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VIP Voices

Nepal Moves into Digital Technology

Tech Forum

Key Technologies of IP RAN

Dinesh Kumar Thapaliya, secretary of MOIC and chairman of the board of Nepal Telecom

Special Topic IP RAN

SDN Builds Elastic IP RAN

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A technical magazine that keeps up with the latest industry trends, communicates leading technologies and solutions, and shares stories of our customer success

ZTE H1 2016 Results

Net Profit Rises to RMB 1.76 Billion R&D Investment Ratio Close to 15%

25 August 2016, Shenzhen, China — ZTE Corporation (H share stock code: 0763.HK / A share stock code: 000063.SZ), a major international provider of telecommunications, enterprise and consumer technology solutions for the mobile internet, announced its results for the six months ending 30 June 2016. The company reported an overall increase in operating revenue of 4.05% to RMB 47.76 billion.

ZTE reported a domestic operating revenue of RMB 27.8 billion, accounting for just over 58% of overall operating revenue. International operating revenue is RMB 19.95 billion, accounting for almost 42% of the group's overall operating revenue.

Net profit attributable to holders of ordinary shares of the listed company rose to RMB 1.77 billion for the six months ending 30 June 2016. Basic earnings per share amounted to RMB 0.43.

The reported operating revenue for carriers' networks business in H1 was RMB 28.74 billion. Operating revenue for government and enterprise business amounted to RMB 4.61 billion. Operating revenue for the consumer business amounted to RMB 14.42 billion. The net cash flow from operating activities reached RMB 2.36 billion, a year-on-year increase of 56.17%.

In H1 2016, ZTE invested close to 15%, or RMB 7.06 billion, of their total revenue in R&D, the largest such investment the company has made to date. Continued investment in R&D will contribute to the sustainable development of the company.

Looking into the second half of 2016, ZTE will seek to grow by leveraging opportunities that arise as the industry restructures. The company will focus on major strategic directions: in-depth development of the carriers' market; value creation in government and enterprise business; integration and innovation in the consumer market, and driving business development in the virtuality, openness, intelligence, cloudification and the internet of everything (VOICE) sectors. They will pursue mutually beneficial growth with customers, partners and other stakeholders, to create a beneficial, digital ecosystem for the industry.

ZTE Announces New M-ICT 2.0 Strategy for the Digital, Open, Sharing Economy

25 August 2016, Shenzhen, China — ZTE published a white paper on its M-ICT 2.0 strategy and vision that will guide the company for the next five years.

ZTE's M-ICT 2.0 strategy is designed to help businesses seize opportunities in an economy defined by the emergence of the sharing economy and the vast use of peer-to-peer networks, and dependent on the pervasive range of cloud computing platforms and services.

Underpinning M-ICT 2.0 are five key trends ZTE believes will play critical roles in the ongoing global economic transformation to an open, sharing, digital economy. These trends are virtuality, openness, intelligence, cloudification and the interconnection of everything. These trends encapsulated in the acronym VOICE will drive innovative collaboration and concurrent advances across various fields. Over the next five years, ZTE will focus on VOICE and the individual and interconnected impacts of each trend as they develop products and services.

"Guided by the strategies and solutions embodied in M-ICT 2.0, ZTE will drive rapid, sustainable development of the global ICT industry," said Dr. Zhao Xianming, CEO of ZTE. "As we capitalize on the VOICE trends, we'll be boldly trying new business models, while reinventing existing practices to capture major market opportunities for ZTE, our partners and customers."

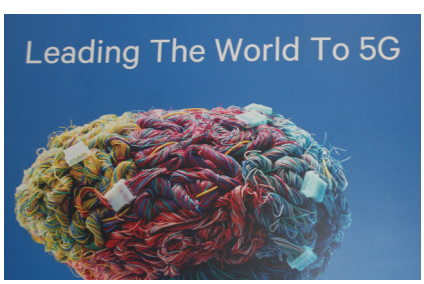
China Unicom and ZTE Sign Strategic Cooperation Agreement on Joint 5G and IoT Innovation

16 August 2016, Shenzhen, China — ZTE announced that a signing ceremony for a strategic cooperation agreement on joint 5G and internet of things (IoT) innovation has been held with China Unicom. Shao Guanglu, deputy general manager of China Unicom and Xu Huijun, CTO of ZTE Corporation, attended the ceremony and signed the agreement. Emphasizing their own capabilities, in line with national innovation and corporate development strategies, both parties will work closely together in the fields of 5G and IoT to foster a sound ecosystem and promote sustainable development of the industry.

China Unicom and ZTE will work together to develop cooperative projects and conduct research on application scenarios, product demands, service applications, market development and other related fields. They will also look at possible future directions of 5G and IoT and aim to achieve research results that meet network development and evolution requirements for new business models. They focus on research and investment in 5G network architecture, mobile-edge computing, cross-layer optimization, bearer and other key 5G technologies to promote 5G development strategies and standardization, and also conduct research and experimental verification of key IoT technologies and implement research and development of service solutions and products to promote technological development and industrial cooperation.

ZTE Completes Phase-1 5G Testing

29 August 2016, Shenzhen, China — ZTE announced the successful completion of phase-1 tests of key 5G wireless technologies as part of China's 5G testing. The company took the lead in verifying key 5G high and low frequency technologies, and passed all tests of multiple key air interface technologies, including high-frequency communications, multi-user shared access, new waveforms, and MIMO.



ZTE Assists Operators to Construct the Strongest Networks

5 September 2016, Shenzhen, China — ZTE has announced that its customer, Hutchison Drei Austria, has beaten six competitors in the service experience score (SES), the largest service survey from a customer perspective, to retain the title of mobile "Service Champion". The SES covers 193 companies in 25 industries, with more than 55,000 customers rating their service experience, and serves as a reliable measurement of customer service and loyalty. In another test organized by smartphone magazine and network evaluation software FLOQ, Drei topped all other competitors again and was awarded as "Best Network".

