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SMART AUTOMOTIVE

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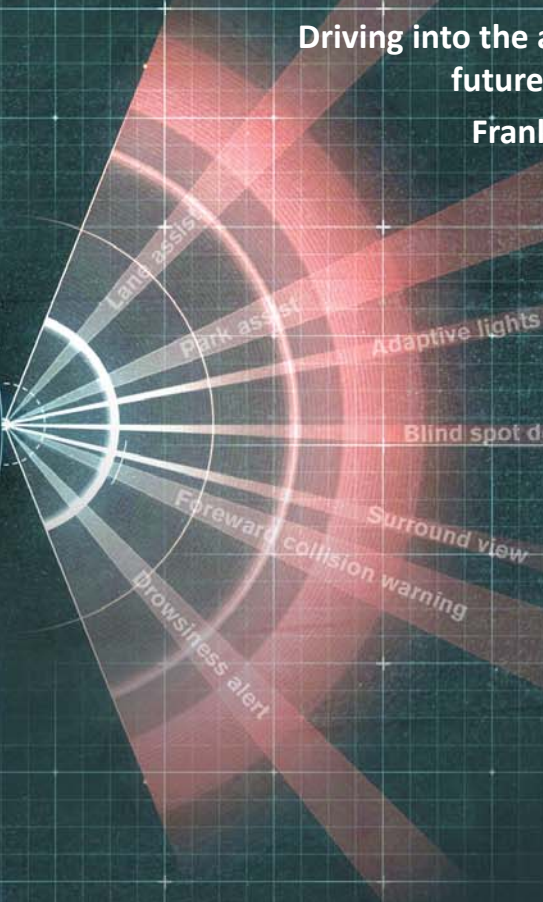
Automotive Telematics • Connected Vehicles • Fleet Management • Infotainment • ADAS

Exploring ADAS



Driving into the automotive future with ADAS

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Advanced Driver Assistance System: Breakthrough Technologies at Mercedes-Benz

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Memory	10000 Tracking Records on Solid State Flash, 100K Erase and Program Cycle, 10 year data retention.
GSM Module	Quad Band GSM 850/900/1800/1900Mhz, DCS GPRS: class10 Coding Scheme CS1 to CS4.
GPS Module	GPS:66 acquisition-/ 22 tracking channels, Ultra high tracking/navigation sensitivity: -165dBm1,Inbuilt patch antenna, 5 Meters Accuracy.
Antennas	Internal Antenna
Communication Interface	TCP/IP on GPRS.
Record Storage/buffer	10000 Tracking Records.
Ports	1-USB Device type, 1 Analog I (fuel) and 2 Digital I/O, 1 Ignition Input
Configuration	Recording delay, transmission delay.
Communication Scheme	TCP socket with Open Session.
Speed Sensor	GPS(default)
SIM Interface	Supports SIM card: 1.8V & 3V Micro SIM
SMS	Supports Text
GPRS Packet Data	Class 10 ; Class 8 (Optional), Coding Scheme CS1 to CS4
LED Indication	Processing, GSM, GPS, USB Detection
Connectors	6 Pin power mate connector
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Maneesh Prasad

Mrs. Bridget Driscoll is the first documented victim of road accident, which took place on 17th August 1896. It was alleged that demonstration car was travelling recklessly "like a fire engine" at speed of 4mph, though the driver did rang bell, it could not alert Mrs. Driscoll.

More than seven decades after, we saw the developments of seat belt reminders, ABS(~1970s) and ESC(~1980s), which were more of safety and convenience features. In last couple of decades we have seen development of FCW, park assist, lane assist, adaptive lights, blind spot detection, surround view, drowsiness alert and more coming in by day under the umbrella of ADAS.

Today road accidents are presenting a worrisome figure. Motor & Equipment Manufacturers Association(MEMA) statistics mentioned loss of over 33,000 American lives and 3.9 million non-fatal injuries with an annual cost of $910 billion to society(~6% of GDP). According to National Crime Records Bureau more than 1,35,000 lives are lost due to road accidents in India and in terms of monetary loss according to International Road Federation(~2012) it is over US$20 billion. Global Status Report on Road Safety, published by WHO, identified causes of traffic collisions as: over speeding, under the influence, not wearing helmet or seat belt,failure to maintain lane or yield to oncoming traffic. According to The Royal Society for the Prevention of Accidents(RoSPA), 95% of all road accidents involve some human error and in 76% of the cases the human is solely to blame.

Last year in Sept.'15, MEMA released a study conducted by The Boston Consulting Group, which says that widespread adoption of ADAS features could avoid approximately 28 percent of all motor vehicle crashes in the United States and further prevent about 9,900 fatalities per year.

EU and USA are mandating the use of autonomous emergency brake and forward collision warning by 2020, a systemic push to ADAS which is somewhere between $5 to $8billion industry(~McKinsey), a number which is meagre compared to $30 billion for audio and $60 billion for climate control. Although the RoI for investment in ADAS is well established, but the consumer willingness to voluntarily absorb the cost will be low in many economies including the developing ones.

Government policy has always played a meaningful role in adoption of technology. Our own draft Road Transport and Safety Bill 2014(yet to be presented), intends to cut down the road accidents and save 2 lakhs lives, leading to 4% GDP savings in first 5 years through innovation and new technology adoption, amongst host of other measures recommended. Quoting from the draft bill, "matters pertaining to the safety of vehicles including implementation of safety equipment of motor vehicles or trailers or semi-trailers or mobile machinery, including as and when feasible, technologies such as intelligent speed adaptation, driver alert control, eye drowsiness detectors, distance closure rate detection and green box monitoring", is an encouraging and forward looking thought process and incorporation of ADAS for passenger and commercial vehicles will go a long way in achieving the objective of saving lives and economic savings.

We at Telematics Wire are of view that automotive industry should take up the cause of lakhs of lives lost in road accident and resulting economic loss of nearly 1% of our GDP. There should be sustained effort to educate and sensitise the end-user community at large about the benefit of active safety equipments. An initiative which can be undertaken under CSR. Further, sustained effort at consensus building and draft bill revision need to be carried out, least the incorporation of ADAS elements gets watered down like some of the provisions in the revised draft bill in 2015.

EDITORIAL

ADAS: Making Cars Safer & Convenient

Automotive manufacturers today are introducing new vehicle control features to save fuel, add security and convenience, and above all make cars much safer to drive. These changes, designed to assist drivers and make vehicles more autonomous in operation, are based on new developments in sensing and high-performance processing enabled by advances in integrated circuit technology. ADAS or advanced driver assistance systems which is among the fastest growing segments in automotive electronics is the key to autonomous operation of vehicles and the core of the driverless car.

We are all aware of Google's development of self-driving technology, which has been widely reported. Less well-known, however, is the extensive work on assisted driving by major auto makers worldwide, and the semiconductor innovations enabling them. Numerous developments are rapidly changing car design, providing an evolution in automotive control that will put semi-autonomous, then fully-autonomous vehicles on the roads in just a few years.

Semi-autonomous and fully-autonomous vehicle control, based on advanced electronic sensing and processing, are valuable for more than just the excitement that comes with a technological breakthrough. They will deliver real benefits in fuel savings, mobility and convenience, travel time, and the efficient use of roadways. Most important, however, are new forms of vehicle control that will work actively to provide added safety.

According to governmental agencies, there are over 400 deaths in road accidents every day in India and about 1.24 million people worldwide die in traffic accidents. Above and beyond the fatalities are the even greater number of injuries and the high cost of repairs associated with car mishaps. Since traffic accidents are overwhelmingly caused by human error—as much as 90 percent, according to some estimates—assisting drivers to control their vehicles more safely is an obvious point of attack for reducing these deaths and damages.

Vehicle control represents not only a remarkable opportunity to enhance road safety, but also a thriving market for firms that offer the enabling electronic technology. Active safety systems represent a fast-growing portion of the $26 billion spent today for electronic components in automobiles worldwide. Leading-edge semiconductor solutions will help speed the introduction of these new capabilities, ushering in greater safety.

Active safety depends on, among other things, Advanced Driver Assistance Systems (ADAS), a set of electronics based technologies that are designed to aid in safe vehicle operation. ADAS innovations help prevent accidents by keeping cars at safe distances from each other, alerting drivers to dangerous conditions, protecting those in the car and on the street from bad driving habits, and performing other safety-related operations. ADAS also provides functions that will serve as important elements of computer-controlled autonomous operation in the future. If self-driving cars promise to free operators to use their time more effectively during commutes and longer trips, ADAS features will help them minimize collision repairs, prevent injuries and save lives.

Self-driving cars remain the ultimate "gee whiz" vision, yet some degree of safety automation has been with us for quite a while in features such as stability control, anti-lock braking, airbags, occupant detection and various kinds of alarms. Building on these traditional capabilities, active safety technology, including ADAS, is evolving through four stages.

First comes passive warning and

convenience systems. Examples include cameras and display for rear view, radar for blind spot detection, and cross-traffic warning that aids in, say, backing out of a parking space between larger vehicles. Some warning systems may include camera image processing for traffic sign recognition, surround views of the car on the road, in-cabin monitors to alert distracted drivers or inattentive drivers who are falling asleep, and other advanced features.

In the second stage of development, these systems can briefly take active control of the car to assist in parking, prevent backing over unseen objects, and avoid collisions by braking or swerving. Sometimes the system actively controls an individual car function, such as adapting front headlights automatically to upcoming curves and other changing conditions.

The third stage involves semi-autonomous operation, when the car takes over driving in certain circumstances, though someone has to stay in the driver's seat ready to resume control. One example is traffic assistance or highway lane self-driving, including adaptive cruise control, which changes speeds automatically to keep pace with traffic on expressways. Both adaptive cruise control and lane keep assistance will be required for expressway driving to keep the car centered in the lane and at a safe distance from other drivers. Lane keep assistance is another example, where a front or rear camera is used to guide the car along the middle of the lane. Park assist will take full control during parking in crowded parking lots and garages. Additionally, in-cabin driver monitoring, when detecting an incapacitated driver, may initiate a fully automatic stopping maneuver to pull a car to the side of the road and stop it safely.

Finally, when cars move to fully autonomous operation in the fourth stage of development, there may be no one in the driver's seat at all. Instead, the only occupant may be an elderly or handicapped person in the back seat, or the car may be empty as it goes to pick up someone at school or the airport.

Each of these four stages builds on the ones before it, fusing existing safety systems into new ones that are more complex. Today, most new cars appear with passive and even some active ADAS safety features, and availability is increasing rapidly. For instance, according to the market research firm IHS Inc., adaptive cruise control is available in almost 25 percent of new cars worldwide, side object detection (also known as blind spot detection) in more than 20 percent, lane departure warning (lane keep assistance) in nearly 20 percent, and autonomous park assist (assisted parking) in ten percent. Features for semi-autonomous operation are starting to appear on high-end vehicles today, while more advanced and more capable semi-autonomous systems are projected to appear in the latter half of this decade. Fully autonomous cars, still experimental today, are expected to follow during the early to middle years of the next decade. As with almost all innovations, ADAS features tend to be introduced in high-end vehicles first, then migrate down to medium-priced and economy cars. In some cases, such as rear-view cameras, commercial vehicles have pioneered adoption because these are features especially valuable in the safe operation of large trucks. While ADAS features are steadily finding acceptance today, moving to semi-automated and fully automated operation faces social, legal, as well as technological challenges. In the past, safety measures have often been driven by legislative and insurance mandates, but automated operation presents a new issue in that the car can take control away from the driver. As a result, law makers and the courts will be forced to determine liability issues, a factor that may slow introduction. Add to this a period of adjustment as the public becomes accustomed to the changes in control and safety and learns to trust automated driving, plus the long lag time as cars equipped with the new systems will have to share the roads with older, unequipped cars. Eventually, smart roadways that communicate with cars will also be deployed, adding yet another factor to that will make for a gradual transition.

Praveen K Ganapathy
Director-Business Development
Texas Instruments

If these legal and social issues require time to resolve, so do the challenges facing technologists. Cars require electronic safety systems to be small, light-weight and inexpensive, yet offer high performance and reliability. The trunks of the self-driving automobiles that are so widely publicized today are packed with advanced electronics that are worth much more than the host vehicles themselves. To change these experimental cars into production units will require reliable and powerful, yet affordable electronics that are much smaller in size.

Just as important are system safety and reliability, not only for the benefits of safe driving, but also because accidents that are caused by electronics failure can delay innovation and acceptance of the new technologies. Reliability is especially critical in a constrained automotive environment, where high temperatures, large voltage swings and vibrations can unduly stress electronic components.

In such a demanding environment, systems must have a failure recovery mode that remains safe to persons in and around the vehicle if something goes wrong. These design challenges take time to address, and the resulting systems require additional time to test effectively on the road. Technology providers need to be prepared to work closely with auto manufacturers throughout these lengthy phase-in periods, a commitment that may be difficult for vendors who are new to the automotive field. Assisted and automated driving relies on multi-modal systems with input from a variety of sensors, including ultrasound, radar, LIDAR (LIght Detection and Ranging) and cameras (color, monochrome, stereo, and infrared night vision). Satellite communications, as well as radio communications with nearby cars (vehicle-to-vehicle) and terrestrial installations (vehicle-to-infrastructure), are also necessary for positioning, localization, highway conditions and other information.

Working in real time, as events on the street occur, ADAS and automated driving systems will have to convert these varied inputs into useful data forms and extract whatever information is necessary. Then the systems must merge information from different sources, decide the correct control action, and communicate appropriately to the driver or automatic control output. With its heavy reliance on cameras and other imaging sensors, assisted or autonomous driving requires a great deal of high-performance vision processing, which by nature is heterogeneous. Typically, low-level processing concentrates on pixel data to create useful images for further processing. Mid-level processing identifies objects of interest in the images, high-level processing uses the resulting information to recognize these objects, and microcontroller decides what the system should do. For example, while low-level processing provides a steady stream of pre-filtered or pre-conditioned video images of a road, mid-level processing identifies sections of the images where important objects could be located.

Next, high-level processing determines what types of objects these are, such as other vehicles, people, animals, signs or traffic lights, plus how fast someone or something is moving. Finally, the microcontroller decides whether to go, stop, or wait until the pedestrian leaves, the light changes, or a nearby car passes. Concurrently, data streams from other input sensors, such as radar, are being examined for information in case there are overriding conditions, such as poor visibility due to fog. Because any given sensor may face challenging external conditions, inputs from different data streams are fused to greatly increase precision and reliability.

Fully autonomous cars will not appear in significant numbers on the roads for a decade or so, and more time will pass before virtually all new vehicles are capable of driving themselves. But in the meantime, a steadily increasing number of vehicles will offer some level of assisted driving to help make them safer while reducing fuel consumption and adding convenience for operators. ■

Steering wheel based driver assistance

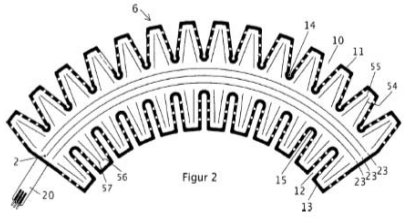
Denis Güzelocak
Founder
Guttersberg Automotive

Denis Güzelocak is the founder and project manager with multiple experience in Europe, Asia and USA. An unusual way leads him from a founder to a global automotive project manager. His enthusiastic initiative in the development for driver assistance systems was the goal on rapid prototyping with the focus for series quality.

Steering wheel technology has over decades changed from a simple handlebar to a high-end equipment element with many integrated functions. Besides transfer of steering forces to the gear box, the absorption of energy in case of an accident has become relevant.

Along with this, the integration of driver airbag modules has led to evolution of steering design. Additional integrated functions are expected in the steering wheel in the coming years.

Assistance systems to safeguard the driver from thoughtless operations as well as controls in case of inaccurate decisions are ready for the market. Many OEM`s are working on autonomous driving or at least for some special traffic situations.



Patented Figur
US 20160061669 A1 / DE 10 2014 007 163 B3

Implementation of ADAS in vehicles designed & manufactured by OEMs or Solution Providers

- One situation e.g. is an assistance in the traffic jump case. As soon as the car in front drives on, the car behind will follow automatically. There is no more need for the driver to concentrate on this action. Up to a predetermined speed a signal will warn the driver to take over the responsibility now.
- Weariness recognition is another important task. Eye monitoring could be one potential but it is very complex to achieve. Steering angle sensors in combination with camera systems in some of today sold cars measure the deviation from the ideal driving direction.

There is demand for recognition of driver's hand on the steering wheel rim / actuator modules. Following optional recognition systems are available as alternative:

- At least the correction come often too late to avoid accidents. Guttersberg´s hand recognition system shows a great promise to take over a better assistant work for the driver. Part of the system is also an electronic evaluation / E-call system. To measure the direct contact of driver's hand to the steering wheel is much faster to counter the steer. There are challenging technical principles to check if /or a hand is not on the steering wheel.

Other systems can fail in some special cases. EMV and ESD fields can affect a faultless function as well as gloves and clammy hands. Not least the driver should be grounded which is a challenge.

The detection sensor system from Guttersberg is based on the resistance principle without the disadvantage above. In addition, it is much more thinly which helps the implementation in a steering wheel or element.

Figure 1: Patented spinal column technology, has space-saving ratio through hybrid construction. Its flap/Finger construction allows adaption to inaccessible areas(thumb rest). Its is able to connect into existing on-board electronics and has gesture recognition and programming capability

Capacitive sensing

Disadvantages of capacitive

- Electric fields surroundings cause interference (frequency, WIFI, EMV, ESD Moisture) obstructs the detection output.
- Detection disorders of electrically conductive materials
- Contact medium needed (grounding) Problem in the detection of gloves / hand prostheses etc.

Camera monitoring

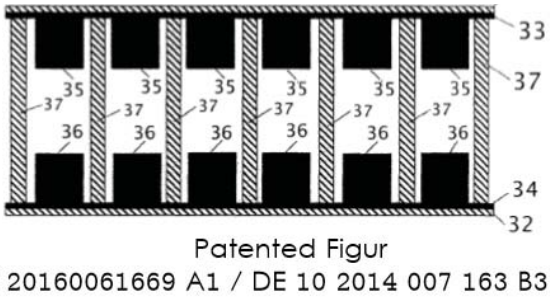
Disadvantages of capacitive

- Micro eye movements (difficult evaluation of and beginning of fatigue)
- Difficult demonstration of reliability/ controllability
- Critical transfer of control to the driver / vehicle
- Various maneuvers normal traffic, "private transport" & "valet parking")

Resistive sensing

Advantages of resistive

- Evaluation can be customized individually
- Robust and cost-effective production
- Detection of electrically conductive and non-conductive materials
- No grounding necessary
- Automatic calibration
- Electronic can be connected with on-board electronics



Patented Figur
US 20160061669 A1 / DE 10 2014 007 163 B3

Figure 2: Development of thermally deformable sensor - and detection fields. It has slim construction as well as low manufacturing costs provision by design modification and use of pre-tested flexible components. Development and modification of elastomers interconnect systems for crack - Heat - and cold resistance. Development of "Wdo Merge method" underwood - and Carbon implementation.

