Embrace GPON Era
Agenda

1. Main Drivers and Challenges for FTTx
2. Huawei FTTx E2E Solution
3. Successful Case
**Competition & services driving 100Mbps To The Home**

Cable operator will deploy 100M per household in 2013

<table>
<thead>
<tr>
<th>Before 2006</th>
<th>2006~2013</th>
<th>2013~2020</th>
<th>2018~</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOCSIS 1.1 &amp; 2.0</td>
<td>DOCSIS 3.0</td>
<td>FTTO for SME</td>
<td>FTTH</td>
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<tr>
<td>down 38M /up 24M</td>
<td>down 200M /up 160M</td>
<td>down/up 1G</td>
<td>1G/HH</td>
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<tr>
<td>1500 Households</td>
<td>125~500 HHS</td>
<td>16~32 HHS</td>
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<td>50M~100M/HH</td>
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Video application will get big development in next few years

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<tr>
<th>Before 2009</th>
<th>2009~</th>
<th>2013~</th>
<th>2017~</th>
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<tbody>
<tr>
<td>HSI + SDTV</td>
<td>HDTV</td>
<td>3D TV</td>
<td>3D Conference Ambient Video</td>
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<tr>
<td>Down 4<del>8M /up 1</del>2M per HH</td>
<td>down nx12M /up nx2M per HH</td>
<td>down nx30M up nx10M per HH</td>
<td>100M~1000M</td>
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**Access Bandwidth Evolution**

- **2001**: 2~20M
- **2008**: 20~50M
- **2012**: 50~100M
- **2016**: >100M

**Competition & services** are two key forces to drive bandwidth evolution.

**To match future development, 100Mbps** access network is a must in next 5 years for TELCO.
Challenges for Massive FTTx Deployment

- How to reduce the cost?
- How to meet the variety of scenarios?
- How to smoothly evolution to NGPON?

- How to re-use the cable in the home?
- How to support Wholesale business model?
- How to easily provide Voice service?

- How to improve the efficiency of ONT deployment
- How to fast service provisioning
- How to do the fast trouble shooting?

- How to provide high quality network design?
- How to provide visible&Manageable ODN?
- How to improve the deployment efficient?
Agenda

1. Main Drivers and Challenges for FTTx
2. Huawei FTTH/C/B E2E Solution
3. Successful Case
HUAWEI E2E FTTx Solution

Industry Convergence

- Power Management (SPM)
- Terminal Management (TMS)
- Service Quality (U2520)
- OLS (N2510)
- Network Management (U2000)

OLT

Splitter

iODN

Home Gateway

IP Network

GE/10 GE

Fixed Operator

Mobile Operator

NBN

MSO

Monitoring and wifi

HSI

IPTV

Voice

Business

GE
OLT in CO Will reduce the Cost of FTTH

- Network flatten is the long-term network trend, OLT in CO is the better choice.
- OLT in CO need aggregation OLT.
Series OLT Meet Variety Scenarios

**MA5600T**
- High-Capacity
- 10U height
- GE/10GE uplink/cascading
- 21 inch frame, 300mm slim design
- 2 *SCU slots, 16*Service slots, 2*GIU slots

**MA5603T**
- Medium-Capacity
- 6U height
- GPON/GE/10GE uplink/cascading
- 19 inch frame, 300mm slim design
- 2*SCU slot, 6*Service slots, 2*GIU slots
Large Capacity OLT: 16k ONT with “16-port GPON Board”

**Specification**
- Power consumption: 105w
- Work environment: -40°C ~ 65°C
- Optical Module: SFP, Class B+/C+ module
- QoS: Support CAR and shaping based on ONT
- Support 10G in main/slave mode and 20G in load sharing mode with SCUN.

