

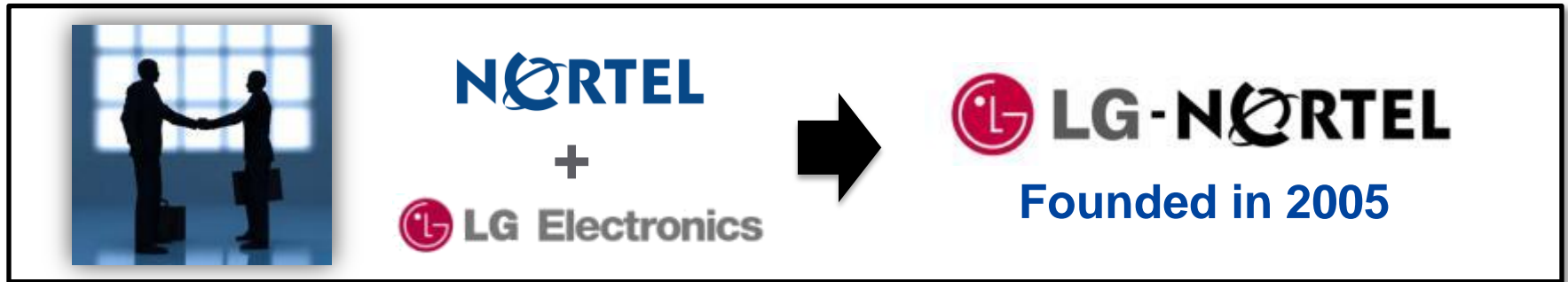
A stylized world map in shades of blue, centered on the Atlantic Ocean, with a grid overlay. The map is the background for the main content of the slide.

# Ethernet Access and WDM-PON

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Business Development Director  
Ethernet Access Solutions, EMEA

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# LG-Nortel Company Description



## LEADERSHIP IN TELECOMMUNICATIONS

- > Leading equipment supplier in Korea: No. 1 Wireless 3G, No. 1 Enterprise Voice
- > Franchise position with largest Korean carriers (SKT, KTF, LGT)
- > Global Enterprise vendor (No. 1 in select international markets)
- > One of Korea's largest telecom equipment vendors
- > Over 30 years of telecom innovation
- > Best-in-class resources develop leading edge telecommunications equipment

- A US\$1 Billion revenue company with approximately 1,300 employees
- 800 employees focused on R&D, 500 employees in Sales and Operations

# Ethernet Fiber Access WDM-PON Team

## LG-Nortel

- Product Leadership
- Hardware / Software / System Integration
- Merge WDM-PON Specialist **Novera Optics**
- Key IPR

## Nortel

- Optical Pedigree
- End-to-end Ethernet solution
- World-wide global sales channel

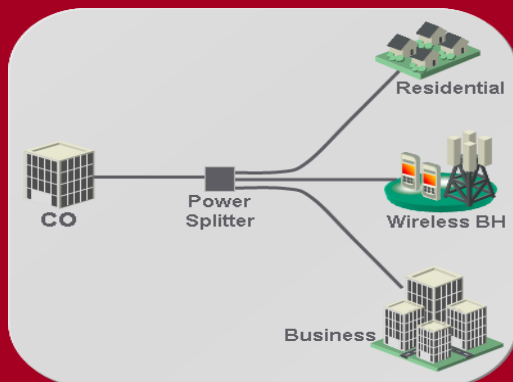
## KT

- Leading initial market requirements
- First WDM-PON commercial deployment
- 160K lines of FTTPole and 2k of FTTH
- Collaborating standardization



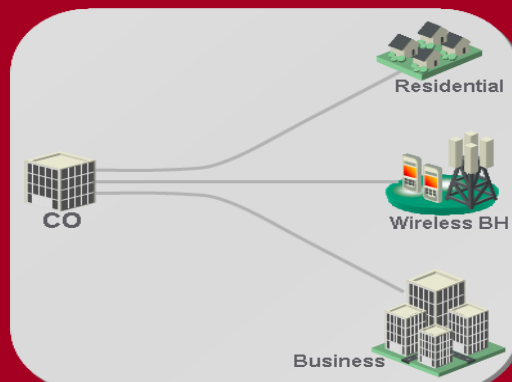
# Fiber Access Technologies

## TDM / GPON



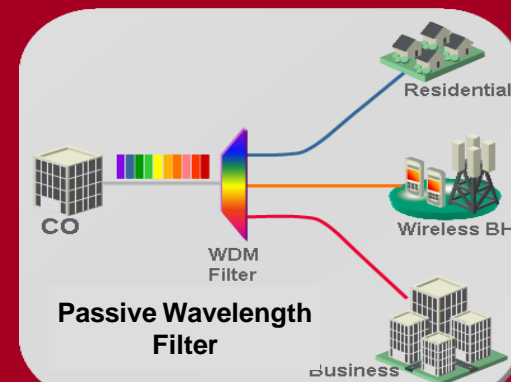
- ↑ Simplified CO Fiber Management
- ↑ Passive OSP Plant Solution
- ↑ Low power consumption
- ↑ Standards/Mature Technology
- ↑ Subscriber Density
- ↔ Interoperability
- ↓ Shared Bandwidth (DS & US)

