

ZTE TECHNOLOGIES

VIP Voice

Daisytek: Empowering
Your Businesses



Expert View

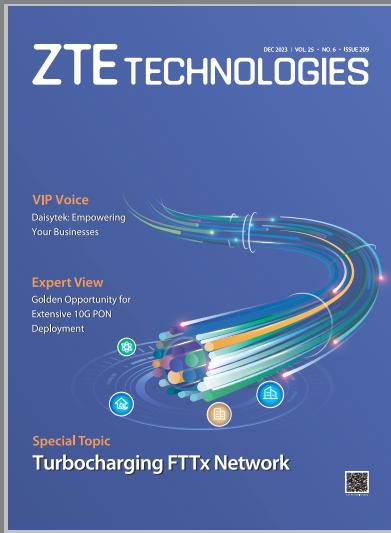
Golden Opportunity for
Extensive 10G PON
Deployment

Special Topic

Turbocharging FTTx Network



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ZTE TECHNOLOGIES

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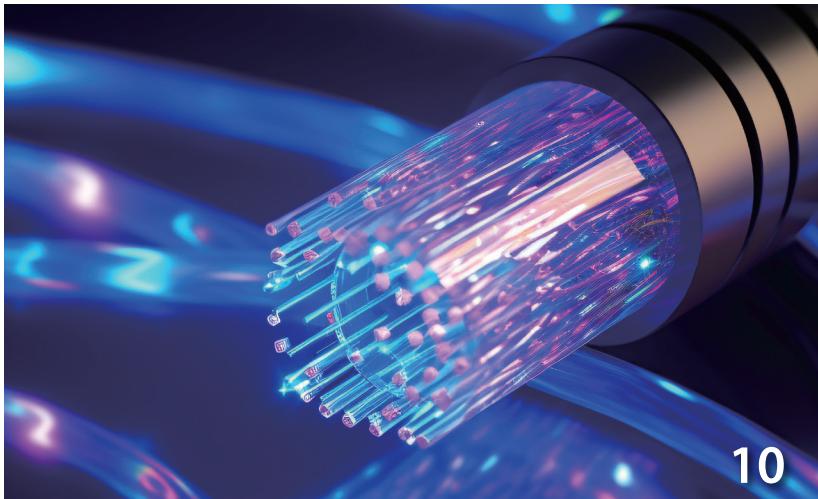
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Source: Mobile World Live



iForte and ZTE Sign an MOU on Telecom Energy Innovation to Fuel Sustainable Development of Network Infrastructure in Indonesia

30 October 2023 — ZTE and PT iForte Solusi Infotek, an Indonesian telecommunication infrastructure company and internet service provider, today announced a strategic collaboration on telecom energy

innovation to fuel the sustainable development of the network infrastructure in Indonesia.

Ferdinandus Aming Santoso, CEO and President Director of iForte and Protelindo Group, Mei Zhonghua, SVP of ZTE, and other executives from both sides have witnessed the signing ceremony. The MOU was signed by Handoko Siputro, Director of Procurement of PT iForte Solusi Infotek and Richard Liang, President Director of PT. ZTE Indonesia, at ZTE's headquarters in Shenzhen, China.

The collaboration aims to focus on in-depth cooperation on key product

projects such as power supplies and batteries to promote innovation and sustainable development in Indonesia's network infrastructure market. The collaboration represents a significant milestone in the future strategic cooperation between ZTE and iForte, marking their proactive exploration in the field of network energy.

Aming Santoso, CEO and President Director of iForte and Protelindo Group, said: "Within merely one year, the footprint of ZTE in iForte has expanded massively. We hope ZTE will continue to support iForte with high-quality products and services to jointly promote the development of digital infrastructure and networks in Indonesia."

The signing of this cooperation memorandum marks the beginning of a deeper collaboration between ZTE and iForte that will facilitate the application of telecom energy innovation in Indonesia. Moreover, both parties will contribute positively to a sustainable future for Indonesia's network infrastructure by working together.



ZTE Releases the Industry's First Tbit All-Optical Access Platform

24 October 2023 — ZTE has unveiled the latest Tbit-level deterministic all-optical access platform, the ZXAA10 C600E, at the Network X exhibition held in Paris, France. This new platform, developed for large-scale 50G PON deployment, has garnered significant industry attention and is poised to drive innovation in FTTx services while contributing to the growth of global optical fiber technology.

ZTE Unveils RoomPON 5.0, Redefining FTTR Solution at Network X 2023

30 October 2023 — ZTE unveiled its latest all-optical series product, RoomPON 5.0, at Network X in Paris, France. RoomPON 5.0 represents a comprehensive upgrade in design, performance, functions, installation and O&M. It redefines the FTTR solution to offer enhanced attractiveness and greater connotation.

The RoomPON 5.0 features an innovative 10-inch screen that provides



a comprehensive view of the entire home network, a first-of-its-kind feature that eliminates the need for applications to be hidden within a mobile phone app.

ZTE and Computer Union Join Forces on Cutting Edge IT Solutions in Thailand

15 November 2023 — ZTE has entered into a collaboration agreement with Computer Union, Thailand's leading IT solution distributor, to collaborate on cutting-edge IT solutions under its latest strategic partnership project.

The contract was signed in Bangkok Thailand by Mr.Teera Phutrakul, Chairman of Computer Union and Mr.Han Zhiming, Managing Director of ZTE Thailand. The signing was witnessed and attended by Miss. Pawasut Seewirot, Director of Saha-Union, Mr. Mei Zhonghua, Senior Vice President of ZTE and Mr. Zhang Wanchun, Senior Vice President of ZTE.

The main goal of this agreement is to



formalize the interaction and strengthen the relationship between Computer Union and ZTE at both strategic and working levels, stimulate and facilitate the development of collaborative and mutually beneficial activities which serve to achieve heightened levels of productivity, efficiency and profitability for their partners.

ZTE has the advantage of integrating various resources from software and hardware manufacturers, solution providers, and service providers, and providing customers with more advanced and reliable

solutions through continuous R&D investment and technological innovation. Through the agreement, Computer Union's Value Added Solutions team, lead by Mr. Darwin Darakananda, Head of Business Development, will explore ZTE offerings to expand its product catalog diversities and provide a comprehensive suite of solutions that meet the requirements of more clients. ZTE is committed to dedicating time and expertise to support Computer Union's vision of establishing a solid digital foundation and exploring Thailand's digital market together.

ZTE Light ODN Solution Facilitates Fast Deployment of Intelligent Network for Bitel in Peru

30 October 2023 — ZTE and Bitel Peru have successfully completed extensive deployment of a 100K HHPP FTTH network, utilizing ZTE's industry-leading innovative Light ODN solution. The implementation has enabled the intelligentization of passive networks during rapid construction, making optical distribution networks (ODNs) visible, manageable, and controllable.

China Mobile and ZTE Deploy the Industry's First Service Container Level Digital Twin Network

10 November 2023 — ZTE, in collaboration with China Mobile's Fujian Branch, has deployed the industry's first service container level digital twin network throughout Fujian province with more than 10 million subscribers.

The network employs innovative technologies for driving the development in network automation and intelligence. Also, it significantly improves customer experience and reduces OPEX.

ZTE Unveils High-Quality Series Servers at the ZTE 5G Summit & User Congress 2023

15 November 2023 — ZTE showcased high-quality servers at the ZTE 5G Summit & User Congress 2023 in Bangkok, Thailand, providing enterprises and operators with excellent data center infrastructure support. Themed "Embrace the Digital Nexus," this summit was held to explore the innovation path of digital broadband transformation together with global partners and industry elites.

Daisytak: Empowering Your Businesses

Reporter: Ren He



In Mexico, fiber optic technology is revolutionizing the telecom industry. Tomas Moran, CEO of Daisytak, a leading Mexican wholesaler specializing in electronic and networking devices, provides insights into his company's competitive advantages, market opportunities, and collaboration with ZTE in the fiber optic segment.

Tomas Moran, CEO of Daisytak

What are Daisytek's competitive advantages?

There are a couple of things that drive our competitiveness in the market. But the main one is our ecosystem of solutions, and we provide for resellers, channels and retail. This ecosystem provides not just the flexibility for any type of resellers in different segments we work with, but also provides services, solutions and financing options that support their businesses in the long term, which is our core. We want to have long-term business relationship, and that's why we are on our path to our 30th year next year.

What are some of the principles guiding you in your role as CEO at Daisytek?

We always base our long-term mission and business strategy on our values, with integrity as our primary value. We have a very important commitment with our customers in terms of providing them with the best solutions and services to empower their businesses. Our slogan, which is empowering your businesses, reflects our principle, and it guides our approach to the market.

What trends or opportunities do you see for wholesalers like you?

I see there are three clear trends in the market. One is certainly the whole FTTx movement. There is a large trend in terms of moving customers from regular and standard cable solutions to fiber solutions in the internet space. I also see a large trend in terms of mobility, and we are investing largely in mobile segments. We want to provide not just tailored solutions but also smartphone devices with great prices for our customers. The last trend is cyber security.

How would you utilize these opportunities?

We are joining forces with the best brands

and the best products. That's why we are working closely with ZTE to deliver these kinds of solutions. I think ZTE has a unique value proposition in terms of the whole infrastructure and internet delivery solutions for the customers. ISPs, I think, value a lot what ZTE has to offer. But we just need to provide them with different options that can go along with their business model. In their subscription based business model, we need to support them in their recurring revenue they are getting. So we would be utilizing the opportunities that ZTE has in our joint partnership.

How would you assess ZTE's products and services? What do you expect for the future cooperation with ZTE?

I consider them as top-notch products and services. I think ZTE is a leading provider in the whole internet and ISP space, with a huge potential for growth. My expectation for this cooperation is to emerge as the largest distributor for ZTE in the country and to provide the best solutions and services for the internet space and the fiber optic segment.

What are your main goals in the next few years?

Our main goal is always to be a key partner to our customers. We want to empower their businesses, which is our mission and main goal. That is going to serve as our main driver for the goals that we are going to have in the coming years. In this empowerment of our customers' businesses, we are going to look at high-growth markets and increase our revenues. But most of all, we want to be focusing on being a very profitable company where we are diversified, where we have a very service-focused business, and where customers see great value. **ZTE TECHNOLOGIES**

Golden Opportunity for Extensive 10G PON Deployment

Sun Jin, FN Product Planning Director, ZTE

Extensive 10G PON Deployment

Due to the significant advantage of fiber over copper as a transmission medium and the decline in fiber optic cable prices, passive optical network (PON), characterized by its fiber infrastructure, passiveness, and P2MP topology, has achieved great success over the past 15 years. As the transition from copper to optical and the acceleration of bandwidth continue to deepen, the deployment of 10G PON and the upgrade from GPON to 10G PON have become industry standards. By the end of June 2023, global 10G PON shipments had exceeded 30 million PON ports, with China's market share accounting for approximately 80%. The extensive deployment of 10G PON in the Chinese market has significantly advanced the maturity of the 10G PON industry chain and reduced costs.

The deployment of 10G PON and the provision of gigabit services are mutually reinforcing. According to analysis data from the consulting firm Omdia, by the end of 2022, gigabit bandwidth services accounted for about 8% of fixed broadband (FBB), and this figure is expected to increase to 28% by 2026. The global deployment of 10G PON is accelerating, and it is estimated that by

2026, global 10G PON shipments will surpass those of GPON. The next three years are expected to be a prime window for 10G PON deployment.

Due to variations in population and economic development, the timing and scale of 10G PON construction may differ among regions worldwide. As 10G PON deployment gains momentum in North America and Europe, it is expected China's market share will gradually decrease, while the Asia-Pacific and South American regions are expected to have a competitive edge in 10G PON construction.

Five Major Factors Driving Extensive 10G PON Deployment

- **New service experience requirements:** Operators have transitioned their construction approach from being technology-driven to experience-driven. Basic broadband services, particularly video services, now account for more than 50% of the total traffic. Platforms like Netflix, YouTube, and Tiktok contribute significantly to this surge in traffic. In the post-pandemic era, remote work, online education, and digital transformation of enterprises and industries have greatly driven the demand for increased bandwidth.

The global deployment of 10G PON is accelerating, and the next three years are expected to be a prime window for 10G PON deployment.

Sun Jin



- Policy support:** According to a World Bank report, every 10% increase in fixed broadband penetration is associated with a 1.38% increase in GDP growth, and each doubling of bandwidth results in a 0.3% increase in GDP growth. More than 140 countries and regions worldwide have elevated broadband network development to the level of a national strategic priority. Some have even included gigabit networks in their development plans. For example, the Chinese government proposed the "dual-gigabit dual-acceleration" plan, the European Union released the Gigabit Community Plan, the German government proposed the Gigabit Germany Plan, and the Italian government launched the 1 Giga strategy. These national policies and financial support mechanisms provide essential guidance and positive incentives.
- Competition-driven:** Operators are currently engaged in fierce market competition to secure more user resources and maximize their profits. It is critical for the operators to use differentiated technologies and services to maintain a competitive edge. This includes offering attractive service packages to improve customer quality of experience (QoE) and

ensure a competitive advantage.