Since 2010, ZTE has modernized the entire mobile network of Hutchison Drei Austria, including its 2G/3G/4G/CN. In 3rd party network performance tests over the past few years, Hutchison Drei Austria consistently comes out as the top performer. It topped the network performance evaluation for the first time in 2011, and recorded another first in 2012. In September 2015, the 3rd party consultant company OpenSignal organized a network evaluation on 183 LTE networks, among which Hutchison Drei Austria network ranked one of the top 10; and in the same year, it topped the CONNECT test in Austria and ranked number two in 10 operators of the DHCA area.

Dinesh Kumar Thapaliya, secretary of MOIC and chairman of the board of Nepal Telecom

Nepal Moves into Digital Technology

Reporter: Ye Mu

Ministry of Information and Communications is governmental body of Nepal that manages postal services, telecommunications, broadcasting, press & information and film development in the country. Nepal Telecom, a state owned telecommunication service provider in Nepal, is the sole provider of fixed line, ISDN and leased-line services with more than 10 million users in Nepal. Recently, *ZTE Technologies* interviewed Dinesh Kumar Thapaliya, secretary of MOIC and chairman of the board of Nepal Telecom. He shared with us the development of telecom sector in Nepal, major milestones of Nepal Telecom, current status of Nepal Telecom's network, his criteria to choose suppliers, 4G strategy and plans for smart city. He also talked about his expectations for ZTE and his vision for Nepal's telecom sector.

How can MOIC accelerate the development of telecom sector in Nepal?

The main objective of the Ministry is to develop and expand the information and communication sector to the rural level in the form of infrastructure for social and economic development through wide spread participation of the private sector as well with emphasis on the dissemination of information and communication technology.

Also, the Ministry plays its roles to make the information and communications sector active so as to preserve various aspects of national identity and significance, as well as to secure people's participation, international cooperation and goodwill in the process of all round development of the nation by creating public awareness.

To develop telecom sector further in Nepal, MOIC brings a favorable regulatory framework with proper licensing, which enables telcos of Nepal to leapfrog on the latest communication technologies using minimum capital investment and operational expenses. Technology neutral on licensed frequencies, infrastructure sharing, usage of rural telecom development funds are main areas where MOIC is serious.

What are some major milestones that Nepal Telecom has achieved?

Nepal Telecom is a state-owned telecom service provider. It has been providing almost all licensed telecom services in Nepal and serving all parts of the country. From its inception, started with magneto system, central battery (CB) exchange and cross bar system, Nepal Telecom made a strategy to move into digital technology. Over the last 25 years, all transmission networks, such as microwave, satellite and fiber, are based on digital technology.

Currently, Nepal Telecom is providing PSTN service through digital exchanges, cellular mobile service on CDMA 1X and EVDO, and 2G and 3G GSM. It is in the process of migrating its TDM-based PSTN system to IP-based PSTN service, which incorporates voice, data and multimedia services. Nepal Telecom will leapfrog to the latest 4G-based wireless services–LTE very soon. Now, a transmission network for 4G services is under construction.

What is current status of Nepal Telecom's network? What challenges do you face as per your role?

The demand for more networks is increasing and the customer expectation for better quality is growing rapidly. The major challenge of Nepal Telecom is to implement projects on time to meet customer expectations. We have prepared a detailed work plan to complete our targets.

What criteria do you use to select suppliers? How will you improve the supplier management?

Nepal Telecom is following procurement guidelines and procedures approved by the government of Nepal. We have a standard procurement process by which equipment and partners are evaluated and selected

ZTE provides a landmark cooperation in which Nepal Telecom and ZTE can both get benefits in terms of time, resources and technologies by working together in this sector.

based on experience of system implementation and quality of products.

Our past experience shows that major projects implementation is delayed due to various reasons. Besides natural disasters and disturbances in the country, we have noticed that some suppliers are deviating from commitments signed in the contracts. There are various reasons for this, which will be addressed in our new contracts.

As 4G is expected to be implemented soon in Nepal, what is your strategy to deploy 4G?

With growing demand for data services, the next solution is to move to 4G deployment. Taking technological advantages of the existing 3G service, Nepal Telecom is planning to move forward by deploying 4G services in the country. For this purpose, Nepal Telecom has been conducting study visits, participating in various 4G/LTE forums and discussing with solution providers for an efficient and effective rollout of LTE services in the country.

Do you have any plan for deploying smart city solution in Nepal?

The government of Nepal has set a national agenda to develop smart cities. As per the budget, a master plan will be prepared to develop Kathmandu, Lumbini and Nijgadh as smart cities.

Moreover, the government of Nepal has plans for developing modern satellite cities in different parts of mid-hill highway in the country. Nepal Telecom is planning to provide connectivity to those cities through optical fiber links. Ten cities in southern belt (Terrai) will be enhanced to make modern cities with modern facilities, like communication infra, green city, and smart city.

How do you evaluate ZTE's team and solution? How would you like ZTE to contribute to Nepal Telecom's network solution?

ZTE has been providing core and network systems to Nepal Telecom mainly in GSM and CDMA services for a long time.

To upgrade and enhance the capacity, increase the network quality and deploy new technologies of next generation, ZTE provides a landmark cooperation in which Nepal Telecom and ZTE can both get benefits in terms of time, resources and technologies by working together in this sector. Quality of products and quality of service are expected with more commitments on action.

What is your vision for the future of telecom sector in Nepal?

Telecom sector is growing fast and changing overnight. To provide quality services and deploy the latest technologies in this sector, MOIC is always providing guardianship to Nepal Telecom for delivering quality service to its customers. Therefore, the sole vision of the MOIC is to lead telecom sector in Nepal by providing innovative ideas and the latest technologies.

