A Study on the MOST150/Ethernet Gateway of In-Vehicle Network

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Summary
As demands increase for the Infotainment System, the Multimedia Networking technology for automobile, called MOST(Media Oriented Systems Transport), has been actively applied to the automobile industry, to meet the demands of the Infotainment System. The MOST25 network technology is being restrictively equipped with some of the car models but the problems with bandwidth and compatibility has arisen. In order to solve this, the MOST150 technology has been developed and further research is being carried out to apply the technology to the automobile industry. Thus, for the effective process of the Ethernet traffic in the realization of MOST150/Ethernet Gateway for automobile, we, in the research, shall analyse the QoS Management Mapping method, including the MOST150's Isochronous channel, the MOST Ethernet Packet Channel, and etc. and study the efficient algorithm.

Key words:
Vehicle Network, MOST , Gateway, QoS Algorithms, Ethernet, IntServ, DiffServ, OPNET

1. Introduction

MOST(Media Oriented System Transport) technology is multimedia network technology optimized for the use of cars and its application, by providing the Synchronization transmission of the audio/video data, and an Automobile Communication Technology That enables the simultaneous transmission of high definition audio/video packet for the Multimedia Services as well as the real time control of single transmission medium. [1]
'Specification Rev 2.5', a Standard for the MOST, had once announced in October 2006, which helped define applications, networks, and hardwares, and latter the MOST Specification 3.0 has announced in March 2008, which helped advance the transfer support from existing 25/50Mbps to 150Mbps by defining the Physical layer, and innovate the technology by adding new functions.
The MOST25 has now already been installed in more than 60 models in Europe and Korea, and the MOST50 has been applied and being mass-produced in Japan. In case of the MOST150, there are active discussions about its Technical Standard and the models equipped with the MOST150 technology is expected to be introduced later this year.

2. Related Research

2.1 MOST25 Frame

2.1.1 Synchronous area

The synchronous area is used for the real-time communication of audio and video data. Before the data can be transmitted, however, a connection must be established by means of the Connection Master, which uses the Control Channel for that purpose.

2.1.2 Asynchronous area

The asynchronous area covers the second part of the 60 data bytes of a frame. Its bandwidth also depends on the Boundary Descriptor and can range from 0 to 36 bytes. It uses a data link layer protocol and transports packet data which are not transmitted cyclically, such as the TCP/IP protocol or configuration data for a navigation system. The protocol is used with two different data field lengths . The 48-byte data link layer protocol transports up to 48 data bytes and the other layer up to 1,014 data bytes.

2.1.3 Control Channel

The Control Channel transports commands, status and diagnostic information administering a MOST network.
In order to prevent the Control Channel from claiming too much bandwidth per frame, it is distributed over 16 frames which are combined into one block . Each frame transports 2 bytes of the channel. The preamble of the first frame of a block has a specific bit pattern to identify the block. The protocol of the Control Channel has a constant length of 32 bytes.

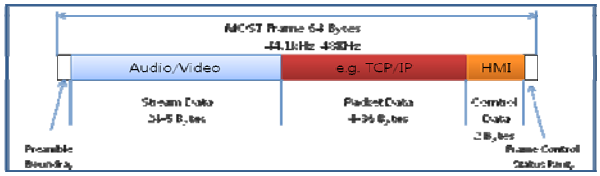

Figure. 1 MOST Frame

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2.2 Introduction of MOST150

MOST150 provides the Isochronous Transfer mechanism that allows the Bandwidth of 150Mbps and a broad range of video application, the Ethernet Channel for the efficient and even IP-based Packet data transfer, and the Ethernet Physical Layer within the car which may bring interworking between existing Infotainment technology of the Intelligent Vehicle and the ITS technology.
In addition, it has the network speed of 6 times faster than the MOST25, efficiency of 98% in transmitting audio/video signals, addressing, collision detection/ recovery, and no need of overhead for broadcasting. Also, several HD video stream and multichannel surround sound can be easily transmitted in parallel on the Internet.
Along with the MOST25 device's control channel for real-time control, packet channel for data transfer service, and synchronous domain including synchronous audio and video channel, the MOST150 has the twice wider bandwidth of control channel, increased payload that transmits bigger packet without segmentation, and prior approval that increases the channel capacity and prevents the loss of messages.[2]

