Broadband Residential Gateways and Networks

Jimmy Shaw
TEL 355
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"Residential broadband access delivers the promise of rich content and unleashes the true commercial potential of the Internet" (Dwight, 1999). Broadband data to households opens up limitless possibilities for new services and applications for consumers. The convergence of different communication technologies means that devices for entertainment and information are becoming more interconnected and "network aware", thus compelling consumers to demand reliable, high-speed, "always-on" services into their homes (Edens, 1999). Integrated service providers must innovate and overcome the challenges of developing residential gateways and delivering broadband data into households. Ultimately, the goal is to bundle services and essentially make residential broadband access another utility, like water and electricity.

Technological advancements and lower costs will continue to fuel the race to deliver high-speed data to the home. Transmission media such as cable modems, xDSL, and fiber optics are already making residential broadband a reality. However, it is the backbone infrastructures that must be capable of handling enormous amounts of data at high-speeds. New companies, such as Level 3 Communications (www.level3.net), are building their own international networks to offer wholesale bandwidth, which will be leased to integrated service providers for data transport at terabit speeds. These scalable high performance networks will rely on packet switching protocols such as IP and ATM, since next generation networks will be converged and treat all traffic (voice, video, data) the same. By constructing purely optical networks and utilizing such technologies as dense wavelength division multiplexing (DWDM), terabit routers, and optical

cross-connects (OXCs), integrated service providers will in essence have unlimited bandwidth to harness.

The challenges of delivering high-speed data to the home go beyond building an adequate backbone to carry the data. Technical, consumer related, and political challenges are the major dilemmas that service providers face now and in the near future. Manufacturers must also consider issues of open standards and compatibility before developing new products. In addition, “plug and play” devices are essential for the simplification of networking for non-tech savvy consumers. Wireless technology is vital to the future of home gateways. Networking devices without wires eliminate confusion, costs, and the mess of dozens of cables.

However, before consumers spend money on high-speed data connections, service providers must address the real benefits that broadband has to offer. Service providers will have heavy competition since the deregulation the Telecom Act of 1996 virtually eliminated barriers to entry and leveled the telecommunications playing field. This competition is beneficial for consumers, assuring them high quality service at reasonable prices. On the other hand, convincing consumers that they need to upgrade home appliances and construct a network may be a difficult task. As information, entertainment, and communications applications converge, consumers will become more demanding. Devices that are “network aware” will creep into homes and networks will slowly develop not be constructed over night. People will not be forced to connect devices together. Smart devices will converse on their own.

In essence, the residential gateway is a platform for delivering multimedia services. The gateway is an intelligent element of a network that “supports the arbitration of call control and signaling between individual networks, resources, users, and services”(Access, 1999). The gateway may be a PC or a stand-alone unit. It must be a highly flexible component of a network that can handle complex transactions using multiple protocols. Applications that take advantage of gateways will make computing more powerful and flawless data transactions crucial. Well-constructed residential gateways will increase productivity, enhance communications, and empower individuals to take better control over their lives. From interactive entertainment to remote control home appliances, the home gateway will make a true “smart home” possible.

Imagine buying a home theatre system that uses wireless technology to communicate with a gateway, which allows streaming video and music on demand. How about having a digital camcorder talk to the home theatre system and centralized telephony equipment that permits high definition video conferencing from flat panel displays in any room in the house? While watching television you see a commercial that briefly flashes a web site address, out of curiosity you could click on the address with your remote control to visit the site. Thirty-seconds later you return to the television show you were watching after purchasing the advertised product. These ideas may seem far-fetched, but residential broadband access puts them within reach.

There are numerous methods of delivering broadband access to the home. Utilizing existing wires that are already in place is the least expensive

method for delivering broadband. Today, cable modems and xDSL technologies both use existing copper wires (coaxial cable and twisted pair) to deliver data to the home at realistic speeds of about 2 megabits per second. These technologies are capable of reaching much higher speeds (30-50 megabits per second), but those speeds may not be adequate for some future applications. Also, cable modems currently operate on a shared bandwidth architecture where users in one area are connected to a head-end unit that has a set amount of bandwidth to utilize. Consequently, as data traffic grows, users experience slower performance. Therefore, DSL technologies currently offer the consumer a dedicated “pipe” that is more reliable and suitable for some bandwidth intensive applications such as web servers.

In order to provide hundreds of television channels, audio and video on demand, advanced telephony, Internet access, and other unforeseen applications, much higher bandwidth will be necessary. Some businesses are finding it worthwhile to invest in upgrading their networks with fiber optics, high-speed switches, routers, and cross-connects. Companies that build these next generation optical networks, that spread further from backbones and deeper into neighborhoods, will have an edge over the competition. By bringing fiber optics into the home, data can be delivered at gigabit, terabit, or even faster speeds. At the moment, no other technology can compare to the speed and reliability that fiber networks provides.

Ultimately, broadband wireless networks that utilize both point-to-point and point-to-multipoint technologies would be ideal. Siemens, a telecommunications

company, has already developed a broadband wireless point-to-multipoint communications system. “It is designed to deliver two-way high-speed data, voice, and video services over the last mile to business and residential markets” (AirNetXpress, 1999). This communications device is small enough to be mounted on a telephone pole within a small subdivision and serve residents who attach tiny transceivers to their roofs. I am convinced that wireless is truly the wave of the future.

In conclusion, broadband residential gateways and networks are becoming a reality. Rapidly evolving technologies and declining prices are making it possible for consumers to have broadband data access in their homes. Internet content is evolving as quickly as technology will allow it. When broadband penetrates deeper into homes, the demands for applications and content to utilize the bandwidth will develop. Integrated providers will likely bundle services to lure consumers to the benefits of a package deal. I feel younger generations will see the advantages that broadband has to offer and help it to become a necessary utility within the household.

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