The management practices and experience of massive FTTR system for ChinaUnicom

Hai Ding
China Unicom Intelligence Network Innovation Center
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What Have We Done

What Should We do

Roadmap of ChinaUnicom home netwroking

p China Unicom initiated the FTTx construction in 2009, and achieved the overall optical reconstruction since 2013 . PON uplink residential gateways have become the mainstream home access terminals, and have evolved from the initial access to the gradual upgrading of routing, networking, intelligent business and other characteristics.

2014-2017 ▶ HGU stage

- using **HGU** instead of SFU，Provide users with functions such as home networking and WiFi connection.,
- each province build **ACS system**, doing HSS/IPTV/VoIP services configuration to **100 million HGUs via TR069**

2022~ ▶ FTTR Stage

- The **first service provider to deploy FTTR equipment**, operation **over 8 million home customers**, also explored the overall management of the FTTR system, even in the absence of standards and experience for reference.

2009-2013 ▶ SFU stage

- FTTH is just taking off, the traditional xDSL modem update to **SFU (Single Family Unit)** equipment.
- each province build **EMS system**, achieve authentication and management of SFU via **OMCI**

2017-2022 ▶ smart gateway stage

- Irelease the self-developed intelligent gateway C middleware to upgrade the intelligent gateways. In addition to the existing provincial EMS+ACS management system, a new **centralized intelligent gateway management system** has been established to uniformly manage over **40 million application service gateways** aroud the country **via JSON+XML**

The management architecture of ASG

p As a business-oriented intelligent terminal, CCSA, BBF, and some open-source organizations (such as PRPL) have conducted research and defined the functions, software, and services of intelligent gateways, and have also imposed more requirements on the management of operators.

- EMS、ACS and application management system working together
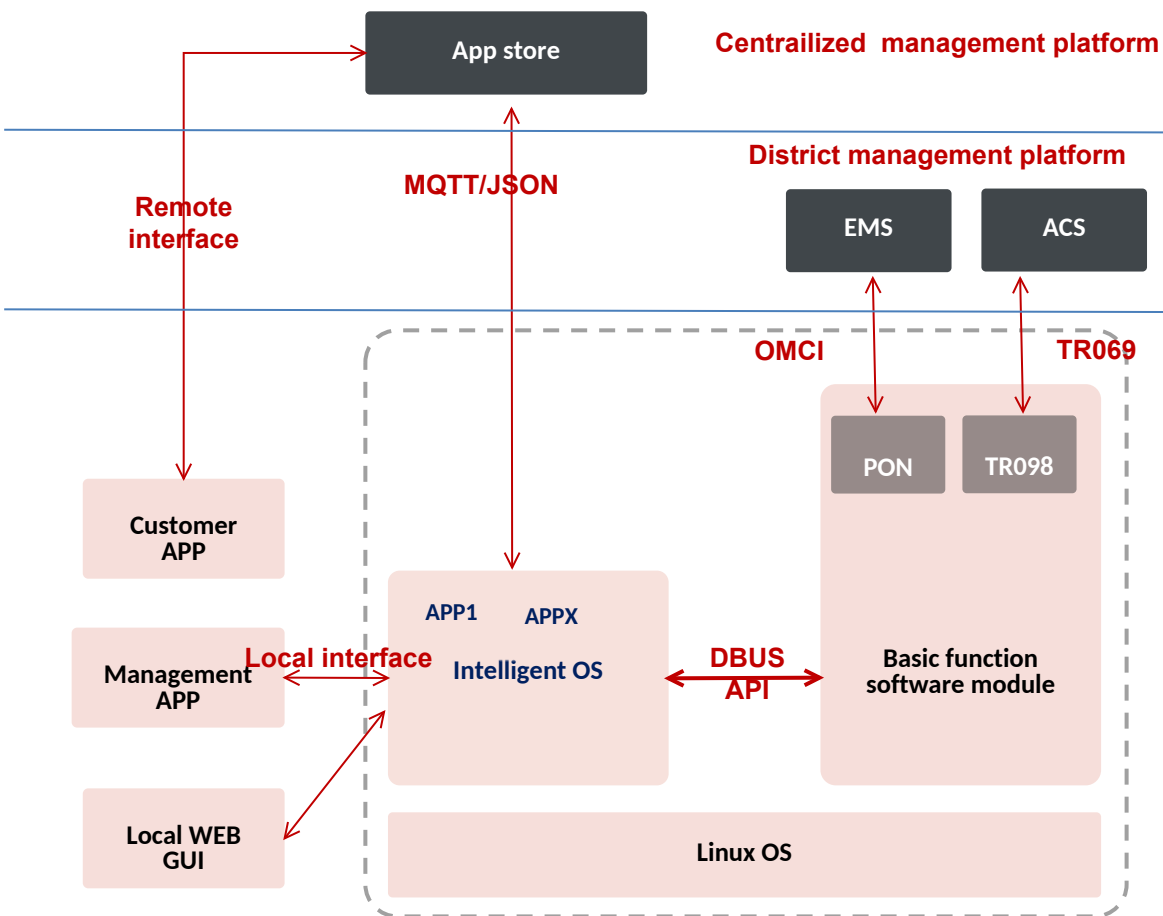
	EMS system	ACS system	Application management system
Authentication &Registration	Yes（via OMCI by SN/LOID）	Yes（via TR069 by OUI+series number）	Yes（via MQTT/JSON by pre-password）
Basis Service configuration	No	Yes（support HSS、IPTV、VoIP)	No
Management tool	simple（focus in PON line status)	complex（support reboot、software upgrade、factory reset、Automatic diagnosis）	complex（provide API interface to users、engineer and value-add service app）
Application operation	No	No	Yes（support install、delete upgrade etc）