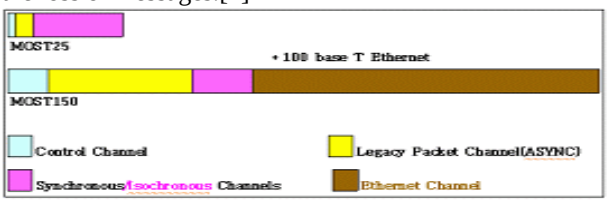

Figure. 2 MOST Frame Structure Evolution

Technologically MOST150 is a big step that addresses the requirements of high speed data and video transport. In addition to higher bandwidth of 150 Mbps, MOST150 features an isochronous transport mechanism to support extensive video applications, as well as an Ethernet channel for efficient transport of IP-based packet data. Using MOST, audio and video signals can be transported with high bandwidth efficiency and with almost no overhead for addressing, collision detection/recovery or broadcast. This way MOST150 offers capacity that packet switched networks can only achieve with much higher gross bandwidth multiple high-definition(HD) and single definition(SD) video streams and multi channel surround sound with premium quality of service can be transported, while simultaneously moving high loads of packet data around.

2.3 MOST150 Channel

2.3.1 Ethernet Channel

One of the features of MOST150 is that it provides two new additional channels of the Ethernet channel and the Isochronous channel. Ethernet channel transmits unmodified Ethernet frames used by computer products, and brings itself into applications, by treating it as the Ethernet and the MAC address. Other Ethernet communication protocols like the TCP/IP stack and the Appletalk still communicate unchanged on the MOST .

Table. 1 Ethernet Packet

Dest Adr	Src Adr	Data	CRC
48bits	48bits	Maximum of 1506 bytes	32bits

2.3.2 Isochronous Channel

Isochronous channel provides the stream data the high QoS and three different Isochronous mechanisms by specifying the dedicated channels.
Burst streaming, which allows stream-transmission when there is different amount of data at each time unit, arrived data will used for the frame buffer that is regularly sent to other devices on network.
Constant rate streaming, even if some streams are isochronal, enables tunneling of stream without synchronization with MOST, so that it removes needs of the sampling speed converter and allows tunneling of clock.

Table. 2 Isochronous Mechanism

Mode	Isochronous	Example
Burst Mode	A/V Packetized Isochronous	Transport stream Transmission
Constant Rate	Discrete Frame Isochronous	44.1KHz signal over 48 KHz MOST
Packet Streaming	QoS IP Streaming Isochronous	QoS IP packetized streaming

Packet streaming, a packet that needs to be transmitted along with the Voice-over-Internet protocol or I2S signal such as the Voice-over-IP, stream segments can be transmitted via Ethernet Channel, or private Isochronous Channel that supports the packet can be specified and transmitted. Because these packets are transmitted without interpretation of their addressing information, extra bandwidth is not required for transmission to several receivers. [3]

2.3.3 IETF QoS Algorithm

The two realization methods of QoS(Quality of Service) in IETF are the IntServ method and the DiffServ method.
Purpose of IntServ(Integrated Services) is to provide QoS via efficient use of available resource when there is traffic on the IP-based Internet. and the RSVP is a method of transmission of QoS standard, which defines the Data Stream or the Data Flow transmitted for practice of a specific application service, to all communication devices on the transmission path, and of proper resource

reservation that helps each communication devices satisfy the designated QoS standard. [4]
DiffServ(Differential Service) let control of user flow at network boundary, and when the user packet flows come into the network, simplifies the complicate process within the network supporting QoS by gathering those in a few traffic class. we shall study the method of realization of efficient QoS Algorithm via appropriate mapping the previously mentioned methods onto the MOST150 technology.[5]

Table. 3 Diffserv and Interserv Comparrison

	Diffserv	Intserv
Service	-Per aggregation isolation -Per aggregation guarantee	-Per flow isolation -Per flow guarantee
Service Scope	-Domain	-End-to-end
Complexity	-Long term setup	-Per flow setup
Scalability	-Scalable(routers mains per aggregate state :core routers per class state)	-Not scalable(each router maintains per flow state)

