



## Expert Views

10G PON Deployment  
and Evolution

## Special Topic

# Accelerating Global Fiber Transformation



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## ZTE TECHNOLOGIES

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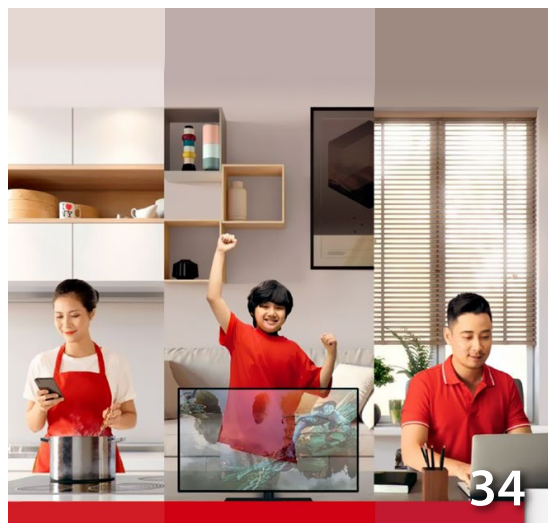
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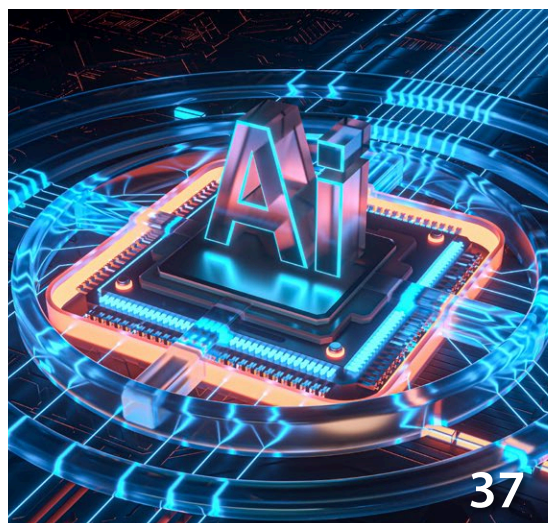
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## ZTE Powers DITO Super Core Data Center in Philippines

19 September 2022, Shenzhen, China — ZTE announced that it has helped DITO Telecommunity, one of the major telecommunications corporations in the Philippines, launch the DITO Super Core Data Center in Batangas, Philippines.

The data center complies with the Uptime Tier III design standard and will become the first one in the Philippines to pass such standard certification. The DITO Super Core Data Center is designed to further improve local digital infrastructure and enhance data services.

The design of the data center focuses on the security of network transmission through resiliency against natural disasters such as typhoons and earthquakes. Also, the facilities pay more attention to the growing concern of the telecommunications industry on energy efficiency and environmental protection in its design and operations.



## ZTE Secures “Telecom Vendor of the Year” Award

7 September 2022, Shenzhen, China — ZTE has been awarded the “Telecom Vendor of the Year” Award, in recognition of ZTE’s great contribution to the telecommunications industry in the Philippines.

Mr. Jin Zhichao, Director of ZTE Philippines P3 Program, has obtained

the “Men & Women Who Matters” Award.

Starting from the construction in 2019 for DITO Telecommunity in the Philippines, ZTE Philippines, with its innovative AMB management methodology, has been assisting DITO Telecommunity in passing the NTC Technical Audit and delivering large-scale commercial networks.

## China Mobile Research Institute, ZTE Accomplish Industry’s First Prototype Verification of Dynamic RIS Technology



9 September 2022, Shenzhen, China — ZTE, in collaboration with China Mobile Research Institute, has jointly completed the prototype verification of the industry’s first 5G base station and dynamic Reconfigurable Intelligent metaSurface (RIS) collaborative beamforming technology.

The verification result shows that, compared with static RIS that can only improve fixed-point coverage, base station and dynamic RIS collaborative

beamforming technology can not only greatly increase the coverage capability of base stations, but also support users’ seamless connectivity even during movement.

In 2021, both parties accomplished prototype verification of the first phase of the RIS technology, and initially explored its feasibility to improve fixed-point coverage in 5G blind spots and weak areas. In 2022, China Mobile Research Institute and ZTE continued to explore the RIS technology, and jointly accomplished the research and development of the dynamic RIS prototype with the collaborative beamforming capability, and accomplished the industry’s first technical verification in the laboratory and field environment respectively.



## China Mobile, ZTE Offer 5G CampSite to Help Mango TV Launch “Guangmang” Wireless Video Production and Broadcasting Platform

7 September 2022, Shenzhen, China — ZTE, together with the Hunan Branch of China Mobile, has helped Mango TV, a Chinese media company, launch the Guangmang 5G Dense Audio and Video Transmission System at the 2022 China New Media Technology Exhibition in Changsha, Hunan province.

The “Guangmang” system, jointly developed by the Hunan Branch of China Mobile and ZTE, is a wireless, high-capacity, and low-latency video production and broadcasting platform

based on the portable 5G private network. The portable 5G private network meets on-site 5G signal coverage requirements by 5G CampSite, a kind of portable 5G base station with integrated cloud, network and service capabilities. The cameras on the site are connected with the portable 5G private network through an externally mounted 5G low-latency encoder, and the captured audios & videos are directly forwarded to the local live production system by the edge computing engine in the 5G CampSite.

## China Unicom, ZTE Accomplish Industry's First Trial of Integrated Sensing, Computation, Control and Communication on Single AAU

9 September 2022, Shenzhen, China — ZTE, in collaboration with China Unicom, has accomplished the industry's first trial of integrated sensing, computation, control and communication on a drone at a low altitude in Shanghai.

This trial, aiming at the low-altitude security of parks, used a single AAU to send and receive communication and sensing signals, so as to implement real-time sensing, monitoring, communication, and control of low-altitude drones. The test result showed that the performance was stable during the communication and sensing process, while the sensing



precision of low-altitude drones reached the sub-meter level and the detection distance exceeded 1 km. In addition, this trial result reflects the technological leadership of China Unicom and ZTE in the integrated sensing, computation, control and communication, and also provides technical support for the follow-up implementation.

## China Mobile, ZTE Complete Industry's First Commercial Verification of Intent-Driven Hierarchical Service Assurance Based on Radio Composer

9 September 2022, Shenzhen, China — ZTE, together with China Mobile, has successfully completed the commercial verification of intent-driven hierarchical service assurance solution based on radio composer in Quanzhou city, Fujian province, realizing “1-minute intent issuance, millisecond-level user experience guarantee, and 3-minute result feedback” as an end-to-end process.

The verification marks a milestone breakthrough as it has turned the intent-driven network concept into commercial deployment for the first time in the industry.

## ZTE and Amlogic Launch Smart 8K STB at IBC 2022

9 September 2022, Shenzhen, China — ZTE, together with Amlogic, has launched ZTE 8K STB (set-top box) at the International Broadcasting Convention (IBC 2022) in Amsterdam, Netherlands.

The 8K STB, connected to a big screen, can present immersive 4K UI and enhance ultra HD video quality, thereby providing audience with an ultimate audiovisual experience. Moreover, with the AI/XR technology, it can showcase an immersive online tour.

# 10G PON Deployment and Evolution

Wang Xinsheng, Chief Engineer of FM Product Planning, ZTE

## Great Success of FTTx Applications Represented by PON in the Past Decade

**T**he last ten years saw fiber to the x (FTTx) technology, whose most typical application is passive optical network (PON), become enormously successful in fixed broadband access scenarios. A recent report from the research firm Omdia showed that compared with 10 years ago, global FTTx users had increased 10-fold to more than 830 million by the end of 2021, accounting for 62.86% of all the fixed broadband (FBB) users worldwide. Omdia data also indicated that gigabit passive optical network (GPON) shipments had reached 60 million OLT ports by Q1 2022, making GPON a common choice for operators building access networks because it enables operators to deliver 100 Mbps speeds on a mass scale.

## The Era of 10G PON Has Arrived

The development of PON applications and technologies is pushing bandwidth demand to gigabit speeds. As its standard and industry chain mature, 10G PON has emerged as the

best technology choice for operators deploying gigabit networks to meet the requirements of a new broadband era.

## Societal Requirements

Research shows a doubling of network bandwidth can lead to 0.3% growth in gross domestic product (GDP). Considering the important role of network modernization in promoting economic development, many countries have launched their national broadband initiatives in recent years. Having previously built the world's largest fiber to the home (FTTH) network, China launched a dual-gigabit plan in 2018 to provide gigabit broadband through both 5G and fixed networks. It plans to build 100 gigabit cities and sign up to 30 million gigabit users by 2023. In South Korea, gigabit services were activated as early as 2014. By 2018, gigabit users already accounted for half of the user base of some operators in South Korea. The European Union's gigabit initiative calls for gigabit access to be made widely available in places like schools, enterprises and public institutions by 2025. Based on the EU

“As its standard and industry chain mature, 10G PON has emerged as the best technology choice for operators deploying gigabit networks to meet the requirements of a new broadband era.”

Wang Xinsheng



initiative, some European countries have launched their own gigabit plans.

#### Service Requirements

The explosive growth of Internet applications in recent years has led to users' increasingly higher requirements for service awareness and experience. At the same time, the emergence of bandwidth-intensive services like high-speed Internet access, cloud computing, the Internet of things (IoT), high-definition (HD) video, and HD monitoring also demands higher bandwidth.

Big video services represented by 4K, 8K, virtual reality (VR) and augmented reality (AR) currently account for the vast majority of ultra-broadband applications. Broadcasts of the PyeongChang 2018 Winter Olympics, Tokyo 2020 Summer Olympics and Beijing 2022 Winter Olympics already began to use 8K technology. According to a report from the Broadband Development Alliance, VR service requires at least the bandwidth of 100–300 Mbps, while 8K VR necessitates a bandwidth of 500 Mbps at a minimum.

As one of the main forms of home entertainment, gaming is presenting drastically higher demand for bandwidth. With its market expanding, gaming is also witnessing drastic improvements in quality. Currently, a 3A game can reach 65 GB in size. While it takes 178 minutes to download such a game with 50 Mbps bandwidth, only nine minutes are needed if gigabit bandwidth is in place. The burgeoning cloud gaming service also imposes high requirements for networks. A 1080p 60 frames per second (FPS) cloud game requires at least 200 Mbps bandwidth. Games are also gradually becoming part of social media, which further increases the demand for bandwidth.

The Covid-19 pandemic spurred the rapid development of long-distance services, making home office and online education integral parts of everyday life. By 2027, the global online education market will grow at a compound annual growth rate (CAGR) of 8.2%. The CAGR of fully digital workplaces will even reach 21.5%. According to the Broadband Development Alliance's analysis, cloud office and enterprise cloud services





require a bandwidth of 100-200 Mbps. These developments indicate that high bandwidth will be a long-term requirement for home networks.

Enterprise applications are another driving force for 10G PON deployment. By 2025, 85% of enterprise applications are expected to be deployed on the cloud, which will bring about a huge increase in bandwidth demand. The 10G PON all-optical access network can deliver a symmetric bandwidth of 100 Mbps to 10 Gbps and provide low network delay and zero packet loss required by enterprise cloudification. The network can also implement redundancy protection. When a link fault occurs, communications can be switched over to a functioning link, thereby ensuring high reliability of cloudified dedicated line service.

#### Competitive Requirements

The introduction of each generation

of network technology is an opportunity to reshape the market landscape. In addition to driving economic growth and meeting the bandwidth demand of future services, 10G PON can also help operators boost competitiveness and get a head start in market competition.

- **Improving user experience and consolidating market share:** 10G PON ensures user bandwidth can be upgraded from 50–100 Mbps to 500–1000 Mbps. Gigabit bandwidth meets the peak bandwidth requirements of multi-device and multi-service operation to deliver the ultimate network experience to users. Gigabit networks are also the foundation of value-added services (VASs) like smart home, gaming, cloud office, and cloud storage. VASs boost user loyalty and average revenue per user (ARPU) by further satisfying diverse user



needs and bettering user experience.

- **Signing up new users and increasing market share:** The history of communications has shown that the emergence of a killer service can lead to explosive growth in bandwidth demand. High ARPU users are usually the first to try such services and to do so, they have to select network operators who offer the services. By rapidly deploying gigabit networks to provide users with popular bandwidth-hungry services, operators vastly increase their revenue. 10G PON deployment can also improve the price/performance ratio of broadband packages and hence attract more users.