Figure 3: The image shows approximation possibility of the technology to human/operators hand. Even by the strong curvature, or by the Curve/bent-made of the sensor, the system keeps their robustness at any time (patented effect).

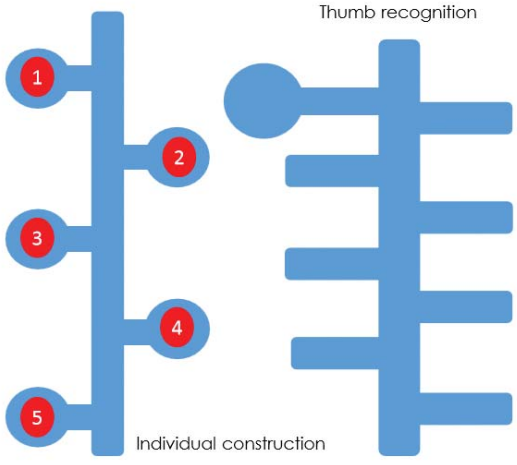
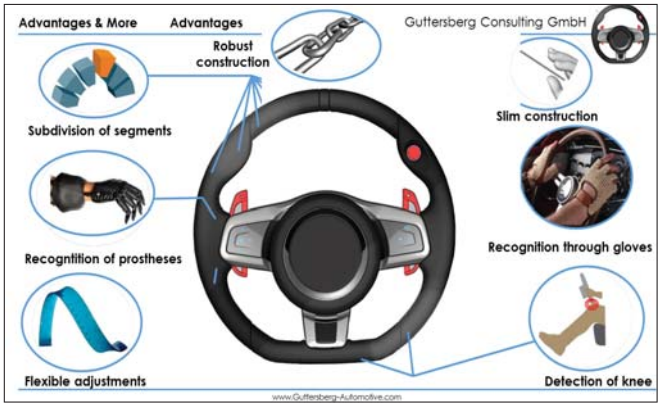


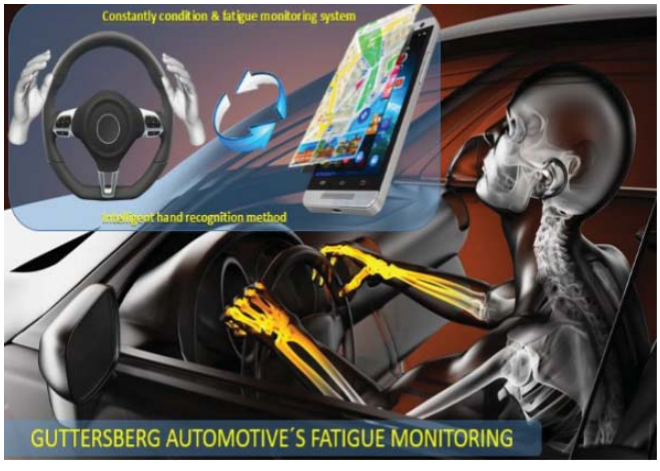
Figure 4: The Individual construction owns the advantage for the recognition of critical contact fields and it also has an individual customer-related layout. Through this, several zones can be printed with certain resistances and material savings can be obtained with the help of optimized usage rapid production through effective design.

Future possibilities in and around ADAS

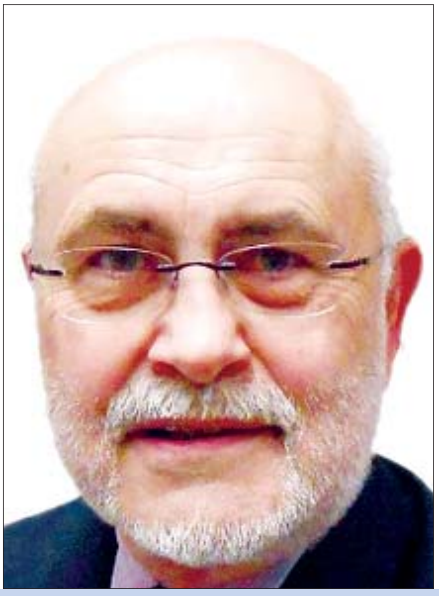
Sequential circuits are possible to assign supplementary functions. This can e.g. help to design steering wheels for handicapped people with acceleration and break function integrated in the wheel. Radio, telephone, route

Figure 5: Important evaluations are possible if the user e.g. directs simultaneously with his knee and his hand at various locations at the same time. It is not any outsmart of technology due to multiple subdivision of segmentation. The overlay detection of driver's hand / knee / stomach on inner and outside rim area can be measured with inaccessible commands, maneuver and areas possible (thumb).





is holding the steering wheel or not. This detection system is accompanied by increased comfort for the driver. In stop-and-go situations e.g. or autonomous driving or convoys, for example, the system can automatically detect and autonomously guide the vehicle in co-operation with other systems at an adequate distance from vehicles ahead.



Martin Kreuzer
Adviser Development Manager
Guttersberg Automotive

Martin Kreuzer has over 35 years of experience in the automotive sector and he is the owner over 120 international patents. He was the head of development at TRW for over 15 Years. He is also a team member of Guttersberg and involved in the development of the ADAS sensors. Martin Kreuzer has accompanied Denis Güzelocak for almost 3 years and derives partly many developmental processes.

There are various levels of integration that could be implemented:

- Notification alarm to wake the driver or focus their attention.
- Linkage with semiautonomous functions to help steer the vehicle to ensure it does not depart from its current lane of travel or get too close to the vehicle in front of it.
- Linkage with autonomous functions to move the vehicle off of the roadway and bring it to a safe stop.
- Linkage with emergency responders and medical alerts – the solution could identify a medical emergency, notify the closest emergency facility and navigate the vehicle to that location for assistance and further.

Guttersberg Automotive uses instead the steering wheel and joystick as a touchpoint for detecting driver fatigue. Guttersberg developed a technology which is able to sense when a driver's grip on a steering wheel has loosened as a sign that he or she may be nodding off as well as an innovative yet easy-to-implement solution to improve road safety. Guttersberg holds numerous patents for this system, one of the Patents "US 20160061669 A1" as patented as emergency and monitoring detection sensor system, which convert various contact information´s into several usable switching signals.■

Driving into the automotive future with ADAS

Frank Schloeder
Acting President
BMW India

The prospect of autonomous, driverless cars continue to dominate the interest in the automobile industry while a quiet transition is already altering our vehicles. The development of sophisticated driver assistance systems has transformed the driving experience altogether. We are witnessing a transition from **vehicle mobility to e-mobility in vehicles.** Advanced Driver Assistance Systems (ADAS) is a promising technology to improve traffic safety, driver comfort as well as increase road capacity and limit energy consumption. We are on the threshold of a new era: a chance to seize the opportunities of digitalization to take individual mobility into a new height. What sounds like the future today will soon be a part of our daily lives.

Since its inception, BMW has been at the forefront of pioneering innovations. With a sharp focus on envisioning the future of mobility, we have been creating a little piece of the future every single day. It has been a tremendous journey from being a manufacturer of aircraft engines and motorcycles to the world's leading manufacturer of premium automobiles to the leading provider of premium mobility and premium services. At BMW, the thinking and actions are geared towards a long term vision. That is the BMW way: past, present and future. We are focused on **Enhanced connectivity, Use of artificial intelligence, and development of autonomous driving**

As our world moves faster towards technological innovations, BMW is taking technological innovation to the next level through autonomous vehicles. BMW Connected is our solution for digital premium mobility services. It connects personal data, physical devices and various services in an intelligent way to create a new and seamless customer experience. BMW Connected is based on an Open Mobility Cloud. This processes data and information from various sources. However, the system doesn't just process this data, it also learns from the user's behavior, habits and preferences. On this basis, BMW Connected is able to offer customized solutions for every daily routine. Each ride is therefore safer, more convenient and more entertaining. The BMW Group is the first auto manufacturer to offer its customers personalized digital services.

BMW Connected also takes the surroundings into account that might be relevant for the customer – such as preferred shopping, a restaurant or a store that has already been searched for online. Real-time data from the cloud opens up almost endless possibilities. This is another area where HERE will be an important asset as the future "reality index" across different industries. Connectivity and highly-automated driving will make mobility safer and simpler.

Recently, The BMW Group showcased its four Vision Vehicles which set out to address the future of mobility. Each made by a different Group brand, they represented a distinct interpretation of future mobility and embody a specific set of brand values. They explore a

number of future themes, including autonomous driving, digitalisation and personalisation - and present premium mobility as completely effortless, constantly available, emotionally engaging and tailored to individual mobility needs. The BMW Vision Vehicle has the signature BMW driving pleasure at its core. Digitalization in mobility has really picked up speed and is a key to enhancing passenger as well as driver experience. Today our cars are already becoming an integral part of the internet of things. Digitalization will bring disruptive changes to our industry

First: IT will offer customers greater convenience and safety – initially through driver assistance systems and then, in the more distant future, through fully autonomous cars.

Second: Customer wishes are changing. Drivers expect to be able to integrate vehicles seamlessly into their life – for example, their smartphone or their connected home.

Third: Both trends will also open up new possibilities to use and experience the interior and the user interfaces of our cars.

And last, but not least: Digitalization will open up the automotive industry to new competition. The BMW Group welcomes competition!

It has always made us stronger. We are well prepared for the challenges of the future. Since 2007, our Strategy Number One has paved the way to sustainable mobility with BMW i. We have expanded our service offering with Drive-, Park-, and ChargeNow. And with "Connected Drive", we have always been ahead of the "classic" competition. Our joint acquisition of HERE – also will give us access to high-definition and real Time maps as a prerequisite for autonomous driving.

The constant search for pioneering innovations that offers the ultimate driving experience is the driving force for the BMW engineers to develop features that enhance Sheer Driving Pleasure.

The technological evolution in cars has been incremental. The need for a hassle-free driving experience has led to major innovations in the automobile industry. One such technology is the **BMW iDrive**. iDrive is one of the easiest and most intuitive way to control entertainment, information and communication. Thanks to the touchpad integrated in the Controller, you can easily enter information such as destinations for the navigation system using your own handwriting.

Driving often becomes a stressful activity due to umpteen reasons. However, At BMW, it is our endeavor to enable driving in a more relaxed style with moments of sheer driving pleasure. Our **Surround View** feature enables just that. It includes camera-based functions like Rear-view camera, Panorama View, Top View and 3D View. Cameras at the front and back of the exterior mirrors provide a 360° view around the vehicle. It considerably improves vision, particularly when driving in and out of difficult entrances or parking in tight spaces

Always know what turn to take next. And that's not all. While you concentrate on the road, the full-colour **BMW Head-Up Display** projects all the data relevant to your journey directly into your line of sight: this includes information such as current speed, collision warnings, Speed Limit Info or control messages. Without

having to constantly switch your gaze from road to instrument panel, you travel in greater safety and comfort.

At BMW we believe that the best way to predict the future is to create it. BMW has a long tradition of creating automotive future. One such fun feature is the unique **Gesture Control** where one's hands do the talking. It is a rigorously thought-out operating concept that recognizes six pre-defined hand movements for control of a number of functions. This includes volume control, accepting or rejecting phone calls, acknowledging check control messages, closing an information window, changing the camera angle etc. There is also the option of pairing a specific gesture with an individual choice of function.

One of the stressful moments in driving is when one has to drive in high traffic and monotonous situations. Imagine a system which makes the maneuvering easier, faster and effortless. This becomes a reality with the **BMW Remote Control Parking** and BMW Display Key with touchscreen, a driver has to align the vehicle (straight and centered) and then park it into a tight parking space without being inside the car. Besides other information, the smart key also displays service reminders, cabin temperature, mileage range and fuel level. Similarly, there is **Traffic jam assistant** which is extremely helpful when one is driving up to 60 km/h. The system allows you to stay relaxed as you pass through the congestion. It automatically maintains the desired distance from the vehicle in front, regulates your speed independently – even braking down to a standstill – and actively shares the steering. Your vehicle is thus able to help you stay in lane, as long as you keep at least one hand on the steering wheel. In a country like India, provision for vehicle safety for driving at night is a critical requirement. Now, in the 21st century, a revolution in safe driving at night is the need of the hour. The revolution, when it comes, will be engendered by the advent of autonomous or "self-driving" vehicles. And the timing may be sooner than we anticipate. Envisioning this, **BMW Night Vision** was created which makes it possible to identify people and large animals at night at a distance of up to about 300 metres. Using thermal imaging, they are also selectively illuminated by the Dynamic Marker Light function

A futuristic technology surprises and pleases at the same time. The innovative camera and radar-based **Driver Assistance** offers comfort and safety enhancing functions and is designed to reduce driving stress. Driving Assistant Plus includes optimizing additions such as Steering and Lane Control Assistant, Lane Keeping Assistant with Active Side Collision, Active Cruise Control with Stop & Go function and Rear Collision Prevention and Front Cross-Traffic Warning. The system operates on all roads and at speeds of up to 210 km/hr. With seamless interaction between real-time data from the cloud, adaptive systems & fully-interconnected products, we are able to create an entirely new mobility for our customers.■

Andreas Mai

Director

Cisco Systems, Inc.

Andreas Mai is an expert in business and technology architectures for 'The Internet of Everything' for automotive and insurance companies, service providers, and governments and is frequently asked to speak at conferences worldwide. During his career, Mai has advised automotive OEMs and suppliers, industrial equipment and aerospace suppliers, and private equity investors in North America and Europe.

DIGITIZATION OF ROAD TRANSPORTATION: $5 TRILLION GLOBAL NET ECONOMIC VALUE AT STAKE

Over the next ten years, the digitization of road transportation creates a net present economic value of $5 Trillion globally, according to a recent Cisco study. Stakeholders in the automotive, mobile service provider, insurance, fleet/telematics, intelligent transportation, mobility-as-a service industries and governments are working on how the digitization of road transportation is going to play out for them. To help business leaders and policy makers with their innovation, investment and partnership strategies, Cisco has created an economic model that integrates over 450 effects of the transformation of road transportation from numerous academic and industry studies into a comprehensive financial model that describes the actual value at stake and the flow of money between the key stakeholders of this tectonic transformation.

The digitization of personal and goods transportation is well underway. Vehicle manufacturers are connecting their products to deliver new in-house and partner services like diagnostics, over-the-air software upgrades, real time traffic and location based services, and real time fleet and supply chain management, just to name a few. Vehicle connectivity also enables vehicle insurance companies to align driver risk with premiums and to reduce the cost of crashes, claims management and customer retention.

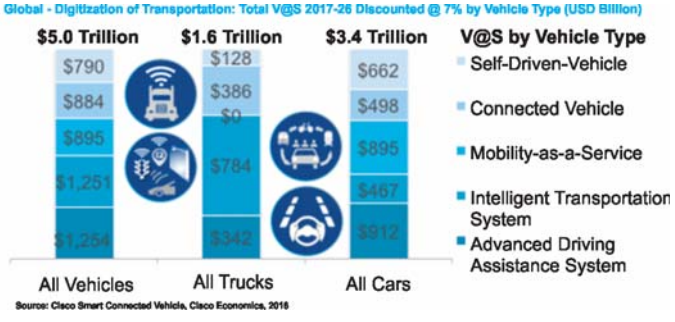
Advanced driver assistance systems are rising quickly to become a must-have feature of new vehicles. Incumbent and new automakers, technology giants and small startups are racing to be first to launch self-driven cars and trucks, with some players aspiring first market ready products as early as 2020.

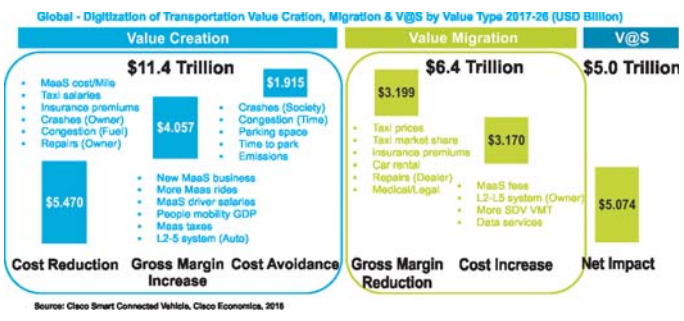
The same stakeholders are investing in car-sharing, ride-sharing and ride-sourcing with the promise of replacing costly car ownership with more affordable mobility-as-a-service. Large logistics providers and small start-ups are connecting shippers, carriers and trucks by creating real time supply chain management exchanges, to reduce the 25% of empty trucks that are congesting our roads globally.

Mayors around the world are investing in intelligent transportation infrastructure to ready their cities for a world where autonomous connected vehicles are converging with other modes of public transportation to replace personal vehicles that are congesting the road to prosperity, and to replace unprofitable public transportation systems with entirely new vehicle and mobility solutions.

Over the next decade, the digitization of the transportation of people and goods creates $11.4 Trillion of net economic value globally, based on a 7% discount rate. During the same time, $6.4 Trillion of value is migrating to other stakeholders, resulting in a net present value of $5 Trillion globally.

The $11.4 Trillion value comprises and distinguishes net new gross margins generated with entirely new businesses like Mobility-as-a-Service, and with selling systems and services for





connected, assisted and autonomous cars and trucks. It also includes cost reductions for users and owners of mobility-as-a-service fleets, and for vehicle owners as a result of less crashes and congestion. In addition, the value factors in the cost avoided by society in terms of lost gross domestic product for time wasted in congestion or looking for parking, lost gross domestic product due to crash related injuries or death, and the cost of emissions caused by traffic inefficiencies.

On the other hand, $6.4 Trillion of value is migrating to other stakeholders in the form of gross margin losses of traditional taxi and car rental businesses due to market share and price erosion caused by new Mobility-as-a-Service players, and due to lost 'crash business' of insurers, repairs shops, as well as medical and legal firms. In addition, the model factors in cost increases resulting from purchasing the required vehicle upgrades and services, new Mobility-as-a-Service fees and more miles traveled with autonomous vehicles.

