

Intel and the HomeGrid® Forum

Helping unify the home networks market by accelerating development and acceptance of the ITU-T G.hn standard

Home networking today is accomplished through a variety of wired and wireless technologies. These technologies all process, transport and store information to enable the connection and integration of multiple computing, consumer electronics and communication devices in the home. Local area networks (LANs) and wireless LANs dominate the market. Less popular network technologies – such as powerline, phoneline and coax home networking solutions – use existing wiring in a home and can fill gaps in coverage or capacity. These technologies could come into play when faced with:

- The difficulty and expense of wiring an existing home for Cat 5 Ethernet
- Dead zones within a home degrade wireless performance
- Wireless transmission speeds prove too slow for streaming high definition (HD) television and other bandwidth-intensive media

Anticipating significant market opportunities in the ever-increasing networking of computing and consumer electronics devices, computing and consumer electronics industry leaders are taking a fresh look at phoneline, powerline and coax home networking solutions. The feeling is that once consumers experience the advantages of being able to freely move content around in the home, they're going to want to be able to do it in every room.

How lucrative could this market be? MultiMedia Intelligence's research predicts that semiconductor revenue alone enabling these interfaces could exceed \$2 billion by 2012.¹

To achieve this kind of growth, some serious difficulties in using these alternative networking technologies (phoneline, powerline and coax networking solutions) need to be resolved. These difficulties include fragmentation of the existing wiring networking market; consumer confusion over the technologies; lack of interoperability between them; low transmission speeds; and poor market penetration. To address these challenges, the International Telecommunications Union (ITU-T) created in 2006 the G.hn (next generation home network technology) workgroup. The workgroup recently completed an "everywire" standard enabling a new generation of devices that can connect through all three of the existing home wiring options.

"An increasing variety of TV-centric consumer electronics devices with IP interfaces is developing. Manufacturers are adding IP interfaces across TVs, DVD equipment, as well as cable, telco, and satellite set-top boxes. While manufacturers and operators are gradually adding IP connectivity, the IP-enabled consumer electronics market has not reached a true inflection point beyond game consoles for hyper-growth. However, this growing installed base of consumer electronics devices with dormant IP ports could quickly become active with a simple network connection or software upgrade."
–Mark Kirstein, President of MultiMedia Intelligence

To help accelerate the development and adoption of this standard, Intel and other industry leaders created on April 29, 2008 a new industry group: The HomeGrid® Forum. An Intel technology strategist was elected its first chairman and president.

A closer look at today's home networking issues

Today there are multiple industry groups and companies working on networking technologies using existing wiring (powerline, phonline and coax). There is no clear leader, no strong ecosystem, and little cooperation between the powerline, phonline and coax industry groups and companies. The result is the fragmented industry that exists today and a total penetration of existing wiring networking solutions that is minuscule compared to Wi-Fi. Shipments of existing wiring chipsets are just in the few millions a year.²

It's challenging enough that each type of wiring has separate standards. It's even worse that there are competing standards for two of the wiring types. Coaxial wiring has two competing standards. Powerline wiring has three. Consumers walk into a store and see nearly identical products using competing standards and either doesn't notice the difference or are confused. The result is consumers often buy the wrong products, and then return them because they don't work. This is a costly problem for the industry. Returns in consumer electronics are a USD 13.8 billion problem annually in the United States³ and approximately a USD 11.5 billion problem annually in Europe.⁴ Global figures would be even higher. Often if a consumer tries to use more than one of these types of products in the home, they all simply stop working. The frustration factor is enormous.

Another issue for any company looking to offer products based on one of the existing in-home wiring networking technologies (e.g., HomePlug, UPA, HD-PLC, MOCA and HomePNA) is the limited access to and high cost of licensing the intellectual property. Because each of the technologies is based on a different type of wiring, there isn't a lot of competition and often just one company owns the intellectual property. This keeps the cost of licensing up.

Some Organizations Developing and/or Promoting Home Networking Standards

Continental Automated Buildings Association (CABA) – An industry association of nearly 400 companies dedicated to the advancement of intelligent home and building technologies in North America. CABA encourages the development of industry standards and protocols, and leads cross-industry initiatives.

Digital Living Network Alliance (DLNA) – An international, cross-industry alliance of consumer electronics, computing industry and mobile device companies. The organization is working toward an interoperability framework enabling digital content to be shared through consumer electronics, PCs, and mobile devices in and beyond the home through wired and wireless networks.

High Definition Power Line Communication (HD-PLC) Alliance – A trade alliance promoting HD-PLC technology to deliver data and multimedia content over existing in-home power lines at the wall outlet.

Home Phonline Networking Alliance (HomePNA) – An industry association of companies organized to develop and standardize technology for home networking over existing coax cables and phone wires within the home. HomePNA also promotes the technology, as well as tests and certifies member products as HomePNA compliant.

