

Infrastructure Sharing In Practice: Sharing Copper and Fiber

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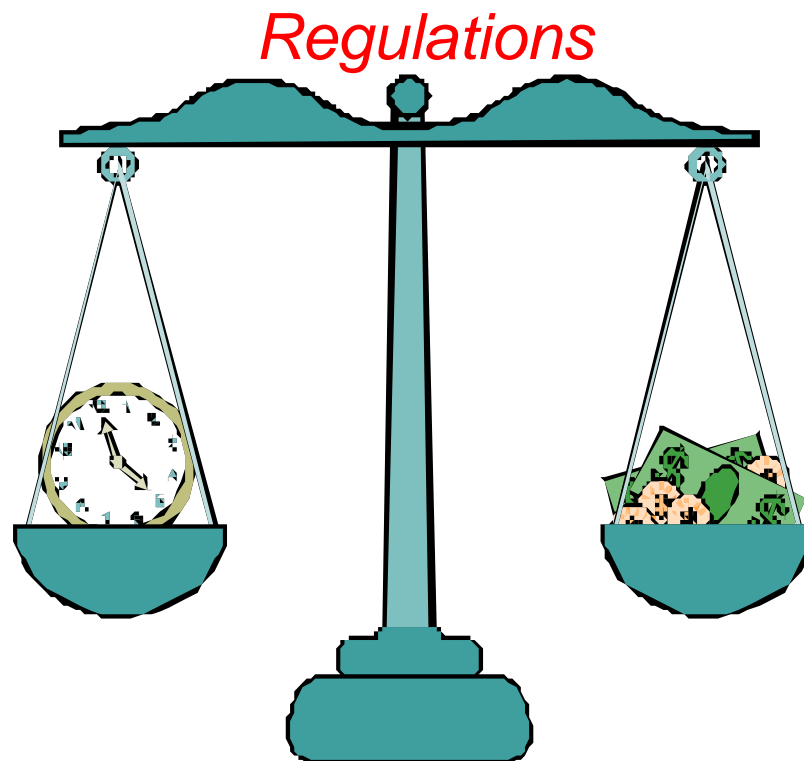
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1 Key Issues for Sharing infrastructure

2 Physical Layer Sharing Solutions

3 Bitstream Open Access Solution

Why sharing?



Time or Money?

Fair or Not?

FTTX Investment and Regulation Overview

Broadband as Country Strategy

Singapore

■ 2005 “iN2015” Plan

- to create 80,000 additional jobs
- to achieve 90% home broadband usage
- to achieve 100% computer ownership in homes

Japan

■ 2005 “u-Japan”

■ 2006 “NGBB Plan 2010”

- 30M per customer
- Broadband Coverage 100%

Regulations

Regulation loose in USA

- 2004 -“FTTX network needn’t open to other operator”
- 2007 – Forbidden apartment and Cable Operator signing exclusive protocol

Strict Regulation in EU

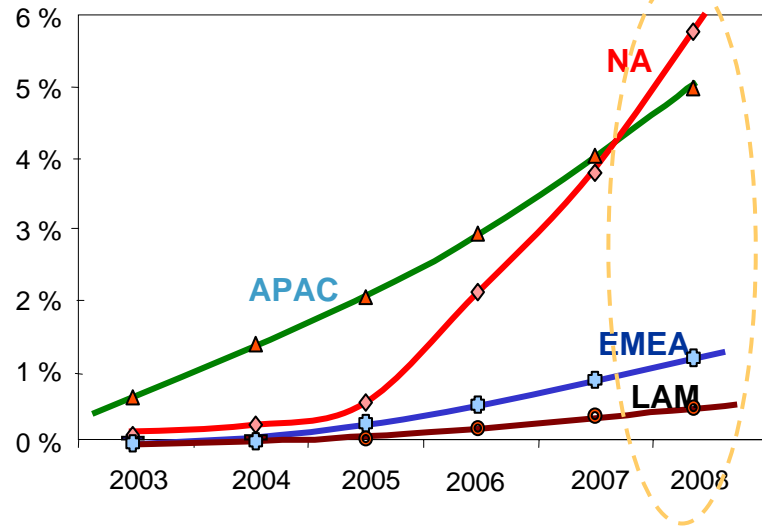
- 2006 – Must open copper and fiber to other operator
- Situation improving in regulation such as ARCEP in France

No regulation limit

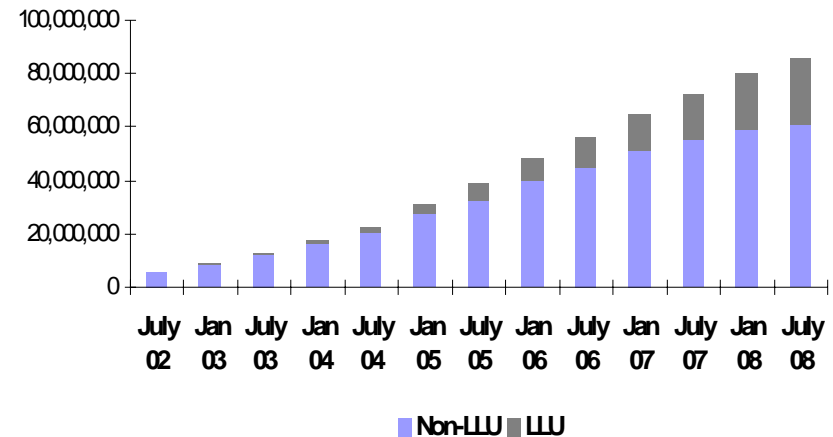
- Japan encourage FTTH by extra allowance to each customer
- China government encourage bandwidth deployment to accelerate economic speed

Different Regulation leads to Different Result

Total Fiber In the Loop penetration (% POTS lines)



DSL subscribers in Europe after LLU regulation



EMEA(EU)

- Growing interest from municipals and CLECs.
- About 1.5M FTTH/B subscribers (by FTTH Council Europe)
- **FTTX slow down because of strict regulations**








NA

- Over 3M FTTH subscribers
- Verizon push on FTTH PON and AT&T FTTH/FTTN Light speed
- **Regulation encourage Tie1 Operators to build their own network**

APAC

- Strong governmental push
- NTT driving FTTH PON volumes
- **Fast deployment because of government supporting**

Mixed Regulations in Western European Countries

Country	Regulator	Regulation remedies					FTTx status
		Duct sharing	Street cabinet sharing	Sub fiber LLU	E2E fiber LLU	Bitstream	
France 	ARCEP	✓		✓			Good
Germany 	BNetzA	✓	✓				
Italy 	AGCOM	✓				✓	
Spain 	CMT	✓				✓	
Netherlands 	OPTA				✓		
UK 	Ofcom					✓	
Portugal 	ANACOM	✓					Good

- **No unified regulation** in European countries.
- **Mixed regulation** in one country.
- **Duct open and Bitstream** concerned most.
- **Infrastructure competition** promote development of FTTx most, such as France and Portugal.

Key Issues of FTTx Construction



No regulation is better than bad regulation.
—Viviane Reding (Commissioner of Europe Commission)

Who invest ?

- NGA needs **huge investment and long ROI cycle**
- **Only telecom giants are able to invest on NGA.** However, they are not willing to pay for NGA when the regulation is not clear. They would not like to see their huge investment are making used by competitors.
- CLECs **are not willing to see** rapid development of NGA when the regulation is not clear.

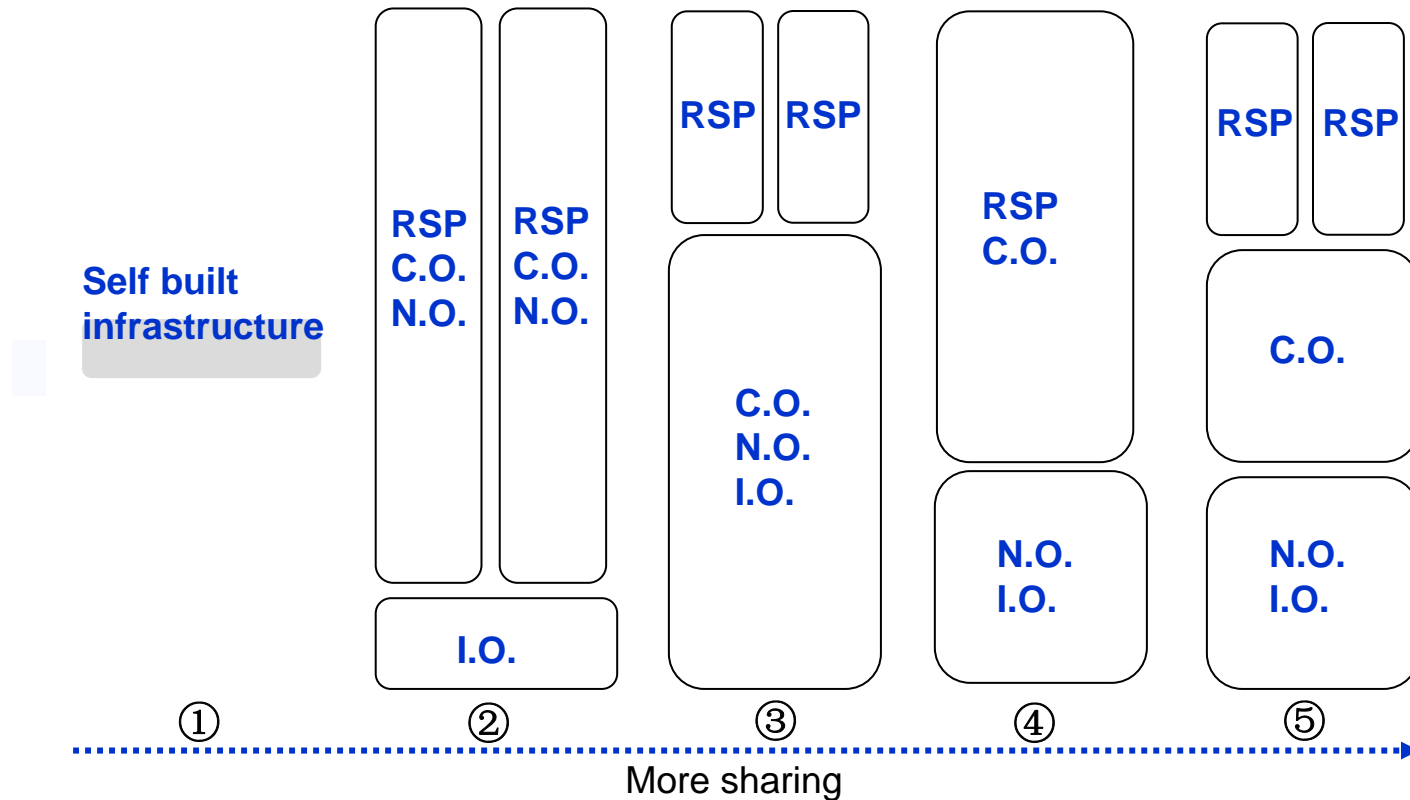
How to open ?

