As urban populations increase, issues such as traffic jams, pollution and road fatalities will grow in tandem. More than half of the world’s population now lives in urban areas (54%), and growth is expected to accelerate in years to come.1 The cost of congestion to the global economy is also growing and is expected to cost Europe and the USA $4.4 trillion between 2013 and 2030.2 Better connected vehicles and infrastructure (Intelligent Traffic Systems—ITS) presents a viable solution to these issues, creating an intelligent road network that is safer, greener and more efficient.

V2X—vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I)—is one of the key technologies that will underpin ITS. V2X works by enabling ad hoc data exchange between the vehicle and environment via wireless Internet networks—in other words, allowing vehicles to interact with each other and the surrounding infrastructure like traffic lights and road signs within a 2000-m range. Vehicles can then alert drivers to potential traffic issues, even beyond the line of sight, so they can adjust their driving accordingly to avoid accidents or congested areas. Alerts could include blind-intersection collision, road condition hazards, road works, presence

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1 According to the World Health Organization http://www.who.int/gho/urban_health/situation_trends/urban_population_growth_text/en/

2 According to the Centre for Economics and Business Research http://www.cebr.com/reports/the-future-economic-and-environmental-costs-of-gridlock/

P. Pype (✉) • G. Daalderop • E. Schulz-Kamm • E. Walters
NXP Semiconductors, Leuven, Germany
e-mail: patrick.pype@nxp.com

G. Blom
City of Helmond, Helmond, Netherlands

S. Westermann
Hamburg Port Authorities, Hamburg, Germany
of emergency vehicles, stationary or slow moving vehicles, traffic jam, accident warnings, as well as traffic signals or signage indicators.

This might sound like a highly futuristic scenario, but V2X chipsets became available for mass production last year (from NXP Semiconductors) and are already being deployed by automakers, usually alongside complimentary technology such as advanced driver assistance systems (ADAS), i.e. radar. V2X-equipped vehicles could therefore be commercially available as soon as 2016. The potential of this technology is already being taken seriously by governments across the world, with numerous high profile V2X trials being implemented.

30.1 ITS Corridor: Austria, Germany and The Netherlands

In 2013, governments in Austria, Germany and the Netherlands signed a memorandum of understanding to create Europe’s first ITS Corridor. The project, which is due to be delivered in 2016, will see 1300 km of motorways between Rotterdam, Frankfurt and Vienna fitted with intelligent transport systems.

The cross-border project is focused on the use of technologies that warn drivers, via onboard units, that they are approaching road works. Drivers can then take an alternative route or reduce speed, improving both road safety and traffic flow. Cars
in the corridor that are fitted with new, in-car equipment can also pass on real-time road traffic information to traffic control centres. With an exact location from GPS systems, centres will have an accurate and up-to-date picture of the traffic situation in specific areas and can manage processes more effectively.

In 2014, technology partners in the project—including Siemens, NXP Semiconductors, Cohda Wireless and Honda—joined forces with politicians and highways agencies across the three countries to run a ‘Communicating Cars’ trial along the corridor, showcasing the benefits of the project. Demonstrations in test fields at Munich, Vienna and Helmond showed how the new technology could alert drivers to warnings such as a slippery road surface, pedestrian crossings, slow vehicles, etc., as well as upcoming road works, oncoming emergency vehicles, pending speed limits and braking of vehicles ahead, all allowing drivers to take the necessary precautions and avoid unnecessary accidents.

On the Dutch part of the ITS-corridor, the Dutch government is working with various partners such as NXP Semiconductors to prove the value of ITS technology in alleviating a core problem experienced on many highways with dense traffic: ‘phantom’ traffic jams caused by driver behaviour and braking rather than accidents or incidents.

‘Spookfiles’, as they are called in Dutch, account for 20% of all of traffic jams in the Netherlands. Prevention or at least mitigation of this kind of congestion could very much support Dutch mobility policy goals to better use the existing infrastructure instead of building new roads.

