FTTH Deployment Strategy of KT

July 10 2007

FTTH Solution Development Department
Network Infrastructure Laboratory KT

Outline

1 **PON Technology**

2 FTTH Deployment in KT

3 Hybrid-FTTH Development

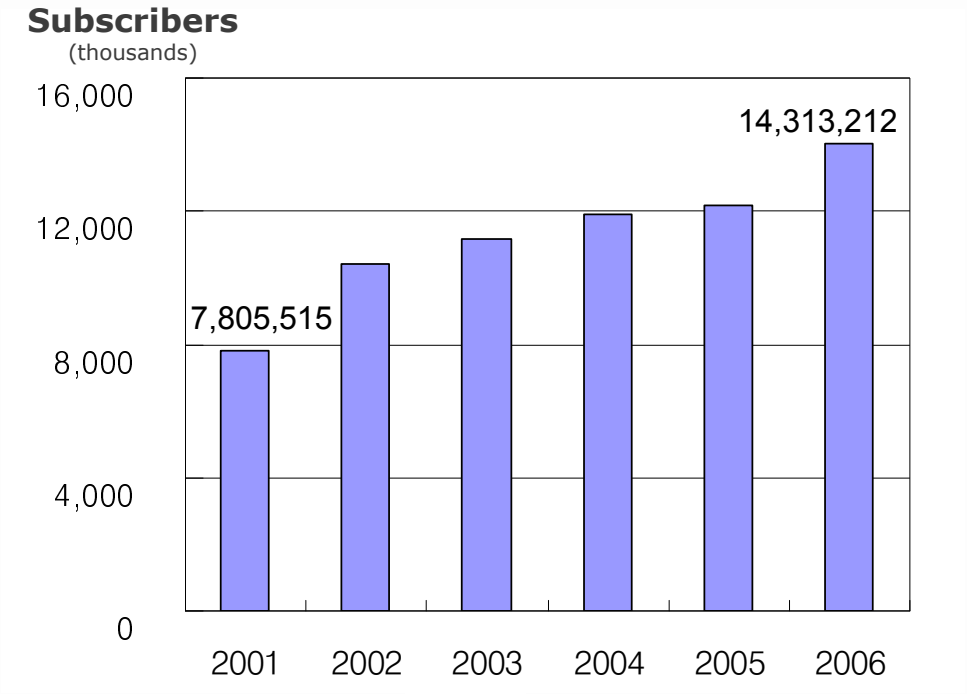
4 FTTH Evolution Plan

5 Conclusion

Broadband Market Status

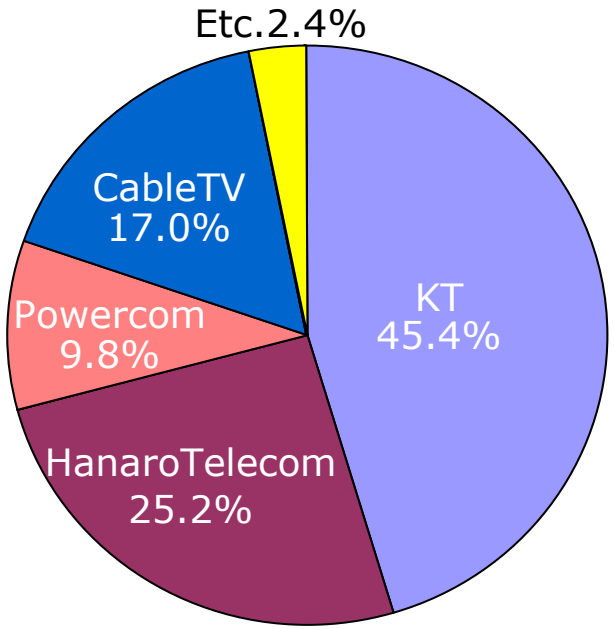
❑ Market Saturated & excessive competition

Number of Subscribers



Source MIC (Ministry of Information and Communication) 2007.4

Market Share Ratio



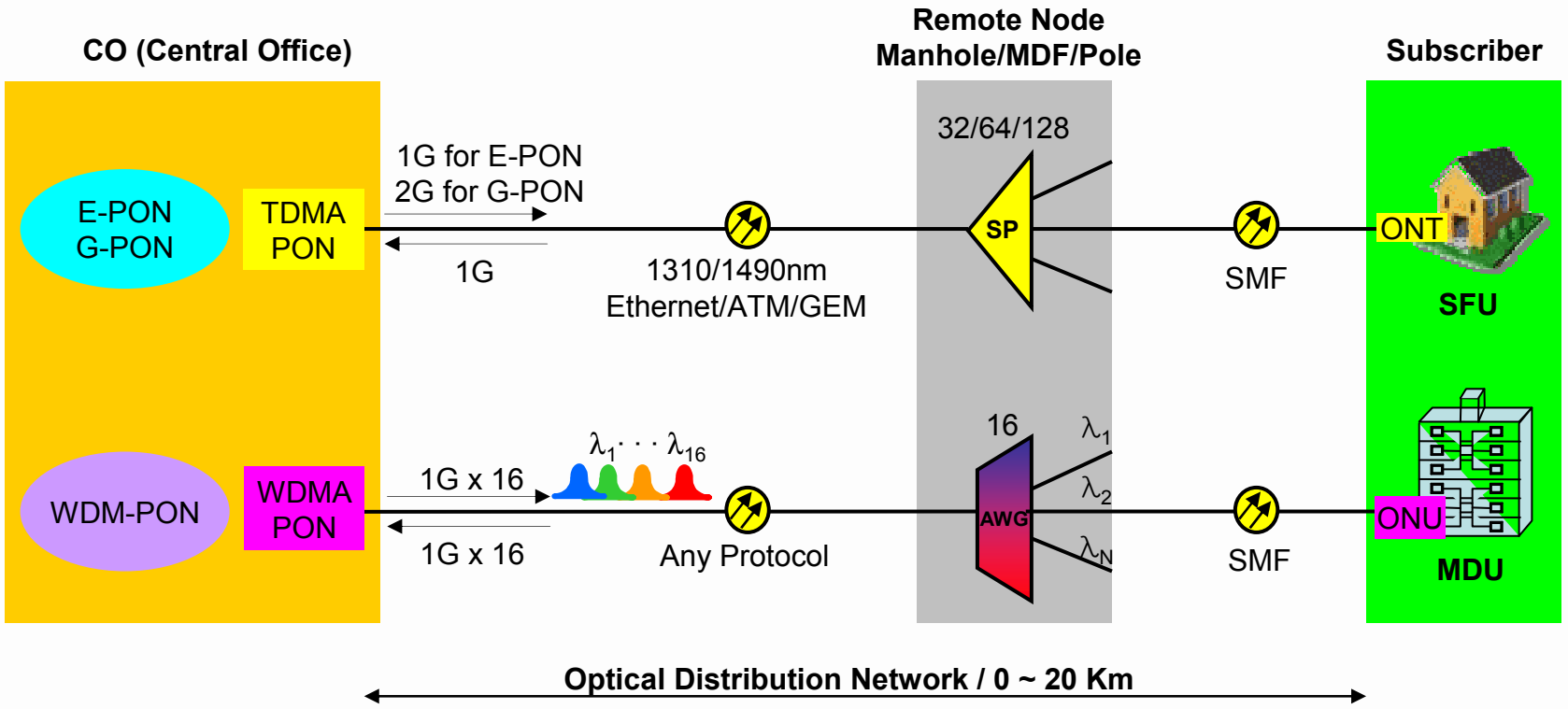
- Penetration rate per home is above 85%
- The age of limitless competition : Telco, CableTV company and new entry (PowerComm 2005.9)

