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AGL Will Be Overtaken by Android Automotive

The Linux Foundation just picked up another new member to work on its Automotive Grade Linux project, the collaborative open source effort to develop a common platform that can serve as a de facto standard for infotainment, telematics and instrument cluster applications. Volkswagen joined earlier this month. Thus far 130 members have signed onto the project; 30 members signed up in 2018.

There is much to recommend AGL. The AGL Unified Code Base platform provides 70% of the starting point for a production project, including operating system, middleware and application framework. “If AGL can establish itself as a true automotive platform, suppliers will have a common set of interfaces their suppliers can write to,” said Tim VanGoethem, vice president of Advanced Mobility Solutions at Harman X, the company’s innovation taskforce. “Instead of paying people to write software on your behalf, you can take advantage of what has been done already and just license it to use in your final product.”

Toyota and the Linux Foundation launched AGL in 2012 and thus far only Toyota has gone on record to say that it is committed to the platform. The first AGL-based Toyota infotainment system was installed on the 2018 Camry in the U.S., in the 2018 Prius PHV in Japan and on some Lexus models. Also, a 2019 RAV4 with AGL-based infotainment was part of Toyota’s booth at CES 2019.

Renesas, an active board member of AGL, started volume shipments of its R-Car SoC with AGL for Toyota in 2017. Dan Sisco, director of Renesas’ Automotive Systems business unit, could not comment on whether any other OEMs were specifying AGL, but noted that “other players were actively engaged in contributing code to the AGL project.”

According to John Scumnioptales, director of product for Alexa Automotive at Amazon, other partners in addition to Toyota have projects at various stages of development underway with AGL. “Other Japanese OEMs are involved.” Amazon, which began its engagement with AGL to make sure that the platform is Alexa ready, led the architecture and definition of voice interfaces in AGL. “We have automotive partners who
are building voice interfaces using Alexa in vehicles that are using AGL and other automotive operating systems,” Mr. Scumniotaes added.

No News Isn’t Necessarily Good News
One of the difficulties in following any progress AGL is making toward becoming a de facto industry standard is the reticence of Toyota and others to talk publicly about any specific adoption plans. Toyota declined my request for an interview.

In June 2018 Mercedes-Benz Vans said it was planning to use AGL as the foundation for a new onboard operating system for connected commercial vehicles under its adVANce project, launched in 2016. When queried if its new electric eSprinter van was equipped with the new OS, the company responded: “Right now we can’t/don’t want to say anything more about our plans for using AGL. If there is any news regarding this topic we will let you know.”

I am not alone in this observation. Strategy Analytics will soon publish a forecast of the operating system share of infotainment systems on an OEM-by-OEM basis. “We have not been able to pry out specifics of the project such as which OEMs are using AGL,” noted Greg Basich, one of the automotive analysts working on the forecast.

Android Automotive Coming on Strong
“Our data show Linux as the fastest growing operating system for infotainment systems right now, rapidly overtaking QNX,” said Roger Lanctot, associate director in the Global Automotive Practice at Strategy Analytics. “QNX has signaled very clearly their shift to focus on hypervisors and safety system implementations outside the infotainment area. Over the past year Android Automotive has become kind of a stampede among the carmakers. It is clear that Android is poised to overtake Linux but it will take a period of years.”

Linux includes implementations under the AGL and Genivi umbrellas, but Linux is also used widely as the core OS by multiple developers of display radios. “For entry-level radios, especially in China, you’ll see a lot of Linux,” noted Andrew Poliak, vice president of product planning, strategy and innovation at Panasonic Automotive Systems.

The embedded operating system that has gotten a lot of attention is Android Automotive. “Unlike Linux, it is a well-established environment
that is backed by Google,” said Harman X’s Mr. VanGoethem. “Google has served itself well in the consumer space providing a mobile [phone] platform with well-defined interfaces, a strong developer ecosystem, and very nice software tools. What makes it attractive to some of the car companies is they can tap into that ecosystem and maybe shift from spending to build proprietary software stacks to focusing on the applications and services that can drive differentiation.”

Volvo and Audi will put vehicles on the road with Android Automotive based systems. The Nissan-Renault-Mitsubishi alliance partners are reportedly planning to implement Android Automotive in future vehicles.

