

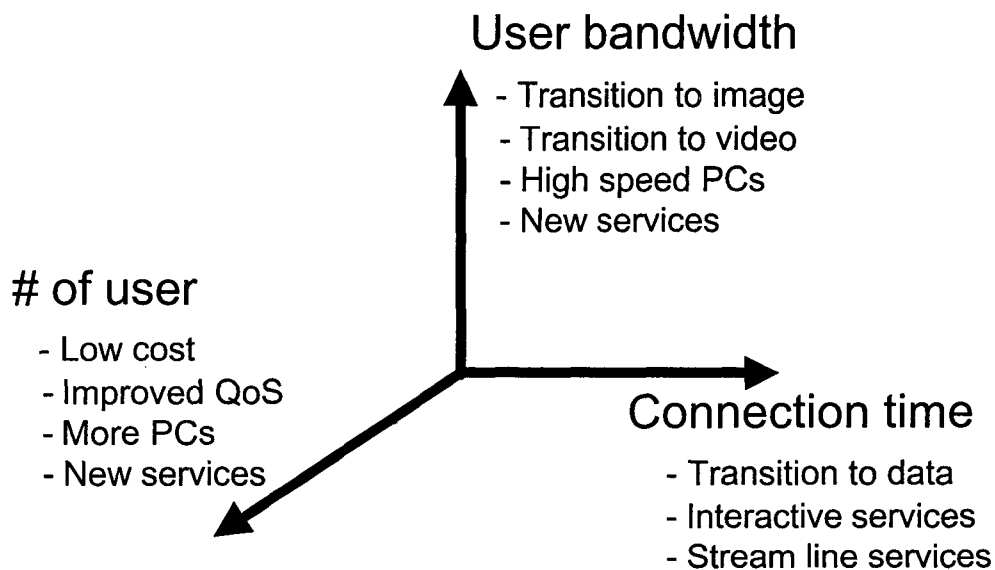
# 저가형 WDM-PON 기술

한국과학기술원, 전자전산학과  
노베라 옵틱스 코리아

이창희



## Traffic Growth





# Bandwidth Demands

## Advanced home user

Services	Bandwidth [Mb/s]
Three HDTV Channels	57.6
Telecommuting/VPN	2
Video Conference (Phone)	1
Two web Surfing	3
Interactive Gaming	1
Two Phone services	0.128
Other New services	?
Total bandwidth	> 64.728

**Business subscriber requires ~ Gb/s services**

**Bottleneck moves to Metro/Access networks**

## Why WDM in Metro/Access ?

### Increase of access and metro traffic

Data traffic increases 2 x /year.

### Dramatic reduction of WDM device cost

DFB laser < \$500

WDM /channel < \$150

### High competition

### Future proof system



# Low Cost Solutions

## Reduce equipment cost

- Bi-directional transmission to save fiber costs
- Reduce WDM source costs
- Reduce WDM component costs

## Reduce operating cost

- Plug and play architecture
  - Eliminate manual adjustment and manual troubleshooting
- Reduce management cost with passive networks
- Reduce inventory costs

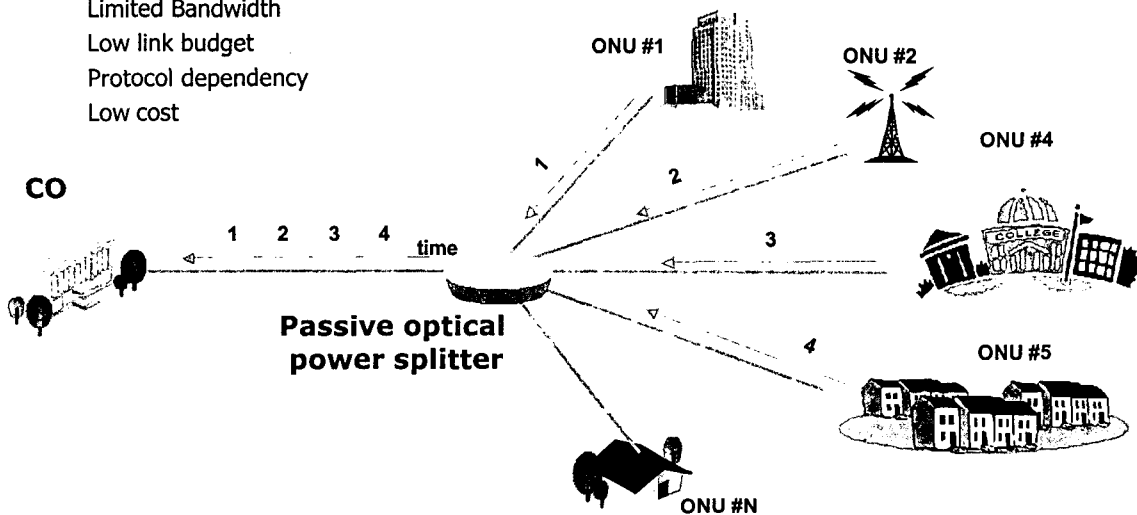
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# Access Network Architectures (Passive TDMA)

