

Home Gateway Designing using Intelligent Network

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Abstract - Digital Home Network is a home network means all the home appliance and home wiring is connected to each other with some network. It is a new application technology which gives services inside a single home or between multiple homes. Home Networking is of three types: Home appliances, Information equipment, Communication equipment. Home networking equipment can exchange information with outer networking using home gateway. Home network should have broadband network function, public network function and compositive multi-service and multi-application, etc. in future.

I. INTRODUCTION

Now, Market is paying more attention on home networking which is based on functions about digital, multimedia, mobility, Broad Band, real time interactively responding and so on, because it can provide diversified and individualized integration service, such as information, communication, handle official business work, education, health protection and so on. The developing of home networking products has become to be correlative industry focus. Home Networking is the collection of elements that process, manage, transport, and store information, enabling the connection and integration of multiple computing, control, monitoring, and communication devices in the home. The price of home computers keep falling, while the advantages for consumers from being connected online investing and shopping, keeping in touch with long distance friends and tapping the vast resource of the Internet CE keep multiplying. However, the rapid proliferation of personal computers (PCs) and the Internet in homes, advancements in telecommunications technology, and progress in the development of smart devices have increasingly emphasized the need for an in home networking. Furthermore, as these growth and advancement trends continue, the need for simple, flexible, and reliable home networks will greatly increase.

II. THE CONCEPT OF HOME INTELLIGENT NETWORK

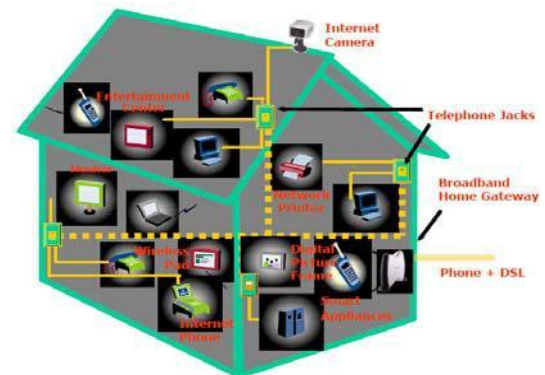


Figure 1 Home Gateway reference model

Home networking is called as Digital Home, it means that PC, home entertainment equipment, home appliances, Home wirings, security, illumination system were communicated each other by some composing network technology, constitute a networking inside home, and connect with WAN by home gateway. It is a new network technology and application technology, and can provide many kinds of services inside home or between homes. Currently, home networking can be divided into three kinds: Information equipment, Home appliances, Communication equipment. Home Gateway reference model is shown in Figure1.

III. TECHNOLOGY STANDARD INVOLVED IN HOME INTELLIGENT GATEWAY

According to home networking service and application requirement, Home networking related technology standard is shown as Figure2.

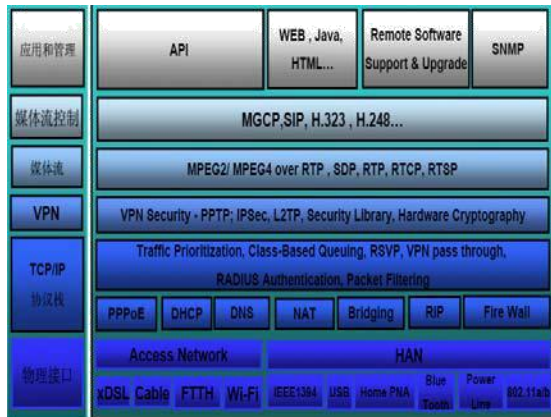


Figure 2 Home networking related technology standard

IV. RESEARCH ON MODEL OF HOME INTELLIGENT NETWORK

A. General network reference model

General networking reference model is dedicated as below, network with limited networking field (include network inside home, network inside office) connect with WAN by all kinds connection way through home gateway. External WAN may be PSTN, PLMN, Internet, RTV networking, and NGN. The way which home gateway connects with WAN may be ASDL, LAN, HFC, wireless and so on, home gateway can support and use many kinds of access methods meantime. Equipment inside home networking can exchange information with outer networking by home gateway, this information communication is bidirectional, user can get information and service which provided by public networking by using home networking internal equipment through home gateway connecting public network, meantime, also can get information and resource to control the internal equipment which provided by home networking internal equipment.

