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Media (Residential) Gateways

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Summary

The primary function of the media gateway is to provide broadband connectivity to the home through cable, xDSL, satellite, and wireless. Secondly, media gateways will provide home networking capabilities by distributing broadband access throughout the home using technologies such as HomePNA (phonelines) or wireless LANs. The demand for greater Internet bandwidth is driving the need for digital modem solutions.

This white paper looks at utilizing an existing PC to provide media gateway type services. Companies like IBM and Ericsson are strongly promoting this concept.

Introduction

The Media Gateway (MG) is a device that connects or bridges a home network to a broadband access connection. It enables communication and data transfer among networked appliances in the home and across the Internet. This white paper introduces and discusses the role of the media gateway in the area of home networking.

A Global View of Media Gateways

Media gateways, also known as service gateways, residential gateways, or home gateways are the key ingredient to providing ubiquitous high-speed Internet access to consumers around the globe. They also provide a platform for integrating the different broadband access types and the several in-home networking solutions. Media gateways bring broadband access into your house and connect information appliances using home networking solutions such as HomePNA, HomeRF, wireless LANs, or IEEE 1394 (FireWire).

Media Gateways—Definition

The evolution of new data broadcasting services has created the need for a special interface or gateway device that can be used to pass digital content between the Internet and a home network. In quite simple terms, the media gateway is a device that connects the different in-home appliances (such as digital TV, digital VCR) with whatever technology (such as IEEE 1394 or phonelines) to a broadband connection (such as DSL, wireless, cable, or satellite). It typically combines functions of a modem, router, or hub for Internet access.

There are different types of media gateways available based on the gradients of functionality required. **Figure 1** provides an overview of a typical media gateway environment. **Figure 1** indicates some of the services and delivery schemes for a single tenant residence that utilizes a media gateway as the interface to in-home networks and consumer devices.

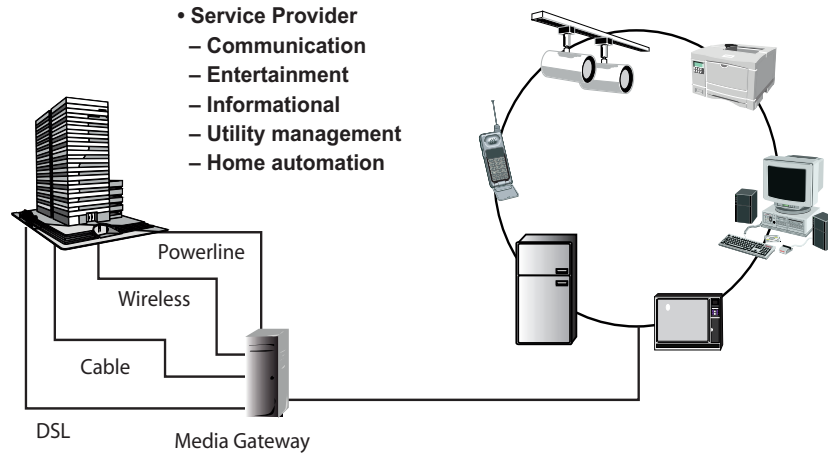


Figure 1: Overview of a Media Gateway Environment

With the deployment of high-speed Internet connections and the push by service providers to offer integrated voice, data, and video services over the same high-speed pipe to different nodes throughout the home, the media gateway is expected to become a key integrated service enabler. Many of the home networking devices that are currently being used by consumers to access broadband networks will incorporate media gateway functionality in the near future. In addition to these devices, a number of dedicated media gateways such as home servers are expected to emerge.

Characteristics of Media Gateways

Media gateways must have a reliable and robust hardware platform. Additionally, the software that runs on a gateway appliance needs to be very reliable and not susceptible to errors. Unlike PC users, the general consumer marketplace will not tolerate rebooting their media gateways. Supporting multiple services such as voice, data, and video are absolutely essential. Another key requirement of the media gateway is security. Functions such as secure e-commerce transactions, remote home control, and access from authorized service providers are critical. Providing quality of service to support a multiple of intelligent devices from different vendors is also extremely important.

Phased Deployment of Media Gateways

Given the fast changing nature of the home networking industry, it is helpful to examine the different generations of media gateways that are been deployed in households across the world. Xilinx believes that the mass deployment of gateways will come in three distinct phases (see Figure 2).

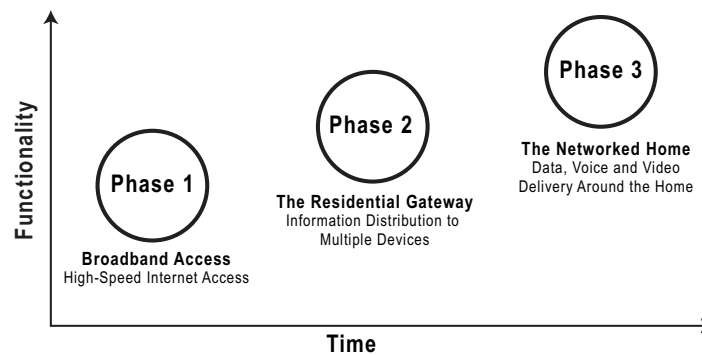


Figure 2: Evolution of Media Gateways

Although the term media gateway is a relatively new one to most people, it already exists in many of our homes already. For example, most of our homes already own a couple of first generation media gateways—a set-top box for receiving television and a modem that allows us to connect with the Internet.

