



**Asia-Pacific  
Economic Cooperation**

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**2010/TEL41/LSG/IR/007**

Agenda Item: 8

## **FTTx Network Trends and ITRI's Related Research and Promotions**

Purpose: Information  
Submitted by: Chinese Taipei



**JAPAN 2010**

**Industry Roundtable: National Broadband  
Networks and Fibre to the Premises  
Chinese Taipei  
6 May 2010**

# ITRI

Industrial Technology  
Research Institute

# FTTx Network Trends and ITRI's Related Research and Promotions

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Deputy Manager and Executive Secretary

Industry Technology Research Institute and FTTx  
Industry Alliance

National Broadband Networks and Fibre to the Premises

Industry Round Table, APEC TEL41, Thursday, May 6, 2010



# Agenda

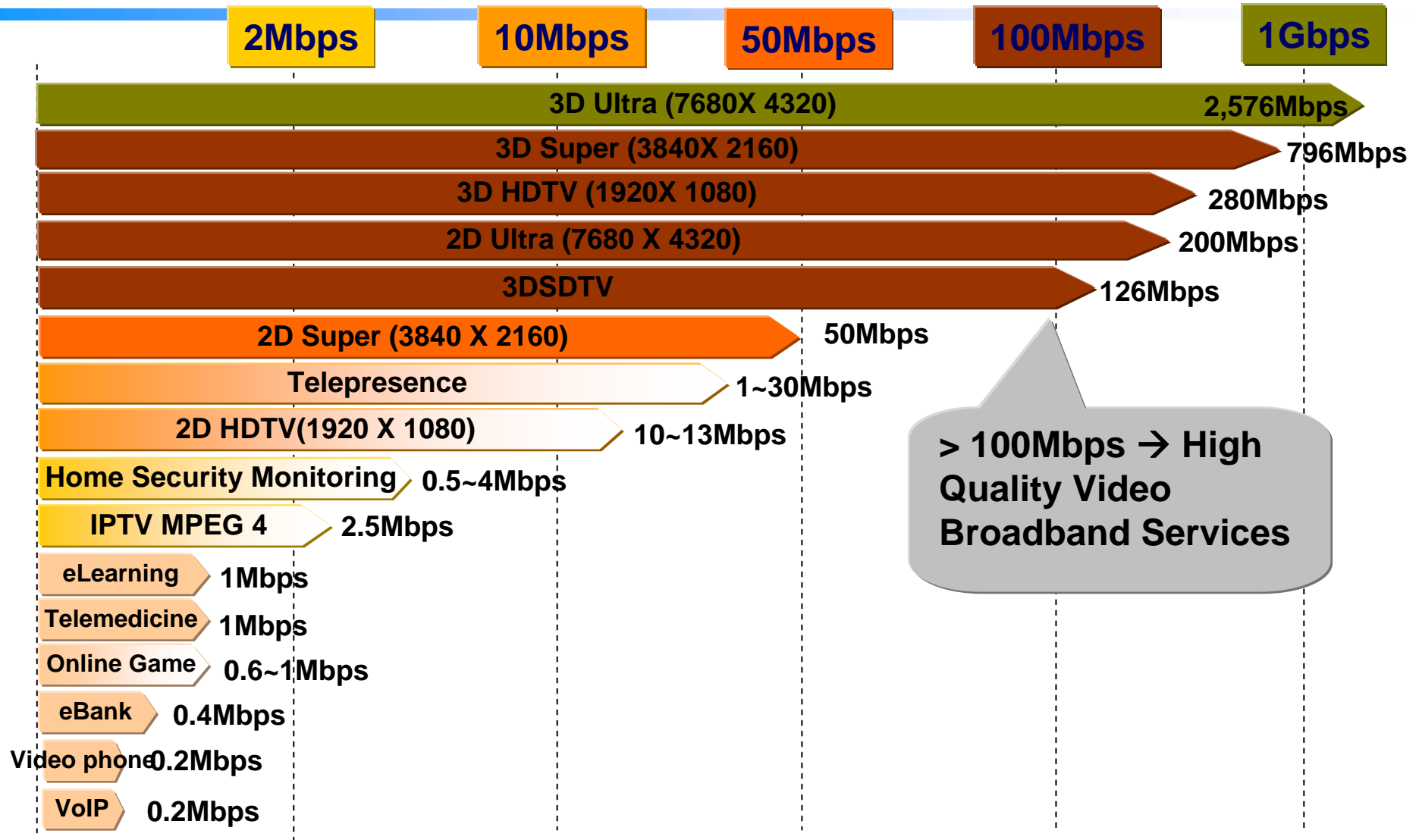
- **Broadband Access Network Developments**
- **Broadband Access Network Convergence**
- **The Market of Globe Optical Access Networks**
- **ITRI's Research and Local Companies' FTTx Network Developments**
- **Conclusions**



# 1. Broadband Access Network Developments



# Rapid Development of Broadband Services





# 3D Interactive TelePresence

## True Sense of Being There



- Cisco's new Telepresence requires 15 Mbps symmetrical bandwidth
- A one-hour conference call = 13.5 gigabytes
- 30 exabytes per year of telepresence traffic is expected in 2012.
- In 2009, the total US Internet traffic is 20 exabytes
- 1 exabyte =  $10^{18}$  bytes, 1 gigabyte =  $10^9$  bytes

