

Appliances Get a HAN

By: Bill Zalud, Contributing Writer, Appliance Design

As devices in the home, including appliances, get more intelligent and with an ability to communicate, homeowners, smart grid-enabled utilities and electronic home systems contractors now face the challenges and connections inherent in home area networks (HAN).

It is a challenge faced by appliance design professionals, too.

"Everything is coming together in the home with information coming to and going from the home," says Michael Rogers, the "Practical Futurist," technology pioneer, novelist and journalist as well as futurist-in-residence for The New York Times and columnist for MSNBC. He points out that there is a growing list of home network applications that include energy monitoring, security, entertainment and healthcare, as examples.

But Rogers sees, in the broadest sense, that there will continue to be a wide-ranging combination of wired and wireless systems in homes, whether it is in-home energy monitoring, primarily HVAC, or more fully-featured whole home energy management that networks diverse appliances with the growing installation of smart meters.

So, not surprisingly, it is anticipated that home energy management will have a crucial influence on the development of HANs. For instance, ON World, the San Diego research firm with a focus on smart technology markets, predicts that 100 million smart meters will be deployed in the next five years and that half of these will have a built-in HAN gateway for in-home energy management programs and services. ON World's survey of 77 utilities in the United States also found that 21 percent are planning to integrate a HAN gateway into every smart meter deployed.



Home area networks continue to expand separately as well as converging with systems outside the home. Intelligent and communicating home appliances are just more devices potentially on the net. Photo courtesy Bosch Home Appliances.



Devices and appliances are getting more intelligent and talking together more," advises Michael Rogers, the "Practical Futurist," technology pioneer as well as futurist-in-residence for The New York Times and columnist for MSNBC.

Others believe that there will be at least another HAN in addition to home energy and its natural connection to traditional home automation nets. According to a white paper by Nathan Ota of Trilliant, a smart grid communications company in Redwood City, Calif., "It's important to note that the term 'home area network' is also used with home-based multimedia applications that integrate voice, video and data communications to support media centers for viewing television and movies, voice over IP, broadband Internet access and other forms of entertainment. It is possible there may be some convergence between the two different HANs someday, but they are expected to coexist as separate networks for the foreseeable future."

So, in the short term, it is a matter of understanding and accessing the energy HAN gateway and then, in the long run, the integration of a utility, appliance or energy management HAN into a home area network that may include information, entertainment, lighting, security and home automation, often Web-accessible.

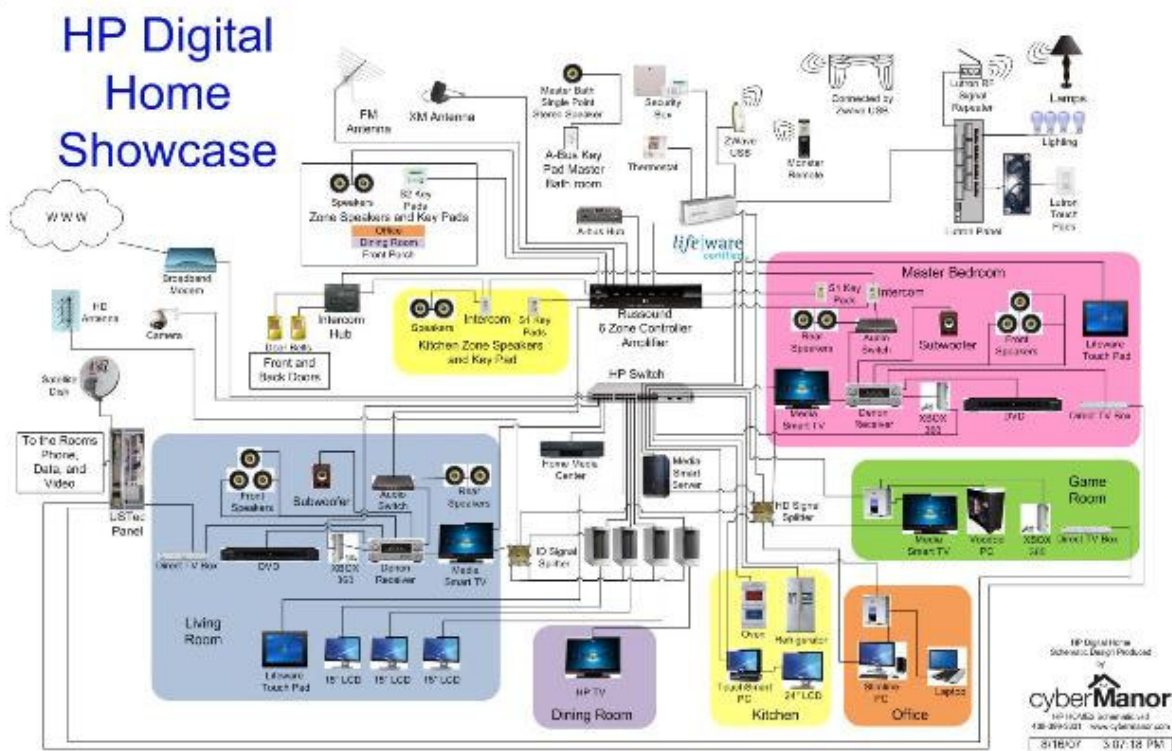
At this point, some appliance manufacturers are focusing on IP and ZigBee as communication