Phase two of the deployment plans involves the availability of a second-generation media gateway that includes advanced features such as broadband connectivity, home networking interfaces, and IP telephony capabilities. The third and final phase of deployment will be based on powerful media gateways that are capable delivering video, voice, and data throughout your house. It will also supply you with other services such as home automation, energy management, security control, etc.

The gateway hardware architecture will be modular in design. The modularity of third generation gateways will support multiple broadband and home network interfacing technologies. This support of multiple backend and front-end interfaces will make the gateway less apt to becoming obsolete with technology advancements. Xilinx also believes that support for modularity will promote the evolution of media gateways into a type of application server that consumers will use to distribute broadband services throughout their homes.

Media Gateway Components

The media gateway provides a unified platform to satisfy all the needs of most consumers providing information, entertainment, and communication. It is a centralized access point between the home and the rest of the world. Since broadband technology is relatively new and continuously evolving, the media gateway will also evolve in its functionality. It will, however, in its basic form contain and combine three distinct technological components: a digital modem, home networking chipsets, and software.

Much of the configuration flexibility is brought about by a gateway's support for a range of different types of modems that provide connectivity to different types of broadband access networks. At the home networking side of the media gateway, a chipset is available which provides the interface to the particular technology running on the home network.

In addition to the various types of broadband and home networking chipsets, all gateways contain computing resources that supports the software required to operate the device. The software running on the media gateway enables the smooth inter-operation of information appliances and services within the home. The complexity, distribution, and technical disparity of the system elements is then hidden from the consumer.

Types of Media Gateways

There are various types of devices that are competing for a share of the media gateway marketplace—PCs, broadband modems, digital set-top boxes, and other possible candidates.

PC-Based Home Servers

The PC-based MG, also known as a home server, is conceptually the easiest path to the media gateway merely by the number of PCs currently in the home and the processing power, digital modem, and presence of a platform for deployment of home networking services. Thus, the current PC provides the closest capabilities to the next generation of media gateways. Existing PCs can perform most of MG functions comfortably.

However, there are certain disadvantages of the PC. The operating systems has traditionally not been a robust part of the PC and the scare of the PC crashing without warning and rebooting a gateway, which provides critical features such as security is not acceptable. Some companies have, however, been pushing the PC-based architecture even within a separate media gateway box such as Ericsson's E-box and IBM's Home gateway.

Modem Centric Media Gateways

Traditional methods to connect to the Web have hit a technological upside. Analog modems using phonelines cannot provide bandwidth beyond 56 Kbps. Modems based on digital broadband technologies are the solution to the problem of increased Internet bandwidth

access. At the broadband end, there is a cable, satellite, or DSL modem termination. While on the home networking side either a HomePNA or HomeRF chipset is present which provides the home networking functionality of a particular technology.

Satellite modems offer speeds of 400 Kbps to 38 Mbps, DSL modems offer 1.5 Mbps to 52 Mbps, and cable-based modems can receive and process multimedia content at 30 Mbps. Usually this gateway is sold in conjunction with services. Local cable or DSL providers subsidizes the cost of the broadband gateway by charging for extended services over 1-2 years. Usually this is an easy to install gateway and the service provider saves money by minimizing service calls.

Multiple types of digital modems are in existence today to take advantage of the growing proliferation of broadband connectivity. In the years to come, Xilinx believes that the following types of digital broadband modems will evolve into a form of a media gateway.

Cable Broadband Modems

For cable operators, home networking is an opportunity to increase the use of broadband data and video services. Historically, cable companies were in the business of offering traditional TV services to their customer base. These companies are now moving into the telecommunications sector and have started to offer a variety of services including high-speed Internet access, free e-mail accounts, hosting of e-commerce sites, and delivering advanced IP based applications.

To capitalize on this new opportunity, operators are upgrading their networks to support these new and exciting applications. To access this mix of applications from a cable company, you need to buy or rent a type of media gateway called a cable modem. A cable modem is best defined as a client device that provides two-way communications (data, voice, and video) over ordinary cable TV network cables. A major benefit of a cable modem home gateway is the fact that the connection is always open, so you never have to go through the slow procedure of establishing a dial-up connection. In some cases, this can take up to a minute, which is very frustrating.

When using a cable modem as a home gateway, you should be aware of a couple of installation considerations. First and foremost it is well documented that the in-home coaxial wiring system is the major source of electromagnetic interference. To reduce noise levels you may need to install a new piece of coaxial cable. Also of concern to home network users is the presence of various terminals such as TV-sets, VCRs, and radios. These devices can generate interference, which could effect the performance of a home gateway.

Today, the provisioning of a cable modem service requires a technician to visit the home, install the new hardware, and configure the TCP/IP protocol stack. The service provider also needs to configure the servers that run the various types of applications, such as web hosting, chat, e-mail, etc. This whole process is expensive and very time consuming.

Consequently, the strategy for most service providers is to develop cable modem technology to allow consumers to implement the service. So once a cable modem is connected to the HFC network, consumers are presented with a registration website where they can select or confirm specific service plans. The elimination for the need of a cable technician is unlikely to happen in the short term. However, as people become more familiar with home networking technologies and manufacturers begin selling computers with internal cable modems, the need to send a technician to a customers' home will decrease.

The security of cable modems is also an issue for users of home networks. An intruder could, in theory, tap into the coaxial cable in a HFC network and capture packets of data that have been transmitted by devices from your network. So if you are using a cable modem to transmit confidential information, consideration needs to be given for making life difficult for the "cable hackers" by using encryption technologies.