- **GPON is not suitable for LLU in duct open mode**, sharing fibers by multiple subscribers. If LLU is must requirement, **Bitstream sharing is better way for open access**
- In FTTC/B scenario, copper LLU is restricted by **the difficulty of remote site deployment.**

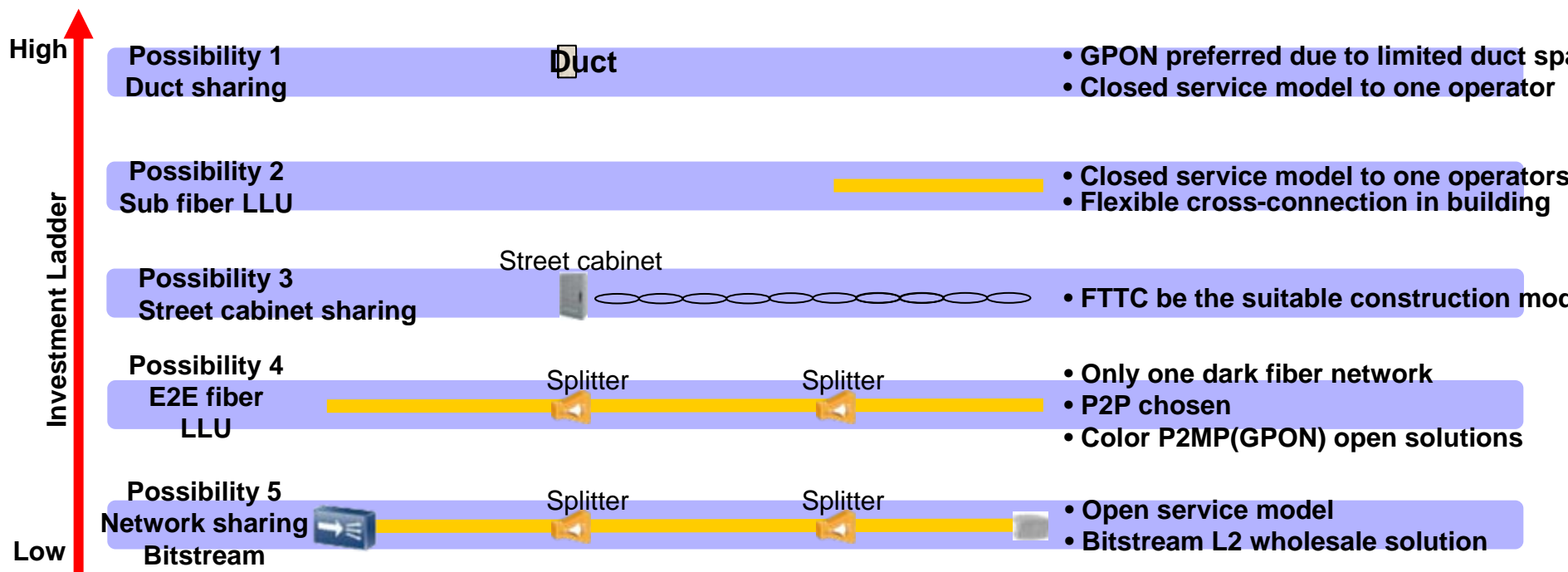
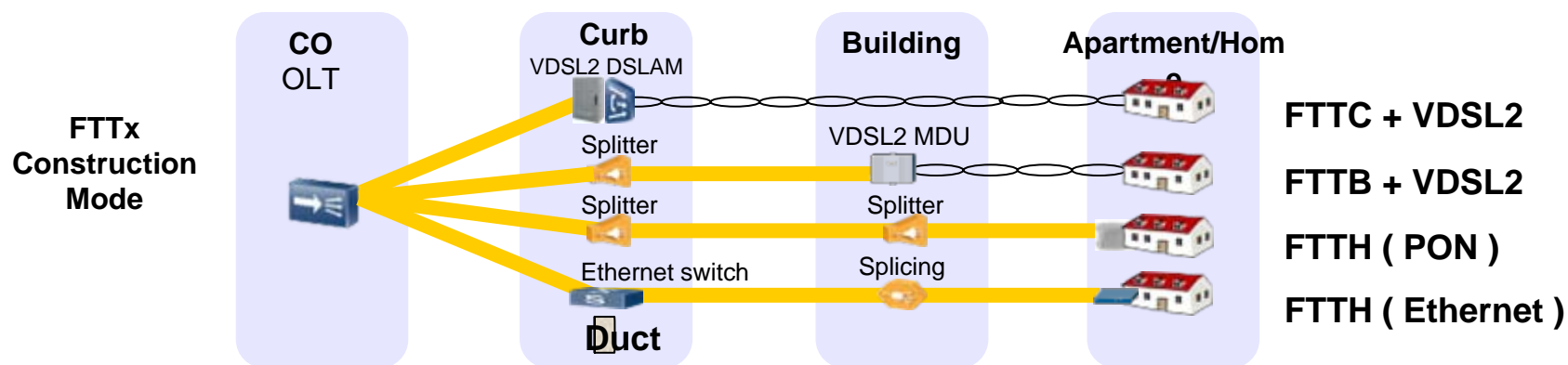
Encouraging investment or encouraging competition? It's a problem!