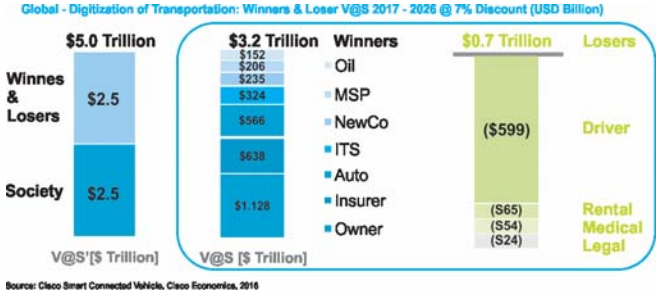
The resulting $5 Trillion value at stake represents the 'true' cumulative bottom line impact of over 450 individual effects for cars and trucks over the next ten years, discounted at 7%. Based on the projected global vehicle penetration rates reaching a little more than 1% for Mobility-as-a-Service and self-driven-vehicles, 4.7% for vehicles equipped with vehicle-to vehicle and vehicle-to-infrastructure communication and 25% of vehicles with embedded cellular technology by 2025, the highest value at stake will be driven by advanced driving assistance systems and Mobility-as-a-Service for cars and intelligent transportation systems and connected fleet for trucks. For each 1% percent point higher vehicle equipment rate, the global value at stake increases $1.7 Trillion or 33% overall and it nearly doubles the value of Mobility-as-a Service and self-driven vehicles.

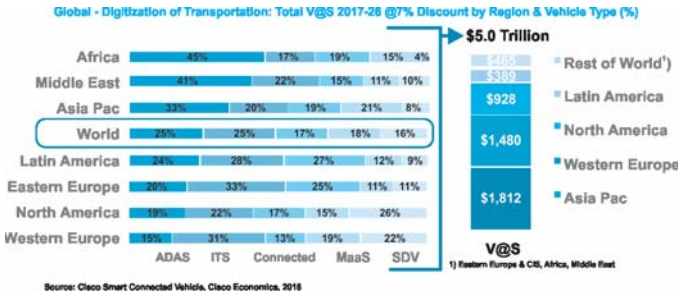
Half of the value at stake is societal. Over the next decade, the digitization of global road transportation can safe 200 Billion Liters of fuel wasted in traffic – the equivalent of 5.8 Million tanker trucks in a line two times the earth equator, and 340 Million metric tons of emissions that could fill over 1,000 supertankers the size of the Empire State building. For each 1% percent point penetration of self-driven vehicles, fuel consumption increases 60 Billion liters, due to more empty vehicle miles traveled. This erases 30% of overall fuel savings of the digitization of road transportation, unless traditional combustion engines are replaced by alternative powertrains.

Factoring in regional crash and vehicle fit rates (see above), as well as crash prevention results from field tests with advanced driving assistance and autonomous systems, this transformation has the potential to avoid 19 Million crashes, prevent 12 Million injuries, safe one Million lives in road traffic over the next ten years. This represents an average reduction of 5% of crashes over the next ten years, growing to 10% by 2025.

In addition, the digitization of road transportation will give people back 250 Billion hours – the equivalent of 400,000 lifetimes or 140 Million work years – they would otherwise waste in traffic. For example, in the USA, people spend an average of 580 hours driving in cars, representing a value of $3,360 per vehicle per year people would work, shop online or consume media in self-driven-vehicles. According to a recent study, Indian drivers spend more than 650 hours just on their commute, with half of the drivers commuting more than 12 hours per week.

Overall, the digitization of road transportation has the potential to create over 70 million jobs by 2026. Contrary to popular belief, new jobs created in society overall and in new mobility services in particular make more than up for job losses of professional drivers, car rentals, health industry and lawyers. Beyond society, the biggest winners are Mobility-as-a-Service fleets, vehicle insurers and vehicle manufacturers, which is a surprising result compared with the typical doom and gloom scenarios. At global car penetration rates of 10%, Mobility-as-a-Service has the potential to make 1.7 Billion more people mobile, particularly in the poorer regions of Asia and Africa, where people who cannot afford to own a car get access to more affordable mobility options. Mobility-as-a-Service is set to cause major shifts of new car sales from mature to emerging markets and from personal to fleet owners, when applying existing car shedding studies and regional differences in car ownership. More than 80% of the value at stake is created in Asia Pacific, Western Europe and North America. Interestingly, the value at stake varies more than 50% per vehicle and type of vehicle and across stakeholder groups, indicating that different regions and countries and stakeholders will require different digitization strategies to capture the maximum value at stake of the digitization of road transportation. Cisco can add value, both technologically and as catalyst for co-creation and innovation. Let us jointly unlock the tremendous value the digitization of road transportation holds for all of us. ■





GET YOUR CAR INSURED WITH ADAS

Sanjay Gupta
Sr. Director & India Country Manager
NXP Semiconductors

Accidents on roads - Can technology minimise this?

Technology is one of the key enablers of growth in the automotive industry today. Consumers are slowly demanding more technology within their cars to not only enhance their driving experience but also to secure their cars.

Security technology has slowly emerged as a key factor, driving the sales of automotive industry today. According to reports, over 1. 25 million people were killed in road accidents in 2010 alone, which is more than the number of people killed in all our wars put together. This is what has prompted car manufacturers to take security very seriously and with the conversations around driverless cars, security technology has hit the limelight at the right time.

ADAS – Can it bring some relief?

Several companies are investing heavily to develop safety and security technologies which can not only warn drivers on high speed, dangerous roads ahead but also save people inside the car incase of severe accidents. One such technology which has gained prominence over the past few years is Advanced Driver Assistance System. ADAS is developed to assist, complement and eventually substitute the driver in the complex process of controlling a vehicle. Few top features ADAS technology includes adaptive cruise control, blind-spot monitoring, lane-departure warning, night vision, lane-keeping assist and collision warning systems with automatic steering and braking intervention. Predictive ADAS is designed to prevent accidents by taking partial control of the car's movement. These automated safe systems are paving the way for tomorrow's fully autonomous car.

While the technology is still at a nascent stage, it definitely has the promise to take the security landscape in the automotive industry to new heights.

ADAS – Is there a demand?

Demand for advanced driver-assistance systems (ADAS) is expected to increase over the next decade, fuelled largely by regulatory and consumer interest in safety applications. For instance, both the European Union and the United States are mandating that all vehicles be equipped with autonomous emergency-braking systems and forward-collision warning systems by 2020. A recent McKinsey survey also suggests that car buyers are becoming even more interested in ADAS applications that promote comfort and economy, such as those that assist with parking or monitoring blind spots.

While the prospect of completely autonomous, driverless cars continues to grab attention and interest across the world, the implementation of security technologies have already started We have already witnessed advanced sensors, cameras, entertainment and other safety features been integrated into the cars. The technology is bringing a change in the way we are operating cars, hence bringing a dynamic shift in our safety and driving experience. ADAS is emerging as the added advantage for drivers which does not only assist them, but also eliminate errors, including blind-spot and lane-departure warning systems, automatic emergency braking, lane-change assistance, drowsiness alerts, and bird's-eye displays.

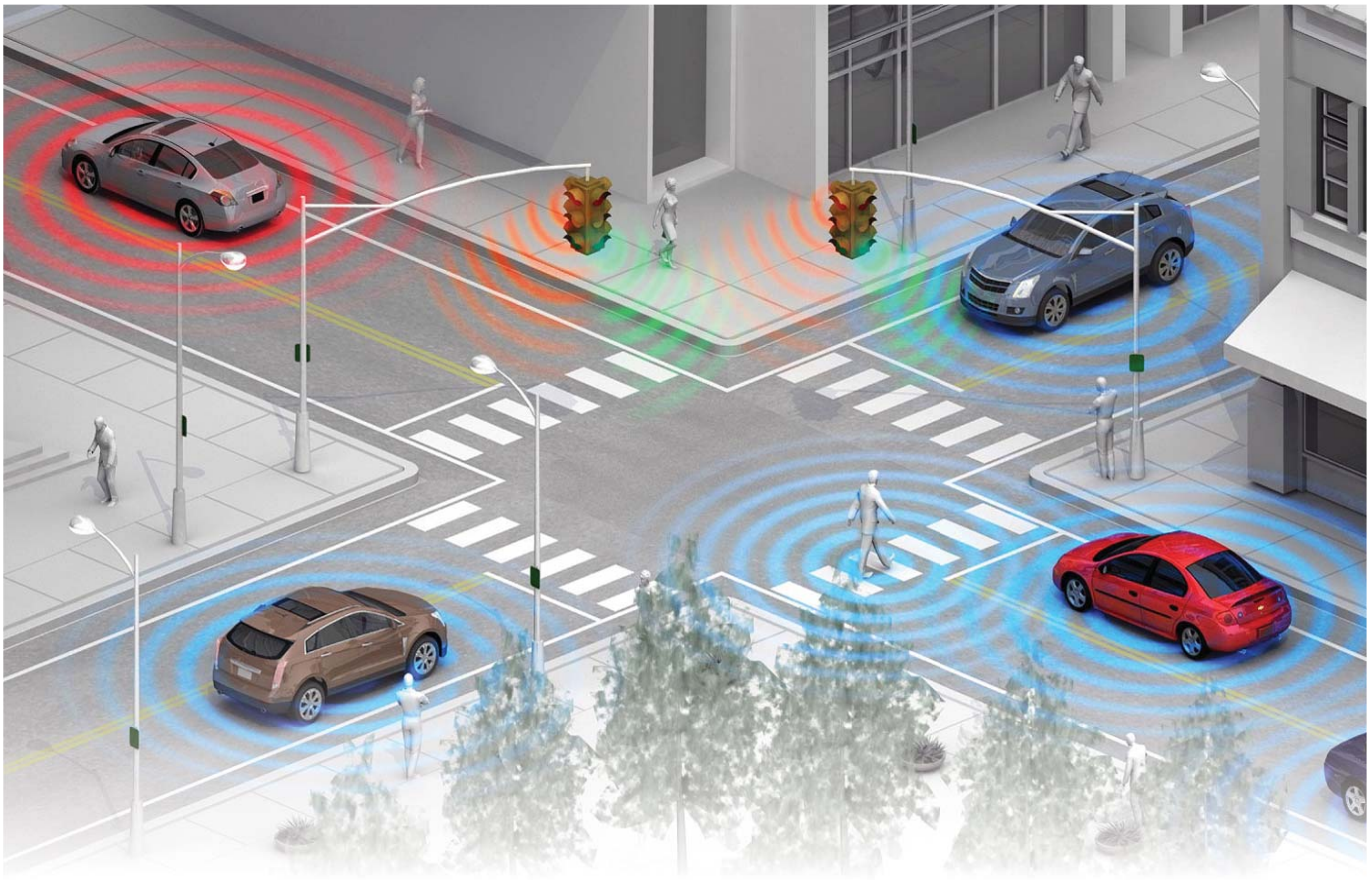
Why do you need ADAS?

ADAS is not only necessary to secure your car, but it also makes your car intelligent and more eco friendly. Here are few reasons why you should shell out some extra money to get ADAS inbuilt inside your car:

- **Increased connectivity:** When the world is getting smarter, why leave out your car? With the help of ADAS technology, your car can be connected on the go
- **Greener Mobility:** Vehicles can better manage their navigation and consumption, thus reducing emissions for a smaller carbon footprint
- **New Mobility:** Analysts predict more car sharing and less car ownership and new technology that will enable individual profiles per driver
- **Increased Safety:** Active and passive safety systems can help to advance the goals of reduced driving risks and zero fatalities

Concept Awareness

ADAS, as a technology has the potential to transform the automotive sector, its current annual revenues—which range from about $5 billion to $8 billion, according to most sources—are modest compared with those for other automotive systems. For instance, 2015 revenues were about $30 billion for audio and telematics and about $60 billion for climate control. Part of the problem is that many of the most promising ADAS applications are still in the R&D phase or have not yet available the market; while some are expensive



and mostly available in premium cars.

Consumer awareness remains the biggest concern for ADAS. The growth projection of ADAS though represents immense opportunity for the technology but also tells us that there is a need for more sophisticated consumer awareness efforts to drive the adoption

But the most important factors inhibiting demand may be a lack of consumer awareness. In a recent online survey of more than 4,500 car buyers in five countries conducted by McKinsey, many respondents were unfamiliar with ADAS applications, and few purchased cars with this technology This finding suggests that once consumers become familiar with ADAS, they will prefer cars with these features.

Approach to build awareness

The automotive companies who explain the systems' features more actively, carefully define and satisfy customer preferences, and price the technology appropriately, on customer value - are likely to be strongly positioned to capture additional economic benefits, drive brand differentiation, and advance toward the deployment of even more autonomous or semi-autonomous vehicles.

There are at least a couple of factors that favor greater ADAS adoption. First, declining prices may provide a tailwind as price becomes an important factor cited for purchase decision. The second factor is the importance of safety to drivers and their increasing awareness of the technologies' capabilities. Drivers have consistently improved vehicle safety, so the technologies can be—and are—a point of differentiation among carmakers and over time may become a "table stakes" factor, making ADAS a likely critical trend for carmakers to embrace.

The application of ADAS systems can significantly reduce the number of road accidents and severity of injuries. Different sensors provide dynamic features including adaptive cruise control, parking assistance, blind spot detection, lane departure warning, drowsiness monitoring, tyre pressure monitoring and night vision. In the early stage of adoption, these systems were limited to luxury segment of vehicles.

How the future looks?

However, with technological advancements and rising awareness among customers, some of these systems are now being integrated into the mid-range and economy class vehicles as well. Stringent government regulations in Asia-Pacific countries are leading to higher adoption of ADAS systems. Complexity in testing systems and huge cost incurred for the installation of ADAS systems are restraining the market growth. The deployment of ADAS systems in low-cost cars and increasing electronic integration within vehicles would be the major trends in near future.

Also with technology majors investing heavily on driverless cars, ADAS will hold key to the success of driverless cars. Security is one of the prime concerns and a roadblock to the success of driverless connected cars and ADAS is really one of the bricks to the wall. But certainly, one of the strongest bricks.

Future holds immense potential, key to making it work will be taking the right steps in the right time.■

Artificial Intelligence in ADAS

Michael Hirsh
Regional Manager for India
Mobileye Aftermarket Division

Michael Hirsh heads Mobileye's aftermarket operations in India and is based at the company's research and development headquarters in Jerusalem. His brief entails liaising with government agencies, and establishing the support infrastructure necessary for the propagation of Mobileye's collision-prevention technology in all market verticals in India. Michael holds an MBA in Technology Management from Tel Aviv University.

Q How does vision based driver assistance compare with the Lidar/Radar based system for ADAS?

A Mobileye essentially offers artificial intelligence. The optimal "machine" known for driving an automobile is still an alert and proficient human driver. Artificial intelligence (in the form of Mobileye vision technology) emulates the human driver and as such relies on our primary sense which is vision – that is the ultimate means for knowing "what is out there", and of course a machine is not subject to distraction or other factors that are known to be the cause of accidents. We are a "Third Eye" in the car. Vision technology can see lane markings and street signs, vision technology knows what a pedestrian or cyclist looks like – and of course vision technology knows what is in our field of vision but nevertheless does not pose a risk of collision. This is the reason that it is the preferred solution. There are hybrid solutions that have been developed in order to augment vision, for example in inclement weather or poor lighting conditions, but the core solution will remain vision technology and this is the direction the industry has chosen.

Q Can you tell us about EyeQ SoC processing platform?

A Mobileye has developed a family of chips called Mobileye EyeQ® to fulfill the need for low power and inexpensive computing platforms which are able to support computationally intensive vision applications and which meet automotive requirements. Initially the EyeQ powered the essential ADAS features such as Lane Departure Warning and Forward Collision Warning. As requirements from the OEM sector have developed, up to and including fully and semi-autonomous driving, Mobileye has continued to evolve the EyeQ platform in order to allow for simultaneous and instantaneous processing of the multiple inputs required to provide such capabilities.

Q What are your aftermarket solutions in ADAS?

A Although initially dubbed "Aftermarket", a more correct term – particularly in the Indian scenario – would be "Retrofit". In a nutshell, Mobileye has taken the essential OEM-based ADAS features and bundled them in a platform that may be retrofitted in almost any vehicle on Indian roads, or rolling off the assembly line. These include Lane Departure Warning, Forward Collision Warning, Headway Monitoring & Warning (tailgating), Daytime Pedestrian and Cyclist Collision Warning and Speed Limit Indication. This retrofit platform is called Mobileye 630 and its implications for India cannot be overstated: World-class ADAS is available now to virtually the entire India road fleet – effectively "shortcutting" a decade-long evolution that has taken place in Europe, the US and other regions.

Q What is Mobileye Shield+?

A Shield+ is a wonderful example of the ongoing interaction between Mobileye, the provider of ADAS technology, and those enjoying the technology in the field. What happened is that fleet operators and city planners came forward and said, okay – you are looking out the front of the vehicle, but what about the vulnerable road users that invariably located at the sides of buses and trucks, particularly in urban environments. They are effectively in the drivers' blind spots and the results are all too known – a huge and tragic toll of pedestrians, cyclists and motorcyclists that are killed or injured during the turning and maneuvering of larger vehicles. In order to combat this,

Mobileye provided additional sensors down the sides of large vehicles which deliver life-saving warnings to the driver that a vulnerable road-user is in

the path or the vicinity. In addition, these real-time warnings and their map location are recorded for later analysis by city planners, and these provide invaluable information on "hotspots" or those areas that effectively constitute "accidents about to happen". Cities have always have had a map of where the crashes have occurred – now we provide a comprehensive map of where the accidents are likely to happen due to infrastructure deficiencies or other readily solvable factors.

Q What are the market indicators which show that a region is ready for adoption of ADAS?

A ADAS is needed wherever there are road accidents. Today, in India, commitment is coming from the top. Road Transport and Highways Minister Nitin Gadkari has just this February appointed an eight-member taskforce to achieve a 50% reduction in road accidents in the coming five years. We have submitted our proposal in the framework of that endeavor and intend to play a pivotal role. India's road toll is among the world's highest and there is widespread and growing awareness that this this is a matter of national urgency, and indeed practical initiatives being taken on the ground. These are all clear indications that the time for large-scale adoption of ADAS in India is now.

Q How far are we in India from large scale adoption of ADAS?

A We are already seeing the first practical steps being taken. The infrastructure for ADAS retrofit installation is already in India – first clients are large bus and truck fleets. And of course we are in active dialogue with government and regulatory partners.

