Service-Oriented Architecture for Cars Is Next

Disruptive change is afoot. Cars will soon be nodes on the Internet. Carmakers will want to mix and match services not only from the cloud but from the vehicle itself so they can quickly and flexibly bring features and capability to their customers throughout the vehicle’s life.

Well known outside of the automotive industry, service-oriented architectures (SOAs) were first described by Gartner in 1996. Gartner defines services as software modules that are accessed by name via an interface, typically in a request-reply mode; SOA, broadly, is a relationship of services and service consumers. The most innovative carmakers have only now begun discussions about how vehicle architectures need to change to accommodate this technology that’s essential to making cars part of the Internet of Things.

“Service-oriented architectures are well known in the IT industry, but for automotive this is the next big step with regard to system and software architecture,” said Simon Fuerst, general manager for software system and software architecture, “This is something the Autosar Adaptive Platform will have to support and Genivi will have to support. (For more on the Autosar Adaptive Platform, see the October 2015 Hansen Report.)

Services can be big or very small. For example, the vehicle’s speed or position can be a service provided by the vehicle. A Web-connected service could direct drivers to available parking and collect payment. “In the future, maps will have several layers. One company might provide the street location. Another company will describe the traffic situation on the street. Others would provide crowd-sourced information about the road condition, if it is slippery, wet or dry,” explained Stefan Ferber. Dr. Ferber is vice president of engineering at Bosch Software Innovation, a business

V2V in the Slow Lane in Europe

It’s hard to find much enthusiasm in Europe for production implementations of vehicle-to-vehicle communications based on ITS-G5, the short range communications protocol based on 802.11p. Unlike the U.S., where V2V could be mandated by the government, and where Cadillac has promised to install V2V communications equipment in the 2017 CTS model, V2V technology will not be mandated in Europe and no carmaker yet has gone on record to say they will voluntarily introduce it.

The Car 2 Car Communication Consortium, comprising 80 members including 16 carmakers, has been working to get V2V up and running in Europe since 2002. The European Telecommunications Standards Institute allocated 30 MHz of spectrum in the 5.9 GHz band for intelligent transportation systems in 2008.

According to the Car 2 Car Consortium general manager, Niels Peter Skow Anderson, the technology is ready but there are still some outstanding issues likely to delay deployment. One is security. With no common European authority, the consortium has not yet decided how it will issue security certificates to ensure that received messages coming from the infrastructure are coming from trustworthy sources. Another issue raised by Germany concerns privacy: Who constitutes personal data and who must give consent allowing the data to be broadcast, the vehicle owner or the driver?

Cellular Technology vs. ITS-G5 (802.11p)

In June 2013, Mercedes-Benz issued a press release announcing plans to bring Car-to-X technology “to our roads by the end of this year, which will enable the exchange of information between individual vehicles . . . .” But while Mercedes-Benz has been active in vehicle-to-vehicle research and helped to establish the ITS-G5 short range communications standard, the technology has not yet been featured in a new Mercedes vehicle. Indeed, Mercedes’ new E-Class, which will be introduced in January 2016, will be equipped with an eSIM (embedded subscription identity module) to connect to a 4G cellular network, not an ITS-G5 module.

Governments have shown little enthusiasm for investing in new roadside infrastructure, which rules out all of the ITS-G5 car-to-infrastructure use cases. A few safety related V2V use cases remain, such as emergency vehicle warning and emergency electronic brake lights. To some, e-brake lights are seen as the most promising V2V safety feature that doesn’t require an infrastructure investment. But radar- and camera-based automatic emergency braking systems are already being offered by carmakers. Communications-based sensors will add little to what already exists, except in cases where a vehicle several cars ahead, unseen by the onboard sensors, stops abruptly. The business case for V2V remains pretty thin, especially when you consider that there will be little safety benefit until a critical mass of vehicles enters the fleet that can communicate with each other.

Another problem for ITS-G5 is that some of the use cases earmarked more than ten years ago for the short-range communications technology can reasonably be handled by cellular networks, such as providing drivers with information about traffic, road conditions and construction zones.