KT's Access Network Status

- KT's Access network
  - High speed Internet subscribers : 6.4 Million
  - xDSL : 66%
    - ADSL, VDSL(10M/20M/50M/100M VDSL)
    - Most DSLAM do not support QoS ➔ Need to be upgraded
  - FTTx : 34%
    - FTTC, FTTH-Pole, N-topia
    - FTTH (E-PON, WDM-PON)
  - For SFU(Single Family Unit) environment, BBx(BrodBand street cabinet) located outside burdens OPEX
  - Rapid migration from copper-based xDSL network to FTTH
  - PON (Passive Optical Network) is a good solution for FTTH

PON (Passive Optical Network)

- PON increases the network efficiency by
  - Minimizing the number of optical fiber loop between CO and residential area
  - Minimizing active nodes at the outside
- Characteristics of PON schemes

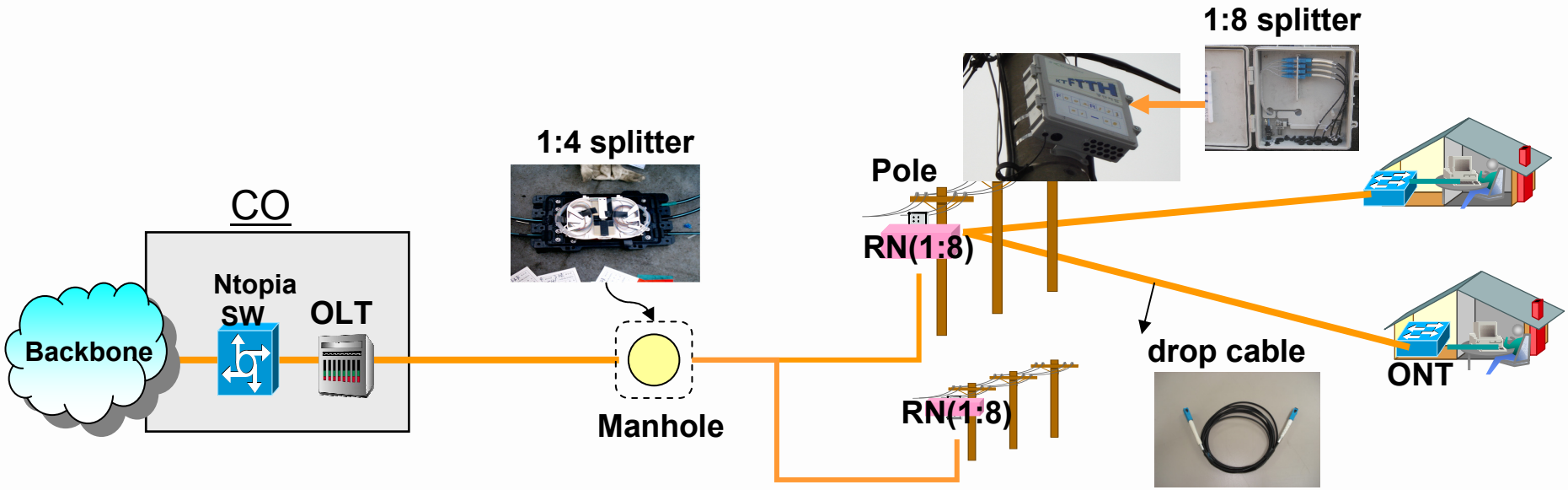


MDF : Main Distribution Frame, SFU : Single Family Unit, MDU : Multi Dwelling Unit

