Web Exec Thinks Carmakers Are Missing Big Opportunity

"App Developers Are the Key"

The conversations today between Web executives and people from the auto industry are probably a lot like the conversations in the early seventies between car guys and folks from the electronics industry who thought electronics could make lots of money for carmakers. There is disbelief on both sides.

Brian Mulloy is a Web and software executive and developer who splits his time between Detroit and Silicon Valley. I spoke with him in his role as vice president for products at Apigee Corporation, a 180-person Palo Alto, California, startup that makes Web APIs and tools to support app developers.

“Every major API out there uses our stuff,” said Mr. Mulloy, “Twitter, Netflix, Facebook, Groupon, LinkedIn, and the weather providers Weather Channel and AccuWeather,” among others.

Prior to the launch of the Chevy Volt in China, OnStar bought an API gateway from Apigee to implement an iPhone app that lets users check the battery, lock and unlock the car. Using Web protocols, the API allows the iPhone app to talk to the connected car. “In the OnStar application, the phone and the car are both HTTP clients and we help make those things work together,” noted Mr. Mulloy.

Lots of businesses have gotten very rich from connecting people to services by means of the Web, and many of those businesses are based on computing platforms like the iPhone, which are far less sophisticated than today’s connected cars. “The automobile is a much more interesting platform to do stuff on than the iPhone,” said Mr. Mulloy. “There are more sensors, more processing power. Every Volt has its own dynamic IP address.”

What’s Next in HVAC

Behr’s Markus Wawzyniak Discusses the Challenges EVs Present. Heat Pumps Show Promise.

HVAC engineering is getting a lot of attention these days as carmakers explore ways to extend the range of electric vehicles. HVAC systems consume an awful lot of energy. Indeed, keeping EV occupants warm requires about as much energy as driving.

Markus Wawzyniak, director of HVAC advanced engineering at Behr, a leading tier-one supplier, summarized the challenge that HVAC engineers are facing with electric vehicles: “In the city portion of the European drive cycle, the average speed is 18 kilometers per hour, roughly 12 mph. At that speed, only two or three kilowatts of energy are required to propel your vehicle down the road. At zero degrees Celsius, you need roughly two-and-a-half kilowatts of energy to maintain an adequate cabin temperature. That is simply to maintain it; it doesn’t account for the energy needed to bring the car up to temperature if it’s been sitting outside. At zero degrees ambient, a compact to mid-size vehicle in city traffic needs about as much energy for driving as it needs for heating. Your 100-mile-range electric vehicle will give you only 55 or 60 miles in the winter.”

Behr and other HVAC suppliers currently offer two types of heating systems that could be used in hybrid and electric vehicles: PTC (positive temperature coefficient) electric air heaters and PTC electric coolant heaters. PTC air heaters, which are not prone to overheating due to their electric resistance increasing with temperature, are presently used in diesel powered vehicles. More energy efficient than internal combustion engines, diesel engines generate too little waste heat to sufficiently heat the cabin, so an auxiliary PTC heater is used. But the PTC heaters used in diesel vehicles typically have a heating performance of about 1,000 to 1,500 watts, while electric vehicle applications require 4,000 to 5,000 watts when the electric heater is the sole source of heating energy.

Some vehicles like the Chevy Volt plug-in hybrid use an electric PTC heater installed in the engine’s coolant circuit. The Volt’s engine isn’t always running, so waste heat isn’t always available. The heated coolant is piped to the air-conditioning module inside the instrument panel where the coolant heats the air for the cabin. Because a pump is needed to operate the system, and the coolant loses some of its energy to the ambient, it is not quite as efficient as the air heater. “Both approaches have pretty high efficiencies. An air heater has an efficiency of 100% and a coolant heater has an efficiency of 80% to 90%,” noted Dr. Wawzyniak, “but either way, you get a reduction of electric vehicle range of roughly half.”

Heat Pumps

According to Dr. Wawzyniak, the technology everyone in the industry is looking at for electric vehicles is heat pumps. They would handle both heating and cooling and are therefore complicated and very expensive, probably costing no less than 200 euros per vehicle, in his estimation.