As we advance to the age of the connected vehicle, with all but the least expensive vehicles equipped with an embedded cellular communications modem to connect to services in the cloud and to receive over-the-air software updates, some carmakers will be reluctant to add a second communications module. According to Juergen Daunis, global director of Ericsson’s automotive business, some carmakers are pushing back. “The space available for multiple antennas is limited,” he noted.

Another argument against ITS-G5, especially for the long term, is that cellular technology is improving. Those improve-

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Vehicle Architectures Will Change

According to Juergen Roeder, head of technology development at Continental, step one of any transition to SOA would be adopting an Ethernet network. “Ethernet provides methods to manage services and applications dynamically.”

Mr. Maag envisions an architecture with two layers, a physical layer and a connected layer. “The physical layer of powertrain, steering and braking control, comprising tailor-made hardware, is functionally oriented and will stay more or less the same for perhaps the next seven or eight years. The connected layer, linked to the outside world and the Internet, will include the infotainment system and will connect to services used to devise [autonomous] driving strategies. In this layer, general purpose computers similar to those used in consumer electronics will be employed. The hardware in the connected layer will come with extra headroom to accommodate over-the-air updates. A smart gateway will provide a security firewall between the physical and connected layers.”

The transition by carmakers to service-oriented architecture will necessitate unprecedented security measures. Today, once a vehicle is manufactured, the software in it is expected to remain unchanged for the life of the vehicle. That is not at all the case for devices that are connected to the Internet. “On the Internet you reach security maybe for today, but tomorrow the game starts again,” cautioned Dr. Ferber. “With carmakers, you are happy you have zero-defect software out there and you do not change it any more. If you bring SOA to the car you must bring the Internet philosophy also to the car. That requires continuous software updates, which brings in a lot of logistics problems. Software is changed continuously, so you need complete version control. It is a different breed than managing parts in your warehouse.”

A Different Technology, Organization and Culture

SOA will require major changes in the way software development is organized and the way it is created. New competencies will be required.

Mr. Maag thinks the transition to SOA will be disruptive, not just for the developers, but for the whole organization. “It is a completely different culture. The IT guys come from an industry where computing power and memory resources are almost infinite. They are used to delivering new software a couple of times a day. They don’t care too much about corporate infrastructures. They don’t worry so much about quality and safety mechanisms, but they are very cautious about security. In contrast, automotive engineers are always constrained by hardware resources. They are very cautious about functional safety. They are used to very slow-paced deliveries, maybe once every three months. Expectations, behaviors, languages, all the things that can be different are in fact different.”

For young engineers or those trained as software engineers, SOA will not be overly challenging. “It will be difficult for the many engineers in our industry who started out as mechanical or electrical engineers and over time became software engineers,” suggested Dr. Ferber. “They have the domain knowledge, but for them it is a bigger step because it is different kind of thinking. It’s more about service contracts and less about control, more about decoupling and not so much about timing behavior and understanding every detail.”

“You can compare this to switching from functionally oriented programming like you do in the C language, to object-oriented programming like you do in C++,” said BMW’s Mr. Fuerst.

To support carmakers as they transition to SOA, suppliers will have to rethink the way they are organized. “To implement service oriented architectures, the industry will have to move from a component orientation to one involving more centralized controllers,” said Russ Shields, chairman of Vgomi LLC. “I have talked to a number of people at suppliers who tell me they are receiving RFQs from car companies that go across multiple business units. They are sorting out how best to organize for that.”

According to BMW’s Mr. Fuerst, even though it is a very new topic, a production vehicle featuring a service-oriented architecture could hit the streets in three to five years.

THE HANSEN REPORT
ON AUTOMOTIVE ELECTRONICS

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Managing Editor Brianne Wolfe
Director of Marketing Michelle Long
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Open Source EV Platforms

We first became aware of OSVehicle while scanning Silicon Valley websites for automotive electronics topics. We came upon the citation below at meetup.com, which was promoting a Silicon Valley Automotive Open Source meetup in early December featuring presentations from four early-stage Silicon Valley startups.

“OSVehicle’s open source, modular, electric vehicle platforms empower new and existing car manufacturers to rapidly develop their own models, saving years of R&D and millions of dollars in investments. At the same time, OSVehicle is a reference platform on which other mobility startups can embed and develop their own models. OSVehicle can shave years off time-to-market for new automotive industry entrants.”