## Point to Point



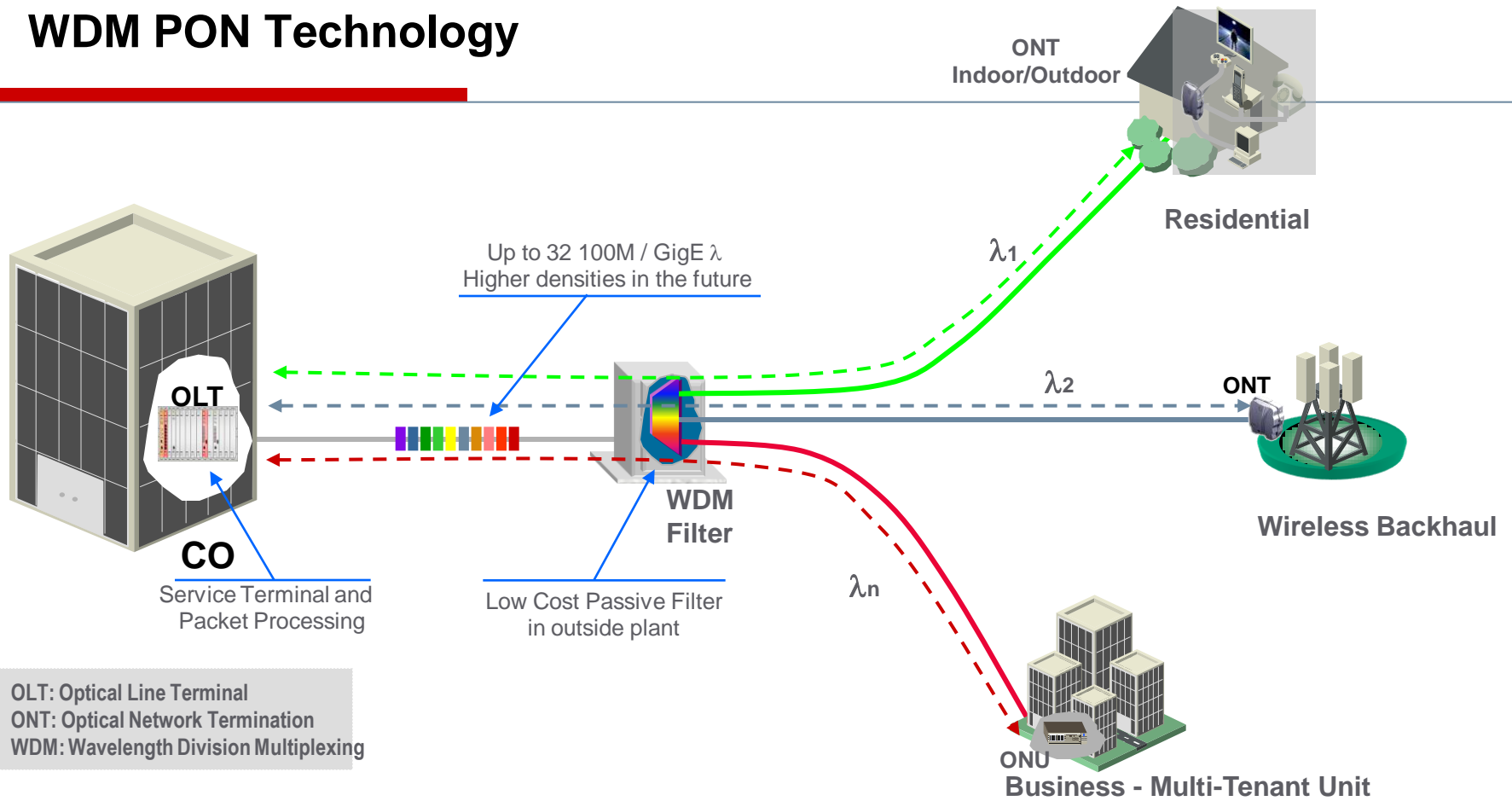
- ↑ Future Proof Architecture
- ↑ Follows Telco wiring Practices
- ↑ Simple Engineering & Planning
- ↑ Interoperability
- ↓ CO Fiber Management
- ↓ Fiber Availability
- ↓ Power Consumption
- ↓ Subscriber Density

## WDM PON



- ↑ Future Proof Architecture
- ↑ Follows Telco wiring Practices
- ↑ Carrier Grade Ethernet
- ↑ Simple Engineering & Planning
- ↑ Interoperability
- ↑ Simplified CO Fiber Management
- ↑ Passive OSP Plant Solution
- ↑ Colourless Optics
- ↔ Subscriber Density
- ↔ Power Consumption
- ↓ Standards Maturity

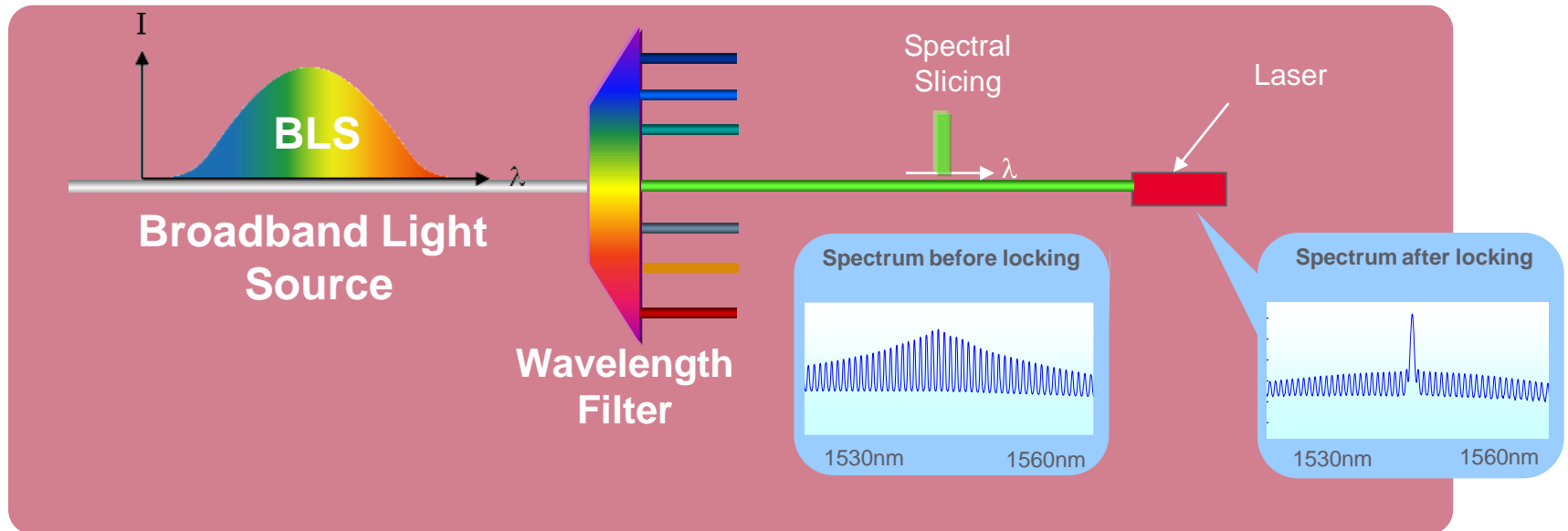
# WDM PON Technology



## Key Values

- Symmetrical bandwidth – Gigabit in both directions
- Secure service delivery – Physical separation of customer traffic
- Simple deployment model - Colorless ONTs, Auto Wavelength Selection
- Optimized Outside Plant - No Outside Plant Electronics, Single Fiber Working

## Automatic Wavelength Locking



**Colourless** ONUs

- Low inventory management cost
- Elimination of high cost wavelength-specific lasers

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# WDM PON product

# Ethernet Access 1100

Future Proof OLT

## Carrier-grade 11-slot chassis, 8 Service Slots

- 19" (W) x 10U (H) x 14" (D); 4 shelves/2.2m rack
- Integrated cooling units & maintenance ports
- 8 Universal Service Slots

## Integrated Packet Fabric

- Redundant, 1+1 protected 240G Switch Fabric
- Up to 8 SFP+ uplinks (GE / 10GE) per Switch card