- Network upgrade and reconstruction:** As the service life of traditional PSTN, DSL, and DOCSIS network technologies and devices progresses, they no longer meet the demands of the new era. For example, some OLT devices that have been used for over a decade have reached the end of their life cycles. They cannot be upgraded or maintained to support new functionalities and performance requirements and thus necessitate an upgrade to a new device platform.
- Continuous decline in 10G PON costs:** The extensive development of 10G PON is also driving continuous cost reductions. According to statistics from the consulting firm Dells' Oro Group, the price of 10G PON ports decreased by 43% from 2018 to 2022, while the cost of 10G PON ONUs dropped by 62%, making the cost-effective deployment of 10G PON feasible. Due to the point-to-multipoint (P2MP) nature of PON, the reduction in PON device prices depends on the decrease in ONU costs.

Moreover, the higher bandwidth of 10G PON translates to faster rates and an enhanced user experience. Considering the tidal and pinpointing effects, the network must accommodate burst bandwidth needs rather than just the

average bandwidth requirement. Typically, burst bandwidth can be 3–5 times that of the average bandwidth.

Four Key Principles for 10G PON Construction

- **Network construction ahead of service provision:** Network construction forms the foundation for service development and must be done ahead of service growth. Considering future network upgrade and evolution requirements, network construction requires early planning and a forward-looking approach.
- **Step by step:** Network construction is not a one-time effort but an ongoing development process. Network deployment leads the way, and customer premise equipment (CPE) is connected as needed. Throughout the construction process, multiple factors such as service development, market competition, and capital investment must be taken into account.
- **Targeting high-value users with high ARPU:** Network construction should foster user development and profit generation by enhancing ARPU and customer stickiness, positioning it ahead of market competition.

- **Considering end-to-end bandwidth acceleration:** FBB network acceleration is an end-to-end project spanning from the core layer to the bearer layer and the access layer. Any of these components may impact the effectiveness of bandwidth acceleration, including Wi-Fi and PON technology upgrades, the availability of sufficient uplink and downlink bandwidth, and the appropriate splitting ratio.

10G PON provides four times the bandwidth capacity of GPON and delivers symmetric bandwidth to cater to the requirements of high-bandwidth symmetric services, such as enterprise private lines, campus private networks, and industrial applications. In addition, 10G PON provides end-to-end gigabit access for FTTx, coupled with Wi-Fi 6/Wi-Fi 7 technologies.

Any-PON: An Excellent Choice for 10G PON Deployment

ZTE recommends adopting the pay-as-you-grow Any-PON approach for building a 10G PON network, ensuring network upgrades.

Any-PON uses different optical modules on a line card to connect different ONUs, enabling flexible on-demand deployment



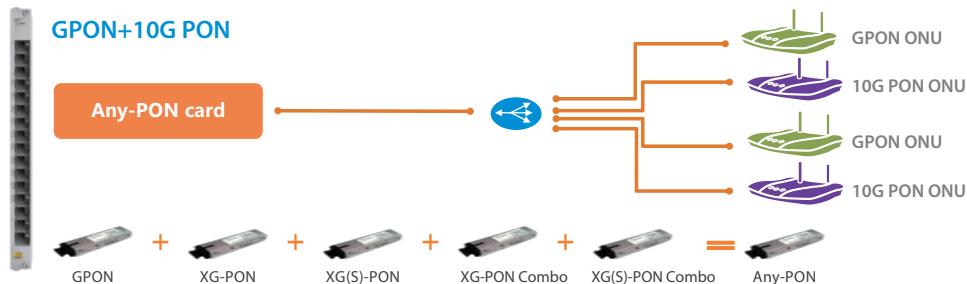


Fig. 1. Network architecture of the Any-PON solution.

of both GPON and 10G PON. An Any-PON line card supports hybrid insertion of five optical module types: GPON, XG-PON, XG(S)-PON, XG-PON Combo, and XG(S)-PON Combo (Fig. 1).

There are two flexible options for deploying a 10G PON network using Any-PON.

- If there is a need for 10G PON deployment in the early stage of network construction, the direct connection of 10G PON optical modules to 10G PON ONUs is an option. Alternatively, 10G PON Combo optical modules can be used to connect both existing GPON ONUs and newly deployed 10G PON ONUs. Combo PON optical modules support the coexistence of GPON and 10G PON ONUs within the same ODN.
- In the early stage of network construction, when there is no immediate need for 10G PON services or in cases of budget constraints, an initial deployment of GPON can be considered to save on initial investments. When the opportunity arises, the upgrade to 10G PON can be made by replacing optical modules and implementing the right to use (RTU) method.

Any-PON offers the advantage of building 10G PON-ready networks with smooth evolution capability. Existing OLT chassis and line cards remain unchanged, and the deployed ODN is not affected. Any-PON can be flexibly upgraded to 10G

PON to align with service development, cost reduction, and capital investment.

ZTE Leads the Way in 10G PON Deployment

As a member of ITU-T and FSAN, as well as a technical leader in the optical access field, ZTE has been firmly committed to advancing the maturity and widespread application of the 10G PON industry chain. Over the past five years, ZTE's global 10G PON shipments have experienced a remarkable 95% compound annual growth rate (CAGR). Specifically, in 2022, 10G PON shipments increased by 130% compared with 2021. ZTE has consistently held a Top 2 position in global 10G PON market share and secured the Top 1 spot in China for 2022. Additionally, ZTE has established partnerships with over 150 operators in the 10G PON sector.

The exceptional performance in these markets is a result of sustained technological investment and strong customer collaboration. ZTE's commitment to consolidating its core capabilities and driving continuous technical innovation is evident. This includes groundbreaking industry initiatives, such as introducing the Combo PON concept, leading the industry's first commercial deployment supporting 10G PON, and offering the first 16-port XG(S)-PON/Combo PON/Any-PON line cards. ZTE consistently delivers high-quality product solutions and services to its global customers. **ZTE TECHNOLOGIES**

ZXA10 C600E: Industry's First New-Generation Tbps-Level All-Optical Access Platform



Wang Xinsheng

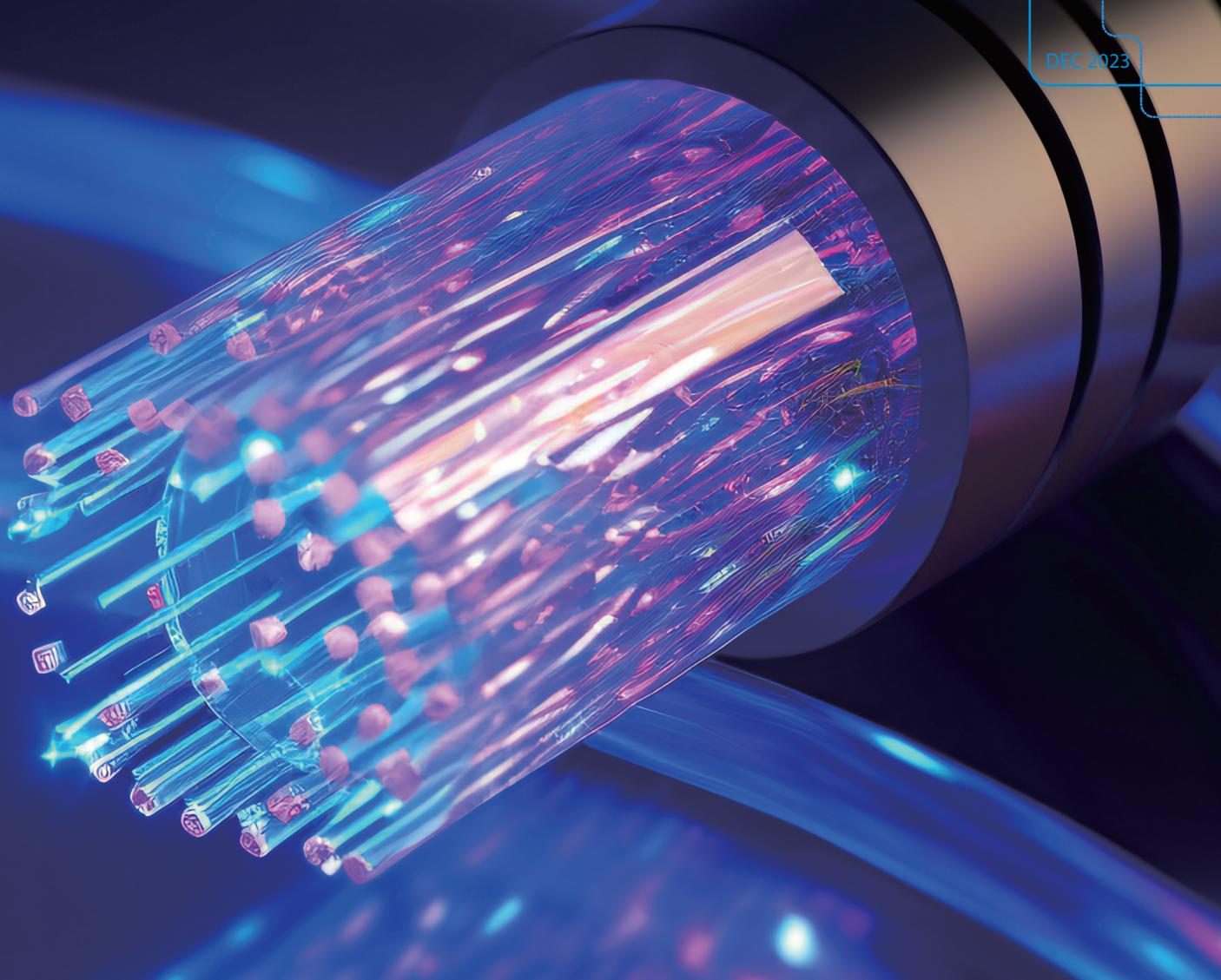
Chief Engineer of FM Product Planning, ZTE

In the post-pandemic era, broadband network development is gaining renewed momentum. Specifically, the development of broadband access has five characteristics:

- **Dominance of video services in broadband network traffic:** Video services have garnered favor among a vast user base through their flexible presentation, robust interactivity, and real-time accessibility. The widespread popularity of platforms such as Netflix, YouTube, and TikTok is further propelling the growth of video services. In addition, video is developing into fragmented and short-form content. According to reports from consulting firms, video services now account for over 50% of global broadband traffic, affirming the adage that "video is king."
- **Increased demand for symmetrical bandwidth:** The emergence of applications like remote work, interactive community, online education, online gaming, and live-streamed shopping has spurred a heightened demand for symmetrical bandwidth. This marks a departure from

the traditional traffic model, where downstream bandwidth far exceeded upstream bandwidth, and poses new requirements for enhancing end-to-end network bandwidth.

- **Accelerated digital transformation:** In the realm of home connectivity, there is a gradual shift away from aging twisted-pair and coaxial cable infrastructure towards fiber-optic solutions. While fiber to the home (FTTH) deployment is still in progress, fiber to the room (FTTR) has emerged as a new trend and a transition to an all-optical home network is becoming the prevailing direction. By the end of 2022, fiber to the anything (FTTx) users had accounted for more than 65% of fixed broadband (FBB) subscribers. In the realm of corporate campuses and



various industries, the adoption of passive optical network (PON) in place of traditional Ethernet has become an industry consensus. FTTx deployment is extending from home settings to corporate campuses, empowering a multitude of industries.

- **Low-cost evolution:** In the post-pandemic era, there is a growing emphasis among operators on cost control. This necessitates network equipment to possess extended deployment and adaptability capabilities, including backward compatibility and forward scalability, to prolong the in-service lifespan of the devices.
- **Finalized 50G PON standard:** With Recommendation G.9804.3 released in 2021 and G.9804.3 Amendment 1 issued in 2023, the 50G PON standard has been

finalized. 50G PON is expected to see a commercial deployment in 2025.

With a profound understanding of the development trends in FBB, ZTE launched the new-generation Tbps-level all-optical access platform, ZXAI0 C600E, at the Network X 2023 trade show. On one hand, this platform is compatible with the service cards of the massively deployed ZXAI0 C600 (Fig. 1), allowing for flexible card intermixing and smooth evolution during network upgrades and service deployments. On the other hand, its bandwidth capacity meets the requirements for large-scale deployment of 50G PON. The platform enables deterministic networking and provides open capabilities to gain enhanced adaptability. Moreover, it adopts energy-efficient technologies

to build a sustainable green network.

