NEK Community Broadband

Technology Committee Meeting Minutes

October 22, 2020

Attendees: Jonathan Baker, Noah Armstrong, Shawn Campell

Christine Hallquist called the meeting to order at 6:12.

Agenda Review

No items were added to the agenda.

New Business

- Christine Hallquist presented a tutorial of Fiber Optics. Discussion ensued. Presentation is attached.

Other Business

- None

Action Items

- None

The Meeting adjourned at 7:04.

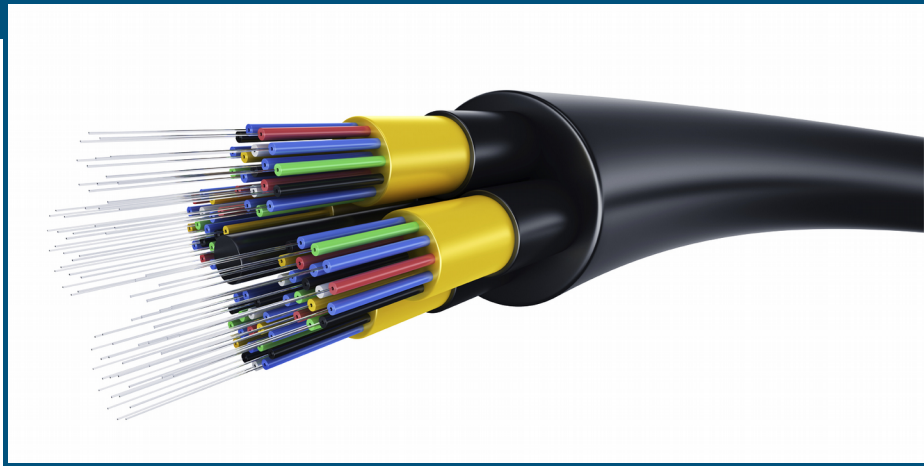
Fiber Optic Technology

How it works

https://youtu.be/0MwMkBET_5I

What a fiber optic cable consists of

- The fiber is just slightly larger than a human hair



- Fiber optic cables are packaged in ‘bundles” enclosed in a sheath
  - Typically 12 fibers to a bundle
  - A 144 strand fiber run will have 12 bundles of 12 each

Types of Fiber

- **Single Mode fiber** is a single stand has one mode of transmission with a relatively narrow light bandwidth. Carries higher data bandwidth than multimode fiber, but requires a light source with a narrow spectral width. Single-mode fiber is optical fiber that is designed for the transmission of a single ray or mode of light as a carrier and is used for long-distance signal transmission
- **Multimode fiber** gives you high bandwidth at high speeds over medium distances. Light waves are dispersed into numerous paths, or modes, as they travel through the cable's core typically 850 or 1300nm. However, in long cable runs (greater than 3000 feet [914.4 meters), multiple paths of light can cause signal distortion at the receiving end, resulting in an unclear and incomplete data transmission so designers now call for single mode fiber in new applications using Gigabit and beyond
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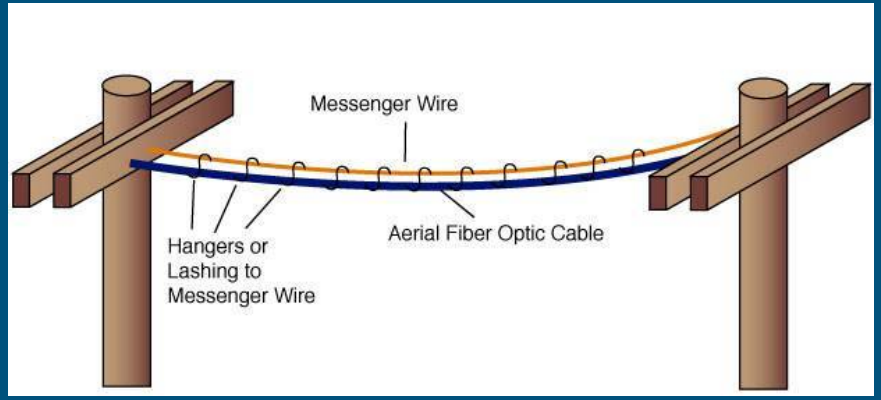
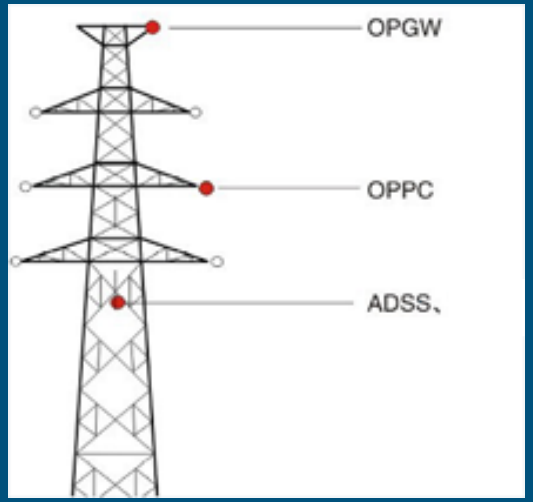
- **Single fiber mode** is compatible with existing fiber deployments and hardware solutions, making vendors keep pricing low and provide multiple variations