## Time Domain Multiple Access

- Low security
- Limited Bandwidth
- Low link budget
- Protocol dependency
- Low cost



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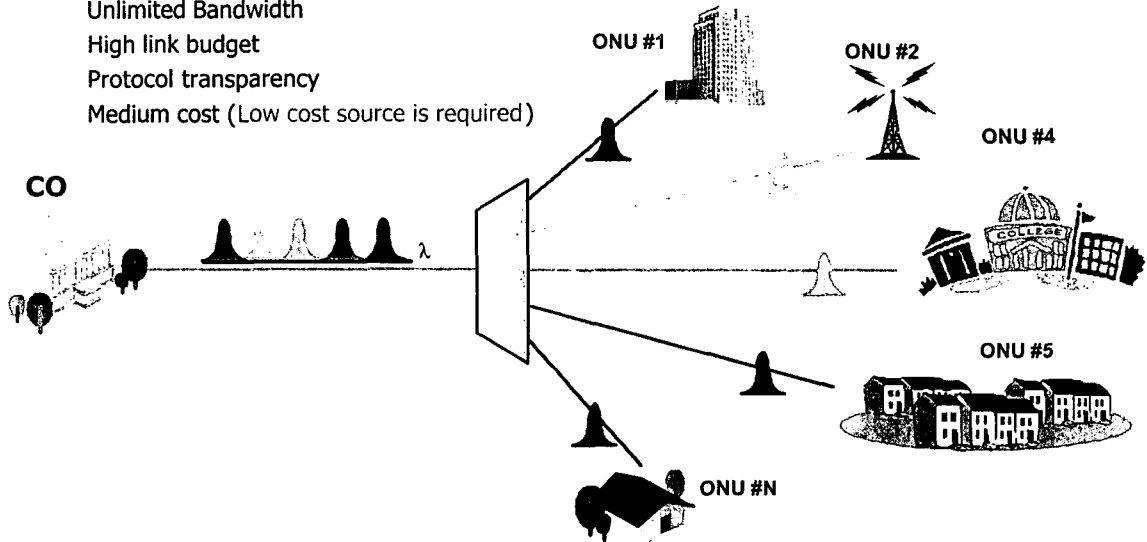
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# Access Network Architectures (Passive WDMA)

## Wavelength division multiple access

- High security
- Unlimited Bandwidth
- High link budget
- Protocol transparency
- Medium cost (Low cost source is required)



## Comparison of PONs

Access method		TDMA	WDMA
Transparency (independency)	Protocol	No	Yes
	Bit rate	No	Yes
	Collision	No	Yes
	$\lambda$	Yes	No
Legacy support		No	Yes
Graceful upgrade		No	Yes
Security and privacy		Low	High
Cost		Low	Medium (Source cost)

WDMA PON (WDM-PON) is the ultimate solution provided a low source cost.





# Transmitter Options

## F-P Laser

Lowest cost, but not adequate performance

## Wavelength specified source

DFB laser

High performance, expensive/high maintenance cost

Tunable laser

High cost, technology not mature

## Wavelength selection free solutions

Novera solution; Wavelength locked F-P LD (KAIST, 1999)

Spectrum sliced ASE (Lucent, 1995)

Reflective SOA (Corning, 2001)

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# Wavelength Locked F-P LDs

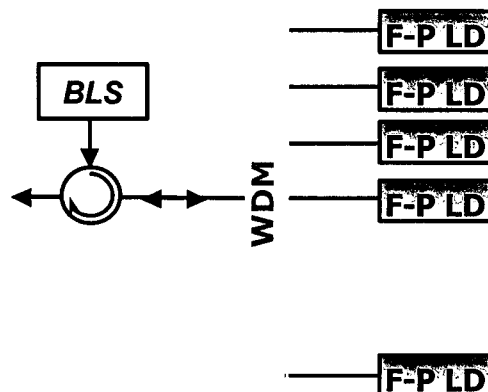
**Lasing wavelength of F-P LD was locked to spectrum sliced ASE light wavelength.**

