



Cost Effective Broadband Improving Your Network ROI

Jack Breeding

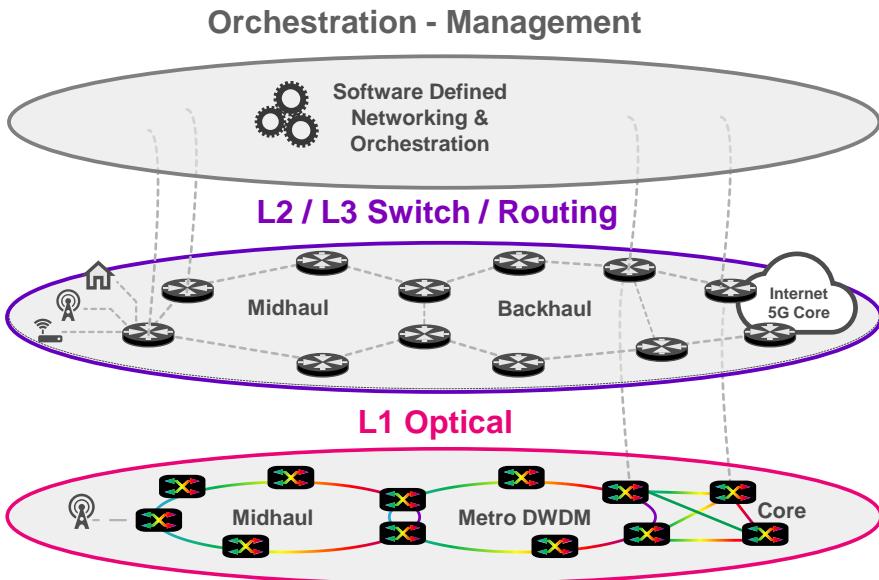
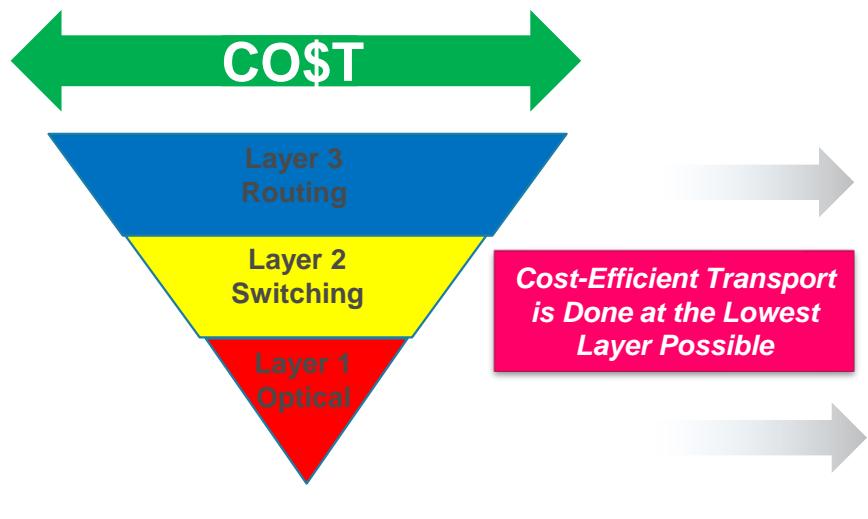
Business Unit Leader, US Rural and Tribal Markets

Turning New Technology Into Revenue

- Cost-Effective and Service Awareness
- Available Transport Technologies
- Critical Need to Spend Wisely
- Middle Mile Scalability is Essential to Keep Up with x-PON Adoption
- Built to Last – Avoiding the Forklift