ZTE TECHNOLOGIES

Cumii:
Bringing Connected Things and Transformation to Africa

Reporter: Zhang Ying

Norman Moyo, CEO of Cumii

Cumii is a Pan-African IoT company that focuses on disruptive technology that transforms Africa. Its philosophy and DNA is built from the internet of things (IoT) , machine to machine (M2M) and big data. Recently, *ZTE Technologies* interviewed Norman Moyo, CEO of Cumii. He shared with us his career history and business philosophy, Cumii's performance of 2015, the solutions and services of Cumii, and the opportunities for IoT sector. He also talked about his comments on ZTE and his vision for Cumii as well.

You were awarded the prestigious Global Telecoms "Top 40 under 40 Telecoms Leadership Award". Could you tell us your career history?

Yes. I started my career in telecommunication in 1998. I think that is the very beginning of the telecom sector in Africa. I used to work for Econet in Zimbabwe before I started my Pan-Africa voyage which took me to Zambia (Celtel), Nigeria (Celtel/Zain), Bahrain (Zain), and Tanzania (Etisalat/Helios Towers). After working in Southern, East and West Africa, I have paid substantive school fees that accord me the title of a diverse Pan-African business manager. The years I spent in Nigeria in particular were very fulfilling. I guess I could say that I earned my second MBA in managing business in Nigeria, one of the most sophisticated and highly rewarding places to do business in Africa. I have been fortunate to be involved in the GSM industry in the late 1990s, at the very onset of the industry. I was also at the forefront of the emergence of a fully fledged tower companies and worked as a CEO for Helios Tanzania, which was the largest towerco in Africa outside Nigeria then. Now I am back within Econet Group and spearheading the first fully fledged Pan-African IoT company, offering connected cars, connected home, and connected health. When I was working in Nigeria as a team leader, our team managed to achieve some very exciting achievements. This is one of the reasons why I have been nominated "Top 40 under 40 Telecoms Leadership Award" by GTB. It is really a high recognition of our big success that we achieved in Nigeria with Celtel where I worked as CMO.

Could you introduce us to Cumii?

Cumii is a Pan-African IoT company. At the moment, what we focus on is three major verticals: connected cars, connected homes, and connected health.

At Cumii, we specialise in disruptive technologies that transform lives, businesses and the global economy. Our philosophy and DNA is built from IoT , M2M and big data. Why did we choose those three verticals? It is because they are very relevant to the continent, and they would create a lot of value for Africa. What we need in Africa is things that impact our patterns of life, improve the quality of our lives, and enhance public health and productivity. I believe our connected car, connected home and connected health can meet all of these requirements.

How would you assess the performance of Cumii in 2015?

Cumii was established in 2014 starting with connected car in Zimbabwe, but it has grown significantly across the continent. The business follows a unique smart partnering model, working directly with mobile network operators in Africa who already have unique business to consumer relationships. Cumii's first major commercial agreement was with Vodacom in Tanzania, which would be expected to transform fleet management environment for both corporates and government alike.

In 2015, we signed up a number of partnerships with some big operators and technology partners in Africa. These partnerships are very important to us. We have built an ecosystem to deliver unique services to our customers in a smart and effective way. We try not to do all things to all people, but do those things we can do better than anyone in the world.

One thing I would like to mention is our execution capability that makes Cumii very unique. To deliver IoT in Africa, we need to execute very differently to overcome the difficult terrain we face in the continent. Every country in Africa is different and unique, which

requires high level of technology and expertise to deploy and integrate services. We created an IoT execution platform called Technite, where industrial engineers, auto engineers, technicians, and other skilled people across Africa can be easily accessed on an application. Technite is like your equivalent of Uber only that on the other side of the app. We have a highly skilled installer capable to install connected home system, fleet tracking devices, fibre to home, satellite in home, and business monitoring systems. Any customer in Africa should be able to open the app on his phone and search for a nearest installer. The system will scan and allocate the nearest pre-vetted, trained and accredited installer to undertake the required installation once we launch services in that country. This is a very unique aspect which will create significant economies of scale, skill and expertise, improve productivity of companies, and reduce installation costs for customers. We have registered more than 1000 highly skilled installers in 17 countries in Africa, and we are targeting to grow this to 10,000 and creating equally the same entrepreneurial opportunities.

We seek to embrace IoT and disrupt our ways of working for the better. We have created a new platform which is going to make it easier for African to do business.

What kind of solutions and services do you offer? How have African markets responded to them?

Connected car is not necessarily a new phenomenon in Africa because tracking services have been around for a while. However, we are reengineering fleet management and personal vehicle management in a progressive and disruptive manner using our big data analytics platform. Companies are keen on enjoying nearly 25% fuel and maintenance savings over and above other services, such as geo fencing services, which report vehicles that stray away from defined routes. Connected car has been well received, particularly by insurance companies. They like the tracking device because it can give them a lot of information about driver behavior and distance travelled, and mitigate against fraudulent claims. Governments in Africa are keen to use this technology to connect all public passenger carrying buses to monitor driver

behavior, thereby reducing public transport accidents. For example, after we shared the concept with the Tanzanian's SUMATRA agency, they have since released a tender to connect all public vehicles in the country. We expect the trend to continue in different parts of the continent.