Widely installed for residential heating, especially in Europe, heat pumps use the components of refrigeration (refrigeration, especially in Europe, heat pumps use the components of refrigeration cooling and are therefore complicated and very expensive, probably costing no less than 200 euros per vehicle, in his estimation.

Leading Tier-One HVAC Makers

Alphabetically
Behr
Delphi
Denso
Valeo
Visteon

Turn to HVAC, page 2
an, compressor, condenser and evaporator) to transfer thermal energy from one place to another.

Unlike a residential heat pump, an automotive heat pump must not only handle both heating and cooling, it must also dehumidify the air like an air conditioning system so the windshield doesn’t fog up. And it needs to do so without overcooling the passengers. Dr. Wawzycki explained: “In a conventional vehicle, that is very simple. You have two completely independent systems: an AC system with refrigerant and a coolant system for heating purposes. The heat pump—an array of hoses, lines, valves and heat exchangers that extend from the front end of the vehicle into the cabin—needs to meet these and other operating requirements with just one circuit. Not only do you need an additional heat exchanger, but you need a new family of electrically actuated refrigerant valves to control the different operating modes.”

Dr. Wawzycki anticipates that all areas of thermal management will need not only more valves, but valves that are extremely energy efficient. “We need valves that consume energy only when they are being adjusted. Valves today are current-free in only one position. In any other position they need a continuous supply of current. While each valve actuator might need just five or ten watts, if you have four or five or six of these valves, as you do in a heat pump, the power consumption adds up,” he noted.

Compared with conventional HVAC systems, which nearly halve an electric vehicle’s range, heat pumps can keep occupants comfortable at a cost of only 20% of the vehicle’s range. Behr continues to invest in heat pumps, but because of their cost and complexity, heat pumps haven’t yet been applied to production vehicles.

**Thermoelectric Systems**

“Behr is one of the key suppliers worldwide of automotive vapor compression systems, so we are continuously on the lookout for alternative ways of generating coldness, for example with thermoelectric or magnetocaloric devices. But their efficiency is very low, and their cost is extremely high,” said Dr. Wawzycki.

“Some OEMs offer thermoelectric cup holders that, at best, keep chilled beverages cold. An automotive air-conditioning system [in contrast] has performance requirements that are two to three orders of magnitude higher than an electric cup holder,” he added. Dr. Wawzycki believes thermoelectric and magnetocaloric are technologies to be watched. If someone makes a significant material breakthrough, then cooling systems using this technology could be viable in ten or twenty years.

**Occupant-Focused HVAC**

In an electric vehicle you can significantly reduce the energy usage if you focus energy only on those areas of the vehicle that are actually occupied.

“This will not help you make a smaller system,” said Dr. Wawzycki, “because some of the time you will have four or five people in your car. But most of the time people are driving by themselves. With input from seat sensors or seatbelt sensors, we can develop air-conditioning systems and control strategies that provide thermal comfort only for the areas where there is a passenger.” This would require additional HVAC actuators to shut off airflow to the appropriate areas of the vehicle.

In early 2012, Denso launched a system that can cut off heating and cooling to unoccupied seats. The interior of the HVAC unit is divided into five sections, each connected to specific air vents.

While occupant-based heating and cooling is appropriate for electric vehicles, we may eventually see it in vehicles with combustion engines as well. “In Europe, not just diesel but also gasoline engines are getting so efficient that often there is not enough waste energy to heat up the cabin. More and more vehicles are therefore being equipped with auxiliary PTC heaters, or they use engine control strategies to artificially boost the rpm or enrich the fuel so the vehicle intentionally runs in a less efficient way to generate more waste energy,” Dr. Wawzycki said. These auxiliary electric heaters can increase fuel efficiency.