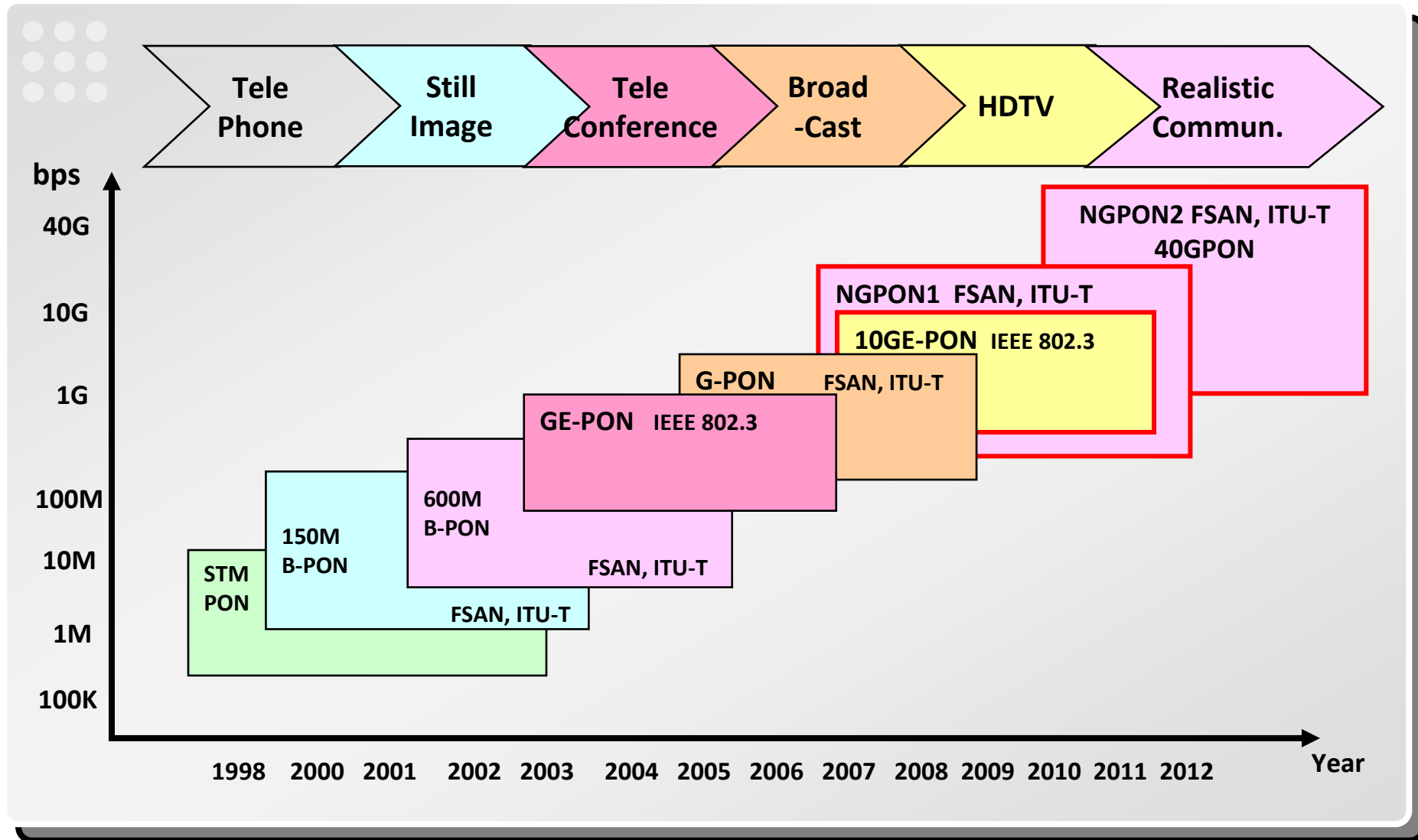


# Live Panorama Ultra-HD Quality Programs

## Feel Like You're Really A Member of The Audience

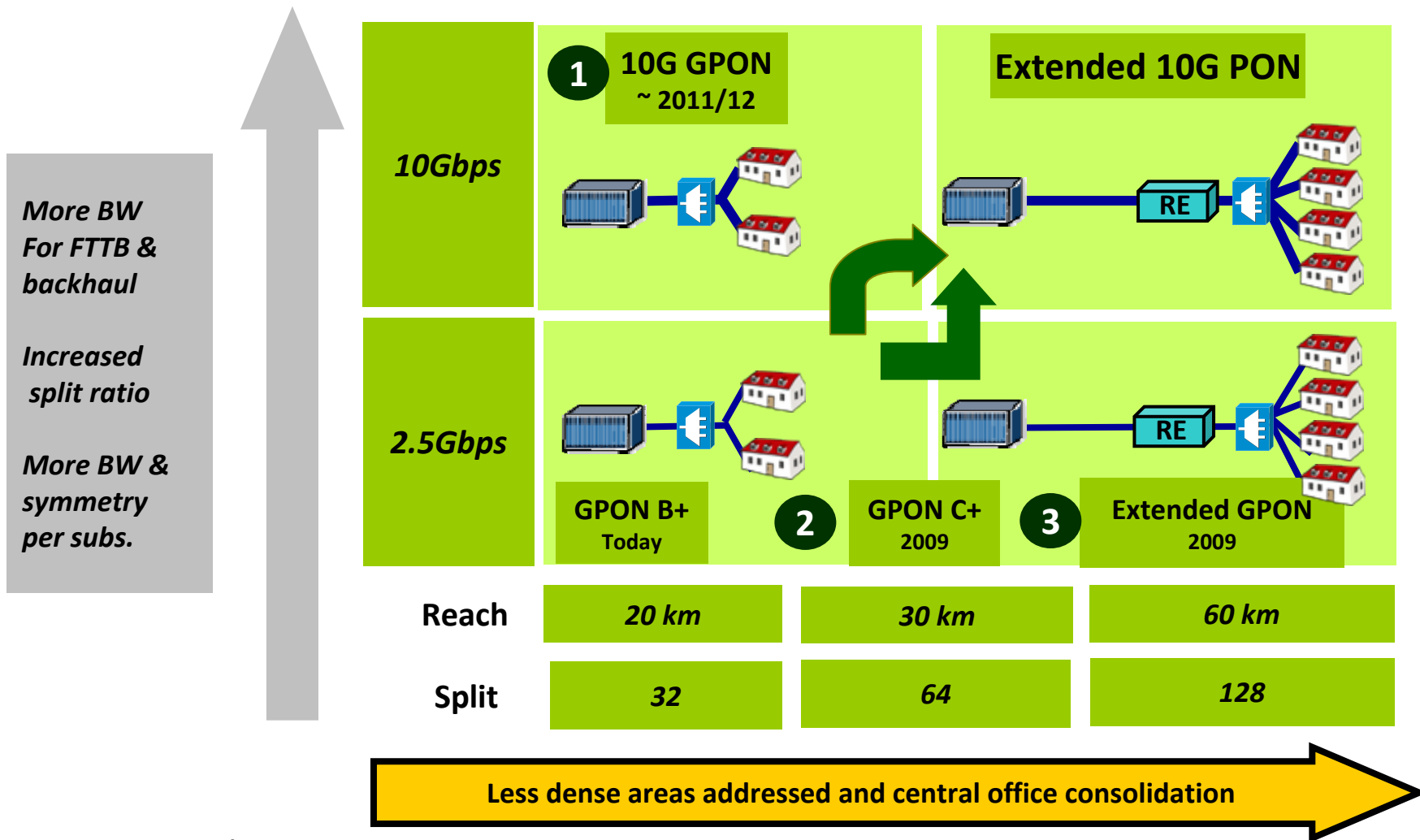


# PON Standards Are Being Developed Continuously to Increase More Bandwidth





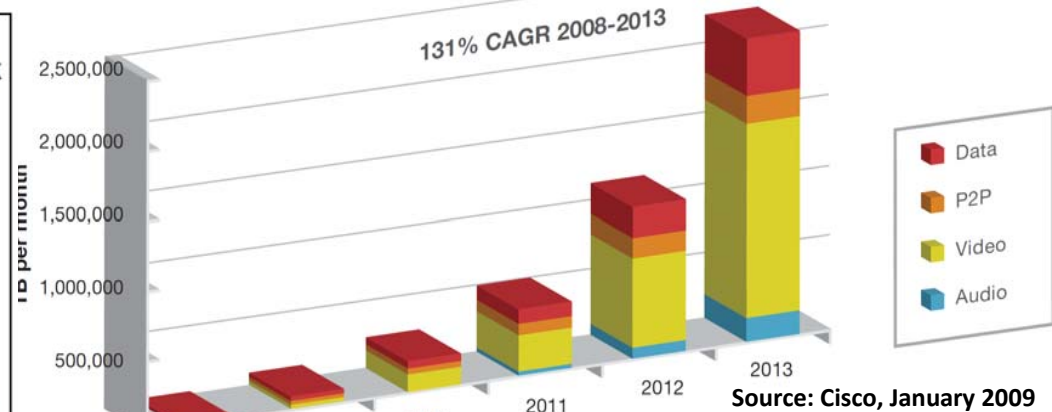
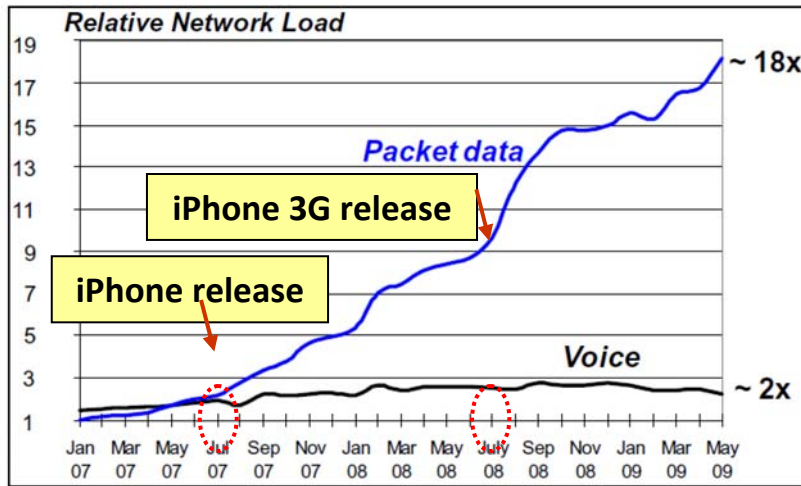
# Evolution of Optical Access Networks Towards XGPON with Reach Extender



Source: FTTH Council 2009

# Mobile Network Traffic Volumes Have Increased Substantially Since 2007

- The growth of data is much higher than voice services in the North American networks
- Mobile data traffic will continuously and explosively double every year
- Internet video becomes the platform of people's social interaction and self-expression



Source: Rysavy Research 2009



Via Legacy TDM

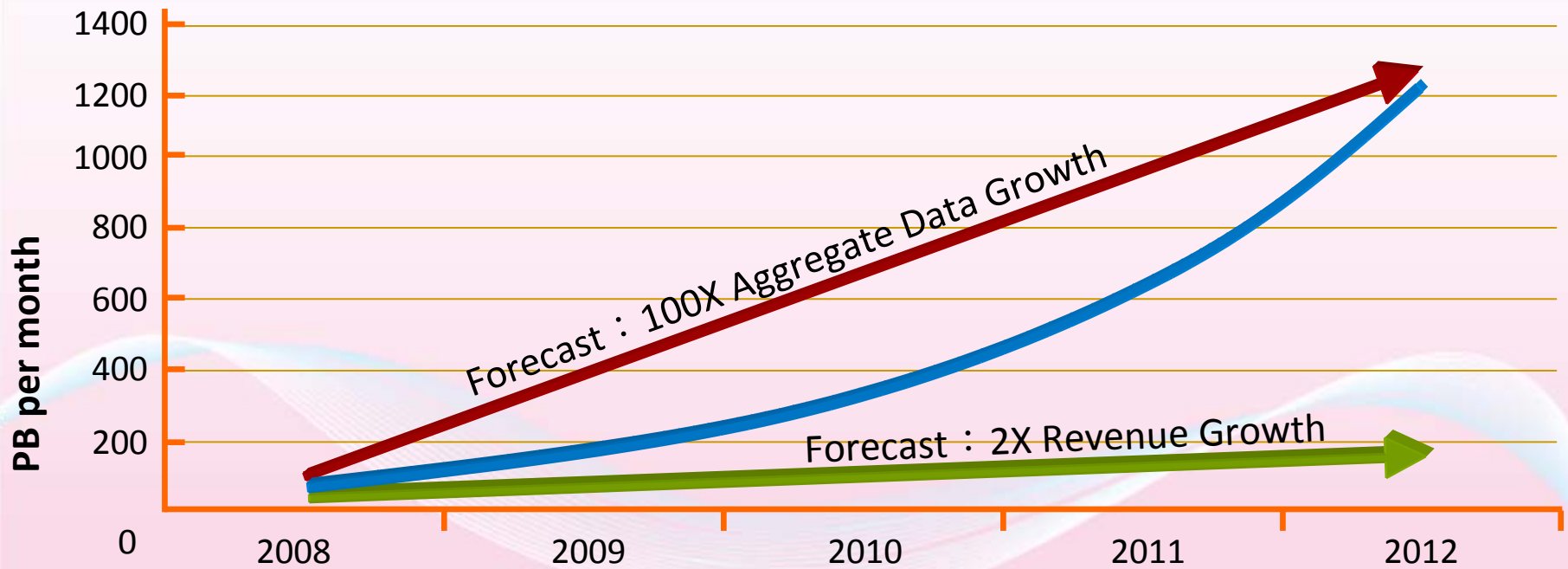
Movies, music, news, more music,  
text, web, more content ..



# Mobile Data Growth Outpaced Revenue Growth

## Operators Have to Find A Cost Effective Solution

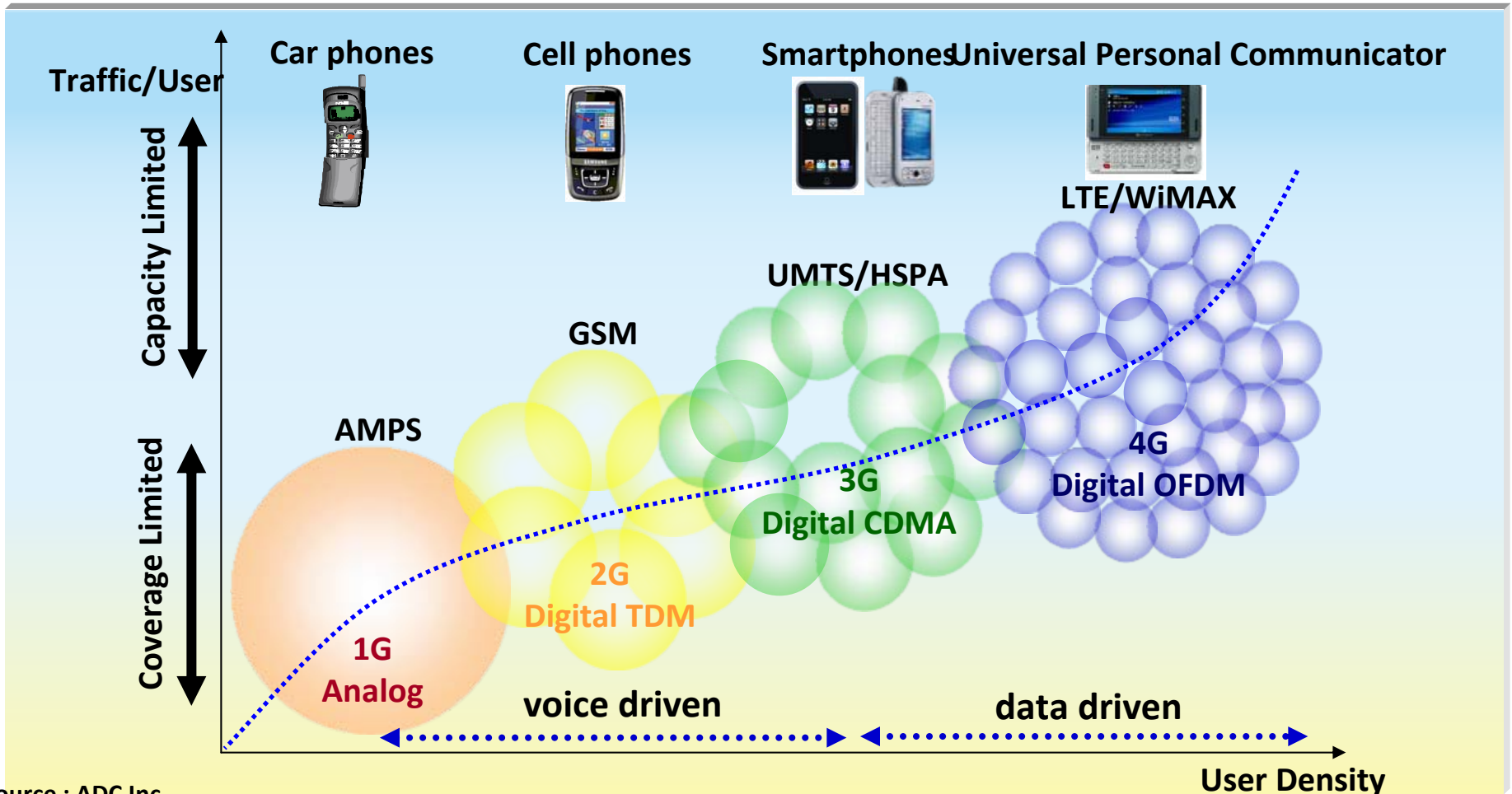
- Experts estimate that in the next 5 years, there will be a 100 fold growth of aggregate data compared to twice the growth of revenue.



