



> **BUSINESS MADE SIMPLE**

WDM-PON Technology: How it can facilitate the last mile

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NORTEL

Agenda



1. *Market trends and requirements*

Market dynamics

Market requirements

Deployment options

Standardization in progress

2. *Nortel's vision of Next Gen Access*

Key Technologies and benefits

Solution Overview

3. *Conclusion*

Market Dynamics

The Challenge for Service Providers



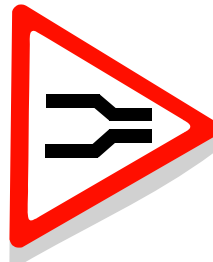
Dynamics: Bandwidth and Content



- More bandwidth hungry applications
- More devices designed to access the network
- Digital content is driving massive bandwidth demand
- Growing competition to win End user
- End users are consuming more than ever

Challenge: Overcoming the Last Mile bottleneck

High bandwidth Core Networks



Bandwidth delivered to End User



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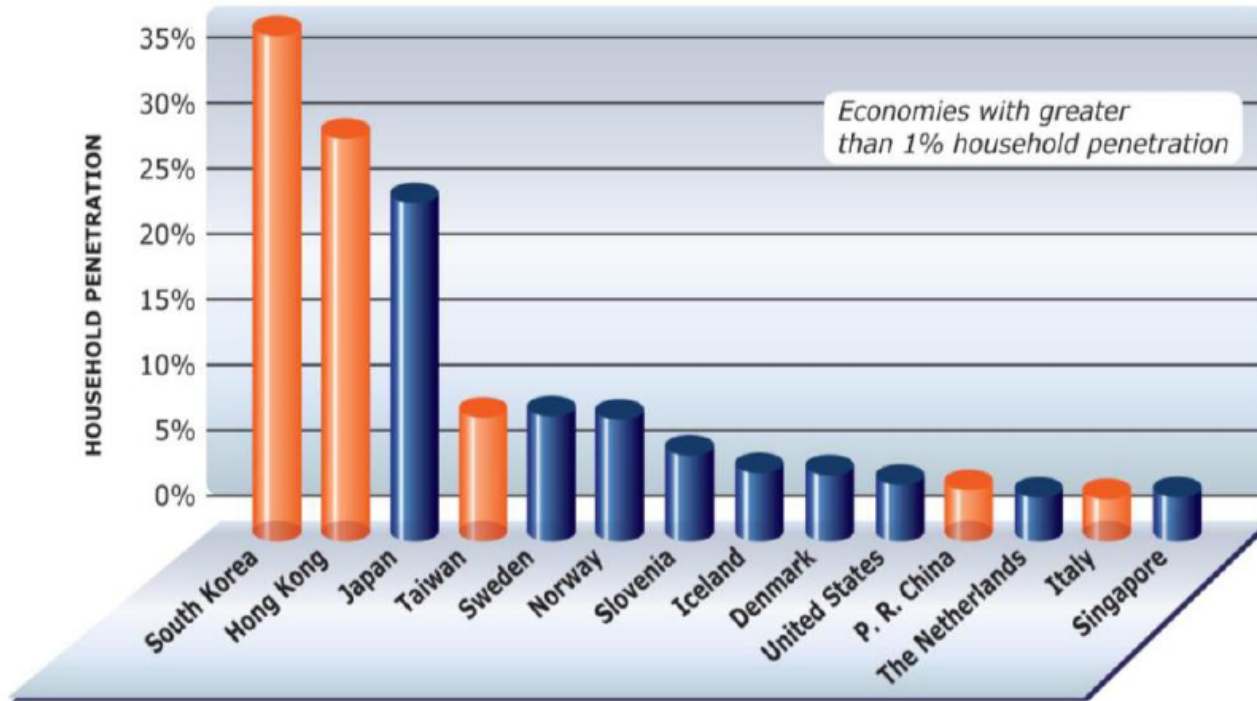


Service Providers are re-evaluating their access networks strategy and business models to remain competitive

South Korea leads the way...

