

HomeGate: The International Standard Residential Gateway

In the past few years, home network wiring installations have become popular in new construction. For existing houses, when installing network wiring is not practical, radio (RF) networks using Wi-Fi are proliferating. The popular applications of a home network include:

- Sharing Internet access
- Exchanging files among personal computers (PCs)
- Distributing audio and video around the house
- Providing telephone and intercom access

Many of these services depend on a connection between the home and the outside world. This connection is provided by a *residential gateway*. The residential gateway is the means for carrying telephone, radio, television, web pages, and e-mail to and from the house. All these services may be delivered via one physical gateway or through multiple gateways, some of which may be built into appliances.

Another category of applications will soon be added to home networks, namely, home automation. For example, you might access the house remotely from work via the residential gateway to turn on the air-conditioning or sauna before returning home, or to disarm a section of the security system so a repairperson can enter the utility room.

There are about 50 manufacturers offering residential gateways with a variety of features. To facilitate market growth, it is essential that all gateways provide a set of primary functions to minimize consumer confusion. Once companies implement the primary functions, they are free to add enhancements for product differentiation at various price points.

In early 2003 work was completed on a world standard for the residential gateway, informally called *HomeGate*. The HomeGate standard defines the architecture of the residential gateway and a primary set of features. This paper introduces HomeGate by first explaining the role of the residential gateway and the value of specifying a standard gateway.

The Functions of a Gateway

One size does not fit all in communications. The network that provides worldwide telephone and Internet services is not appropriate for a home network. A gateway is a communications device that interconnects two dissimilar networks.

The primary responsibility of a residential gateway is to link an access network outside the house with a network inside, as shown in Figure 1. Among the functions of a gateway are translating message formats, adapting transmission speeds, and moving messages onto a different medium (radio to wire, for example). The external network is an example of a Wide Area Network (WAN), while the home network is based on Local Area Network (LAN) technology.

Services are delivered via signals from service providers, such as a security company, an Internet merchant, or an electric utility. The gateway converts the signals to the LAN format; it is a line of demarcation between the service provider and customer equipment; and it balances limited access for the service provider with privacy for the customer.

The Benefits of Standards

Standards play essential roles in facilitating trade and commerce. Without standards, the plug might not fit into the outlet. We depend on standards for watching TV, for placing international telephone calls, and for loading film into a camera. Standards are agreements on how to apply technology consistently in practical situations.

A benefit of complying with standards is lowered production costs. For example, if an appliance maker wants to interconnect two products via a home network, engineers can be assigned to invent a communications scheme (called a protocol). This may involve building custom hardware and software. Alternatively, the manufacturer can buy an interface module with embedded software that conforms to a standard communications protocol. Incorporating an interface module usually costs much less than hiring or reallocating staff for communications design.

There are two organizations responsible for international standards in commerce. The IEC (International Electrotechnical Commission) was founded in 1906 to coordinate the trans-border flow of electricity. The ISO (International Organization for Standardization), established after World War II to stimulate international trade, spans the gamut of standards from film speed to screw thread-pitch to shipping container size. (A third world standards organi-

zation, the International Telecommunications Union (ITU), is a branch of the United Nations. The ITU sets standards for radio frequencies and telephony.)

ISO and IEC have formed a joint committee to standardize information technology. HomeGate was developed by a subcommittee under this umbrella. The HomeGate standard is designated as ISO/IEC 15045, and is available from Global Engineering Documents (<http://global.ihs.com>).

HomeGate: The International Standard

The committee that wrote the HomeGate standard has members from 34 countries (23 voting countries and 11 observers). Meetings are held twice a year, typically with participation by experts from countries in Asia, Europe, and North America.

As shown in Figure 2, the function of HomeGate is primarily to translate between a WAN protocol and a LAN protocol. Translation consists of re-coding commands, event reports, and data from one protocol (WAN or LAN) to the other. HomeGate includes the following additional features:

- Firewall
- LAN Adapter
- Application Controller

Firewall

A firewall is a popular Internet term for a device (hardware and/or software) that limits what types of messages can flow into and out of the house.

A firewall in a residential gateway allows the user to exercise control over external data entering the house. The user and service provider would agree on specific access rights to deliver purchased services. For example, if there were an agreement for monthly meter readings by a utility, the HomeGate firewall could prohibit daily reads.