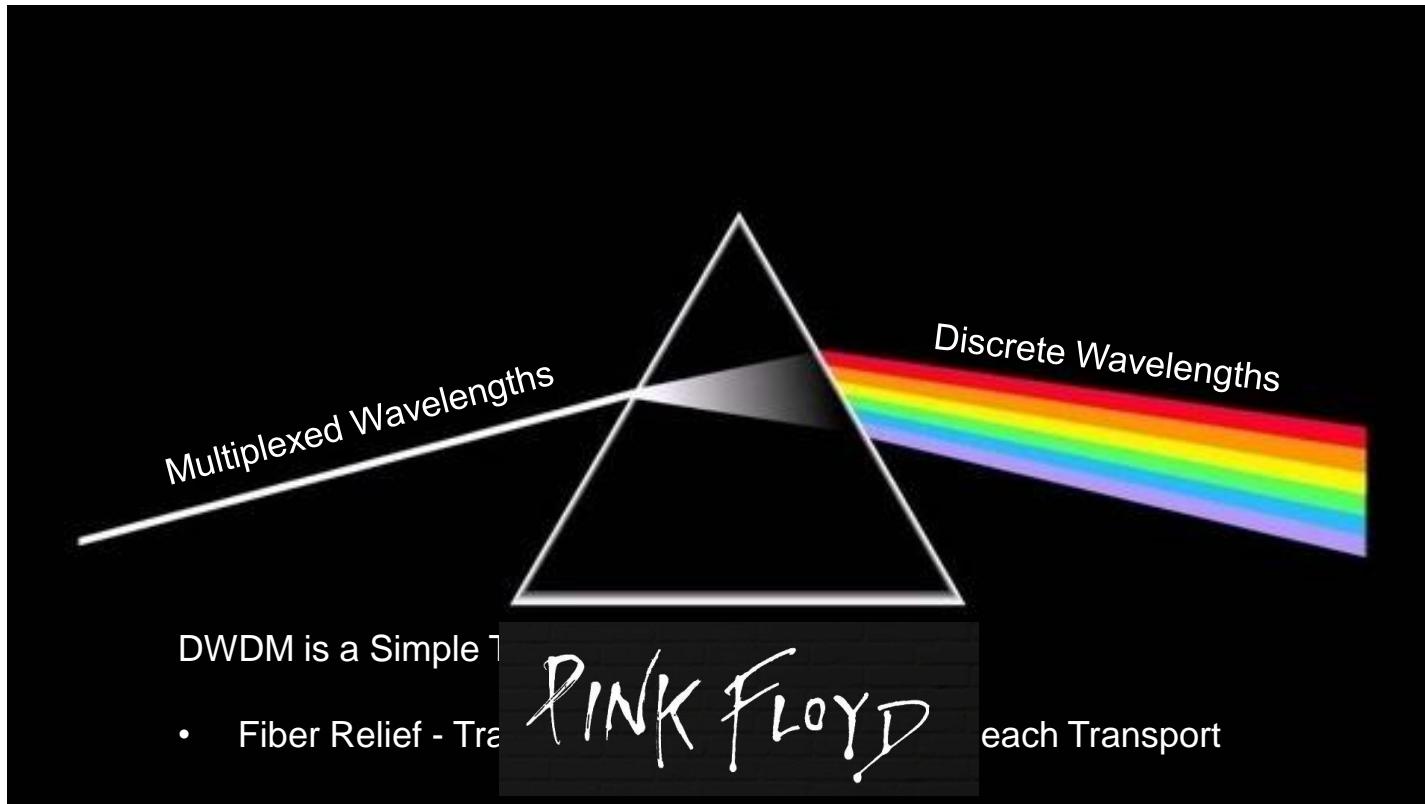


Cost Effective Use of Technology



Transport Technologies Can Be Deployed Separately or In Combinations to Support Requirements

DWDM Optical Transport



Optical Layer Flexibility

Optical Transport Solution



Massive Scale

- Wavelengths Support Bandwidth from 10Gb to 1.2Tb+
- Typical Optical Design Provides Dozens of Wavelengths
- Increase Backbone Capacity As Needed

*Unmatched Capacity
Extended Reach
Scales Easily*



Not Just 'Dumb Pipes' Anymore

- Signal Health Monitoring and Alerting
- Instant Fiber Break Detection and Geo-Location
- Layer 1 ULL Encryption



