ISBN
9787303166541

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Challenges of FTTR management

China Unicom

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China Unicom FTTR Operation Profile

1. Product layout

- Issued the "Notice of Gigabit Optical Network Trial "
- Issued "China Unicom New-Generation Optical Home Network solution and Construction Suggestions"

Release enterprise standard in April 2022

Expected: initiate the C system adaptation test in June 2022

Expected: complete the launch of the C system version in September 2022

04/2021 — **11/2021** — **2022**

- Issued the "Notice on Launching the Marketing and Promotion of FTTR Optical Broadband Products"
- Issued the "China Unicom New Generation Home Optical Network Solution and Construction Suggestions "V2.0
- By the end of 2021, all northern key cities and part of key cities of southern provinces launched FTTR
- By the Mid 2022, all northern cities and southern cities have launched FTTR products

2. Business progress (End of March 2022)

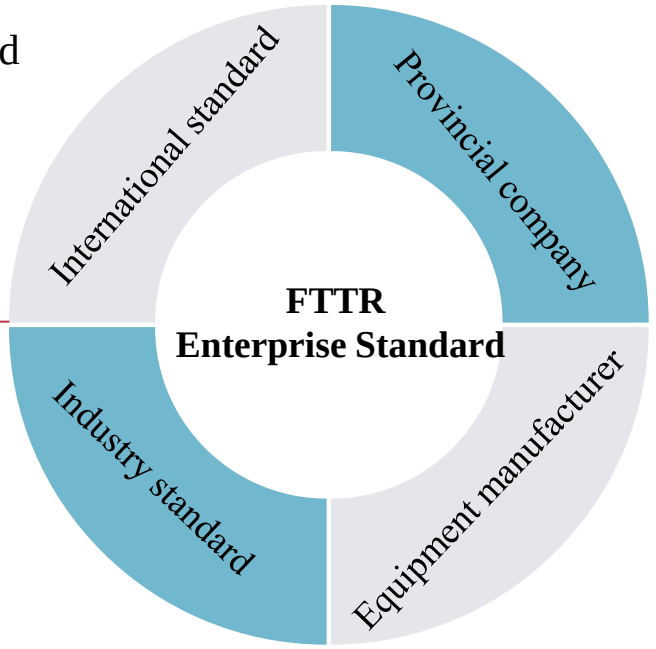
- A total of 110,000+ users in 7 provinces including Shandong, Beijing and so on.
- FTTR service have been released in the remaining 17 provinces including: Shanghai, Jilin, Hubei, Hunan, Fujian, Tianjin, etc.

FTTR Industry Profile

The preparation of FTTR enterprise standard is currently affected by multiple factors, and suffers from many of the disputes in the terminal form and management.

1. International standard

The ITU-T SG15 Q18 started the G.fin since Feb 2020, and consent the Use case and Requirement Report at April 2021. Since then, G.fin began to be standardized in the form of four parts.



2. Industry standard

The industrialstandard was officially established in early 2021, and in progress now.

3. Provincial company

Shandong and Tianjin have independently prepared standards for pilot works, but they basically rely on the manufacturer's own platform and the provincial ACS.

4. Equipment manufacturer

Many equipment manufacturers are actively researching on FTTR. But only few earns a mature P2MP overall solution, while others fail to provide much technical support; For this manufactures with mature solution , however, which is not conducive to standardization as it is filled with private protocols.

Challenges of FTTR management

- The main challenges for management are as follows:
  1. At present, China Unicom has been providing FTTR services and developing a certain scale of users. As a relatively expensive service, the quality of network should match the price.
  2. For now, the international standard and Chinese industry standard are under study, so China Unicom must formulate the enterprise standard as a temporary solution without so much references.
  3. China Unicom is promoting intelligent system(C operating system) on ONU, and deciding to apply C system on FTTR terminals, which most equipment manufacturer do not have the proper device.
  4. The provincial companies has its own condition: some prefer managing FTTR based on existed system(ACS or others), some prefer new system.
  5. Existed systems of China Unicom do not have the enough capabilities to match the management requirements.