Q Can we look forward to vision only based autonomous vehicles?

A As I mentioned, vision technology will always serve at the core of autonomous solutions. We may expect radar and Lidar to be used to supplement sensing capability.

Q Whom would you consider competitor – Tier-1 companies working in ADAS or companies like Google, Uber and Tesla who are joining the automotive party?

A Mobileye is regarded as the world leader and innovator in ADAS and works with leading Tier-1 companies, and through them with most leading auto manufacturers. There are additional players who occupy a relatively small part of the market whom we could consider competitors. We work with Tesla, and Uber and similar companies are potential clients. Yes, Google has demonstrated technology for autonomous driving. However, Mobileye has developed a mapping technology called REM™ (Road Experience Management™) which provides essential road data for autonomous vehicles with far less band width and far greater accuracy that other solutions on offer.

And a final word

I am thrilled and honoured to have the opportunity to participate in India's ADAS drive, and even more so to have found here such willing and visionary partners for this worthy endeavour. These are exciting times and, given the pace of technological acceleration in India in all sectors, I believe Indians can look forward to enjoying lifesaving ADAS technologies in the immediate term. We are proud to be taking part in the charting of India's road safety roadmap. ■

Vector Informatik
Riding the Power of Innovation

Brahmanand Reddy Patil
Managing Director
Vector Informatik India

Q In span of less than three decades Vector Informatik has created a space in the automotive sector. What has been critically important in this journey?

A The company was founded on April 1st, 1988 by Eberhard Hinderer, Martin Litschel, and Dr. Helmut Schelling. Based on this engineering company, an international, continuously growing enterprise has emerged. From the beginning, the typical Vector values of innovative power, fairness, honesty, and loyalty were in the focus - among the employees as well as towards customers. These traditional values, combined with a visionary view, were and are the foundation for our successful growth.

Q Does diagnostic tools like CANdelaStudio, CANdesc, CANoe.DiVa have their roots in CANalyzer of 90s?

A The diagnostic tools support the Engineer in specification (CANdelaStudio), development and generation of diagnostic software components that go into ECUs (CANdesc) and integrated validation (CANoe.DiVa) of Diagnostic functions.

The process oriented approach in ECU/Vehicle diagnostics calls for high quality specification at the early phase of development. The CANdela approach formalises the requirement management by leading to "diagnostic templates" specific to OEMs.

Q How correct it is to say that increasing usage of ECUs in vehicles, the relevance and need for CANalyzer will always be there?

A On a vehicle network and during the development of an ECU, the key focus is always to check whether communication is on and what type of communication it is. CANalyzer performs these checks via analysis, diagnostics, logging and stimulation of the bus.

Besides CAN, it also has options for several other interfaces, even Ethernet, CAN-FD, Car2x.

The new release of CANalyzer 9.0 supports AUTOSAR 4.2 System Description. CANalyzer is getting more and more necessary with the ever increasing and complex bus systems in the vehicles.

Q What are the offerings and solutions from Vector Informatik in ADAS and connected vehicle domain?

A Vector offers comprehensive solutions for various tasks involved in developing ADAS systems in the form of software and hardware tools and embedded software components:

- Measuring instruments to acquire multi-sensor data
- Checking and optimizing ECU functions
- Software components
- Algorithm design

Software tools include CANape Driver Assistance, vADASdeveloper, BASELABS Create and VX1000 hardware

The embedded components relevant for ADAS like Ethernet, AVB, Safety and Security are part of MICROSAR – the Vector AUTOSAR basic software.

Q Can you share your views on the usage of testing tools in India's automotive space?

A The increasing electrical & electronics technology in Indian automotive space has resulted in complexity rise in the area of testing. Hence the usage of off-the-shelf testing tools has also increased. The need for modular and scalable Hardware-In-Loop systems like Vector VT-System is rising. The Indian Tier1/Component makers have started using the testing tools indicating that they have entered into ECU development for Indian and Global OEMs.

Q Are your diagnostic tools used during the service and maintenance of vehicle also? If yes, have you seen any shift in usage pattern over the last few years in India?

A Indigo is one such tool. It gives

the user a quick overview of a vehicle's status and allows detailed diagnostics of individual ECUs.

Service and maintenance tools are still predominantly custom built in India. But the penetration of new technology (like remote diagnostics) and release of newer vehicle models with new features makes it difficult to keep up these custom built diagnostics tools.

Q While some of the active safety features like brake assist, lane assist etc has cut down on the road accidents and fatality, what new 'assist' option can we expect in ADAS in future?

A The Traffic Jam Assist is an option we need in India especially in our cities. There is some development happening in this area already. This system relieves the stress from drivers in cities and also on highways in some emergency situations where additional lanes are formed. Additional functions like blind spot assist, side distance control and pedestrian Mobile GPS to Car2x communication are expected in the near future.

Q There are plethora of sensors being used for active safety like radar, lidar, optical camera etc. Do you see them converging for the analysis and assistance.

A Yes, the data from these multiple sensors is already converging.

A crucial factor for success is full detection of the car's surroundings with all relevant objects. This includes reliably predicting how a traffic scenario will develop. Different sensors acquire the vehicle's surroundings, and the sensor data is then analyzed and merged in the ECUs.

The probabilistic ADAS algorithms are constantly performing sensor data fusion, processing the images and evaluating large quantities of data to identify and validate objects.

Q Would you like to comment on R&D in automotive sector in India?

A Investment in R&D is growing in India by 5-10% each year. India has been a chosen location for engineering and development for Global Auto OEMs and Tier1s and by leveraging this advantage, the local automotive sector should be able to ramp-up faster.

The "Make in India" initiative by Industry and the Government must be combined towards building a Brand India that strives for quality and innovation. There has to be a paradigm shift towards TCO (total cost of ownership) rather than individual product/process-step costs. I see this shift already happening as across the automotive industry there is a drive at the top towards this goal and the engineers in the labs are eager to innovate.

However, it takes some time for these to converge and take charge. Meanwhile, the major companies are leveraging their capacities by in-organic acquisitions and JVs and mutually deploying their strengths and key positions to sustain the competition. ■

Innovation and Technology are Driving the Future of Personal Mobility

Erica Klampfl
Global Mobility Solutions Manager
Ford Motor Company

Erica Klampfl is Ford's Global Future Mobility Manager, defining Ford's near, mid, and long-term mobility strategy to make mobility affordable economically, environmentally and socially. Previously, she led the Strategy and Sustainability Analytics group at Ford Research and Advanced Engineering.

Since the introduction of the automobile more than a century ago, personal mobility has changed radically. Cars have become more affordable to more people, and the global transportation landscape has shifted to become increasingly connected, urban and crowded. In all this time, however, one thing has remained the same: Personal mobility is about much more than just moving from A to B. It's about human progress, and giving individuals the freedom to choose how they move and improve their lives.

In 2012, Bill Ford introduced our Blueprint for Mobility, a vision for the future that provides solutions for short-, mid- and long-term mobility needs. It calls for private businesses, regulators, cities and countries to take action to address the transportation challenges ahead for a more sustainable and viable future.

Ford Smart Mobility, which Ford CEO and President, Mark Fields introduced earlier this year at CES, is our plan to use innovation to take Ford to the next level in connectivity, mobility, autonomous vehicles, the customer experience, and big data. We want to test new ideas and address the growing transportation challenges around the world and have initiated a series of mobility experiments to test unconventional and breakthrough transportation ideas, to create better customer experiences and more flexible models for services like car-sharing. We also want to encourage social collaboration that will help to shape how the world moves.

In the early days of the automobile, Henry Ford helped put the world on wheels, making high-quality cars at an affordable price for the average worker. But today the solution to ensuring mobility for all isn't as simple as putting more wheels on the road: About one billion cars are already in use, and some estimates expect that number to rise to four billion by 2050. This issue is especially acute in urban areas in countries like China and India, where traffic congestion is already a major concern and car ownership is becoming more attainable.

At Ford, we're approaching mobility in the 21st century with four megatrends in mind: explosive population growth in urban areas, an expanding middle class, air quality and public health concerns, and changing customer attitudes and priorities.

These trends prescribe how we're approaching the future of urban mobility. It's an approach that recognizes that sometimes the solution may not be a private car but shared ownership models, ride sharing, or a multi-modal journey that requires a combination of different types of transportation. It also considers rural settings, where public and advanced transportation options are limited and basic services harder to attain. Greater integration between the technologies in automobiles, mobile devices and

infrastructure will change how we interact with the services that move us from point A to point B. Each city has its own unique set of challenges. Take Chongqing, for example. The enormous Chinese municipality is home to almost 30 million people in a geographically diverse setting, with transportation options ranging from a funicular railway to trains and buses. As part of our Innovate Mobility Challenge Series – a component of Ford Smart Mobility – we challenged developers to find a way to optimize the available mobility options in Chongqing. The winner created a platform that enabled users to find the most efficient route to their destination using multiple modes of transportation, which can help reduce congestion and pollution.

In India, monsoon season can cripple cities for weeks at a time, with flooded roads and railways making mobility frustrating, time-intensive and dangerous. The Monsoon App Downpour challenge asked developers to come up with ways to leverage software and data – both historical and real-time – to provide a tool that can help people navigate through monsoon storms. The winning app, Mumbai Monsoon Helper, allows users to plan routes that avoid the most water-soaked areas using information gathered via crowd-sourcing. No one can stop the rain, but we can find ways to work around it.

These are just a few examples. Ford has also spearheaded app competitions in North America, Europe, Africa and elsewhere in Asia Pacific, addressing issues like parking, increasing access to healthcare, and improving the delivery of services in rural and urban areas. A key component in our mobility strategy is getting people all over the world involved, and working with individuals, industry, academia and governments to find innovative solutions that meet the unique needs of different locations.

One way Ford is embracing the spirit of collaboration is Techstars Mobility, driven by Detroit. Ford is one six major corporations backing the mentorship-driven accelerator program, which will foster emerging transportation startups that are working on innovative mobility solutions. The 10 winners were selected from hundreds of applicants representing 42 countries on six continents, and will receive funding and business plan support to incubate their ideas, ranging from new lithium ion battery technology to a ride-sharing app to a Web browser that doesn't require a data connection.

Ford is also leveraging university alliances to break new ground in transportation research. In China, Ford is partnering with Chongqing University and the Chongqing Engineering Research Center of Intelligent Transportation Systems to develop a more accurate and predictive model for bus arrival and departure times. The project will use data collected from 8,900 buses on 520 daily bus routes to help reduce total travel time and energy consumption, and will empower individuals to make more informed decisions with better information about wait times.

From the very beginning, innovation has been integral to every part of Ford's business. In the world with 28 megacities of over 10 million people – a number expected to jump to 41 by 2030 – rethinking how we all interact with the transportation options around us is crucial for creating more efficient and sustainable cities. At Ford, this means thinking beyond the car and engaging with other organizations to create a better world where personal mobility is more convenient, efficient and attainable for all. ■

Advanced Driver Assistance System

Breakthrough Technologies at Mercedes-Benz

As the inventor of the automobile, Mercedes-Benz has a rich history of over 130 years of pioneering, experiencing and evolving technology in passenger cars. It is said, with time only one thing is constant, change. It could not be more appropriate to use technology as an example to substantiate this saying. Technology literally means the application of scientific knowledge for practical purposes, especially in industry. For us, cars are not a mere mode of transport but a companion itself. We believe making cars is a combination of art, science and psychology. Mercedes-Benz considers car tech as one of the incessantly developing phenomena in the tech world and the future literally has no boundaries. Technology in cars can be broadly segregated into three key criteria namely engine/drivability, safety features and convenience/connectivity devices. Developing environment friendly automobiles is yet another crucial criterion for Mercedes-Benz. Thus, we aim to develop fuel-efficient and environmentally-sustainable premium automobiles without compromising on the characteristic brand features – safety, comfort and refined driving pleasure.

Over the years, the contribution of technology in cars has only been on the rise. It is amazing how the cup holder for instance, was considered a revolutionary advancement in the automobile world. Gradually with time, electronic fitments like an air conditioner, music system etc. started making their way as standard accessories. Today, in the 21st century technology is all about being connected and entertained regardless of the location one wants to venture.

The term, Advanced Driver Assistance System simply corroborates the idea of advanced systems that assist a driver while he/she is driving by performing monitoring, warning, braking and steering tasks. When it comes to safety, security, technical support and advancement, these exclusive systems play an integral part in defining a car's caliber. Way back in 1978, we presented the second-generation anti-lock braking system (ABS), developed together with Bosch. This unique technology enabled a driver to retain steering control even during emergency braking. Today, our cars are well equipped with advanced driver assistance systems such as Attention Assist, Electronic Traction System (ETS), DIRECT SELECT, DYNAMIC SELECT, Curve Dynamic Assist, Crosswind Assist, Lane Keeping Assist, Active Blind Spot Assist, Brake Assistance System (BAS), Active Parking Assist (Parking Package with 360°Camera), PRE-SAFE®; DISTRONIC PLUS with Steering Assist, Stop&Go Pilot and COMAND Online with New Generation Telematics to name a few!

Attention Assist signals the driver about the danger which has either risen from fatigue or under the influence of sleep. The state-of-the-art sensors immediately start sending alerts based on the behavioral changes of the driver, in turn avoiding danger. Another revolutionary concept from the house of Mercedes-Benz is PRE-SAFE®. It is essentially an assistance system that can help prepare the occupants for an accident before it happens, PRE-SAFE can detect that certain types of collision might be imminent. In the precious moments before impact, it can snug the front seat belts and adjust the front head restraints to help optimize the effectiveness of the restraint systems. ETS (Electronic Traction System) ensures the wheels are aligned in a manner that if one loses traction or if one wheel runs faster than the others, the braking system slows down the whole function to regain control over the vehicle. To further alert another car that is tailing a Mercedes-Benz, our unique system ADAPTIVE BRAKE LIGHTS flashes a red warning signal thereby avoiding rear-end collisions by signaling the driver, ensuring a safe drive.

Curve Dynamic Assist helps the car in conditions where steep curves are involved, the braking pressure applied during difficult conditions reduces pressure to the rear axle. On the other hand, Crosswind Assist gives protection against strong gusts of wind which can help the car from sudden lane switching or losing control.

Similarly, a feature like Lane Keeping Assist alerts the driver when one deviates from a traffic lane. Another revolutionary feature, Active Blind Spot Assist, detects a vehicle in one's arena/radius and is capable of immediately turning on the signals and applying the brakes if the vehicle deviates to another lane. Brake Assistance System (BAS) was one of the most extensively researched technologies developed by Daimler-Benz. It increases the force on braking system during emergency, one of the most

"Advanced Driver Assistance System simply corroborates the idea of advanced systems that assist a driver while he/she is driving by performing monitoring, warning, braking and steering tasks."

thought through technologies to avoid accidents. We believe safety is a must not only when the car is in high speeds but also otherwise. For instance, parking can be a tedious task, especially in a crowded country in India. Our Active Parking Assist is an automated system which helps finding parking space and the car navigates automatically into located spaces, all the driver has to do is to monitor the accelerator and brakes.

DISTRONIC PLUS with Steering Assist is a trademark from Daimler that essentially keeps the speed in check and it also focuses upon the vehicles in a traffic situation, it allows the car to automatically keep up with the vehicle in front in tailbacks as well as assist with steering. This works on a radar system for which the Indian government needs to delicense certain radar frequencies. Similarly, features like Lane Keeping Assist, Blind Spot Assist are also unavailable in India.

We at Mercedes-Benz thrive at offering the best in class features to fulfil the contemporary needs of the modern consumers. Features like Navigation, telephone, audio, video, internet, Wi-Fi hotspot, COMAND Online controller with New Generation Telematics, Touchpad, Parking Package with 360°Camera, Keyless GO Start/Stop, Dynamic Select (A special feature in certain cars where the driver gets to choose from five different modes to suit pertinent driving terrains) are offered to customers worldwide. We are glad that all the aforementioned features are available in India today. ■

Who Will Win the Connected Cockpit?

Joel Hoffmann
Open Platform Marketing Manager
Renesas Electronics

The concept of combining the user experience across the instrument cluster, the center console, and the other screens in the car (including smartphones) has been looming for almost a decade.

And yet, there are very few cars on the road that utilize a single system to accomplish all of those goals. Why is that? Let's meet our experts to get the answer:

- Chris Giordano from DiSTI, producing functionally safe software tools since 1999 that will build the user experience of integrated instrument clusters to meet ISO 26262 up to ASIL D safety requirements.
- Chris Andrews is with Visteon, a tier one supplier that has a notable imprint on the industry. He heads up the advanced engineering group that's promoting the idea of reducing costs for the OEMs and has been talking to a lot of customers.
- Joe Fabbre from Green Hills Software, a prominent supplier with deep experience in functional safety systems, the technology behind the instrument clusters in the cars today.
- Ian Byers from Renesas Americas, an incumbent supplier to today's instrument clusters that aren't necessarily domain controllers or ECU consolidation, as well as a significant supplier to infotainment systems.

Hoffmann: I've heard some of you say that ECU consolidation is catching on, do you think it's going to become widespread?

Byers: Over the last four or five years we've seen a lot of concept-type programs hosted by either an OEM or a Tier 1. They want to try out consolidation, see what the performance is like, see if they can get the user experience that they want out of it, and also in many cases they're taking a look at the security investments, combining multiple different code bases together, and it certainly adds to the complexity of the overall system.

Fabbre: I'd agree that dealing with the complexity is the key to successful consolidation. Today we have proven technologies in both hardware and software that allow us to safely combine these complex components. Modern processors have features that assist with virtualization, isolation of peripherals in the system, and provide enough processing power to host disparate work loads. The real challenge is building the right software architecture to keep things safe and secure. We've been doing this for a while now, and I believe we are at a point where it will become widespread.

Hoffmann: Ultimately the OEMs decide when something's going to be bought even though as suppliers we would like to sell them all kinds of things. It's not about technology per say, but technology can bring money savings. When does the money savings come in for the OEMs?

Andrews: It's not solely about cost savings. While that is always important, the main reason to change to a consolidated solution is the improved user experience. With regard to the cost savings, there are obvious first-order BOM savings in addition to second-order savings like system costs, complexity reductions and organizational savings. This organizational savings come from realigning with a more system-solution mindset – thinking of the cockpit as one team with one HMI and multiple inputs and outputs. Both the suppliers and OEMs benefit from this approach, as long as the risks are managed. For example the cluster, HUD and infotainment were all separate departments. So how do we take all of that and roll it into a single team? This creates some new hurdles of how to validate and manage a complex product of this type.

