Optics: FTTH & What's Next? Market Watch

FTTH 및 광통신의 동향

Choi young bok

Let's KT

Access to Broadband Network & New Life

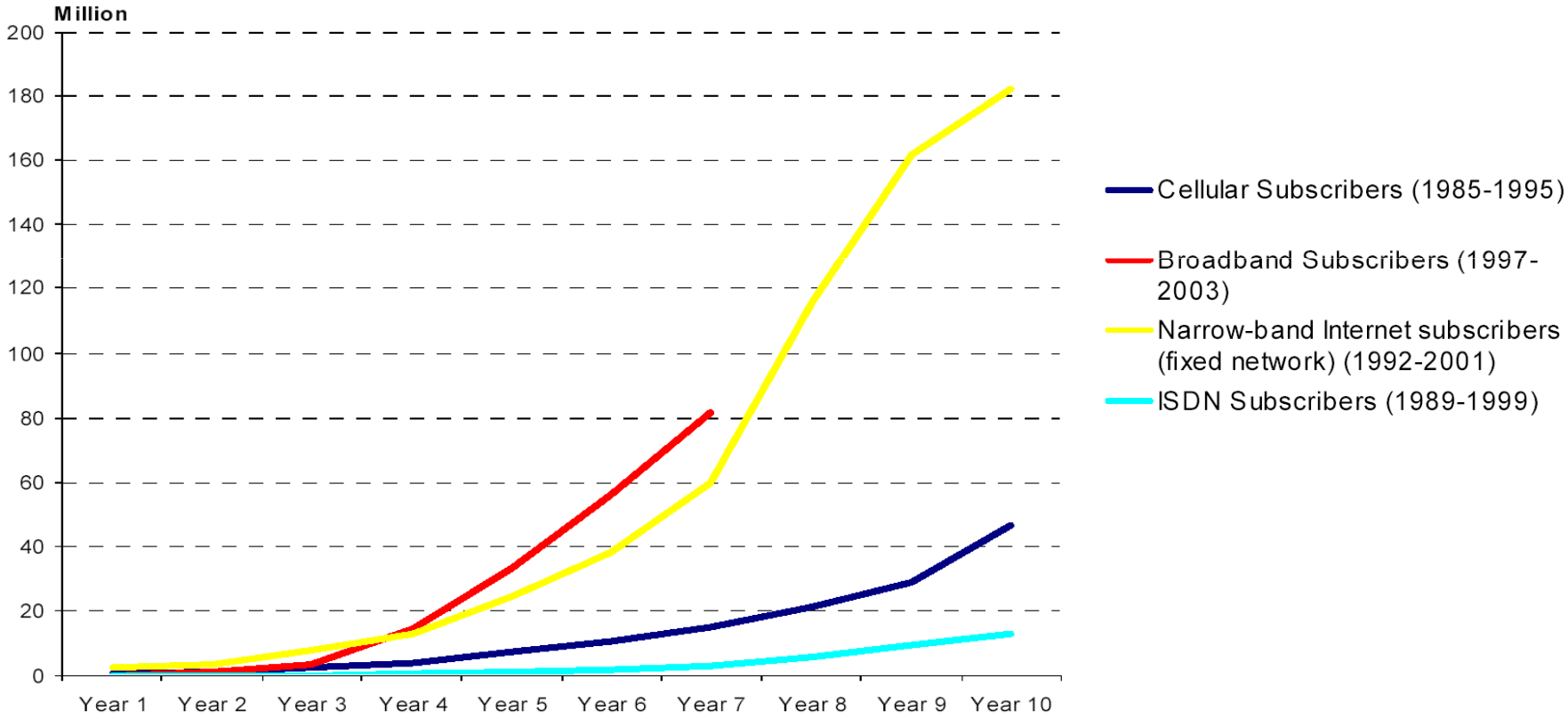
KT

"The Value Networking Company"

Contents

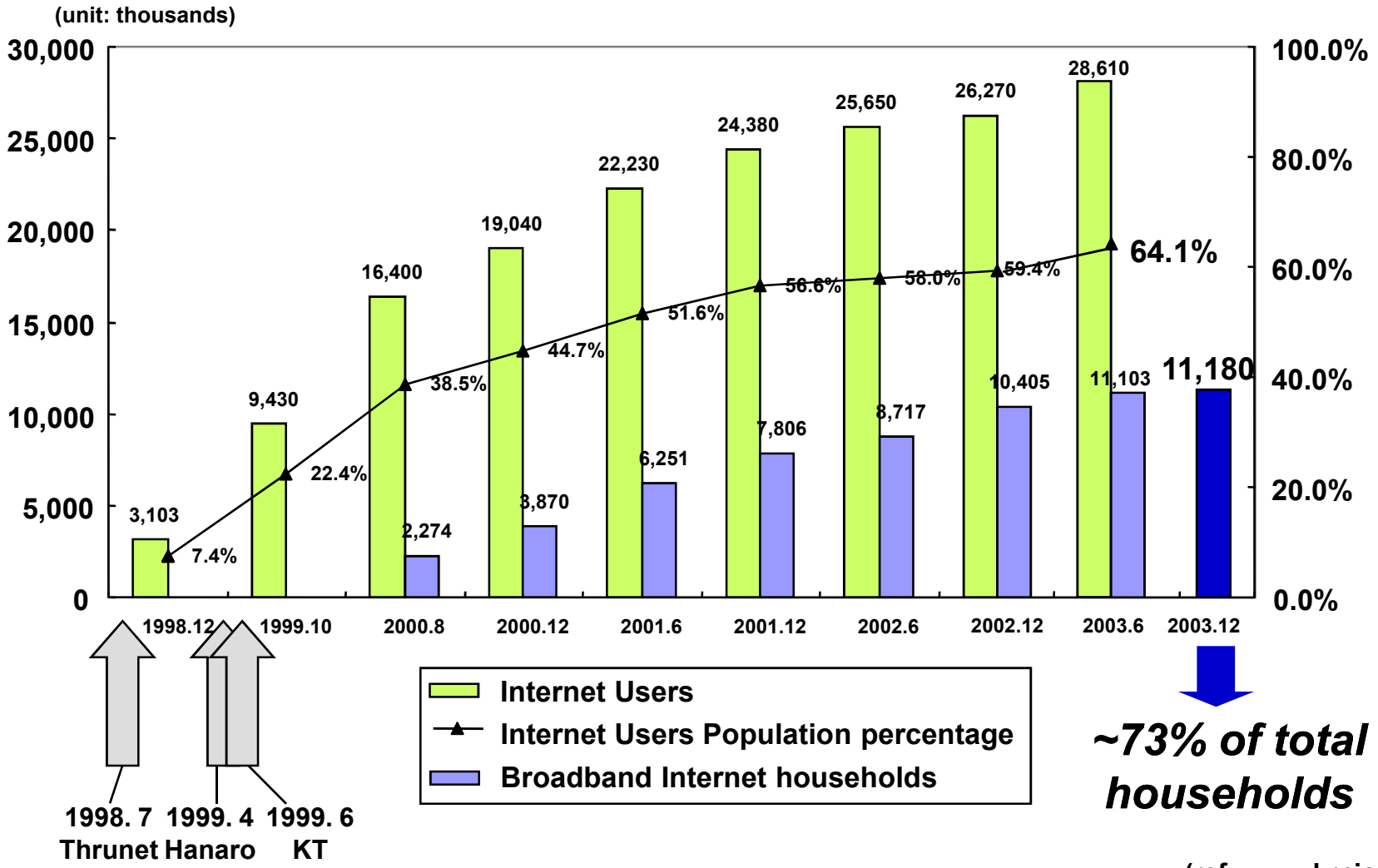
Broadband Internet Business

Broadband take-up over first 10 years is faster than previous services across the OECD countries.



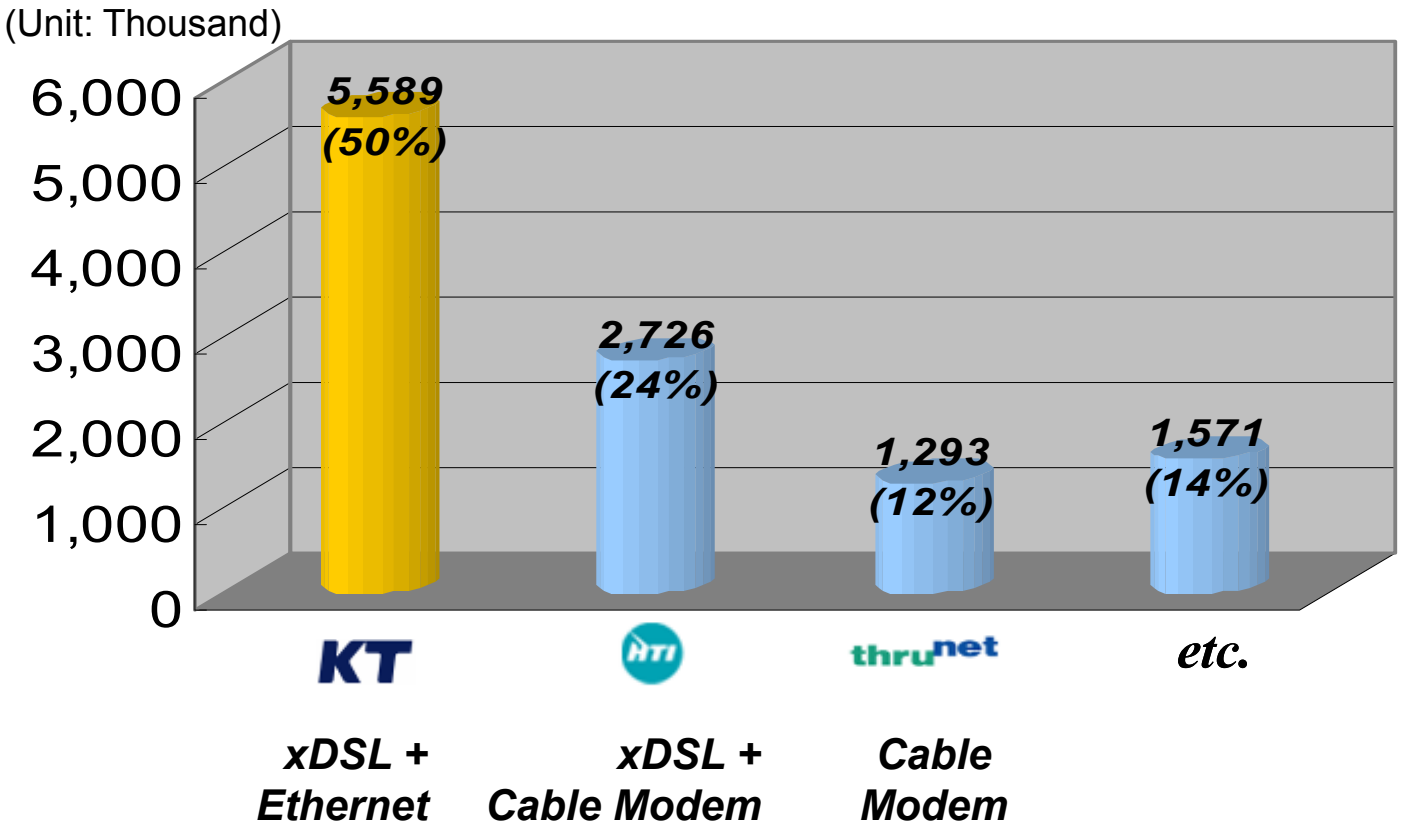
(ref: www.oecd.org)

Broadband Internet Business in Korea



(ref: www.krnic.or.kr)

Broadband Technology & Market Share

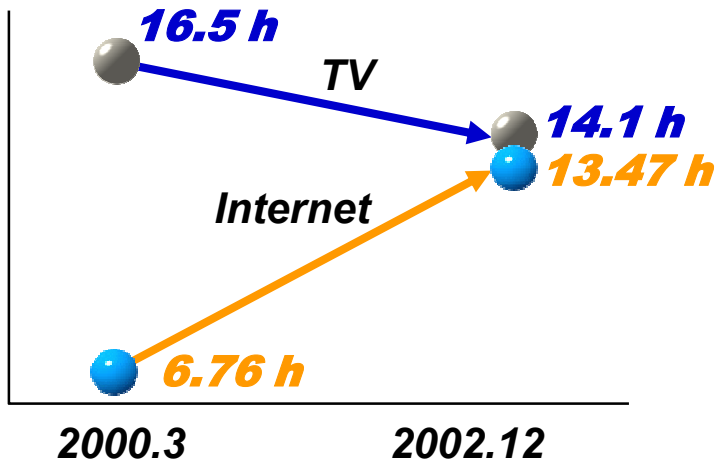


(ref: www.mic.go.kr, Dec. 2003)

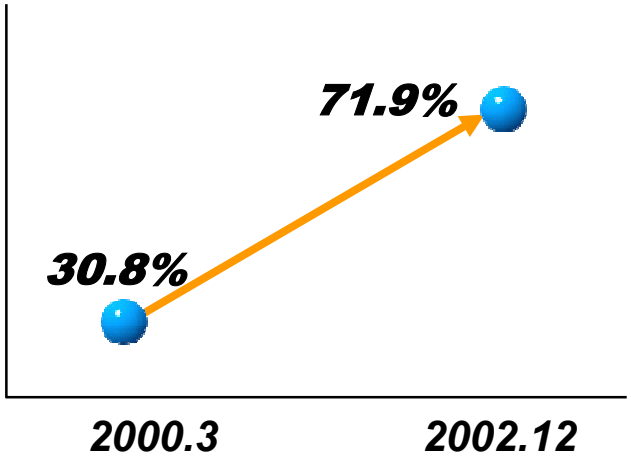
Broadband Internet & Change of Life Style

- **Phenomenal increase of broadband Internet usage**

Weekly hours spent on Internet & TV



% of daily Internet users



(ref: isis.nic.or.kr)

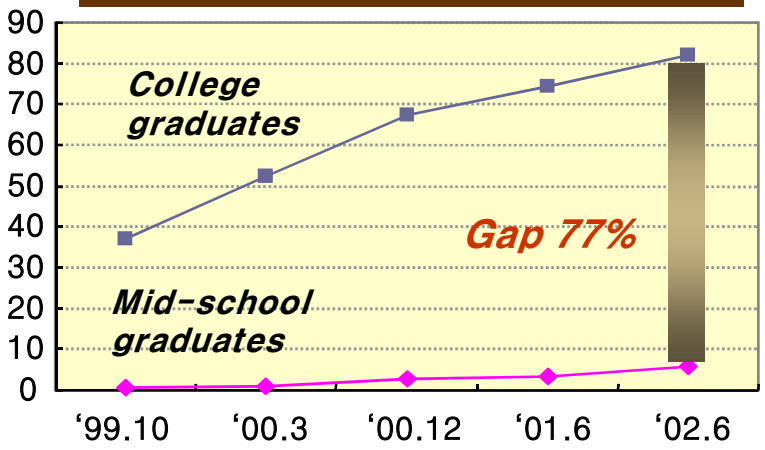
On-Line Activities

- **Off-line activities being shifted into on-line activities**

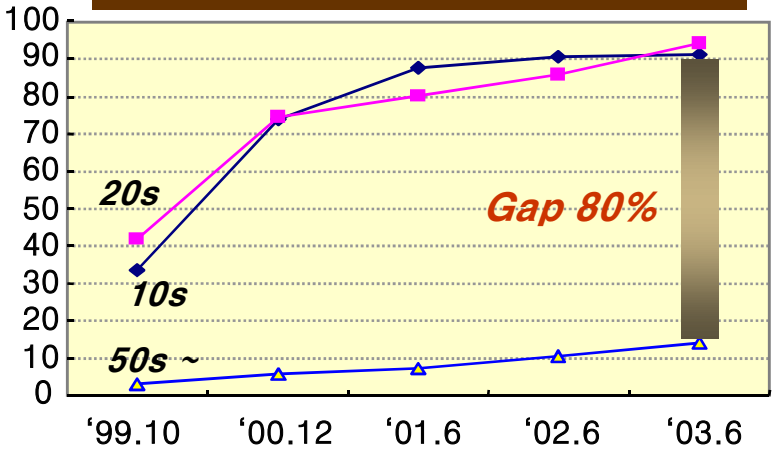
On-line Banking	• More than 30% of transactions done through Internet • 0.12 Million users in 1999 → 22 million in 2003
On-line Stock trading	• More than 50% of total transactions via on-line • 11 Trillion in 1998 → 3732.7 Trillion in 2003 (Korean Won)
e-Commerce	• 17% of total commerce transactions • 58 Trillion in 2000 → 238 Trillion in 2003 (Korean Won)
Public certificates	• 7.7 million public certificate users (2003.4)
On-line game	• Market size 2.5 times the size of console game market • Evolving into another type of entertainment area • Game league similar to professional basketball league

