

Build Entertainment-Grade Consumer Home Networks for Simplicity

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Increasingly, the biggest challenges designers of consumer electronics products face have less to do with performance or feature-richness, and more to do with ease of use and simplicity. This is especially true in entertainment networking, where multiple technologies currently vie for adoption, and consumers have made it clear they want a simple solution, right out of the box. In the coming years, home-entertainment networks will emerge that enable consumers to access, manage and share a wide range of high-bandwidth digital content, across a variety of platforms including HDTVs, DVRs, game consoles, home gateways, PCs and home media servers. Converting all of the required networking nuts and bolts into a plug-and-play, uniformly satisfying consumer experience is the next great leap.

To make this happen, home entertainment networks must be capable of self-setup and self-configuration. Connectivity must be a built-in capability, in conformance with universal standards so that consumers needn't worry about interoperability issues as they pick and choose from among the equipment options of different vendors. In many cases, entertainment networks will not be connected to a PC, so it may be impossible for users to either configure or manage any software, themselves. The network will need to have the intelligence to configure and manage itself.

HomePlug® AV delivers all of this, enabling a high-quality, 200 Mbps-class network over existing powerlines within the home while supporting demanding multimedia-networking requirements. The HomePlug AV PHY layer provides a baseline 110 Mbps information rate with secure, robust, near-capacity communications over noisy powerline channels. HomePlug AV's most important feature for consumer electronics product designers, however, is its ability to deliver "instant networking." It requires no new wires, no configuration software, and no knowledge of networking technology. For a point-to-point connection, all that is required to instantly form a network is for the devices to merely be plugged into the powerline. Additional devices can be joined to this network by plugging them into the powerline and pressing the SimpleConnect button.

Each HomePlug adapter has its own media access control (MAC) address that

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identifies it on the network. The highly efficient MAC layer supports both Time Domain Multiple Access (TDMA) and Carrier Sense Multiple Access (CSMA), as well as AC line cycle synchronization to provide superior channel adaptation in the face of common line cycle-synchronized noise (see Fig. 1). TDMA access provides enhanced QoS guarantees including guaranteed bandwidth reservation, high reliability, and tight latency and jitter control. Connection-oriented Contention Free (CF) service supports these QoS requirements, and HomePlug AV also provides four levels of connectionless, prioritized Contention-based service to support both best-effort applications and those that rely on prioritized QoS.