Hoffmann: I've been noticing more

CEOs than ever before getting on stages and talking about their vision to self-driving cars, create more automated cars. It helps to bring new energy and maybe some restructuring inside organizations might be a result.

Andrews: We are seeing varying degrees of change at the OEMs, as well as tier suppliers. This transition to automated mobility is affecting all participants in the automotive ecosystem. It is really a matter of ensuring that our organizations are taking advantage and planning for the change to come. It's here now. Not just to save money, but to keep the consumer experience that they expect.

Hoffmann: What is the status of the auto industry's acceptance of virtualization in the user experience?

Fabbre: Virtualization is not only becoming accepted in the industry, it is also being designed in for production vehicle programs today. One of the first places it is happening is in the consolidation of digital instrument cluster and IVI systems where the user experience is critical. We mentioned complexity earlier. Clusters have OpenGL stacks and 3D graphics and they're starting to ramp up in terms of software complexity; but compared to an IVI system, where we have multimedia stacks, echo and noise cancellation, connectivity like Bluetooth, Wi-Fi and all the components that make up an IVI system; those things are typically millions and millions of lines of code. It's enormously complex. How can you separate that complexity from something that might have a safety critical function? One really common misconception in our industry is that virtualization gives you separation. It doesn't. It is certainly an enabling component of a consolidated system, but you also need separation to provide the appropriate levels of safety and security in these systems.

Hoffmann: I'm thinking back on a conference in Ludwigsburg, Germany where they talked about virtualization, over a year ago, and it was clear that the OEMs there did not think virtualization was ready for the auto industry. And yet, everybody in this room is using virtualization in the cloud.

Giordano: Depending on the OEMs, some of them like to dictate what they're familiar with and some of them are trusting that their Tier 1 suppliers are using the right tools for the job. So I don't think there's a right or wrong answer here. Like you said, some of the most secure systems in the world are using virtualization now, just in different domains. But you have to look at the entire environment; you have to look at the threat analysis and many different factors and realize that there are a lot of unknowns leading up to your final decision.

Hoffmann: When Apple shipped the original iPhone, this new technology called Bluetooth was about to be released but it wasn't quite ready. And I remember that they had a software over-the-air update you could get and people would magically have new hardware in their phones. So do you see that happening in the auto business?

Byers: Some of the problems we see today are how, even in the automotive, we still typically do not have customers that get into every piece of software, every feature, every way to use the accelerators we have in our hardware. This is a big way in the future for our customers and end users to get the features and functionalities that they may not have had. As a whole it allows the customers to delay the feature until it's ready, as long as they put the hardware into the system.

Hoffmann: You need the mechanism to upgrade the software somewhere in the life cycle of that car. I want to take it a little bit further, let's suppose we've got a single domain controller running instrument cluster and center stack and it links to all your smart phones. How far can you take that model - to autonomous driving with a single computer controlling everything?

"The concept of combining the user experience across the instrument cluster, the center console, and the other screens in the car (including smartphones) has been looming for almost a decade."

Joe Fabbre
Director, Platform Solutions
Green Hills Software

Giordano: If it's an eventuality, it's pretty far out there. From what I've seen in a number of different research projects that have been popping up, people like to drive their cars. People enjoy driving their cars and a lot of people have a hard time putting trust in the technology. Given there are a number of generational gaps in there but I can't even get my wife to use the backup camera in her new car. So I think it will happen, but it's going to be a ways out there still. Not until the OEMs and Tier 1 suppliers develop the systems that build the trust of the public through trials, beta tests and detailed system evaluations.

What I learned from this group is that the multi-domain controller development is interwoven with three other technology shifts that require even more coordination at the OEM level. Automated driving is changing user expectations of the cluster and driving methods, over the air software needs to encompass all ECUs in the car and the various departments in the OEM that develop them, and virtualization applied to security as all these new interconnections are being driven quickly into engineering departments.■

THE FUTURE OF MOTOR INSURANCE

How car connectivity and ADAS are impacting the market

Andrea Keller
Business Development Manager
Automotive Solutions at Swiss Re

For the automotive industry, relatively little has changed over the past three decades – until now. New driver assistance technologies and connected services are ushering in a new world of motoring in which the driver hands over greater responsibility for their driving decisions to the vehicle.

With the World Health Organization (WHO) estimating that road traffic accidents kill 1.2 million people every year and cost economies 1%-3% of their gross national product, the role of insurance is hard to ignore. And, for both insurers and automakers, the upheaval in the automotive industry presents both challenges and opportunities.

Technologies which drive changes in motor vehicle safety and impact both loss frequency and severity will have an increasing impact. HERE and Swiss Re's recent research found that within a six-year period over $20 billion would be trimmed from annual premiums as a result of increased road safety enabled by automated car technology.

Car Connectivity

Even though cars have turned into complex computing environments, for the most part, they remain unconnected. But car manufacturers are now racing to equip their vehicles with connectivity options.

Car connectivity provided by mobile phones, allows for basic connected services such as real-time navigation or usage-based insurance. However, because of its dependency on an external/third-party device, the number of value-added services enabled by tethered connectivity, is limited. With embedded connectivity, connectivity enabled by a receiver unit built into the vehicle itself, it becomes possible for the vehicle to transmit data generated by its on-board sensors to the cloud, enabling more sophisticated connected services, such as live contextual data from that enhances Advanced Driver Assistance Systems (ADAS) functionality.

We expect that by 2020, more than two-thirds of cars sold worldwide will have some form of connectivity. The adoption of hybrid telematics solutions will grow the fastest, with a compound annual growth rate of about 88%. By 2020, approximately 260 million connected cars will be on the roads worldwide. Since modern upscale cars are equipped with dozens of sophisticated sensors, there are vast streams of driver data that could be aggregated, processed, analyzed and harnessed for different purposes.

ADAS

Compared to older counterparts, modern cars are not only connected but also smart. One of the technologies underpinning this trend is ADAS - designed to automate and adapt vehicle systems, while increasing road safety. The most common ADAS are currently focused on collision avoidance, such as forward collision warning and blind spot information, as well as driver aids, such as park assist, adaptive cruise control and automatic high beam control. Car connectivity is expected to further enhance ADAS by enabling the delivery of real-time data to the driver. This has become known in the industry as 'connected ADAS', and is regarded as a key step on the path to fully automated driving.

According to IHS, the number of ADAS units produced in 2020 is expected to reach an average of 1.7 ADAS per car. Unsurprisingly, consumer interest is growing. A 2015 consumer study which Strategy Analytics conducted revealed that in Europe, the U.S. and China the overall interest in ADAS features as well as the willingness to pay for them has risen significantly.

However, the willingness to pay for highly automated driving features remains relatively low, perhaps where consumers are unfamiliar with the technology and are reluctant to give vehicles control of their lives. We believe this will change as the awareness of ADAS benefits grows.

Our study analyzed each accident category and the potential impact of selected ADAS features on the frequency of accidents in these categories. Assuming that they are fully utilized at all possible times the research found Basic ADAS would reduce accidents on motorways by 16.3% and by 11.6% on other roads, Sophisticated ADAS would reduce accidents on motorways by 25.7% and on other roads by 27.5% and Advanced ADAS would reduce accidents on motorways by 45.4% and on other roads by 27.5%. Showing a clear benefit from all levels of ADAS functionality - the potential to cut motorway accidents nearly by half.

Insurers must take strategic decisions now about how to thrive in an era of data-driven insurance. Delays in adapting business models may leave key players vulnerable to competition from new entrants from both the automotive and adjacent industries such as software-centric companies which have been honing their capabilities in big data processing and analytics. Especially as the levels of data analytics understanding and insight are only going to grow. By utilizing a combination of different datasets, insurers will be able to find previously hidden or non-obvious patterns and insights, entering the realm of context-aware Vehicle Behavior Analytics (VBA).

VBA will enable the evaluation of individual driving behavior in the context of other drivers. For example, as a provider of navigation and traffic services, HERE every day collects data from billions of probe data points from large populations of vehicles, which it then processes on its map. The result is a large database of data points precisely assigned to different roadways, enabling HERE to understand how the population drives on almost any road. Using this information, a given driver's data can be matched to the same roadway sections and normalized against this population model to create a 'driver score' for each roadway section.

When seeking the context for a vehicle's behavior, insurers can examine what traffic conditions were like on the road at a point in time, to understand the context in which a driver was traveling. For instance, a driver may have been traveling at 60 Kmh in a 50 Kmh zone, but if the majority of the traffic around him or her was also moving at the same speed this driver might have been behaving in the most responsible manner. Similarly, by fusing data on driver behavior with weather data, it could be determined that, while a driver was driving within the speed limit, his speed was inappropriate given heavy rain had reduced visibility and increased the risk of his tires slipping.

Insurers can also utilize databases of driver behavior to offer a data-driven policy without having access to data specifically taken from the customer's car. Using its database of vehicle accident data, HERE is also able to allocate a 'safety score' to a roadway to reflect the estimated likelihood of an accident per given number of vehicles. With this, an insurer can identify roadways where accidents are more likely than average – data that can then be used to better assess the risk of a driver's typical routes.

As more vehicles get connected, there are more opportunities for insurers and automakers to analyze individual driving behavior in the context of other drivers and other data not just retroactively, but in near real-time. Car connectivity enables them to establish regular touch points with drivers by using VBA as an early warning alert system that can also better predict new risks.

For automakers, being able to offer data-driven insurance at the point of sale will enable them to broaden their portfolios of financial services and reposition themselves along the insurance value chain. Managing UBI subscriptions will enable them to keep in touch with customers, while drivers' positive experiences will affect the consumer preference towards a particular car brand. Plus, direct access to customers and their cars would create huge databases for delivering personalized recommendations.

Motor insurance is on the cusp of a transformation as new technologies pave the way to safer roads and enable insurers to pursue data-driven business models. Going forward, embedding new technologies will become key for insurers to prosper amid a host of changes. Clearly, UBI and, increasingly, VBA will provide opportunities for insurers, whatever they may look like, to harness the power of driver data to offer more personalized, customer-centric products. At the same time, the industry must also prepare for a world where vehicle ownership is becoming less important for some. With a myriad of changing mobility options becoming available, players must consider how they will insure someone not just for use of a vehicle but for all risks associated with their mobility. ■

Bernd Fastenrath
Product Marketing Manager
Digital Transportation Infrastructure
at HERE

"Technologies which drive changes in motor vehicle safety and impact both loss frequency and severity will have an increasing impact. HERE and Swiss Re's recent research found that within a six-year period over $20 billion would be trimmed from annual premiums as a result of increased road safety enabled by automated car technology."

HERE and Swiss Re teamed up to look at how two important developments in particular – the growth of in-car connectivity and ADAS – might impact the market for and distribution of motor insurance.

Solving the Biggest Worry with Connected Cars: Security

Mahbubul Alam
CTO & CMO
Movimento Group

Mahbubul Alam is a frequent author, speaker, and multiple patent holder. He was brought to Movimento in early 2015 to reinvent technology and strategy, leading a transformative era. Prior to joining Movimento, Alam spent 14 productive years as a groundbreaking technologist and strategist at Cisco on two continents.

Connected cars with their software-based control systems are the most significant step forward in the automotive world except for one issue - security. With cars turning into rolling wireless networks, they open the door to a new realm of security vulnerabilities that worry car drivers who care about safety. With driverless cars on the horizon, connected car safety only increases in importance.

Consumers read about recent incidents like the Volkswagen emission-control software scandal, the remote hack of a Jeep Cherokee, and speculative predictions that accompany any paradigm shift, with the result being a loss of trust. Mass incidents of car hacks have not happened so far but consumer sensitivity is growing. Clearly, trust is a big deal for an automotive industry that depends upon eager buyers of the latest vehicle models and hence manufacturers and OEMs must develop secure, hack-proof vehicles and networks to put buyer worries in the rear-view mirror.

It is easy to understand why consumers do not have total confidence; the torrid pace of new development in car electronics is automating vehicles so rapidly that drivers are forced to depend upon the electronic control units (ECUs) and networks in their cars unless they opt to keep driving an old-school model, which does not benefit the auto industry. Considering these developments, automotive OEMs certainly understand that they need to expand their focus from the physical safety of drivers, passengers, and vehicles to the protection of car data, cloud services, and the in-vehicle ECUs that control an increasingly larger part of the whole driving experience.

Happily, from a technological perspective, today's connected car is a marvel. Tomorrow's computer on wheels -- aka, the family car -- has the compute power of 20 PCs, more than 100 million lines of code, and processes up to 25GB of data per hour. Every day, new developments are taking place in the areas of self-driving functionalities using sensors and communication technologies to enable autonomous vehicles. These developments will have profound implications on all the stakeholders in the automotive ecosystem.

Currently most of the automotive OEMs, suppliers, and technology companies have been focused on sensor-based solutions – Advanced Driver Assist Systems (ADAS) such as parking assistance, warning systems, adaptive cruise control, and lane-keeping systems to avoid collision and manage traffic. ADAS combine advanced sensors including RADAR, LIDAR and stereo cameras with ECUs and software to allow vehicles to respond to their immediate environment. In parallel, wireless technologies such as Dedicated Short-Range Communication (DSRC) is being used by connected vehicles to mitigate crashes through vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications.

However, in their current form, both sensor-based and connectivity-based technologies have limitations in terms of providing a complete and

cost effective self-driving experience. Further development is required before they are ready for adoption in mass market.

In order to keep connected cars updated with the latest software, automakers are embedding connectivity with higher broadband capabilities in vehicles for over the air (OTA) software upgrades. According to a new report by ABI Research, "By 2022, there will be 203 million vehicles on the road that can receive software OTA (SOTA) upgrades. Among those vehicles, at least 22 million will also be able to get firmware OTA (FOTA) upgrades."

Among all these development, what is missing so far is a security paradigm that will help automotive OEMs create a truly autonomous vehicle without the fear of cyber attack. OTA software and security providers need to collaborate to deliver a cloud-based security solution that can confine the potential hacks to single-car applications, preventing access to the entire car. This automotive security solution must enable real-time breach detection as well as have the ability to update vehicles with new patches, making OTA updates virtually impervious to potential hacks.

In order to achieve an unprecedented level of protection for both OTA updates and car-to-cloud communication in vehicles, the automotive industry needs security platforms like those adapted for other sensitive services such as Software-Defined Perimeter (SDP) architecture developed by the Cloud Security Alliance that can prevent credential theft, server exploitation and connection hijacking by dynamically connecting only authenticated users to the protected servers and applications. Software updates and security go hand-in-hand and partnerships between market-leading vendors in both domains are essential for a trusted customer experience. SDP is one of the viable solutions to enabling this.

Before now, each of the various electronic systems in a car had their own security solution, creating multiple entry points for hackers. With SDP; access control, encryption, and routing can be integrated to accommodate a car's growing array of electronics. This OTA security solution restricts automotive supply chain partners to only have access to their own data, car module or cloud app while the OEM maintains total control of all communications, ensuring complete protection of the car. Each application or module in the car has its own unique secure network connection abstraction, thus ensuring that a hacker does not gain access to the whole car and that supplier confidentiality is maintained.

Junaid Islam
CTO & founder
Vidder

Junaid Islam is the CTO and founder of Vidder and prior to this, he founded Bivio Networks, which developed the first Gigabit speed software based security platform in the industry. Junaid also helped create networking standards such as Frame Relay, ATM and MPLS while at StrataCom and Cisco. Currently, Junaid is the Co-Chair of the Software Defined Perimeter (SDP) research group.

Additionally, data in transit from the car to the cloud is protected by encrypted connections.

Best practices for automotive security are still evolving and thus collaboration between the automotive and security industries is critical for vehicle safety. Automotive security cannot be an afterthought. It is necessary to make it an integral component throughout the design phase. The companies who embrace the various facets and forces required to achieve the vision of the crash-proof autonomous vehicles will be the clear leaders in the automotive ecosystem.

OTA software updates have been a bonus for the car industry and drivers alike, enabling less-costly recalls for car makers, easier ways to upgrade car features, and allowing drivers to avoid the need to continually bring their car back to the dealer for updates. With the creation of a comprehensive security solution, connected cars have the level of cybersecurity that finally can inspire confidence in drivers. ■

Next Generation Telematics Protocol

Ragu Sivaraman
Founder
MacMetry

He is an entrepreneur who combines advanced technological skills with astute business knowledge. He started as a Software Engineer at Oracle Corporation and had grown to be an entrepreneur in Connected Car Industry. Ragu lead various connected car projects in China, India and US for major OEMs including Toyota, Qoros, Mercedes and Volkswagen.

The Next-Generation Telematics Protocol (NGTP) is a technology-neutral telematics approach that aims to provide greater flexibility and scalability to the automotive, telematics and in-vehicle technology industries to offer better connectivity and integration of data and services aimed at drivers, passengers and the vehicle itself (e.g., airbag deployment notification services).

Objective:

The NGTP Solution – Next Generation Telematics Pattern is an Open and Adaptable Connectivity approach for delivering over-the-air services to in-vehicle devices and handsets alike, with the focus on open interfaces across the entire service delivery chain. NGTP enables an easy integration of legacy systems, allowing older and newer vehicles alike to access new telematics offerings including the EU pending eCall initiative.

This framework was initially developed between BMW and telematics service providers (TSPs) Connexis and WirelessCar, but was later adopted by other companies. NGTP is neither a traditional standard nor a product. NGTP aims to provide a general reusable solution to a commonly occurring problem. In the software development community this is called a design pattern. This is why the use of pattern instead of protocol in the NGTP.

In order to foster collaboration and innovation, the specifications that constitute NGTP are public under a Creative Commons license.

Since publishing NGTP 1.0 in January 2008, the NGTP Group established real world implementations based on the NGTP pattern and received a lot of interest from the telematics industry.

The NGTP Group believes that flexibility is more important and has chosen the pattern approach. NGTP's developers have established six objectives:

- furnishing a technology-neutral pattern and coherent user interface for telematics services,
- lowering obstacles to collaboration,
- implementation of new technologies,
- sustaining legacy systems for connectivity,
- encouraging innovation, and
- growing the value for vehicle manufacturers, service providers, content providers, and drivers.

Architecture: There are two versions of NTGP. NTGP version 1 permits the supply of new services faster based on the Telematics technology advances. In addition, varying customer needs can be addressed more quickly by substituting old services with new ones without the stress of introducing technical modifications within the vehicle.

