



# RURAL PERSPECTIVES

## Let's Innovate Now

**The Time is Right for Broadband**

CBRS, RDOF, 5G Fund for Rural America and You

Sam Lisle. October 22, 2020

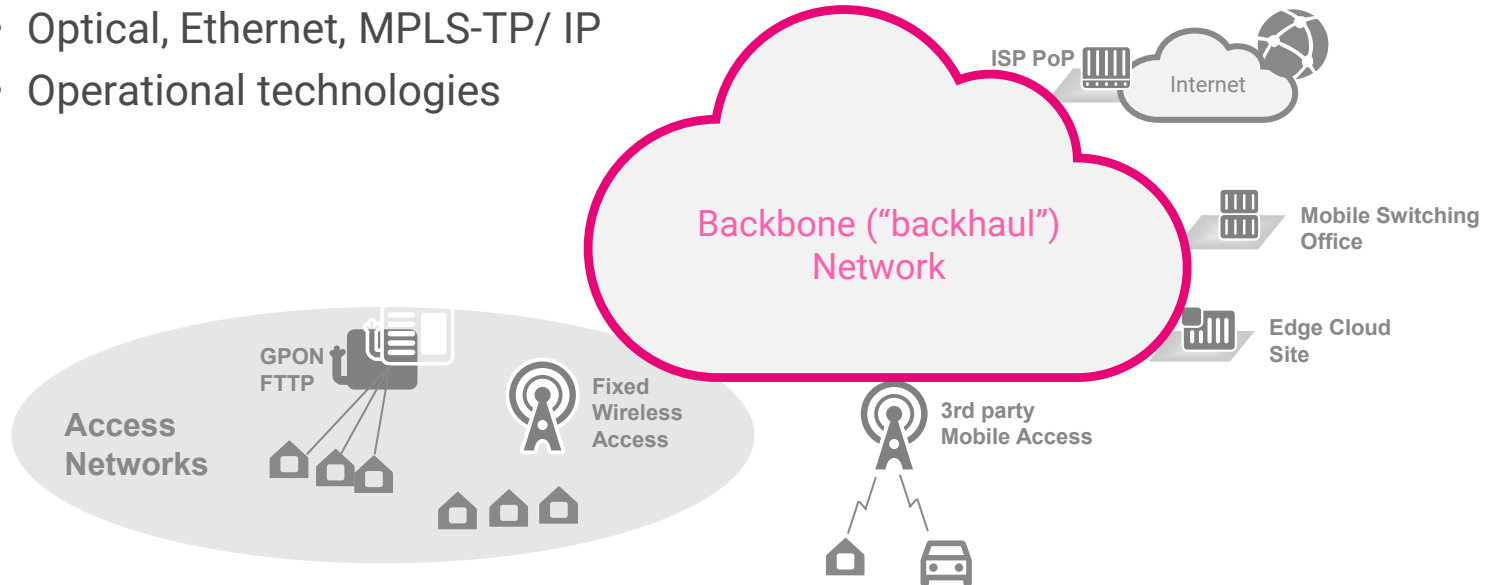
# The Time is Right for Broadband

- Work From Home (WFH)
  - Cloud gaming
  - Telemedicine
  - Tiger King 2.0...
  - Digital divide pain
- RDOF - \$20B over 10 years
  - 5G Fund for Rural America - \$9B over 10 years
  - State initiatives
  - Consortia forming
  - CBRS spectrum for fixed and mobile



