Optic Cost Estimation for 10G EPON Downstream

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Introduction

- In order to provide enough power budget for the three channel insertion loss cases, two disparate solutions have been proposed for downstream; pin-PD@ONU & APD@ONU

- Pros & cons were discussed, but not reach an agreement to select one solution. Especially, there were inconsistent opinions on the cost estimation.

	Pro	Con
pin-PD@ONU	Lowest cost solution (fully subscribed); system cost should comprehend replacement of ONUs during lifetime of OLT	More costly solution (fully subscribed and first costs)
APD@ONU	Low development cost and short time-to-market	Expensive ONU (fully subscribed system)

Source: APD vs PIN pro-n-con.pdf by Robert Lingle Jr.

Assumptions for Cost Estimation

- Relative Optic Component Costs

	Pin-PD ROSA	APD ROSA	EML TOSA	EML TOSA (high power)	SOA	EDFA
Relative Cost	1X	3X (2X)	10X	10X	20X	40X

Note: relative optic costs from 3av_0611_lee_1.pdf

- PMD parameters

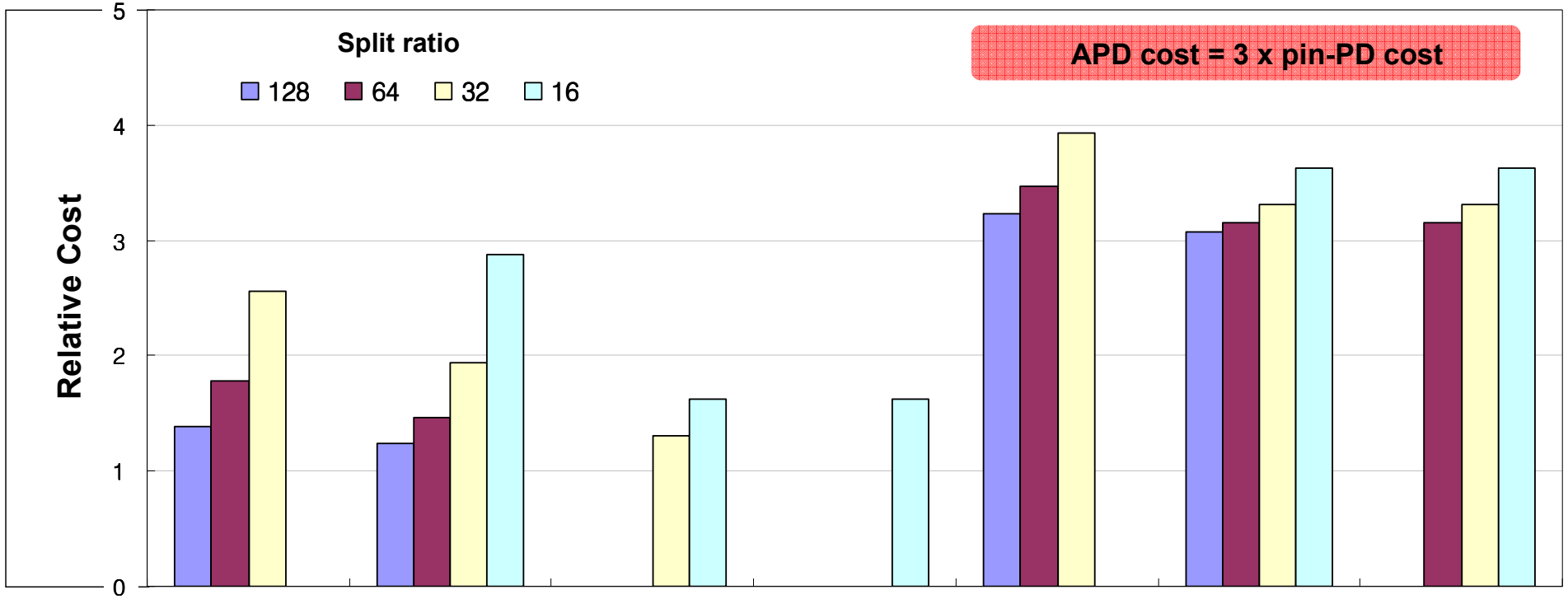
Parameter		Value
Tx Output Power [dBm]	EML+EDFA	+15 ~ +17
	EML+SOA	+10 ~ +11
	EML (high power)	+2 ~ +3
	EML	0
Rx Sensitivity [dBm]	Pin-PD	-18 ~ -16
	APD	-24
FEC Gain [dB]	FEC	3
	EFEC	4

- Expected Channel Insertion Loss

Split ratio	Distance	Value [dB]
128 (note)	20 km	35 ~ 38
	10 km	30 ~ 33
64 (note)	20 km	32 ~ 35
	10 km	27 ~ 30
32	20 km	29
	10 km	24
16	20 km	24
	10 km	20

