

New Progress in FTTx: Technology and Deployment



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China Telecom
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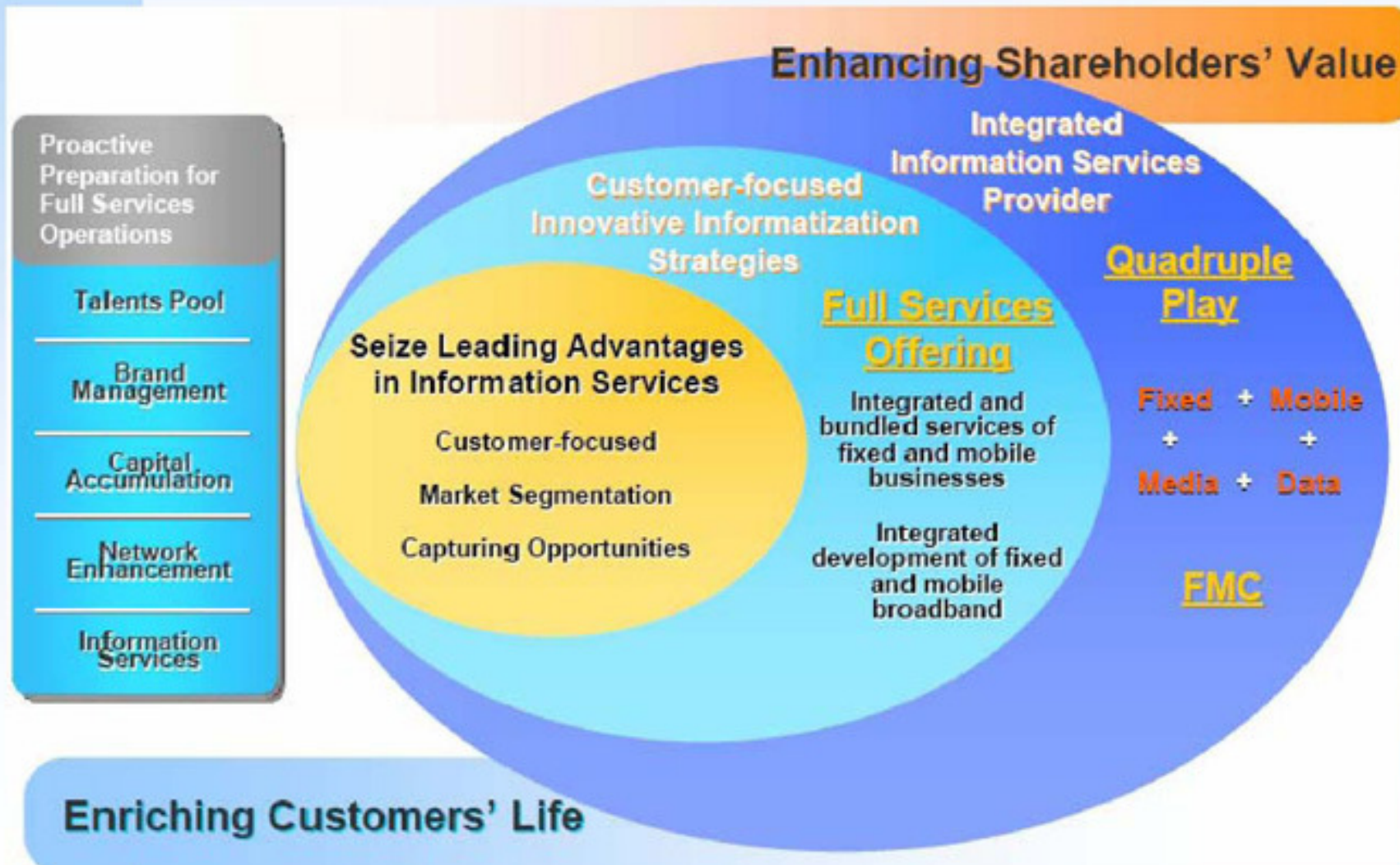
Overview: CTC Broadband development