# Great Broadband Needs a Great Backbone

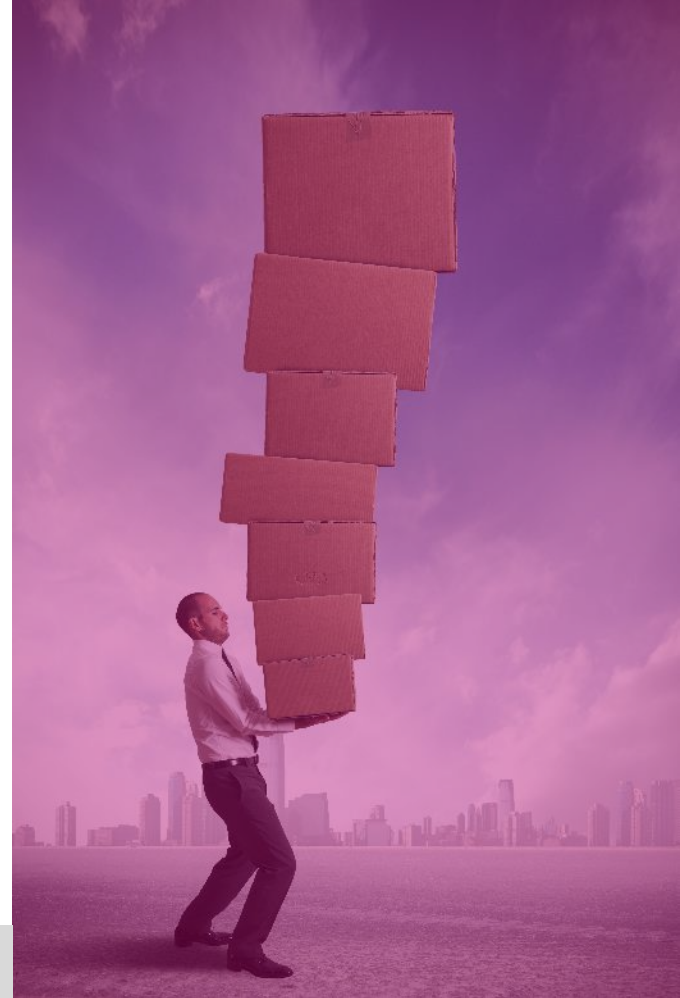
- Connects access networks to the Internet PoP / application
- The backbone is the cornerstone
- Many technologies/tools to choose from
  - Optical, Ethernet, MPLS-TP/ IP
  - Operational technologies



# Backbone Carries Many Loads

- Scale
  - Capacity and distance
- Range of applications
  - Gaming, OTT video, distance learning, telehealth... etc
  - Traffic isolation with diverse QoS
- Operational simplicity
  - Keep costs down with tools
- Positioned for the next opportunity
  - Backhaul for 5G mobile traffic

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# Dealing Effectively with Scale

- Access technology is great for **access**
  - xPON, FWA
- Backbone delivers **scale**
  - Optical, Ethernet, MPLS, MPLS-TP
- RDOF winners will offer higher speeds
  - Scale to higher bandwidth/capacity
  - Backbones of 100G+
- Internet PoPs may not be in your backyard
  - Scale to more distance
  - 100km away and beyond
- Can never have enough: Cheese puffs' bacon, Bacon-flavored cheese puffs, **Bandwidth**



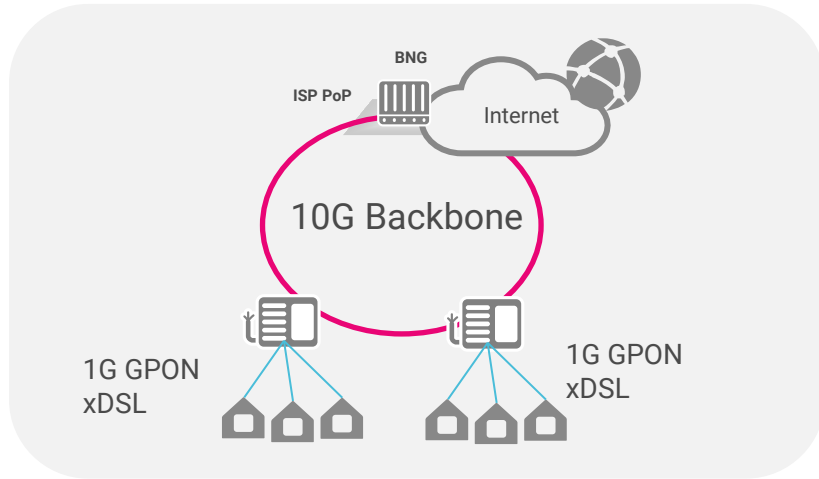
## RDOF Speed Tiers

Tier	Speed – Mb/s (down/up)
Minimum	25/3
Baseline	50/5
Above Baseline	>100/20
Gigabit	> 1000/500

