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HiperLAN2 Transparent Bridge

Broadband Wireless Connections without Constraints

The IEEE1394 technology is becoming popular for connecting digital audio/video devices such as a camcorder to the TV, in a short distance. Thomson has now developed a wireless bridge that extends such network to many kinds of IEEE1394 equipment in the entire home.

With the embedded HiperLAN2 5GHz standard, connecting devices becomes easy: no need to run cables or drill holes in walls. For existing devices, simply install them where you like, replacing the IEEE1394 cable by the bridge, and that's it. Full interoperability in a transparent way!

The IEEE1394 serial bus offers high bandwidth, is plug-and-play and provides adequate QoS (Quality of Service) support for audio and video streaming. Unfortunately the cable length is limited to 4.5m, thus restricting options to install devices in such a network. The HiperLAN2 radio technology enables a full coverage of the home for broadband applications without the constraints of a wired infrastructure, while securing the transmission with QoS.

Within the HomeNet2Run project Thomson has combined these two technologies into a 'transparent bridge', in order to allow one or several IEEE1394 devices, including legacy devices, to be connected with functionality equivalent to a wired link.



Development board with Thomson's HiperLAN2 chipset

Self configuration

Plugging or removing a device from a IEEE1394 network triggers an automatic reconfiguration procedure for the entire network, including IEEE1394 clusters connected by a transparent bridge. The bridge portals participate in the configuration tasks of their cluster (self-identification, tree identification and manager arbitration) while exchanging the topology information with the peer equipment across the HiperLAN2 link, so that in the end each IEEE1394 device sees a single wired bus with a unique topology.

Synchronisation

During the configuration process a single cycle master is elected to synchronize all devices connected through the transparent bridge in a unique virtual IEEE1394 network. Bridge portals participate in the synchronisation by emulating the cycle master for their local cluster.

A mechanism has been designed to ensure that all emulated cycle masters run at the same frequency as the elected cycle master,



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but there will be a constant offset. The bridge knows the offset value and updates all time-stamped packets when they cross the bridge.

Asynchronous traffic

On wired IEEE1394 clusters all packets are transmitted to every device. The transparent bridge optimises traffic forwarding by filtering according to the packet headers. The bridge portals detect the destination of each message, local or remote, using topology information exchanged during the configuration phase.

Isochronous traffic

For isochronous traffic (e.g. video streams) the bridge analyses IEC61883 protocol messages exchanged between source and destination instead of message headers, to find out streams that need to be forwarded. In order to guarantee full Quality of Service the forwarding decision is based on the bandwidth available on the wireless link and on the information provided by the various devices in their status registers.

Visibility

During the self-configuration process, bridge portals, as any IEEE1394 device, receive addresses and so can be seen by every device in the network, but legacy devices never access them. Bridge portals contain special Control and Status Registers (CSR) in agreement with the IEEE1394 standard. These registers signal the presence of a transparent bridge to another bridge portal and allow exchange of information between bridges inside a cluster.

Advantages and limitations

The Thomson HiperLAN2 transparent bridge differs from the specification of the IEEE1394.1 group in the following aspects.

- It is relatively simple and easy to implement in a product.
- It forwards bus resets to the entire network.

It takes care of legacy devices by switching automatically the traffic from one portal to another without the need for special bridge-aware devices.

With a transparent bridge, some limitations occur:

- The total number of nodes in the complete network is limited to 63 as the virtual network encompasses a single bus.
- The transaction time-out is limited (due to the non-visibility of the wireless link)
- The number of IEEE1394-portals is limited by the reduced number of ports per node.

Thomson contribution to HomeNet2Run

The development work has been carried out within the HomeNet2Run project, a three-year duration project with participants from Belgium, France, Germany, Italy, Netherlands and Switzerland. The Eureka label was granted in 2001.

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