Cable Modem Standards

Cable modems comply with one of four major international standards— CableLabs, EuroDOCSIS, EuroModem, and DVB-RCC.

1. The CableLabs certified cable modem project, formerly known as DOCSIS (Data Over Cable Service Interface Specification), defines interface requirements for cable modems involved in high-speed data distribution over cable television system networks. The standard provides cable modem equipment suppliers with a fast, market-oriented method for attaining cable industry acknowledgment of DOCSIS compliance. This has resulted in high-speed modems being certified for retail sale. The first generation of the specification is DOCSIS 1.0. The 1.1 technology was released in 2000 and includes support for multimedia services including voice communications. Most of the DOCSIS 1.1 features are software based and are available through software upgrades. A question that you might want to ask before purchasing a cable modem is whether the platform is DOCSIS 1.1 upgradeable.
2. The EuroDOCSIS standard is expected to be widely adopted and will help accelerate data-over-cable deployments in Europe and Asia. EuroDOCSIS specifications allow cable operators to deploy standards-based CMTS solutions with approximately 33 percent more bandwidth than is typically configured in DOCSIS-compliant systems.
3. The EuroModem specification was developed to allow cable operators to deliver Internet access and timing critical services such as voice telephony and video conferencing services to their subscribers. The EuroModem specification describes a cable modem solution that fits very well into European cable networks.
4. Members of an organization called EuroCableLabs have developed the Euromodem specification. The cable operators who are involved in the consortium are from various European countries. The consortium has defined two different types of modems: Class A and Class B. Class A modems are capable of transmitting data at very high speeds downstream (maximum of 50.8 Mbps) and 3 Mbps upstream. They are capable of accessing the Internet at high speeds and support a number of security technologies. Class B is the second type of modem that has been considered by the group. It extends the functionality of Class A devices through the support of time-critical services such as video conferencing and telephony.
5. From the outset of DVB, interactive applications were perceived as being the cornerstones of the new generation of digital television. DVB has divided its interactive services package into a set of Network Independent Protocols and a series of medium specific return channel specifications. The DVB Return Channel through Cable specification (DVB-RCC) is the product of a long collaboration between DVB and the Digital Audio Video Interactive Council (DAVIC). It provides a means of carrying interactive services over cable networks with bit-rates up to 3 Mbps in both directions.

Note: DAVIC is a non-profit Association based in Switzerland, with a membership which culminated at 222 companies from more than 25 countries. It represented all sectors of the audio-visual industry: manufacturing (computer, consumer electronics, and telecommunications equipment) and service (broadcasting, telecommunications, and CATV), as well as a number of government agencies and research organizations. DAVIC created a number of industry standards for end-to-end interoperability of broadcast and interactive digital audio-visual information and of multimedia communication.

How Cable Modems Operate

A standard cable modem has two connections; one port is connected to the TV outlet on the wall and the other to the in-home network. The cable modem will then communicate over the cable network to a device called a Cable Modem Termination System (CMTS).

Note: The CMTS is a central device for connecting the cable TV network to a data network like the Internet.

The speed of the cable modem depends on traffic levels and the overall network architecture. Theoretically speaking, cable modems are capable of receiving and processing multimedia content at 30 Mbps. This is literally hundreds of times faster than a normal telephone

connection to the Internet. However, in reality, subscribers can expect to download information between 1 and 1.5 Mbps because the bandwidth is shared by a number of home networks throughout the neighborhood.

As regards to frequency ranges, operators define a portion of the frequency spectrum to carry the data. In general, the downstream path (headend to home network) will range between 50 MHz and 750 MHz. A frequency range from 5 to 42 MHz is used when transmitting information from the in-home network to the headend unit. Cable modems are primarily used for receiving and transmitting TCP/IP traffic including multimedia content and Web accesses data.

A major benefit for consumers who use this type of media gateway is the fact that the connection is always open, so they never have to go through the slow procedure of establishing a dial-up connection. The architecture of a typical cable modem is shown in **Figure 3**.

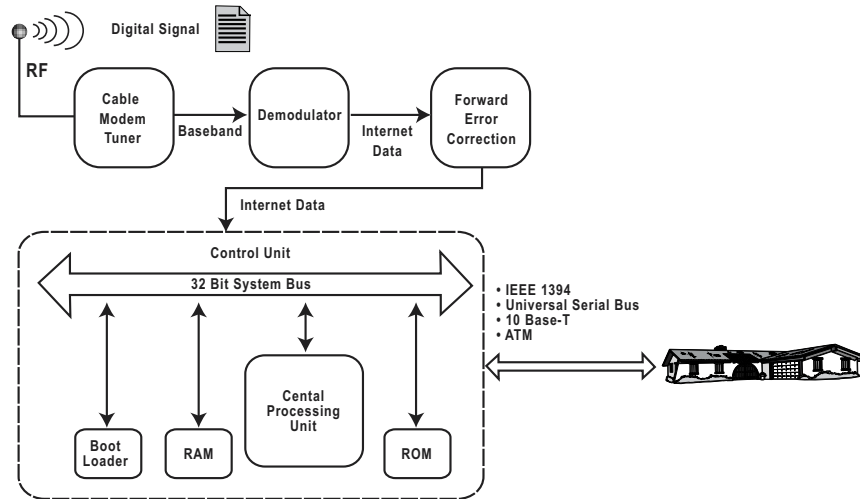


Figure 3: Architecture of a Typical Cable Modem

From **Figure 3**, the tuner in the cable modem receives a digital signal from the network and isolates a particular channel that contains the Internet data. It then converts the signal from RF levels back to baseband. The baseband output signal from the tuner is then forwarded to a demodulator. The function of the demodulator is to sample the signal and convert it to a digital bitstream. The bitstream contains video, audio, and IP data. Once the bitstream has been recovered, it is forwarded to the forward error correction unit and checked for problems. The signal is then passed into the control unit. From the control unit, data is passed on to the home network using one of the following high-speed data port interfaces.