The platform could be the basis for many electric vehicle types, from city cars to off-roaders, to special purpose vehicles that target emerging market niches.

A video on the OSVehicle website asks the question, “What’s next for mobility?” and the reply is, “We’d like to think that open source will bring not just vehicles to the next level, but the whole transportation industry.”

Wow. We know what open source has done for software: it’s given us Linux. Google, Twitter, Facebook and Amazon are all powered by Linux. Open source software is developed as a public collaboration and made freely available. OSVehicle is gearing up to apply the open source development model to electric vehicles.

“We decided to open up our know-how by releasing the hardware platform to open source,” said Alberto Loddo, OSVehicle’s chief financial officer. “It includes the transmission, motor, motor driver, battery management and a CAN bus. Our clients can download the platform’s 3D files for free and start developing on top of the platform. ... We see open source as a lever for clients to start working on possible enhancements to the platform, which they would then release in open source as well.”

Additionally, OSVehicle plans to develop a modular open source software and electronics platform upon which infotainment, Internet connectivity, self-driving and other capabilities can be layered. The company will soon be looking for a chief technical officer who can guide that development from an office in Silicon Valley.

Just as carmakers produce multiple vehicle models from a single platform, OSVehicle’s idea is to provide the platform on which multiple car companies can produce models targeted for whatever market niche they serve, big or small, thereby minimizing the investment required for each vehicle. “We are able to serve lower volume niches because they are all based on our platform. Our clients won’t have to make 100,000 units to break even,” said Mr. Loddo.

In order to further minimize the burden on new electric vehicle businesses to raise millions of dollars in investment capital, OSVehicle will facilitate a distributed manufacturing modus operandi relying on a network of contract manufacturers. Its first manufacturing partner is in China.

The Business

The company has so far booked orders for 12 key customers. Another source of revenue will be services the company can provide such as help with project conception, engineering, assistance in road-legal certification, bill-of-material optimization and manufacturing-as-a-service.

The company is conducting a search for two B2B sales executives with automotive experience, who can help sort through the many inquiries the company has received. According to Mr. Loddo, “The hard part right now isn’t a lack of interest, rather it’s assisting people with questions and qualifying the many proposals we are receiving as well as processing and closing service contracts.” Presently the company is working through 50 serious leads for car development projects, a high percentage of which will require OSVehicle services.

Investors Wanted

Tin Hang Liu, co-founder and CEO of OSVehicle, was born in Italy and has lived in San Francisco, Paris, Bangkok and Shenzhen, China. He founded the social media division of SEOLAB and later did a startup.
The Company Profile... Renesas Electronics

**Headquarters:** Tokyo, Japan, www.renesas.com

**FY 2014 Sales:** ¥791.1 billion ($6.4 billion)
**R&D:** 11.5% of sales
**Capital Expenditure:** 4.2% of sales
**Operating Margin:** 13.2%
**Net Margin:** 10.4%
**Cash Flow from Operations:** ¥116.7 billion ($954.5 million)
**Working Capital:** ¥360.4 billion* ($2.9 billion)
**Interest Bearing Debt:** ¥254.8 billion* ($2.1 billion)

**Major Shareholder:** Innovation Network Corp. of Japan

**Shareholders’ Equity:** ¥335.3 billion* ($2.7 billion)

**Market Capitalization:** ¥1.43 trillion ($11.6 billion) as of December 2, 2015

**Renesas Automotive FY 2014 Sales:** ¥323.0 billion ($2.62 billion)

**Top Customer:** Denso
**Top Products:** Microcontrollers

*As of September 30, 2015
Note: FY 2014 ended on March 31, 2015.

**Background**

Renesas was created in 2003, when Hitachi and Mitsubishi Electric combined their semiconductor operations into a joint venture called Renesas Technology. In 2010, NEC Electronics acquired the joint venture and changed the name of the business to Renesas Electronics to leverage the Renesas brand recognition already established in the microcontroller market. Prior to the acquisition, Renesas Technology and NEC Electronics were the world’s two largest microcontroller suppliers but each had some gaps in its product portfolio.

