# Past, Present and Future Access Network Infrastructure Capacity Requirements for NG-EPON

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TECHNOLOGY & PRODUCT™
IMPACT THROUGH INNOVATION

# Supporters

# Questions addressed by this contribution

- What average usage capacity should NG-EPON support over time?

- What peak speeds should NG-EPON support over time?

# Internet Access Usage Growth Rate Theory Broadly Accepted by Internet Providers

## Nielsen's Law of Internet Bandwidth

by **JAKOB NIELSEN** on April 5, 1998

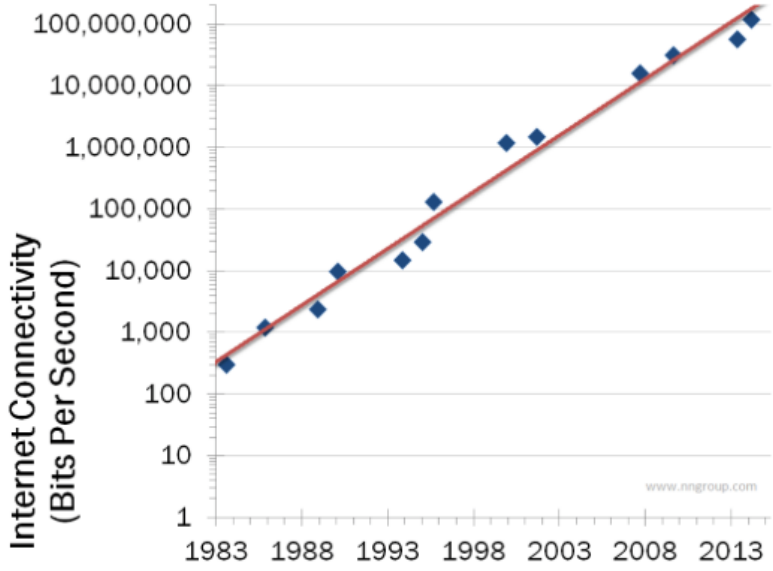
Topics: Technology Web Usability

**Summary:** Users' bandwidth grows by 50% per year (10% less than Moore's Law for computer speed). The new law fits data from 1983 to 2014.

Nielsen's Law of Internet bandwidth states that:

- a high-end user's connection speed **grows by 50% per year**

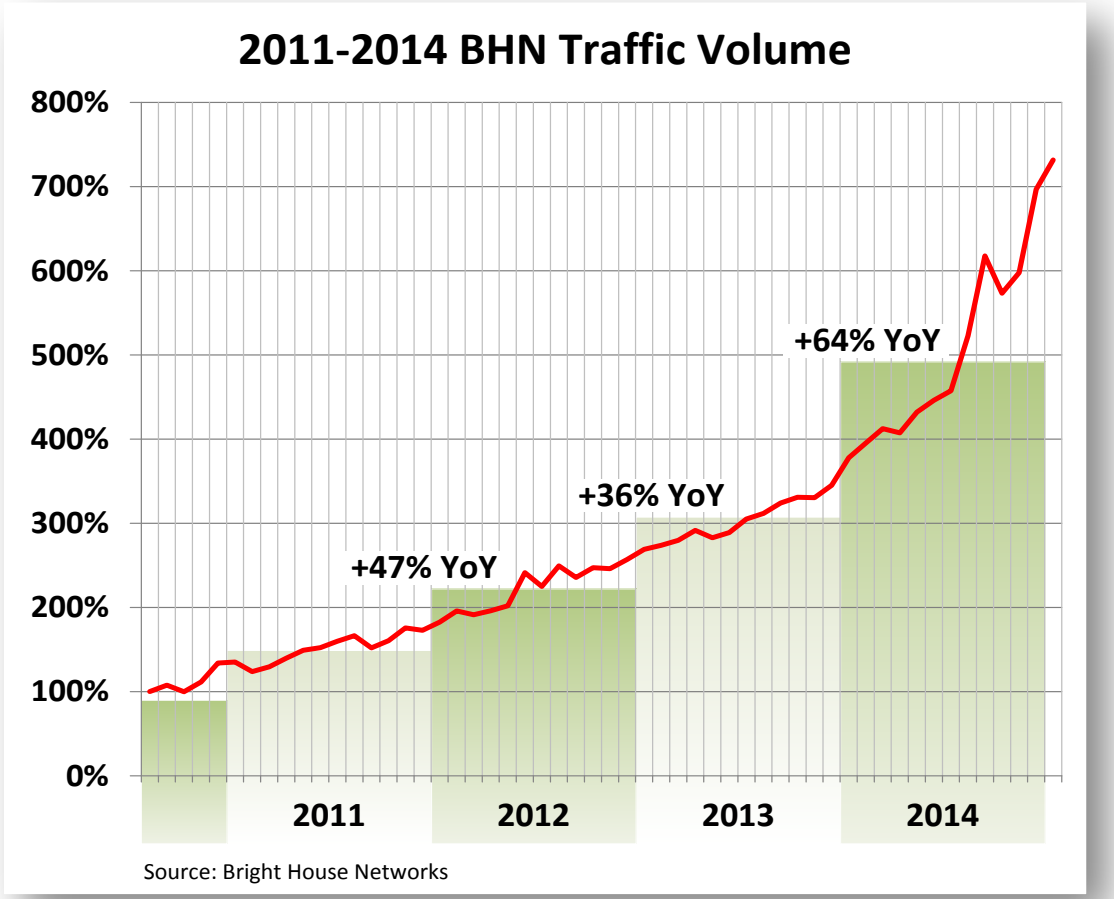
The dots in the diagram show the various speeds with which I have connected to the Net, from an early acoustic 300 bps modem in 1984 to an ISDN line when I first wrote this article (and updated to show the 120 Mbps upgrade I got in 2014). It is amazing how closely the empirical data fits the exponential growth curve for the 50% annualized growth stated by Nielsen's Law. (The *y*-axis has a logarithmic scale: thus, a straight line in the diagram represents exponential growth by a constant percentage every year).