NTGP version 2 supports openness and flexibility by splitting the parts of the telematics delivery chain, and launching a 'dispatcher' to offer a single interface between the vehicle's telematics unit and the telematics of the service provider. The open interface generated by NGTP also enables the OEMs (Original Equipment Manufacturer) to constantly introduce new services to both legacy vehicles and new models over the whole vehicle lifecycle.

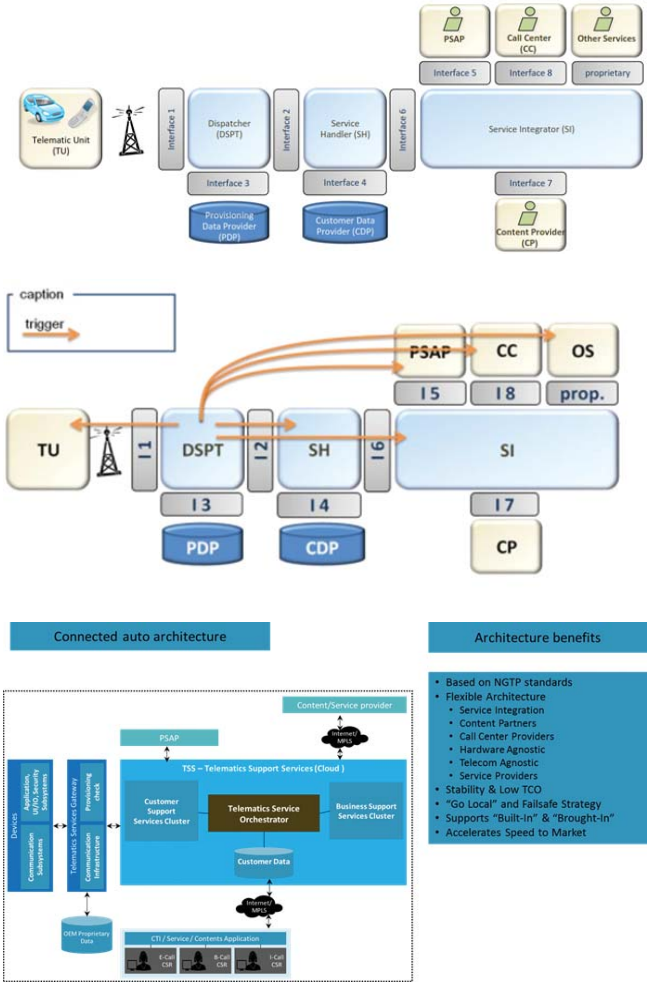
NGTP will enable vehicle manufacturers to use the best offerings from a variety of partners while maintaining a consistent driver experience. The new pattern will also allow service providers (SP) and content providers to sell the same services to multiple vehicle manufacturers.

The NGTP architecture is depicted in Fig. 1. The key component is a technology-neutral intermediary called the Dispatcher (DSPT), which connects the vehicle's Telematics Unit (TU) to the Service Handler (SH) and Service Integrator (SI).

Design Concepts:

Events are the most important objects within NGTP. An event is a kind of use case instance, which is identified by a worldwide unique ID. The so-called Event-ID is a logical Event-Identifier, created either by the TU or in the NGTP backend (depending on the originator of the service).

It is not equal to a session ID, because an event can consist of several sessions



with different session IDs. One or more messages may be assigned to the same Event-ID, meaning that all messages are related to the same use case instance (event). The Event-ID ties the messages together and identifies the event throughout its whole lifecycle inside the NGTP system. The messages may also use different sessions and transport technologies (e.g., data and voice call).

NGTP identifies the messages and will assign a message to an existing event or create a new event. Thus, the Event-ID is also the key to technology independence (bearer independence).The Event-ID also allows to resume event processing after an abort. It enables seamless bearer switching within a use case and is the base for several cross functions such as logging or monitoring. Event-IDs are either generated by the TU or the DSPT depending on whether the use case is TU-originated or backend-originated. Example: The driver in the vehicle wants to use a service from the Call Center. The TU creates an Event-ID, establishes an IP-connection with the NGTP backend, sends an initial data message and then starts a voice call.

The technology used may depend on different aspects like country or company specific restrictions or already available and reusable solutions. It should also be possible to switch a technology during a running event. This can be for example a switch of the used communication technique in case of a bad or broken radio reception.

The technology independence also requires that a security mechanism is not based on predefined technologies such as https, to keep the flexibility of the concept. For this reason, the security mechanism is also based on the message format and not on the technology. Security has to be handled by each service component.

NGTP and Cloud:

NGTP increasingly rely on cloud-based service delivery platforms to power program features and light-up user experiences for millions of vehicles. Loose coupling of the NGTP components provides flexibility and extensibility to the architecture. A new or an additional component (i.e. content provider) may be added easily to the system as long as it implements the same interface. Given the high stakes, evaluating and selecting cloud service delivery providers—and the platforms they operate—is fundamental to the success of every NGTP architecture. –

The cloud infrastructure focuses squarely on efficient utilization of the base infrastructure .This includes virtualization, routing and storage management. The cloud platform manages the services running on the infrastructure. The services provided by the cloud are what the consumers actually use.

Cloud computing provides dynamically-scalable and virtualized resources as a service. Users do not need knowledge of, expertise in or control over the technology infrastructure that supports them. The value which cloud can deliver is:

- Enable faster deployment of new capabilities.
- Improved consistency and quality of new capabilities
- Increased efficiency in the use of IT resource
- Faster integration with partners, vendors, customers and suppliers

Future NGTP Design and Serverless Architecture

While cloud computing has been a game changer in number ways in the automotive industry for NGTP, but the emergence of serverless computing/ architectures in the cloud computing model had set another example of what it (and in particular AWS) has been able to achieve in service delivery.

Serverless is about abstracting users away from servers, infrastructure, and having to deal with low-level configuration or the core operating system. Instead, developers make use of single purpose services (such as S3 for storage or Auth0 for identity management) and elastic compute platforms (such as AWS Lambda) to execute code.

By composing and combining different services together in a loose orchestration we can now build complex systems very quickly and spend most of their time focusing on their core business problem. These serverless systems can scale, grow and evolve without developers or solution architects having to worry about remembering to patch that web server yet again.

By combining NGTP and Serverless architecture we can clearly create a highly modular and event driven systems that are capable of launching adaptable and cost effective telematics services of the future. ■

Functionality of UBI Business Model

Thomas Hallauer
Director
PTOLEMUS Consulting Group

Thomas Hallauer is the director of research and marketing at PTOLEMUS Consulting Group. With more than 15 years of experience in the domain of telematics and location-based services, he is an expert in new products and services in the automotive, motor insurance, tolling and positioning industries. Thomas is the author of the ETC Global Study 2015, and co-wrote the UBI Global Study.

The value of Telematics in the mobility industry has just grown 14 fold Mobility has been at the centre of the past month's business news. Thomas Hallauer, research director and Justin Hamilton, Business Analyst at PTOLEMUS consulting group, analyses the impact of the recent announcements on the insurance sector. In the process he shares some insights and results from the new Connected Mobility Global Forecast which details the 14 markets exploding thanks to telematics technology.

Car manufacturers are making great strides to control the global B2B car sharing, rental and leasing markets through either launching or acquiring companies such as Car2Go, DriveNow, Zoomcar, Myles and MiCar. Alongside this, Silicon Valley continues to invest heavily in ride hailing and application based mobility platforms. Uber's recent valuation of $62.5 billion could even lead one to argue that we are now in the era of the mobility tech bubble.

As a result, we expect the number of cars shared to explode from roughly 125,000 in 2015, to more than 1.3 million in 2020 in Europe alone (this figure includes B2C and P2P models). A good example is GM, which recently merged all of its existing sharing schemes under a single brand; Maven. Among its more typical consumer offering, Maven is also rolling out car sharing schemes for residents of specific apartment buildings in large cities, taking advantage of attached parking. The use of OnStar, GM's embedded telematics platform, will provide the service with a competitive advantage over non-OEM providers who will continue to rely on third party telematics suppliers.

Onstar is actually proving to be a very serious advantage for GM in the race to own the connected vehicle. The data platform has been used for years to send mileage data to insurers and is now much stronger with more data choice and more partnership models. Allianz has signed with GM in Germany, Octo has an agreement for the whole of Europe and Verisk is working with the GM platform to provide usage-based insurance (UBI) data to US insurance carriers.

The European car manufacturers are following a different strategy. Daimler's Car2Go platform has become the largest car sharing scheme in the world, driven largely by its early commitment to more flexible, one-way sharing options. Car2Go has over 14,000 vehicles worldwide and in excess of 1.9 million members. After launching in China with 400 cars, it has attracted 78,000 users in less than 2 months of operation. It's closest rival and former leader, Zipcar, has failed to match this breakneck growth and has little hope of regaining its lost crown. In 2015, we estimate that Car2Go had a turnover of approximately €126 million. Daimler are aiming to increase this to €800 million by 2020. Car2Go has also joined forces with Deutsche Bahn's well established Flinkster brand in Germany to offer one-way services. At the same time Daimler is working on 5 trials across Europe to include insurance as part of its portfolio. One of them is in the UK, where it offers a UBI proposition for young drivers purchasing a new Smart Forfour model.

BMW's DriveNow is hot on the heels of its German competitor with more than 4,000 cars and over 500,000 members, in spite of its later entry. BMW recently launched a sister service, ReachNow, in the US, which will utilise the company's i3 electric car. The German OEM has already found additional ways to capitalise on the technology which underpins the DriveNow network, by introducing a car sharing element to their Alphabet leasing brand.

Mass car sharing or self-drive is a relatively new proposition in India, although the market leader, Zoomcar – which only launched in 2013 – plans to have more than 5,000 cars in place this year. Close competitor Myles, has reported an impressive utilisation rate of 75% across its fleet of 1,200 self-drive cars. The company has similar plans to grow the fleet to 5,000 cars over the coming year.

Car pooling as a mobility service reaches customers in a variety of ways. Typically, car pooling exists as a pre-arranged service between one private individual and another who share a similar origin and destination. Delivering the platform on which this exchange can take place has propelled BlaBlaCar to the unique status as France's sole unicorn (defined as a company with a market capitalisation of over $1 billion prior to flotation). Ride hailing apps such as Uber and Ola, however, have been quick to offer a car pooling option of their own, where passengers sharing the same destination can also share the cost.

Last month, it was announced that the Google-owned navigation app, Waze had entered the $30 billion car pooling space. Waze's proposition

allows users to share the cost of their daily commute by offering rides to their peers. Days later, Apple announced a $1 billion investment in China's Didi Chuxing – just one part of a $7 billion investment round. Since launching in 2012, the Chinese ride hailing and car pooling service has grown exponentially and now fulfils over 10 million rides per day.

Uber, Ola and Lyft have all seen significant success with their pooling option. Nonetheless, they rely on networks of contracted drivers to provide transportation, making money by taking a commission from each fare. BlaBlaCar on the other hand built and acquired a network of drivers that do not expect the revenue from pooling to cover anything more than the fuel cost of the ride, making the concept easier to manage and without legal restrictions. With an app able to match drivers and riders in real time, BlaBlaCar would become a major competitor in the global pooling market.

One thing is certain: the newly demonstrated interest of tech giants like Google and Apple in the car pooling space means that competition is going to drive down prices. Only the most streamlined business models will remain competitive, which means all players will have to continue to innovate to survive.

Car rental companies on the other hand are facing serious threats with car sharing encroaching on their market, dwindling margins, rising insurance costs and the growing menace of well funded mobility players. The $58 billion car rental market could well become the car sharing market.

Car rental companies currently manage more than 6 million cars worldwide. The edge of the rental business rests in their ability to effectively manage these assets.

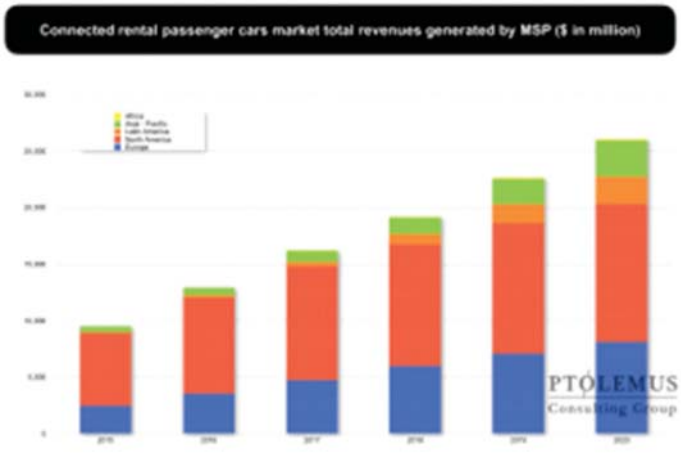
The rental business has always survived on razor thin margins. Now, telematics allows rental companies to monitor each vehicle and charge each customer the best price depending on the distance driven, location, behaviour and time. Indeed the vehicle and driving data can help justify additional customer charges such insurance, refuelling or extra mileage. It also protects rental companies' vehicles against theft and will impact the insurance premiums they pay, especially for the growing business of luxury car rental.

Telematics also cuts cost from the rental process with tracking and keyless technologies enabling automated car sharing solutions and improving the use of each vehicle by having more short trips, a free floating fleet and larger coverage in cities.

The sector is moving fast, Avis acquired Zipcar, then the world's largest car sharing solution, in 2013, Europcar recently acquired Ubeeqo, another car sharing solution provider, and Hertz launched its own on demand car sharing scheme. The world's third largest car sharing scheme, DriveNow, is a joint venture between BMW and rental company Sixt.

Connected rental growth

We estimate the share of connected rental passenger cars worldwide will grow from 14% today to 40% in 2020. These vehicles will generate a revenue of more than $25 billion for car rental companies.That said, car rental growth will hinge on ability to connect and manage assets. If car rental companies don't invest in connected cars, car sharing companies will and 6 million rental cars will soon become shared cars. It is clear the innovation around connected vehicles has not escaped insurers, who stand to benefit immediately from the devices they have managed to install onboard.



A number of options are used today, but many opportunities remain to add services, whether directly by the insurance carrier, or – as looks more likely – through partnerships.

Leading leasing companies have also been quick to take advantage of the potential from connected services in managing their fleet, providing a cut-price fleet management systems and, at the same time, tying up the data (and the infrastructure costs) with insurers. This is precisely what TrakGlobal has done with Volkswagen leasing.

The problem for many insurance carriers is that the UBI business model is very difficult to make with devices costing as much as $80 - $85. The search for the right balance between cost, functionality and reliability has led the German insurers to trial and buy in bulk 500,000 12V cigarette lighter adapters. If accident detection is not the priority, smartphone-based UBI has the potential to make insurers a significant partner in the markets described above by adding flexibility to the offering along with driver data and predictive risk evaluation.

The mobility markets are of interest for 2 different types of players. Firstly, the incumbent players who are able to use their infrastructure and assets to finance service providers acquisition and with the view of becoming more service oriented. Secondly, the "sharing economy" players who are only interested in the service transaction and will never own any real assets. Uber is not the only one in that case, Rakuten is a leading retailer owning no inventory, Airbnb does not own any hotel and Facebook does not own any content. So, will the next mobility player build no car?

It is possible, but more likely, these players will not outsource motor insurance for very long. So, in the mobility market insurers will not be able to partner with Silicon Valley companies. They will need to foster partnership with OEMs.■

ADAS empowering Fleet Management and UBI

He Chongzhong
Founder & CEO
Hangzhou Nicigo Technology Co. Ltd.

According to official statistics, nearly 1.3 million people die in road crashes each year, on average 3,287 deaths a day. An additional 20-50 million are injured or disabled. And more than half of all road traffic deaths occur among young adults ages 15-44. 94.9% death is caused by improper driving behavior. Unless action is taken, road traffic injuries are predicted to become the fifth leading cause of death by 2030. ADAS is proven to be the most effective technology for driving safety.

ADAS

Advanced driver assistance systems (ADAS) are systems developed to automate/adapt/enhance vehicle systems for safety and better driving. ADAS contains various functions, such as Forward collision warning (FCW), Headway monitoring and warning (HMW), Lane departure warning (LDW), Driver drowsiness and inattention detection and so on.

ADAS usually includes three steps, the first step is to gather data by different sensor like Radar, LIDAR, ultrasonic, camera, and night vision device, the second step is to process data by local processor or both local and remote processors, the third step is to make decision, when detect the risk or problem, the system will issue warning signal by light and voice.

ADAS technology is becoming popular for automotive makers, besides the high-end luxury cars, now more and more medium-end cars are equipped with ADAS technology (FCW, LDW) also as the NCAP and regulation for ADAS and AEB is under implementation in the next 5 years. Therefore, it is expected that the OEMs will become the largest ADAS market.

The most potential market is ADAS based UBI (Usage Based Insurance) market, ADAS can significantly reduce the accident by 10%-30%, which will result in the reduction of premiums while client is rewarded for good driving behavior, ADAS help mitigate the difference of insurers and consumers, China Nicigo company launched the world first ADAS-based UBI (ABI) model and cooperated with a few of big insurance companies such as PinAn insurance, Pacific insurance and it is expected that ABI user base would take off in the next 5 years.