Digital Divide in Korea

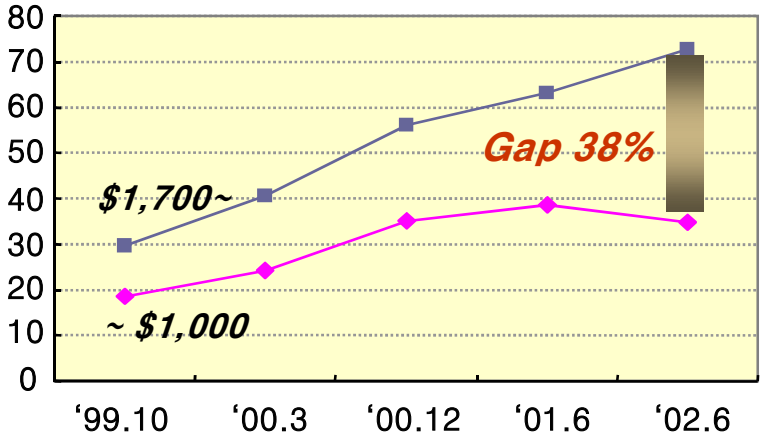
Education



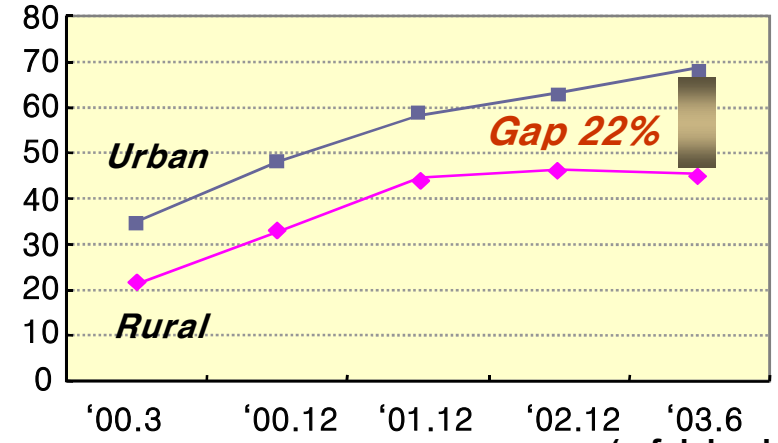
Generation



Income



Urban-Rural Internet Usage



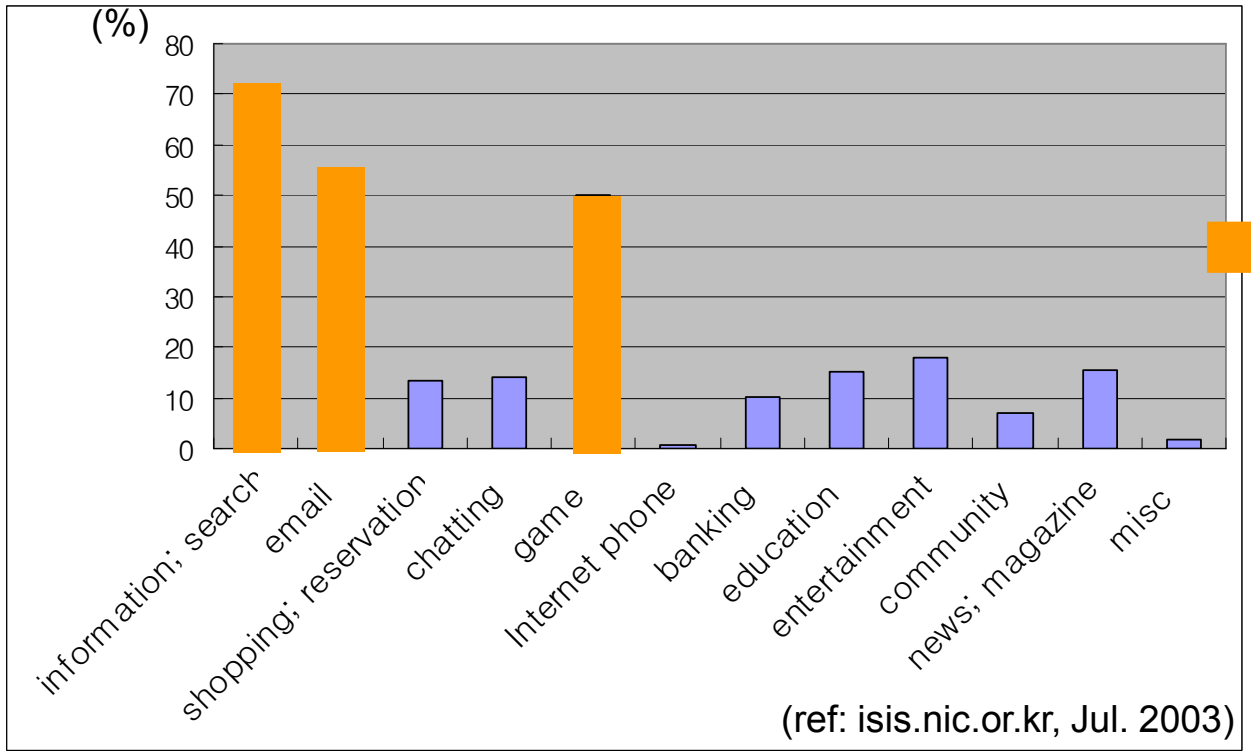
(ref: isis.nic.or.kr)

Two Sides of the Broadband Internet Business

Dark Side **&** ***Bright Side***

Current and Future Broadband Applications

Survey on current Internet usages



Mainly used for best-effort, data-oriented, store-&-forward applications

Next generation broadband applications

quality-based, interactive/distributive media applications

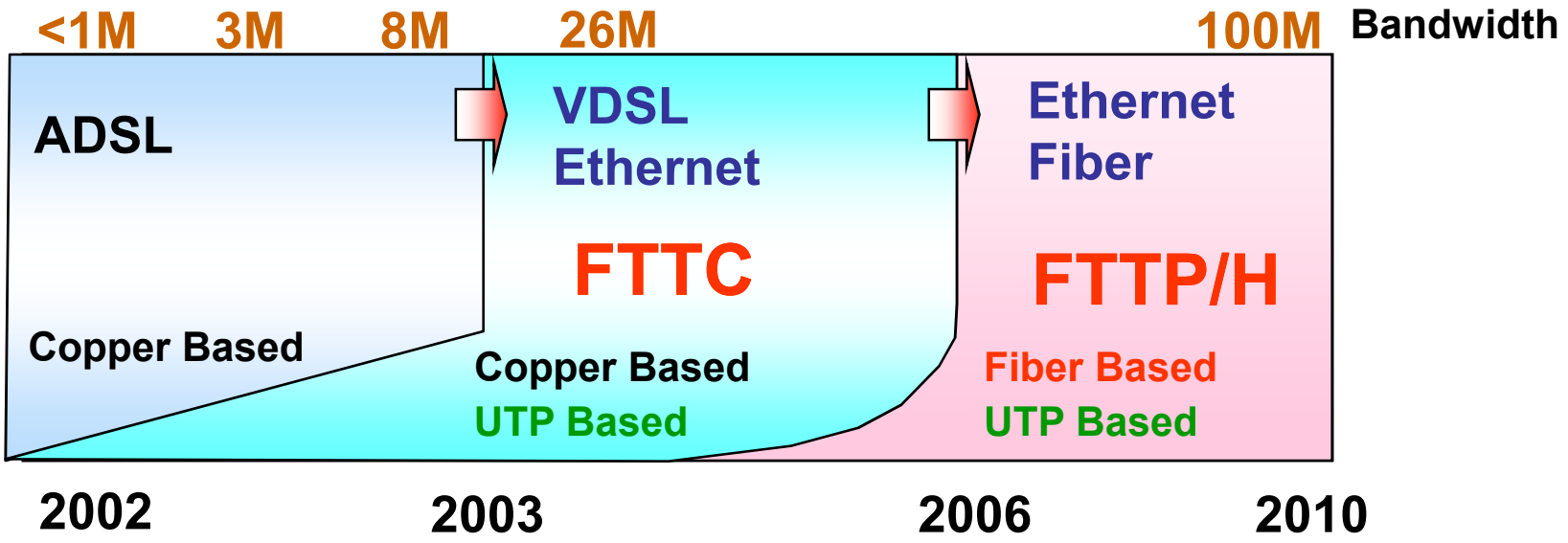
Next Generation Broadband

- Different business
  - From access service to end-to-end service
  - Both best-effort & QoS service
- Different network
  - More bandwidth
    - for Internet access → for enhanced services (e.g., media service)
  - Controllability
    - for QoS & security

Broadband Evolution

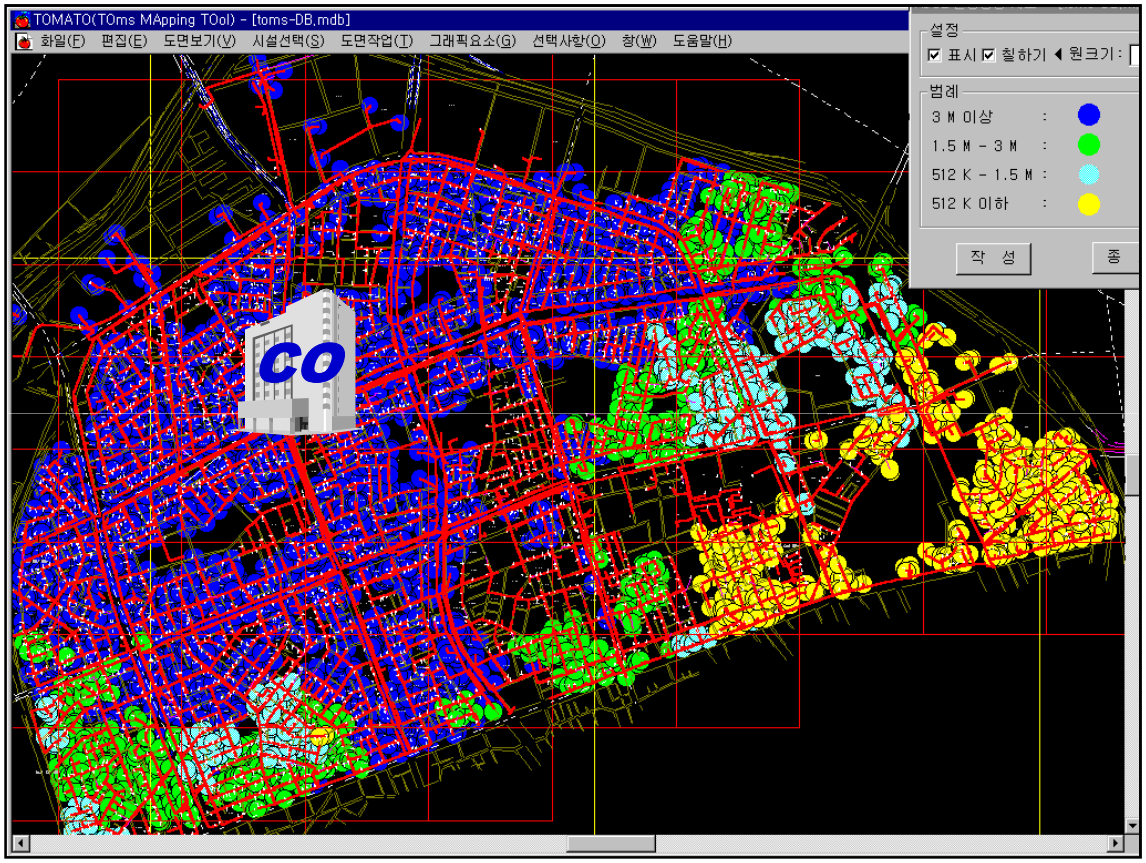
- **Target: 100Mbps per household**
  - Streaming Video(HD Level, 3 channel) : total 60M
  - Internet :10M
  - Interactive multimedia communication: 4Mbps
  - Misc.