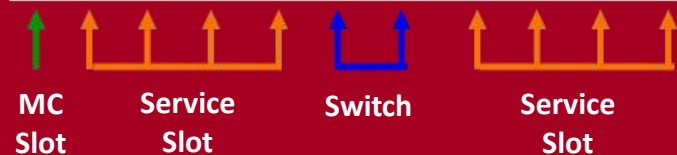
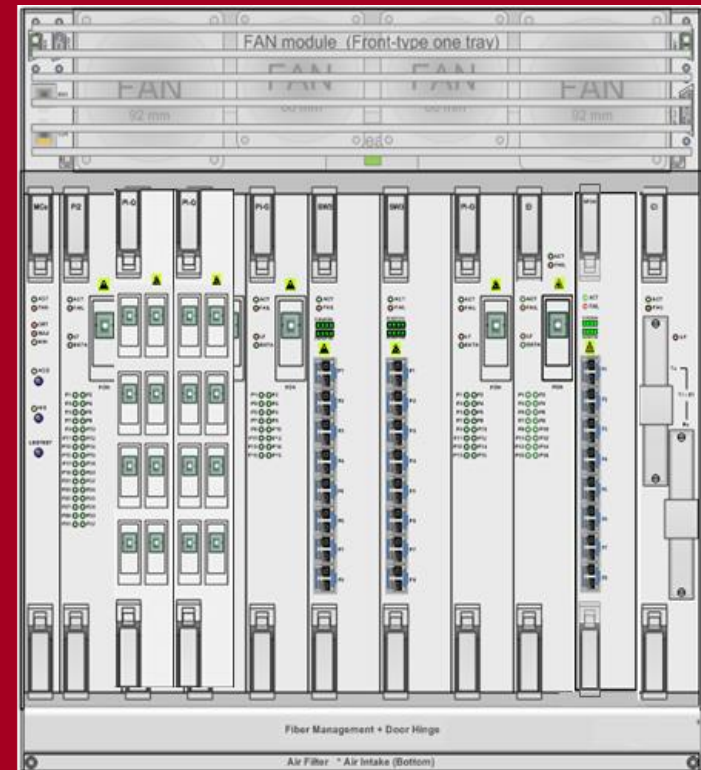
## Service Interfaces

### • Ethernet WDM PON

- Single Port/Single Fiber Working/Colourless
- ITU-T G.8032 E-SPRING Support
- 32 wavelength / 100Mbps
- 16/32 wavelength / 1Gbps

### • E1/T1 Circuit Emulation Service card

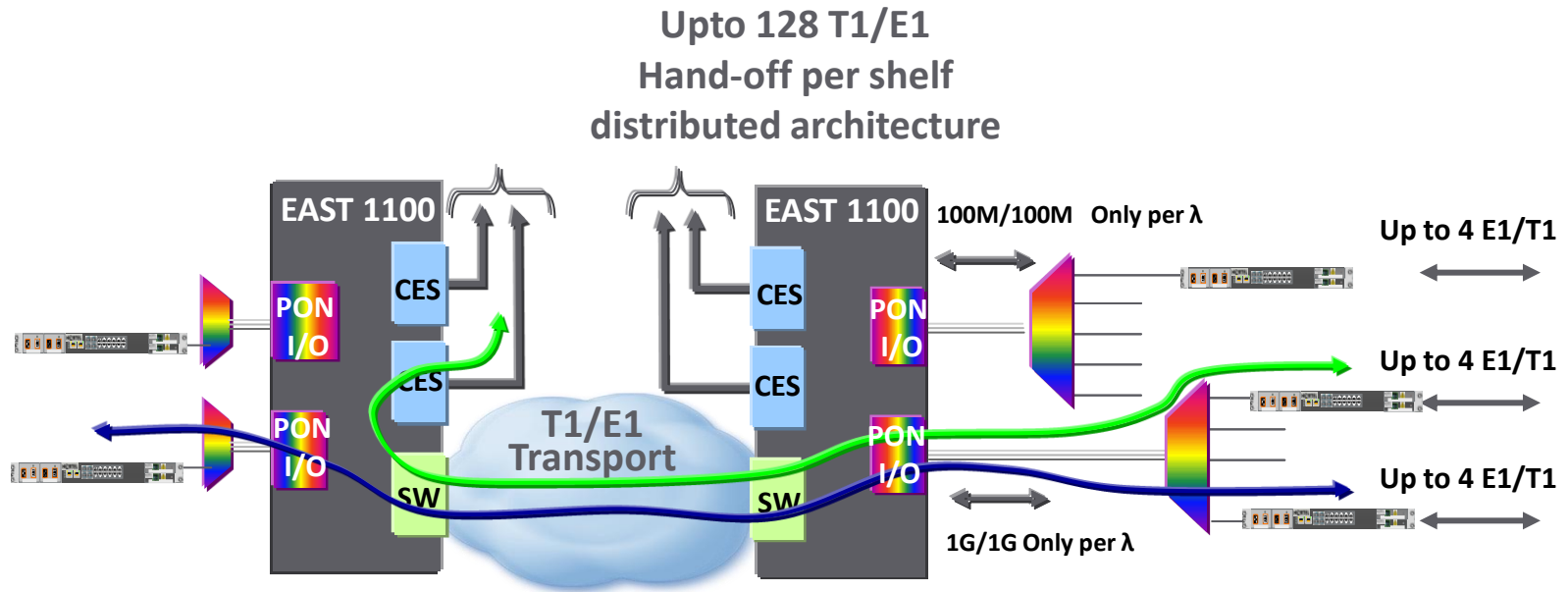
- 32xE1/T1 per CES interface card



Next Generation Fiber Access platform  
with an evolution to 40G per slot



# Business services: E1/T1 Circuit Emulation Service



## ➤ CES for TDM/legacy backhaul applications

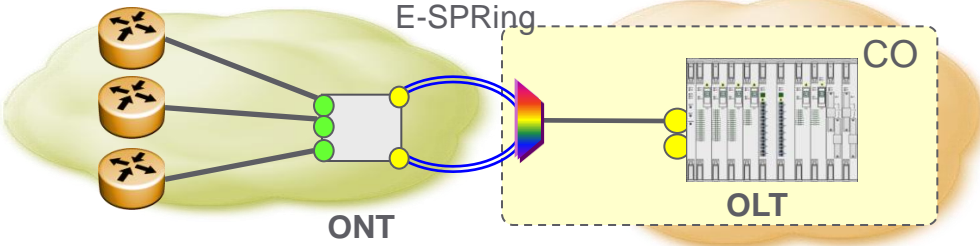
- Up to 32 E1/T1 ports per unit
- Up to 4 cards can be equipped on the shelf
  - consideration based on copper wiring cabling
- Equip PON Service unit from Left to Right Slot (1 – 8), T1/E1 CES unit from Right to Left (Slot 8 -> 1)
- T1/E1 capable provide sync timing to wireless bay station [futures]