The new company failed to show a profit until fiscal year 2014. Sales declined by nearly 9% per year between fiscal 2010 and 2014. The earthquake and tsunami that hit Japan in March 2011 damaged eight Renesas manufacturing facilities, effectively reducing its production capacity by half. With a net loss of ¥168 billion in 2012, Renesas reorganized with funding from a consortium of Japanese companies, including Hitachi, Mitsubishi Electric, Toyota, Nissan, NEC, Keihin and Denso, and the government-backed Innovation Network Corporation of Japan (INCJ).

INCJ currently holds 69% of Renesas shares and, according to reports in the *Wall Street Journal*, is considering selling some or all of its interest in the company. Given the wave of consolidation underway in the semiconductor industry, Renesas will be competing against larger companies next year. For example, a combined Freescale and NXP could control 13.6% of the automotive semiconductor market, based on IHS data for 2014. Infineon, the number-two automotive semiconductor supplier in 2014, according to IHS, reportedly has expressed interest in investing in Renesas. Renesas and Infineon together had a market share of 19.7% in 2014 (Renesas 10.4%, Infineon, 9.3%). Japan currently accounts for just 7% of Infineon’s sales.

Renesas segments its automotive business sales into two product categories it calls automotive information systems, which includes devices used mainly in infotainment and cockpit systems, and automotive control systems, which includes devices used for engine, chassis, airbag and body controls. Sales are split 50-50 between the two categories, which both include microcontrollers, analog and power semiconductors, and system on chip (SoC) products.

**Global Focus**

With headquarters in Japan, Renesas operates 12 sales subsidiaries, six design and application technology companies and nine manufacturing facilities around the globe. In 2014, 41.5% of Renesas’ automotive sales were to Japanese customers. Prior to the tsunami devastation, Renesas relied on Japan for roughly 60% of automotive sales.

Continued on page 5
“The tsunami forced the Japanese auto industry to look at second sources,” said Amrit Vivekanand, vice president of Renesas’ North American automotive business unit. “Because of that Renesas lost business with our Japanese customers in the 2011-2013 time frame. The Japanese tier ones also lost business during those years. Renesas realized that we needed to grow our business outside of Japan, and since then we’ve compensated for that loss with business in other regions.”

Among the changes made by Renesas was the relocation of its Global ADAS Solutions Group from Japan to Dusseldorf, Germany. It also moved its autonomous driving research from Japan to the United States, with operations in both Silicon Valley and Detroit. Renesas has built autonomous vehicle prototypes and is working with non-Japanese customers on development projects. “We are really working to determine what the market outside of Japan is looking for,” Mr. Vivekanand said. “We are trying to find commonalities and meet the market requirements for all our customers.”

Automotive Products

Renesas’ automotive product line (by order of sales volume) includes the RH850 microcontrollers; the R-Car system on chip (SoC) solutions; analog solutions much of them mixed signal, a combination of analog IP with digital control; and lastly, power devices, including intelligent power devices, MOSFETs and IGBTs.

Microcontrollers account for 65% of automotive sales, much of which comes from the RH850 line. The RH850 product line was developed by Renesas following the merger of NEC with Renesas in 2010. NEC had the V850 line of microcontrollers and Renesas the SH line. Employing 40nm embedded flash technology, the RH850 line of 32-bit devices is used in the powertrain, cluster, body, airbag, chassis/braking systems and for motor management in electric and hybrid vehicles, nearly every vehicle system with the exception of infotainment. RH850s are also used as vehicle interface processors in infotainment systems. Renesas also has RH850 devices in traditional radios.

Renesas’ R-Car SoCs are the company’s second-largest product. In contrast with microcontrollers, an SoC’s flash memory is external to the device, with many of the peripherals on board. “An SoC can run at a clock rate of more than a gigahertz, whereas MCUs typically run in the 100 to 300 megahertz range,” said Mr. Vivekanand. “SoCs are replacing microcontrollers in infotainment systems even at the low end. The entry-level R-Car SoC will take care of what used to be done by the audio microcontroller. That lets our customers use R-Car for their entire infotainment system range,” he said. The R-Car family of devices share common peripherals across all product lines.