- **Broadband evolution**



ADSL

- **Existence of areas with poor quality (distance sensitive)**

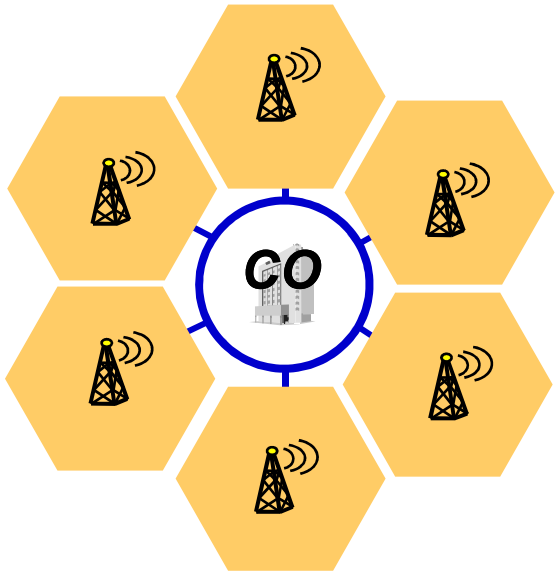


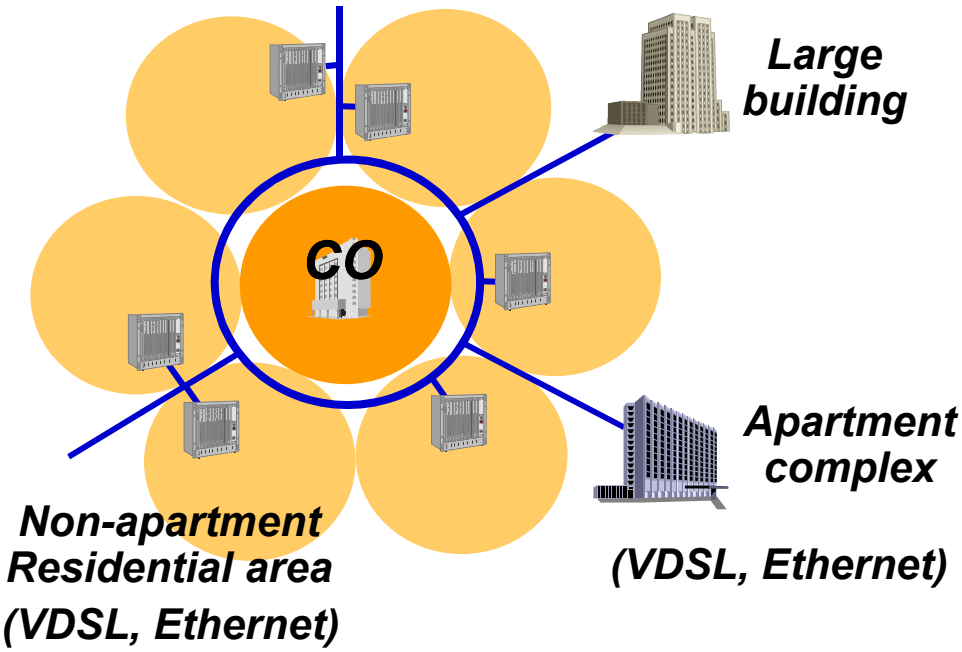
(ref: KT, 1999)

- **Start of FTTC-based access network deployment**

FTTC

- **Purpose: ① remove areas with poor quality,**
  ② increase speed
- **Introduction of "cell" concept in fiber distribution**



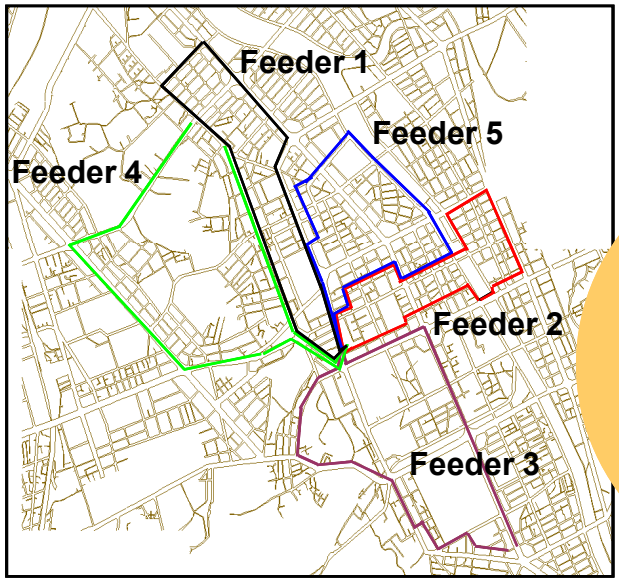


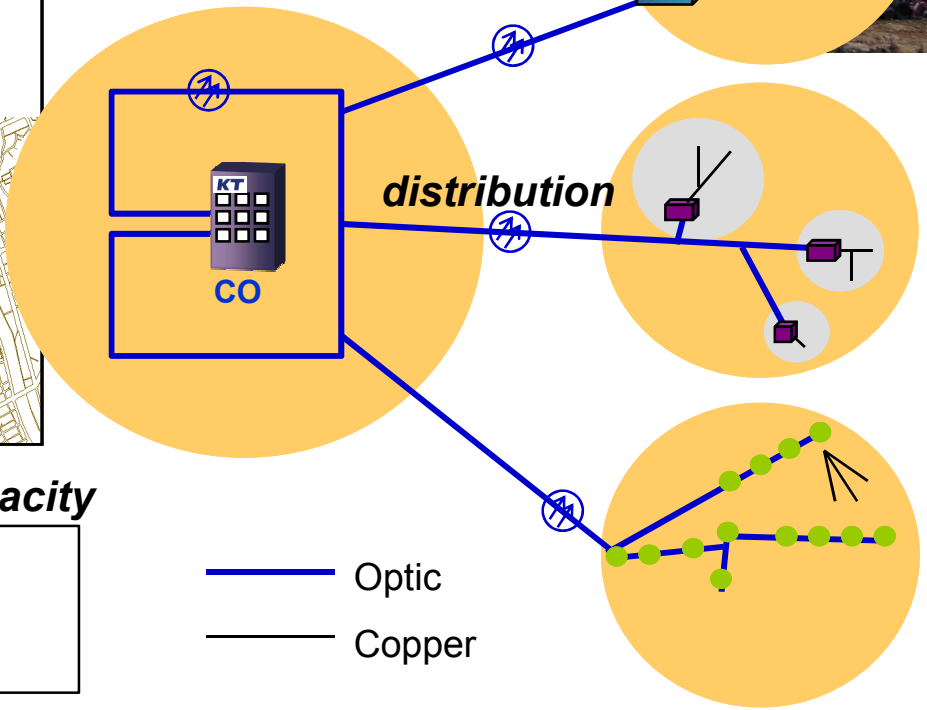
<Cellular Mobile>

<Building, Apartment complex, Residential area>

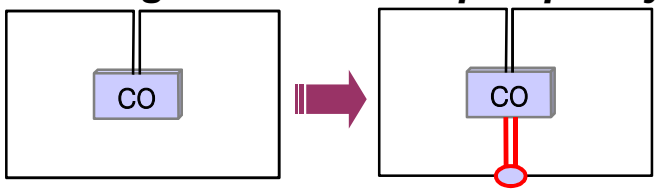
FTTC: Fiber Distribution

- Feeder loops around the CO
- Distribution: branching from the feeder loop
- Cell size depending on demand density





Doubling the feeder loop capacity



Evolving into FTTH

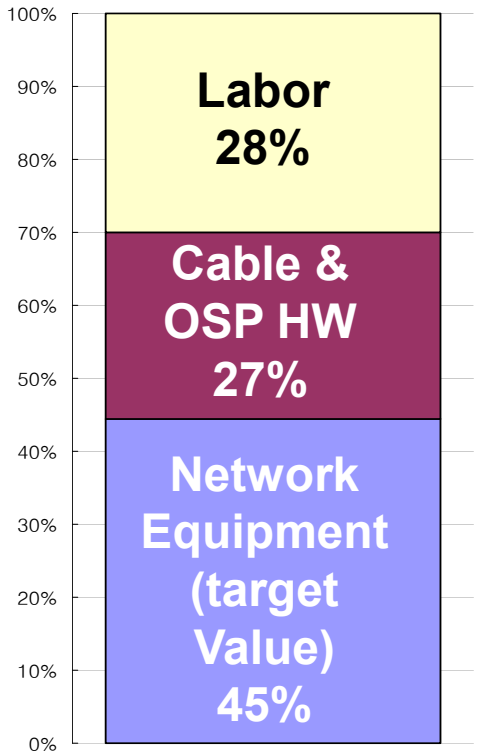
- **Criteria for technology selection**
  - Features
    - ✓ Bandwidth: dedicated 100Mbps
    - ✓ Protocol & bit rate transparency
    - ✓ Graceful Upgradability
    - ✓ Security & privacy
  - **Cost: CAPEX & OPEX**

- **Passive optical network technology as an attractive solution**
  - **TDMA vs. WDMA-PON**
  - **Feature vs. Cost**

Considerations for FTTH Deployment

- **Deployment cost**
  - Comparable to xDSL deployment cost (< 150%)
  - Adoption of mature optical component technology
- **Outside plant cost**
  - Significant portion of the total deployment cost (cabling + labor)
  - Maximum OSP resource re-use
  - New technologies, e.g., micro cable

Target cost structure



(cable cost: 19%)

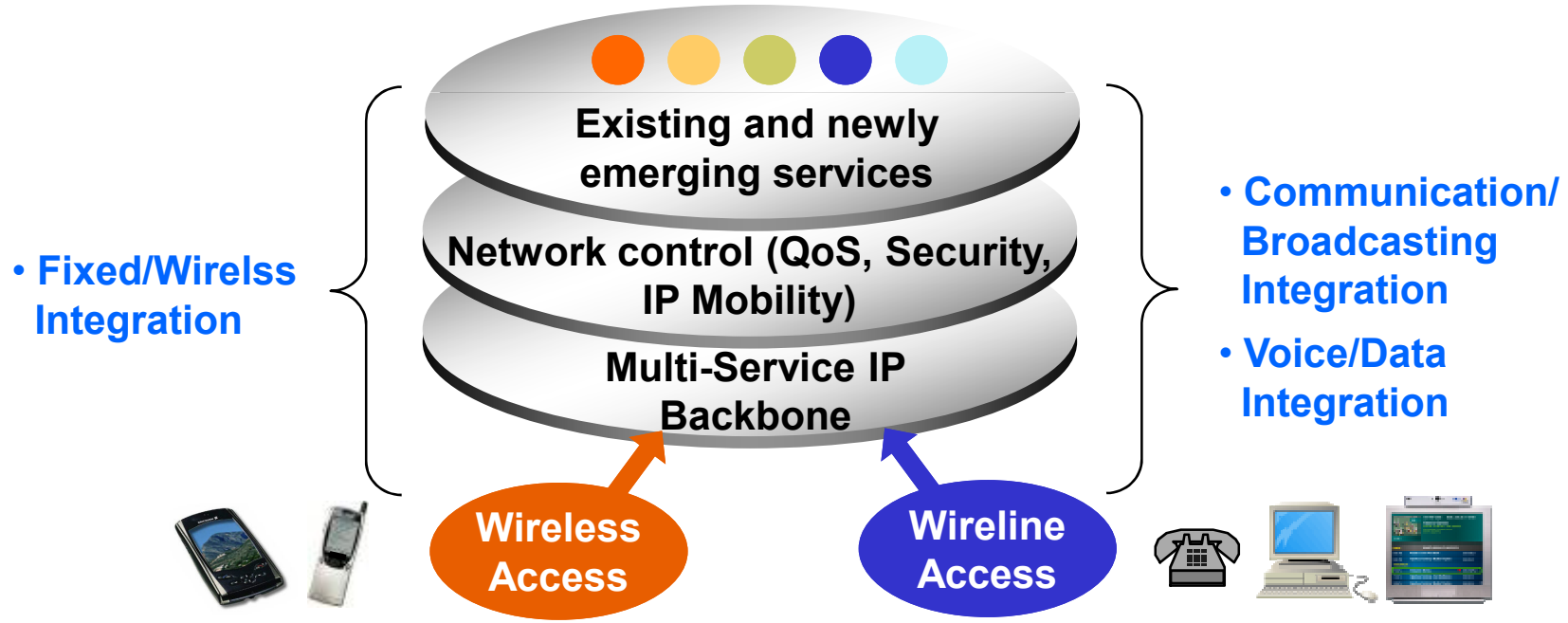
Considerations for FTTH Deployment (cont.)

- **Services that pay off**
  - Needs to prove profitability
  - Continuous pursuit of premium-class services needed

- **Regulatory issues**
  - TV broadcasting over IP
  - Unbundling issue

Summary

- Broadband business in Korea calls for new market
- Next generation broadband: different business & different network
- Fiber to the Premise/Home as the basic building block
- The Big Picture: BcN Initiative in Korea



Let's KT

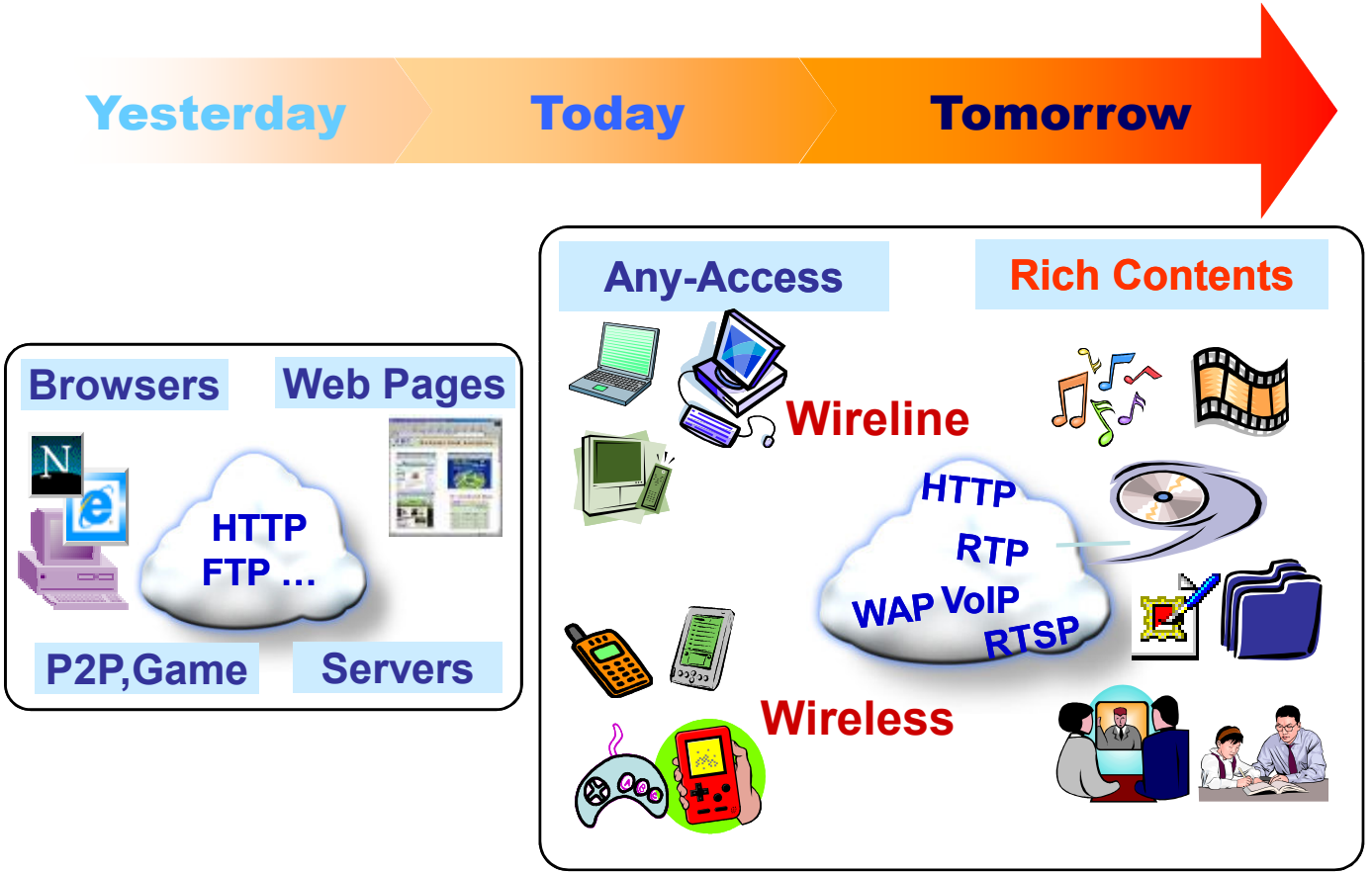
Why FTTH

KT

"The Value Networking Company"