Many corporate networks are connected to the public Internet via a processor that inspects data flows to prevent access into the local network from unauthorized or malevolent sources. The HomeGate firewall provides similar privacy management for consumers.

A home may be more vulnerable to attack via the Internet than a business. Many business computers are attacked because they are challenging to hackers. However, businesses have experts on staff overseeing hardware and software protections. As a result, they have rarely suffered severe financial losses from

hackers and network penetration. (For more about privacy issues, please see the articles I wrote for the Winter 2000 and Spring 2001 CABA Quarterlies.)

LAN Adapter

Ideally, a home network should be based on one standardized communications protocol. Unfortunately, there has been a proliferation of home network communications protocols such as CEBus, Echonet, Konnex, EIA-709 (based on LonTalk), X-10, etc. Ideally, we should all be aiming toward one network protocol, but this is unlikely soon. Therefore, HomeGate accommodates modules that translate messages from one home network protocol to another.

Application Controller

HomeGate may optionally be a repository for application control functions to support home subsystems such as security, energy management, lighting, etc.

HomeGate Implementations

Many of us already live with special purpose gateways. A set-top box converts a WAN cable signal to the format for a television set. Another gateway on the same cable might be connected to a computer for high-speed Internet access. Similarly a DSL (Digital Subscriber Line) gateway provides high-speed Internet access via the public telephone network. Other gateways are available for distributing TV and Internet directly from satellites.

An objective of the HomeGate specification is to accommodate this variety of gateways. The simplest gateway connects one WAN to one LAN. A more complex box accommodates multiple WANs and multiple LANs. If multiple gateway boxes are installed, HomeGate specifies methods for these boxes to communicate in order to coordinate service delivery. Multiple gateway boxes may be linked by the LAN, via a private channel, or (less likely) via the WAN, presumably provisioned by the service provider.

The HomeGate standard does not constrain the physical realization of a residential gateway. However, one suggested general-purpose implementation is a box with plug-in cards, as shown in Figure 3. This figure shows a variety of plug-in cards. The specific set of plug-in cards depends on the WAN and LAN technologies implemented. As explained in the previous section, optional features for the LAN-side of HomeGate include application controllers and adapters to interconnect incompatible LANs.

Further HomeGate Developments

HomeGate is a multi-part standard. The first part describing the system architecture is complete and approved. The next part deals with the internal structure of the gateway. Some of these functions include:

- WAN Interface Module
- LAN Interface Module
- Content and control-data flows
- Internal bus
- Internal communications protocol
- Network management

An important application of a gateway is service aggregation to allow the simultaneous delivery of many services. One solution that HomeGate can accommodate is OSGi (Open Services Gateway initiative), a JAVA-based scheme developed by an industry consortium.

The standards development process is open to all companies and technical experts. Influencing standards can facilitate product marketing and prevent export barriers. Participation starts at the national level by joining the committee that sets policy in your country.

Conclusion

Builders have learned that home networks help sell new houses. Consumers realize that home networks simplify access to the Internet, link PCs, facilitate home theater, and add value to the property. Access to home networks from public networks via a residential gateway will motivate a growth in service delivery.

HomeGate provides a public standard for the next-generation of expandable information platform in the home. HomeGate will replace the current plethora of other specialized “gateways” and “set-top” boxes. HomeGate will accommodate all present and future networking technologies, both inside and outside the home including DSL, cable, satellite, wireless, and optical fiber access networks, as well as various home networks for entertainment, energy management, security, and tele-medicine.

The HomeGate standard is an essential ingredient for home networks. As home networks proliferate, home applications will be introduced, and the home systems industry will grow.

