MARVELL ENABLES NEXT-GENERATION OF AUTOMOTIVE CONNECTIVITY

Anil Gercekci, Marvell

A leader in connectivity, networking and computing platforms, Marvell enables future high-bandwidth connectivity solutions for automotive, serving an array of worldwide customers.

Based on its well-established cellular and WiFi/Bluetooth (BT) product portfolio in the consumer and enterprise industries, Marvell continues to deploy 3G WiFi/Bluetooth combination solutions in automotive. With new 802.11ac high-bandwidth WiFi capable of more than 400Mbps with one antenna, and more than 800Mbps in multiple-input and multiple-output (MIMO) mode, car companies are provided the ultimate opportunity to offer Internet on Wheels to users for streaming multiple video and map downloads, as well as secure over-the-air upgrade capabilities. Simultaneous dual-band operation enables new applications where legacy networks can be managed in coexistence with BT. This allows high data rate video streaming to take place on the "quieter" 5GHz band. MIMO capability using multiple antennae provides sustained high throughput in the case of car-to-infrastructure communications at longer ranges at the same Tx power levels as in a single antenna case.

Following its deployment of 3G solutions in automotive, Marvell next-generation 4G LTE products not only offer more bandwidth, but also more users per cell. The complete 3G/4G solutions from Marvell offer voice and data traffic with chip sets designed for worldwide use. In addition, TDD-LTE and FDD-LTE Release 10 capability with 300Mbps downlink and 100 Mbps uplink bandwidth and carrier aggregation is important for car companies as they deploy new models worldwide.

Never before have so many high-technology solutions been made available simultaneously to car companies. This becomes possible as the technologies that are proven in other market verticals become available for automotive applications. Marvell's industry knowledge and field-hardened solutions provide a proven advantage to the automotive industry.

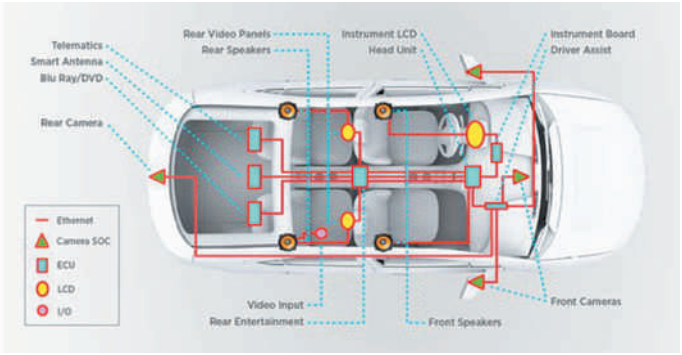
In 2010, Marvell introduced low-cost WiFi Access Point technology in vehicles called Marvell Mobile Hotspot (MMH). By coupling BT and near field communication (NFC) radios on the same physical die, Marvell continues to innovate and include all the standard features needed for rugged multiband multiuse case implementation for automotive.

As Apple Car Play and Google Automotive Link become ubiquitous, the use of WiFi will become common place in automotive electronics. This will allow automotive manufacturers to profit from the embedded or tethered options they may want to have in vehicles with simultaneous dual-band operation - a capability well served by Marvell products.

Simultaneous BT 4.1 LE, 2.1, NFC and WiFi operations place important design constraints on automotive OEM infotainment system architects. These are resolved by the use of on-chip CPUs, where the MAC functionality is implemented locally, enabling major reduction of workload on the host computer, as well as reduction in software (SW) integration efforts by the system supplier.

Marvell has also been driving wired connectivity in automotive since 2007. Based on its market leadership in IEEE-standardized 100Mbps, 1Gbps and 10Gbps solutions, plus experience in Audio Video Bridging (AVB) standards, Marvell continues to innovate and provide leading-edge solutions to the automotive industry. The company has also spearheaded the development of the 1000 B-T1 IEEE specification since 2011, helping to drive this Ethernet PHY technology to enable high-bandwidth data transmission in vehicles to allow low or no compression of video necessary for Advanced Driver Assistance Systems (ADAS.)

Coupled with AVB and Time Sensitive Networks (TSN) standards, Marvell products take into account the needs of the automotive industry for predictable and bound latencies of data transfer, as well as Quality of Service (QoS), required in automotive applications.



Going forward, the use of unshielded twisted pair (UTP) cable for full duplex transmission will enable a lower footprint for connectors resulting in smaller module sizes. This low profile is also important for remote modules such as cameras, Telecommunication Units (TCU) and other sensors, like Radar and LIDARs, where space is at a premium in the remote node. As system-on-chips (SoCs) continue to evolve to include Ethernet PHYs, the space savings become truly visible. Together with power-saving implementations, such as Energy Efficient Ethernet (EEE), where a significant part of the PHY power dissipation can be reduced, as in the case of low duty cycle traffic, the power efficiency of the sensors is improved.

A significant aspect of the ease of use for Ethernet is the availability of Ternary Content Addressable Memory (TCAM) in the switches. This allows snooping deep into the incoming frames at wire speed well beyond the MAC header, enabling detection of even the IP address for making decisions based on header content. This allows the switch to make decisions to route the message to the appropriate destination at wire speed without any SW intervention from a host processor. Examples of this usage include snooping and trapping certain messages, and routing them to the appropriate ports for examination during the SW debug phase of the project, or only passing a certain set of messages upstream to save Host CPU power. Such conditional routing will also be key for improved security in Ethernet networks.

Remote Management Frames (RMF), sent via Ethernet to modify certain IO pins on switches and the PHYs, provide additional flexibility and cost reduction. A good example of this is the switching of power on/off to the remote nodes from the switch via Power over Data Line (PoDL) without additional wire connections. The IO available on the switch that can be controlled via RMF provides the appropriate control for such PoDL.

In conjunction with PHYs, Ethernet-enabled SoCs, and multiport switches are being offered as complete end-to-end solutions to realize various goals such as: ADAS, rear view cameras, surround view, diagnostics/SW upload and a AV distribution within the vehicle.

As progress in ADAS and autonomous driving encompasses the fusion of multiple sensor transmission and processing technologies, the ongoing collaboration between carmakers and semiconductor providers will continue to be key for finding innovative techniques to solve ever-growing integration problems.

Anil Gercekci is Director of Technical Marketing, Automotive. MSc in Electrical engineering from EPFL Lausanne in 1975, Anil has been IC design engineer and MCU design manager from 1976 to 2003 and joined Marvell in 2005. He owns 14 patents.