Home multimedia networks demand higher performance

A white paper

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Home multimedia networks demand higher performance

The growing diversity of IP-based services and consumers' desire to share digital media content around the home are driving the need for ever-higher bandwidth in home networks. The emergence of several audiovisual (AV)-capable standards for different physical media has been sufficient to fulfil current throughput needs. However, as more and more IP-based appliances enter the market, and consumer quality expectations increase, the need for a technology that will deliver sustained higher bandwidth in the near future becomes apparent.

Communication technologies have come a long way in the past few years, providing users with throughputs that enable files to be shared and devices to be connected at a price point that will not break the bank. However, significant advances in both throughput and price are needed to make the digital home truly a reality. A summary of currently-available technologies for home multimedia networks is presented in Table 1.

	Physical data rate	**Cabling/installation cost**	**AV-level Coverage**	**Availability of connection point**	**Vulnerability to attacks**
802.11a/g	56Mbps	0	Single room	None needed	High
Ethernet	100Mbps	$$$	Whole network	0	Low
HPNA3.0	128Mbps	$$	Whole Network	3 per home	Low
Coax/ MoCA	270Mbps	$$	Whole Network	4 per home	Low
Powerline AV	200Mbps	0	Whole home	Several per room	Low

Table 1 – Home multimedia network candidate technologies

A further limitation in most network technologies is free and ready access to a connection point anywhere in the home. Phone plugs and coaxial connectors are generally not present in every room of the house nor always conveniently located near AV-connected device clusters. This is particularly apparent outside the US, where the coaxial installed base is far less extended. It is not cost effective for operators or consumers to install CAT5 Ethernet cable to connect a home entirely.

There is no doubting the convenience of wireless technologies that allow the consumer to be connected anywhere within the home. However, even with multiple antenna systems signal strength diminishes greatly with walls, making the achieved throughput inadequate for whole home multimedia coverage. Another limitation of wireless technologies is the strict QoS requirements for latency and jitter needed to transmit video content.

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Today's AV-capable powerline technologies solve both the throughput and coverage/reach issues for today's services and also provide the necessary QoS mechanisms for content distribution around the home. However, current AV-capable standards do not provide the throughput necessary to support the IP-based services that will soon be offered to the consumer.

The emergence of AV-capable technologies has helped enable operators to offer bundled services of data, voice and video. New access technologies being rolled out, such as ADSL2+, VDSL, FTTH, provide throughput rates in excess of 100Mbps. As installation costs go down, we can expect fiber technologies to be deployed more extensively, not only in countries like Japan, but worldwide.

As part of the bundle package, many operators are now offering internet protocol television IPTV services. We expect that consumers will demand improved video quality, and more control over their programs. As prices for TV sets and various display devices shrink, high definition television (HDTV) will find a wider base in the household. A single HDTV stream may require up to 20Mbps of available bandwidth. However, IPTV offers additional services and features that will surely be exploited, such as picture-in-picture, simultaneous multi-channel viewing, digital content recording, e.t.c. The incorporation of these features implies a significant increase in the throughput required for true interactive IPTV services.

The digital home of the near future will allow consumers to share content between a wide variety of connected devices. Files will be stored in the consumer's PC, media server, or attached storage station, and will be accessed from any other appliance around the home, such as TVs, projectors, mp3 players, AV receivers e.t.c. Thanks to the work of several standardization bodies and working groups, such as the DLNA, devices will be able to recognize each other and connect seamlessly in order to share audio files, video files, movies, pictures, or any other kind of digital files.

IP-enabled consumer electronics devices, such as DVDs/DVRs, PVRs, TVs, network attached storage (NAS), home theatres, speakers and projectors will be available in the not too distant future, and the connected home will run performance-demanding applications. For example, we will see 7.1 Dolby surround home theatres connected through the power lines, requiring up to 6Mbps of bandwidth and strict QoS rules. We will also see audio streamed around the home, allowing you to listen to your favourite music in any room at any moment using powerline-enabled speakers.

Unlike PC-based data networking, where sporadic glitches in network performance can be accepted by the user, home multimedia networking technology must provide the user with a perfect experience in order to be deemed satisfactory. A consumer will simply not accept network slow-down while watching a movie or listening to a song. For this reason the networking technology must provide sufficient bandwidth headroom so that network congestion never occurs, even when network usage is at its peak. This kind of reliability can only be provided with the combination of three critical components: higher bandwidth to provide sufficient headroom to guarantee performance even during temporary interferences; fast error recovery; and strict QoS control to use the available bandwidth efficiently, but without restricting the available bandwidth headroom to dangerously low levels. This means that to transmit reliably two HDTV streams, it is not sufficient to simply provide 40 Mbps typically, or even in 95% of the cases. Rather it must

be provided continuously for the entire duration of the usage in at least 99.9% of the attempts.

