Jaspar Steps Up

With a lot of help from their friends, the Germans have created most of the network standards planned or in use for vehicles made the world over. The most widely accepted of these include the CAN (mid-speed), LIN (low-speed) and FlexRay (high-speed and secure) communications protocols. Not stopping there, the Germans also initiated the Autosar open system architecture partnership, which is developing a common design approach so ECUs software and hardware will plug-and-play even though it is produced by different suppliers on behalf of different models or carmakers.

In the past, the Japanese have seemed content to let Germany take the lead on standards. No more. While in Japan for the Tokyo Motor Show recently, I spoke with top electrical engineers from Toyota, Honda and Nissan and learned that the Jaspar (Japan Automotive Software Platform and Architecture) consortium aims to speak with one voice not only about Autosar and FlexRay, but also regarding microcontroller and tools standards.

Toyota managing officer Takashi Shigematsu, one of Jaspar's founders said, "The Germans have led many of these activities, and we appreciate that. It is great that the timing is such that we Japanese should lead certain parts of this automotive electronics work." Founded September 8, 2004, Jaspar membership includes Toyota, Nissan and Honda along with electronics parts makers, semiconductor makers and tool makers, among others.

Toshihiko Abo, deputy general manager of Nissan's electronics engineering division has been active in Jaspar from the beginning. Mr. Abo remembers talking with Toyota before Jaspar was formally announced: "We discussed cooperating in noncompetitive fields, whatever they might be--software, communications, micros and tools and more, Jaspar is an open-ended consortium."

"We are currently setting up a tools working group in Jaspar," noted Mr. Shigematsu. "Unless OEMs around the world speak with one voice, each of them will make different requirements, which leads to duplicated efforts for the OEM and for the tool vendors." Tool vendors have been urging carmakers to co-ordinate their tool requirements for more than a decade so that tool components can seamlessly connect to each other without a lot of engineering effort. A working group is also being organized to develop common microcontroller requirements.

The objective of the group: plug-and-play microcontrollers that fit a variety of operating systems.

Honda, which has been a member of Jaspar since October 2004, joined the Jaspar board in September 2005. Honda is keenly interested in supporting both Autosar and FlexRay.

Jaspar's Role in Autosar and FlexRay

Because the Jaspar consortium will represent the common position of the Japanese automotive electronics industry, it sees itself on equal footing with the Autosar and FlexRay groups. Jaspar will review the Autosar and FlexRay specs and offer suggestions about how they can be improved. The FlexRay standard is Jaspar's first priority. Jaspar will also develop an implementation layer for each of the standards. Nissan's Mr. Abo: "The European consortia have a global view and a top-down approach to the specifications, but from the Japanese viewpoint, the definition of the implementation level is not sufficient." With the implementation layer specified, the application developer's work is much reduced.

In the case of FlexRay, Mr. Abo wants to be sure that suppliers of electronic control units have a sufficiently detailed specification so any supplier's conforming ECUs can be plugged into any FlexRay system.

CEA's MOST Aftermarket Gateway Fights Uphill Battle

Growth of the mobile electronics aftermarket in the United States has been modest over the last few years with sales of head units, amplifiers, CD players and changers declining in favor of factory-installed audio and entertainment systems. New E/E architectures have made updating or adding to factory systems in the aftermarket all but impossible as carmakers deploy fiber-optic or other networks to integrate sophisticated systems. A big problem for aftermarket installers, for example, is radio head units that are integrated with climate controls: there's no way to replace the head unit without affecting the HVAC. Other challenges to aftermarket installers include the risk of damaging features such as tire pressure and the oil-life expectancy display if the radio is removed, plus the likely loss of OEM warranties for the affected parts.

In response to these challenges, the Consumer Electronics Association (CEA) has been working with the Media Oriented Systems Transport (MOST) cooperation to develop a gateway to the vehicle that would be friendly to aftermarket devices. Published in May 2004, CEA 2012 defines a MOST interface that carmakers could install in their vehicles; aftermarket suppliers could use that common interface to safely plug in a variety of products such as upgrades to the audio system like amplifier, sub-woofer and speakers, or a navigation system.

Last January at the 2005 Consumer Electronics Show in Las Vegas, CEA was promoting the CEA 2012 MOST aftermarket gateway at its booth, but since then the subject has received much public attention. Alpine and Unwired Technology also showcased CEA MOST gateways at their booths at CES 2005.
Unwired Technology demonstrated an early prototype of an IR-headphone system where four headphones could listen to separate audio tracks. The system was designed to plug into a MOST interface. “We haven’t brought that aftermarket device to market because, so far, no carmakers are offering a MOST gateway,” explained Unwired Technology President, Larry Richenstein.