General Motors and Honda adopted an earlier version of Android for automotive four or five years ago, when Google wasn’t supporting Android as an embedded system. “So they had to go and make all the changes themselves, and their only real choice was to fork it to make it appropriate for automotive,” said Patrick Brady, vice president of engineering for Android, in an interview with The Verge.

Here from the Linux Foundation is their argument against Android Automotive: “Android is under the control of one company. Google drives the product roadmap and direction, and they also typically want access to data and other information that automakers may not want to share.”

While it is true that putting Android on phones has had a tendency to commoditize the devices, that has not been the case for the carmakers who have based their infotainment systems on Android. “If you look at the systems that have come to market, it would be very hard for consumers to know that these systems are built on top of Android,” said Mr. VanGoethem. “Those carmakers have been able to leverage the Android environment yet come forward with a very unique experience. … And just because you are using Android doesn’t mean that Google gets all the data. There are interfaces an application can see from the car, but the carmaker decides what applications are running on the system. Controls are available to carmakers depending on how they want to build out those services.”

Panasonic’s Mr. Poliak also doesn’t see the need to be wary of Google and Android Automotive. “We have been investing a lot in Android. It’s going to have great commercial success.”
ELISA
In February, the Linux Foundation launched its Enabling Linux in Safety Applications (ELISA) project to define a series of methods and processes with the goal of certifying Linux-based safety-critical systems. ELISA will work with certification authorities and standardization bodies in multiple industries to establish how Linux can be used as a component in safety-critical systems.

The Linux Foundation and AGL have been trying at least since 2016 to address all software in the vehicle, including clusters, head-up displays, telematics, ADAS and autonomous driving, but have yet to accomplish that goal. Recalling his experience when he worked at QNX, Mr. Poliak put his finger on the challenge. “At QNX when we went for safety certification the first thing the auditor said was, ‘Is it open source?’ You have to demonstrate where all the requirements came from and have traceability from the requirements to the implementation. It is very hard in an open source environment to do that.”

Toyota, AGL’s main champion, is the driving force behind ELISA. Commenting for this article, Masato Hashimoto, general manager of the E/E Architecture Development Division, Advanced R&D and Engineering at Toyota, wrote: “Open source software has become a significant part of our technology strategy, and we want to help make it easier to use Linux-based applications.”

If the industry is able to find a path to certify Linux-based platforms for safety-critical applications, that would put a dent in the market for safety-critical software suppliers such as Green Hills Software, QNX and the Panasonic subsidiary, Open Synergy.

Thus far just one other automotive company besides Toyota has signed up for the project, BMW Car IT, the carmaker’s software company. Given the challenge, more automotive partners will be needed if the initiative is to succeed.◆
SmartDrive Has Massive Data Trove for AV Developers

SmartDrive Systems, a fast-growing video safety and transportation intelligence company based in San Diego, California, has compiled the world’s largest storehouse of more than 250 million analyzed risky driving events. “We are collecting edge case safety events from 150,000 vehicles every day,” said the company’s COO, Jason Palmer. SmartDrive equips each vehicle with forward-facing and driver monitoring cameras.

While the company is primarily focused on providing video-based safety services for trucking fleets and public transit, SmartDrive’s valuable trove of video data has attracted the attention of autonomous vehicle developers.

The company has been working with a series of autonomous vehicle developers. “It’s a growing part of our business. Going into 2020 it could be 10% to 20% of total revenue,” said Mr. Palmer. Last year just 3% to 4% of the company’s revenue came from the emerging AV market.

From its installed base of 150,000 vehicles, SmartDrive generates 150,000 to 200,000 unsafe driving events (aka edge cases) per month. “That includes tens of thousands of pedestrian collisions and near collisions,” said Mr. Palmer.

The company records between 10 million and 20 million miles worth of data every day. Most of SmartDrive’s vehicles have anywhere from two weeks to three months of continuous video storage that resides in the vehicle. The edge cases are automatically offloaded to the company’s data center.

A series of algorithms is used to determine what constitutes an edge event. Hard braking or hard swerving events will trigger 20- or 30-second recordings. SmartDrive connects to vehicle systems to help establish when there is a forward collision warning event or the driver is following too closely. Recordings of each event are sent to SmartDrive’s office in India where 500 employees analyze and label each video segment. “We’ve been doing that for 14 years, so we have a huge labeled database of all these edge cases that are part of the core safety service we provide to fleets,” said Mr. Palmer.
Services for AV Developers
SmartDrive has put together a portfolio of services for autonomous vehicle developers.

