LUDANEK ON & ICT

INTELLIGENT TRANSPORTATION SYSTEMS

Over the past 50 years, the automotive industry has undergone what could be described as a technology revolution. Fuel efficiency, environmentally sound vehicle powertrain concepts, increased electronics, driver assistance, and safety features like ABS and airbags are just a few of the improvements that have taken place, which have led to sustainable, safer, and more comfortable driving. »»»

> BY CONNECTING VEHICLES AND COMBINING THE VALUABLE DATA THEY TRANSMIT WITH INFORMATION ABOUT THEIR ENVIRONMENT, WE CAN CREATE A PLATFORM THAT CAN HELP IMPROVE TRAFFIC FLOW AND INCREASE SAFETY

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TODAY, WE ARE in the era of connectivity. Vehicles are no longer isolated entities moving from one place to another, but are an intricate part of a greater transportation system. In the future, we can look forward to increased levels of comfort in vehicles, greater degrees of driver assistance, and more advanced safety features. To achieve this, we need to partner up and develop solutions together with a holistic and end-to-end approach. We need to learn from each other and share advancements in technology. Thankfully, today's industries are ripe for the collaboration that is needed to build integrated solutions. How Scania and Ericsson work today highlights just how greater we are together.

How do you see the automotive industry evolving in the context of digitalization and mobility?

Throughout its history, both the automotive industry and ICT have relied heavily on technology, standardization, continuous improvement, and not least R&D. New technologies are shaped by external influences and regulations, but the direction development takes is primarily determined by customer demand. The customers in my industry include a wide range of enterprises and individuals — from professional truckers and bus drivers, to regular citizens who need a vehicle to get around. The enterprise sector — including logistics, shipping, and tourism, for example — has a significant influence on the technological innovations we prioritize. Once again, clear similarities arise between my industry and ICT.

The technological advances that have taken place in the automotive industry, along with the developments that have come about in a number of tangential sectors like materials and electronics, and governmental regulations that have come into force, have shaped several waves of innovation (illustrated in *Figure 1*) over the past 65 years. The result of all of these developments is a safer, more efficient, and more comfortable driving experience.

The 1970s oil crisis has had a long-lasting impact on the automotive industry all over the world, putting fuel-efficiency firmly at the top of our list of technological development priorities. The crisis led to a dramatic shift in R&D, as fuel-saving technologies, and more efficient engines became top priorities. The powertrain, for example, was improved with innovations like gasoline direct injection and start-stop systems, which, along with new lightweight vehicle materials, led to improved fuel consumption and fewer efficiency losses. These technologies are pretty much standard components in the vehicles being built today.

The 1990s were marked by the birth of mechatronics. The introduction of sensor technologies and affordable electronic control units (ECUs) led to the replacement of control and mechanical systems with electrical and electronically steered actuators.

The boom in the consumer electronics market began at the turn of the 21st century. User demand for new functionalities like navigational support systems, air bags, and driver assistance had to be met, and so the era of automotive electronics began.

Looking ahead, *Figure 2* illustrates some of the developments that drivers can look forward to. While today, development focus is on end-to-end resource management (during manufacturing, operation, as well as the end-of-life phase of a vehicle), in the future, we can look forward to much greater levels of driver assistance. The way I see it, manufacturing and production processes have undergone four revolutions, becoming more efficient with each one. In the beginning of mass production, engines were powered by steam, then electricity took over. Later on, computing power took control, and now the Internet of Things (IoT) has ushered in a whole new era of possibilities.

The fourth industrial revolution of production — which we refer to as Industry 4.0 — is not actually limited to the IoT, but encompasses other aspects like cybersecurity, big data analytics, and integration across traditional organizational boundaries. But, as more things become connected, the significance of each aspect rises. When people, for example, share their location data, a lot of information is generated. But to make any use if it, big data analytics must come in to play.