Source: Edited from Cisco, from Operators' network data and Analysts, 2008

# Challenges to Upgrade the Wireless/Mobile Networks

- Higher Bit Rate & Higher Carrier Frequency → Smaller Cells
- Higher Bit Rate & More Packeted Traffic → Higher Peak Bit Rate





## 2. Broadband Access Network Convergence

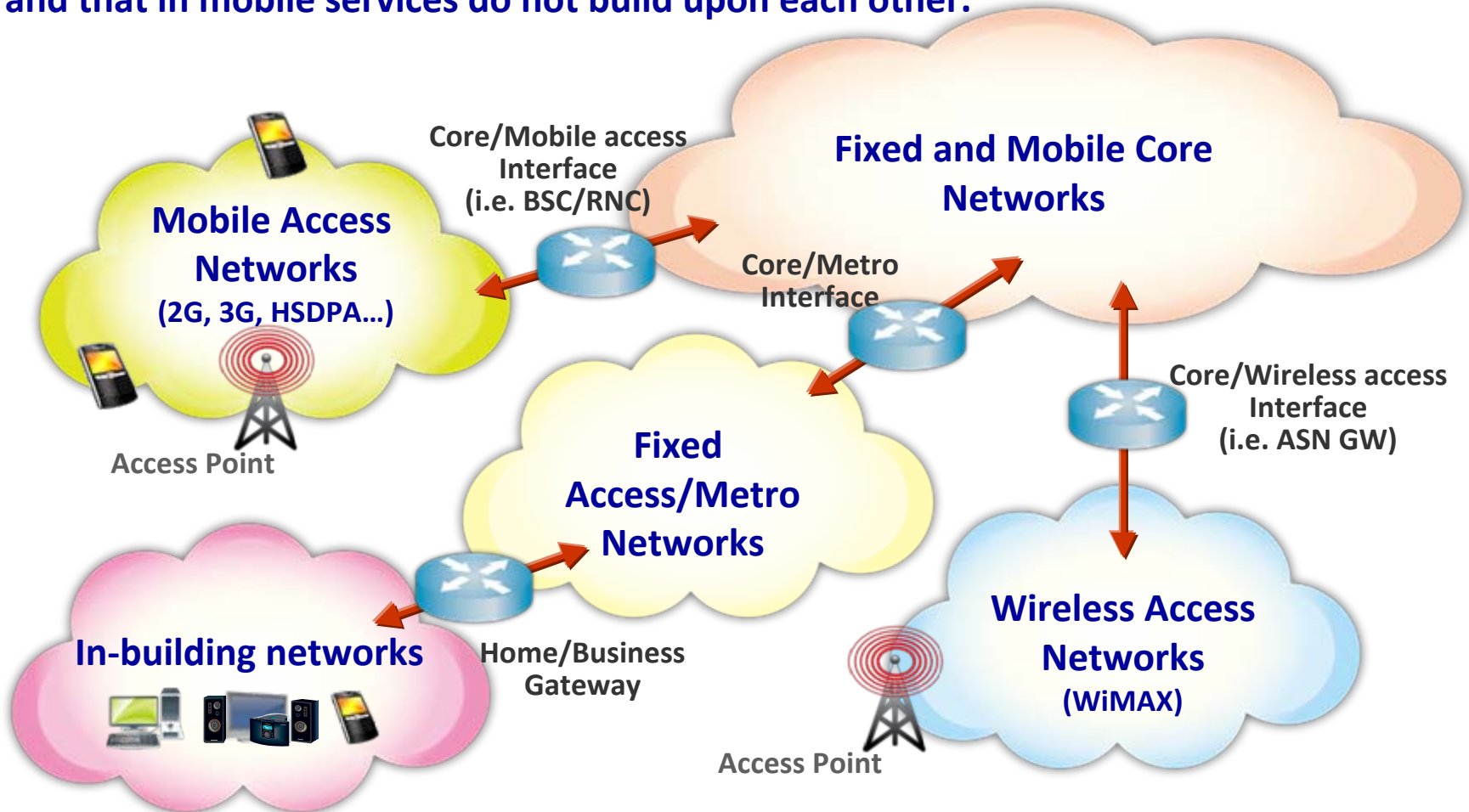






# Today: Three Separate Infrastructures for Fixed, Mobile And Wireless Access Networks

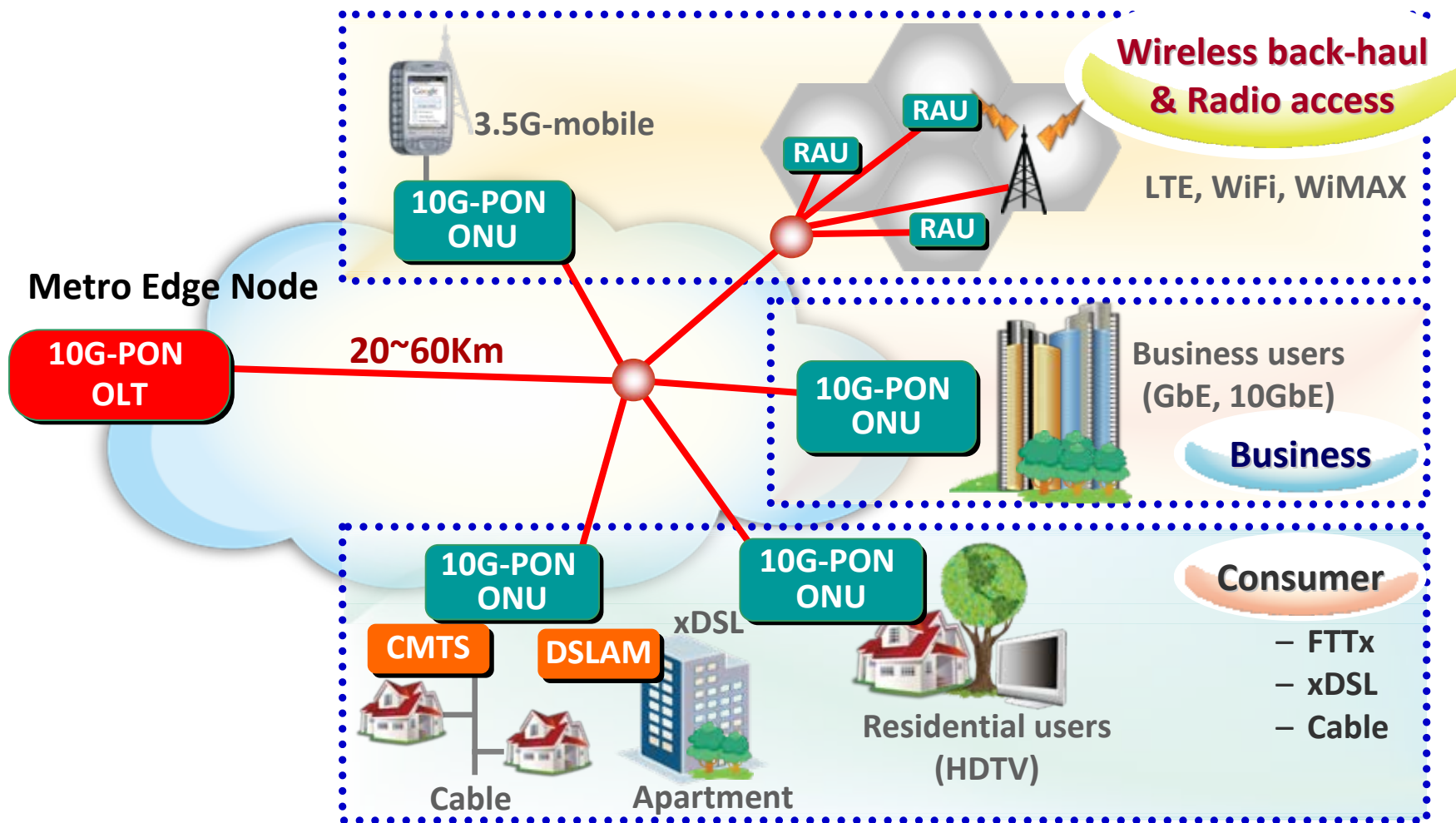
- Currently, FTTx construction in the fixed broadband field is separated from the construction of the mobile infrastructure. As a result, the investment in fixed services and that in mobile services do not build upon each other.