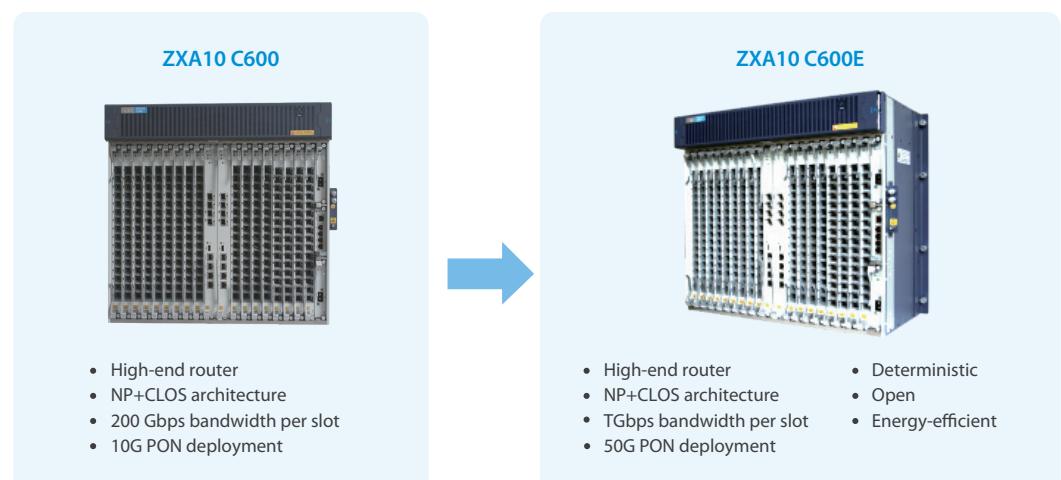
ZXA10 C600E has the following features:

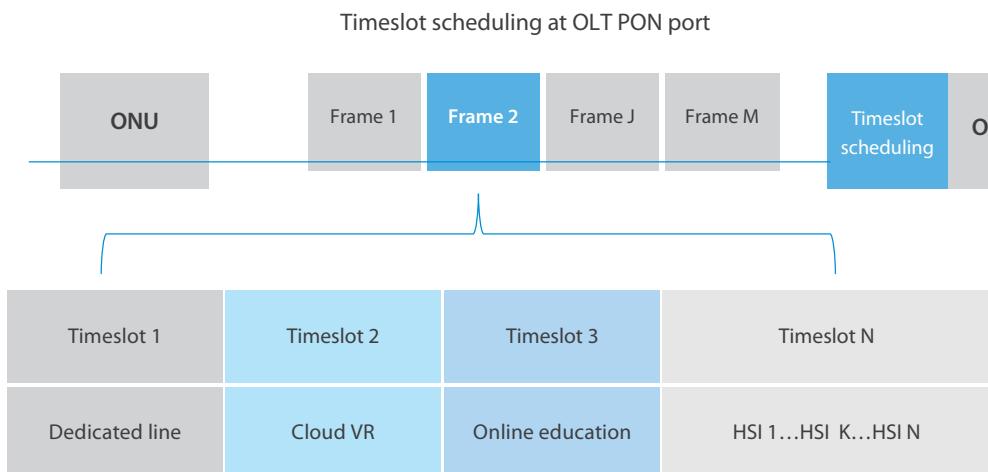
- **Compatibility with the service cards of ZXIA10 C600:** To ensure smooth network evolution and seamless platform switchover, ZXIA10 C600E is forward-compatible with service cards of ZXIA10 C600, including GPON, 10-Gigabit-capable symmetric passive optical network (XG (S)-PON), Any-PON, Combo PON, 50G PON Combo, point-to-point (PtP), and Ethernet uplink cards. This facilitates hybrid networking of ZXIA10 C600E and ZXIA10 C600, allowing for the intermixing of service cards. As a result, operators can minimize the expenses associated with network upgrades.
- **Tbps-level per-slot bandwidth capability to meet the requirements for large-scale 50G PON deployment:** Employing the Combo PON concept to implement the evolution from GPON to 10G PON and further to 50G PON is a cost-effective solution that requires minimal changes to the existing network. Tbps-level bandwidth meets the requirements for large-scale deployment of the 50G PON, 10G PON

and GPON Combo solution. GPON, 10G PON, and 50G PON optical network units (ONUs) can be connected on demand and coexist within the same optical distribution network (ODN), without the need to modify existing optical line terminals (OLTs) and ODN. 50G PON devices are highly compatible with the in-service ONUs, minimizing the cost of network upgrades.

- **Deterministic bandwidth and latency:** To meet the requirements for deterministic bandwidth, low latency, and low jitter in certain industrial scenarios and campus environments, ZXIA10 C600E employs hard pipes to guarantee the necessary bandwidth and low latency for services. For instance, through the use of single-frame multi-burst technology to trade bandwidth for time, the latency can be reduced by up to 75%. The hard pipe technology is employed to create hard slices for downstream PON traffic. By adopting a hard pipe scheme, the original scheme of statistical multiplexing for downstream PON traffic is optimized to ensure the performance. The dynamic bandwidth allocation (DBA) on the PON ports is

Fig. 1. Comparison ▶ between key features of ZXIA10 C600E and ZXIA10 C600.





◀ Fig. 2. Fixed time slot allocation mechanism.

based on time-slot scheduling and can achieve fixed slots, fixed bandwidth, and fixed latency (Fig. 2). This ensures that the end-to-end latency for traffic flowing through the PON system remains constant and deterministic. On the software side, the system can timestamp deterministic traffic at the entry. At the exit, in addition to the regular first in first out (FIFO) queues for QoS scheduling, a separate scheduling queue is in place for each deterministic traffic flow. According to the timestamp and fixed latency of a deterministic traffic flow recorded at the entry, priority scheduling is performed to ensure precise end-to-end latency control for packets as they traverse the PON system.

- **Openness:** ZXIA10 C600E uses an open network architecture and supports the standard NetConf/YANG protocols, enabling it to be managed by third-party element management systems (EMSSs) or software-defined networking (SDN) controllers and to be orchestrated by third-party orchestrators. It enables telemetry with performance statistics and analysis produced in seconds. With its built-in blade servers, ZXIA10 C600E supports

third-party applications, thereby creating an open and decoupled network architecture.

- **Energy efficiency:** ZXIA10 C600E employs four levels of energy-saving measures—at the equipment, service card, port, and chip levels—to construct a sustainable FTTx network. These measures involve supporting multiple generations of PONs in the same device, dynamic energy reduction for service cards and fans, and shutdown or idling of service cards and ports as needed. Future port traffic can also be adjusted based on network traffic predictions at PON ports to lower energy usage. These measures collectively reduce power consumption and carbon emissions of ZXIA10 C600E, contributing to the development of an eco-friendly FTTx network.

As a next-generation all-optical access platform, ZXIA10 C600E boasts enhanced functionalities and superior performance compared to ZXIA10 C600. Positioned to meet the future demands of optical access network deployment and technological evolution, ZXIA10 C600E is poised to become the primary optical access platform for the 50G PON era. **ZTE TECHNOLOGIES**

Light ODN: Building a Visual, Manageable, and Easy-to-Maintain ODN



Yang Yang

Fixed Network Product Planning Director, ZTE

As the deployment of fiber to the X (FTTx) network deployments continue to expand, the importance of the optical distribution network (ODN) as the "nerve endings of the optical network" connecting millions of households is becoming increasingly evident. Each year, a massive amount of optical fiber is deployed across the globe, resulting in significant amounts of dumb resources. Consequently, efficient network construction and management of dark fiber resources have become critical for operators in building a competitive optical network.

Operators need a centralized, standardized, and full-lifecycle system to perform fine-grained management of the dumb resources and dark pipes of the optical network. This system should serve as a real-time, accurate, and reliable intelligent management platform for network resources, and provide a scientific and rational basis for network planning.

The key requirements for the visual management of optical network resources are as follows:

- **Accurate data:** Data regarding optical network nodes, including site information, equipment information, network connections, equipment identifiers, and port occupation, should be accurately collected, transmitted,

and recorded.

- **Accurate routes:** Information about network routes, including routing topology information, information about same-pipe or same-cable routes, and route change information, should be accurately collected, transmitted, and recorded.
- **Accurate predictions:** Network resource usage and network performance trends should be accurately analyzed. Strategies for network topology optimization and network capacity expansion should be accurately predicted.

Light ODN Offers Visual Management of ODNs

ZTE's Light ODN solution can help customers quickly create visual, manageable, and easy-to-maintain ODN networks for various application scenarios. It reduces the complexity of ODN operation and maintenance while also improving resource utilization efficiency to decrease redundant investments.

Light ODN comprises the FEB series pre-connectorized devices, prefabricated cables, and an intelligent management platform. A mobile app is used to scan the QR codes on the pre-connectorized devices and the barcodes of the optical cables to collect their information. The

network management system (NMS), digitally presents the optical link topology of the entire network. This process enables real-time collection and synchronization of ODN resources and make the optical link topology visible and manageable, with resource accuracy reaching 100%.

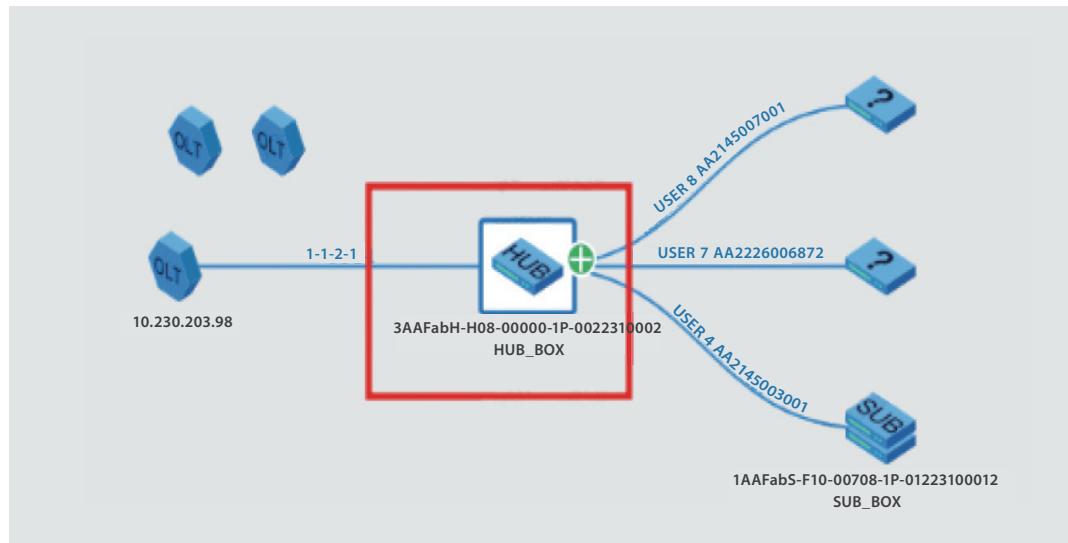
The visual management of the ODN encompasses the physical fiber network, the digital network, and intelligent management:

- **Physical fiber network:** Pre-connectorized boxes with QR codes and pre-connectorized optical cables with barcodes are used to build the physical optical network. The pre-connectorized connections outside the boxes and the point-to-point single-core connections of the cables make it easy to collect the optical link information.
- **Digital network:** The mobile app is used to scan and identify the connections of ODN materials such as boxes and optical cables based on image recognition technology. The results generated are transmitted in real time to the NMS, where they are electronically recorded and managed as the basic data of network topology. Based on the acquired

information, the NMS presents a digital network topology that perfectly matches the physical fiber network.

- **Intelligent management:** With the accurate data from the digital network, optical link resources can be visualized on the NMS. A geographic information system (GIS) is employed to display the resource information on a map, thereby providing visual guidance for O&M. Additionally, optical link resource usage is intelligently analyzed to inform resource optimization strategies that guide network O&M and expansion to save time and reduce OPEX.
- **Efficient O&M:** When users report faults, automatic testing and diagnosis of faults are initiated for the point to multi point (P2MP) network. Faults of the fiber lines, such as breaks, bends, and connector contamination, are identified and accurately located. Based on the test and diagnosis results, maintenance personnel can perform troubleshooting quickly and easily.

ZTE's Light ODN solution can clearly present the following resource data on the logical view page of the NMS (Fig. 1):



◀ Fig. 1. Logical topology on the NMS.

- Basic view of the ODN, which shows information such as device types, device serial numbers (SNs), device names, and split ratios.
- Routing topology of the deployed devices, which is produced using AI-based analysis.
- Status information, including device alarms and fiber break alarms, of the optical links of optical network units (ONUs). The information is displayed in both images and text.

Light ODN is able to diagnose ODN links (Fig. 2). When an ONU goes offline, the NMS initiates diagnosis of the ONU's link and records the range of the fiber break in the topology view. This makes it easy to discover and troubleshoot the fault.

