

Edited by Kevin Jost

Freescle, STMicro to codevelop chips

Freescle Semiconductor and **STMicroelectronics** are teaming up to jointly develop chips for the automotive market. The two will also cross-license Freescle's PowerPC 32-bit processors and ST's power technologies.

The two companies will jointly develop chips beginning with 90-nm processing techniques, then evolve to smaller

geometries. The joint design effort, which will begin with roughly 100 employees, will be headquartered near Munich, Germany. The companies will augment this design group with engineers who remain with existing design teams. Though they will design products and share some process information, sales and marketing of the chips will remain separate.

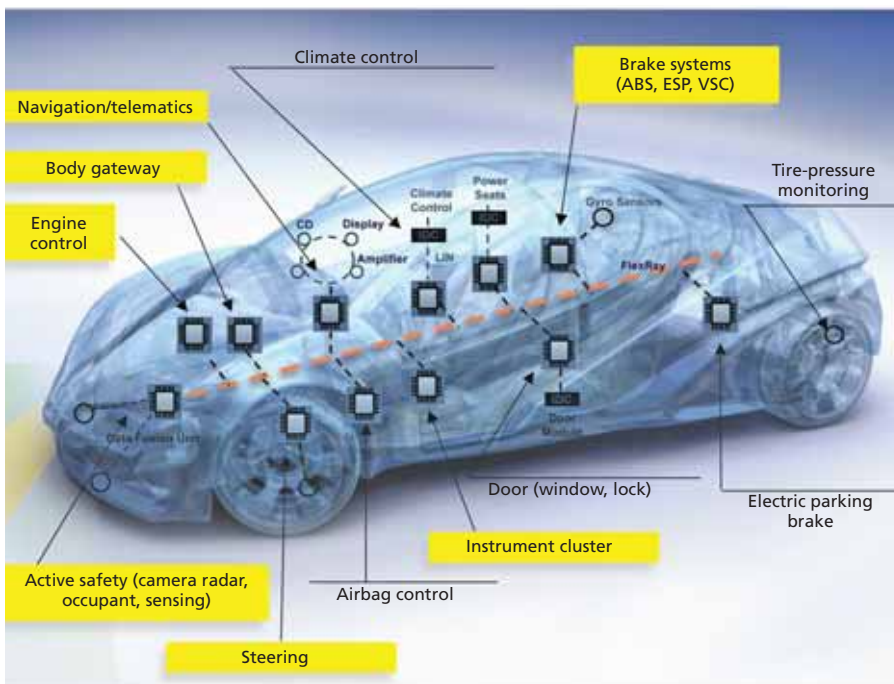
A key focus of the agreement is to develop the PowerPC architecture, which addresses the fastest-growing segment for automotive microcontrollers. According to **Strategy Analytics**, this segment should double from \$1.5 billion last year to \$3 billion in 2006.

The companies are both heavily involved in automotive applications, so they are not expecting short-term revenue for projects designed within the combined design project. "In 2009, we expect to see significant impact in the market," said Ugo Carena, General Manager of ST's Automotive Product Group.

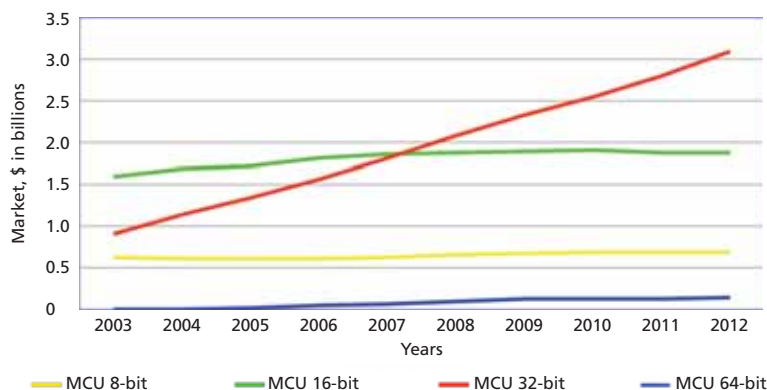
Strategy Analytics estimates that, in 2004, the two companies held the number one and number three positions, jointly controlling 21% of the \$16 billion automotive semiconductor market. The research house estimated Freescle revenues at \$1.8 billion and ST sales at \$1.3 billion.