technologies, but there are many options that may be coming from other devices and services centering on the home. Check out the "alphabet soup" of approaches elsewhere in this article.

Specific to home energy, starting as early as 2014, home energy management systems (HEMS) will see, according to ABI Research of New York and London, accelerated shipments of these systems. By 2016, nearly 44 million will hit world markets, when they will generate revenue of about \$2 billion.

Sam Lucero, M2M connectivity practice director with the analyst firm, explains, "We view utilities as the largest channel for HEMS going to market. Utilities have been focusing their efforts on smart meter deployments. But in the next few years, HEMS will ramp up to deliver the utilities 'demand response' benefits on top of their smart meters. "Utilities will not be making HEMS systems themselves: Two groups of vendors provide the actual systems. One is small private HEMS vendors. They now face increasing competition from home automation vendors that offer HEMS as one part of their overall home area network product lineups.

Ota points out that in some designs, "HAN gateway" may also interface with a neighborhood-area network, which interconnects meters together into an advanced metering infrastructure network. On a project management basis, as the new smart grid infrastructure rolls out, choices include either integrating the HAN gateway into the smart meter that communicates outside the home or residing the HAN gateway function in the home in some other device.



As compared to DIY or Geek Squad work, professionally designed and installed home area networks are complex but payoff in homeowner convenience and cost savings. Pictured is the schematic for a HP digital showcase home created by cyberManor.

In the latter approach, there will be more involvement by the homeowner through some type of command and control platform which accesses, reads energy use and itself can control myriad appliances and devices.

Yet, as more technology goes home bound, the current and future of home area networks remain evolving. For homeowners, there are many choices and some confusion when it comes to the HAN platform, especially in whole home, customized and more complex designs.

A bad thing, huh? Well, look at it differently. A lot of choices mean value for appliance designs that correctly anticipate HAN technology. Confusion means there is an opportunity to educate buyers and HAN integrators, potentially to "right sell" or even upsell now or later.

“Look at it as if you are the IT manager for the home,” says Rogers. In addition, “home systems are moving decisively to IP.”

One example: Bridging the gap between mass market and custom home electronic systems, Honeywell Total Connectables Web-based monitoring services. In what Honeywell calls its "Connected Home" solution, a refresh of its Web interface includes support for wireless thermostat and lighting controls, and integration with home automation systems as well as interoperability with smart meters. “The rise of mobile apps, IP video, and open standards for home automation creates tremendous opportunities,” says Jonathan Klinger, vice president of marketing for Honeywell Security & Communications, Melville, N.Y.

A Lot of HANs on Deck

There is no one home area network that connects everything and everyone together.

- Utility to Home Energy Management
- Home to Homeowner's Standalone Energy Management
- Appliances to HAN
- Home Security: Intrusion, Fire, Video
- Home Automation
- Entertainment
- Information Services
- Home Healthcare

Benefits of Smart Meter Technology

It enables a number of current and future services for homeowners, including:

- Hourly electric and daily energy use data presentment
- Energy alerts to notify customers when they're approaching a higher priced tier and to encourage a change to their energy use
- Outage information
- Remote service connection as a convenience for utility customers and one day appliance manufacturers
- Special time-varying rate programs.
- Home area network in-home energy management devices that display the energy use of appliances

Maneuvering the Alphabet Soup of Home Area Networks

There are diverse approaches, wiring, protocols, proprietary and open standards when it comes to home area networking. Most often a number of wired and wireless methods coexist or run separately. Still, it is obvious that the smart grid, intelligent appliances, the Internet and a growing attraction by homeowners to receive information and control things through mobile devices are all influencing the future. Here are some thumbnails of existing and emerging approaches.