# Business services: 1+1 protection

## Customer Sites

## Provider Network

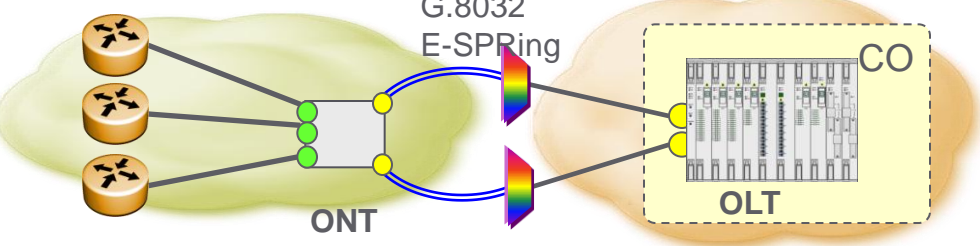
G.8032  
E-SPRing



## Customer Site

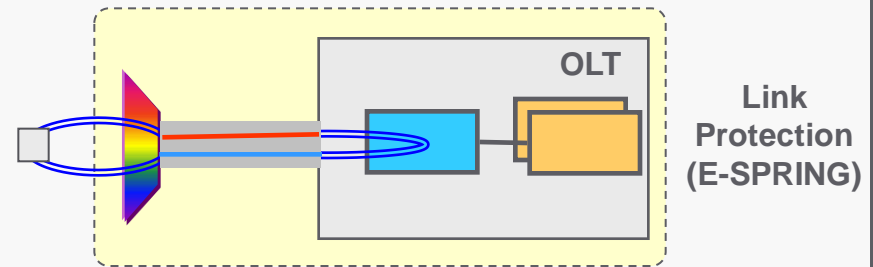
## Provider Network

G.8032  
E-SPRing



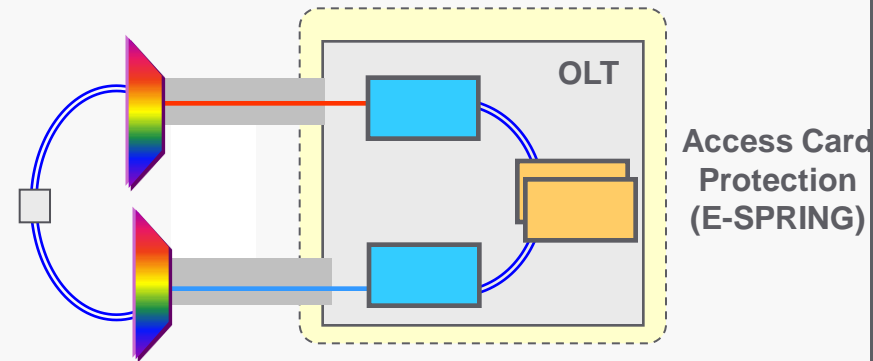
## Internal View

PI card  
SW card



Link  
Protection  
(E-SPRING)

Up to 32 x  
E-SPRing Per RN



Access Card  
Protection  
(E-SPRING)

# Business services: Ethernet OAM - 802.1ag, Y.1731

## ➤ Fault Detection using ETH-AIS

## ➤ Fault Notification using ETH-AIS

- ETH-AIS Transmission
- ETH-AIS Reception (ONT/ONU only)

## ➤ Fault Isolation using LBMs, LTMs

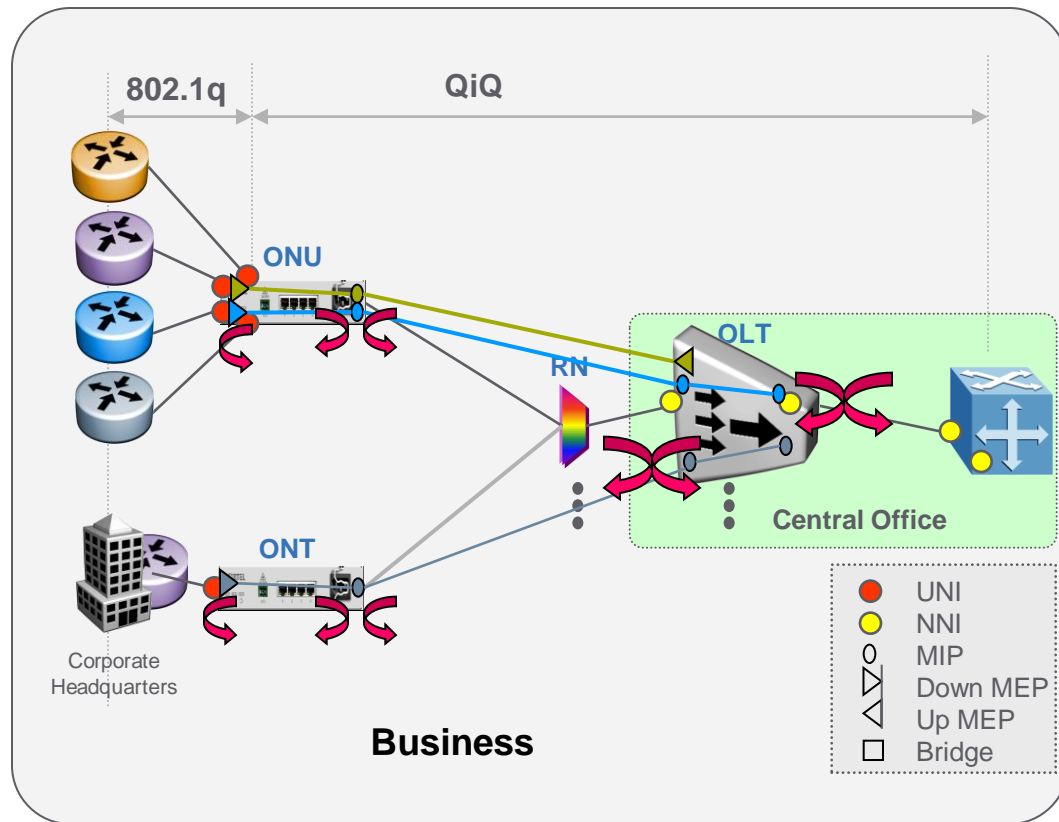
- Loopback L2 Ping
- Linktrace L2 Traceroute

## ➤ Fault Verification using

- LBMs for MTU validation
- LBMs for SLA validation (BW stress test)
- LBMs for Round Trip Delay measurements
- LTMs to discover service topology

## ➤ ONU Client Port Conditioning

- P2P Services
- Business ONT/ONU only



## ▪ Remote fault verification

## ▪ Remote fault isolation

## ▪ In-service fault detection, notification, isolation, verification, and client port conditioning

# Ethernet Access 1100

## Ubiquitous Ethernet Services & OAM

### EMS

- Interfaces: XML, Corba
- NE Discovery
- Fault Management
- Provisioning
- Inventory
- Performance
- EMS Redundancy
- Security
- Service Manager