Two ways to hang fiber

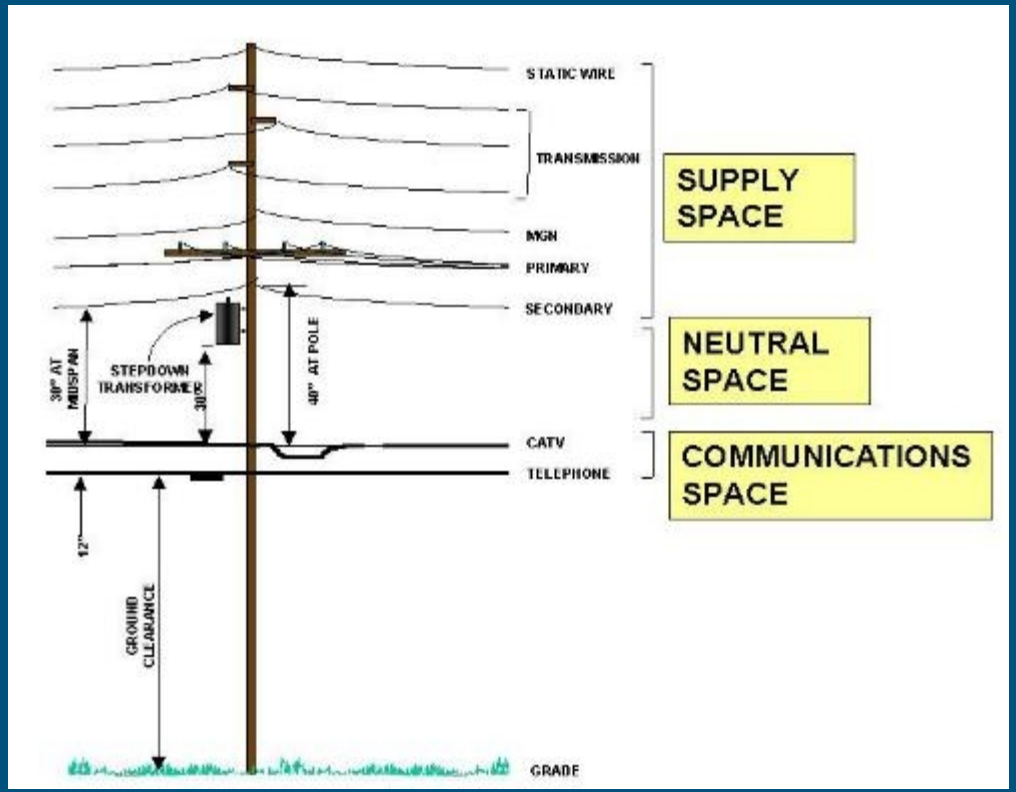


- Most traditional telecommunication installations hang fiber from a messenger (steel cable). That cable has to be 40” away from the lowest electrical conductor. The steel messenger adds weight to the pole, which can result in pole change-outs. These change-outs are very expensive.



- All Dielectric Self Supporting cable **(ADSS**) has no metallic parts. It can be placed in the electric space. It is also much lighter. VELCO figured they could use ADSS fiber with 72 strands as it does not materially impact pole loading. Optical Ground Wire **(OPGW**) has fiber in the core of the top conductor of transmission towers, Optical Phase Conductor **(OPPC)** has fiber in the core of the power line itself.

Telecommunication clearances



- These clearance requirements are what drives the cost of make – ready (typically make-ready adds 30% to the capital cost):
  - The telecommunications conductor must be 40’ away from high voltage conductors and 36” away from low voltage.
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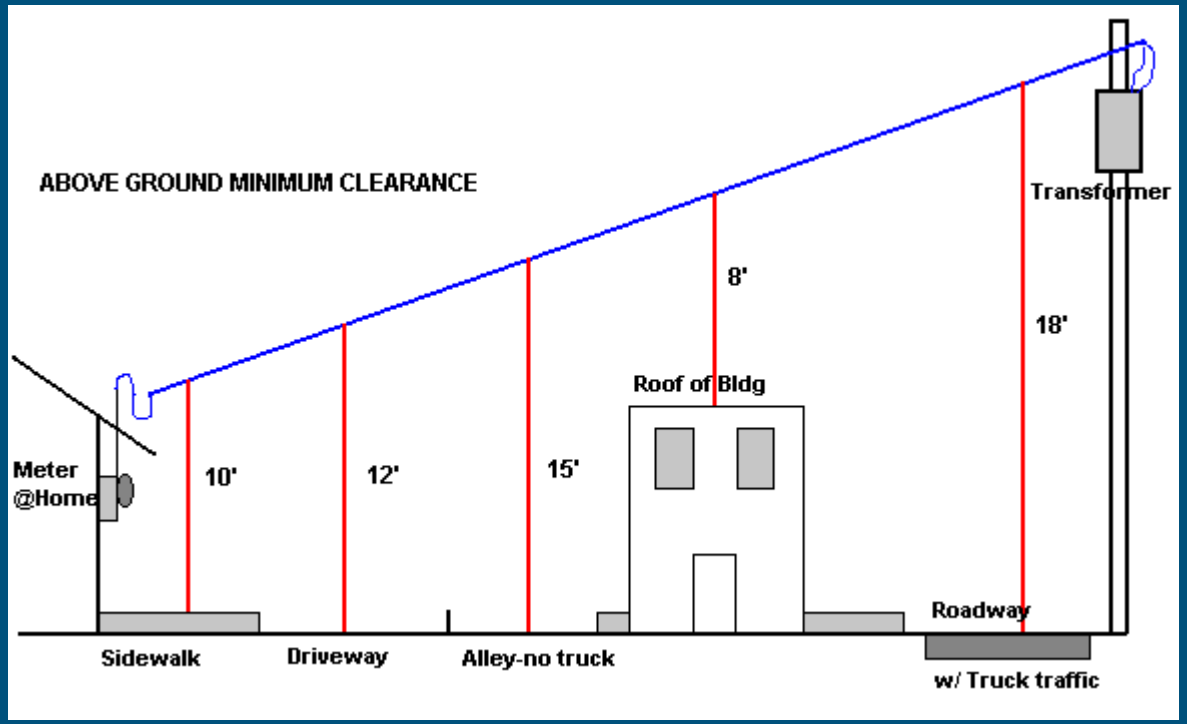
Ground clearances and system weighting



