



PON Optical Module- Meet Next Generation PON Technology Trend

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Agenda



PON Market and Challenges on Optical Module



PON Optical Module for Current Networks Demand



Next Generation GPON and EPON

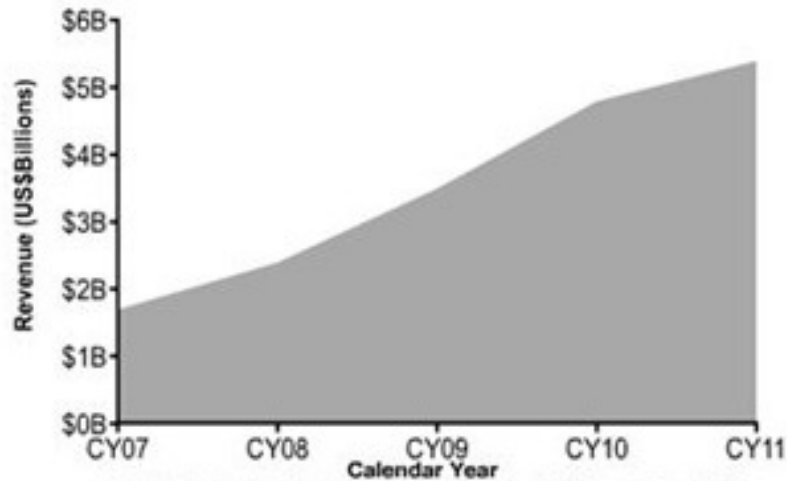


Source-Photonics from Chip to Module

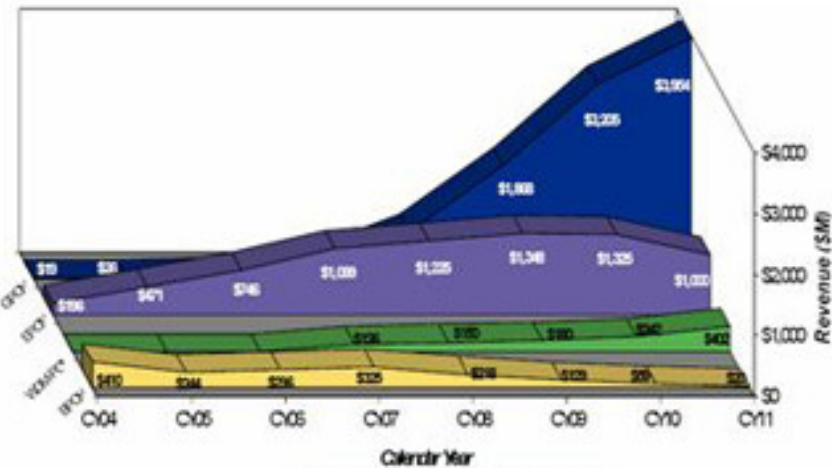
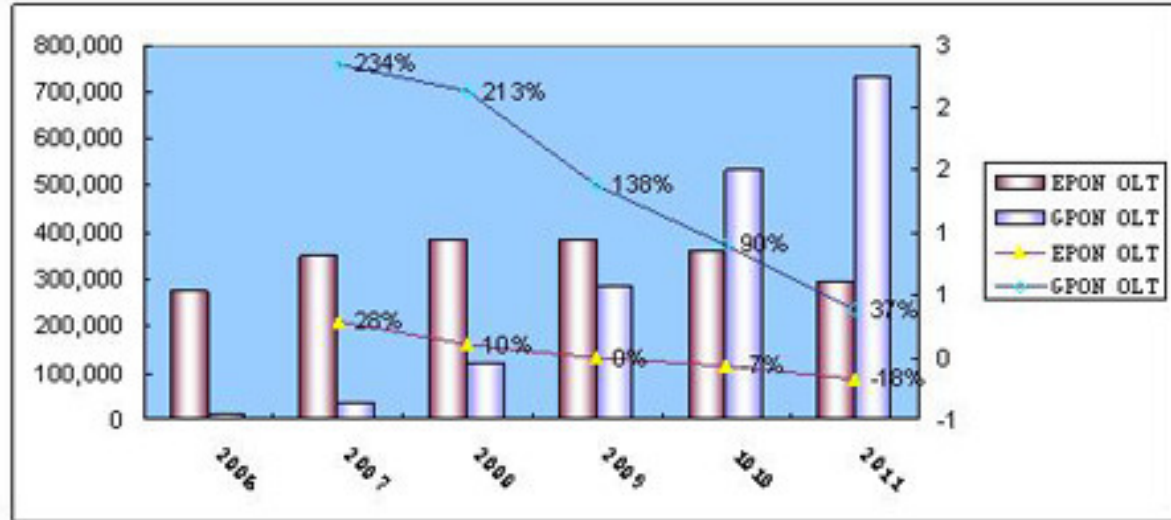