Cockpit Electronics and Integration

Renesas sees the dashboard and center stack as another area where its SoCs can provide product differentiation for customers, especially as central displays replace traditional radio displays. “What used to be just a basic radio is now turning into almost a full-blown computer in your car,” said Ian Byers, cockpit marketing manager for the United States. “In the past, some of the simpler radios still required a microcontroller type of product, where you had a system control and a simple vacuum fluorescent display. Now, even on low-end cars, new infotainment systems require a microprocessor or SoC to drive the graphical content and multimedia content playback. Renesas provides scalability with our range of SoCs, that cover high-end systems as well as entry level,” Mr. Byers said. According to Renesas, by 2020, all infotainment systems will use SoCs.

Some OEMs and tier-one infotainment suppliers are beginning to look seriously at integrating control of the infotainment system with the instrument cluster, and ultimately with a head-up display. “Especially when the vehicle has a high-end reconfigurable TFT-only cluster, the OEMs are definitely looking at integration,” noted Mr. Byers. “This can be a challenge for tier ones who have traditionally done infotainment-only development. They may not have experience yet with some of the safety requirements and restrictions of a cluster. I think it’s just a question of time. Some of our tier-one customers have already done safety and infotainment integration in the cockpit.”

Engineering organizations at the OEMs may have to become less vertical for cross-domain integration to progress smoothly. “In many cases the OEMs have segmented...”
engineering teams. Getting those paths and boundaries sorted out can be a challenge as well,” Mr. Byers added.

ADAS and Autonomous Driving

Of all the applications served by Renesas’ products, advanced driving assistance systems in the short term and autonomous driving in the long term are seen as the applications providing the greatest opportunities for sales growth. “Renesas already covers the powertrain, safety, braking and chassis domains. That has given us experience in functional safety across the board. We can now apply that experience to ADAS,” said Mr. Vivekanand.

Euro NCAP requirements for automatic emergency braking were a factor in moving ADAS operations to Germany. “The European market is the production leader in this space. Our team is working on solutions for this market,” noted Craig Johnson, Renesas senior marketing manager for automotive in Silicon Valley. One of those solutions is an ADAS Starter Kit. “Our R-Car H2 system on chip is built into an eval board, which will be the building block for a number of products including a surround view camera solution.”

The ADAS Surround View Kit, an extension of the Starter Kit, combines up to four cameras, supplied by Integrated Micro-Electronics Inc., and multiple gigabit multimedia serial links (GMSLs) from Maxim Integrated Products, on a miniature automotive chassis.

Renesas’ strategy includes partnering with algorithm developers, one of which is Itseez, a Russian company with offices in Silicon Valley. The two companies have demonstrated an ADAS reference platform using Itseez’ algorithms for traffic sign recognition, lane departure warning and forward collision warning portal on the R-Car H2 hardware platform.

In the short term more ADAS features will be moving into infotainment systems. “We know that infotainment systems will start to have ADAS features,” said Mr. Johnson. “Surround view will be in the infotainment system at first. It is today. But when we have fully autonomous vehicles you’ll have a dedicated system, and those things will be separated.”

New Products

◆ Third-Generation R-Car

In early December 2015, Renesas announced the first member of its third-generation R-Car automotive computing platform, the R-Car H3. Built using 16nm processes and employing ten ARM computing cores, this exceptional system on chip is capable of handling autonomous driving features and high-end infotainment/cockpit systems, two fast growing, compute-intensive applications.

SoCs have primarily served infotainment applications—in 2014, Renesas SoCs were in 60% of all infotainment SoC applications worldwide. This new device doubles the performance of the previous generation while adding many new features. What is unique about R-Car is its compliance with ISO 26262 and ASIL B functional safety requirements which lends itself to a system-level implementation that is ASIL D. This makes the R-Car H3 well suited to ADAS and autonomous driving applications. The on-chip IMP-X5 parallel programmable engine offers advanced image recognition technology in addition to the CPU and GPU.

R-Car H3 features two, four-core computing clusters, an ARM Cortex-A57 cluster and an ARM Cortex-A53, plus two Cortex-R7 cores. The A-57 is a high-performance 32-bit and 64-bit core suitable for compute-intensive applications such as speech recognition or to run complex ADAS algorithms. It achieves processing performance of 40,000 DMIPS (Dhrystone million instructions per second). The device has nearly 1,200 pins.