◆ Risk Analysis
The first is an analysis tool that helps developers understand the risks associated with the areas where their vehicles will be deployed. The analysis could reveal how often they will see speeding, how often they will see cars running a stop sign, or how many times per million miles they can drive without having a collision with a pedestrian. “We can break that down by zip code, geographic area, vehicle and road type,” said Mr. Palmer.

◆ Simulation
SmartDrive can provide videos of these edge cases, but developers are increasingly asking for simulations. The company is able to convert its video footage into simulations, which it can deliver to its customers. “There is more standardization around OpenSCENARIO and ASAM so we can start to build them so they work across a broader set of tools,” Mr. Palmer noted.

◆ Monitoring
SmartDrive has begun to deploy its monitoring systems in order to provide reporting on how an autonomous vehicle is being operated and how it compares to manually-driven vehicles that are operating under similar conditions in the same area.

Risk analysis is the biggest part of SmartDrive’s AV-developer business.
Simulation is ramping up.

Regulators
SmartDrive has been working on a research project with the U.S. Motor Carrier Safety Administration on highly autonomous commercial vehicle benchmarking: How to measure the safety of autonomous vehicles?

“Working from our large database from manually driven vehicles, we can tell you, how the safest 10% of drivers operate, and what their driving skills look like, and compare that against an automated vehicle,” said Mr. Palmer. “Now you can go to a regulator, for example in Phoenix, and tell them, ‘my autonomous vehicles have avoided 2,000 collisions that these human drivers couldn’t.’ That would carry more weight with regulators than if you said, ‘I tested this against some simulations that I built myself.’”

Privately held, SmartDrive Systems employs 800 people, 300 in the U.S. and China, the rest in India. Ninety percent of revenue comes from customers in the U.S. and Canada.

The Hansen Report on Automotive Electronics, April 2019
www.hansenreport.com
The Company Profile: Nvidia

**Thumbnail Sketch**

**Headquarters:** Santa Clara, California  
**FY 2019 Revenue:** $11,716 million  
**R&D:** 20.3% of revenue  
**Operating Margin:** 32.5%  
**Net Margin:** 35.3%  
**Operating Cash Flow:** $3,743 million  
**Working Capital:** $9,228 million*  
**Long Term Debt:** $1,988 million*  
**Total Shareholder Equity:** $9,342 million*  
**Market Cap:** $115.7 billion  
**Employees:** 13,277, of whom 9,486 were engaged in R&D*  
**Revenue per Employee:** $882,428  
**FY 2019 Automotive Revenue:** $641 million  
**Top Automotive End Customers:** Audi, Mercedes-Benz and Tesla  
*As of January 27, 2019, the end of Nvidia’s fiscal year 2019

**Nvidia Sales and Operating Margin by Fiscal Year**

2015 to 2019 CAGR: 25.8%

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<tr>
<td>2018</td>
<td>9,714</td>
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<tr>
<td>2019</td>
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**Operating Margins by Fiscal Year**

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<tr>
<td>2018</td>
<td>33.0%</td>
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<tr>
<td>2019</td>
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**Nvidia Revenue by Market**

FY 2019 Total: $11,716 million

- **Gaming,** 53.3%  
- **Professional Visualization,** 9.6%  
- **Datacenter,** 25.0%  
- **Automotive,** 5.5%  
- **OEM & IP,** 6.5%

**Background**

Co-founded by Jensen Huang, Chris Malachowsky and Curtis Priem in 1993, Nvidia quickly gained world recognition for its invention of and success with graphics processing units (GPUs). Originally designed to simulate virtual worlds in video games and films, GPUs’ high-performance computing power is increasingly being applied in artificial intelligence to accelerate both deep learning and machine learning processes. In fiscal 2019, sales of GPUs accounted for 87% of Nvidia’s revenue.

While Nvidia’s largest market is computer gaming, which accounted for 53%...
of sales in FY 2019, the company also serves three other major markets: professional visualization, datacenters and automotive, which has been growing at nearly 37% annually since 2015.