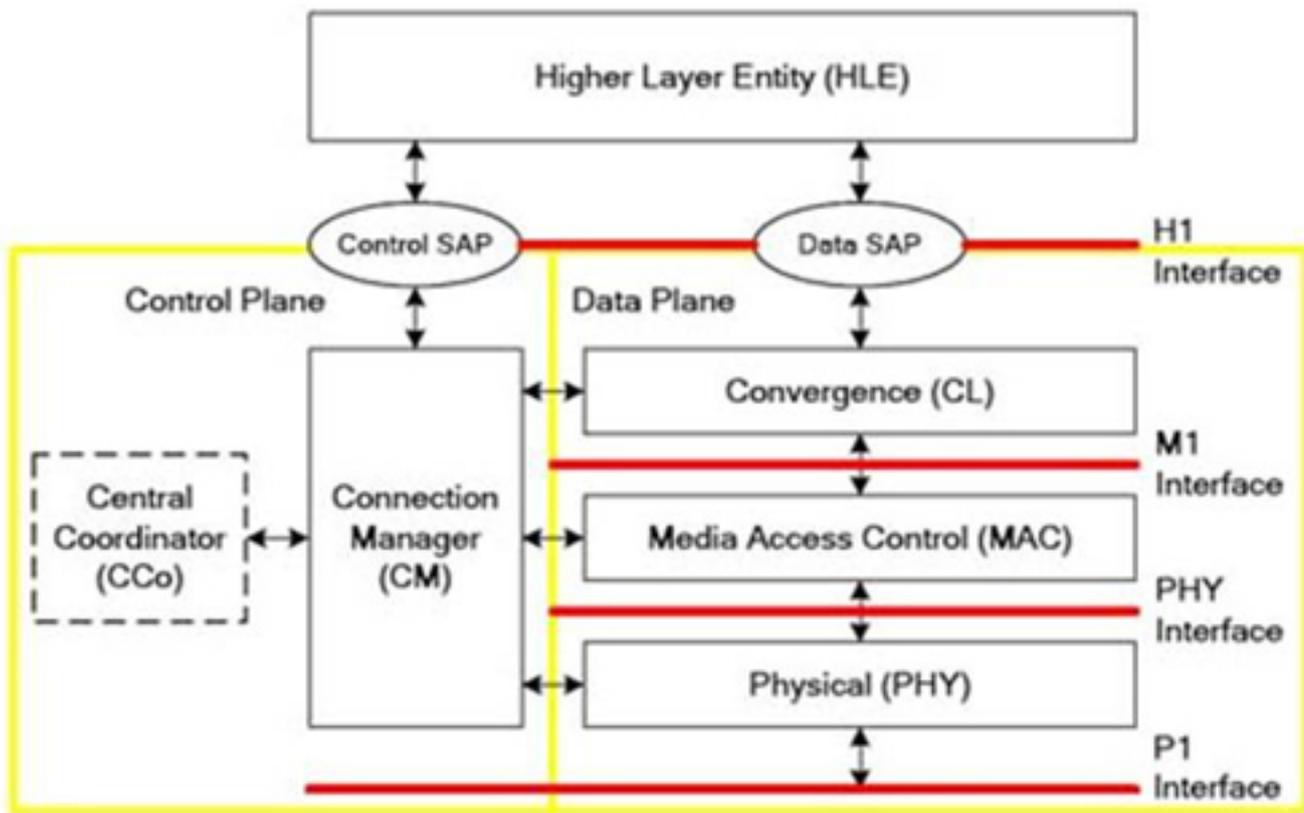


Fig. 1: HomePlug AV Architecture

Additionally, HomePlug AV features built-in security technology based on 128-bit Advanced Encryption Standard (AES). HomePlug AV dynamically and automatically changes encryption keys, and security is further enhanced by virtue of the closed electrical wiring infrastructure. Despite the tight security, it's still easy to set up and configure the network. HomePlug AV supports several different user experiences for adding stations, and its flexible design ensures that any given station can participate in multiple AV networks.

This is in stark contrast with HomePlug AV's biggest contender from a performance perspective - 802.11n WiFi - which requires many additional considerations related

to setting up and securing a network. The security piece, alone, may involve MAC filters (which are easily spoofed), access control lists (ACLs), wired equivalent privacy (WEP), Wi-Fi Protected Access (WPA) or WPA2, the latter combining AES data protection with pre-shared key (PSK) or 802.1X authentication. More recently, the optional Wi-Fi Protected Setup (WPS) certification program provided a more convenient way to enable WPA2 on many embedded Wi-Fi devices, but the setup and security process is not a universally embedded and automatic function as with HomePlug AV.

There are opportunities to further improve HomePlug AV performance within its easy-to-deploy and highly secure network model. For instance, Gigle Networks has developed Mediastream™, a flexible, robust and efficient wideband multi-carrier PHY technology that works with the company's home-networking IC to deliver a channel rate of approximately 1Gbps on diverse media. Mediastream technology can operate on powerline, phonenumber or coaxial cable, either simultaneous with or independent of the HomePlug® AV channel, for a high level of flexibility in supporting deployment topologies (see Fig. 2). When Mediastream is used over phonenumber, it coexists with POTS, HPNAv3.1 and all xDSL variants. Mediastream™ also has the flexibility to occupy any of the available frequency ranges on the Coax cable, meaning that it can easily coexist with DOCSIS, CATV, satellite TV or MoCA as required.

