APD@ONU
for 10GE-PON

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APD@ONU vs PIN@ONU

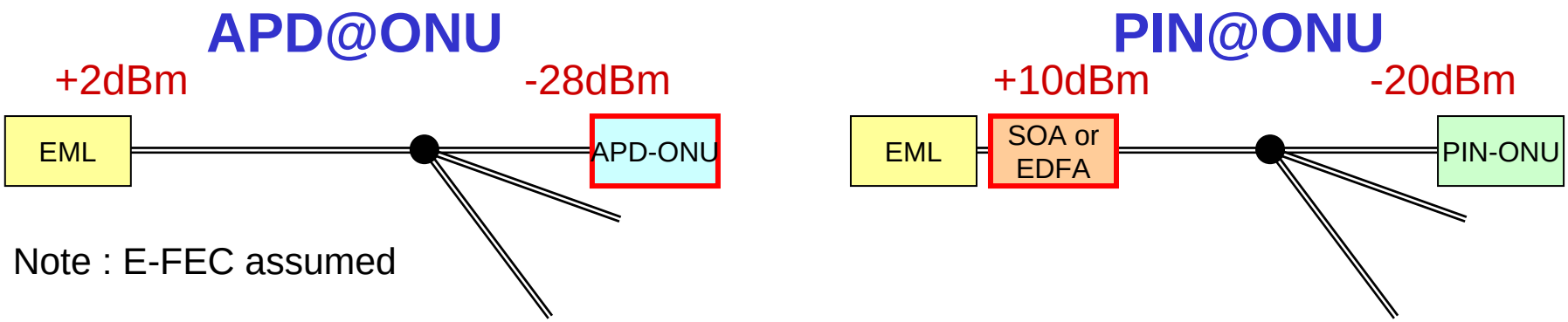
APD@ONU a simple structure

- No SOA/EDFA in OLT
- High-power EML almost available in XFP(80km) application

Low optical launch power : Close to 1Gs and 10G-U/S

- Small WDM filter crosstalk
- No fiber-non-linearity issues
- No SOA-reliability issue
- Small power dissipation

ClassB++ Power Levels



Note : E-FEC assumed

Optical Component Costs

	Lee	Gokhale	Schrans (Note)	A	B	C	D
PIN ROSA	**1**	1	1	1	1	1	1
APD ROSA	**3**	3	2.5	**7**	**10**	3.5	3
DML TOSA (High Power)	**2**		2 - 3 **4**	2	2.5 - 8	2	2 (Single Lens) 4 (Double Lens) 6 (TEC)
EML TOSA	**10**	10	10 - 12	8	10	6	10
SOA	**20**	20		30	30	20	20
EDFA	**40**	50		50	40	50	50
EML+SOA (int.)		20		35		25	
DFB+SOA+EA (C-band)		15					

Reference : 3av_0703_takizawa_1.pdf

Note : Power Budget Ad hoc E-mail (May 9,2007)

Transceiver Cost Assumption

Configuration (OLT : ONU)		PIN		APD
		SOA	EDFA	
1:32	D/S only	1.9	2.6	3.6
	Optics Total	6.0	6.7	7.4
1:16	D/S only	2.9	4.1	3.6
	Optics Total	7.1	8.3	7.8
1:8	D/S only	4.8	7.3	4.3
	Optics Total	9.1	11.6	8.6
1:1	D/S only	31	51	13
	Optics Total	38	58	20