Xilinx Solutions for Cable

Figures 4 and detail the functionality of a cable modem and a cable modem-based media gateway. Xilinx Spartan™-II FPGAs provide solutions in system interfacing (PCI, UART, DMA), encryption, clock management, memory controller (SDRAM, SRAM, flash), and I/O control.

These features are used to interface to several home networking technologies (such as Ethernet, USB, USB 2.0, HomePNA), and ASSP functionality (such as Cable MAC)

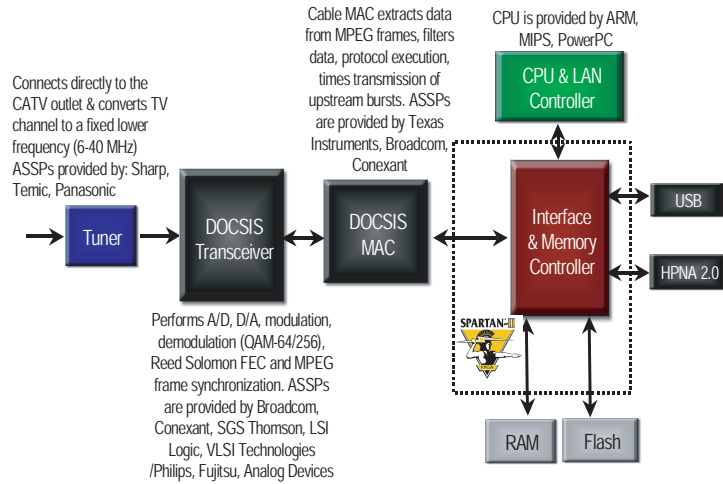
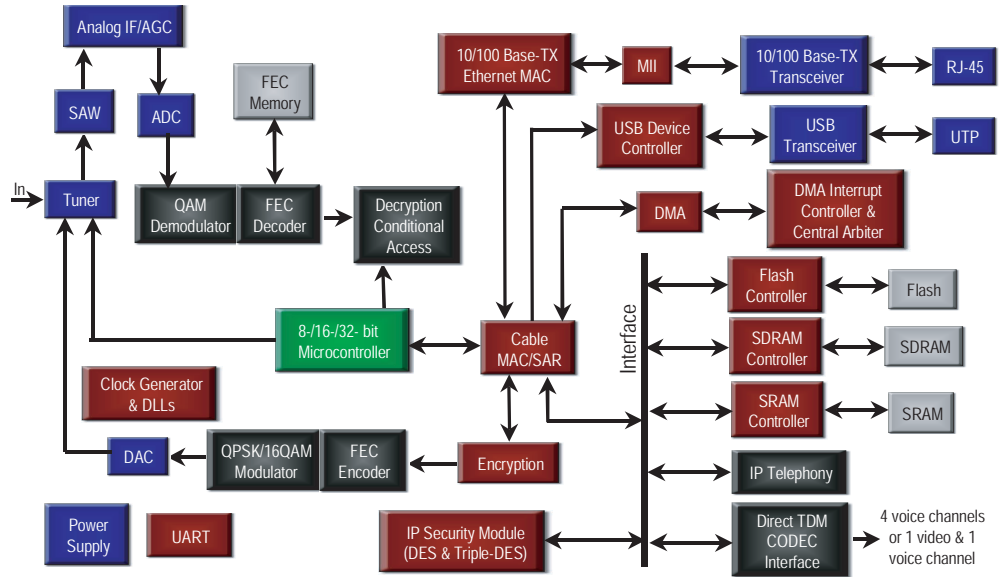


Figure 4: Cable Modem



Cable Modem Based Media (Residential) Gateway

Satellite Modems

Similar to the cable operators, satellite service providers are also delivering broadband connections to their subscribers. Consumers who connect their in-home networks to a satellite broadband platform are accessing a shared media that is broadcasting at rates ranging from 2 Mbps up to 38 Mbps. The transmission speeds from the service provider to your home is quite high. However, the upload speeds are limited to a telephone modem transmission rate.

The interaction with this high-speed connection is facilitated through a dish and a satellite modem.

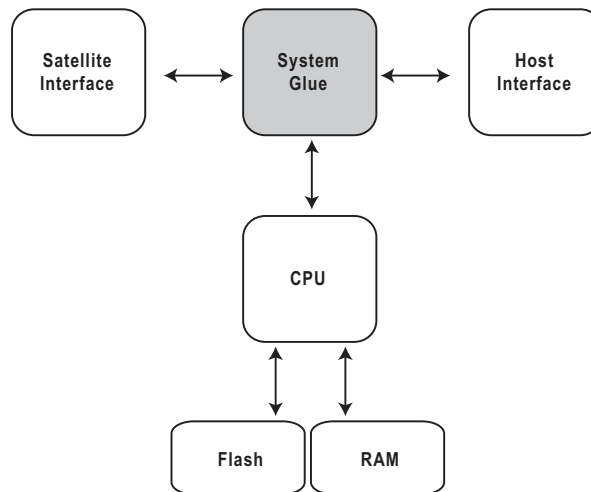


Figure 5: Architecture of a Typical Satellite Modem

Figure 5 shows the key functional blocks of a satellite modem. The main functions of the interface include:

- Receiving a digital signal from the satellite network and isolating a particular channel that contains the Internet data
- Converting the analog signal to a digital format
- Checking for errors

The host interface provides an interface between the satellite modem and your home network. USB and Peripheral Component Interconnect (PCI) are the two most popular host interfaces.