Figure 1
Waves of innovation

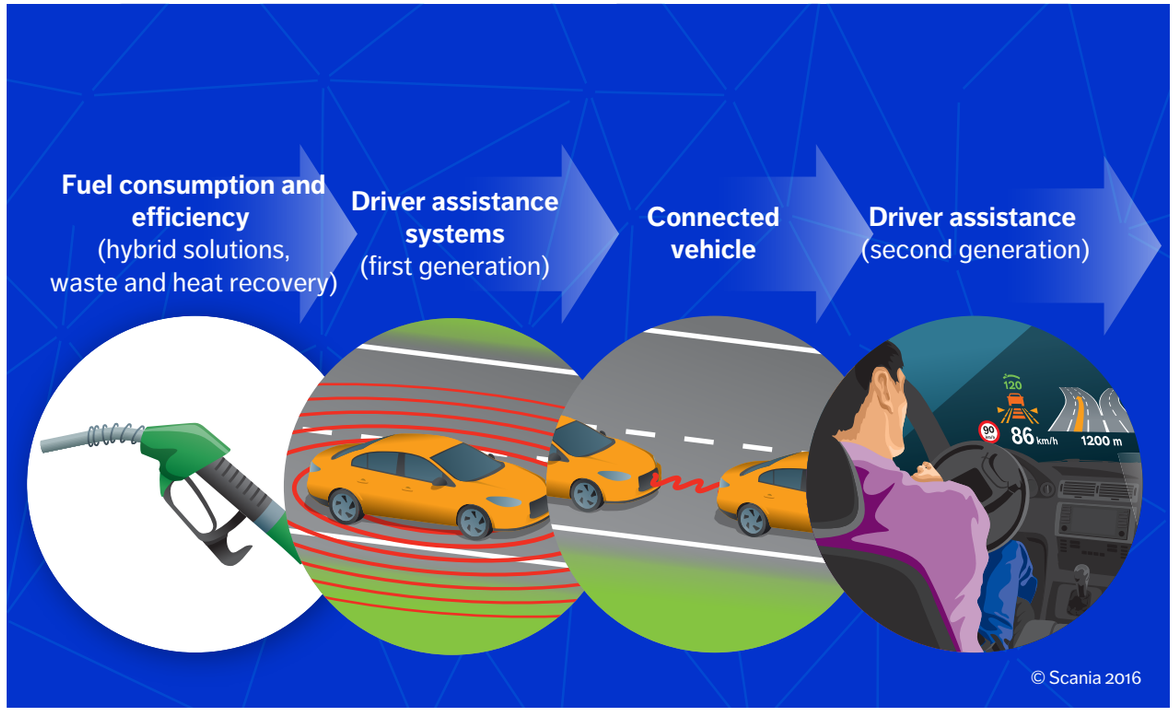

Figure 2
Evolution of technology

Today, we live in a world based on connectivity and digitalization. Individuals and enterprises alike are taking advantage of the capability to connect almost anything to a network, the possibility to make data available through the cloud, and the ability to mash massive amounts of data together to create an enriched understanding of everything, everyone, and every inch of space on the globe. The opportunities opened up by mobility and digitalization have enabled the automotive industry to create new functionalities and capabilities, boosting efficiency and safety, while offering a higher level of comfort.

By connecting vehicles and combining the valuable data they transmit with information about their environment, we can create a platform that can help improve traffic flow and increase safety. In this new business model, the car manufacturer turns into a provider of mobility, and the truck manufacturer shifts into the transport management domain.

But throughout the whole process of transformation, digitalization, development, and connectivity, the automotive industry has remained true to its basic principle: to come up with ever more efficient, and environmentally sound vehicle powertrain concepts.

What is your view on the intelligent transportation system (ITS), and what kind of technology evolution is required for it to be a business success?
Logistics, both in Europe and in the US, are well-developed and optimized systems. Europe spends about 8.2 percent of its GDP on the transportation of persons and goods: below US spending of about 9.4 percent. China, however, spends 18 percent of its GDP on logistics. That China's relative spend is around double that of Europe/US is an indication of the degree to which European/American transportation systems (a fundamental parameter for a successful economy) have been optimized. Yet despite these seemingly positive figures, 24 percent of trucks run empty, and transportation utilization capacity is just 54 percent – highlighting a common issue shared by cellular and transportation networks.

In theory, utilization of transportation systems could be raised to about 85 percent. Achieving such a level, however, would require improved flow control and a connected system that incorporates order, supply, as well as all the transportation partners. In short, what we need is an ITS that can connect the various stakeholders to each other.

These stakeholders include suppliers, infrastructure owners, society, and logistics providers. An additional challenge for the ITS is the global trend toward urbanization. Transportation of goods and persons across bustling city centers is a key element of modern urban logistics. However, implementing an ITS to cope with our complex city structures requires state-of-the-art connectivity, as well as new business and governance models that give due weight to the needs and wishes of all stakeholders.