Benefits of PON

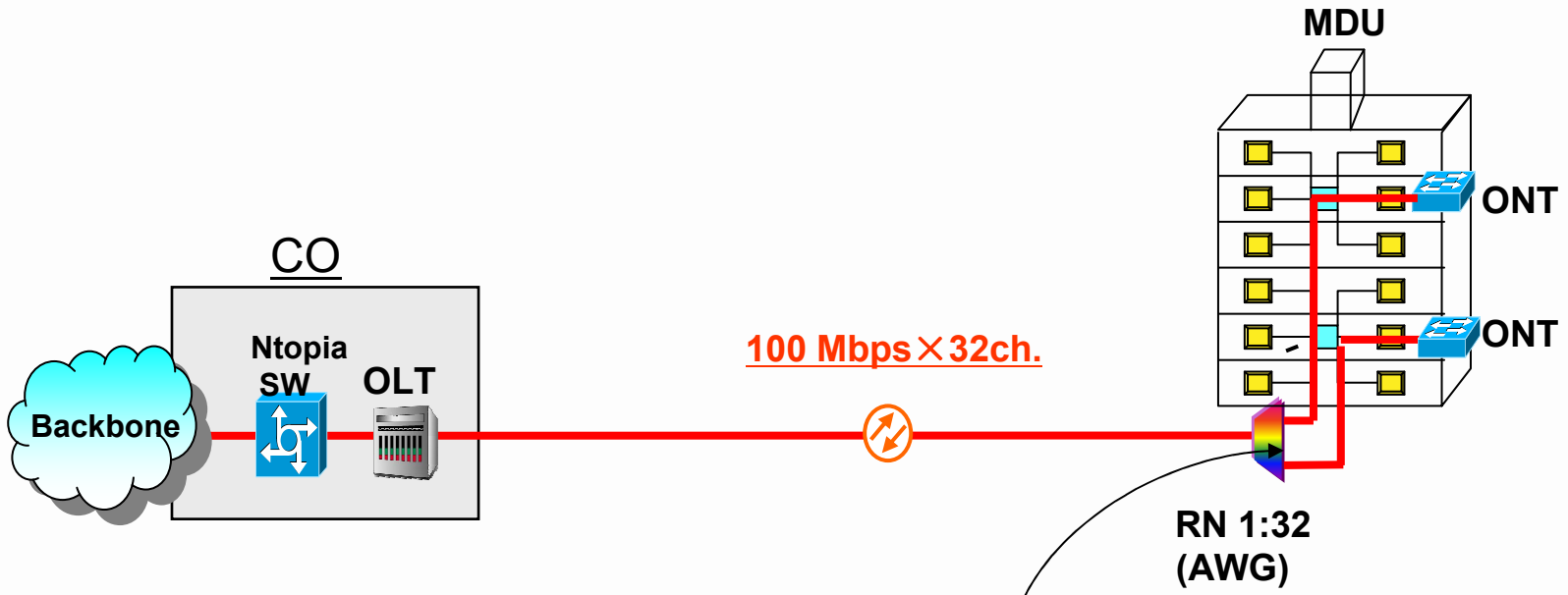
- Better performance
  - Wide bandwidth
  - High QoS and availability to provide video service
  - Distance independent speed
- Low Capex
  - Longer life cycle than xDSL
  - Low system cost
- Low Opex
  - Low operation cost
  - Lower failure rate than xDSL
  - Short MTRS (mean time to repair service)
- Better business chance
  - increase market share
  - provide network capability for new services (IP-TV, VoD)

E-PON Topology



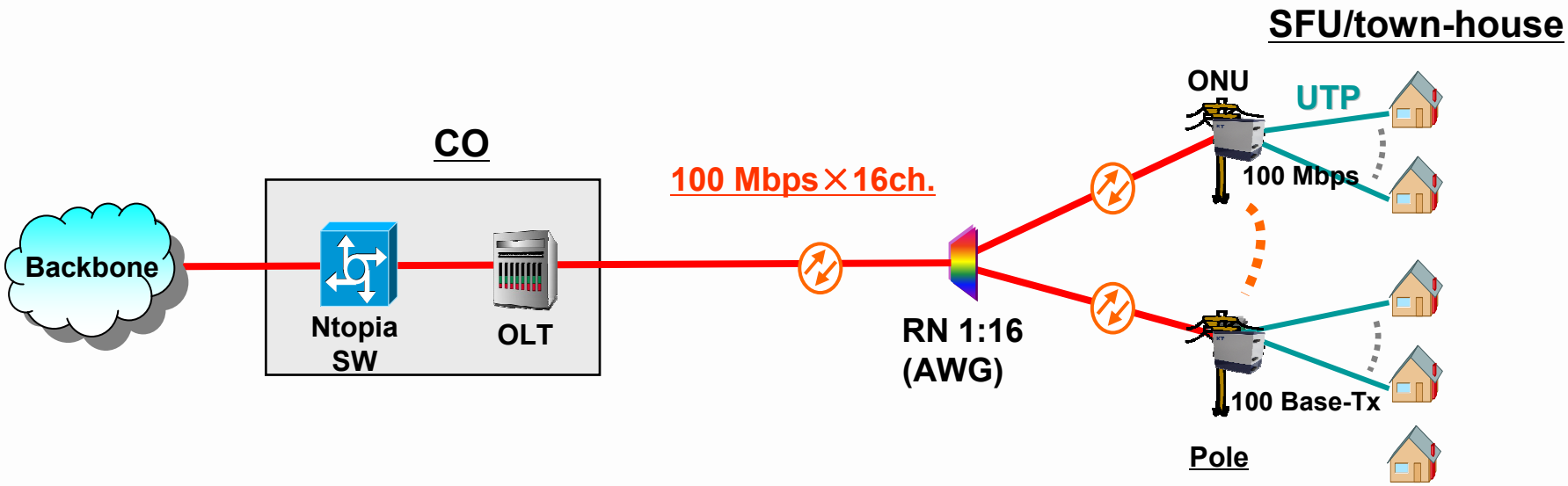
System configuration	 3 types OLT and ONT 640 or 512 subscribers/shelf  FE 4-port 1G PON I/F port
Features	○ applied system : E-PON, 10km and 20km ○ 32 subscribers/1G, up to 100Mbps speed to subscriber ○ network topology : star topology, two stage splitting(1:4 → 1:8) ○ target region : SFU, Premium class MDU

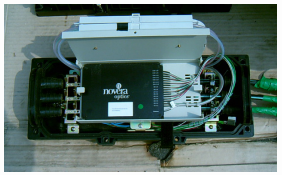
WDM-PON Topology



System configuration	 WDM-PON OLT 320 subscribers/shelf  RN (AWG located at MDF)  FE 4-port ONT 100M PON I/F port
Features	○ applied system : WDM-PON, 10km and 20km ○ 32 subscribers/3.2G, 100Mbps dedicated speed to subscriber ○ network topology : star topology, one stage splitting(1:32) ○ target region : Premium class MDU