### The Next 3–5 Years Will Witness Large-Scale Deployment of 10G PON

Generally, a technology begins commercialization 2–3 years after the finalization of its standard and starts large-scale commercial deployment after a further 2–3 years. Both 10-gigabit-capable passive optical network (XG-PON) and 10-gigabit-capable symmetric passive optical network (XGS-PON) technologies have entered the massive deployment stage. Because the 10G PON industry chain, which covers equipment, optical modules and chips, has matured, 10G PON deployment is actually accelerating globally. Some countries like China have already reaped benefits from broadband initiatives and are using the successes to drive the deployment of 10G PON. 10G PON construction in China, which makes up a large chunk of the global broadband market, will further bring down 10G PON costs and serve as a good example for other regions.

Globally, the next 3–5 years will be the window for large-scale deployment of 10G PON.

### 50G PON is the Choice of Next-Generation PON After 10G PON

High bandwidth is becoming a basic requirement of networks, and the application of PON technology is expanding from home broadband to industry sectors such as telemedicine, smart manufacturing, and mining communication. As a result, networks not only should provide more bandwidth, but also need to reach higher standards in terms of latency, packet loss, jitter, quality of service (QoS) and user experience. The International Telecommunication Union - Telecommunication Standardization Sector (ITU-T) considered the requirements of multiple application scenarios, and on that basis, drafted the requirements for next-generation PON. It decided to focus on 50G PON, whose single-wavelength rate is 50 Gbps, in its exploration of next-generation PON technologies. In 2016, the ITU-T started to formulate the single-wavelength 50G PON standard. In February 2018, the ITU-T selected 50G PON instead of 25G PON as the next-generation PON technology after 10G PON. In the second half of 2021, the ITU-T published the first version of the 50G PON standard. The time before 50G PON is put into commercial use is the window for massive 10G PON rollout. With the already highly mature 10G PON industry chain, operators should seize the opportunity presented by the window to deploy 10G PON and come out on top in the market reshuffle, because 10G PON can be migrated to 50G PON and coexist with 50G PON in the same ODN. **ZTE TECHNOLOGIES**

# Lending 5G-Advanced and 6G a Hand with Intelligent 'Super Surfaces'

Source: Capacity Media

**T**hough 5G deployments are very much the flavour of today, some are already looking forward to the types of technology to deploy to support the next generations of mobile technology. Alex Wang, managing director for radio-access-network (RAN) solutions at ZTE, explains how reconfigurable intelligent surface (RIS) technology provides one answer for 5G-Advanced and 6G.

5G is just starting to take off in many countries worldwide, after early adopters started launching the technology in 2019. But while it still has plenty of growth ahead, some are looking even further into the future to pave the way towards the next mobile generation.

This next generation, 6G, is expected to arrive in around 2030, following the emergence in the middle of this decade of the 'half-generation', 5G-Advanced. Mobile technologies will keep moving on, spurring those at the cutting edge to carry on planning ahead to ensure that the transition to the next stage of the journey is as smooth as possible.

As networks have densified to meet growing coverage and capacity needs, part of this is about finding fresh technologies that improve the efficiency of new mobile generations, and cut deployment costs and time. At the same time, it is essential to meet today's growing demand for greener, low-carbon networks.

## Reconfigurable Tech

One up-and-coming technology that the industry believes can fulfil these requirements is known as reconfigurable intelligent surface (RIS), or metasurface. This aims to facilitate the dynamic control of radio

signals between a transmitter and a receiver, thus boosting network coverage and signal penetration.

Alex Wang, managing director for RAN solutions at ZTE, explains that the technology can help overcome propagation challenges involving outdoor coverage and indoor penetration.

The technology uses so-called 'metasurfaces' that are electromagnetically controlled and can be installed at or attached to places such as lamp posts, walls or windows to help shape the wireless-propagation environment. A signal that hits the 'intelligent super-surface' can be formed into beams that precisely target different users' devices and help ensure seamless connectivity even during movement.

Wang says these capabilities have significant potential to improve the performance of technologies supporting 5G-Advanced and 6G. "RIS will tremendously enhance coverage for operators deploying those solutions," he says. "It's a marriage of mobile communications and materials technology. You can achieve different kinds of beamforming, with flexible and intelligent reflection."

He also cites different types of RIS—namely reflective RIS, which reflects radio signals off objects, and transmissive RIS, which can help signals penetrate deeper indoors.

**RIS is a very promising technology for 6G, and we are also working actively to bring this technology forward into the 5G era with 5G-Advanced.**

**Alex Wang, Managing Director for RAN Solutions at ZTE**



## Emerging Tech

ZTE unveiled its RIS proposition at the Mobile World Congress in Barcelona this March, envisaging the service as a core technology for underpinning 5G-Advanced and 6G. Having already begun research on RIS a few years ago, the vendor has been working with operators, universities, scientific research institutions and standardisation bodies to explore the concept.

It has run prototype tests with several operators that Wang says have worked well, verified the concept and received positive feedback. In outdoor tests that ZTE carried out in conjunction with millimetre-wave (mmWave) technology being used in 5G deployments, RIS both succeeded in boosting signal strength and also enhanced speeds by up to 50 times.

The improved coverage is important not just for cost reasons, but also because the power consumption of the technology is lower than for base stations, adds Wang. This, he says, allows the deployment of a greener network.

And he says operators are enthusiastic about the prospects for using the technology. "They are looking for more effective solutions, from reducing hardware costs to reducing power consumption and opex as well," he says. "So this is definitely one area that is worth continuing in pursuance of that."

He adds that operators are looking to find ways to enhance the performance of existing technologies. "Some operators are talking about

how to further improve the performance of higher-frequency bands," says Wang.

## Meeting Demand

With regard to this, he says ZTE is keen to put itself at the forefront of developments by pursuing innovations that match operator requirements, pointing to its previous efforts to take a lead on massive MIMO for Pre5G and 5G. "There is definitely a demand in the market from the operator side—and also, there is continuous innovation and technology evolution from our side," he says.

In addition, ZTE is a founder member of the RIS TECH Alliance (RISTA) established in Beijing four months ago, as an initiative to spur research into and growth of the new technology, as well as its standardisation. Wang points to the traction this alliance has gained to highlight the interest that RIS is generating, with around 100 members having already signed up to RISTA.

Though many challenges lie ahead in areas such as how best to deploy the technology as networks densify and standardise it for future use, Wang is positive about its prospects.

"RIS is a very promising technology for 6G, and we are also working actively to bring this technology forward into the 5G era with 5G-Advanced," he says. "We are working together with different partners to verify and make it a success. It's a long-term mission and we are moving step by step."

**ZTE TECHNOLOGIES**



# ZTE's Innovative Practices in Optical Fiber Transformation



**Sun Jin**

Fixed Network Product  
Planning Director, ZTE

**W**ith the enrichment of broadband access scenarios and continuous service innovations in recent years, and facing tremendous pressure from telecom operators and OTT providers, multi-service operators (MSOs) need to accelerate the transformation and upgrade of their cable TV networks, and the way forward is migration to full-fiber infrastructure. The construction of an all-fiber network lays the foundation for the digital transformation of society and its future-proof nature maximizes the network's return on investment.

Having been in the optical access field for 20 years, ZTE is committed to bandwidth acceleration and application innovations, and continuously leads the development and commercial practice of optical access technologies. ZTE's state-of-the-art end-to-end optical access products and solutions have been deployed by over 270 operators in more than 100 countries around the world, helping them deploy FTTx networks in a faster and more economical way.

## ZTE's Innovative Products and Solutions

### Series of FTTx Products Support Commercial Use of Gigabit Services and Diverse Deployment Scenarios

Based on the innovative future-proof flagship optical access TITAN platform, ZTE's OLT products are the first in the industry to adopt a fully distributed architecture over high-end routers, with industry-leading switching capacity and access capability. The innovative dual-channel WDM Combo PON solution integrates three functions in one card. Compared with the traditional external WDM1r solution, the Combo solution greatly saves equipment room space, without adding extra devices or changing the ODN and the optical power budget. One TITAN platform supports three generations of PON technologies (GPON, 10G PON and 50G PON), and one Combo



line card supports two generations of PON technologies (GPON and 10G PON), enabling smooth network evolution and protecting the operators' investments.

ZTE's ONU series provide a wide range of interfaces including GPON, XG-PON, XGS-PON and 50G PON interfaces at the WAN side, and Ethernet, USB, Wi-Fi, IoT interfaces at the UNI side, to address different user requirements and meet various FTTx scenario requirements. In addition, ZTE is the first in the industry to provide EasyMesh-certified CPE series, which support plug-and-play interconnection of heterogeneous devices and help operators deploy and launch their networks quickly and flexibly.

#### **Options of Combo PON and Any-PON Support Flexible Upgrade to 10G PON Based on Service Development Needs**

ZTE Combo PON solution uses the XGS-

PON and GPON technologies operating on different wavelengths and multiplexes the two different wavelengths in one optical module to transmit and receive XGS-PON and GPON optical signals independently. The Combo PON optical module has a built-in multiplexer that multiplexes and demultiplexes the uplink and downlink wavelengths required by the XGS-PON and GPON. The Combo PON optical module implements multi-wavelength transmission and processing over a single fiber. Meanwhile, as XGS-PON operates over the same wavelengths as XG-PON, Combo PON naturally supports the compatibility with XG-PON ONUs, successfully realizing the coexistence of XG-PON, XGS-PON, and GPON. By using the Combo PON solution, the operators can construct the central offices in a one-off manner, and deploy GPON or XG(S)-PON CPEs as per demand.

In the areas where operators face

financial pressure in deploying 10G PON CPEs in a short term, the Any-PON solution can be adopted to deploy GPON at the early stage of network construction and evolve to 10G PON as needed. Any-PON can support GPON, XG(S)-PON and Combo PON by inserting different optical modules into a line card. Compared with Combo PON, Any-PON supports GPON and XG(S)-PON access by replacing the optical module according to the operator's planning, without changing the ODN or replacing the line card. But the Any-PON solution may require two or more site visits, and a license upgrade during the upgrade to 10G PON.

#### **Pre-Connectorized Solution Accelerates Fiber Transformation**

The ODN accounts for 50%–70% of the entire FTTH network construction cost, and 90% or above of the total FTTH construction time. Therefore, ODN is the key to fiber transformation.

During the ODN construction, operators will face the problems of long construction cycle, great construction difficulties, and high costs. In particular, much fiber splicing needs to be done, which requires specialized construction tools and technical personnel. In the areas where labor costs are high or technical personnel are insufficient, fiber splicing makes it difficult for operators to deploy fiber networks, which hinders the pace of fiber transformation.

To meet the requirements for efficient and budget-friendly optical fiber network construction, ZTE launched the pre-connectorized solution, including a series of indoor and outdoor pre-connectorized boxes and pre-fabricated optical cables (Fig. 1). The plug-and-play pre-fabricated connectors replace the traditional complicated optical fiber splicing, thus reducing the difficulty in

optical fiber connection and improving construction efficiency. The solution provides the industry's first pre-fabricated connectors that support blind plug-in and self-lock, adopts a modular design, and supports all-weather deployment, making operations easier and networking more flexible. ZTE has accumulated extensive experience in ODN turnkey projects. At present, the company has deployed ODNs in more than 50 countries and regions with more than 20 million homes passed.

#### **Success Cases**

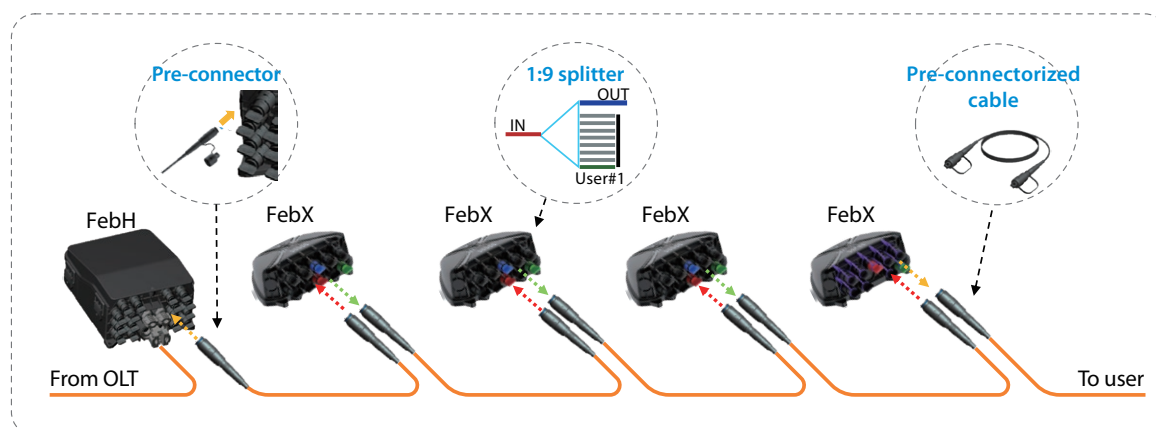
##### **Combo PON Helps IZZI Quickly Construct FTTx Networks and Migrate from HFC**

The MSOs' networks are mainly cable networks, which have been applied on a large scale in the European and American markets. In particular, the American market accounts for more than 70% of the global cable network market.