Connected home is an integrated alarm and security system (sensors and cameras) that comes with home energy automation features like remote light switches, power consumption monitoring, and air conditioner control. Connected home helps homes and small businesses reduce their energy costs substantially, and improve security both at home and at their business premises. A mother with a connected app in her hands can monitor the welfare of her children at home by tapping onto her phone, switch off and switch on lights, even better still define simple rules such as air conditioner and lights should be switched off as soon as a room is empty. Imagine the amount of power we save in both public and private institutions if all lights and air conditioners were sensor monitored. Considering the catastrophic and paralyzing effect of poor power or dirty power situation in Africa, any technology that has potential to reduce 40% consumption of power from a business or a home has potential to create a seismic effect to the continent's economy. Africa sometimes suffers more from inefficient use of a scarce resource like power. Intelligent technology can help and IoT provides the answer in the short to medium term.

Cumii believes that there are three things that will transform the continent, telecoms, power and health sector. Cumii Health as a business is an integrated health sector platform in the IoT space. Cumii's first offering evolves around wellness monitoring products. Our first focus was to tackle one of Africa's "silent" killers, blood pressure and diabetes. Our IoT platform is leapfrogging the continent towards a smart health continent without the huge infrastructure investment most countries have made. Let me better illustrate it for you this way. We are going to connect Mr. Mwangi in a remote village in Kenya with a sim enabled device to measure his chronic blood pressure, his readings will be sent to his daughter's phone in the city, and simultaneously to a medical specialist who will monitor if his readings are within acceptable levels in real time. Mr. Mwangi will also receive periodic health tips on how to improve his readings and stay healthy. If indeed the doctor notices anything untoward on the readings, there is a "dial a doc" service or the doctor will recommend a check up. A single innovation here has eliminated the need for Mr. Mwangi to jump into a bus to visit a nearby clinic, which probably would cost him $50, and possibly another $20 to see a doctor plus medicines. We are offering this service on a monthly subscription service below $5 per month, and payments are all integrated to the MPesa/Eco cash mobile platforms. This is the power of very relevant localized application of IoT to the health sector in Africa. You can imagine other services we can integrate to this platform and the benefits that can accrue to health planners from the big data.

What opportunities do you identify in IoT?

Beyond connected car, connected home, and connected health, there are a lot of opportunities. By its nature, IoT is extremely broad. What Cumii is trying to do is to find those opportunities that meet the market needs in Africa. We want to help the ordinary men in the street, the business men improve their business performance, the minister of health who is trying to transform the health sector, and the minister of education who is trying to use technology to improve the quality of education. Connected agriculture is also a good opportunity. We are expanding our product roadmap to include animal tracking. Cows matter to Africa and are a valuable investment and asset to ordinary farmers.

Those are things we are looking for. We will only focus on those verticals that will create the most transformation for Africa and certainly a service that will enable a housewife to open and close curtains while sitting in their office. It will only come in a little later down the pipeline.

What is your business philosophy?

First, I like to find and do things that I'm very passionate about; this is very important. I want to find what my team is passionate about, and when we find it, we follow it through fanatically. I wrote about these

in my book, *Rumble in the Jungle, Leadership from an African Perspective.* Second, we have to understand what business we are in. What is the very thing that Cumii can do better than any company in the world? The answer is: we can be the best IoT company in Africa. That's how we become very unique. I believe we can do our business very well, because we combine the best of global technology, we get the knowledge of the African market, and we can open many partnerships in Africa.

The third thing is to understand the one thing that drives our business. What is that one thing? For Cumii today, it is just achieving a smart connection. We like to connect machine to machine, man to man, and machine to mobile. For the next 36 months, getting a smart connection is what we will intensely focus on.

The last but not least, my philosophy is about smart business and smart partnering. I always believe in working smart, not working hard. I encourage my team to learn to work smarter, which means we have to leverage on people and companies who are good at what they do, not trying to do things that others can do better than us. Always looking for a good horse to ride on, we try to build a very lean and agile organization which is a very small, experienced and qualified team, working with our smart partners. We are going to establish an ecosystem with smart partners to deliver what we want to deliver for our customers. For me, I believe we are the next generation organization, and what we need to do is continue to focus on executing well.

How do you comment on ZTE's technologies and solutions? What are your expectations for the cooperation with ZTE?

First, in Africa, ZTE has become one of the strongest and trusted technology brands today, particularly from the equipment and technology point of view. ZTE has got a massive Pan-Africa footprint, and Cumii is a Pan-Africa player, so we immediately see a strategic overlap in the countries that ZTE operates and the same countries that Cumii aspires to play. That is a good opportunity right there. Let's just work together.

Second, ZTE has got technology and good capacity to scale up. We want to be able to leverage on that technology and capacity to scale up. ZTE has not only facilities but also actual networking experience. That's why we choose ZTE as one of our key strategic partners for IoT.

Third, I have been to ZTE headquarters three times over the past 10 years. When I came here the first time, there were very few IoT products or services on offer. Now, I found that ZTE has moved very far from where I last left. For me, this is the kind of direction I'm keen on to build on.

ZTE is customer-oriented. It is flexible and sensitive to customer needs in different markets. ZTE can provide various solutions and quality services for customers according to their painpoints. That is very exciting for me. I'm happy with it.

