Sun and OnStar to Jointly Create Java Middleware

Global Automotive Standard is Likely Result of BMW, GM, Ford, DaimlerChrysler, Honda and Volkswagen Group all plan to use Java middleware in production vehicles within the next five to seven years. Without a standard, however, the full benefits of Java middleware may not be realized. (See box below.)

OnStar, a unit of General Motors, and Sun Microsystems, Palo A Ito, California, recently announced that they will cooperate to develop Java middleware and promote it as a global standard. OnStar, the largest automotive telematics service provider/aggregator, and Sun, the inventor of Java technology, are in a good position to establish what could well become that standard. OnStar and Sun will submit their Java middleware to A M I-C (Automotive Multimedia Interface Collaboration) in the hope that A M I-C will ultimately endorse their work as the global automotive middleware standard.

Automakers expected that A M I-C, which formally began in October 1998 with five carmakers, would already have developed and endorsed a set of standard Java APIs, but A M I-C’s progress has been slow. Perhaps because it grew to include all 12 major carmakers, who until recently had to all agree on all aspects of decisions, the bylaws of the collaboration.

Meanwhile, suppliers in the industry began to work on a number of versions of automotive Java middleware.

Sun wrote in a white paper that the company “continues to support A M I-C’s efforts. However, with some suppliers now advancing their own proprietary technology implementations to satisfy their short-term market goals, there is the possibility that the effectiveness of A M I-C’s work may be compromised. Therefore, Sun is seeking to play a leading role in preventing such fragmentation by working with industry market makers to create a de facto standard aligned with A M I-C’s earlier work.”

The only onboard product Sun intends to sell is its Java middleware, which could add about $1 to the OEM cost of multimedia in the vehicle. Even if Java middleware were used in every light vehicle produced in the world, that’s only a $55 million market—tiny compared with Sun’s main market, computing equipment. Sun says it will produce and sell an automotive middleware product only as a means to an end: More vehicles with Java middleware.

The company provides TTP software-development tools and training. It has

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BMW and Mercedes Choose FlexRay

New Fault-Tolerant Bus for Electric Brakes

Since some makers of upscale vehicles—among them, BMW, Mercedes and Audi—hope to have electric brakes in production vehicles by the MY 2004 or MY 2005 timeframe, they have been looking at real-time communications protocols that would give them a safety-critical bus to link system components. Electric brakes, which are smaller, lighter and eventually will be less expensive than hydraulic brakes, can be more easily integrated with adaptive cruise control, ABS and stability-control systems.

In real-time computer control systems there are two fundamentally different approaches to control: time-triggered control and event-triggered control. In time-triggered systems, all activities are carried out at certain points in time, so all nodes in time-triggered systems have a common notion of time based on approximately synchronized clocks. In time-triggered systems, important messages, like safety critical ones, are assigned a higher priority and time is made available for them, even if another message is in the process of being sent about another event. By contrast, in event-triggered systems, all activities are carried out in response to events, so an event could occur and occupy the bus at the expense of a high-priority message. Some protocols, like FlexRay, are capable of both time- and event-triggered communications.

TTP (Time Triggered Protocol) technology was developed over the last fifteen years at Vienna University of Technology, under professor Hermann Kopetz, who started TT Tech Computertechnik A G (Vienna, Austria) to commercialize TTP. The company provides TTP software-development tools and training. It has

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patents to TTP technology, including the TTP/C IP module that it licenses to the semiconductor industry. Honeywell’s Engine and Systems Division will collaborate with TTTech to manufacture electronic control systems for aircraft engines.

Silicon suppliers interested in working with TTTech to supply automotive TTP-based silicon have been fewer than expected. ARM Ltd. (Cambridge, England) is developing TTP CPU cores, which together with TTP communications controllers can be manufactured into safety-critical system-on-chip solutions for vehicles. Austria Mikro Systems (Graz, Austria) is another TTP silicon maker involved with automotive applications.