PON Market

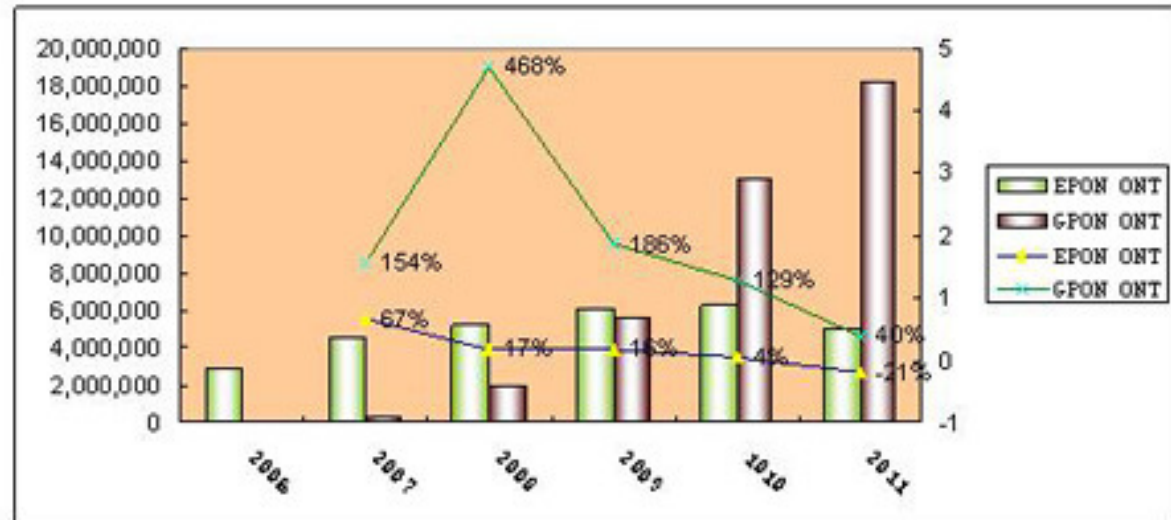
Worldwide PON Equipment Manufacturer Revenue Forecast



Source: Infonetics Research, PON and FTTH Equipment and Subscribers Market Share and Forecasts 4Q07