**FP can be modulated directly.**

**No isolator and TEC for FP LD.**

**Lowest cost and highest performance**

**Patent pending (Korea and U.S.A., 1999)**



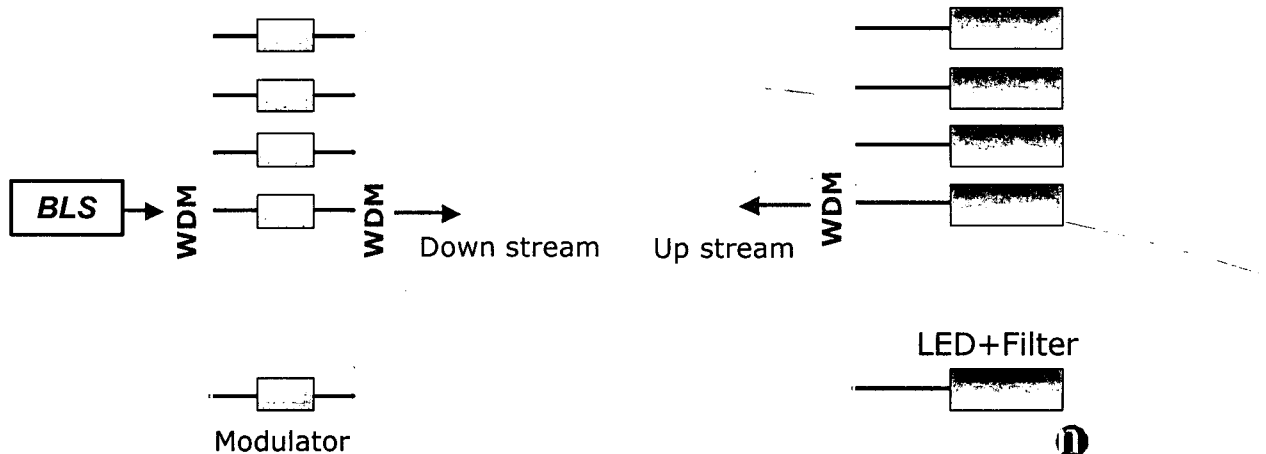
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# Spectrum Sliced ASE

**Needs external modulator for down stream.**  
**LED and filter can be used for low speed up stream.**  
**High cost due to external modulator.**  
**Lucent Technology (1995)**

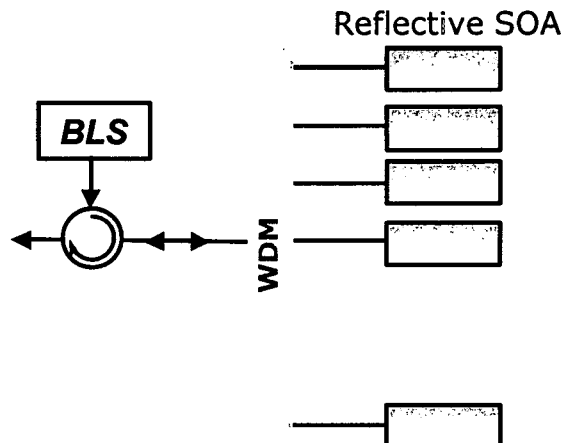


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# Reflective SOAs

**Spectrum sliced ASE light was amplified by reflective SOA.**  
**SOA can be modulated directly.**  
**SOA is an expensive component.**  
**Corning (2001)**



