G.hn: ITU-T Standard is Triggering a Mass Market for Wired Home Networking

An overview of the technology that enables high-speed communications over existing home wiring. By Chano Gomez, Director of Business Development at Lantiq North America and co-chair of the HomeGrid Forum Marketing Working Group

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Since 2008, Chano has been actively involved in the development of ITU-T standards G.9960 and G.9961 (G.hn). He currently serves as co-chair of the HomeGrid Forum Marketing Working Group, and previously as chair of the HomeGrid Forum G.hn Contributions Working Group.

Prior to joining Lantiq, Chano was VP of Technology and Strategic partnerships at DS2, where he was responsible for product management, product marketing and standardization activities in the area of wireline home networking semiconductors.

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Lantiq is a fabless semiconductor company specializing in broadband communications that offers an ►

ITU-T G.hn: the open standard approach

The Service Provider requirement for a true mass market home networking technology led to development of the G.hn standard. The name G.hn comes from the words "Home Network", and the prefix "G" refers to the family of standards on "Transmission systems and media, digital systems and networks" developed by ITU-T and supported and promoted by the HomeGrid Forum. Other well-known standards in the G series include G.992.1 (ADSL), G.992.5 (ADSL2+), G.993.2 (VDSL2) or popular audio codecs like G.711 and G.729.

G.hn was specifically designed to address the problems found in existing wired networking technologies:

One PHY/DLL, multiple wires: G.hn defines a common PHY (Physical Layer) and DLL (Data Link Layer) architecture that can operate over any home wiring, including power lines, phone lines and coaxial cables. With G.hn it is very easy to design a single chip that can operate over any wire, because all the key parameters (modulation, error correction, encryption, medium access control, etc) are common across different physical media.

Reduced System/Chip Design Effort: The fact that a single chip can operate over multiple wires provides benefits to equipment vendors (they now don't need to design systems with multiple chips, so cost is reduced) and silicon vendors (they now don't need to design multiple chips to address multiple markets).

Economies of Scale: Volumes for different market segments are now combined: because the chips used in one region for coaxial networking are essentially the same chips that are used in another region for powerline networking, the economies of scale help reduce manufacturing costs tremendously.

Minimizing IPR Uncertainty: All companies that have contributed to the development of the ITU standard submit IPR (Intellectual Property Rights) statements. These guarantee that any patents they own that are essential to the implementation of the standard will be made available on RAND terms to any other vendor. ITU IPR procedures have been harmonized with other international standards organizations like ISO and IEC.

Next-Generation Data Rates and Scalability: The G.hn standard specifies operation with data-rates up to 1 Gbit/s. The standard has been developed in a way that allows implementations with different trade-offs in terms of power consumption, silicon complexity and performance, while guaranteeing full interoperability. For example, while one vendor may implement a high-end G.hn device with a maximum data rate of 1 Gbit/s, another vendor may design a low-complexity device with a maximum data rate of 10 Mbit/s, and both will be fully interoperable.

This high degree of scalability is one of the key reasons why G.hn is attracting interest for a broad number of applications, ranging from Telco-oriented multi-room HD IPTV applications (which may required hundreds of Mbit/s) to very energy efficient Smart Grid applications (which just need a few Mbit/s).

G.hn: Technical Overview

The G.hn standard, which was approved in June 2010, is composed of two separate documents: Recommendation G.9960 (Physical Layer) and Recommendation G.9961 (Data Link Layer).

Implementing the new ITU-T G.hn standard

Within less than a year since the G.hn standard was approved, new Integrated Circuits compliant with the standard are reaching the market. One example is the XWAY™ HNX100 series from Lantiq, announced in January 2011.

One of the chips in the series, the HNX176, provides a complete implementation of the G.hn standard, including support for all physical media types (powerline, phone line and coaxial cable), and support for all band-plans (25, 50 and 100 MHz).

In addition to G.hn functionality, the HNX176 provides a number of high-speed system interfaces, including 10/100/1000 Ethernet PHY, RGMII and PCI express, to ensure applications can get access to the high-performance communication link enabled by the G.hn standard.

Target applications for the HNX176 include network adapters, residential gateways, set-top boxes, HDTVs, PCs, network storage, wired/wireless bridges, distributed speaker systems, etc.

These developments at Lantiq, amongst others, demonstrate the great strides that are being made in the adoption of the G.hn standard as the technology of choice for the next generation of home networking and Smart Grid applications. First deployments of G.hn products will occur during 2011 and the HomeGrid Forum's Compliance & Interoperability (C&I) Roadmap outlines a range of practical steps for service providers and equipment manufacturers. This roadmap includes the appointment of accredited test houses, the first interoperability plugfests, and the first shipments of certified products.