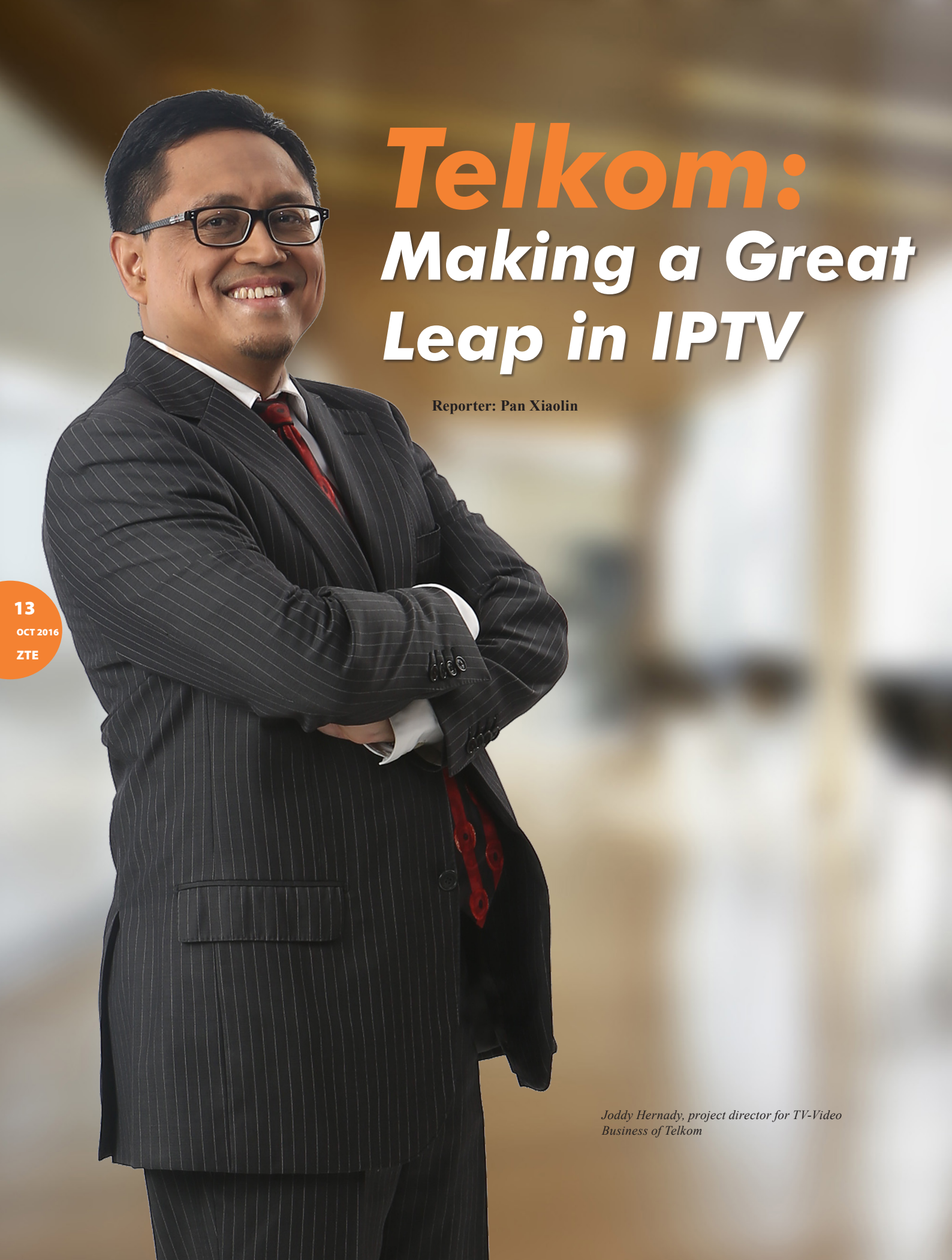
What is your future vision for Cumii?

We want to be one of the most successful Pan-Africa IoT companies in Africa, and we want to help Africa leapfrog in the next generation. We are very interested in transforming African through technology. I think that is what we are going to do.

IoT can be adopted in all industries, whether it is health, agriculture, or education; we cut across all these sectors. Our vision is to become one of the biggest enablers of the next revolution in the continent. That is our aspiration. ZTE TECHNOLOGIES

Telkom: Making a Great Leap in IPTV

Reporter: Pan Xiaolin



Joddy Hernady, project director for TV-Video Business of Telkom

Telkom, the largest telecom services company in Indonesia, increased its IPTV subscriber base from less than 100 thousand to one million with the partnership of ZTE in 2015. This year Telkom has set up a more aggressive target to develop three million IPTV users. *ZTE Technologies* interviewed Joddy Hernady, project director for TV-Video Business of Telkom. He shared Telkom's IPTV strategy and its cooperation with ZTE.

Telkom is the largest telecom services company in Indonesia that provides mobile, internet and data services. What are the keys to your competitive advantages and leading position?

The key reason why Telkom has been the No.1 operator for so long is that we have completely integrated services ranging from fixed to mobile data and videos. The Indonesian telecom market is basically a mobile market and Telkom owns the biggest share. Telkom is also the only operator in Indonesia that provides both fixed and mobile services covering the whole Indonesia. With the vast infrastructure coverage we have established a large sales and operation team throughout the country. We can leverage this advantage for both off-line and online services. The current online hotel booking is not available for all hotels in Indonesia except for star hotels in big cities. However, Telkom's sales staff throughout Indonesia can help non-star hotels offer online services. The large sales team can give us more chances to cooperate with more companies that usually cannot be approached by online players. This advantage will certainly support our on-line services that will be created in the very near future so that we are able to compete with online/internet players in online services.

To gain an upper hand in the market, operators are thinking of transforming their services and networks. What do you think are the main issues and challenges faced by operators in Asia right now? How do you think Telkom can compete in the current challenging environment?

If we are talking about network and service transformation, three key things will become our challenges: people, process and technology. And amongst this, people are the most important one because people will drive to change the process, tools and technology. We are now entering the internet and digital era, many new internet players have been born, and many of them are threatening the telco's traditional services. We are being disrupted now. The answer for this is we need to go to other industries and build a new arena to sustain our growth. Internet has changed everything. There is no border any more amongst industries. What we have now is a new arena or a new digital ecosystem involving so many industries. Hence, we need new people who understand this trend, and we need people from various background and various industries as well. This is a big challenge for all telcos who are almost from homogeneous background with relatively old people.

