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# INFOTAINMENT — THE DASHBOARD DILEMMA

Flexible chipsets are helping OEMs cope with fast-changing consumer technology.

According to the research firm Frost & Sullivan, the automotive infotainment systems market is experiencing rapid growth in all five segments -- navigation systems, rear-seat entertainment, compressed audio, satellite radio and satellite video. For North America, research analyst Sandeep Kar expects

lytics' automotive and telematics practice, estimates that by 2011, about 85% of OEM CD-based audio systems will be able to read compressed audio files. There is also strong interest in interfacing with iPods and other portable music devices.

"Automakers can see that consumers want to have a lot of audio and

phones were first integrated in vehicles, and then quickly became outdated." That poses a dilemma for OEMs, who have to decide now, based on the consumer electronics products and services currently available, what infotainment options they will offer three or four years hence, when the consumer electronics landscape will look very different.

"Ten years ago a consumer could bring a single CD into the car for one album of content. About four years ago, consumers could move multiple albums into the car by using internal disk changers in the head unit. Two years or less ago they could play MP3 files on one or more disks, and with the iPod, they could have a whole library available," said Ken Erickson, business line executive for integrated media systems at Delphi Corporation ([www.delphi.com](http://www.delphi.com)). "Now, consumers can transfer audio files one CD at a time, with a plug-and-play device like the iPod, or through a WiFi connection. All three have pros and cons, and there is no industrywide agreement. That's one of the reasons why there is hesitancy: a consumer is likely to have a vehicle a lot longer than they will have any particular electronic device."

Blaupunkt's Peters suggests that automakers look at the standards currently available for connecting products. "One of the next ones we see is FireWire (1394), for high-speed transfer of video and audio data." USB is another contender. "Whether or

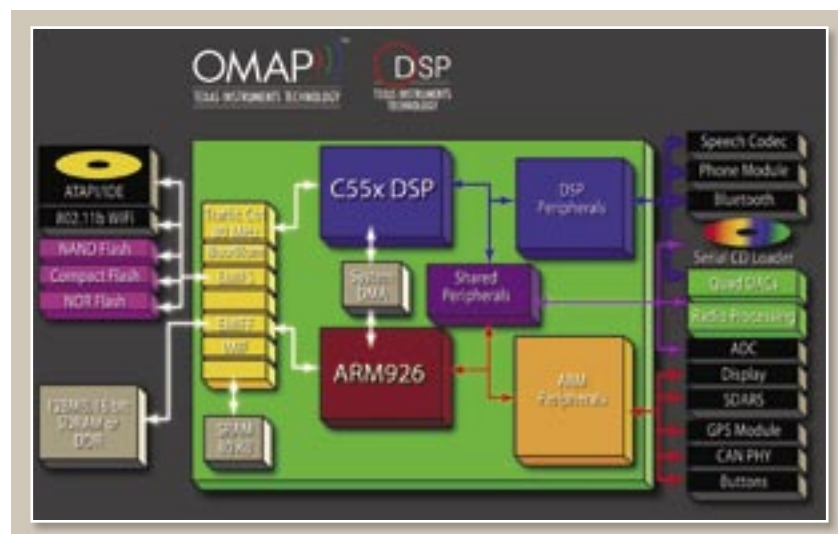


Figure 1. TI's OMAP processor architecture combines a DSP with an ARM core.

total OEM and aftermarket revenues to grow from \$2.67 billion in 2004 to \$6.2 billion by 2011.

Strategy Analytics expects infotainment growth to be driven by the introduction of increasingly multifeatured entertainment systems; for example, CD players able to accommodate compressed digital audio files, primarily in MP3 but also in WMA. Joanne Blight, director of Strategy Ana-

lytics' automotive and telematics practice, estimates that by 2011, about 85% of OEM CD-based audio systems will be able to read compressed audio files. There is also strong interest in interfacing with iPods and other portable music devices. "Automakers can see that consumers want to have a lot of audio and video data, so there is a benefit to having a hard disk drive in a vehicle, but they also see customers who want to carry music data with them, on an iPod or other storage device," noted Mark Peters, director of engineering and program management, car multimedia, at Blaupunkt, a subsidiary of Robert Bosch Corporation ([www.blaupunktusa.com](http://www.blaupunktusa.com)). "Automakers learned a painful lesson when cell



Figure 2. Atmel's ANTARIS 4 GPS chip features a CMOS baseband (ATR0621) and a BiCMOS front end (ATR0601).

not to include a USB port, and how to support it, is an extremely hot topic," said Brian Fortman, worldwide marketing manager for digital radio and entertainment in Texas Instruments' Automotive Infotainment Group ([www.ti.com](http://www.ti.com)).