Thus far, it is mostly the German makers of upscale vehicles who have committed to factory installing a MOST network in high-volume applications. MOST defines the protocol, hardware and software layers necessary to implement a high-speed, plug-and-play, fiber-optic infotainment network. Other carmakers, most notably Toyota and Honda, are considering the implementation of MOST networks some years from now, but they won’t do so unless MOST is shown to be highly reliable and cost effective. (Please see our article in the October 2003 issue of our publication.)

MOST is not yet possible, carmakers use IEEE 1394 only if driven to do so by consumer demand for particular features that benefit the consumer and if MOST components get more cost effective.

Aaccording to Stephan Lehmann, global automotive strategy manager for Freescale TSPG, another major obstacle to the implementation of MOST is that the standard isn’t completely open. In his view, because full compliance testing of MOST is not yet possible, carmakers use MOST today according to their specific interpretation of an open standard. “The question is,” according to Mr. Lehmann, “How do you prove that your MOST interpretation is interoperable with all the other implementations?”

A new greater obstacle will be getting carmakers to install a gateway in their vehicles, which some OE engineers see as an opportunity for low quality consumer products to intrude into the vehicle. One of Nissan’s top electrical engineers told me recently that Nissan has no interest in a MOST gateway for consumers. “That would be dangerous,” said Toshimi Abo, deputy general manager of the electronics engineering division of Nissan Motor Co. “If the consumer electronics in the car fails, the consumer would blame it on us.”

Besides the reliability issues of giving greater access to the aftermarket, carmakers will certainly consider the potential loss of hundreds of millions of dollars of revenue should the mobile equipment aftermarket start to take a big bite out of the market for factory-installed features.

While our research has not been exhaustive, we found only one top OE engineer, Stephan Wolfslies, vice president in charge of electronics development at Mercedes, who sees the MOST consumer electronics gateway as a positive development.

Las Vegas is the place to be each January as auto electronics movers and shakers come to town from around the world. Most visit the Consumer Electronics Show to learn what they can from companies who directly serve mobile electronics consumers in the aftermarket. Carmakers come looking for fresh ideas about what electronics features to consider for factory installation and to learn about hot new portable products that consumers may one day be operating in their vehicles. This year, CES will run from January 5-8, 2006.

Worth a look while at CES is the SuperSession Connect2Car: The Auto-mobile Convergence with Consumer Electronics, organized by the same industry insiders who produce the excellent Convergence Conference on Transportation Electronics in Detroit every other year. (Convergence 2006 is set for October 16-18, 2006. The Connect2Car session on January 6 from 10:00 a.m. to 3:00 p.m. will consist of two panel sessions moderated by Bobby Likis of the Car Clinic. Between the panel sessions, a luncheon keynote will be delivered by Mark V. Rosenker, acting chairman of the National Transportation Safety Board. A t

Hansen Report on the efforts to replace fiber-optic cable with twisted-pair copper, considered a more reliable physical layer for MOST.)

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Continued from page 1
Dual Displays and iPods

At the Toyota Motor Show you can stroll along a single aisle connecting the three main exhibit halls and pass booths devoted almost exclusively to OEM quality for the navigation, telephone, radio and sound system. A long with BMW, Harman Becker and Oasis Silicon Systems, Mercedes is one of the pioneers of the MOST protocol and has used it in its vehicles since MY 2002.

For now the Consumer Electronics Association is promoting MOST as a gateway only for portable devices, not just the iPod, but other portable music players (e.g. portable multimedia hard drives or Flash memory drives), satellite radios, cell phones and Bluetooth nodes. “We are starting with the simplest devices and expect it will expand from there,” said Chris Cook director of mobile electronics member relations for the Consumer Electronics Association. CEA proposed USB, RS-232 and CAN as possible control interfaces on the consumer side of the 2012 gateway. CEA won’t be demonstrating MOST at its booth at CES 2006 in January.

We asked Mr. Cook why carmakers should provide a gateway to consumer devices. “The research we’ve done shows that consumers would rather buy a vehicle that gives them the option to upgrade the electronics,” said Mr. Cook. “That capability increases demand for the vehicle and puts carmakers in a position to be the enabler of technology rather than the provider. Plus they can make money on the gateway,” he pointed out. Mr. Cook sees the gateway becoming a product that carmakers could perhaps bundle with premium option packages. CEA is trying to tell the auto industry “This is how you keep up with technology.” With the gateway, consumers would have far more choice than they have today. Mr. Cook recently left the CEA to take a job as director of strategic business with 12-volt accessory supplier, AAMP of America.