**Benefits**
- Refer to the 8 port GPON board, 16 GPON board will increase capacity of OLT, reduce the site number.
- Increase utilization rate of uplink because of more GPON port Sharing the uplink.
Large Capacity OLT: 16k ONT with 40G Control Card

### Specification
- Throughput (bps): 480G, 20G for each slot, 40G for each slot in load sharing mode.
- Support load sharing and M/S mode.
- Network interface: 4*10GE/1GE (SFP+/SFP)
- Support 16K ONT.
- Support synchronize Ethernet.
- MAC table: 128K.
- ARP table: 16K.
- Routing table: 16k for IPV4 and 8k for IPV6.

### Highlights
- 20G/slot with single control card; 40G/slot with load sharing.
- Multi core process, which can support 16K ONT.
- Expand L3 access capability with new forwarding engine.
Series ONTs meet variety Scenarios

- **Bridge**
  - HG8010: 1GE
  - HG861: 1GE, 1CATV
  - HG8040: 4GE

- **Bridge&Voice**
  - HG8110: 1GE, 1POTS
  - HG8240B: 4GE, 2POTS
  - HG8242: 4GE, 2POTS, 1CATV

- **Home Gateway**
  - HG8245/HG8245T: 4GE, 2POTS, 1USB, WiFi
  - HG8247/HG8247T: 4GE, 2POTS, 1USB, 1CATV, WiFi
  - HG8447: 4GE, 4POTS, 1USB, 1CATV, WiFi
  - HG8045: 4GE, WiFi

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Reddot Award

Small size, Reddot award in 2010
Bridge/voice/HG
POTS/GE/USB/RF/WIFI

Cost  Smart  Deploy  Maintain
MXU series product

FTTC/B DSL

MA5616:
• 256POTS/128AD/192VD/64G.SD
SDL/32ISDN
MA5616 support vectoring in R311C01

MA5662: 48VDSL2

MA5622A: 24VD COMBO
MA5623: 24VD, wish SPL
MA5623A: 48VD, no SPL,

MA5652: 8/16/24VDSL2

MA5662

MA5652

MA5662

MA5652

FTTB LAN

MA5612:
• fixed: 2GE+6FE+16POTS
• Expansion 2 slot: 8FE*2/16POTS*/2/8E1*2

MA5620/6:
• 8/16/24FE*8/16/24POTS

MA5626:
• 4GE+4FE, 8/16/24FE POE/POE+
• 8FE

MA5622A, MA5623A support Vectoring

MA5626 reverse POE

Leased line

MA5612:
• fixed: 2GE+6FE+16POTS
• Expansion 2 slot: 8FE*2/16POTS*/2/8E1*2

MA5628:
• 4GE/FE +4E1

MA5628:
• 4GE/FE +4E1

MA5620/6:
• 8/16/24FE*8/16/24POTS

Cable

MA5632:
• 64~128 EOC

MA5631:
• 64~256 EOC

MA5632

MA5631

FTTW Video Surveillance

MA5669:
• 2GE/FE POE+

MA5626 POE:
• 4GE+4FE/16FE/24FE
• POE+/POE

MA5621:
• 4*GE/FE+4 RS485

MA5621A:
• 4*FE+2RS485

MA5669

MA5632

MA5626

MA5621

MA5621A

Cost
Smart
Deploy
Maintain
Outdoor solution MXU overseas

Integrated equipment

MA5662
- 48VDSL2
- IP66

MA5652
- 8/16/24VDSL2
- IP55

MA5628
- 4GE/FE +4E1
- IP55

MA5669
- 2GE/FE POE+
- IP55

MA5631
- 64~256 EOC
- IP55

MA5612
- 32POTS/24FE/E1
- IP55

MA5616
- 128POTS/64ADSL2+/96VDSL/64C
- IP55

MA5620
- 16/32/48FE+16/32/48POTS
- IP55

S50  650*560*200
- 1PCS AC MA5612
- 32POTS/24FE/E1
- 1PCS AC MA5616 (half PCS)
- 128POTS/64ADSL2+/96VDSL/64C

S100
- 830*720*250
- 1030*720*250
- 1110*720*250
- 1PCS AC MA5616
- 1256POTS/128ADSL2+/192VDSL/128LAN

S300
- 1350*850*450
- 3PCS DC MA5616
- 768POTS/384ADSL2+/576VDSL/384combo/192LAN

Cost  Smart  Deploy  Maintain

Wall mounted, floor in/outdoor, IP55

Integrated equipment

Floor installation, outdoor/indoor IP55

HUAWEI TECHNOLOGIES CO., LTD.  HUAWEI Confidential
Mature GPON Migrate to 10G PON Solution