Global FTTH/FTTB Ranking

>> Economies with the Highest Penetration of Fiber-to-the-Home / Building+LAN



Mid-Year 2008 Ranking

Source: Fiber-to-the-Home Council – Jul 08

■ Economies where majority architecture is **Fiber-to-the-Home**

■ Economies where majority architecture is **Fiber-to-the-Building+LAN**

Real Consumer demand for Higher Bandwidth

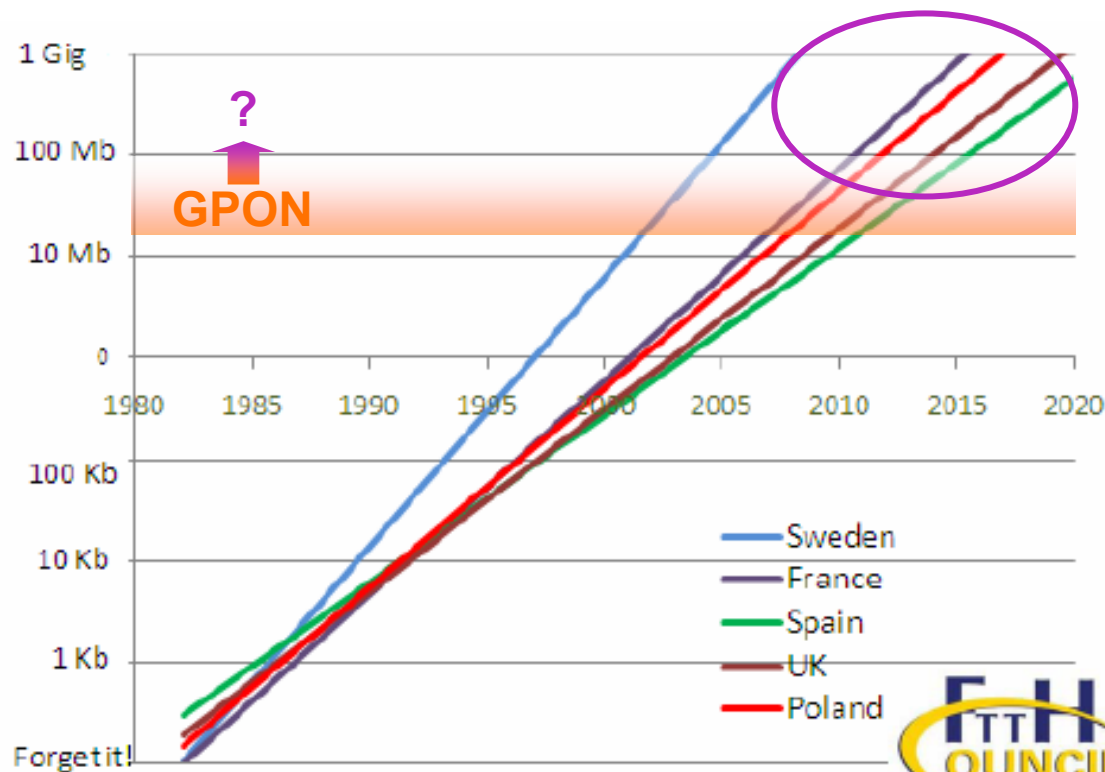


❖ Nielsen's law for bandwidth is analogous to Moore's Law for silicon

		CAGR	Compound over 10 years
Nielsen	Bandwidth	50%	57x
Moore	Computing	60%	100x

❖ Defined several years ago but our study of historical data for several European countries suggests that it provides a good guide to what is happening

❖ Spain and UK just behind N curve – other countries are ahead



Source: Ventura study for FTTH Council Europe





Fiber Access Assertions

- > **Ethernet** will be **Everywhere**
- > **Residential, Business** and **Backhaul services** will converge to single infrastructure
- > **Fiber** will progressively replace copper in the access to cope with traffic increase
- > **New cable laying remains the #1 cost**, thus PON technologies which optimize usage of the existing fiber are key
- > But legacy TDM PON (GPON) is not Future Proof and is not well suited to converged Residential/Business/Backhaul infrastructure
- > OPEX considerations are critical in the Last Mile

NextGen Fiber Access solutions required for continued Service Evolution and Innovation

Next Generation Ethernet Fiber Access:

Key attributes wish list



> **Operations Simplicity**

> **Support Converged Business/Residential services**

> **Highly Scalable, Deterministic Solution**

> **Dedicated, Point-to-point, Symmetrical Bandwidth**

> **In-Built Security**

> **Evergreen**

Fiber Access Deployment options

Point to Point

- + Future Proof Architecture
- + Follows Telco wiring Practices
- + Bit Rate & Protocol Independent
- CO Fiber Management
- Fiber Availability

Active Remote

- + Simple deployment model
- + Flexibility of #Users vs Line Rate
- + Bandwidth Upgradeability
- Shared Bandwidth
- Active electronics in OSP
- High power consumption
- Sub-Optimal Scalability