For more information visit:
www.lantiq.com
www.homegridforum.org

innovative product portfolio for next-generation networks and the digital home.

HomeGrid Forum is a global, non-profit trade group promoting the International Telecommunication Union's G.hn and G.hnem standardization efforts for next-generation home networking and SmartGrid Applications. HomeGrid Forum promotes adoption of G.hn and G.hnem through technical and marketing efforts, addresses certification and interoperability of G.hn and G.hnem-compliant products, and cooperates with complementary industry alliances.

SUMMARY:
Devices based on the new open G.hn standard will allow consumers and service providers to deploy reliable home networking using existing home wiring such as power wires, phone lines or coaxial cables. The fact that G.hn supports multiple wire types in a single chip will facilitate lower system costs thanks to increased competition and economies of scale. Less than a year since the new ITU-T standard was approved and adopted by the HomeGrid Forum and its members, first products are already appearing. Lantiq's XWAY™ HNX176 is one of the first commercially available products to provide a Gbit/s implementation of the G.hn standard.

One of the main drivers for the rapid growth in broadband access networks deployed by Telecommunication Service Providers in recent years is the possibility of enabling new services (like High-Definition IPTV) that require very high bit rates. Today, Service Providers have a range of technology options available when deploying broadband access networks, including ADSL2+, VDSL2 and GPON.

Bringing broadband access at speeds up to 1 Gbit/s only solves part of the problem. The next challenge for Service Providers is how to connect each device in the subscriber home (TVs, PCs, set-top boxes, etc) so that consumers can really take advantage of the high-speed service anywhere in their homes?

Why not use Ethernet or WiFi?

While wired Ethernet may be a viable solution in luxury new home construction, service providers must focus on the mass market represented by existing residences. Even if the latest generation of flat-screen TVs come with Ethernet ports, most households have no, or only limited, Category 5 cabling. Installing new infrastructure is typically labour cost intensive and very disruptive to consumers. For these reasons, Ethernet has not been a popular solution by IPTV Service Providers.

With the advent of 802.11n, point connections for IPTV service delivery are now viable. However, a robust, all wireless network supporting HD video streams in addition to other in-home data services is still a technical challenge. In many application scenarios discussed today, service providers are seeking a balance of a wired network "backbone" with wireless links to support a variety of entertainment nodes (including tablets and flat-screen TVs).

Using Existing Home Wiring for IPTV

For all the reasons mentioned above, video and data service providers look to solutions that use existing home wires such as electrical wiring, coaxial cable or phone wiring. The criterion used by service providers to choose one physical medium is typically determined by the availability of specific wiring type in each region. For example, while coaxial cable connections are widely available in most North American homes, they are not usually found in the average European home.

The result is that while many North American service providers have chosen solutions that use coaxial cable networking (such as MoCA or HomePNA), most Service Providers outside North America use powerline networking (such as HD-PLC, HomePlug or UPA).

To date, these technologies have seen moderate success, due to a mix of technical limitations and market dynamics. (Researchers at iSuppli estimate that total number of wired networking ports shipped in 2009 was ~30 Million).

One obvious limitation is that these technologies in general operate over a single wire type (powerline only, or coaxial only). If a service provider wants to deploy a home network that uses more than one wire type, then it needs more than one transceiver (i.e., more than one chip). This increases significantly the overall system cost, which makes this solution inappropriate for most applications.

The second limitation is that in general these technologies are so different from each other (they use different modulation schemes, different error correction schemes, different encapsulation methods, different encryption, different QoS architecture, etc) that it is impractical for silicon vendor to offer support for multiple standards in a single chip (as a dual mode chip could probably be twice as big a single mode chip).

Another limitation tightly related to the two mentioned above is that, given the differences between technologies, it is difficult to achieve economies of scale due to technology fragmentation. Although 30 Million units were shipped in 2009, probably no more than 10 Million units were shipped of each technology type. Small volumes imply higher manufacturing costs, and eventually higher prices for end-users.

A final drawback of the single-wire home networking technologies is that each one of them has usually been developed by a single company or a closed consortium of companies, instead of through an open standardization process with participation from multiple providers. (The exception is HomePNA, which was standardized in ITU-T as Recommendation G.9954). Having technologies developed by a single company instead of through an open standard process usually means that access to necessary Intellectual Property becomes more difficult due to uncertainties on patent licensing. That uncertainty disappears when a standard is developed through a well-known SDO (Standard Development Organization) such as ITU, which has rules that require all participants to make any Intellectual Property available in RAND (Reasonable and Non-Discriminatory) terms to any vendor that wants to implement the standard.