Japanese Speakers Only

Theoretically at least, Jaspar is open to any engineer capable of making a strong contribution to the work of the organization, regardless of his company affiliation. However, that engineer must be fluent in Japanese and willing to attend frequent meetings in Japan. The Jaspar website is in Japanese only. One of the strong motivations for Jaspar is the expense and inconvenience of traveling to AutoSar and FlexRay meetings abroad and speaking a non-native language. Some suppliers with offices in Japan, Bosch and Freescale for example, are members of Jaspar.

While Ford and GM contribute to the FlexRay and AutoSar consortia and are members, their influence in global automotive electronics standards making is not nearly as strong as the Germans and the Japanese. There is no American equivalent to Jaspar.

Corporation was exhibited in the Sanyo booth. The vast majority of navigation units sold in Japan come with TV.

VICS Still Growing in Japan

VICS (Vehicle Information and Communication System), Japan’s government- and industry-sponsored traffic information service launched in 1996, serves more than 13 million customers today.

VICS Receiver Shipments in 000s of Units

<table>
<thead>
<tr>
<th>Year</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
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<td>998</td>
<td>1,684</td>
<td>2,092</td>
<td>2,536</td>
<td>2,768</td>
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</tr>
</tbody>
</table>
The Company Profile... Freescale Semiconductor

**Background**

From 1953 until July 2004, the company that today is Freescale Semiconductor Inc. operated as Motorola SPS, the semiconductor products sector. With over 50 years experience developing embedded processors and sensors, as well as pioneering process and packaging technologies, Freescale aims as an independent company to become the number-one, number-two or number-three supplier in each of its target markets: automotive, wired and wireless networking and computing, and wireless communications. Freescale claims the number-one spot in automotive semiconductors today, with its products on the road in 40% of new cars worldwide.

Motorola spun off Freescale in July 2004 through a $1.58 billion IPO of roughly 121.6 million shares of Class A common stock at $13 per share, about 30% of the company’s equity. Together with a debt offering, Freescale raised approximately $2 billion. Motorola retained its 67.5% ownership of Freescale until December 2004, when the parent company distributed all its Class B stock to Motorola shareholders. Freescale stock is listed on the New York Stock Exchange, and the company is included in the Standard and Poor's Index.

S&P gives Freescale a BB+ credit rating with a positive outlook, noting the benefits of some restructuring but also the lack of profits in the wireless business segment and that segment’s continued reliance on Motorola.

Europe is Freescale's fastest-growing region for automotive sales and produces nearly the same amount of revenue as the Americas, according to Paul Grimme, vice president and Transportation and Standard Products Group general manager, speaking at a Deutsche Bank Securities conference in early November.

**Automotive Business**

Freescale’s automotive business is included in the Transportation and Standard Products Group, which accounted for 45% of Freescale sales in 2004. The automotive market accounted for more than 70% of TSPG sales in 2004 and nearly 32% of Freescale's total sales. When we profiled Motorola SPS in 1998, automotive contributed only 17% of total sales.

Freescale's most important competitive distinction is product leadership: "We provide the most advanced technology..."
Freescale 2004 Automotive Sales by Product

2004 Automotive Sales: $1,817 Million

- Processors, 73%
- Analog and mixed signal ICs, 21%
- Sensors, 6%

Freescale Stock Price Since IPO

Global Automotive Semiconductor Sales by Supplier and by Application

2004 Total Market: $15.1 Billion*

- Infineon, 9.1%
- ST, 8.3%
- Renesas, 7.0%
- NEC, 6.2%
- Toshiba, 6.1%
- Philips, 6.0%
- Bosch, 5.9%
- Fujitsu, 2.2%
- TI, 3.4%
- Others, 28.0%

2005 Total Market: $16.3 Billion*

- Powertrain, 28%
- Driver Information, 9%
- Audio, 10%
- Safety, 13%
- Chassis, 15%
- Security, 5%
- Body, 20%

*Includes chips for in-car entertainment

Data: Strategy Analytics, Milton Keynes, U.K.

that gives our customers unique capabili-
ties with which to differentiate their prod-
ucts," explained Peter Schulmeyer,
director of strategy for Freescale's Trans-
portation and Standard Products G roup.
A n objective measure of that product
leadership is the high percentage of sales
that Freescale spent on R&D in 2004:
16.9%.