Light ODN Implements Real-Time Fault Location and Visualizes Fiber Health Status for Efficient O&M

Light ODN achieves remote, real-time, and automatic monitoring of the quality of fibers across the entire optical network, covering optical access networks, optical mobile backhaul networks, optical metropolitan area networks, optical backbone networks, and optical data centers. The monitoring encompasses detecting changes in the transmission characteristics of fibers and predicting the trends of the changes. After a fault is discovered, the NMS promptly issues an alarm and quickly and accurately locates the fault to facilitate troubleshooting and reduce the workload of maintenance personnel. This function offers reliable assurances for the maintenance of the optical network. Key features of Light ODN in fiber monitoring include:

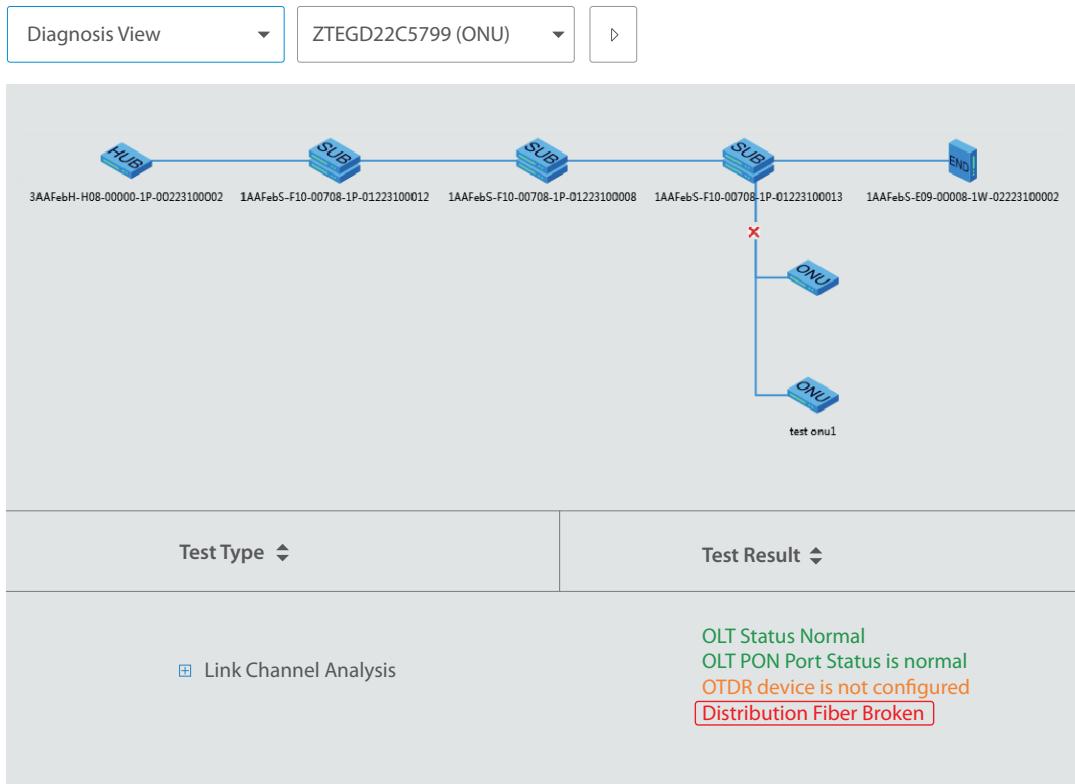
- **Centralized fiber monitoring system:** The fiber monitoring system can monitor a greater quantity and a wider variety of fiber resources. Monitored device resources

are shared to improve the utilization of the monitoring system.

- **Diverse detection methods:** To meet different scenarios and requirements, the monitoring system supports detection by different combinations of parameters like pulse width, dynamic range, resolution, and time.
- **Real-time fault monitoring:** Depending on the user's requirements, the monitoring system supports periodic or real-time fault monitoring using a polling mechanism. When a fault is detected in the optical network, the system promptly issues a fault alarm to speed up the O&M response.
- **Intelligent identification of fiber events:** Powerful algorithms are used to identify fiber events intelligently. The identification results are then compared against the fiber health database to accurately diagnose fiber events.
- **Visualized fault location:** Fault points detected by the monitoring system are displayed in real time on a GIS map, making it easy to quickly find the actual fault locations and troubleshoot the faults.
- **Extensive system interfaces:** The monitoring system supports functions such as northbound interfaces, southbound interfaces, and reports and statistics. It can seamlessly interconnect with the operation support system (OSS) to provide operators with more-intuitive monitoring results to facilitate O&M.

Light ODN Guarantees Sustainable Development of ODN Networks

The Light ODN solution is designed in light of the development trends and key requirements of optical network construction. It aims to enable the efficient and fast building of secure, reliable, and fully visible optical networks. Leveraging innovative AI technology, Light ODN



◀ Fig. 2. Link diagnosis results page.

renders ODN topology and links visible and manageable and makes resource statistics constantly accurate. On that basis, it constructs an intelligent, real-time, and accurate optical network monitoring system, thereby enhancing operational efficiencies and reducing operational costs.

In addition to enabling rapid network construction, Light ODN allows for the optimization of ODNs and the visualization of dumb resources. It advances the application of PON technology in enterprise, campus, and home scenarios like fiber to the room (FTTR). By combining the NMS of the ODN with the element management system (EMS) of the OLT, Light ODN creates an end-to-end fully visualized PON network that serves as an intelligent foundation of all-optical access.

On top of its existing features like pre-connectorization, image recognition, automatic data synchronization, and

network topology restoration, Light ODN will incorporate research results in areas such as fiber sensing and intelligent analysis and prediction. It will combine AI analysis and prediction applications, and integrate key technologies such as all-parameter perception of optical networks, automatic topology discovery, real-time link monitoring, fault location and delineation, and risk prediction and warning to help operators build digitalized, intelligent FTTx networks with integrated sensing and communication capabilities.

ZTE's Light ODN solution has been deployed in multiple countries including Peru and Indonesia. In addition to helping operators rapidly build ODNs, it also makes optical network topologies visible and optical network resources manageable, enhancing the utilization efficiency of optical infrastructure and achieving a win-win with the customers. **ZTE TECHNOLOGIES**

ZENIC ONE 2.0: Building an E2E FTTx O&M System



Zhu Zhenghua

Chief Engineer for Fixed Network Product Planning, ZTE

End-to-end (E2E) management and O&M of FTTx networks is the key to ensuring the smooth operation of the entire network system. This includes the whole processes from planning, construction and maintenance to optimization, enabling operators to implement precision marketing. Only a unified platform can improve O&M efficiency, optimize information systems, improve network quality, and further improve the service experience.

The O&M process involves many aspects, with fault processing being the most important. Statistics shows that home network faults account for 59%, access network faults account for 28%, and content source faults account for 13% of the total. During FTTx O&M, isolated systems face many challenges. Firstly, the faults are widely distributed across different segments, and only the E2E system can accurately locate the faults. Secondly, there are many types of faults, resulting in time-consuming processing. Implementing E2E comprehensive analysis, efficient compression, and correlation analysis can improve the efficiency. Finally, the alarm information is often scattered. Only a unified platform supporting information sharing can realize E2E system optimization, improve network quality and enhance the service experience.

To meet market demands, ZTE has developed the ZENIC ONE 2.0, an E2E management system based on a unified PaaS platform. This system integrates multiple

systems, including the CO-end management, control and analysis system ZENIC ONE, the CPE management cloud platform SCP, and the home broadband service perception analysis system CEM, to enable cross-domain interoperability. The function modules on the ZENIC ONE 2.0 can be combined or separated to implement on-demand flexible deployment.

The ZENIC ONE 2.0 E2E system (Fig. 1) not only manages OLTs, ODNs and home networks to implement E2E management at the network layer but also pays attention to user service experience and provides user experience management.

During the O&M process, the ZENIC ONE system provides corresponding functions in all four stages of maintenance, optimization, marketing and planning, aiding operators in achieving autonomous network. Below, the functions in the areas of maintenance, optimization, marketing, and planning are described in detail.

E2E Display for Enhanced Maintenance

- **E2E network topology display to enable manageable networks:** The ZENIC ONE system supports E2E network topology display of the access network, enabling visual management of the entire network. This includes visualization of user service, highlighting service quality and low QoE occurrence. It also includes visualization of the home network with clear display of

parameters and connection quality, and visualization of service links using different colors to indicate real-time service connection status. Additionally, it provides visualization of ODN where data is automatically uploaded after the QR scanning based on the pre-connectorized solution. The dumb fiber resources are displayed on the map with 100% accuracy to depict the entire network topology.

- E2E precise and fast fault location:** Real-time E2E fault diagnosis and accurate fault locating are crucial. The ZENIC ONE 2.0 system implements intelligent E2E fault diagnosis on all the paths. When a video is lagging or frozen, it first creates a network topology profile and identifies the topology lines level by level to determine the termination node of the fault. It then checks the device status and alarm information of the faulty topology node to quickly identify the cause of the user service fault and restores the fault according to the actual cause.

- E2E accurate discovery of low QoE users for timely improvement:** The ZENIC ONE 2.0 system actively identifies low QoE users, and pinpoints the root causes. It makes a comprehensive analysis of videos, web pages, games, emails, instant messages, and upload/download services, performs E2E diagnosis for low QoE users, and quickly identifies and locates the root causes. At present, the system achieves an

85% accuracy rate of identifying low QoE user and reduces the time for locating root causes to 10 minutes.

In the case of China Mobile Yili, the system helped the operator reduce the user complaint rate from 2.5% to 0.41%, improving the user satisfaction, and reduce the low QoE root cause locating time, improving the O&M efficiency.

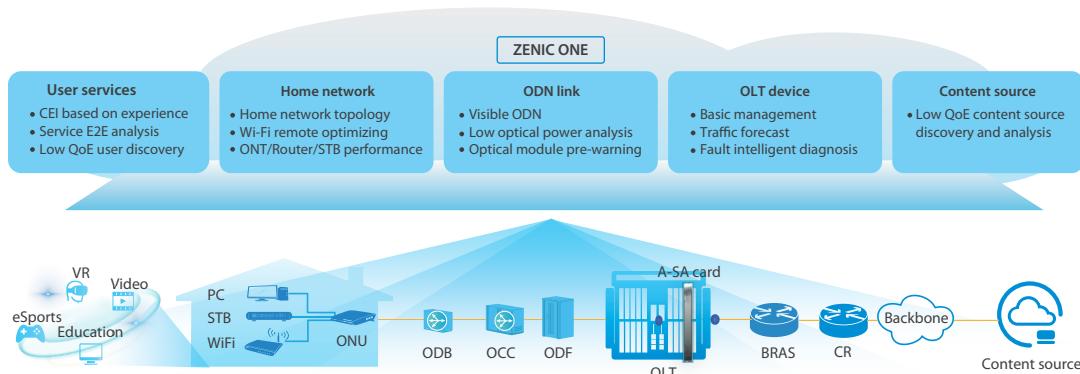
E2E Analysis for Faster Optimization

PON Optimization

For PON networks, the ZENIC ONE 2.0 system supports second-level data collection, ensuring a more accurate reflection of network details. The platform guides the uplink port expansion by analyzing the peak bandwidth on the uplink port and facilitates PON port upgrades by analyzing the traffic on the PON port. Furthermore, the system can identify high-value users to proactively recommend value-added service packages by analyzing the uplink port traffic of users.

Home Network Optimization

Optimizing the home network can directly and effectively improve user satisfaction. In densely populated areas, after the initial installation of a batch of devices, the system can perform periodic and continuous channel optimization to reduce Wi-Fi channel interference. Using the home channel tuning



◀ Fig. 1. ZTE's ZENIC ONE 2.0 end-to-end management system.

function, the platform collects and analyzes relevant information to continuously tune the channel, enabling users to enjoy an increasingly better Wi-Fi experience.

Content Source Optimization

The ZENIC ONE 2.0 system analyzes content sources, encompassing access users and access traffic, and presents the findings through graphs. It provides a detailed list of the service quality of each content source, enabling operators to gain a comprehensive understanding of the content source quality. A content source with a low score is identified as a low QoE content source. The system generates a list of low QoE content sources, accentuating the low QoE indicators, to aid operators in optimizing content sources.

Utilizing AI for Enhanced Precision Marketing

The ZENIC ONE 2.0 system introduces a new way of marketing — precision marketing. The customer experience management subsystem within the system collects and extracts data from the built-in blade server, enabling the generation of multi-dimensional configuration files. Meanwhile, these multi-dimensional user files can be integrated with other service data to form user profiles. This empowers operators to execute precision marketing based on home terminals, packages, and membership, preventing customer churn.

In fact, with the continuous optimization of the AI algorithm, operators can make comprehensive user analysis and recommend customized packages. This not only saves marketing costs but also significantly increases sales efficiency. For instance, home Wi-Fi can be recommended for users with poor network coverage, game acceleration services for online gamers, livestream acceleration services for Internet celebrities. In recent years, the ZENIC ONE 2.0 has helped China Unicom and China Mobile achieve

remarkable results in precision marketing and customer satisfaction improvement.

Traffic Analysis for More Efficient Planning

The ZENIC ONE 2.0 system provides expansion or service planning suggestions through analysis and calculation based on existing network resources and traffic. If the uplink or downlink peak bandwidth usage of the uplink port and PON port exceeds 70%, it suggests expanding the capacity of the OLT or PON port. It can identify the key areas for business development by analyzing the concurrent installation rate of ONTs and STBs, as well as plan key user development areas by analyzing the number of connected users.

The system can also analyze the average video service traffic of users in different areas to support the expansion of self-operated STB services, and plan the STB service development according to the concurrent installation rates of different terminals in specific areas.

Summary

The ZENIC ONE 2.0 E2E system not only covers the entire FTTx network, providing management and network analysis functions for OLTs, visual topology for dumb ODN resources, and remote tuning function for home networks, but also focuses on user experience and identifies low QoE users through E2E service analysis to prevent potential risks and actively improve user experience.

The system provides full support for operators during the whole process of "maintenance, optimization, marketing, and planning". It's a powerful tool for the operators' autonomous network development and can effectively promote their revenue growth. Having been fully verified and acknowledged by China Mobile, the ZENIC ONE 2.0 will help more operators worldwide to implement E2E management of FTTx networks. **ZTE TECHNOLOGIES**

Smart Cloud Platform:

Wi-Fi in Hands, Experience in Mind

Mesh Wi-Fi has now become the dominant choice for home users. Managing home network devices efficiently from a remote location and monitoring the quality of home Wi-Fi has emerged as a new challenge for operators. To address this, ZTE has launched the smart cloud platform (SCP), the industry's first integrated management platform. Designed to align with the development trends and management characteristics of customer premises equipment (CPE), SCP empowers operators to visualize and control home Wi-Fi networks, enhancing the quality of home Wi-Fi experience. Its rich functionalities offer substantial value to various departments within the operator, assisting the O&M department in enhancing operational efficiency, the marketing department in increasing revenue generation, and the provisioning department in improving installation efficiency.