Last fall at the automotive electronics conference in Baden-Baden, Germany, BMW and Mercedes announced that they had changed their plans about adopting TTP for their X-by-wire systems and are now developing FlexRay instead. BMW and Mercedes have partnered with Philips Semiconductor and Motorola Semiconductor Products Sector, who will help define and develop the FlexRay system. The suppliers will support the effort with silicon: Philips for FlexRay transceiver chips, and Motorola for FlexRay communications controllers. Engineering samples are due in 2002, and production samples by 2003.

Although Motorola has been working in an alliance with TTTech since the summer of 1998, when BMW and Mercedes got behind FlexRay instead of TTP, Motorola quickly switched allegiance, as a business card we picked up at Baden-Baden graphically illustrated. The card from Motorola’s TTP Program manager, Gary Hay, had the initials “TTP” crossed out and the word “FlexRay” handwritten above it.

For brake-by-wire systems, carmakers want a standard for the communications data bus that is deterministic and fault-tolerant, characteristics that apply to both TTP and FlexRay, but carmakers also want a high data rate and a bus that can handle distributed control. FlexRay can handle a redundant communications channel, a requirement of electric brake systems, which have two electronic control units at each wheel, plus two central ECUs. Dr. Wilibert Schleuter, in charge of electrical engineering for Audi, told us that Audi, which has been cooperating with TTTech, has begun to talk with BMW and Mercedes about FlexRay. “We want one standard together with the other carmakers. That is our first priority.”

The FlexRay web site (www.flexray-group.com) lists BMW, DaimlerChrysler, Philips and Digital DNA/Motorola as partners. The companies plan to take FlexRay beyond the protocol stage, to define the physical layer, service aspects, power and wake-up modes. Their intent is that FlexRay be open and a de facto standard, leading to a formal standard. Engineers at these companies told us they started finding problems with TTP as they built prototypes: (1) TTP was too slow, whereas FlexRay is capable of a net data rate of 5 M bps (10 Mbps gross); (2) TTP was inflexible, changing the programming on one TTP node meant all the nodes had to be reprogrammed; (3) TTP could not handle both event-triggered and time-triggered protocols on the same bus, whereas FlexRay can; and (4) TTP could handle only a fixed bandwidth; engineers want to be able to send control data at a faster rate than diagnostic data. FlexRay is now considered the answer to all four insufficiencies.

FlexRay is based on the ByteFlight communications link invented by BMW for airbag systems and made public in May 1999. ByteFlight is a round-based protocol: A master controller sends out a sync pulse to start a round, from which all nodes are synchronized. A filter receiving a sync pulse, each node starts a timer whose duration is determined by priority so that high-priority messages always get sent first.

BMW is working on this safety-critical bus with help from semiconductor makers Infineon Technologies, Motorola and Elmos Semiconductor.

FlexRay is certain to play an important role in the development of electric brakes, and reflecting that is the listing of Continental as one of two supporting companies on the FlexRay web site; the other company is Delphi. German tire and auto electronics-maker Continental is already jointly developing electric brakes with Siemens, on behalf of BMW, and developing electric brakes with Mercedes, through its subsidiary Continental Teves.
Maybe Decades Before 42-Volt Systems Reach Entry-Level Vehicles

One of the drivers of the changeover to 42-volt electrical systems in vehicles is growth in electrical loads. In high-luxury vehicles, new features taken together with existing features are pushing the electrical load beyond the 3.5-kW capacity of 14-volt generators. High-end vehicle makers like BMW, Mercedes and Audi will begin putting 42-volt generators in some of their production vehicles by 2004 or 2005, but decades may pass before entry-level vehicles will need 42-volt generators.

Delphi Automotive Systems estimates that if the historic trend in worldwide demand for power output at peak generation continues unchanged in high-end vehicles, electrical demand will grow at just 5% per year. At that rate, it will take more than 25 years before the transition to 42-volts would be needed in an entry-level vehicle, as today’s 1-kW demand ramps up to the limit of 14-volt generators, 3.5 kW. That assumes that the electric motor would not also be used for propulsion, since that would require an additional 7 kW to 10 kW of electrical power and a quick transition to 42 volts.