Note: The PCI technology was developed by Intel and is capable of simultaneously transmitting 32 or 64 bits of data between hardware components.

The application specific system glue is required for interconnecting the CPU and memory components with the host and satellite interfaces.

Xilinx Solutions for Satellite

The primary role of the Spartan-II is for system interconnectivity. The ability to provide multiple interfaces within the home to phonelines-based, Ethernet-based, or 1394-based information appliance networking is unachievable in an ASSP/ASIC.

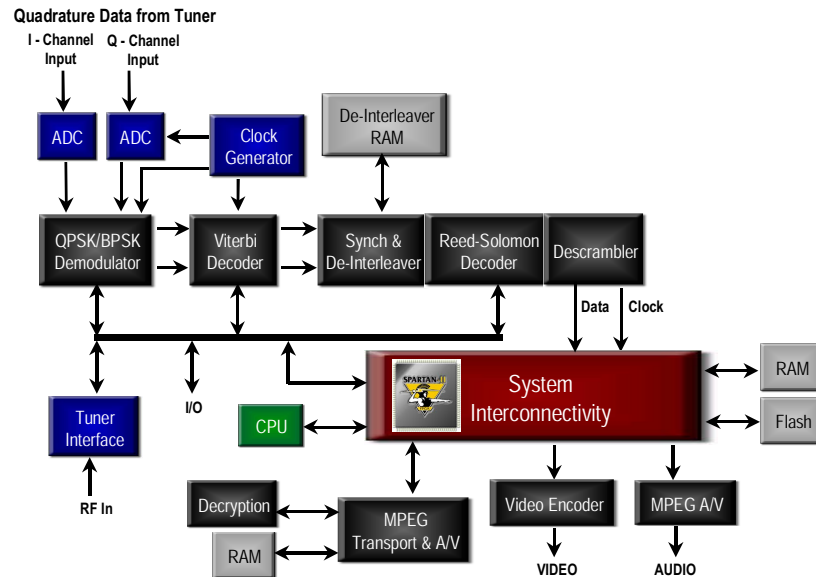


Figure 6: Satellite Modem Based Media Gateway

DSL Broadband Modems

Broadband modems based on DSL technology are widely used by consumers to boost the Internet bandwidth available to appliances running on their in-home networks. DSL broadband modems support data transmission over standard telephone lines as much as 50 times faster than the analog modems used by most homes and small businesses.

An Asymmetric Digital Subscriber Line (ADSL) circuit consists of two ADSL broadband modems connected by a copper twisted-pair telephone line. To maintain backward compatibility with the standard telephone system and to avoid disruption of service due to equipment failure, the voice part of the frequency spectrum is separated from the digital modem circuitry by means of a passive filter called a "POTS splitter". This means that if the ADSL modem fails, the POTS service is still available.

Under this configuration you are able to simultaneously make voice calls and transmit Internet data over the same broadband DSL pipe. When an ADSL transmission is received at the central office, a more advanced POTS splitter is used to send the voice traffic to the public telephone network and data to the Internet.

From a consumer's perspective, using a DSL modem as a gateway device to the outside world has become significantly easier over the past couple of years. In 1999, large PC manufacturers such as Dell and Compaq began shipping computers with high-speed DSL modems

Xilinx Solutions for DSL Modems

Xilinx Spartan-II FPGAs provide clock management, HDLC controller, memory controller, system controller, and interfacing to home networking technologies such as HomePNA, Ethernet, and USB (Figure 7).