FTTR Characteristic Analysis

p   Through over three years of installation, management, and maintenance for more than 8 million users, we believe that FTTR has three extremely important characteristics that operators should consider and find out the solution based own requirement and current situation.

a device vs a system

u   Unlike managing traditional gateways, routers, and other equipment, where operators can treat each device independently, the MFU and multiple SFUs of FTTR must function as a unified whole to accurately represent a single user. A significant challenge lies in how to quickly, accurately, and cost-effectively identify and group these multiple devices on the operator's management platform.Especially when considering the scale of millions of users and the dynamic nature of SFU information that is constantly changing.

Meeting Standards vs. High Quality

u   Compared to traditional gateways and routers, the biggest advantage of FTTR for users is the provision of exceptional network experience and high-quality maintenance capabilities, which attract high-end users. This requires not only the collaboration between FTTR's MFU and SFU devices to deliver better network connectivity, but also the ability of operators' systems and maintenance personnel to provide optimal solution recommendations for users in any environment.
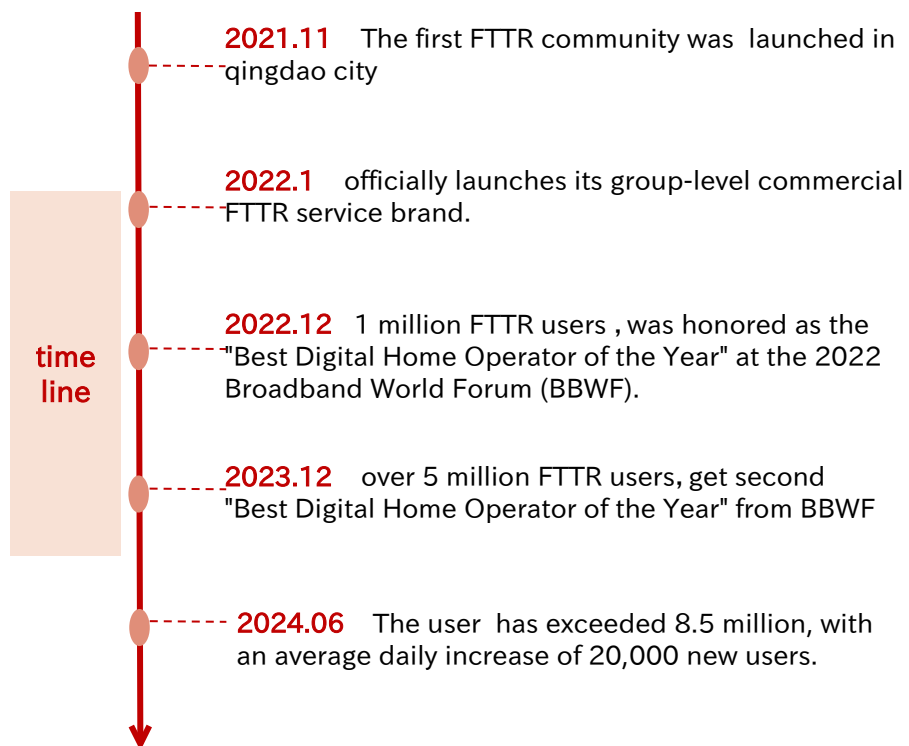
Network Connection vs. Smart Applications