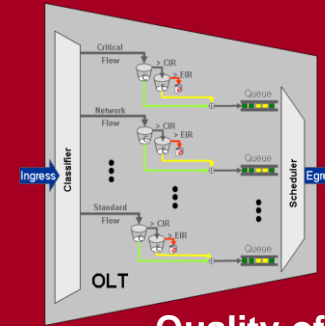
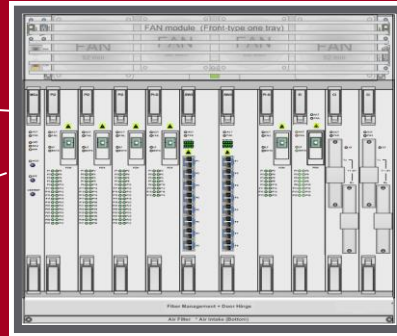
### North-South OAM

- Command Line Interface
- XML/Netconf
- SNMP V3
- Syslog

### OLT/ONT

#### East West OAM

- 802.3ah OAM Slow Protocol
  - Discovery
  - Critical Events: link fault, dying gasp
  - Event Notification
  - Remote Loopback Requests
- 802.3ah Extensions
  - Provisioning, Performance monitoring, Fault monitoring, System Recovery, Upgrades
- 802.1ag/Y.1731 Ethernet OAM
  - Loopback
  - Link trace
  - Round Trip Delay
  - Client Port Conditioning via AIS



### Quality of Service

#### Flexible Classification

- Layer 1: Physical port
- Layer 2: 802.1q (VLAN ID or Pits) or Ethertype
- Layer 3: ToS or DSCP
- Layer 4: Source/Destination TCP/UDP port

#### Metering, Marking and Policing

- Dual rate three color metering and marking algorithm.
- Configurable bandwidth profiles.

#### Queuing/Scheduling

- 8 queues per port
- Active Q Mgmt (RED, WRED)
- Strict Priority and/or DWRR
- Per Class Shapers



### Residential Services



### Business Backhaul Services

### L2/L3 Services

- 802.1q/802.1ad/QiQ encapsulation
  - 802.1Q ingress and Egress VID translation.
  - 802.1Q VID translation with QiQ
- MEF Services
  - EPL, EVPL, E-LAN, E-TREE
  - Feature rich UNI capabilities at ONT and OLT
  - Layer 2/3 Control Protocol transparency
  - Circuit Emulation (E1, T1)
- TR-101 Services
  - 1: 1 and 1:N service mappings
  - Service and Subscriber based tagging Models
  - Wholesale Services
- Multicast- IGMP v2/v3, PIM SM,SSM, IPTV ACL
- Voice (SIP), Security, SyncE

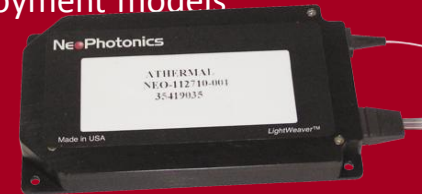
Transparent to underlying topologies – WDM PON, Ethernet



## Outside Plant Enclosures collaboration with Ecosystem partners

- Partnering with lead global FTTH supplier
- AWG Component Integration within existing OSP solutions
- Coexistence with PLC power splitter technologies

- WDM Filter based on AWG technology
  - Athermic , Cyclical design
  - Extended temperature application
- Flexible/ Ruggedized packaging available for multiple applications and installations
  - Pole Mount, Cabinet Style, manhole/buried
  - Mechanical Packaging available for flexible deployment models



# Ethernet Access 1100

## ONU Residential Portfolio Strategy

### Indoor Residential Design



- Stylish, Compact and Environmentally friendly design
- Voltage power adaptor (90~264Vac)
- Optional UPS Power Connector
- Installed vertically or horizontally with available cradle
- Temperature : 0° to 50 °C, Humidity : 5 ~ 95%
- **Interfaces**
  - Multi-port RJ45 e/w upto 4 10/100 Base-T
  - Upto 4 RJ11 Ports
  - Optical Connector – SC/APC

### Outdoor Residential Design



- Small Form Factor (SFU, SBU only)
- NEBS, GR1350, GR63, GR49 - Enhanced Lightening Protection 6Kv
- -40c to +65c (+45c with solar load)
- Optional outdoor Slack Fiber Management
- Optional Internal Fiber Raceway

### Optional Residential Gateway Capabilities



- Small Form Factor (SFU, SBU only)
- **Interfaces**
  - Multi-port RJ45, 4 10/100 Base-T
  - 2xPOTS RJ11 Ports, WiFi b/g/n
- Home Networking



+ extensive portfolio of 3<sup>rd</sup> party CPE solutions from Ecosystem partners:

- WDM PON
- GPON
- Ethernet Pt-Pt



# Fiber Access Landscape

|                         | G-PON   | WDM-PON   | P2P Ethernet   |
|-------------------------|---|---|--|
| Fiber Utilization       | <ul style="list-style-type: none"> <li>• <b>Optimized fiber infrastructure</b> reducing first-in FTTH deployment cost and recurring OPEX</li> </ul>                                     |   | <ul style="list-style-type: none"> <li>• <b>High fiber counts</b> being home run to CO</li> </ul>                          |
| OSP Infrastructure      | <ul style="list-style-type: none"> <li>• <b>Passive OSP</b> drives reduction in OSP installation and recurring OPEX</li> <li>• Active equipment <b>consolidation</b> into CO</li> </ul> |   | <ul style="list-style-type: none"> <li>• <b>Active equipment distributed</b> in Small Office or Active Cabinets</li> </ul> |
| Applications / Services | <ul style="list-style-type: none"> <li>• Tailored for <b>Residential 3-play</b></li> </ul>  | <ul style="list-style-type: none"> <li>• <b>Residential, business &amp; backhaul</b> enabled by symmetric, dedicated bandwidth</li> </ul>   |  |
| Network Simplicity      | <ul style="list-style-type: none"> <li>• <b>Shared asymmetric</b> bandwidth per subscriber</li> </ul>   | <ul style="list-style-type: none"> <li>• <b>Dedicated symmetric</b> bandwidth to all subscribers</li> <li>• Simple engineering</li> </ul>   |  |
| Network Evolution       | <ul style="list-style-type: none"> <li>• <b>Complex upgrade</b> → scaling end-user b/w requires <b>OSP changes</b></li> </ul>   | <ul style="list-style-type: none"> <li>• <b>Deterministic</b> → simplified capacity planning</li> <li>• Evergreen → <b>no change to OSP</b> as line rates evolve</li> </ul>                   |  |
| Security                | <ul style="list-style-type: none"> <li>• <b>Logical</b> customer &amp; service separation only</li> </ul>   | <ul style="list-style-type: none"> <li>• <b>Dedicated wavelength</b> providing <b>physical</b> separation for <b>simplified</b> security, fault isolation &amp; service disconnect</li> </ul> |  |

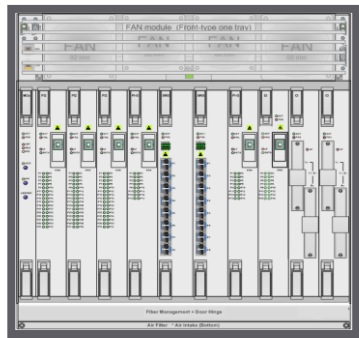
**WDM-PON provides the fiber relief of PON solutions while maintaining the operational values of P2P Ethernet**