Our company is also facing this situation. To overcome this, we are strengthening our organization by putting more resources into digital business. We will create a new digital business department under Director Digital and Strategic Portfolio. With the digital organization, we will explore more our key capabilities so that we can leverage all our mediation capabilities such as payment, big data and digital advertising to improve internal process effectiveness, strengthen our core products, and help other companies develop their businesses. We want to be the best platform enabler for the new digital ecosystem in Indonesia We will also explore the areas in which Telkom can enter digital services and provide amazing digital experience to our customers.

In the process of transforming our network and infrastructure, we have to see the global trend. We believe that everything will be based on video in the

Telkom and ZTE have worked so closely that our subscriber base has increased from less than 100 thousand to one million. No other pay TV operators in Indonesia could achieve the same result in one year.

future. Video consumption will increase from time to time and this is a global trend. Our current network and infrastructure is not ready for videos, so we are moving to change it based on internet and video-centric concept. This is a new challenge for us because we need to learn new technologies and also to change supporting systems, processes and the mind of people. With a video-centric network and infrastructure, we will be able to deliver all digital services in very good quality and best experience.

Since we are not strong in R&D as other mainstream operators, we are trying to follow them in selecting major new technologies. For example, it is completely new for us to implement fiber to the home, so to get a better know-how, we are cooperating with three leading Asian telecom operators China telecom, SK telecom, and NTT this year. We want to keep up with the benchmark of their technologies, business process and people's capability. This is not easy but necessary.

Why did Telkom select ZTE as its partner for IPTV? How does IPTV fit in Telkom's overall business strategy?

Telkom started its IPTV project in 2010. ZTE was among top 5 global vendors at that time. With its advanced, proven technology, ZTE owns extensive experience in IPTV. Also ZTE offered the most favorable commercial conditions. These are the main factors we selected ZTE as our partner for IPTV.

However, we slowed down the pace of IPTV development in 2012 until 2014, because we started developing TV business focusing on internet services like OTT. After two years we found out the direction was not absolutely right. Since 2015, we have adjusted our video strategy and started to deploy IPTV as a bundle of services with broadband and voice to increase our customer base. The bundled service brand is IndiHome. We offer free 1000-min call for voice, several broadband packages that customers can choose, with the lowest one being 10 MB per second of internet, and more than 100 TV channel options. With current 4 million broadband users, we are ambitious to develop our key voice and broadband users into IPTV users. IPTV is used as a tool for customer retention, but we will develop additional features such as OTT video and advertising platform to make IPTV as a new revenue driver.

How would you comment on the cooperation so far, and how is Telkom benefiting from it?

Telkom and ZTE have worked so closely that our subscriber base has increased from less than 100 thousand to one million. No other pay TV operators in Indonesia could achieve the same result in one year. We have got full support from ZTE in terms of capacity, expansion, and platform development. This year we have set up a more aggressive target to develop three million IPTV users, and by 2020 we will target to increase up to 16 million Indihome users. ZTE is supporting us well for our IPTV development. In our

R&D, we have established a joint innovation center. In our operation, ZTE has put resources to work with us on platform development, operation and maintenance.

Can you briefly describe your IPTV service offerings and how customers have responded?

Currently, we have more than 100 IPTV linear channels bundled with voice and broadband. We can also provide video on demand, karaoke and home shopping. 300 video channels on demand will be added next month, and more new features such as OTT services will be added so that our customers will have more and better choices.

Telkom is a leading operator that provides affordable bundled services to meet user needs. There are a plenty of opportunities and potentials to develop home video entertainment because we have around 60 million households in Indonesia. Our challenge now is not on the demand but on the supply itself. How can we deploy our fiber infrastructure quickly to serve our growing customers? Starting this year, we will introduce TV and video services based on IPTV and OTT technologies. Both IPTV and OTT services will be integrated in one set-top box. We are doing this, because young people, especially netizens, may prefer to choose OTT services which enable them to watch programs anywhere at any time, while others still prefer to watch linear TV/video services that are available on IPTV. To serve various customers, we will analyze their behavior from time to time so that we can offer a diverse combination of content to satisfy them. The OTT platform has been tested, and we will put OTT services into commercial use soon.

4K represented by HD video is becoming a trend in the era of big video. How do you plan to develop your IPTV services?

Telkom has done a 4K trial with ZTE, and it turned out to be a success. But in practical implementation, we should consider the readiness of a 4K ecosystem. We have to make sure our users have the 4k television before we provide 4k content. We are in the process of negotiating with some 4K content providers and we will have at least two 4K channels in 2016. We are also in the process of making 4K miniseries in cooperation with local production house. We will invite our famous actors who play in *Raid and Star Wars* to be key actors for the 4K miniseries. In 2015, Telkom and ZTE established a strategic collaboration by setting up a joint innovation center (JIC) for big video (IPTV and OTT) in Indonesia. The JIC will be responsible for creating the latest technologies, seeking valuable partners, and developing and operating new value-added services.

What do you think can ZTE improve to create more value for Telkom's development in the future?

The success of Indihome has given an impetus to operators in Indonesia who plan to offer IPTV services. To take the lead and be more competitive in the market, Telkom needs to add more features and services to the platform and make its content distinctive that improves user experience. Currently, it takes much time on developing features and user experience/user interface. This is because ZTE's main R&D team works in China. I hope in the future some key R&D work related to the development of electronic program guide (EPG) or user experience/user interface would be done in Indonesia to make deployment faster. Each market is unique. As far as I know, in China there is no advertisement-based mechanism on IPTV, but in Indonesia we are offering IPTV not only based on subscription but also on advertisement. With more resources from ZTE, we can leverage the JIC to speed up our new service commercialization, make the analysis closer to our market and update our platform features more quickly to meet user needs.

