



MOST – The Way Ahead

The future of infotainment networking can be divided into two categories. For the European luxury brands, which have driven the adoption of MOST from the very beginning, the future will surely look different than for the many followers focussing on the mass market.

As of today, only 10 to 20 percent of all passenger vehicles are equipped with an infotainment network. At the same time, many car makers who have not previously been highly focused on infotainment systems are facing the need to improve in order to keep pace with the digital world, offering networked applications. For those car makers, it is very important to rely on a technology which is proven and shipping in high volume, offering state-of-the-art performance and low price at a minimum risk. The re-use of MOST50 or MOST150 technology is a rock solid and straightforward approach, providing a well-understood network and taking advantage of the existing MOST specifications, components, software stacks, and development tools. The focus is on low-cost, low-risk, and a very short time to market. The available data rates are more than sufficient for the transmission of even multiple HD channels; the protocol stack, which has been developed and debugged for more than ten years, offers almost everything needed.

With the MOST50 UTP electrical physical layer, in production since 2007, even a point-to-point link between a head unit and a DSP audio amplifier can be cheaper than an analogue connection plus a digital control bus.

In-vehicle networking today and tomorrow

Since the foundation of the MOST Cooperation in 1998, 13 years have elapsed. More than 100 car models relying on the powerful infotainment backbone have been launched, and the third generation of Media Oriented Systems Transport and MOST150 is about to be launched for mass production. As always, even before one technology generation is close to its peak, the question arises: what comes next?

By Harald Schöpp

Looking at the premium OEMs, the requirements are different. In-vehicle infotainment is about to saturate the market in terms of new and useful functions and features. Connectivity outside the car is becoming much more important than pure entertainment. More and more IP-based applications will arise, making extensive use of the MOST Ethernet Packet channel (MEP), which is new and specific to MOST150. Here, any standard protocol stack can be used on top of MOST, providing both the advantages of a synchronous network and a powerful data pipe for IP/Ethernet data.

Just as important is an appropriate high-speed interface connecting the network to equally high-speed processing devices, making use of the full network bandwidth without loss.

Bandwidth requirements will be driven by fast software updating and fast media access to on-board mass storage devices, portable consumer devices attached via USB, and car-to-x applications connected via either WLAN or LTE.

■ Driver assist network is required

The need for a driver assist network is a hot topic in the industry, and there is the fundamental agreement by many OEMs and tier 1 suppliers that there will be a new cluster in the electric/electronic ecosystem of the vehicle for driver assist applications.

However, as with all new technologies, one of the key questions is how to start. Besides all the technical discussions, the economic implications will play a major role in decision-making. Using MOST150 for driver assist networking has the clear advantage that from the very beginning, future applications can benefit from and share in the volume generated by the infotainment market. From 2013 onwards, MOST150 based driver assist networks can have a jump start in terms of volume. In contrast, any other technology that is not yet established in the automotive market will have to blaze its trail through low initial volumes and immaturity – MOST

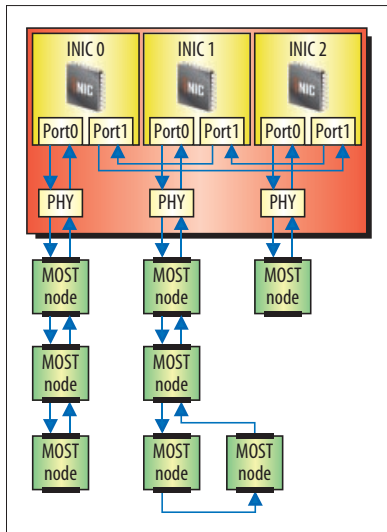


Figure 1. Topology options using the "OS81111 Dual Port INIC" for MOST150.

and FlexRay experienced exactly the same thing during their infancy.

It has been shown that by adding an appropriate safety layer, MOST can be enabled to address functional safety requirements up to ASIL D, while at the same time being able to re-use a major part of the technology and specifications that have been developed and debugged over the last 13 years. Over the longer term, uncompressed video transmission requirements may drive the bandwidth requirements of a driver assist network, too.

The MOST roadmap

A major strength of MOST technology is the careful balancing between technological possibilities, market requirements, and economic considerations. It

is extremely important to show a clear cost-down roadmap in parallel to technological advancements. Several different aspects need to be addressed, including data transport capacity, physical media, and topology options. As there will be an increasingly strong tie between infotainment/telematics and driver assist, requirements from both areas need to be fulfilled.