Due to the technical limitations of the cable network, IZZI, a Mexican operator, faced three major challenges: first it was unable to provide high bandwidth (especially uplink bandwidth) with limited shared spectrum resources; second, it faced the competition from both telecommunications operators and OTT vendors; and finally it needed to deal with the complicated management of active devices and high costs.

Under the trend of MSO transformation and based on IZZI's requirements, ZTE recommended that IZZI use the TITAN platform to construct its FTTx networks. ZTE's industry-first Combo PON solution based on the TITAN platform supports GPON and 10G PON access without changing the existing ODN, and allows migration of existing GPON users to 10G PON on demand. Compared with traditional solutions, this solution saves 60% of equipment room space and 26% of





◀ Fig. 1. ZTE's pre-connectorized solution.

deployment costs (estimated based on 5 years).

IZZl adopted different network construction strategies for different areas:

- For greenfield deployments, GPON was the first choice. IZZl used XGS-PON to deploy networks oriented to enterprise users, and promoted 10G PON+Wi-Fi 6 deployment.
- For the purchased FTTH networks, cut over services and devices step by step. In terms of services, cut over broadband and video services first and then VoIP services. In terms of devices, cut over ONTs first and then OLTs.
- For the areas where the network has been deployed, migrated the high-value areas to FTTx and migrated the traditional areas from DOCSIS 2.0 to DOCSIS 3.0/3.1.

IZZl used ZTE Combo PON solution to build its FTTH networks in greenfield areas, providing three-network integrated services to the home users and providing services to the enterprise users via XGS-PON. It also planned to provide home users with a bandwidth of up to 500 Mbps. Moreover, ZTE Combo PON solution supports continuous bandwidth upgrade.

#### ZTE's Key E2E Capabilities Help Megacable Achieve Fast Fiber Transformation and Save TCO

Mexican cable operator Megacable faced a number of problems such as high O&M costs, limited technical evolution and inflexible

service deployment. After analyzing Megacable's challenges and requirements, ZTE recommended it to use FTTH to reconstruct its cable networks.

ZTE provided end-to-end turnkey delivery to Megacable, including OLTs, ONTs and outside plant construction (OSP) of the ODN, and guaranteed the high quality and rapid delivery of the OSP project with its outstanding product performance, rich design experience, and professional local teams.

After a successful optical network transformation, Megacable adopted proactive marketing strategies and designed diversified packages for all important bandwidth levels. In particular, Megacable offers rich and competitively priced packages with speeds of 100 Mbps or above, covering 100Mbps, 200 Mbps, 350 Mbps, 500 Mbps, and 1000 Mbps. Through fiber transformation, Megacable increased its market share, and achieved continuous and stable revenue growth.

ZTE's fiber transformation solution has been commercially deployed by a number of MSOs and helped them seize the opportunities in the wave of fiber transformation. Continuously consolidating its basic capabilities and focusing on customer needs, ZTE will help MSOs build a competitive edge, and achieve industry expansion and business success. **ZTE TECHNOLOGIES**

# Light ODN Enables Rapid FTTx Deployment



**Yang Yang**

ODN Product Marketing  
Director, ZTE

In the past decade, the share of fiber to the x (FTTx) in fixed broadband (FBB) deployment has been climbing every year. By the end of 2021, FTTx had accounted for at least 66% of FBB networks and become the primary mode of FBB construction. As the underlying technology of FTTx, passive optical networking (PON) has also seen fast development in this process. In an FTTx deployment, especially in a fiber to the home (FTTH) network, the optical distribution network (ODN) makes up 50% to 70% of the total cost. That makes the ODN the most important part of FTTH deployment as it is directly linked to the operation and maintenance (O&M) of the optical access network, the implementation of the FTTH solutions by equipment vendors, and the development of the optical cable systems integration market. For all its importance to FTTH deployment, however, the ODN still presents pressing problems for operators, including poor construction efficiencies, large investments and management difficulties.

## Future-Proof Light ODN Solution Helps Operators Rapidly Build Intelligent ODN Networks

An FTTH network involves a long construction period, a high cost, and a long time to market (TTM). To help operators solve these problems, ZTE has developed its Light ODN solution, which innovates the technical features of ODN products and creates value for operators by slashing the cost of ODN construction. On the one hand, the solution makes the ODN lightweight, including making it pre-connectorized and eliminating the need

for splicing throughout the installation process. On the other hand, it changes ODN resources from a dumb to a manageable and visual status. With these capabilities, the solution can help operators rapidly build premium ODNs and precisely manage the network resources. Operators can use the solution to rapidly build a visual, manageable and controllable all-fiber infrastructure network that can accelerate their transformation into all-optical operations.

Traditionally, ODN construction involves many steps, requires engineers with fusion skills, and is therefore inefficient. Light ODN employs single-core and multi-core pre-connectorization technology to replace the traditional splicing technique. Thanks to the modular pre-connectorized products used by the solution, it takes only ten minutes for one engineer to complete installation at one site. A key component of the solution is ZTE's patented pre-connectorized optical connectors that support blind-mating and self-locking. The blind-mating mechanism uses a unique mechanical design of the connectors to automatically align them, thereby reducing the operation difficulty, completely preventing connector damage caused by misoperations, and shortening the connection time from nine to five seconds. With the self-locking mechanism, the latches of the connectors automatically rotate and lock after the insertion operation is completed. This prevents connection failure and connector detachment and reduces the connection time per port from ten to three seconds. The enhanced connection reliability and installation efficiency resulting from the self-locking mechanism cuts the deployment cost by 30% and the construction time by 50%.

Light ODN supports flexible networking, and a typical four-level cascading scheme uses one-core optical cable to save fiber cores. The solution can adapt to different application scenarios, including medium- and low-density areas, far-flung places, office buildings, and fixed-mobile convergence scenarios.

Light ODN uses a combination of fiber link sensing and artificial intelligence (AI) technologies to realize a digital and intelligent ODN with capabilities like resource management, visual topology, fault location, and fault early warning. These functions together serve as a foundational platform for accurate O&M of the ODN. Light ODN employs intelligent image scanning technology that lets engineers use an app to scan the quick response (QR) code or barcode on pre-connectorized products. By combining the product information obtained from the scan with the geographic information system (GIS) information of the products, the port connection relationships of the ODN can be quickly established. With all this connection relationship information, the network topology can be instantly presented after ODN construction is completed. This method of visualization ensures a 100% accuracy of network resource information and helps to boost network O&M efficiency.

### Digital and Intelligent ODN Management Enables Efficient network O&M

ZTE's Light ODN solution provides digital and

intelligence ODN management that involves visual network topology, digital network resources, visual network status, and digital and intelligent network O&M (Fig. 1).

#### Visual Network Topology

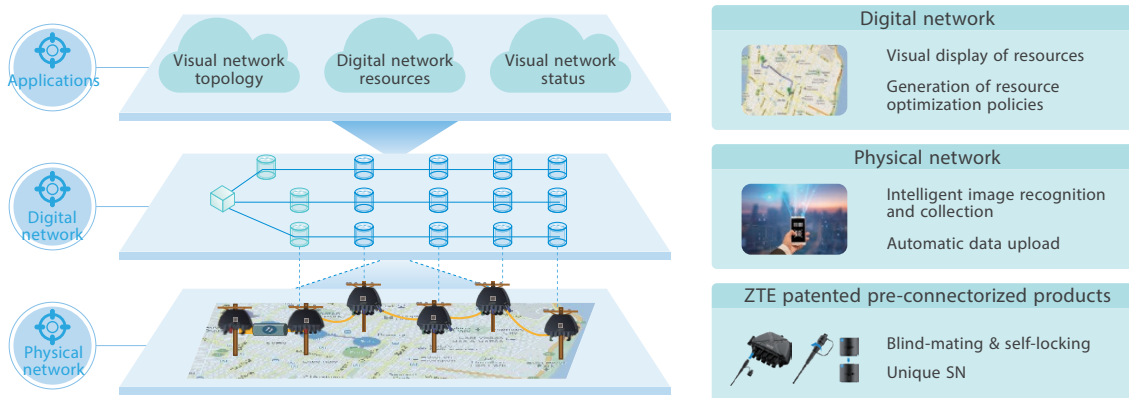
The ODN network topology can be identified and obtained digitally.

#### Digital Network Resources

- **Equipment resources:** The equipment types in the network can be digitally obtained and entered into the resource system.
- **Line resources:** The connection relationships of network equipment are automatically obtained by AI analyzing resource data.
- **Link resources:** By using AI to analyze resource data and link sensing metrics, a connection relationship comprising a PON port of the optical line terminal (OLT), a port of an optical splitter, and an optical network unit (ONU) can be identified.

#### Visual Network Status

- **Changes in network topology:** The solution uses fiber link monitoring technology to discover changes in network topology, user, and ODN connection relationships.
- **Changes in network performance:** By collecting such performance data as link attenuation, reflection, and return loss, the



◀ Fig. 1. ZTE's Light ODN solution.



solution can detect end-to-end performance changes, perform comprehensive analysis, and give early warnings.

#### Digital and Intelligent Network O&M

- **Network acceptance:** Engineers can remotely detect and discover network topology, collect network performance data, and digitally enter the data into the ODN management system.
- **Topology presentation:** The network topology can be presented based on the ODN resource database and the link sensing technology. End-to-end topology information can be automatically displayed and updated.
- **Network monitoring and early-warning:** The network and resource status can be monitored in real time or periodically so that faults can be located, responsibilities can be assigned, and fault early-warnings can be issued.

The Light ODN solution is designed to provide customers with services covering the full lifecycle of a premium intelligent ODN, including fast deployment and accurate O&M. By significantly simplifying ODN construction, the solution improves deployment efficiency by 50%, shortens TTM by 30% and reduces the total cost of ownership (TCO) by 20%.

#### Light ODN Solution Ensures Sustainable Development of Optical Networks

While optical fiber has long been the “blood vessel” for transmitting signals, now it also functions as a “nerve” that monitors signals. Armed with AI, the Light ODN solution is becoming the key to improving the deployment, operation and monitoring of optical networks. Using the big data generated from long-time monitoring, the network management system can make a comparative analysis against the network health database and diagnose network faults. Big data modeling and analysis are carried out on the network management

platform. Innovative AI technology makes ODN topology and link loss visual and manageable while also producing resource statistics that are always accurate. Consequently, an intelligent, real-time, and accurate optical network monitoring system can be built to improve O&M efficiency, reduce O&M costs, and help operators cut expenditure on ODN construction.

#### Light ODN Solution Evolves to Meet Customer Requirements

The following features and capabilities of the Light ODN solution have been planned:

- An intelligent management architecture with a built-in O&M system that can automatically identify changes to passive network equipment and topology. The architecture can implement automatic discovery and acceptance of end-to-end ODN topology.
- Automatic issuance of work orders and identification of node equipment. The entire process is managed as a closed loop.
- Real-time connection identification and topology management.
- Capability to detect multiple parameters of an optical network. Compatibility between fixed and 5G networks.
- Physical link monitoring, real-time prediction and alerting, and proactive O&M.
- Intelligent end-to-end ODN O&M to meet dynamic changes in physical resources.