**Automotive**

At $641 million, Nvidia’s automotive business segment accounted for just 5.5% of the company’s total revenue in fiscal 2019. But that percentage is expected to grow in the future. Nvidia, with its eyes fixed on being a major player in the emerging market for self-driving technology, has been devoting a large share of R&D spending to in-vehicle computing, a market which it expects will climb to $25 billion by 2025.

In addition, Nvidia is addressing an expected $3 billion market in 2025 for self-driving training and development, and a $2 billion self-driving simulation and validation market. Revenues resulting from those types of investments will be recorded in Nvidia’s Datacenter business segment.

In 2015, 95% of Nvidia’s automotive hardware and software sales were infotainment related. But since then infotainment has become more or less commoditized, and with little profit to be made, Nvidia stopped bidding for new infotainment business. Instead it has been focused on cockpit business, where the cluster is integrated with the infotainment system and fused with artificial intelligence. Nvidia won cockpit business with Mercedes for its MBUX intuitive user-experience infotainment system, which premiered in the new A-Class in 2018 and is rolling...
out through the entire Mercedes-Benz line up. Nvidia has also picked up user-experience business with the Chinese carmaker Nio.

As its 10-K states, Nvidia’s invention in 1999 of GPUs (graphics processing units) established the company as the leader in visual computing. By 2006, it had expanded the parallel processing capabilities of the GPU for general purpose computing. Today, Nvidia GPUs power the world’s fastest supercomputers. They have proven well suited for deep learning and are now being applied in applications for machine learning powered by AI.

**Platform Strategy**

Jensen Huang, co-founder, president and CEO of Nvidia, has lately been clear in his public comments that Nvidia is no longer just about building chips, that the company is looking to expand the usefulness and value of its platforms.

Nvidia’s strategy for automotive is realized in the DRIVE platform, which includes:

- DRIVE AGX, the high-performance, energy-efficient, in-vehicle hardware platform that incorporates Nvidia’s Xavier system on chip for sensor data processing, map localization and path planning
- The DRIVE AP2X software stack integrates DRIVE AV software for Level 2+ to Level 4 autonomous driving, as well as DRIVE IX software for AI-based computing inside the car, enabling features such as driver monitoring.
- DRIVE Constellation, a simulation hardware platform for testing and validation at the datacenter, with DRIVE Sim software

In addition to the DRIVE platforms for in-car computing and AV (autonomous vehicle) simulation, Nvidia has a dominant position in AI training. Twenty-five carmakers and 15 tier ones rely on DGX super computers for training neural networks. The total number of automotive companies using DGX jumped from roughly a dozen in FY 2017 to more than 60 in FY 2019. Driving data is col-

### Top Automotive End Customers in FY 2019

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<td>Audi</td>
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<td>Mercedes-Benz</td>
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<td>Tesla</td>
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<td>Toyota</td>
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### Distinctions Claimed by Nvidia

- Nvidia invented the GPU (graphics processing unit) in 1999.
- The world’s largest computer graphics company
- DGX-2 is the world’s most powerful AI training tool.
- Xavier is the most complex SoC ever built.
- Nvidia is the only company delivering an end-to-end, open platform for building autonomous vehicles, from the vehicle to the cloud.
lected, labeled and fed into a DGX system. Nvidia claims that its next-generation AI system, DGX-2, is the world’s most powerful AI training tool and the world’s first two petaFLOPS system.

We asked what distinguishes Nvidia from competitors such as Intel, for example. “Unlike others, we are developing an end-to-end solution based on a single architecture—from the training of the DNNs [deep neural networks] to the testing and validation with Constellation, to what is deployed in the vehicle,” said Danny Shapiro, senior director of automotive. “It is an open architecture, so anyone can develop on it and it will run across all our platforms.” In differentiating Nvidia’s offerings from the competition, Mr. Shapiro added, “One of our competitors grew as a result of acquisitions and has four different architectures that aren’t compatible with each other. A CPU architecture is different from an FPGA, which is different from a DNN processor, which is different from a smart camera. When trying to scale up from smart cameras, it is simply impossible to take a low-power camera ECU and turn that into an AI supercomputer. Conversely, we are starting with supercomputing technology and bringing it into the vehicle to solve the incredible challenge of safe autonomous driving.”

The company expects that its DRIVE AGX platform will provide the bulk of automotive revenues by 2024. Those revenues will come from engagements it has already begun with Volvo, Mercedes and Toyota and also from its robotaxi customers.