Solution
Separate WDM1r shelf
• 3U
• 16 slot
• 2ports/slot

Easy Engineering

Unified Panel
Unified Authentication
Unified Configuration
Unified NBI
Unified ONU Mange.
GPON RF Overlay Solution with FTTH

The most economic and quick way in start up stage for triple play service

- Normally used in FTTH scenario, the third wavelength 1550nm for RF TV service.
- Additional components comparing with pure FTTH solution:
  - **1550Tx**: 1550nm CATV optical transmitter.
  - **EDFA**: amplifying CATV signal to meet the requirement of link budget.
  - **WDM coupler**: couple GPON and CATV signals
  - **2 type of ONT**
RF overlay Home Networking

**Scenario 1:** FTTH RF Receiver + Standard ONT

- FTTH RF Receiver
- VolP
- DTV STB
- RF

**Scenario 2:** Built-in RF Receiver ONT

- DTV STB
- RF

**Models and Specifications:**

- **HG8010:** 1GE
- **HG8110:** 1GE, 1POTS
- **HG813:** 4FE
- **HG8245/HG8245T:** 4GE, 2POTS, 1USB, WiFi
- **HG8240/HG8240B:** 4GE, 2POTS
- **HG8242:** 4GE, 2POTS, 1CATV
- **HG8447:** 4GE, 4POTS, 1USB, 1CATV, WiFi
- **HG861:** 1GE, 1CATV
- **HG863:** 4GE
- **HG8247/HG8247T:** 4GE, 2POTS, 1USB, 1CATV, WiFi

**Cost**

- Smart
- Deploy
- Maintain
Distributed CMTS fully complied with DOCSIS 3.0. CMC of D-CMTS located in the Fiber Node instead of HUB.

D-CMTS solution compared to the traditional CMTS solution has the following advantages:

1. CAPEX cost reduction, having significant bandwidth cost advantage.
2. HUB Simplification.
3. significantly improved the traditional CMTS upstream bandwidth.
4. compatibility with DOCSIS Modem and OSS which can protect existing OSS investments.
Bandwidth acceleration without in-building fiber

AN@CO

FTTC

MSAN

curb

Building

Floor

Customer Premise

Residential

Business

POTS / BRA / PRA / TDM G. SHDSL

ADSL2+ / VDSL2 / SHDSL / ATM

ADSL2+

POTS / BRA / PRA / TDM G. SHDSL

Residential

Business

GE

GPON

P2P (FE/GE)

MA5616

MA5622A

MA5623/23A

MA5662

MA5652

Outdoor cabinet

OLT

AGG

Node

MA5603T/MA5600T

Cost

Smart

Deploy

Maintain

VDSL2

ADSL2+

POTS

FE

Residential

Business

FTTB

FTTC

switch
Video Surveillance solution based on PON

1: MA5669
- 2GE, outdoor integrated, POE, pole, wall, and wire mounted
- 2GE, support POE
- Install on pole, wall, wire
- Scenario: 1~2 IPC

2: MA5621A
- 4FE+2RS485
- Outdoor/indoor
- 4FE+2*RS485
- Install in outdoor/indoor cabinet
- Scenario: <4 IPC/Analog camera

3: MA5621
- 4GE+4RS485
- Outdoor/indoor
- 4GE+4RS485
- Install in outdoor/indoor cabinet
- -40 ℃ ~ 85 ℃, lighting protection 6KV
- Scenario: <4 IPC/Analog camera