Open Mode from Operator View

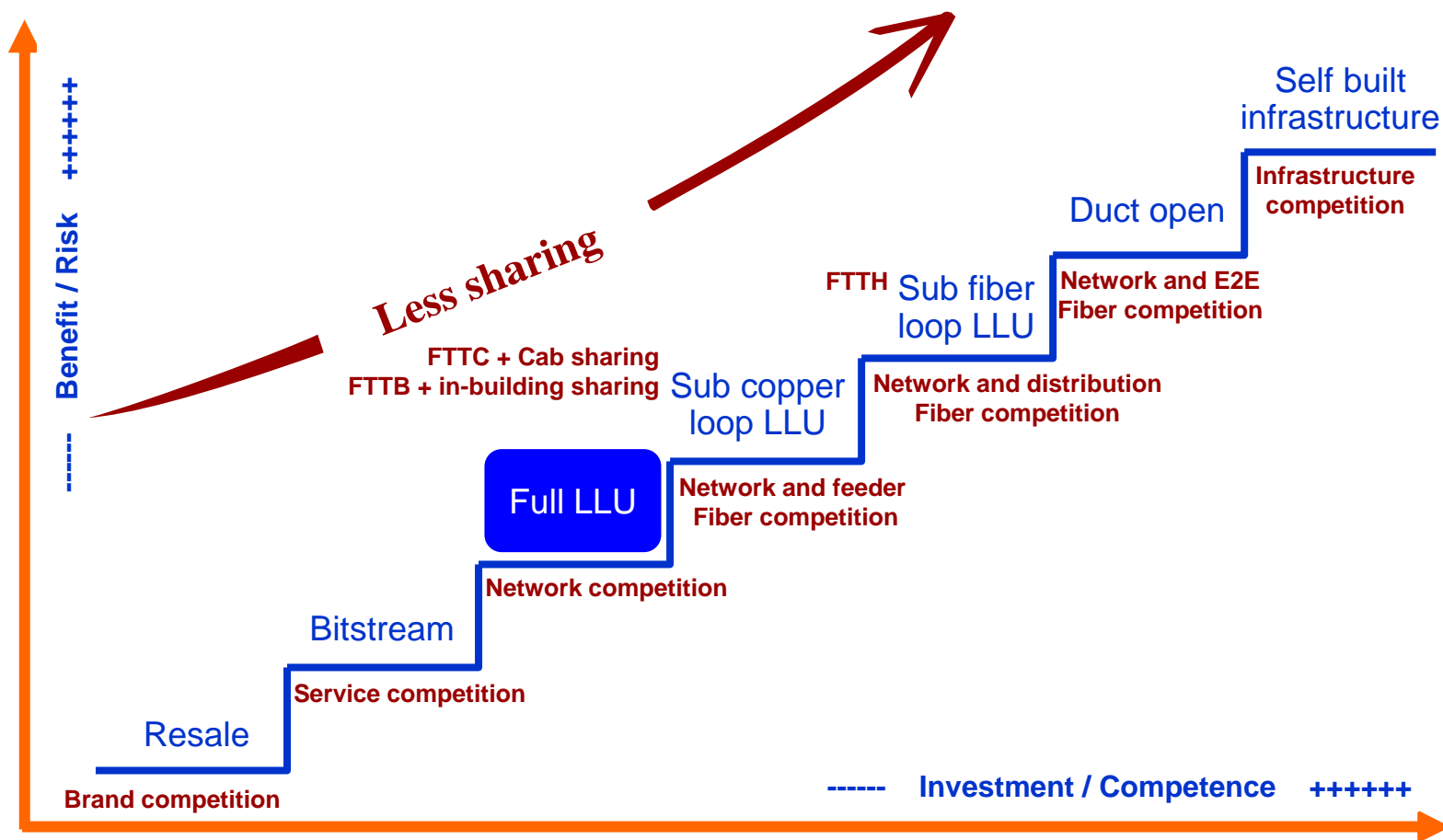
Open Access Model Options



Possible Open Mode of FTTx



Investment Ladder Becoming More Complex in NGA Age



- ✓ More steps appears on NGA investment ladder. All of them appeared in European countries.
- ✓ **LLU is preferred by competition driven market**, providing the best competence and less investment, equipment investment only.

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LLU Copper Sharing

LLU Fiber Sharing

Wavelength Sharing

3 Bitstream Open Access Solution

LLU for copper is a big business



The screenshot shows the Openreach website, a BT Group business. The navigation bar includes links for 'My Openreach', 'Our products', 'Become a customer', 'Our network', 'News', and 'Pricing'. The main content area is titled 'LLU' (Local Loop Unbundling) and features a yellow background with a white van. Text on the page states: 'Local Loop Unbundling enables Communications Providers to offer the full range of voice and broadband services, without having to route through BT's main network.' Below this, there are four links: '→ Signing up for LLU', '→ Forecast Forms and Guidance', '→ EMP Systems Information', and '→ MPF and SMPF Product Information'. A small text block under 'Signing up for LLU' mentions finding information to sign up as a new LLU communications provider.

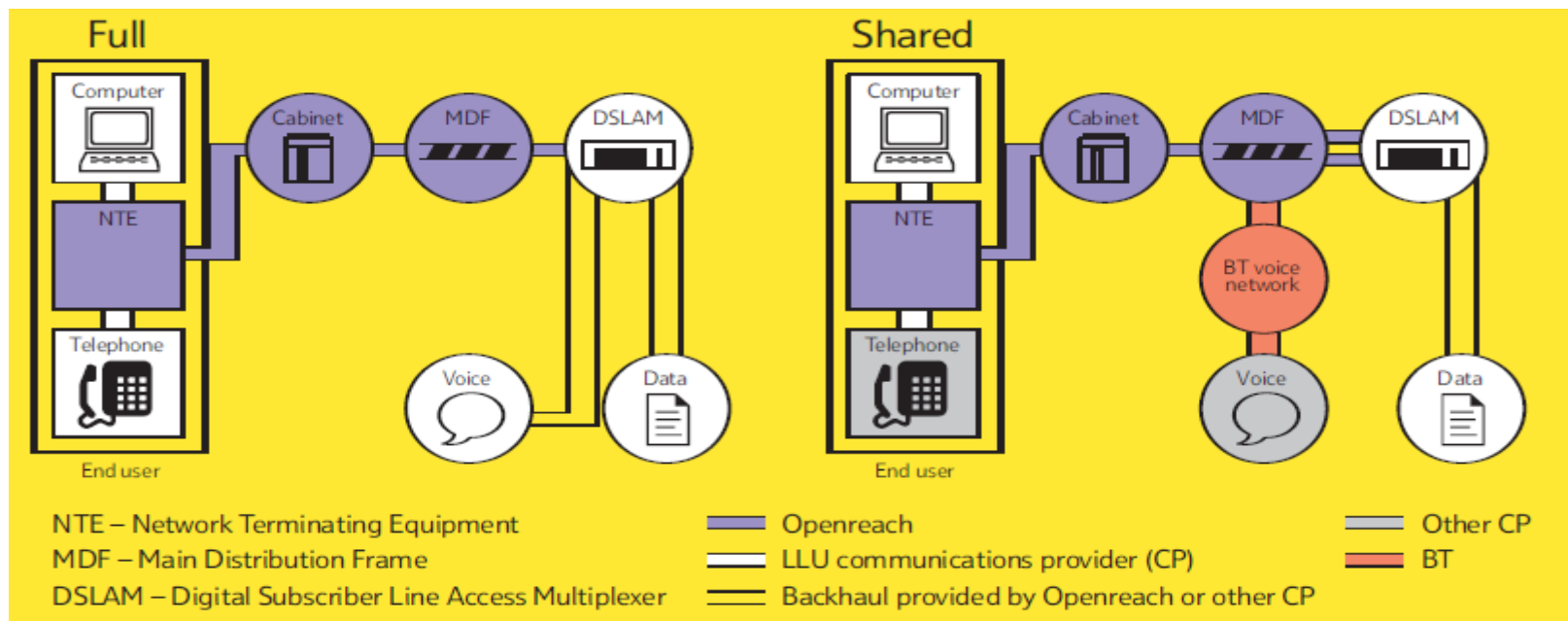
KEY FACTS

1. In February 2007, over **1,500** local exchanges had an LLU presence within them.
2. More than **1.6 million lines** have now been unbundled and the total is increasing at an average of **157,000 lines per month**.
3. **LLU lines have increased by 640%** since the creation of Openreach in January 2006.
4. Openreach now has the capability to deliver more than **one million unbundled lines a year**.

“LLU is a **critical part of Openreach's business**, and the success of our LLU customers is of **paramount importance to us all**. Over the past couple of years, we have made many improvements to the products, prices, delivery systems and supporting processes. “

BT Openreach CEO: Steve Robertson

Copper unbundling solution




Full Mode

Communications Providers have total responsibility for the relationship with their customer, while Openreach provides maintenance for the local loop and responds to fault reports

Shared Mode

the end user has contracts with both the narrowband provider (WLR CP) and the LLU Communications Provider.

Tailong mode: Value-oriented network deployment

Tailong Company profile	Cooperation Content	Benefits
 <ul style="list-style-type: none">A local company who performs well in broadband access network construction in chengdu cityStrength: Strong relationship with local Real Estate 、Community assess management	<ul style="list-style-type: none">Tailong responsibility : access network investment、maintenanceCNC responsibility: BB service operation <ul style="list-style-type: none">Revenue Share: Tailong company shares 70% of broadband access fee but not including content revenue	<ul style="list-style-type: none">Saving Capex in access networkSaving Opex in the network maintenanceReducing investment riskRapidly deploy BB service <ul style="list-style-type: none">Network coverage reached 150+ communities , 200+ commercial buildings in 1 year in 2002Net BB adds 40,000 in 2002

Local operator cooperates with mainstream operators to overcoming the resources shortcoming

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Fiber Physical Sharing Solution

Pros:

No duplication on the infrastructure deployment

Cons:

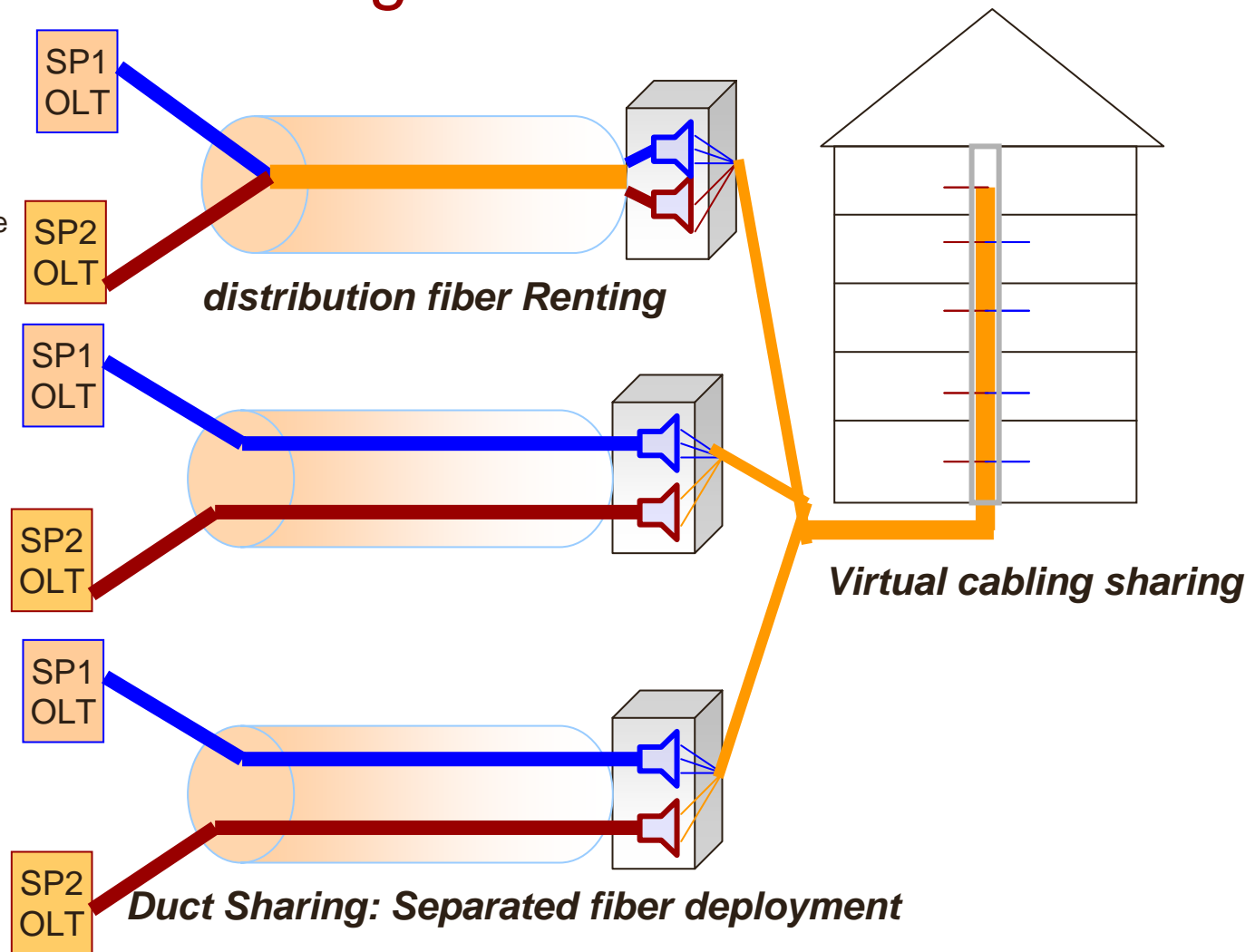
- Big initial investment on the infrastructure, ROI is a doubt
- Limited to GPON architecture

Pros:

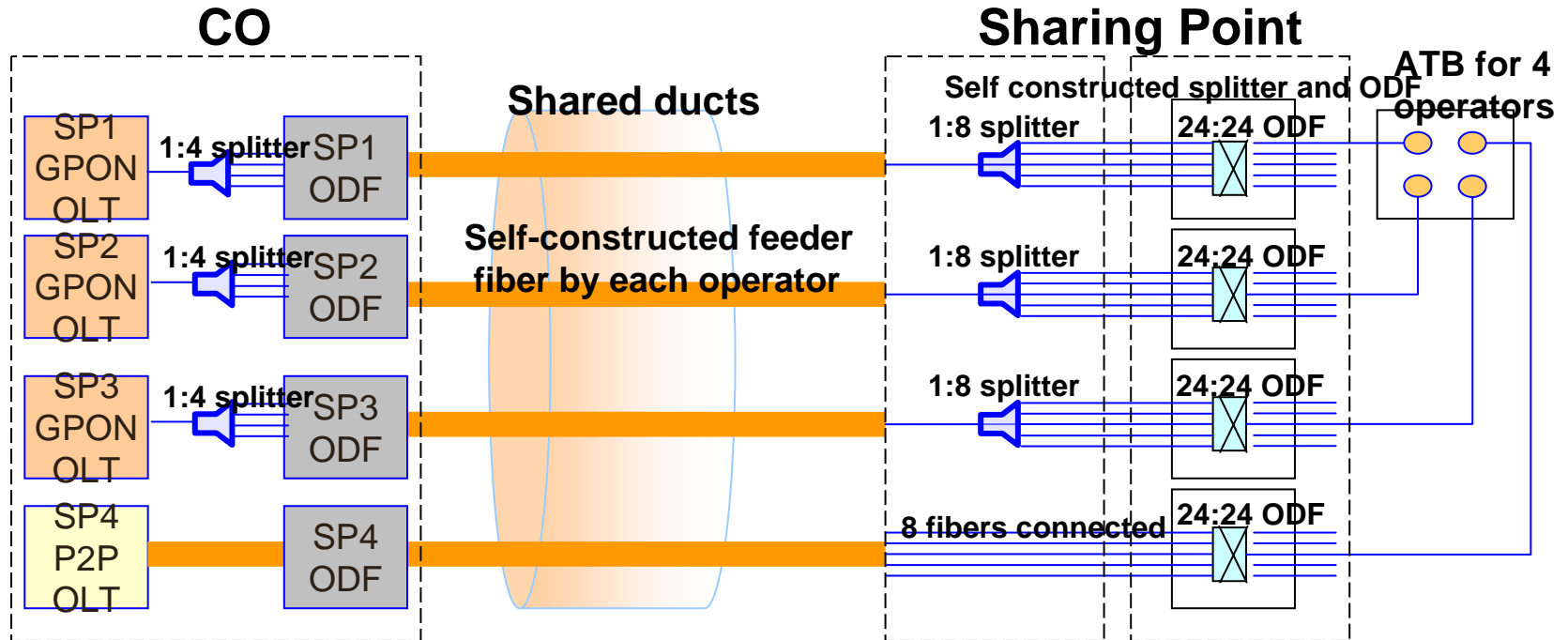
- Share the initial investment and risk

Cons:

- Lose the control to OLOs
- Limited to GPON architecture



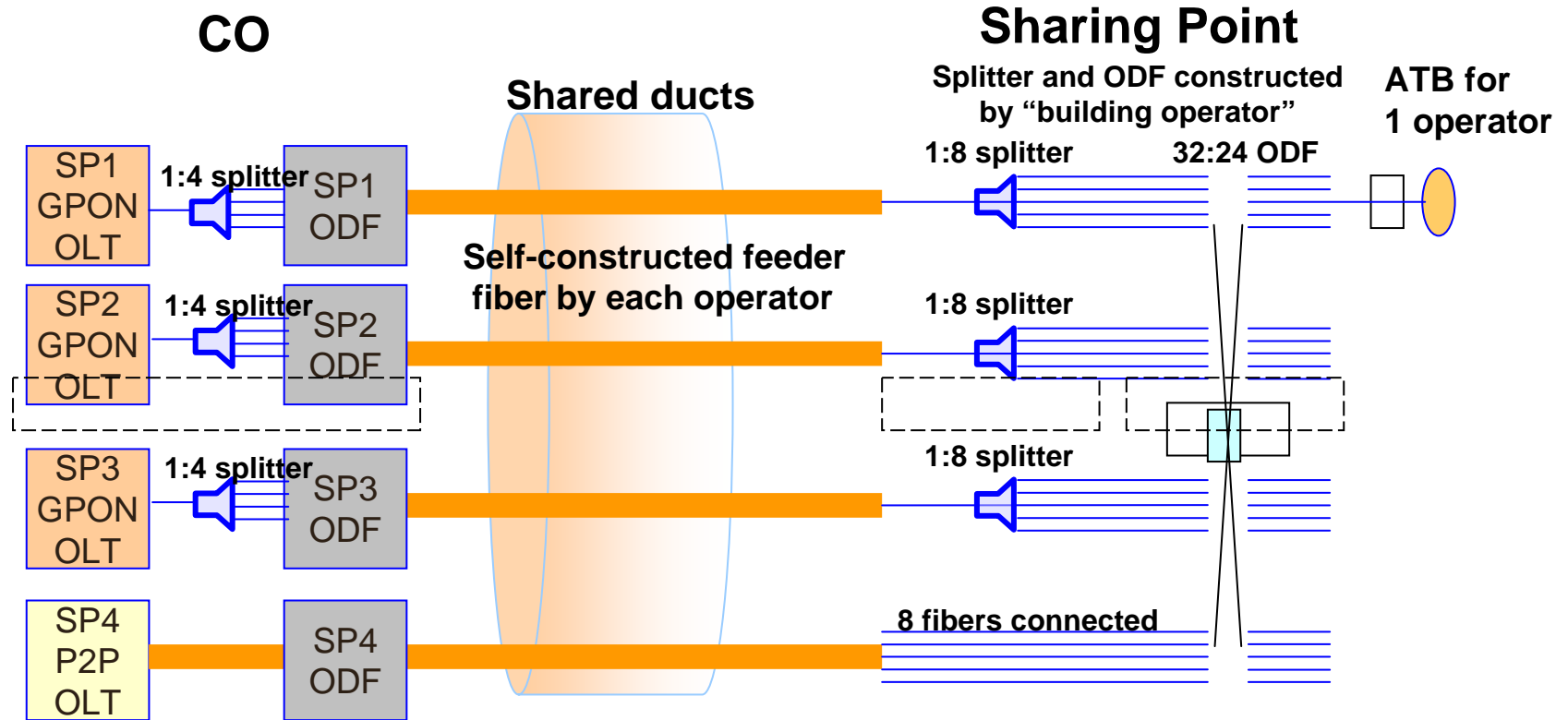
Multi-fiber As the Major Solution



**User changing different operator by connecting different ATB in household.
Isolated network operation even when customer changing operators.
An ODF with 4 units of 24*24 requested, isolated operation space for 4 operators.**

Assumption : 3 existing GPON operators, 1 P2P operator. A residential building with 24 households. 30% penetration at the beginning for each operator. The final penetration target is 100%.