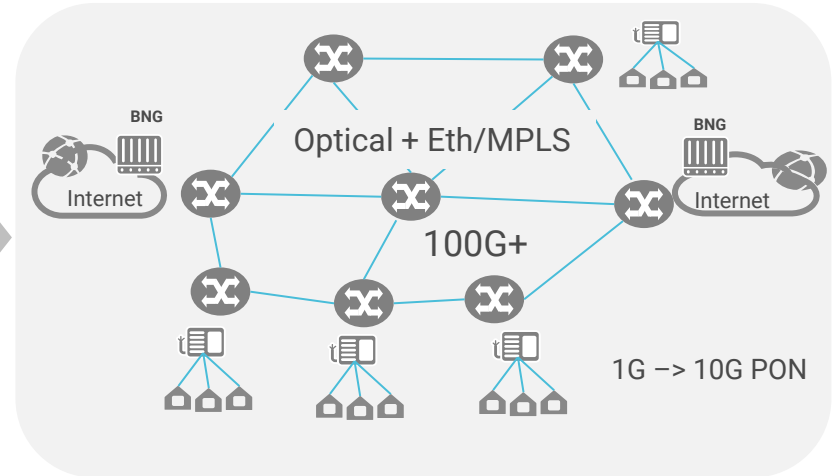
(CAF II was just 10/1 Mb/s)

# Speeds and Sites Increase

## 100G + in the backbone



- 10M -100M Access
- Lower Speed 1G PON
- Single PoP / Single Ring
- 10G “backbone”
- Access platform = small scale backbone

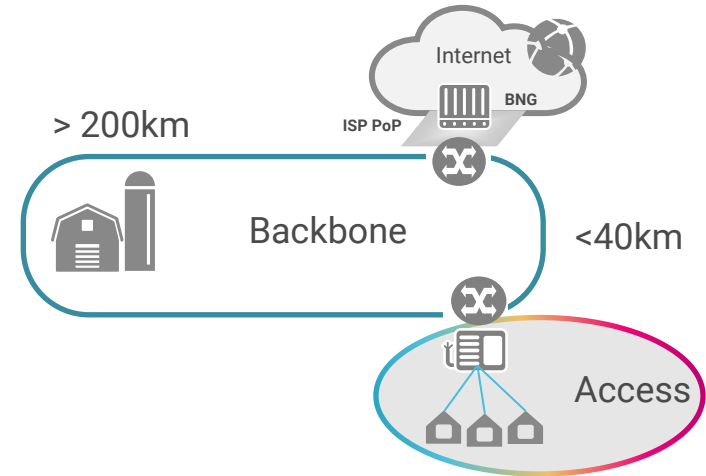


- 25M / 100M – 1Gb/s access
- Higher speed 10G PON
- Multi-PoP / Mesh
- Higher Capacity 100G +
- Backbone / access separation

# Scaling for Distance

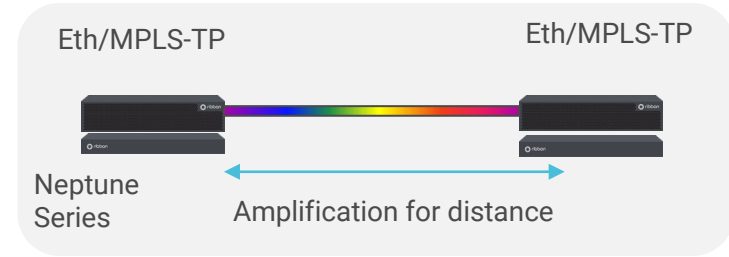
- Internet PoPs not always conveniently located
  - > 40-80km away
- Diversity may require a very long route
  - > 100's of km
- Can't get there with just Eth/MPLS routers/switches

*Backbone often requires optical amplification to achieve distance*



# Toolkit for Capacity and Distance

- Ethernet/IP with integrated amplifiers
  - Cost-effective especially for 1x100G
  - Can cascade to reach 100's of km
  - Single platform – small dose of optical
- Micro-ROADM layer
  - Scaling beyond 1x100G
  - Fully automated
  - Different waves for different applications
    - Broadband, OT, IT, 5G
  - New technology options lower cost/size
  - 20x space reduction over earlier generations




