The Best Future Proof Solution to a Vehicle Network Design – Using the 1394 Automotive Standard

1394 Automotive Standard offers long life cycles and the best combination of performance, security, flexibility, and cost

In today's economy -- where R&D investments are difficult to justify and long life cycles for electronic technologies are mandated -- the 1394 Automotive network offers an excellent solution for all in-vehicle electronic applications. Whether your platform is an entry level or a luxury model, the same technology is shared and is expandable -- even at the dealer level. The 1394 Automotive technology was developed by automakers and Tier 1 and component companies with baseline requirements for today's automobile; and it meets the requirements expected over the next 10 years. In addition, several proven automotive harnessing systems are specified for maximum flexibility, and all are interoperable with multiple sources for cost effective implementation. The 1394 Trade Association, AMI-C and IDB Forum have spent eight years developing and proving out this superior networking technology. The 1394TA leads the effort now with proposed device compliance testing and extensions to the standard. The results will be new and innovative automotive entertainment systems, as illustrated in Figure 1.

Figure One

1394 Automotive enables a reliable, sophisticated rear seat audio and video entertainment system. (Photo courtesy of Nissan Corporation)

The developers of the 1394 standard know the competition, with technologies like MOST and Ethernet for networks. They feel strongly that these other technologies do not and will not compare with 1394 Automotive now or, even more importantly, over the long-term. For applications such as navigation (VGA quality), multiple HD quality video and audio content, camera systems for driver assistance and enough bandwidth to add more, only 1394 Automotive is ready and capable.

Comparing 1394 Auto, MOST, and Ethernet

Ask your engineering teams to compare 1394 Automotive, MOST, and Ethernet side by side using the following variables and you will see the ones that the other technologies either don't offer or are vastly inferior to 1394 Automotive on these building blocks for networking:

- Reliability
- Cost
- Aggregate maximum bandwidth and expansion
- Media Access Control
- Isochronous capabilities
- Reverse/legacy compatibility and scalability
- Media choice (harness flexibility)
- Flexible topology (Star, Rings, Tree, etc..)
- Silicon costs
- IP license fees
- Silicon industry support
- Synergy with other control technologies
- Synergy with broad consumer technologies
- Auto device discovery and configuration protocols
- Tested and available software

The 1394 Automotive standard defines data rates as fast as 800 Mbps (called S800 or FireWire 800) today. Since 1394 is backward compatible, this means that they support any 1394 devices operating at S100, S400 and S800 seamlessly and simultaneously. The next generation of silicon for S1600 and S3200 (1.6 Gb/second and 3.2 Gb/second) is defined and will ship in 2009. These too will be fully backward compatible to 1394 Auto Standard that exists today.

First-generation MOST25 operates at 22.5-Mb/second, maximum. The MOST group has also defined a 150Mb/second version called MOST150, a non-backward compatible spec completed in the spring of 2008. Major harnessing changes may be required when MOST transitions to higher speeds.

A single MOST25 network will not support all of the A/V traffic that automakers envision, and the next-generation MOST150 technology will fall short on performance and backward compatibility. There will be no economy of scale with older MOST products that can't be carried forward to new designs. This is too little and too late compared to 1394 Auto today and for the future.

Ethernet brings the same advantages and disadvantages to the auto that it does to home video-centric networks. Ethernet is a 'best-effort' system and therefore lacks the quality of service guaranteed by 1394. There is also no IT department to reboot your automobile entertainment system when it freezes. Such support is not needed with 1394 Auto, which automatically resets by design when any devices are changed.

There are also different media choices – copper or optical fiber. MOST was defined from the start based on optical media. The first 1394-centric automotive spec also specified fiber; IDB-1394 has been fiber based since initial publication. With advances in signaling and silicon technology resolving the EMI and EMC challenges of copper, automakers and Tier 1 suppliers can mix and match fiber and copper using 1394,whatever their preference or experience. The newest 1394 Automotive S800 is based on copper interconnects and three different automotive proven systems were specified.