SDN Builds Elastic IP RAN

By Zhu Yinan

Large-scale deployment of IP RANs enables operators to carry 2G/3G/LTE mobile backhaul and government and enterprise network services. However, the evolution of mobile internet and customized dedicated lines sets higher demands for packet transport networks in terms of fast cross-domain service provisioning, dynamic bandwidth adjustment, and network capability opening. The vertical and closed architecture of existing networks can hardly meet the service requirements in the ICT era due to difficult upgrade, limited expansion, and inflexible application. The network development trend is open and virtual.

Zhu Yinan
Senior Solution Manager of BN Product Team, ZTE

Significance of the Introduction of SDN to IP RANs

With the introduction of software defined network (SDN) to IP RANs, an SDN IPRAN can manage network resources, orchestrate services in a unified way by deploying hierarchical controllers, and implement service innovations by opening northbound application interfaces.

- High efficiency: fast service provisioning. Diverse services and constant changes require IP RANs to respond immediately, so fast delivering fleet and mobile backhaul services is necessary. The introduction of SDN enables network interaction between different vendors and end-to-end service management.
- Intelligence: automatic network optimization. In view of the increasing scissors difference between operators' investment and revenue, and the contradiction between traffic and bandwidth in network planning, how can we predict bandwidth based on service application to optimize network resources in real time? According to data analysis and by virtue of SDN, networks can be automatically optimized to improve bandwidth efficiency.
- Reliability: quick recovery from faults. In an IP RAN, services are provided and managed through manual configuration and the element management system (EMS), which may result in blind areas in fault handling. The dynamic SDN algorithms can quickly recover the network from faults and ensure secure and reliable services.
- Convergence: multi-purpose network.

To improve utilization, base station backhaul and fleet services, and home-customer services share the same physical network. How can we turn one physical network into several logical networks? The answer is SDN controllers, which manage and schedule network resources in a unified way, generate multiple logical networks through virtualization, and implement fragmented transmission of various services.

ZTE's SDN IPRAN

ZTE's SDN IPRAN includes APPs, D-controllers, an orchestrator, an H-controller, forwarding-plane devices, EMS, and ZXDNA (Fig. 1).

The D-controllers provide services, query topology, and manage and maintain devices in a single domain. With an open architecture, the D-controllers support interoperability of devices from different vendors, and the southbound interfaces support multiple standard protocols. For the IP RAN devices already massively deployed in the existing network, the EMS provides IP RAN network resources to a controller, which orchestrates IP RAN services through data sharing (database) without modifying devices or affecting services.

The H-controller orchestrates and controls services across domains. With the capability of cross-domain topology, resource discovery and management, and cross-path calculation, it optimizes end-to-end paths in the network.

The orchestrator manages end-to-end services, stores service databases and policy databases, and configures service resources.

ZTE's SDN IPRAN has the following features.

Automatic Service Provisioning

ZTE's SDN IPRAN controls and manages IP RANs in a centralized way. The SDN controllers automatically obtain network topology, calculate and select paths, and set up service channels without manually configuring complex IP/MPLS protocols on devices. In addition, one-click deployment of IP RAN services shortens the configuration time by more than

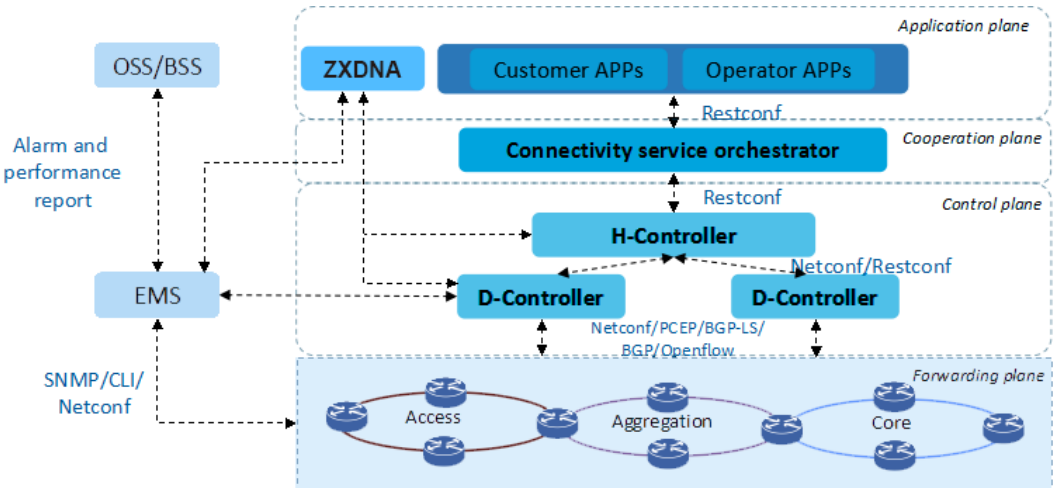


Figure 1. ZTE's SDN IPRAN architecture.

20 minutes. A maintenance window APP is used for service maintenance, reducing the workload of daily maintenance by 80% and increasing the O&M efficiency.

Network Reliability (TE HSB+BGP FRR) and Controller Cluster

In an IP RAN, multiple protection mechanisms are used for service redundancy. ZTE's SDN IPRAN is equipped with TE HSB+BGP FRR protection policies by SDN controllers to improve network reliability.

The SDN integrates the control plane to the controllers whose reliability is therefore vital to the network. With elastic IPSDN controllers and mature cluster components, ZTE's SDN IPRAN supports: data slicing and load sharing for data consistency, backup and restoration, the active/standby and cluster modes for controller protection and load sharing, and distributed calculation for allocating tasks to different cluster nodes.

BoD

With the constant change in service demands, how to match open, real-time, and on-demand data bearers becomes a major issue for IP RANs. BoD is therefore introduced to address this issue.

BoD is an application developed based on Restful API, a northbound standard. Users manage service bandwidth on the BoD APP interface, such as providing and adjusting online-bandwidth, and customizing the bandwidth calendar.