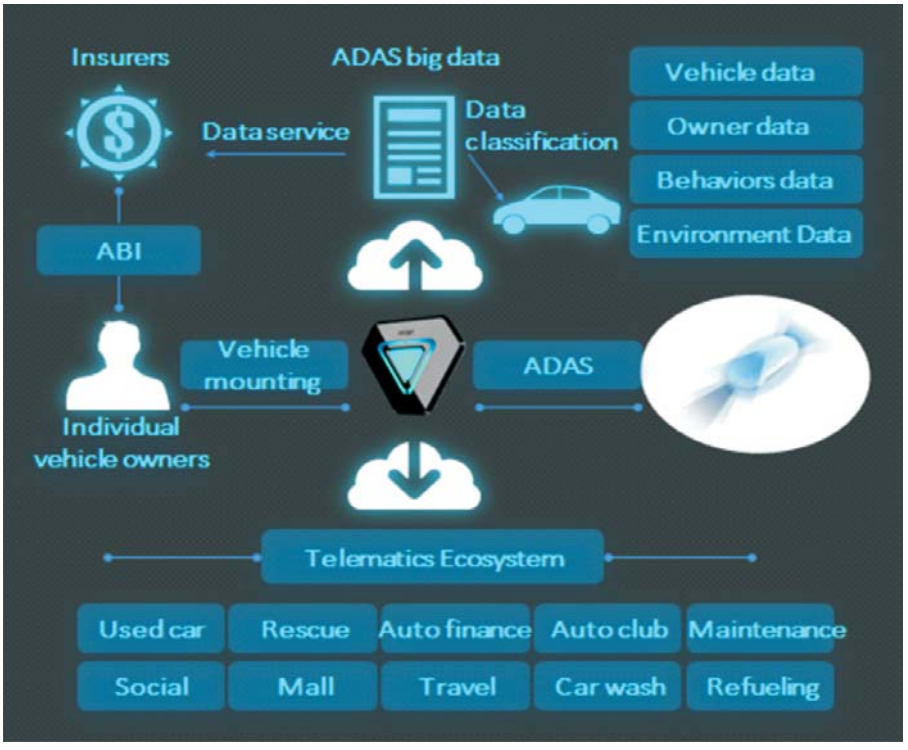
Benefits of ADAS

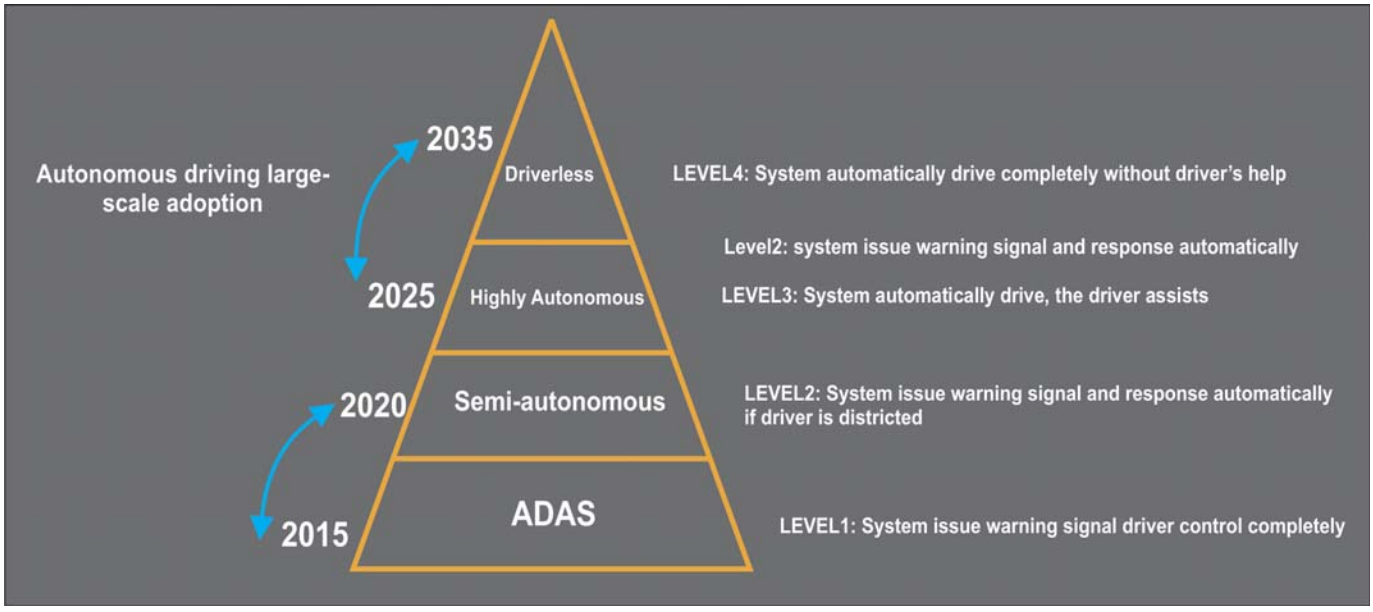
For fleet management company: ADAS will reduce vehicle collision accident and fuel consumption by 10%-30% and 3%-8% respectively. The most important thing is that ADAS can provide the indicator of driver behavior analysis, which will be helpful for fleets to improve operational efficiency.

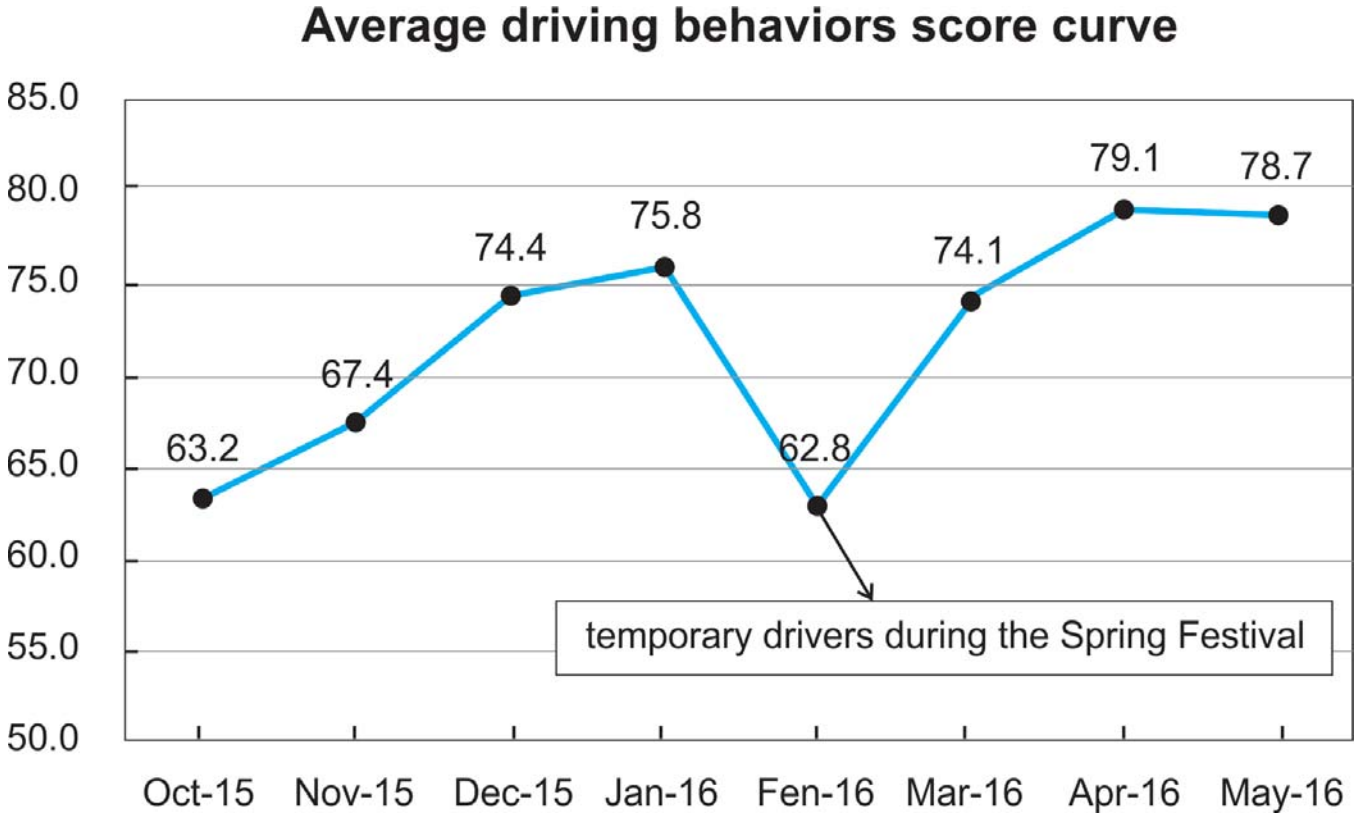
For Insurance Companies: It is estimated that ADAS will reduce claims by 10%~20%, and reduce fraud cases by 15%~20%. ADAS will help insurance companies to collect vehicle and driver data and customize UBI premiums by analyzing driver's behavior data.

Future possibility

Generally, we think the ADAS is the first stage for autonomous car, and in the future will combine with multiple







ADAS can significantly reduce the accident by 10%-30%, which will result in the reduction of premiums

sensors and systems, finally evolve to full autonomous. So the ADAS based UBI would be also future insurance model.

Nicigo ADAS

Nicigo has launched ADAS system for quite a few fleet companies and insurance companies. Below is one project for one fleet company in China (Total 500 fleet vehicles), through the driving score curve, the fleet company can clearly understand each driver behavior score, and the accident rate also decreases significantly, in the 6 months after installation of ADAS, the collision accident is Zero, while at same period of last year, the collision accident is 5. ■

VEHICLE TO VEHICLE COMMUNICATIONS

Saving Lives & Infringing on Privacy

Gene Carter
Director of Product Marketing
Security Innovation

We have nearly reached the practical limit on accident survival rates through devices such as airbags, seat belts and crumple zones. Now the focus has shifted from surviving accidents to stopping the accident from ever happening. The key to reducing accidents is improving awareness, which can be done with sensors or with data communications. Sensors have made great progress over the past few years as more new cars use them for safety features including lane departure warnings or short-range collision warnings. These technologies will undoubtedly save lives, but they are limited to detecting line of sight hazards in the immediate vicinity of the vehicle. There are other types of accidents that short-range radar and your own eyes can't detect in time, such as stopped traffic as you speed over a highway hill or when a driver on the cross street runs a red light. Research has shown that an increase of one second in the reaction time available to a driver can cut the chance of an accident by up to 90%.

This is where Vehicle to Vehicle (V2V) communications comes in. Vehicles will be equipped with WiFi-like devices, using 802.11p protocol for over the air communications at ranges of up to 500 meters. Vehicles broadcast Basic Safety Messages (BSM) which include location, speed, direction and other information, such as if the driver is braking. V2V-equipped vehicles communicate peer to peer, rather than going through a cell tower or other infrastructure and use these BSMs to determine if a crash is imminent. The US Department of Transportation (USDoT) estimates that up to 80% of accidents involving more than one vehicle (and having unimpaired drivers) will be prevented by V2V. (See Figure 1 for V2X use cases)

A technology that can potentially save thousands of lives and billions of dollars by preventing automotive accidents sounds ideal, but there are concerns about the impact on security and privacy. The public is worried that their privacy could be jeopardized by a technology that is transmitting their location 10 times per second. A review of the comments on one internet article about V2V highlights this concern (See Figure 2). In order for V2V technology to be effective, a majority of vehicles must be transmitting BSMs. To ensure that the necessary critical mass of vehicles will participate in the V2X program, the US government is in the process of mandating V2V technology for all new cars sold in the US.

Authorities are aware of the public's deep privacy concerns, so they have taken great pains to create a system that will protect privacy as much as possible. Here's how they do it.

First let's look at the BSMs. As mentioned earlier, they contain information essential to determining if an accident will occur, but they do not include any personally identifiable information, e.g. license plate number, VIN, vehicle make/model. Someone monitoring the BSMs cannot tell who sent the message. However, every BSM is digitally signed, so it would be possible to associate that signature and track a vehicle by following that signature. To prevent this, each vehicle rotates at least 20 different certificates (used for digital signing) each week, so that it becomes much more difficult to track a vehicle by the signature. The 20 certificates are then discarded after 7 days and a new set of 20 certificates is used. Furthermore, any other potentially trackable electronic identifiers, including the media access control address (MAC address) or stack identifiers, are also switched. So tracking a vehicle by monitoring the signals it is transmitting is a difficult and impractical endeavor.

The next concern that then arises is that the government, hackers or other groups will tap into the data stored within the certificate authorities to learn which certificates have been issued to each vehicle. Tracking would then be much easier if one could match any certificate to the car that signed

Figure 1: V2X Use Cases

V2I Safety	V2V Safety	Convenience
Curve speed warning	Forward collision warning	Smart cities
Spot weather	Red light violation	Parking information
Work zone safety	Slow traffic ahead	Truck platooning
Bridge height	Aggressive driver warning	Speed harmonization
Pedestrian in crosswalk	Emergency vehicle notification	Queue warning
Stop sign gap assist	Road hazard detection	Insurance pricing

Figure 2:

colcnor
"I see a message popping up on the display " You have just been issued a speeding ticket" Sounds more and more along the lines of "1984" and we keep helping it happen."

facefurny3
"While the collision avoidance technology would be great, I fear this would provide yet another way for police and other agencies to track your whereabouts on an almost constant basis. Call me paranoid, but I don't like being tracked without a valid reason."

jwalk1221
"Just what we need another massive infringement of our privacy. Why not just put a chip in our head when we are born!"

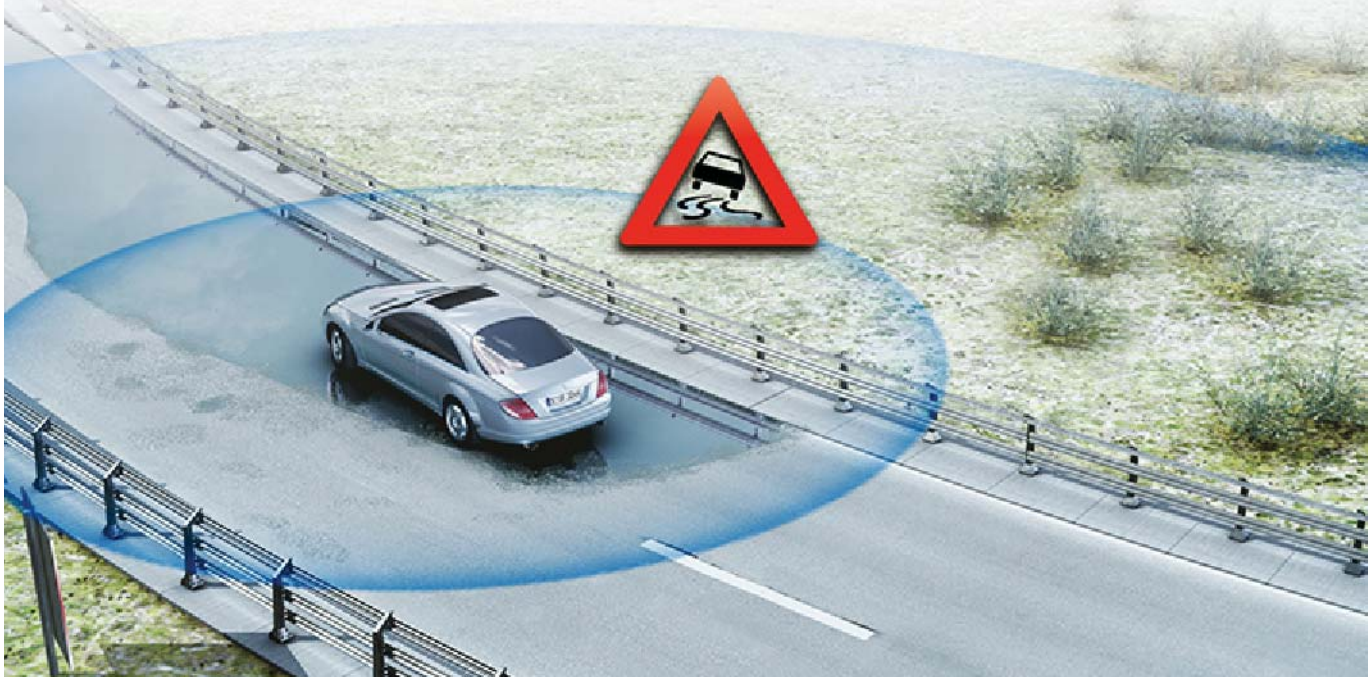
the message. The V2V system was designed to give each organization only a piece of the information required to identify a vehicle by the certificate, so multiple databases would need to be compromised to get the complete picture. For example, the Root CA and Intermediate CA are "air-gapped," meaning that the computers are not connected and thus the transfer of certificates requires someone to physically go to a well-guarded room, with 2 other people, and copy the certificate onto removable media.

Let's look at the overall design of the V2V Security Credential Management System (SCMS) to see how privacy is protected. The V2V SCMS has the same basic structure as the one used by the Internet – there is a Root (RCA), Intermediate (ICA), and Pseudonym (PCA) Certificate Authority (See Figure 3). Each CA verifies that the CA below it has the authority to issue certificates - a hierarchy of depth.

Every system in practice, including V2V systems, also has a Registration Authority (RA) along with a PCA that ensures that you (as an end user) are entitled to the certificates for which you are asking. For example, when Amazon goes to Symantec RA to ask for Amazon.com certificates, Amazon produces evidence that they do in fact own the Amazon.com domain. This is an important step in the security, as it prevents people from owning legitimate certificates for websites that aren't theirs. It doesn't matter how secure the certificate is if you can't trust the legitimacy of the ownership.

There are unique features of the V2V system, beginning with the Enrolment CA (ECA). In any SCMS, it is good security practice for certificates to have a limited validity period. In cars, due to the huge volume of identities and certificate requests, the process needs to be automated as much as possible. The ECA was created for this purpose. The ECA issues each V2X device an enrolment (long-term) certificate at the start of the device's life, usually on the manufacturing site, and the device uses that long-term certificate to request certificates from the PCA.

When a car runs low on PCA certificates (remember, they use 20 each week and then discard them), they use their enrolment certificate to prove who they



are to the PCA, and then the PCA will issue the car new certificates, which the car will use in talking to other cars.

Special privacy requirements have been added to the V2V system. If a car received new certificates directly from the PCA, the PCA would know which car had which certificates. Whoever had access to that PCA could track the vehicle by listening for those certificates. Instead, the vehicles send their requests for new PCA certificates to the RA, which caches and collects requests from multiple vehicles, shuffles the requests together, masks the requesting vehicles' public keys and then sends the complete set of shuffled requests to the PCA. The PCA then issues new certificates, but encrypts them prior to sending them to the RA. The RA then passes the encrypted certificates back to the requesting vehicle for use.

Without precautions, the RA would know the current location of the requesting vehicle. Therefore, a Location Obscurer Proxy (LOP) converts the location of the requestor into a generic IP address, which is then given to the RA.

So the LOP knows an IP address is requesting something, the RA knows the Enrolment Certificate of the vehicle, and the PCA knows which certificates are being issued, but none of these entities knows the information the other ones know. Hackers would need to combine data from both the RA and the PCA to know which vehicles had which certificates, but even then they would not know in which region in the US the vehicle is located.

Other safeguards have been put into place to be able to revoke all certificates from malfunctioning or hacked units without exposing the certificates of properly functioning devices, but that is a complex system best left for a separate article.