At the MOST Forum 2010, a prototype version of a multi-port INIC for MOST150 was presented. The OS81111 implements a two port architecture which enables prototype design for alternative network topologies (figure 1).

In a very elegant way, several topology options can be realized, including ring, daisy chain, and star. Obviously, in such a pseudo-ring architecture, the bandwidth is shared between the different branches in the event that a star topology is implemented.

Within the last year, technology has advanced and the requirements have become more defined. To meet these needs, a true multi-port INIC chip is being developed by SMSC, eliminating the bandwidth sharing of the prototype (figure 2).

With this chip, each branch will provide full 150 Mbit/s data transport capacity. In addition to the well established MediaLB 6-pin-interface providing a bandwidth of 300 Mbit/s, a standard high-speed interface offering a minimum 1.2 Gbit/s is implemented. The interface will match interfaces used by the media processors found in multimedia or driver assist processing units. The different branches themselves will run on MOST150, with the additional option that each branch can be hot-plugged or cut off without impacting communication within the rest of the system. Each branch may consist of a ring itself, or a daisy chain, in which case the dual-port INIC is used. This architecture addresses use cases that require a true star architec-

ture, e.g. coming from the driver assist domain, while at the same time maintaining the principal advantages of MOST, including the synchronicity and the low latency of the network.

The need for higher bit-rates

It has always been a particular strength of MOST to not shoot for the highest bit-rates technically possible, but rather find the appropriate sweet spot, as discussed previously. Instead, the development of new functions and features, speed grades, and physical layers has always been driven by the MOST Cooperation, collecting the real market requirements of a broad community. In figure 3, the driving functions for MOST25, MOST150, and also the future generation are shown.

The absolute speed grade for the future generation of MOST is not yet entirely determined. The same principal was applied when MOST150 was developed: it was clear that a bandwidth of more than 100 Mbit/s would be required, but the exact bandwidth was determined by other parameters, such as the strong requirement of keeping the POF and the connector system identical to MOST25.

The feasibility of implementing a speed grade up to 10 Gbit/s for a next generation has been investigated already. The even more interesting question is: what does the automotive market really need? Why would people like to transport data at such high speed and what kind of data is it?

And what is the appropriate physical medium and what is the overall system cost, including an automotive grade network interface controller, physical medium, and connector system? Solutions are being developed for POF, PCS, and coax physical layers, with each solution offering certain advantages but also trade-offs. Staying with POF and boosting the bandwidth to the 1 Gbit/s range by smart modulation techniques may be an interesting option, keeping the advantage of handling a well-known optical cable and connection system and taking full advantage of the MOST150 volumes in the market. Also, what is the appropriate time line to introduce the next generation to the market, given the fact that

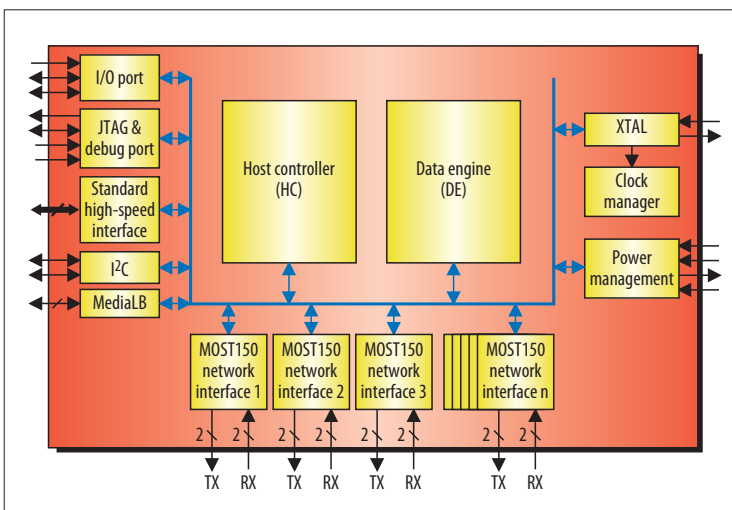


Figure 2. Block diagram Multiport INIC.

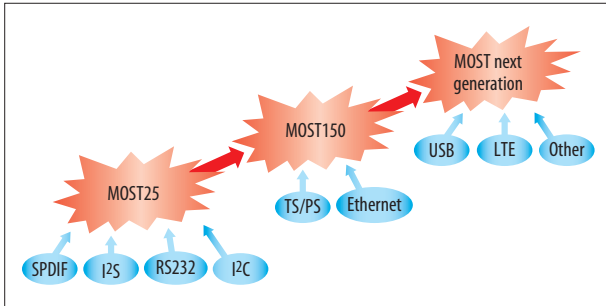


Figure 3. MOST roadmap.

