



GIGABIT FTTH: EXAMINING ULTRA-HIGH SPEED NETWORK MOMENTUM.

BACKGROUND

While Fiber-to-the-Home (FTTH) technology has been deployed by broadband carriers for many years now, it is just recently that Gigabit FTTH has gained significant momentum. Gigabit FTTH delivers at least the capability of 1 Gbps in the downstream path to end subscribers, with many current Gigabit service providers offering a similar symmetrical speed in the upstream path as well. This Gigabit FTTH momentum is highlighted with the entrance of global Internet powerhouse Google, who has planned or deployed three Gigabit FTTH networks in Kansas City (both the KS and MO versions), Austin, TX, and Provo, UT.

Indeed, there is a growing Gigabit FTTH ecosystem including companies like Google. But there are a range of smaller service providers, some of whom were actual pioneers in the Gigabit FTTH movement, including EPB of Chattanooga, TN and LUS Fiber of Lafayette, LA. A number of organizations are a part of this ecosystem as well, including Gigabit Squared and Gig.U. The FCC has even taken notice, with immediate past FCC chairman Julius Genachowski calling for at least one Gigabit FTTH community in each of the 50 states by 2015.

While Google gets much of the attention regarding Gigabit networks, there are a range of service providers large and small who also offer the service. CenturyLink recently announced a Gigabit initiative for a part of Omaha, NE. VTel, an independent telco in Springfield, Vermont recently launched, and the Institute for Local Self Reliance, an organization that advocates for municipally owned broadband networks, reports that over 40 municipal owned telecom networks across 13 states have launched Gigabit FTTH service¹. Pricing for Gigabit services is wide ranging. Interestingly, VTEL, probably one of the smallest Gigabit service providers offers the best pricing, at least for now, at \$35 per month. Other offers can top out at \$300 or more per month. Google charges \$70 per month.

WHAT EXACTLY IS GIGABIT FTTH?

The Gigabit FTTH movement can certainly be classified as a buzz moment, with lots of hype. The

entrance of Google certainly helps fuel that buzz. In reality, Gigabit FTTH is much more of a marketing term than a technology. Just about any existing FTTH provider can decide to offer Gigabit services by simply upgrading their existing electronics, if that is even necessary. There is no need to lay new or retrograde existing fiber. The move to Gigabit is more of a marketing and business decision, than a technology one.

In this regard, Gigabit FTTH is service offering that for whatever reason has caught the attention of the industry, press, and to some extent, regulators. One Gigabit is a nice round number, that companies like Google conveniently describe as “100x faster than today’s broadband.” In reality, according to Akamai, the average U.S. broadband connection at the time of this paper’s publishing is 7.4 Mbps². So technically, it’s really 135x faster than today’s broadband.

HOW MUCH BANDWIDTH IS ENOUGH?

Google and others like to claim that 1 Gbps bandwidth is a desirable bandwidth goal. But realistically, does any consumer need that much bandwidth at their home? As discussed earlier, the average broadband connection speed today is around 7 Mbps. The FCC’s broadband plan calls for rural markets to receive at least 4 Mbps downstream, and calls for 50 Mbps downstream to be within reach of 100 million homes by 2015. By 2020, the FCC’s plan calls for 100 Mbps to 100 million homes.

There is no denying the demand for bandwidth is growing exponentially. Consumers are coming to expect faster and faster speeds. By today’s standards, a broadband connection of 30 – 50 Mbps is considered very fast and more than adequate to meet the demands of subscribers. That’s not stopping faster approaches though, with many cable companies and FTTH providers also offering 100 Mbps or more broadband tiers.

The increased consumption of video by consumers is the primary driver for these faster speeds. We’re

seeing a growing number of households that now possess multiple HDTVs. According to Leichtman Research Group, 75% of U.S. households now have at least one HDTV, with 51% having more than one³. Additionally, with the growing penetration of tablets and smartphones in the home, video consumption is no longer tied to just the TV. Multiple streams, often multiple HD streams, some of which are delivered over-the-top (OTT) are now quite common, putting a strain on a service provider's broadband network. As a result, the industry is seeing more and faster demand for bandwidth, causing the average broadband speed to increase rather dramatically. According to Akamai, the number of U.S. households receiving 10 Mbps or more downstream broadband (currently 19%) jumped 90% between fourth quarter 2011 and fourth quarter 2012⁴.

The impact of video on bandwidth is only going to accelerate. The next generation of HDTV, or 4K TV, is already upon us, with 4K TVs now beginning to ship. This latest version of HDTV has a resolution of 2160 x 3840 pixels, compared with today's HD which generally offers 1920 x 1080 pixels, or roughly 4x the resolution and 4x the amount of bandwidth necessary to transmit it. There is even 8K HDTV on the books for the future, which doubles the pixels and bandwidth requirements for 4K HDTV.

So while the demand for Gigabit FTTH today is probably not justified, it is conceivable this demand may come soon, especially if 4K HDTV is rapidly adopted. Beyond video consumption, interesting developments and innovation are happening with high bandwidth applications that may also make 1 Gbps broadband more desirable. Several Gigabit service providers including Google and EPB are facilitating laboratories of sorts in their Gigabit markets, inviting developers to create applications designed specifically to take advantage of 1 Gbps speeds.