u   As the most crucial solution for operators to enter the smart home era, FTTR not only provides users with traditional access and connectivity services but also leverages the hardware capabilities and home coverage advantages of FTTR to offer tangible services and various value-added home services. Therefore, the development of FTTR inevitably trends towards intelligence, business orientation, and systematization.

Milestones of China Unicom's FTTR Development

中国联通
China unicom

p Since 2021, China Unicom has launched the commercial application of FTTR business. Over the past three years, it has achieved remarkable results in terms of business, and launched its own products in terms of standards, management systems, users, and installation and maintenance tools.

Milestones of Service Development

2021.11   The first FTTR community was launched in qingdao city

2022.1   officially launches its group-level commercial FTTR service brand.

2022.12   1 million FTTR users，was honored as the "Best Digital Home Operator of the Year" at the 2022 Broadband World Forum (BBWF).

2023.12   over 5 million FTTR users，get second "Best Digital Home Operator of the Year" from BBWF

2024.06   The user has exceeded 8.5 million, with an average daily increase of 20,000 new users.

time line

Milestones of Technology Development

01 Standards

- In 2022, China Unicom issued an enterprise standard that guided the production of 1.5 million FTTR devices. In 2023, the 2.0 version was released, which upgraded the management mode, performance, and hardware specifications. it infect over 7 million devices

02 Manage system

- It defined a new TR069 parameter model and intelligent middleware, established a three-level management system, and achieved the capability of daily digital analysis for millions of FTTR households

03 Installation Guidelines

- We are currently developing an installation manual and conducting training for all installation engineers to help them complete the FTTR system installation within 1.5 hours and meet high-quality standards.

04 Services APP

- We provide dedicated management APPs for FTTR users, enabling them to query and configure their FTTR networks from anywhere and at any time.

what have we done-FTTR Installation tool

p   engineers can use the toll install the FTTR system more quickly, easily, and with higher quality;Considering that the device has not been connected to the network during configuration, and for better timeliness and success rate, the tool must use the proximal interface to access the device.

install

LOID config
- After automatically reading the LOID, it is configured onto the MFU (Multi-Function Unit).

Wi-Fi config
- Modify the WiFi SSID name and password, and generate a guest network with one click.

IPTV port config
- Flexible configuration of IPTV service ports for MFU and SFU.
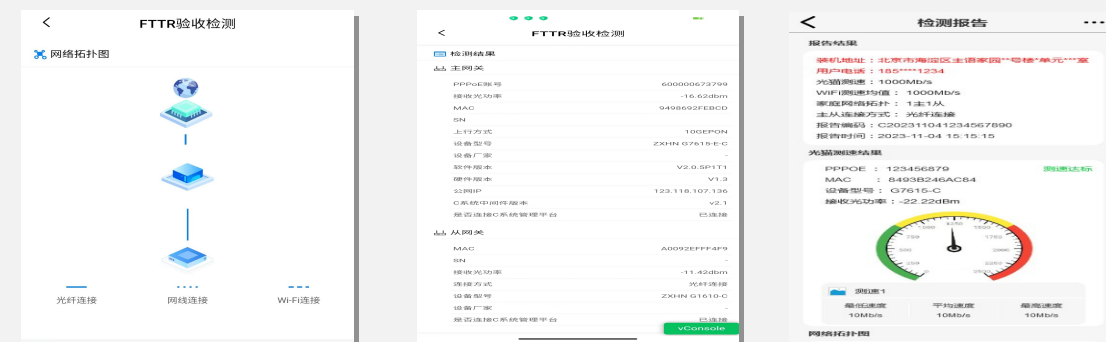
higher quality

link detect
- Detection of optical power reception for MFU and SFU connection (on/off)