ZigBee

ZigBee is a specification for a suite of high level communication protocols using small, low-power digital radios based on the IEEE 802.15.4-2003 standard for low rate wireless personal area networks (PAN), such as wireless light switches with lamps, electrical meters with in-home-displays, consumer electronics equipment via short-range radio needing low rates of data transfer. The ZigBee Alliance is an

open, non-profit association of members comprised of businesses, universities and government agencies. At zigbee.org

Z-Wave

Z-Wave is a proprietary (from Sigma Designs) wireless communications protocol for home automation, specifically to remote control applications in residential and light commercial environments. The technology uses a low power RF radio embedded or retrofitted into home electronics devices and systems, such as lighting, home access control, entertainment systems and household appliances. The Z-Wave Alliance is an international consortium of manufacturers. At z-wavealliance.org

OpenADR

Aimed at energy management, demand response is a set of actions taken to reduce load when electric grid contingencies threaten supply-demand balance or market conditions occur that raise electricity costs. Automated demand response (ADR) consists of fully automated signaling from a utility, electrical independent system operators and regional transmission organizations (ISO/RTO) or another appropriate entity to provide automated connectivity to customer end-use control systems and strategies. OpenADR provides a foundation for interoperable information exchange to facilitate automated demand response. The OpenADR Alliance is comprised of industry stakeholders for demand response communication protocol. At openadr.org

OpenHAN

The OpenHAN suite of standards for home area networks and home grids is promoted by the OpenAMI (automated meter reading) and UtilityAMI. Both efforts aim to standardize powerline networking interoperation from a utility point of view and ensure reliable communications co-extant with AC power outlets. Both utilities and vendors of home control have promoted such standards. The OpenHAN label usually denotes standards favored by the utilities and distinguished from the OpenADR standards that aim to ensure open access to customer electricity use data by service providers. At osgug.ucauiug.org

HomePlug

HomePlug is a broad name for various powerline communications standards that support networking over existing home electrical wiring. Several different standards fall under the HomePlug umbrella. Some target broadband applications such as in-home distribution of TV, gaming, and Internet content, while others focus on low power and extended operating temperatures for applications such as smart power meters and in-home communications between electric systems and appliances. The HomePlug Powerline Alliance owns the HomePlug trademark. At homeplug.org

G.hn and HomeGrid

G.hn is the common name for a home network technology standard developed under the International Telecommunication Union (ITU-T) and promoted by the HomeGrid Forum. It supports networking over powerlines, phonelines and coaxial cables with data rates up to 1 Gbit/s. At homegridforum.org

IPv4 and 6

Internet Protocol version 6 (IPv6), to succeed IPv4, operates by transferring data in small packets that are independently routed across networks. Each data packet contains two numeric addresses that are the packet's origin and destination devices. Since 1981, IPv4 has been the publicly used version of the Internet Protocol. IPv6 allows for vastly more numerical addresses, but switching from IPv4 to IPv6 is challenging. 6to4 is an Internet transition mechanism for migrating from IPv4 to IPv6, a system that allows IPv6 packets to be transmitted over an IPv4 network. The IPSO Alliance promotes IP for smart object communications. Smart objects are small computers with a sensor or actuator and a communication device, embedded in objects such as thermometers, car engines, light switches, appliances, and machinery for applications such as home automation, building automation, smart cities, structural health management systems, smart grid and energy management. At ipso-alliance.org

Three-tier IP Gateways

There is architecture for internetworking between home automation networks and a TCP/IP based wide area network, such as the Internet. The architecture abstracts the functionality of any home network into a driver layer (tier one), and provides a common access layer (tier two) from any TCP/IP network application (tier three) to a local home automation network. Clients and application programs may transparently access services and resources on the home network and appliances connected to the home network may access resources and services on the TCP/IP network.