Application

- Leased Wave Services / Leased Spectrum
- Backhaul Services

Lambda 4: 200Gb / 400Gb

Lambda 3: 200Gb / 400Gb

Lambda 2: 100Gb / 200Gb

Lambda 1: 100Gb / 200Gb

Customer Case Study: Rural Broadband

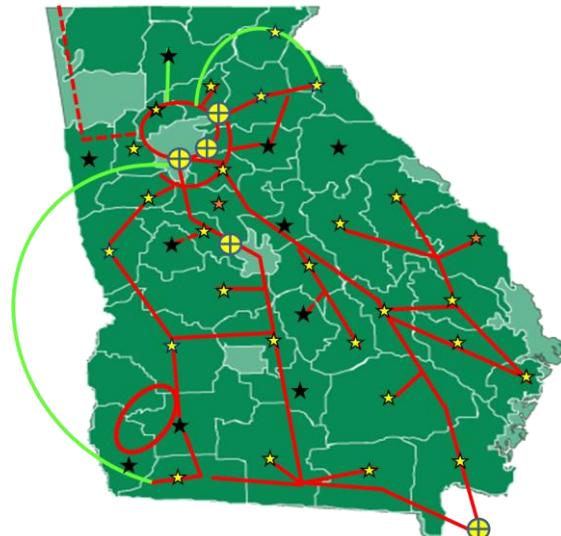
US Cooperative for Power Generation & Transmission

Customer Challenge

- Critical Need to Control Operational Destiny
- Need for Greater Network Capacity
- Essential to Improve Reliability and Security



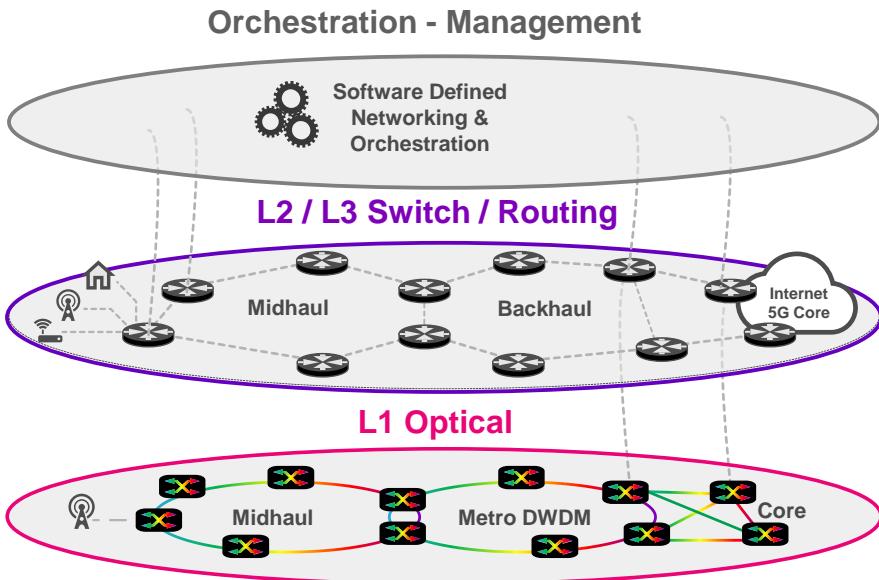
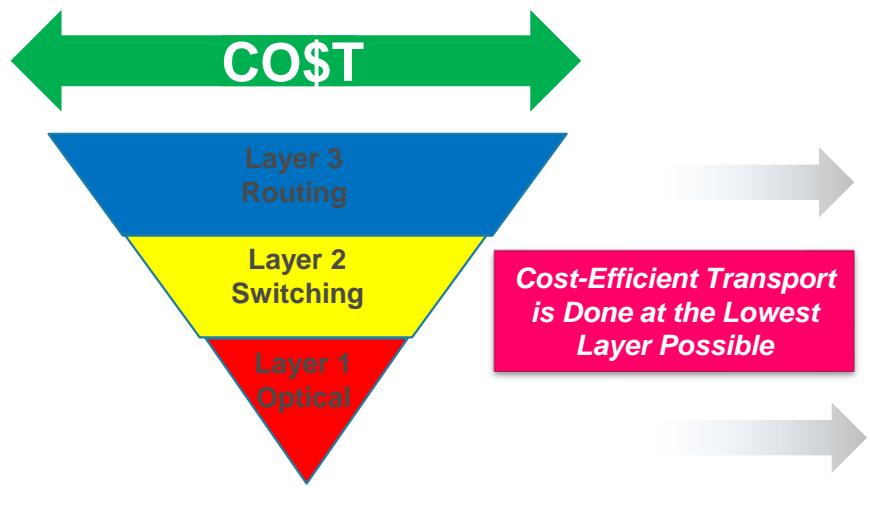
**Georgia
Transmission
Corp**
TSO owned by
38 EMCs.