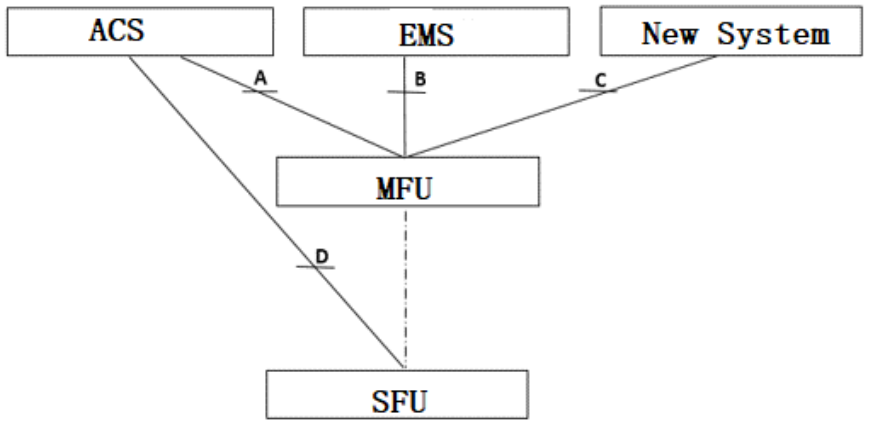
China Unicom FTTR Management Solution

Given the above factors, two management solutions coexist, and the three management platforms jointly run the FTTR equipment in the preparation of the FTTR enterprise standard.

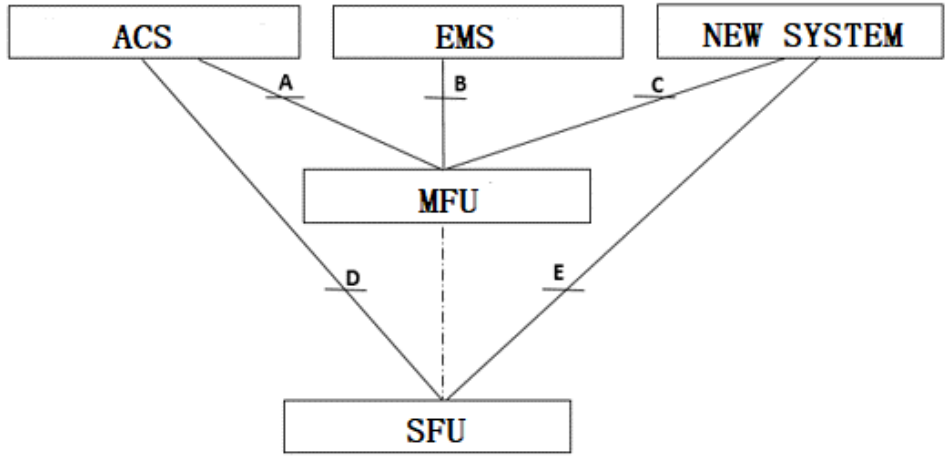
1. EMS(Provincial Branch): Responsible for the configuration and management of the physical and link layers related to the PON interface of the master device.

2. ACS(Provincial Branch): ACS follows the TR-069 series of specifications, and undertakes functions such as business issuance, configuration management, software upgrade, and fault positioning for FTTR equipment.

3. NEW SYSTEM(Group): mainly provides support and management capabilities for FTTR equipment and clients, including gateway remote configuration, client management, plug-in management, developer management and online data management, as well as the data collection of FTTR gateway network quality. It provides the network quality reporting for users based on big data processing and analysis.