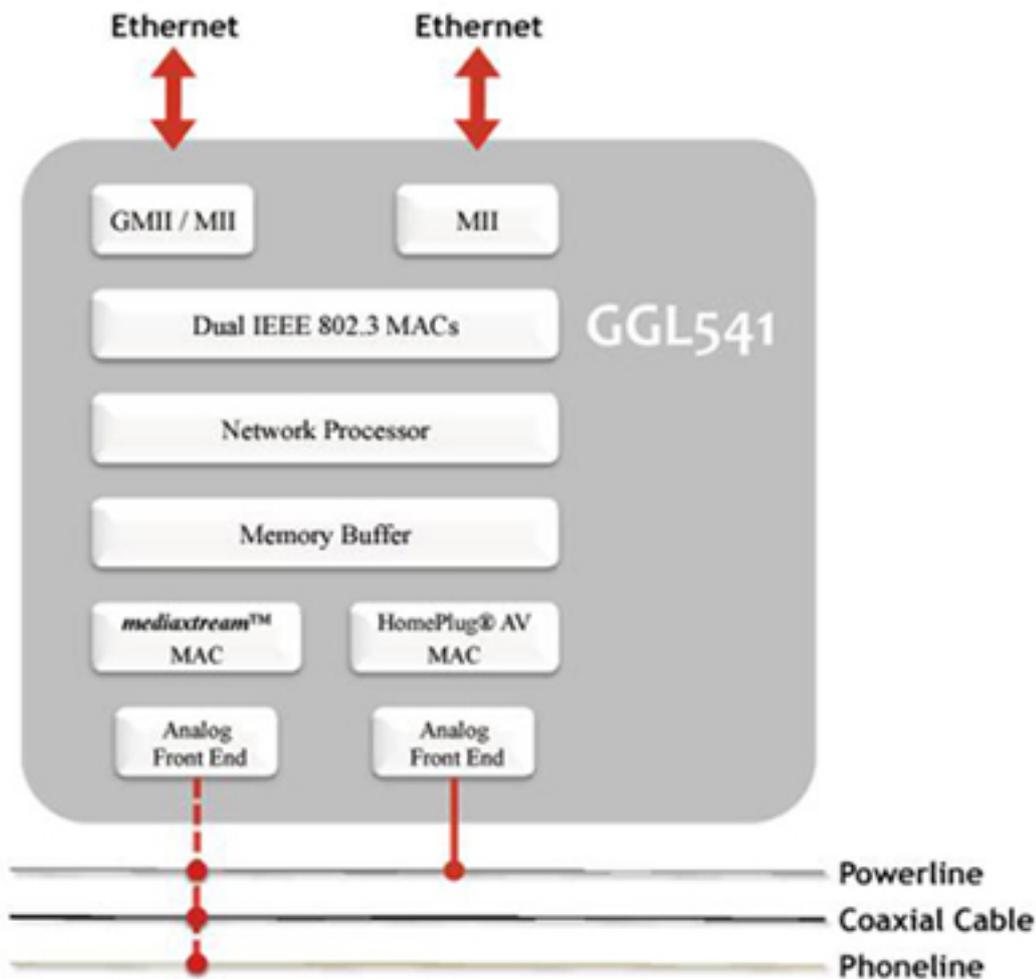


Fig. 2: Mediapstream technology.

Additionally, to further improve coverage and performance, each Gige device includes an intelligent routing engine technology known as xtendnet™, which can be used with mediastream™ technology to maintain the low effective end-to-end latencies demanded by video, VoIP, and gaming applications. xtendnet operates over a wide dynamic range, even though it uses very low power levels, in line with EMC regulations. This makes it ideal for transporting video content over the most demanding cable networks.

For networks with more than two nodes, the xtendnet engine will monitor QoS and line rates to make sure each node is reachable and determine the best options for information delivery. For single-channel HomePlug® AV devices, xtendnet can decide to act as a conventional HomePlug® AV node, or as a repeating node, or both. When repeating, the node will regenerate and re-amplify received signals for improved signal coverage.

For dual-channel devices, xtendnet can decide to either aggregate the two channels for greater performance, or maintain channel separation for independent routing.

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For example, if mediastream is used on coaxial cable, while HomePlug® AV is used on powerline, xtendnet will determine if either channel should act as a repeater or not, and how traffic should be routed between the channels. In this way, the nodes will form a dynamically configured mesh network, and use routing and repeating to optimize coverage and performance. Adding more nodes actually increases coverage and routing options, making the network more robust.

Entertainment-grade consumer home networks will provide the foundation for exciting new services and programming content delivery in the coming years. By combining the plug-and-play simplicity of HomePlug AV with advanced technologies that ensure gigabit performance and whole-home coverage, consumer-electronic product designers are well-positioned to capitalize on major new market opportunities.

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