### 30.2 Helmond

Also in urban areas, optimising the use of existing infrastructure is one of the main goals for using ITS. The city of Helmond is involved in Compass4D, a 3-year European project designed to show concrete benefits of Intelligent Traffic Systems for citizens, city administrations and companies. The trial involves a pilot fleet of more than 600 vehicles—including buses, taxis, emergency services vehicles and private cars—across Helmond and six other European cities, all equipped with interoperable onboard units that can ‘communicate’ in real time to road side units. Drivers of these vehicles receive alerts from the units to improve energy efficiency and increase road safety. The services fall into three main categories:

- **Red light violation**—if another vehicle has or is about to violate a red light (including emergency services vehicles) or if they are at risk of violating a red light. Drivers are also warned about other nearby vehicles and vulnerable road users (pedestrians and bicycles) that are also acting on a green light.
- **Road hazard warning**—either static hazards such as road works or ‘dynamic’ which could include a car suddenly braking up ahead.
- **Energy-efficient intersection**—provides information on traffic light sequences such as ‘time to green’ or ‘time to red’.
Armed with this information, drivers can be much more aware of their surrounding environment and have more time to react to potentially hazardous situations to avoid collisions. Improving reaction times at traffic lights and knowing to cut the engine in a case of a long wait can also reduce congestion and pollution. The pilot will end in December 2015, but Helmond as well as most of the other Compass4D-project partners already decided to continue the services after the project phase.

Helmond also has been involved in a European trial to improve fuel efficiency and reduce CO₂ emissions of trucks by 25%. Freilot uses V2X to allow 14 traffic lights along Helmond’s major through road (Europaweg Kasteel-Traverse and Deurneseweg) to communicate with onboard devices in trucks and fire brigade vehicles. The vehicles are given priority passing at traffic lights and issued with speed advice based on surrounding traffic to ensure optimum efficiency. The system also allows truck drivers to book loading spaces in cities with heavy traffic to save valuable time. Pilots began in 2010 and have been so successful that the city decided to keep it going. Lyon, Bilbao and Krakow are also involved in the project.

30.3 Hamburg

V2X systems are a core enabler of safe and efficient platooning, where freight trucks travel very close together, optimising airflow and creating a slipstream for the vehicles to move in, saving energy and fuel consumption. The technology enables vehicles to communicate with each other, so if the first vehicle brakes, the others
automatically do the same, without driver intervention. The vehicles can then travel at optimum distance to drive efficiency (40–50 ft), even at high speeds on highways, without sacrificing safety.

Of course, vehicles need to stay together for the entire journey, which can be particularly difficult through traffic lights. Also, for platooning, one vehicle needs to take a lead. A lot of traffic flow enhancements can already be performed with convoys. A trial at Hamburg Port demonstrated how this could be achieved. A convoy of five freight trucks was fitted with onboard V2X units from NXP that could communicate with traffic lights around the Hamburg Port, as well as each other. This meant that traffic lights ‘knew’ when a group of vehicles were together and could ensure the entire group passed before the lights turned back to red. Truck drivers were permanently informed about the presence of other trucks in their vicinity by means of a small display.

The trial also demonstrates how intelligent transport system could protect vulnerable road users like school children. By integrating RFID tags into the school uniforms, the road side units were able to detect when school children were crossing the road, change lights accordingly and send alerts to the vehicles with onboard units.

While this trial only took place over the course of 1 day, Hamburg Port is planning to implement permanent systems in the near future. This will start with roadside units at one crossing and 30 trucks with onboard devices, extending to more than 10 crossings and up to 200 trucks in the coming years. Furthermore, NXP is in talks with a school uniform manufacturer in Hamburg to integrate RFID tags into the uniforms. This would be a citywide project which could significantly improve road safety for school children. The authors would like to thank the Hamburg Port Authority (HPA) and the Hamburg Ministry for Economy Transport and Innovation for their continuous support in these trials.

Internet convergence and the birth of intelligent traffic systems is a pivotal moment for the automotive industry and society. Smart mobility will, without a doubt, improve road safety by reducing human error (which causes 90% of traffic accidents today), reduce congestion and improve energy efficiency which costs the global economy billions every year.

Integrating automotive systems with the Internet does of course have its risks. If systems are hacked and fed the wrong information, or manipulated to perform certain tasks, there are potentially fatal consequences. The industry therefore needs to work together to ensure the quality and integrity of data. Privacy also needs to be protected so individual driver behaviour cannot be tracked. These are key issues that will determine the trust of consumers and wide-scale adoption of connected, self-driving cars needed for safer, greener and more efficient road networks. With its security and identification technology, NXP is perfectly suited to circumvent attacks and to make the traffic safer while protecting users.
As the trials already underway prove, ITS presents too many benefits to ignore. The industry now needs to work towards standardisation and securing trust of manufacturers and consumers so that full benefits can be realised. Groups like the Car2Car consortium, ETSI and the High-level ITS Advisory Group to the European Commission will play a driving role in this process, as well as the successes experienced from ITS trials around the world.