Enabling Remote Home Network Management: Transitioning from "Black Box" to Visible and Manageable Operations

The ZTE SCP is the industry's first integrated platform that can manage mesh access points (APs), IP cameras (IPCs), and fiber to the room (FTTR) devices simultaneously. Based on ZTE's flexible and open-source TECS cloud foundation (TCF), SCP supports interactions with managed devices through protocols like

MQTT, WebSocket, TR-069, and TR-157 BDC. Combined with AI and big data analysis technologies, it enables remote visual configuration management of home networks. It provides real-time insights into the current and historical performance of home networks, transforming operational management from a "black box" into a visible and manageable system (Fig. 1).



Zhang Lin

SCP International
Marketing
Representative, ZTE

Opex Savings: Rapid Fault Handling with Abundant NBIs and Third-Party Device Management via Open SBIs

For the O&M department of the operator, SCP possesses leading capabilities in Wi-Fi network analysis and diagnosis and offers a wide range of northbound interfaces (NBIs) and southbound interfaces (SBIs). It allows engineers to quickly locate faults in home networks based on various factors, such as interference, coverage, connectivity, site, and device. It also supports solving some faults remotely with the click of a button.

- **Abundant NBIs for rapid fault handling:**

SCP provides a variety of NBIs to connect with operators' existing operation support systems (OSSs), enabling call center agents to handle faults online. When a user contacts the call center to report a fault, an agent can quickly follow the procedure described in the operation guide to locate and resolve the fault. This reduces the need for engineer visits and boosts user satisfaction.

- **Open SBIs for connecting with third-party**

devices: SCP offers open SBIs that are friendly to devices from third-party vendors, and also allows management of third-party devices through plugins. This enables devices from multiple vendors to be managed on a single platform, enhancing user experience and reducing operators' CAPEX and OPEX.

Leveraging Precision Marketing Reports and Service Identification and Acceleration Features for Profit and Revenue Growth

For the marketing department of the operator, SCP provides precision marketing reports as well as service identification and acceleration features, which can be packaged separately to generate profit and increase revenue.

- The precision marketing reports help marketing personnel discover high-value users that can be targeted for broadband package upgrades and mesh AP sales. SCP can conduct deep analysis, produce

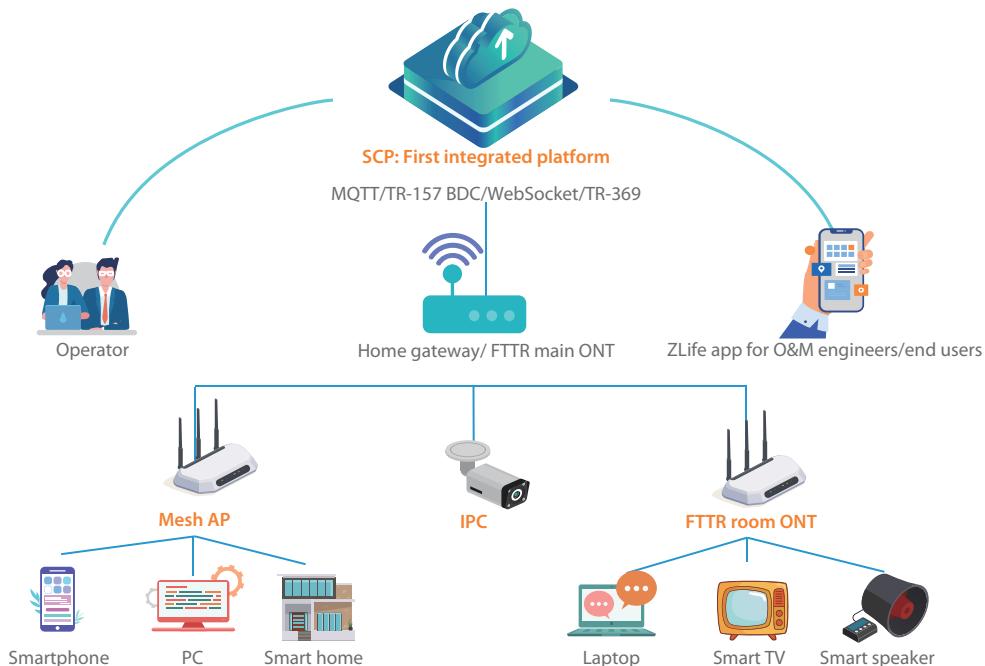
various reports, and give suggestions that help marketing personnel recommend bandwidth upgrade packages, mesh AP purchases, gaming acceleration bundles, and more.

- The service identification and acceleration features can be sold as separate packages to achieve profit and increase revenue. SCP provides flexible and fine-grained parental controls to intelligently identify and analyze age-inappropriate websites and apps accessed by children to ensure healthy Internet use for kids. Additionally, SCP can employ deep packet inspection (DPI) plugins and QoS policies to accelerate services, thereby boosting the sales of livestreaming, video, and gaming acceleration packages.

Enhancing Efficiency: ZLife User App for Self-Installation and ZLife Provisioning App for Intelligent Acceptance

For the provisioning department of the

Fig. 1. SCP makes home Wi-Fi network quality visible and manageable.





operator, SCP provides a user version of the ZLife app for end users and a provisioning version of the app for engineers. The user app supports functions like home network topology visualization, Wi-Fi configuration, parental controls, network optimization, and network speed testing to help users manage their home networks. The ZLife provisioning app supports overall topology visualization, segment-by-segment speed testing, intelligent acceptance, and one-click diagnosis to help provisioning engineers conduct intelligent installations.

- Engineers can connect the ZLife provisioning app to the work order system to implement intelligent acceptance tests, thus improving installation efficiency and reducing OPEX.
- End users can use the ZLife user app to install mesh APs by themselves, which greatly enhances the user experience because the procedure is simple and eliminates the need to wait for engineer visits.

Conclusion

The ZTE SCP is a unified, high-performance, and open intelligent management cloud platform that empowers operators to remotely and visually manage home Wi-Fi networks, enhancing O&M and installation efficiency while ensuring a perceptible and dependable user experience. It also boasts industry-leading capabilities in Wi-Fi network analysis and diagnosis and provides rich reporting functionalities to help operators carry out precision marketing and increase revenue and ARPU.

ZTE has over two decades of experience in and a deep understanding of the home networking field. Leveraging its extensive expertise in CPE products, ZTE has developed SCP to help operators manage home networks more effectively. Going forward, ZTE will continue to introduce innovative features to SCP to help operators enhance the competitiveness of their network services and expand their markets. **ZTE TECHNOLOGIES**

FTTR-B Opens New Horizons for Small and Micro Enterprises

**Zhao Jing**

FM Product Planning
Manager, ZTE

Fiber to the room (FTTR) all-optical networking is bringing a second fiber transformation revolution and is experiencing explosive growth in China. The FTTR technology gives operators the confidence to commit to bandwidth guarantees, the tool to fully utilize their installation and maintenance advantages, and the means to develop the small and micro enterprise (SME) market.

Traditionally, over 90% of SMEs build their own networks using equipment purchased from the open market. These networks lack unified standards for design, deployment, and operation and maintenance (O&M), leading to issues like severe bandwidth bottlenecks, poor Wi-Fi coverage, frequent network failures, and difficulties in localizing faults. As a result, they cannot meet the digital transformation needs of enterprises.

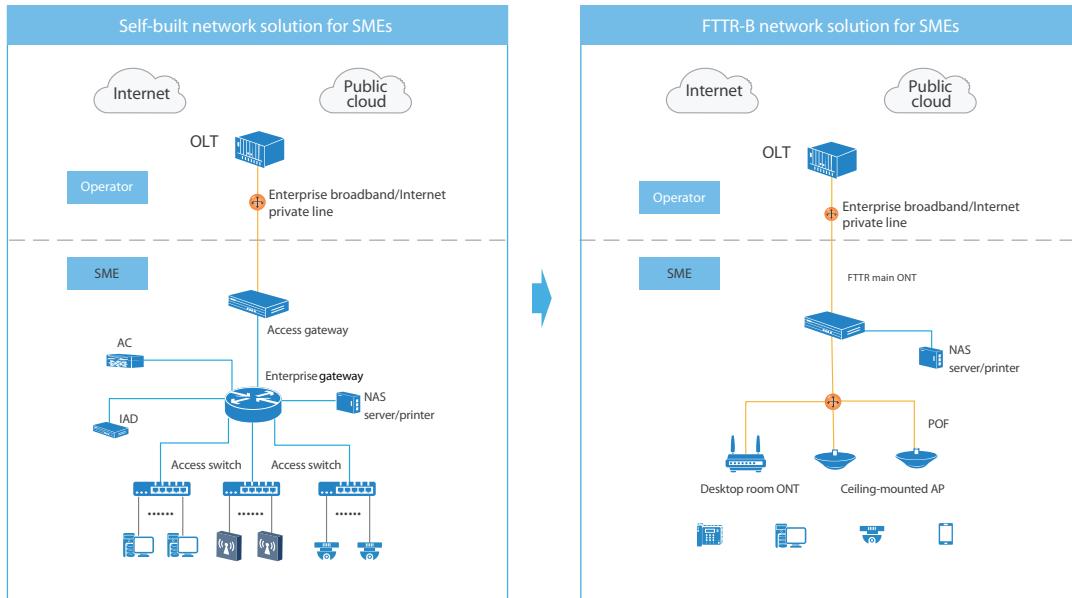
As fiber-to-the-enterprise installation inevitably transitions to fiber-in-the-enterprise deployment, ZTE has launched the FTTR to business (FTTR-B) solution to help SMEs build all-optical enterprise networks based on passive optical network (PON) technology. In the solution, the FTTR-B main optical network terminal (ONT) is the core device sitting at the entry to the enterprise network. The main ONT connects to the operator network through an uplink PON port and to several room ONTs via a downlink PON port to form an all-optical local area network (LAN). With its integration of the functions of an access gateway, a router, an access controller (AC), an integrated access device (IAD),

and a power over Ethernet (PoE) switch, the main ONT enables all-in-one simplified networking by replacing multiple devices essential to a traditional enterprise network.

In addition, the solution uses fiber as the transmission medium and replaces the traditional P2P copper-based connectivity network with a point to multi point (P2MP) fiber-based optical distribution network (ODN) within the enterprise network. The ODN features compact devices, robust environmental adaptability, resistance to electromagnetic and lightning interference, and no need for equipment maintenance. Compared with cable, fiber has a much longer lifespan of up to 30 years, is much cheaper, and therefore can significantly reduce the overall network construction cost. As shown in Fig. 1, the FTTR-B all-optical network solution can be used to replace the traditional self-built network approach of SMEs. By enabling the construction of an all-optical enterprise network characterized by superfast deployment, ultimate user experiences, and ultra-simplified O&M, the solution can help SMEs with their digital transformation.

FTTR-B Helps Operators Reap Value in Installation, Maintenance and Management Services and Develop Value-Added Services

FTTR-B enhances network connectivity for enterprises, thereby increasing network revenue. By transitioning from a single fiber



◀ Fig. 1. Evolution of network solutions for SMEs.

for enterprise broadband/Internet private lines to an FTTR-B all-optical enterprise network, connections are expanded from a single point to an entire network (Fig. 2). This improvement not only enhances customer stickiness, but also leads to a threefold increase in ARPU and an 80% reduction in network churn rate.

FTTR-B enhances the installation and maintenance service connection for enterprises, leading to increased revenue in the installation and maintenance service sector. The operator can provide maintenance for the FTTR-B enterprise network. This not only enhances customer retention but also allows the operator to increase revenue by offering value-added services. These services include basic maintenance services like speed tests, on-site engineer visits, and analysis reports, as well as advanced maintenance services such as quality analysis and network optimization.

FTTR-B enhances the telecom service connection for enterprises, increasing telecom service revenue. Through the combination of network and cloud service, it enables one-hop cloud access via VxLAN/IPsec. This enhancement facilitates the deployment of value-added services

such as video acceleration, office application acceleration, and acceleration for specified users/websites.

FTTR-B Builds an All-Optical Enterprise Network with Upgraded Access Bandwidth, User Experience, and O&M Capability

Superfast Deployment

The FTTR-B enterprise network features a simplified two-layer P2MP architecture, 32 concurrent connections, various installation methods, and flexible power supply.

- **One network to the user side:** Fiber replaces copper and extends to the user side, reducing the overall cabling workload.
- **One network for integrated service access:** One optical network provides both wired and Wi-Fi access to services including data, voice, and video.
- **One device with multiple functions:** The all-in-one FTTR main ONT integrates the functions of an access gateway, a router, an AC, an IAD, and a PoE switch, simplifying device provisioning and deployment.
- **One-network evolution:** The all-optical network can be smoothly upgraded to

10G PON and 50G PON without re-cabling, protecting the investments of SMEs.

The FTTR-B solution utilizes power over fiber (PoF) technology to address the challenge of powering networks within SMEs. PoF provides power over a photoelectric composite cable. While the traditional copper cable used in power over Ethernet (PoE) technology can deliver power only over a distance of less than 100 meters, the photoelectric composite cable can supply 15W of power within an 800-meter range. The photoelectric composite cable is easier to deploy and costs less than that of the Category 6 copper cable, making it the best option for an enterprise network. In scenarios requiring power supply over a long distance, the photoelectric composite cable can be used to facilitate the rapid deployment of the FTTR-B network.