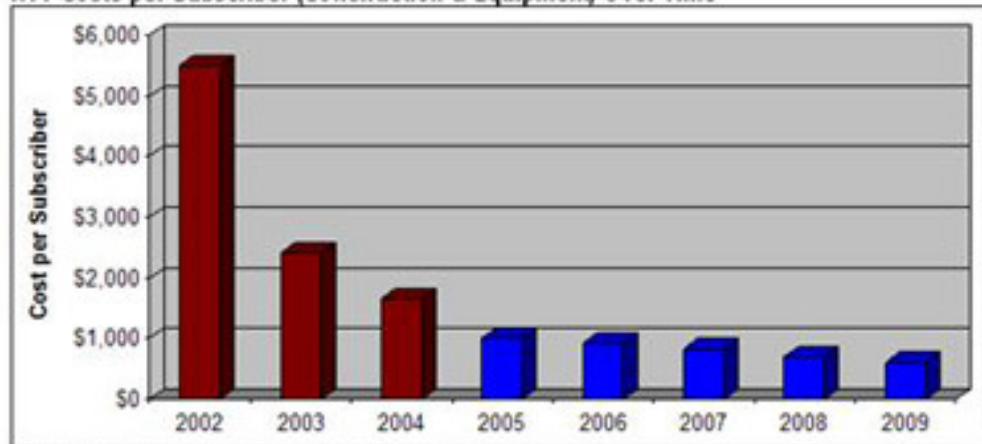
Source: Infonetics Research, 4Q07



source
PHOTONICS

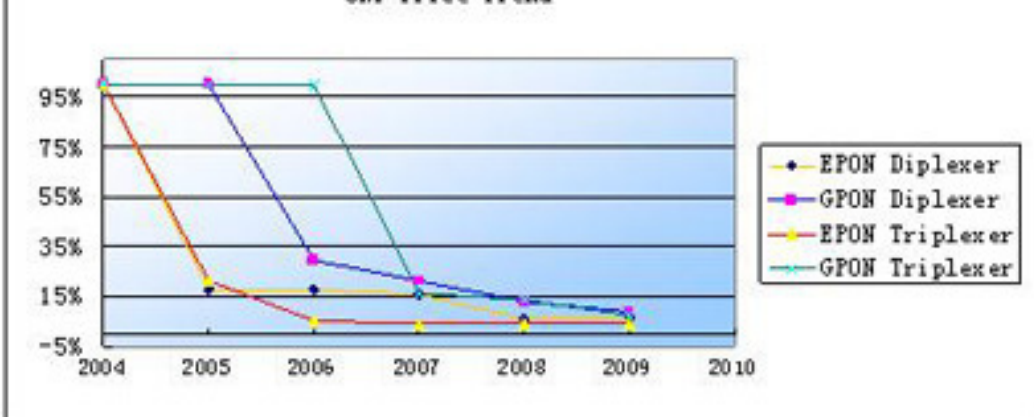
Cost Effective Solution Win the Market

NTT Costs per Subscriber (Construction & Equipment) Over Time



Source: NTT East; costs for 2005-2009 are estimates

ONT Price Trend



ONT
Fiber
Splitters
OLT
Connectors
Splices
Non-OLT Central Office

※ CaPex Relative Components

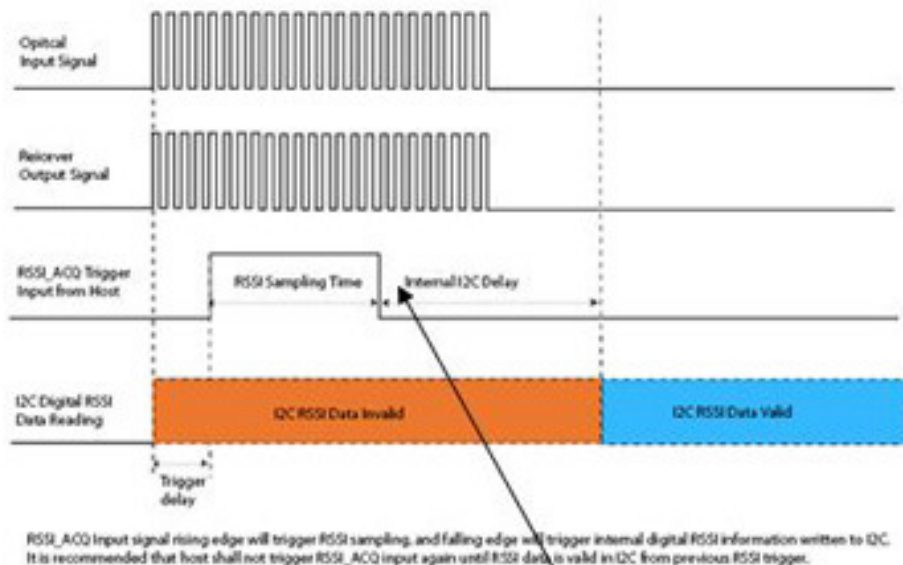
- Optical Module Cost Reduction with Lower FIT
- Guideline to reduce the cost under Parameters define in standard
- Optical Module with Monitoring feature to reduce Opex



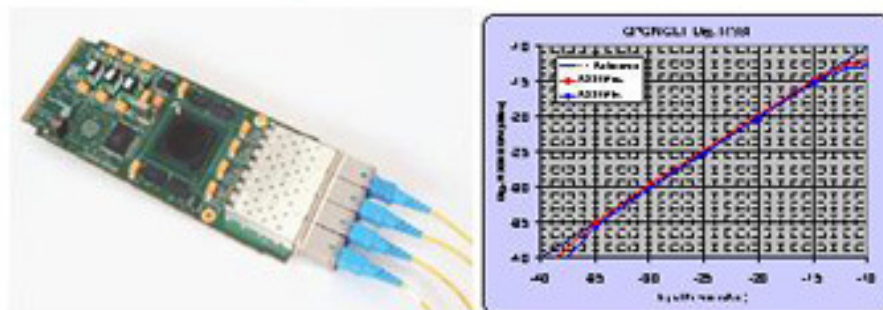
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Shortest Burst RSSI Feature & High Density Slot GPON

- > **The solution to fully comply with ITU G.984.2 timing requirements guard time**
 - 44 bits pre-amble
 - 32 bits
- > **Fast ranging capability, can use 44 bits pre-amble also**
- > **Offer industry widest dynamic range, extend from -8 to -30 dBm input ranges with 15dB stress**
 - Overload > -6 dBm
 - Sensitivity > -30 dBm (meet with -28dBm FSAN spec with margin)
- > **Fast (300nS) digital RSSI capability**