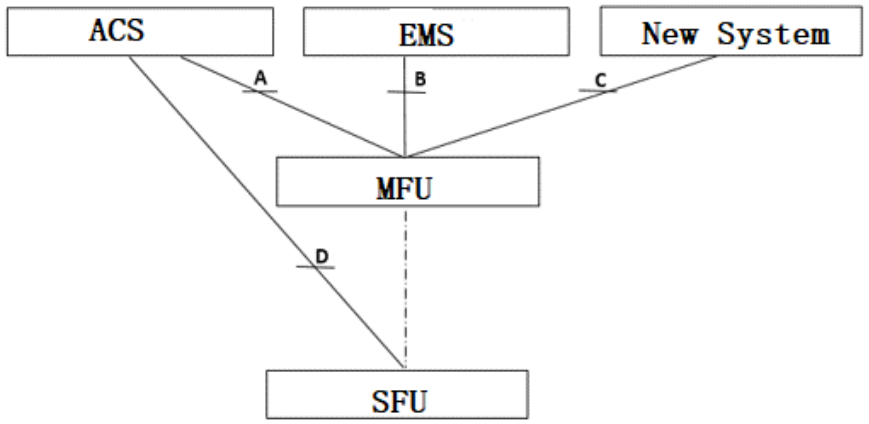
Master Managed Mode



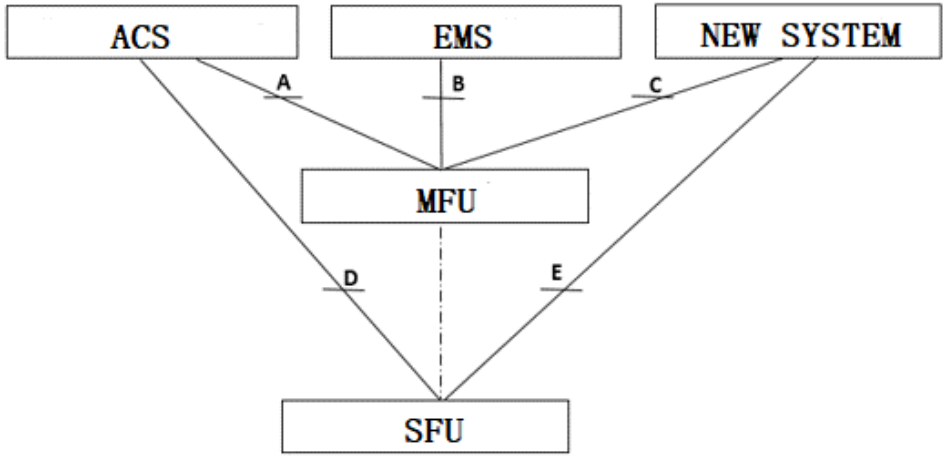
Master-slave independent management mode

China Unicom FTTR Management Solution

- A : the logical interface between FTTR master device and ACS to realize the unified management FTTR master devices, home network and internal equipment of home network;
- B : the logical interface between the FTTR master device and the EMS to realize the remote management of the PON interface and some services of the FTTR master device;
- C: the logical interface between FTTR master device and new system, which can realize the management of FTTR master device, plug-in loading, Wi-Fi, configuration, home network visualization and other functions;
- D: the logical interface between FTTR slave device and ACS to realize the unified management of FTTR slave device registration and upgrade;
- E :the logical interface between FTTR slave device and new system, which can realize the management of FTTR slave device, plug-in loading, Wi-Fi,configuration, home network visualization and other functions.



Master Managed Mode



Master-slave independent management mode

Ununified Technical Route of FTTR Enterprise Standard

1. Two technical routes of FTTR management model are both flawed. The final selection is controversial

	Master Managed Mode	Master-slave independent management mode
Management plan	Only install the C system and WiFi plug-in on the master device, and define the interface between the master device and the new system. The configuration and information collection of the slave device and the home network are completed by private protocols (developed by the manufacturer, not defined) between the master device and the slave device.	The master and slave devices, as a special gateway device, need to install the C system + WiFi plug-in to collect relevant data and complete the corresponding operations
Main work for standardization	Define the master device interface of the C system, not only satisfies the management and information collection of the master device, but balances the management of the slave device and the overall information collection of the home network.	It needs to create a new management process and business logic on the new system, and integrate the master and slave devices together to enable the overall management of FTTR
Problems	Except for Huawei, other potential manufacturers may fail to offer complete private protocol support.	1. Huawei may not meet the requirements of the enterprise standard, resulting in the failure to incorporate into the management system 2. Weak and limited capability of the new system may not be able to meet all management requirements