FTTH-Pole Topology



System configuration	 WDM-PON OLT (16 channel)  RN (AWG located at Manhole) ONU at Pole or Wall 
Features	○ applied system: 100Mbps WDM-PON, 10km and 20km ○ 16~24 subscribers share the dedicated 100Mbps/ONU ○ distance from ONU to subscriber was limited about 100m due to LAN technology ○ target region: SFU with UTP indoor wiring, town house, office building

Comparing PON Topologies

Topology	E-PON	WDM-PON	FTTH-Pole
Bandwidth	Up/down Maximum 1G/1G	Up/down Dedicated 100M/100M	Up/down 100M/100M
Distance limit	No distance limit	No distance limit	<100m
Termination equipment	ONT	ONT	None
In-door wiring	Optical drop cable	Optical drop cable	UTP
Difficulty of service opening	High	High	Medium
strength	▪ Speed not limited to distance ▪ few service failure	▪ Speed not limited to distance ▪ few service failure	No termination equipment
weakness	Dedicated 30M/30M	Expensive	Speed limited to distance

Outline

1 PON Technology

2 FTTH Deployment in KT

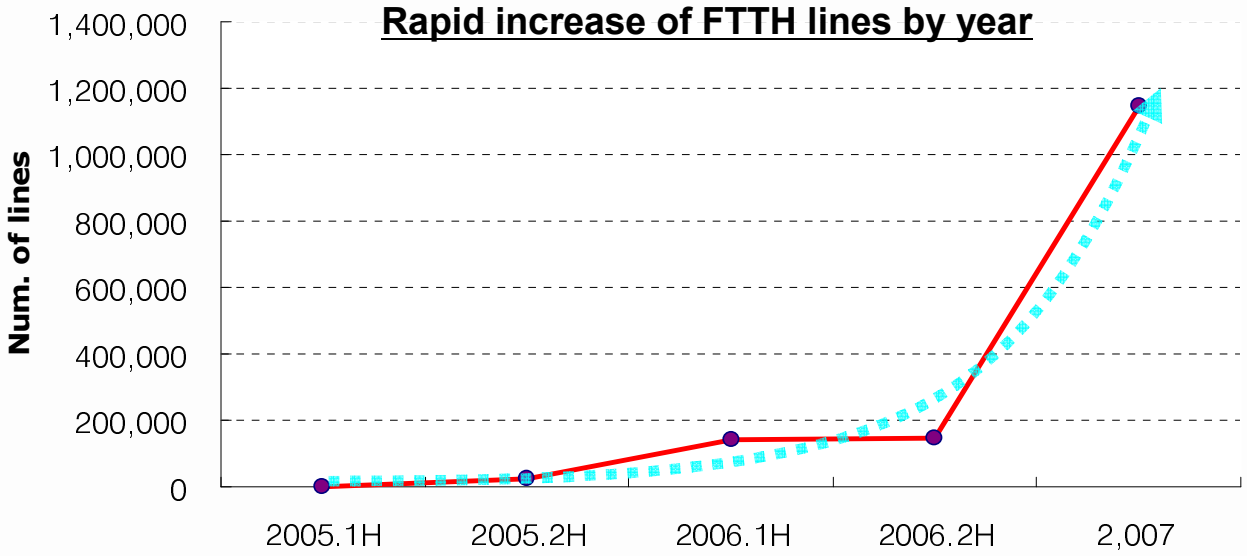
3 Hybrid-FTTH Development

4 FTTH Evolution Plan

5 Conclusion

FTTH Deployment Status

- **2005**
  - 2K subscribers at Gwangju city, MDU environment (100M WDM-PON)
  - 20K subscribers at Seoul city, SFU environment (E-PON)
- **2006**
  - 120K subscribers at Seoul city, both SFU & MDU environment (E-PON)
  - 2K FTTC(Hybrid-FTTH) field trial test (WDM-PON)
- **2007**
  - More than 1Million E-PON lines is deploying
  - More than 300K lines Hybrid-FTTH is planed to deploy



FTTH Pilot Project in Gwangju City

❑ Outline

❖ Title : FTTH Service Development Pilot Project

❖ Period : 2005 ~ 2009 (5 years)

Year	Facilities (lines)	Subscribers	Network topology	FTTH System
2005	2,016	1,487	FTTH	100M WDM-PON
2006	2,016	941	FTTH	E-PON
2007	2,609	more than 750	Hybrid-FTTH, FTTH	Giga WDM-PON, E-PON

❑ Goals

❖ Deploying 20 thousand FTTH lines in five years

❖ Providing convergence services through FTTH network

❖ Technical Evaluation of FTTH based service platform

FTTH Service in Gwangju City

Services	Details
Broadcasting	❑ IP-TV : over 22 channels
Value Added Service	❑ Electronic Program Guide Service (EPG) ❑ Network-based Personal Video Recorder (N-PVR) ❖ Network-based Time-shifted TV Service ❖ Network-based Video Recording Service
VoD	❑ KT HomeN VoD (Movie, TV Drama, Animation, Kids Education, Sports, Health, etc)
Internet Access	❑ KT Megapass (FTTH)