Ultimate User Experience

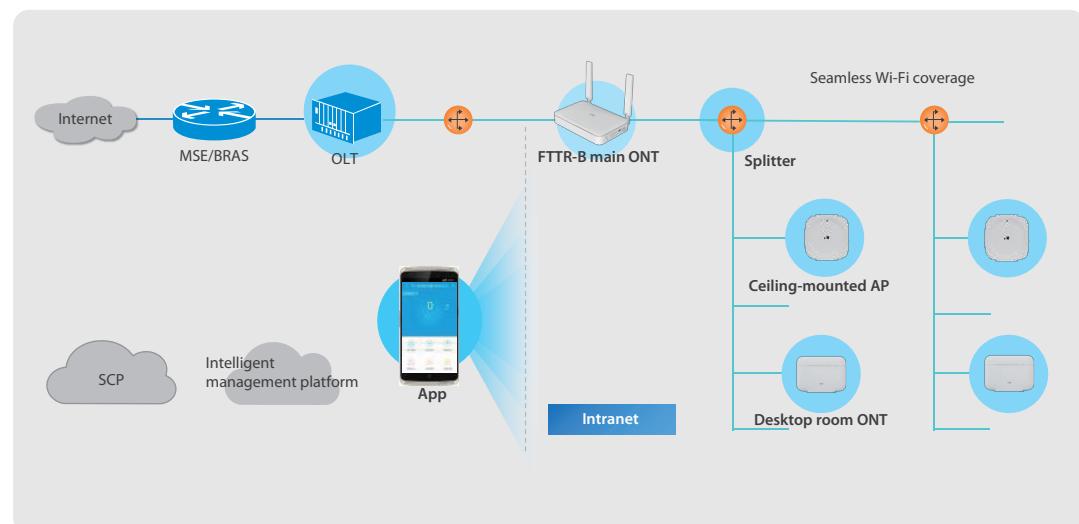
The FTTR-B network offers 2 Gbps bandwidth through both wired and wireless connections, delivers low latency, and enables flexible capacity expansion and unified authentication.

- The FTTR-B main ONT uses 10-Gigabit-capable symmetric passive

optical network (XGS-PON) technology in the uplink, which enables it to deliver bandwidth ranging from 1 Gbps to 10 Gbps to an SME. In the downlink, the ONT employs GPON technology to allow for gigabit-plus access experiences. The ONT is also equipped with a 2.5 Gigabit Ethernet (GE) port to ensure both wired and wireless speeds of over 2000 Mbps, meeting the requirements of various application scenarios such as wired network expansion and intranet server deployment of the enterprise.

- The ceiling-mounted all-optical Wi-Fi 6 AP deliver seamless gigabit Wi-Fi coverage without any dead zones in SMEs.
- The FTTR-B main ONT integrates access controller (AC) functionality to perform centralized control and management of all wireless APs in the network, including configuration delivery, parameter modification, intelligent radio frequency management, and access security control. Integrating the AC functionality into the ONT optimizes resources, enhances data forwarding efficiency, and unifies AP policies and AP management at the ONT to implement flexible network expansion.
- The FTTR-B network has a unified authentication point for both wired and wireless access. Switchover between wired

Fig. 2. FTTR-B solution for SMEs.



and wireless is imperceptible to users. Wireless roaming handover is superfast without being perceived by users. These features ensure smooth and uninterrupted services and enhance user experiences.

Ultra Simple O&M

The FTTR-B solution provides one-stop network O&M that covers planning, installation, acceptance, maintenance, and optimization, providing enterprise customers with confidence in the reliability of their networks.

SMEs usually have a limited budget for network O&M and lack a network management platform or dedicated O&M personnel. The FTTR-B solution uses a combination of the SCP and a mobile O&M app to simplify network O&M by making it lightweight and visual.

- The O&M app simplifies installation and maintenance, implements fast service provisioning, and standardizes network installation and acceptance. It offers one-click performance optimization and remote fault localization to reduce OPEX by 30%.
- The solution utilizes AI and big data technology to provide different bandwidths for VIP and regular users, accelerate enterprise applications, and intercept entertainment applications, thus ensuring an efficient enterprise network.
- The solution has unified user authentication policies to identify users and match them with services. It provides portal authentication, allowing both wired and wireless IPs to be identified as natural person users, with authentication policies stored in the cloud. When a user moves to another location, there is no need for re-authentication. This makes it easy for operators to provide targeted advertisements and personalized offerings, fostering connections among



operators, equipment vendors, and content service providers to create an industry ecosystem.

As a powerful tool for operators to expand the enterprise market, FTTR-B has huge potential. Statistics show that, by the end of 2022, there were over 52 million enterprises in China, with the FTTR-B market exceeding 2.5 billion yuan. In the Chinese market, tenders for over 160,000 sets of FTTR-B devices were completed in the first half of 2023, and this figure is projected to surpass 2 million by 2026. In international markets, SMEs including hotels, shopping malls, and campuses are experiencing a growing demand for broadband upgrades, and they increasingly need FTTR-B to transform their networks.

By deploying the FTTR-B solution, operators can expand their cloud customer base among SMEs, increase service revenue, and enhance customer stickiness. FTTR-B all-optical networking is poised to help operators tap the blue-ocean market of SMEs as a new avenue for growth. **ZTE TECHNOLOGIES**

50G PON: Evolution Direction Beyond 10G PON

**Liu Fangbin**

Fixed Network
Product Planning
Manager, ZTE

After the release of the XGS-PON standard in 2016, ITU-T embarked on research into next-generation PON technology. In 2018, ITU-T determined that 50G PON would be the technology development direction after 10G PON. In the second half of 2021, the first version of the 50G PON standard was officially released. 50G PON, with a bandwidth five times higher than 10G PON, provides a better service experience to meet future requirements, covers more scenarios, and supports a smooth migration from 10G PON to 50G PON.

50G PON Technology and Industry Chain are Maturing

According to ITU-T G.9804, 50G PON provides a bandwidth five times higher than 10G PON, and supports a downlink single-wavelength rate of 50 Gbps and flexible uplink rate options of 12.5 Gbps, 25 Gbps, and 50 Gbps. 50G PON maintains the P2MP topology, and provides a coverage distance of up to 20 km with a splitting ratio of up to 1: 256, catering to bandwidth access from 10 Gbps to 50 Gbps. In the 50G PON rate verification test carried out by German operator DNS:NET, 50G PON reached a downlink rate of 45.62 Gbps and an uplink rate of 21.87 Gbps.

50G PON uses single-fiber bidirectional transmission, employing broadcast mode in the downstream and TDMA in the upstream for point-to-multipoint

communication between OLTs and ONUs. Key technologies encompasses wavelength selection, line coding, line rate, FEC, common TC, and PHY layer components. ZTE is committed to improving 50G PON standards and industry chain maturity and has made significant breakthroughs in some key component technologies. The company has submitted over 75 50G PON standard proposals, with those on technologies including the physical layer parameters, low latency, and FEC already adopted by standard organizations.

With the rapid growth of video services and the digital transformation of enterprises/campuses, there are increasing requirements for network determinacy that covers deterministic bandwidth, latency, and jitter control to support multiple business scenarios. Deterministic 50G PON technology provides broadband scalability and is compatible with multiple access rates, enabling precise bandwidth control. Furthermore, it ensures high reliability by providing technical support for high-reliability service applications, including Ethernet uplink protection, Type B/C and hand-in-hand protection at the PON port level. By using the end-to-end low-latency rigid hard pipe technology, deterministic 50G PON can implement high-level service isolation, and construct rigid pipes with low latency and low jitter. Deterministic 50G PON also provides precise latency and jitter control capabilities to meet the requirements of industrial control scenarios that are

sensitive to latency and jitter.

To meet the requirements of deterministic campus networks, ZTE has introduced industry's first precise 50G PON technology at MWC 2022.

Currently, the 50G PON standards are almost complete and in the final preparation stage for commercial use. The focus of 50G PON has been shifted from standard formulation to commercial deployment. ZTE has carried out 50G PON demonstrations, tests, and pilots with more than 30 operators, continuously promoting cooperation and maturity of the industry chain in this field.

50G PON Covers Diverse Application Scenarios

As the next-generation optical fiber access technology, 50G PON is expected to be commercially available by 2025, starting with ToB scenarios and expanding to ToH scenarios.

50G PON offers uplink and downlink symmetric 50 Gbps bandwidth, meeting the high-bandwidth service requirements of enterprises and enabling symmetric 10G LAN applications. On the one hand, 50G PON+FTTR-B can meet the application requirements of small and medium-sized enterprises (SMEs), such as hotels, street stores, and cafes, ensuring a good user experience. On the other hand, 50G PON can implement 10G all-optical access for campuses and enterprises, meeting the deterministic requirements for latency and jitter in scenarios such as development zones, industrial parks, and factories.

In September 2022, China Mobile and ZTE successfully completed the 50G PON backhaul field trial with 5G small cells in its existing network, confirming that the 50G PON equipment, integrated with the latest optoelectronic devices, can precisely carry and guarantee high bandwidth and low latency services of 5G small

cells. In September 2023, China Telecom Guangdong and ZTE jointly launched China's first 10G-to-the-enterprise application with 50G PON technology at the Nanshan Science and Technology Park in Shenzhen.

For home networks, 50G PON+FTTR can provide ultra-high bandwidth, accommodating various services such as smart home, online education, online games, VR, and online live streaming. The high bandwidth, low latency, and low jitter features of 50G PON also support mobile backhaul and indoor coverage requirements.

ZTE will continue to work with operators to verify the technical feasibility and equipment maturity of 50G PON in different application scenarios while exploring more application scenarios.

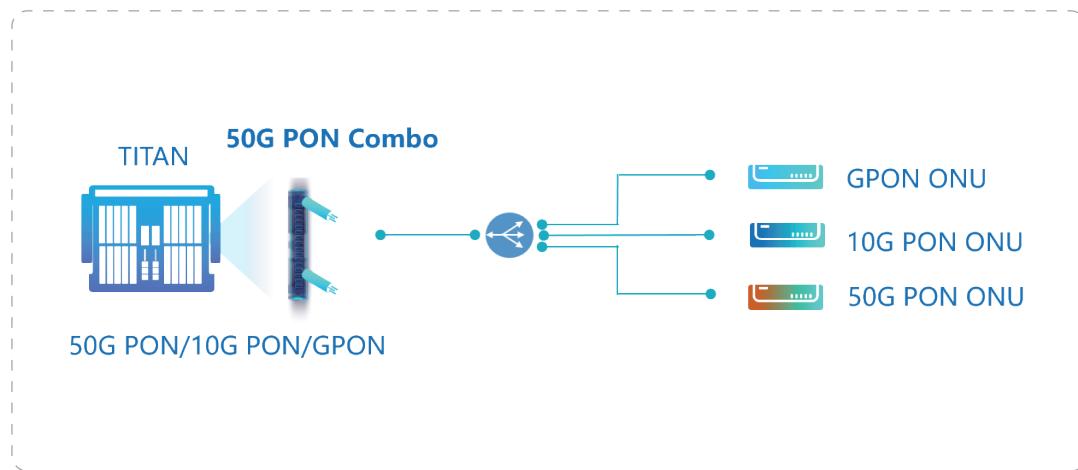
Smooth 50G PON Upgrade Protects Investment

In terms of network evolution, ZTE recommends the Combo PON concept for a smooth migration from existing PON to 50G PON. This concept enables GPON, XG(S)-PON, and 50G PON to coexist on a single platform and line card, tripling the equipment life cycle and saving network construction investments.

With the addition of a third uplink wavelength band (1284–1288 nm) to the 50G PON standard at the beginning of 2023, 50G PON does not need to reuse the existing GPON and XGS-PON wavelengths, laying the foundation for the coexistence of 50G PON, 10G PON, and GPON ONUs on the same network.

ZTE took the industry lead by releasing the 50G PON & 10G PON & GPON three-mode Combo PON solution (Fig. 1) at MWC 2023, and ZTE is also the first vendor to apply the Combo concept to the upgrade from 10G PON to 50G PON. This solution, featuring an independent

Fig. 1. ZTE Combo PON solution for smooth evolution to 50G PON.



wavelength stacking mechanism, supports GPON, 10G PON and 50G PON, shares the same ODN and platform, and solves the problems of high construction costs, large footprint, complex optical fiber cabling, and difficult operation and maintenance during the evolution from GPON to 10G PON and then to 50G PON. This solution helps operators quickly and flexibly provision high-bandwidth services, simplifies network construction, and saves deployment costs.

In the network upgrade process, the three-mode Combo PON solution does not need to adjust the ODN or change the existing OLT configurations and user service data during network upgrade, facilitating flexible deployment and smooth network evolution. Meanwhile, the solution integrates the 50G PON, 10G PON, GPON, and optical multiplexer functions into the same optical module without requiring extra equipment or additional equipment room space, which greatly saves the types of line cards and simplifies maintenance and management.

