# CAN is taking over light vehicles

*CAN is mainly used in vehicles: automotive, marine, or heavy industry. Now there is a new kid on the block: e-bikes and scooters, commonly called light vehicles.*


(Photo: Comodule)

Comodule is a company based in Berlin, Germany, and Tallinn, Estonia, which develops connectivity technology for the light vehicle industry. The light vehicle industry is growing faster than any other mobility related sector. In the last 50 years, bicycle production has by far exceeded the production of cars. The main reason is urbanization: since 2007, more people live in cities than in rural areas. Simply put, there is just not enough space for cars in metropolitan areas and people need smaller personal vehicles to get around. This need has sparked the fast development of the 2-wheeler product, the introduction of electrically assisted bicycles (in short: e-bikes), as well as the electrification of the loud and smoky scooters. Smart city planning has brought many public sharing systems across the world. At the end of 2014, 712 cities had public bicycle sharing systems with more than 800 000 bikes.

Electrification has brought new challenges to the industry. The most important of them is the stable communication between components. An e-bike has three main electrical units: a battery with its management system, a motor with its controller, and an HMI to display information to the user. In many cases these components are not produced by the same supplier and need a convenient way to communicate. In the automotive industry, there are common standards to follow. There are strong, industry-wide organizations and corporates who work together to unify systems. The light vehicle sector is still more like the wild-wild west without standardization. Depending on the brand, you can find almost all commonly known communication protocols: I²C, UART, EIA-485, SPI, CAN, and others. Additionally, a UART-based protocol called Bikebus was developed. This is a great technological hurdle to building universal hardware solutions for the industry.

At Comodule, we have spent two years to develop a hardware solution that can support a wide range of different protocols on the same hardware unit. Although this is possible, it is by no means an optimal solution as low-level protocols have their limitations. We are happy to see that the industry has realized that a more flexible and stable system can be developed for the small extra cost of CAN hardware.

A good example of this is a project at hand with a German electric scooter developer. The vehicle will have up to three interchangeable battery units. In fleet operations like delivery, the batteries can be changed between different vehicles. Inside the battery unit, a management system controls each individual cell while on the vehicle level the main control unit manages three different battery units with potentially different capacities. At the same time, the Comodule solution has to make sure that live information is available online for each single battery unit as well as for every vehicle.

Because there can be up to three Comodule telematics units in the vehicle at the same time, our hardware units have to coordinate which one of them sends all the information to the Cloud. This kind of complex system can only be built on top of an advanced protocol like CAN, where every single unit has its own specific ID and can broadcast data to a common bus. The biggest hurdle for IoT adoption is not the firmware nor server deployment but the communication. Today, M2M networks are based on 2G or 3G GSM. Both of these are aged technologies not meant for low power and data transmission. Secondly, there is no global standard. The US has decided to close down 2G networks while Europe is discussing closing down 3G. This creates a situation where it is impossible to build cheap global telematics units.

Luckily, the GSM industry has made rapid progress. In June 2016, the umbrella organization of telecoms 3GPP completed the standardization of the NB-IoT, a narrowband radio technology developed for the Internet of Things (IoT). In short, this means cheap hardware ($ 5), low-power consumption (5 years on an AA battery), and minimum data consumption. Nokia and Tele2 are deploying one of the first ever nation-wide NB-IoT networks right here on our home-turf in Estonia, while Comodule exclusively tests and validates this technology.

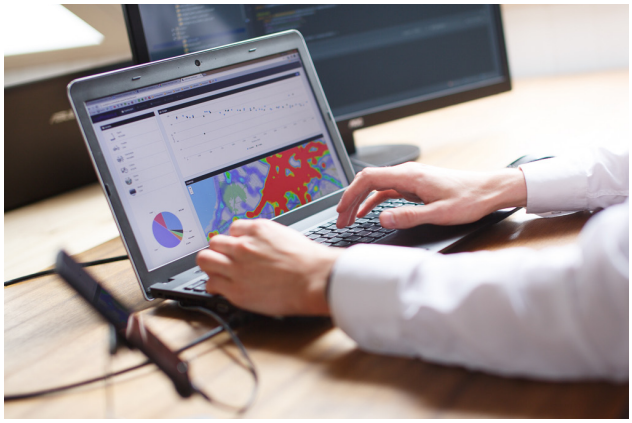

*Figure 1: The data analytics platform tracks and monitors vehicles remotely and performs over-the-air software updates (Photo: Comodule)*