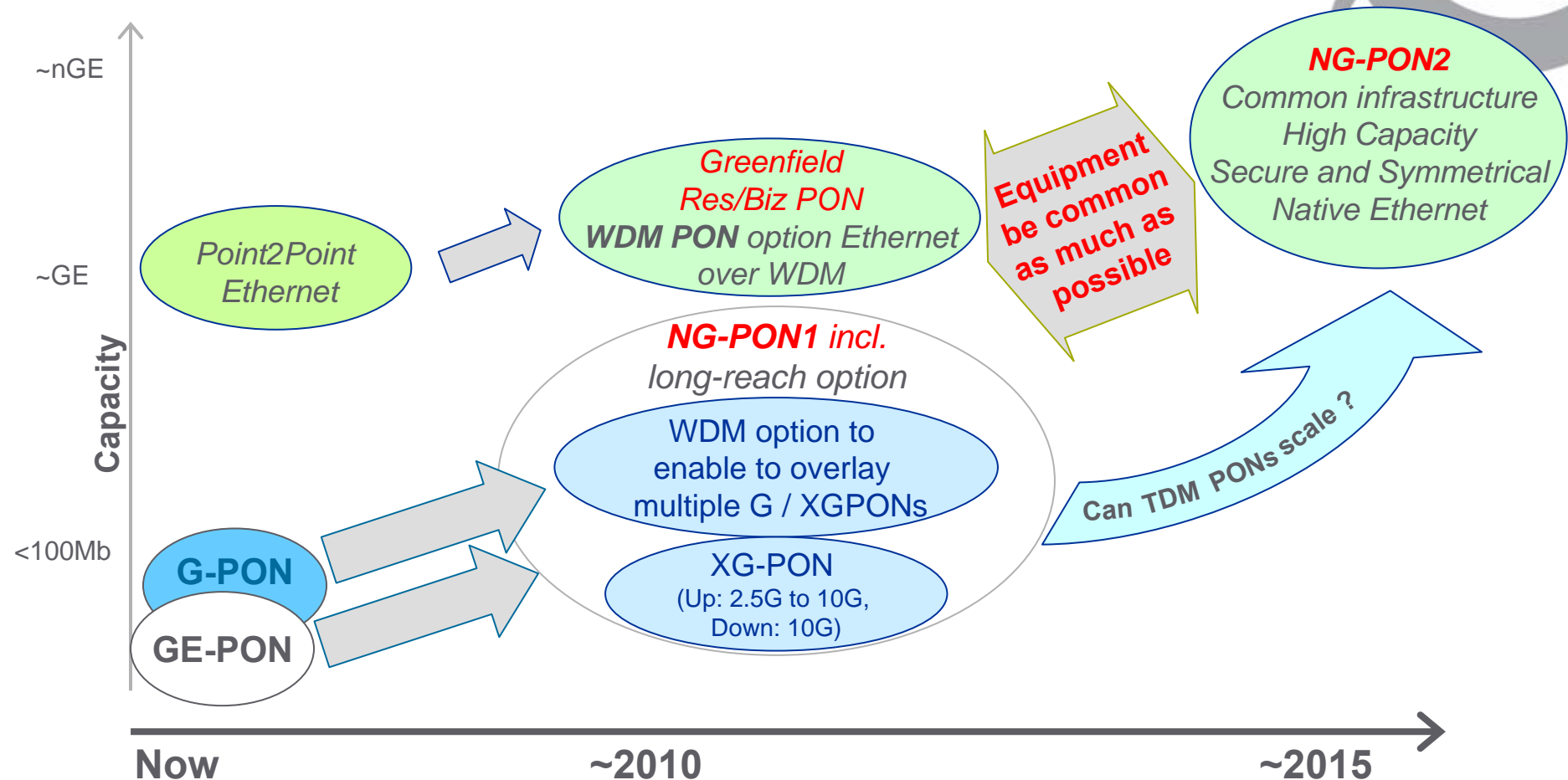
TDM PON

- + Simplified CO Fiber Management
- + Passive OSP Plant Solution
- + Low power consumption
- + Maturing Technology
- Shared Bandwidth (DS & US)
- Real time Software Intensive
- Complex upgrade evolution

WDM Fiber Access

- ADVANTAGES of P2P & TDM PON**
- + **Secure, Reach, Scalability**
- + **No Wavelength Planning & Limited Engineering**

Standardization Evolution



WDM PON current availability sets a new standards path!