Solution

- **Layer 1 Optical Transport**
 - Easily Scales as Demand Scales
 - Began as a 10G, Now Carrying 200G Lambdas
- **Highly Reliable**
 - 8-fold Reduction in Trouble Tickets
 - Integrated OTDR Fiber Health Management
- **Per Service Configurable Security**
 - Encryption for OT Traffic, Unencrypted for ISP/Partner Traffic
- **Statewide Backbone for Service Delivery**
 - Residential Broadband Service
 - Wireless Backhaul
 - Wave Services

Cost Effective Use of Technology

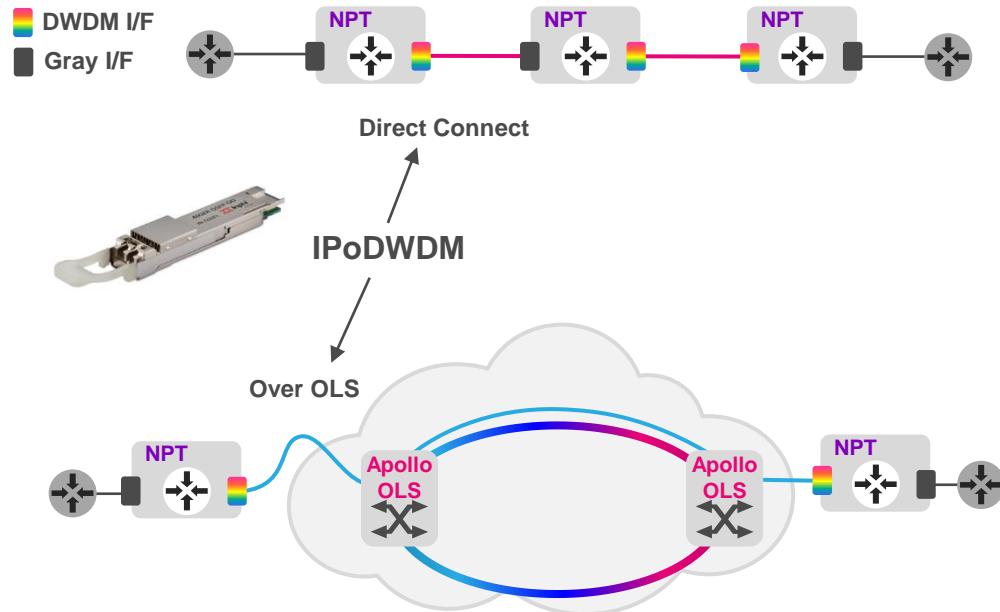


Transport Technologies Can Be Deployed Separately or In Combinations to Support Requirements

IPoDWDM Options – Eliminate Transponders

IPoDWDM  

- OIF 400G ZR and OpenZR+ for standard multi-vendor solution
- IPoDWDM single layer peer to peer high-capacity connectivity
- IP over Optical Multilayer
- Pluggable DCO tunable and rate configurable: 100G/200G/400G
- Reduce Spend on Signal Conversion