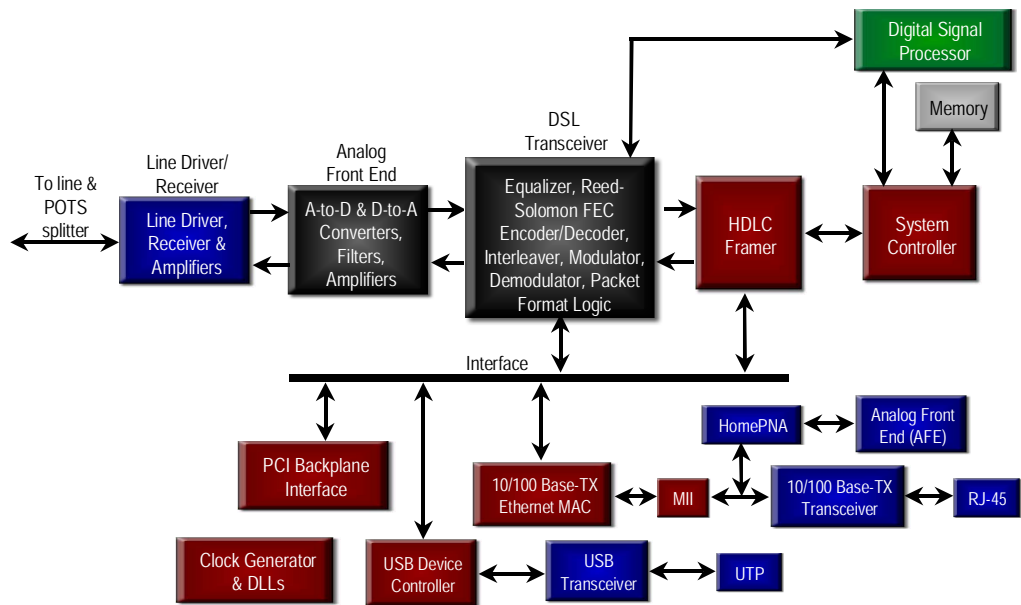


Figure 7: DSL Modem Based Home Gateway

Digital Set-Top Boxes

In the early seventies, the only piece of equipment that people needed to watch TV was a standard television that they were able to purchase at their local store. In the 1980s, this simple model began to change. Cable and satellite providers required the consumer to connect their TVs to their networks. In parallel to this development, operators decided to scramble TV signals, requiring a special box to descramble the signals at the consumers home.

Today, digital television requires an appliance called a set-top box to receive and decode digital transmissions into a form suitable for display on analog television sets. When you think of a set-top box, you generally picture a TV set and a black box connected to the set with multiple wires. The true picture of a digital set-top box is one of a complex electronics device comprised of a myriad of hardware and software components. It is usually connected to your TV set and the cable connection on the wall. They are normally installed and configured by the local cable, terrestrial, or satellite service provider. Set-top boxes can also be described as types of computers that translate digital signals into a format that can be viewed on a television screen.

Types of Set-Top Boxes

The digital TV market comprises of a large population of set-top boxes working in homes across the globe. This huge installed based of digital set-top boxes can be broadly classified into the following categories:

- Low cost entry-level
- Mid range
- Advanced

Entry level set-top boxes are capable of providing traditional broadcast television that is complemented with a Pay Per View system and a very basic navigation tool. Broadcast TV set-top boxes have no return channel, and therefore do not imply interaction with computer servers located at the headend.

Note: Return path is defined as the physical channel that facilitates two-way interaction between TV viewers and the service provider.

However, they are capable of receiving data that is contained within the digital MPEG-2 stream. Entry level set-top boxes are low cost and come with limited quantities of memory, interface ports, and processing power. Mid-range set-top boxes include a return or back channel, which provides communication with a server located at the headend. These set-top boxes are capable of providing e-commerce, video-on-demand, Internet browsing, and near-video-on-demand services. The presence of a return channel further allows for broadcasts customized to the local viewing population and enables the set-top box to support e-mail and local chat-style communication services.

These types of boxes have double the processing power and memory capabilities of broadcast TV boxes. This category of set-top boxes is ideal for consumers who want to simultaneously access a varied range of new multimedia and advanced Internet applications from the comfort of their homes.

Set-top boxes from the advanced service's category bare close resemblance to a multimedia desktop computer. They can contain more than ten times the processing power of a low-level broadcast TV set-top box. Enhanced capabilities in conjunction with a high-speed return path can be used to access a variety of advanced services such as video teleconferencing, home networking, IP telephony, video-on-demand, and high-speed Internet TV services.

Additionally, you will be able to use enhanced graphical capabilities within the box to receive high-definition TV signals. Most of the set-top boxes in this category have the capability to store video on a hard disk drive and provide the capability to record and view video simultaneously. Such receivers also come with a range of high-speed interface ports, which allow them to be used as a media gateway. For cable, terrestrial, and satellite companies, set-top boxes that support advanced technologies is seen as an opportunity to increase revenue streams.

Architecture

The anatomy of a typical set-top box is built around traditional PC hardware technologies (see [Figure 8](#)).

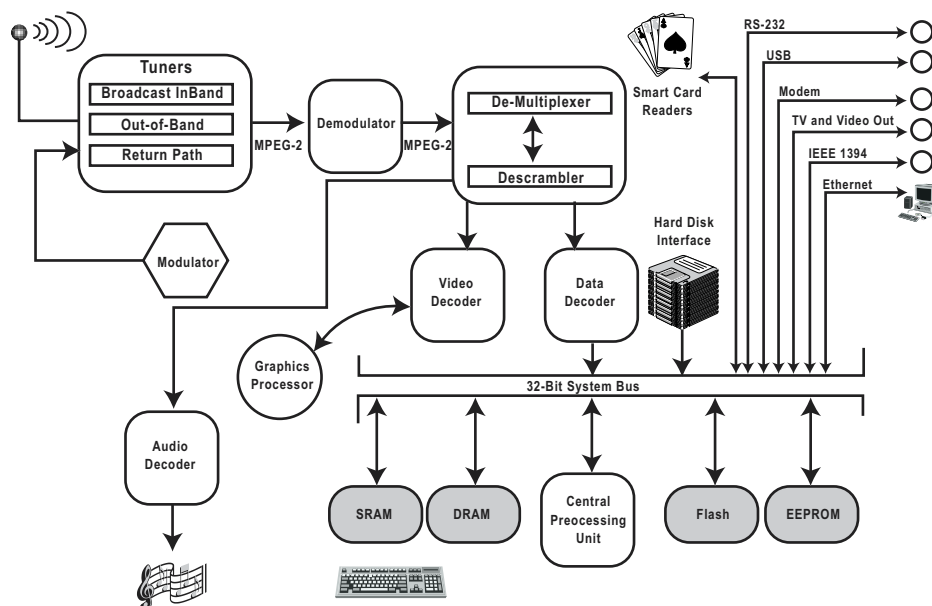


Figure 8: Architecture of a Digital Set-top Box

Digital set-top boxes contain various types of silicon chips that are used to handle and process digital video and audio services. All the silicon chips are connected to the system board and are able to communicate with each other via buses. The CPU is responsible for coordinating the different component parts of a set-top box. As more features become available to subscribers,

set-top boxes will require higher performance CPUs to keep pace with increased data throughput.