ROADM Layer includes amplification for distance



# Range of Applications – Diverse QoS

- Internet-based OTT Entertainment
  - High bandwidth, “best effort”
  - Latency ok. some loss ok.
- Cloud gaming
  - Low latency is critical
- Distance learning
  - Security, walled garden
- Telehealth
  - Encryption, privacy

*Different traffic types on a single network requires 'traffic engineering'*



'Oversubscribing' is **essential**

'Oversubscribing' can be a **problem**

Stolen bits are **disaster**

'Unfettered access is a **problem**

# MPLS-TP Guarantees Performance

- MPLS – “Transport Profile”
  - IP networking operated like SONET
- Engineered connections with “right” QoS
  - Connections are denied if network cannot support
- Deterministic network performance
- Isolate different traffic types and applications from one another
  - Ensure Tiger King 2.0 doesn’t harm gaming, telehealth
- Simplifies network operations
  - Point and click provisioning
  - Like SONET circuits with flexibility of IP/MPLS

*MPLS-TP: simple and guaranteed for diverse services backbone*



# Achieving Operational Simplicity

## Activating new service - finding problems

Ribbon  
Solutions



- No specialized knowledge
- Point and Click
- Lower-cost technician
- Remote operations
- No “Swivel chair” – single tool for optical and IP/MPLS



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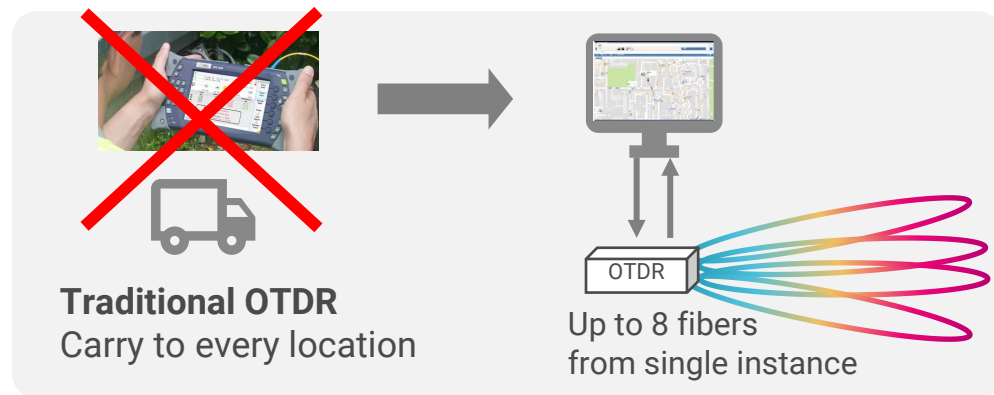
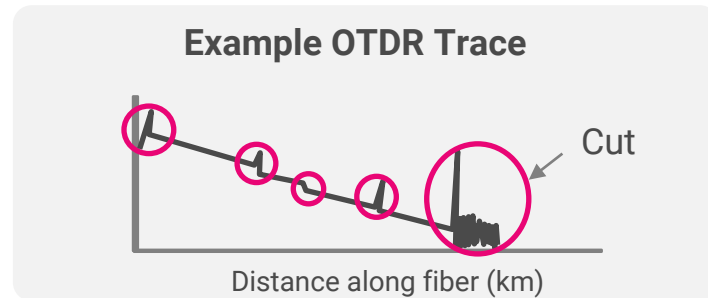


Traditional  
Switch/routers

- Specialized knowledge
- Command line interface
- Certified, High-cost technician
- Hands-on
- Swivel chair - different systems for packet and optical

# “Network OTDR” Quickly Pinpoints/Predicts Fiber Problems

- Optical Time Domain Reflectometer (OTDR)
  - Locates defects on a fiber to within meters
  - Ports to GIS database for lat/lon
- Traditionally a hand-held device carried to the field
- Now automated / integrated into the backbone