Single-fiber As the Supplemented Solution



User changing different operator by jumping patch cord on ODF at “Sharing Point”. Normally all the splitters and ODF constructed and maintained by “building operator”. Jumping operation by “building operator” always needed for new subscription of any operators.

An ODF of 32*24 requested.

Assumption : 3 existing GPON operators, 1 P2P operator. A residential building with 24 households. 30% penetration at the beginning for each operator. The final penetration target is 100%.

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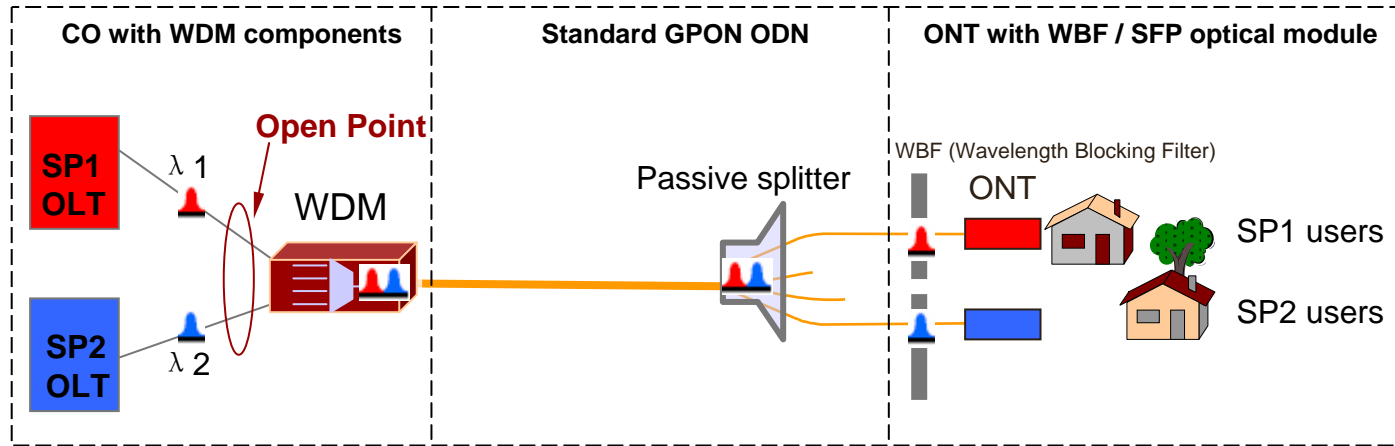
LLU Copper Sharing

LLU Fiber Sharing

Wavelength Sharing

3 Bitstream Open Access Solution

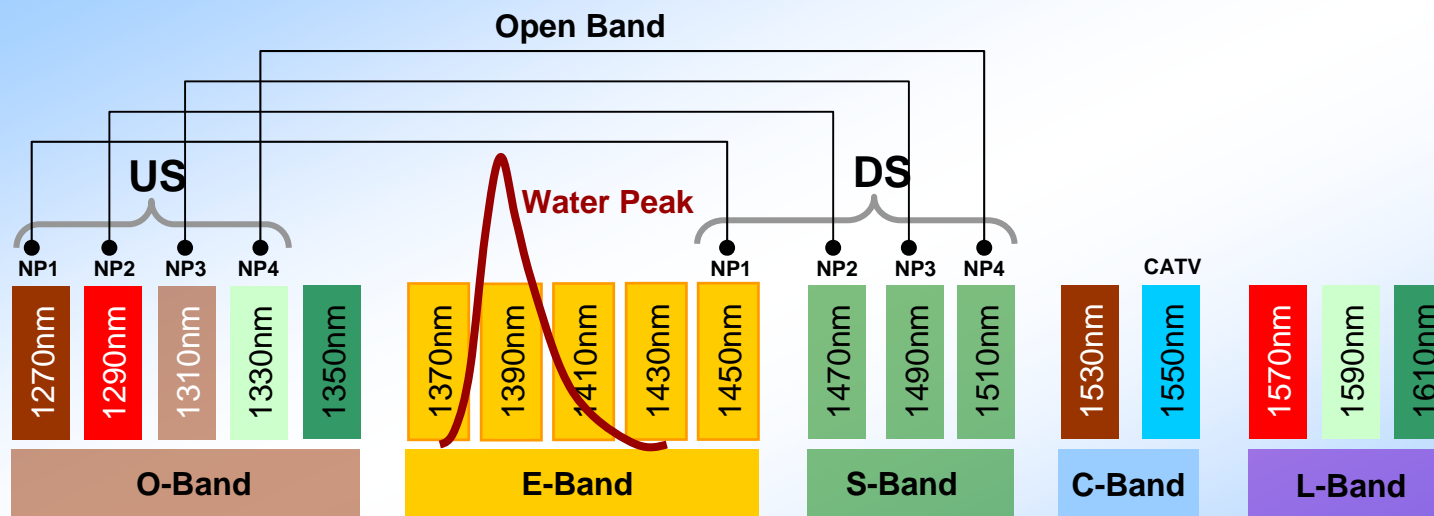
“Colored GPON”——P2MP Unbundling Solution



- ✓ Principle : The wavelength resources on fiber is managed effectively, just like frequency resources at present.
- ✓ WDM technology introduced in a unique P2MP ODN, which make GPON system “colored”, to realize λ unbundling.
- ✓ Each GPON system belongs different operators, whose λ is assigned by regulators.
- ✓ The optical module on OLT and ONT are the only difference between colored GPON and standard GPON.
- ✓ ODN architecture and splitter ratio are kept same with GPON.
- ✓ Operators deliver ONT of their own to customers.
- ✓ λ allocation is compatible with GPON and future XG-PON.

Multi-ISP Supported within CWDM Band Plan

18 CWDM channels (ITU-T G.694.2)

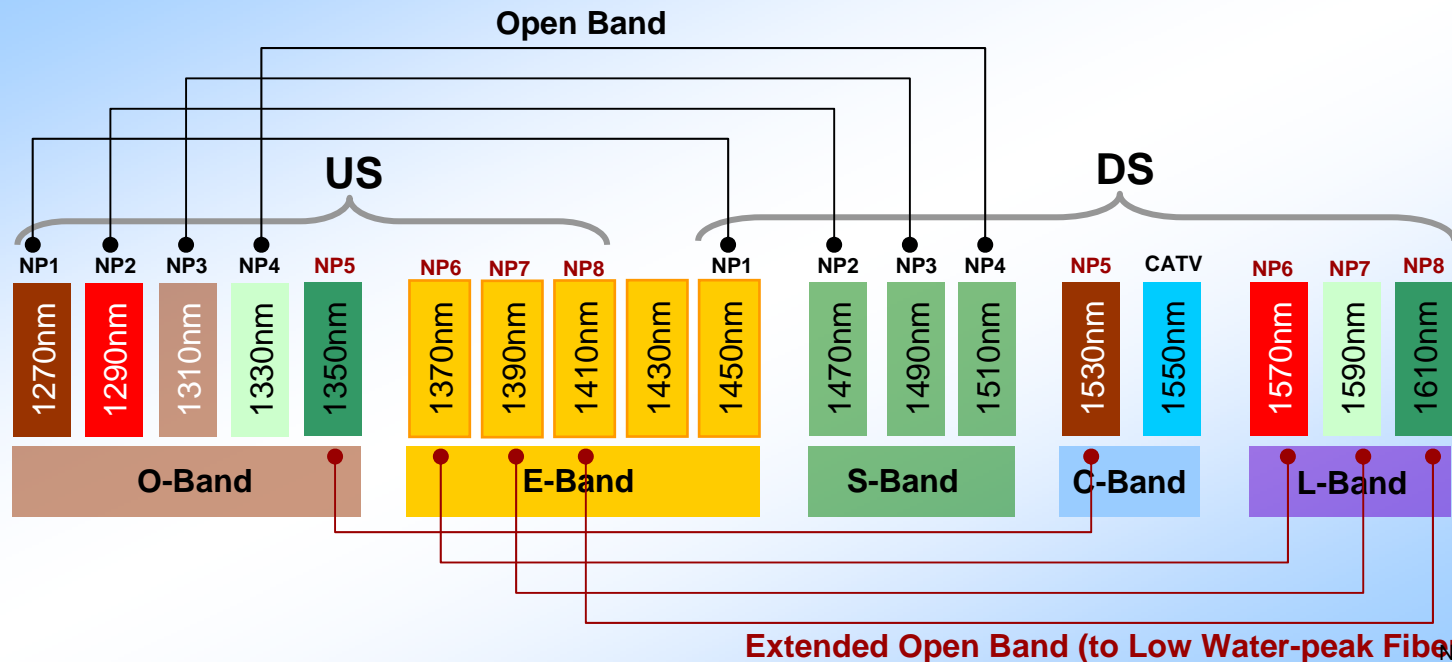


NP : Network Provider

- ✓ λ allocation : Standard G.694.2 CWDM wavelength allocation
- ✓ GPON/XG-PON numbers : 4 PON systems for high water-peak fibers, for 4 operators.
- ✓ Compatible with XG-PON : XG-PON defined with 1270DS/1570US