The high-end processors will be focused on applications including engine and transmission control as well as fault-tolerant systems such as drive- and brake-by-wire, advanced vehicle control, and driver information systems. Carena said ST will not drop its other CPU (central processing unit) architectures and will continue to develop ARM processors for other automotive applications.

Freescle feels that licensing ST components such as power MOSFETs (metal-oxide semiconductor field-effect transistors) and IGBT (insulated-gate bipolar transistors) will augment its existing product lines, letting the company more easily address system



The Freescle/STMicro agreement targets many aspects of vehicle electronics.



The 32-bit PowerPC architecture addresses a high-growth market.

designs that require power handling. That includes hybrid vehicles, which have far higher voltages than those used in conventional vehicles.

"This license fills some of our gaps," said Paul Grimme, General Manager of Freescale's Transportation and Standard Products Group. Freescale had access to some of these products when it was part of **Motorola**, but that segment of the business was lost when Motorola spun off **On Semiconductor** prior to Freescale.

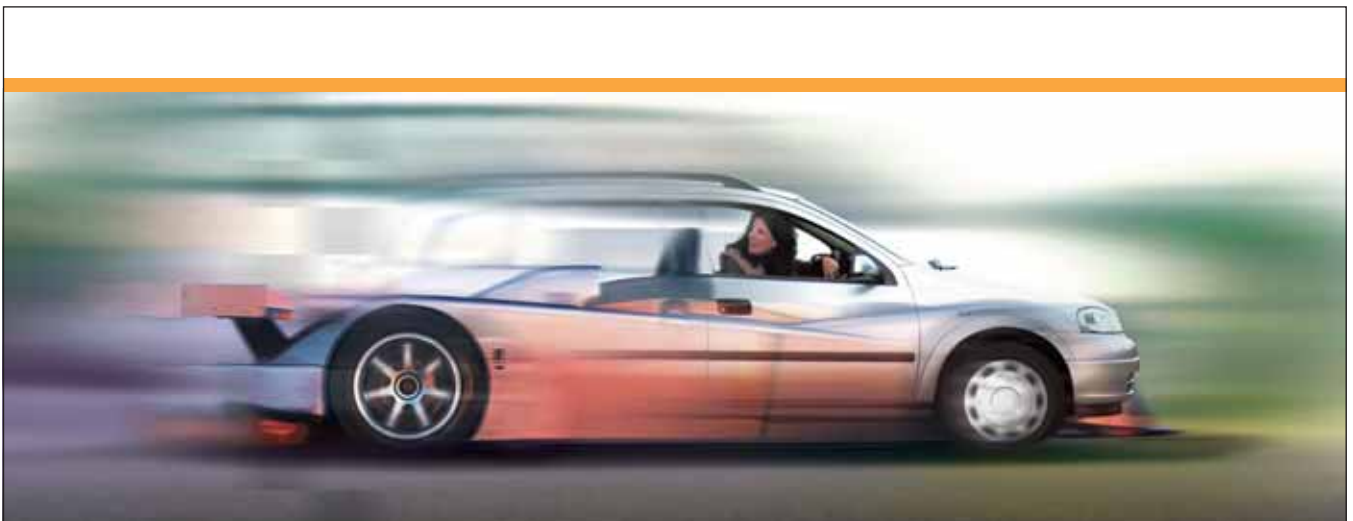
ST and Freescale predict that having

a second source for electronics will be a key market benefit. They also feel that joint development will shorten time to market and offer both companies better capabilities to address system-level challenges.