The Integrated Transport and Research Lab (ITRL) at KTH Royal Institute of Technology was established to address this very issue. Here, under one collaborative umbrella, Scania, Ericsson, and KTH have begun to develop innovative and holistic technical solutions to address global environmental transport challenges, by taking a long-term and multidisciplinary approach to the matter (as illustrated in *Figure 3*). As partners, we are working together to develop seamless transportation services for use within modern infrastructures, novel vehicle concepts, as well as new business models and policies — all of which need to be tuned and optimized.

> FUNDAMENTALLY, THE FUTURE ITS NEEDS TO BE ABLE TO DELIVER ECONOMICAL AND ECOLOGICAL BENEFITS TO EVERYONE AND EVERYTHING IT ENCOMPASSES

What are the key use cases and connectivity requirements for ITS/ICT?
Fundamentally, the future ITS needs to be able to deliver economical and ecological benefits to everyone and everything it encompasses. This includes commuters and drivers, enterprises (like shipping companies and couriers), and the organizations that control them (like transportation operators). Scania's aims and commitment lie in the development and delivery of customized solutions for sustainable transportation. In this context, our aim is not only to satisfy the needs of our direct customers (such as trucking companies), but also those of the people and enterprises that use our solutions daily as they commute to work, travel around, or ship goods from one place to another.

To develop the future ITS, we need to identify the opportunities for improvement from a holistic point of view, so the overall solution can be integrated in the logistics chain end-to-end. The ICT industry is a fundamental enabler in this chain, as it provides the vital ingredient of connectivity, allowing the various transportation stakeholders to connect. A key element for the future system is guaranteed and controlled data security, with defined access and handling responsibility. Together with the users of transportation, the technology provider for the connected infrastructure needs to develop methods and techniques that will provide the right level of security and the right tools for access and responsibility.

The key ICT technologies are mobility, broadband, and cloud. Will they all be adopted by the ITS?
Yes, these key technologies will be adopted by ITSs with permanent availability and a high level of security. The connectivity requirements for

transportation are vastly different from other applications such as providing connectivity to consumers, say, or remote operation of machinery in an underground mine or on a construction site. The demands of ITS in terms of availability and security, for example, are high. And while the latency of the link for communication with response services needs to be low, it needs to be even lower for haptic systems where the controller needs instant feedback — such as is the case for telesurgery.

What are the greatest opportunities and challenges involved, and what specific kind of security technology is needed?

Cars, trucks, buses, trains, and even people will deliver high volumes of data — including information on location, a given traffic situation, speed, and weather — to cloud computing centers over a broadband connection. All this data needs to be mashed with information delivered by other stakeholders in the transportation system to create a holistic view of the flow of people and all modes of transportation in a given geographical area. Fast, intelligent analytics are needed to assess the aggregated data, and offer an overall view before a real-time transportation flow control can be carried out. In the future, transportation systems — both within and outside urban conglomerations — will become highly dependent on analytics, so the failure or incorrect results of data mining will risk collapsing the entire value chain.

In my opinion, a two-step approach should be taken to providing a solution. First, players like Scania should develop solutions with partners in ICT. Second, a cloud architecture and a data infrastructure are needed to test use cases for a wide variety of applications around the world, considering different countries, and including cross-border scenarios.

The telecom industry has created a scalable and cost-effective technology platform that provides connectivity to over 7 billion people. How do you think this platform is relevant to your industry?

Connectivity and the telecom network are essential components of the future intelligent transport system and Industry 4.0. As a scalable architecture technology, connectivity and networks provide a cost-effective platform that can support the rapid development of new use cases and innovative applications, which reflect the intensifying demands of users. In China (the second-largest growing telecoms market), for example, more than 7 million new mobile subscriptions were established in Q3, 2015. For the same period, more than 13 million subscribers were created in India*. So, the ICT and transportation industries need to adopt a long-term global perspective; we need to know how to organize the data, and how to analyze it to avoid self-accelerating and uncontrolled data mining.

To gain this global, long-term perspective, specialists with different kinds of expertise working in a variety of industries need to be able to come together and collaborate on possible use cases. Given this fundamental requirement, Scania and Ericsson are ideal strategic partners; we can conduct the necessary research, using concrete use cases, as well as considering the demands of the entire problem space. This is in direct contrast to the traditional way of working, where each industry player developed their part of the solution in isolation.

What is the impact of big data and analytics? Can you share your views on the information model for the automotive industry, for example?