300nS RSSI Acquire/sampling time



source
PHOTONICS

Functionality and Stability of PON Networks

				
Transceiver	<i>GPON OLT</i>	<i>GPON ONT</i>	<i>GEPON OLT</i>	<i>GEPON ONU</i>
SFF 8472	<i>Digital RSSI</i>	<i>DDMI</i>	<i>Digital RSSI</i>	<i>DDMI</i>
Laser Failure Indication	✓	✓	✓	✓
Power Leveling Support	<i>NA</i>	<i>Support</i>	<i>NA</i>	<i>NA</i>
FEC Support	✓	✓	✓	✓
Optical leakage Indication	<i>NA</i>	✓	<i>NA</i>	✓
Temperature Harden	✓	✓	✓	✓

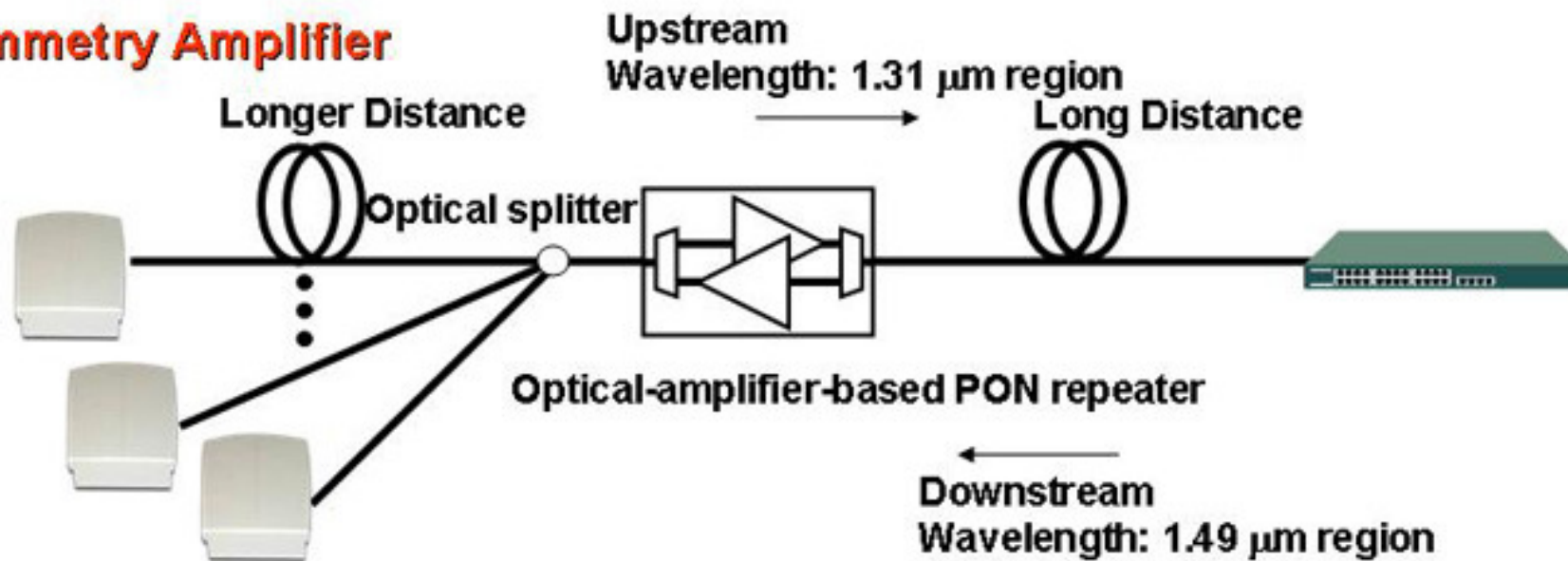
PON system should consider to support the following features

- Avoid abnormal Optical Leakage of one ONU to affect other ONU's performance*
- Monitoring system working status at optical layer*
- Longer reach application*
- Outdoor application*