IP STB for FTTH Service

Service Main Screen

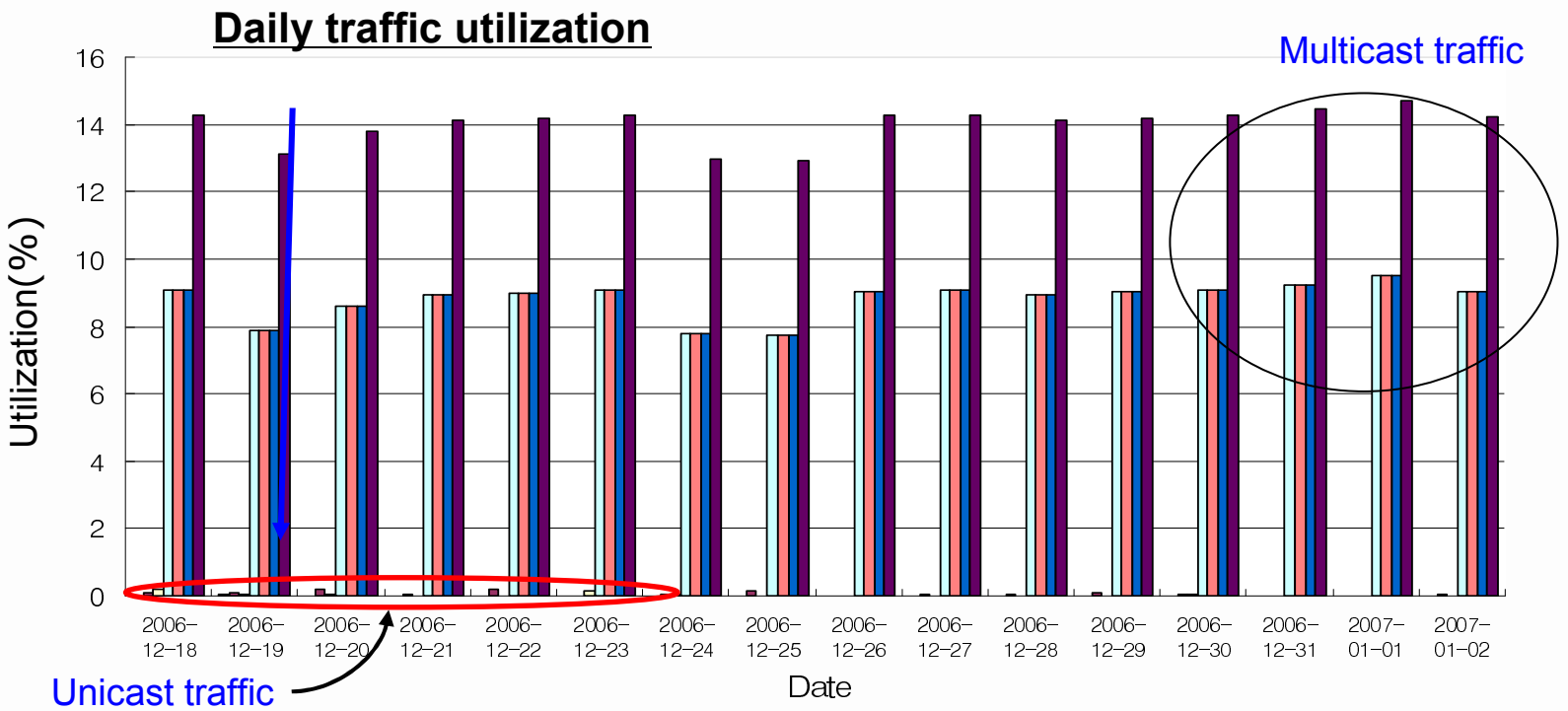
EPG, IP-TV

N-PVR

VOD

FTTH Service Result in Gwangju City

- Multicast traffic utilization higher than any other services
  - 22 channels
    - HD channel : 20Mbps (MPEG-2)
    - SD channel : 4Mpbs (MPEG-2)
  - Unicast traffic utilization was much smaller than multicast
  - Video service increases bandwidth utilization



Outline

1 PON Technology

2 FTTH Deployment in KT

3 **Hybrid-FTTH Development**

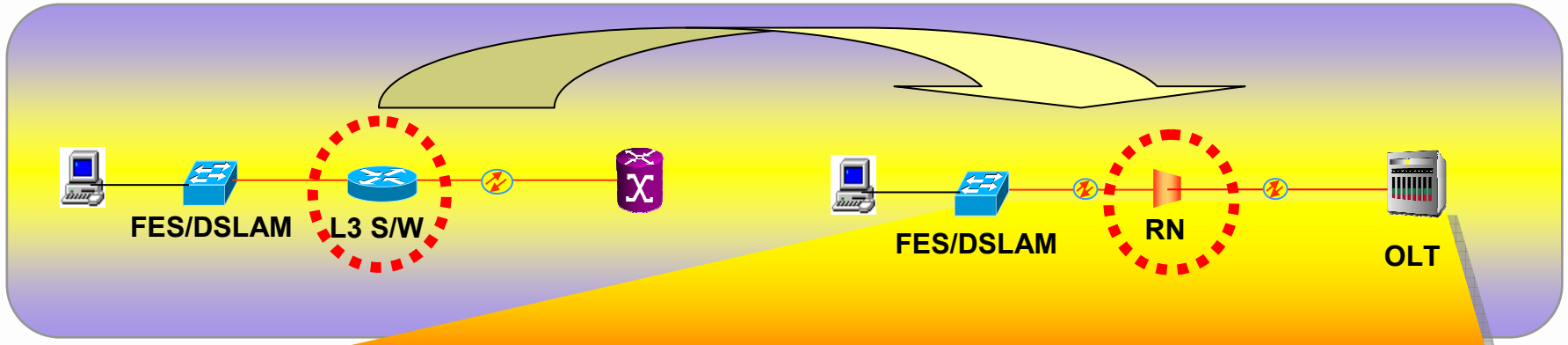
4 FTTH Evolution Plan

5 Conclusion

What is Hybrid-FTTH?

- *Hybrid-FTTH* is targeted for subscribers in apartment complex
  - Hybrid-FTTH is a PON technology combined with Ethernet or DSL technologies to maximize cost efficiency by reusing the existing wiring of apartment complex (UTP or TP)

Hybrid-FTTH solution

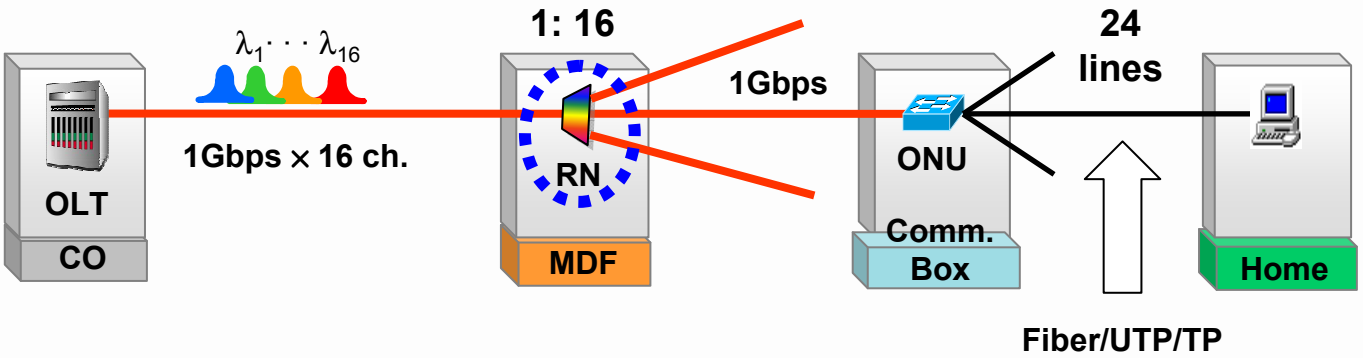


- Minimize outside active nodes ➔ improve network manageability
- Improve network reliability by using passive devices
- Improve bandwidth by applying PON solution(~32Gbps/feeder core)

