

# PROJECT PROFILE

CA114 |

### Advanced next-generation non-galvanic wireless connectivity to boost automotive and industrial sectors [WiCon]

The WiCon project will provide a low-cost and highly-integrated wireless system for the automotive and industrial market segments, and one which does not deploy undesirable galvanic connectors. This project involves the development and implementation of high data-rate, multi-standard transmitters and receivers in combination with polymer waveguides carrying millimetre wave (mmWave) signals needed for next-generation Gbit Automotive Ethernet and Industry 4.0.

Galvanic connectors are a bottle-neck in electronic systems and need to be replaced for very good reasons. Firstly, galvanic connections limit application flexibility by the physical connection between components and galvanic connectors, which require accurate mutual positioning of the contacting ends. Connectors for high-speed and high pin-count applications are also costly and are not normally waterproof (thus requiring additional mechanical elements in the casing to provide a certain amount of protection against water and dust ingression); and their wear-and-tear and limited ruggedness can lead to functional failure.

There is also the question of the physical size of the connector becoming a limiting element in the ultimate form factor of portable devices. In some systems, the non-deployment of galvanic interconnections is necessary for eliminating the propagation of common mode-coupled internal disturbances; or for isolating high-voltage components from other parts of the system, for human safety. Finally, conventional wired links based on twisted pairs have undesirable frequency-response and attenuation properties which limit the maximum cable-length allowed between host and devices.

### Tomorrow's wireless links for power and data

Deploying polymer fibre-based point-to-point datalinks, WiCon aims to provide practical, effective and cost-efficient solutions addressing the next generation of high data-rate connectivity in automotive, industrial and datacom products.

These solutions will largely focus on a state-ofthe-art functional element: the high-speed radiofrequency (mmWave) link for bi-directional, multi-Gbps data-transfer over polymer fibre. Additional features of this high-data-rate link circuitry include a very small latency, and full duplex and multiplechannel operation. Project aims (and deliverables) are to:

- Define functional requirements for galvanicconnector replacement in high-speed datacom for industrial and automotive applications (such as Automotive Ethernet);
- Develop and demonstrate innovative system concepts (such as server back planes, conveyor belts and automotive electronics) leveraging new hardware building blocks for contactless data transfer. These building blocks will be the ultimate example of highperformance, mixed-signal components, and will help consolidate the European leadership position in this market segment;
- Create low-cost solutions for Gbps-plus data transfer, replacing fibre optics components in datacom links, by means of polymer cables operating as electromagnetic (EM) waveguides for mmWave carrier signals;
- Implement functional demonstrators addressing the functional requirements of the high-data-rate RF link.

#### Addressing Europe's needs

This project supports the European effort towards the development of a new class of energy-efficient systems capable of sensing, communicating and actuating in a smart and power-efficient manner. According to the CATRENE programme's vision, mission and strategy document, "Because of power consumption, flexibility, size and cost requirements, the next generation of communication electronics systems will require new technologies and architectures that combine adaptability and performances in a novel way."

In concrete terms, WiCon secures the competitive power in several European industry sectors. The automotive industry is crucial for Europe's prosperity. This sector provides jobs for 12m people



#### PROJECT CONTRIBUTES TO

Communication
Energy efficiency
Digital lifestyle

#### PARTNERS

KU-Leuven NXP Belgium NXP Netherlands TE Connectivity TU-Delft

#### COUNTRIES INVOLVED

Belgium The Netherlands

#### PROJECT LEADER

Joost van Beek NXP

#### KEY PROJECT DATES

January 01, 2015 - December 31, 2017

and accounts for 4% of European Union (EU) GDP. The EU is among the world's biggest producers of motor vehicles and the sector represents the largest private investment in R&D.

## A question of trends and growing markets

With the emergence of autonomous and driver-assisted vehicles it is expected that many data-intense technologies will be installed in the car, such as radar, lidar (a detection system which works on the principle of radar but uses light from a laser), GPS, and computer vision. This will further trigger the need to network and distribute that information throughout the vehicle at high datarates, resulting in a market growth for in-vehicle networks (IVNs) due to increased demand for these data-hungry applications. In fact, it is expected that the annual number of network nodes will increase from 3 billion in 2016 to more than 5 billion in 2022.

Furthermore, industry is moving towards higher bandwidths to cater to a growing need for more datacom, thanks to such trends as Industry 4.0 (or fourth industrial revolution, the current trend in automation and data exchange in manufacturing technologies) and the Industrial internet of things (IIoT). These trends require that all 'things' are directly IP (internet protocol) addressable, for which Ethernet is the most logical choice. Most current Industrial Ethernet systems are running at the higher levels of the automation pyramid. With the need for IP addressability also down to the process (sensor or actuator) level, the need for gigabit Ethernet solutions that can withstand harsh industrial environments is on the rise. New gigabit, wired data communication technologies, like mmWave, arising from other sectors (like automotive), could also be used in Industrial Ethernet applications and standards.

The Industrial Ethernet is estimated to grow by 54m nodes in 2015 with a CAGR of 15.5% for the coming five to 10 years. Looking at the five year period, 2018-2022, this would mean 567m new Industrial Ethernet nodes. And for the ten year period, 2018-2027, this would amount to 1.73 billion new nodes. Now, if we assume a starting penetration rate of only 1% and an annual penetration growth of 0.5%, the market potential of mmWave solutions would amount to 66m nodes over a ten-year period. And if the annual penetration growth would increase from 0.5% to 1%, the potential would grow to 115m nodes.

Finally, here is a most interesting observation that could further increase WiCon's benefits and potential. Ethernet implementations based on mmWave could also deliver advantages over copper in such areas as electromagnetic immunity. low latency, and environmental resilience (like corrosion), as well as in easier field termination. lower weight, and passive contactless, in-line connectivity. And depending on cost, mmWave technology could, in fact, completely displace traditional copper, significantly increasing its market potential.

CATRENE (E! 4140), the EUREKA Cluster for Application and Technology Research in Europe on NanoElectronics, will bring about technological leadership for a competitive European information and communications technology industry.

CATRENE focuses on delivering nano-/microelectronic solutions that respond to the needs of society at large, improving the economic prosperity of Europe and reinforcing the ability of its industry to be at the forefront of the global competition.



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