Automakers are asking component and system suppliers to pack a lot of functionality into smaller real estate, according to Tarun Gupta, infotainment innovation expert at Siemens VDO Automotive ([\[www.siemensvdo.com\]\(http://www.siemensvdo.com\)\), "Boxes have to operate audio, video, CD, MP3, DVD, telematics, cell phones, navigation -- and we have about two-and-one-half inches to work with. It's quite a challenge from an engineering viewpoint -- first develop the technology, then integrate it and make it smaller." To meet that challenge, Siemens VDO Automotive has developed top-level architecture \(TLA\), a software platform that enables third parties to develop additional software and services and add them to a central system in the vehicle without having to alter any other installed components.](http://www.sie-</a></p></div><div data-bbox=)

TLA works with Java and open services gateway initiative (OSGI), and accommodates OEMs' specific human-machine interfaces. Hardware includes a 32-bit, 166 MHz, 300 MIPS main processor that is connected through a PCI bus to a companion gateway chip that meets I/O requirements, provides connectivity

solutions, and offers a graphic acceleration capability to support navigation displays.

Semiconductor companies are similarly focused on flexibility. The infotainment strategy at Renesas Technology Corp. ([www.renesas.com](http://www.renesas.com)) is to match processing power and integrated peripherals precisely to customers' requirements, according to Paul Sykes, marketing manager for car infotainment systems. Renesas offers H8 and SH1 microcontrollers for basic car audio applications; 32-bit SH-2A MCUs with integrated peripheral support for digital car audio applications, and higher-performance SH-4A MCUs for navigation, telematics, and other car information systems.

Last August, Renesas introduced four SH7261 MCU models based on the SH-2A CPU core. The devices integrate peripherals such as a CD-ROM decoder, CAN controller and serial sound interface. Sykes said future SH-

2A devices will enable higher-speed CD ripping and will support the digital storage formats common in consumer electronics applications; for example, integrating a hard disk drive interface without the need for external logic. "Our goal is to optimize peripheral modules and processing capability for flexibility and cost," he said.

With 400 MHz, 720 MIPS performance and a memory management unit, Renesas' SH-4A MCUs support the higher-end, real-time operating systems and multiple middleware modules required for navigation systems, according to Sykes. The SH7770 includes 2-D and 3-D graphics engines, a GPS baseband processing function, and more than 50 peripheral modules.

Texas Instruments ([www.ti.com](http://www.ti.com)) addresses automotive infotainment applications with OMAP processors and DaVinci technology. Its OMAP processor for automotive infotainment processor includes USB 2.0-

compliant full-speed host, client and on-the-go ports; a secure digital (SD) memory card interface; an integrated LCD controller with on-chip frame buffer; a hardware ATA interface; and an on-chip 10-channel, 10-bit analog-

to-digital converter (ADC) and advanced ADC controller for supporting system-level functions such as monitoring radio signal strength or interfacing to low-cost gyroscopes (Figure. 1).



Figure 3. MOST devices based on intelligent network controllers (INIC) can answer requests even if the network is not running or not yet started on an external host.



Figure 4. Alpine's DVA-9965 features HD radio as well as an analog AM/FM tuner. It plays CDs and DVDs, and is iPod- and satellite radio-ready.

The processor can support wireless connectivity such as Bluetooth or Wi-Fi for media content exchange within system power limitations, and it has sufficient headroom for advanced applications, such as using a car radio to rip a CD to a hard disk drive. Recently, TI introduced two new system-on-chips for infotainment, both based on DaVinci technology, which is intended to reduce the time and cost required to add video to an application by allowing developers to write APIs for storage, networking and video interfaces instead of having to write and optimize codecs or program a DSP. Fortman said the DaVinci devices can reduce a hardware bill of materials by as much as 50%. The TMS320DM6443, for digital video decoding, and the TMS320DM6446, for encoding, combine TI's TMS320C64x+ DSP core, with an ARM926 processor plus video accelerators, networking peripherals and external memory/storage interfaces, all specifically tuned for video.