FTTx Trial and Deployment

New Development of PON Technologies

Summary

Accelerating Strategic Transformation



Strengthening Brand Oriented Operations

Integrated Information
Service Provider



“One Home”
Household
customers



“BizNavigator”
Enterprise
customers

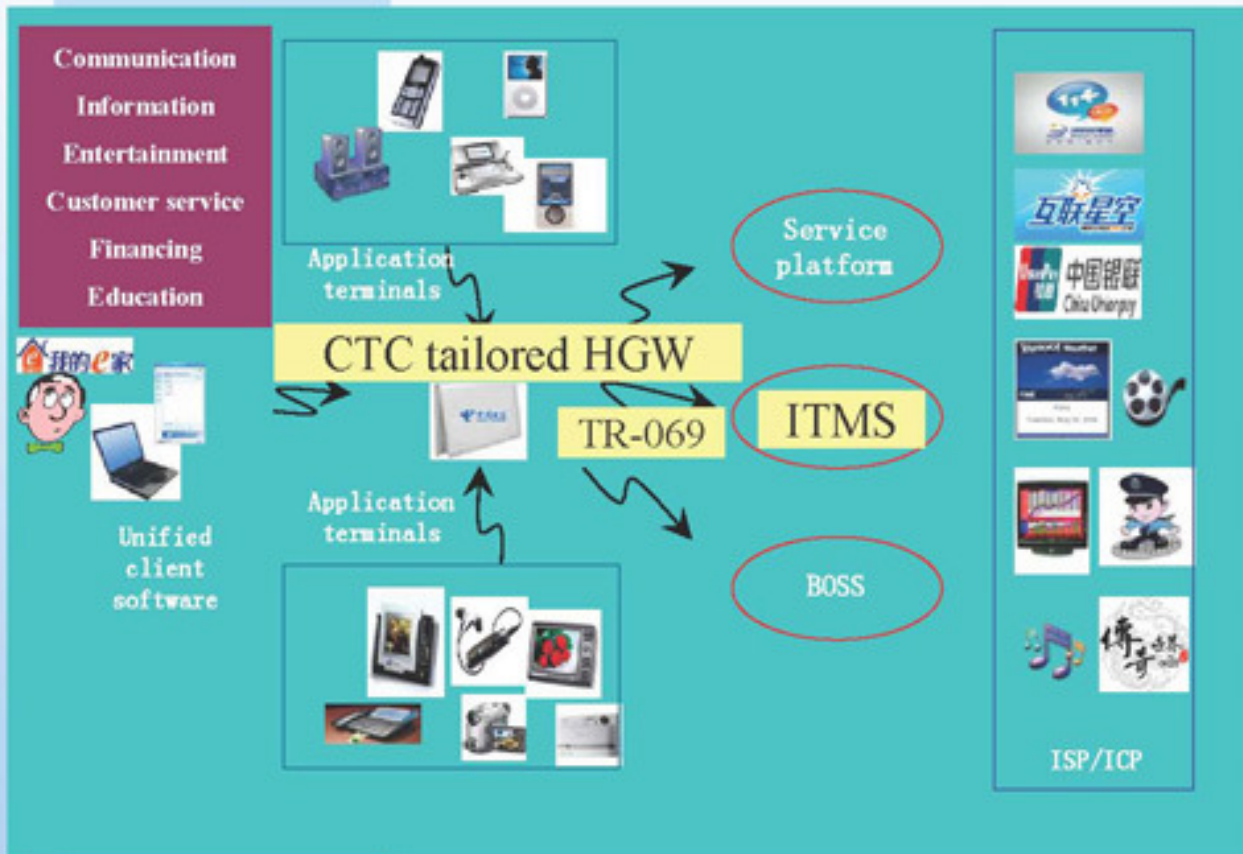
Individual
customers

Customer
brands



Service
brands

“One Home” Services



“One Home” Communication

High speed access by multi-terminal, VoIP, WLAN roaming, FMC, etc

“One Home” Information

Information subscription, home surveillance, home payment, etc.

“One Home” Entertainment

IPTV, VoD, online gaming

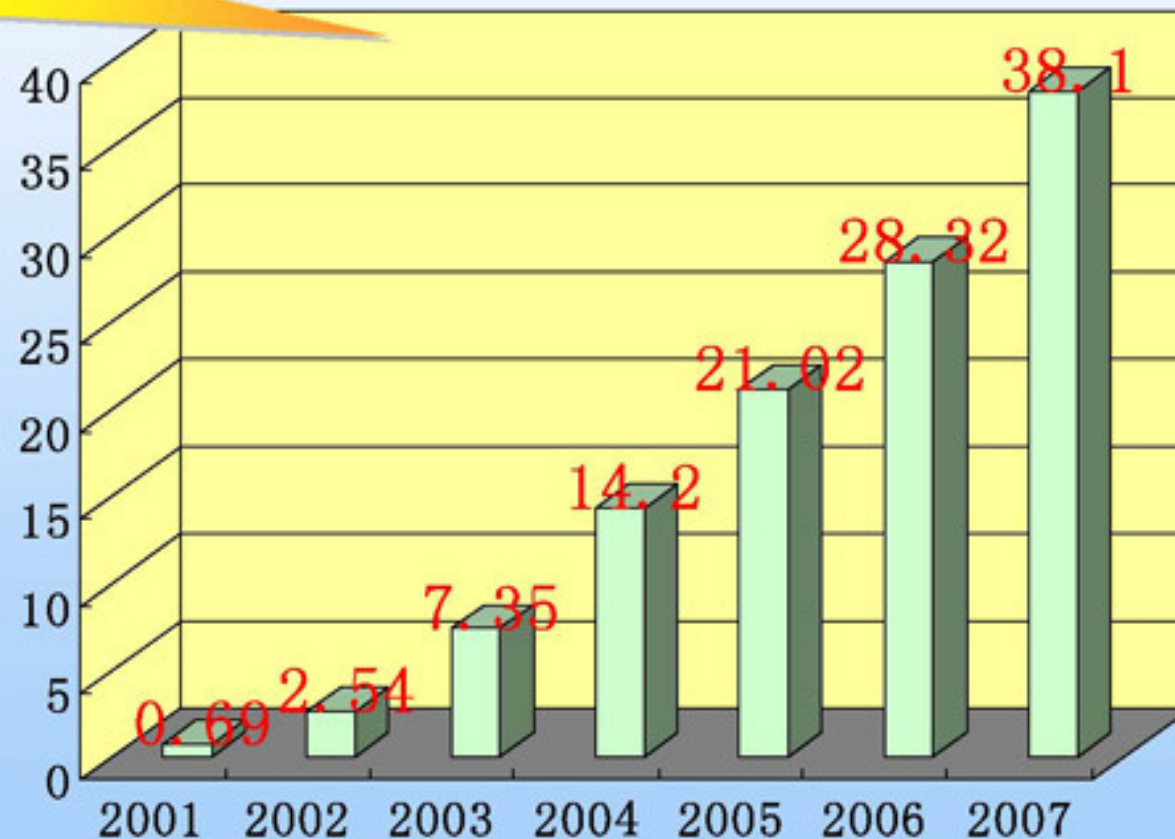
CTC Broadband Development

>7M annual growth since 2004!