This is not the first time the two companies have joined forces. Since 2002, the two have worked along with **Philips Semiconductors** to develop CMOS (complementary metal oxide semiconductor) technology processes for 90-nm and smaller geometries in what's called the **Crolles 2 Alliance**.

In another of the many joint agreements used throughout the electronics industry, Freescale teamed up with **IBM** for PowerPC development just days before announcing the linkup with ST. Motorola also joined **Power.org**, a group begun last year to promote PowerPC technology. That 40-member group focuses on nonautomotive applications, as does the IBM-Freescale joint venture. ST has no current plans to join Power.org, Carena said.

Terry Costlow



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Korean automakers upgrade telematics

South Korean automakers led by **Hyundai Motor** and its affiliate **Kia Motors** are making their cars smarter by taking advantage of the stunning progress of South Korea's IT

(information technology) infrastructure. Hyundai is now developing 512-MB memory telematics, known as Mozen, for new sedans that will debut in the near future. Currently, the automaker's



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ArvinMeritor's latest door module technology will radically change the way OEMs design and assemble door systems. By integrating the doorframe with the window regulator, ArvinMeritor has increased cockpit space, improved fit and finish, reduced window noise, and improved glass stability. This is just one more example of how ArvinMeritor is integrating components into solutions that move the world.

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briefs

Philips Automotive Playback Modules and **Visteon** demonstrated their first car jukebox module concept at the 2006 Consumer Electronics Show (CES) in January in Las Vegas. While listening to one disc, consumers can simultaneously record up to 10 CDs into the system's flash memory at 4X speeds. Visteon's advanced user interface is said to give them the ability to navigate quickly and intuitively through the music tracks stored on the system. The Car Jukebox concept allows users to listen to up to 7 h of their favorite music. Once content has been stored in the Car Jukebox memory, users can leave their CD collection at home. In addition to playback of several formats such as CD DA, MP3, and WMA files, the concept can also record from external sources such as AM/FM or satellite radio. The unit fits in a half-DIN sized slot, reducing the interior real estate required by current CD changer units.

At the 2006 Geneva Motor Show, **Microsoft** and **Fiat** unveiled the first production cars featuring a Windows Mobile for Automotive (WMfA) in-car infotainment system called Blue&Me, which enables consumers to more safely use mobile devices such as Bluetooth-enabled mobile phones and digital entertainment devices. Its USB (universal serial bus) port can connect with a variety of personal music players and other devices. The software is upgradeable, so it can be refreshed to accommodate consumers' changing needs, supporting future devices and new industry standards. The low-cost in-car system was developed in under two years, with costs kept in check by using a standardized platform across multiple models.

According to **Frost & Sullivan**, the European automotive industry is witnessing a growing trend towards installing active safety systems in vehicles, which is one of the biggest factors propelling the demand for obstacle-sensing technologies. "The critical role played by sensors, and the absence of a definitive sensor that fulfills the equally important requirements of obstacle sensing and classification, has created an attractive market for various competing and complementing technologies," said Research Analyst Karthikeyan Vijayakumar. Valued at about €14.4 million in 2004, the European market for obstacle-sensing technologies is likely to increase substantially to €194.7 million in 2015 at a compound annual growth rate of around 26.7%. This is largely due to the introduction of vision and short-range sensors as well as the growing penetration of long-range radar sensors in passenger and commercial vehicles.



Hyundai's 256-MB telematics system is installed in the company's Grandeur luxury model.

new luxury model, the Grandeur, is armed with 256-MB telematics memory chips, compared with the automaker's initial 96-MB offering. To better control the automaker's powerhouse of engines, Hyundai is also trying to upgrade its engine control unit (ECU) to 32 bit from the current 16-bit ECU and previous 8-bit examples.

Various levels of telematics technology are installed on Hyundai's Azera, Equus, Sonata, and Santa Fe SUV in South Korea. Besides route guidance, current systems are used for vehicle-theft tracking. The company has real-time image services for drivers in its mid- to long-term plan. It is working to upgrading its current DVD navigation to encompass 4.5 million different types of information; the automaker's previous model of CD navigation had 220,000. Advancements are also planned for SOC (system on chip) applications that process driving information.