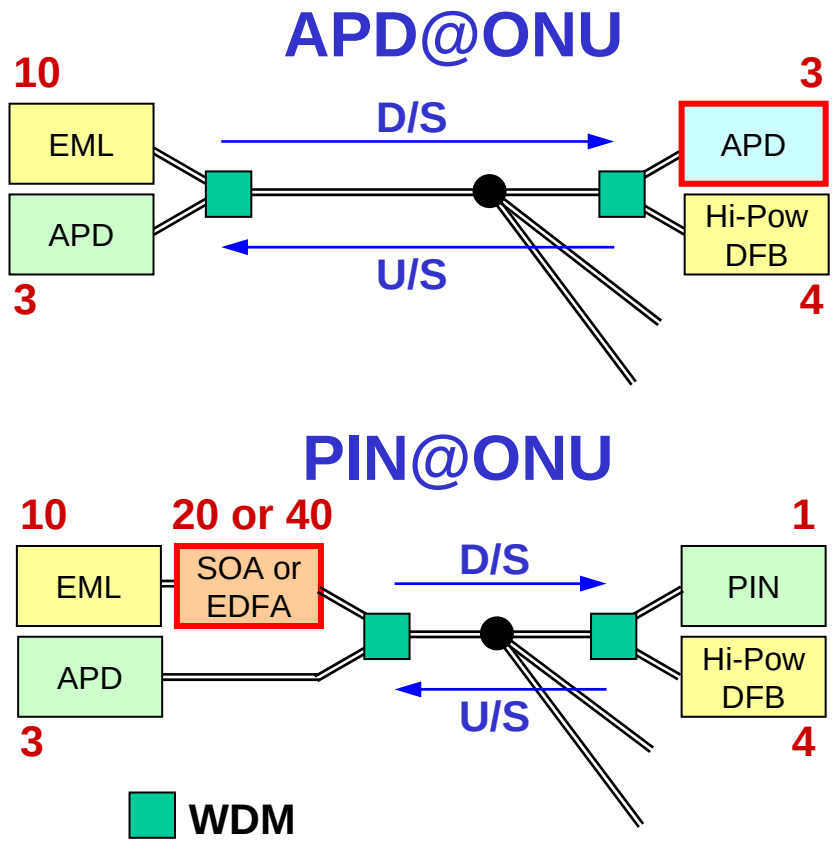
10%

3x

Note : PIN costs '1x'

High-Power-DFB costs '4x' by 'Schrans'

Other optics costs by 'Lee'

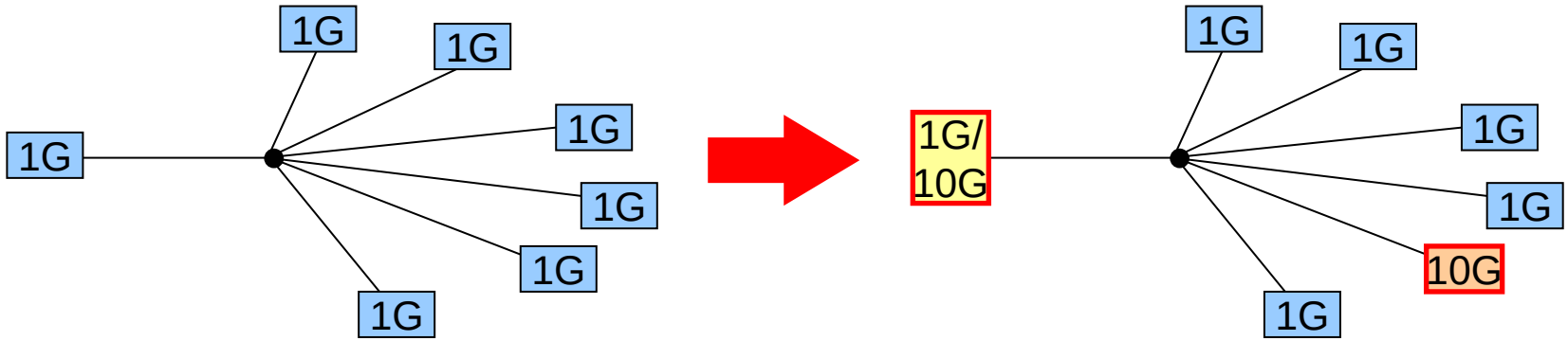


- Only 10% difference at 1:32 in total optics
- APD@ONU always cheaper if APD costs within 2x
- OLT 3x cheaper

APD@ONU is cheaper

Low-cost OLT saves initial CAPEX

- Easy 10G introduction in co-ex case lowers market barriers



Single OLT/ONU pair serves all the ODN Classes

- Reduces the variety of vendor products and carrier spares

Suppliers competition will reduce 10G-APD cost

- Single supplier dominates so far the telecomm market, but newcomers now rush into the datacomm field
- No big room remains for cost reduction of already-matured 10G-PINs