Nvidia’s platforms include both hardware and software, how much of each depends on the customer. “The tier one is going to customize the hardware board based on the sensor configuration, how many cameras, how many connectors, and how much processing horsepower is needed,” said Mr. Shapiro. “Our
software is open, meaning customers use their own and/or license some of it from us.”

**Automotive Product Strategy**

**Self Driving and the User Experience**

Nvidia’s chief product planner is CEO Jensen Huang, who is known simply as “Jensen.” He lays out the broad strokes of where he wants Nvidia’s technology investment to go by having the company tackle very difficult problems that can potentially be solved through GPU computing.

“Autonomous vehicle [development] is one of the world’s greatest computational challenges,” he asserted in his keynote address at the GTC 2019 developer conference in March. “Safety is a great concern. The technology is really complicated. The software we have to develop is still quite significant. It is an artificial intelligence challenge and a system integration challenge.”

Nvidia has been investing in its vision for self-driving technology at least since 2010, well before most major carmakers became convinced that the technology was a worthy goal for investment. “We have had to pursue our own feelings about what the future is going to hold,” said Jensen. “If there are no customers, you pick a direction, you keep on going. Eventually they are going to get behind us, and we are going to be able to help our customers figure out what they need. The economics will work out.”

“We are making the fundamental investments for the future of autonomous vehicle computing—the [in-vehicle] computer, the software stack and the development system to support this industry for the long term,” said Jensen in a talk to a group of market analysts who attended the GTC 2019 conference.

Those investments to benefit Nvidia’s automotive business have been substantial and it may take up to five years before they yield a return.

Nvidia is clearly in the forefront of two very hot topics that are hugely attractive to investors: artificial intelligence and autonomous driving. Nvidia’s AI and AV development partners include Toyota, Mercedes-Benz, Volvo, ZF, and Continental among many others. Thus far, more than 370 carmakers, truck makers, auto suppliers, mapping companies, sensor developers and others are developing on DRIVE computing platforms from Nvidia.
In fiscal 2019, the bulk of Nvidia’s automotive business was still processors for infotainment applications, followed by engineering services and the DRIVE modules it builds for Tesla’s Auto Pilot system. Nvidia provided a significant amount of engineering services in fiscal 2019 to Toyota and Volvo, as they integrate the DRIVE platform into future vehicles. Volvo’s production is expected to start in the early 2020s. Volvo’s initial production release will deliver Level 2+ assisted driving features and driver monitoring.

**Key Automotive Customers**

- **Tesla**
  
  Nvidia and Tesla Motors started working together in 2011, before the Model S was introduced, and today Nvidia processors power the infotainment system and digital instrument cluster in the Model S and Model X. The Nvidia DRIVE PX AI computing platform also runs Tesla-developed neural networks for vision, sonar and radar processing for Models S, X and 3.

- **Toyota**
  
  This March Nvidia announced an agreement with Toyota Research Institute-Advanced Development (TRI-AD) to collaborate on the training and validation of self-driving vehicles. As part of the collaboration Toyota research teams in Japan and the United States will utilize the Nvidia DRIVE Constellation simulation platform, including DRIVE Sim software.

  The cooperation builds on an agreement made two years ago for the two companies to jointly develop AI software and hardware that will lead to Toyota employing DRIVE AGX Xavier or DRIVE AGX Pegasus in-car computers to power autonomous driving systems that are planned for market introduction.

- **Volvo**
  
  Volvo and Veoneer, along with their joint venture, Zenuity, began a self-driving development partnership with Nvidia in June 2017. Production vehicles built on the Nvidia DRIVE AGX car computing platform are planned for sale as early as 2021.

- **Volkswagen**
  
  In January 2018, Nvidia began working with Volkswagen to create new cockpit experiences based on Nvidia’s DRIVE IX computing platform. VW’s new I.D. Buzz electric minivan is expected to use DRIVE IX technology to create intelligent co-pilot applications including convenience and assistance systems based on processing sensor data from both inside and outside the car. I.D. Buzz is scheduled for launch in 2022.