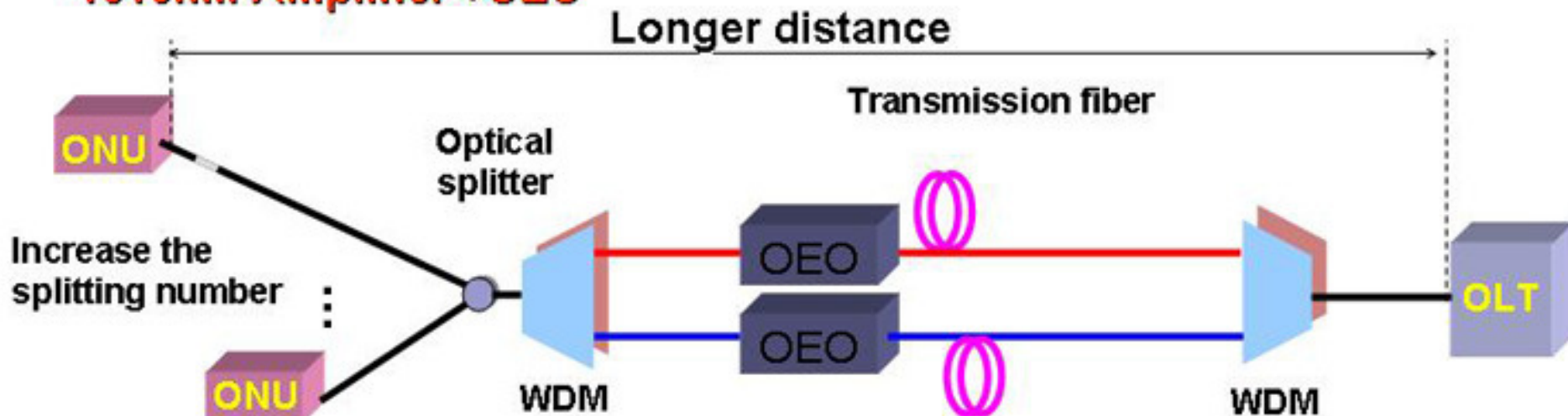


Extender of GPON ITU-T G.984.re

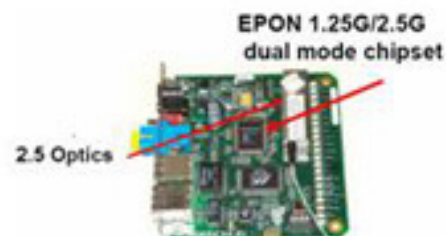
Symmetry Amplifier



1310nm Amplifier + OEO



2.5G EPON



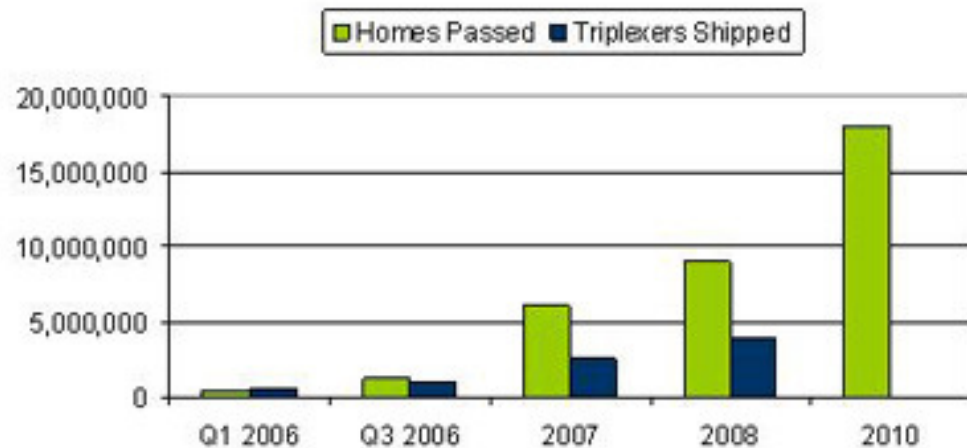
Application Code	2000Base-Px20-D	2000Base-PX20-U
Optical	DFB/APD	DFB/APD vs FP/PIN(*)
FEC Feature Support	✓	✓
SFF 8472	RSSI	DDMI
Burst Mode Timing	512ns guard time	32ns Burst-on/off

- Optical Module design should consider different network application scenarios of GEPON and 2.5G EPON
- FP/PIN solution can meet 2000Base-PX20-U practical industry demand, can share the same ONU platform as GEPON
- Co-exist with GEPON platform by CWDM Technology

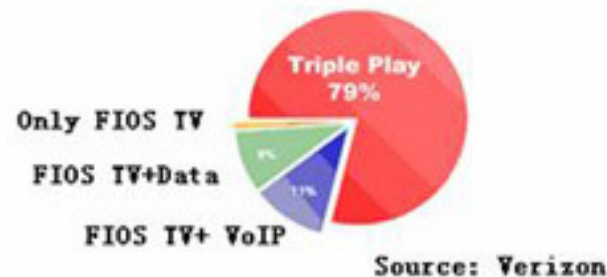


Triple-Play Service based on RF Overlay

Verizon TV FiOS Deployment Plan



FIOS TV User



AT&T Deployed U-verse service in 41 cities of USA



⇒ Continued Increasing Demand on Data Bandwidth

⇒ Demand advanced Video

⇒ Full Service Providing: POTS, Data, Video

⇒ Triple play offering by MSO

⇒ Reduced Costs (Actives & Passives)