B. Internal reference model of Home networking

Internal reference model of Home networking includes four kinds function entities:

- (1) HA (Home Access): home networking connects function entity, this function entity is on the edge of home networking, is used to connect home network and access network. It also provides bridge connection function to connect other function entities of home networking. HA also can directly communicate with other function entities (HD) which adapt private connection way.
- (2) HB (Home Bridge): Home networking bridge connects function entity, bridge connect network in home. It makes it possible to connect various networks which adopt different physical connection.

(3) HC (Home Client): Home networking client function entity which provides concrete service for user and can communicate with function entity which adopting private connection way in home networking (HD).

(4) HD (Home Device): decoder function entity in Home networking, connects with home networking client by private connection way, and provides concrete service for user.

There are many physical ways to implement four function entities. For example home gateway can only provide function HA, and also can provide function HA, HB and HC at the same time.

C. Physical layer reference model of Home networking

Physical layer reference model of Home networking is shown Figure 3. Connection way among each function entity can be wire or wireless way.

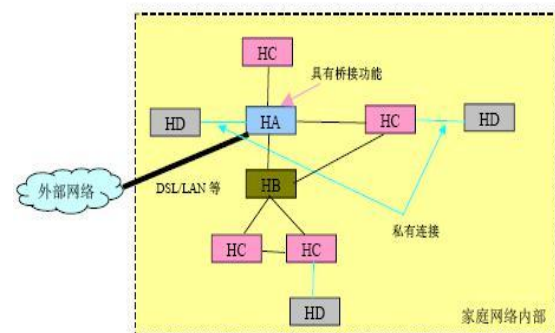


Figure 3 Physical layer reference model of Home networking

- 1) HA can connect with HC, HB, HD directly. HA can connect with HC through HB, or connect with other HC through HA, and HC also can connect with other HC directly.
- 2) HB can connect with HA and HC.
- 3) HC can connect with HA, HB, HD directly. HC can connect with HA or other HC through HB, or can connect with HC through HA, and HC also can connect with other HC directly.

D. Link layer reference model of Home networking

Home networking ,internal link layer reference model is shown as Figure 4, HB acts as transparent bridge connection equipment, When HA acts as bridge connection function between HCs. It also can take HB as transparent bridge equipment.

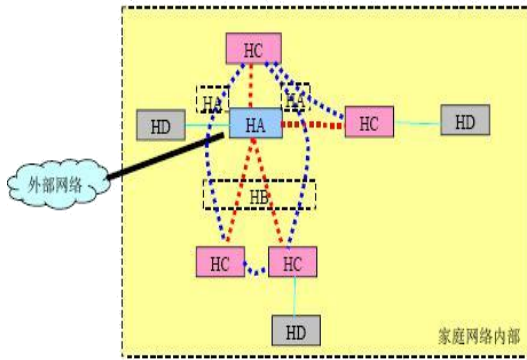


Figure 4 Link layer reference model of Home networking

1) Composing a mesh network connection between HCs: directly connection between HC; or using HA's or HB's bridge function to connect. Every HC in home networking can communicate directly by this mesh network.

2) Star connection between HA and HC: HC can connect with HA directly, or HC using HB's bridge connection functions to connect with HA. By this star connection, each HC or HD in home networking can communicate with outer public network by HA.

3) HD can connect with HA and HC by private connection way, user can communicate with HD by HC or HA. At this time, we can take HC and HA as bridge equipment. what HC and HA provided is bridge function between home networking equipment which follows common function service interface standard and other equipment which adopts private connection way

E. IP layer reference model of Home networking

From IP layer, internal home networking corresponds to LAN. HA and each HC are in the same region of sub network. HA acts as gateway of LAN to connect outside network. IP layer reference model of Home networking is shown as Figure 5.