ZTE's Light ODN solution has been deployed in countries including Colombia, Peru, Argentina and Spain to help operators economically construct ODNs and accurately manage network resources. The solution realizes automatic sensing of resource information and intelligent management of networks, thus turning the traditional optical network into an intelligent infrastructure network characterized by transparent management, fast service provisioning, and quick troubleshooting. This brings significant reductions in O&M costs and creates sustainable business value for operators. **ZTE TECHNOLOGIES**

# Building Green FTTx Network for Sustainable Future

The global temperature has been rising at an average rate of 0.08°C per decade since 1880, making climate change a pressing concern for humankind. Against this backdrop, it is inevitable for enterprises and industries to seek sustainable development through adopting green practices. The ITU forecasted that by 2030, the carbon emissions in the ICT industry would decrease by around 45% compared to the 2020 levels. For fixed-network operators, achieving green growth involves efforts on five fronts:

- Accelerating the adoption of green energy and transforming the paradigm of energy use.
- Adopting new processes, new solutions, and new designs to reduce the power consumption of equipment.
- Planning networks in a holistic manner to boost energy efficiency.
- Strengthening automatic and intelligent energy consumption management to improve energy conservation.
- Disposing of disused facilities in a way that maximizes resource reuse.

As a leading player in the telecommunications industry, ZTE is able to contribute to these efforts by employing green technologies, building green central offices (COs), deploying green networks, implementing green production and transportation, and following green practices throughout the product lifecycle.

## Green Technologies Improve Energy Efficiency

ZTE actively assists operators in fiber transformation by building future-proof fiber to the x (FTTx) networks with energy-efficient, fiber-based passive optical network (PON) technology. FTTx is significantly more environmentally friendly compared with copper access networks. Take the digital subscriber line (DSL) as an example, which is a copper access technology. FTTx emits only one fifth of greenhouse gases and consumes just one third of power of DSL. Fiber as a material is also more sustainable than copper. Production of one kilometer of copper generates 10.8 kilograms of carbon dioxide, while the same output of fiber has a carbon footprint of just 3.07 kilograms. Moreover, fiber enjoys a longer lifecycle than copper. In contrast to copper technology, FTTx can increase energy efficiency by 60 times.

As PON technology evolves, FTTx networks will become faster, more reliable, incur lower OpEx, and produce less carbon emissions.

## Green COs Lay the Foundation of Energy Efficiency

ZTE constantly develops new processes, solutions and designs around PON technology. The resulting innovations reduce energy consumption at the chip, card and equipment levels, enabling operators to build green COs.

- **At the chip level:** ZTE's optical line terminals (OLTs) are equipped with



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in-house 5-in-1 chips whose integration level is twice that of the industry average. Because of the higher the integration level, the lower the power consumption per unit volume, each Combo PON port of the OLTs consumes 32.7% less power than the Code of Conduct on Energy Consumption of Broadband Equipment Version 7.0 (CoC V7).

- **At the card level:** The Combo PON and Any-PON cards of OLTs can be deployed flexibly. The Combo PON card, which carries innovative 3-in-1 Combo PON optical modules, reduces line card types by 67% and does not introduce additional power loss. Upgrading GPON to 10G PON with the Combo PON card saves 60% space compared with upgrading schemes that use an external optical multiplexer. The Any-PON card integrates five access technologies, enabling technological upgrades by just swapping the optical modules in the card without replacing the card itself. In other words, by simply replacing the optical modules of the Any-PON card, operators can implement multiple access modes like GPON, XG(S)-PON and Combo PON, thereby saving 80% line card types and avoiding a waste of resources caused by card replacement.
- **At the equipment level:** Small-capacity OLTs make network deployment more flexible and are suitable for deployment in far-flung and sparsely populated areas, new buildings in cities, and fixed-mobile convergence (FMC) scenarios. In these places, large-capacity OLTs may cause a waste of resources and capital because a large number of their slots may be left idle. Another benefit of a small-size OLT is low power consumption. For example, a 2U OLT consumes 59% less power than a large-capacity one, and a 1U OLT slashes power consumption by 76% as compared with a large-capacity one. The carbon

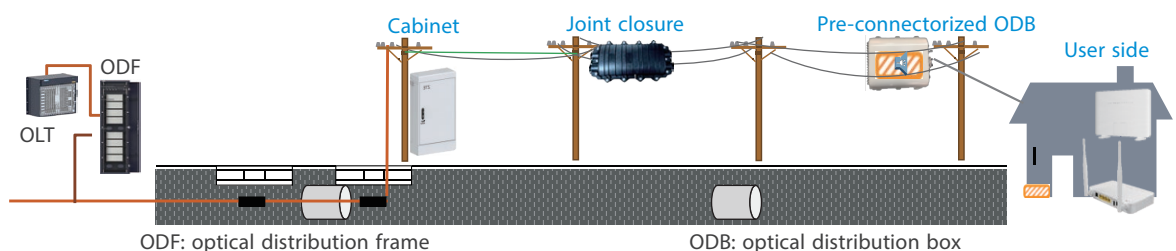
emissions reduction produced by a 2U OLT and a 1U OLT each year is equivalent to the amount of carbon absorbed by 76,000 and 183,000 trees, respectively.

### Green Networks Reduce Energy Waste

ZTE plans networks in a holistic manner, paying attention to all levels of deployment from COs to the whole network to increase energy efficiency (Fig. 1).

- **Cabinets:** ZTE's small cabinets adopt natural cooling that does not consume any power. In addition, they can maximally reduce noise and meet the strictest noise criteria set in the ETSI ETS 300 753 standard, making them applicable to scenarios with a low tolerance for ambient noise, such as hospitals and libraries. Air circulation inside the cabinet is independent of that outside the cabinet. This mechanism cuts the amount of dust introduced from the outside into the cabinet as much as possible, leading to less wear and tear and lower maintenance costs for the equipment in the cabinet.
- **ODNs:** ZTE uses EU RoHS 2-compliant environmentally-friendly materials to construct optical distribution networks (ODNs). Its eMonitor solution can implement automatic preventive maintenance of ODNs, accurately locate faults, and guide engineers in troubleshooting. As a result, operators can reduce the energy consumed to manually check the network and locate faults. Moreover, ZTE ODNs use fully pre-connectorized products that do not need hot soldering on-site, thus avoiding the wear and tear caused by plugging and unplugging, improving termination efficiency by 80%, and saving 50% deployment time.

Fig. 1. Components of an FTTx network.





- **ONUs:** ZTE's optical network units (ONUs) feature well-rounded energy-efficient designs. The in-house ONU chips also constantly evolve. The chip design has gone through several development stages from separation of GPON MAC and 10G PON MAC to full-mode MAC and then to programmable full-mode MAC. Consequently, the power consumption of ZTE GPON ONUs is currently 20% lower than the CoC V7 standard.

## Green Delivery Enhances Overall Energy Efficiency of Network Projects

ZTE's smart factory uses an industry-leading intelligent packaging line for subracks. The line automates the whole process of subrack packaging to save labor and production costs. The factory also uses automatic conveying equipment to improve the efficiency of material distribution by 30%. The cutting-edge sorting system of the factory boosts operation efficiency by 220% over traditional sorting methods.

A digital supply chain is also established. ZTE uses a combination of data and algorithms to drive the digital twinning of its supply chain, which in turn realizes real-time sensing and smart decision-making and enables the best solutions to be produced and efficiently implemented. ZTE's visualized, perceptive and adjustable intelligent operation center allows big orders to be rapidly processed and the delivery period to be shortened. Working with the world's top logistics service providers, ZTE has built an agile global logistics network that includes 14 international transfer hubs, 31 domestic provincial-level warehouses and 7,400-plus global freight routes. Its intelligent early-warning system for risks enables dynamic selection of transport solutions and reduces the environmental impact of delivery.

## Green Product Lifecycle Management Controls Waste Disposal and Strengthens Resource Reuse

ZTE analyzes, evaluates and manages the

lifecycle of its products, which ranges from product design at the beginning to waste recycling at the end, in strict accordance with the ISO 14040 standard for environmental impact assessment. It practices the principle of 3 Rs—reduce, reuse and recycle—throughout the product lifecycle to minimize the environmental footprint of products.

- **Reduce:** ZTE complies with the EU's RoHS 2 standard and has established an environment management system based on the IECQ QC 080000 specification to minimize the hazardous substances used in its products. By using more environmentally-friendly materials and modernizing production techniques, ZTE cuts the volatile organic compounds emitted throughout the lifecycle of its products by more than 90%. In 2012, ZTE eliminated the use of halogen-based flame retardants in its products. In production and operations, it practices lean management and constantly upgrades its manufacturing process to conserve resources and energy.
- **Reuse:** ZTE adopts green packaging and modular product designs to maximize the reuse of materials. More than 70% of ZTE's cabinets are packed in cartons. 100% of package printing for ZTE products uses plant-based ink instead of petroleum-based ink. 100% of ZTE products are modular and platform-based to facilitate maintenance and reuse.
- **Recycle:** ZTE products adopt a recyclable design that allows scrapped products to be easily disassembled, reused and classified and different materials to be easily separated. ZTE has joined forces with environmental service providers to build a global green recycling network. In addition, it provides operators with one-stop equipment recycling services including disassembly, recycling and disposal.

ZTE is committed to environmental protection and actively promotes sustainable development to create value for customers. **ZTE TECHNOLOGIES**

# Wi-Fi 7 Scenarios and Technologies



**Zhang Zhigang**

Fixed-line CPE Product  
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## Wi-Fi 7 Scenarios

As bandwidth-hungry, latency-sensitive services like 4K/8K video, virtual reality (VR), augmented reality (AR), real-time gaming, remote working and cloud computing gain widespread adoption, users are demanding higher throughput and lower latency from Wi-Fi technology. Wi-Fi 7 features efficient physical layer (PHY) and medium access control (MAC) technologies to deliver increased throughput and decreased latency needed to support the services. The IEEE 802.11be Task Group (TGbe) is discussing drafts of the Wi-Fi 7 standard and is expected to release the finalized version at the end of 2023.

## Key Innovative Technologies of Wi-Fi 7

To meet the requirements of high-bandwidth and low-latency application scenarios, TGbe discussed a number of key innovative technologies to be incorporated into the 802.11be, or Wi-Fi 7 standard. For example, to increase throughput, TGbe adopted the 320 MHz, 16-spatial-stream (SS) multi-user multiple-input multiple-output (MU-MIMO), 4096-quadrature amplitude modulation (QAM), and multi-link architecture in the extremely high throughput (EHT) PHY specification. To decrease latency, the discussions focused on enhancing spectrum utilization, improving anti-interference performance and making technological adjustments for real-time applications (RTAs). For spectrum utilization, TGbe discussed technologies including the EHT preamble,

multi-resource unit (RU) support, implicit sounding, explicit feedback, virtual basis service set (BSS), hybrid automatic repeat request (HARQ), distributed MU-MIMO, and multi-access point (AP) sounding. For anti-interference performance, it deliberated over techniques like preamble puncturing, synchronous channel access, null steering, coordinated optical orthogonal frequency division multiplexing access (Co-OFDMA), and coordinated spatial reuse (CSR). For technological adjustments for RTAs, TGbe considered using applicable features of the IEEE 802.1 time-sensitive networking (TSN) specification and discussed technologies like faster backoff, new access categories (ACs), transmission opportunity (TXOP) capturing, multi-AP joint reception, and asynchronous channel access.

## PHY Improvements of Wi-Fi 7 Are Decisive Factor in Increasing Throughput and Reducing Latency

- **320 MHz bandwidth:** Because the unlicensed spectrum of 2.4 GHz and 5 GHz bands is limited and congested, Wi-Fi 7 adds new bandwidth modes, including contiguous 320 MHz, 160+160 MHz, 240 MHz, and 160+80 MHz, and can operate in the 6 GHz band. Wi-Fi 7 also has effective mechanisms to improve the spectrum utilization of non-contiguous bandwidth. Non-contiguous bandwidth facilitates the coexistence of adjacent networks and can provide high speeds in the absence of contiguous spectrum. TGbe also considered band aggregation, which enables the establishment of multiple

links across different frequencies.