⇒ Reduced Maintenance Costs



Triplexer PON Module-Decided by Infrastructure

Sample Triple Play Features and Prices (California Markets 12-07)

	Verizon (LA)	AT&T (LA)	Comcast (SFO)	Charter (LA)	COX (LA)	Time Warner (LA)
Package	Verizon Freedom Essentials and FiOS TV, w/FiOS 5M Data	AT&T ALL Distance, w/U-Verse 200 w/ "AT&T Yahoo! Broadband U-verse Enabled"	Digital Voice Service (VoIP) with High Speed Internet and Digital Preferred Cable	The Charter Bundle: Cable Big + HHS 5M + Telephone	Cox Digital Suite: Digital Cable, Preferred Tier Internet, and Unlimited Calling Plan	All The Best
Local	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited
VAS	3VAS	13VAS	13VAS	14VAS	12VAS	11VAS
Voice Mail	Included	\$5.00	included	included	\$5.95	\$3.95
Toll/LD	Unlimited	Unlimited	Unlimited	included	Unlimited	Unlimited in CA and \$1.05/min outside CA
Voice Bundle	\$49.99	\$39.99	\$33.00	included	\$40.54	included
Broadband	\$39.99	\$40.00	\$33.00	included	\$51.95	included
Max Downstream	5M	6M	6M	5M	7M	6M
Max Upstream	2M	1M	364K	512K	512K	512K
Video	FiOS TV Premier	U-Verse U200	Digital Starter	Cable Big	Digital Cable w/ Variety Tier	Digital Cable Variety Package
Fiber/Wireline	\$42.99	\$59.00	\$33.00	included	\$63.74	included
Satellite	N/A	NA	NA	NA	NA	NA
#of Channels	254	342	148	147	223	173
Analog Channels	0	0	78	34	83	67
Digital Channels	135	237	9	46	41	39
Music Channels	94	47	45	46	72	45
HDTV Channels	25	58	16	21	27	22
DVR Service*Box	\$15.99	included	\$69.99	\$15.95	\$15.20	\$15.00
HDTV Service*Box	\$9.99	\$10.00	\$11.95	\$6.95	\$5.25	\$5.00
Set Top Box	\$4.99	included	included	included	\$5.25	included
Bundle Discount	\$22.98	\$14.00			\$30.70	
Total Bundle	\$109.99	\$138.99	\$69.00	\$119.97	\$140.78	\$94.85