Location detection
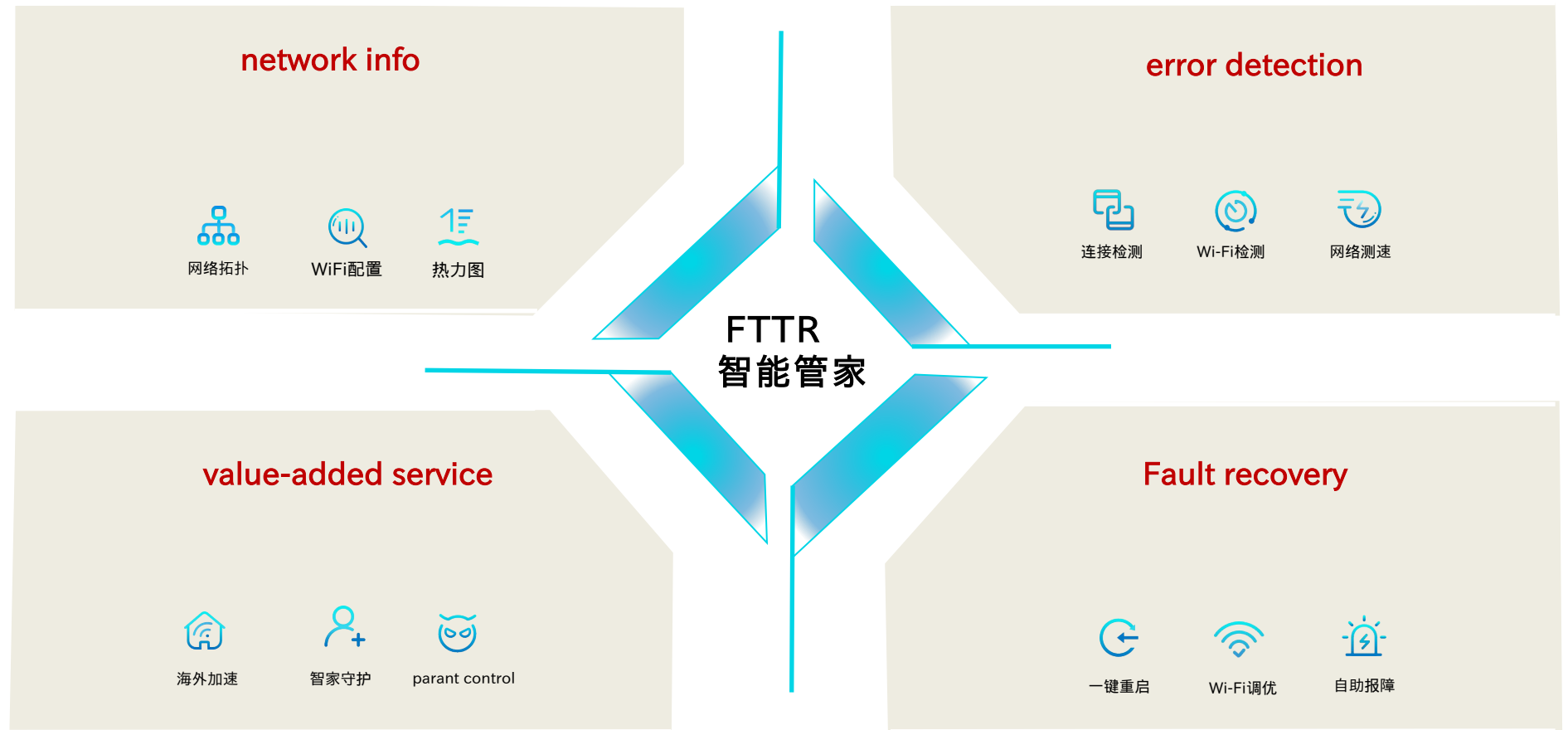Identify whether the placement of MFU and SFU is too close, and whether the gateway is obstructed.