# Access Networks Convergence via XGPON

## Convergence of Fixed Residential, Enterprise And Mobile BS

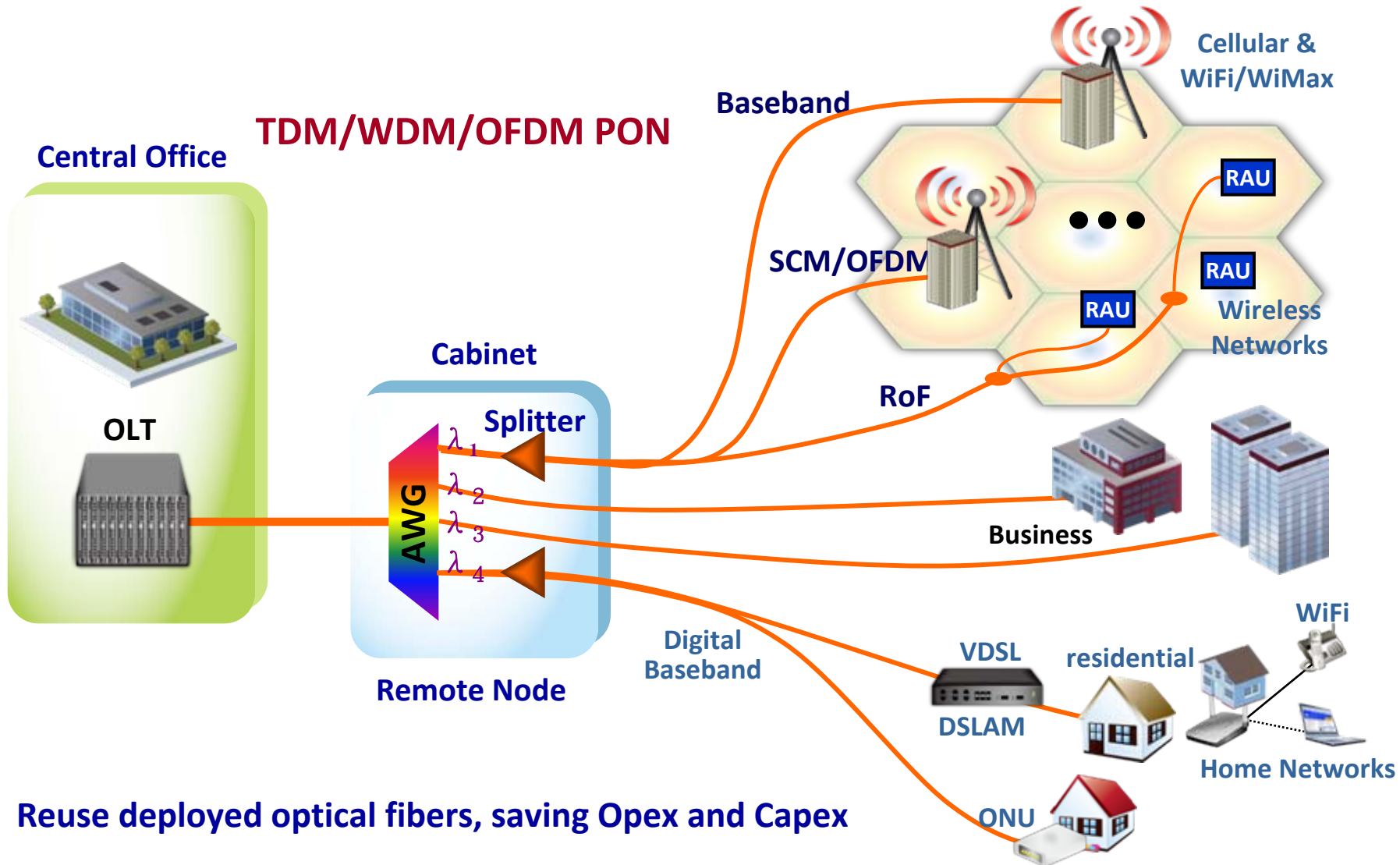


- Reuse deployed optical fibers, saving Opex and Capex



# Access Networks Convergence via Optical Access Links

## Convergence of Fixed Residential, Enterprise And Mobile BS



- Reuse deployed optical fibers, saving Opex and Capex



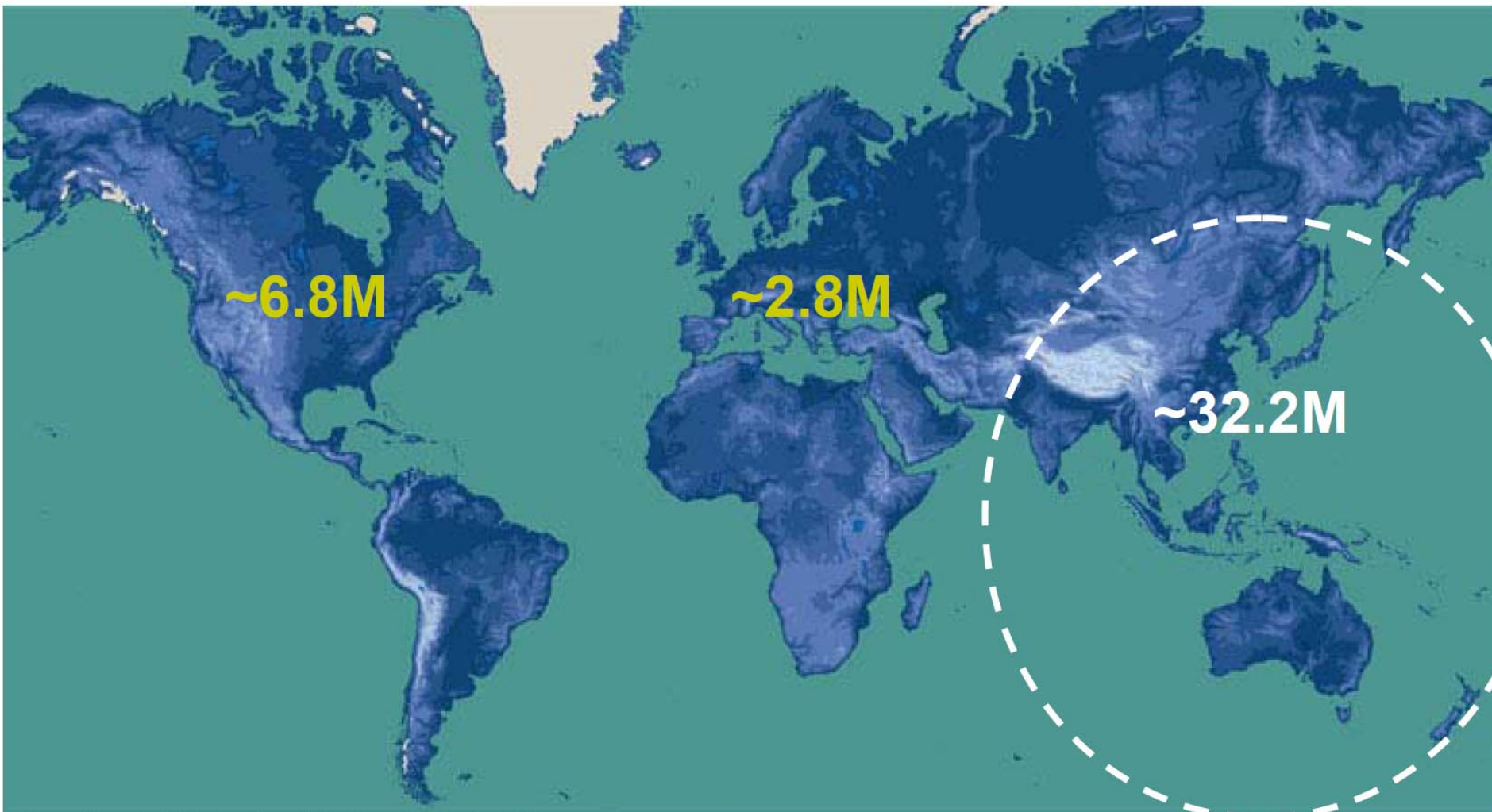
# 3. The Market of Globe Optical Access Networks







# FTTH/B Subscribers Connected (Sept. 2009)

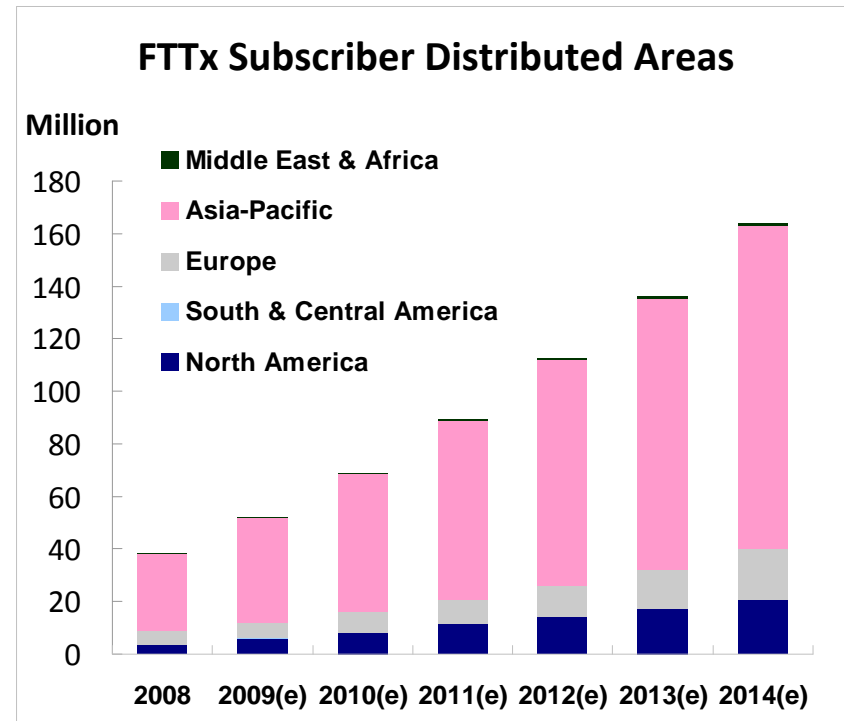
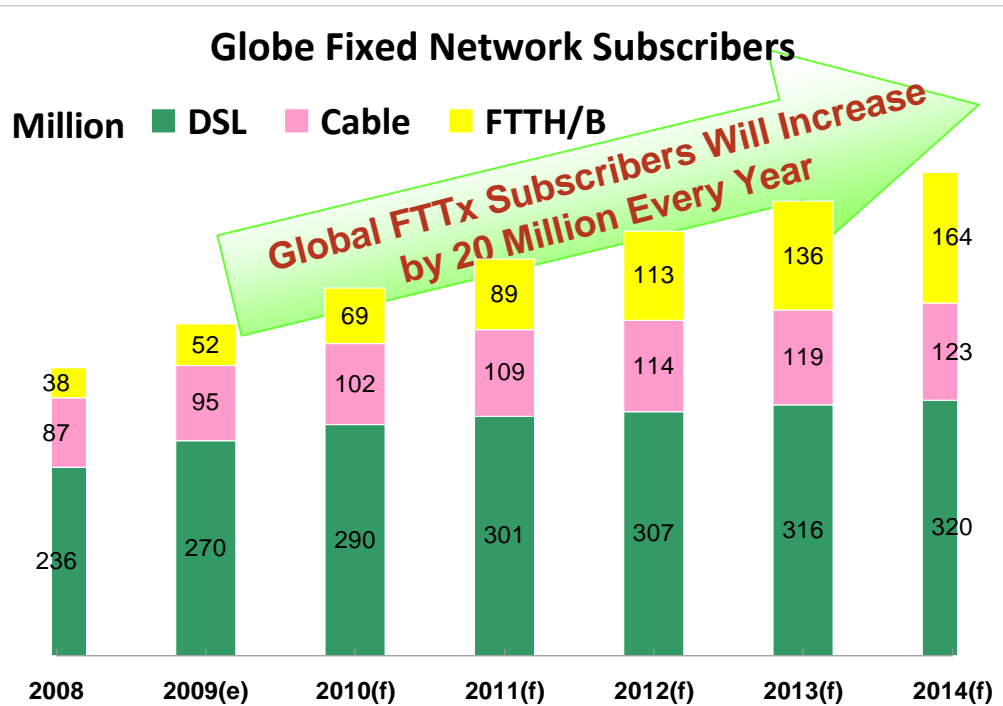