Traffic Growth

- Internet
- Mobile
- VOD
- Online Gaming



Capacity

- IP Links Growth from 10G to 100G with Trend to 400G and Beyond



Topology

- Transition from P2P Lines to Rings and Virtual Mesh Topologies



Network Simplification

- Fewer Protocols
- Programmability and Automation



Openness

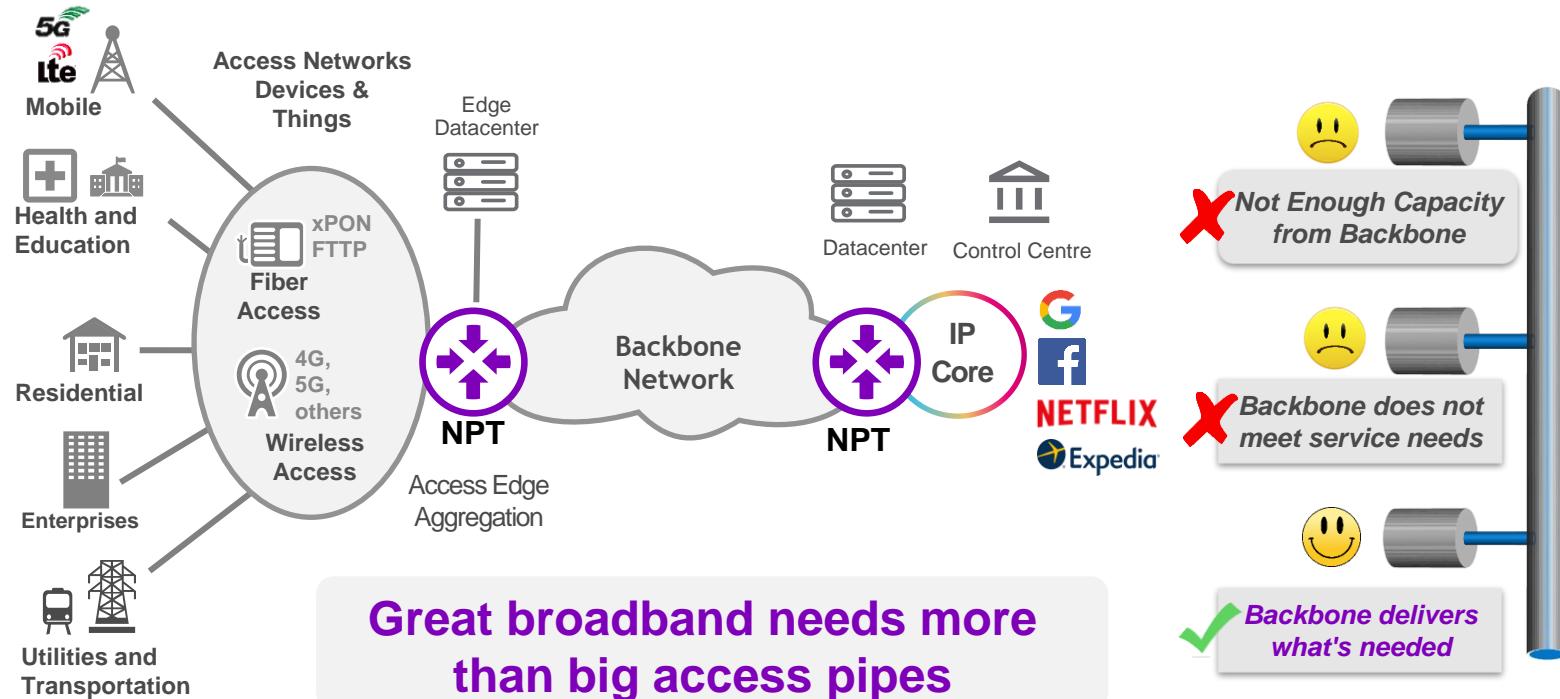
- Standardized Interfaces
- Decoupling Software from Hardware



