Home Networking: Connectivity in the last—100 Yards

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Once the primary domain of businesses and other large organizations, broadband technology is now fundamentally and rapidly changing the way consumers utilize home computers. Technologies such as T1, frame relay and Asynchronous Transfer Mode (ATM) have long enhanced the business user's Internet experience by enabling fast web downloads and rich interactive services made possible by high-throughput data connections. Now, high-speed technologies such as digital subscriber line (DSL) and cable modems are quickly making the broadband experience a pervasive reality in the home as well.

The broadband market is experiencing explosive growth, as home users have come to expect the same lightning-fast download times and interactive content they enjoy at their place of work. From a total subscriber base of 3.8 million in 1999, for all broadband technologies combined, industry analyst In-Stat predicts a dramatic growth curve for this sector. The firm predicts broadband subscribers will increase from 21.5 million in 2001 to 35 million in 2002. By 2005, In-Stat forecasts there will be nearly 84 million broadband users worldwide.

Clearly, a remarkably enhanced user experience is quickly making broadband a must-have service for home users. Fast Internet access is currently the overwhelming motivation for new subscribers.   Other existing and new applications that drive the need for high-bandwidth connections will also speed the rapid growth of broadband technologies. Some of these include streaming media, video conferencing, IP telephony, e-commerce, webcasting and multi-player gaming.

As a comprehensive solutions provider for cable modem and DSL applications, Texas Instruments (TI) is helping to meet the intense consumer demand for advanced broadband. In 2000, TI shipped nearly 3 million cable modem chipsets (30 percent of the market) and supplied the technology for over 11 million DSL products (30 percent of the market). TI's comprehensive approach to broadband incorporates all of the hardware, software and system-level expertise required to enable designers at both ends of the wire to quickly and cost-effectively implement advanced solutions.

TI and other industry leaders are moving forward with home networking technologies that will make the end user's broadband connections a truly integrated and powerful home technology. Broadband connections, such as DSL and cable modems, bring data to the home at lightning-fast speeds. Where the broadband connection ends, at the user's residence, advanced home networking technologies are needed to give users a powerful way to share information among a host of computers, peripherals and intelligent appliances within the home. Just as a water main delivers large amounts of water to a customer's home, broadband is the fat "pipe" that will bring users large amounts of data. Home networking, like a house's internal plumbing, then distributes the product intelligently to different users within the home.

Communication through e-mail, file or printer sharing, and shared Internet access among different computers within the home are obvious benefits of home networking. In addition, home networking will enable a host of compelling networked audio and video applications. In short, home networking significantly enhances the broadband experience by taking the power of high-speed access and making it available to many computers and other devices within the home.

Wireless Home Networking – the Technology of Choice
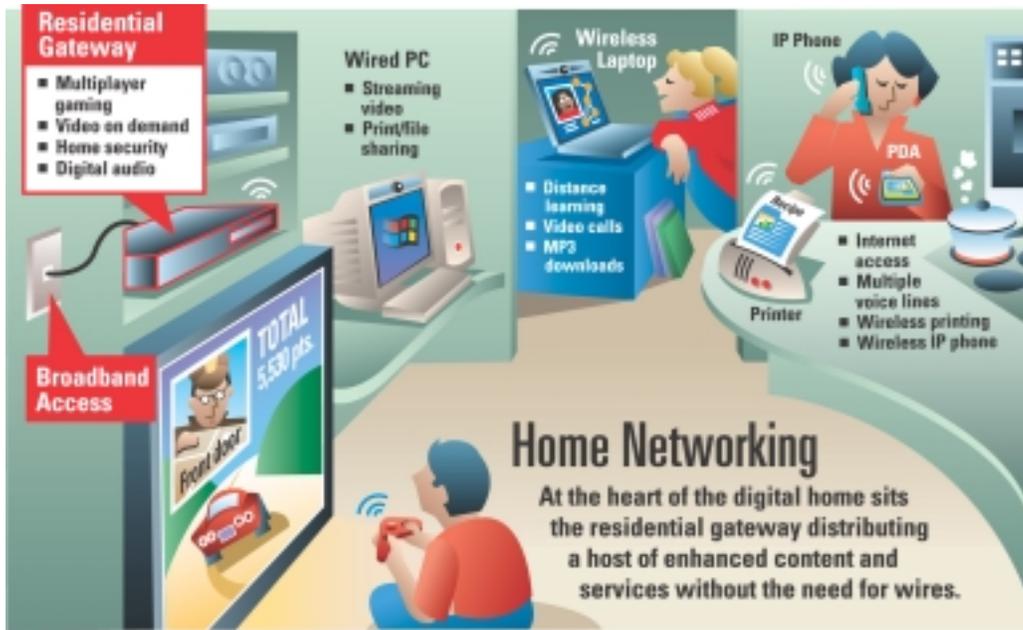
As broadband technology proliferates, consumer interest in home networking is growing rapidly. A recent report by the Yankee Group indicates that nearly 25 percent of home consumers with PCs are interested in purchasing home