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# Applications

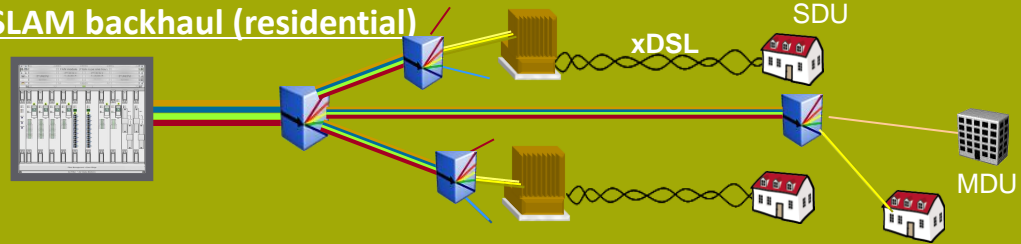


# Applications

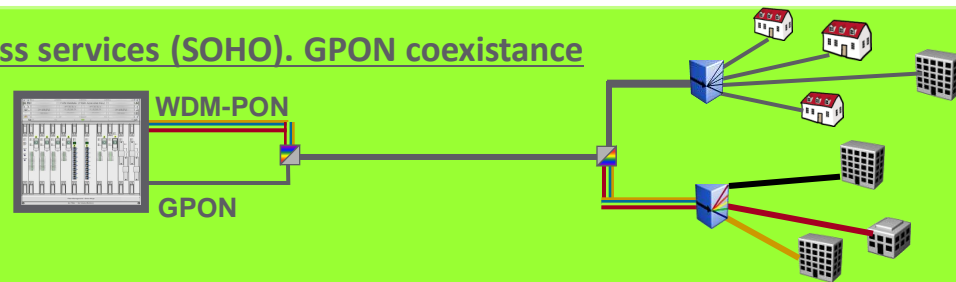


**Ethernet Access 1100**  
Fiber Optical Line Terminal

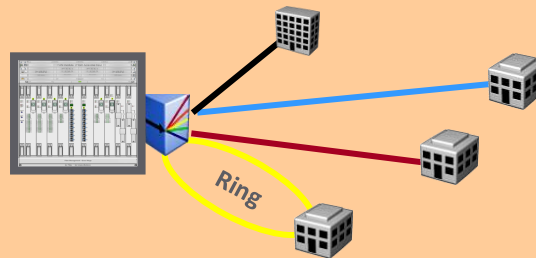
## IP-DSLAM backhaul (residential)



## Business services (SOHO). GPON coexistence

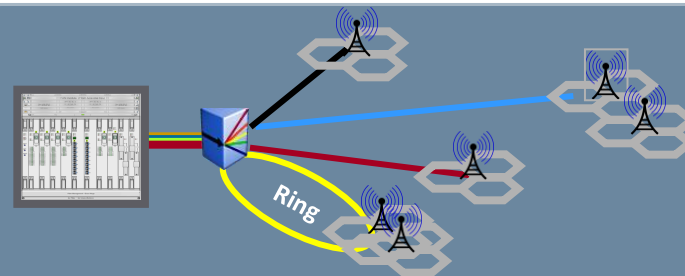


## Business services. Large corporations



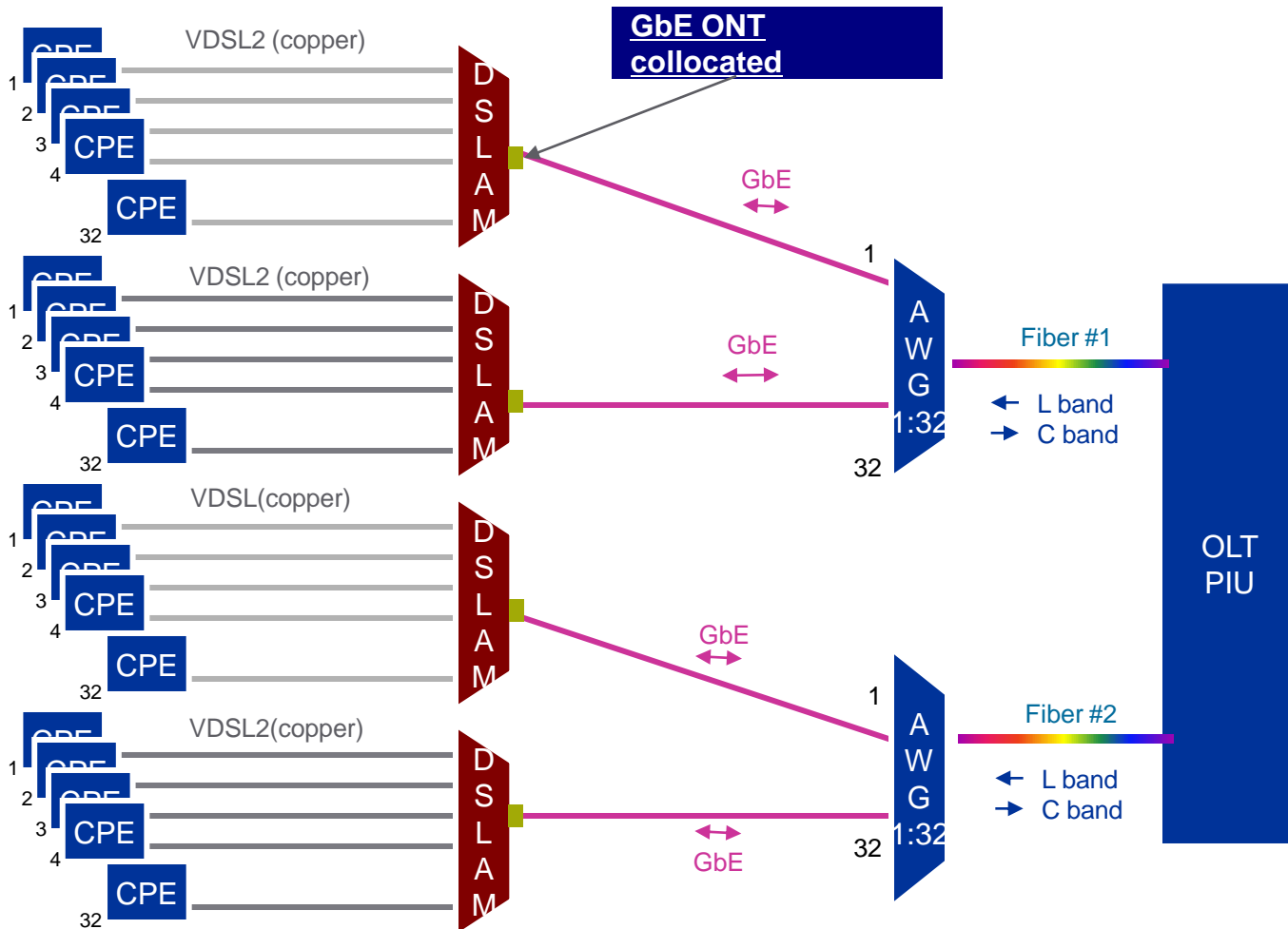
- Secure, Scalable (QiQ)
- Redundancy (E-SPRing)
- Remote Diagnostics (802.1ag, Y1731)
- TDM circuit extension