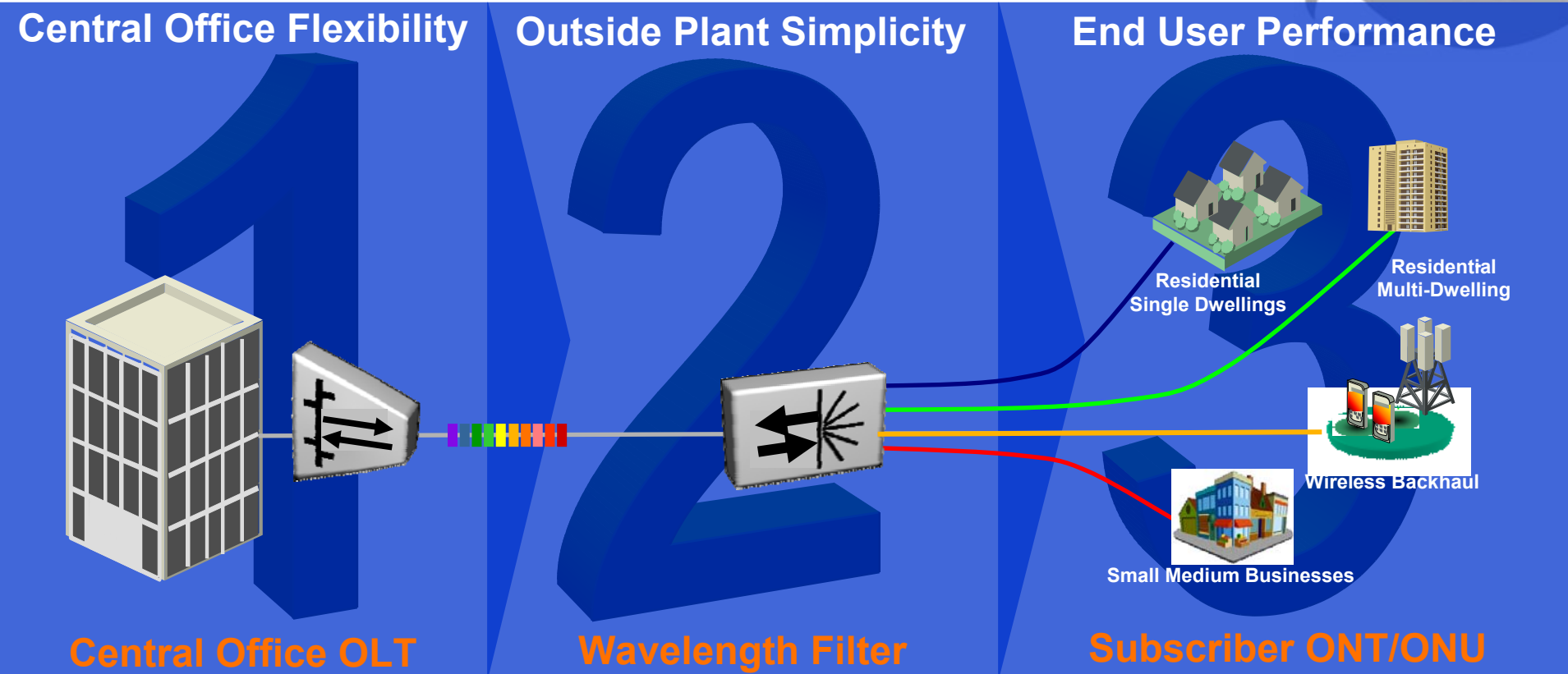
□ Our plan on NG-PON2

- ❖ KT is going to start the commercial deployment of NG-PON2 (WDM-PON) from the next year
- ❖ In this reason, we wish to initiate a discussion on the revision of NG-PON2 timeline in FSAN NG-PON standard roadmap
- ❖ Also, We propose FSAN vendors to more actively participate in NG-PON2 R&D and its standardization process



Nortel's vision of Next Gen Access

Fiber Access Made SIMPLE



What matters in FTTH?