Java...

Middleware standard for automotive APIs is developed by Sun and OnStar it will be open, and other middleware suppliers will emerge. While OnStar and Sun have indicated that they will solicit input from the entire industry, they will make all final decisions to move the development process forward quickly.

Sun’s Java is Widespread on the Web

Sun Microsystems, with sales of $15.7 billion in 1999, makes hardware, software and services that serve the Internet. Java has emerged as one of the key enabling technologies in the age of the Internet. Hundreds of companies are developing new Internet appliances designed to leverage the use of the Internet, and today any device that openly browses the Internet has a fundamental requirement for Java, which runs the Java applets that exist on over one million web pages.

Attempts by Sun to develop standard Java middleware with the auto industry began at least three and a half years ago, and for nearly two years, Sun consulted to AMI-C. Sun says it has kept a low profile in the auto industry, focusing on establishing Java as a standard in mobile devices like cell phones and PDAs. Sun believed that the automotive industry would take longer to evolve, but the wireless industry is already offering navigation and concierge services on much lower cost devices than those offered by carmakers.

Jim DeStefano, who is spearheading Sun’s efforts to create Java standards in the automotive industry, elaborated: “There’s major competition out there from the portal providers. There are services offered on cell phones that cost you fifty cents, the same services that a $2,000 auto navigation system can do.” Carmakers need next-generation Internet-enabled devices to stay competitive in the mobile multimedia area, Mr. DeStefano cautioned, and that means they need Java and should not delay any longer.

One of the reasons why the auto industry has gone slowly is that some carmakers are concerned that the cost of proposed Java middleware is not justified. The middleware layer of software requires extra computing capability and extra memory, but Mr. DeStefano noted that this extra footprint will be cost-effective. “Some carmakers are foolishly trying to save pennies [but in doing so], they may be losing many dollars in added service revenues.” The size of the footprint for Java middleware will be small, comparable to the footprint required for cell phones or set-top boxes. Sun believes that standard Java middleware would be applicable to many in-vehicle systems retailing from $50 to more than $1,000.

What is Java Middleware?

Middleware is the layer between the computer’s operating system and the application programs. Java automotive middleware includes a Java virtual machine, and there are several versions in the market such as Sun’s JVM, IBM’s J9 and Hewlett-Packard’s Chai. Standards for the embedded Java virtual machine are already in place. Standards for a set of automotive application programming interfaces (APIs) are currently lacking, which delays implementation of telematics features in the vehicle. Part of the Java framework sits in the device that is embedded in the car, and a portion of it sits back in the server infrastructure at the service provider.

In designing Java automotive middleware, Sun wants an open, flexible standard, compatible with existing standards and with existing mobile devices. Sun will define the standard with no advantage to any particular supplier. OEMs and suppliers will be able to make products based on the standard that are different from other product offerings. Components embedded in a vehicle, which could last for 10, 15 or 20 years, need the capability to easily receive updates.

continued on page 8
Corporate Background

TRW is celebrating its 100th anniversary, as its roots go back to 1901 when the Cleveland Cap Screw Company began in Cleveland, Ohio. Renamed several times, the company became Thompson Products in 1926, and in 1958, merged with defense corporation Ramo-Woolridge (Los Angeles, California); later the initials TRW alone became the company name. In 1958, NASA’s first step into space was with TRW’s Pioneer 1 satellite, the first built by industry. From 1961 through the mid-1980s, the company began acquiring at least one major business every year, focusing on those with long-term strategic growth potential in a number of industries.

By 1989, TRW’s commercial electronics, energy-related businesses and some minor automotive product lines had been sold. Divesting non-strategic and under-performing assets and streamlining its core businesses continued until 1993.

In the 1990s, the company quickened its acquisition pace again. Many of the acquisitions have been European companies, and TRW continues to have a large presence in Europe. At year-end 1999, TRW had approximately 122,000 employees, of whom about 48,000 were employed in Europe and 45,000 in the United States. In 1999, TRW sales were split almost evenly between Europe and North America, with a small amount going to Asia and Latin America.