APD@ONU is smaller

Small OLT saves footprint in central offices

- XFP size available for 10G EML transceiver
- Simple 1G/10G OLT may be packed in the current 1G size

PIN@ONU doubles 1G/10G OLT size

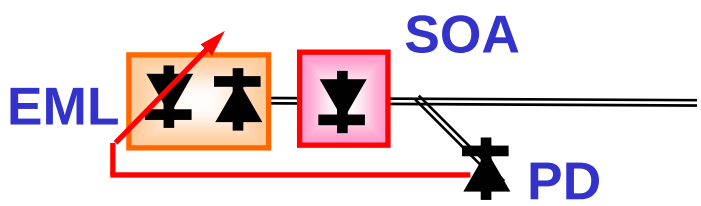
- EDFA in OLT??, which almost doubles the size
- SOA/EDFA huge power dissipation prevents size reduction

High-power EML anyway necessary

- PX10 in PIN@ONU needs similar Tx power of APD@ONU

SOA needs complex power control

- SOA output monitor feedback to control EML bias
- EML power range necessary for SOA gain deviation

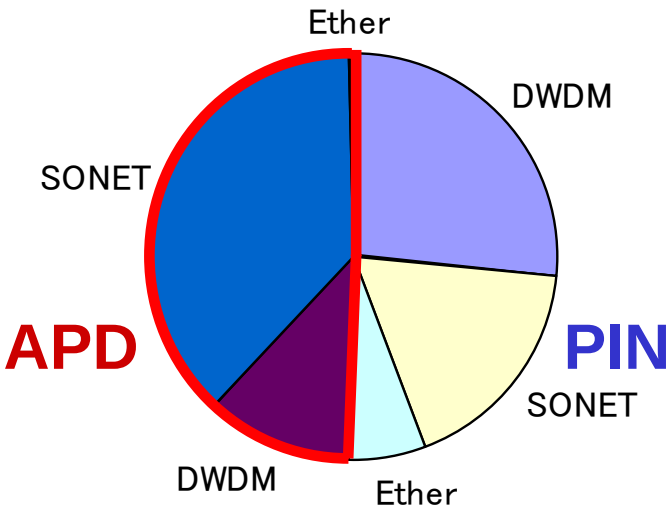


APD@ONU is hotter

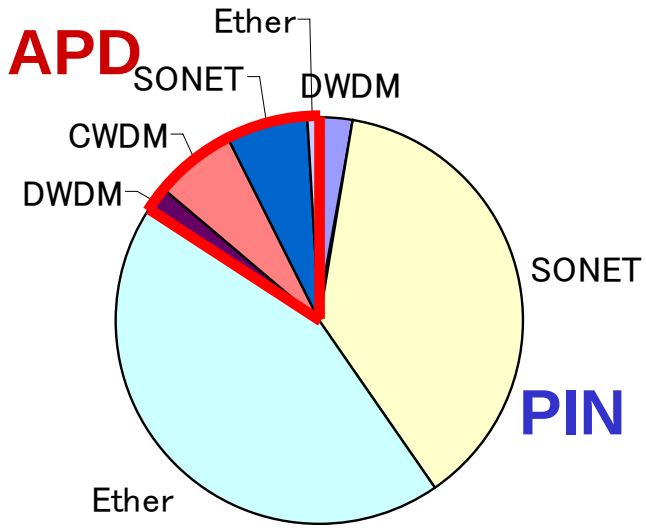
Volume APD production will stimulate the whole 10G market

- Almost half 10G transceivers use APDs, unlike 1Gs
- APD@ONU will contribute to the worldwide 10G networks including backhauls for access systems

10G Rx



1G/2.5G Rx



Unit Volume

CY2007

Source : ovumRHK, Biannual forcast for optical components vendors: WAN revenues, unit volumes, and ASPs, March 1, 2007

Why not APD@ONU?!