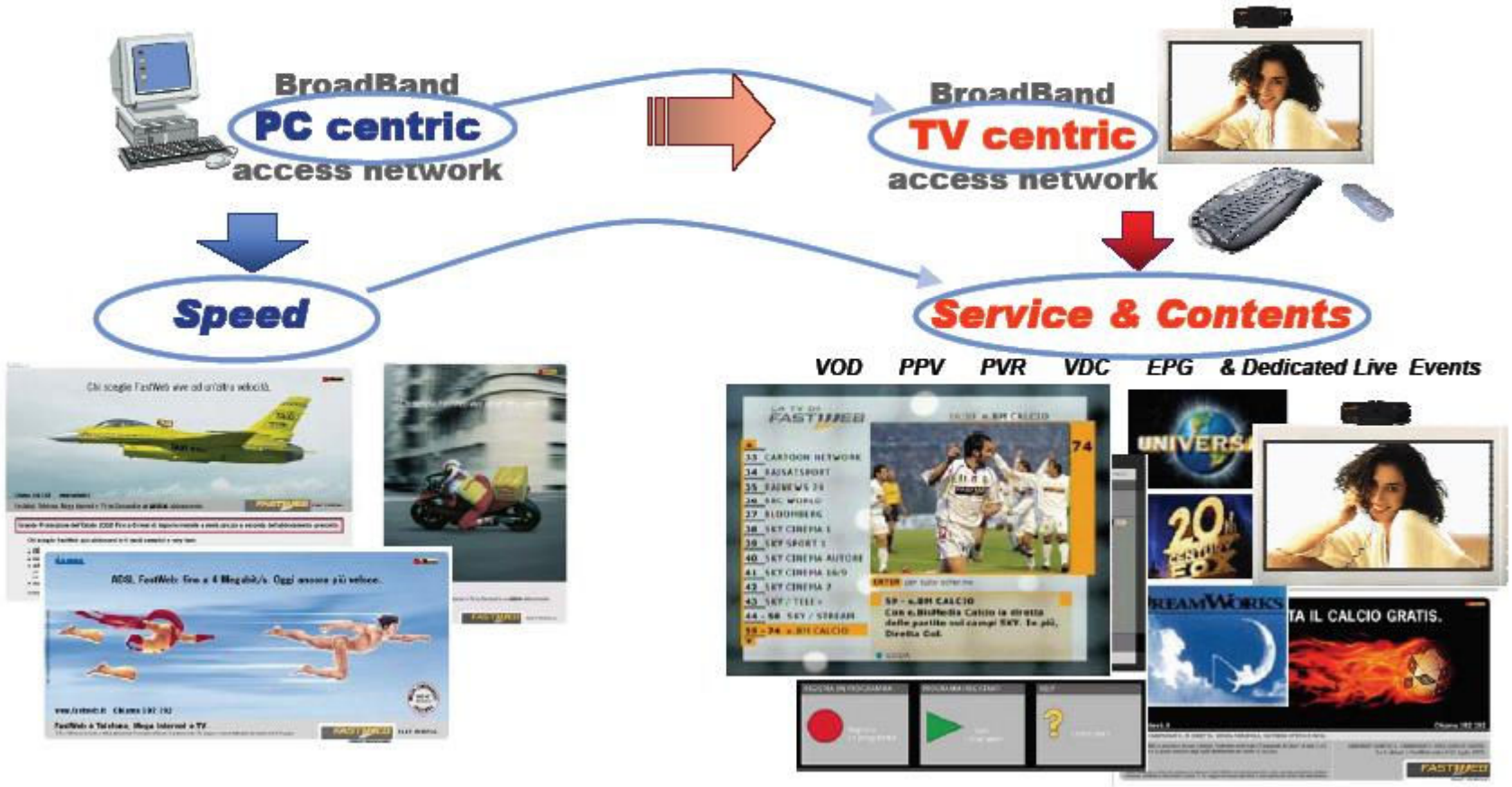
서비스 패러다임 변화

- 단순 데이터 서비스 -> 멀티미디어 서비스



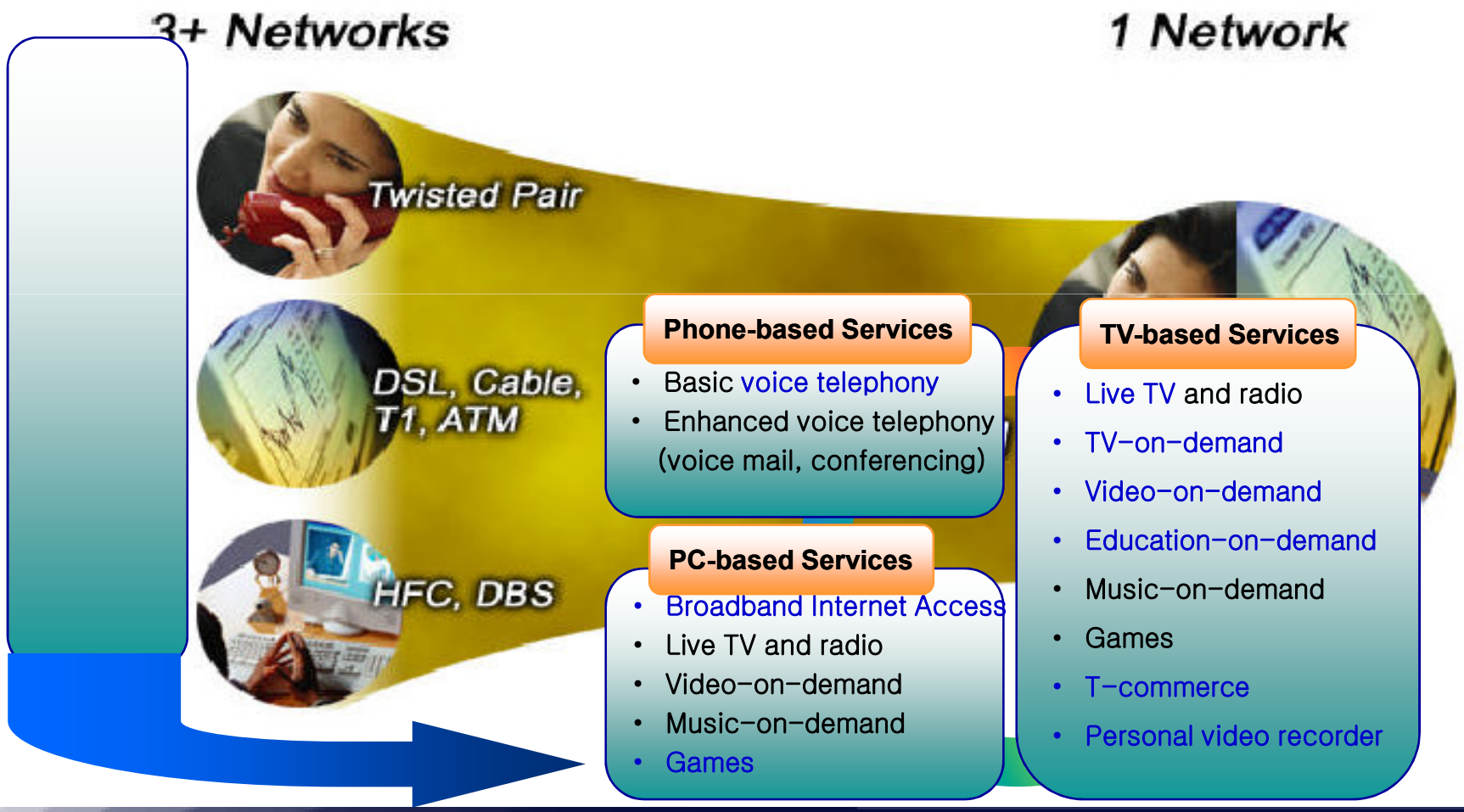
서비스 패러다임 변화

- PC 기반 서비스 -> TV 및 영상단말 기반 서비스

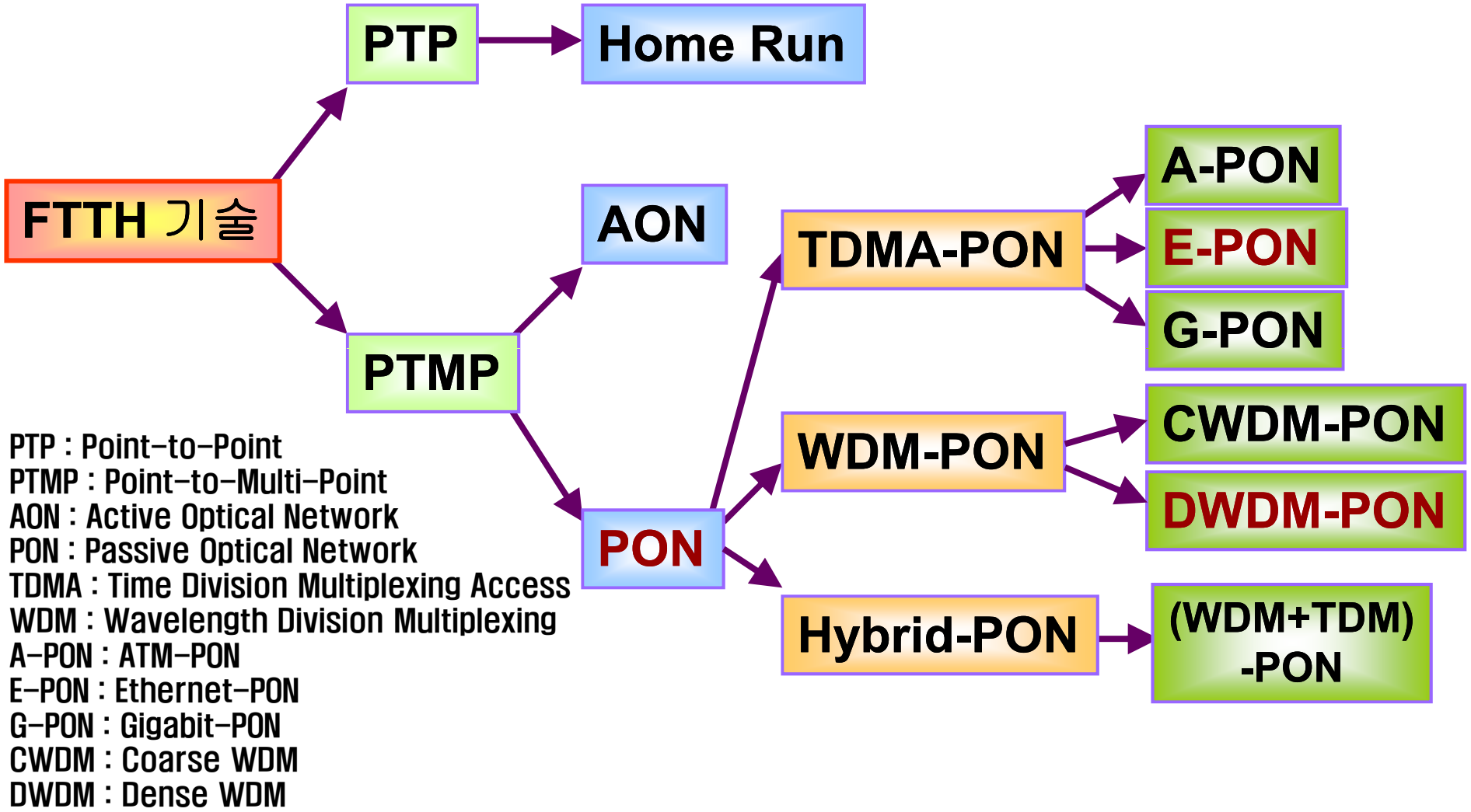


TPS

- TPS (Triple Play Services) -> QPS (TPS + wireless)



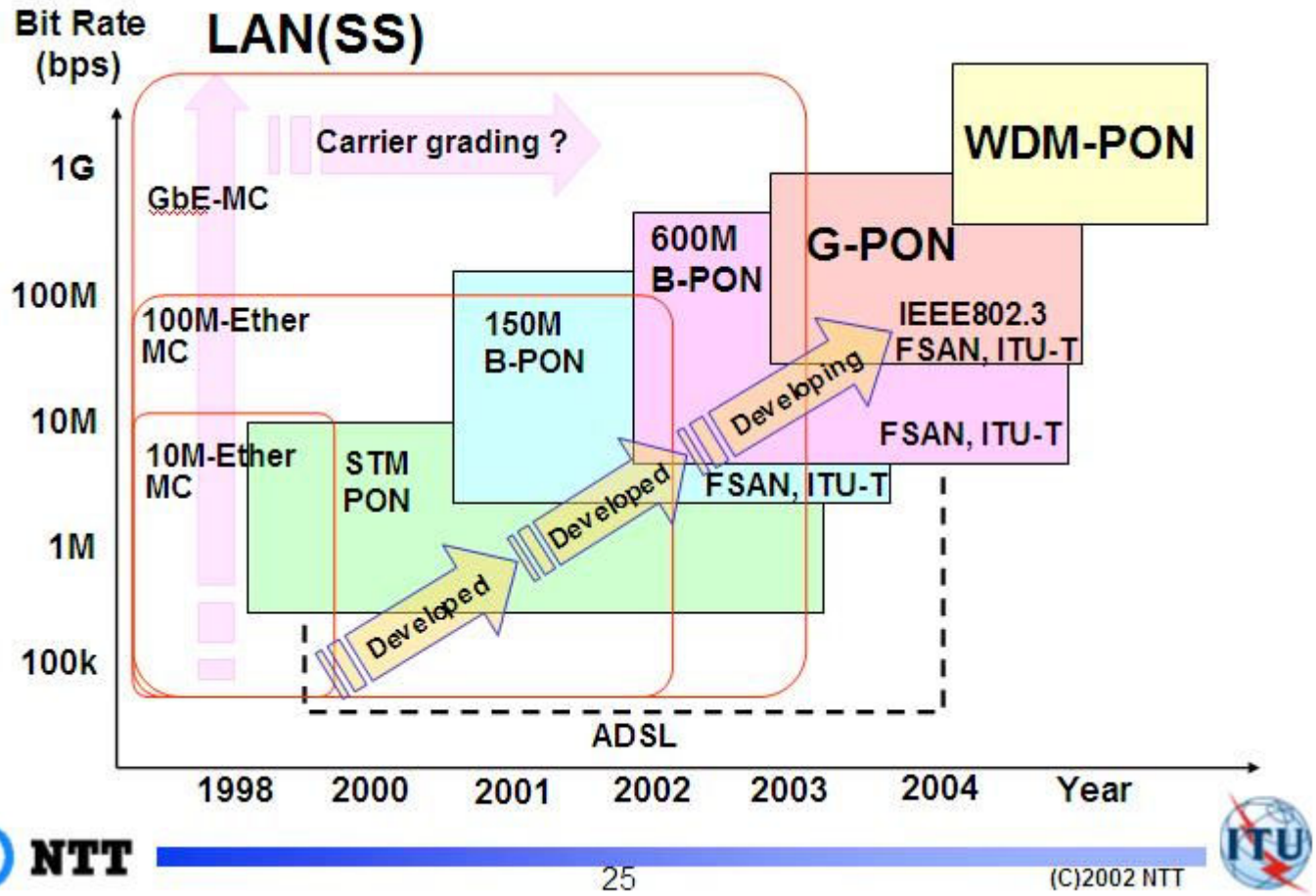
FTTH 기술 tree



PTP : Point-to-Point
PTMP : Point-to-Multi-Point
AON : Active Optical Network
PON : Passive Optical Network
TDMA : Time Division Multiplexing Access
WDM : Wavelength Division Multiplexing
A-PON : ATM-PON
E-PON : Ethernet-PON
G-PON : Gigabit-PON
CWDM : Coarse WDM
DWDM : Dense WDM

