

Development of a Home Gateway for Digital Home Environments

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Abstract

This paper presents a Home Gateway(HG) that centralizes devices interfacing a access network and a home network. The HG supports networking modules(TCP/IP for Ethernet, ADSL, HomePNA, IEEE1394, PLC) and telecommunication systems(PSTN/SLT, VoIP, Video Communications). The HG is expected to be a core device for the integrated digital home environment.

I. Introduction

As the information and communication technologies including computers, softwares, and the network are rapidly developed, the computer-related activities are getting more generalized even at home. As the broadband network infrastructure such as an xDSL is popularized, internet is also used frequently for a variety of purposes. People begin to use more than one computer connected with one another, and several home appliances are going to be related closely with the network. Therefore, the home network utilized for a simple terminal of the global network in the past is being expanded to another part of the sub network. Because it is relatively hard to establish additional network lines in the home area, the pre-constructed telephone line or the power cable can be effectively utilized as a proper transmission medium. In addition, the contemporary and new-future houses and apartments, the network lines that are compatible with newly proposed protocols need being constructed during the building processes. For a variety of connecting home-area protocols with the existing external network, we require a new gateway that does not only make the home-area network operating in the sub-network but also connects to the external network. A Home Gateway(HG) interconnects home appliances by means of heterogeneous network paths such as power cables, telephone lines, RF and etc[1]. In the same way to the current gateways, the HG plays a key as a router that makes a subnet with connecting the entire home-area network, and translates different protocols to be matched to the xDSL or Ethernet established externally[2]. Furthermore, the HG becomes gradually to meet the requirements of the medium between Internet and the home appliances. It is necessary in the course of evolution from simple home appliances to Internet information appliances. A HG generally supports the OSGi[3] standard as a midstage service transfer platform between the hardware and the system software. In this sense, the home network can be constructed with a HG which locates in the center of Internet appliances. It differs from the conventional home automation schemes focused on low-speed simple data communications. However, there are a lot of problems to exchange existing network environments into new home networks. For example, IP address assigning that is a key to internet appliances can be a

model problem. However, it is well known that the IP header has only 32bit address fields in IPv4. Thus, as upgrading home-network environments, home appliances need by for more IP addresses, which incurs a serious IP address shortage problem.

Moreover, the adoption of dynamic IP address assigning in the current xDSL technology is an obstacle against HG's expansion to the home server. The dynamic method of assigning IP address to maintain is the IP address pool by sharing the limited IP addresses only when a certain network device requires. Therefore, the HG can be activated as a normal server with IP address confirmation when required to be connected to the external network. In Section 2, we describe the basic structure of the HG. In Section 3, implementation results of the HG also described. The paper concludes with Section 4.

II. Home Gateway Architecture

The basic structure of the HG in the digital home environment is shown in Fig.1.

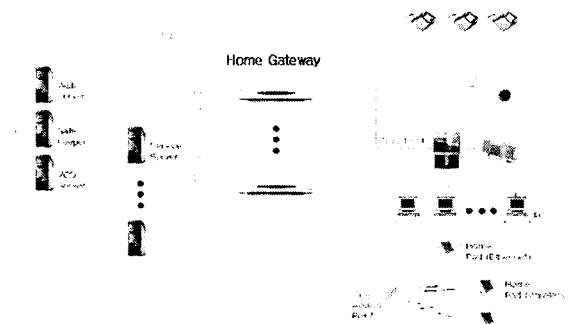


Fig 1. Overview of the system

The HG essentially enables the followings:

- To offer more expanded services and capabilities to manage home appliances,
- self-upgrade the softwares of the HG and other appliances to correct or reconfigure those,
- To access to the home appliances from the external network, and