

Home Gateway Design based on Intelligence

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Abstract- Digital Home Network is known as Home networking . It means that PC, home entertainment , appliances, wirings, security, were communicated with each other by some composing network , constitute a networking home, and connect with home gateway by WAN. It is a new networking technology and appliance technology, and can provide many kinds of services inside or between homes. Currently, home networking can be catageroized into three types: Information Communication Home appliances or Communication equipment. With the help of home networking home gateway Equipment inside home networking can exchange information with outer networking , this communication of information is on both direction, user can get information and service given by public networking with the help of home network internal equipment through home gateway connecting public network also can get resource information to control the internal equipment which provided by home networking equipment internal . On the basis of network model of home networking, there are four functional entities inside home networking: AH, BH, CH, and DH. (1) AH (Home Access) - home networking connects function entity; (2) BH (Home Bridge) – Home networking bridge connects function entity; (3) CH (Home Client) - Home networking client function entity; (4) DH (Home Device) - decoder function entity. There are many physical ways to implement four entities. Based on these four entities, there are reference model of physical layer, link layer, IP layer and application layer.

In the home network should have broadband and public network function and compositive multi-service and multi-application function etc.

Keywords – Digital, Network, Intelligent

I. INTRODUCTION

Market has laid more attention on home networking which based on functions multimedia, digital mobility, , real time, Broad Band interactively responding because it can provide individualized and diversified integration , such as communication, information handle business

official work , health protection, education and so on. The developing of networking home products has become to be related industry focus.

II. THE CONCEPT OF HOME INTELLIGENT NETWORK

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 types of services inside 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.

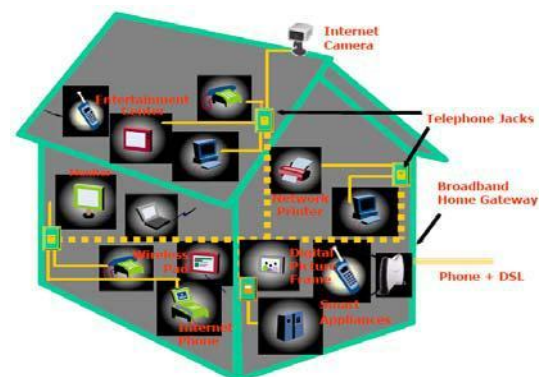


Figure 1 Home Gateway reference model

III. TECHNOLOGY STANDARD INVOLVED IN HOME INTELLIGENT GATEWAY

According to “home networking service and application”, Home network associated technology standard is shown as Figure2.

应用和管理	API	WEB, Java, HTML...	Remote Software Support & Upgrade	SNMP
媒体流控制	MGCP, SIP, H.323, H.248...			
媒体流	MPEG2/ MPEG4 over RTP, SDP, RTP, RTCP, RTSP			
VPN	VPN Security, PPTP, IPsec, L2TP, Security Library, Hardware Cryptography			
TCP/IP 协议栈	Traffic Prioritization, Class-Based Queuing, RSVP, VPN pass through, RADIUS Authentication, Packet Filtering			
物理接口	PPPoE	DHCP	DNS	NAT
	Bridging	RIP	Fire Wall	
	Access Network		HAN	
	xDSL	Cable	FTTH	Wi-Fi
	IEEE1394	USB	Home PNA	Bluetooth
	Power Line	802.11ab		

Figure 2 Home networking related technology standard

IV. RESEARCH ON MODEL OF HOME INTELLIGENT NETWORK

4.1 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 types of 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, HFC, wireless a home gateway can support and use many alternative of access methods meantime. Equipment inside home networking can exchange data with outer network by home gateway, this information communication is on both sides direction, user can get information and service provided by public network by using home networking internal equipment through home gateway connecting public network, also can get data and resource to control the internal details which are provided by home networking internal equipment.

4.2 Internal reference model of Home networking

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

(1) AH (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. AH also can directly communicate with other function entities (DH) which adapt private connection way.

(2) BH (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) CH (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 (DH).

(4) DH (Home Device): decode 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 AH, BH and CH at the same time.