MOST150 is just about to launch into production this year?

Some boundary conditions are clear already: the bit-rate will be beyond 1 Gbit/s. Both the optical and electrical physical layer will be available, and MOST will remain a synchronous network providing a payload efficiency of nearly 100 percent, with the ability to seamlessly transport IP packet data. In order to serve the driver assist market, relevant parameters will be considered to fulfill the functional safety requirements according to ISO 26262. Other open items, such as appropriate interfaces to the application processor and of course overall system cost are being considered before the product and system concept can be finalized.

■ MOST in the market

It is critical for any new technology to cross the chasm between being a niche technology and becoming a widely accepted standard (figure 4).

Looking at semiconductors for the automotive industry, the difference between the semiconductor world and the automotive industry is quite significant: e.g. the definition of "reasonable volumes" required for state-of-the-art silicon solutions in terms of performance, quality, and price is different. The same applies for product life cycles, particularly in the area of technologies like infotainment and driver assist.

To overcome this hurdle, repeated attempts have been made to import technologies from the consumer space into the car and thus gain scaling effects in terms of both volume and price. The most recent examples are USB and Ethernet. However, at second glance, it becomes obvious that this has not worked as hoped. Technologies need to be optimized before being used in a

car, with respect to either the environment or the application. In the case of infotainment/consumer networking, no major cross brand standard has been accepted and implemented by the major players of the consumer space, although repeated attempts have been made. And all the cell phone industry could agree to harmonize is a common charger.

The conclusion is that automotive requirements, particularly in the networking area as a part of the DNA of the car, require automotive-specific developments. But once a technology has been developed and optimized for the car, adding all the specific functions and features required for in-vehicle use, the consumer industry still does not want to pay a premium, as most of these features are not needed in the consumer world. All in all, it leads to optimized solutions for the car, such as CAN, FlexRay and MOST. In that context, single source supply situations also need to be looked at in a different light.

MOST has been in the market since 2001, having crossed the chasm with implementation in about 12 percent of all passenger vehicles. In 2007, SMSC and Harman announced the opening of the MOST link layer for MOST25 including a roadmap for MOST150.

Perhaps not surprisingly, no company has licensed the technology for MOST25 so far. The reasons are pretty obvious: in contrast to CAN, where several hundred million nodes are sold each year, the overall market size is still too low. For MOST50 and MOST150, however, the picture looks different, even if only infotainment applications are considered so far.

MOST150 has already been adopted by VW/Audi, Daimler, and other OEMs. The volume curve will start to rise more steeply from 2013/14 onwards, when the roll-outs of high-volume models start. At the same time, MOST50, which is very well suited for the mass market – as Toyota/Lexus have proven – and has already found more adopters in the fast

follower community mentioned above, will follow a similar pattern.

This will lead to quick cost reductions, which makes it very attractive for non-infotainment application areas to participate in the high-volume effects of MOST in the infotainment area. So it can be expected that MOST interface implementations by other semiconductor companies will now make technical and commercial sense, in contrast to MOST25.

For CAN and MOST, it has taken more than ten years to reach such a point. Any new technology will have

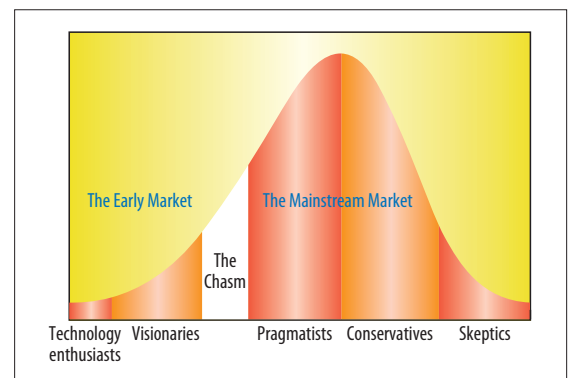


Figure 4. From Early Market to Mainstream Market.

to follow the same pattern. In times with even greater cost pressure, the pre-investment, which has already been made for MOST for over a decade, will also have to be made for other technologies, being new to the car. Crossing the chasm means offering superior technology at low price for low volume over several years.

MOST has already crossed it – with a clear future technological and commercial roadmap. *sj*



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