Broadband access technologies

- DSL
- Active Ethernet
- EPON
- WLAN

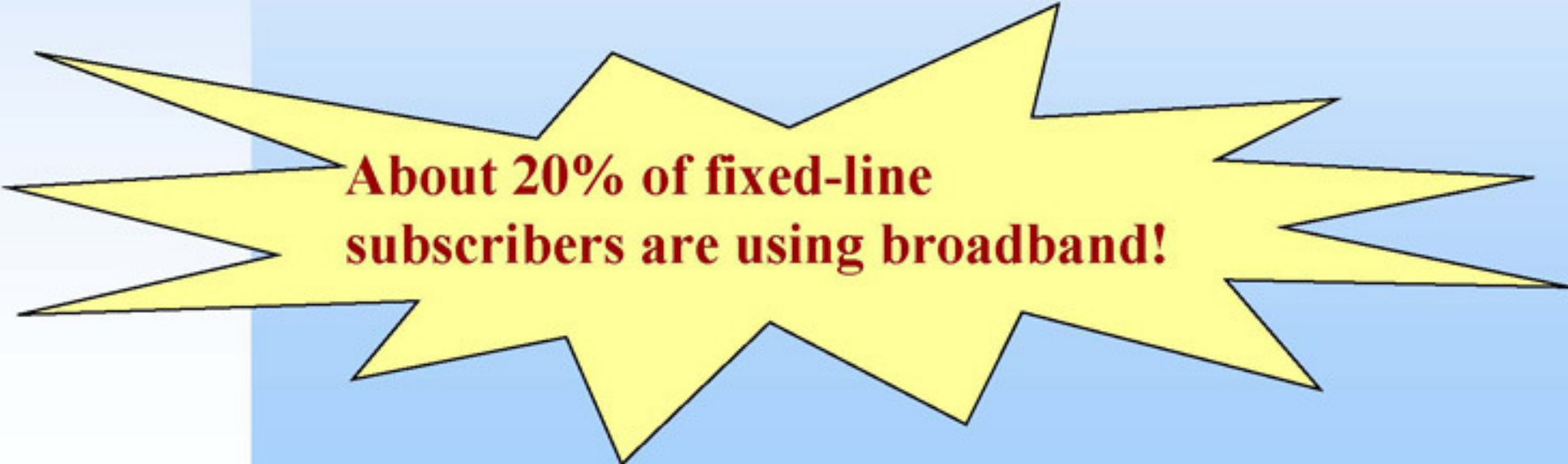
Broadband subscriber (M)



CTC Broadband Development

2008.6

- **Fixed-line telephone subscribers: 220M**
- **Broadband subscribers: 42.7M**



About 20% of fixed-line subscribers are using broadband!

CTC Broadband Development

- **HGW and ITMS (Integrated Terminal Management System) widely deployed**
- **“One Home” service subscribers: 14.5M (2008.6)**

About 30% of broadband subscribers are using Home Gateway!

CTC Broadband Development

1H2008

- Overall revenues: RMB 94.7B
- Non-voice revenue: 43%
- Broadband ARPU: >RMB 80

Broadband subscribers and revenue are increasing rapidly, becoming the top driver for the revenue growth!

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Access Network Transformation