Source: International Advisory Group FTTH Council (September 2009)  
[FTTH C NAR/Mike Randers (Sept 2009); FTTH C Eur/IDate (June 2009; including Russia); FTTH C AP/Ovum (June 2009)]

See the Light



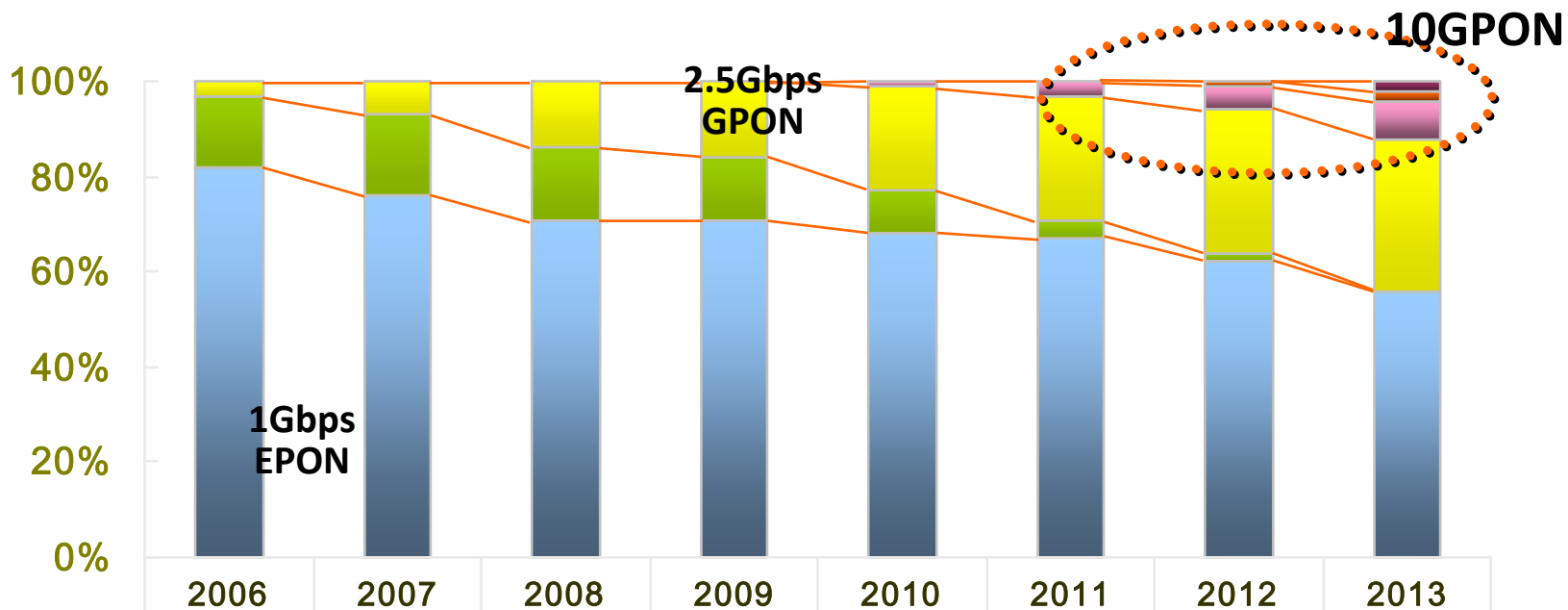
# Global FTTx Subscribers Will Increase by 20 Million Every Year



- ❑ Cable service subscribers have leveled out, the DSL market has stabilized. Future growth of FTTx users will be the most obvious service.
- ❑ In 2012, the broadband subscribers of FTTH and FTTB in Asia Pacific will increase to over 100 million users.



# The Shipment of 10GPON Will Increase Gradually After 2012



	2006	2007	2008	2009	2010	2011	2012	2013
WDM-PON	0%	0%	0%	0%	0%	0%	0%	2%
10G-GPON	0%	0%	0%	0%	0%	0%	1%	2%
10G-EPON	0%	0%	0%	0%	1%	3%	5%	8%
GPON	3%	7%	14%	16%	22%	26%	30%	32%
BPON	15%	17%	15%	13%	9%	4%	2%	0%
GE-PON	82%	76%	71%	71%	68%	67%	62%	56%

Source : MIC March 2009



# 4. ITRI's Research and Local Companies' FTTx Network Developments

**Developed  
FTTx Key  
Technologies**

**Establish GPON  
Test Center**

**Accelerated  
GPON IOP  
Testing**

**Established  
FTTx + PLC  
Demo Site  
and Field Trial**

**Assisted Taipei  
City to Be an  
International  
Fiber-Optic City**

# ITRI 2.5Gbps GPON Technologies

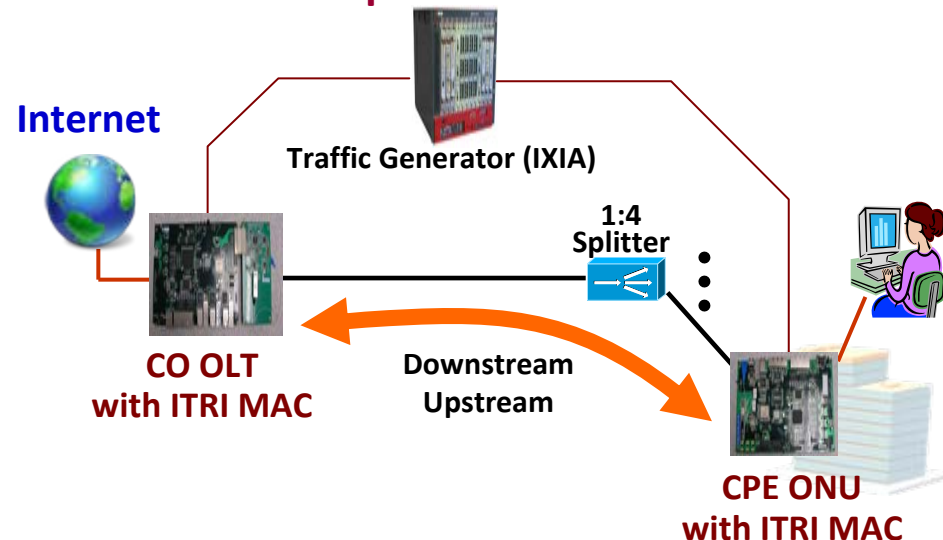
- ITRI developed advanced PON technologies to accelerate the development of local vendors' FTTx products

## □ 2.5G GPON Research Results

- **2.5G GPON Transmission Key Modules**
  - Developed GPON OLT / ONT MAC with transmission data rate achieves 2.488Gbps/1.244Gbps. Optical Triplexer.
- **2.5G GPON OLT**
  - Developed Pizza-Box-Type GPON OLT, the features are :
    - ✓ Total 16 GPON ports, bandwidth up to 40Gbps
    - ✓ Total support up to 1024 ONTs
    - ✓ Provide fiber line fair-over function
    - ✓ 4 OLT modules design with cost flexibility

## □ Partners

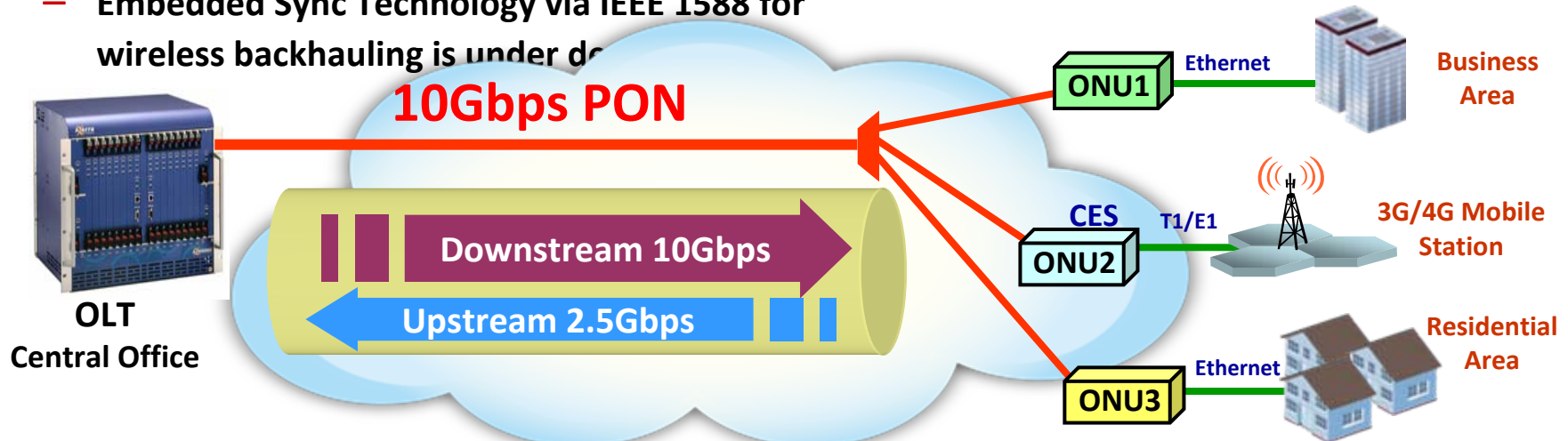
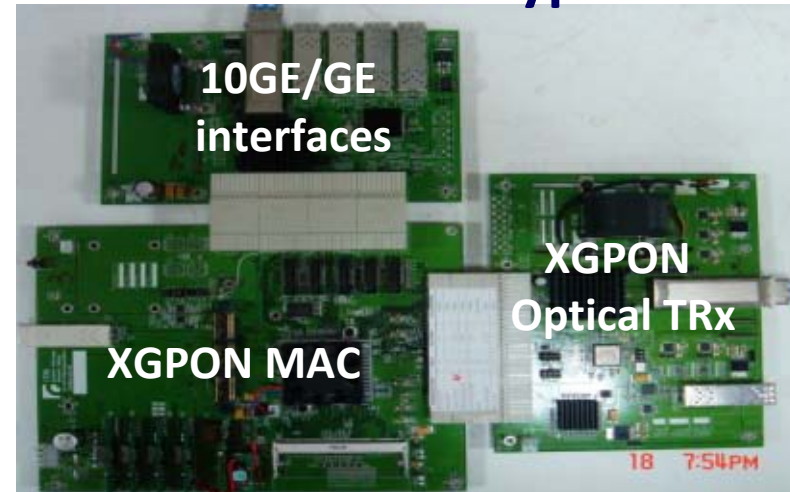
- FY 99 : EDIMAX 、 DNI
- FY 98 : Billion 、 Gemtek 、 Sercomm 、 Accton 、 Acradyan
- FY 97 : Tecom 、 DNI 、 Tailyn 、 Hitron
- FY 96 : ZyXEL
- FY 95 : Alpha 、 Comtrend



