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IEEE1394-IEEE802.3 Transparent Bridges for Home Networks

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In 1995, a new high-speed serial bus standard IEEE1394-1995 was ratified, and it has been applied for various consumer electronics devices. The emergence of consumer electronics devices with IEEE1394 interfaces drove the development of home network application systems. On the other hand, the enhancement of the full-duplex media access control technology in IEEE802.3 networks and the extension of the virtual LAN technology which is specified by IEEE802.1Q standard, created a priority control mechanism and a flow control mechanism in IEEE802.3 networks. The result is that IEEE802.3 networks are collision free and QoS(quality of service) aware networks, in recent years. The main goal of this research is to connect IEEE1394 networks and IEEE802.3 networks and provides attractive services to home network users or home network application systems.

ECHONET, which is a home network specification proposed by consumer electronics venders, defines technologies that integrate networks consisting of various communication protocols and transmission medias by software converting in upper software layers. However, it is difficult to provide high quality video or music data transmission to user application systems, because software converting may be interrupted and caused unnecessarily delays. This paper describes IEEE1394-IEEE802.3 transparent bridges using data-link layer technologies.

IEEE1394 provides two basic data transfer services, the asynchronous data transfer and the isochronous data transfer. The IEEE1394 asynchronous data transfer service provides a packet delivery protocol for packets to an explicit address and return of acknowledgment. IEEE1394 asynchronous transfer consists of physical layer, data-link layer and transaction layer. The IEEE1394 isochronous data transfer service provides a broadcast packet delivery protocol for packets transferred regular intervals. On the other hand IEEE802.3 provides only asynchronous data transfer service. And IEEE802.3 only defines

physical layer and data-link layer. These differences arise serious problems for IEEE1394-IEEE802.3 transparent bridge designing. The difference of frame header format, the difference of maximum payload length and the link-speed mismatch also causes problems.

In order to exchange frames between IEEE1394 networks and IEEE802.3 networks in asynchronous transfer service, the difference of the protocol stack must be solved. We designed the new transaction layer that is suitable for IEEE802.3 networks and introduced it for IEEE802.3 networks connecting part, inside of the bridges. Also, we proposed the neutral frame format called "asynchronous_unitdata". The neutral frame format is used to exchange IEEE1394 asynchronous frames and IEEE802.3 asynchronous frames.

In order to provide transparent frame relay services between IEEE1394 networks and IEEE1394 networks, the difference of maximum payload length must be solved. we proposed the fragmentation to the compatible length.

In order to manage smooth frame transmissions, the link-speed mismatch must be solved. We proposed the new arbitration technique. Which increases flow rate from IEEE802.3 networks to IEEE1394 network compare to ordinary fairness arbitration.

In order to establish connections between IEEE1394 networks and IEEE1394 networks for a real time data transmission, connections must be identified as an unique end-to-end connection, we proposed the new connection management technique. Which establishes end-to-end bandwidth reserved connections using CMP(Connection Management Procedures) and IEEE802.1Q implemented switches.

In order to exchange frames between IEEE1394 networks and IEEE802.3 networks in isochronous transfer service, the difference of frame header format must be solved. We proposed neutral frame format called "isochronous_unitdata". We presented the frame exchange between IEEE1394 isochronous frames and IEEE802.3 isochronous frames using the "isochronous_unitdata".

In this paper, we addressed the differences of IEEE1394 networks and IEEE802.3 networks. We proposed a new IEEE1394-IEEE802.3 transparent bridge. The proposed architecture includes no changes to existing upper layer protocols or services. Which offers a great opportunity for home network venders and users to develope attractive home network application systems.