The percentage of R&D funds devoted to the automotive segment has declined somewhat over the past few years. Capital expenditures in 1999 were $865 million and were expected to remain level in 2000. The debt created by the $7 billion LucasVarity purchase in 1999 has shaped a number of financial decisions in the last year, including restructuring and divestment of some businesses.
complexity of integrating components in occupant safety systems.

The first passenger airbag the company made was for the Mercedes S Class in 1988. This year, TRW’s European operations will produce their 50 millionth airbag, having produced over 260 million seatbelts during its 40 years in safety systems. TRW continues to expand its side-impact airbag business with what the company calls bio-adapted side-bag seat systems and advanced door bags, including knee-bag lower-leg protection and curtain bags for head and rollover protection.

Another area that the company believes excels in is power electronics, for instance, in TRW’s electrically powered steering systems. Here too, TRW touts its integration of components in chassis and powertrain controls. In body control systems, the company is gathering systems together in pre-assembled modules like the overhead console module, which serves as an integration site for RKE, home access, tire monitoring, navigation assistance and vehicle information and communications. A nother module that the company believes can be cost-competitive is the microprocessor-controlled, multiple-function steering column system, which supports a number of body control functions. According to TRW, it is the first company to feature fully automatic electronic climate-control systems, as well as the first with a rain sensor that operates through solar reflective glass to automatically adjust wiper speed for rain or snow.

One of the capabilities that TRW believes sets it apart from the competition is radio-frequency (RF) applications. According to the company, it is a leading producer of original equipment RF remote keyless entry systems, the newest of which not only will open the vehicle doors but also allows the driver to start the vehicle with the push of a button on the key fob. RF automotive applications also include vehicle immobilizers.

Currently, TRW Automotive Electronics has 35 manufacturing facilities in operation in 13 countries (Please see the list on page 7.)

**Purchase of LucasVarity**


On March 25, 1999, TRW Inc. purchased LucasVarity for about $7 billion: $6.8 billion in cash and the assumption of net debt. The two companies complement each other regionally: LucasVarity customers predominated in Europe, while TRW served mostly North American customers. Both companies operate in the same two industries, aerospace and automotive parts, areas that TRW has targeted as strategic to its future.

Due to the LucasVarity acquisition, TRW Automotive Electronics sales grew significantly in 1999, with Lucas adding about $435 million, bringing TRW Automotive Electronics’ total sales to $1.6 billion. Lucas added 5,600 auto electronics employees worldwide. A utomotive electronics sales in 1999 were 49% in Europe vs. 41% in North America.

As a result of the $7 billion LucasVarity acquisition, TRW has a large debt load. Current liabilities significantly exceeded current assets at the end of 1999, accounting for a working capital deficit of $1.53 billion. By the end of September 2000, TRW’s working capital deficit worsened to $1.732 billion.

Restructuring occurred throughout TRW during 1999 and 2000, with six plant closings in 1999, and possibly five more in the process of closing in 2000. In 1999, TRW sold part of Lucas Rists Wiring Systems for $45 million, and will continue to divest the rest of the wiring business.

In January 2000, TRW sold Lucas Diesel Systems to Delphi Automotive Systems for approximately $875 million. Lucas made diesel control systems, including fuel injectors and pumps. TRW will continue on following page.
TRW Automotive Electronics

TRW Automotive Products

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LucasVarity’s Product Contribution

Lucas' biggest contribution to sales is in the area of body control systems, which in 1999 made up 44% of TRW Automotive Electronics sales.

A ready in the switch business, TRW gained the following automotive electronic and electrical products from the Lucas acquisition: additional HVAC controls, a rain sensor, a variety of panel and steering-column switches, assemblies and relays. The Lucas acquisition also brought TRW some ABS electronics business that Lucas had sourced to outside suppliers but will now source to TRW Automotive Electronics.