## Wireless Backhaul

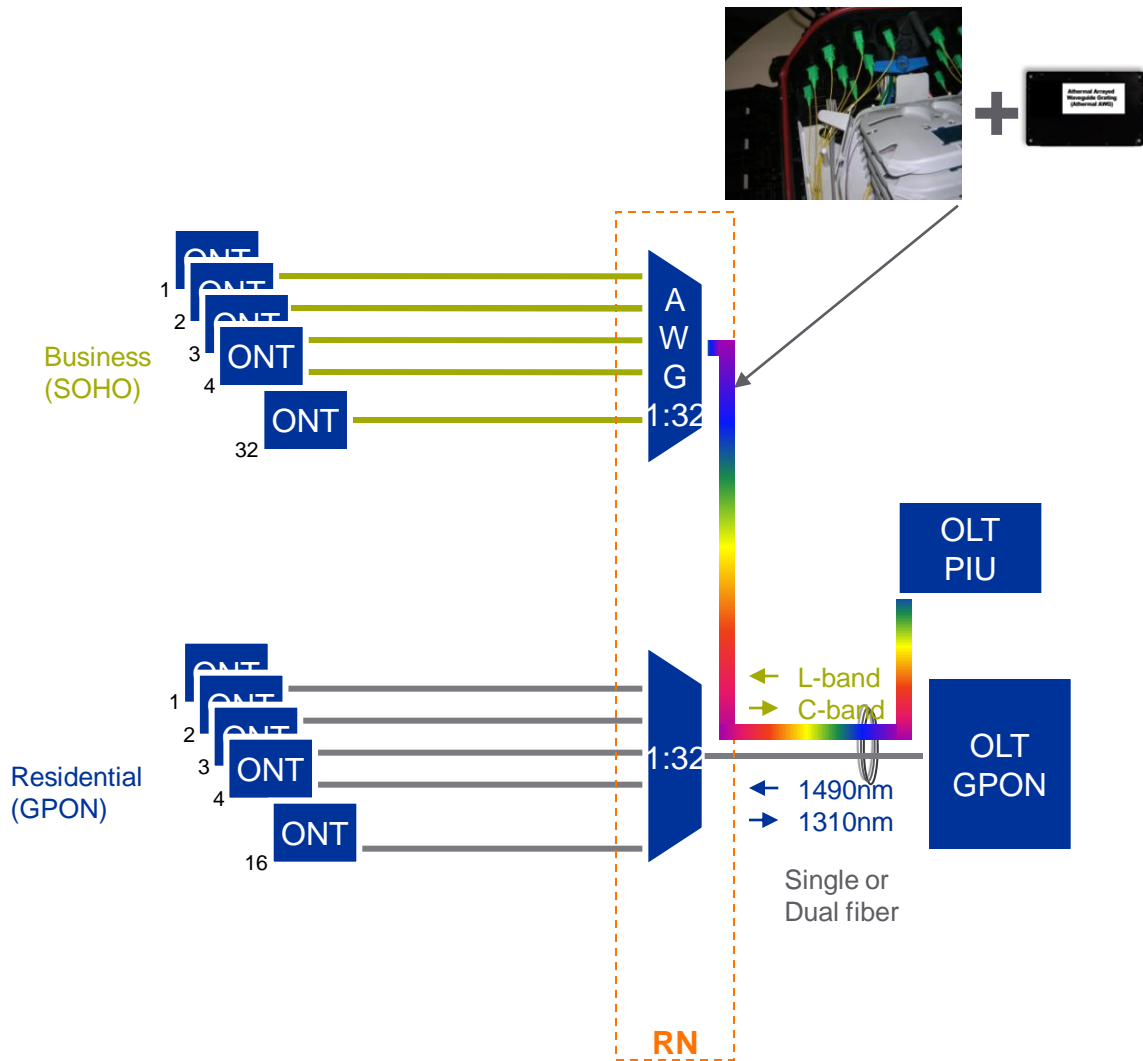


- Secure, Scalable (QiQ)
- Redundancy (E-SPRing)
- Remote Diagnostics (802.1ag, Y1731)
- TDM circuit extension
- Synchronization Distribution

# Applications (1/4) – IP-DSLAM Backhaul



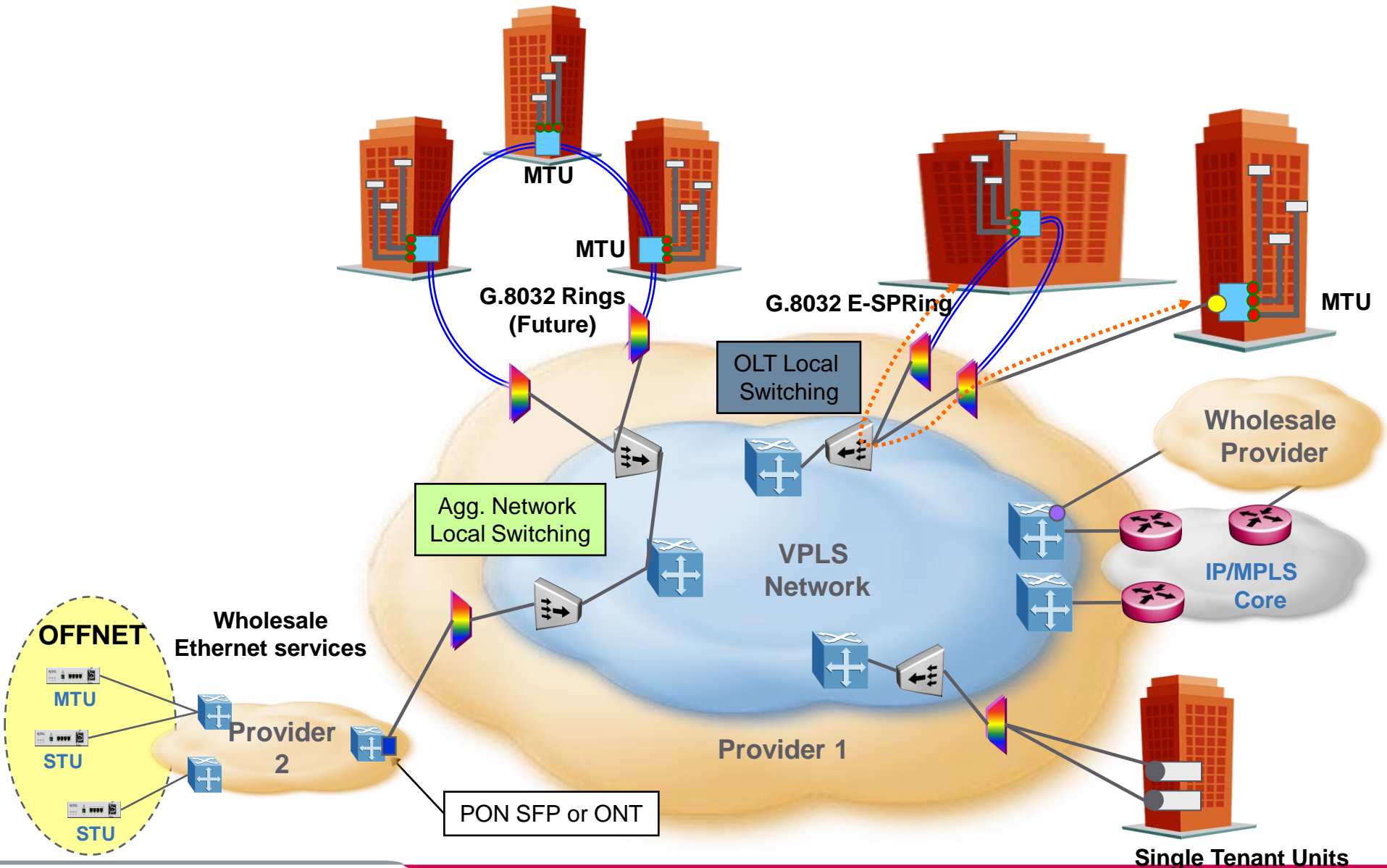
# Applications (2/4) - Business services. SOHO (over GPON)