Narrow Band AN

Broadband AN

Transport media

Copper wire dominated

Copper wire dominated

Optical fiber dominated

Speed

Low speed

Medium, asymmetrical speed

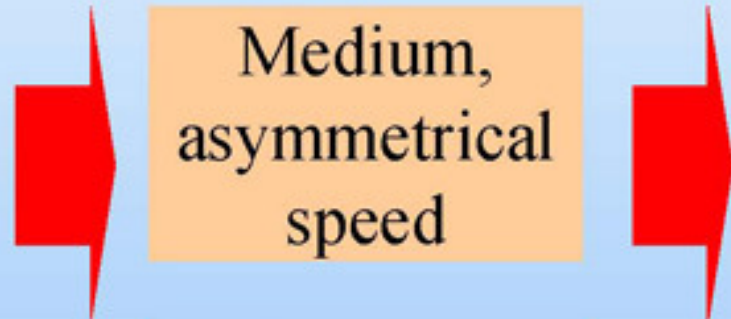
High, symmetrical speed

Service

Voice, low-speed data

Separate voice, data service

Multiple, convergent services

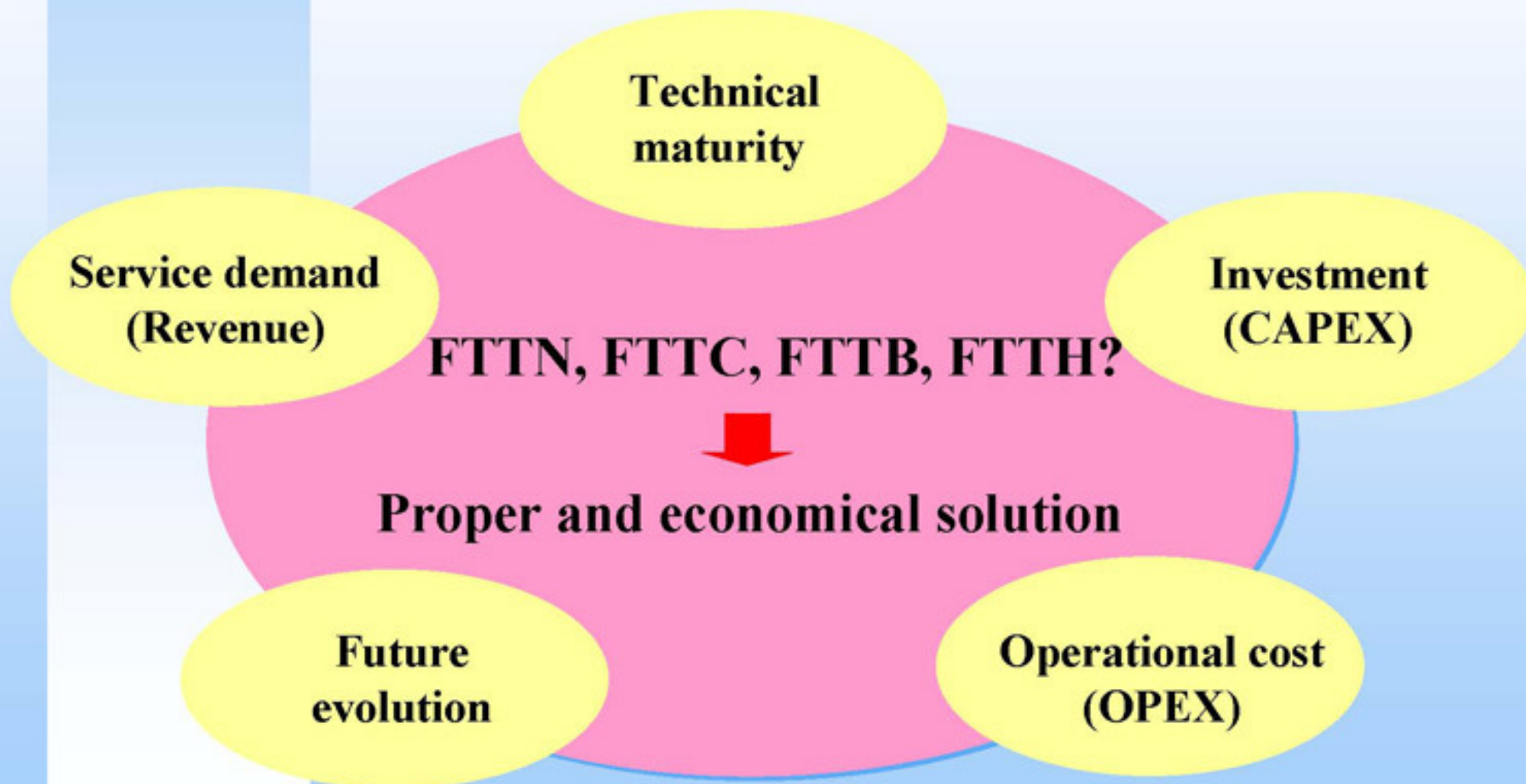


Access Bandwidth Demand and Target

Providing **20Mb/s** downstream bandwidth for high - end customers in 2010

Services bandwidth demand (Downstream)	IPTV: 1ch HDTV	6-10M
	2ch SDTV	4-6M
	Video communication:	1-2M
	High speed Internet:	2-4M
	Network gaming:	300-800K
	2ch VoIP:	200K
Bandwidth target (Downstream)	2010: 20Mb/s	
	Long future: 50-100Mb/s	

FTTx Strategies



FTTx Strategies

Urban areas

- **Near-term (2008-2009), capable of providing 16Mb/s DS**
- **Green field (new area)**
 - Stop deploying feeder & distribution copper wires
 - FTTB (PON) + LAN
 - FTTO/FTTH for business or high-end residential customers
- **Brown field (existing area)**
 - (recommended) FTTB (PON) + ADSL2+
 - (optional) FTTN + ADSL2+, copper wire length < 500m

FTTx Strategies

Urban areas

- **Mid-term (around 2010): capable of providing 20Mb/s DS**
- **Long-term: support 50-100Mb/s DS**
- **Green field (new area)**
 - **FTTB (PON)+LAN**
 - **FTTH, on the condition that the cost can be remarkably reduced**
- **Brown field (existing area)**
 - **FTTB (PON)+VDSL2**

FTTx Strategies

Rural areas

- **Principally stop deploying feeder copper wires**
- **Fiber to the village using FTTN+DSL**
- **Near-term (2008-2009): push forward fiber to key administrative villages and large natural villages**
- **Mid-term (around 2010): cover most of the administrative villages by fiber**

FTTH Field Trial

- **First Stage: 2005.4-2007.6**
- **Locations**
 - 4 provinces: Shanghai, Guangdong, Hubei, Beijing
- **Technologies**
 - EPON field trial
 - GPON lab test
- **Subscribers passed: >6000**

EPON Mass Deployment

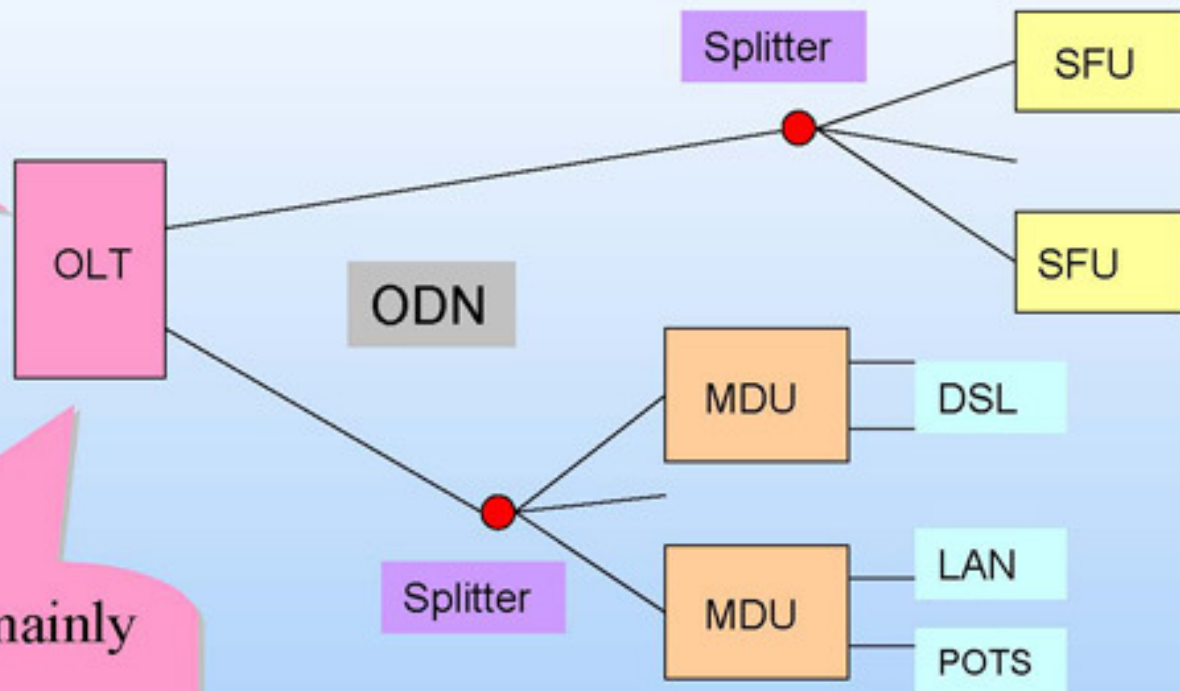
- **Started in 2H2007**
- **Scenarios**
 - **FTTB(EPON) + LAN**
 - **FTTB(EPON) + ADSL2+**
 - **FTTH**
 - **FTTO**