Hyundai expects it eventually will be able to provide car infotainment (information and entertainment) services as South Korean electronics companies including **LG Electronics** expand their investments in the sector on next-generation projects. Its customers will be able to enjoy the Internet and home entertainment, such as music and movies, in their cars in addition to the geographical and location services provided by telematics.

Kia Motors also is making its car smarter. Its current 30-40 SOC per car is up from about 10 chips in the late 1990s. The

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Hyundai's The Mozen telematics system is installed on the Azera, top-of-the-range Equus, and Sonata sedans, as well as the Santa Fe SUV.

automaker is also planning on using 32-bit, 4-8 MB memory chips in navigation and it is striving to make some of its cars into "moving offices" by upgrading their telematics, which were first installed in the Optima and Legal models in November 2004. Telematics upgrades are now planned for the Opirus sedan as well as Sorento and Sportage SUVs by helping service centers remotely identify problems in the cars with the aid of engine computer chips.

Over the past 10 years of rapid IT progress, South Korea has achieved

numerous milestones and breakthroughs. In 1996, the country rolled out the world's first commercial CDMA (code division multiple access) mobile phones service, emerging as a new force to be reckoned with in the global mobile communications markets. In 1998, the world's first broadband Internet service was launched in South Korea. Through these and other achievements, South Korea's IT industry has come into its own as a national growth engine.

Telematics is one of the 10 core next-generation technologies that South Korea is seeking to develop as part of the nation's future growth industries. The other growth engines, according to the government, include next-generation mobile communication, digital TV, home networking, ITSoc, next-generation PC, embedded SW, digital contents, and intelligent robots.

Of the long-term investment, 112.3 billion won will be spent in developing core telematics technologies, including

driving safety information database development technology, and expanding the sales of telematics terminals at home and abroad. The government will soon launch open-type telematics terminal software and upgraded image services will be pursued in the mid- to long-term.

"The upgrading of telematics, including navigation systems, would help South Korean car [companies] upgrade [their] competitiveness against other global giants such as [Mercedes-Benz]," Daeje Chin, Minister of Information and Communication, told **SAE**. But, he added, "When it comes to automotive telematics, South Korean automakers, I think, are pretty competitive against the major global players."

Currently, Japan accounts for about 60% of the global telematics market, with Europe and the U.S. making up about 30 and 5%, respectively. South Korea accounts for about 1%.

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System-level E/E design needed

As the complexity of automotive electronic and electrical (E/E) systems increases, one would expect design processes to follow suit. In reality, current design methodologies are lagging considerably, resulting in lower quality and increased development time and costs. Automakers recognize that their low-tech design methods are on borrowed time and are seeking a system-level design process for which the entire E/E architecture is designed using a top-down approach.

Many of today's production vehicles are loaded with high-tech features, with high-end vehicles containing as many as 80 electronic control units (ECUs). Furthermore, the majority of these ECUs must communicate with one another in real-time to realize the features while adhering to all functional timing requirements. Specifying and developing a highly distributed, reliable, real-time E/E system is a complex challenge that requires specialized practices and tools, causing automakers who try to design without them to risk delivering lower-quality products.

Even vehicle features that are typically perceived as simple on the surface contain inherent complexities not manageable using traditional engineering methods. As an example, consider a real-world implementation of the power door lock's lock-all feature. The requirements are fairly straightforward: all doors must lock within 200 ms, and all locks must be actuated within 20 ms of one another. This does not seem very challenging, but in actuality requires four microprocessors, three communication buses, two communication protocols, and at least three multiplexed messages, as well as operating systems, software drivers, and application code.