One such application under development in Kansas City is the Software Lending Library, where the Kansas City Public Library is developing the ability for citizens to check out software remotely, allowing them to use software applications on their desktop computer, via Google's Gigabit network. "Remote desktop software is notorious today for running a remote computer significantly slower than on a local machine, but Gigabit transfer speeds would allow people to borrow titles as complex as Photoshop with ease," reports Seth Rosenblatt for CNET⁵. "A program like Photoshop or Illustrator, you can actually run those via remote

desktop over Fiber and have a pretty good experience," said David LaCrone, Kansas City Public Library's sole digital branch manager in CNET's "Fast fiber: Apps coming at 70 percent the speed of light" article. Beyond this example, these laboratories are creating applications that are outside the scope of our current imagination and will probably help justify the need for ultra-high speed broadband networks, perhaps faster than anticipated.

WHAT'S NEXT FOR FTTH?

While today's FTTH technology allows service providers to offer Gigabit services, there is innovation happening that will make Gigabit offers even more achievable. Newer FTTH standards include XG-PON1 and XG-PON2, which use 10 Gbps downstream/2.5 Gbps upstream and symmetrical 10 Gbps, respectively. These standards offer the type of bandwidth horsepower that make 1 Gbps to the home easier to manage. Verizon is currently conducting trials of XG-PON, and also recently conducted a test of XG-PON2, where the test demonstrated an application layer throughput to the premise of 9.1 Gbps upstream and downstream⁶. Verizon says they like these advanced FTTH options because they fit with their existing GPON technology.

Another FTTH development worth noting is WDM-PON. This emerging technology works with existing GPON outside plant designs, but replaces a typical GPON 1:32 splitter with a 1:32 WDM and/or DWDM optics in the optical line/optical network terminals (OLT/ONT). This allows each ONT to have a full 1 Gbps or even 10 Gbps connection. In essence, WDM-PON provides the equivalent of an active Ethernet connection over a PON type network. This approach provides complete physical separation of end users' traffic and security.

SHOULD YOU BUILD A GIGABIT NETWORK?

Not unlike any network decision, the decision to build a Gigabit FTTH capable system should be rooted in business and market factors that are unique to each situation. Competitive factors, economic development issues, and the company's financial position and health are all major factors to consider. This is definitely not a "build it and they will come" scenario. Rather, it's a carefully researched and planned endeavor, driven by market conditions on the ground.

All things being equal, most service providers would prefer a FTTH network. It brings with it some sense of a hedge against the future – preparation for whatever bandwidth demands are to come. The question for service providers who don't currently offer FTTH service has less to do with Gigabit service and more to do with a decision point to build FTTH.

As a point of reference, Finley sees clients gain about a 75% penetration for high speed Internet in a "greenfield" deployment, which is where an incumbent builds FTTH in their incumbent territory. In more of an overbuild scenario where you are competing with an existing incumbent or other established competitor, a more realistic penetration rate may be 25%. In either case, service providers are strongly encouraged to conduct market assessment research to gain an understanding of the existing market factors and their implications.

Existing FTTH providers have a less complex decision to make. Offering Gigabit service across an existing FTTH network may require some electronics upgrades, including new ONTs. Or the capability may already be inherent. A major factor is the impact on bandwidth backhaul costs. That variable cost will certainly be impacted by the decision to offer Gigabit service. There are ways to mitigate those costs, including the use of local caching services, especially for Internet delivered video content. Regardless of the costs, the move to Gigabit service should be carefully evaluated by existing FTTH providers as well.

One market segment where Gigabit service makes more sense today is anchor institutions, including colleges/universities, hospitals, school systems, libraries, and enterprise sized businesses, among others. These anchor institutions should be looked upon as more than just potential customers, but also as potential partners. They may be of assistance in building a business case for Gigabit service or just FTTH service in general. They may have access to resources that can be jointly put to use. Organizations like Gig.U target anchor institutions and other economic development organizations with resources to bring Gigabit or other ultra-high speed services to communities.

CONCLUSION

Google says they are offering Gigabit FTTH to push the second generation of broadband, a migration they think should see a 100x improvement in broadband speeds. In their view, the first generation

of broadband also saw a 100x improvement in Internet performance, when the industry migrated to broadband from dial-up service. Why should the second generation be any different?

Those are admirable goals, but one could argue the market may not be ready quite yet for this 100x improvement. Time will tell. In the interim, bandwidth demand will certainly increase thanks to a voracious appetite for video and for applications that we can't even imagine yet. Broadband service providers will need to prepare for this reality.

That preparation may involve offering Gigabit services, or not. Regardless of approach, proper research and planning is required and a long term view should be taken. Finley Engineering can provide support and guidance to clients as they evaluate their long term broadband future. We're prepared to meet whatever future plans our clients have.

1. Community Network Map, <http://muninetworks.org/communitymap>
2. Akamai: 19% of U.S. Internet Users See Average Speeds Above 10 Mbps, <http://www.telecompetitor.com/akamai-19-of-u-s-internet-users-see-average-speeds-above-10-mbps/>
3. LRG Research Notes, 1Q 2013, http://www.leichtmanresearch.com/research/notes04_2013.pdf
4. The State of the Internet 4Q12, http://www.akamai.com/stateoftheinternet?WT.ac=soti_banner
5. Fast fiber: Apps coming at 70 percent the speed of light, http://news.cnet.com/8301-1023_3-57589753-93/fast-fiber-apps-coming-at-70-percent-the-speed-of-light/
6. More Insight on Verizon's 10 Gb/s XG-PON2 Trial, <http://www.telecompetitor.com/more-insight-on-verizons-10-gbs-xg-pon2-trial/>