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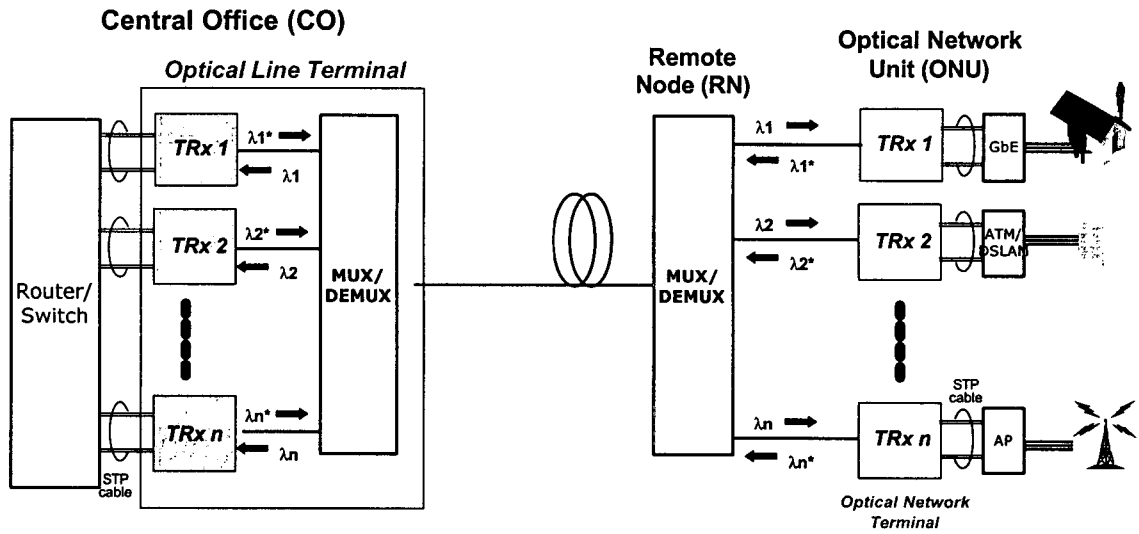
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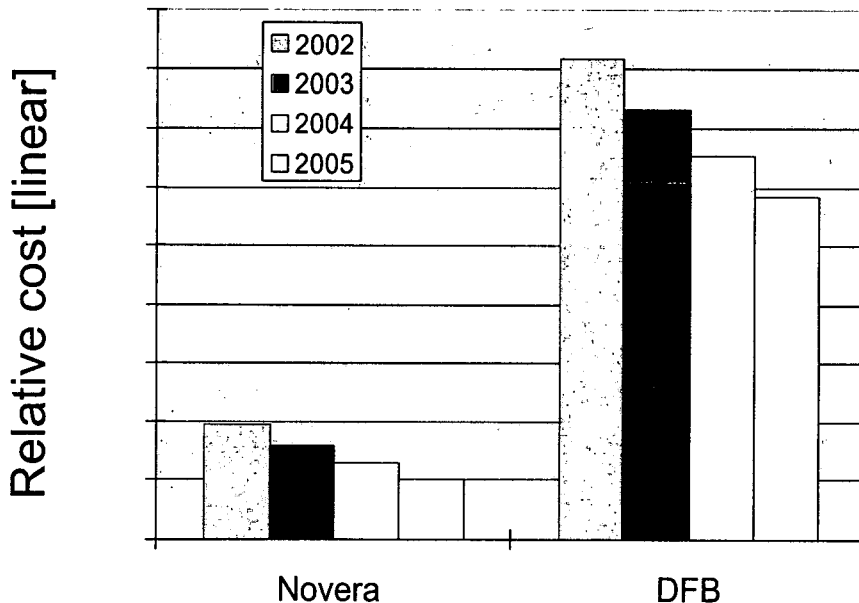




# WDM PON for Broadband Access



## Material Cost per ONU



Estimated cost based on RHK component cost prediction.  
Calculated for 32 subscribers

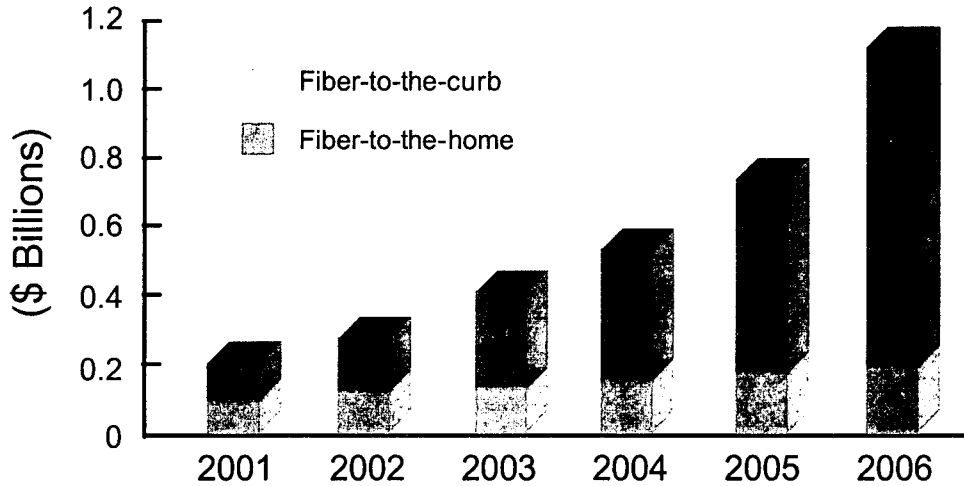






# PON Market Estimation

Annual fiber-in-the-loop equipment market in the U.S.



Source : KMI Group

## Features of NovaPON™

### High capacity WDM-PON

- High reliability due to no active elements in field
- Protocol transparency
- High security and privacy
- Point-to-point dedicated connectivity
- Transmission-speed/length : Gigabit-Ethernet/20 km of SMF
- Maximum number of ONUs : 32

### Low fiber count through bi-directional transmission

### Wavelength locked FP LDs

- Low equipment cost; FP LDs instead of expensive DFB LDs
- Low operation cost; free from wavelength restriction
- Low inventory costs; Non-wavelength specified lasers

### High compatibility

- Graceful (or modular) upgrade
- Supporting legacy systems without protocol conversion