Using a distributed architecture may seem like an overly complex approach to implementing a relatively simple feature. Instead, why not simply hardwire a button directly to the door-lock actuators? The answer to this is cost. Wiring harness costs are among the most expensive vehicle components—second only to the powertrain. Therefore, much effort has been made to minimize the amount of vehicle wiring. This has resulted in an explosion of in-vehicle

networks based upon standards such as J1850, controller area network (CAN), and local interconnect network (LIN). Today, the most complex vehicles have as many as 10 distinct networks.

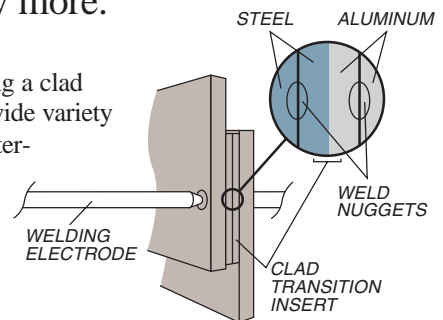
The obvious trade-off for the reduction

in wiring costs is increased design complexity. Determining how to optimally allocate the many vehicle functions to a limited number of resources, while ensuring that the solution provides real-time behavior, is a problem that

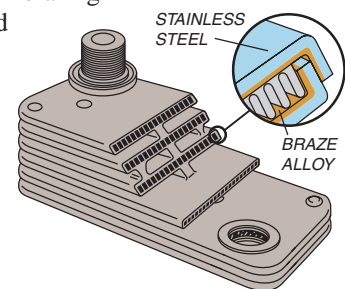
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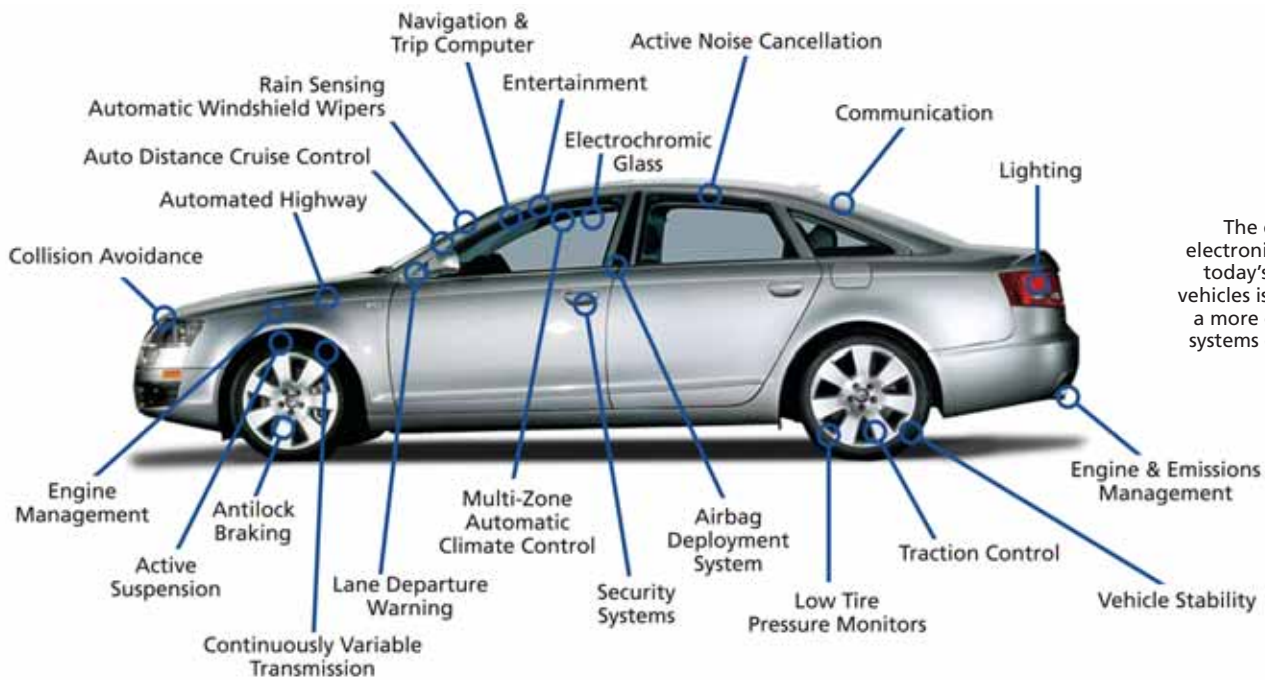
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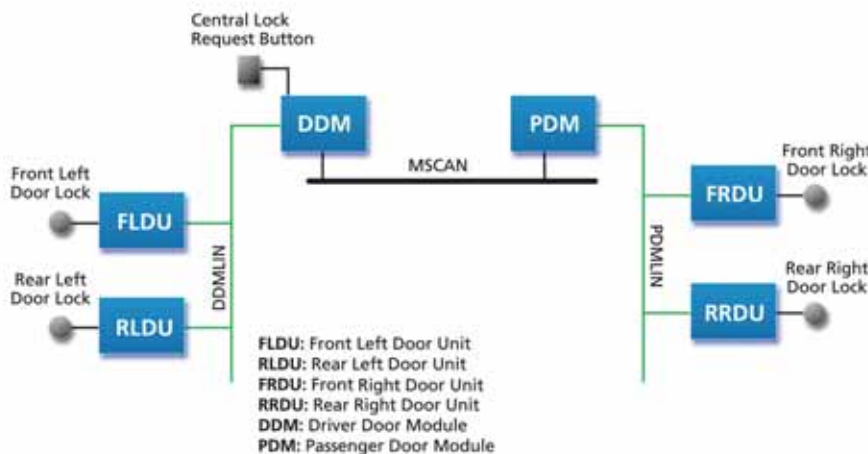
The explosion of electronic content in today's production vehicles is making for a more complicated systems engineering challenge.

