

MOST Network System Supporting Full-Duplexing Communication

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Abstract—Increasing network reliability and reducing the fault tolerance of Media Oriented System Transport (MOST) network which has been adopted by major car maker such as BMW, AUDI, as in-vehicle backbone network has to be employed the full duplexing configuration. In this paper, proposed MOST network system is applied to two communication ports which enable to provide redundant path. Thus proposed system can avoid shut network down when network breaking problem is occurred. In this paper, it is an aim to present platform implementation based on the dual SRAM-Media Local Bus (MediaLB) in order to support the full duplexing communication mode in vehicular network system

Keywords—Full Duplexing, MOST, In-vehicle Network System, MediaLB

I. INTRODUCTION

Full duplexing data buses in vehicle network system are exclusively used for preventing network break. The Media Oriented System (MOST) that is data bus technology currently used in cars with a data rate up to 150Mbps has a role of infotainment application adapted on multi-media transmission only in car. But, today's in-vehicle network is not limited for the only multimedia application. In-vehicle network has to be required as a gateway to exchange the data with other network continuously. In case of the vehicle system, Car Area Network (CAN) operating low rate data related to body, multimedia and chassis of car is collected and transformed into higher network frame through the network having higher data rate like as MOST in order to avoid network traffic jam.

As needed in-vehicle network must connect with that data directly are used in controlling body and chassis of car like CAN or LIN or Synchronous Ethernet, MOST which is enabling to accommodate a variety of in-vehicle network has to be considered fault tolerance of data transmitting and reception when the network has a sudden breaking. Thus, in this paper, it is proposed that new MOST network configuration has full duplexing architecture having redundant channel.

In chapter II., it is introduced general MOST Network System and MOST Gateway system. Proposed MOST network based on full duplexing configuration is described in chapter III. And the implementation of proposed system is showed in chapter IV. This paper is concluded in Chapter V.

II. MOST NETWORK SYSTEM

MOST is the de-facto standard for efficient and cost-effective networking of automotive multimedia and infotainment system [1]. The current MOST standards released MOST150, 150Mbps network bandwidth with quality of service (QoS) support

A. MOST Network Device

The basic of MOST network device, as it is shown in Figure 1. It shows a device with and optical Physical Layer (oPhy). The Fiber Optic Receiver (FOR) transforms the light signal into an electrical signal, which is transmitted to the Rx input of the Network Interface Controller. The Data Link Layer is realized in the MOST Network Interface Controller, which controls the access to the routing engine. Through the routing engine, data which user wants to transfer are transformed into packetized frame. The data from various automotive applications operated in MOST ring network consists of three message channels into control, synchronous, and asynchronous as called real packet data message channel. The control channel is used to invoke a service on a remote MOST node operation. And synchronous data is suitable to streaming service playing real-time multimedia. The packet channel is well fit into TCP/IP, data communication and recently Ethernet packet type is pertained shown in Figure 2.

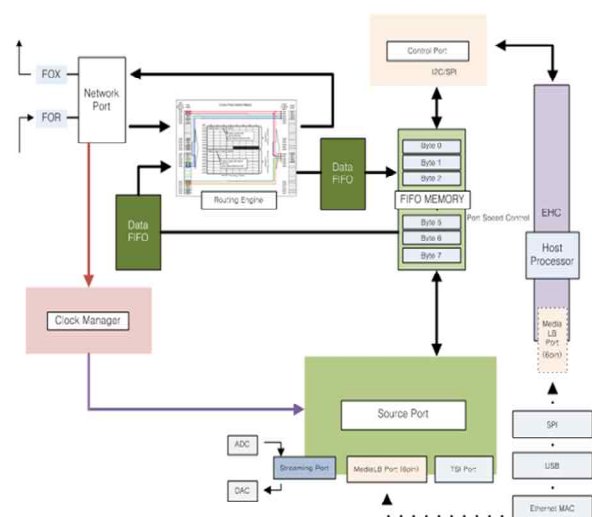


Figure 1. MOST Network Device Model

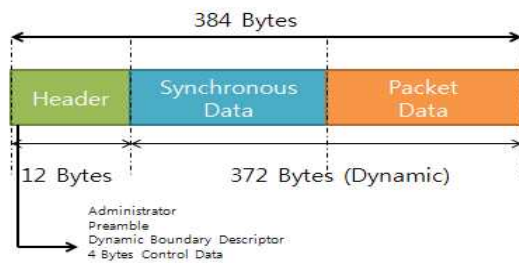


Figure 2. Structure of MOST150 frame

B. MOST Network Management

The basic architecture of a MOST network is a logical ring topology which transmits the data from one device to another [2][3]. For the data that, from Network Master to Network Slave, MOST devices are wanted to transmit flow between nodes only one way in ring network.