Note: Values from 3av_0611_hajudczenia_1.pdf

Cost Estimation for Downstream

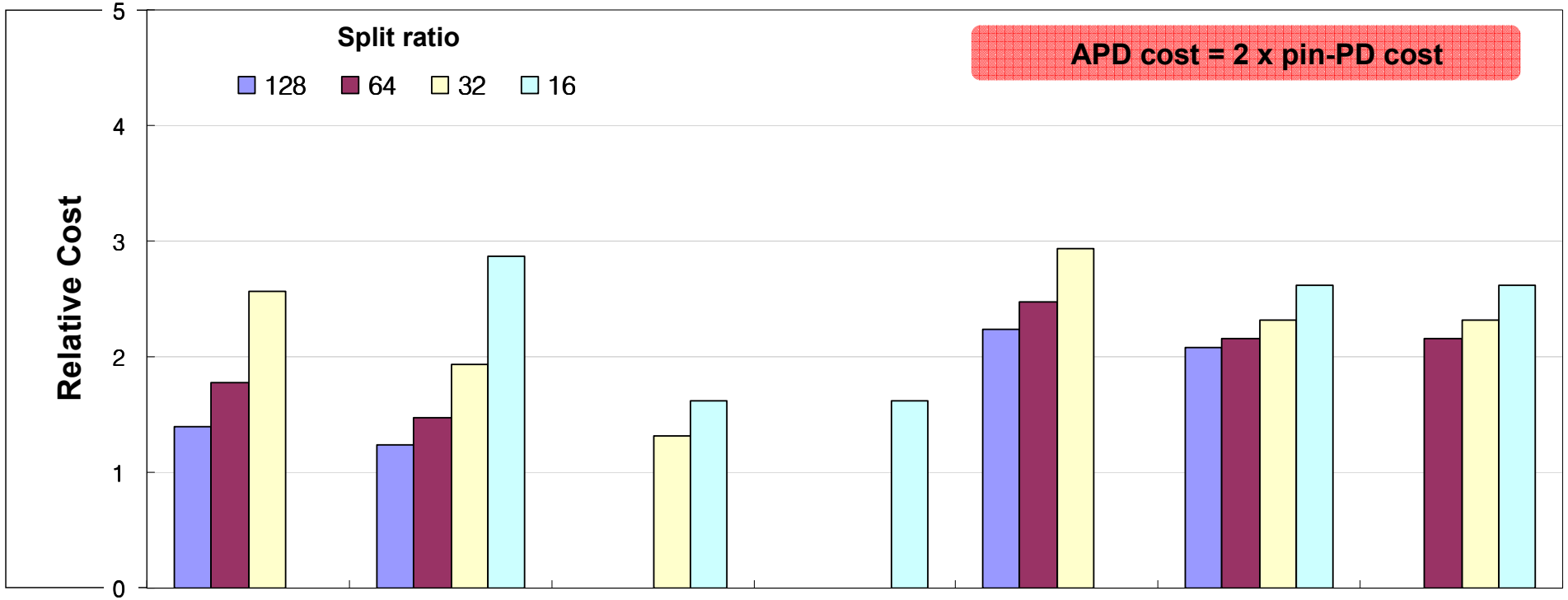


Tx	EML+EDFA	EML+SOA	High power EML	EML	EML+SOA	High power EML	EML
Rx	pin-PD				APD		
Power Range	34 ~ 39 dB	29 ~ 33 dB	21 ~ 25 dB	19 ~ 22 dB	37 ~ 39 dB	29 ~ 31 dB	27 ~ 28 dB
CHIL Cases	128 ONUs @20km	128 ONUs @10km 32 ONUs @20km	16 ONUs @20km	16 ONUs @10km	128 ONUs @20km	128 ONUs @10km 32 ONUs @20km	16 ONUs @20km

71% ↑

123% ↑

Cost Estimation for Downstream



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19% ↑

61% ↑

Summary

- **Pin-PD @ ONU is cost effective for downstream**
  - **At ONU side, using Pin-PD provides cheaper solution than APD for entire ODN classes;**

CHIL [dB]	pin-PD@ONU	APD@ONU
20	EML@OLT	EML@OLT
24	High power EML@OLT EML+SOA@OLT	EML@OLT
29	EML+SOA@OLT	High power EML@OLT

61~123% ↑

19~71% ↑

- **APD @ ONU will be cheaper than pin-PD @ ONU for downstream when;**
  - "SOA cost is higher than split ratio × (APD cost – pin-PD cost)"
    - **For example, at 32 split ratio, APD @ ONU is cost-effective if SOA cost is higher than 32X and APD cost is lower than 2X relative to pin-PD cost**