Auto Electronics Product Focus: Integrated Safety Systems

Leveraging the close ties with its sister segments, Chassis Systems and Occupant Safety Systems, the A automotive Electronics segment has taken as its mission to become the integrated safety systems expert for passive, active and driver systems, including the associated sensing technologies. Tom Doyle, TRW Automotive Electronics vice president in charge of technology, manufacturing and quality, elaborated: "We want to be the brains for advanced smart safety systems... including chassis systems that integrate vehicle stability control, tire monitoring, steering and ABS. ... That will give TRW significant growth potential." A mong the new products that will help TRW complete this mission are: airbag systems and the new Distributed Systems Interface (DSI) bus standard, radar sensors, tire monitoring and vision systems.

◆ A irbag Systems and the New D SI Bus Standard: Two years ago, TRW and M otorola began promoting their jointly developed DSI bus as a standard, and in October 2000, TRW announced that a major carmaker would use the two-wire serial bus on several 2002 models for a launch in April 2001, the first application of a dedicated safety bus standard in the market. DSI’s open architecture has plug-and-play flexibility, and as an open standard, there are no royalty payments or licensing fees.

Sing a simple two-wire bus that provides both power and communications, DSI enables simultaneous support for sensors and actuators; the two-wire serial bus links safety-critical sensors and components on a dedicated, moderate-speed communications circuit. DSI enables the use of the latest generation of fast "intelligent" digital sensors and actuators in safety systems, including dual-stage front airbags, weight sensors, electronic seatbelt pretensioners and side-impact protection systems. The bus system would initially connect only sensors such as crash sensors, passenger-position sensors and weight sensors, but eventually will also link seatbelt pretensioners and various airbags to the airbag/safety-restraint controller.

In addition to reducing manufacturing and design complexity, DSI reduces the number of components or discrete part numbers that automakers and suppliers must track, thus cutting costs. The two-wire design reduces the amount of wiring, which means less weight, easier assembly and less maintenance once installed.

◆ Radar Sensors: In 1994, TRW was among the world’s leading developers of radar sensors for use in adaptive cruise control (A CC) systems, based on technology that the company was transferring from its aerospace segment. TRW quit development, however, in 1995. Its acquisition of LucasVarity brought TRW back into the radar sensor business. A utocruise Ltd., a 50-50 joint venture of LucasVarity and T homson C S F, is a developer and manufacturer of long-range radar for automotive applications; sales are to tier-one suppliers and directly to customers. A utocruise, based in Brest, France, was established in 1998.

When asked about TRW’s 1995 departure from and current return to radar sensors, Mr. Doyle quipped, “It is amazing what acquisitions will do for your technology roadmap;” and then he added seriously, TRW had earlier decided to wait "because of the huge investment required..."
for radar development, but we found that others had been doing it and doing it quite well." The company also realized that radar A CC would tie in nicely with other active safety features coming onboard from the TRW Chassis Systems group, and with passive safety systems like occupant protection. For example, vision systems may be used in A CC systems, stop-and-go features and pre-crash, pre-airbag deployment sensing.

A utocruise's radar sensor technology is based on radar technology that came from parent Thomson-CSF, the number-one defense radar supplier in Europe. The sensor, which uses monolithic microwave integrated circuit (MMIC) technology, has a forward-looking range up to 150 meters and operates at vehicle speeds ranging from 30 kilometers per hour to 180 kilometers per hour. "MMICs are superior to what we have seen from the competition because they are easily manufactured in high volume," suggested TR W's Dr. H. Pfannschmidt. "So the mission of a utocruise should be to generate market share [in order to gain] economies of scale." Dr. Pfannschmidt was appointed executive vice president and general manager of TR W Automotive Electronics in August 1999; he has a degree in electrical engineering and joined TR W in 1997.

A utocruise expects sales of its radar sensors to grow to over $75 million by 2005. TR W expected this promising new product to be in production by the end of 2000, but that project was moved out until the fall of 2001, when radar A CC will appear in an upper-class European car. (The radar sensor application will be announced at the Frankfurt Motor Show in fall of 2001.) In September 2000, a utocruise announced two radar sensor deals: A utocruise will provide A CC radar sensors for German truck-maker MAN, and the other deal is with Visteon. Visteon and A utocruise will cooperate in the development and supply of A utocruise radar sensors. Visteon would initially purchase sensors manufactured by the JV, but the agreement also gives Visteon the right to manufacture A utocruise sensors that Visteon could integrate into electronics it manufactures.