# ITRI Advanced 10Gbps XG-PON Prototype

- **ITRI XGPON OLT and ONU**
  - Following FSAN and ITU-T G.987
  - Downstream : 10Gbps @ 1577nm
  - Upstream : 2.5Gbps @ 1270nm
  - Support 10GE/GE, T1/E1 interfaces
- **XGPON Key Technologies**
  - 10Gbps FEC Encoder/Decoder
  - 2.5Gbps Burst Mode CDR
  - 10Gbps BM CDR is under development
  - Circuit Emulation Service Technology
  - Embedded Sync Technology via IEEE 1588 for wireless backhauling is under development

## ITRI XGPON Prototype

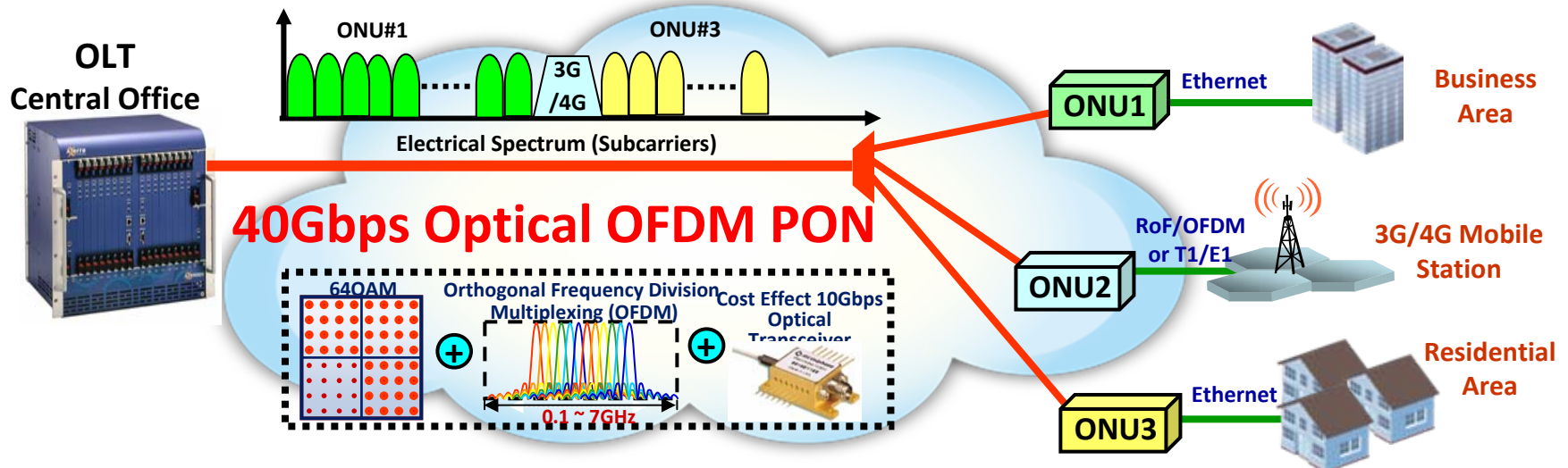






# ITRI Proposed 40Gbps Optical OFDM PON to FSAN NGPON2

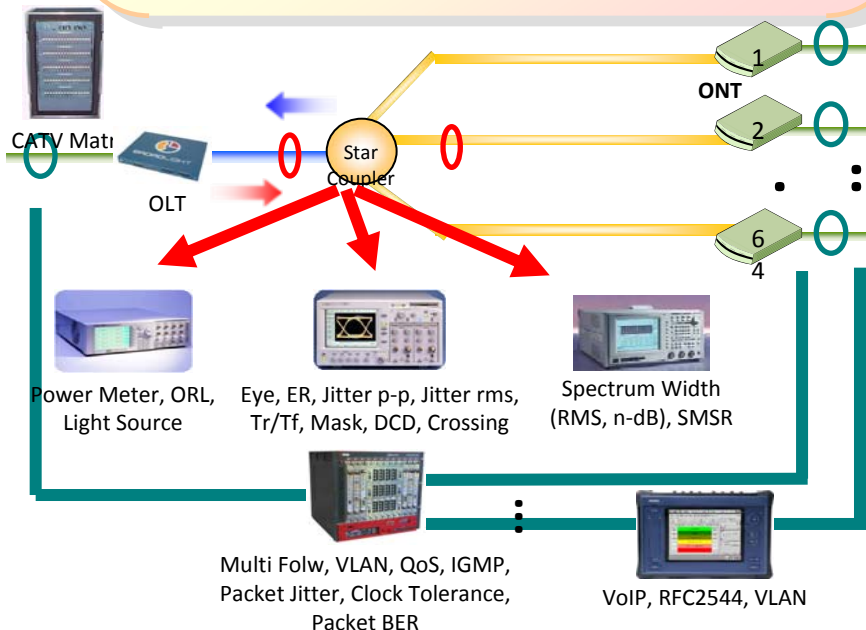
- Operators in FSAN asked the vendors to propose the solution for NGPON2
  - The major requirements include the 40Gbps throughput and cost effect architecture.
- ITRI proposed 40Gbps Optical OFDM PON technology to FSAN
  - Subcarriers can be allocated to different ONUs and specific wireless nodes.
  - OFDM can encode vector signals in each subcarrier, thus reducing bandwidth requirements.
    - + 40Gbps 16QAM signal only occupy 11GHz bandwidth, while 64QAM signal only occupy 7GHz BW
  - Benefits of bandwidth reduction
    - + XGPON 10Gbps optical components can be reused.
    - + Components and transmission issues, like receiver thermal noise, linearity, and dispersion, can be reduced.



# ITRI Built the Optical Communication Technologies Test Center to Provide GPON Test Services

## • GPON Test Items

- ONU/OLT Transmitter
- Optical Distribution Network (ODN)
- ONU/OLT Receiver
- Synchronization
- Optical Compatibility Verification
- ONU Turn-Up and Management
- OMCI Functionality
- Interoperability Plugtest Test



## • ISO/IEC 17025 Certificated



Spectrum Analyzer



Bit Error Rate, Jitter tolerance,  
Q factor, Tj/Dj/Rj,  
Eye Diagram/Margin



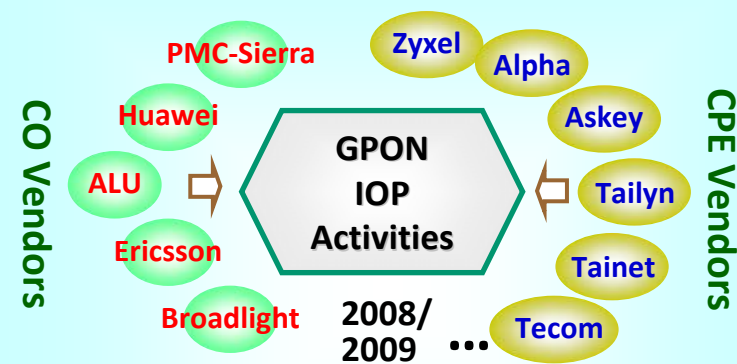
Visible Inspection Prob clear  
performance of fiber  
connector



# ITRI Held FTTx/GPON IOP to Increase the Interoperability of Optical Access Equipment

- **Interoperability between CO and CPE equipment is essential in telecommunications**
- **Strategies**
  - Hold IOP events : Define the test plan and invite important CO site vendors
  - Establish permanent IOP center
- **Benefits**
  - Achieve cost ( travel and usage fee) and time savings
  - Increase the interoperability and interaction between local CPE vendors and CO vendors.

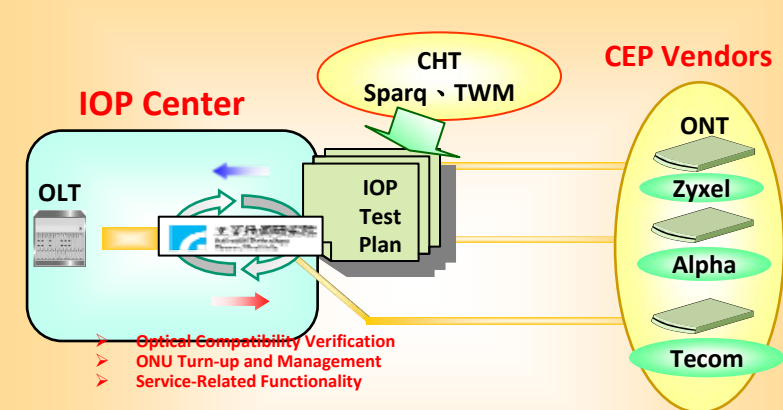
## 2008 IOP Events



## Achievements

- Cooperated with CHT to hold two GPON IOP events (2008/5 、 2008/11)
- Increase the interoperability between CPE vendors and CO vendors