W hile Freescale has the largest share
(12%) of the automotive semiconductor
market, that claim may not stand for very
much longer. Since 1997 Freescale's auto-
motive business has grown at just 4.8%
per year, a few percentage points below
the growth rate of the market.

O perating margins for TSPG have
been improving for the past three years. In
2004 the segment produced $231 million
in operating revenue, or 9% of net sales.
A ccording M r. Grimme, 15% operating
margin is the long term goal for TSPG.

Freescale is counting on sales growth
coming from increased electronics con-
tent in vehicles and increased market

share, particularly in markets outside the
U nited States. A s a long time supplier to
Delphi and Visteon, Freescale's future
sales are to a large degree tied to the for-
tunes of G eneral M otors and Ford. W hile
Freescale declined to rank its customers by
sales, its third-quarter SEC filing notes
that 5% of company revenues and 10% of
T SPG sales are related to shipments to
Delphi, currently in C hapter 11 bank-
ruptcy. Freescale's third-quarter 10Q states:
"Delphi has noted an unsecured debtor claim of approximately $23 million
related to the Company [Freescale] in its initial C hapter 11 bankruptcy filing docu-
ments. ... T he Company has recorded an allowance of $10 million due to the poten-
tial impairment of the trade receiv-
ables." Freescale also noted that any
UAW work stoppages at Delphi in con-
nection with the Delphi restructuring
would have a "material adverse effect on
T SPG's business." A t press time, such a
work stoppage appears to be gaining mo-
mentum.

Freescale expects to pick up automo-
tive business in Japan next year and hopes
to win market share in Japan by offering
products not readily available from com-
petitors such as Renesas and N EC. T hose
products, according to M r. Grimme,
include high performance PowerPC micro-
processors as well as "some analog
processors and some sensors." Freescale
also sees growth opportunities in naviga-
tion in Japan and Europe. In 2004 just 5% of
total Freescale sales were from Japan.

W hile winning domestic business in
Japan is noteworthy, given the strong
Japanese preference for doing business
with fellow Japanese, any sales gains made
there are likely to be small. Freescale's
predecessor, M otorola, has been doing
business in Japan since 1968 and by 1991
had managed to win just $30 million in
automotive semiconductor sales, about
3% of the market at the time. A ter many
years in Japan, Freescale's share of the
Japanese market is down to just 2.1%
continued on following page
Freescale Semiconductor

presently. Very few Western automotive electronics suppliers have attained the market share of Japanese business that Freescale has.

Elsewhere, the company also sees market opportunities from vehicle production growth in China, South Korea and Eastern Europe. Peter Schulmeyer believes China is his most promising market long term. “The electronics supply industry in China is still in its infancy. China is very interested in developing its own supplier industry, and we certainly want to be there in the beginning as that happens,” he said. In 2005 Freescale established an applications and systems lab in Shanghai, China to facilitate development work with local customers. They built a similar facility in Seoul, Korea.

While Freescale’s annual report claims “nobody puts more silicon in cars than we do,” the company is reluctant to reveal exactly where that silicon goes. Freescale does not break down TSPG sales by application, but lists its primary automotive applications alphabetically: airbags, anti-lock braking systems, comfort, engine management, instrument clusters, navigation and tire pressure sensors, plus radio.

Powertrain applications account for the largest share, 28%, of the $16.3 billion worldwide automotive semiconductor market in 2005, according to U.K.-based market researcher Strategy Analytics. Strategy A nalytics expects demand for automotive semiconductors to grow by 7.8% annually through 2006, driven not only by emissions and fuel economy regulations, but also by performance, safety and infotainment.

Freescale claims it holds “up to 50%” market share for powertrain electronics today. In 1978 the company, then Motorola SPS, introduced the world’s first microcontroller for engine management, the 4,000-transistor MC 6801.

32-bit devices

Freescale expects demand for 32-bit microcontrollers in vehicles to expand rapidly as engine management features such as electronic throttle control, variable valve timing and cylinder deactivation become more widely applied. Advanced safety features including adaptive cruise control, electronic stability control and vision-based systems will also require increased performance from embedded processors.

Freescale continues to improve the performance of its MPC5x family of PowerPC-based 32-bit microcontrollers, first brought to market in the mid-1990s. PowerPC microprocessors are designed to an open standard jointly developed by IBM, Apple and Motorola.

According to Freescale, its MPC5554 latest-generation RISC-core, 32-bit microcontroller offers five times the performance of its predecessors, with more on-chip functionality and 2 M B on-chip Flash with longer term data retention capability. MPC5554 is the company’s first qualified product based on Freescale’s MPC5000 family, with more derivatives in development.