- To build for the long term, especially on the outside plant construct
- To make operations easier
 - Automatic wavelength selection upon activation
 - Dedicated and Symmetrical P2P or P2MP bandwidth
 - Consistent Operations and Engineering methodologies

Nortel's Ethernet Access

Service Provider Benefits

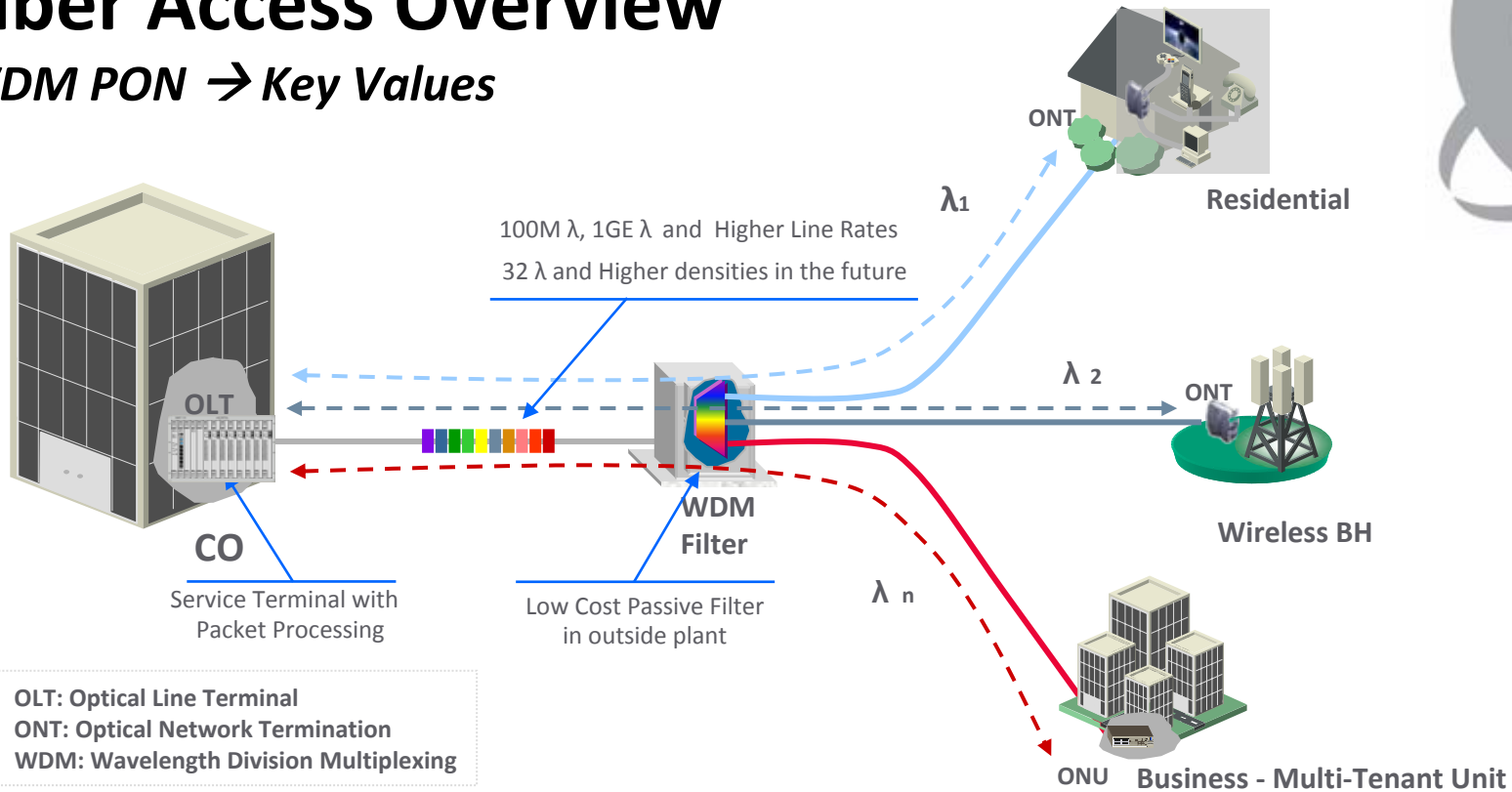


- > Provides a **future proof** point to point construct with a secure bi-directional wavelength per customer
- > Provides a **simple deployment** and OPEX friendly architecture
 - passive splitter, Colorless ONTs, single fibre working
- > **Service Velocity** - Tailored to scale for Residential and/or Business services on a per user basis

The future of fibre Access, available today

Fiber Access Overview

WDM PON → Key Values



OLT: Optical Line Terminal
 ONT: Optical Network Termination
 WDM: Wavelength Division Multiplexing

Simple Engineering & Deployment



- Infrastructure independent service evolution
- “Plug & Play” colourless optics at end use