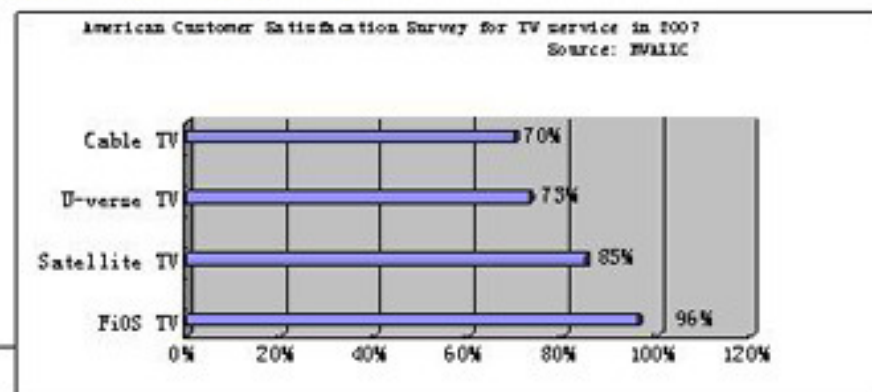


- GPON Triplexer
- SFU & MDU
- USA market



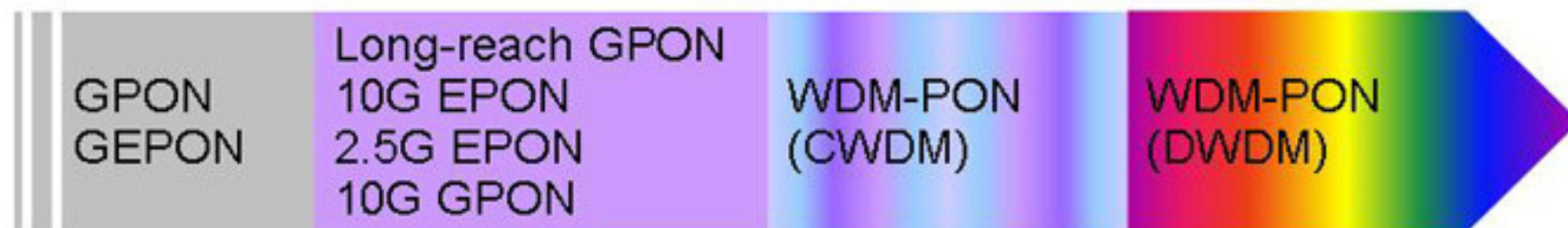
- GEPON Triplexer
- SFU
- China market

Telcos	Services	MSOs
1Mb/s (DSL) going to 50 Mb/s (FiOS)	High-speed Internet	2Mb/s going to 50Mb/s (DOCSIS3.0)
25 channels going to 200	HD-TV Channels	25 channels going to 200 channels
FiOS and U-Verse	Major CAPEX	DOCSIS3.0 and Switched Video



Next Generation PON

- > GPON NG
 - GPON wavelength blocking filter (WBF)
 - 100km extended GPON
- > EPON
 - 2.5G EPON
 - 10G EPON
- > New PON Trend



10G EPON - IEEE 10GEPON 802.3av

> Package Form



> Power Consumption

🔥 SFP+ trend: Lower power consumption

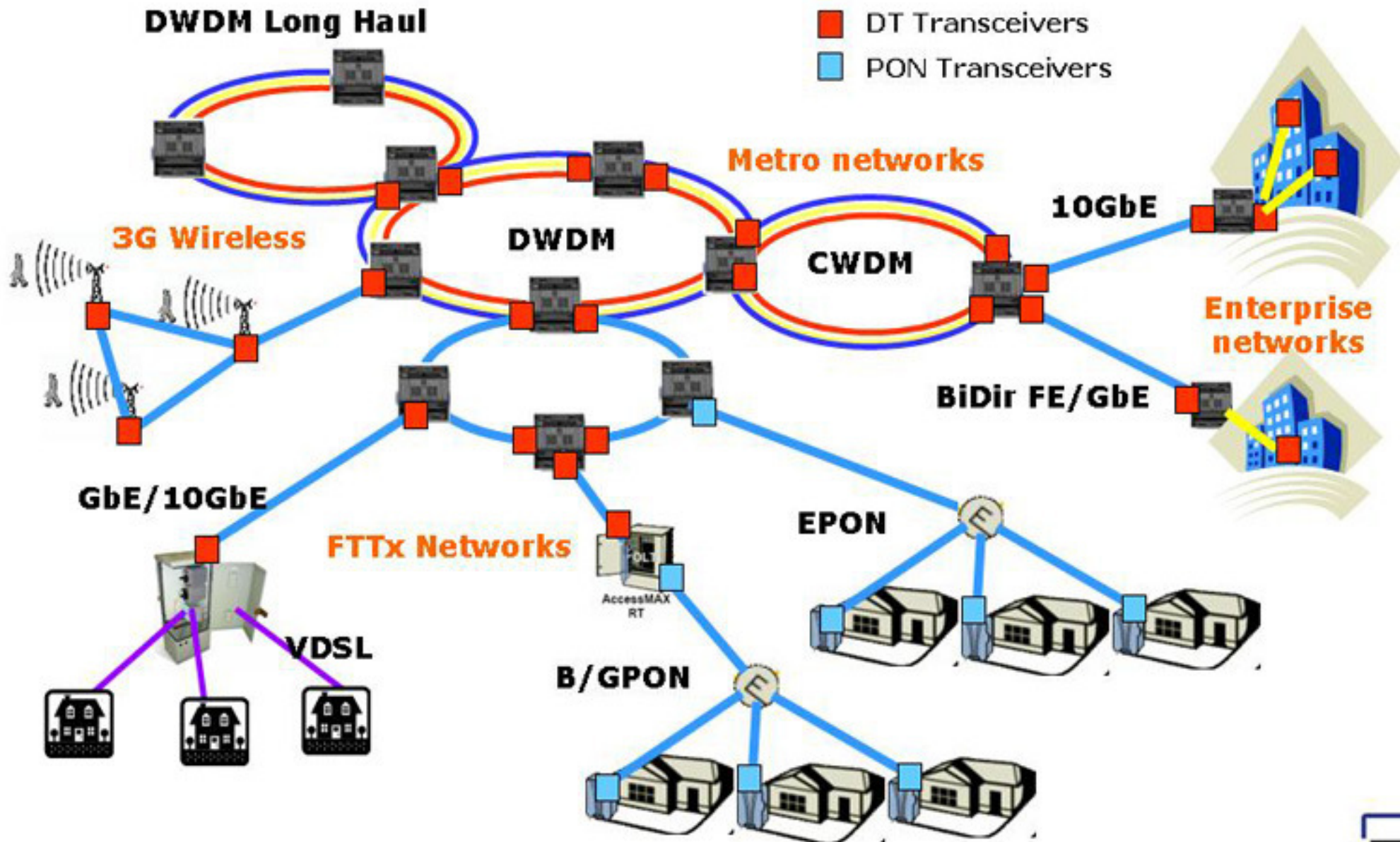
🔥 10G EPON: 1.5W-2W

> Wavelength Allocation for upstream under symmetric and asymmetric (1270nm/1310nm)