In the automotive industry, we distinguish information models from each other on the basis of function, such as driving support, and intelligent driving functions. Each model brings with it tougher demands for both security and availability. Applications that use vehicle-to-vehicle (V2V) or vehicle-to-infrastructure (V2V) communication, for example, enable traffic to be organized in a safer manner than it is today, but they are demanding in terms of security, availability, and latency. Real-time, secure information received from traffic control signals, from sensors on the road that can detect obstacles, or from potentially hazardous situations — such as road accidents — and other systems can be

*Ericsson Mobility Report
http://www.ericsson.com/mobility-report

Figure 3: Vision of a sustainable transportation system

used as input to the warning strategy for predictive automatic influence for car, bus and truck drivers.

Today's trucks come complete with an onboard camera system that works in conjunction with the automatic emergency braking (AEB) system. Images from the camera system can be combined with radar information, taken from sensors permanently fixed to the front of the truck. The technology needed to share the data collected by these systems with traffic control towers already exists. However, before it can be put to wide-scale use, a number of questions need to be answered, such as: how to regulate responsibility and security, and how to handle additional data analysis. Some sort of a breakthrough is needed — either by creating a standalone solution, or by creating a solution together with a communication provider and other stakeholders, in an organized and regulated manner. Drivers — both private and professional — are expecting massive improvements in terms of comfort and fuel options, as well as better functionality when it comes to increased automation in vehicles.

How should we push for a collaboration between the ICT and automotive industries in terms of innovation, both from a technological and a business model/best practices standpoint?

The question here also contains the answer. We need a neutral and independent test arena in which to develop use cases and build cooperation as partners. The Connected Mobility Arena (CMA) project in Kista, Stockholm is just such a test arena. And so, within the context of the ITRL, the next step is to define the operating environment needed. Other cooperation areas will include the autonomous operation of mining equipment, which will require the integration of additional partners.

How and where should we collaborate on standardization, interoperability, and regulatory issues to create a system of systems?

Scania has many years of experience in building customized buses and trucks using its modular kit system. Each construction kit includes a set of smart, well-defined interfaces between the different component parts, and various performance steps. This component box/interface/API approach could be the basis of a solution that would fit well with Ericsson's approach to customized connectivity, based on network slicing; both approaches being firmly rooted in standards and best practices.

Our teamwork looks set to create a whole new ecosphere in terms of safety, resource management, and comfort. I am proud to be part of it and glad to have Ericsson on board. ✱

AUTHOR

Dr. Harald Ludanek

Executive Vice President, Research and Development, Scania CV, Södertälje

◆ Attending the Clausthal University of Technology as a postgraduate engineer, German-born Harald Ludanek chose rotor dynamics and mechanical vibrations as the topic for his PhD thesis.

Today, he maintains a keen interest in technology both at work and at home. He has a few science-based hobbies, as well as a love of gardening, guitar playing, and handcrafts. But it is doubtless that it is his undying passion for engine mechanics that really drives him, and he applies this passion daily in his job as Head of R&D for Scania in Södertälje, Sweden.

He also has a fervent interest in cultivating collaboration between Scania and other key players – both within and outside the automotive industry. He is constantly on the lookout for companies to collaborate with, for the benefit of all partners and ultimately all vehicle drivers. He believes that creating efficiencies, will help to hit emissions targets, and minimize environmental impact.

IN THE PAST, Scania's development of robust, practical, reliable technology has been boosted by collaborations with car companies like Porsche. Now, Ericsson is providing the connectivity that will one day enable the truck driver to have an office and a comfortable living space all in one: Ludanek's vision for the ultimate in cabin comfort.

How then has Ludanek mastered the tricks of the truck trade?

Early on, with a doctorate in engineering, he joined Volkswagen's Research Centre in 1992, moving on in 2000 to head up the global coordination of the company's 25 worldwide development centers.

In 2002, he became Head of Technical Development and member of the executive board at Škoda auto a.S. in the Czech Republic.

He then moved on in 2007 to head up Complete Vehicle Development and Prototyping at Volkswagen AG until September 2012, when he was appointed Executive Vice President and Head of Research and Development at Scania.

SINCE 2011, he has chaired the supervisory board of the engineering consultancy IAV GmbH, Berlin, Germany and been a member of the supervisory board of the IMF TÜV Nord in Sweden.

Having come full circle since his student days, today he lectures in automotive management and technology at Clausthal University of Technology, where he is also a member of the supervisory board.