Network Convergence

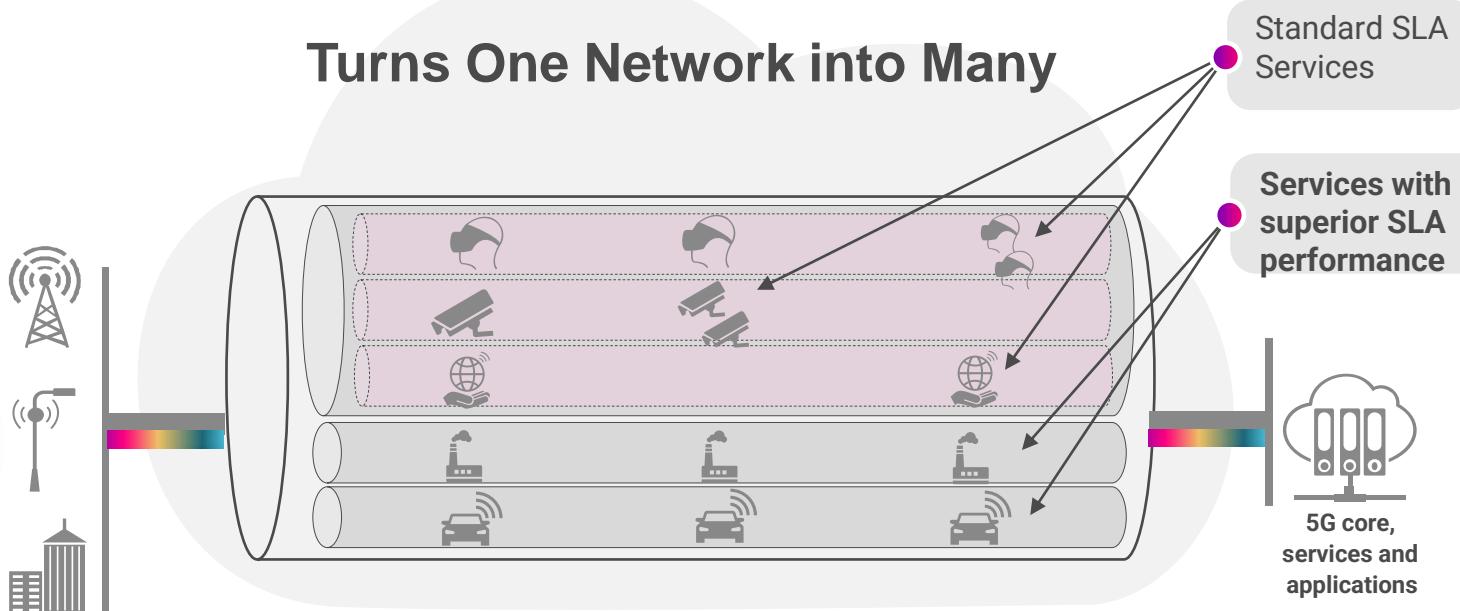
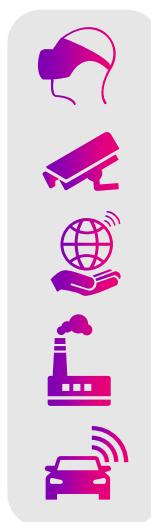
- TCO Savings
- Extended ROI
- Additional Revenue from Service Diversity

Rural Broadband: Improve Your Service Offerings



Network Segregation using Transport Network Slicing

Turns One Network into Many



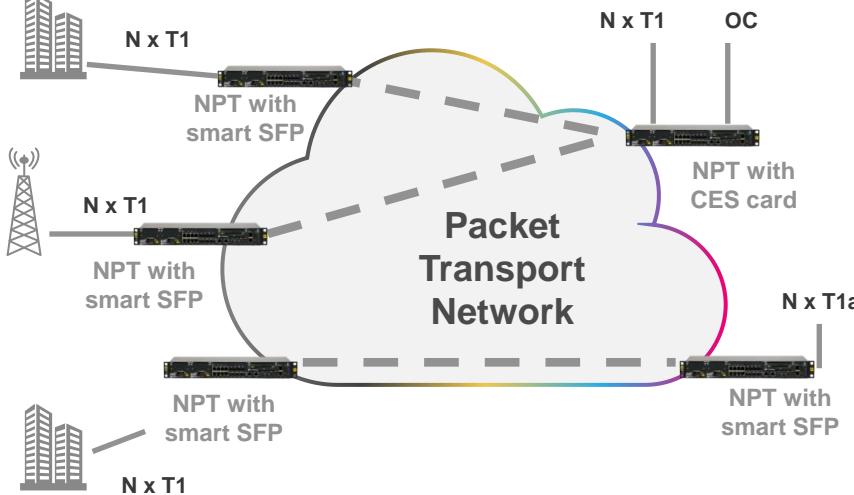
Hard Slices: Fiber, Wavelength, FlexE
Soft Slices: MPLS-TP, SR, VPNs



TDM to IP Migration: Circuit Emulation Services

Seamless and risk-free transport of legacy circuits

- **Comprehensive CES technology**
 - Both smart SFP pluggables and service cards
 - Supports SAToP, CESoPSN and CEP
- **Multiple Applications supported**
 - TDM aggregation
 - Voice Trunk Migration
 - Legacy Service Migration
- **Proven expertise**
 - Field proven processes for network migration
 - Supported many different solutions environments