- **Audi**
  
  MIB infotainment, Virtual Cockpit, zFAS
Safety Force Field
In March 2019, Nvidia published a 24-page white paper that details Safety Force Field (SFF), the company’s computational safety framework for preventing collisions. SFF is a robust driving policy that analyzes and predicts the vehicle’s environment and determines a set of acceptable actions to protect the vehicle, as well as others on the road, from collisions. SFF would be implemented as a software module within the self-driving vehicle’s motion planning stack.

Intel’s Mobileye division introduced a similar concept in 2017. Other autonomous vehicle developers have developed safety models. The hope is the global community of AV developers will consider all the models and meld them into a single framework that optimizes safety for all.

“Absolutely, SFF software implementations can be combined with other approaches,” noted Neda Cvijec, senior manager for autonomous vehicle software at Nvidia. “We are very open about it. All of us believe in provable planner methodologies. We have the same intent, the same goal. We don’t insist on a particular planner. This can be mathematically verified, but let’s go further and validate this in simulation.” For more details, please visit www.nvidia.com/sff.

Constellation and DRIVE Sim Simulation Platform and Ecosystem
Simulation tools are in the critical path of self-driving development. Nvidia has responded to the demand with the announcement last month that it will begin delivering DRIVE Constellation computers and DRIVE Sim software to customers this year, starting with Toyota. Nvidia will likely be a leading player in an AV simulation market the company expects will reach $2 billion annually by 2025.

At his presentation at Nvidia’s GTC conference last month, Zvi Greenstein, head of product development for simulation and mapping, explained why simulation is so essential. “Autonomous vehicles are very complex. Nvidia Xavier, the SoC on our self-driving computer, is the most complex SoC ever built. A self-driving car will use multiple SoCs, very complex sensor sets and 20 deep neural networks that have been trained on a lot of data.”

Developers need to be certain that their vehicles can handle rare and dangerous conditions. Accidents on U.S. highways occur every 279,617 miles (450,000 km), according to Mr. Greenstein. “We need a platform that can test the car against accidents and near accidents. Actual on-road testing for that many miles is simply not viable.”
And finally, autonomous vehicle testing involves a continuous reaction loop; the vehicle and the environment are dependent. “The environment changes based on the AV vehicle’s action and vice versa. These are extremely difficult problems to solve, impossible without computer simulation,” he added.

Nvidia expects to sell thousands of Constellation platforms. Each customer engagement will require a lot of engineering support to customize the hardware and software to fit the vehicle and the region where it will operate.

**Drive Constellation Virtual AV Simulator**
- Hardware-in-the-loop system level simulator
- Timing accurate and bit accurate
- Scalable platform—data centers
- Simulates rare and difficult conditions
- Efficient—test only scenarios of interest

**Drive Constellation Architecture**

**Drive Sim Simulation Ecosystem**
Nvidia’s simulation platform includes DRIVE Sim software, an open system in which ecosystem partners including system integrators can integrate their tools.

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The Hansen Report on Automotive Electronics, April 2019
www.hansenreport.com
Ludwigsburg Automotive Electronics Conference: June 25-26, 2019

The International Automobil-Elektronik Kongress in Ludwigsburg, Germany, is by far my favorite conference of the year. I have been attending this conference for more than 20 years, and it never disappoints. I always come away with new thinking about the challenges our industry is addressing and where technology is headed.

The congress is advised by a high-level board that includes top electrical engineers from BMW, Ford-Werke GmbH, Daimler, Volkswagen and Audi, along with C-level executives from Bosch and Continental under the direction of Ricky Hudi, who pioneered much innovation when he was Audi’s top electrical engineer. Mr. Hudi is now managing director of the advisory firm, Future Mobility Technologies.

The top-level speakers, all seasoned executives representing our global community, will cover the major industry trends including autonomous and connected mobility, end-to-end architecture and engineering tools. Among the 24 presentations scheduled during the two-day conference are these:

- Christoph Grote, Head of Electronics Development, **BMW**, on future industry scenarios
- Chuck Gray, Director of Electrical and Electronics Systems Engineering, **Ford**, on software
- Wolf-Henning Scheider, CEO, **ZF Friedrichshafen**, on autonomous driving
- Thomas Müller, Vice President of Development Chassis and Autonomous Driving, **Audi**, on architecture design
- Thomas Form, Head of Vehicle Technology and Mobility Experience, **Volkswagen**, on the challenges of automated and connected driving
- Fei Hao, CEO, **Banma Network Technology**, on intelligent mobility, AI and big data
- Alfons Pfaller, Head of Architecture/Platform Electrics/Electronics, **Audi**, on platforms
- Takashi Yoshizawa, Vice President, **Nissan Motor**, on the autonomous driving challenge
- Sachin Lawande, President and CEO, **Visteon**, on autonomous driving architecture
- Uwe Michael, Head of Electric and Electronics Development, **Porsche**, on the Taycan, the carmaker’s first fully electric sports car
- Uwe Keller, Director of Autonomous Driving, **Daimler**, on urban automated driving
Many of the presentations and all presentation slides will be in English. Simultaneous English translation is available for the German speakers. Each presentation is followed by a short question and answer period, and there are ample opportunities throughout the two-day conference to network with fellow conferees, most of whom are mid-level managers and above. At least 36 companies will exhibit at the conference. Visit www.automobil-elektronik-kongress.de to register or download the program.

Momentum Is Building for a Self-Driving Safety Standard

Any fatal accident involving autonomous vehicles anywhere in the world has the potential to put the brakes on this emerging industry. Safety needs to be the topmost priority for developers. There is good news on this objective. According to an email I received this month from Reiner Friedrich, vice president for autonomous driving and driver assistance product and requirements at BMW, a healthy quorum of developers has agreed to contribute to a safety-by-design approach to validating and verifying vehicle safety. The partners plan to publish their white paper titled, “Safety First for Automated Driving,” at least in time for the Electronics In Vehicles conference, October 16-17, 2019 in Bonn, Germany. The companies participating with BMW in drafting the paper so far include Aptiv, Audi, Baidu, Continental, FCA, HERE, Infineon, Intel and Volkswagen.

Baidu already announced last July that it was working with Intel to integrate and deploy Mobileye’s Responsibility-Sensitive Safety (RSS) model in both the open-source Project Apollo and commercial Apollo Pilot programs. Mobileye is an Intel company. Nvidia, which isn’t on BMW’s list, published its self-driving safety white paper, “Safety Force Field,” in March of this year. For more on that, see the Nvidia company profile, page 14 of this issue.
Roland Berger Examines the New Mobility World

In the fifth edition of its semi-annual Automotive Disruption Radar report, the Roland Berger consultancy takes a deep dive into the evolving world of autonomous mobility services and the growing global acceptance of electric vehicles. The Automotive Disruption Radar is based on a survey of 16,000 car users in 17 countries.

Here are some highlights from the report:

EV sales in China have tripled in the last two years, reaching 4.3% of total vehicle sales and establishing China as the clear leader in electric vehicles. Globally, EV sales represent 2.6% of total vehicle sales. Charging infrastructure is still lacking, a major complaint from consumers everywhere, but the shortage of facilities is being addressed. In China, for example, the public charging network was expanded by 40% last year.

Worldwide, there are more than 250 fully electric or hybrid cars on sale, making up 18% of the total vehicle model portfolio.

Commercial robotaxi operations “with significant revenues” could be a reality in just five years’ time, according to Roland Berger, but significant technical and market challenges need to be addressed for that to happen. The authors suggest that if consumer confidence in autonomous driving technology can be won, the other hurdles in front of AD could be overcome. A lack of trust in the technology was the main reason cited by consumers for not wanting to use autonomous mobility services. Nevertheless, 45% of survey respondents said they would give up their cars in favor of robocab services.

China is also the world leader in rolling out car-sharing and ride-hailing services.

Venture capital investment in mobility companies peaked in 2017 at $21 billion. Those investments dropped by 38% in 2018, to $13 billion, half of which went to startups developing artificial intelligence.
Roundup: 2018 Financial Results for Hyundai Mobis, Lear, ZF

**Hyundai Mobis**

2018 Sales: 35,149 billion KRW ($31.1 billion)

Change from 2017: 0%

2018 Operating Margin: 5.8%, the same as 2017

Outlook for 2019: N/A

Sales in the Modules and Parts division, which includes Electrification, Core Parts and Module Assembly, dropped slightly, by just 0.2%. Regionally, sales in China and especially in North America decreased, but Europe showed an increase of nearly 4%. The Module Assembly business was down 7.5% due in part to a temporary shutdown of a plant in North America. Electrification sales (which comprise 6% of the division’s total sales) were strong, increasing 54% over the prior year driven by increased sales of battery electric vehicles. The After Sales segment revenue increased modestly, by 1.1%.