Giga WDM-PON

- Giga WDM-PON is an economic Hybrid-FTTH solution which provides 16 up/down wavelengths, 1Gbps per wavelength
  - minimizes active nodes at the outside
  - improves network reliability by using passive devices
  - improves bandwidth by applying PON solution(~16Gbps/feeder core)

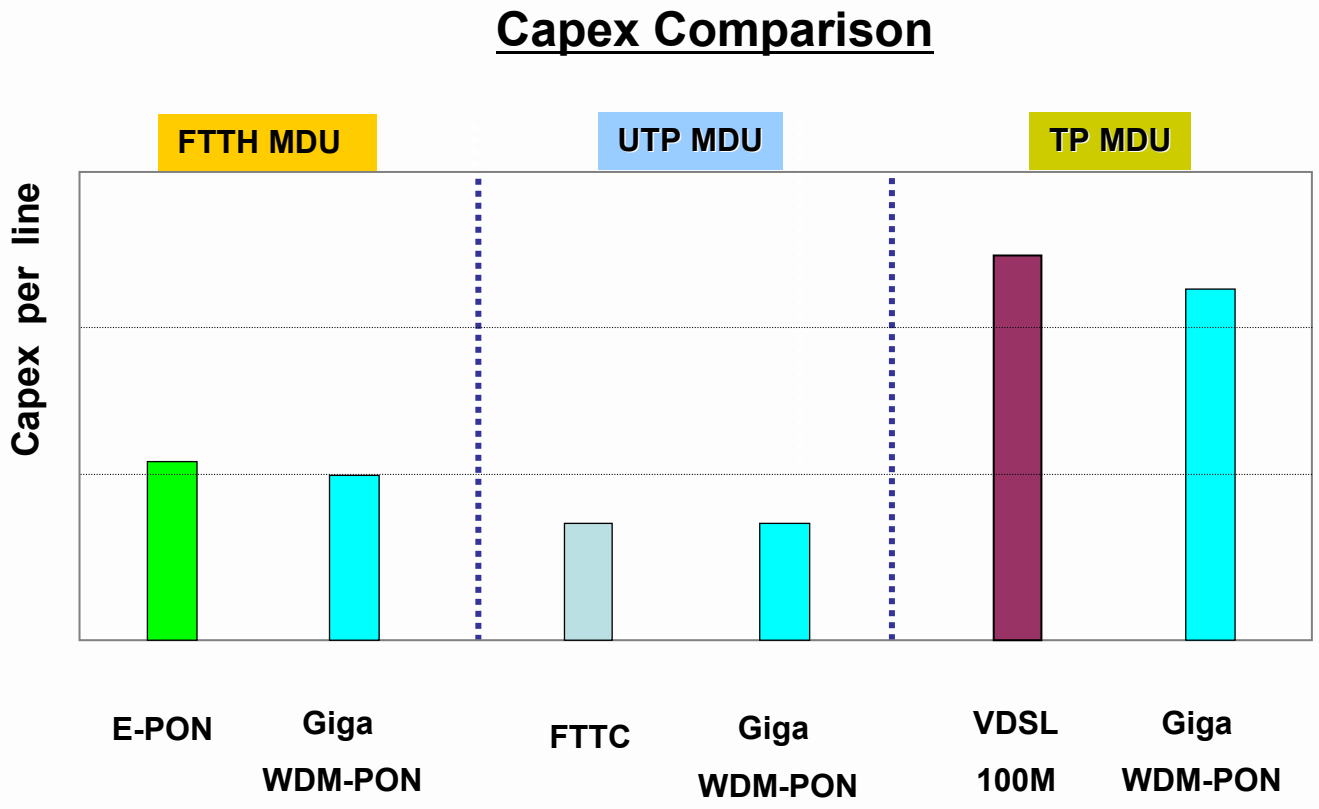
Hybrid-FTTH topology



MDU or Office	Premium class	1st class	2nd class	3rd class
ONU type	ONU-F	ONU-T		ONU-V

Giga WDM-PON : Capex

- For the FTTH and UTP MDU, Giga WDM-PON is a very cost effective solution
  - Capex includes system and outside plant costs
- But for the TP MDU, Capex is greatly increased because of VDSL2 modem