Source: Nielsen Norman Group

Empirical data from almost 20 years has very well tracked this theory. However, it does not clearly differentiate peak speed growth from usage growth rate.

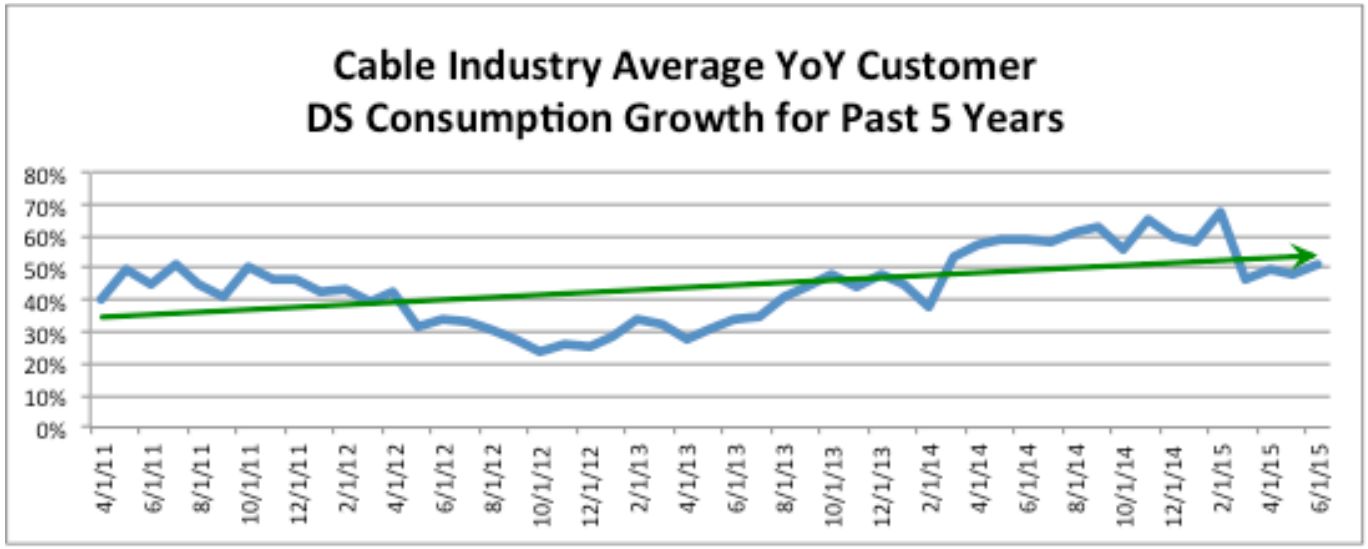
# Previous Contributions Regarding Observed Usage Growth Rate