- Ground clearances also need to be maintained. The addition of a telecommunications cable one foot below the secondary distribution feed often can require a pole change-out
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- System weighting can also be an issue. Adding a telecommunications cable can sometimes cause the overall system weighting to exceed specifications. Sometimes that can be a relatively minor cost (adding or changing a guy wire), while sometimes it can be a major cost (pole change-outs run about $12K)
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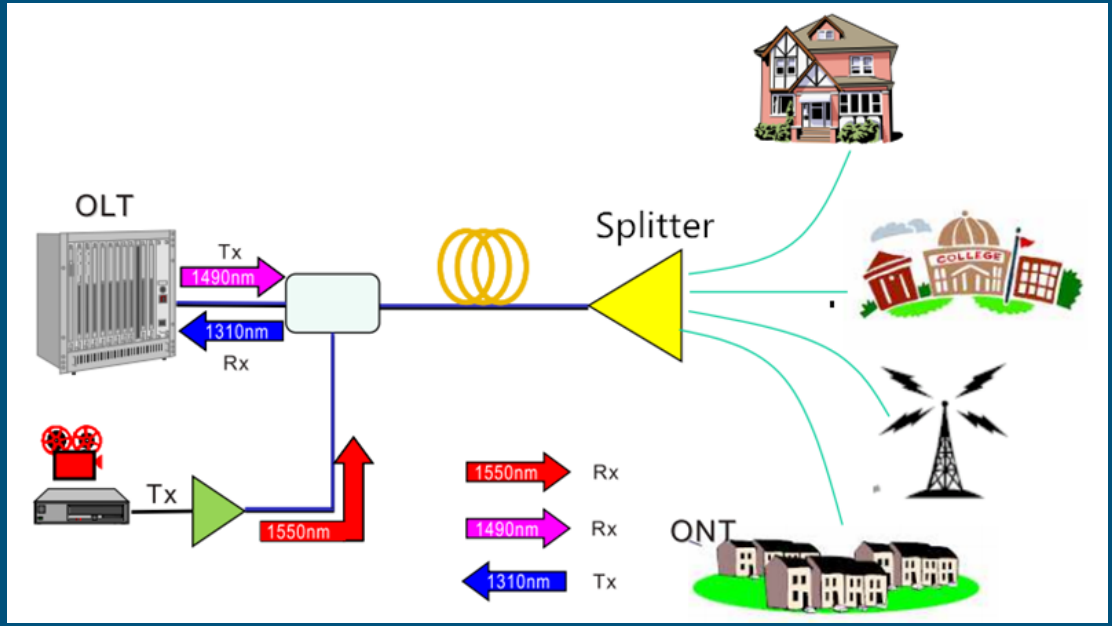
High Level FTTx Network Diagram



The start of the network is the optical line terminal **(OLT)**. It converts the traffic in the carrier's internal backbone network to the optical wavelengths and framing structure used by the Passive Opt Network (PON).

Within the OLT equipment are a CPU, gateway router, and network cards. The incoming fiber line interfaces to the OLT via a small form pluggable (SFP) transceiver.

An optical splitter is an essential component used in an FTTH PON where a single optical input is split into multiple output. This enables the deployment a Point to Multi Point (P2MP) physical fiber network with a single OLT port serving multiple Opical Network Terminals **(ONTs**) The ONT is the demarcation point between the fiber-optic network and the subscriber premises Ethernet wiring to the subscriber router, which serves the subscriber's device.

Finally the optic signal is presented to the consumer through the Fiber Modem on the customer premise.

Corning’s FlexNap optic system

https://youtu.be/9MX0pXyMIKo

Discussion