4.3 physical layer reference model of Home networking

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

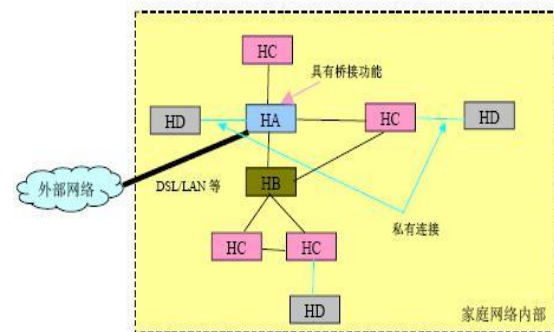


Figure 3 Physical layer reference model of Home network

1) AH can connect with CH, BH, DH directly. AH can connect with CH through BH, or connect with other CH through AH, and CH also can connect with other CH directly.

2) BH can connect with AH and CH.

3) CH can connect with AH, BH, DH directly. CH can connect with AH or other CH through BH, or can connect with CH through AH, and CH also can connect with other CH directly.

4.4 Link layer reference model of Home networking

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

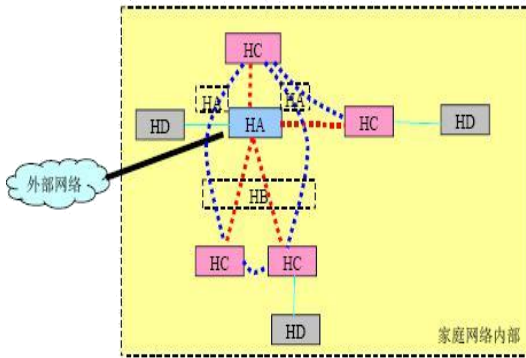


Figure 4 Link layer reference model of Home networking

1) Composing a mesh network connection between CHs: directly connection between CH; or using AH's or BH's bridge function to connect. Every CH in home networking is able to communicate directly by this mesh network.

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

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

4.5 IP layer reference model of Home networking

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

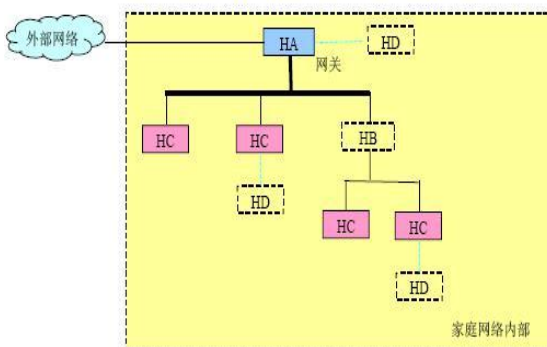


Figure 5 IP layer reference model of Home networking

DH connects with AH and CH by private connection way, it take as the extension service which provided by AH and CH.

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

In phase of ipv4, it doesn't eliminate 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 require 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.

4.6 Application reference model of high layer

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

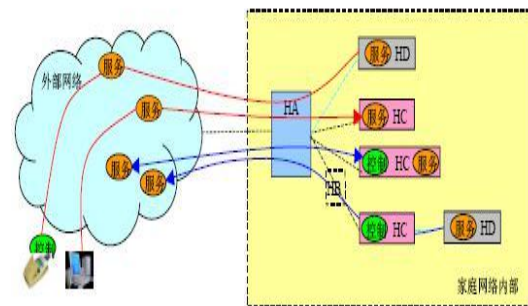


Figure 6 Application reference model of high layer

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

Some CH in home networking also can replenish corresponding operation and controlment interface to

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

V. 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 associate with public network. Home Network could elongate 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 data,voice, high-quality audio-video, multimedia,and and management and service controlment. 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.

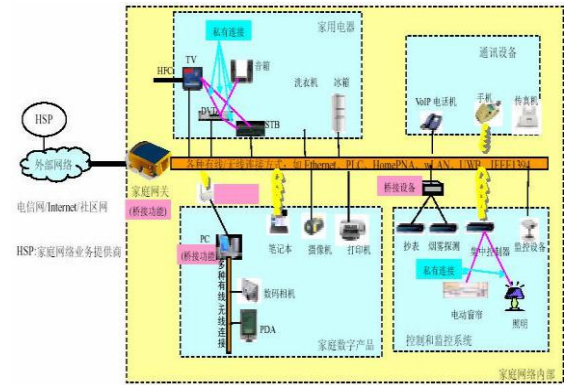


Figure 7 Future Digital Home Intelligent Networking

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