Flexibility



- Point-to-point and point-to-multi-point connectivity

Performance

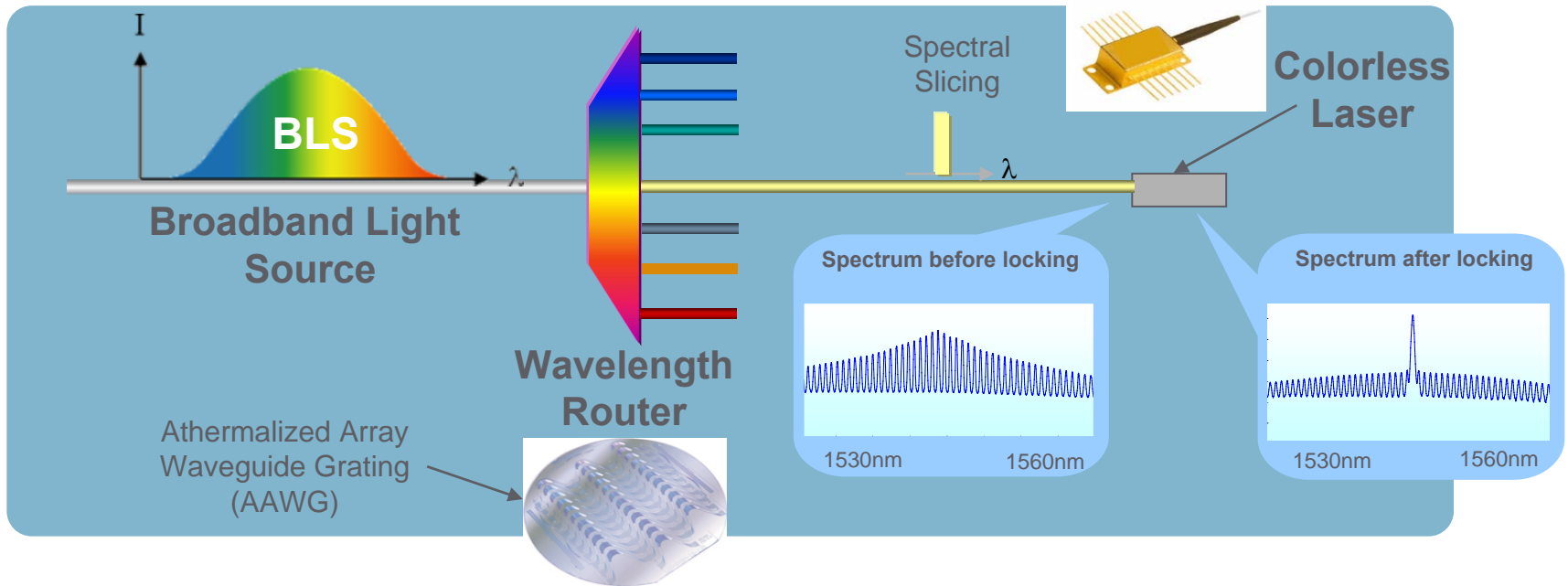


- Symmetrical bandwidth (upstream/downstream)
- Dedicated wavelength/ bandwidth per end user

WDM Fiber Access

Enabling Technology

Automatic Wavelength Locking



Identical, **Colourless** ONUs using low-cost lasers

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

Ethernet Access 1100 Portfolio Summary

OLT

Ethernet Access Service Terminal



EAST 1100

- 13 slot Chassis
 - Upto 8 Service Slots
 - 5 Slots reserved for Commons
 - Redundant switch fabrics
- Network Interface/ Switch Units
 - Up to 8 Network Interfaces
- Mixed Access technology support
 - WDM-PON
 - Point-to-Point Ethernet
- Density
 - Upto 1024 λ / rack (4 shelves)
- Advanced L2/L3 Packet Engine

ONT

Ethernet Access Residential/Business Unit



EARU 1112

- Indoor Residential Design
- Stylish, Compact and Environmentally friendly design
- Low power consumption
- Installed vertically or horizontally with available cradle
- Identical, colorless ONT/ONU
 - Fully colourless operation
 - Low inventory management cost
- Interfaces
 - 4 10/100Base-Tx RJ-45 ports
 - Optical Connector – SC/APC
- Advanced QoS and Classification

EMS

Ethernet Access Manager 1100

- Alarm & Event Management
- Configuration Management
- Provisioning Management
- System/PON Port
- Backup & Restore
- Statistics Management
- Software Version Management



