfox partners have numerous robust industrial solutions which are available commercially or as sample specimens, and which are ideally suited to tracking within smart industrial applications. Currently, a major application field for these trackers is load carrier management in nearly all forms – from extremely expensive special load carriers to comparably cheap hygienic plastic pallets as used in the foodstuffs industry. With expensive special load carriers, there is always a return on the investment, provided that losses can be avoided. But far more interesting are the many additional benefits which can be drawn from uninterrupted process transparency – e.g. increased load carrier handling, which is always possible. Information about location, movements and outgoing goods, monitoring of theft indicators, detection of route deviations, calculation of expected arrival times, detection of arrivals, as well as continuous recording of stock and inventory functions, are all immensely valuable data which can be pulled from a simple tracker. If logistics is complemented by additional sensors, further data, such as IBC levels, temperature measurements for HACCP documentation in the foodstuffs industry, event detection for shocks which can lead to damage, and much much more, can also be collected.

Images: steute Technologies GmbH & Co. KG

steute Schaltgeräte GmbH & Co. KG
Brückenstr. 91
32584 Löhne, Germany
Phone: + 49 (0) 5731 745 0
Fax: + 49 (0) 5731 745 200
info@steute.com
www.steute.com