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**THE HANSEN REPORT ON AUTOMOTIVE ELECTRONICS**

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Managing Editor/ Brianne Wolfe
Circulation Manager
Director of Marketing Michelle Long

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**Semiconductor Bill of Materials for ICE and Hybrid Vehicles in 2015**

<table>
<thead>
<tr>
<th>Component</th>
<th>ICE</th>
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<tr>
<td>Sensors</td>
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<td>16%</td>
<td>18%</td>
</tr>
<tr>
<td>Power</td>
<td>76%</td>
<td>64%</td>
</tr>
</tbody>
</table>

Source: Strategy Analytics' data provided by Infineon Technologies
In a talk given last summer at an Ignite Great Lakes event in Michigan, Mr. Mulloy quoted Ryan Sarver, director of APIs and platform at Twitter, who supports his view that cars represent enormous, untapped value. “APIs make cars a software platform, not just a hardware platform. ... The most valuable platforms provide [either] a large audience and user acquisition or unique data. Cars have the potential for both.”

“What we have seen with archetypes like Twitter, Facebook, Google and Amazon is that when you make your API a Web-based API, the level and scale and the amount of value that gets unleashed starts to change dramatically. Two things happen. One is that since the protocols are very simple, everybody knows how to make HTTP requests, which is at the heart of all this. The second thing is there are just so many examples of value getting unleashed that regardless of the context, be it financial or automotive or anything in between, you can really find cool apps that are being created, and that encourages even more creativity,” Mr. Mulloy observed.

The problem, he believes, is that the developers building the Instagrams and Facebooks of the world aren’t killing themselves to make creative apps for the car. “If I was in charge of the automotive industry that is the number-one thing I would fix. Getting the innovative folks like those who created Instagram to focus on the automobile as a computing platform,” he said. Facebook recently purchased the mobile photo sharing tool company, Instagram, for one billion dollars.

Ford, OnStar and others are engaging with Web-application developers. OnStar announced it will open its proprietary API to app developers in the first half of 2012. GM claims its ATOMS (Advanced Telematics Operating Management System) is the most powerful automotive cloud platform available today. Working with several universities, OnStar also runs a Student Developer Challenge that invites students to offer voice apps.

Ford, who has had similar engagements with students, says it presently offers its customers seven apps with more on the way. (Twitter, in comparison, has more than a million registered apps.) Ford has also engaged with developers in India on apps specific to the Indian market and conducted an app developer challenge competition in 2011.

According to Mr. Mulloy, these engagements with developers don’t go nearly far enough. “When the chief marketing officer of Ford wakes up and realizes that one of the most important markets where he needs to proactively promote his product is application developers, then he will be in good shape. He needs to understand that he is competing for the same eyeballs that Apple is, in terms of making his products more valuable.”

Sandbox for App Developers

“Having seen a couple of these [Web] platform companies up close and personal, how they take off, what you really want is to delegate the creativity to those application developers,” said Mr. Mulloy. “Seeing in the R&D lab in Dearborn you might not see exactly what is new and cool that the car should be doing. So instead you should create a sandbox that takes account of all the risk factors around distracted driving and the things needed to mitigate that risk and hand that back to the developers. Then get out of the way and let them go bananas with the connectivity points, the sensors and actuators and everything else that you have safe access to and see what they can make that’s compelling.”

If you are a car guy, at this point it would probably be a good idea to take a deep breath and consider that while this sounds provocative and a bit crazy, there might be much here worth considering. Could Web applications engage other parts of the vehicle besides infotainment? Could the safety protocols outlined in ISO 26262 provide some guidelines? Could enough of the vehicle be safely opened up to developers to inspire more robust developer involvement?

Apigee’s core product is its API Gateway. “Anytime you are on the Netflix site, whether it’s from a game console or phone or laptop or iPad, every request that goes from your device to Netflix servers, goes through us. Any time there is a device on one side and the cloud on the other, we kind of sit in the middle.”

Apigee’s products, which can scale from very small to very large customers, can be deployed in three different ways, according to Mr. Mulloy: “We can deploy in the Amazon EC2 cloud or folks can use us as software, where we give them a virtual machine and they run it in their data center, the option OnStar chose. Or you can buy a hardware client from us. Of the three form factors, the trend is going more toward people doing things in the cloud, because they can get started easier.”