Bypassing 200G, the Move is to 400G+ Lanes

Services Traffic

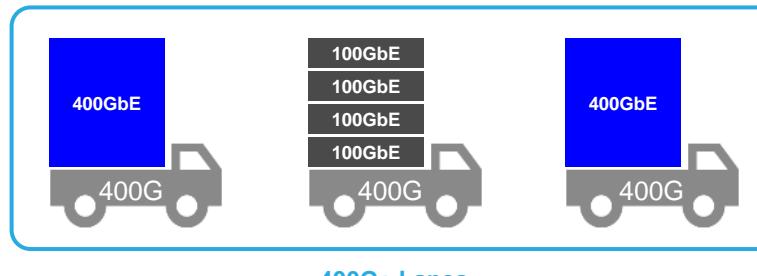
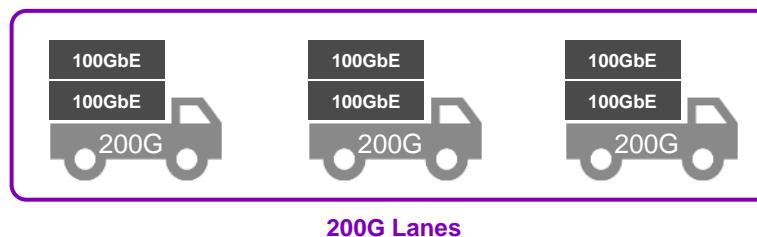
Yesterday

100 GbE

Today

400 GbE

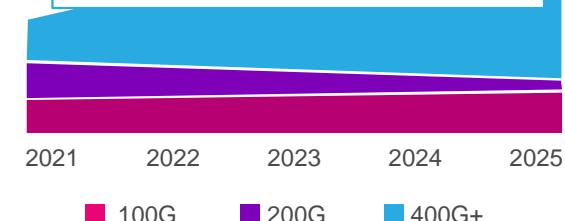
Optical Network



Market Forecast

400G+ Ports Shipments Forecast
(Source: Cignal AI)

400GbE ZR+
Coherent
Flexible 100-400G
Price Parity with 100G!



Customer Case Study: Twin Valley Telephone

Large Rural Service Provider, Clay Center, Kansas

Customer Challenges

- **Scale to Provide Robust Middle Mile**
 - Backbone Sized to Accommodate Current and Projected Growth
- **Network Reliability**
 - Automated, Flexible and Optimized Traffic Failover

Solution

- **IP/MPLS 400GbE Backbone**
 - Service Awareness
 - Sub 50ms Service Restoration (TI-LFA)
 - Advanced Traffic Engineering (SR-TE)