## 2010 Permanent IOP Facilities



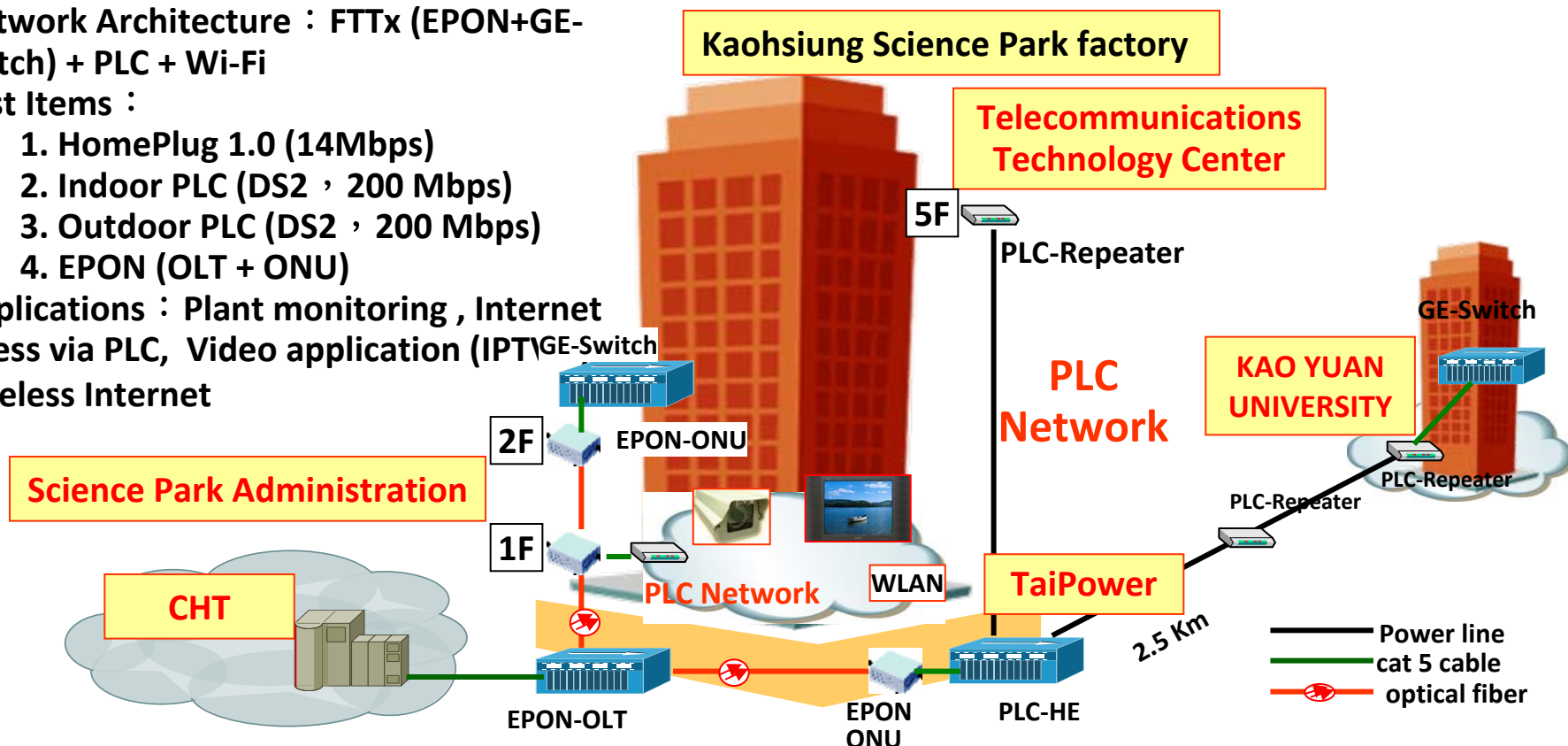
## Strategies

- Continue cooperating with CHT to hold IOP events
- Cooperate with CO vendors to establish the FTTx/GPON IOP center to create a permanent IOP testing facility

# ITRI Established a FTTx + PLC Technologies Verification Environment

- Increased FTTx+ PLC network planning and establishment experience
- Verified the performance of broadband services in FTTx + PLC + Wi-Fi networks

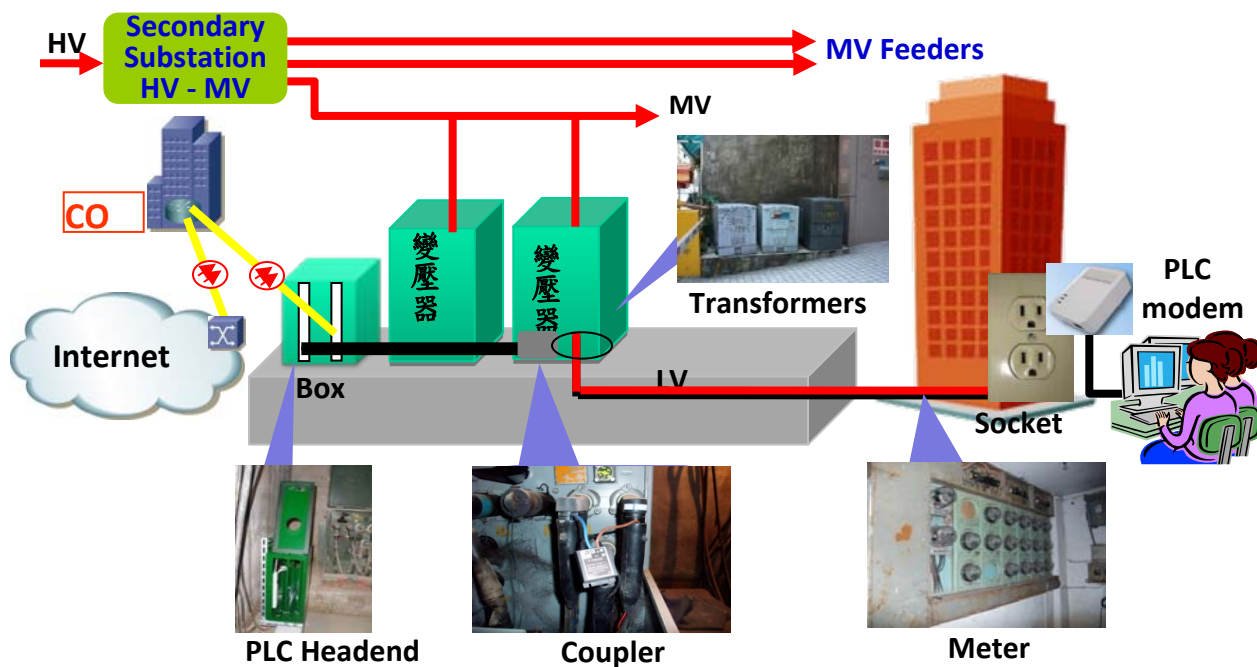
- Area : Kaohsiung Science Park
- Network Architecture : FTTx (EPON+GE-Switch) + PLC + Wi-Fi
- Test Items :
  1. HomePlug 1.0 (14Mbps)
  2. Indoor PLC (DS2 , 200 Mbps)
  3. Outdoor PLC (DS2 , 200 Mbps)
  4. EPON (OLT + ONU)
- Applications : Plant monitoring , Internet access via PLC, Video application (IPTV), Wireless Internet





# ITRI Helped to Build the FTTx+PLC Field Trial Networks in Urban and Remote Areas

- Use of broadband PLC so that networks can be connected to every family, and also breaks through barriers to access household wiring, and reduces network construction costs.
- cooperated with Taipower, Sparq, TFN Media, Digital United, Sony to establish FTTx+PLC field trial in Taipei city and Dahu Village in Fanlu Township of Chiayi County.



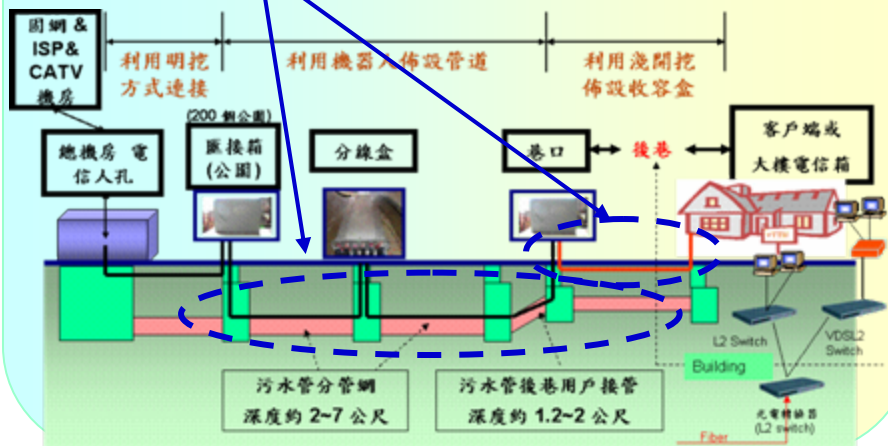


# Assisted Taipei City to Become an International Fiber-Optic City

- Optical fiber deployment in Taipei is restricted by the laws and cost of road excavation.
- A Feasibility study of the fiber optic network construction in the sewers → Overcome the restriction of road excavation
  - Helped promote the Taipei optical network pilot project (2006 ~ 2007)
  - Evaluate the feasibility

- Help Taipei city to officially launch the fiber optic deployment project via sewage trenches (2008/10)
- Serve as the consultant team of Taipei city fiber optic deployment project (2009~2010). To assist the city government with network planning, business model analysis, network and technical education training.

- Prove the concept of fiber optic network construction in sewage system
- Break through the network established restrictions



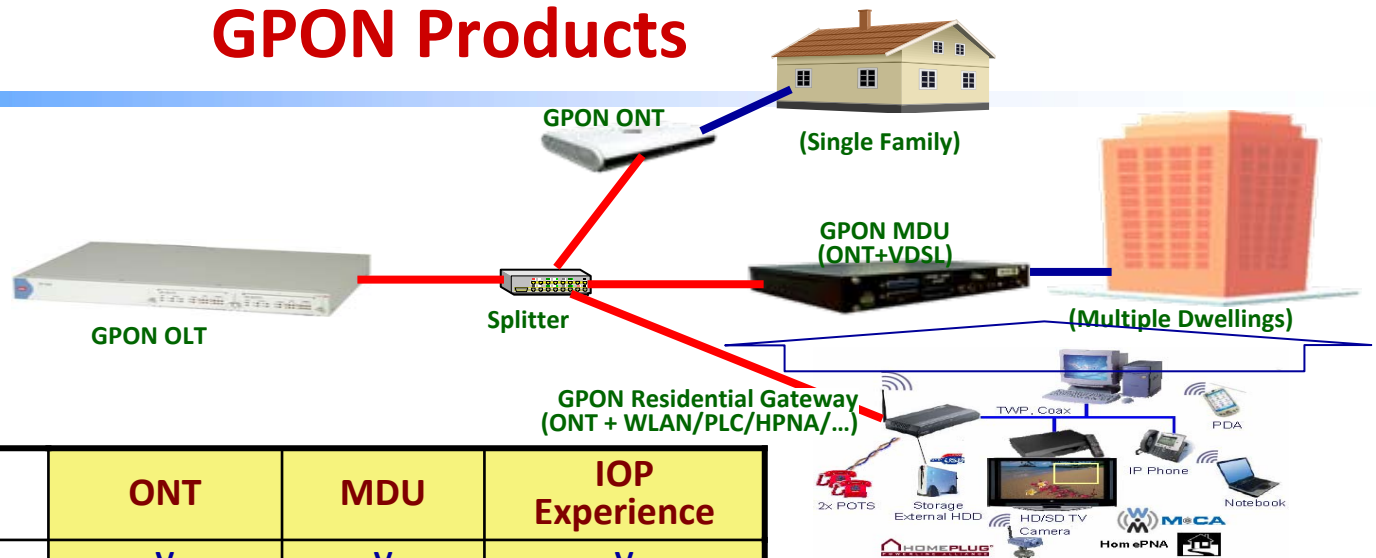
## Target 760K household connections / 50 Mbps Capacity