HVAC...

Consumption by 10% to 15%, so occupant-based heating could be an effective fuel-saving strategy.

48-Volt Bus

High-voltage components today are extremely expensive for two reasons: because of safety requirements and because they lack economies of scale. If the 48-volt bus advocated by the German carmakers finds application in enough high-volume vehicles, it could make some HVAC components for electric and hybrid vehicles significantly more affordable.

Dr. Wawzycki proposed this example: Electric vehicles require an electric air-conditioning compressor and electric PTC heaters, which each consume between four and five kilowatts of energy. Those components now get connected to the EV’s high-voltage bus, which could be at 120 to 300 volts. But if 48-volt systems are widely applied, it is likely there will be 48-volt electric compressors and 48-volt PTC heaters widely available for high production volume internal combustion vehicles. “Today we make high-voltage PTC heaters with four to five kilowatts of heating performance. I could get the same performance with 48 volts at a much lower cost, because I would have bigger production runs, and I would not have the high voltage safety requirements.”
The Company Profile... Mentor Graphics

Background

Founded in 1981 and headquartered in Wilsonville, Oregon, Mentor Graphics produces electronics design automation software aimed at developing highly reliable electronics products quickly and cost-effectively. Its main EDA products are printed circuit board design tools, a segment where it claims market leadership, and integrated circuit design tools. Including revenue from large multimarket suppliers, the automotive market accounts for roughly 10% of Mentor Graphics' sales.

With 70 offices worldwide, the company serves many industries including military, aerospace, communications, semiconductor manufacturing, consumer electronics and others. Mentor is publicly traded on the NASDAQ under the symbol MENT.

Automotive

Mentor Graphics is one of the largest companies in the business of supplying electronic design automation tools and software to the automotive industry. As such, it is able to offer the broadest range of tools, starting from the design and layout of integrated circuits and printed circuit boards all the way up to the design of wiring harnesses and data communications networks. Mentor Graphics tools and software support all automotive domains including vehicle control systems based on Autosar, and Genivi-compliant infotainment systems. Other products include tools for mechatronics simulation, systems modeling, mechanical analysis, flow simulation and thermal measurement. Many of the company’s tools can be linked to each other.

Integrated Electrical Systems Division (IESD)

IESD has been serving the transportation industry since the early 1990s, longer than most of Mentor's other product groups, and therefore generates the most automotive sales. Under the leadership of general manager Martin O'Brien, the former global sales director for Tyco Electronics’ OEM business, IESD produces a line of software tools for the design, analysis, manufacture and service of electrical systems used primarily in automotive and aerospace platforms.

Mentor Graphics claims more than a 50% share of the merchant market for integrated electrical system tools. It competes with tool vendors Zuken, based in Japan, and IGE+XAO, a French company. But a majority of Mentor Graphics’ competition comes from its customers’ own in-house-developed tools.

Nearly all of the division’s automotive revenue is generated by its Capital tool suite, first launched in 2003. Three tools...
form the foundation of the Capital line of products:

- **Capital Logic** is used to develop connectivity data for each individual electrical system using constraints and design rules established for the vehicle.
- **Capital Integrator** automatically creates the wiring design that integrates those systems aboard the vehicle platform.
- **Capital Harness** derives actual wiring harness assemblies to connect each of the vehicle systems to power, sensors, actuators, and networks.

The suite supports a number of add-on tools, for example view generation and electrical simulation tools. Although the Capital tool suite, with its roots in wiring harness design, constitutes 95% of the division’s revenue, three-fourths of IESD revenue comes from electrical system design and integration apart from harness design activities.

“The primary advantage of these products is that they all sit on a common data repository,” said Mr. O’Brien. “They write data into illustrations, wiring diagrams, view diagrams,” noted Mr. O’Brien.

A year ago Mentor Graphics announced three new Capital tools, and in November 2011 a fourth tool was added to the Capital suite. Together the four tools effectively double Mentor Graphics’ served market, bringing the total to roughly $400 million.