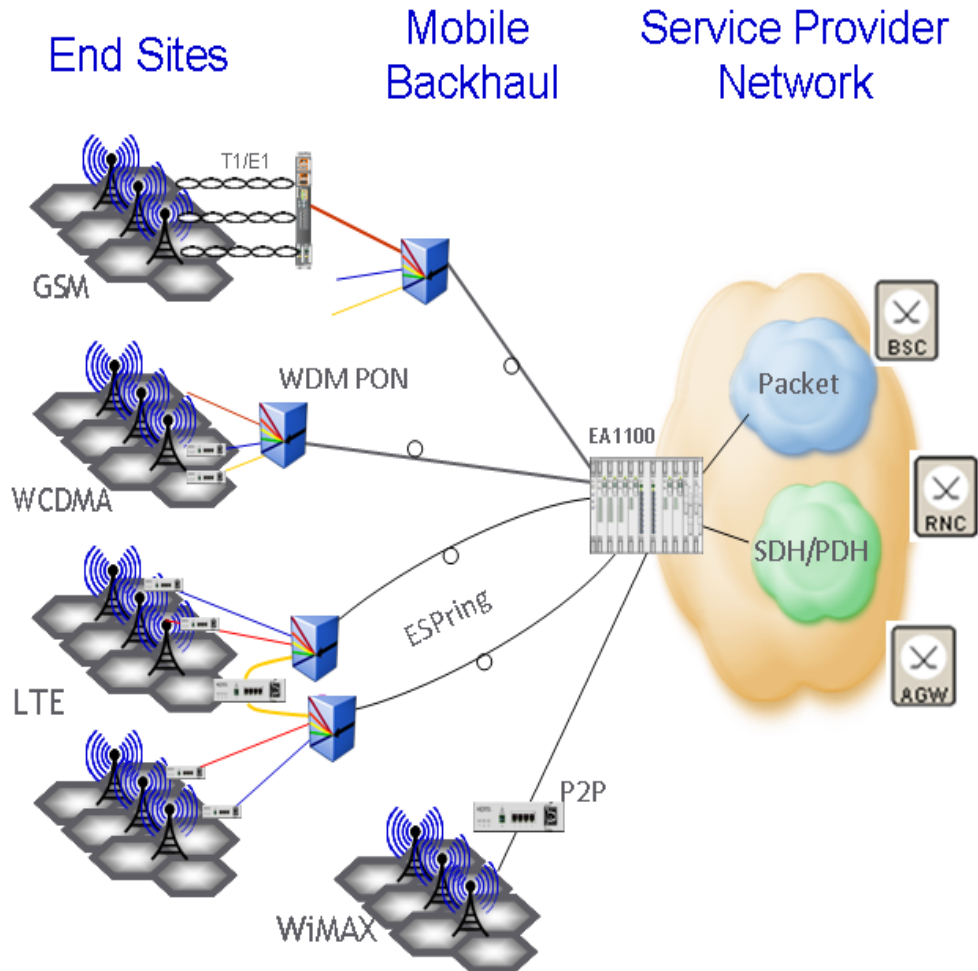
## Advantages

- Optimized Ethernet based fiber edge offering advanced business services
  - Scalable upto 1GE per user
  - Symmetrical Bandwidth
  - Single Fiber
  - 32 wavelengths per PON
  - not shared
- Carrier Grade Protection
  - E-Spring (ITU-T G.8032) Protection – To prevent traffic disruption; 50mSec restoration
- Carrier Grade OAM
  - Layer 2/3 Control Protocol transparency
  - 802.1Q, QiQ Support, ELAN
  - Multi QoS, Metering, configurable BW, WRED/RED, DSCP
- Remote Monitoring
  - 802.1ag, Loopback, Link Trace, CCM Generation
  - Y1731 Capabilities - Round Trip Delay, Client Port AIS

# Applications (3/4) – Large corporations (IP/MPLS)



# Applications (4/4) - Wireless Backhaul



## Advantages

- Optimized Ethernet fiber edge offering for cost effective network transition to 3G/4G/WiMAX backhaul
- Scalable Fiber infrastructure
  - **symmetrical bandwidth per  $\lambda$**
  - **Upto 1G services, Single Fiber**
  - **32 wavelengths per PON**
  - **Secure, not shared**
- Network Resiliency
  - **E-Spring G.8032 Line Protection – To prevent traffic disruption**
- Synchronization – For efficient handoff between BTS/NodeB and remotes
  - **Local BITS Timing**
  - **Physical Line – Sync E**
  - **Adaptive Clock Recovery -1588v2 Ready**
- TDM Support – For backhaul 2G/3G/4G cellular traffic
  - **CESoE Encapsulation**
  - **Headend T1/OC3/12 handoff**

Future Proof Wireless Infrastructure

# Lead customers

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# Summary

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## Passive Outside Plant Designs

- **Leverages** the passive outside plant design principles

## Technology

- **WDM PON – Tailored for Backhaul and Advanced Business Service**
  - **Sustainable** bidirectional bandwidth than alternative technologies
  - **Dedicated** point to point bandwidth per wavelength that is secure and scalable
  - New subscriber turn up is **independent** of existing subscribers

**LG-Nortel EA1100** Platform cost effectively support Business, Residential and backhaul applications ubiquitously

