Performance and Reliability:
Home Network Technology Standard Comparison

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MoCA®, HomePlug® and Wi-Fi® are all home networking standards in common use, and each have different benefits and drawbacks. G.hn, managed by HomeGrid, is also promising to emerge as a fourth home networking standard although it has yet to achieve mass deployment. Each of the governing bodies for each technology makes claims about the performance and reliability at which their technology operates. However, these claims are often out of alignment with what happens in the real world, and many times there is no proof or field test to back it up.

This paper compares the performance claims by the four home networking standards identified previously. It will identify the sources of the claims, whether tests were conducted to validate these claims, and if the number on the box matches the number actually realized in the home.

Operators need to know actual data rates in the home and how often these advertised rates can realistically be expected. They cannot design a network topology and forecast bandwidth requirements based on personal opinion or a brochure.

How Fast Do These Networks Have To Be?

To accommodate the proliferation of devices and services in the home, including over the top (OTT) and ultra HD, operators are continuously trying to forecast and manage bandwidth requirements. Home networks need to cope with peak loads generated by streaming to and from multiple devices, general increases in Internet traffic in and to the home, the emergence and adoption of UHD-formatted content, increase home automation and emergence of IoT and advertised WAN or network access speeds, all at the same time.

For example purposes, we offer the following scenario. First, we identify a home with three TVs (common in the US though not necessarily in all other countries), each with UHD capability, plus three additional video streams on smaller screens. We also add 5 Mbps for other Internet traffic to create a "peak" home environment.

The minimum requirement for a home network in this scenario is three UHD streams at 25 Mbps each, three portable device streams 2.5 mbps each, with the additional 5 Mbps for "other" activity.

	2016	**2017**	**2018**	**2019**
3 UHD streams @ 25 Mbps each	75			
3 HD streams on portable devices 7.5 Mbps	7.5			
Other traffic	5			
Total home network Mbps	87.5	109	137	171

Even though international use patterns are about two years behind the U.S., data requirement will rise to 171 Mbps by 2019. We will use this number as our target performance for in-home performance.

It should be noted there will also need to be some headroom built in as some consumers' use patterns and requirements are beyond the average.

Fact or Fiction: Validated Performance vs. Unsubstantiated Claims

The table below charts the claims and corresponding real world speeds by each technology standard.

Rethink Research uses 90 percent outlet, or node, coverage as the benchmark for performance reliability. Performance and reliability are joined at the hip as operators need to know both prior to designing their networks.

Based on analysis of public domain information, direct conversation with representatives of the various network standard groups and vendors, Rethink Technology Research believes these are the correct performance metrics for each network technology standard today. A couple of performance rates are admittedly estimates due to lack of credible evidence.

Data rates in Mbps	**PHY Rate**	**MAC Rate**	**Advertised Data Rates**	**Real Data rates in 90% of home**	**Ratio claimed to be real**	**Information Source**
MoCA 2.0	700	400	400	400	100%	From MoCA tests available publicly
MoCA 2.0 Enhanced Mode	1400	800	800	800	100%	From MoCA web site
G.hn over coax	1000	850	500	*	*	Estimates and claims by Alliance; no real world tests available.
HomePlug AV2	750	500	500	100	20%	HomePlug whitepaper, one stream
HomePlug AV2 MIMO	1500	1000	1000	200	20%	HomePlug whitepaper, three stream
G.hn over power line	950	500	475	100	21%	IC vendor claims
G.hn over power line MIMO	1700	850	807	170	21%	IC vendor claims
Wi-Fi 802.11ac 4x4 5 GHz	1733	850	910	90	10%	Various publications and vendor marketing materials, Wikipedia

* There are unconfirmed reports of G.hn over Coax reaching anything from 400 Mbps to 850 Mbps, but these are all point to point figures, and none are measured across multiple outlets in a single home or across 90% of outlets in multiple homes.

It is recognized that if an individual were to conduct tests in their own home with a device that embeds any of these technologies it is possible to achieve different speeds than identified above. For instance, 350 Mbps with a Wi-Fi connection is possible but is also dependent on the number of devices in use, distance from an access point and construction materials. If there are four or five devices, or more, on a

wireless network, with desired access in different rooms with thick walls in between, data transfer rates are likely to suffer.

Analysis

The results identified for MoCA 2.0 in the above chart are based on recent tests conducted by MoCA in 108 homes around the U.S. Tests were conducted as randomly as possible and all homeowners were volunteers. There were no stipulations for condition or age of the in-home, coaxial wiring, or type of pay TV service (i.e., cable, satellite or telco/IPTV). The Alliance also announced results publicly.

No other standard body has tested for performance and reliability in this many homes. MoCA plans to conduct the same tests internationally.

MoCA also published results for MoCA 1.0 field tests it conducted in 250 homes in the U.S. in 2005. These tests confirmed 100 Mbps throughputs in 97 percent of all outlets.

HomePlug conducted tests for HomePlugAV2 and reported the results in a white paper available on their web site. However, the tests were conducted in just six homes, as noted in the white paper.

A HomeGrid representative told us that G.hn delivers 850Mbps on 500 feet of RG6 coax in one of their executive's homes. This is not a comparable test. It is one home. In addition, RG6 cable can be defined in many ways and the age and condition of splitters and amplifiers need to be taken into consideration. Not everyone lives in a new house with new wiring.

The closest to a real world speed for G.hn we obtained was from South Korea, where G.hn is actually used in network access applications but this is a different use case entirely. While 500 Mbps of throughput to every home was validated, it is unknown as it was not tested if the same speed was available on every outlet.

Summary

This document is intended to be the benchmark for any discussions and deliberations regarding the performance claims of the various home network standards bodies.

The next time you are presented with performance claims by a vendor as to performance of one of the technologies referenced in this document, ask two questions. One, how often is the data rate achieved? And two, can you prove it?

Sources

Average numbers of TV homes (registration needed)
MoCA repeats field test that rocketed it to initial success
Just how big is China's Cable and TV market
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