Outline

1 PON Technology

2 FTTH Deployment in KT

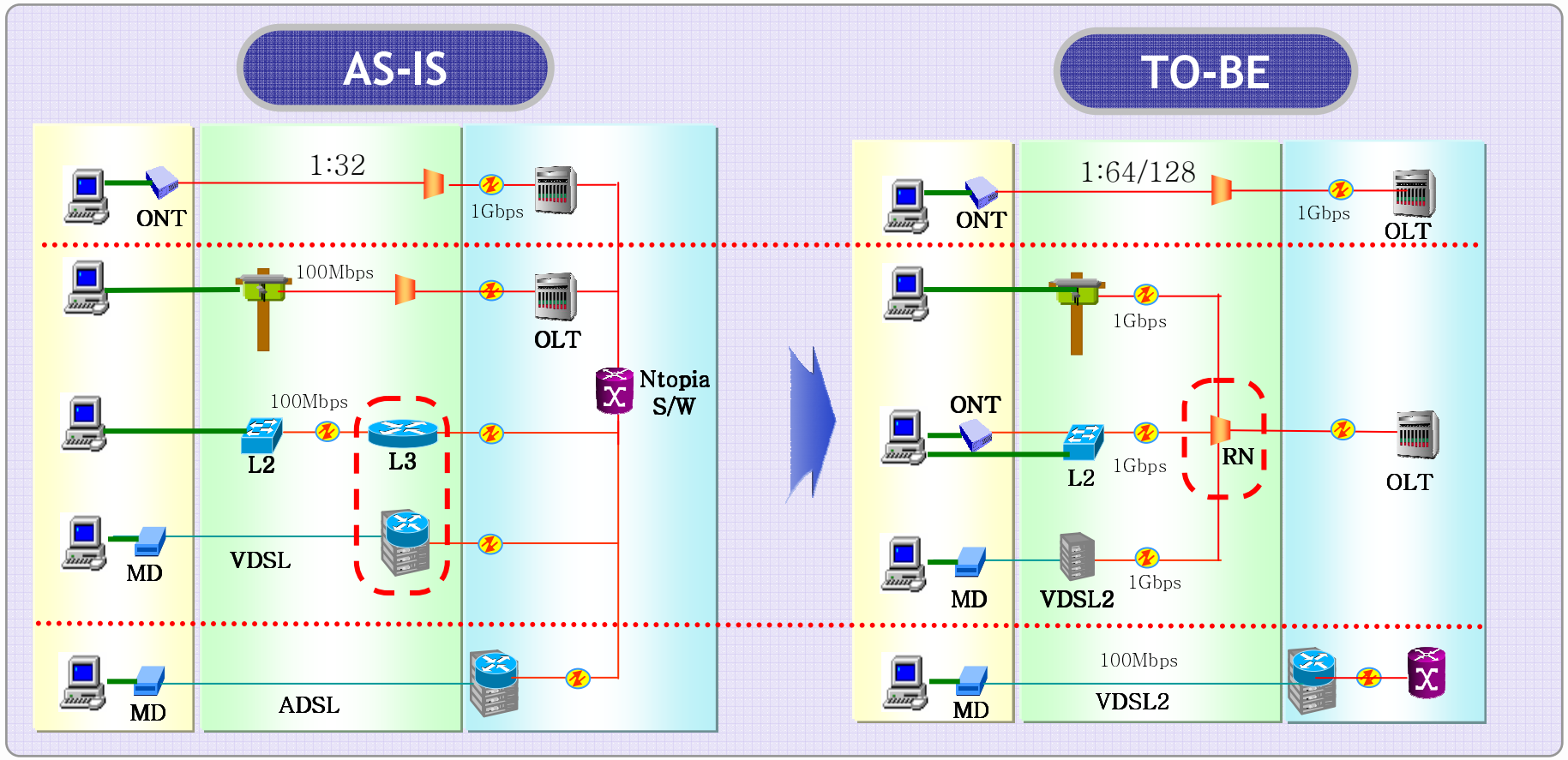
3 Hybrid-FTTH Development

4 FTTH Evolution Plan

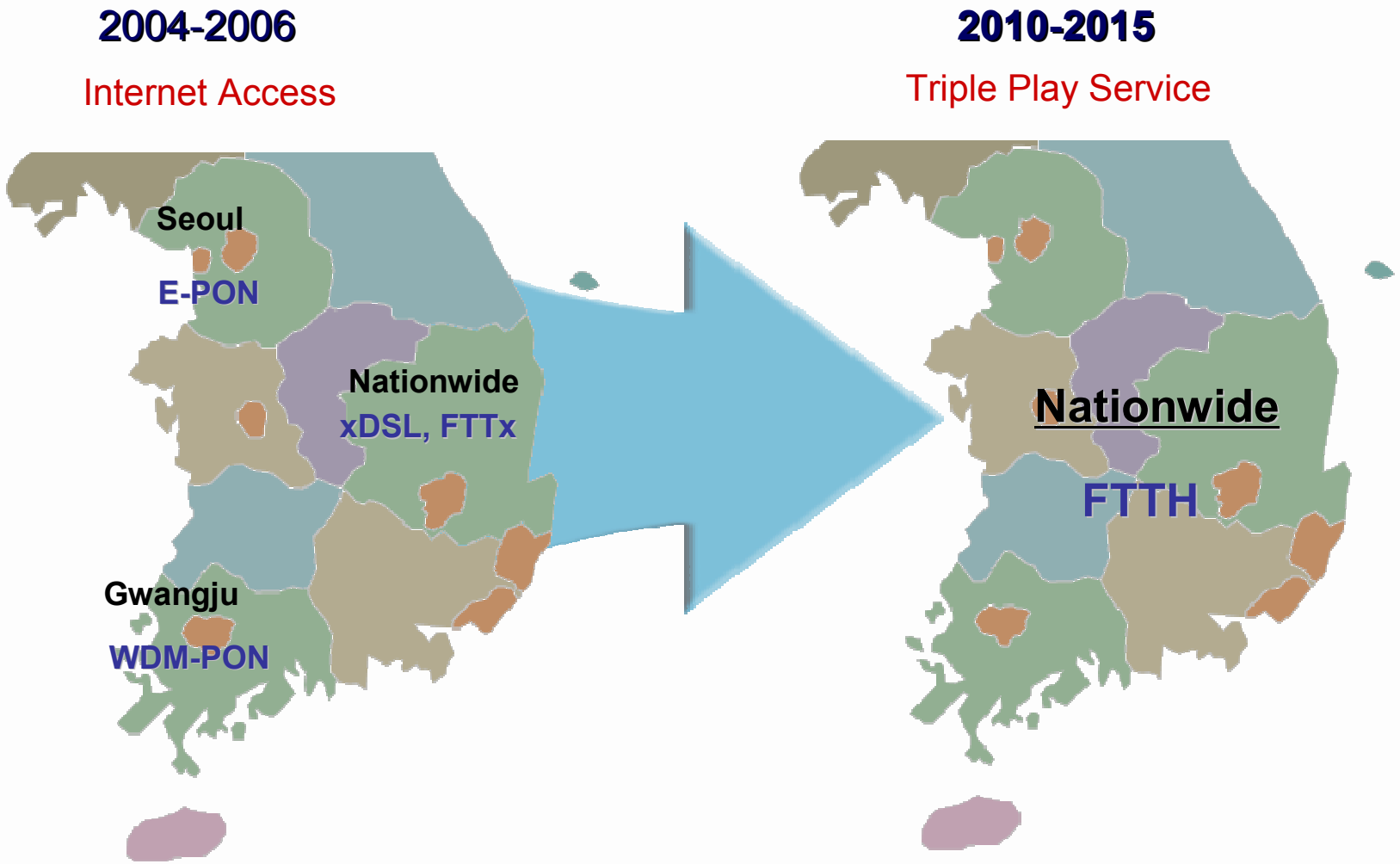
5 Conclusion

FTTH Deployment Strategy

- FTTH or FTTC for the distant service areas from CO
  - Fiber wiring ➔ FTTH deployment
  - UTP or TP wiring ➔ FTTC deployment
- VDSL2 for the SFU subscribers near to CO



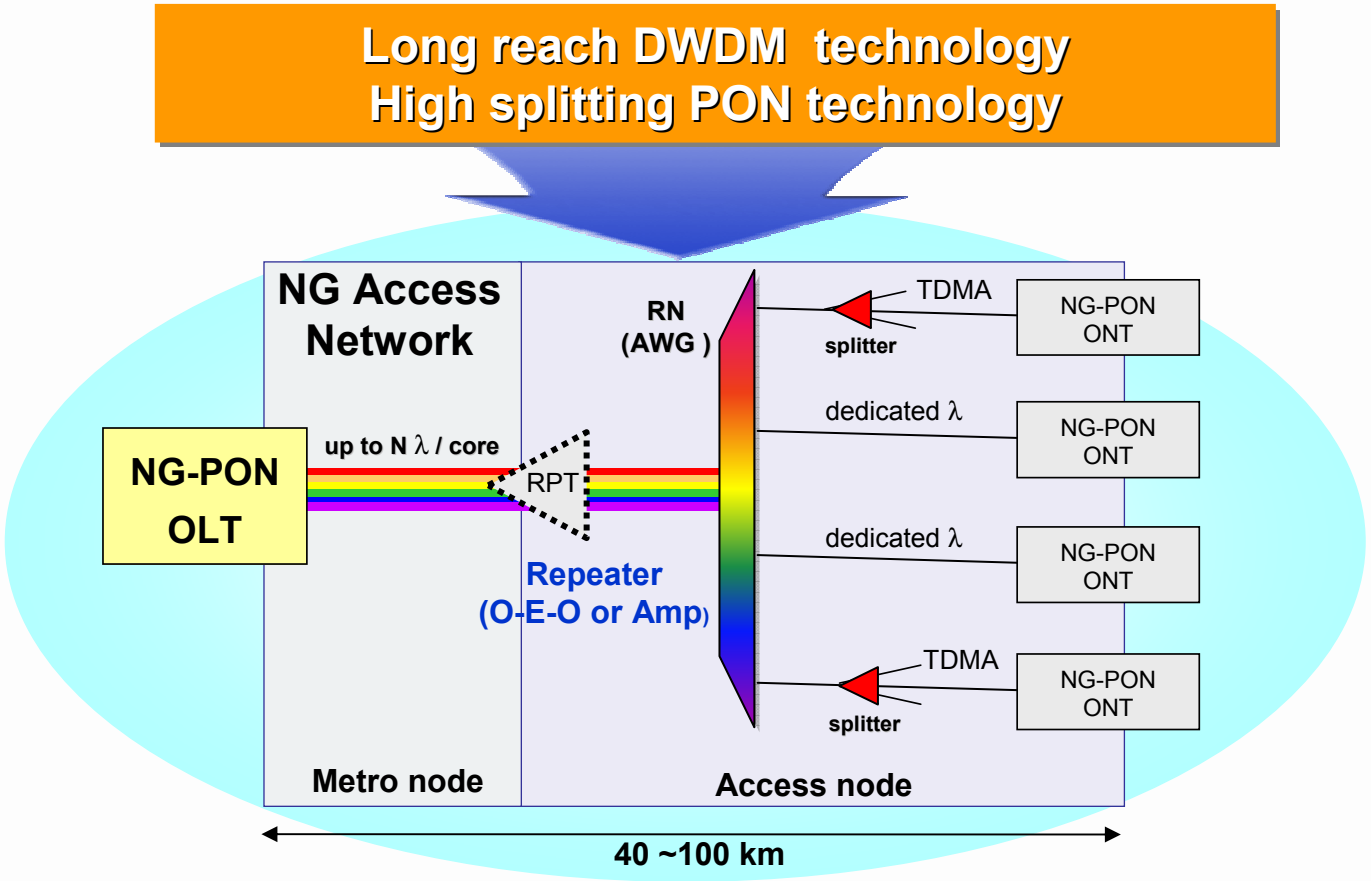
KT's FTTH Roadmap



❑ Goal : about 90% FTTH up to 2010, finally 100% FTTH in 2015

WDM-PON Technology Evolution

- Extending the access segment further up to the metro area : 40 ~ 100Km
- Opex minimization by reducing number of active nodes and simplifying the management
- Evolution to the NGA network



Outline

1 PON Technology

2 FTTH Deployment in KT

3 Hybrid-FTTH Development

4 FTTH Evolution Plan

5 **Conclusion**

Conclusion

- KT is now deploying massive FTTH lines in using PON technology
  - PON will open new business market and reduce Opex
- FTTH trial service in Gwangju city
  - verified the feasibility of video delivery service
  - E-PON and WDM-PON provide good TPS performance
  - Opex reducing methods is necessary to operate FTTH network efficiently
- Giga WDM-PON will be a good hybrid-FTTH solution reusing the existing CPN infrastructure
  - KT has developed Giga WDM-PON suitable for MDU environment
  - We applied gigabit DWDM technology first in the world
- WDM-PON combined with TDMA technology will be the solution for the NGA network