networks within the next two years. With consumer interest clearly established, the relevant question is then–which home networking technology will win the market? In the past, a consumer was forced to use wired Ethernet and run cables throughout the house to achieve a networked home. This solution has proven to be difficult for some and has led to a movement known as "no new wires." The basic tenet of "no new wires" is that home connectivity should be accomplished without requiring the expense of running wires. Currently, there are two ways this can be accomplished:

1. Make use of existing wires in the home
2. Wireless networking technologies

The use of existing wires has been around for several years in the form of the Home Phone Network Alliance (HomePNA™) standard, which makes use of existing telephone lines in the home. However, HomePNA constitutes only a US opportunity - owing to the fact that most homes worldwide average only one phone outlet. Also, this solution does not address the corporate space; therefore users could not leverage the same technology at work and at home. These and other factors caused HomePNA to actually lose 28 percent of the market from 1999 to 2000, though the home networking market, as a whole, grew by 97 percent during this time.

Another new attempt to make use of existing wires is HomePlug™ - a technology that utilizes the power lines in a home for data transmission. Although HomePlug does not have the same US-only constraints, it remains to be seen if this standard can overcome the confusion of using wires for reasons other than their original intents, which has also plagued HomePNA. Additionally, as with HomePNA, HomePlug is unable to address the corporate market, which may limit its presence.

At this point, consumer interest indicates that the most attractive "no new wires" technology is no wires at all. Consumers are already accustomed to wireless remote controls, portable phones and other "wireless" home products, and the flexibility and mobility of wireless technology makes it inherently attractive to the user. Currently, the market is primarily focused on two wireless technologies, HomeRF™ and IEEE 802.11b, popularly known as Wi-Fi™. Although both use fundamentally similar technology, Wi-Fi is gaining rapid acceptance, with a technologically superior architecture and implementation. Early on, HomeRF appeared well positioned in terms of cost and industry support. However, both of these advantages seem to be eroding, as the price of Wi-Fi products has dropped and a number of HomeRF supporters, most notably Intel, have chosen

Wi-Fi over HomeRF. It is becoming evident that the wireless technology of choice for the corporate space is Wi-Fi, and if history is any indication, the corporate space will drive technology in the home.

Wi-Fi – Building Industry Momentum

With its clear advantages over competitive "no new wires" technologies, Wi-Fi is already gaining major industry support. Currently, more than 80 companies support the Wireless Ethernet Compatibility Alliance (WECA), whose mission is to certify interoperability of Wi-Fi products and to promote Wi-Fi as the global wireless LAN (WLAN) standard across all market segments. In addition, there are already close to 100 Wi-Fi-certified products from 38 companies, primarily for applications in business environments, already on the market.

