Automated Telemetry for Data Center Physical Fiber Layer Analysis

Bob Shine, Alan Gibbemeyer and Tony Kewitsch
Telescent
Fiber in Data Centers

• Hyperscale data centers have >100,000 fiber connections
• Fiber plant typically reused during compute refresh cycle
• Fiber can be decade old in some data centers

Source: IEEE 802.3 Beyond 400G Study Group May 2021, Stone
Challenges with Fiber Plant

• Remediation required during installation
• Unknown performance as fiber plant ages (poor record keeping)
• Trend to higher bandwidth optics with tighter link budgets
• MPI challenges at higher bandwidth w/ multiple links on a campus

Source: JOCN/Microsoft Oct 2019, Mark Filer
Link Budgets for New Optics

• 400G FR4 and DR4/4+ have a tight loss budget
• Higher order PAM X optics have even tighter loss, tighter back reflection specs
• All of this puts more and more pressure on DC fiber plant and OSP fiber plant
• To avoid failed links the fiber plant can be measured and characterized before use, for troubleshooting and during upgrade cycles
Telemetry with Automated Optical Switch

- Software controlled reconfigurable cross connect with large port count
- Platform for automated in-situ fiber characterization with remote OTDR
- Ability to add other monitoring equipment
- High Reliability
  - Latched Fiber-Fiber Connections
  - NEBS Level 3 Certified with contract manufacturing
Unique Scalable Algorithm

- Telescent knots, braids and strands algorithm
- Truly disruptive
  - Connect, disconnect, reconfigure with any-to-any capability from any initial state
- Protected by 51 patents
  - KBS algorithm, machine learning, compact robotics, tensioned fibers, cleaning unit
Robotic System in Action

- Each system is like a self-contained meet-me-room
  - >1,000 duplex ports per system
  - Upgradeable, 96 duplex ports per fiber tray
- Reconfiguration made in 1 to 4 minutes
- Low loss, latched, low power draw
- Operation shown with enclosure doors open
Automated Telemetry Use Cases

- Automated characterization during deployment
  - Provide baseline for future or identify cases for remediation
- Automated characterization during DC refresh
  - Characterize fiber plant to confirm performance for new equipment
- Reduce “turned off” fiber links
  - Match distribution of Tx/Rx with performance of fiber links
- Ongoing automated characterization
  - Confirm performance / monitor for degradation
- Optimization of bandwidth in ML clusters → 3x speed
Automated Solution Example

- Deploy robotic cross connects with instrumentation for power and OTDR measurements
- Pre-connect all cabling and automatically test fiber plant – collect test database and verify dark fiber performance
- Robotic provisioning of connections over fiber – test
- Remedy poor fiber or automatically re-provision links to good fiber
Case Study: Mox Networks

ROBOTIC CROSS CONNECT CONFIGURATION

EXCEPTIONAL SERVICE DELIVERY

PERFORMANCE METRICS:
✓ REMOTE TEST AND PROVISIONING OF FIBER = EXCEPTIONAL SERVICE DELIVERY
✓ REMOTE TESTING WITH CUSTOMERS = RAPID CUSTOMER SUPPORT
✓ SERVICE RESTORATION = QUALITY ASSURANCE
✓ CONTINUOUS FIBER TESTING AND MONITORING = OPTIMAL PERFORMANCE
✓ HISTORICAL RECORD OF ALL TESTS = OPTIMAL PERFORMANCE
✓ CABLE FAULT ISOLATION WITH GEOGRAPHIC LOCATION = QUALITY ASSURANCE
Summary

- Fiber plant remains in use over multiple compute refresh cycles
- New optics driving tighter loss budgets
- Robotic system with automated diagnostic equipment allows for remote telemetry of fiber plant
- Can be integrated with other network control software to provide visibility and control of the fiber layer
Thank You

shine@telescent.com
gibbemeyer@telescent.com
kewitsch@telescent.com