Colored GPON System Extendable for 8 Operators

18 CWDM channels (ITU-T G.694.2)



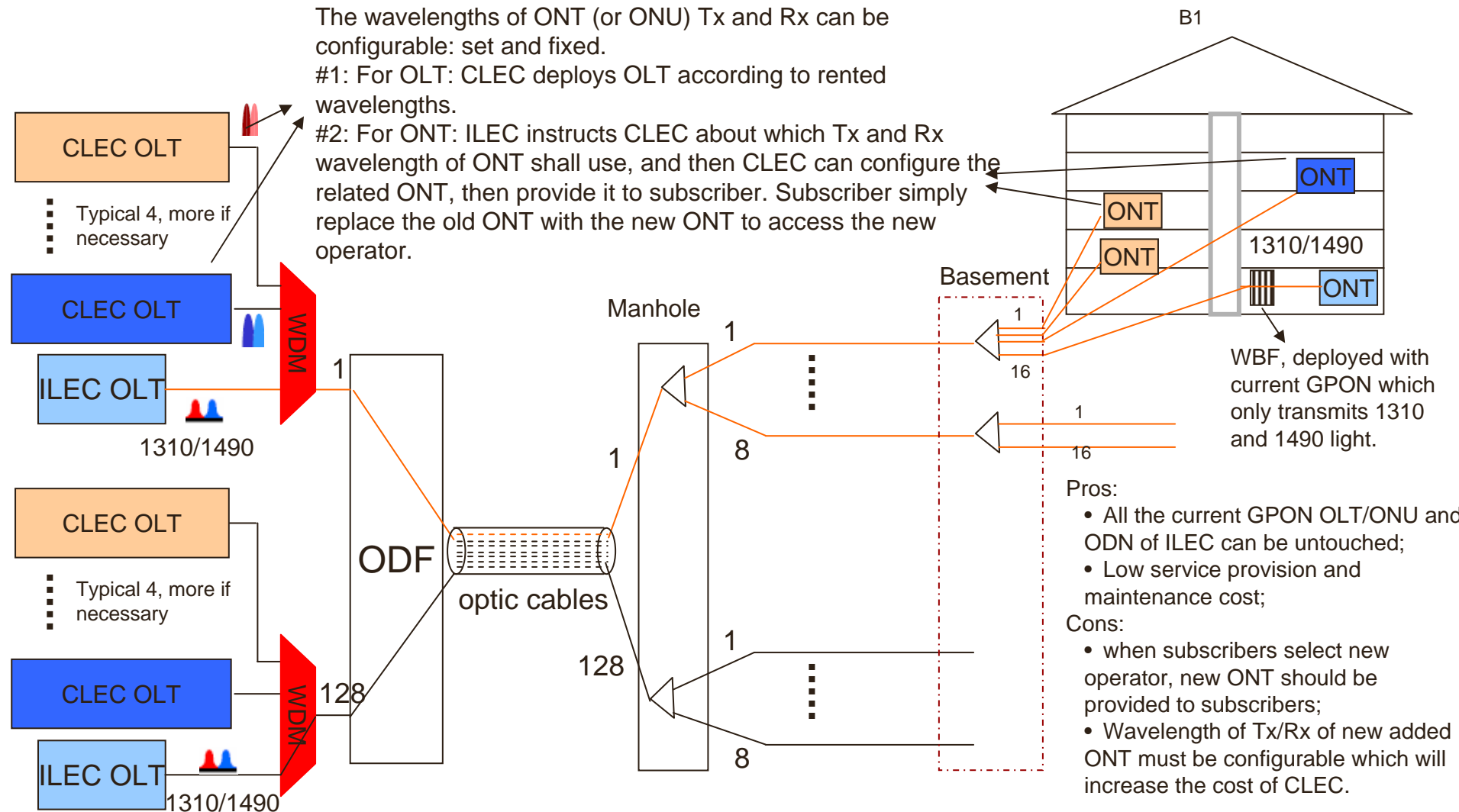
- ✓ When using low water-peak fibers, another 4 DS/US can be assigned.
- ✓ 8 PON systems, which is 8 operators can be coexisted in a same P2MP ODN.

GPON LLU Solution- Colorful GPON

The wavelengths of ONT (or ONU) Tx and Rx can be configurable: set and fixed.

#1: For OLT: CLEC deploys OLT according to rented wavelengths.

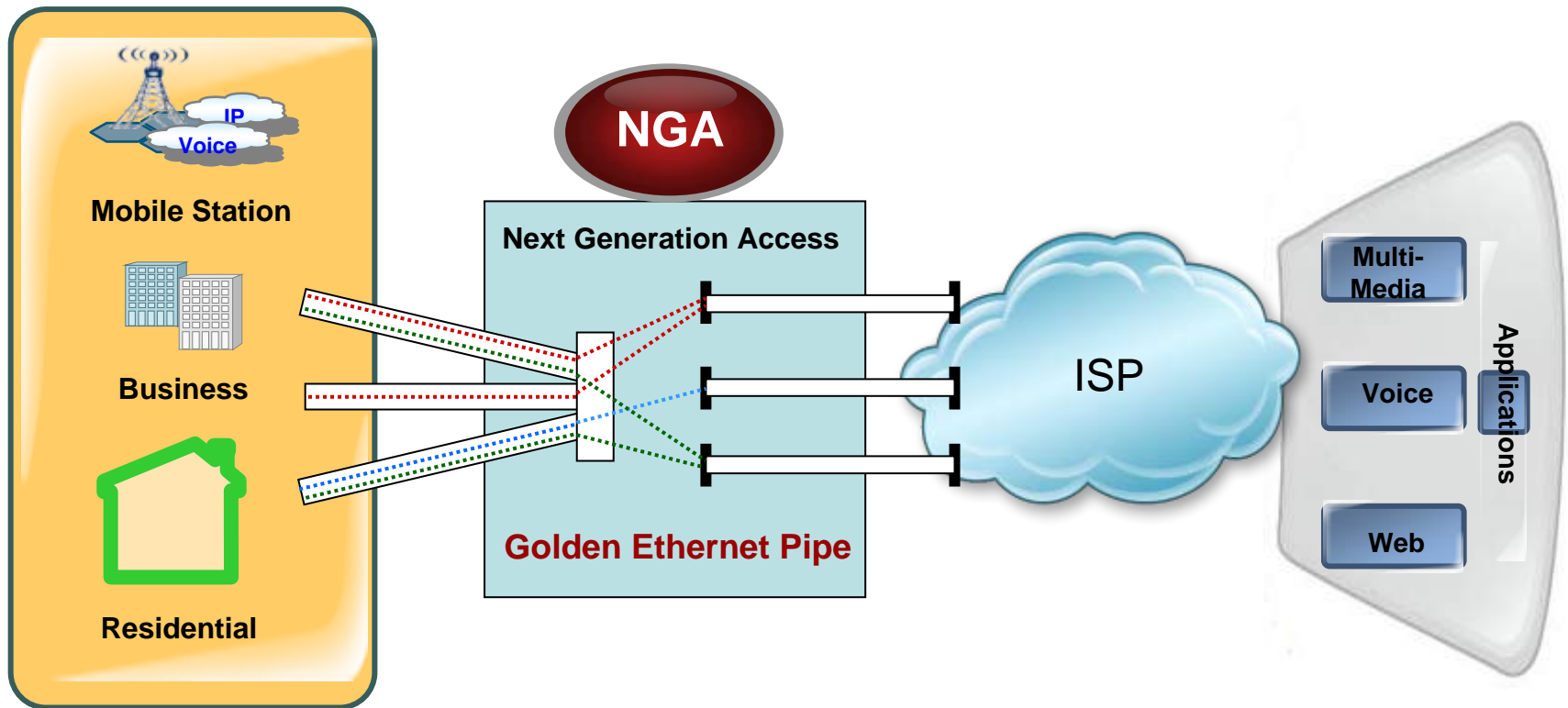
#2: For ONT: ILEC instructs CLEC about which Tx and Rx wavelength of ONT shall use, and then CLEC can configure the related ONT, then provide it to subscriber. Subscriber simply replace the old ONT with the new ONT to access the new operator.