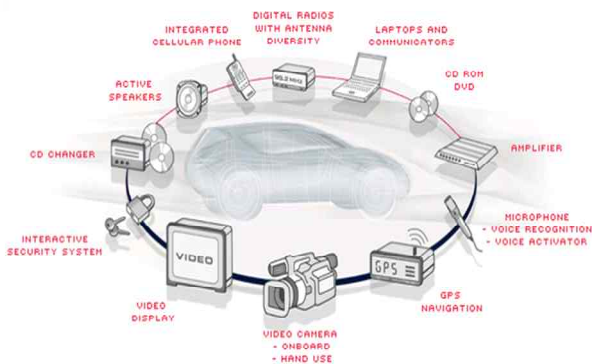


Figure 3. MOST Network Device Model

Generally, this topology in Figure 3 is used but, this is not mandatory. A combined ring, full duplexing mode, can be realized. Devices having dual port increase the system reliability and reduce the case of errors of networking. In order to make MOST highly available, each node must have two receivers and two transmitters. If there is a ring break problem between nodes, the ring can be closed via the redundant segments by changing logic.

III. FULL DUPLEXING MOST NETWORK

A. Dual SRAM-MediaLB Interface

In order to make the data connection path, SRAM interfacing method is used generally. Data transferred from bus architecture access into SRAM space and linked in Network Interface Controller through the MediaLB interface. MediaLB interface is an on-PCB or inter-chip communication bus, specially designed to a common hardware interface. Especially, MediaLB supports all the MOST network data

transport; synchronous, control, asynchronous and isochronous data [4][5]. MediaLB uses a time-multiplexed bi-directional signal line for MLBCLK, MLBSIG and MLBDAT signalling. Figure 4. depicted MediaLB connection of implementation. Thus, achieving the full duplexing communication mode, proposed MOST devices adopt the Dual SRAM to MediaLB configuration

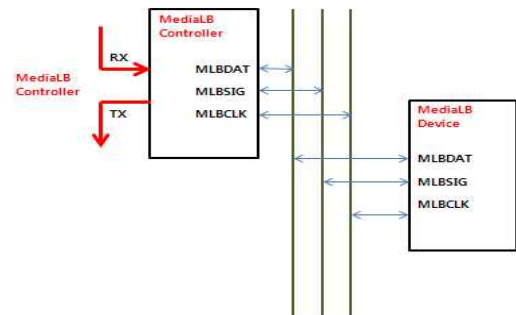


Figure 4. Connection Diagram of MediaLB

B. System Architecture

Transferred data from Fiber Optic Receiver (FOR) and Fiber Optic Transceiver (FOX) is assigned in routing table of Network Interface Controller and moved in predetermined address. And addressed data are divided into control, synchronous and asynchronous data and gone to registries in SRAM.

Proposed MOST devices are usable that it can be connected with other network device such as industrial Ethernet, CAN, or LIN easily as a Gateway. For example, proposed dual port MOST network system is transferred into the CAN by the Human Machine Interface (HMI), which implements the gateway functionality. Through the SRAM memory registry, data which the source requests to transmit are stored in predetermined space of memory and from the different network node which read the data at defined memory area. That means, it could be a data sharing and exchanged between the MOST network system and the rest of the vehicle network. It is described in Figure 5.

MOST- Industrial Ethernet Gateway is showed us the possibility of connectivity to Ethernet based network in Figure 6.

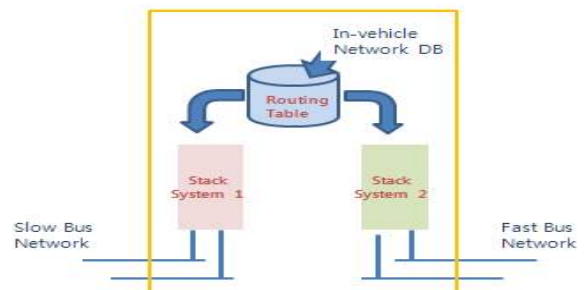


Figure 5. Basic structure of a Gateway

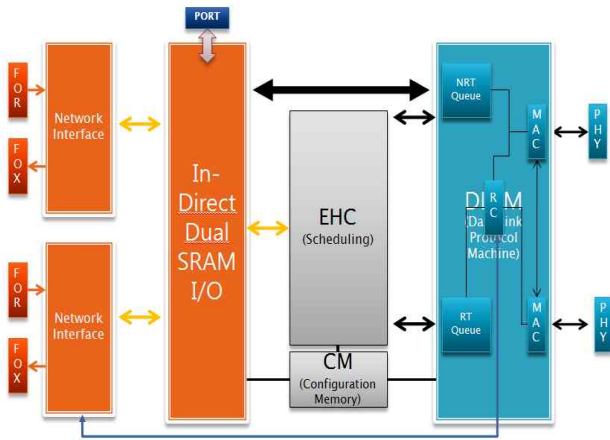


Figure 6. Connectivity of the MOST Network System with Industrial Ethernet System

IV. RESULTS

Through the dedicated logic design, we constructed an FPGA prototype to validate the hardware and software in MOST network environment.