China Unicom FTTR Management System Capability Status

1. ACS(upgrading)

Upgrade is required to support the management of FTTR master and slave devices, which mainly involves two functional requirements

	Master device	Slave device
Device management	➢ Management of downlink optical interface of FTTR master equipment; ➢ FTTR slave device access limit; ➢ Uniform allocation of FTTR slave logical IDs ➢ Full routing function configuration	➢ Query and Management of Uplink Optical Interfaces of FTTR Slave Devices ➢ Slave device reset, reboot and upgrade ➢ IPTV service configuration
Asset management	Master equipment asset management	Slave device asset management

2. New system (under development)

C system + WiFi/optical link network management and data collection plug-in needs to be iteratively developed with all management functions required by standard (master-slave device management, home network tuning, etc.), and develop the master-slave interaction protocol easymesh +CU-link protocol

3. APP of Installation and maintenance (under development)

Installation and maintenance APP need to add FTTR products.

FTTR enterprise standard compilation - master-slave device exchange information

For the Master Managed Mode, the master and slave devices need to accomplish the following interaction information

1. Wi-Fi configuration parameter query

Including Wi-Fi SSID name, SSID enable, authentication and encryption method, key, maximum number of access users, channel, bandwidth, transmit power and other configurations;

2. Attached device information

Including STA's MAC, IP, rate, RSSI, number of antennas, packet statistics, 802.11K/V/R support capability, etc.;

3. Slave device SSID statistics

Including the statistics of sent and received packets of specific SSIDs;

4. Slave device resource occupancy rate query

Including memory and CPU usage;

5. Neighbor AP information query

Including neighbor AP's SSID, RSSI, noise, authentication mode, working mode, maximum rate, frequency band, etc.;

6. The master device should be able to read the information from the slave device

Including device model, manufacturer information, optical link parameters, online status, distance, performance data, and information such as power failure and optical path failure.

7. The slave device should be able to get the OUI and TR069 SN value of the master device.

FTTR Optical Link Budget

Two solutions are formulated referring to the GPON standard and the status quo of the existing industry chain:

1. Solution a: The optical port of the master device refers to the GPON Class B+ category, the transmit optical power is +1.5~5dBm, and the receive optical power is -8~-28dBm.

2. Solution b: The master device transmits optical power of -2 to 2dBm, and receives the optical power of -8 to -23dBm. The master and slave devices will support the definition of optical power indicators in different scenarios to meet lower optical power budget requirements.

Solution b has not been strictly verified and needs to be discussed in the future. And each solution should has a matched optical splitter specifications.

Equipment Manufacturer FTTR Products

Investigation on the status quo and opinions of mainstream venders for management solution.

	Whether have a master-slave private protocol	Solution
Vender A	1. Support private protocols Master-slave device Wi-Fi roaming optimization, SSID synchronization 2. Functions such as the slave device attached information, device resources query, etc.	Only the master device installs the plug-in. The master device acts as a proxy for the slave device
Vender B	1. Support private protocols 2. Largely collect information from the gateway, including device information, optical power, resource usage, etc.; However, it does not support network-wide Wi-Fi adjustment and optimization	The master and slave devices install plug-ins respectively
Vender C	Easy mesh protocol	The master and slave devices install plug-ins respectively
Vender D	Easy mesh protocol	The master and slave devices install plug-ins respectively

Expectation of FTTR management

- Promote the formulation of ITU G.fin standards, especially the master-slave device exchange information;
- Promote the reunification of management mode;
- Expand FTTR application scenarios.

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Thanks!