4: MA5626
- 4(GE+FE), 8FE, 16FE, 24FE
- Outdoor/indoor
- 4GE+4FE/8FE/16FE/24FE, support POE
- Install in outdoor/indoor cabinet
- Scenario: >4 IPC/Analog camera
ODN is the Key Point to Ensure Long-term FTTH Network

- FTTH ODN should keep unchanged for 30 years.
- FTTH ODN should meet the requirement of NG PON seamless migration.
- Complicated environment, ODN equipment quality is important.
Huawei E2E and High Quality ODN Solution Guarantee Long-term Availability

14-18 kinds of test Guarantee Quality

- Water-temperature
- Anti-dust compression
- Pressure vibration

Consultant
- Feasibility analysis
- Investment estimation
- Technical analysis

Planning & Design
- Network plan
- Network design
- Engineering design

E2E Product
- ODN/FAT/FDT/TB/ATB, etc
- Customization

Engineering
- Construction
- Project management
- Maintenance support
Key Issues in Large Scale ODN Network

- **Manual Record**
- **Manual Input**
- **Manual Verify**
- **Paper work order**

Low efficient
High fault rate

- Fiber Route Unmanageable
  - The fault rate in database is up to 20%

- Port Status Uncertain
  - The rate of new line available in one time is 45%

- Hard to Locate Fault in precision
  - The rate of inaccurate dispatch is 40%

It costs 30% of OPEX in case of these key issues!
iODN: Visible & Manageable

### ID Tag, Identified passive resources
- Identified passive connector
- Identified optical links
- Identified network resources

### Network Management, E2E Visible Network
- E2E optical network management
- Automatic Topology collection
- Accurate Geography Information

### Automatic Record, 100% Accurate
- Auto. Checkout with planned data
- Auto. Return to U2000 by wireless or cable real time

---

#### 5%~35%
**Utilization of optical cable**
- Before
- Now

#### 90%~100%
**One Time Provision**
- Before
- Now

#### 20%~50%
**Manpower Saved**
- Before
- Now

---

Utilization of optical cable

One Time Provision

Wrong Dispatch Rate
**iODN: Realize Efficient Deployment**

**Automatic Network Planning**
- 10 times efficiency increased.
- Optimized and coherence output saving up to 25% cost.

**Optimized Output**

**Global Project Management**
- Professional training to sub constructors.
- Whole workflow verified SOP template.
- Time saving by 50%.

**E2E intelligent, ease deployment**
- Huawei iODN pre-connectorised solution saves total cost 10%~20%, save man-hour 60%.

**Experienced Engineering Implementation**
- 10 years Turnkey experience.
- 50+ expert team to deal with complicated scenarios.
- Innovative techniques such as fiber blown and micro trenching to increase the efficiency by 25%.

**Professional Partner**
Challenges in FTTx Maintenance

1. How to fast service provisioning
   - Huawei Solution: Compatible with DSL NBI, standard interface, fast integration

2. How to realize unified management for FTTH and DSLAM
   - Huawei Solution: One NMS for access network (DSLAM, MSAN, OLT, ONT)

3. Massive ONT deployed in home, high engineer dispatch cost
   - Huawei Solution: Remote monitor and diagnose, automatic software upgrading

4. Massive ODN node, hard for fault location
   - Huawei Solution: Fast fault diagnose, fast and precision location
Huawei Converged FTTx O&M solution

- **Whole lifecycle E2E**
  - network design, construction, service provision and maintenance
- **One NMS for passive and active**
  - OLT+ODN+ONT
- **Automatic information close loop**
  - No data transferred by manual, fast and accurate
OSS fast integration

Abundant NBIs, fast integration

Rich integration cases, learning successful experiences

Pre-integrated with mainstream OSS, reducing the difficulty of integration
ONT Plug&Play, No Configuration on Site