We mapped our logic design into Xilinx gate Vertex chip and implemented a test board. The test PCB board contained FPGA, flash memory, external RAM, MOST Network Interface Controller. Figure 7 shows the FPGA network test board supporting dual port configuration for MOST Network operation. Table 1 provides a summary of the implemented field programmable gate array (FPGA) utilization which can be shown that small memory usage can be expected the area-effective chip size when the IP changed into system on chip base.

TABLE 1. DUAL SRAM-MediaLB FPGA (DEVICE UTILIZATION SUMMARY)

Target Device	XC5VLX110	
Slice Logic Utilization		
	Number of Slice Registers	6,986
	Number of Slice LUTs	15,347
	Number of route-thrus	897
	Number of occupied Slices	6,103
	Number of LUT Filp Flop pairs used	17,233
	Number of BlockRAM/FIFO	18
	Number of BUFG/BUFGCTRLs	8
	Number of DCM_ADVs	2
	Total Memory Used	630KB

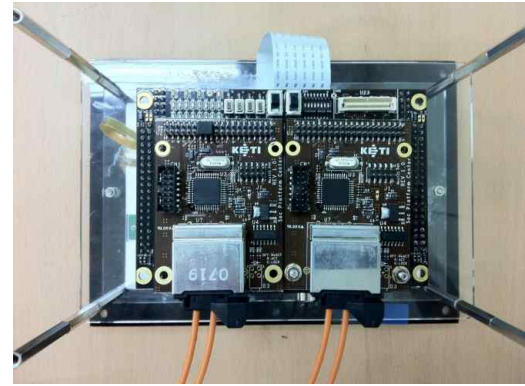


Figure 7. MOST Device FPGA Platform supporting full-duplexing mode

A. Timing Simulation

Shown in Figure 8, timing simulation serves as an interface between the MediaLB and a SRAM interface, implementing MOST data exchange. All designed logic functions are including transmission of commands and data when finding network error. With MediaLB1 or MediaLB2 enabling selection logic, it is able to use the redundant data path. The oPhy module set in the proposed platform provides the status of network connection from INIC network check algorithm. Given the status of network, unless MOST network system is working normally, dual port selection logic is actuated.

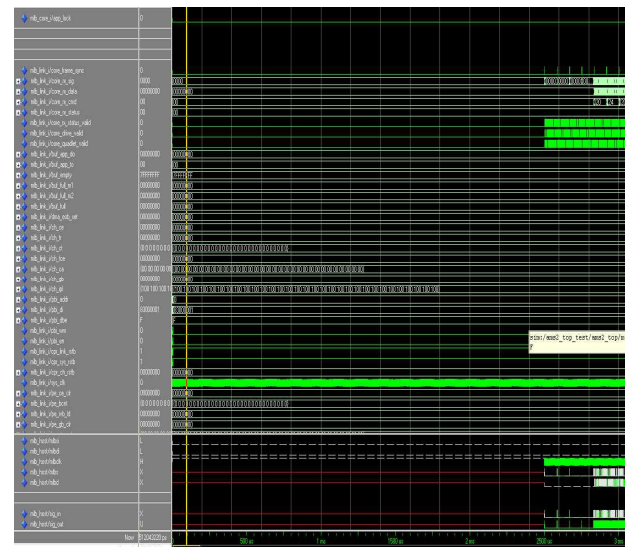


Figure 8. Timing Simulation of the proposed dual SRAM-MediaLB

V. CONCLUSION

In this paper, we presented the implementation of MOST platform having dual ports in order to support full duplexing communication. It can be given the benefit of stability of network operation. Thus it needs to be implemented and we

made FPGA test board supporting dual port communication. It's the change that we can test real operation of the FPGA prototype for full duplexing environment. As mentioned in the previous chapter, the designed dual SRAM-MediaLB interface is developed in memory efficient realization. Also, this proposed platform is expected that it can be a role of in-vehicle network gateway served interoperability between other networks which are required to ensure the high reliability and redundancy.

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