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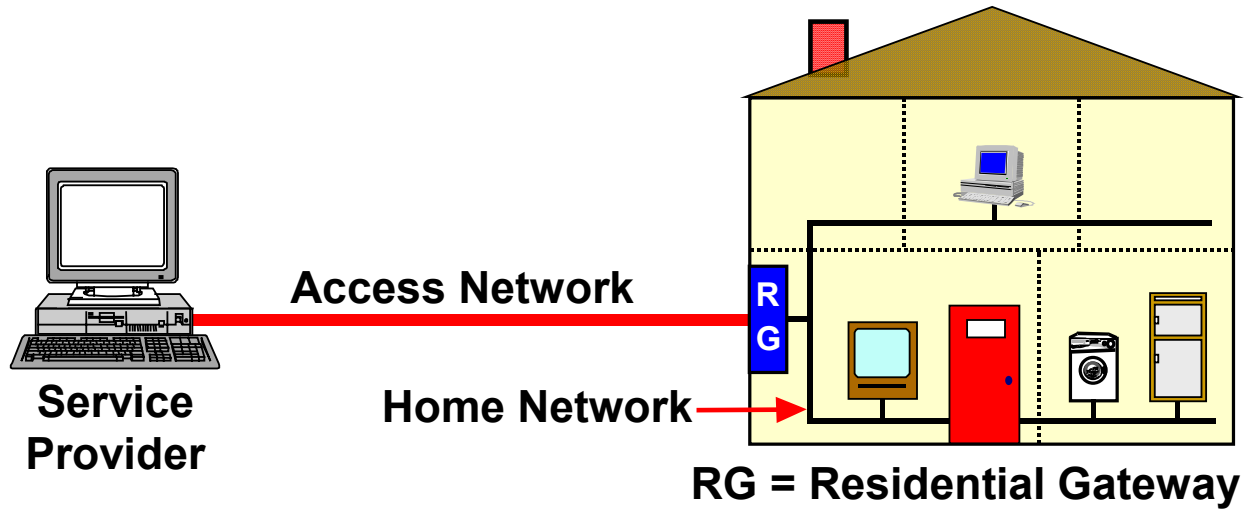