In addition, the solution uses the wavelength division mode, automatically matches the 50G PON channel, 10G PON channel, and GPON channel with different types of ONUs, and inherits the existing OSS provisioning process. The service provisioning flow remains unchanged

while both the service provisioning and the cutover get easy. The solution is applicable to a variety of scenarios, such as the broadband network upgrade and reconstruction, greenfield, and MSOs' optical fiber transformation. It is a highly applicable cost-effective solution that allows for continuous bandwidth upgrade and evolution of FTTx network.

Conclusion

As a technology leader in the optical access field, ZTE has achieved several significant milestones in the development of 50G PON technology. In 2022, ZTE launched the world's first precise 50G PON prototype at MWC 2022 and the world's first 50G PON+Wi-Fi 7 ONU prototype at the FTTH Conference. In 2023, ZTE introduced its three-mode Combo PON solution at MWC 2023 and its Tbit-level all-optical access platform, ZXAA10 C600E designed for the large-scale deployment of 50G PON networks at the Network X exhibition.

Leveraging its extensive experience in the development of FTTx and profound understanding of the future development direction of PON technologies, ZTE will continue to drive innovation in 50G PON technology, expand the 50G PON all-optical foundation, and accelerate the advancement of the 50G PON industry chain. **ZTE TECHNOLOGIES**

CEM: A Powerful Tool for Analyzing Low QoE in FTTx Networks

FTTx Network Development and User Experience

FTTx networks, based on the passive optical network (PON) technology, have been developing for more than 20 years. The global FTTx penetration rate had exceeded 65% by the end of 2022. FTTx broadband has become an essential part for modern households, providing technical infrastructure for various applications such as high-speed Internet (HSI), video streaming, online education, and online office.

As network technology evolves over time, the O&M of FTTx networks has gradually changed from the previous rough mode, focusing on key performance indicators (KPIs), to a refinement and experience-oriented approaches. User experience has becoming increasingly important. More than 64% of users consider user experience the most important factor when choosing a service provider, and 48% of users are willing to change providers for a better experience according to research. In addition, the COVID-19 has spurred a heightened demand for broadband user experience improvements, raising the bar for users' expectations of their broadband network providers.

FTTx provides users with fixed broadband services such as IPTV, video streaming, and Internet. The bandwidth and speed of FTTx networks used to be the major concerns of

users. However, with the upgrading of PON technologies and continuous bandwidth acceleration, the network speed is no longer a bottleneck that limits user experience. Users have gradually become less sensitive to bandwidth increases. Instead, the focus has shifted towards service-specific quality indicators, known as key quality indicators (KQIs), which include factors like delay, jitter, response success rate, response time, connection stability, and video smoothness. To monitor, quantify, analyze, and manage the user experience, customer experience management (CEM) systems have emerged.

CEM Solution Helps to Improve User Experience

To align with operators' shift from network performance-based O&M to user experience-based O&M, and to meet their needs for transitioning to big data operations, ZTE has launched the CEM solution for FTTx networks (Fig. 1). Positioned at the service quality and user experience layer, the CEM system can perceive the service experience of home broadband users, and provide accurate data support for analyzing low quality of experience (QoE) issues, delimiting and locating root cause, actively optimizing low QoE, and enhancing user satisfaction.

The CEM solution enables collaboration of the built-in blade in OLT with the big data analysis system to provide user



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experience-oriented O&M service support. A built-in blade board is inserted in PON OLT to minimize equipment room space, resolve power supply and consumption issues, and enhance the edge computing capability on OLT. The service traffic of broadband users is forwarded to the built-in blade board through the OLT. The built-in blade board identifies the specific service type of the user, extracts key service quality indicators, and calculates the segment delay to facilitate the delimitation of low QoE issues.

After identifying services and finishing the initial processing of basic indicators, the board uploads the processed data to the CEM big data analysis platform. The CEM platform makes comprehensive analysis and calculations based on the raw data and third-party system interconnection data. It gives quantitative presentation of user experience, performs low QoE identification, root cause delimitation, and generates AI user profiles. This helps operators improve user experience and implement precise marketing strategies.

CEM Enables Wider Broadband Service Identification

In the CEM solution, PON OLT needs

powerful computing capabilities to support the collection, analysis, and processing of service information. An OLT built-in blade board acts as a tool for collecting broadband service data. The new-generation OLT built-in blade board uses ZTE's self-developed CPU and network processor, occupying only one slot of PON OLT (Fig. 2). The system can identify six major categories of broadband services, including video, gaming, web browsing, email, upload/download, and instant messaging. For each service type, the system selects the KQIs that affect the service for data collection and analysis as the basis of user experience quantification. ZTE's CEM system can identify more than 18,000 service sources. A single built-in blade board can collect, analyze, and process service traffic from multiple OLTs, serving around 10,000 users. This built-in blade not only enhances the value-added service processing capabilities of OLTs, but also ensures low energy consumption and no additional space required in the equipment room, thereby reducing operational expenses (OPEX).

Clearer Insight into Low QoE Users

Quantifying user experience has been challenging due to its subjectivity and abstraction. ZTE's CEM solution addresses

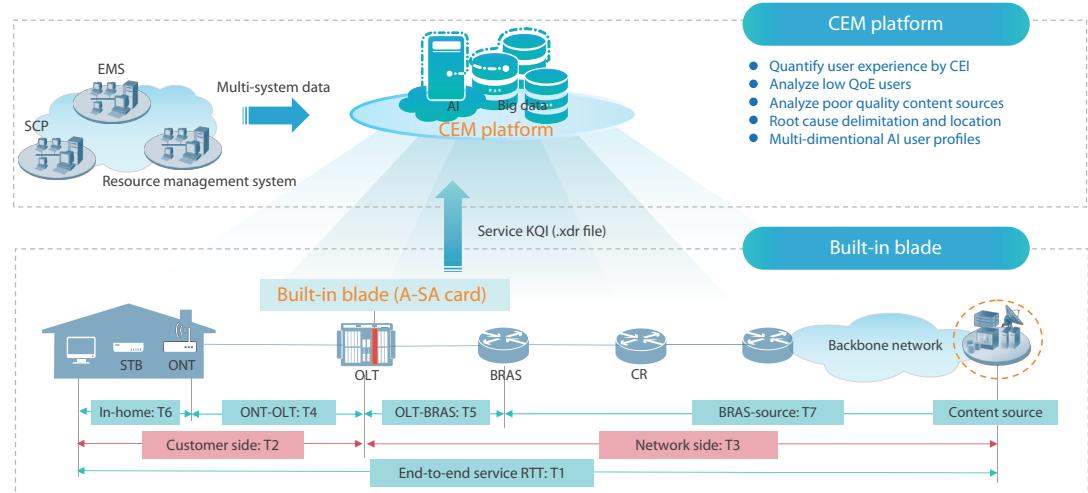


Fig. 1. Architecture of the CEM solution.



◀ Fig. 2. OLT built-in blade.

this issue by creating an intelligent user perception evaluation model that leverages a neural network algorithm based on transformer structure. It comprehensively considers data such as access network link status, home networking status, and service experience indicators. Additionally, it takes into account the temporal aspect of human experience memory by employing long short-term memory (LSTM) neural network training. This results in the generation of customer experience indicators (CEI) for quantifying user experience, providing a comprehensive reflection of user experience change trends, and actively identifying low QoE users. The system enables real-time monitoring of CEIs by areas, devices, ports, and users, and supports 7×24-hour KQI metrics and user access traceability, helping operators gain clear insights into user experience.

Faster Location of Low QoE Root Cause

ZTE's CEM solution uses OLT built-in blade boards to move the service protocol analysis tool closer to the user side. It calculates the segment service delay in the FTTx network to provide a low QoE delimitation capability. By analyzing the delays and packet losses in the segments of the "home network – ONU – OLT – BRAS – content source" path, it can more accurately identify issues between the

network segments and facilitate fault delimitation. The CEM system can interconnect with third-party systems, such as EMS, resource management system, and remote management system. It can precisely locate low QoE users and analyze the root causes based on system data, covering over 20 low QoE scenarios. According to China Mobile's existing network deployment experience, the adoption of ZTE's CEM solution enables China Mobile to shorten the time needed to locate the root causes of low QoE from over four hours per user to just 10 minutes, thus substantially improving its efficiency in identifying the root causes of low QoE.

As the growth rate of broadband user base slows down, operators need to explore new network operational methods. In the future, broadband operational strategies will gradually change from scale-based and bandwidth-focused operations to experience-centric management, which has become a widely accepted trend. Prioritizing user experience, delivering scenario-based SLA guarantees to a vast user base, creating deterministic broadband experiences, and securing additional premiums will be the objectives of operators. ZTE is willing to partner with operators worldwide in building high-quality experience-driven FTTx networks, assisting in their transformation. **ZTE TECHNOLOGIES**

New-Generation High-End Switch

ZXR10 C89E: Facilitating Digital Transformation of Enterprise Campus



Wen Ping

Wireline Product
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Digital transformation is accelerating across numerous industries, and there is a growing trend towards building robust data networks. The rapid adoption of cloud computing, big data, and Internet of things (IoT) is fueling an explosive growth in data traffic. The traditional traffic models are evolving in both operator networks and enterprise campuses. As southbound and northbound traffic steadily rises, eastbound and westbound traffic is also soaring as a major traffic mode. The existing 10GE network architecture is inadequate to accommodate these traffic changes, making 100GE and multi-100GE network convergence the mainstream choices.

Core/aggregation switches play an increasingly important role in the network. They are responsible for connecting a large number of access-layer devices, handling the convergence of northbound and southbound user traffic, and exchanging a great deal of eastbound and westbound traffic. This presents unprecedented challenges for device performance. Scalability, reliability, and security are also key indicators that users consider when evaluating aggregation-layer devices.

ZXR10 C89E is a flagship high-end core switch developed by ZTE for ultra-broadband networks. It can be widely used as a campus core, data center

(DC), or metropolitan area network (MAN) aggregation switch in scenarios such as telecommunications networks, campus networks, medical networks, government networks, energy networks, and financial networks. This switch is designed to build a 100GE-class ultra-high-bandwidth data network for customers.

The ZXR10 C89E series switch adopts a large-capacity, fully distributed modular design and offers high-density full-wirespeed solutions for GE, 10GE, and 100GE ports, catering to the demands of multi-layer link bandwidth. It delivers comprehensive support for perfect QoS, all-round security protection, and multi-service transport, enabling users to construct an efficient, intelligent, and reliable network. The series consists of three types of products: ZXR10 C89E-4, ZXR10 C89E-8, and ZXR10 C89E-12, each with varying capacity. For specific details, please refer to Table 1.

CLOS Architecture to Significantly Increase Forwarding Efficiency

ZXR10 C89E employs a CLOS architecture that incorporates in-house non-blocking switching chips, a distributed switching design, and multiple switching planes to maximize data forwarding efficiency. It utilizes a cell switching mechanism to split a data packet into multiple equal-length cells,

Table 1. Comparison of the ZXR10 C89E series switch.

	ZXR10 C89E-4	ZXR10 C89E-8	ZXR10 C89E-12
Number of service slots	4	8	12
Switching board	Two switching boards for dynamic redundancy backup	Four switching boards for dynamic redundancy backup	Four switching boards for dynamic redundancy backup
Main control board	Separation of main control and switching, 1:1 hot standby		
Service board	48/24 × GE electrical interface, 48/24 × GE optical interface, 48/24 × 10GE optical interface, 6 × 100GE optical interface		
Input power supply	DC, AC, and high-voltage DC; 2+2 redundancy	DC, AC, and high-voltage DC; 3+3 redundancy	DC, AC, and high-voltage DC; 3+3 redundancy

which are evenly forwarded on each switching plane to assure load balancing throughout the entire system.

All-Programmable Chips to Ensure Rapid Launch of New Services

ZXR10 C89E utilizes in-house NP chips to deliver powerful programmability. When protocol evolution and technology updates require changes in forwarding processes, customers can update software to support these changes without hardware replacement. This allows services to be launched quickly and flexibly, ultimately protecting customer investments.

Ultra-Large System Capacity with High-Density Ports to Offer High Scalability

ZXR10 C89E supports up to 48 wirespeed 10GE interfaces or six 100GE interfaces per slot, making it suitable for campus and data center, enabling continuous upgrades and capacity expansion. The entire system offers

a maximum of 576 GE/10GE optical ports and 72 100GE optical ports.

It employs a hardware architecture that separates main control from switching. The Mesh structure is adopted for connections between multiple switching planes and line cards, ensuring high performance and scalability for the system.

It also supports the VSC stacking technology, so that multiple switches can be stacked for high redundancy and scalability.

Building an Ultra-Stable Network Core

ZXR10 C89E features highly reliable architecture, high-reliability control, high-reliability system, comprehensive security protocols, and all-round reliability functions, helping to build an ultra-stable network core.

- **Highly reliable architecture:** ZXR10 C89E provides redundancy and hot-swappable support for critical system components such as control boards, switching boards, fan modules, and power modules. ZXR10



C89E-4



C89E-8



C89E-12

ZXR10 C89E series switch

C89E further enhances equipment stability by adopting a hardware separation design from control boards and switching boards.