- **Capital Level Manager** is used by vehicle product planners to define the vehicle’s electrical features and reach the optimal balance between optional offerings (configuration complexity) and the added cost incurred by including “giveaway” components. It also provides decision validation to avoid costly harness rebuilds.

- **Capital ModularXC** decomposes harness designs in terms of modular sub-assemblies linked either to optional features or to manufacturing convenience. The former supports a way of managing configuration complexity common among European OEMs and heavy truck makers. The latter reduces manufacturing costs by optimizing production or logistical efficiency. ModularXC supports automated module breakdown, component selection, bill of materials and drawing creation.

- **Capital Harness MPM**, fed with data from either Capital Harness XC or Capital ModularXC, this tool models harness designs against production capabilities to create structured bill-of-materials data for enterprise resource planning (ERP) systems. The tool helps minimize inventory and obsolescence costs and achieves economies of scale by identifying subassemblies that are common across different harness designs.

- **Capital Publisher** provides the opportunity for a carmaker to repurpose the vehicle electrical system data that was created and stored during the planning, design, engineering and manufacturing processes for service documentation. Using Capital Publisher, an OEM’s service organization can reformat the engineering data into illustrations, wiring diagrams

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**Major Acquisitions of Companies with Automotive Prospects**

<table>
<thead>
<tr>
<th>Year</th>
<th>Company Name</th>
<th>Product Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>Harness Software</td>
<td>Wire harness design and engineering tools</td>
</tr>
<tr>
<td>2003</td>
<td>First Earth</td>
<td>Electrical systems simulation and analysis tools</td>
</tr>
<tr>
<td>2004</td>
<td>VeSys Ltd.</td>
<td>Wire harness design and engineering tools</td>
</tr>
<tr>
<td>2005</td>
<td>Volcano Communications Technologies</td>
<td>Automotive network design tools</td>
</tr>
<tr>
<td>2008</td>
<td>Flomerics Group PLC</td>
<td>Thermal and flow analysis tools</td>
</tr>
<tr>
<td>2010</td>
<td>Virtual Garage product line from Freescale</td>
<td>Architectural and service solutions</td>
</tr>
<tr>
<td>2011</td>
<td>Flowmaster Group</td>
<td>Fluid system simulation software</td>
</tr>
</tbody>
</table>
and mechanical views that support the service technicians. When integrated with the carmaker’s diagnostics system, the service data can be tied to a unique vehicle identification number, which could dramatically reduce the time needed for repairs.

“The system will dynamically generate the section of the electrical drawing the service technician is interested in. Maybe there is a problem with a solenoid. He can go directly to the electrical diagram with that solenoid and see what is interacting with it to quickly diagnose a problem. … We launched Capital Publisher in mid-2011, and several carmakers have already ordered it. In terms of interest from carmakers and aerospace, this is the hottest product we have ever released,” said Mr. O’Brien.

Cut Leads per Vehicle Remains Stable

Mentor Graphics executives are in a good position to witness wiring harness trends. In the past, the number of cut leads and the weight of the wiring harness grew as electronics content grew, but for several years now, the amount of harness wiring in the average vehicle has been stable, along with the number of ECUs.

According to Nick Smith, IESD product director, “You can find exceptions to that, for example in the emerging nations where feature content is on the increase, or with electric and hybrid vehicles. But if you step back far enough you are seeing the average number of cut leads is no longer increasing. Nevertheless, with the number of available options on the rise we are still seeing a rapid rise in the number of potential electrical configurations and that adds to complexity, which is causing people trouble.” While it may be troublesome for some people, that ever-increasing complexity creates a healthy demand for Mentor Graphics Capital tools.