2.4 Gateway
Since information has to be exchanged between the individual bus systems, they are interlinked by means of a gateway. It is the central task of a gateway to transmit signals from one network into another. For this purpose, signal filter tables are used in the gateway
The MOST-CAN Gateway is implemented in the HMI or in the central gateway. There are different levels of abstraction for the CAN bus and the MOST Interface. Whereas there are signals that are transported to a specified position in the CAN frame, the MOST interface consists of the function block. All important signals that have to be exchanged between the MOST system and the rest of the vehicle network are combines in the FBlock Vehicle

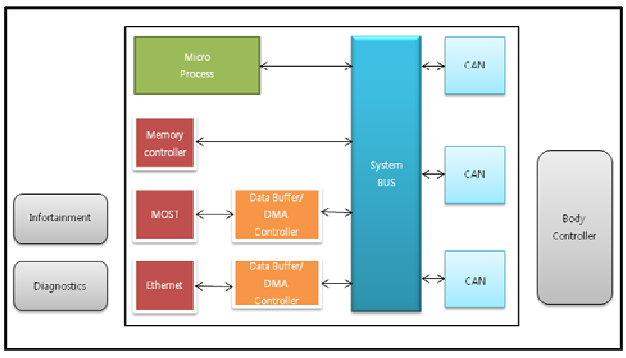

Figure. 3 Gateway hardware Architecture

3. Implementation

On MOST150 network, we need to achieve the maximization of the QoS, a performance measurement criteria of communication service from end-users' viewpoints, as well as assure proper interworking between all the components, for the users expecting that all the components of a vehicle, from the Drive Train and the auxiliary system to the multimedia system is orderly inter-work, and that there is no interruption of audio and video output or delayed voice of the satellite-based navigation system.[6]

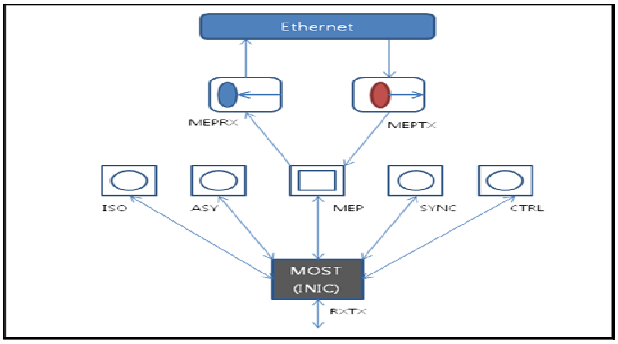

Figure. 4 MOST Device in OPNET

In order to solve such problems, this paper attempts to guarantee the QoS in the process of multimedia data such as audio and video, using MOST150 technology and IETF QoS Management mapping technology and mapping each MOST150's Isochronous Channel and MOST Ethernet Packet channel onto InterServ/RSVP and DiffServ along with the suggested algorithm.

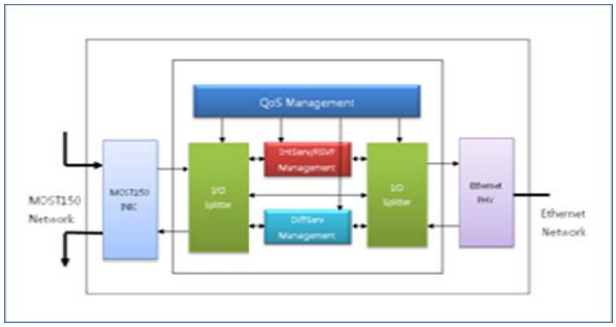

Figure.5 QoS Mapping Concept

4. Conclusion and Further works

In order to improve the performance of QoS of the MOST150/Ethernet Gateway, we have studied methods of "how to process In-vehicle network, V2V communication, V2I communication more efficiently" for the live camera,

multimedia system, vehicle maintenance, and data update, that are becoming increasingly sophisticated, by mapping the IETF QoS methods onto the MOST150 technology.
In the future, we shall specifically realize the suggested QoS Algorithm of MOST150/Ethernet Gateway through the OPNET simulator, analyse and investigate the result to advance the performance of MOST150/Ethernet Gateway.

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