Remote Nodes Wavelength Passive Filter



WPF1132c
Cabinet Tray



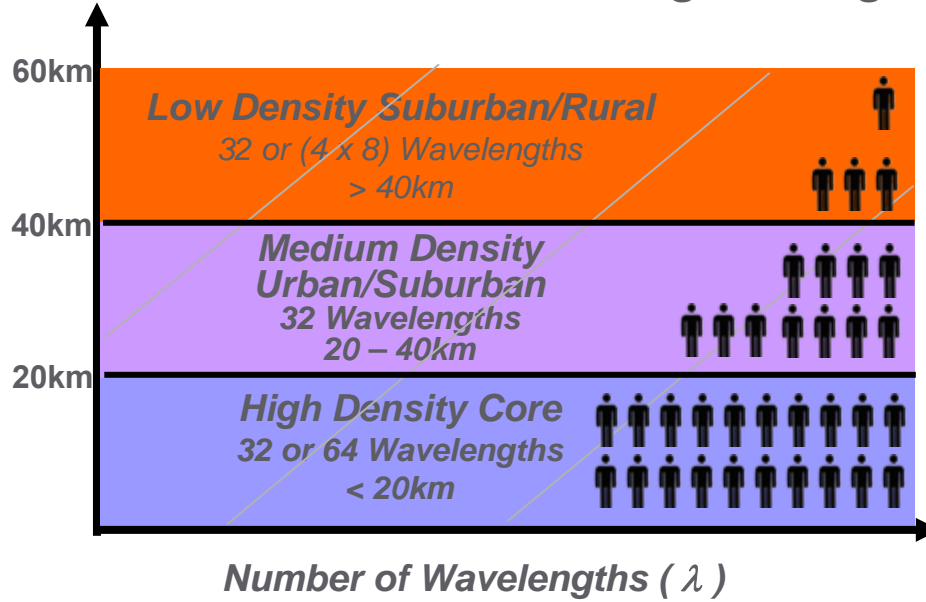
WPF1132r/p
Ruggedized / Pole

Engineering Considerations

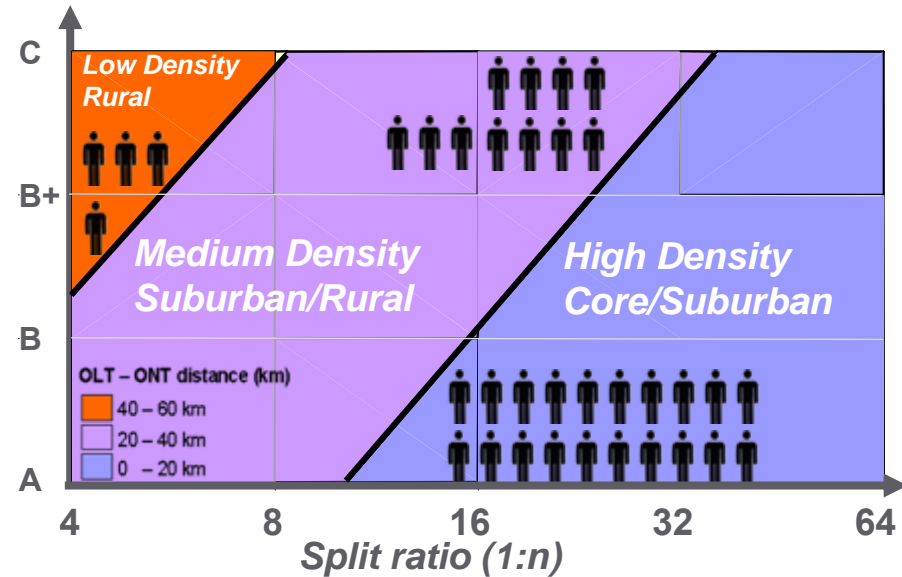
Nortel's Ethernet Fiber Access vs others xPON