- **4096-QAM:** In scenarios where the AP and the only station (STA) have the same number of antennas, MU-MIMO is not applicable. In this case, the only way of increasing bandwidth is to improve the QAM constellation. However, the bandwidth gain decreases with every improvement of the QAM constellation. For example, while 1024-QAM increases the nominal data rate by 25% compared with 256-QAM, 4096-QAM manages only a 20% rise over 1024-QAM.
- **More-effective preamble puncturing formats and mechanisms:** In Wi-Fi 7, preamble puncturing is extended to 320 MHz bandwidth, improved for the multi-user (MU) PHY protocol data unit (PPDU), and added for the SU PPDU. These enhancements improve channel utilization.
- **Multi-RU allocation:** An AP can allocate RUs to different STAs for downlink (DL) or uplink (UL) transmission. Allocating only one RU for each STA will reduce RU diversity, and RU diversity greatly improves the experience of RTAs. Wi-Fi 7 supports allocating multiple RUs to each STA. Because the main drawback of multi-RU allocation is that implementing the technology and scheduling the RUs are complex processes, TGbe limits the number of RU combinations. To improve spectrum utilization, it is better to combine a large RU(s) with a large RU(s) and a small RU(s) with a small RU(s).
- **Advanced PHY:** TGbe discussed multiple advanced PHY technologies including HARQ, full-duplex (FD) operation, and non-orthogonal multiple access (NOMA). Although these technologies significantly boost spectral efficiency in transmission retries and bidirectional simultaneous transmissions, they incur a high cost. Whether to include them in the final Wi-Fi 7 standard will require more discussions.

## MAC Enhancements Consolidate PHY Improvements of Wi-Fi 7

One of the revolutionary features

distinguishing Wi-Fi 7 from the previous Wi-Fi standards is its local support for multi-link operation (MLO). This helps Wi-Fi 7 deliver very-high data rates and very-low latencies, and is essential to meet the 802.11be project authorization requirements (PARs) for high bandwidth and low latency. In addition, this feature allows for efficient use of channel resources and prevents interference in dense deployments.

- **Multi-link device (MLD):** Wi-Fi 7 introduces the MLD concept, which consists of several affiliated devices. While each device has a PHY interface toward the MAC layer, the MLD has a single interface to the logical link control (LLC) layer. This concept simplifies packet fragmentation and reassembly, duplicate detection, and dynamic link switching. Wi-Fi 7 includes two multi-band MAC architectures: independent MAC and distributed MAC. Each MAC architecture is divided into the upper and lower MAC layers. The upper MAC layer supports most MAC operations such as aggregate MAC service data unit (A-MSDU) aggregation/de-aggregation, and sequence/packet number allocation, while the lower MAC layer supports only a small amount of MAC operations like MAC protocol data unit (MPDU) header creation, cyclic redundancy check (CRC) verification, and MPDU aggregation/de-aggregation. This mechanism implements the switchover between a single traffic ID and multiple traffic IDs without causing a big MAC overhead.
- **Multi-link channel access:** The MLD can access and transmit data asynchronously through multiple links, and transmit and receive data simultaneously in the 2.4 GHz, 5 GHz and 6 GHz bands. The closer the channels of the affiliated device to each other, the more power leakage from the affiliated device to the other devices. This leakage or interference complicates simultaneous transmission and reception. To address the problem, Wi-Fi 7 introduces a synchronous MLO scheme at the cost of

decreasing the channel access and lowering the throughput. Another solution for cutting inter-device interference is to disable transmission while the receiver is receiving data.

- **MLO for RTAs:** Due to the diversity of channels, MLO is regarded as an effective method of improving transmission reliability and reducing latency. Wi-Fi 7 provides two modes of MLO: duplicate mode and joint mode. In duplicate mode, the transmitter sends copies of a data frame through multiple links. After the receiver obtains a copy, it discards all the copies delivered thereafter. This mode significantly enhances transmission robustness. In joint mode, the transmitter sends a data frame over multiple links without generating any copies. This mode reduces transmission latency.
- **Multi-AP operation:** One goal of TGbe is to improve network performance by using the MAC layer protocol to strictly coordinate channel access, transmission scheduling, and the joint transmission of the same data. TGbe considered two types of multi-AP systems. The coordinated multi-AP system uses a single AP to send and receive the entire data, while the joint multi-AP system employs multiple APs to send and receive the data. TGbe discussed CSR, Co-OFDMA, coordinated beamforming (CBF), and joint transmission and reception (JTR) as the multi-AP techniques. These techniques require different levels of synchronisness, with coarse frame-level synchronization for CSR, symbol-level synchronization for CBF and Co-OFDMA, and accurate time and phase synchronization, which is the most difficult, for JTR.
- **MAC EDCA QoS improvement:** In order to use IEEE 802.1 TSN techniques to improve enhanced distributed channel access (EDCA), TGbe analyzed the backoff process, ACs, and packet policies. However, many techniques used in the IEEE 802.1 TSN, which is a wired Ethernet network, are not directly applicable to Wi-Fi networks. The techniques must be

applied selectively or modified before application. Consider a typical scenario where video traffic and online gaming traffic are concurrently transmitted. In this case, EDCA needs to be upgraded by placing the gaming traffic in the voice (A-VO) AC queue or introducing a new AC. If an RTA frame is about to expire, the backoff count can also be sped up. In the worst-case scenario, the channel can be permanently allocated to the RTA frame. Moreover, Wi-Fi 7 also allows changing the TXOP rule.

## Summary

The core functions of the Wi-Fi 7 standard are providing extremely high throughput and supporting RTAs. Wi-Fi 7 improves EHT PHY technologies to implement very-high rates and ultra-low latency. However, EHT PHY alone cannot reliably provide end users with high throughput and low latency in complex real-world environments. In light of this limitation, Wi-Fi 7 also introduces enhanced MAC technologies. Because some of the EHT PHY and enhanced MAC technologies incur a high cost, their implementation may be pushed back to Wi-Fi 8.

Currently, 6 GHz spectrum has been authorized for Wi-Fi use in the US, Europe and South America. In countries and regions where 6 GHz spectrum has not been authorized for Wi-Fi use, bandwidth gain can also be produced by employing MLO technology that utilizes both 2.4 GHz and 5 GHz spectrum. For example, in China, MLO is used to combine 40 MHz in the 2.4 GHz band and 160 MHz in the 5 GHz band to generate 200 MHz bandwidth.

ZTE has long been actively involved in the development of the IEEE 802.11, or Wi-Fi standards. With its experts serving as the chair of the 802.11 TGbe and AMP TIG, ZTE is participating in the entire process of Wi-Fi 7 development and has made important contributions to the definition of key interfaces and parameters of the PHY and MAC layers of the standard. [ZTE TECHNOLOGIES](#)



# Cloud Wi-Fi Creates Ultimate Home Broadband Experience

**W**ith its technology rapidly advancing, services continuously developing and applications constantly emerging, fixed broadband (FBB) has become an essential infrastructure in everyday life.

The Covid-19 pandemic has dramatically changed how people live and work. Previously the home only served as the place for people to live in, but now it is a multi-functional venue where life, work and entertainment are all concentrated. On the one hand, this shift accelerates the development of new services like remote working, videoconferencing, online education, and virtual reality (VR)/augmented reality (AR). On the other hand, it presents ever higher requirements for the user experience produced by home networks.

Against this backdrop, operators need to transform their operations and pay more attention to the experience of home broadband users. They should deploy premium FBB with differentiated features to improve user experience and enhance user satisfaction. The FBB deployments should also help operators implement new services and achieve good investment returns. Home networks mainly operate on Wi-Fi, whose quality is difficult to monitor. A home

Wi-Fi network usually contains numerous devices with different capabilities. These factors combine to cause difficulties in user experience management. If operators are to shift their operational focus from developing broadband services to improving user experience, they have to tackle the network issues first.

## Wi-Fi Network Experience Is Difficult to Manage

A good user experience sits at the heart of home broadband services. As advances in access network technology have mainstreamed 100 Mbps or even gigabit speeds, user experience is no longer bottlenecked by network bandwidth. The development of broadband has allowed an increasing number of devices to connect to the home network. Nowadays a home usually has 10 or more networked devices, most of which are connected via Wi-Fi. Wi-Fi has become a necessity for home users, generating more than 80% of home network traffic. On the flip side, the widespread adoption of Wi-Fi has also led to a surge in user dissatisfaction. Statistics show that around 60% of user complaints about home networks are related to Wi-Fi.

- Different homes have different layouts. A home usually has a



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complex internal environment and consumes a wide variety of network services. Additionally, the operating environment of Wi-Fi constantly changes as people move about and into or out of the home.

- It is difficult for traditional network management metrics to reflect the experience issues of Wi-Fi users. For example, poor coverage and heavy interference of Wi-Fi signals cannot be directly linked to troubles experienced by applications, such as stalling and disruption. Moreover, roughly 90% of the issues with the experience of applications get discovered and handled by operators only after users lodge complaints about them.
- The operation and maintenance (O&M) of a home network is largely conducted through truck rolls, which take a long time and hence decrease user satisfaction. Statistics indicate that O&M engineers spend 90% of their time on on-site troubleshooting.

Frequent customer visits raise the O&M cost for operators.

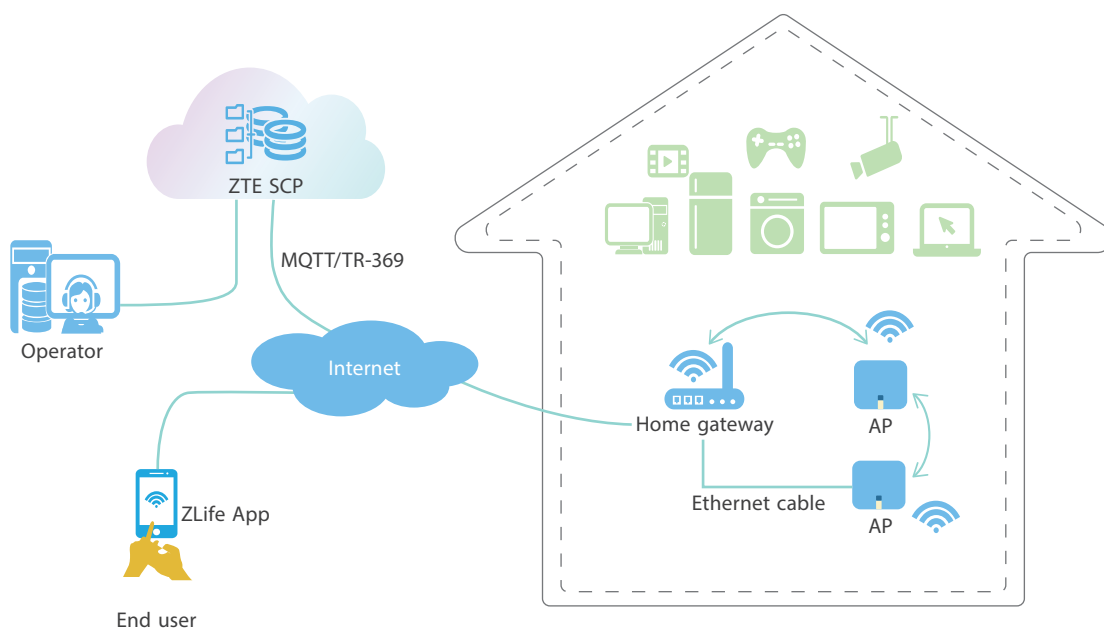
- As services including online education, remote working, cloud gaming, and VR/AR grow in popularity, home users become more sensitive to issues like video stalling and image blurring. The difficulty of managing users' Wi-Fi experience will gain more prominence and seriously hamper operators' efforts to develop home broadband services.

To address the issues above, operators must build a visible, manageable and controllable network management system to accurately locate network faults and improve user experience.

### ZTE Cloud Wi-Fi Solution Enables Visible O&M of Home Networks

In view of the pain points encountered by operators in operating and maintaining the

Fig. 1. ZTE Cloud Wi-Fi solution.



networks, ZTE has launched a Cloud Wi-Fi solution that allows for intelligent O&M. The solution is centered around the smart cloud platform (SCP) developed by ZTE using artificial intelligence (AI) and big data technologies (Fig. 1). By mining the data produced by intelligent fault diagnosis of home network devices, the platform can help operators better operate and maintain home Wi-Fi.

The ZTE SCP has three main features: visibility and manageability of home networks, diagnosis of home network faults, and multi-dimensional analysis and optimization of Wi-Fi. In addition, it allows end users to remotely access a home network via a mobile app to perform functions such as network management and troubleshooting.

### **Visibility and Manageability of Home Networks**

The ZTE SCP visually displays the home network topology, including information about how the home gateway and access points (APs) are networked, the backhaul links, the quality of the links, and so on. Moreover, the platform allows operators to view the historical changes in the home network topology, the information of home network devices, and the curve of home network quality scores. From the home network topology interface, users can go to the device management interface on the SCP, where they can view the real-time status of devices and perform basic device management functions, such as configuring Wi-Fi parameters and changing the passwords for logging into the web GUIs of home network devices.