Two years ago, operators believed that an IPTV networking technology needed to deliver 40 Mbps of sustained, usable throughput in order to provide an adequate cushion for the future. Within months and after a small number of home trials, the requirement had increased to 60 Mbps. Today, most operators desire 70-100 Mbps in order to future-proof their services for the medium term.

Operators have shelved technologies that fail to provide a convincing and cost-effective roadmap for meeting tomorrow's needs. Field experience has demonstrated the need to provide room for growth not only for one's own services, but also for the subscriber's bandwidth-competitive, in-home applications. By looking at the rate in which operators' requirements grow every year, the services that will be offered in the future, and considering a typical product lifetime of connected CE devices, it becomes obvious that today's AV technologies fail –and by far- at providing the throughput cushion needed.

Table 2 shows an example of peak throughput values in a connected home. Though not all homes will make use of all these products, networking technologies should allow for the most performance demanding scenarios. Additionally, for markets where multi-dweller units (MDUs) are most common, bandwidth needs to be shared between networks. This leads to a necessary increase in performance by a factor of two or three. If we consider the requirements mentioned in the paragraph above and apply them to a digital home network scenario, it becomes apparent that today's AV-capable technologies fall short on delivering the required performance.

HDTV + PiP	40Mbps
HDTV to PVR	20Mbps
SDTV	4Mbps
DVD	10Mbps
Advanced surveillance system	12Mbps x 2 = 24Mbps
E-AC-3 Surround sound	6.1Mbps (today 3Mbps)
Broadband internet access	20Mbps
File sharing to projector	2-3Mbps
Total/home	127Mbps
MDU bandwidth sharing	x2
TOTAL	254Mbps

Table 2 - Throughput requirements in the connected home

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mediaxtream™

Gigle Semiconductor offers the only true future-proof solution for the digital home at a price point that allows for CE integration and mass market deployment. Gigle's *mediaxtream*™ technology can provide physical level throughput rates of up to 1Gbps, eradicating the limitations of currently available technologies for the consumer electronic and communication markets. *mediaxtream*™ offers throughput rates of up to 1Gbps at the physical level. As in all communication technologies that do not use a dedicated channel, peak performance will depend on instant channel quality. In any case, these bandwidths will provide sufficient headroom to support any number of connected devices within a home. *mediaxtream*™ extends the home throughput-reach map as shown in Figure 1 and meets the anticipated near term increase in network bandwidth requirements identified in Figure 2.

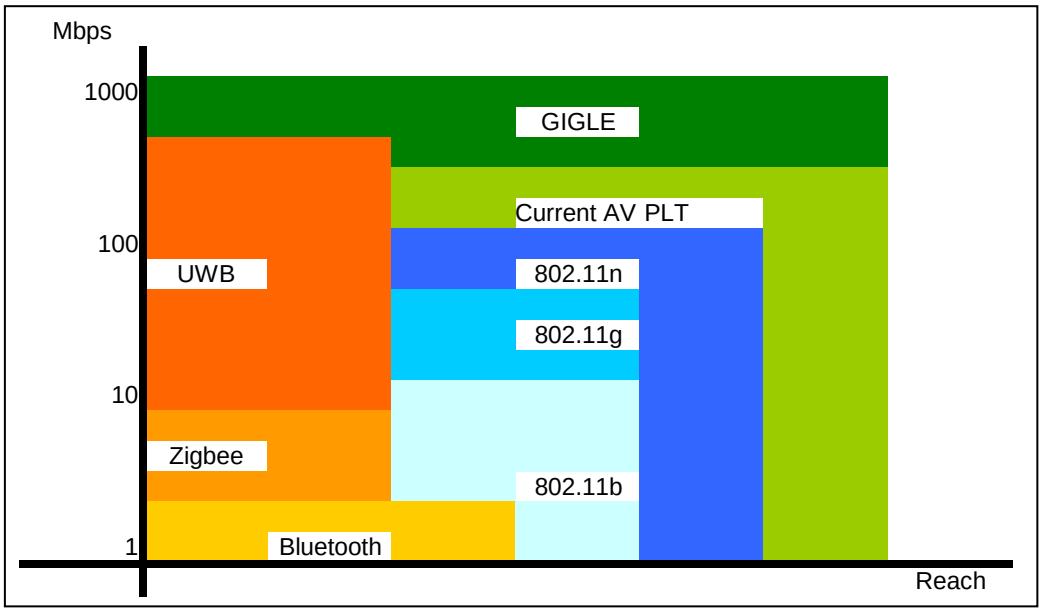

Figure 1 - Throughput and reach map [2]