◆ Tire Monitoring: TRW has been working on tire monitoring systems associated with run-flat tires for several years. Run-flat tires have stiff sidewalls and can be operated for about 50 miles without air. A flat in a run-flat tire might go unnoticed, however, without monitoring that alerts the driver to the loss of pressure. TR W saw an opportunity to integrate its expertise in RF and safety applications with tire-pressure monitoring.

In April 1998, TR W announced its strategic alliance with SmarTire Systems, of Richmond, British Columbia, Canada. TRW licensed SmarTire technology for OEM applications. SmarTire will pursue the aftermarket, and the two companies will cooperate to develop future tire monitoring technology. TRW currently owns 9% of SmarTire, with an option to buy an additional 10% of the company. Michelin marketed by TR W as TRW TireWatch™ the system utilizes a pressure/temperature sensor at each tire, which transmits data via RF to a display/receiver, which can be packaged in the rearview mirror, overhead console or instrument panel. This system uses visual and audible signals to inform the driver about tire status. The tire sensors can be mounted on the valve stem or on the wheel, using alternative mounting techniques such as stud-mounting.

In September 2000, TR W signed an agreement with Michelin to cooperate in the development and marketing of tire monitoring devices. Initially, the two companies will market TireWatch transmitters integrated with Michelin's Pax System and Logic software. Pax is a redesigned assembly that prevents the tire from coming off the wheel when the tire goes flat. Michelin Logic is an algorithm that predicts when the tire is becoming marginal. The two companies will work together to develop a next-generation sensor/transmitter.

TR W expects the tire-monitor market to heat up once the U.S. National Highway Traffic Safety Administration (NHTSA) decides how to implement the Transportation Recall Enhancement, Accountability, and Documentation (TREAD) Act. Signed into law in the wake of the Firestone tire safety recall, a provision in the TREAD Act directs NHTSA to complete rulemaking that will require all new vehicles to have a dashboard indicator that warns the driver if the tires are under-inflated. That requirement will become effective in November 2003.

While tire-pressure monitoring is promising in the U.S., TR W's first major order for TireWatch is from a major European carmaker; production will begin in the first quarter of 2001.

◆ Vision Systems: TR W has been working hard to meet the requirements for smart restraint systems that are spelled out in NHTSA's Interim Final Rule. In particular, the company is interested in vision systems for front-passenger seat occupant sensing. Ronald Mucklely, vice president and general manager of TR W Automotive Electronics safety and security systems, elaborated: "We are trying to measure the position of the occupant. The previous attempts, using infrared and ultrasound, are still under investigation, but with advances in silicon camera systems, the cost-to-benefit ratio of vision systems has come to the point where we think that it is a much more interesting technology."

TR W will explore using low-cost CMOS imaging devices and hopes to deliver prototype systems to carmakers in six months, with systems ready for production in time for MY 2005. In addition to cost, the Company Profile Continued
the other major challenges relate to the imaging algorithm and proper target illumination to allow the image to be read by computer in all sorts of light, from direct sunlight to darkness.

In September 2000, TRW took an equity stake and signed a licensing agreement with Eyematic Interfaces, a Los Angeles, California-based developer of computer-vision technology that enables model-based encoding of humans. Funded by Deutsche Telekom’s T-Venture, Omron Corp. of Japan, and private investors, Eyematic is marketing its proprietary human recognition and sensing technology. Eyematic’s computer vision technology needs only a low-bandwidth transmission rate, as low as 2 Kbps, so it is easily scaled to various telecommunications technologies like wireless and broadband networks.

A few passenger-position sensing, TRW expects to use computer-vision technology in other new product developments: stop-and-go adaptive cruise control (for near-range sensing), pre-crash sensing (for restraint-systems), lane-keeping systems, drowsy-driver systems, intrusion protection and identification of authorized operators.