### **Diagnosis of Home Network Faults**

The ZTE SCP implements Wi-Fi quality analysis based on the historical and real-time configuration and performance data reported by home network devices. Engineers can view a maximum of 30 days worth of data to pinpoint the exact time of a fault. The platform can automatically identify six types of faults, analyze them, and suggest solutions accordingly. Common faults can be diagnosed remotely and located quickly, and some of them can be fixed remotely.

### **Multi-dimensional Analysis and Optimization of Wi-Fi**

The platform can analyze the key metrics of 2.4 GHz and 5 GHz Wi-Fi, including coverage, interference and connections, to evaluate the overall quality of the home network. Based on the Wi-Fi analysis and employing big data, the platform can also generate a dashboard for users with poor quality of experience (QoE) and use it to analyze the bottlenecks of the home network. After that, the platform can utilize the AI technology to produce a Wi-Fi template for a home and deliver it to the devices in the home network to dynamically optimize the Wi-Fi quality.

Through its three core functions, ZTE Cloud Wi-Fi solution helps operators remotely locate home network faults and optimize home Wi-Fi. In addition to reducing engineer visits and cutting O&M costs, the solution can decrease user complaints, improve user experience, and thereby boost operators' competitiveness. **ZTE TECHNOLOGIES**

# Small Outdoor OLT Cabinets for Rapid FTTx Deployment



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With the ongoing copper-to-fiber migration, fibers are deployed even closer to the user's homes, and accordingly the OLTs in FTTx networks have been brought closer to users. Small-capacity OLTs and auxiliary outdoor cabinets are popular with users due to their small dimensions, light weight, budget friendliness, and efficient deployment. Small-capacity OLTs usually account for approximately 80% of the total OLT deployment, and small-capacity outdoor sites approximately 80% of the total outdoor site deployment.

## Outdoor Sites Have Extensive Applications

In order to narrow the digital divide between urban and rural areas and achieve ubiquitous access, some countries have launched rural broadband plans, such as Thailand's Village Broadband Internet Project and Egypt's Decent Life Initiative. Some countries provide free Wi-Fi to remote areas. The operators are more and more concerned about the coverage in suburban, rural and remote areas where there is a relatively small population dispersed over a large area, and a need for a large number of sites. With more flexibility, small outdoor OLTs are more applicable to delivering access to remote and rural areas.

Urban areas, with a high user density and a large population, have always been a battleground for operators, and the broadband penetration rate in urban cores has almost saturated. New commercial

buildings and new communities are becoming the focus of the competition. New entrant operators focus on making breakthroughs through rapid network deployment while incumbent operators are looking for ways to reuse existing site resources, such as mobile base stations or fixed network access sites, to achieve rapid and economical deployment of new sites. In either scenario, small outdoor sites have absolute advantages.

## Challenges and Requirements for Outdoor Site Deployment

Harsh natural environments pose a great threat to outdoor sites. For example, outdoor sites must withstand high temperatures, high solar radiation, high dust, and devastating dust storms in a tropical desert climate, and high temperature, high humidity, high salt fog corrosion, frequent thunderstorms, and ultra-strong typhoons in tropical oceanic regions.

Limited deployment space and prolonged deployment time due to land acquisition and civil works are engineering risks frequently encountered by operators. Complicated engineering and installation operations such as trench excavation and fiber splicing that can only be completed by professional personnel increase the difficulty and expenditure of deploying outdoor sites.

In rural and remote areas, there are a large number of sites in actual deployment, which is highly sensitive to costs. In addition, the installation and maintenance difficulty should be minimized due to inconvenient transportation. Some sites may be deployed

in the areas with unstable electrical grids and frequent power outages, and the outdoor sites need to provide stable power supplies and sufficient batteries to the main equipment they accommodate.

In urban areas, operators need to rapidly deploy sites with scalable capacity. In addition, they need to effectively use existing resources to save investment, for example, retaining VoIP services while supporting differentiated services, and reusing the original optical cables, power cabinets, and even cable distribution resources during the upgrade of legacy sites.

It can be seen that an ideal small outdoor cabinet should not only meet the common challenges faced by outdoor sites but also the differentiated requirements of urban and rural scenarios.

## Light Cabinet Solution

Based on years of experience in access network deployment, ZTE provides the Light Cabinet solution to customers to implement economical and efficient deployment of small-capacity outdoor sites. This solution has four highlights: light, reliable, reusable and sustainable.

### Light

The rapid deployment of light cabinets helps customers save initial investment. ZTE's small OLT cabinets use an aluminum enclosure with outstanding anti-corrosion performance and is at least 30% lighter than the galvanized iron cabinet of the same dimensions. They support flexible installation modes such as pole-mounted and wall-mounted installation. Although light in weight, they provide complete functions such as structural division and support, power supply, power distribution, backup, monitoring, cable distribution, and temperature control, and support one-stop deployment. ZTE's smallest fixed network access cabinet EC100 is very light, and can be pre-connectorized, free

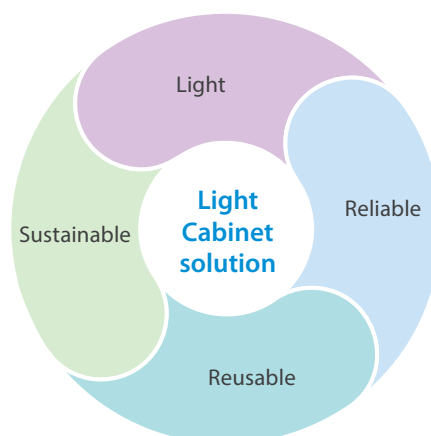
from the dependence on professional splicing technicians, further compressing the cabinet installation time and saving manpower, logistics and engineering expenditures.

The "light" feature is also reflected in lightweight operation, low power consumption and low noise. ZTE's small OLT cabinets based on the green design principle use ZTE's in-house developed high-efficiency folded-plate heat exchanger and organ-pipe type heat exchanger, which, when combined with the adjustable fans, and the intelligent speed adjustment strategy designed and optimized for the main equipment, can minimize the power consumption and noise while dissipating the heat inside the cabinets. When the cabinets accommodate no more than 16 PON ports, the cabinets use natural cooling, which can meet the requirements of ETS 300 753 Class 4.1E protected-area level.

### Reliable

To address harsh natural environment challenges, ZTE's outdoor cabinets are specially customized to meet the requirements of extreme climatic environments, such as high temperature, high humidity, and high salt fog corrosion.

The heat dissipation system of the cabinets ensures that the equipment can operate properly at 50 degrees Celsius in direct sunlight. The cabinets have an enclosed architecture, and the internal and external





circulation are separated to effectively prevent corrosive air from entering the cabinet. The customized double-layer aluminum enclosure and hot-dip galvanized installation kits greatly improve the anti-corrosion performance of the cabinets. The IPX5 rating can resist the super typhoons and thunderstorms in tropical areas. The addition of anti-condensation sponge and sealing strips can more effectively prevent the equipment within the cabinet from moisture. The cabinets with surge current ratings up to 50 kA can also withstand level-17 super typhoon or Category 4 hurricane, much higher than the level-14 typhoon or Category 2 hurricane specified in the industry. The cabinets also integrate a IK10 anti-vandal structure.

Reliable power supply is also very important to outdoor cabinets. ZTE's small-capacity outdoor PON OLT cabinets use high-performance power units, which support wide-amplitude input voltages, fault alarm and automatic recovery, and remote monitoring and protection of battery against abnormalities. The cabinets also support flexible options of lead-acid batteries and lithium-ion batteries, and flexible configuration of the battery capacity.

### Reusable

For the operators with existing outdoor sites, deploying FTTx networks with the existing resources effectively saves investment. ZTE's small-capacity outdoor PON OLT cabinets can use power supply resources of the existing sites. The cabinets can be wall-mounted or pole-mounted, facilitating in-situ installation. In particular, the fly-weight EC100 cabinet supports an ultra-wide pole diameter range of 60-380 mm, allowing for the installation on the same pole and tower with the mobile BBUs or the installation with existing cabinets on a utility pole.

The cabinets can also be reused. ZTE's OLT cabinets in the existing network can be smoothly upgraded to support XGS-PON services only with the upgrade of the heat

dissipation performance and adaptation of the power system. The lead-acid batteries in the old cabinet can also be upgraded to li-ion batteries through the reconstruction of the battery compartment.

### Sustainable

In the access network projects of several countries, the small outdoor cabinets customized to the sustainability requirements of the operators are favored for their capacity scalability and equipment integrability.

For example, the EC70E cabinet supports up to 64 GPON ports/32 XGS-PON ports, 24-core fiber uplink and 120-core fiber downlink, and the battery capacity can be configured flexibly. All of ZTE's small cabinets are designed with scalability, supporting the ODF capacity redundancy of 50%–85%, 1+1 redundancy backup for the power rectifier, heat dissipation of high-power XGS-PON cards, and 2–5.2 hours of backup power when the equipment operates in its full configuration.

ZTE also provides specially designed small cabinets that integrate optical splitters, video multiplexers, and OTDR. Flexible support of devices allows flexible deployment based on the operator's existing network conditions, thus saving deployment costs.

### Summary

Lightweight is a direction for solving problems in deploying outdoor sites. Safe and reliable outdoor cabinets can cope with harsh environments and save maintenance costs in rural and remote areas. Reusable existing site resources, scalable cabinet capacity, and flexible device integration can help operators deploy outdoor sites rapidly in urban areas.

In addition to the small-capacity OLT outdoor cabinets, ZTE can also provide end-to-end FTTx series products covering the EMSs, cabinets, OLTs, ODNs and ONTs to meet the overall network construction requirements of operators. **ZTE TECHNOLOGIES**

# ZTE's Precise 50G PON Technology

## Development of PON

**D**ue to its considerable advantages over copper access in terms of transmission media, passive nature and point-to-multipoint topology, PON has been widely used in the last decade.

In the development of PON technology, the standards organizations ITU-T/FSAN and IEEE have played a significant role. At present, XG(S)-PON and 10GE-PON standards have been formulated and relevant products have entered the large-scale deployment phase, and the technical research of the next-generation PON has been put on the agenda. The next-generation PON has two research trends: one is to improve the single-wavelength rate and the other is to improve the total rate through multi-wavelength multiplexing. IEEE employs multi-wavelength stacking and channel bonding to provide two 25 Gbps channels to achieve 50 Gbps. ITU-T/FSAN focuses on the single-wavelength 50G PON technology to meet the requirements for next-generation PON in homes, businesses, and mobile backhaul/fronthaul scenarios.

## 50G PON Key Technology Analysis

The 50G PON standard (G.9804 series) has currently three sub-series, among

which, G.9804.1 defines the general requirements for higher speed passive optical networks, G.9804.2 the common transmission convergence (ComTC) layer specifications, and G.9804.3 the physical medium dependent (PDM) layer specifications.

### G.9804.1: Overall System Requirements

The overall requirement is to provide a bandwidth capacity five times higher than 10G PON, a maximum fiber distance of 20 km, a downstream rate of 50 Gbps, and flexible upstream rate options of 12.5 Gbps, 25 Gbps, and 50 Gbps.

### G.9804.2: ComTC Layer Specifications

When the rate of the 50G PON line is increased, the receiver sensitivity will decline. The performance of the receiver needs to be improved so that the massively-deployed ODN networks can be reused. To lower the requirements for high-speed optical components, 50G PON introduces the low density parity check (LDPC) scheme for FEC. For latency reduction, 50G PON applies dedicated activation wavelength (DAW), cooperative DBA (CoDBA) and bandwidth allocation interval reduction.

- **DAW:** A DAW can be a wavelength newly defined for 50G PON or one deployed for a PON system prior to 50G PON. It can be an independent



**Li Yuxuan**

Fixed Network Planning  
Manager, ZTE

upstream wavelength or a pair of upstream and downstream wavelengths. The DAW technology avoids opening a quiet window on the upstream wavelength, thereby eliminating the delay caused by the quiet window.

- **Co-DBA:** The OLT learns about the upstream service transmission requirement of the ONU through the upstream equipment, and then allocates bandwidth to the ONU in advance, hence reducing as much as possible the time for which the data is buffered in the ONU.
- **Shortening the bandwidth allocation interval:** The interval between bandwidth allocations for the ONU is reduced, thus reducing the time for which the data is buffered in the ONU. Each T-CONT supports a maximum of 16 bursts per 125  $\mu$ s frame.