Capable also of high-performance 3D rendering, the device features Imagine Technologies’ PowerVR X6650 graphics engine. “This can be used for the infotainment or the center stack displays, but we also see these devices used in systems that integrate infotainment and cluster or dashboard,” said Mr. Byers. “This core provides a high level of functionality and we’ve added some distinguishing IP to be able to split the graphics performance between the safety-oriented functions, where you can’t have latencies, and the infotainment side.”

To reduce the design workload, R-Car H3 is also available as part of a system-in-a-package (SiP) that includes a high-speed external LPDDR (low power double data rate synchronous DRAM) memory and serial flash boot memory.

The R-Car H3 includes new IP built in to address security. “One of these things is the boot device itself,” explained Mr. Byers. “We have hooks in this device to actually authenticate the code that is booted and make it such that code that is not authenticated, or users who don’t have the right keys for the device, won’t be able to boot software. Only the intended software from the manufacturer will be able to run on these devices.”

“R-Car H3 is our most promising new automotive product,” declared Mr. Vivekanand. Samples are available now. Mass production is scheduled to begin in March 2018 and is expected to reach volumes of 100,000 units per month by March 2019. Renesas is already working on some development projects with R-Car H3, one for a center stack and one that involves integrating the cluster and center stack.

◆ Second-Generation R-Car

Aimed at infotainment systems, R-Car SoCs are offered in three versions: entry level (E), mid-range (M) and high end (H). The R-Car H2 (second generation) device integrates nine CPU cores: four sets of quad-core ARM Cortex A15 for high performance; four sets of quad-core ARM Cortex-A7 for low-power computing; and an SH4A CPU for real-time processing. The device is the world’s first automotive LSI to employ ARM’s big.LITTLE method of dynamic process allocation, used to deliver the application at the lowest possible power drain, shifting and sharing execution between the most appropriate CPU cores.


Microcontrollers with 28nm Embedded Flash

Another promising product is Renesas’ improved 28nm embedded flash memories capable of very fast read and rewrite speeds. Renesas has prototyped 4 MB program storage and 64 KB data storage that
achieved the industry’s highest readout operation speed of 6.4GB/s at over 200 MHz. Prior to that, Renesas had verified read operations at 160 MHz in a prototype chip fabricated with 40nm geometries. 

Automotive systems using the technology will be able to boot up even more quickly. 

The technology has also achieved the industry’s highest write throughput of 2.0 MB/s. “That is really exciting because it means shorter programming and erase times for carmakers interested in implementing over-the-air software updates,” said Mr. Vivekanand.

OTA Updates

While over-the-air update capability is currently limited to a few carmakers, with Tesla leading the way, Renesas sees it becoming vital to carmakers looking forward to the 2020 model year and beyond. “About the same timeframe as our R-Car generation three, customers are going to want that level of integration and the ability to update over the air. From the discussions we are having lately, it is almost always a request,” said Mr. Byers.

Memory and throughput are important factors for executing over-the-air updates, as is an “undo” function in case the update goes awry. Another consideration for Renesas is the feature sets that go on their devices. “We sometimes put features on the devices that don’t actually get used in production, either because of the development costs or the development timeframe. Without OTA capability the functionality that is shipped is all the functionality the customer gets,” Mr. Byers noted. When over-the-air updates are available, carmakers can add those features that perhaps weren’t thoroughly tested or finalized at the time of production. “It’s a challenge for us,” admitted Mr. Byers, “because we have to predict what features are going to be important four years in the future when our device actually gets used in production.”

Software

Renesas already offers elemental software such as board support packages or software stacks for microcontrollers but no application software. That is going to change. Planning is underway at Renesas to address the problem it sees as fundamental to speeding up carmaker’s development cycles, software development. According to Mr. Vivekanand, “If we can offer software that is configurable, that is easy to use, that really addresses issues in the application space that are not value add for the customer, then I think we can help solve their software problem.” Customers are increasingly looking to device suppliers like Renesas to build reference platforms. “Once we build the reference platforms it becomes a question of do we want to sell this as a product, a packaged piece of software.”