Software programs are required to operate digital set-top boxes. There are three types of set-top box software: operating systems, middleware, and applications. The operating system keeps all parts of the set-top box operating together. The middleware system is a layer of software programs that operates below the interactive TV applications and above the operating system. Viewers use application software to watch TV and use interactive features.

Other Media Gateway Candidates

While set-top box, PC, and modem-based media gateways seem more conceivable ideas, gaming consoles, personal video recorders (PVRs) and utility metering devices provide an imaginative and interesting platform to evolve into potential home gateways. Companies like Microsoft and Sony believe that high-speed game consoles could serve as the gateway or hub to the digital home of the future.

Today, PVRs provide an interface to a broadband digital network. Moving forward with home networking around the corner, the role of the PVR is expected to change. Xilinx believes that PVR manufacturers will increase support for an interface that provides connectivity to a range of different home interconnection technologies. The PVR will truly evolve into the media gateway of tomorrow.

Some of the likeliest supporters of the concept of media gateways come from the energy-utility industry. Utility centric gateways are an interesting part of media gateways. In fact, the concept of a utility company installing a new gateway device in their customers homes to provision new services has been gaining ground since the early 1990s. From a utility company's perspective, service gateways provide overall cost savings by minimizing service calls (through automated meter reading) and energy management and optimization. Hardware and installation costs are recovered by providing multiple services. The push for utility gateways will come from the service provider's end rather than the consumer.

Market Trends and Applications

Rapid implementation of integrated voice, video, and data services along with home networking and other value-added services, is creating an explosive market for media gateways. The high-tech market research firm, Cahners In Stat, predicts the MG market will rise sharply from \$100 million in 2000 to \$5 billion in 2005. MGs will evolve over the next few years from devices that provide basic broadband access to complex integrated services gateways, thus enabling remote management and value-added services such as home security control and video-on-demand. From a market that hardly existed in 1999, the beginning of 2001 sees actual products shipping by many different industries.

Market Drivers and Inhibiting Factors

There are a number of driving factors behind the development of the media gateway market, including:

- The availability of new home networking technologies
- Increased demand for non-PC based appliances
- Intelligent homes
- TV centric applications
- Network operators expanding their service offerings
- The Internet
- Broadband connections
- International standards

The second generation of home phonenumber networking components is available today. Powerline and wireless technologies are beginning to gather momentum and demand is increasing at an exponential rate. The availability of these new technologies combined with the

explosion of non PC based appliances is driving the demand for a single appliance that is capable of connecting in-home appliances to the public Internet—a media gateway.

The home automation market is growing at a tremendous pace. There are about 40,000 new homes constructed in the United States each year with a value of more than \$1 million. Market research firm Parks Associates estimates that about 80 percent are installing some form of intelligent electronic control system. The creation of a new breed of smart homes that can be managed and controlled from the public Internet can be achieved through a media gateway.

In addition to these factors, there is a large push by service providers and network operators to expand their revenue streams and move beyond their traditional service models. These large telecommunication companies are upgrading their infrastructures to facilitate the delivery of these new services to their subscriber bases. To allow them to manage these new services, the network operators are also working very closely with a number of vendors to develop media gateways that will be capable of supporting the new services.

The Internet is also proving to be an important market driver for media gateways. Some people believe that the Internet will be as widespread as utilities such as water and electricity. The ability to have a device like a media gateway to control the flow of information between the internal home appliances and the Internet is seen as a crucial part of this vision. With PC costs moving down fast, people are finding it easier to have multiple PCs for different members of the home. However, a single broadband connection is still prevalent and Internet access being driven through this one access point requires some type of media gateway device.

Industry standards are crucial for enabling mainstream consumer adoption of media gateway products. Consortiums like the Open Services Gateway Initiative (OSGi) are working to define and promote an open media gateway standard for connecting the coming generation of smart consumer and small business appliances with commercial Internet services.

The rate of media gateway deployments is growing at a phenomenal rate, however, there is a potential to accelerate deployments even further than the current rate, if a number of inhibitors are eliminated. Hurdles that are currently inhibiting the mass deployment of media gateways in households across the world include:

- Lack of clear business models
- Lack of customer education and mass confusion
- Lack of mechanisms for supporting media gateways.

There is an unclear ownership model when it comes to installing media gateways in the home. Media gateways are expensive and most service providers want to get out of owning and maintaining these appliances. To implement this type of strategy, service providers will need to convince consumers to buy into the concept of purchasing a media gateway. This is expected to be an extremely expensive business model to implement.

There are many different types of consortiums and manufacturers promoting their own type of media gateway. The wide variety of products and technologies is making life difficult for consumers who want to choose a gateway that is appropriate to their needs. Support is also a major concern in media gateway deployment. If every consumer who buys a gateway appliance also requires computing skills, then the gateways will only be suitable to a relatively small section of our society.