Figure 1 – The Role of the Residential Gateway

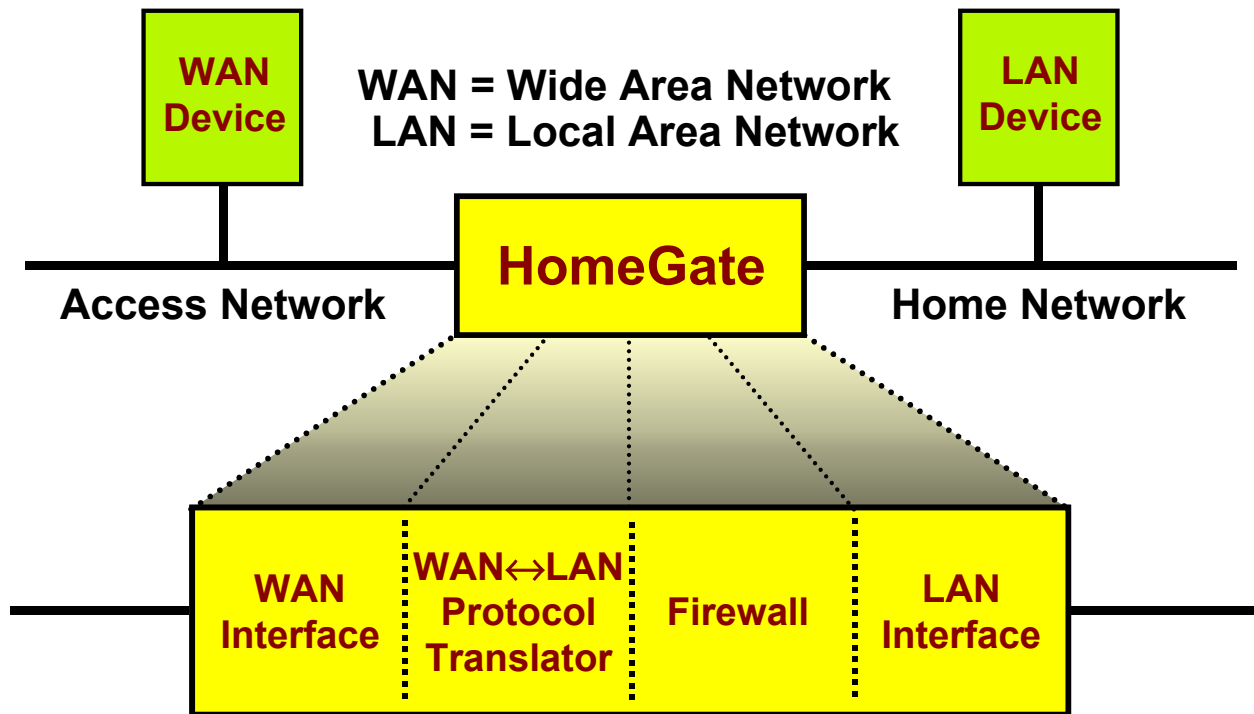


Figure 2 – The Functions of HomeGate

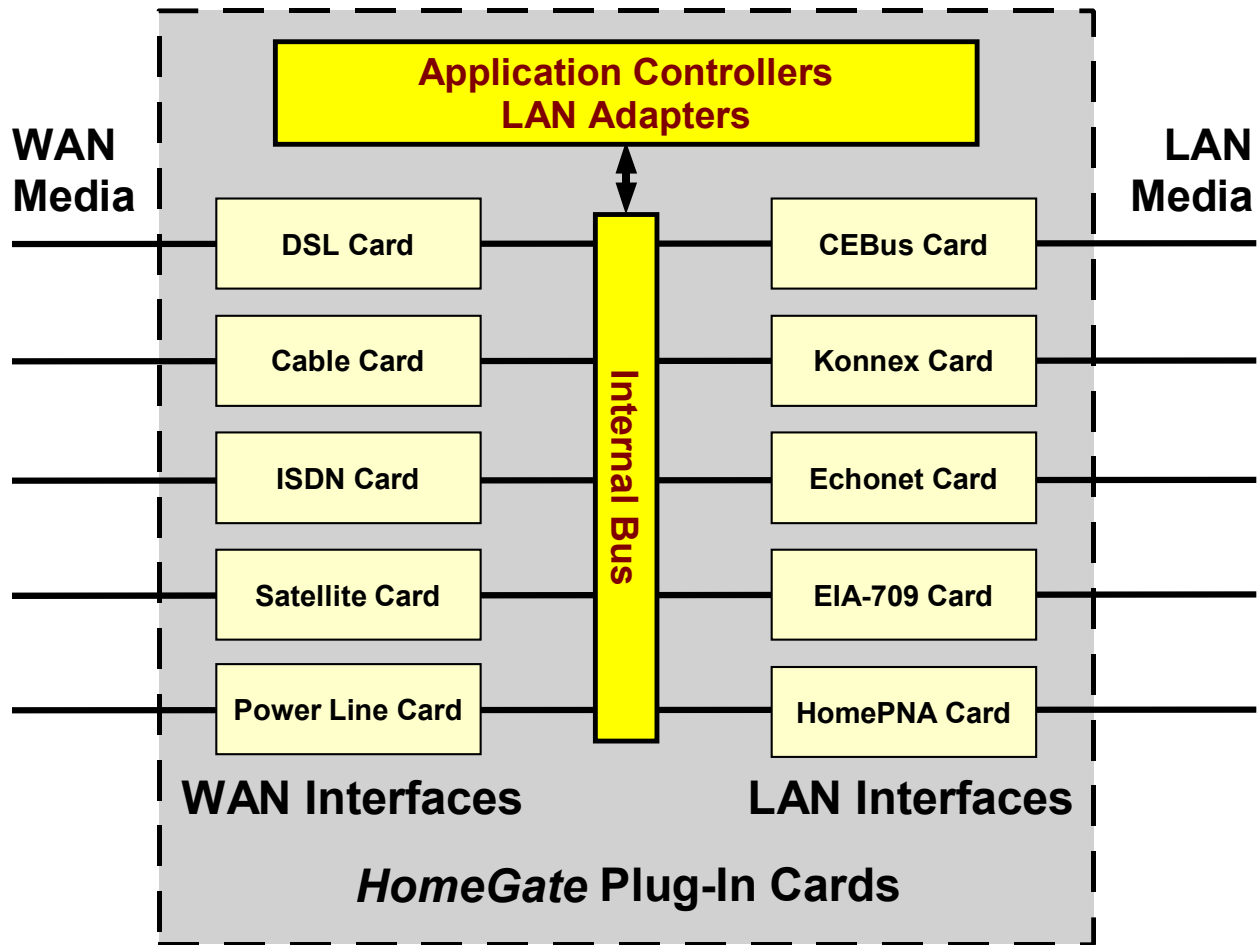


Figure 3 – An implementation of HomeGate