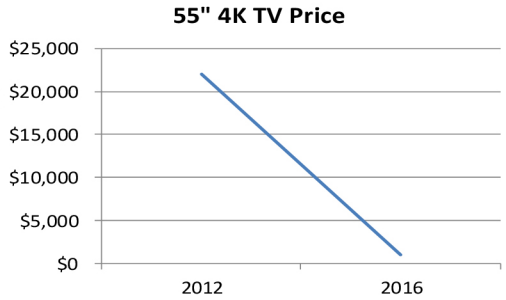
How to Speak “Fiber Geek”
Article 1 – Bandwidth Drivers and Standards

The fiber optic cable world has come a long way over the past 30 years. Products have become more rugged and user friendly, making it easier for people to enter the industry and work handling optical fiber and cable. While this is great for the industry, many people may understand the “how to” but not necessarily the “why” of fiber optics. To understand the “why” behind fiber and cable products, the next step is to become a full-fledged “fiber geek.” Because the industry changes so quickly, true fiber geekdom is an ongoing process. The purpose behind this series of articles is to enable the reader to understand some secondary fiber specifications and take the next step on the fiber geek ladder.

While this first article will provide some background, future articles in this series will go point by point through fiber specifications and their importance to the network.

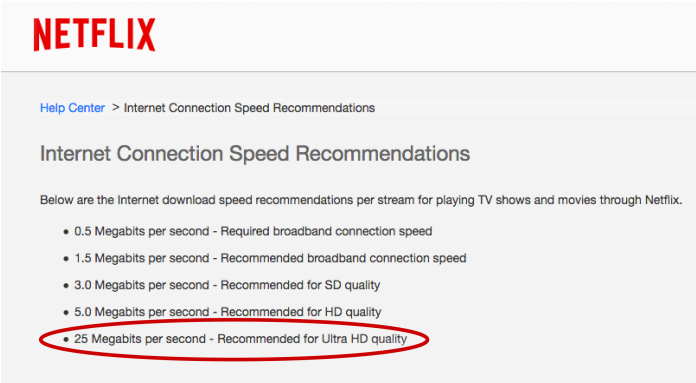
Bandwidth demand continues

The demand for bandwidth continues unabated, driven by Web 1.0/2.0, mobile and now streaming video. The result is an expected Compound Annual Growth Rate (CAGR) of approximately 22% across the network through 2020[1].



While that’s somewhat old news, new bandwidth demand is on the horizon, potentially driven by several relative sources including 4K TV, virtual reality and an expansion of the “Internet of Things.”

Ultra HD TV, also known as 4K TV, first appeared on the radar screen approximately four to five years ago. While 4K TV offers twice the resolution of standard HDTV, the first models were priced at more than $20,000. Since then, the cost of 4K TV units has dropped rapidly to the point that they are now ubiquitously available at most electronics stores.



While linear TV packages still don’t offer many 4K options, over-the-top video providers such as Netflix and Amazon Video are rapidly adding content.

The primary reason that 4K TV is significant to bandwidth demand is that each 4K channel requires up to 25 Mbps, more than 2X the typical HD video requirement. Considering the number of TV screens that are typically on in a household, the potential demand could be a significant increase versus current HDTV demand levels.

However, 4K TV is just the starting point since 8K TV is on its way. Although they are very costly, 8K TVs are commercially available and some content is beginning to trickle out, including the 2016 Rio Olympics.[2]

High resolution screens are also an integral part of the experience promised by virtual reality. Virtual reality, while in its commercialized early stages, holds the promise of significantly changing the way that we experience media of all types. However, there’s a catch – **fully networked 4K** virtual reality will require hundreds of megabits per second (or more) of bandwidth.[3]

High resolution video will continue to use bandwidth as it becomes embedded in various networked applications such as telemedicine, remote medical monitoring and distance learning.

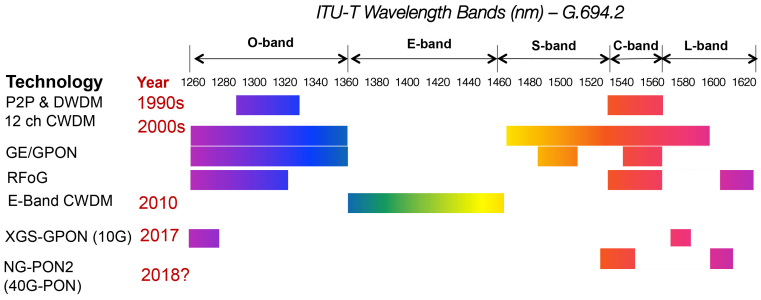
Finally, we’re also in the early stages of the “Internet of Things,” where sensors from various devices including cars, trackers and all sorts of things communicate with each other to do their jobs for us.

Why does optical fiber care?

This bandwidth demand can be satisfied in three ways:

1) Faster electronics
2) More wavelengths on the fiber
3) More optical fiber

Historically, the fiber industry has used all three of these methods to meet demand. Electronics are getting faster and more wavelengths are being placed on fiber, using either Coarse Wavelength Division Multiplexing (CWDM) or Dense Wavelength Division Multiplexing (DWDM) technology. Once fiber is deployed, it’s very expensive to replace. For this reason, the fiber that’s installed should be capable of withstanding multiple generations of hardware while also having plenty of room for additional wavelength growth.



The graphic on the right highlights how wavelength usage has grown over the past three decades. For the first 30 years, applications were focused in the 1310 nm and 1550 nm regions. Given the explosive demand for bandwidth, it’s reasonable to

assume that the next 30 years will require many more wavelengths, with potential applications across the entire optical spectrum.

Standards

Standards are important. They help to ensure a minimal level of network compatibility and performance.

For outside plant single-mode optical fiber, two standards are critical:

1) ITU Recommendation G.652, “Characteristics of a single-mode optical fibre and cable”[5], and
2) ITU Recommendation G.657, “Characteristics of a bending loss insensitive single-mode optical fibre and cable for the access network”[6].

Increasingly, fibers meeting both the G.652D and G.657A1 standards with a 9.2 µm mode field diameter are used to provide bend insensitivity for cables used in the outside plant. Additional bend insensitive standards are available for different applications and will be addressed more thoroughly in a future article in this series.

The standards-making process is an arduous one. Fiber standards are global and standards makers strive to achieve balance and fairness. However, standards often provide only minimum performance levels. In fact, fibers that meet the standards may struggle with some current as well as future applications.

For this reason, it’s best to insist on performance beyond the standards for many applications. The next articles in this series will highlight various specifications and explain where performance beyond the standards is most important.

Summary

The demand for bandwidth is expected to continue far into the future, driven in part by requirements for breakthrough applications such as higher resolution video, virtual reality and other applications. We expect this demand to continue to drive the need for optical spectrum provided by fiber. Fiber standards, such as G.652 and G.657, are very important for network designers in setting minimum performance levels, but can ultimately be insufficient to meet the requirements for future networks. For this reason, performance beyond the standards can be very important.

References

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[2] http://www.cnet.com/news/8k-tv-broadcasting-coming-to-japan-during-2016-olympics/

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