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Home Gateways for an easier digital Life at Home

DOMINIQUE MOIX A Home Gateway connects the home network with the telecom access network and provides services to the customer on the application level. This article describes the components and functions of Home Gateways and their benefits to both the customer and the telecom operator.

For an ADSL customer, the ADSL modem or router connecting the home network to the Internet currently offers network level services such as routing, Network Address Translation (NAT), firewall and Dynamic Host Configuration Protocol (DHCP) only. However, devices are now appearing which offer application level services. These services can be uploaded, installed and managed remotely by an operator. Examples of such services include multimedia services (for example VoD, MOD), home automation, home security, remote access service, personal services (email, content sharing), or detection and configuration of new devices attached to the home network. ADSL modems capable of offering application level services remotely are called Home Gateways. Note, however, that there are several definitions of Home Gateways, such as those found in "IEEE Communications Magazine" of May 2004 [1].

Why a Home Gateway?

Today, a typical telecom customer may own one or several PCs or laptops, a TV set with a video recorder and a DVD player, a stereo system, a digital camera, camcorders, MP3 players and various telephones. These devices are not all interconnected, thus representing connectivity islands: one island for the video and audio devices, another one for the computers and a last one containing the telephones. Now there are solutions available for interconnecting these islands: for example, media adapters allow a customer to stream video or audio files from his PC to the TV set. However, for each application the customer needs to buy, integrate and manage a new device. That is where service providers can help the customer by installing and managing an application on the customer Home Gateway.

We can take the example of a customer who wants to install a network camera allowing him to see what is happening at home from anywhere over the Internet. Today, the customer has to buy the camera, configure it with a PC, and then adjust firewall and NAT settings on his ADSL router. All these steps, besides being time-consuming, are prone to configuration errors and can be executed only by people with some expertise in this area. A simpler and more convenient way for the customer would be that, when buying the Internet camera, the shop can remotely upload a piece of software onto the customer Home Gateway. At

home, the customer then just has to plug the camera into his home network. The uploaded software automatically detects the camera and configures both the Home Gateway and the Internet camera. The Internet camera and the associated service are thus working in a plug-and-play-mode and the customer has nothing to configure.

Figure 1 displays the architecture of a Home Gateway infrastructure. At the network level, the Home Gateway connects the access network with the home network. This connection can be based on xDSL, on cable technology or on fibre. Connection from the Home Gateway to the home devices can be established via Ethernet cabling, WLAN, Powerline, Bluetooth, USB, Firewire or home automations buses such as X-10, KNX or LONWorks. The Home Gateway interconnects all the different types of devices over different network technologies and it performs routing, Network Address Translation (NAT), firewall and Dynamic Host Configuration Protocol (DHCP).

The backend system located at the operator premises manages the Home Gateway. Via remote management software updates, configuration of devices and enabling of new services can be realised from a single backend system for all the connected Home Gateways. Service providers are connected to the backend system via the Internet, so the telecom operator takes the role of a service aggregator. The service providers develop and offer services to the operator who integrates them into the backend system. The potential services are numerous and range from advanced VoIP services to home automation, home security and health services. The operator can bundle services and may tailor them to its customers and their infrastructure. For example, the operator can offer a first or second line VoIP service where the Home Gateway is automatically configured for the operator VoIP infrastructure. Additionally, managing the Home Gateway from remote may help to reduce the support costs for the operator. The customer benefits include ease of installation and use, and higher satisfaction.

Today the software used in the Home Gateways is often proprietary. However, alliances such as the Open Service Gateway initiative (OSGi) are developing open specifications for Home Gateways.

The Bluewin Home Gateway Trial

Bluewin started this summer a Home Gateway trial with approximately one hundred customers. The proposed ADSL Home Gateway offers standard network level services such as firewall, DHCP, WLAN and Ethernet ports. With the help of the associated backend system, the following application level services can be installed on the Home Gateways: Internet access control, content screening, web remote