#### G.9804.3: PDM Layer Specifications

- **Wavelength design:** Currently, 50G PON can only use a small portion of wavelengths in the O band, which are not enough. After many discussions, ITU-T has made it clear that 50G PON will not coexist with GPON and 10G PON at the same time. ITU-T has decided on some wavelengths and is still discussing the other wavelengths.
- **Line coding:** ITU-T has considered PAM4, duobinary and NRZ line coding schemes in its early discussions. Because the PON system has stringent requirements for the optical power budget, ITU-T finally selected the NRZ with the highest signal receiving performance.
- **PHY components:** The PHY components of 50G PON mainly include key optoelectronic devices such as optical transmitter modules, optical receiver

modules, laser device drivers (LDDs), burst-mode transimpedance amplifiers (TIAs), and clock-data recovery (CDR) chips. Experiments and simulations show that, by using a 50G EML transmitter and an APD receiver, 50G PON can attain a single-wavelength rate of 50 Gbps.

### Features and Application Scenarios of Precise 50G PON

According to the current technical features of 50G PON, ZTE launched the industry's first precise 50G PON technology that optimizes the traditional best-effort transmission mechanism into a more reliable transmission mechanism over hardened pipes, which delivers precise bandwidth, precise latency and precise jitter.

First, the precise 50G PON technology, which optimizes the timeslots and changes the multiplexing of the traditional PON technologies, can not only provide 50 Gbps per wavelength but also deliver access rates ranging from 2 Mbps to 10 Gbps based on hard slicing. Second, ZTE uses the DAW technology to eliminate the latency caused by the quiet window and the single-frame multi-burst technology to reduce the transmission timeslots and unnecessary timeslot overhead, thereby reducing the latency in a 10 km transmission from 1.5–2.5 ms to within 200  $\mu$ s. Finally, it provides precise jitter to optimize the traditional priority-based scheduling into fixed latency scheduling and reduce the jitter from the millisecond to nanosecond levels.

Take the comprehensive campus network access as an example, operators only need to build one feeder fiber to provide network coverage to the office, monitoring, manufacturing, and wireless access scenarios. In addition to coverage,



◀ Fig. 1. The world's first precise 50G PON prototype unveiled by ZTE at MWC 2022.

campus networks usually need to provide precise latency and jitter. For example, telemedicine requires the latency to be less than 50 ms and the jitter to be less than 200  $\mu$ s, grid relay protection requires the latency to be less than 200 ms and the jitter to be less than 50  $\mu$ s, and underground mine communications require the latency to be about 30–100 ms. In the above application scenarios, precise 50G PON can be used to connect different terminals, and then access the public cloud or the operator's network to provide time-sensitive services.

At MWC 2022, ZTE unveiled the world's first precise 50G PON prototype (Fig. 1), which is a milestone in the exploration of 50G PON application scenarios, the development of 50G PON technology and the maturation of the 50G PON industry chain. The precise 50G PON prototype featuring ultra-large bandwidth, low latency and low jitter can meet the demands for ultra-high bandwidth access in the home and enterprise scenarios, and support mobile xHaul and deterministic campus networks. In terms of bandwidth, the prototype supports up to 50 Gbps per wavelength, which is five times higher

than the speed of the already massively deployed 10G PON technology.

### Future Prospects

The release of the 50G PON standard has received wide attention in the industry, and the maturity of the industry chain has also been put on the agenda. It is expected that the 50G PON industry chain will gradually mature by 2025, and 50G PON will be commercially ready by 2025.

As an ITU-T member, ZTE is committed to the maturity of 50G PON standards and industry chain improvement. The company has made breakthroughs in the technologies of some key components, and has submitted more than 30 50G PON standard proposals with those on physical layer parameters, low latency and FEC already adopted by the standards organizations. In the future, ZTE will develop key optical component chips, achieving win-win cooperation with its peers, and explore the full-scenario and full-service access capability enhancement, access network architecture integration and innovation, multi-network integration, and engineering O&M to help operators reduce overall investments and costs, and improve efficiency and value. **ZTE TECHNOLOGIES**





# Converge ICT: FTTH Giant in the Philippines



**Yin Chiming**

FN Product Planning  
Manager, ZTE

## Background of FTTH Development

**W**ith the full maturity of fiber-to-the-home (FTTH) technology and the rapid decline in cost, passive optical network (PON) has been gradually recognized by operators and users because of its low cost, high reliability, long lifecycle and easy maintenance. Moreover, the neighboring countries of the Philippines have deployed PONs on a large scale and operated successfully. This provides a good reference model for the FTTH industry in the Philippines.

Converge Information and Communications Technology Solutions Inc (Converge ICT) was founded in Angeles City of the Philippines in 1996. After a careful and in-depth analysis of the market, Converge ICT decided to completely transform its networks to FTTH in 2018, taking PON as the only technical route for FTTH, and invested heavily in building HomePass and developing end users. By sticking to the rapid expansion strategy,

Converge ICT deployed a large number of HomePass devices to seize the fiber-to-the-home market, took high-value cities such as Manila and Cebu in the Philippines as its main expansion targets, and enhanced its brand reputation by taking advantage of the opportunity of less than 20% FTTH penetration rate in the country. Converge ICT also attached great importance to the quality of FTTH networks and Wi-Fi experience to ensure user stickiness.

## Road of FTTH Construction

Converge ICT started FTTH transformation in 2018 and chose ZTE as its partner to jointly build the FTTH network. They determined to use the FTTH solution and evolution path that leverage the dual-band optical network terminals (ONTs) to meet user needs for high-quality Wi-Fi experience and the Any-PON solution to meet user needs for smooth evolution to 10G PON. Converge ICT adopted ZTE's C350 optical line terminals (OLTs) as well as F660 and F670L ONTs. The



scheme met the needs of Converge ICT for fast and flexible network deployment and dual-band Wi-Fi. By actively deploying the interoperability technology, Converge ICT broke down the barriers between different equipment suppliers, so that ZTE's ONTs and OLTs could be rapidly deployed in areas where Converge ICT needed to expand.

Since 2020, Converge ICT has deepened its cooperation with ZTE and deploying ZTE's OLT C650 on the new-generation TITAN platform on a large scale. This is also the stage when the user base of Converge ICT has soared. Converge ICT not only grasps the opportunity of rapid expansion of FTTH users, but also makes full plans for bandwidth-hungry and low-latency FTTH services in the future. The unique Any-PON service card deployed on the OLT C650 provides GPON service through the GPON optical module, and the GPON ONT can drive down the deployment cost. When upgrading to 10G PON services in the future, Converge ICT only needs to replace the GPON optical module with any 10G PON optical module and does not need to make any change to ODN. Considering both the current cost and the convenience of future upgrade, this solution has become a universal solution used by Converge ICT in all its networks. Converge ICT has also adopted ZTE's dual-band ONTs, with F670L as the main delivery model. The dual-band ONT solution helps Converge ICT improve Wi-Fi experience of end users, gain market reputation, and further secure and expand the market share.

### Achievements of FTTH Transformation

Converge ICT had more than 1.6 million FTTH users and more than 11 million HomePass users from 2018 to the first quarter of 2022. Its FTTH users exceeded that of the powerful competitors, making Converge ICT the second largest FTTH providers in the Philippines. The FTTH revenue of Converge ICT in the first quarter of 2022 exceeded 100 million USD.

Thanks to precise market strategies and user positioning, the FTTH ARPU of Converge ICT has been maintained a high level. This gives Converge ICT more confidence to further increase its investment in FTTH. Targeting the FTTH market in major cities in the Philippines, Converge ICT had successfully developed more than one million subscribers in Manila, the capital of the Philippines, and Cebu City, the Philippines' second largest city as of the first quarter of 2022. Its FTTH brand Fiber X has been greatly favored in the Philippines, and was rated as "Top-Rated Fixed Network" in the country by a third-party network evaluation company Ookia in the first half of 2022 (Fig. 1).



◀ Fig. 1. Converge ICT wins "Top-Rated Fixed Network" award.

### Prospects for the Future

The current FTTH penetration rate in the Philippines is only about 20%, and a large number of users are still using FWA or DSL services. However, PON-based FTTH has already been recognized by operators as the only future-oriented fixed broadband technology. Other major operators in the Philippines are also gearing up, aiming to rapidly increase their market share in the fierce competition that follows.

Converge ICT now has full confidence in the next round of competition. It is widely deploying HomePass in densely populated areas in the Philippines to seize the key urban user market, deploying ZTE's TITAN-based OLTs for the next-generation PON on a large scale, establishing market brands such as Fiber X, and expanding sales partners nationwide. These strategies will lay a solid foundation for rapid growth of Converge ICT in the future, and Converge ICT's FTTH business will continue to maintain high-quality and rapid growth in the Philippines. **ZTE TECHNOLOGIES**

# PHỦ SÓNG CẢ NHÀ WIFI LUÔN MẠNH



## Viettel: Creating New Home Wi-Fi Experience



**Cai Zhilan**

CPE Product Planning  
Manager, ZTE

Vietnam is located in Southeast Asia, with a population of 98 million. Its economy has developed rapidly in recent years, with an annual growth rate of more than 6%. The number of FTTH users in Vietnam is about 16.8 million, and the FTTH penetration rate exceeds 60%. The mainstream bandwidth in the country was 80–100 Mbps in 2021.

Founded in 2004, Viettel is the largest telecom and mobile operator in Vietnam. With practical and efficient network technology planning, Viettel is rapidly developing its telecom services around the country. It started large-scale GPON deployment in 2014 and became

Vietnam's largest FTTH operator in just a few years. Viettel had more than 7 million FTTH users in 2021, accounting for 43% of the market.

Viettel provides FTTH users with a variety of network packages, ranging from entry-level 50 Mbps to high-speed 250 Mbps to meet the needs of different user groups. However, due to the rapid development of FTTH and market saturation, Viettel urgently needs to find new service growth points to increase its revenue.

### Weakness of Wi-Fi Coverage

Most of the residential buildings in Vietnam are stand-alone buildings with

a long and narrow structure, usually 2–3 stories, a large area and many rooms. It is difficult for a single common Wi-Fi CPE to achieve whole-home Wi-Fi coverage. Despite the increasing FTTH bandwidth, users still have a poor Wi-Fi experience. Some users configure different Wi-Fi APs via network cables, but it is inconvenient to commission and maintain them, and the configuration is complex.

In addition, Vietnam is the second largest coffee producer in the world, with a deep and rich coffee culture and a extremely high density of cafes. The cafes there usually have a large area and high population density, which pose high requirements for the coverage, stability and concurrency ratio of Wi-Fi networks.

In this context, Viettel decided to adopt the Mesh Wi-Fi intelligent networking solution and the Cloud Wi-Fi management platform to launch new services, while solving the problem of home Wi-Fi coverage, so as to provide users with a seamless Internet experience. The Cloud Wi-Fi management platform can also provide home Wi-Fi network management and fault diagnosis, offer users professional O&M guarantee and after-sales services, and thus enhance user experience.

### Intelligent Mesh Networking + Cloud Wi-Fi Solution

The optical line terminals (OLTs) and optical network units (ONUs) deployed in Viettel's existing networks are mainly supplied by mainstream vendors such as ZTE, and Viettel has started large-scale deployment of dual-band Wi-Fi 5 ONUs. ZTE recommended that Viettel adopt

the ONU+AP Mesh networking solution, which only needs to purchase a separate Mesh AP and work with the dual-band Wi-Fi 5 ONUs to realize intelligent mesh networking of the whole home. To meet the requirements of Viettel, ZTE provided a Mesh AP product that could leverage its self-developed Mesh Wi-Fi solution and work with commercial ONUs to implement Mesh networking. Also, ZTE provided Viettel with a customized Cloud Wi-Fi management platform that could manage and upgrade the Mesh APs remotely and locate and diagnose home network faults.

ZTE's Mesh Wi-Fi solution and Cloud Wi-Fi management platform helped Viettel increase service revenue while reducing CAPEX and OPEX.