- In 2 years, Taipei city hoped to achieve 760K household connections and the deployment of fiber-optic cable and related equipment (the coverage rate is 80%)
- Provide their citizens with >50Mbps bandwidth for a low fee
- Achieve public broadband application using a fiber-based network platform

## Benefits

- Broadband network construction in the sewage pipes to improve the economic value by reducing the amount of additional new construction.
- Reduce road excavation and the waste problem

# Development Status of Local Manufacturers' GPON Products

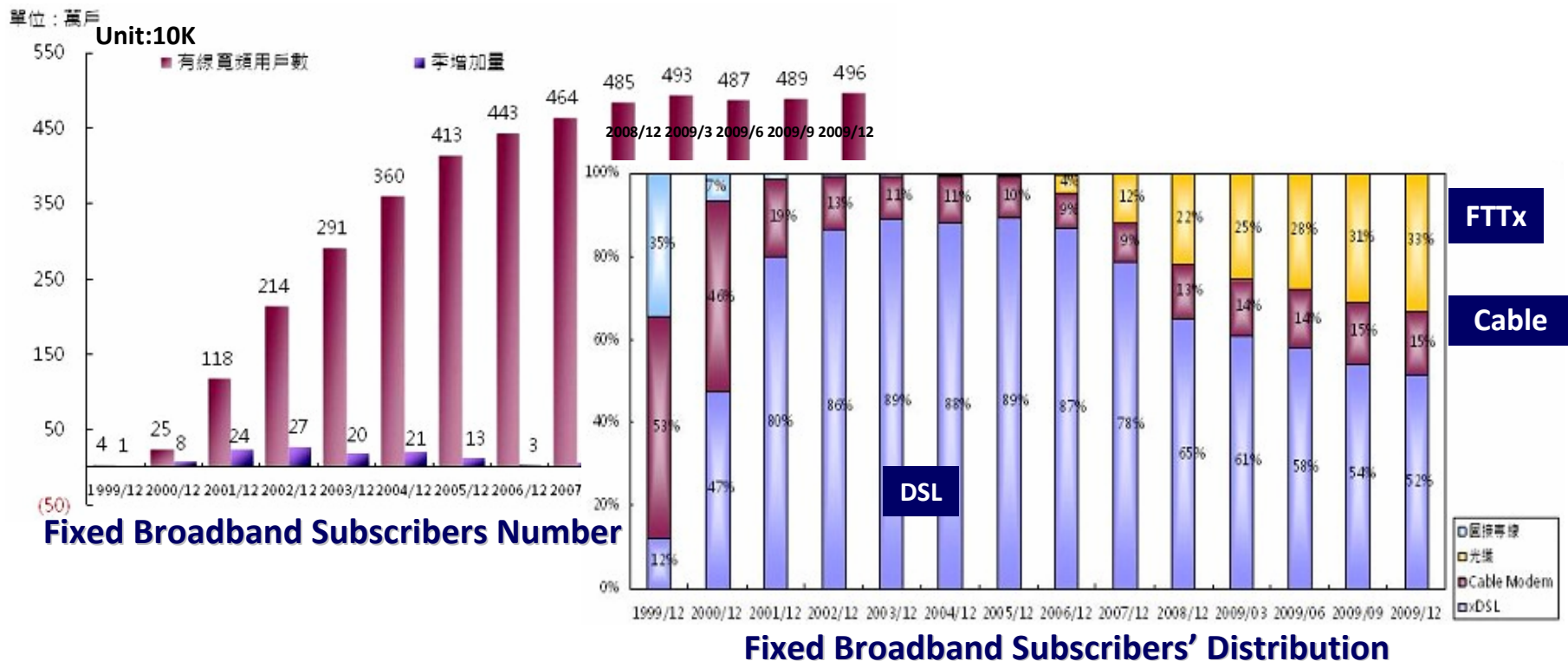


	ONT	MDU	IOP Experience
1. ZyXEL	✓	✓	✓
2. Alpha	✓	✓	✓
3. TECOM	✓	✓	✓
4. Billion	✓		✓
5. Comtrend	✓		✓
6. DNI	✓	✓	✓
7. Tailyn	✓	✓	✓
8. SerComm	✓	✓	
9. EDIMAX	✓		
10. Tainet	✓		✓
11. Gemtek	✓		✓
12. XAVi	✓	✓	✓
13. Askey	✓	✓	✓



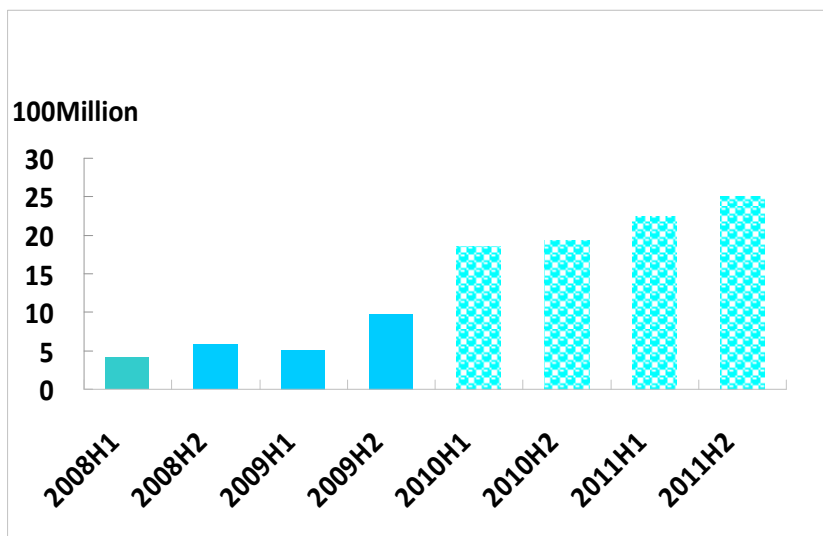
# Local Fixed Broadband Subscribers

- In 2009, the number of local fixed broadband subscribers was close to 5 million.
  - Optical access subscribers increased by 120K in Q4 2009, it amounted to 1.64 million, and the proportion of all fixed broadband subscribers was 33%;
  - There were 2.56 million xDSL subscribers, and the proportion continued to decrease to 52% in Q4 2009 ; There were 0.76 million cable modem subscribers, the proportion was 15%.

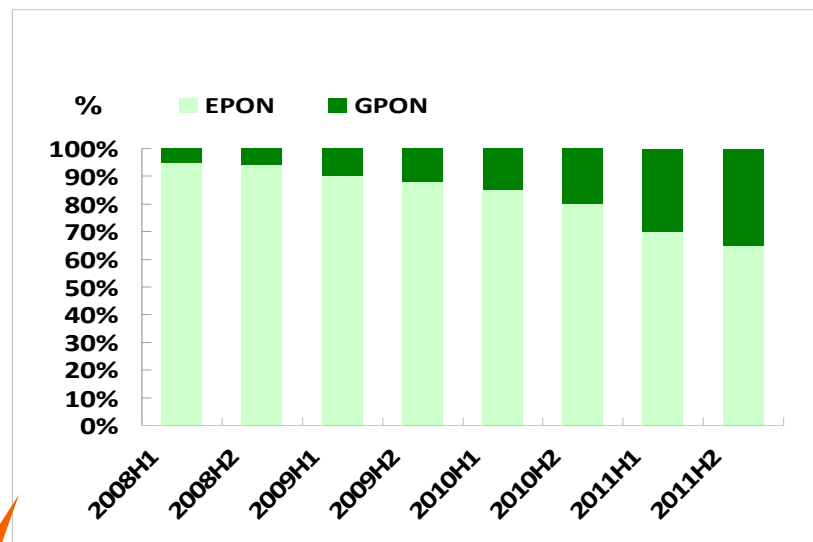


# Production Values of Local Vendors' ONU and ONT

Local PON ONT/ONU Production Value

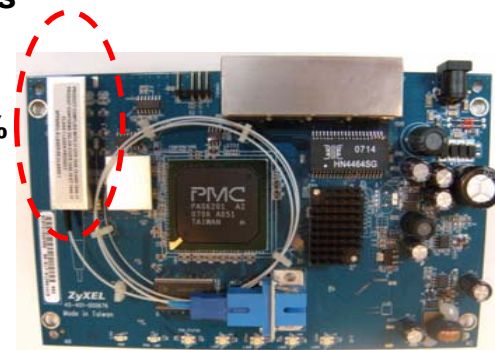
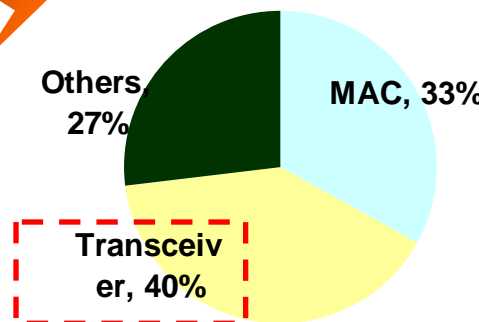


G/EPON ONT/ONU Ratio



- ❑ In 2009, local PON ONT/ONU production value is 1.489 billion NTD, and the annual growth rate is 49.6%.
- ❑ The key component of ONT/ONU is the optical transceiver.

PON ONU Components

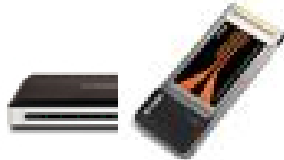




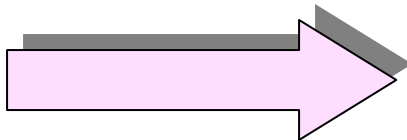
# Global Broadband Internet and Mobile Internet Vendors

## Global Broadband Internet and Mobile Internet Vendors



Provide more than 80% of  
broadband network CPE  
equipment all over the world

2009 Local network communication vendors' global market share		
<b>WLAN</b> 		<b>90%</b>
<b>DSL Modem, Cable Modem</b> 		<b>&gt; 80%</b>
<b>Home Gateway / IP Broadband Router</b> 		<b>80%</b>



## FTTx will be Next !



**Thank You for Your Attention**