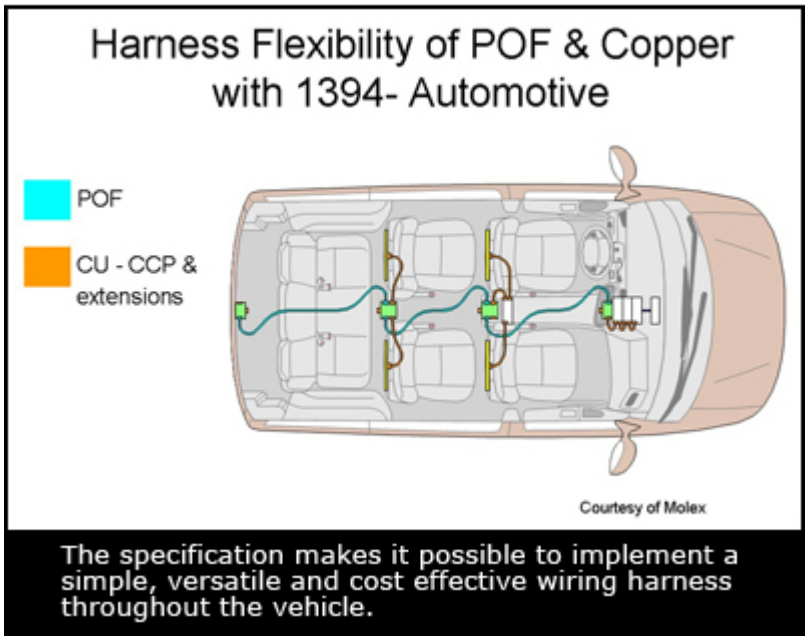
1394 Auto is the most flexible of any network or bus-based interconnect, allowing for bus, star, ring, daisy chain, tree, and other topologies, and the topologies can be mixed and matched using 1394 Auto in a ring for fail-safe operation that will survive any single cable or device fault.

Cost, maturity, and reliability

Cost: Cost is of primary importance. Many factors such as the number of silicon players, maturity in a technology base, harness flexibility and licensing fees come into play in understanding applied cost.

1394 Auto benefits from synergistic deployment in the computer and entertainment space that continues to drive down silicon costs. There are 1394-based industrial control cameras and hard drives that can be adapted for use in autos. All of the connector and automotive harness systems as illustrated in figure 2 selected for 1394 Auto already are shipping worldwide with multiple sourcing.

Figure Two



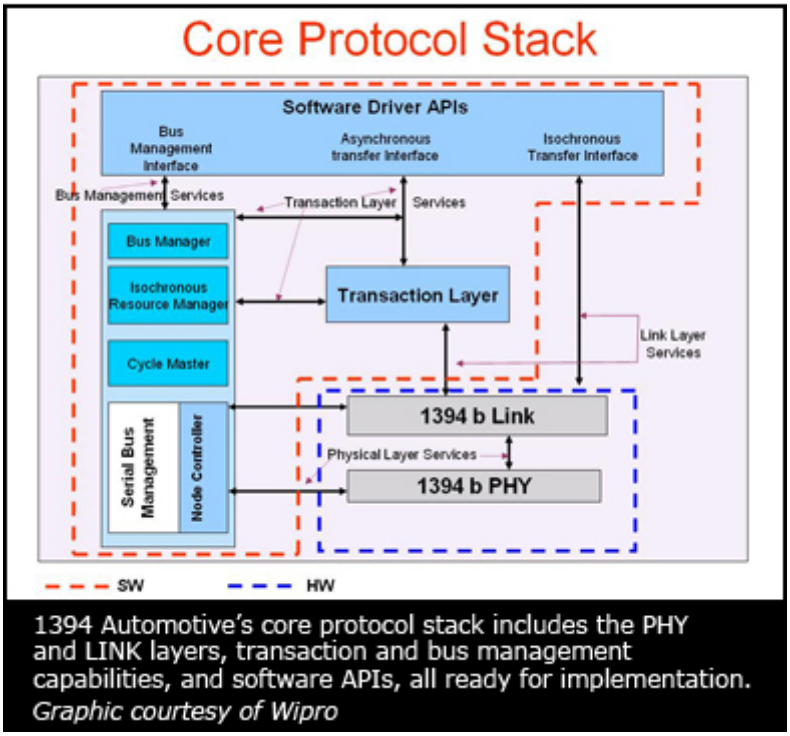
Maturity: Automakers also favor mature technologies. 1394 specifically offers a decade of usage in video-centric applications. Automotive-grade 1394 components for 800-Mbps are widely available while components from other technologies not.