Customer Case Study: Wireless Backhaul

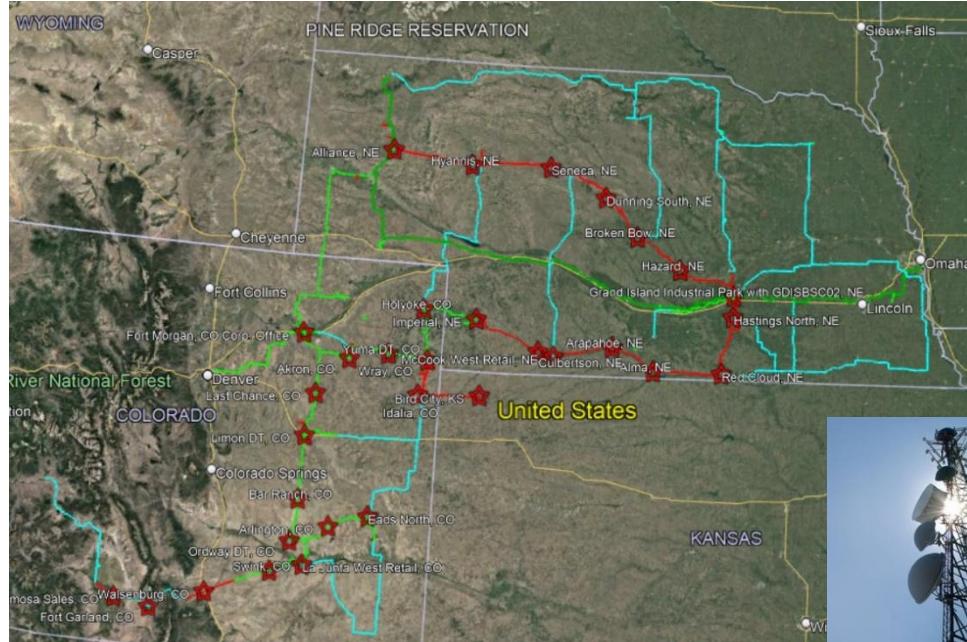
Large Rural Wireless Provider

Customer Challenges

- **Reliability is Paramount**
 - Hard Requirement for 5 x 9s Operation
 - Monitoring 2300km+ of Fiber
 - Reduce MTTR Fiber Outages
 - Sub 50ms Service Restoration
- **Aggressive Growth**
 - Backhaul for 1000+ Towers
 - Dual Data-Center Connectivity
 - Bandwidth and Service Diversity

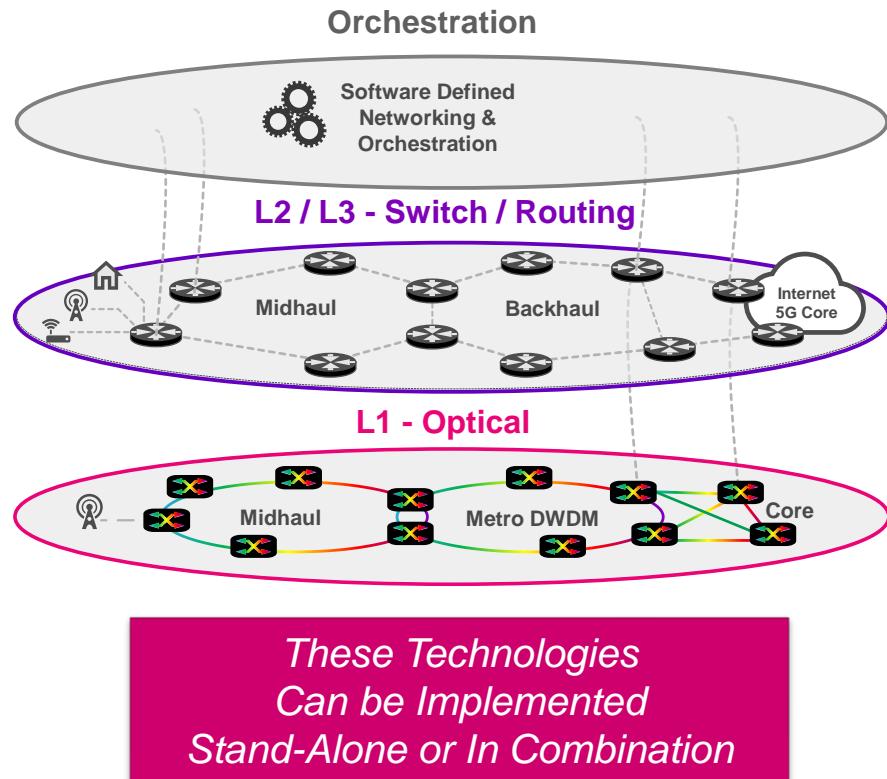
Solution

- **Comprehensive IP and Optical Design**
 - Provides Low Latency, Cost Effective Backhaul as well as Higher Level Service Awareness and Resiliency over 200GE & 400GE



In Summary: Design for Today, Scale to Tomorrow

- Today's Advanced Feature and Protocol Availability Are Game Changers
- Build to Meet Current Requirements But...
- ...What is Built Today Should Scale to Meet Future Demands Without a Forklift
- Add Revenue Potential
 - Wave Services
 - Per Service Encryption
 - Customized Service Awareness



Highlights

- Standards-Based IP and Optical Solutions
- Globally Deployed in Over 140 Countries
- No Persistent Licensing Fees
- 100% US-Based Support
- *Buy America Act and BABA Compliant*
- 10-12 Week Delivery on Entire Catalog





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ACCELERATING NETWORK TRANSFORMATION