In addition to helping OEMs adapt to rapidly changing consumer electronics technology, semiconductor manufacturers and tier one suppliers are striving to lower costs and increase performance in next-generation devices. Atmel Corp. ([www.atmel.com](http://www.atmel.com)) considers its ANTARIS 4 GPS navigation chipset state-of-the-art for performance, so it will focus on cost and size reductions for future generations, according to product manager Frank Gruson. In designing ANTARIS 4 jointly with u-blox AG

([www.u-blox.com](http://www.u-blox.com)), Atmel combined CMOS and BiCMOS processes to reduce power consumption and increase tracking sensitivity. The chipset (Figure 2) consists of the ATR0621 baseband, fabricated on a 0.18  $\mu\text{m}$  CMOS process, and the ATR0601 RF front-end, a BiCMOS device. An optional low noise amplifier (LNA), ATR0610, is manufactured on a silicon germanium (SiGe) process. The ANTARIS 4 chipset consumes 40% less power than its predecessor (62 mW at a 1 Hz update rate in continuous tracking mode), and power consumption can be further reduced with the chipset in FixNow power-saving mode. The ANTARIS 4 offers up to -158 dBm tracking sensitivity and circular error probability of  $\pm 2.5$  M in good signal conditions. Time to first fix after a cold start is 34 seconds. "Low power consumption is important in automotive applications because the system has to be able to function in an emergency, even if the main battery has been removed," said Gruson.

The ANTARIS 4 also requires fewer external components than its predecessor. The baseband chip provides a USB port as well as serial ports, eliminating the need for a USB or RS-232 converter and making the chipset suitable for plug-and-play PC products, and it supports serial EEPROM as a cost- and space-saving alternative for Flash EPROM for storing configuration settings. GPS firmware is integrated in ROM, thus the chipset requires no external Flash memory

for stand-alone applications.

The infotainment networking technology Media Oriented Systems Transport (MOST) is also being enhanced. SMSC ([www.smsc.com](http://www.smsc.com)), which acquired MOST chip developer OASIS SiliconSystems Holding AG ([www.oasis.com](http://www.oasis.com)) last year, has faster MOST chips awaiting formal introduction, according to Henry Muyschondt, director of business development for SMSC's Automotive Infotainment Systems group and technology coordinator for the MOST cooperation. MOST currently operates at 25 Mb/s, but the new chips will operate at 50 Mb/s and 150 Mb/s.

MOST networks will also benefit from intelligent network interface controllers (INICs) (Figure 3) that promise to reduce the time required for system development, facilitate system upgrades, prevent application malfunctions from affecting network integrity, and relieve the external host controller from real-time processing tasks. INIC-equipped devices will be able to answer requests even if applications are not yet started on an external host. Muyschondt added that to simplify assembly, a version of MOST is being developed that will run over unshielded twisted pair wiring as an alternative to fiber-optic cable.

Frost & Sullivan's Kar expects hard disk drives and wireless connectivity to evolve as key backbone technologies for automotive infotainment applications. "The market for legacy infotainment systems is saturated except for compressed audio and portable device enhancements," said Kar. "Most infotainment systems makers currently offer iPod connectivity. USB connectivity and support for small flash devices is next in line, followed by hard disk drives with WiFi chipsets that will enable wireless downloading of files to a vehicle from a consumer's PC," he added.

"The challenge for hard disk drives in automotive applications is

the automotive environment -- hot and cold temperatures, humidity, and vibration; also longevity. But hard disk manufacturers have been able to address those points, said Dan Benyamin, vice president of engineering for mobile electronics at PhatNoise, a Harman International company ([www.phatnoise.com](http://www.phatnoise.com)). Frost's Kar credits PhatNoise with pioneering the use of hard disk drives for automotive entertainment.

Automakers are specifying Firewire and USB for vehicles to be launched in 2008 and 2009, according to Blaupunkt's Mark Peters. "There is talk about WiFi, but we haven't seen much of a requirement in terms of hard specifications. We are seeing requirements for Bluetooth." "Increasingly, Bluetooth is a standard feature on midrange phones, and more vehicles will have it," agreed Joe Notaro, director of marketing for STMicroelectronics' Automotive Business Units ([www.st.com](http://www.st.com)).