System Level Engineering (SLE) Division

The Automotive Networking business, which is part of the SLE division, is the second largest within Mentor that specifically targets the automotive industry. In 2005, Mentor Graphics acquired Volcano Communications Technology, a startup that specialized in automotive networking software. Volcano’s principal investors were Volvo and Motorola (now Freescale). With that acquisition came a product called VNA (Volcano Network Architect), a tool used to create, optimize and analyze vehicle networks. Along with VNA, Mentor Graphics also gained embedded middleware stacks that implement inter-ECU communications over CAN or LIN. The CAN software is called VTP (Volcano Target Package); the LIN software is called LTP (LIN Target Package).

“Volcano products are so far deployed in 300 million ECUs,” said Serge Leef, who runs the System Level Engineering division. “Carmakers who are using it include Volvo, Jaguar Land Rover, SAIC, Mazda, Ford Europe and Aston Martin.” Other Volcano software users include Daimler and Volkswagen, who use the product in LIN nodes.

Proprietary Mentor Graphics’ Volcano products are being supplanted by a symmetric Mentor Graphics product line called Volcano VxSx, based on Autosar, a software standard that is being embraced by carmakers the world over. In place of VNA there is a design tool for the Autosar flow called VSA. In place of VTP/LTP embedded software is the Autosar BSW (basic software) product named VSTAR.

“A lot of the thinking that went into Autosar was influenced by precursor technology like Volcano. Volcano has always promoted a top down [design] philosophy, which is ‘first let’s architect this, then design it, virtually experiment with it and optimize it, all before we build it,’” explained Mr. Leef. “So when we build it our chances of success are much greater.”

Volcano-based solutions still provide the bulk of Mentor Graphics’ Automotive Networking revenues; only 20% to 30% of revenues has been Autosar related. “But we see Autosar ramping up dramatically. In one or two years we expect it to be all Autosar and no Volcano,” said Mr. Leef. Early adopters Daimler and Audi have been employing Autosar version 3, and while Mentor Graphics has an Autosar 3 solution the company decided that Autosar 4 is a much better target for its investment, “Because that is where the whole market is expected to move, as opposed to a few early adopter companies,” said Mr. Leef. “Compared with the competition’s, our 4.0 stack is the most complete.”

Mentor Graphics expects to make significantly more money from selling Autosar software licenses than from selling Volcano design tools. The number of tool seats per carmaker or supplier is only in the tens, whereas software licenses are priced according to the number of ECUs in which the software will be embedded. All license payments are made at the front end of a project.

The company is competing for several pieces of Autosar 4.0 software business in Europe: with BMW for 40 ECUs, and

Distinctions Claimed by Mentor Graphics

◆ The world’s second-largest maker of electronics design automation tools
◆ Mentor Graphics owns the number-one share of printed circuit board design and layout tools.
◆ All five of the top automotive harness manufacturers worldwide employ the Capital Harness design and engineering tool. Three of those companies have standardized on the tool.
◆ Mentor Graphics owns more than a 50% share of the merchant market for integrated electrical system tools.
with Volvo for 40 ECUs as well. Both carmakers have placed Mentor Graphics on their short list of Autosar 4.0 suppliers. Another likely source of business, a U.S. carmaker—probably GM—has indicated it will deploy Autosar 4.0 in 70 ECUs in a new platform. The majority of Mentor Graphics’ projects are for Autosar 4.0, the version that supports partial networking, which can switch off power in unused ECUs to save energy.

Autosar is still at a very early stage in its deployment. According to Mentor Graphics’ calculations, less than 30% of today’s ECU design starts are based on Autosar. And while many carmakers are in a wait-and-see mode to see how the early deployments of Autosar work out, all of them have pilot Autosar projects in the works, according to Mr. Leef.

One of the main benefits of using system level tools from Mentor Graphics is the ease with which they can be integrated with the company’s electrical systems, harness and mechatronics engineering tools.

**Delphi Partnership**

Mentor Graphics shared development of the Autosar 4.0 software stack with Mecel, a Swedish subsidiary of Delphi. The two companies have cross-licenses to each other’s technology. The operating system, LIN, CAN, FlexRay, Ethernet basic software and the tools were developed by Mentor Graphics; Delphi handled the systems services, memory and communication software, as well as the runtime environment. “The alliance with Delphi is how we were able to get the Autosar 4.0 solution to market faster than any of the other vendors,” said Mr. Leef.