OLT Deployment

Coverage rang: <5km
in urban area

Centralizedly deployed, mainly
in CO

(rather than distributedly
installed in residential areas)



ODN Deployment

High utilization of OLT PON IFs and splitter ports
Easy maintenance and management

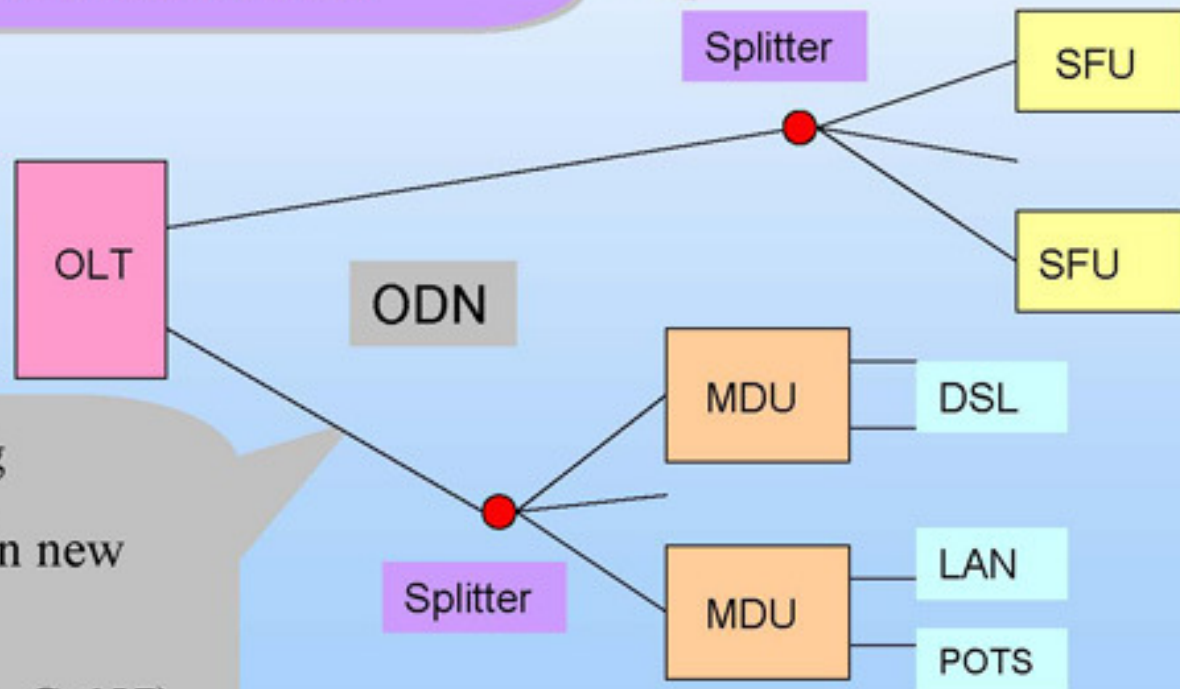


- Concentratedly deployed
- Mainly in one stage
- Near the subscribers

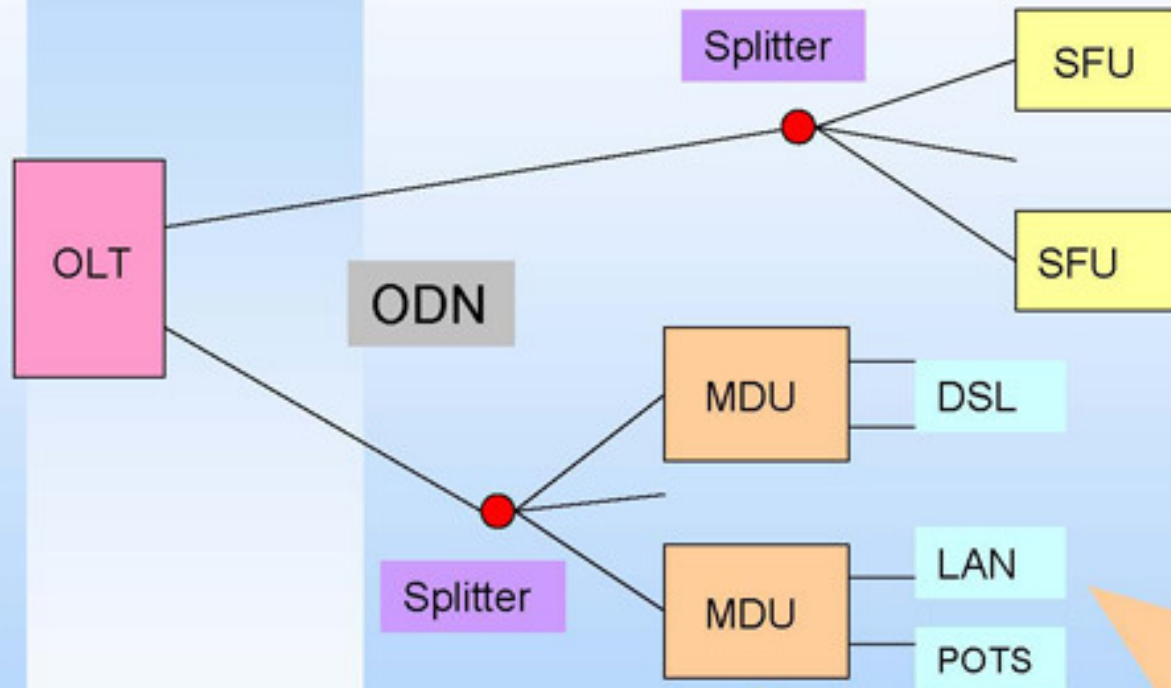
Fiber cable deployment: considering FTTH