Installation and Maintenance Report
- Compare comprehensively with the FTTR completion requirements.
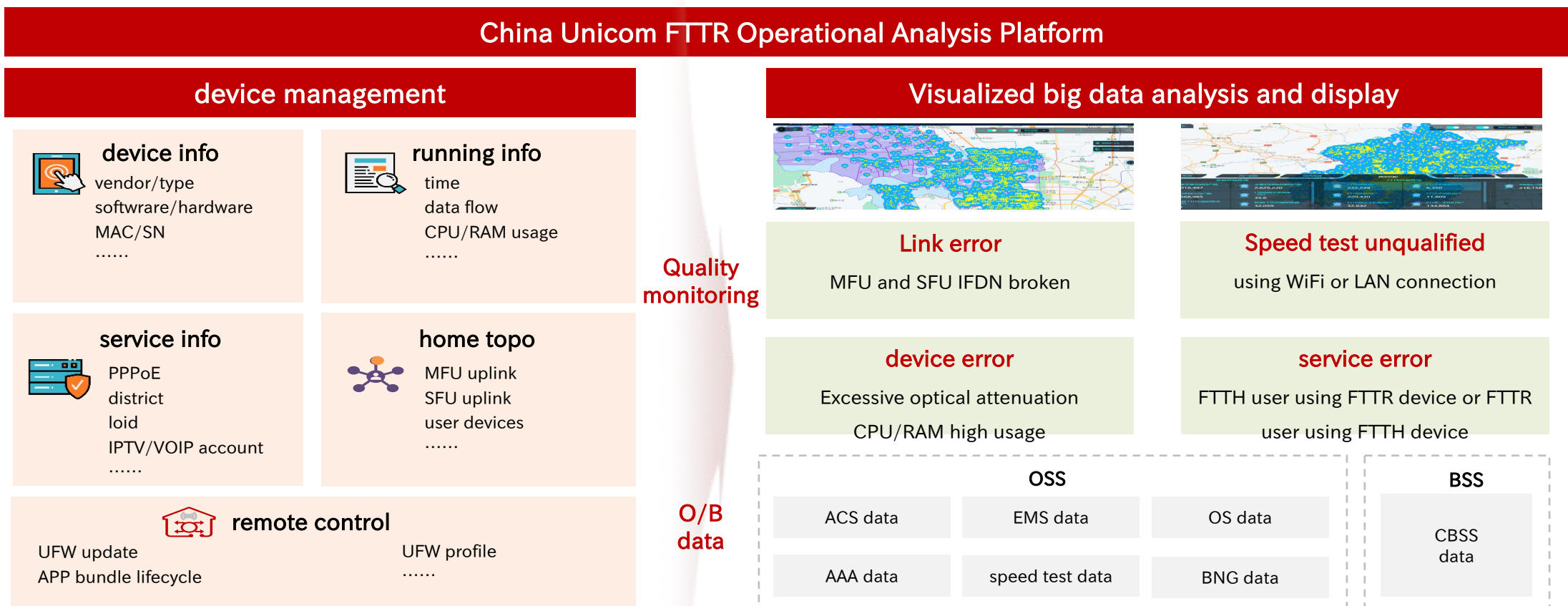
what have we done-FTTR APP for residential customer

p The user APP enables users to access their home network information anytime, anywhere, and manage, control, and configure their home network according to their personal preferences.Operators must be able to support millions of users accessing simultaneously, and must also consider the security and privacy of data on home networks.

network info

网络拓扑   WiFi配置   热力图

error detection

连接检测   Wi-Fi检测   网络测速

FTTR 智能管家

value-added service

海外加速   智家守护   parant control

Fault recovery

一键重启   Wi-Fi调优   自助报障

2 million users, over 35% MAU

what have we done-FTTR Operational Analysis Platform

p The analysis platform is designed to assist the backend support operators in understanding the user's network status, intelligently predicting home network failures, and rapidly helping users locate and resolve issues. what more important is survilliance non-standardized deployment scenarios by vendors (such as FTTR devices under 1G PON OLT, using Ethernet or even WiFi connections between MFU and SFU, etc.).