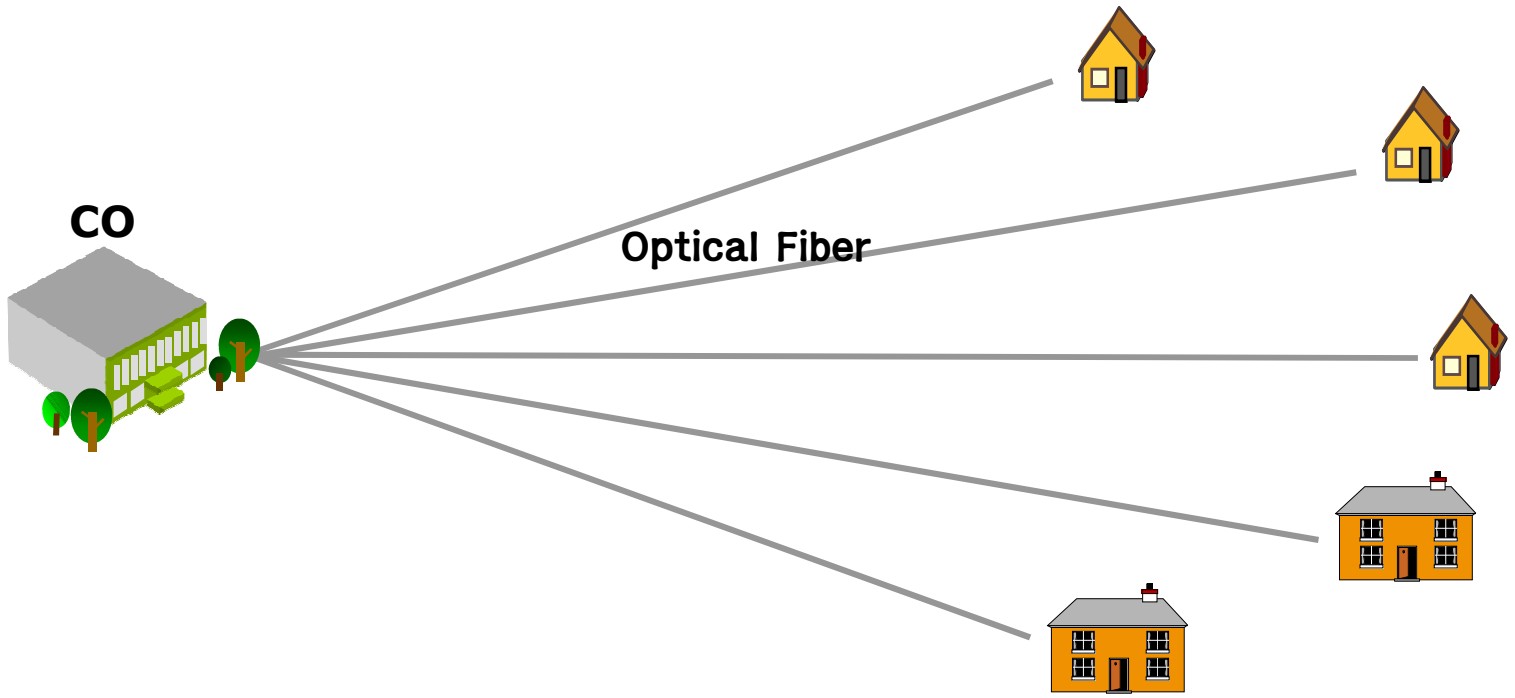
FTTH 기술 진화 로드맵

Trend of Broadband Access Studies



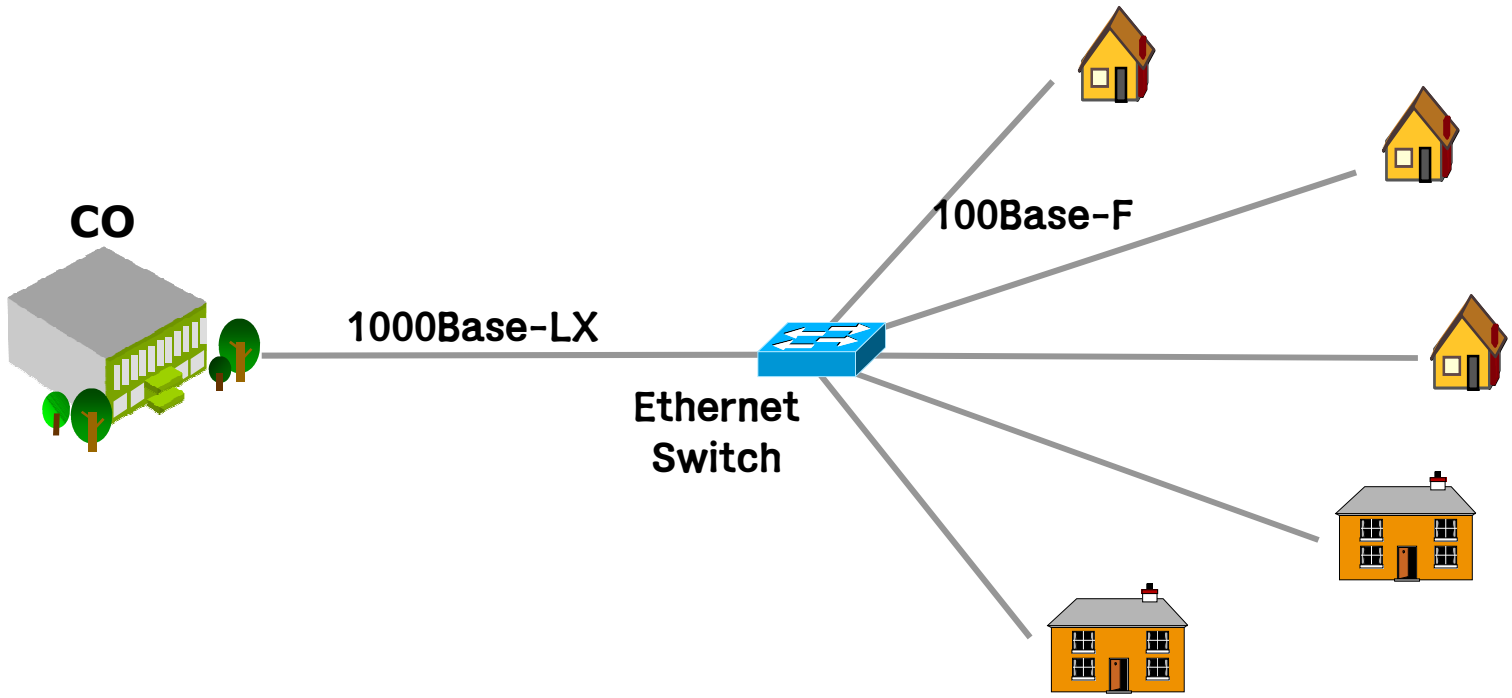
PTP – Home Run

- 2N (or N) fibers
- 2N Transceivers
  - Too many fiber cores required
  - Too many transceivers



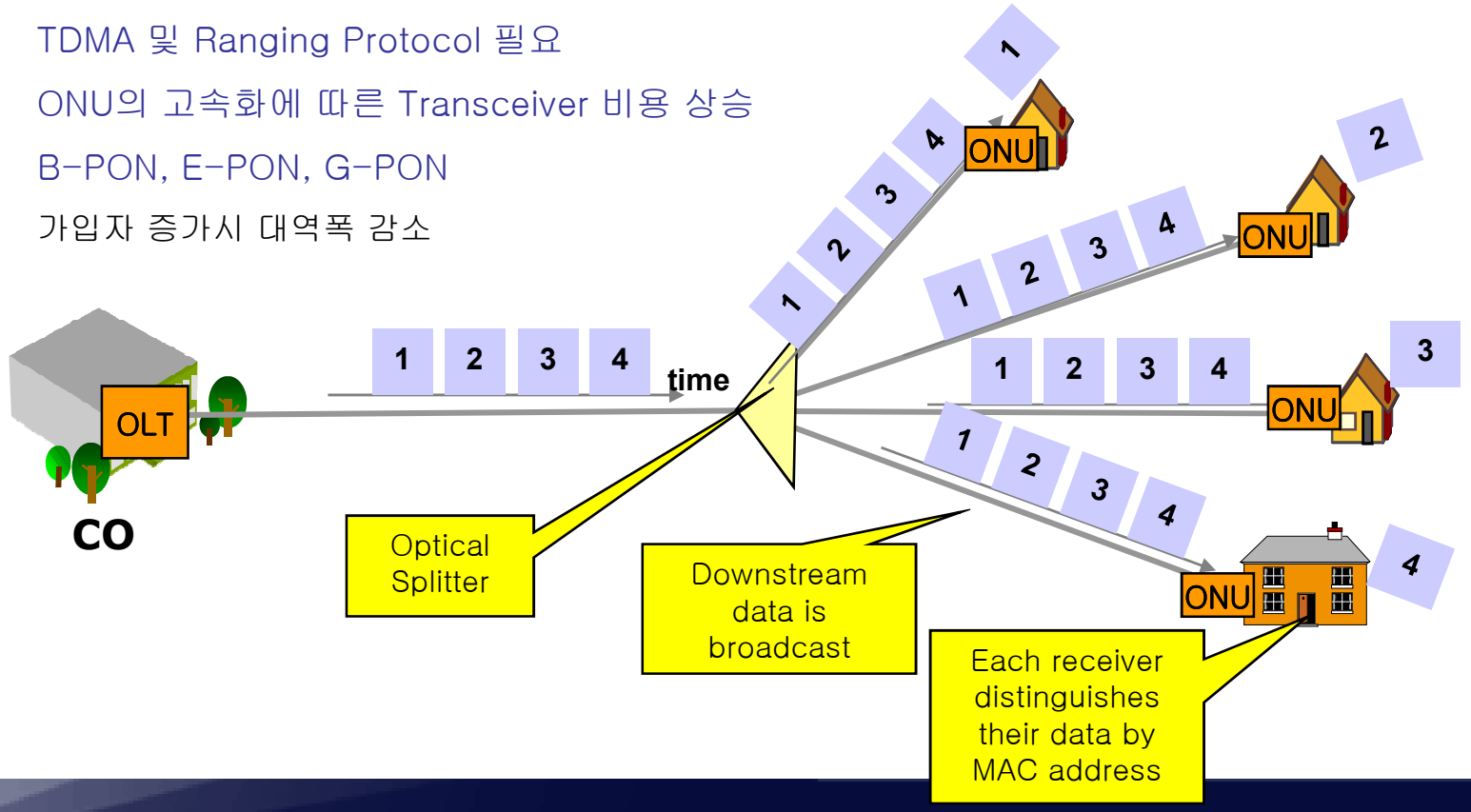
PTMP – AON

- AON(Active Optical Network)
  - 2N+2 optical transceivers
  - Field에 전력공급
  - 옥외구조물
  - 운용 유지보수 비용



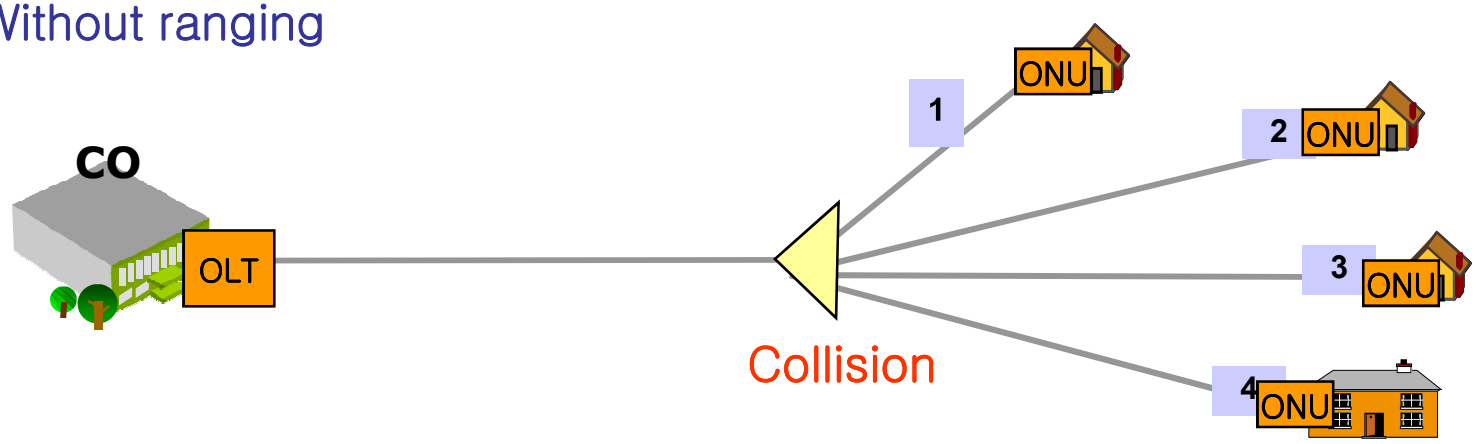
TDMA - PON

- Downstream bandwidth is shared among all connected ONUs
- TDMA-PON
  - N+1 optical transceivers
  - Field에 전력공급 불필요
  - TDMA 및 Ranging Protocol 필요
  - ONU의 고속화에 따른 Transceiver 비용 상승
  - B-PON, E-PON, G-PON
  - 가입자 증가시 대역폭 감소

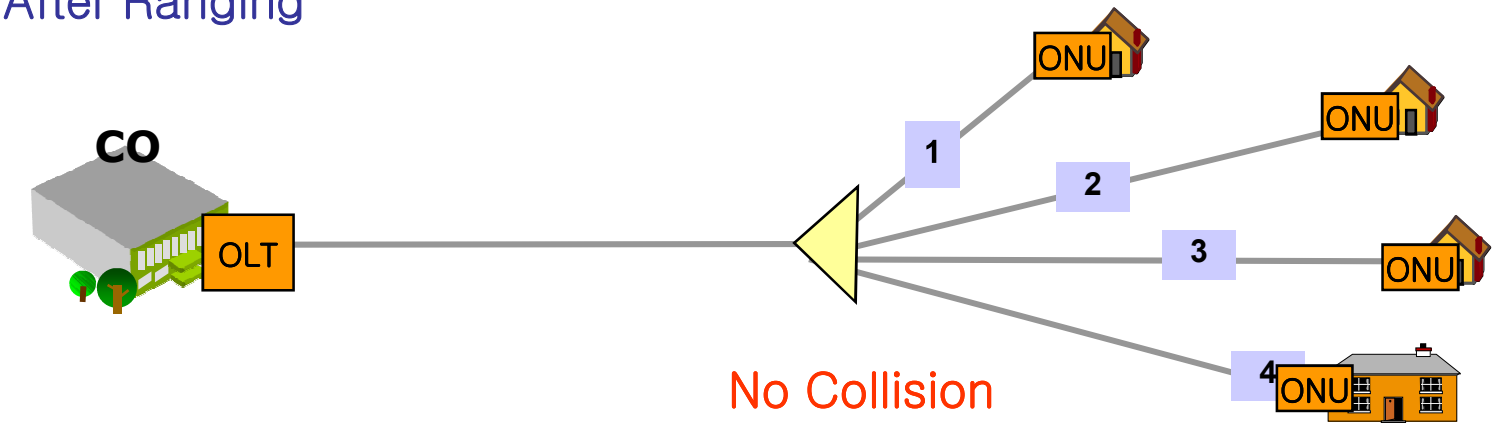


TDMA – PON (Ranging 기능)