Wi-Fi

Wi-Fi, a trademark of the Wi-Fi Alliance, is within enabled devices such as a personal computer, video game console, smartphone, or digital audio or video player. They connect to the Internet when within range of a wireless network connected to the Internet. The alliance has generally enforced its use to describe only a narrow range of connectivity technologies including wireless local area networks (WLAN) based on the IEEE 802.11 standards, device to device connectivity such as Wi-Fi Peer to Peer, and a range of technologies that support PANs, local area network (LAN) and even wide area network (WAN) connections. At wi-fi.org

Wi-Gig

The Wi-Gig specification enables high performance wireless data, display and audio applications that supplement the capabilities of today's wireless LAN devices. Wi-Gig tri-band enabled devices, which operate in the 2.4, 5 and 60 GHz bands, deliver data transfer rates up to 7 Gbps, more than 10 times faster than the highest 802.11n rate while maintaining compatibility with existing Wi-Fi devices. Additionally, the technology was designed to support a multitude of applications on both low power and high performance devices, including consumer electronics, PCs, handheld devices, streaming video and home networking equipment. The Wireless Gigabit Alliance adopter members develop wireless products that use the unlicensed 60 GHz spectrum. At wirelessgigabitalliance.org

WiMAX and WiMAX Advanced

WiMAX (Worldwide Interoperability for Microwave Access) is a telecommunications protocol that provides fixed and mobile Internet access. The current WiMAX revision provides up to 40 Mbits with the IEEE 802.16m update expected to offer up to 1 Gbits fixed speeds. The name WiMAX was created by the WiMAX Forum, which describes it as "a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL." At wimaxforum.org

4G LTE

In telecommunications, 4G LTE (Long Term Evolution) is the fourth generation of cellular wireless standards. It is a successor to the 3G and 2G families. 4G LTE and WiMAX are moving to meet standards as set through ITU-R IMT-Advanced (International Mobile Telecommunications Advanced) requirements for 4G standards, setting peak speed requirements for 4G service. See IMT-Advanced elsewhere in this sidebar. A 4G system is expected to provide a comprehensive and secure all-IP based mobile broadband solution to laptop computer wireless modems, smartphones, and other mobile devices. Facilities such as ultra-broadband Internet access, IP telephony, gaming services, and streamed multimedia may be provided to users.

IMT-Advanced

International Mobile Telecommunications-Advanced (IMT-Advanced) systems are mobile systems that include the new capabilities of IMT that go beyond those of IMT-2000. Such systems provide access to a wide range of telecommunication services including advanced mobile services, supported by mobile and fixed networks, which are increasingly packet-based. IMT-Advanced systems support low to high mobility applications and a wide range of data rates in accordance with user and service demands in multiple user environments. IMT Advanced also has capabilities for high quality multimedia applications within a wide range of services and platforms, providing a significant improvement in performance and quality of service. At itu.int

UPnP

Universal plug and play (UPnP) is a set of networking protocols for primarily residential networks without enterprise class devices that permits networked devices, such as personal computers, printers, Internet gateways, Wi-Fi access points and mobile devices to seamlessly discover each other's presence and establish functional network services for data sharing, communications, and entertainment. It is promoted by the UPnP Forum. At upnp.org

Bluetooth

Bluetooth is a proprietary open wireless technology standard for exchanging data over short distances (using short wavelength radio transmissions) from fixed and mobile devices, creating PANs with high levels of security. Created by Ericsson, it was originally conceived as a wireless alternative to RS-232 data cables. It can connect several devices, overcoming problems of synchronization. It is managed by the Bluetooth Special Interest Group, with member companies in telecommunication, computing, networking, and consumer electronics. At bluetooth.org

LonWorks

LonWorks is a proprietary networking platform specifically created to address the needs of control applications. The platform is built on a protocol created by Echelon Corporation for networking devices over media such as twisted pair, powerlines, fiber optics, and RF. It automates various functions within buildings such as lighting and HVAC. Peer-to-peer architecture means there's no need for a central computer or controller. At lonmark.org

X10

X10 is an international and open industry standard for communication among electronic devices for home automation. It primarily uses powerline wiring for signaling and control, where the signals involve brief radio frequency bursts representing digital information. A wireless radio based protocol transport is also defined. X10 was developed by Pico Electronics remote control home devices and appliances.

BACnet

BACnet is a communications protocol for building automation and control networks. It is an ASHRAE, ANSI, and ISO standard protocol. It was designed to allow communication of building automation and control systems for applications such as heating, ventilating, and air conditioning control, lighting control, access control, and fire detection systems and their associated equipment. The protocol provides mechanisms for computerized automation devices to exchange information, regardless of the particular building service they perform. At bacnetinternational.org

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