Microsoft and Starbucks are among the major corporations that have adopted Wi-Fi as the wireless networking technology of choice. Microsoft has installed a Wi-Fi network throughout its entire Redmond, Washington campus, and Starbucks has adopted added Wi-Fi coverage to over 300 store locations to enable customers to wirelessly access the Internet. In addition, major airports worldwide are lining up to install Wi-Fi networking systems to give passengers wireless access to Internet, e-mail and other networked applications.
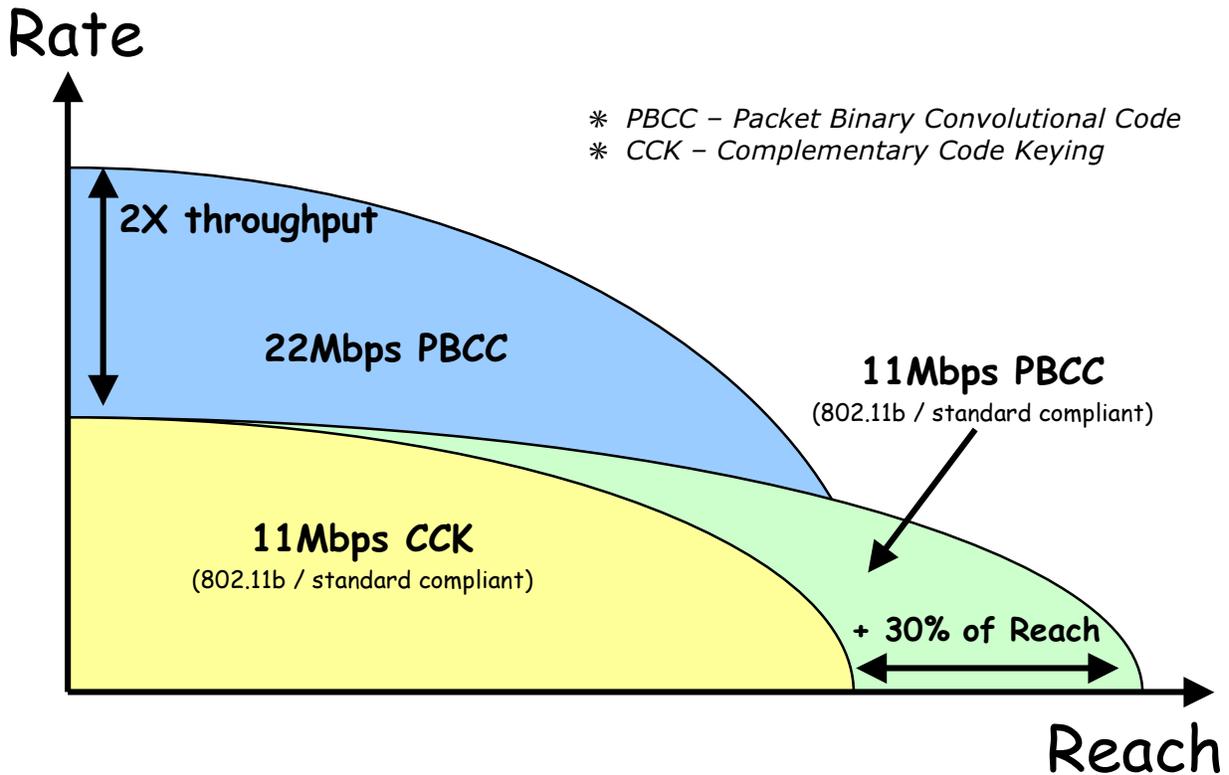
Texas Instruments: Implementing Improved Wi-Fi Technology

As Wi-Fi adoption continues to accelerate, the market is demanding better performing and more highly integrated Wi-Fi consumer products. Texas Instruments is answering this demand, by developing a wireless LAN solution to increase the deployment of Wi-Fi technology in broadband homes and offices. TI's new chip improves WLAN coverage area by 70 percent over competitive solutions in real life environments, which is the result of a 30 percent linear distance improvement. This reach/area improvement is vital for the home user market since, unlike most wireless LAN products available today, it means consumers only need to purchase one access point or gateway to cover their entire home.

The new chip, the ACX100, is comprised of an integrated Medium Access Controller (MAC) and baseband processor, combined with on-chip PCI, mini-PCI, PC Card, and USB interfaces, thus eliminating the need for external bridging components. The chip supports both the mandatory CCK (Complementary Code Keying) and the optional PBCC™ modes of the current IEEE 802.11b standard.

With PBCC modulation, end-to-end solutions using TI's ACX100 offer a coding gain advantage of 3 dB over current CCK-only 802.11b solutions, allowing for the 70 percent coverage area improvement.

Improved IEEE802.11b Performance Vs. Current Solutions

Rate

∗ PBCC – Packet Binary Convolutional Code
∗ CCK – Complementary Code Keying

2X throughput

22Mbps PBCC

11Mbps PBCC
(802.11b / standard compliant)

11Mbps CCK
(802.11b / standard compliant)

+ 30% of Reach

Reach

To further address corporate needs, the ACX100 includes a 22Mbit/sec high rate mode as a differentiating option for the customer, while maintaining full backwards compatibility with the currently existing installed base. This data rate effectively doubles the current 11Mbit/sec supported by 802.11b and is available as a standard feature of the ACX100.

As 802.11b continues to evolve to address video and voice, TI is committed to developing next generation products supporting the Quality of Service and Security enhancements defined by the 802.11e and 802.11i standards,

respectively. Also, TI has been developing the technology for 802.11a and will be bringing a product to market with this capability in the near future.

Conclusion

As broadband has become more readily available, home users increasingly demand the performance advantages of broadband connections. Wireless networking will serve as a powerful and complementary technology for building shared computing environments in the home. Wi-Fi, which has already gained wide support within the business community, is poised to become the dominant choice for home networking as well. By choosing technologically advanced Wi-Fi solutions provided by Texas Instruments, system developers can build performance-enhanced, comprehensive solutions that meet the current and future needs of home networking customers.