

Cable Operator Inputs for 100G+ Beyond 10k

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Supporters

- David Claussen Charter
- Phillip Chang Comcast
- Jeff Finkelstein Cox
- George Hart Rogers
- Kevin Kwasny Charter
- Eric Menu Videotron
- Brian Soloducha Shaw
- Rudy Welter Altice USA
- Richard Zhou Charter
- Steve Burroughs CableLabs
- Alberto Campos CableLabs
- Curtis Knittle CableLabs
- Steve Jia CableLabs
- Gary Nicholl Cisco
- Mark Nowell Cisco
- Fernando Villarruel Cisco
- Jing Wang CableLabs

Background

- Have been discussing a “black-link” style approach in SG
 - Define requirements for the end-points, and not on the channel in between
- Concern expressed in prior meetings that this requires engineering of the system, does not allow “plug and play” type solution
- Have been working with cable operators to understand
 - Types of network scenarios to be supported
 - What type of solutions are desirable
- This deck summarizes some of those cable operator inputs, and identifies ways to ensure solutions address their needs

Previous Contributions

- Backhaul for Distributed Architectures in MSOs from Fernando Villarruel (http://www.ieee802.org/3/B10K/public/17_09/villarruel_b10k_01b_0917.pdf)
 - Outlined MSO transition from analog to digital fiber links for distributed architectures
 - Key point: MSOs plan to re-use existing fiber in analog to digital transition
- Beyond 10km PHYs MSO Reference Channels from Curtis Knittle, Matt Schmitt, and Fernando Villarruel (http://www.ieee802.org/3/B10K/public/18_01/knittle_b10k_01_0118.pdf)
 - Provided more detail on MSO use cases and network environment, including example reference channels
 - Key points: 1-2 fibers available, variety of distances and network designs

MSO Optical Distance Survey (from Beyond 10km PHYs MSO Reference Channels)

- Surveyed CableLabs member companies for information on current optical link distances from headend/hub to current fiber node
- 12 cable operators from Europe and North America responded
- Weighted average of survey results based on number of subscribers per operator
 - <30km: 69%
 - <40km: 88%
 - <60km: 94%
 - <80km: 98%
 - <120km: 100%

Additional MSO Plant Survey Results

- Number of optical channels
 - 1 channel: 50%
 - 2 to 15 channels: 37%
 - 16+ channels: 13%
 - Future trend: shifting to more optical channels per fiber (roughly 1/3 each)
- Optical amplification
 - No amplification: 81%
 - Hub only: 12%
 - Other: 7%
- Bidirectional transmission method
 - Single fiber: 21%
 - Fiber pair: 79%
 - Future trend: expecting single fiber percentage to grow

MSO Feedback on Optical Amplification

- Generally deploy optical amplifiers when attenuation on link is greater than approximately 12-17dB
 - Varies between operators
 - Each link is unique
- Getting these links to work requires an engineer with appropriate expertise
 - Adjustments made as appropriate
 - Amplifiers added if/when needed
- While common components are generally used, some amount of adjustment to get each link to work is normal and expected, given range of different channels they operate in

General MSO Objective for Beyond 10k Solution

- Solution needs to be robust enough to work on existing optical plant
- This will allow for some degree of “drop in”
 - Should work with most of existing optical equipment/setup
 - May allow removal of optical amplifiers in some cases (for example, if final solution has better reach/link budget performance)
- However, some degree of engineering of each deployment is expected
 - Plant engineering expertise always needed to deploy

How Do We Get There?

- Define transmitter and receiver specifications for key parameters
 - For example: power levels, OSNR, etc.
 - Sufficient to support compliance testing of solutions
- Evaluate proposed requirements against example reference channels
 - For example, as in http://www.ieee802.org/3/B10K/public/18_01/knittle_b10k_01_0118.pdf
 - Ensures solution meets key MSO needs
- Comprehensive set of Tx/RX optical parameters plus common framing and FEC requirements ensures multi-vendor interop over nominal links
 - IEEE strength
 - Enables broad adoption

Summary

- MSO optical plants vary significantly
 - Wide range of scenarios, although defining some examples is possible
- MSOs expect some degree of engineering to deploy
 - Solutions robust enough for existing optical plant, with engineering expertise to make it work
 - Desire multi-vendor interoperable solutions to drive scale
- Achievable by developing common requirements in IEEE
 - "Black-Link" type approach
 - To include appropriate transmitter and receiver requirements