- Without ranging



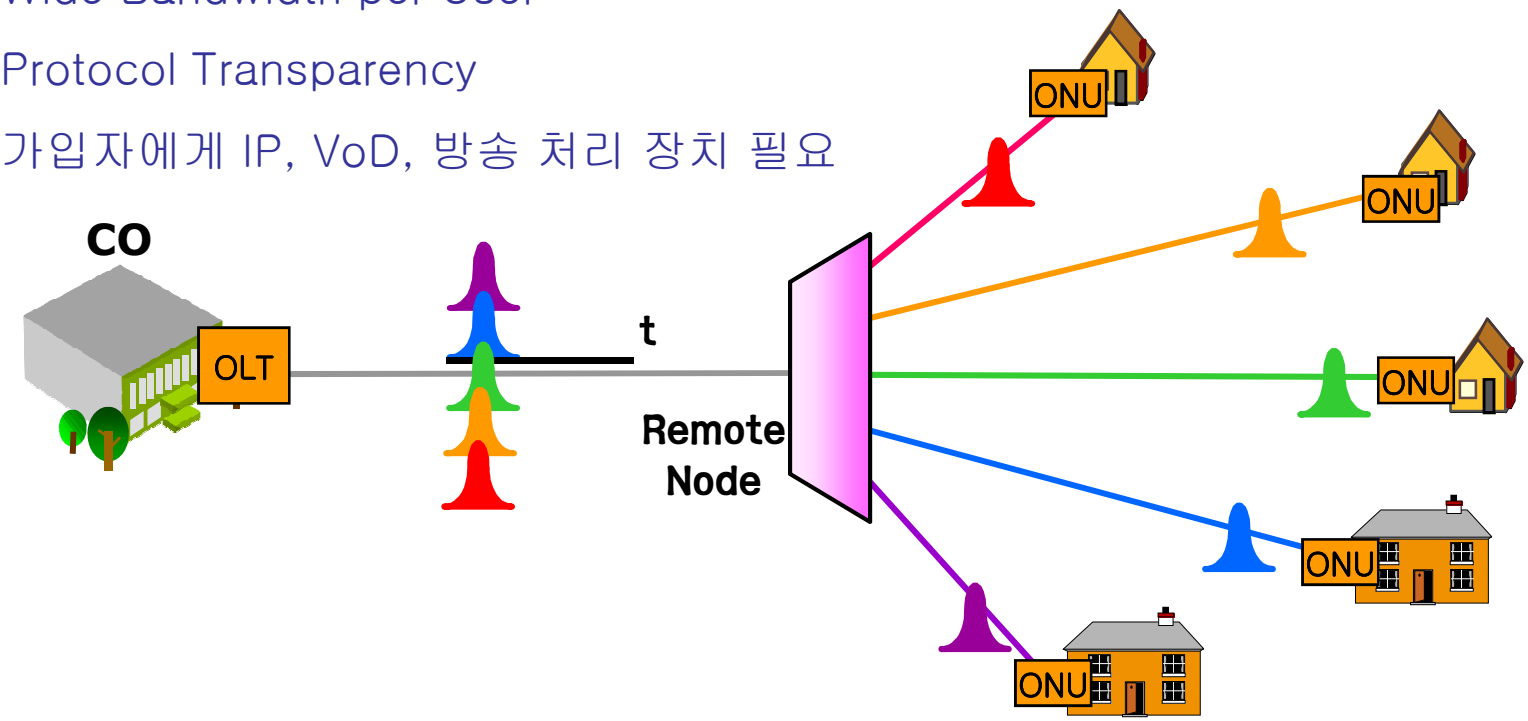
- After Ranging



Upstream ➔ TDMA protocol

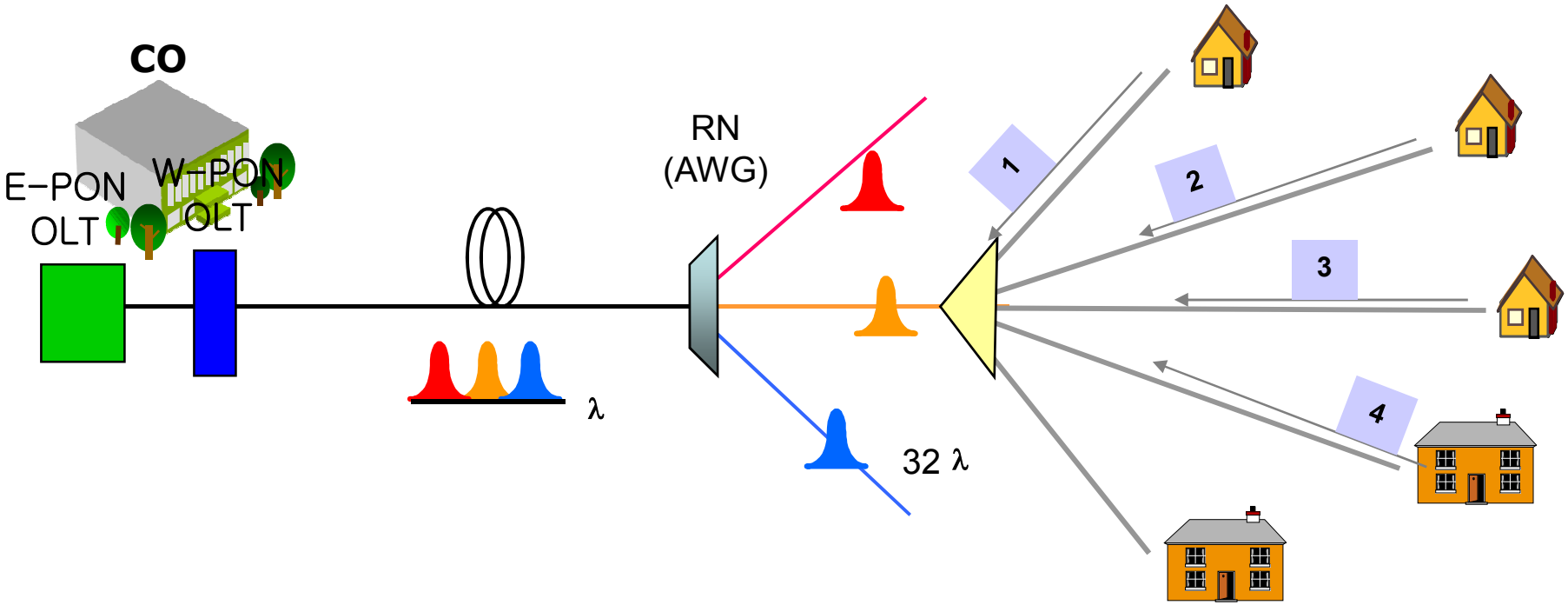
WDM – PON

- One lambda for one user
- N+1 optical transceivers
- Field에 전력공급 불필요
- TDMA 및 Ranging Protocol 불필요
- Wide Bandwidth per User
- Protocol Transparency
- 가입자에게 IP, VoD, 방송 처리 장치 필요



Hybrid – PON

- Hybrid-PON
  - Field에 전력공급 불필요
  - Large Subscriber number per feeder cable
  - No more Feeder cable



FTTH OSP

Choi young bok

KT

1. Evolution of FTTH in KT

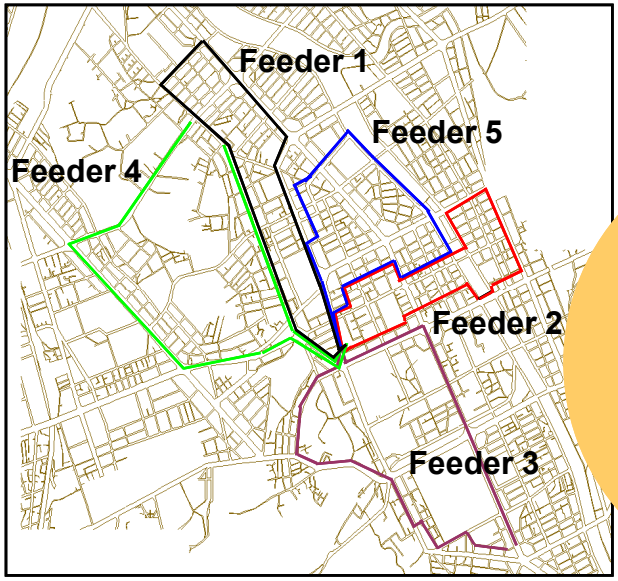
2. R&D OSP New tech

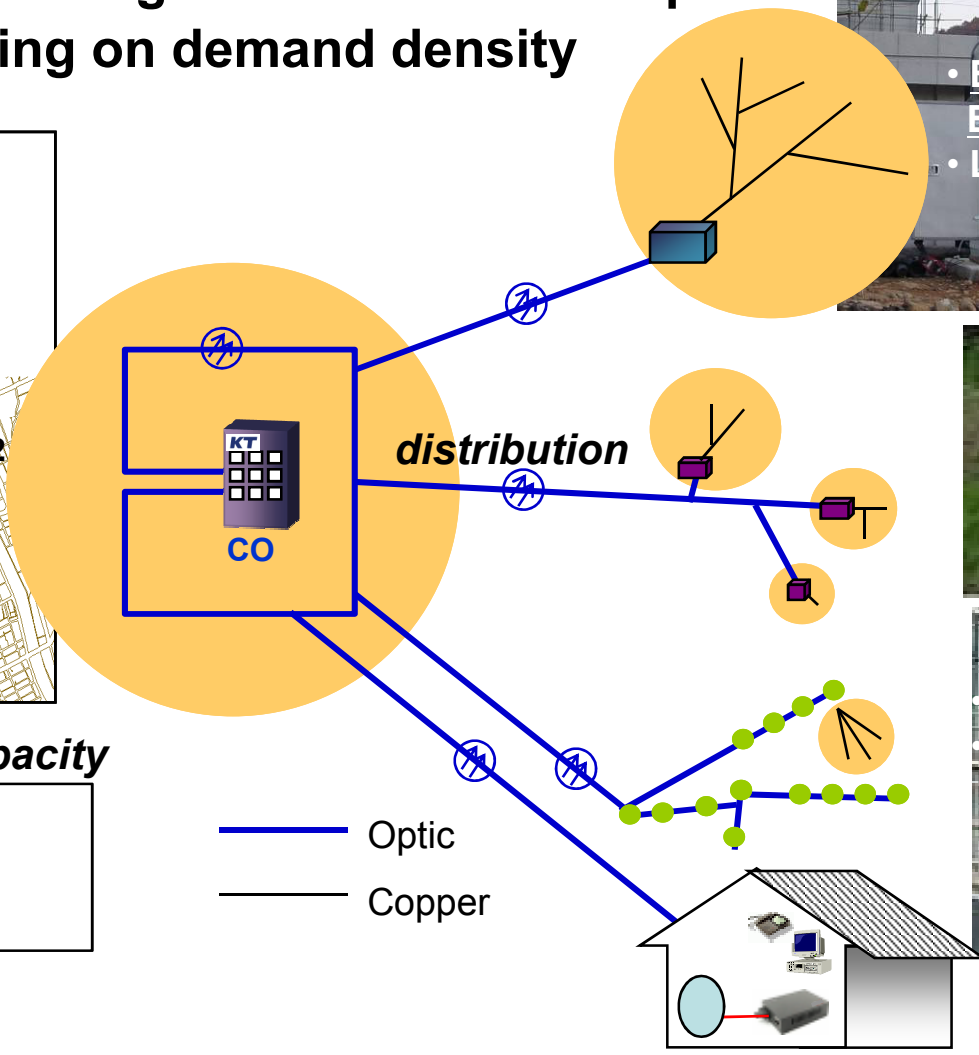
3. OSP Equipments, Devices and Mat'ls

4. Future works and Issue

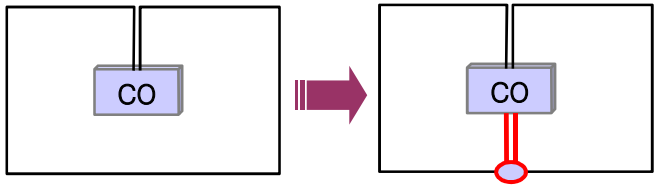
From FTTC to FTTH

- Feeder loops around the CO
- Distribution: branching from the feeder loop
- Cell size depending on demand density





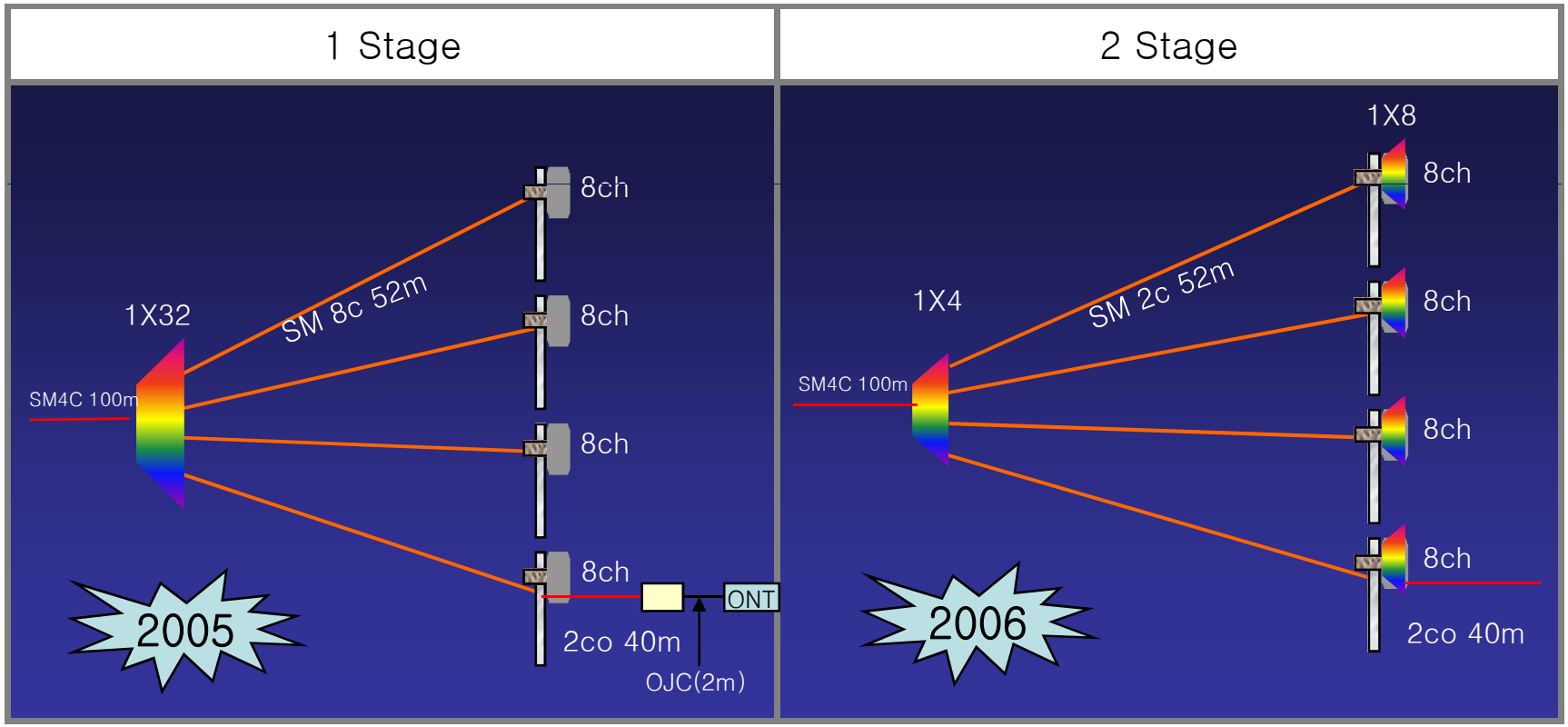
Doubling the feeder loop capacity



FTTH 2004~6 [주요변화]