- Fiber count >6 for one building
- Vertical fiber cable deployed in new buildings
- High intensity indoor fiber (e.g. G.657)



MDU Deployment



Concentratedly deployed

- MDU(LAN): 100m
- MDU(DSL): 300m

Special requirements for FTTB

- Port number: 16/24 for MDU(LAN)
- Fanless design
- Lightning proof: Power IF >4KV, User IF >1.5KV
- Power: 220V AC & -48V DC modules for selection
- Temperature range
- Environment supervision

Voice Service Support

FTTB

- **Provided on the network side (mandatory)**
 - **MDU with embedded IAD**
- **Provided on the user side (optional)**
 - **HGW (eth uplink)**
 - **Soft terminal (“One Home” client)**

FTTH

- **SFU+HGW (eth uplink)**
- **HGU**
- **Soft terminal (“One Home” client)**

Voice Service Support

Voice traffic transport

● FTTB/FTTN mode

- w/o BAC
- Static private IP address
- IP MAN (recommended)
/dedicated network

● User terminal mode

- BAC necessary
- Dynamic public
/private IP address
- IP MAN

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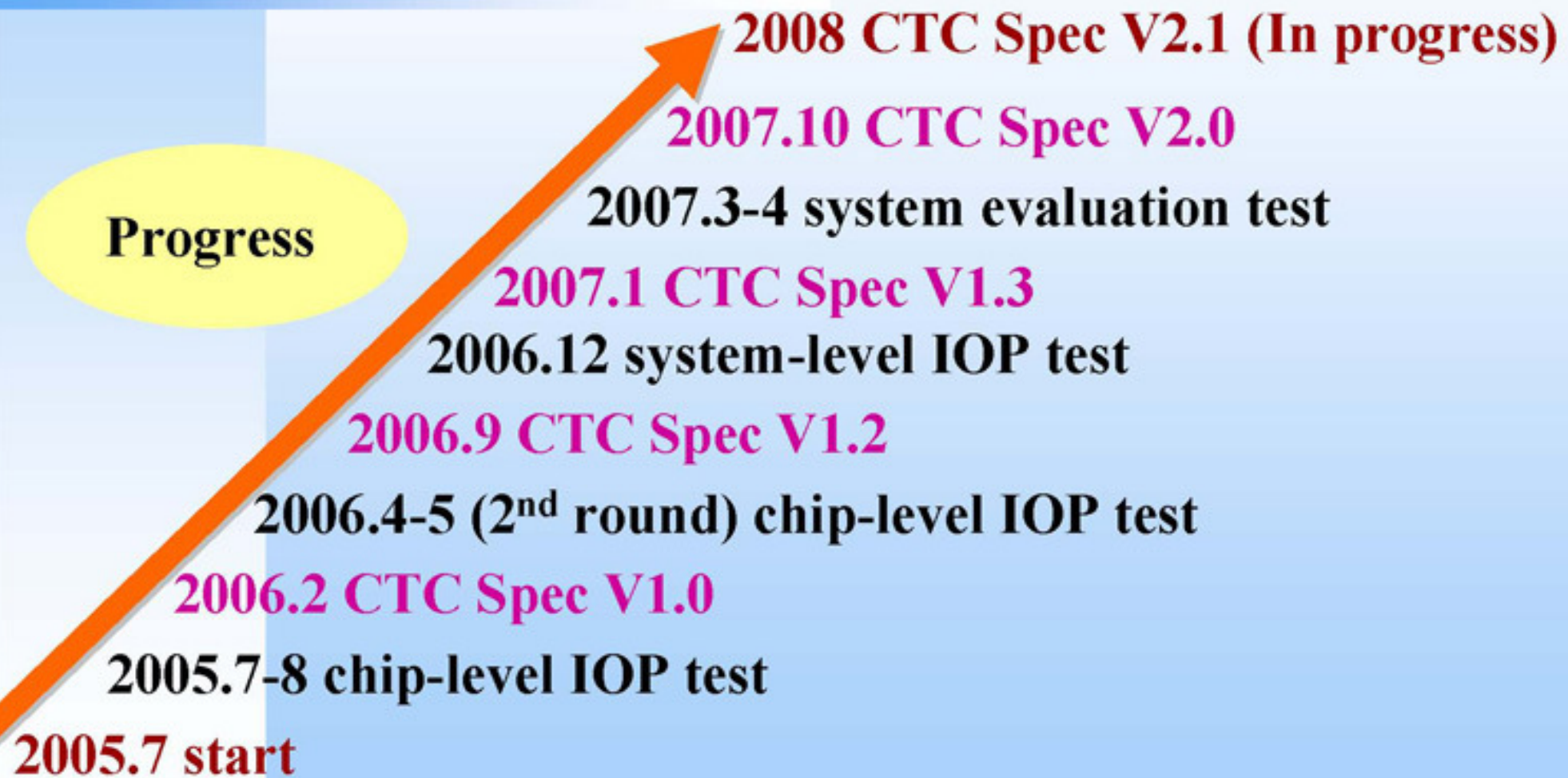
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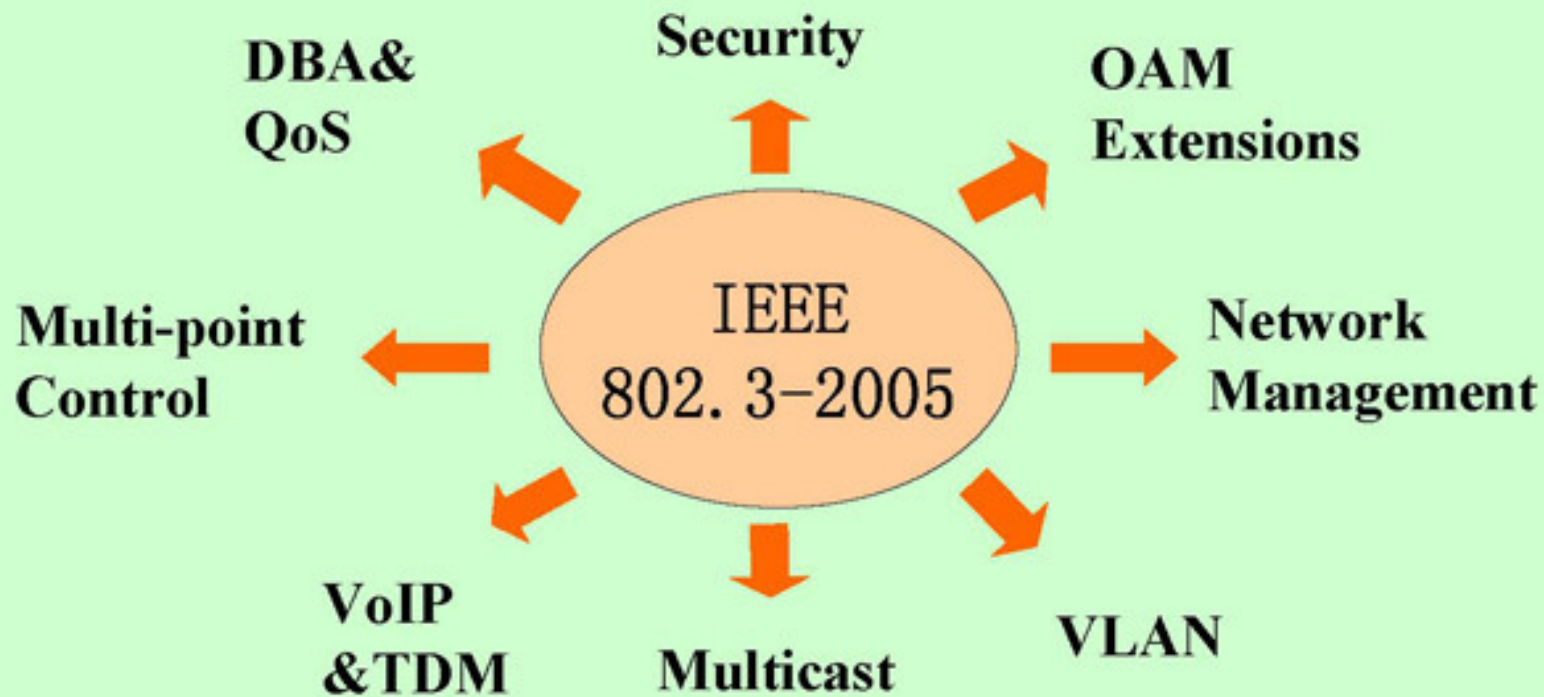
EPON Spec & IOP