- **High-reliability control:** This feature is achieved through complete isolation between control and forwarding planes, with a multi-core multi-process processing mechanism that ensures device management, route calculation and entry synchronization do not affect each other.
- **High-reliability system:** ZXR10 C89E boasts a fully distributed software system architecture, supporting intelligent, dynamic loading and updates at the process level, allowing flexible addition of new functions without interrupting service upgrades. It also supports distributed protocol processing to increase efficiency and stability.
- **Comprehensive security protocols:** ZXR10 C89E provides secure SSH login modes and user-level access control. It offers various protocol security protection methods, including ARP, STP, DHCP, and robust routing protocol encryption algorithms to ensure protocol security.
- **All-round reliability functions:** ZXR10 C89E provides a comprehensive set of reliability features including ERPS, FRR, GR, Ethernet OAM, MC-LAG, and other service protection functions. These functions can ensure network security.

Abundant IPv6 Functions to Facilitate Network Transformation

ZXR10 C89E supports basic IPv6 protocols such as RIPng, OSPFv3, IS-ISv6 and BGP4+, along with carrier-class IPv6 functions like DHCPv6 snooping and PIMv6. Furthermore, it boasts robust IPv6 forwarding and routing capabilities and supports dual-stack deployment for both IPv4 and IPv6. The system also provides comprehensive IPv6 management and maintenance, ensuring high security and reliability. Additionally, ZXR10 C89E supports IPv4 to IPv6 tunnel conversion to facilitate a smooth transition from IPv4 to IPv6.

Green, Energy-Efficient, and Eco-Friendly

ZXR10 C89E features a highly efficient power system, minimizing power conversion losses. Its advanced chip technology reduces component energy consumption, resulting in reduced operational power consumption. Dynamic speed-controlled fans support continuous speed adjustment. It is also compatible with a 240V/380V high-voltage direct current supply system, enhancing power efficiency of the equipment room. Complying with lead-free RoHS, WEEE, and ISO14001 standards, ZXR10 C89E utilizes eco-friendly packaging materials, aligning with the "Green Earth, Nature Care" philosophy.

Network Virtualization and SDN Free Mobility

ZXR10 C89E offers the functionality of VxLAN virtual network and SDN free mobility.

- **VxLAN virtual network:** ZXR10 C89E builds a VxLAN overlay virtual network on the basis of traditional L2 and L3 networks, achieving the decoupling of network identity from physical location. Through the use of the BGP-EVPN protocol, VxLAN tunnels can be automatically created, enabling the automatic provisioning of virtual networks.
- **SDN free mobility:** ZXR10 C89E provides user group-based identity authentication and automatic SDN controller policy delivery, enabling automatic provisioning of user services and eliminating the need for secondary authentication during user roaming.

The ZXR10 C89E series switch is a new generation of core switch developed by ZTE based on its self-developed architecture. It offers high capacity and high performance while fully ensuring the high reliability and availability of the system. It builds new-generation data networks and accelerates digital transformation for customers. **ZTE TECHNOLOGIES**



Link Net Achieves Fast End-to-End FTTH Deployment in Indonesia Using Light PON Solution

Accelerating FTTH Deployment

As the global fiberization process accelerates, FTTH has found widespread deployment worldwide for its excellent technical features such as ultra-high bandwidth, long-haul transmission, and energy efficiency, making it a critical access technology for fixed broadband networks. However, due to Indonesia's extensive island geography, the cost of FTTH construction remains high, resulting in a relatively low maturity in fixed broadband infrastructure with a penetration rate of only 17%. To improve national broadband accessibility and boost digital growth, the Indonesian Ministry of Communication has outlined strategic broadband network development goals for the 2020–2024 period. This plan aims to increase the country's fixed broadband penetration rate to 30%, necessitating the construction of approximately 28 million lines of FTTH networks. As a leader in Indonesia's fixed-line market, Link Net actively responds

to the national strategy and has launched large-scale FTTH deployments in regions like Java, Sumatra, Sulawesi, and Kalimantan according to its own growth plans.

New Challenges

Link Net, the second largest fixed-line operator in Indonesia, has a fixed broadband network with more than 3 million homes passed, among which 2.4 million belong to the hybrid fiber-coaxial (HFC) network. During the network upgrade and transformation process, Link Net has two options to consider: one is to upgrade the existing HFC network using the Docsis technology, and the other is to build an FTTH network using the PON technology. After a thorough assessment, Link Net prefers PON that utilizes a passive optical fiber network over Docsis that involves active access, as PON has substantial cost savings in O&M. Moreover, considering the limited global applications and unclear future evolution path of the Docsis technology, Link Net has made a firm decision to use the



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PON technology for the construction of its fixed broadband network.

Throughout this process, Link Net has consistently selected ZTE as its partner to build FTTH networks and explore PON applications. After in-depth analysis of the fixed-line market in Indonesia, Link Net took the lead in commercializing the Any PON solution in 2021, which enables its network to support GPON access while satisfying the uplink/downlink symmetric 10G PON bandwidth needs of government and enterprise users, as well as the smooth evolution to 10G PON for home users in the future. As the scale of FTTH construction continues to expand, Link Net not only considers optimal solutions for active equipment but also places increasing emphasis on cost savings within the ODN segment. Traditional FTTH construction modes come with the following challenges:

- **High costs of building a new equipment room:** Traditional PON construction involves building a new equipment access room for optical line terminal (OLT), which has a large footprint, leading to high costs for site construction and right-of-way permits.
- **Long debugging time:** Each OLT requires technical engineers to perform on-site service configuration, with a debugging and commissioning time of more than one day.
- **Much fiber fusion splicing:** Traditional ADSS optical cables require core-by-core fiber fusion using a dedicated fusion splicer. Link Net needs skilled fusion splicing technicians to perform these operations. Moreover, due to the large number of fiber cores in ADSS cables, their installation is both time-consuming and labor-intensive.
- **Difficult optical network O&M:** In the FTTH network O&M phase, Link Net finds that as ODN devices are replaced and some FTTH users disconnect, a growing number of ODN ports fail to be identified in terms of their availability. Additionally, managing the ODN port connections results in substantial O&M costs.
- **Difficulties in planning for discrete regions:** On the one hand, due to construction permits and user intentions, some existing HFC

network areas that cover tens of thousands of users have to be divided into several discrete sub-regions for phased FTTH network upgrades. On the other hand, with the increasing prevalence of FTTH construction, scenarios involving distributed deployments in rural, suburban, and island areas are on the rise. Continuing to employ traditional ODN centralized deployment approaches will inevitably reduce the utilization of OLT ports and the ODN network, which hinders the protection of investments.

Light PON Solution for Fast End-to-End FTTH Deployment

To address these challenges, Link Net made an extensive technical analysis and a business case study, and worked with ZTE to explore tailored solutions that cater to Link Net's needs—the Light PON solution. This innovative modular network construction solution composes lightweight OLT, Light ODN, and cloud network management Zenic One. It can address the range of challenges that Link Net encounters when using traditional solutions, enabling Link Net to expedite FTTH deployment at a lower cost.

- **Zero equipment room construction:** Using the small-capacity OLT product C610, there is no need to build an equipment room. It can be installed on existing steel poles, effectively reducing the difficulty and cost associated with obtaining right-of-way permissions.
- **Zero-configuration commissioning:** Customized OLT zero-configuration commissioning technology enables personnel to commission the equipment without the need to visit the site. Based on calculations, for every 500 OLT installations, Link Net can save 120 person-days of work, resulting in a 99% increase in installation efficiency.
- **Zero on-site fusion splicing:** By introducing pre-connectorized optical cables with connectors pre-installed in the factory, there is no need for on-site fusion splicing by the construction personnel. These pre-connectorized optical cables support



lengths ranging from 50 meters to 1000 meters, allowing for flexible adaptation to the existing network infrastructure. Moreover, the pre-connectorized optical cables are lightweight with fewer fiber cores, enabling installation by just two on-site personnel. This has led to a reduction of approximately 40% in the construction timeline of Link Net's FTTH network.

- **Visible and manageable optical network:** The Light up ODN functional module is added to the ODN device, where each Light ODN device has a unique QR code or pre-connectorized cable barcode. With the customized Light up app on a mobile phone, the user can easily scan and record the serial number and port information. At the same time, using AI cameras to identify ODN port usage and automatically upload the data to the network management platform. The platform, which integrates a GIS system, displays the ODN topology, significantly reducing the workload for the Link Net O&M team. This achieves a visual and manageable ODN network, leading to a reduction of approximately 30% in O&M costs for Link Net, with an operational cost reduction of \$0.20 per ODN port per year.
- **Precise deployment for investment protection:** The deployment ratio of distributed sites, especially in base station areas, rural suburbs, and phased HFV transformation areas, can be increased. Link Net selects the deployment of small-capacity Light PON solutions to

ensure precise network deployment, accurate user coverage, and ultimately safeguard investments.

Promoting Large-Scale FTTH Development to Create Digital Future in Indonesia

At present, Link Net has built a FTTH network with over 3 million home passed, covering 27 cities across the country. The construction of all-optical broadband infrastructure has also provided Link Net with a higher competitive edge in the market, facilitating the growth of new services. By employing leading and innovative high-end products on a long term, Link Net has achieved a high ARPU of over IDR340,000 and a fixed broadband package bundling rate of more than 95%. By the end of 2022, its enterprise business revenue had grown by 16.4% year-over-year. In the future, it aims to become an infrastructure provider with the goal of 8 million FTTH home passed in the next five years, offering all-optical access network services to more enterprise and home users. After the FTTH network is delivered quickly on a large scale, Link Net will offer faster and more stable fixed broadband network connections for Indonesian fixed-line users, along with a wider range of innovative digital services, ensuring that every household can fully enjoy the convenience and opportunities of the digital era. **ZTE TECHNOLOGIES**

ZTE's Hu Junjie: All-Optical Foundation Inspires New Experience in Digital Era

Source: Mobile World Live

Hu Junjie, Vice President and General Manager of Wireline Marketing at ZTE, has delivered a keynote speech titled "All-Optical Foundation Inspires New Experience in Digital Era" at Network X, an event held by Informa in Paris, France. During his presentation, Mr. Hu shared ZTE's insights and practices in the development, deployment and evolution of optical networks.

Mr. Hu believes that the global fiberization process is accelerating in the new era. The average FTTx penetration rate worldwide is expected to increase from 69.9% in 2022 to 80.2% in 2027, with projections nearing 90% in regions such as Asia, Eastern Europe, North America, and Latin America. However, global digital development remains imbalanced. Statistics reveal that 34% of the global population lacks Internet connectivity, with even higher proportions in specific countries and regions. Developed countries boast an 80% connectivity rate compared to 36% in developing countries. Urban areas achieve 82% connectivity, while rural regions lag at 45%. Furthermore, there's a substantial gap between high-income and low-income areas, with rates of 92% and 26%, respectively.

In this critical period of global digital transformation, leveraging the role of fiber infrastructures becomes even more essential. Ubiquitous fiber access is key to establishing fair access and bridging the digital divide in various regions of the world. In fact, numerous

countries worldwide have implemented national strategies for fiber development. Examples include the Net Pracharat project in Thailand, the Decent Life initiative in Egypt, and Italy's Piano Italia a 1 Giga project. These initiatives aim to enhance Internet access, education, healthcare, employment opportunities, and digitalization in rural areas of their respective countries.

On the other hand, fiber development continues to expand and deepen, further reducing the experience gap among different household members, including seniors and children, and fostering the creation of a digital home. For instance, to address the security needs of seniors and children, Chinese operators employ the FTTR all-optical home network architecture, integrating smart speakers, AI cameras, visual door locks, and doorbells to provide comprehensive security solutions for smart homes, ensuring multiple layers of security.

As the global aging process accelerates, the focus on elderly care and senior-friendly technologies has intensified. In Fujian Province, China, a demonstration community-based



smart home for senior care has been established. This innovative project leverages FTTR home all-optical networking, along with the integration of smart speakers and healthcare devices. The smart speakers play a multifaceted role by offering health detection, medical care support, and companionship, making senior care both smart and compassionate.

Over the past three decades, optical networks have played an indispensable role in the continuous evolution of bandwidth capabilities, ranging from 56k to 10G, and the rapid development of applications, transitioning from traditional web browsing to intelligent applications. WDM networks have progressed from single-wavelength 2.5G at the end of the twentieth century to the current single-wavelength 400G/800G era. WDM networks have been originally applied only for backbone, while by now they have been expanded to all scenarios of ULH backbone, core metro, DCI, 5-in-1 access as well as SDH replacement. The access network is undergoing a transformation, shifting from G/EPON to XGS-PON and 50G PON, establishing a robust optical foundation for the advancement of the digital economy.

As the cornerstone of the digital economy, ZTE has been committed to innovating its foundational capabilities. Through continuous iterations of architectures, algorithms, and processes, ZTE has been expanding the scope of service scenarios and service objects of optical networks, collaborating with operators, enterprises and consumers to build an environmentally friendly and low-consumption industrial ecosystem. Taking OTN as an example, the 800G pluggable transceiver module with higher integration reduces power consumption per Gbit by 68%, effectively assisting customers in building high-performance next-generation optical networks.

Moving forward, ZTE is eager to collaborate with global partners to expand network coverage through end-to-end all-optical networks and accomplish comprehensive digital transformation, ensuring equitable access. Leveraging ultimate network capabilities, ZTE aims to bridge experience gaps and boundaries, enabling a broader range of scenario experiences. Together with global partners, ZTE strives to create a ubiquitous, ultimate, green, and efficient all-optical era. **ZTE TECHNOLOGIES**

To enable connectivity and trust everywhere