"In the future, Bluetooth will be used not only for mobile phones but also for other consumer electronics, such as iPods and PDAs," said Angela Flynn, director of OEM marketing at Clarion Corporation of America ([www.clarion.com/usa](http://www.clarion.com/usa)).

Flynn said that iPod connectivity with touch screen control is generating significant interest. She added that USB and SD card support are also popular, as is mass storage. "USB is more popular on the retail side, but we see it becoming much more popular in the OEM market over the next three years," she said. This month Clarion plans to introduce a "music catcher" that will record and play back the equivalent of six CDs of music.

Clarion's VRX755VD, an in-dash multimedia station with an iPod interface, earned Frost & Sullivan's 2005 Product Innovation award. The next-generation model, VRX765VD, is satellite radio-ready, plays WMA as

well as MP3 CDs, and offers touch screen DVD control, among other interface enhancements.

Consumers are increasingly aware of the value of rear-seat entertainment, according to Kar. "They see other people with it, and they want it," he said, adding that prices for rear-seat entertainment systems are continuing to fall while functionality increases. Prices for satellite radio receivers are also dropping rapidly, and as a result, Kar sees 2007 as the breakthrough year for infotainment.

Growth in rear-seat entertainment and satellite radio is likely to stimulate demand for satellite video. Working with its chipset maker, STMicroelectronics, receiver manufacturer Delphi Corp. ([www.delphi.com](http://www.delphi.com)), and an as yet unidentified automaker, Sirius Satellite Radio ([www.sirius.com](http://www.sirius.com)) plans to launch a satellite video service in 2007, according to Jim Collins, Sirius' vice president of corporate communications. The service is likely to include two to four channels of cartoons, music videos and other content for children, teens and "tweens," broadcast to screens embedded in a vehicle's back seat. Sirius intends to base its video platform on Microsoft's Windows Media Video 9. Rival XM Satellite Radio ([www.xmradio.com](http://www.xmradio.com)) also plans to launch a video service.

Collins added that Sirius is developing a proprietary hierarchical modulation scheme that will enable it to expand the number of channels it offers from 120 to 150 without compression, and without impacting sound quality. The other option for satellite TV reception comes from KVH Industries Inc. ([www.kvh.com](http://www.kvh.com)), which is marketing an embedded automotive TracVision system based on hybrid phased-array antenna technology. The system provides in-motion reception of a mobile satellite-programming package from DIRECTV. KVH president Martin Kits

van Heyningen said the antenna is installed within the vehicle's headliner and its cover is hidden below the level of a roof rack. Cadillac has okayed the aftermarket version of TracVision available for dealer installation and Avis Rent a Car offers its on Hummer H3s in Phoenix. Frost & Sullivan predicts that more than three million vehicles will be equipped with mobile satellite TV systems by 2007.

For yet another consumer choice, HD radio is right around the corner. "We believe HD radio is going to be very significant, but we have to look at it over the long term. It's in its first phase now," said Steve Witt, vice president of marketing at Alpine Electronics of America, Inc. ([www.alpine-usa.com](http://www.alpine-usa.com)). "HD radio holds significant promise because of its multicasting capabilities. That digital terrestrial infrastructure will begin to deliver datastreams that can be used for things like real-time traffic information, whether simple alerts or integration into a sophisticated navigation system, as well as providing additional datastreams of content yet to be imagined."

In the first quarter, Alpine expects to begin shipping the DVA-9965, an in-



Figure 5. Blaupunkt is readying 3-D navigation for launch as early as 2009.

dash, DVD mechanism-based head unit with HD radio built-in (Figure 4). "The head unit with HD radio, plus a traditional AM/FM analog tuner, plays all CD and DVD formats, and is iPod- and satellite radio-ready," Witt said.

For introduction a bit further down the road, Blaupunkt is working on navigation system enhancements, including a 3-D display (Figure. 5), and natural language voice recognition. "In 3-D navigation, the driver won't just be seeing a road network, but the experience will be more like driving through a photograph," said Peters. That function is expected as early as 2009. Natural voice recognition, which could be ready for the 2010 model year, will take consumers well beyond the limited command sets available today. ■

#### **ABOUT THE AUTHOR**

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