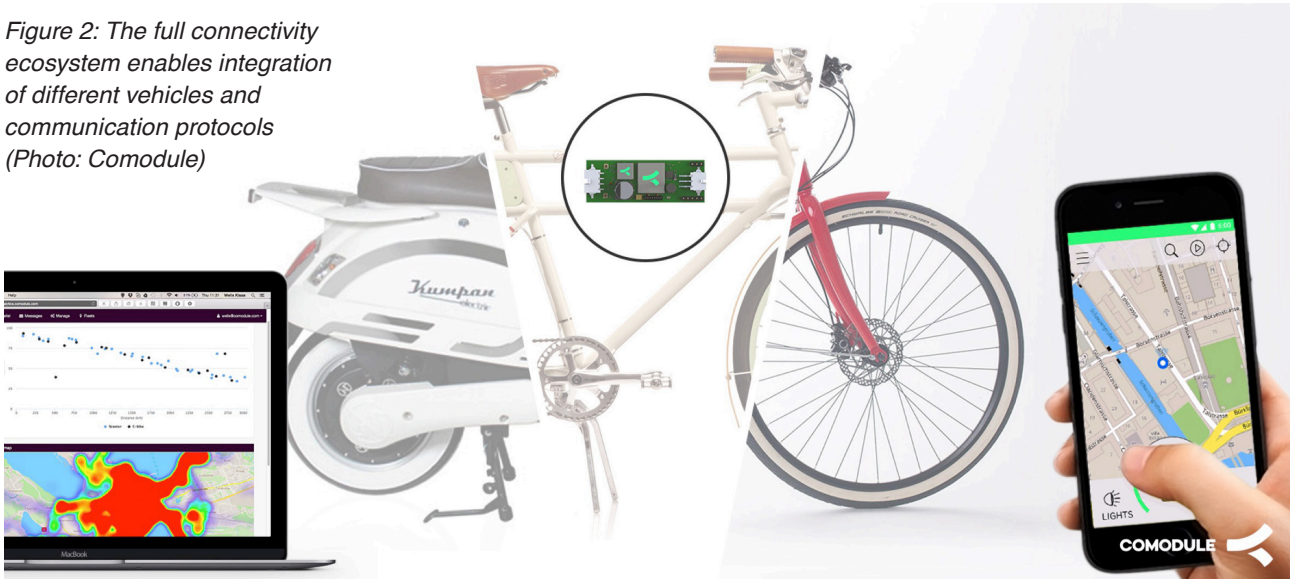


*Figure 2: The full connectivity ecosystem enables integration of different vehicles and communication protocols (Photo: Comodule)*

In the future wireless communication and connectivity will be immensely important. In many cases direct connections to the Cloud might turn out cheaper and more robust than wiring a physical connection and using a single transmission source. Think about the scooter battery example: with NB-IoT we would connect all batteries directly to the cloud saving a lot of time during the custom development on the firmware level. The transition from firmware to cloud managed creates opportunities and challenges for all parties. For a protocol like CAN, its future success depends on how it can act as a bridge between wired and wireless connections. On the other hand, there is definitely a huge potential in the CAN-to-cloud transition over the new NB-IoT standard. We at Comodule are working hard to be the first company to offer a stable out-of-the-box solution that has a promising future in all parts of industry, not only bikes or scooters. We think that the full deployment of NB-IoT will take the world from talking about IoT to full-scale adoption. We can't wait…

Comodule is a technology company that develops connectivity platforms for bicycle and scooter OEMs. The company employs 15 people with backgrounds from automotive electronics, to Linux kernel development, mobile payments, and electric racing cars. The founders came together while building racing cars at university as part of the Formula Student series. The founding team spent years in the Formula Student Team Tallinn and brought the Estonian team to place third out of 500 teams from all over the world. The 4WD electric racer had 1200 Nm, an extremely complex CAN-based distributed battery management system, and raced from standstill to 100 km/h in less than 3 s.

Comodule has developed and mainstreamed a scalable connectivity platform that allows collecting, analyzing, and visualizing vehicle data. The solution is based on a universal communication electronics unit and modular software. The company's connectivity solution consists of three parts: communication electronics, a smartphone application, and a Cloud platform for data analysis. Integrated Bluetooth, GPS, and GSM provide a simple and secure connectivity to control the vehicle wirelessly . We are able to receive information from the CAN protocol and send it directly to the GSM server. The mobile application visualizes this data, provides range estimation for electric vehicles and can track the vehicle if stolen. The Cloud-based data platform enables the manufacturer to take advantage of usage and vehicle data, gather information, and hopefully make better marketing and product development decisions.

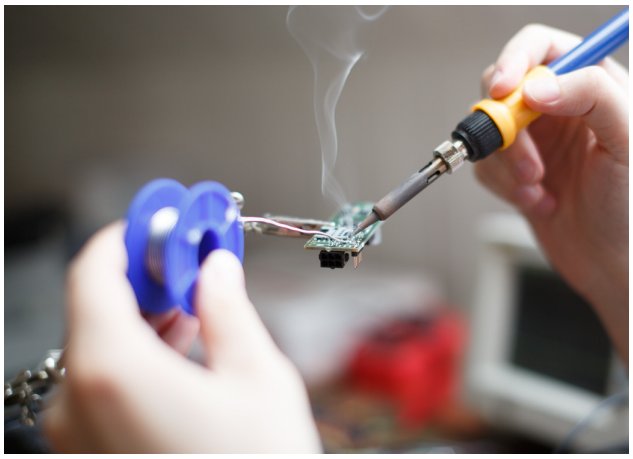

*Figure 3: Automotive grade hardware is small in size and low in power consumption (Photo: Comodule)*

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