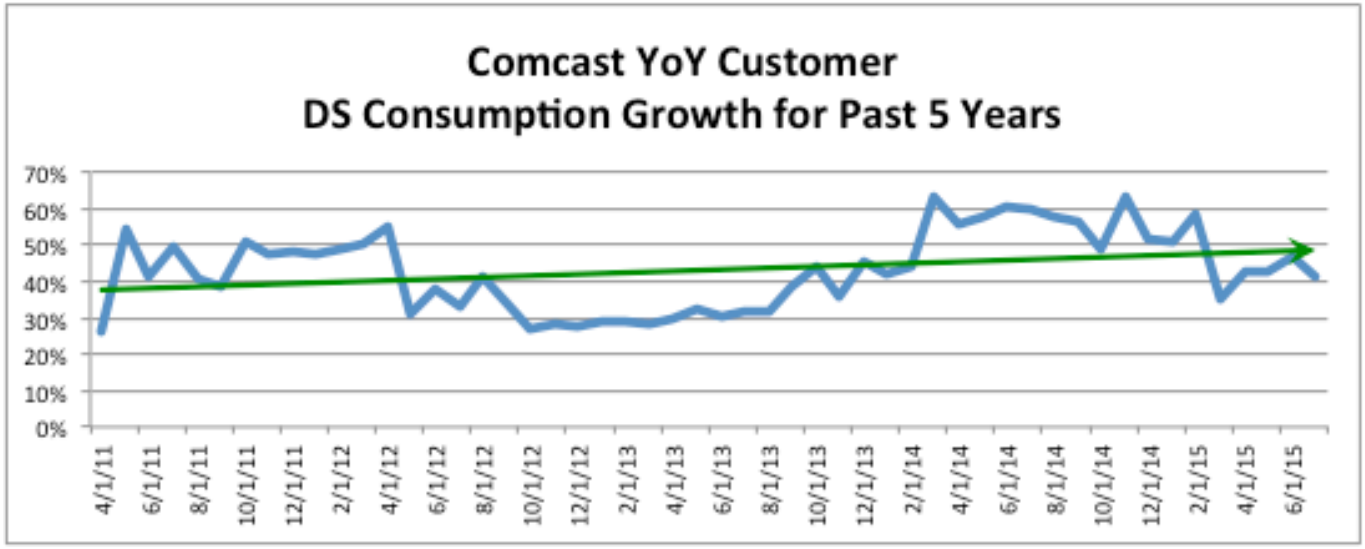



Notice the slight dip in usage growth rate around 2013 and slight increase in the last 2 years

NG-EPON CFI Presentation
(ngepon_cfi_R19 - Slide 17)