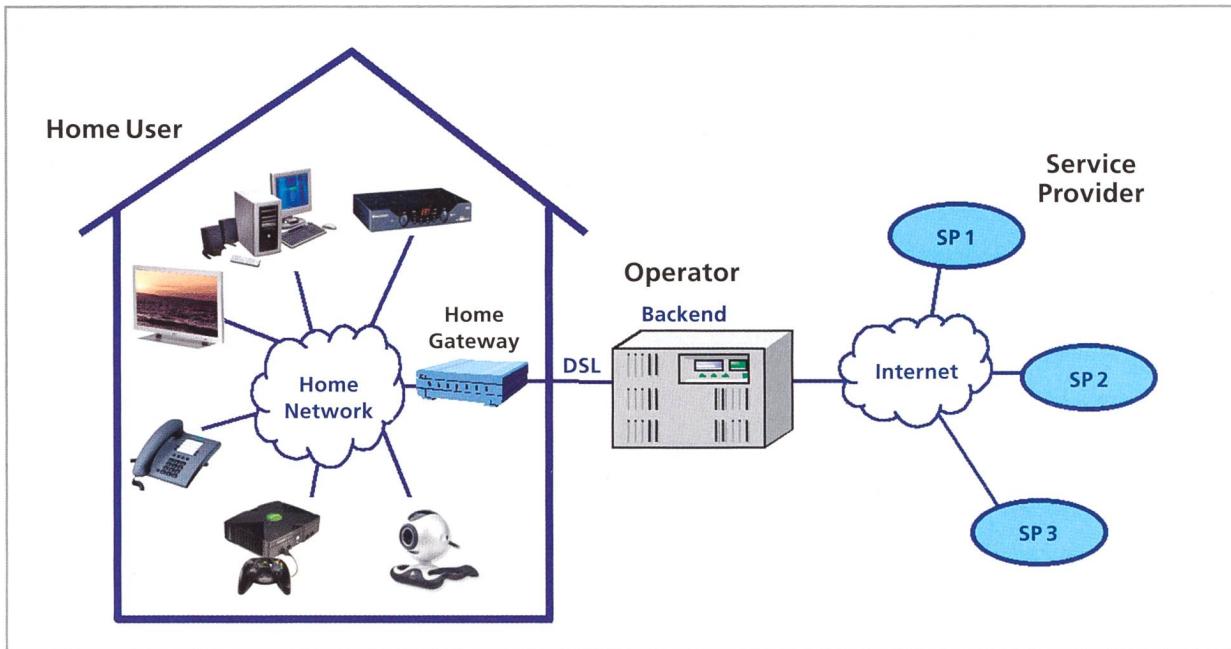


Fig. 1. Home Gateway Architecture.

access, and a firewall monitor. Internet access control checks if and when a given home user is allowed to access the Internet. Content screening prevents users to access sites with offending content. For this service, a third party service provider rates the requested web site and based on this information the gateway allows or blocks access to this site, depending on the user category. Web remote access allows a user to remotely access a home computer from the Internet and to share files. A dynamic DNS solution supports non-static IP addresses. Finally, the firewall monitor records all attacks aimed at the home network. A VoIP gateway could also have been installed on the Home Gateway from the backend, but this service was not pushed to the customer Home Gateways since VoIP was not the focus of this trial.

Home networking devices, such as WLAN network bridges, Powerline to Ethernet Adapters, Powerline to WLAN adapters, and PCMCIA cards for notebooks, help to extend the connectivity among all home network devices. By asking well selected questions to the customer, Bluewin determines which device is adapted to a given type and location of home computers. A configuration guide then helps the customer to interconnect all his computers.

Outlook

The Home Gateways available today still lack many of the desirable features for easy home networking services. Some of these features are support for authentication, quality of service, security and billing. Open standards and available services will also help the deployment of Home Gateways. These features are slowly emerging.

There is no killer application for the Digital Home, but well chosen bundles of services that match the need of specific customer segments will form a very attractive service offering. The operator should be aware that interesting services may be implemented on other devices than the

Home Gateway. For example, a firewall service can be implemented at the Internet service provider premises, in the Home Gateway, or in the customer computer. Furthermore, the telecommunication industry should be aware that the Home Gateway functionality may be implemented in devices other than the ADSL modem. It is natural to implement a VoIP gateway in an ADSL modem, but it is not obvious that entertainment or video services should be implemented in an ADSL modem. Due to their more powerful CPU, Set Top Boxes and computers are the favourite choice for implementing entertainment and video services.

Remote management of Home Gateways and home devices are challenging: The home environment is not under full control of the operator and thus may cause configuration difficulties, as home devices are replaced after a few years and the home environment is very complex, due to the huge variety of devices (e.g. different kinds of PCs, consumer electronics devices, TVs, phones, digital cameras, entertainment systems, home automation solutions, etc.). Nevertheless, telecom operators are well positioned to fully exploiting the potential of Home Gateways by integrating the backend system in their network and service management infrastructure. While this integration will be a lengthy process due to unequal maturity of the various components, controlling the backend offers telecom operators the opportunity to act either as a wholesaler or as a retailer for the applications. ■

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