In short, the designers of the V2V SCMS realized that without privacy protections, the V2V system would be rejected by the American public and the safety benefits would not be realized. While no system is infallible, these privacy protections will go a long way in safeguarding drivers' locations. In May 2016, a U.S. Appeals Court ruled that police do not need a warrant to obtain a person's cellphone location held by wireless carriers, so there are much easier ways for drivers to be tracked than through V2V. ■

Autonomous All-Terrain Driving by Jaguar Land Rover

The next step in technology taken by Jaguar Land Rover (JLR) is the autonomous off-road driving concept. The Autonomous All-Terrain Driving, the research project aims to make the self-driving car capable over all surfaces, in all environments. Rather than moving on smooth roads, the technology enables the JLR vehicles to drive anywhere in the world. According to the company, the sensors used in this type of car have capabilities to see better than a human driver. The vehicle's high levels of artificial intelligence make it suitable to adapt to any kind of surrounding. Both Jaguar and Land Rover products will use Surface Identification and 3D Path Sensing to give the car a 360-degree view of the world around them. This wireless V2V communication system shares

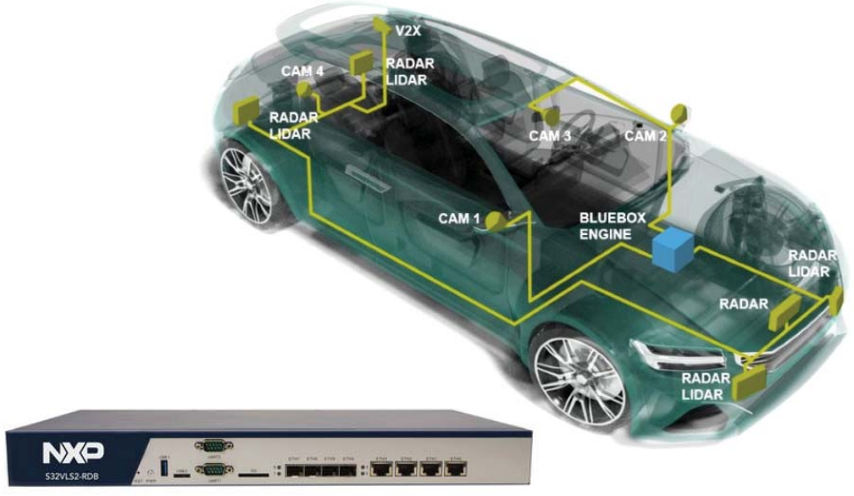
information including vehicle location, wheel-slip, changes to suspension height and wheel articulation, as well as All-Terrain Progress Control (ATPC) and Terrain Response settings instantly between the two vehicles.■

Savari V2X solutions

Savari's new range of products include MobiWAVE™ On-Board Units (OBUs), StreetWAVE™ Road-Side Units (RSUs) and V2X middleware, which will target automotive manufacturers, tier one suppliers and governments that want to make roadways safer and more efficient. MobiWAVE platform is an industry standard and software configurable as a Vehicle Awareness Device (VAD), Aftermarket Safety Device (ASD) and a complete-off-the-shelf device for automotive manufacturers, tier one suppliers and aftermarket suppliers.

The next-generation model supports the latest USDOT DSRC specification, is fully version USDOT RSU 4.0-compliant, offers easy remote management via any SNMP browser and is available in a ruggedized compact form factor. The company's V2X software stack is comprised of over 1.5 million lines of code. The latest release is compliant to the 2016 version of the USDOT specifications.■

NXP BlueBox



NXP BlueBox has central computing engine, together with radar, LiDAR, and vision sensing, as well as an on-board secure V2X system. In the autonomous vehicle system, multiple streams of sensor data are routed to the BlueBox engine, where the streams are combined to create a complete 360° situational real-time model of the physical environment around the vehicle. The engine also combines NXP's S32V automotive vision processor and its LS2088A embedded compute processor for a low-power and small-footprint approach. It enables Level 4 autonomous cars, a standard developed by the Society of Automotive Engineers (SAE) that refers to a vehicle with a high level of automation.

NXP BlueBox engine is an open-platform, Linux-based solution programmable in linear C language that automotive manufacturers can easily customize to their needs for optimal product differentiation. It processes 90,000 million instructions per second with power consumption at less than 40 watts and will be available for automakers by 2020. ■

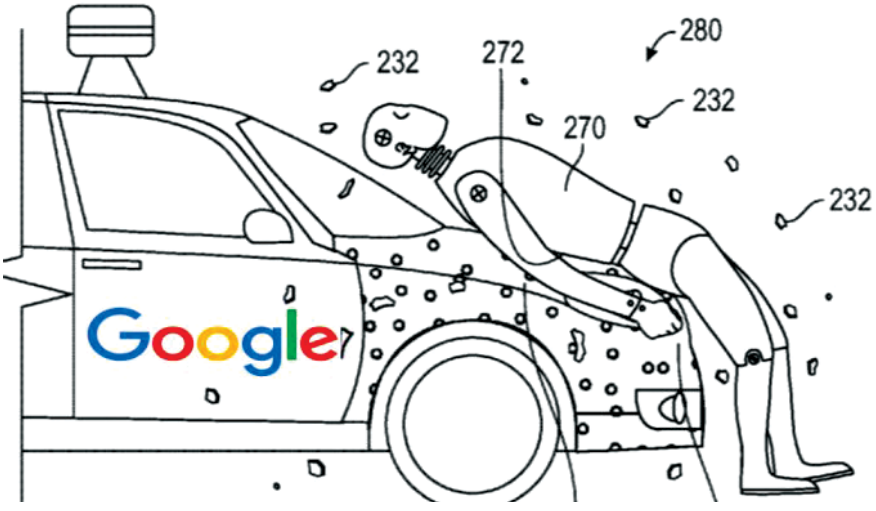
'Anomaly Detection' for automotive cybersecurity

Symantec's Anomaly Detection for automotive to protect against zero-day cyber-attacks in connected vehicles. It prioritizes incidents based on perceived criticality and risk. It uses machine learning to provide passive in-vehicle security analytics that monitor all Controller Area Network (CAN) bus traffic without disrupting vehicle operations, learn what normal behavior is and flag anomalous activity that may indicate an attack. ■

Protecting pedestrians with "human flypaper"

Google has filed a patent meant to protect pedestrians in the event they're hit by a car, called 'human flypaper'. The person hit by car would be stuck to an adhesive on the hood of the car on impact, which would prevent them from bouncing off the car and sustaining even more injuries. The patent describes an "eggshell-like" coating on the hood. When hit, it would then crack and reveal the adhesive.

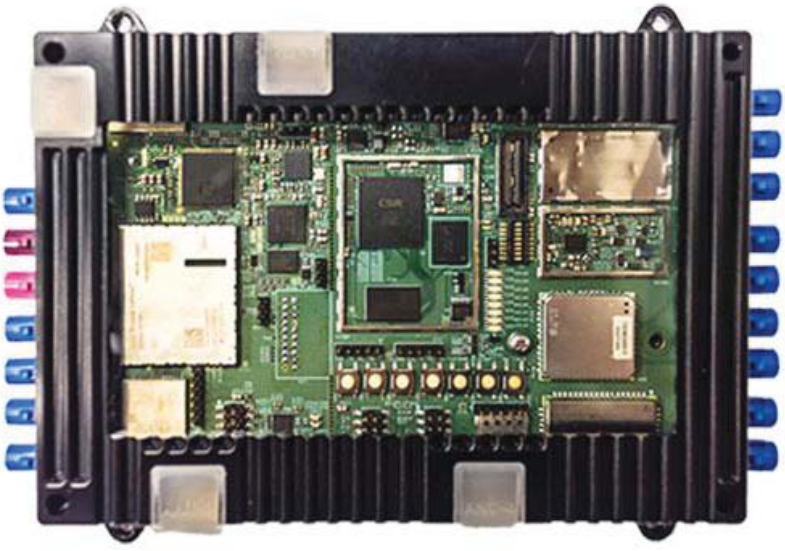
Google specifically mentions self-driving cars in its patent, acknowledging that "on occasion, collisions between a vehicle and a pedestrian still occur" despite them working towards smart cars that can prevent collisions. Though it says in the human flypaper patent that autonomous cars will eventually be able to avoid all accidents. ■



Qualcomm Connected Car Reference Platform

The Connected Car Reference Platform is built upon Qualcomm Technologies' automotive product and technology portfolio, including Qualcomm Snapdragon X12 and X5 LTE modems. It features in-vehicle networking technologies such as Gigabit (OABR) Ethernet with Automotive Audio Bus (A2B) and Controller Area Network (CAN) interfaces.

It aims at accelerating the adoption of advanced and complex connectivity into the next-generation of connected cars. The platform is designed to solve for challenges such as wireless coexistence, future-proofing and support for a large number of in-car hardware architectures.■



SAP Vehicle Insights

SAP Vehicle Insights offers services to manage connected vehicles, including basic data analytics that can be used for fleet analytics, vehicle diagnostics and mobility-as-a-service scenarios.

It enables companies to use information about entire fleets and car-specific key data like gear recognition, fuel stops, scores for economical driving or heat mapping to improve not only the management of their fleets but also of individual vehicles. With predictive maintenance functions for mileage and tire wear, repairs can be planned more efficiently, thus reducing costs.

Rolls Royce 'Vision Next 100'

Rolls-Royce has unveiled its vision of the future of luxury mobility called Vision Next 100. It has revealed how a futuristic car looks as it has included a glass canopy roof that opens with the door to a luxurious interior.

The company has also named the new artificial intelligence system 'Eleanor', which is specifically designed to match user's expectations. Much like other artificial intelligence programs being developed, Eleanor would be connected to the car owner's life beyond the Rolls-Royce Vision Next 100. Apart from that, the boot space is in front of the cabin and the roof opens up with the door. The 28-inch tall, but narrow wheels are hand-built from 65 individual pieces of aluminium and the cabin is suspended from the vehicle's wheels via exposed arms and struts.■

DeNA's first self-driving 'Robot Shuttle'

DeNA self-driving buses are EZ10 from a French driverless technology startup, EasyMile. The EZ10 electric shuttle will be the one, which will carry passengers through different locations in and around Tokyo. However, in order to avoid any risks or congestion, the service will likely be used in low traffic areas such as private roads or college campuses. Robot Shuttle can seat up to 12 people and travel up to 40 kilometers per hour. Along with that, it utilizes cameras, sensors, and a high-powered GPS system to navigate through roadblocks and traffic. ■

TomTom Webfeet

TomTom WEBFLEET solution helps to save fuel as well as localise vehicle positions and improves car maintenance planning. WEBFLEET platform will use the data sent by the manufacturer-fitted telematics units of Peugeot, Citroën and DS cars.

This platform includes automotive-grade digital maps, TomTom's navigation software NavKit and its live Traffic service. The solution improves vehicle performance, save on fuel, support drivers and, with enhanced visibility of your data, increase overall fleet efficiency. ■

Alibaba unveils internet connected car

SAIC Motor and Alibaba Group's first internet-connected car is fitted with YunOS operating system with an aim to make vehicles smarter for future. The automaker unveiled the web-enabled car, a Roewe RX5 sports utility vehicle under SAIC's subsidiary brand, is priced from 148,800 yuan (HK$172,600). It can be connected with other smart devices to enable drivers to remotely unlock the car or control in-car air-conditioning with a smartphone. Apart from that, the operating system enable drivers to use voice commands to open and close windows, control navigation, as well as make mobile payments and restaurant bookings. ■

Mergers & Alliances

- Samsung acquires Joyent, to boost its connected car businesses
- LG joining the connected car squad with Volkswagen
- Daimler strikes a deal with Athlon Car Lease
- BMW, Intel, Mobileye form joint alliance to develop driverless cars
- KDDI partners with Gemalto to offer connected cars and IoT solution
- Clarion & KOTEI Informatics form joint venture
- Uber expands self-driving car partnership, may tie-up with Hyundai Motor
- PSA Group & Safran partner to build security of connected vehicles
- STMicroelectronics strengthens connected car base with ETAS & ESCRYPT
- Symbio and Tamul Multimedia collaborates for connected car services
- Octo Telematics & Oracle working together on telematics data collection
- Airbiquity expands its software offering, partners with EnGIS Technologies
- HERE and Hyundai join hands to offer free map updates
- FCA in talks to partner with Uber to build autonomous cars
- Savari and Security Innovation to work together on cybersecurity
- Toyota & KDDI team up to develop platform for connected cars
- Alibaba & SAIC to form a joint venture for connected cars
- Mobileye and GM to collect map data through self-driving cars
- Intel acquires Itseez to improve navigation and driver assistance
- Toyota and Uber sign MoU for mobility services
- Google selects Harman as audio technology partner
- Qualcomm & Google are working together to bring Android in cars
- INRIX and Parkmobile developing solution for connected cars
- Mobileye and STMicroelectronics to develop sensor for autonomous driving ■

Bits & Bytes

Magesh Srinivasan
Global Sales Director - Connected Car
HCL Technologies

Advanced Driver Assistance Systems (ADAS) is drawing inspiration from human biology to replicate nature instilled processes and capabilities of the human body and applying these principles to ensure the safety of the driver and passengers inside an automobile. This is a case of technology seeking to amplify human capability to eliminate safety concerns emanating from human error.

Automotive innovation teams are building algorithms that create 'Deep Learning' in neural networks on the silicon chip. Deep Learning is a stream of machine-to-machine communication that enables processing of complex tasks, such as, image synthesis and recognition. Installing complex Deep Learning algorithms into silicon accomplishes high processing efficiency with low power consumption. This new breed of image processing units will power automotive systems and enable growth in visual intelligence on a logarithmic scale. The goal is, to emulate the human eye and brain, to create capabilities that can identify objects within image frames in motion, real time!

It is exciting to know that, '0' and '1' built on logical data paths bring machines to life and enable useful outcomes. This is the basic building blocks of artificial intelligence in embedded automotive technology.

What does this mean in our daily life?
Take, for example, the image based assistance available through 360 degrees live camera feed on side view mirrors. The dynamic and holistic perspective it provides assists driver of large commercial vehicles to pilot the vehicle with 'zero' damage in the most challenging driving conditions and tricky parking scenarios.

'Auto Park Assist' on passenger cars is a useful feature for most drivers who struggle to 'Parallel Park' on crowded streets. This feature has matured considerably over the recent years, thanks to intelligent software that combine cameras and sensors to achieve spatial awareness and precision control to auto-park the car.

Another exciting area is 'Driver Wellness'. Sensors in the automobile monitor the vital statistics and onboard cameras monitor facial expressions of the driver. The system is capable of detecting 'drowsiness' owing to fatigue or alcohol consumption and alerts the driver in time. It can even take over 'control' if the driver fails to respond to the warning alerts. The goal is to save lives both for people inside the car as well as on the road.

Overcoming 'blind-spots' is another critical feature enabled via visual imaging intelligence and onboard sensors.
The automobiles we experience today are undergoing a massive rethink in design and capabilities. Innovations and inventions are casting a new mould that will birth greater safety and a 'seeing and sensing' automobile.■

News & Updates

- Self-driving cars are being tested by their own instructor 'Synthia'
- u-blox launches miniature untethered dead reckoning receiver
- ATrack to provide telematics solution with PodsystemM2M's platform
- ALMAGuide introduces advanced lane assist technology for vehicles
- Omnitracs launches telematics solution for Mack Trucks, Volvo
- Uber plans to track driver behaviour through app
- IBM debuts into driverless vehicles, launches Olli with Local Motors
- General Motors to expand research team of autonomous cars in Ontario
- NHSTA: Federal guidelines on self-driving cars coming in July
- Adrian Flux launches UK's first driverless car insurance policy
- INRIX 'Off Street Parking' now available in Mercedes Benz
- Bosch demonstrates 'Home Zone Park Assist' technology
- Faraday Future is eyeing Michigan to test its self-driving cars
- Redpine Signals launches V2X solution for connected car market
- Microsoft not producing autonomous cars, working for mobile offices
- IMS granted European patent for mobile-based telematics services
- India and the Asian market: opportunity for telematics
- Toyota Connected: Concept explained by CEO, Zack Hicks
- CSC expands digital insurance services with UBI solution
- Elektrobit launches EB cadian, cloud-based service for connected cars
- u-blox gets awarded for Internet of Things innovation
- INRIX expands in-car parking services with PayByPhone
- Anritsu Signaling Tester supports connected car platform
- Octo Fleet- an insurance telematics solution, launched in North America
- Technavio: Telematics insurance will boost the global motor vehicle insurance market
- Google's self-driving cars are being taught how to honk
- Baidu confirms mass production of self-driving cars by 2021
- Google's take on Android Auto and connected cars
- Korea: SK Telecom unveils 'T map for Car', a connected car platform
- AppCarousel expands connected car platform with Monetization Suite
- Telematics enabling smart mobility for India– opportunities & challenges
- DesignWare EV6x processor, optimized for embedded vision applications
- WebLink smartphone platform to interface with SmartDeviceLink
- Intersil unveils laser diode driver for heads-up displays
- New version of VeriStand software released
- HARMAN receives Lincoln Luxury Award from Ford
- Michigan moves beyond of testing driverless cars, to allow operation of self-driving cars
- BMW to catch up in autonomous tech, launch fully autonomous car in 2021
- ADAS ONE: in-vehicle camera system for FCW and LDW
- Google opening autonomous car testing center in Michigan
- Omnitracs unveils Roadnet Anywhere v4.1 for fleet management solutions
- According to TNS and BearingPoint BMW, Audi and Mercedes have most user-friendly connected technology
- UBI to drive insurance IT spending in US
- Continental gets award for its active safety package
- UBI on a rise globally, Canada catching up
- Arrow Electronics' semi-autonomous car hits record 152mph
- Uber begins testing autonomous hybrid Ford Fusion in Pittsburgh
- AT&T expands its options for connected car customers
- Honda Research Institute USA tests 2nd generation autonomous vehicle
- Ex-Googlers rev up plan for self-driving trucks
- Tier 1 supplier roles get disrupted by autonomous vehicles as ADAS ecosystem expands
- VerifEye Technologies introduces AMOVI Taxi product line
- Google pays Arizona drivers to test self-driving cars
- Mobileye introduces collision avoidance technology in India
- Logitech launches Logi ZeroTouch for hands free car control
- UK: Calibration of windscreen mounted cameras
- Tesla plans to launch 500,000 electric vehicles by 2018
- UK Govt sets up vehicle telematics agreement for safety and security
- Insurers warn drivers to stay secure from autonomous cars
- eDriving/IDS merger leads to formation of eDriving FLEET
- Car owners want their vehicles to be connected with home: Parks Associates
- Focus of telematics industry shifting from commercial vehicles
- Insurance industry to be affected due to autonomous cars: Volvo ■

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