Reliability: 1394 is the most reliable. It has been deployed in very difficult environments. For example, the F-35 Joint Strike Fighter relies on 1394b technology to link more than 60 nodes in systems that provide real-time mission information, weapon systems control, and engine and flight controls. That's a tough and unforgiving proving ground, and 1394 is continuing to be applied in this critical environment,

Flexibility: the 1394 Auto standard offers another vital advantage: flexibility. A 1394 Auto network lets engineers provide flexible harnessing and allows 1394 connectors at various locations around the car which dealers can take advantage and easily add or upgrade devices by simply plugging them in and letting the 1394 Auto network identify and automatically configure them. None of the other competing technologies come even close. These same harnesses can be used in an entry level model and a luxury platform for many years to come with greater scales of economies.

All of the protocols are well defined and proven. For a look at the stack, see figure 3.

Figure 3



1394 Automotive's core protocol stack includes the PHY and LINK layers, transaction and bus management capabilities, and software APIs, all ready for implementation. *Graphic courtesy of Wipro*

1394 Automotive is the Superior Choice

When you consider Ethernet, MOST and 1394 Auto from the system level, it's clear that 1394 answers the needs of the automakers and provides superior performance. It meets all of the major demands that automotive networks face today and far into the future with

a cost effective, mature, proven technology with a long-term road map. 1394 Auto, with its long history, secure content protection, proven standards-based automotive protocols, wide variety of topologies, and various flexible wiring harnessing, offers by far the best future proof solution to a vehicle network design for entertainment, navigation, information, and driver assistance applications.

Sidebar: Background on 1394

The makeup of the modern automobile, measured in terms of dollar value, is increasingly electronic in nature. The auto doesn't stand alone -- the design of everything from home music systems to factory-control systems to automotive systems take advantage of Moore's Law advancements in semiconductors that usurp and improve upon formerly mechanical or electromechanical systems with data converters, processors, and software. The trend toward electronics results in dozens or even hundreds of processing islands or – nodes – spread throughout the auto. Both the need to share data among the nodes and the efficiency of a shared-media interconnect, make some sort of automotive network a necessity in next-generation designs. Current and future designs include the need to move video around the auto for safety, navigation, and entertainment applications. The 1394 Automotive standard offers the best combination of topology, performance, cost, and data security for those next-generation designs.

The 1394 Automotive standard is derived from, and is compatible with, the widely deployed entertainment and computing interconnect that is alternately referred to as IEEE 1394, FireWire (originally an Apple term but now broadly used), or i.LINK (Sony). A decade ago, 1394 technology was already shipping in applications such as digital cameras. The designers of the 1394 architecture optimized the interconnect from day one as a peer-to-peer multimedia-capable bus. Jointly, the 1394 Trade Association (1394TA) and the former IDB Forum realized that FireWire capabilities would match future automotive networking needs and together defined IDB-1394 (Intelligent transportation systems Data Bus using 1394 technology).

The original IDB-1394 standard specified the use of optical media in the auto because at the time auto designers felt noise would be an issue for copper media. Subsequently, silicon developments and improved shielding technologies have evolved that allow the use of copper cabling in the auto. The 1394TA recently augmented the original work with a copper specification and auto designers now have a choice of media. The 1394TA will shepherd the auto spec now under the brand 1394 Automotive.

The move toward a networked automobile began more than a decade ago. As electronics moved into systems ranging from mission-critical braking and engine control to entertainment and convenience features such as music systems and power mirrors, the electronic islands had to be tied to the driver's seat with what quickly became bulky wiring harnesses. The harnesses added significant weight and cost, and

were unreliable and inefficient to install and later service. Now, with the 1394 Automotive standard, these issues are resolved.