- **Low investment:** The ONU+AP Mesh networking solution reduces the investment of one AP compared with the ad hoc networking formed by APs. When deploying Mesh services in its existing network, Viettel only needs to add Mesh AP(s) under ONU to realize Mesh networking without replacing the existing ONU. Compared with the AP ad hoc networking, the ONU+AP Mesh networking solution reduces the equipment deployment cost by 33%.
- **Excellent signal coverage:** The ONU+AP Mesh networking solution supports "1+1" or "1+N" application scenarios. It can flexibly select the number and connection mode of APs according to different application scenarios so that smart networking can cover every corner of the user's home, thus achieving whole-home Wi-Fi coverage and improving user satisfaction.
- **Easy O&M management:** The Cloud Wi-Fi management platform customized

Fig.1. Viettel's Home Wi-Fi service.



by ZTE for Viettel supports remote management and fault diagnosis of ONUs and Mesh APs. Some faults can be remotely fixed, helping Viettel reduce truck rolls and O&M costs.

Viettel successfully put the Mesh Wi-Fi solution into commercial use, launched Home Wi-Fi service, and established the Super Net brand at the end of 2019 (Fig. 1). It has become the first operator in Vietnam to promote and commercialize Mesh Wi-Fi networking services.

### Creating a New Digital Life Experience

After Viettel launched its Home Wi-Fi service in Vietnam, the service ignited the market and was widely favored by users. Vietnam has also become the country with the most extensive commercial use of Mesh Wi-Fi services in Southeast Asia.

The Mesh Wi-Fi solution supports flexible deployment. It can be used

not only for homes with large areas and multiple rooms, but also for sidewalk cafes and small restaurants that can be found everywhere on the street. With the promotion and popularization of the Mesh package “Super Net” as a basic service of fixed-line broadband packages, Viettel has gradually increased its subscriber base. By the end of December 2021, the number of Viettel’s Mesh Wi-Fi subscribers had exceeded 200,000, and the average revenue per user (ARPU) value of its fixed-line broadband had increased accordingly. According to CEO of Viettel, the Mesh package “Super Net” is a successful sub-project that bolsters its revenue in recent years.

As a leading telecommunications operator in Vietnam, Viettel plays a significant role in Vietnam’s fixed-line broadband market. Viettel will continue to work with ZTE to strengthen cooperation in new technologies and solutions and bring more and more wonderful digital life experiences to the Vietnamese people. **ZTE TECHNOLOGIES**



# ZTE Takes AI Across the Network to Drive Efficiency

Source: Mobile World Live

**A**cross the world, 5G networks offer increased capacity and higher speeds for consumers. More than 737 million subscribers now enjoy the next-generation mobile service in 72 countries, data from GSMA Intelligence showed. Meanwhile, monthly data usage has jumped nearly threefold compared with LTE networks.

While the new networks are significantly more efficient, delivering more bits per megawatt of energy, overall power consumption is soaring as data usage grows exponentially. Industry insiders forecast 5G energy consumption could triple by 2025.



**Peter Jarich**

Head of GSMA Intelligence

Peter Jarich, head of GSMA Intelligence, kicked off a recent Mobile World Live webinar by saying building a green network starts by looking at your data assets to understand how and where you are using energy, and where efficiencies can be made.

"Start doing something now," he suggested,

by beginning transformation planning for renewable sources and resource optimization.

In fact, AI-driven network management is increasingly part of every vendor's offering.

GSMA Intelligence research found 57 percent of operators surveyed expect network energy costs to increase by up to 20 per cent in the next three years as demand for data continues to climb, he said. "It's not surprising then that 66 per cent of respondents view energy efficiency strategies as very important," noted Jarich.

Jarich also recommended thinking beyond equipment to the entire supply chain.

## Driving Efficiency

Ding Yi, senior director of analysis and strategy at ZTE, noted climate change has forced the industry to rethink how it builds and operates networks, with the mobile sector emerging as a leader in the move to net-zero emissions.



**Ding Yi**

Senior Director, Analysis & Strategy at ZTE





He argued that in addition to supporting more sustainable development of communications networks as data demand soars, more energy-efficient equipment can also significantly lower Opex for operators.

Research by GSMA Intelligence estimated the RAN accounts for 73 per cent of an operator's energy consumption and the core network 13 per cent.

Yi explained that improving efficiency is mostly about shutting things down in a smart way by applying AI to a cloud platform. For example, at night most RAN equipment continues to consume energy even when not active.

ZTE incorporated shut-down mechanisms and a hibernation mode to AAUs, reducing consumption at idle times to just 5 watts. Normal power consumption with low traffic is typically 200 watts, Yi said. "This is the foundation of our toolkit."

As the company investigated where in the network to use AI algorithms, its research teams realised it was clear they should be deployed in as many places as possible.

## More Than Hardware

ZTE's latest green network solution is focused on the underlying hardware in the base station, as AAUs and RRUs account for more than 80 per cent of power consumption at the base station.

The company was the first in the industry to apply AI algorithms on base stations, he claimed. "The cloud platform has some limitations. Putting AI on the BBU creates real-time responses and makes it more nimble."

Yi acknowledged AI-driven networks are not new, but deploying AI directly to the base station is a recent innovation. "Cloud platform AI is the norm in the telecoms industry at present, but power saving using local AI at the base station is truly innovative."

Based on big data analysis, the platform automatically identifies network energy saving opportunities, predicts network traffic trends and identifies co-coverage cells. The system also automatically generates energy saving policies and implements network-level intelligent energy reduction management and site energy-saving coordinated scheduling.

ZTE takes a three-layer approach to improving energy efficiency: starting with the hardware, using in-house developed chips and powering its algorithms with advanced software.

With improvements in computing power used in base stations, more intelligent strategies can be introduced, allowing cross-domain information affecting consumption to be automatically generated at the base station to improve optimization.

Nearly 20 operators, including China's major three mobile players, have deployed its PowerPilot Pro on some 900,000 base stations running on more than 30 networks globally.

Earlier in the year, Chengdu Telecom partnered with ZTE to use the vendor's

AI intelligent solution to reduce energy consumption, potentially cutting consumption as much as 34 per cent on its 5G network.

## Core Gains



**Yang Rui**

Technical Director of Cloud  
Core Network at ZTE

ZTE technical director of cloud core networks Yang Rui insisted focusing on the core network can make a big difference in an operator's green transformation efforts.

"Although the energy consumption of core networks only accounts for about 13 per cent of telecoms networks, there are still many parts that need to be optimized," she stated.

ZTE's goal is to continue improving system performance—using the minimum resources for the maximum capacity, deploying full virtualization to lower the watts used for each bit of tariff, she said. Being service aware is also vital, requiring the system to apply a 'green brain' for energy saving policies based on service perception.

To reach these objectives requires not only open systems in order to collaborate with partners but a cloud native platform.

Yang explained a cloud platform, more than ever, plays a significant role in overall network performance. "It provides flexible adoption of different functions, like data forwarding and control signalling processing. For different kinds of applications, we can assign different resources and adjust the network setup."

The platform supports a dynamic power saving mechanism to automatically shut down some resources when there's no payload and

can run defragmentation to release extra resources that have been consumed.

A heterogeneous cloud infrastructure provides the most efficient resource for applications, she added. In addition, unified management and orchestration of different processors also depends on the perception of service and global resource orchestration.

These intelligent energy management systems also can be applied to network slices, which means they can be used across different types of data centres.

## Smaller Is Better



**Liu Xiaoguang**

Chief Engineer of Digital  
Energy Planning at ZTE

Liu Xiao Guang, chief engineer of Digital Energy Planning at ZTE, explained that simplifying telecoms sites can dramatically reduce power consumption, for example, by fitting the air conditioner, power supply, batteries and transmission into one cabinet. ZTE has done the same with its pole sites.

For data centres, cooling and power distribution consume the vast majority of the energy. Liu noted new technologies such as indirect evaporative air handling units (AHUs) and liquid cooling can reduce power usage effectiveness (PUE).

"If we want to move closer to our carbon neutrality targets, more renewable energy, coupled with intelligent energy management, needs to be used to power hungry 5G networks. And energy storage systems will make renewable energy more reliable and useful," Liu stated. **ZTE TECHNOLOGIES**

# Guangzhou 5G Smart Transportation on the Way

Source: Light Reading

**G**uangzhou, also known as Canton, is the third largest city in China after Beijing and Shanghai. In 2020, China Mobile, Guangzhou Municipal Transportation Bureau, ZTE and over 10 other industry partners joined together and announced the world's first 5G smart transportation city in Guangzhou.

Over the past two years, the project has been benefiting not only the 20 million people in Guangzhou City but also the various industries and the government agencies. The transportation systems included are buses, subways, and high-speed trains, which are now enjoying improved automated operation and maintenance, more efficient dispatching and management, and improved passenger satisfaction.

It is the world's first 5G smart transportation city with all city's transportation systems involved, comprehensive and beneficial to the entire city transportation system ecosystem. No other 5G transportation project has been on such a large scale and fruitful in making people's life better. These provide examples for digital transformation of urban planning and governance.

## Promoting Digital Transformation of the Transportation Industry

The transportation industry has now

improved operation efficiency, safety, security, customer satisfaction and better business results.

As the industry's first high-speed rail uses HD smart eyes, the two-minute machine vision and AI replace two man-hour detections. The failure rate is reduced by 20%, and the maintenance cost is reduced by 20%. The first 5G high-speed railway with a super-line-of-sight distance of early warning with at least 8 km is used for real-time monitoring and AI image processing, identifying risk factors and raising alarms automatically. The first 5G high-speed railway with mass data storage improves the work efficiency by 10 times. The average daily processing capacity of the industry's first 5G intelligent railway marshalling station is 13,500 vehicles, increasing efficiency by 70% and reducing manpower by 25%.

The industry's first 5G smart subway includes the industry's first 5G subway train, the industry's first 5G high-precision positioning subway, and the industry's first 5G private network slicing application subway. The full-scene intelligent subway service has been realized; as a result, the operation efficiency has been improved by 20%, saving more than 30% of manpower for the on-site customer service and monitoring position in the station hall.

As the industry's first 5G intelligent bus dispatching system, the scheduling of bus

lines is shortened from one week to one day. In addition, the system achieves the matching of passenger traffic to improve the traffic of 10%. Also, the industry's first 5G road patrol improves the risk detection rate of the Nansha Bridge by more than 65%.

In addition, the health and occupational safety of employees of transportation companies have been greatly improved by 5G. For example, high-speed railway vehicle repair personnel, tunnel repair personnel, and road and bridge preventive maintenance personnel can view the machine test results in a comfortable monitoring room. They do not need to tolerate high temperatures or cold weather, and do not need to repeatedly bend over the waist or climb into the bottom of the vehicle any more. They can now avoid going deep into the tunnel or high up the bridge, which greatly reduces the risk of work injury.

## 20 Million Population's Travel Experience Changed

This project has changed the travel experience of the vast majority of people in a city with more than 20 million people.

- **Comfortable and time-saving:** The 5G network-based app "Traveling" has provided streamlined travel service for 10 million users. Passengers can query the bus arrival time, whether seats are available or not, and whether traffic is crowded. With real-time data, the all-in-one 5G security check machine enables passengers and luggage to pass through the gate quickly, shortening the average turnstile duration during peak hours by 20%. The bus control center can monitor the operational status of buses in real time and flexibly adjust the transport capacity, and shorten the waiting time of passengers.
- **Safe:** 5G high-speed rail ultra-sight distance early warning system, 5G digital tunnel, bus status data

monitoring, safe driving early warning and other applications all guarantee travel safety. In case of emergency, the AR security glasses on subways can quickly compare data and raise alarms, thus speeding up the handling of security incidents.

- **Enjoyable:** With the application of the indoor SuperMIMO technology, passengers can enjoy the uplink bandwidth exceeding 750 Mbps in the subway carriage at a distance of up to 160 km. In addition, after getting on the vehicle, passengers can access the intranet of 5G mobile phones without perception, and enjoy local on-board movies and the latest information in the "Life on HSR" (High Speed Railway) and "Tencent Video" apps (Tencent being the largest social media company in China). The metro positioning system can be interconnected with third-party apps to provide accurate navigation, shopping, and catering information for passengers.

## Guangzhou 5G Smart Transportation City Model Replication

Up to now, the Guangzhou 5G Smart Transportation City project has been awarded several national awards and formed multiple industry standards. The success of the project has triggered dozens of cities to replicate and promote similar systems.

Smart transportation has huge business potential in the future. In the next few years, we hope to usher in brand-new passenger services and a thorough change in the transportation field. In the next few years, the smart transportation industry is expected to grow by 130 billion US dollars by 2024.

Guangzhou, leading the trend of 5G Smart Transportation City, will keep the innovation spirit to continue with better transportation solutions to benefit both consumers and the industry as a whole. **ZTE TECHNOLOGIES**

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