# Additional Usage Growth Rate Data

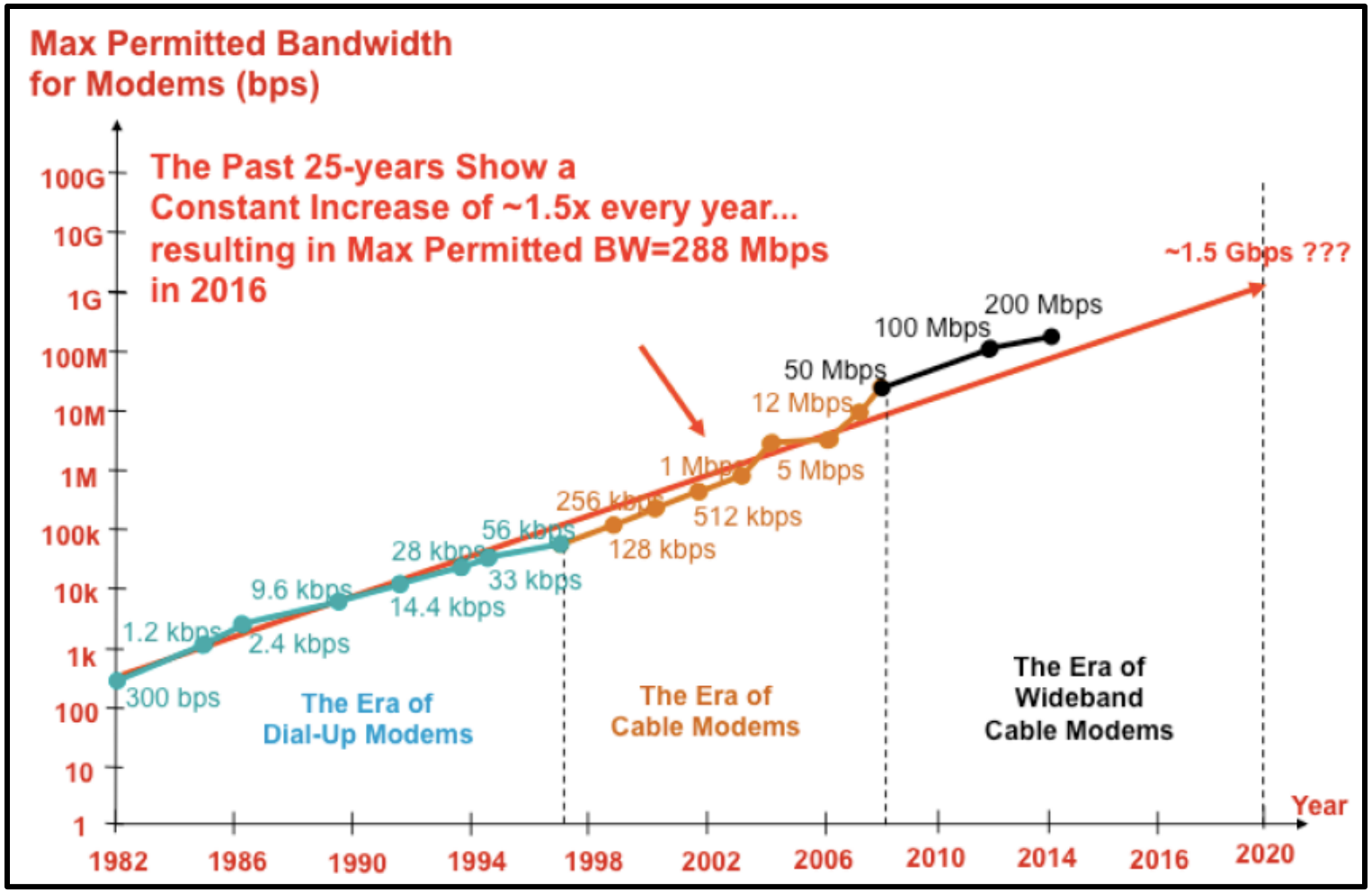



Cable Industry data courtesy of CableLabs

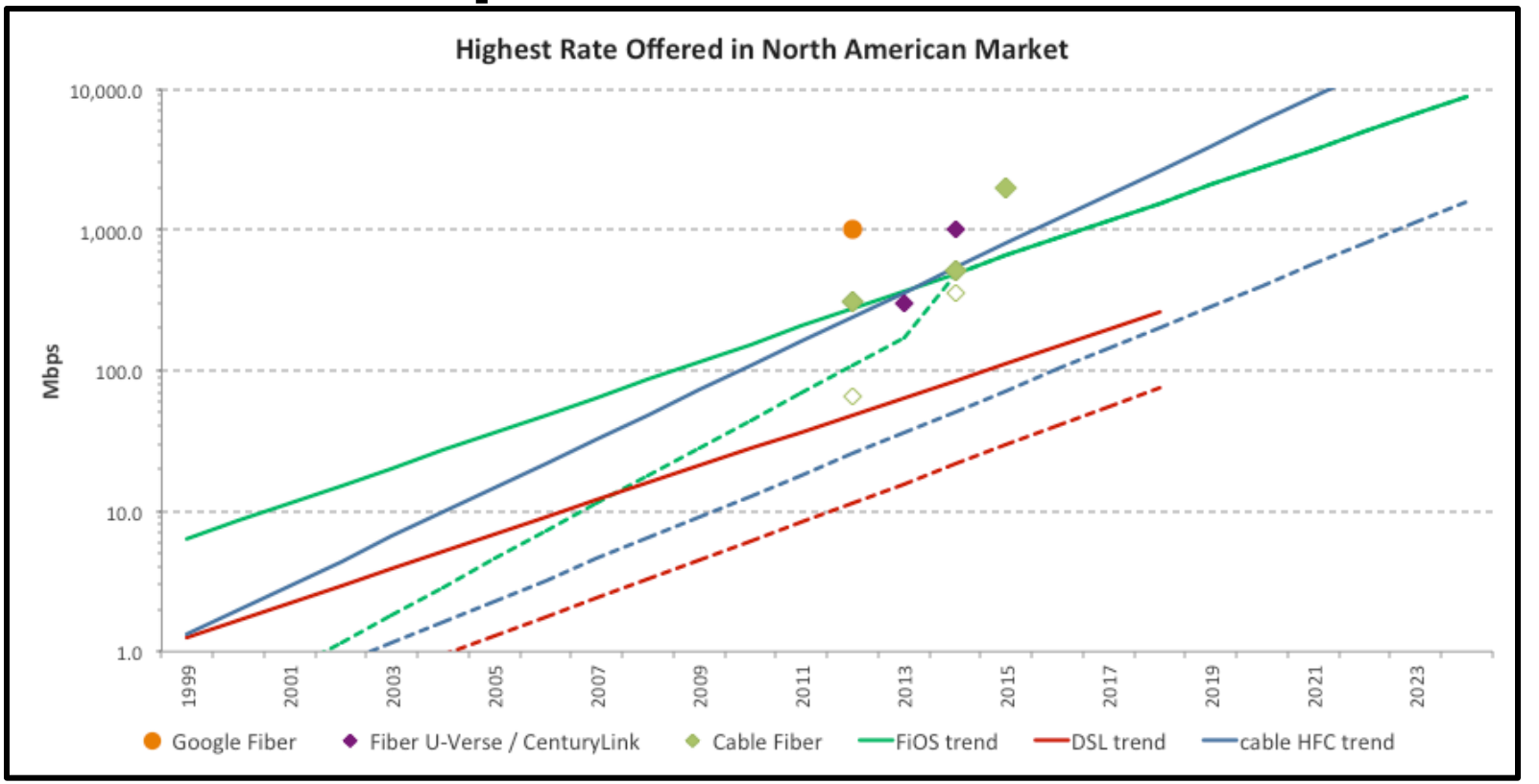
Notice the same pattern, with a slight dip in usage growth rate around 2013 and slight increase in the last 2 years. We may be heading to another period of slight dip in usage growth.