Xilinx Spartan-II FPGAs in Media Gateways

The media gateway, which could either be a PC, digital modem, set-top box, or PVR will be responsible for bringing broadband access into the house and distributing it to the appliances in the home. While Spartan-II FPGAs can today perform most of the functionality required for a media gateway, there is value in using low-cost, Spartan-II FPGAs for functions that ASSPs cannot perform.

Figure 9 shows how Spartan-II FPGAs have today brought programmable solutions to the heart of the system. While Xilinx programmable logic solutions can perform functions of a cable MAC, DSL receiver chipset, and satellite modem chip, the Spartan-II FPGA provides significant advantages in interfacing the different broadband access ASSPs and disparate home

networking technologies. In addition, features such as DLLs and block RAM provide system features such as clock management and glue logic functions. Hence, Spartan-II FPGAs provide an interface to access technologies such as DSL, cable, satellite, etc., and home networking technologies such as wireless LANs, Bluetooth, IrDA, HomePNA, Ethernet, FireWire, etc.

Spartan-II FPGAs also provide solutions as a HDD interface. This provides the ability to interface with multiple HDDs with proprietary interfaces. The Spartan-II family provides encryption capabilities using DES, triple DES, and even proprietary encryption schemes. Spartan-II FPGAs also provide system interface functions such as PCI, USB, etc. in residential gateways.

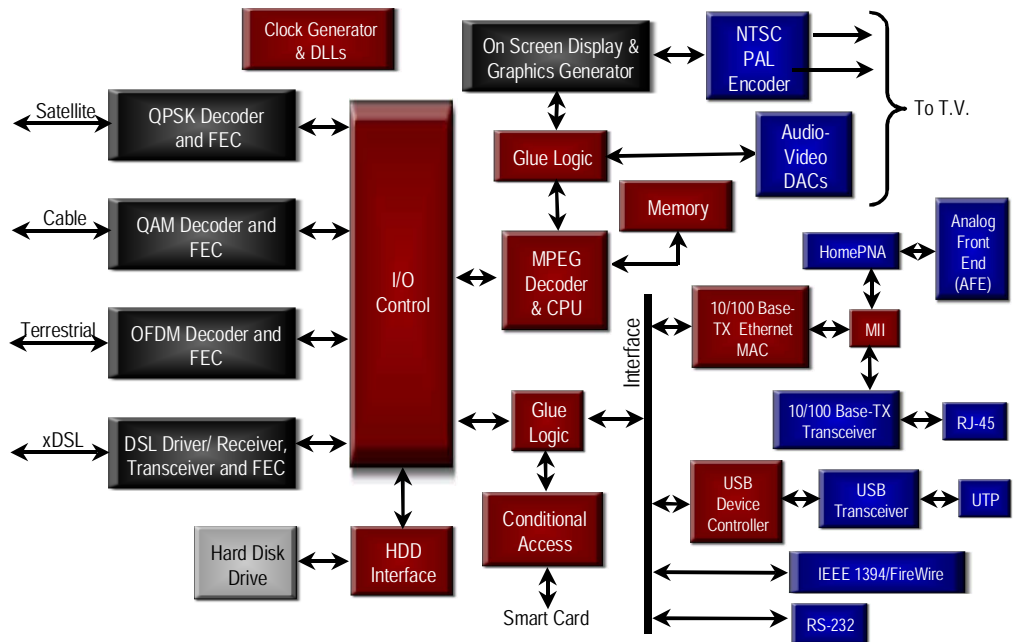


Figure 9: Media (Residential) Gateway

Conclusion

The primary function of the media gateway is to provide broadband connectivity to the home through cable, xDSL, satellite, and wireless. Secondly, media gateways will provide home networking capabilities by distributing broadband access throughout the home using technologies such as HomePNA (phonelines) or wireless LANs. The demand for greater Internet bandwidth is driving the need for digital modem solutions.

This white paper looked at utilizing an existing PC to provide media gateway type services. Companies like IBM and Ericsson are strongly promoting this concept.

Also discussed were the various classes of digital modems that are expected to evolve into the next generation of media gateways. A cable modem is a device that allows high-speed data access—from a PC to the Internet—via a cable TV (CATV) network. It is a modem in the true sense of the word—it modulates and demodulates signals—and it delivers Internet data to the desktop at blazing speeds. It simply uses the increased bandwidth of the TV cable instead of an ordinary phoneline. Cable modem services were introduced to the market much earlier than DSL services and as a result gained a much larger customer base.

With the rapid increase in demand for high-speed data services, DSL modems offer telecommunications providers with a technology that increases the bandwidth of the local loop without making huge investments in new fiber technologies. The convergence of television and computers is going to take a major step with the proliferation of digital TV technologies. This new environment will facilitate the broadcasting of data alongside video and audio content.

One of the more practical devices for accessing and using this new media is the set-top box. The set-top box, once a relatively passive device, is now evolving into a powerful media gateway that is capable of variety of services such as automation, energy management, security, and control to consumers around the world. Many set-top box manufacturers have announced a new set-top reference platform called a PVR. These new devices have two tuners and enable simultaneous recording and viewing of live TV broadcasts.

The purpose of the different forms of media gateways described in this white paper is to encourage consumers to take advantage of this wide range of new e-services.

Revision History

The following table shows the revision history for this document.

Date	Version	Revision
03/21/01	1.0	Initial Xilinx release.