Multimedia over Coax Alliance (MoCA) – A trade alliance for developing specifications for home networking over in-home coaxial cable, which is commonly used for antenna connections to TVs and radios, and cable TV. Although MoCA is an open standard, at the time of this writing there is only one supplier of MoCA chipsets.

Universal Powerline Association (UPA) – A trade association covering all power line communication markets and all power line communication applications. The UPA focuses on promoting the growth of power line communication technology by delivering certified products that comply with agreed specifications. Its specifications so far target UPA coexistence, Broadband over Powerline (BPL) networking, and in-home systems and solutions.

This is unfortunate because there is a real need in the market to use existing wiring for networking. High definition television is coming on strong and has higher bandwidth requirements for streaming than most wireless technology can provide. Also, there is a real market for whole-home networking – enabling connection of devices in every room of the home through a variety of networking technologies. The ideal application for such a network would be IPTV offered by a service provider as part of a complete video, voice and data service. Good examples of such services are AT&T U-Verse and Verizon FiOS.

The solution is connectivity over any wire

The way forward is to develop a unified technology standard for enabling connectivity over any wire, anywhere in the home. The goal would be for consumers to be able to buy devices that can plug into any existing wiring (coaxial, phonenumber or powerline) and automatically network (nothing to install) with other devices adhering to the standard.

Such a solution will require a standard for a single Physical Layer/Media Access Control (PHY/MAC) technology that works on coax, phone lines and power lines. To meet the needs of modern home networking, the technology would have to deliver reliable signals capable of handling multiple HD broadcasts. This would mean operating two to five times faster than today's existing coax, phonenumber and powerline solutions.

The time is ripe for such a standard. With HD televisions coming on strong, home wire networks are getting more attention. To give an example, B-STAR (the Shanghai Engineering Research Center for Broadband Technologies & Application) in China recently installed in 10,000 Shanghai residences a HomePNA-based solution from Sigma Designs. This solution uses coax cable to deliver broadband Internet access and HD television throughout a home. B-STAR expects to be in one million residences in 2010. This is just the tip of the iceberg in the potential market for home wire networks in China and a solid indication the market has already started to take off.

Starting out with a blank piece of paper

ITU-T, where this unified standard was developed, is the perfect standards body for this standardization effort. It's a global organization and an international standards-setting agency under the United Nations. ITU-T is also sanctioned by the World Trade Organization. Its Telecommunications Standardization Sector establishes global standards in the form of ITU Recommendations. Among ITU-T's many successes is the DSL standard that is now responsible for more than 600 million installed DSL devices around the world. Study Group 15, the group responsible for DSL and other technologies used for digital transmission is the one that developed the ITU-T G.hn suite of standards.

"This is an ambitious effort, but I think it's necessary; otherwise, consumers might face the prospect of home networking products that not only don't interoperate, but actually interfere with each other."

—Les Brown, ITU-T G.hn group chairman and senior standards manager for Lantiq

To avoid giving any one company's existing technology an advantage, ITU-T drafts standards by starting out with a blank piece of paper and agreeing on technology building blocks one at a time. This means each standard is developed from the ground up. An advantage of this process is that it avoids having performance levels or other features limited to what's available in existing technologies.

The ITU-T uses a consensus-based decision process. Proposals for each building block are considered and the best solution decided on collectively by the members of the workgroup. By the time the entire specification is finished, the group has essentially already voted for each of its components. This can make ultimate approval by workgroup members easier. What constitutes “consent” is decided by the workgroup’s chairman and ITU-T processes.

“We did not want [ITU-T G.hn] to be a duplication of existing technologies; rather, we wanted to position it as a next generation with performance beyond today’s versions of MoCA, HomePlug and the others.”
–Barry O’Mahony, an Intel senior staff systems engineer who works with the ITU-T G.hn group

The G.hn workgroup has about 35 members, including Intel, and represents a good cross section of the home networking industry worldwide. The workgroup includes service providers, consumer electronics companies, personal computing companies, IP licensing companies, and silicon suppliers. Importantly, its

members include all the silicon suppliers for the existing powerline, phoneline and coax networking technologies. The goal of the workgroup is to create a standard for a single PHY/MAC technology that can run over coax, phone lines and power lines, improve performance over current transmission speeds, and provide a more reliable quality of experience. In the end, such a standard is in everyone’s interest because the enormous market it would create is more lucrative than the current multitude of tiny niche markets created by existing home wire network technologies. The biggest challenge facing the G.hn workgroup, like many standards workgroups, is simply getting all its members to work together on a common standard and support it.