# Previous Contributions Regarding Offered Peak Speed Growth Rate




NG-EPON ICAD Report
(ng_epon_report – Figure 17)

# Additional Contribution Regarding Offered Peak Speed Growth Rate




Compilation courtesy of CableLabs

- Solid lines indicate DS and dashed line indicates US
- Cable industry peak speed growth rate has been higher
- Fiber-based services may have a more aggressive growth rate than traditional copper-based services

# Comcast Boots Up 2-Gig Residential Broadband

## 'Gigabit Pro' Debuts In Atlanta, To Reach 18M Homes In 2015

4/02/2015 7:45 AM Eastern
Last updated at 4/03/2015 8:46 AM

By: Jeff Baumgartner
Follow @thebauminator

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Comcast has entered the Gigabit era.

Aiming to one-up 1-Gig residential broadband offerings from the likes of AT&T and Google Fiber, Comcast next month will introduce Gigabit Pro, an uncapped, fiber-based, symmetrical 2 Gbps service that will initially be offered to more than 1.5 million customers in Atlanta and expand the service into more Comcast markets throughout 2015.

"We'll first offer this service in Atlanta and roll it out in additional cities soon with the goal to have it available across the country and available to about 18 million homes by the end of the year," Marcien Jenckes, executive vice president, consumer services for Comcast Cable, explained in this blog post.

**TakeAway**

**Comcast will use FTTP to deliver a 2-Gig**

# NG-EPON Capacity Support Projection Should Focus on Peak Speed Growth

- Peak speed growth rate has been more consistent than usage growth rate
  - Empirical data collected over time shows a usage growth rate of 30 to 60%, with slight increase over time
  - Long term observation of peak speeds shows a consistent growth rate of 50% year-over-year
- Usage growth has been independent of speed growth
  - Speed increases don't result in usage increase bumps
- Internet access networks are designed to support offered peak speeds at peak usage times
- To be effective, NG-EPON must support the expected peak speeds for at least 7-10 years
  - At least 3 years to deploy and at least 4-5 of active use

# Extrapolating Peak Speed Growth Trend

| Year | Peak Speed Projection | Event |
|---|---|---|
| 2014 | 1 Gbps (Actual) | Industry Connection |
| 2015 | 2 Gbps (Actual) | CFI and SG |
| 2016 | 3 Gbps | TF |
| 2017 | 5 Gbps | TF and Samples |
| 2018 | 7 Gbps | Standard and Trials |
| 2019 | 10 Gbps | Initial Deployments |
| 2020 | 15 Gbps | Year 2 |
| 2021 | 22 Gbps | Year 3 |
| 2022 | 33 Gbps | Year 4 |
| 2023 | 50 Gbps | Year 5 |
| 2024 | 75 Gbps | Year 6 |
| 2025 | >100 Gbps | Year 7 |

Access networks have to support the offered peak speed during peak usage periods. Therefore, access networks are designed with at least a 2x headroom from the offered peak speed.

NG-EPON should support 100 Gbps and beyond

# Summary

- Usage growth and peak speed growth are not the same
  - Usage growth is independent of peak speed growth
- Internet access networks are designed to support offered peak speeds during peak usage periods
  - Access networks designed for at least 2x peak speeds
- Offered speed growth rate at Internet service provider networks has increased at a rate of 50% year-over-year
  - Empirical data from the past 20 years shows this trend
- Extrapolating the observed peak speed trend to the expected lifespan of NG-EPON indicates that NG-EPON should support 100 Gbps and beyond to be effective