one vehicle function can have unknown side effects that may cause another function to stop working properly. In many cases, engineers end up chasing their tail in the quest to solve these types of problems and can have no assurance that intermittent problems will not surface in the hands of consumers.

Fortunately, technical solutions do exist today that are allowing automakers to incorporate system-level design methods. Some OEMs are using sophisticated network scheduling tools to design deterministic, real-time CAN networks, while others use advanced microprocessor simulators to analyze latencies in their embedded code. While these technologies alone provide significant benefit, it is the merging of these types of technologies that the industry is really after, and solutions are on the horizon.

One of the most important solutions is in the form of a new set of standards from the **AUTOSAR** (Automotive Open System Architecture) consortium that focuses on improving design processes, increasing scalability and flexibility, leveraging off-the-shelf components, and optimizing resource usage. AUTOSAR will be the basis for comprehensive, seamless tool-chains that will allow automakers to design robust, high-quality E/E systems while minimizing development time and warranty costs, resulting in increased profitability.

This article was written for AEI by **Jason Paskvan**, Senior Transportation Product Specialist, Mentor Graphics.



Even a simple door-lock system requires an architecture using CAN and LIN.

many automakers are unable to solve. Implementing the door-lock feature requires an electrical engineer to consider things such as CPU (central processing unit) utilization, interrupt latencies, OS (operating system) task switching, CAN communication latencies, LIN communication latencies, execution time of communication drivers, buffer utilization, application polling intervals, and hardware latencies.

Even in isolation, designing and validating the door-lock feature is not a trivial task. The problem becomes exponentially more complex when you consider that there are many dozens of functions all competing for the same resources. Proper design of the door-lock feature, for instance, requires precise

knowledge of worst-case latencies. An engineer must know, among other things, the worst-case interrupt latencies, the least-optimal OS task switching, the maximum amount of time it will take to access the CAN bus and send a message, and worst-case polling intervals. This information can only be known if all of the features are designed from a system-level perspective, implying that each feature is designed with knowledge of resource requirements of all other features.

Without system-level design, there can be no assurance that features will work when brought together. System-level failure is a common problem with current methods, and solving these problems can be next to impossible. Making changes to