China Unicom FTTR Operational Analysis Platform

device management

device info
vendor/type
softwrare/hardware
MAC/SN
……

running info
time
data flow
CPU/RAM usage
……

service info
PPPoE
district
loid
IPTV/VOIP account
……

home topo
MFU uplink
SFU uplink
user devices
……

remote control
UFW update
APP bundle lifecycle

UFW profile
……

Visualized big data analysis and display

Quality monitoring

Link error
MFU and SFU IFDN broken

Speed test unqualified
using WiFi or LAN connection

device error
Excessive optical attenuation
CPU/RAM high usage

service error
FTTH user using FTTR device or FTTR user using FTTH device

O/B data

OSS
ACS data	EMS data	OS data
AAA data	speed test data	BNG data

BSS
CBSS data

9

− What Have We Done

= What Should We do

Requirements for upgrades and improvements

p Starting from the second half of 2023, China Unicom initiated a FTTR high-quality development improvement plan. Through conducting surveys with numerous users and management personnel, the company has obtained valuable feedback.

p Based on these feedbacks, we have identified numerous upgrade requirements across different stages of FTTR's full lifecycle management and operation.

| Installation tool	management system	fault detectiion	smart device

- More clear: Define high-quality installation and delivery details.
- More convenient: Easily complete the configuration of all services on all terminals.
- More powerful: Automatically identify the distance between the master and slave devices. etc

- Efficiency improvement: Unified operation for MFU and SFU to reduce operation times and resources.
- Concurrent capability: Capable of real-time updating the status changes of massive MFU/SFU devices, such as the online/offline behavior of FTTR-B SFU

- More comprehensive: In addition to device failures, it is also necessary to cover line failures (such as IFDN) and configuration failures (such as loop detection).
- More intelligent: Leveraging the technical advantages of FTTR, it provides more intelligent optimization and recovery solutions.
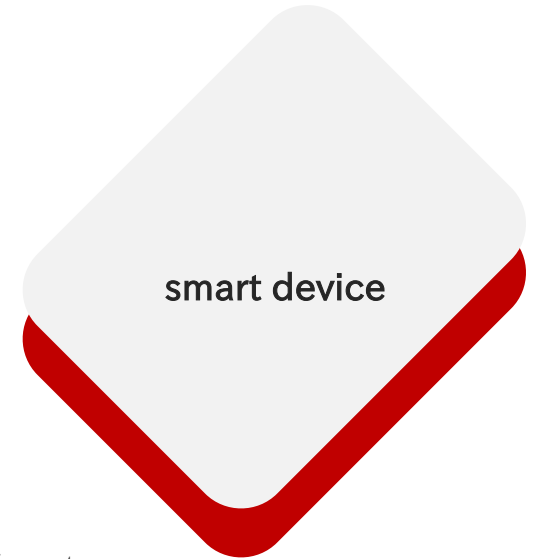
- As intelligent terminals, achieving business-level intelligent collaboration between MFU and SFU involves several key aspects, including application installation, data sharing, and capability invocation.

Future plan and some thoughts

p As an important participant in the FTTR industry, China Unicom hopes to continue advancing and improving relevant standards together with various standard organizations and is willing to contribute its own strength.

The management between MFU and SFU

p Refine FMCI and WMCI, enrich capabilities such as terminal authentication and fault location;

p consider opening internal capabilities in the form of standard APIs;

p add requirements for collaborative management of multiple MFUs.

Remote Management to FTTR

p Explore solutions for managing all SFUs through an MFU proxy;

p how to collect and manage real-time data from multiple SFUs;

p how to ensure concurrent efficiency and security when opening management platform capabilities to users.

Management for Smart device

p How to manage smart gateways, including middleware and applications

p how to manage the service collaboration capabilities between master and slave devices.

Management of High performance

pHigh-quality construction: Define the standard of high-quality completion and delivery when operators build FTTR

pHigh-quality experience: Define the standard of high-quality service experience when FTTR network carries different family services

END