**Embedded Software Division (ESD)**

The System Level Engineering division (above) isn’t the only Mentor Graphics business selling embedded software. The Embedded Software division, a fifty-plus million dollar business that grew 38% last year, with more than 200 employees, makes runtime software (including operating systems, middleware and user interface solutions), tools for embedded software development and professional services. Each business—software, tools and services—accounts for about one-third of ESD revenues. Among the markets served by ESD, which in addition to automotive include mobile handsets, consumer electronics, industrial systems and medical devices, the fastest growing is automotive, where the division is focused on open source infotainment solutions, including telematics and instrument clusters, based on Linux or Android.

“Prior to July 2009, we were squarely in the proprietary tools and RTOS (real time operating system) business; we didn’t offer any open source software like Linux or Android,” said Glenn Perry, general manager of ESD. “That’s when we purchased Embedded Alley, whose founders were some of the earliest developers to port Linux onto something that is not a PC.”

In November 2010, Code Sourcery was purchased. “They lead the embedded development communities for Linux and Android tool chains, the compliers, debuggers and integrated development environments,” noted Mr. Perry.

Those two acquisitions gave Mentor Graphics a set of products and services it could offer around embedded Linux and Android. In a market worth well over $100 million in commercial Linux licenses annually, Linux products have been aimed primarily at the networking and consumer electronics markets. But, according to Mr. Perry, automotive is the fastest-growing market for Linux- and Android-based solutions, primarily driven by infotainment.

“We supply an Android or Linux that is optimized for a customer’s specific application. Along with the runtime platform we integrate our complete suite of tools, which are often tuned to the customer’s specifications. We maintain and support the entire platform as a standard, commercial off-the-shelf product. We have a team of automotive experts who help with everything from the architecture of the platform to the final implementation and test.”

The Embedded Software division’s best-selling automotive product is Mentor Embedded Linux Base IVI Platform, a commercial offering based on a Genivi-compliant, open source implementation. Mentor Graphics adds functionality, tests and tunes the software, and delivers a turnkey product built according to the customer’s needs. Here Mentor Graphics competes with Intel’s Wind River subsidiary and with Montavista.

The second major product in terms of automotive revenue is Sourcery CodeBench, a development tool for Linux- and Android-based systems. The ESD’s third-largest product in terms of producing automotive revenue comes from Mentor Graphics’ 2006 acquisition of Inflexion UI, which included tools and a runtime engine for developing animated 2D and 3D user interfaces.

Mentor Graphics is on the board of the Genivi alliance of carmakers and suppliers developing open-source infotainment platforms based on Linux. ◆
Roundup: Aisin Seiki, Denso, Lear, Magneti Marelli, Mobis

Aisin Seiki Co. Ltd.
FY 2012 Sales: ¥2,304.1 billion ($28.6 billion)
Change from FY 2011: up 2.1%
FY 2012 Operating Margin: 5.3%, down from 6.1% in FY 2011

Outlook for FY 2013: Aisin is forecasting an 8.5% increase in sales, to ¥2,500 billion ($31.1 billion). Operating margin should improve to 6%.

Aisin depends on Toyota for nearly 64% of its total sales and Toyota's unit production grew by 4.8% in fiscal 2012. Aisin's second-largest customer is Volkswagen/Audi, which accounts for approximately 9% of sales.

Aisin's largest subsidiary company, Aisin AW, which produces automatic transmissions, hybrid drives and navigation, increased sales 7.1% to ¥915.1 billion ($11.4 billion). Automatic transmission unit production increased 8.9% to 5.7 million units while navigation production was up 13% to 1.48 million units. Aisin Seiki's Information Related Products segment accounted for 5.6% of total sales. Included in the segment are navigation, parking assist, lane departure warning, front and side monitoring systems and driver monitoring.

In January 2012, Aisin Seiki's president told employees the company is facing real threats from globalization: "If we don't make it through this point, we might not only fail to achieve further growth, but may also end up losing our foothold. We should all recognize that it is a make-or-break time for the company."

