

Uniting wired and wireless home networking



Increasing Reliability Across the Home Network With the IEEE P1905 Hybrid Networking Standard

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The reality of converged video, voice, and data transport throughout the home is that there is no one “silver bullet” technology that is guaranteed to work in all environments and operating conditions. Service providers desire to reduce the cost of networking the home, and while the ability to rely upon a single network technology would be ideal, it simply is not realistic given that the likelihood of coverage in any particular room in the house is never 100%. Power outlets can be found in every room, but part of a home may be on a different phase, thus reducing the performance of powerline communications (PLC). Wireless coverage, too, is not guaranteed as it depends upon the construction and density of a home's walls and is vulnerable to interference.

Even when coverage is consistent, effective throughput may vary. For example, some service providers support streaming of standard definition (SD) video using PLC. Reliability, in this case, is achieved by massively oversubscribing the link: a network technology with a 200Mb/s PHY rate is used to deliver a 2Mb/s stream. In some homes, the network technology may be able to carry more data, but these service providers have concerns to reliably support a second SD stream or even a single stream of HD in all homes. Similarly, a Wi-Fi router might reach the corners of a home but if the data rate is not high enough or sustainable, picture quality will visibly suffer. The fact is that lack of coverage or insufficient throughput, even for short periods, comes at the risk of expensive service calls and, ultimately, loss of customers.

To meet the needs of today's consumers and service providers, a hybrid network which employs multiple technologies offers a higher probability that an alternative network path is available. Hybrid networks increase the confidence with which service providers can reliably supply services through complementary coverage. For example, traditional phone lines and cell phone towers can go out of service but it is highly unlikely that they will fail at the same time. A home with both of these technologies can be reasonably assured of continuous phone service.

Within the home, a blend of wired and wireless network links can be similarly deployed so that when one interface fails or degrades, another will still be active. For example, when Wi-Fi coverage is interrupted, PLC can pick up the load. Further, Wi-Fi and PLC channels can be aggregated, extending the range for which a given required throughput level is achievable into areas where both Wi-Fi and PLC signals are individually relatively weak. Delivering as close as possible to 100% coverage in this way enables service quality and continuous operation. It also helps reduce expensive service calls to a minimum.

Many service providers have come to understand the need for a hybrid network. The difficulty they have faced in deploying such networks, however, is that each element of the network has had to be set up, managed and operated independently of the others. There has been no unifying standard to allow consumers to use multiple networks transparently. Enter the IEEE P1905 hybrid networking project.

Unifying the Home Network

The work behind P1905 has been defining a common data and control Service Access Point for hybrid networks based on established home networking technologies. Packets can arrive and be transmitted over any interface, regardless of the upper protocol layers or underlying network technology.

Specifically, P1905 introduces a software layer between layers 2 and 3 that abstracts the individual details of each interface, aggregates available bandwidth, and facilitates seamless integration. This layer simplifies setup, for example, by eliminating the need for a user to enter different passwords to access each of the links. P1905 also specifies end-to-end quality of service (QoS) while simplifying the introduction of new devices to the network, establishing secure connections, extending network coverage, and providing advanced network management

features including discovery, path selection, and Quality of Service (QoS) negotiation.

Reliable connectivity is required for multiple simultaneous video, voice, and data streams as well as applications such as YouTube, Netflix, and Hulu that all take throughput. Even homes with a single TV can benefit from a hybrid network to connect their many other digital devices, including phones, tablets, gaming consoles, picture frames, video players, PCs, and laptops. Currently there is no other single technology which unites the growing array of wired and wireless technologies, platforms, and environments. Among the many benefits P1905 offers are:

Ease of Use: It is imperative that network setup and use is transparent to consumers. P1905 provides common setup procedures for adding devices to a network, establishing secure links, implementing QoS, and managing the network.

Fallback: When a link goes down temporarily or is congested, an alternative route is available. This reduces the number of problems and interruptions that users experience, as well as reduces the number of support calls that service providers must manage.

Aggregated Throughput: The ability to use all of a hybrid network's available throughput across the different interfaces is essential for maximizing throughput.

Multiple Simultaneous Streams: With applications such as interactive TV, even a single person may be watching multiple streams simultaneously.

Load Balancing: The hybrid network must be able to intelligently distribute video over different paths to limit congestion and maintain reliability. For example, a handset could be streaming video over a strong Wi-Fi connection while two set-top boxes receive different streams over PLC. If the PLC connection begins to degrade, either through interference or congestion from other devices on the network, one of the set-top boxes can automatically shift part or all of its load to the Wi-Fi connection.

QoS: P1905 specifies end-to-end QoS without compromising the internal integrity of any protocol or medium over which it runs.

Backwards Compatibility: Many service providers already have installations within the home using HomePlug, Wi-Fi, Ethernet, and Multimedia over Coax Alliance's MoCA specification. P1905 is being designed for interoperability with deployed technologies.

Security: P1905 allows devices to be configured the same way with a simple button push, for example. P1905 also enables consistent password and authentication procedures for legacy devices.

Advanced Diagnostics: The overall network monitors itself to ensure reliable and uninterrupted operation.

Self-Install: This element is essential to keeping costs down. To achieve this, equipment has to be simple to install for consumers and capable of self-configuration. For example, when a homeowner plugs in a second access point – regardless of whether it is PLC-, MoCA-, or Wi-Fi-based – the primary AP will automatically configure it to take the network name and password. Pairing is kept simple through a standard push button mechanism, thus avoiding complex password configurations.

Mobility: Wireless connectivity is required to support mobile PDAs, handsets, and tablets.

Universal Connectivity: For true transparency, consumers need to be able to connect to the hybrid network from every room in the house without having to be aware of which part of the network their device is currently interfacing with. Users must also be assured of seamless handover when moving from one room to another.

Energy Management: Optimizing network power usage across different technologies results in more efficient and greener operations.

Wide Industry Support: Major companies are working together to form a compelling standard. Broad industry support from chipmakers, OEMs and service providers results in a diverse and extensive ecosystem of equipment and services.

Changing the Face of the Home Network

One network technology cannot be guaranteed to provide continuous, 100% coverage. P1905 extends the opportunities available to service providers by increasing network reliability through transparent management of the hybrid network. It does not propose to solve hypothetical issues but rather addresses today's real home networking problems that need solutions before service providers can deploy hybrid networks with confidence.

IEEE P1905 broadens work that has already been done by major network players and brings the best aspects of these technologies under the same standards umbrella. For example, Broadcom's Xtendnet is an intelligent, decision-making software architecture that enables a hybrid powerline-coax network with the ability to dynamically switch streams between the different media. Xtendnet has been deployed in Asia and offers a proof-of-concept of many of the fundamental technologies and capabilities that make up P1905. In addition, companies such as Broadcom support the relevant media, standards, and interconnects and provide them as integrated platforms to ensure the highest possible reliability while simplifying design and reducing end-equipment cost.

P1905 represents a fundamental advancement for home networking with its forward-looking procedures, protocols and guidelines which make hybrid networks easier to setup and use while elevating their overall performance. P1905 will be especially important for deployments of home networks with multiple video streams to ensure that the vast majority of consumers have a positive experience.

As network technologies continue to evolve to meet the ever-changing variety of media services, hybrid networks that can support the different types of data and provide increasing levels of coverage within the home will become more important. P1905 will serve as the bridge between the multitude of wired and wireless technologies to provide consumers with the flexibility to fully connect their homes. For service providers, continuous, reliable and quality delivery of service means the ability to offer new premium services that attract new customers and increase operating revenues.