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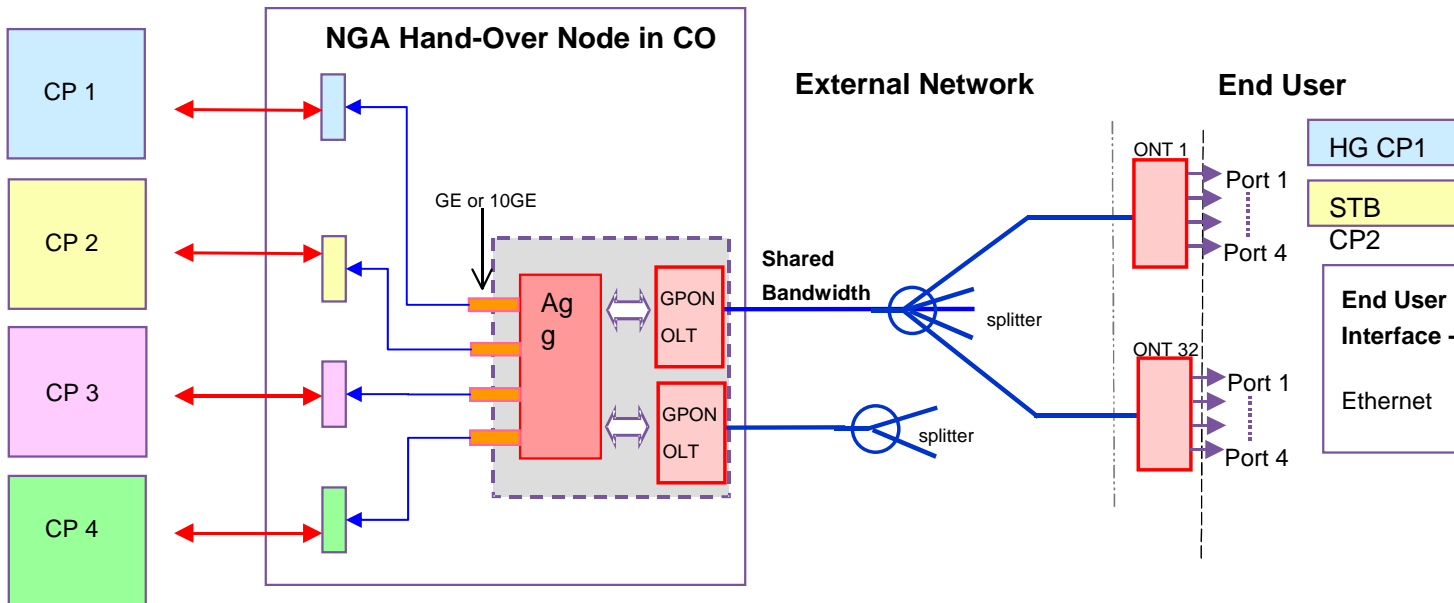
Bitstream Solution for Mixed NGA Network architecture



✓ Separated network and service.

- ✓ Common NGA infrastructure for different service providers
- ✓ Fair access for each service provider and **pure Ethernet pipe**
- ✓ Guaranteed Ethernet Pipes for CPs to provide innovative services to the customers of their own.

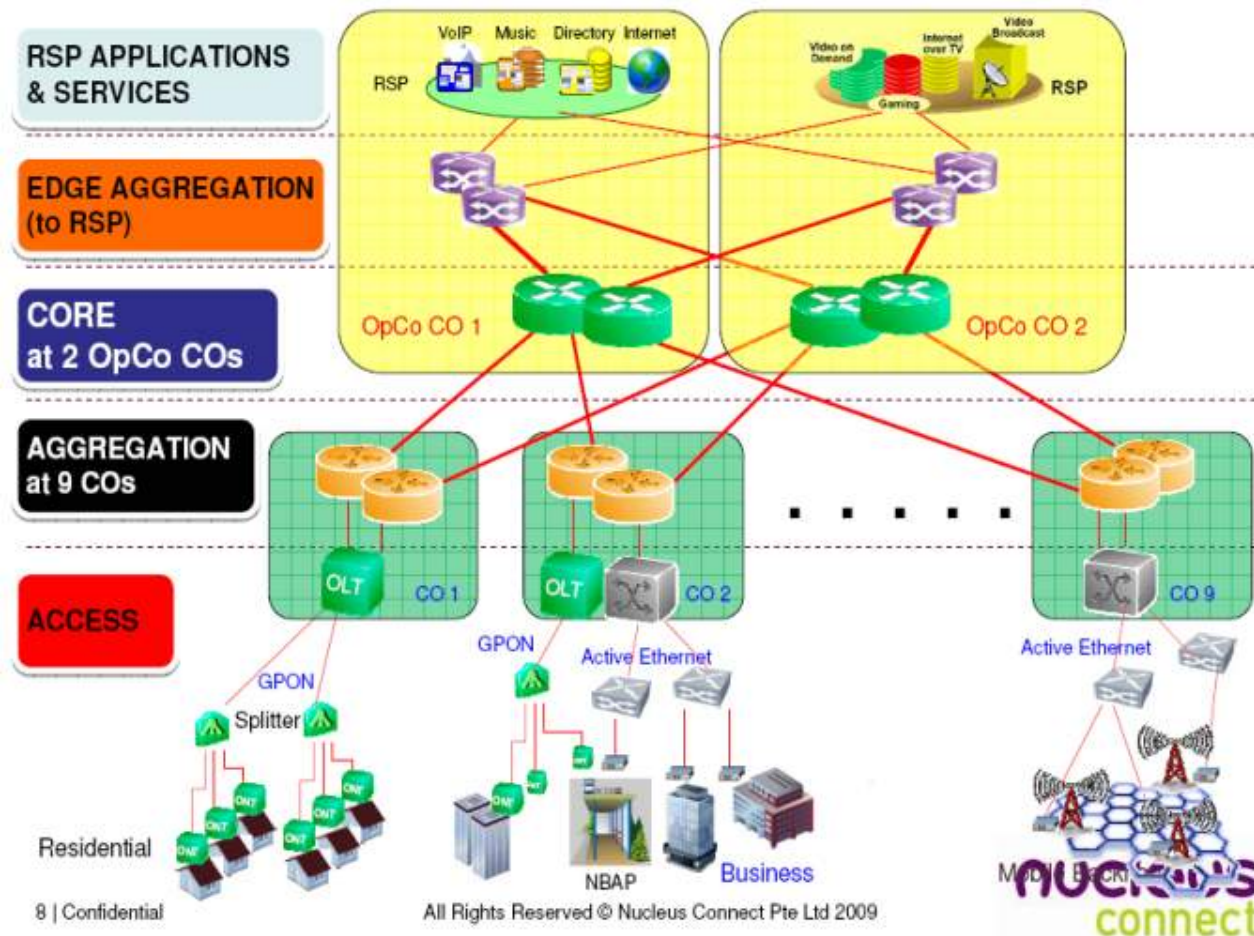
Bitstream L2 Wholesale Access Network Architecture



- ✓ **GE physical interface provided to CP as network side interfaces.**
- ✓ **Ethernet ports on ONT defined as user side open interfaces.**
- ✓ **Ethernet pipe simulated by FTTH network for all the CP and all the applications.**
- ✓ **CP deploy service terminals to end user based on the Ethernet pipe.**

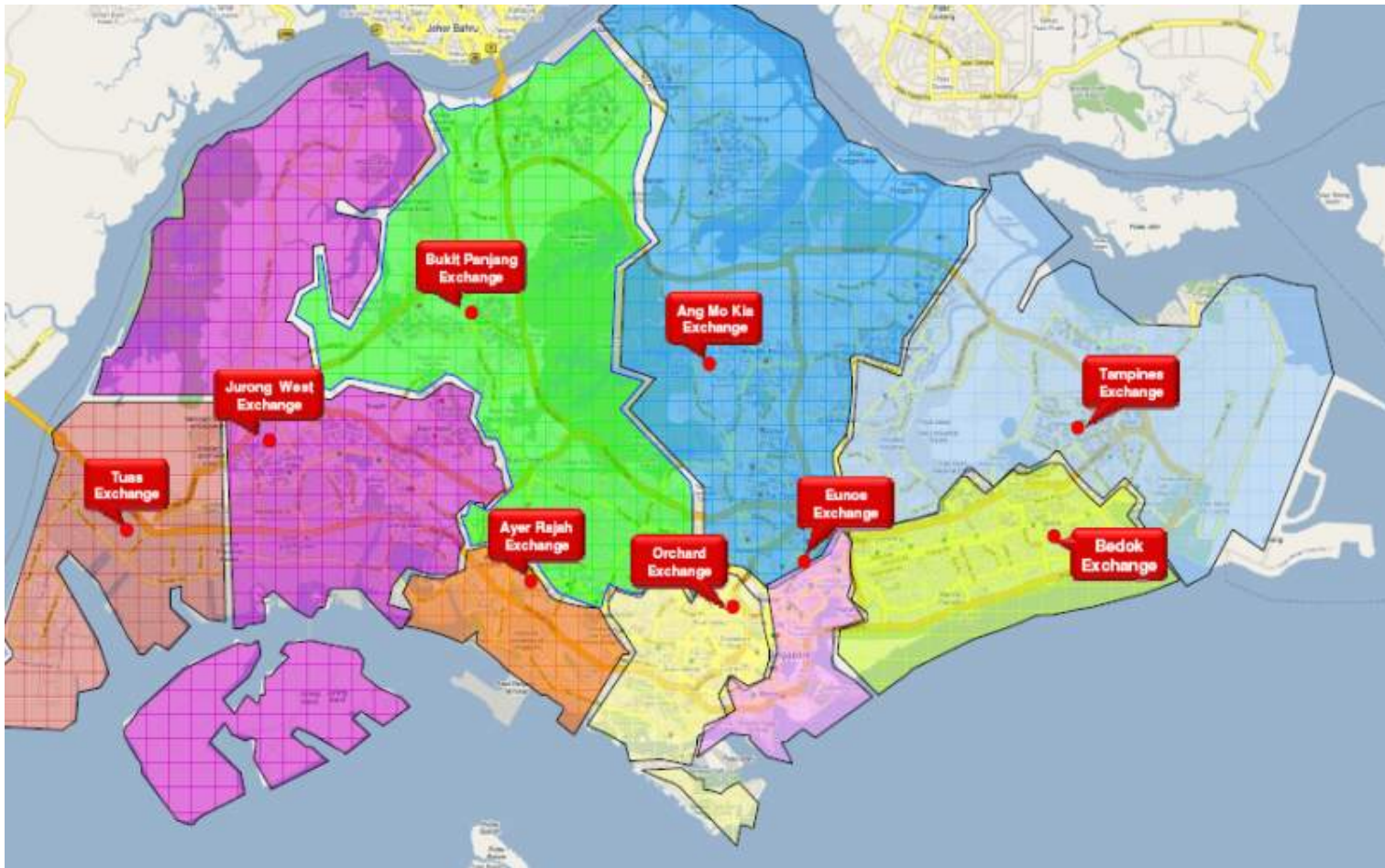
Bitstream Mode in Singapore-NC(1)