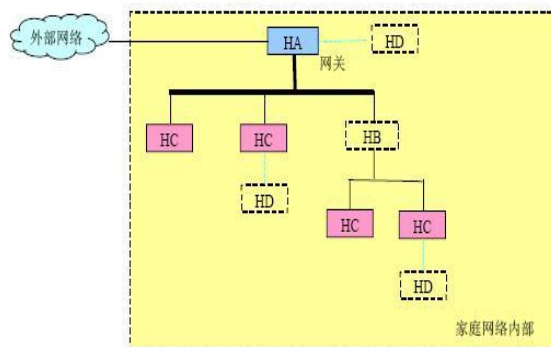


Figure 5 IP layer reference model of Home networking

HD connects with HA and HC by private connection way, it take as the extension service which provided by HA and HC.

Networking interface which HA, connecting with outside networking should have IP address which is assigned to HA's outside port. This address could be a legal public IP address, and also could be a private IP address; HA and each HC is in the same sub network in home networking. In phase of ipv4, each HC usually use private IP address which is assigned by HA. If HC has many networking ports, it can have many IP address at the same time.

In phase of ipv4, it doesn't exclude some equipment using or getting a public IP address in home networking, such as VoIP telephone of soft switch using public IP address directly. So it needn't HA provide function to traverse private network. At this time, this equipment can use public IP address to communicate with outside directly. If this equipment need communicate with internal equipment of home networking at the same time, then this equipment need get another IP address in the range of this home networking IP address.

F. Application reference model of high layer

The application reference model between internal and outside home networking communication is just like Figure 6.

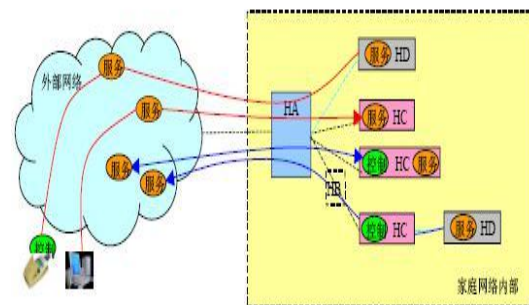


Figure 6 Application reference model of high layer

In home networking, HC and HD are function entities which provide service to user, based on these function entity can provide concrete service and application to user. User can use equipment operation, controlment function outside home networking to access home networking through HA (such as WEB interface, mobile phone, which is abstracted as controlment in the reference model). User can access service which provided by HC or HD. The typical work way is the equipment which provided controlment function provide user interface, then it transmit user command to HC or HD which support concrete service. And the controlment equipment finished corresponding task. At last it feedback the result to user.

Some HC in home networking also can provide corresponding operation and controlment interface to

users (for example PC, which is abstracted s controlment). Then HC is connected with outer networking by HA and accessing the service which provided by outer network.

IV. SUMMARY

In the future, the Digital Home Networking should support:

(1) There should be a broadband network connection which could connect each information terminal such as Home Appliances, PC, through flexible Home Intelligent Cabling System or wireless environment in the Digital Home Networking.

(2) Digital Home Networking must connect with public network. Home Network could extend the function and application of the Common Network to the family by Home Gateway.

(3) There are many service and applications offered by Digital Home Networking. Home Networking could provide compositive voice, data, multimedia, high-quality audio-video and service controlment and management. So as to arrive the aims of the share abundant information and medias among the home internal terminators; Arrive the aims of information communication between home terminators and outer public networks.

In the future, Digital Home Networking is just like Figure 7.

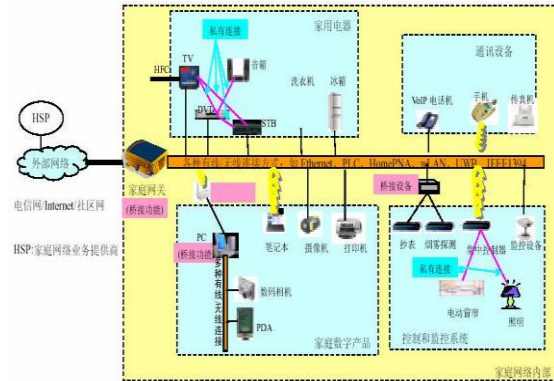


Figure 7 Future Digital Home Intelligent Networking

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