Ethernet Fiber Access Engineering



TDM PON Engineering

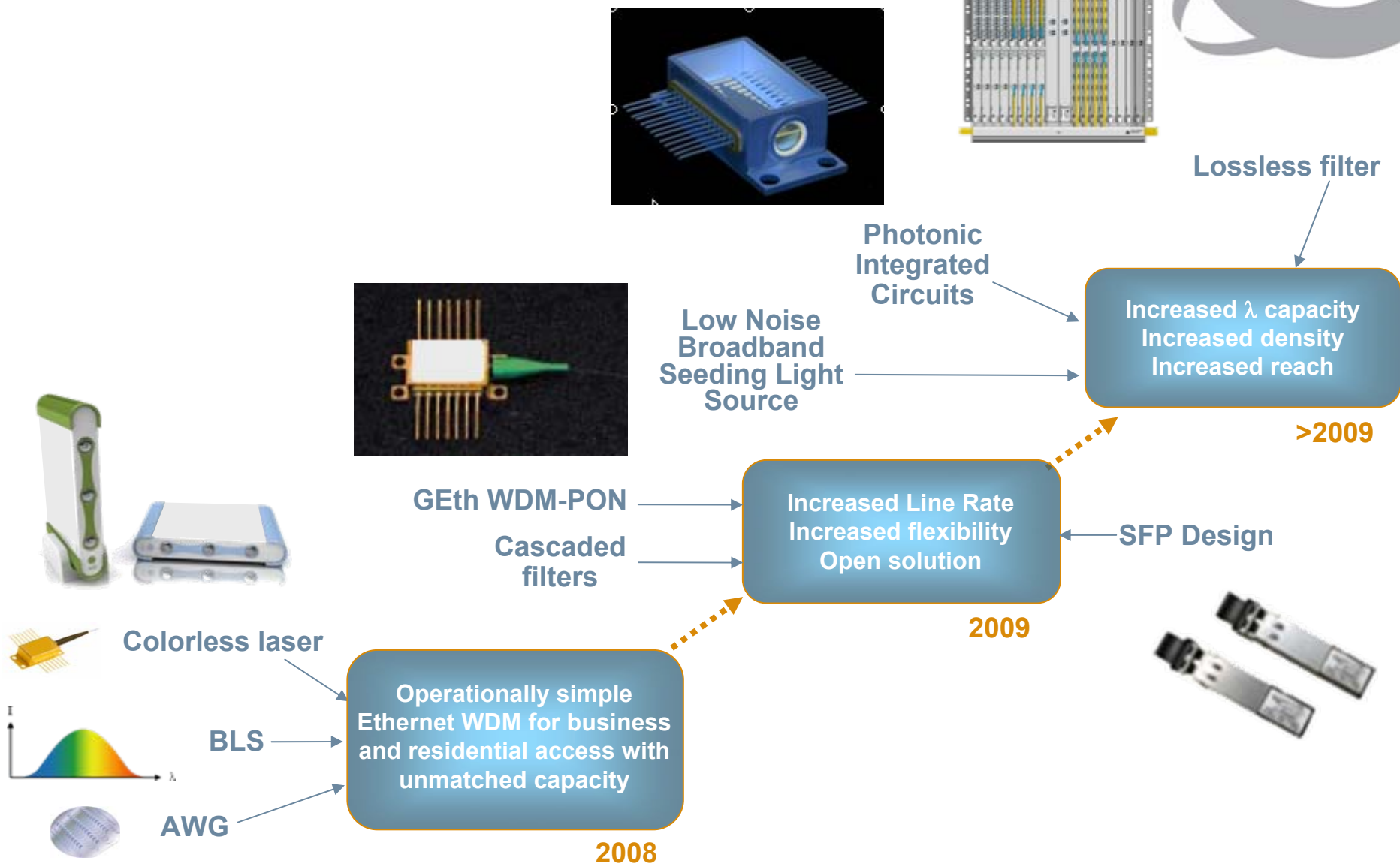


- **Passive OSP WDM Filter**
 - LOW loss components
 - # Port independent ~ 5db loss
 - User bandwidth independent of #subscribers
 - Reach is independent of bit rate
- Simple & Flexible OSP operations model**

- **Passive Splitter**
 - HIGH Loss components
 - 32 power split ~ 17db loss;
 - 64 Split ~ 20db loss
- User bandwidth is inversely proportional to distance and # of subscribers

CANNOT maintain a consistent Engineering methodology

Technology Direction





Conclusion

Customer Trials and Summary of Engagements



Since 1Q - 2008

- ✓ 2 public on-going deployments
- ✓ 15+ Lab and/or Field trials performed
- ✓ Understanding and validating applications
 - ✓ Business/Residential Services: VPN, Residential
 - ✓ Wireless Backhaul
 - ✓ Backhauling remote DSLAMs

deterministic

innovative

symmetrical



**Nortel's Ethernet Access
Solution
with WDM-PON**

open

foundational

secure

simple

dedicated



NORTEL

Business made simple

Thank you