- No specialized knowledge
- Graphical Point - Click
- Lower-cost technician
- Remote operations
- No “Swivel chair”

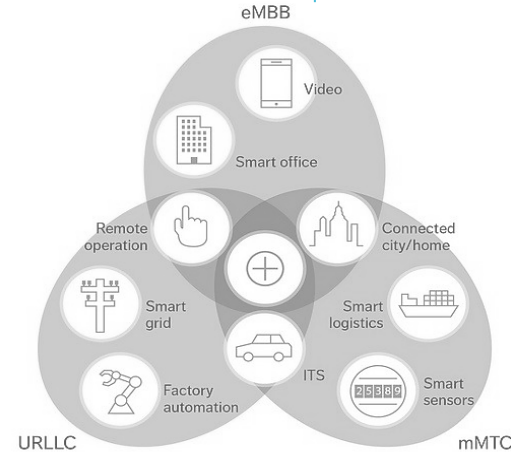
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# The Next Opportunity – 5G Transport

- \$9B 5G Fund for Rural America
  - A 5G small cell on every pole
- Backhaul will be essential
- A huge revenue opportunity!
- Backhaul must support “network slicing” (traffic isolation)
  - To support multiple mobile operators
  - Support multiple service types

5G Services are diverse

Enhanced mobile  
broadband - Bandwidth

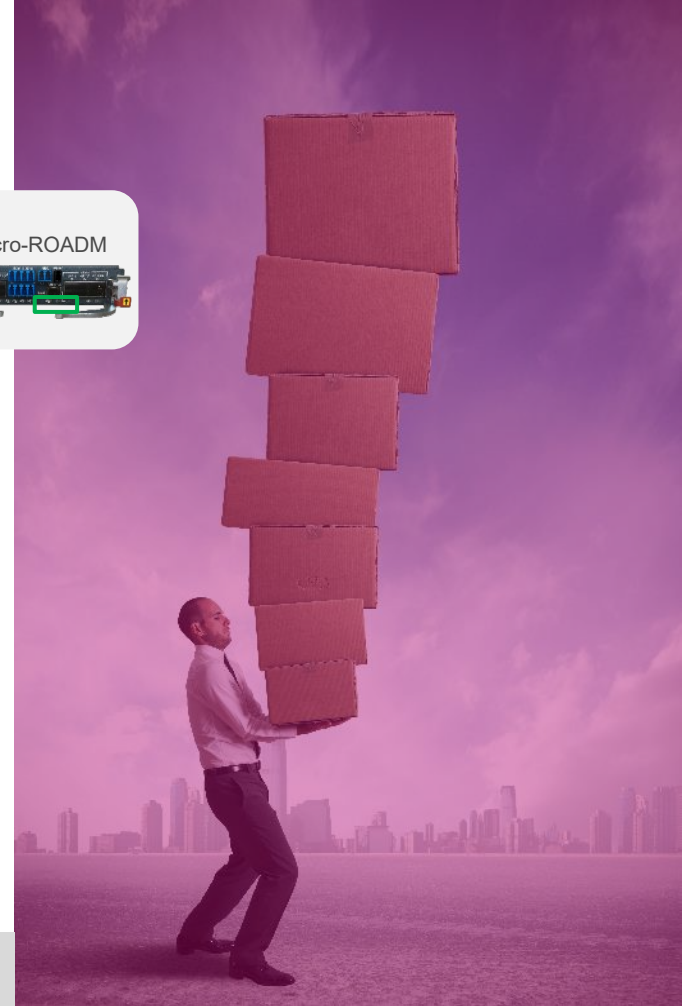


Ultra-reliable low  
latency connectivity  
- Lowest latency,  
highest availability

Massive machine-  
type communications  
- Scale at low cost

# Building a Great Backbone

- Scaling for capacity and distance
  - Separating access from backhaul
  - Low-cost ways of handling distance
- Support the range of applications
  - Point and click MPLS-TP circuits
- Operational simplicity
  - Point and click management system
  - Network OTDR
- Positioned for the next opportunity
  - Network slicing for 5G mobile transport



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Thank You