Home multimedia networks demand higher performance

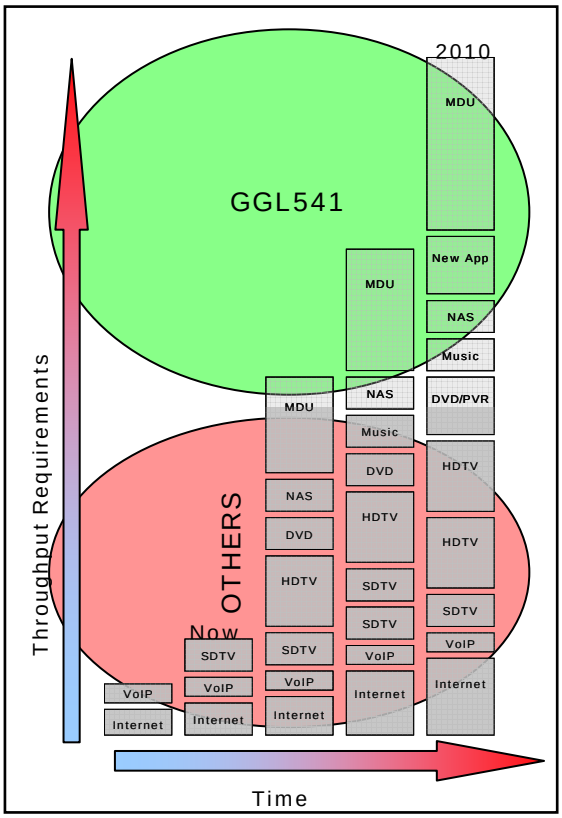

Figure 2 – Near term network bandwidth requirements

xtendnet™

As more nodes are added to the network, channel reutilization leads to an increase on overall network throughput. In a meshed network topology, where nodes communicate with many devices, total aggregated network throughput is considerably superior to that in a two node network as shown in Figure 3. Achieving the full potential of the technology in meshed networks allows for all the services and applications running in the connected home to do so smoothly and problem free. Every Gigle Semiconductor network integrated circuit contains Gigle's *xtendnet*™ technology, which enables each node added to the network to support mesh/Adhoc networking capabilities, increasing the overall range of the signal, assuring whole-home coverage, and improving throughput between products that are far apart.

Besides providing sufficient performance for bandwidth hungry applications, *mediaxtream*™ and *xtendnet*™ based products can make use of alternative wireline infrastructures. Different hardware configurations can make these technologies fit for use in already-installed power line, coaxial and twisted pair cables. These products provide a solution for the coverage and installation cost limitations of other technologies. The ubiquity of wires in the home allows for the expansion of networks based on other technologies by means of bridges, such as WiFi or UWB based products.

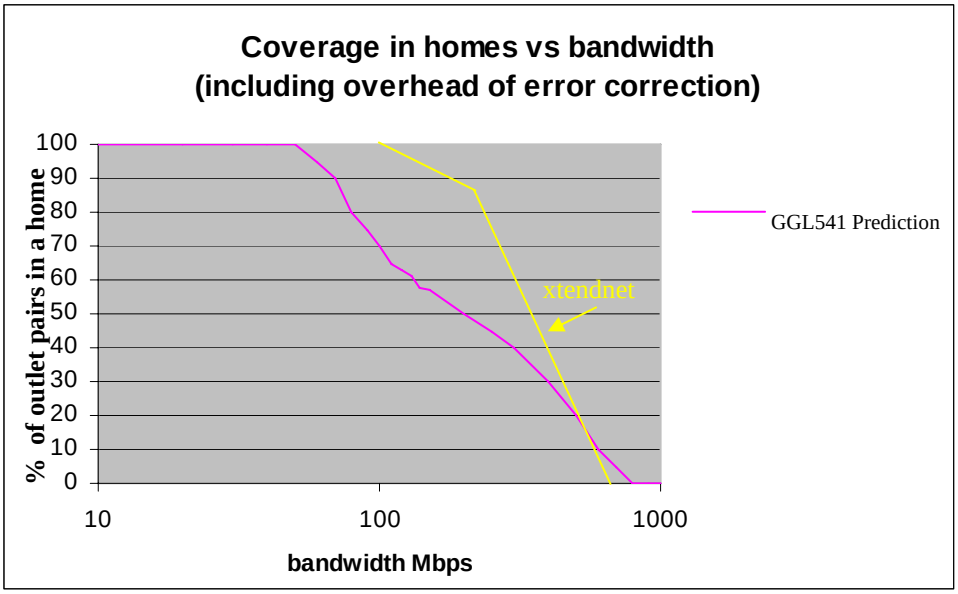

Figure 3 - Coverage vs. Bandwidth (1)

Advanced QoS mechanisms make efficient use of the extra bandwidth available ensuring proper content delivery and glitch-free operation.

(1): Diagrammatic presentation only. Values are based on performance estimations, and should not be taken as guarantee of performance.

Conclusion

The digital home will become a reality when there is a technology or combination thereof that can satisfy all the needs for content distribution within the home. Gigle's *mediaxtream*™ and *xtendnet*™ technologies are the only solution that addresses both the performance requirements and the pricing issues that have held back the networked consumer electronics AV market to date.