Denso Corp.
FY 2012 Sales: ¥3,154.6 billion ($39.2 billion)
Change from FY 2011: up 0.7%
FY 2012 Operating Margin: 5.1%, compared with 6.0% in FY 2011.

Outlook for FY 2013: Sales are projected to grow 8.4%, to ¥3,420 billion yen ($42.5 billion) with operating margin returning to 6%.

Nearly half (49%) of Denso's sales are to Toyota Group, which meant a difficult first half of the fiscal year for Denso, given the vehicle production cuts following the 2011 earthquake and tsunami. Honda is the second largest OE customer, accounting for 6.2% of sales. Denso's sales increased in the second half of the year, but the strong yen depressed full-year net margin to 2.8%, compared with 4.6% the prior year.

Denso was among the companies investigated by the U.S. Department of Justice for antitrust violations, in Denso's case concerning body ECUs and HVAC control panels, and paid a fine of $78 million as part of its plea bargain.

Thermal Systems is Denso's largest product segment, accounting for approximately 30% of sales in FY 2012, followed by Powertrain Control, which accounted for 25% of sales.

Lear Corp.
2011 Sales: $14,157 million
Change from 2010: up 18.4%
2011 Operating Margin: 5.6% compared with 5.2% in 2010

Outlook for 2012: Lear expects sales in the range of $13.95 billion to $14.35 billion with operating income between $740 million and $790 million.

Sales in Lear's Seating segment increased 16% to $10,943 million. The Electrical Power Management Systems (EPMS) segment showed even stronger growth: 25.6%. Lear attributes EPMS' sales improvement to increased production of platforms where Lear supplies content, to currency effects and $122 million in new business.

For more information, please see the Lear Company Profile in the December 2011/January 2012 Hansen Report.

Magneti Marelli
2011 Sales: 5,860 million euros
Change from 2010: up 8.5%
2011 Operating Margin: 0.5%, down from last year's 1.4% operating margin

The company cites healthy performance in Germany, Brazil, China and North America as one of the drivers behind its sales growth. The Electronic Systems segment sales grew 16% over the prior year, to €722 million euros, with help from increased sales of instrument clusters in China, and telematics boxes and body electronics in Europe.

Electronics revenues were also helped by increased hands-free module sales to Chrysler, as well as eCall and telematics control unit sales to PSA.

New electronics business orders in 2011 included body electronics orders from BMW, Audi and Fiat and instrument clusters for Fiat and Haima in China.

In Lighting, sales increased 14% over 2010, to 1,808 million euros, with new orders received from Mercedes, BMW, Hyundai/Kia and Chrysler. Magneti Marelli provides full LED headlights for the Mercedes CLS.

At the Beijing Auto Show this spring, Magneti Marelli demonstrated its first Genivi-compliant infotainment system, which it codeveloped with Wind River.

Mobis
2011 Sales: 26,294,579 million KRW ($23.2 billion)
Change from 2010: up 18.7%
2011 Operating Margin: 10.2%, compared with an 11.3% operating margin in 2010

In January 2012, Mobis announced it had won $1.07 billion in new business with General Motors and Chrysler. Mobis will supply center stacks to GM and rear LED lights to Chrysler. Non-Korean carmakers currently account for 10% of Mobis’s sales. The company's goal is to increase that percentage to 20% by 2020, which it plans to accomplish by increasing sales in India and China. In India, Mobis will focus on the growing market for airbags and audio systems.

Mobis has existing business with Daimler, BMW and Volkswagen in Europe.

Mobis announced in April 2012 the launch of its new, full-LED adaptive forward lighting system, which will debut on the 2013 Kia K9 in Korea. The amount of illumination is optimized for the current driving conditions such as low-speed city driving or high-speed highways, for weather and for the curve in the roadway.

Mobis's front lighting also incorporates high beam assist, using a camera mounted on the windshield to detect oncoming vehicles and adjust the beams as needed.