Mobis’ proposed spin-off and merger with Hyundai Glovis, announced last year, was canceled following pushback from activist shareholder hedge fund Elliott Management Group. Elliott proposed resolutions seeking dividend payments to shareholders and seats on the board of directors for two candidates proposed by Elliott. The proposal was defeated at the annual shareholders’ meeting in March 2019, but pressure to reorganize and loosen the Chung family’s control of the Hyundai chaebol is likely to continue.

Mobis’ R&D spending has increased by 14.1% per year since 2014, but at 2.4% of sales, it trails its competitors’ investments.

At CES 2019, Mobis’ second appearance at the venue, the company highlighted its efforts in autonomous driving, ADAS, integrated cockpit control and connectivity. In March 2019, Mobis invested $4.9 million in Deep Glint, a Chinese computer vision startup, its first investment in a non-Korean company. The company said it plans to make further investments internationally to develop technology for autonomous and connected vehicles, including AI-based image recognition. It plans to begin full-scale production of camera sensors for autonomous driving in 2022.
Lear Corp.
2018 Sales: $21,149 million
Change from 2017: up 3.3%
2018 Net Margin: 5.4%, compared with 6.4% the prior year
Outlook for 2019: Little to no growth, with sales expected in the range of $20.9 billion to $21.7 billion

Lear operates two business segments. The largest, Seating, including both complete seat systems and components, accounted for 76% of sales. Sales growth in the Seating segment was less than 1%.

The other reporting segment, E-Systems, produces wire harnesses, terminals, connectors and power distribution boxes, for conventional as well as 48V architectures, along with electronics modules and software. E-Systems sales increased 11.6% over the prior year. The segment’s top five customers are Ford, General Motors, Renault-Nissan, Jaguar Land Rover and Volkswagen.

Overall sales growth came largely from Asia, especially China, as well as Europe and Africa. Sales in North America slipped by 2%. Lear’s annual report notes that increased penetration of crossovers and SUVs in global vehicle production is a boost to business. Lear content per vehicle, especially seating, can be significantly higher in that vehicle segment.

Lear recently announced its planned acquisition of Seattle-based Xevo Inc. for $320 million. Xevo developed a cloud-based framework for drivers to interact with mobile apps, and an in-vehicle e-commerce platform.

In mid-2018 Lear hired John Absmeier to be its chief technology officer. Mr. Absmeier had been senior vice president and general manager at Harman, responsible for Harman’s ADAS/AV business unit. Prior to that he worked at Samsung Electronics and led the acquisition of Harman by Samsung.

ZF
2018 Sales: €36,929 million
Change from 2019: up 1.3%
2018 EBIT Margin: 4.1%
Outlook for 2019: Little growth is expected, 2.9% at best. Sales are projected in the range of €37 billion to €38 billion, with adjusted EBIT margin between 5% and 5.5%.
In March 2019 ZF announced its plans to acquire Wabco for approximately $7 billion. The sale is expected to close in early 2020. Wabco is a leading supplier of braking controls for commercial vehicles. The company said the acquisition will make ZF less dependent on the cycles of the passenger vehicle market in the long term.

In March 2019 ZF also announced it took a 60% share in the Dutch maker of automated people movers called 2getthere. It is also a joint venture partner with Transdev and e.GO in developing and launching an autonomous electric shuttle vehicle service.

ZF made some organizational changes in Q4 2018 in an effort to make the company more nimble. The former Active & Passive Safety Technology division (which includes the former TRW Automotive) is divided into three smaller divisions: Passive Safety Systems, Active Safety Systems, and Electronics and ADAS. In 2018, Active & Passive Safety Technology sales declined by 13.2%, partly due to the divestment of the Global Body Control Systems business in April 2018.

While sales in the Car Powertrain Technology division declined by roughly 11% last year, ZF noted that demand for automatic transmissions remained strong. In April 2019, the company announced its largest ever single transmission order, in the amount of “two-digit-billion-euros.” The order from BMW for ZF’s latest-generation, 8-speed automatic transmissions will start production in 2022. The technology can be varied to suit conventional, hybrid and electric vehicles.◆