Progress



EPON Spec & IOP

CTC EPON Spec



EPON Spec & IOP: Achievements

(1H2007) Achieved large-scale, all-around, chip and system level EPON IOP for the first time in the world!

- **Large-scale, chip & system level**

- 3 major chip vendors
- 10+ system vendors

- **All-around**

- **Optical layer**
- **MAC layer**
- **OAM/OAM extensions**
- **Service support functions**

New Improvements on EPON Spec

- **Optical Layer Supervision**
- **Software download and upgrade**
- **Logical ID based ONU authentication**
- **Service DBA / Multiple LLIDs**
- **VLAN operation modes**
- **Higher processing capabilities**

Working on
CTC EPON
Spec V2.1

OLS (Optical Layer Supervision)

- **Monitored parameters (5)**
 - Transceiver Operating Temperature
 - Transceiver Supply Voltage
 - TX Bias Current
 - TX Output Power
 - RX Received Power(based on SFF-8472)
- **Alarm/warning thresholds (4)**
 - High alarm level
 - Low alarm level
 - High warning level
 - Low warning level(for all the 5 parameters)
- **OAM Extension**

OLT

Link diagnosis

Performance prediction

Software Download and Upgrade

- **OAM Extension based on TFTP**
 - EMS: TFTP Server
 - OLT: TFTP Proxy
 - ONU: TFTP Client
- **Approach**
 - OLT writes the file into ONU
 - ONU is not allowed to read the file from OLT
- **Implementation requirements**
 - SFU: OAM based
 - MDU: OAM based, SNMP based

Enhancement of OAM Message Freq.

- OAM message frequency should not be limited to **10 frames/s** as specified in IEEE802.3-2005 Clause 57 for “slow protocol”
- OAM message processing capability for OLT/ONU should be no less than **100 frames/s**
- Accelerate software download process

Logical ID Based ONU Authentication

- **Two authentication methods:**
 - **Physical ID based (hardware dependent)**
 - EPON MAC, GPON SN, HGW SN
 - **Logical ID based (hardware independent)**
- **Advantages of logical ID based authentication**
 - **Simple pre-provisioning & batch provisioning**
 - **Easy to install**
 - Location is independent of physical equipment
 - **Convenient for equipment replacement after failure**
 - without the need to modify data in EMS
 - **More management information**

Logical ID Based ONU Authentication

- **Implementation requirements**
 - **OLT: 3 modes**
 - **Physical ID based**
 - **Logical ID based**
 - **Hybrid: using physical ID based authentication first; if not successful, initiating logical ID based method**
 - **ONU: both physical and logical ID based methods**