The need for an industry forum organization

While ITU-T is a perfect place to develop the standard, it has no mechanism for: 1) marketing the G.hn technology to the industry, 2) ensuring compliance to the G.hn specification, and 3) ensuring the interoperability of G.hn products. All are critical must-haves for deploying a

technology. Consequently, Intel and other industry players saw the need for a companion group that could perform a similar role to how the Wi-Fi Alliance works to commercialize IEEE 802.11, the set of standards governing wireless LANs. The Wi-Fi Alliance has been immensely

successful. Despite various coverage, capacity and installation challenges for 802.11 technologies, the Wi-Fi Alliance has made Wi-Fi a household name and ensured the interoperability of 802.11 products.

“ITU-T G.hn already has the critical mass necessary for an ecosystem. It could be embedded in hundreds of millions of products someday.”

–Matthew Theall, Intel Digital Home Group technology strategist and chairman and president of the HomeGrid.

The HomeGrid Forum was founded to perform a similar function as a forum to ITU-T G.hn. Response to its formation has been extremely positive with more than 300 press articles. A vast majority of these articles supported the idea of a unified wired networking market. Started by four founding members, the forum has grown quickly to 23 current members, with more in the process of joining.

One advantage for the organization is that HomeGrid founders have little or no stake in existing approaches. According to Matthew Theall, an Intel Digital Home Group technology strategist and chairman and president of the HomeGrid, they were “all simply aware that there is a fragmented existing home wire networking market today and that they and a number of other companies were interested in working towards a common technology.”

The group is already proving a potent force in contributing to the standards effort. The Forum provides a meeting ground for individual companies to develop common positions for presentation at ITU-T G.hn meetings. HomeGrid Forum members have made over 50 percent of the contributions to ITU-T G.hn technology creation efforts. The Forum also actively works to forge liaison agreements with key industry groups, such as DLNA, UPA, HD-PLC Alliance, CABA and others.

The HomeGrid Forum’s objectives

The HomeGrid Forum is working with ITU-T G.hn to align the industry on a single PHY/MAC solution capable of meeting next generation home wire network needs. By doing this, the Forum seeks to:

- Reduce market fragmentation
- Reduce product and development cost while increasing competition
- Simplify consumer implementation of wired home networks
- Ensure compatibility with other home wired technologies

Ultimately, the HomeGrid Forum envisions a home wire networking technology that reaches everywhere in the home, is robust enough to stream multiple HD

“Our member companies are committed to making G.hn a reality in a timely fashion. HomeGrid members contributed more than half of the technical papers at the past two ITU-T G.hn meetings and are eager to continue our collaboration on this vital next generation home networking standard.”
–Matthew Theall

broadcasts, requires no installation because it uses household wiring, and complements wireless networking by spanning the areas Wi-Fi can’t effectively reach. The HomeGrid Forum is working to encourage the deployment of the ITU-T G.hn suite of standards (G.9960, G.9961, and G.9972).

Importance to Intel

An important objective of Intel’s Digital Home Group is to connect all the devices in the home. The most promising solutions for doing this have been wireless technologies. Yet if you look at wireless technologies today, they don’t meet all the needs for connecting devices in the home, particularly something as bandwidth intensive as several streams of high definition video. Consequently, Intel has a wired networking strategy that includes sending video, audio and data over multiple wire types in the home.

For Intel, helping the ITU-T G.hn work group establish a single standard for all three types of home wire networks is the ultimate goal because it will allow the company to develop a single piece of silicon or platform that can be used anywhere in the home. Without such a standard, Intel would have to develop multiple SKUs – different solutions for each flavor of home wire network. A single networking technology for all three types of existing home wiring will make it easier to expand the market for Intel's home networking products. Some benefits of the final standard are lower equipment development costs and lower deployment costs for service providers. Benefits for the consumer will be greater ease of use, simpler configuration, and, due to increased competition, probably a lower cost per networkable device.

"We believe that the close cooperation between ITU and the HomeGrid Forum will enable customers to deploy G.hn products much sooner."

–Richard L. Stuart, chair of the ITU-T G.hn workgroup

What lies ahead

The ITU-T G.hn standard was officially finalized in June 2010. Products based on the standard could be available as early as late 2010 or first part of 2011. In the meanwhile, there is a lot for the HomeGrid Forum to do. Currently, the Forum is forging ahead on interoperability guideline work such as certification testing methodologies and is continuing to recruit members.

A major effort of the HomeGrid Forum will be getting consumer electronics and set-top box makers to include more home network links generously across their product lines. What's been keeping many of them on the sidelines is the uncertainty about all the competing specifications. Having one standard for all home wire networks and an organization set up to ensure interoperability and marketing should encourage them to take the next step.

Learn more

More information about HomeGrid Forum can be found at www.homegridforum.org. A list of frequently asked questions is available at www.homegridforum.org/about/faq/.

1 Ibid.

2 "The Everywire Standard: G.hn and HomeGrid Forum," Broadband Home Report, May 15, 2008.

3 "Consumer electronics sales to reach \$171B in 2008," Electronic News, January 11, 2008.

4 "European returned electronics cost \$11.5 billion in 2007, says Accenture," EE Times Europe, July 24, 2008.