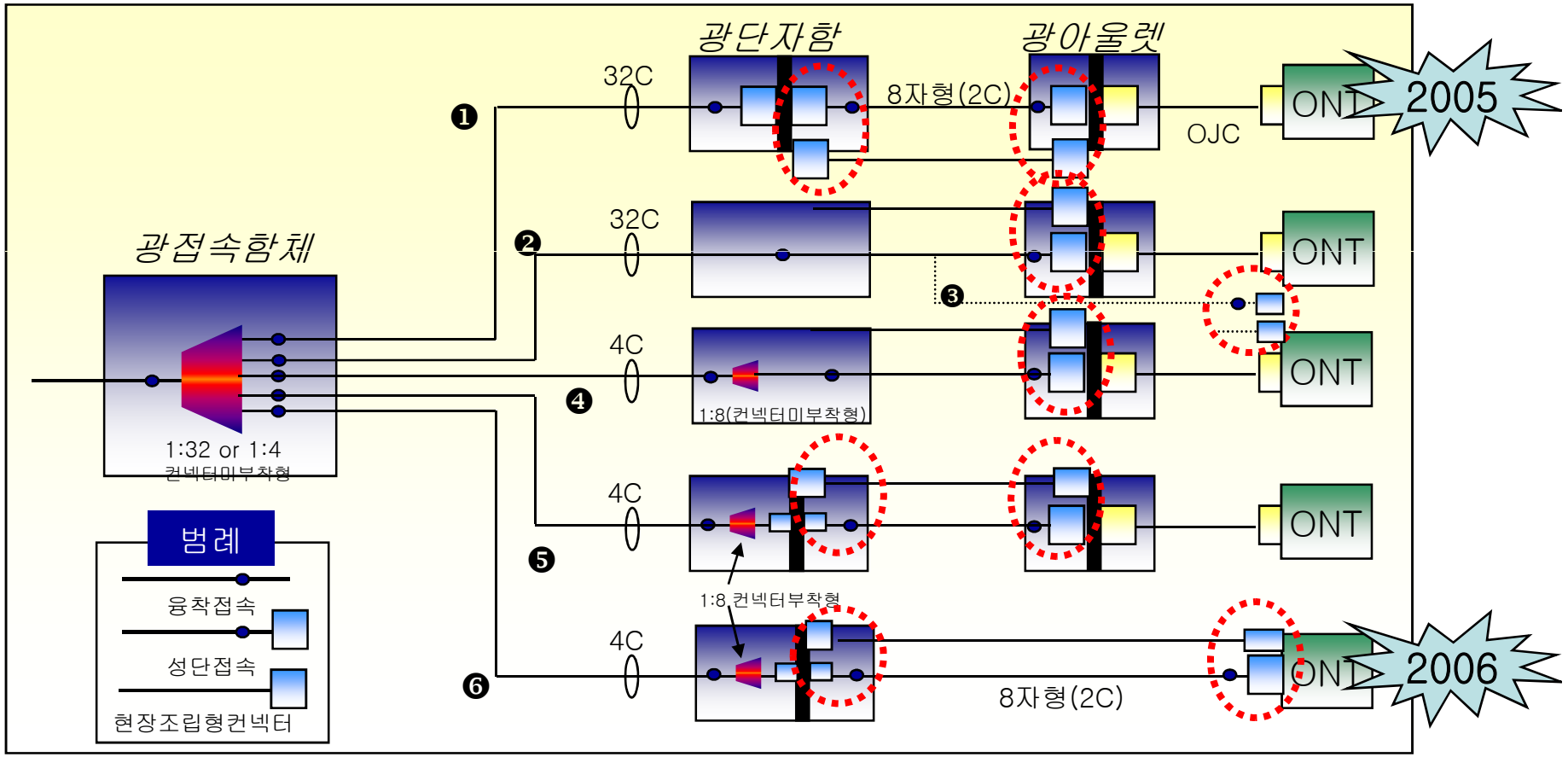
Branching

- 1 Cell of 32 Subscribers
  - 1x32 Splitter (at RN), 4 Distribution Boxes with 8 Channels each
  - 1x4 Splitter (at RN), 4 Distribution Boxes with 1x8 Splitter each → 30% Cost Reduction (est.)



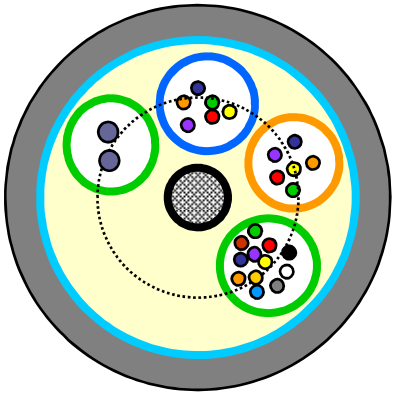
FTTH 2004~6 [주요변화]

▪ **FTTH Model의 접속 구조에 현장 조립형 컨넥터 추가적용**
– 가입자 개통을 위한 인입케이블 컨넥터화에 적용

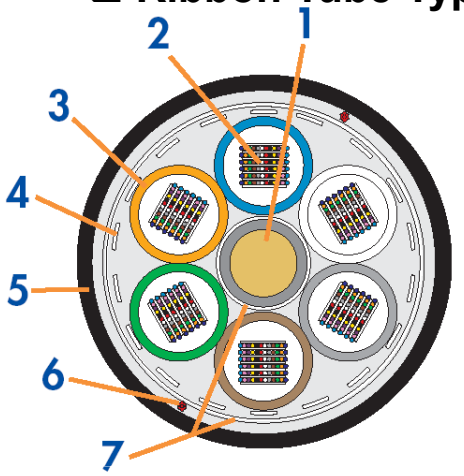


OSP Mat'ls [Optical Cables]

❑ Loose Tube Type

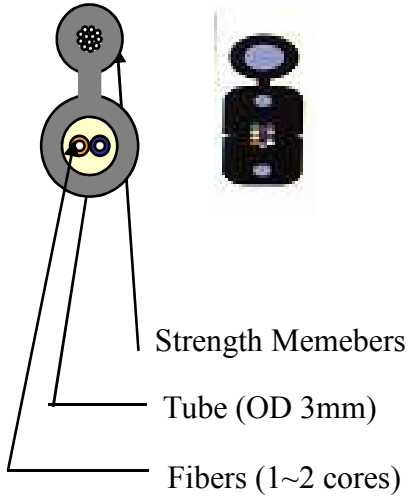


❑ Ribbon Tube Type

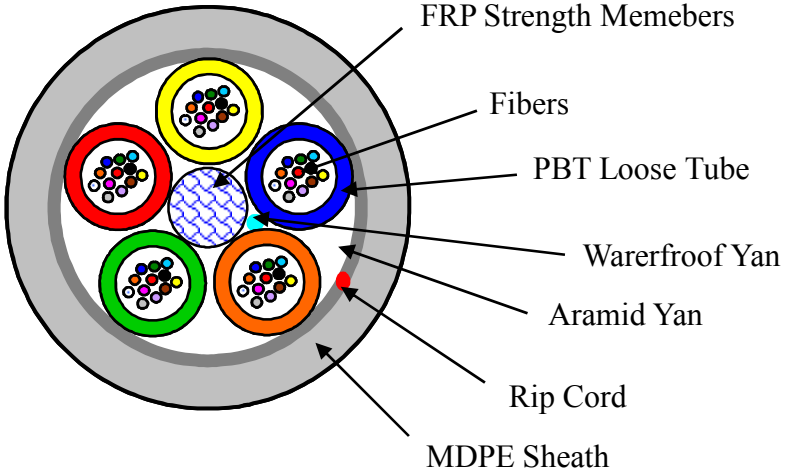


1.Strength member
2.Fibers in ribbon
3.tube
4.Buhher tube
5.sheath
6.rip-cords
7.Insulation tape

❑ Drop Cable



❑ Slender Cable

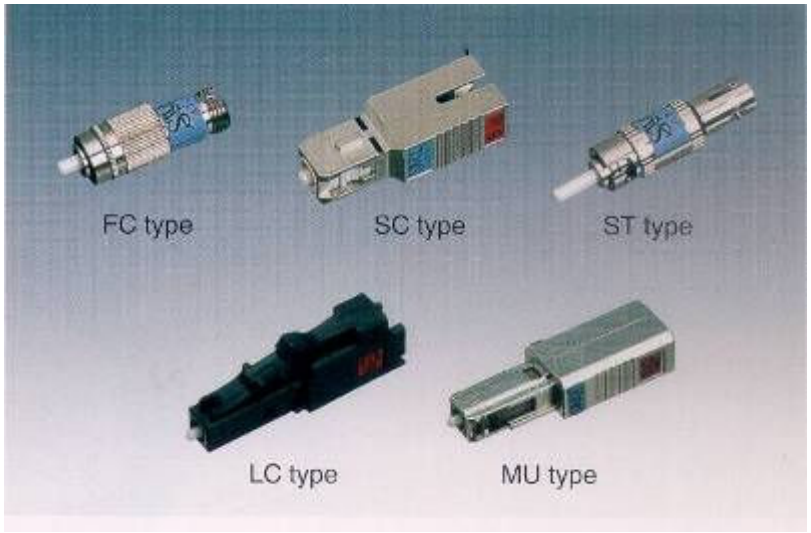


OSP Mat'ls [Optical Terminator]

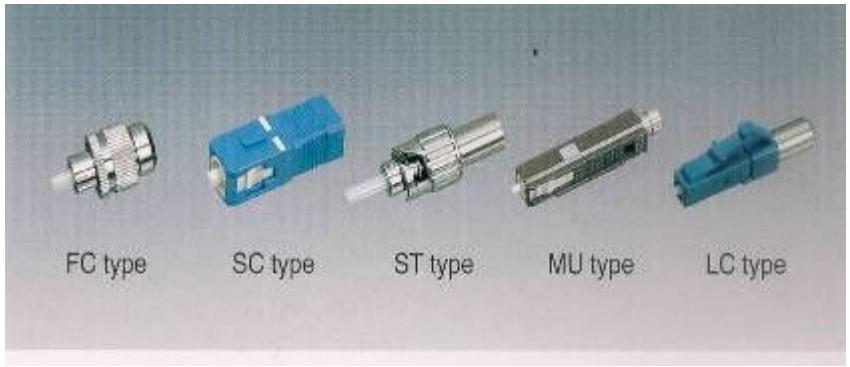
➢ 광감쇠기 및 광종단기 ➔ 광종단장치내 수용

광감쇠기(Fixed Optical Attenuator)는 광전송로상의 광전력을 감쇠시키는 수동소자이며,
광종단기(Optical Terminator)는 광전송로의 종단으로 부터 반사되는 광전력을
상쇄시키는 수동소자로서 광커넥타의 종류별 구조를 가짐.

✓ 광감쇠기(**Matal-ion doped fiber** 적용)

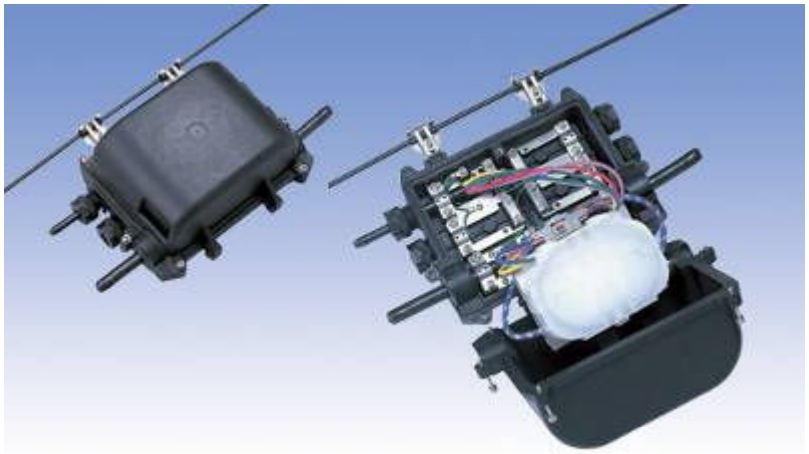


✓ 광종단기(**Matal-ion doped fiber** 적용)



OSP Mat'ls [Optical Closure]

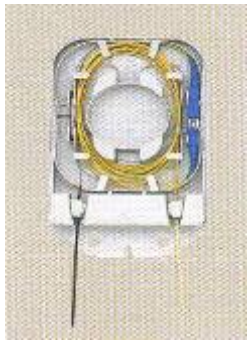
➢ 길이 **35cm**이하, **64**심 이하(가공 및 지하겸용)



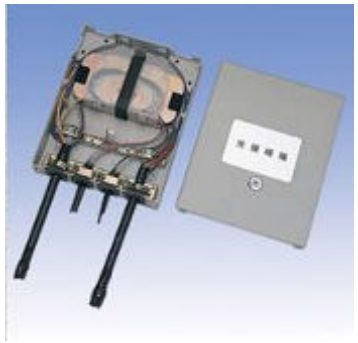
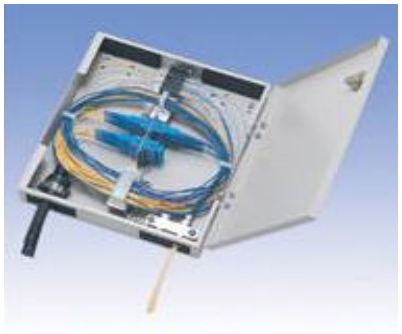
➢ 길이 **20cm**이하, **24**심 이하용(가공)

OSP Mat'ls [Optical Box]

➢ 광종단박스

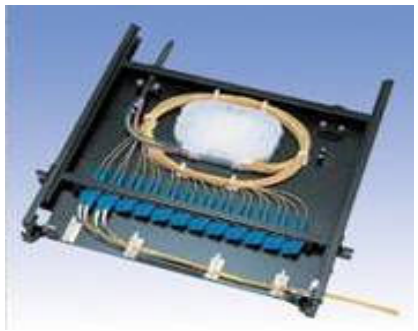
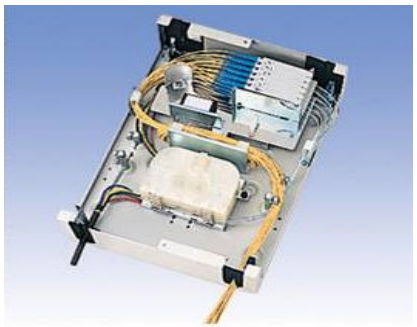



➢ 구내 소심광케이블 접속함

➢ 대형건물 광분배반

➢ 중,소형건물 광분배반 셀프

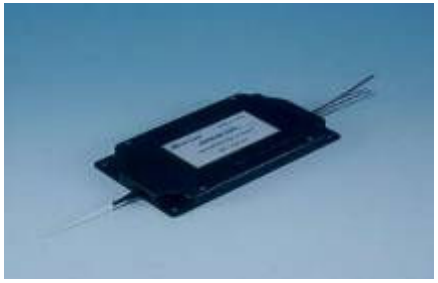



➢ 구내 광분기함

OSP Mat'ls [Optical Device]

➢ 광스플리터 접속형

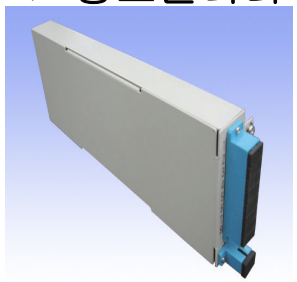
➢ 파장분배기 접속형



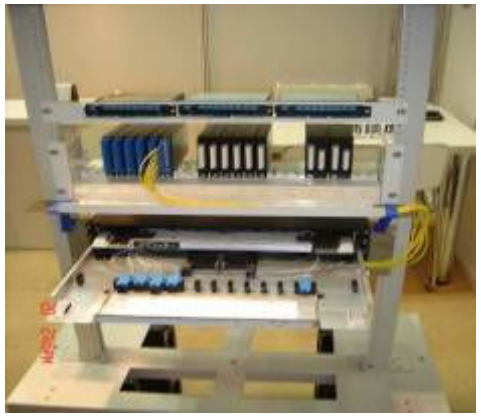
➢ 광스플리터 커넥터형

➢ 파장분배기 커넥터형

➢ 광스플리터 카드형



카드형이 장착된
구내 성단함



OSP Mat'ls [fusion and….]