At the Convergence conference in 2004, GM and Freescale announced that all future GM powertrain developers globally would specify Freescale’s MPC5500 family of PowerPC microcontrollers. With this family, Freescale can take advantage of model-based programming to a greater degree than in the past. Model-based controls, which calculate equations in real time, place significantly greater requirements on the microcontroller than do look-up tables, where the calculations are made before the vehicle is produced. Model-based controls provide greater precision. The MPC5500 family gets its performance from parallel processing where many instructions can be run at the same time. Designed from scratch with automotive requirements in mind, each MPC5500 family microcontroller is comprised of about 30 million transistor gates.

Freescale customers get more than just a microcontroller when they choose the MPC 5500; they get a development environment with which products can be quickly readied for market. In the GM application, after the first microcontroller was built, it took Freescale just two days to get the first prototype chip up and running from the time it was plugged into the first board. In the past, this step might have taken three months or more.

The first production runs for the new GM business are scheduled to begin in 2008. The two companies say they will be

Freescale TSPG Core Capabilities
Part of Freescale’s growth strategy is to leverage the competencies it won in the automotive market in the industrial, computer and consumer product markets.

Products
- Embedded processing
- Power management
- E-Switches
- Solid state sensors

Competencies
- Processor cores
- Connectivity
- Embedded Flash
- Smart power integration
- Micromachining

Top Automotive Customers
(listed alphabetically)

BMW Delphi*
Bosch Motorola
Continental Teves Siemens VDO
DaimlerChrysler Visteon

*S.R. Schulmeyer noted, is the trend toward more autonomous vehicle control functions, especially systems contributing to active safety such as electronic stability control, collision avoidance and vision-based lane-keeping systems.

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While sharing a traditional Bavarian breakfast of beer, white sausage and pretzel in the café at Audi's Frankfurt Auto Show facility, Dr. Willibert Schleuter explained some of the things that make electronics engineering at Audi special, besides the German carmaker's Bavarian roots.

"Because electronics has the greatest potential to bring disaster to a carmaker, we decided it was extremely important to bring together a strong team of people from different departments around the company: development, product and project management, purchasing, IT systems, cost control, production planning and quality assurance, and put them all under one roof." Engineers from Bosch, Siemens VDO, Harman and other suppliers also reside at Audi's new Electronics Center.

Situated near company headquarters in Ingolstadt, Germany, about 40 miles north of Munich, the most remarkable thing about the Audi Electronics Center, besides its striking modernity, is that the facility was built on the organizational maxim developed by MIT Sloan School researcher professor, Tom Allen. According to Professor A llen, communications among engineers gets worse the farther from each other they are located. Professor Allen's research revealed a distinct correlation between distance and frequency of communication. "If you bring people together, their time is more active and they make faster decisions," noted Dr. Schleuter.

Connecting Autos, Labs and Offices

The Electronics Center design and its thoughtful integration within the Ingolstadt grounds were implemented by one of Germany's top architectural firms, Düsseldorf-based RKW Architektur + Städtebau (Architecture and Urban Planning). RKW partner Matthias Pfeifer explained what motivated his work. "It was very important, for Dr. Schleuter in particular, to bring these people close together. The first step to good communications is seeing each other. So we had to design it so people from the offices and the workshops could easily do that," explained Mr. Pfeifer. A huge hall in the middle of the building with open galleries makes it easy to find a colleague. Smaller spaces including open courtyards and gardens provide "home bases" that also facilitate communications. According to Mr. Pfeifer, good communications goes beyond open sight lines and pleasant meeting places: "It was also important to create a very big roof so everyone could feel part of this working community, all pulling in the same direction."

The electronics team, now numbering 750 employees, took possession of the 21,100 square-meter Electronics Center, with 9,000 square meters of workshop, laboratory and test facilities, in September 2003, and according to Dr. Schleuter it is already showing impressive results. "We used it for the Audi A8. I compared the statistics from the start of production of the A6, the sixth generation, to the A8. Here were five-times fewer problems with the A8," declared Dr. Schleuter.

This year German consumers showed their appreciation for the Audi brand. In a survey of 100,000 drivers by auto motor und sport magazine the Audi A8, A6, A4 and A3 each took first place in their segments.

American customers, however, weren't so positive about the A8's reliability. A survey in Consumer Reports magazine found more than the average number of electrical and power equipment problems in the A8 in 2004 and 2005 vehicles. The magazine gave the A8 a predicted reliability rating of "poor" for both years.

Audi's top electrical engineer, Dr. Schleuter has held his position longer than any of his peers at Mercedes, BMW or Volkswagen.