Java...

Java Automotive Middleware Implementations

Before picking OnStar to co-develop the Java middleware, Sun found the process of selecting a partner challenging. Mr. DeStefano explained: “If we picked another first-tier supplier, then the other tier-ones wouldn’t accept it. If we picked a specific automaker, the other automakers wouldn’t accept it. In the case of OnStar, they want to sell their services in everyone’s cars.” Given its aggressiveness in establishing the telematics market, OnStar was probably the best choice Sun could have made to help establish a standard. OnStar, the world’s largest telematics service provider/aggregator, expected to have 800,000 subscribers by the end of 2000, and expects to have four million by the end of 2004.

Prior to the Sun and OnStar announcement that they will cooperate to develop Java automotive middleware, a number of other companies had Java middleware in the works for automotive applications.

IBM director of automotive solutions worldwide, Raj Desai, told us that IBM has been a contributor to advancing Java standards and sees the Sun and GM effort as consistent with what IBM has been doing. “A nothing to move standards forward. We decided to help that effort, but at the same time, standards get set not by talking, but by doing and implementing real things.” IBM tools and embedded Java technology, including IBM’s J9 Java virtual machine, form the basis of several developments involving Java middleware that will come to market sooner than OnStar Java implementations. “Our track record in the embedded market is that we usually implement 18 months ahead of Sun, and we are ahead of them in automotive implementations,” declared Mr. Desai.

Possibly the first Java application to make it into production involves PSA Peugeot Citroen. Aaccording to IBM, PSA could eventually put Java platforms in 80% of their production vehicles. IBM and PSA worked together to develop the Citroen Xsara Picasso networked vehicle prototype, unveiled at the Paris Auto Show in October 2000.

IBM also has an alliance with chipmaker Intel involving automotive Java platforms and IBM’s J9 Java virtual machine. IBM has been supporting research done by Daimler Chrysler Research and Technology, North America. That research involves the remote acquisition of data from vehicles, and one area being studied is Java class libraries and the J9 virtual machine.

Motorola Semiconductor Products Sector has developed a Java platform with IBM. Called mobileGT, it includes a Java virtual machine, real-time operating system and the PowerPC microprocessor. Motorola TCG (Telematics Communications Group) supplies the hardware platform used in OnStar-equipped vehicles, and has landed an OnStar contract to supply a thicker Java-based platform. TCG has worked for two years developing Java middleware that would work atop mobileGT. Tim VangOethem, Motorola TCG director of sales and marketing for systems, platforms and applications, told us that Motorola would probably like its own middleware to end up as the standard but will reasonably defer to its major customer, OnStar. “The industry needs a standard... [Sun and OnStar] intend to solicit input from different parts of the industry to round out whatever expertise they may not have, and Motorola then could bring in our understanding of wireless infrastructure.”

A company (formerly SmartMove), a venture capital startup based in Leuven, Belgium, with U.S. headquarters in Cambridge, Massachusetts, is a leading European automotive technology provider with its OTF (Open Telematics Framework) product, “the first end-to-end Java-based open software design for the entire telematics pipeline,” according to the company. In a recent study on global automotive telematics, UBS Warrburg LLC, a global financial services organization, heralded A company’s OTF Java-based technology as the solution to system compatibility and standardization, facilitating the interface between vehicle systems, telematics products and various telematics applications. The company has reached agreements with major carmakers to develop future telematics services for carlines across Europe. A company and Webraska (Poissy, France), a worldwide provider of wireless navigation, mapping and traffic information, will cooperate to port Webraska’s Internet-based Distributed Navigation on A company’s J9 Java in-vehicle platforms. The first pilot project with a car manufacturer is planned to be running in early 2001.

Delphi Electronics chose a Java technology solution for its companion brand Mobile Multimedia Systems, which include navigation, voice recognition, text-to-speech, CD/DVD-ROM drive, cell phone and more. Delphi uses HP’s Java virtual machine, Chai.