> Power Leveling will consider for Symmetric application



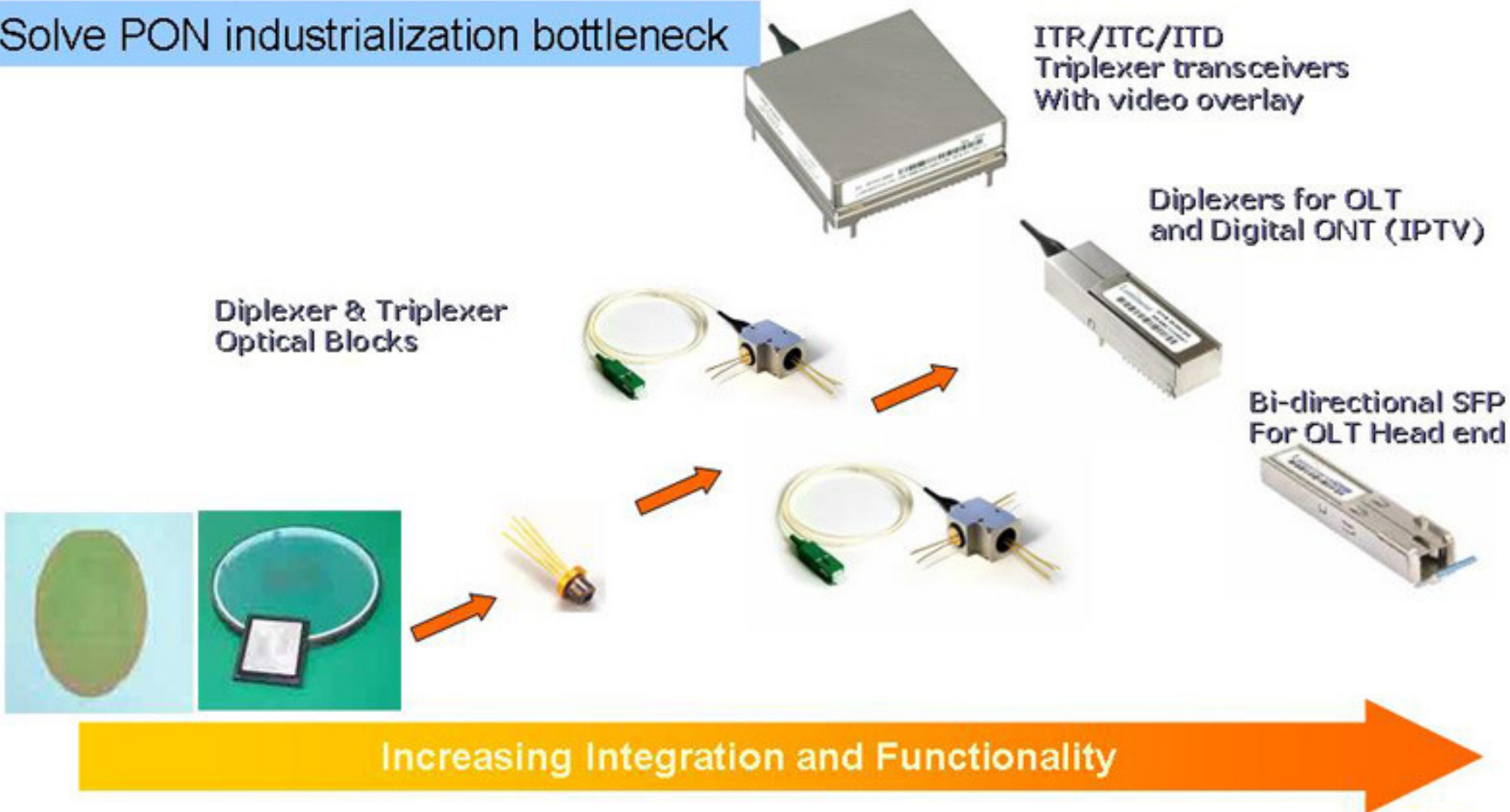
Source Photonics- Full Line Optical Module Provider



source
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Vertical Integration – from Chip to Module

Solve PON industrialization bottleneck



source
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Thank You!



source
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