➢ *소형, 저가격, 누구나 쉽게 사용(방법만 알면 특별한 기술이 없더라도 접속이 가능)할 수 있는 방향으로 개발*

✓ *FTTH용 융착접속기*



✓ *광섬유절단기*





✓ *광섬유 접속 보조공구*

단심분리기

리본나이저(Furukawa)

리본나이저(Sumitomo)

4심리본분리기

2심리본분리기

플라스틱 스트립퍼

스닙툴(리본심선 제거)

케이블외피절단기

광옥외선지지선분리기

현장조립광커넥타공구(1)

현장조립광커넥타공구(2)

현장조립광커넥타공구(3)

광커넥타페룰클리너

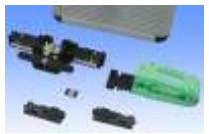
광전화기

광섬유심선대조기(1)

광섬유심선대조기(2)

광섬유심선대조기(3)

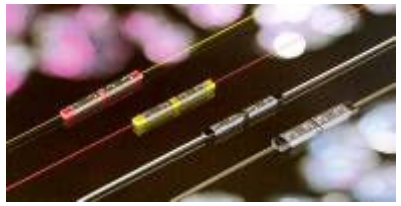
기계식접속자조립공구(1)

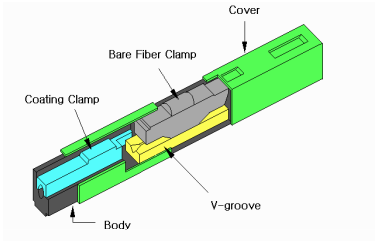


기계식접속자조립공구(2)

OSP Mat'ls [Splicing]

❑ Mechanical Splicing

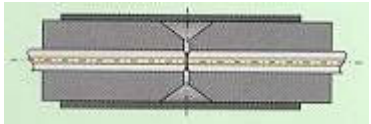




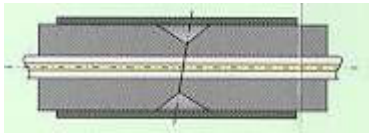
❑ Fusion Splicing

❑ Connector Splicing

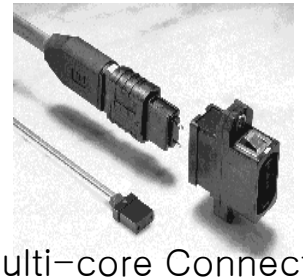
- ✓ Ferrul Shape: PC, APC
- ✓ Housing and Assembly: Biconic, SC, FC, ST, D4, MU



<Ferrul PC type>



<Ferrul APC type>

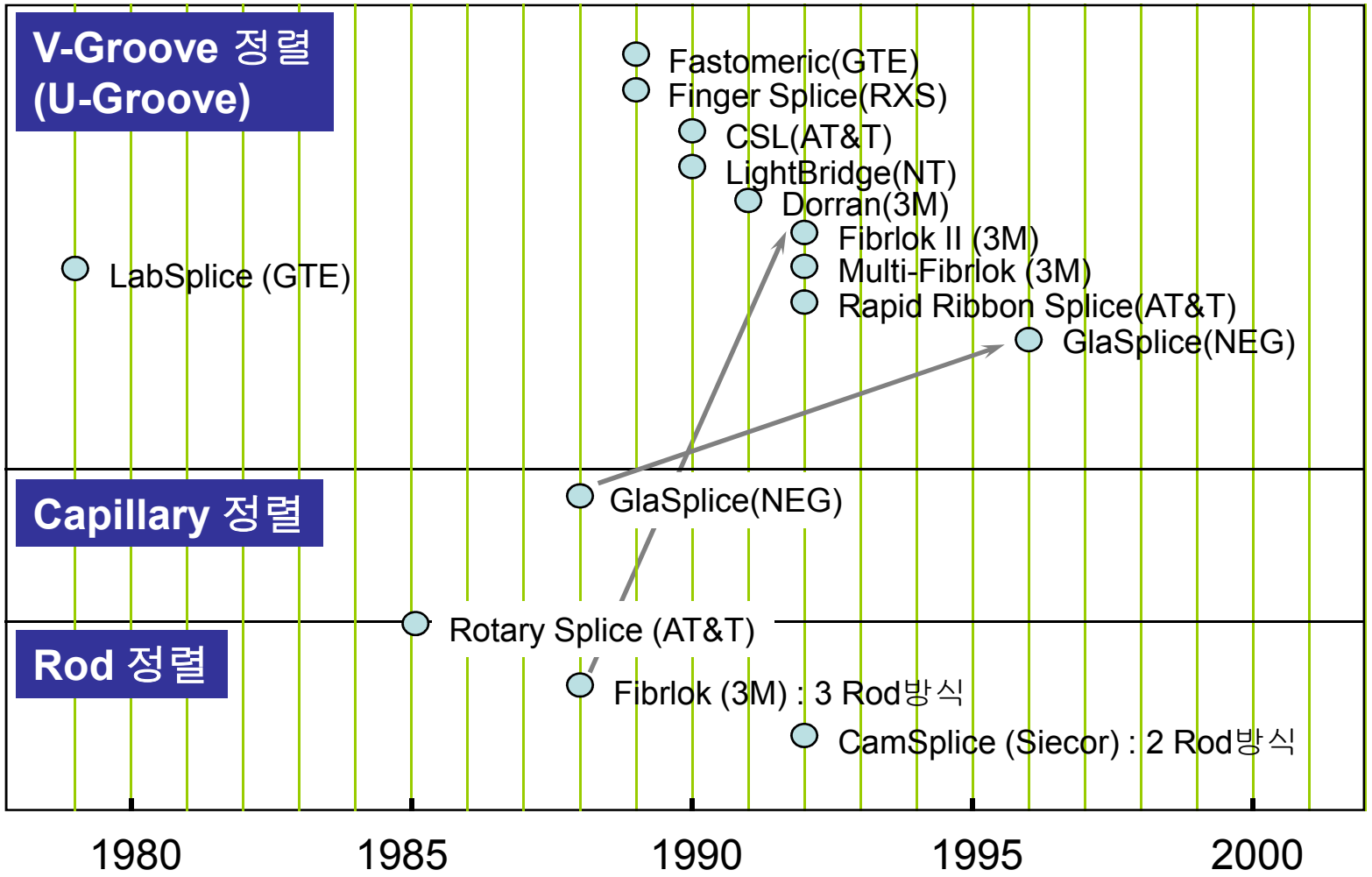


<Multi-core Connector>

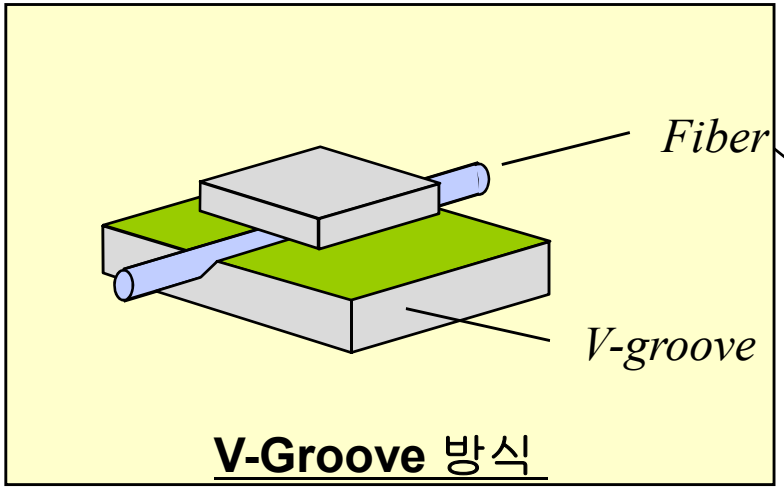
<Spot Connector>

Mechanical Splicing

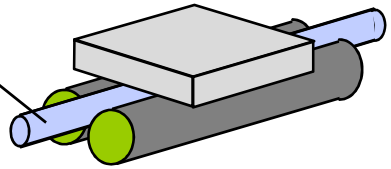
제품별 개발시기 및 정렬방식



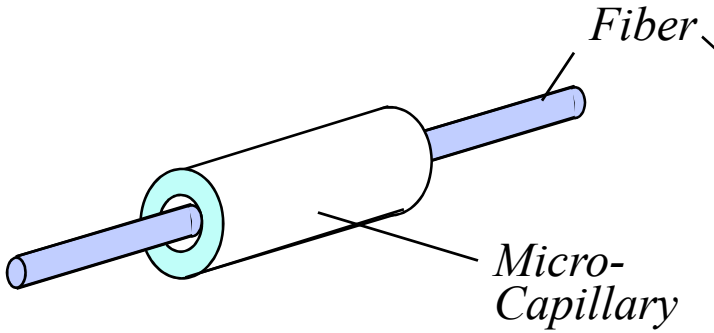
Mechanical Splicing 접속구조



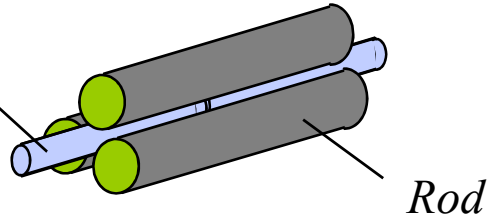
V-Groove 방식



2-Rod 방식

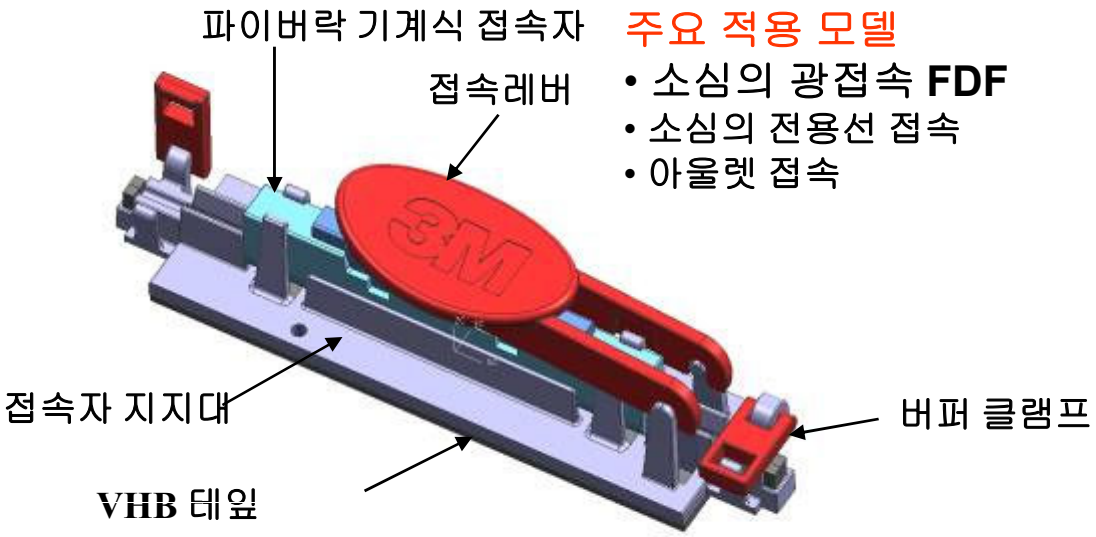


Capillary 방식



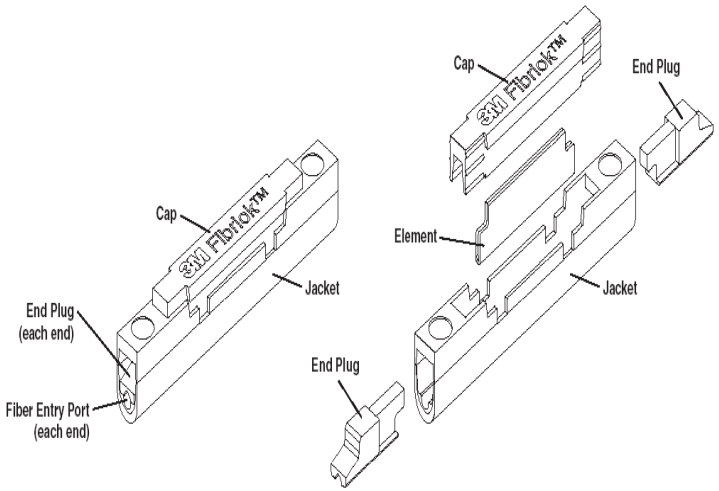
3-Rod 방식

3M Mechanical Splicing



주요 적용 모델

- 소심의 광접속 **FDF**
- 소심의 전용선 접속
- 아울렛 접속



특징	장점
접속자 지지대와 접속툴 일체형	별도의 접속툴이 필요없슴
푸쉬버튼으로 접속	사용이 편리
버퍼 클램프	900um 파이버의 고정이 용이
3M VHB 테잎	단자함 어디에나 부착이 가능

3M Mechanical Splicing

The RECORDsplice system comprises two items

Splice

- Description: RPI-SA100

Toolkit

- Description: RPI-TK100

현장조립용 광커넥터

1.페룰 연마법(Conventional connector field installation)

- 광커넥타의 구성 부품들을 조립하여 광섬유 심선에 연결하고
- 페룰 단면으로 도출된 광섬유를 절단, 연마하여
- 광섬유심선을 광커넥타화하는 방법

Step 1 : 광섬유심선 인출작업

Step 2 : 광섬유 단면 처리

Step 3 : 광커네타 조립

(1) 구성부품 조립 (2)본딩작업(Bonding) (3) 경화 (+ oven) (4)페룰단면 연마(+ polish)

소요시간 : 6분15초 소요

광학적특성 : 삽입손실 0.5dB이하, 반사손실 45dB 이상

현장조립용 광커넥터

페룰연마법의 작업과정

➢ 단면처리된 광섬유를 페룰내 삽입하고,
광커넥타 구성품들을 조립한다.

➢ 페룰내 에폭시 주입

➢ 페룰 단면으로 도출된 광섬유를 절단한다.

➢ 페룰 단면을 폴리싱페이퍼로 연마한다.
(4단계 : 5um, 1um, 0.3um, 소프트 페이퍼)