■ Solution Overview



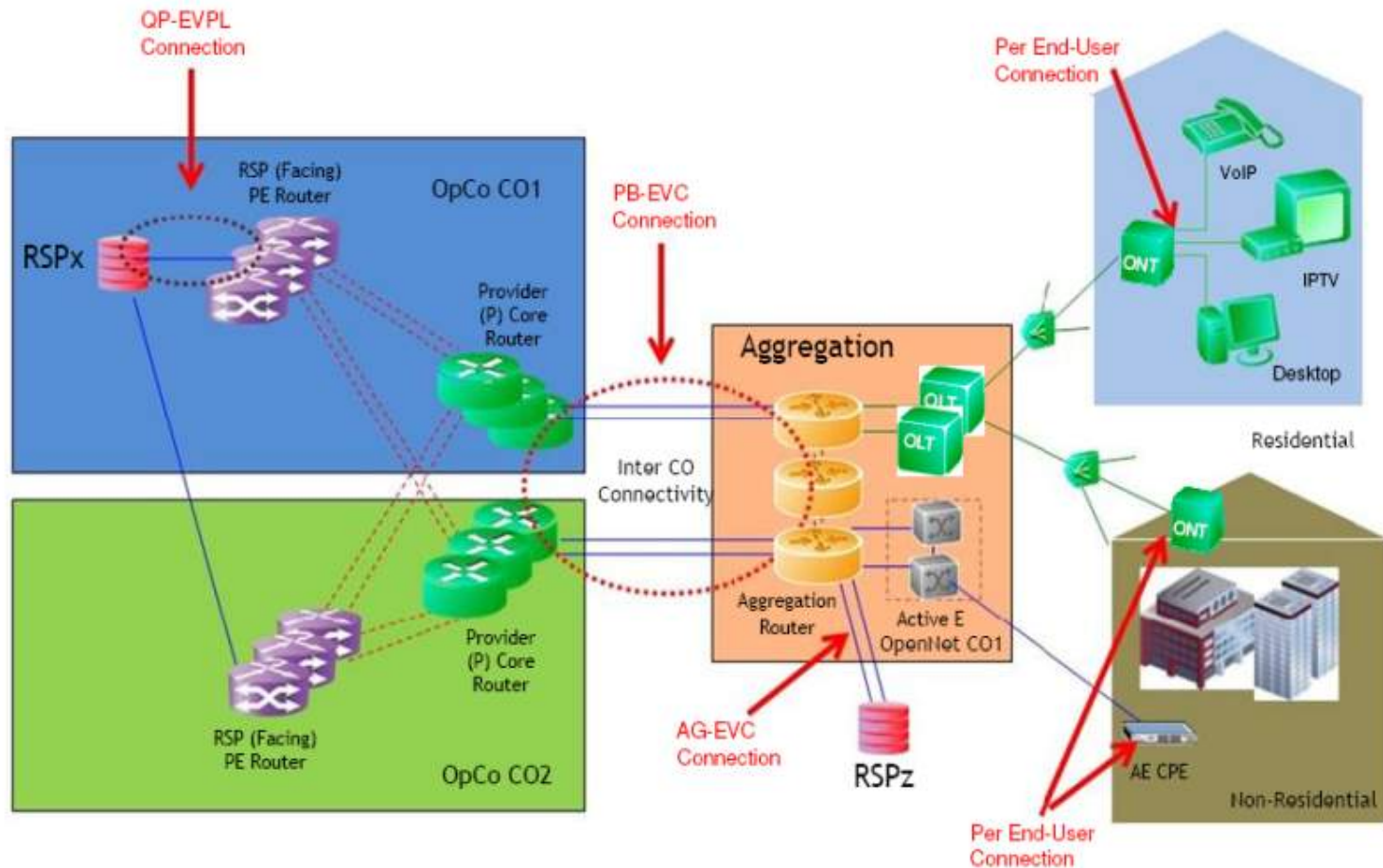
Bitstream Mode in Singapore-NC(2)

■ Network Toplogy, CO location in Singapore



Bitstream Mode in Singapore-NC(3)

■ Connection of Bandwidths Pipe for Sale



Bitstream Mode in Singapore-NC(4)

■ Class of Service

Class of Service	Network Characteristics	Applications
Class A	Real Time	Voice (VoIP), Real time Financial Transactions, Mobile Backhaul, and etc
Class B	Near Real Time	IPTV, VOD, e-Learning Video Conferencing, Remote Home Surveillance and etc;
Class C	Mission Critical	Data Storage, VPN, Interactive Traffic, Signalling Traffic and etc
Class D	Best Effort	High Speed Internet, Email, Instant Messaging (IM) and etc.

	Outer Priority	Inner Priority	DSCP	Service
Class A	5	Defined by RSP	EF	Voice
Class B	4	Defined by RSP	AF31	Video, VOD, Conference
Class C	2	Defined by RSP	AF21	VPN, data Storages
Class D	1	Defined by RSP	BE	HSI
SNMP	6	-		Management/monitor traffic
Reserved	7,3,0	-		7 reserved for equipment

Bitstream Mode in Singapore-NC(5)

■ Principle for Bandwidths Sale from iDA

Basic BW Requirement from iDA:

	Uplink CIR/PIR	Downlink CIR/PIR
FE	0/50	25/100
GE	10/500	25/1000

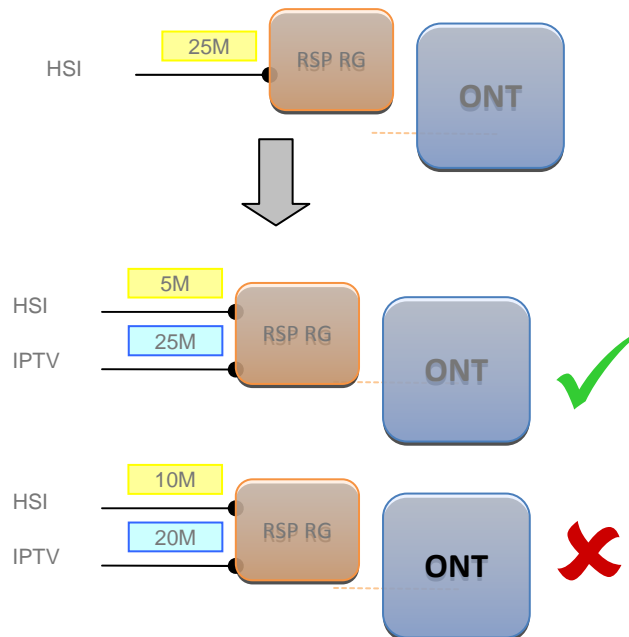
Principles for BW leasing to RSP:

1. Min BW leasing for all RSP is 25M downstream
2. Min BW increment is 5M for one RSP
3. If RSP adds extra service, they can re-allocate BW for the services but at least one service must be more than 25M

Example:

Day 1: RSP provide 25M HSI service, meet min BW leasing requirements of 25M (Principles 1)

Day 2: User request for additional services, so RSP lease another 5M (e.g.) for the extra service, which is the min additional BW request. The RSP can re-allocate the BW for the different service, e.g. HSI is 5M and IPTV is 25M. (Principles 2,3). Eg HSI is 10M and IPTV is 20M is forbidden (Principles 3).



Key Requirements of Bitstream

Key competitive requirements of Ethernet Active Line Access

Functionality	Justification	Technical requirements
Security enablement	<ul style="list-style-type: none">• Secure delivery of services• Authentication of users	<ul style="list-style-type: none">• Separate traffic streams• ALA-users implement own security
QoS enablement	<ul style="list-style-type: none">• Satisfactory delivery of voice and video	<ul style="list-style-type: none">• ALA-provider offers QoS information• ALA-user labels traffic
Multicast enablement	<ul style="list-style-type: none">• Bandwidth savings in backhaul of one to many services (e.g. IPTV)	<ul style="list-style-type: none">• Choice between ALA-provider and ALA-user implemented solution• Common interface• Static and dynamic support
Flexible customer premises equipment	<ul style="list-style-type: none">• To allow CPs to innovate in CPE functionality	<ul style="list-style-type: none">• Common Ethernet interface (initial)• Wires- / Fibre-only interface (future)
Flexible interconnection	<ul style="list-style-type: none">• There is no universally economical interconnection point	<ul style="list-style-type: none">• Local, regional, national interconnect• Common interface• Freedom to move

Summary

- **Copper line LLU mode is very mature, local operator is preferred to manage and wholesale the last mile infrastructure**
- **End to End fiber LLU is not fit for GPON, only good for P2P or “Colored GPON”**
- **Sub loop unbundling for fiber is needed for P2P and GPON mixed scenario**
- **Bitstream mode for sharing will be the mainstream mode for National Broadband Access mode because only need to invest once for End to End network and infrastructure.**

Thank you

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