Auto Configuration

1. ONU Installation
2. ONU Powers on and Auto Register(password,SN)
3. Software and Configurations Auto Download

Remote Acceptance Test

1. Start Simulation test
2. Call Test
3. HSI Test
4. Test Report

- No laptop needed to be equipped.
- No configuring needed on site.
- High efficiency for ONU installation on site.
Easier Daily Maintenance

- **Resource Fast Locate**
  - PON graphic topology, resource alias
  - <Ctrl>+F global search

- **Global Template, Effective to Whole Network**
  - Configure one time, Effective to whole network
  - Adjust Mass Subscriber Service

- **Remote reset**

- **Auto version manage, Batch upgrade**
  - Define upgrade policy
  - Auto check version
Fast Fault Demarcation, Avoid Invalid Dispatch

Remote LB-fast fault demarcation

Loopback as per UNI (depends on LSW)

UNI#1
UNI#2
UNI#3
UNI#4

Loopback as per ONT

OLTn

POTS line test - ONT and phone demarcation

U2000
SoftSwitch
IP CORE
ONT

Visible ODN fast demarcation – OLT, Trunk fiber, access fiber or ONT

Fiber broken in A
Fiber broken in B
Los
Losi

Dying Gasp

ONU 1(ONU ID1)
ONU 2(ONU ID2)
GIS based Display , Accurate Fault Location

Solution:

Accurate location

GIS display

Instructions on troubleshooting

- Huawei OTDR supports 1:64 splitter ratio, accurate locating fiber fault position, easy to arrive at the point of failure, shorten fault recovery period.
- FBG + OTDR, accurate fault demarcation indoor/outdoor, inside and outside of building, improving troubleshooting efficiency
- Test result will be displayed on GIS map, not the traditional logical map, speed up the fault location
## Huawei E2E FTTx Solution Conclusion

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<th>Cost Effective</th>
<th>Smart Design</th>
<th>Fast Deployment</th>
<th>Easy Maintainance</th>
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<tr>
<td>• Agg OLT reduce CO cost</td>
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<tr>
<td>• Series ONT meet all scenarios</td>
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<tr>
<td>• Seamless migration to NG PON</td>
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<tr>
<td>• RF overlay Solution for efficiency</td>
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<tr>
<td>• Open Access Solution for wholesale business model</td>
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<tr>
<td>• Good IOT</td>
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<tr>
<td>• Excellent Voice Platform</td>
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<tr>
<td>• E2E and high quality ODN soltion</td>
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<td>• iODN Brings a “3A”- Class Optical Network</td>
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<tr>
<td>• Good Inter-operation Between OLT and ONT Speedup Deployment</td>
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<tr>
<td>• Inherit DSL NBI, fast OSS integration</td>
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<tr>
<td>• Auto service provisioning</td>
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<td>• Fast and precise fault location</td>
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Huawei Global FTTH Deployment

- **Global first 10G GPON** on site test in Verizon
- **Engaged in 6 of Top 10 operators** (Telefonica, DT, FT, TI, BT, Vodafone)
- **The world’s largest GPON FTTH** (Etisalat, 1.3M)

*From: Infonetics Research, Feb, 2012*
Etisalat, Global Largest GPON Deployment

Challenge,
• Low efficient service provisioning
• Low take-rate caused by slowly ODN deployment

Solution,
• Customized OMCI for OSS system. Plug&Play ONT service provisioning.
• Huawei “easy ODN” solution, completed 5000+ users deployment in 3 months, the efficiency is 50% higher than others.

Benefit,
• 1.3M FTTH ports is under construction!
PT, Most Successful GPON FTTH in EU

Challenge,
- Low market share in new TV field vs. cable TV
- Bandwidth bottleneck: DSL vs. cable
- Existing revetments protection: existing home gateway

Solution,
- TV centered GPON FTTH network
- Large CO, passive optical network, easy for maintenance
- CATV Overlay

Benefit,
- 30% family coverage in Portugal in one year!

“Partnerships with key and experienced suppliers is a real advantage!”

-Luis Alveirinho
Director of Engineering and Network Planning for PT

Portugal
Thanks