Renesas’ Strengths

Renesas is the world’s leading supplier of microcontrollers to the automotive industry and it holds a 60% share of the market for infotainment SoCs. According to Amrit Vivekanand, three major factors separate Renesas from the competition:

Production Quality: “With our broad product portfolio, covering braking and engine control, powertrain, all those spaces, as a company we’ve developed a very high safety culture that shows in the quality of our SoCs.” Renesas is strong on both the control side and in SoCs.

Low Power: “The parent companies of Renesas figured out how to reduce power consumption of our devices across the board and the benefits and lower risks of that are still evident today. For example, some of our mid-range R-Car products still don’t require a cooling fan. With our expertise in low power consumption we do very well from a long term reliability standpoint.”

Deep Experience in Automotive: “We have seen the evolution of this automotive electronics business from relatively simple to very complex systems that include functional safety, lifecycle management and pre- and post-production support. Our customers appreciate that history we have with them.”

Renesas’ Challenges

Mr. Vivekanand highlighted three major challenges the company faces.

Increasing software content in vehicles: “Renesas’ challenge is to help customers deal with this issue. The automotive industry doesn’t hire enough software engineers; they hire electromechanical engineers and teach them software.”

Globalization as a company: Renesas has made progress building its global customer base and becoming less reliant on Japanese customers.

Getting beyond functional safety: ISO 26262 focuses on products and subsystems. Renesas believes the industry should start looking beyond that to “fail operational” reliability at the vehicular level even though an individual system might fail. “It requires new architectures, high speed networks, all kinds of new things,” said Mr. Vivekanand.

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Renesas Products by Application

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<tr>
<th>Application</th>
<th>Renesas Products</th>
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<tbody>
<tr>
<td>Hybrid electric vehicles/Electric vehicles</td>
<td>RH850/C1x, RL78/F1x, IGBTs</td>
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<tr>
<td>Powertrain</td>
<td>RH850/E1x, MOSFETs, IGBTs, Mixed-signal ASICs</td>
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<td>Body</td>
<td>RH850/P1x, RL78/F1x, MOSFETs, IGBTs, Mixed-signal ASICs</td>
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<td>Airbag</td>
<td>RH850/P1x, RH850/P1x, RL78, MOSFETs, IPDs, Mixed-signal ASICs</td>
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<tr>
<td>Cockpit (dashboard/instrument cluster, infotainment systems, navigation)</td>
<td>RH850/D1x, R-Car, RL78</td>
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Notes: RH850: 32-bit microcontrollers; R-Car: system-on-chip; RL78: 8/16 bit microcontrollers; RZ/A: ARM microprocessor with on-chip RAM
V2V...

After missing several deadlines, that phase-in period begins in 2016 with 100% compliance required by 2018. The Cameron Gulbransen Kids Transportation Safety Act, signed into law in 2008, but it took NHTSA until 2014 to issue its final rule, requiring rearview visibility technology to be installed. A U.S. mandate will probably take longer to implement, though. The Cameron Gulbransen Kids Transportation Safety Act requiring rearview visibility technology was signed into law in 2008, but it took NHTSA until 2014 to issue its final rule, after missing several deadlines. That phase-in period begins in 2016 with 100% compliance required by 2018.

A U.S. mandate will probably take longer to implement, though. The Cameron Gulbransen Kids Transportation Safety Act requiring rearview visibility technology was signed into law in 2008, but it took NHTSA until 2014 to issue its final rule, after missing several deadlines. That phase-in period begins in 2016 with 100% compliance required by 2018.

“While there are slight differences in the software, Europe and the U.S. use the exact same V2V hardware,” said Ulrich Stahlin, who oversees V2X projects at Continental. “If you have a mandate in the U.S., the carmakers that operate in both regions will probably include the V2X boxes in their European vehicles as well.”

OSVehicle...

Alberto Loddo can be reached at alberto.loddo@osvehicle.com; his phone number in San Francisco is 929-225-4230.

- French regional funding for four models: car sharing, tourism, agriculture and last mile delivery vehicle
- University, electric utility and municipality funded car sharing project
- Specialty vehicle maker developing a vehicle that can be air dropped into remote areas
- Italian IT company investing in a connected vehicle division
- California-based EV company developing a high-performance passenger vehicle
- Chinese EV maker developing a high-speed, high-range vehicle
- Finnish yacht maker developing a medium-speed L7e vehicle for Europe