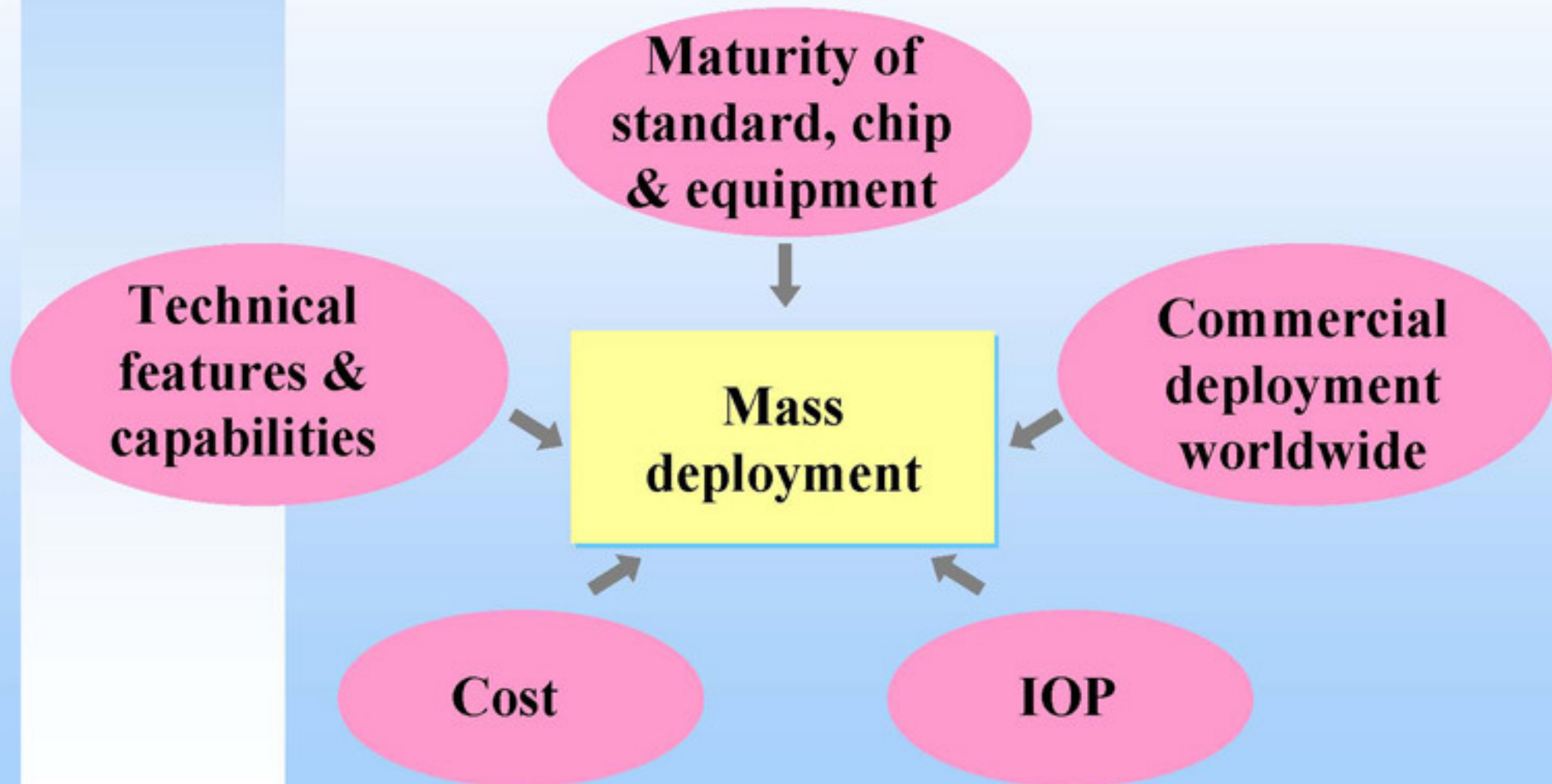
Research on GPON

- **GPON system evaluation tests**
 - 2005.6, 2 vendors (together with EPON)
 - 2006.7-8, 4 vendors
 - 2007.7-9, 9 vendors
- **GPON IOP tests**
 - first round: 2008.1-3, 6 vendors
- **GPON Spec formulation**
 - 2007.11, V0.1
 - 2008.5, V0.2

GPON IOP Situation

- **Great progress in the past 2 years**
 - FSAN, several operators
- **No serious obstacles in ONU activation and simple Ethernet service**
- **Main problem: OMCI**
 - L2 functions (bridge/mapping/filtering)
 - VLAN
 - Multicast
- **1+ years needed**

Criteria for Technology Selection



Comments on EPON

- **EPON is mature and suitable for mass deployment in CTC**
 - Simple, easy to develop
 - Sufficient chip and system vendors
 - Large-scale, all-around, chip-level and system-level IOP
 - Mass deployment in east Asia
 - Stable operation in the field trial of CTC for two years
 - Continuously decreased cost

Comments on GPON

- **GPON still needs further progress and evaluation**
 - **Complicated standard and good features (e.g. US BW control and allocation, alarm and performance monitoring)**
 - **Choice of major operators in the US and Europe**
 - **Few commercialized ASICs (especially for OLT)**
 - **IOP has not fully realized**
 - **Commercial deployment in the beginning stage**

Next Steps of PON R&D

EPON

- Further improvement of CTC Spec based on deployment experiences
- EPON HGU Trial
- **10G EPON**: lab test, 1H2009; field trial, 2H2009

GPON

- IOP test: 2008-2009
- Modification of CTC Spec
- Field trial at a proper time

WDM PON

- Follow the progress
- Lab test

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**FTTB(PON)+LAN in green field,
FTTB/FTTN+DSL in brown field,
FTTH for high-end customers**

**EPON is mature and being massively
deployed**

**CTC will push forward the development
GPON, especially its IOP**

**Accelerating the
transformation to
the new generation,
optical dominated
broadband AN**

‘Connecting The World’



中国电信
CHINA TELECOM

客户至上 用心服务 Customer First Service Foremost

客户服务热线 10000
Customer Service

Thank you!