- Bandwidth provisioning on demand. With the BoD APP, users select ports, service bandwidth, and SLAs from the rented resources, and then services are provided on line.
- Bandwidth adjustment on demand. When the bandwidth demand changes, users directly modify the bandwidth by logging in to the APP and select services as they like.
- Bandwidth calendar customization. Users customize the automatic bandwidth adjustment policy on the BoD APP according to their demands. The bandwidth can be adjusted at a certain time point of a day or from a period of time.

Smooth Evolution from IP RANs to SDN IPRANs

How do the existing IP RANs smoothly evolve

into SDN IPRANs is a common concern of operators. To reduce the difficulty of the introduction of SDN and protect the investment of operators, ZTE's SDN IPRAN upgrades smoothly from the existing IP RANs to SDN IPRANs by introducing D-controllers and H-controllers without changing the existing IP RAN hardware. The principle of the upgrade is as follows: the EMS of IP RAN abstracts all IP RAN devices in a unified way, opens network resources and topology to D-controllers through vendor-defined interfaces, and thus controls the existing IP RAN through D-controllers. In view of massive configuration data in the EMS, the upgrade supports the coordination of D-controllers and the EMS.

Significance of ZTE's SDN IPRAN

ZTE's SDN IPRAN achieves hierarchical intelligent control and network capability opening by introducing SDN. Through hierarchical controllers, it deploys, operates, and maintains services in a unified way, and implements services innovations with open northbound application interfaces.

- Improve the efficiency of cross-domain service provisioning. Fleet services are set up and changed in real time, which involves fast service provisioning, bandwidth adjustment, and service migration. The introduction of hierarchical controllers improves efficiency of service provisioning in the cross-domain and cross-vendor scenarios. After users customize services through an APP, the controllers quickly respond to their demands. The duration for service provisioning and adjustment decreases to several minutes, which was previously several months in the existing network. This greatly improves user experience.
- Increase the utilization of network resources. By collecting network resources, the ZXDNA analyzes data and suggests network adjustment. According to the rules, the controllers dynamically adjust network resources.
- Promote O&M efficiency. The centralized control plane provides end-to-end O&M and protection for detecting resources and services in real time. In case of network failure, the controllers can calculate paths to recover services as long as there are physically reachable routes.
- Network virtualization for fragmented-resource sharing. The controllers abstract and fragment network resources. The fragmented network resources form multiple logical networks to independently control the resources for mobile backhaul services, fleet services, and home-customer services, thus facilitating optimized operation and management of network resources.
- Open system for service capability improvement. Restful network programmable interfaces can lead the industry to open model and make networks adapt to quick service launch. This avoids network reconstruction and reduces CAPEX and OPEX.

The Application and Outlook of ZTE's SDN IPRAN

Cooperating with domestic and overseas operators, ZTE has trialed SDN several times in the IP RAN field.

ZTE helped Jiangsu branch of China Telecom in prototype design and pre-commercial trial of the SDN IPRAN, promoting the application of SDN. Moreover, ZTE worked with Jiangsu branch of China Unicom to deploy the SDN IPRAN in Yangzhou and performed loaded tests on 4G LTE voice and data services, reducing the high maintenance costs due to enormous NEs in the IP RAN.

In addition to domestic operators, ZTE cooperated with overseas operators, such as Vodafone, in IP RANs and completed verification tests of SDN PoC, promoting the commercial progress of SDN in the IP RAN field.

In the future, with the expansion of SDN IPRAN trials, the resource optimization, network capacity openness, and O&M simplification brought by the SDN will speed up the commercialization of SDN IPRANs.

Seamless MPLS for Fast and Flexible Service Deployment

By Li Xinyu

Li Xinyu
BN Product Planning Manager,
ZTE Corporation

Seamless MPLS is a network architecture or network design concept rather than a new protocol or technology. It aims to expand the MPLS domain to the access layer and combine the convergence layer, core layer, and access layer into one MPLS domain. As a result, the entire network based on unified IP/MPLS technologies can carry multiple services.

Seamless MPLS was originally designed to carry metropolitan fixed-line network services. A large amount of layer-3 access devices including convergent OLTs that support simple MPLS label functions are deployed for the upgrade of metropolitan access network. These layer-3 access devices use MPLS PW or L2VPN to carry home broadband services.

The seamless MPLS architecture has the following advantages:

- It uses unified IP/MPLS without extending existing protocols. IP/MPLS is highly mature and facilitates network interoperability among various vendors.
- It provides unified MPLS OAM as well as protection and recovery technologies to implement end-to-end rapid protection switching.
- It enables fast and flexible service deployment. Service configuration is made on access network devices rather than other nodes. This greatly increases service provisioning efficiency. Moreover, service deployment is independent of network architecture. In other words, access points do not need to be aware of MAN and backbone network architecture, and service points can be deployed anywhere in the network.
- It provides unified carriers for fixed-line and mobile networks to carry various services for home users, business users, and mobile base stations. With fixed and mobile convergence, all services are carried in one network.

Seamless MPLS Deployment

Seamless MPLS is deployed through inter-area LDP, LDP downstream on demand (DoD), BGP label unicast (LU), end-to-end rapid protection switching, end-to-end OAM, and entropy label (Fig. 1).

- Inter-area LDP: In a seamless MPLS architecture,

MAN and backbone network comprise a complete MPLS domain, and MPLS interaction is implemented between them. RFC 5283 extends LDP and has no constraints on precise routes for inter-area LSP except for the longest route matching. In the seamless MPLS architecture, convergence routes of a backbone network can be notified to each MAN, but detailed routes of each MAN cannot be notified to the backbone network. Thus, the number of IGP routes in each area is reduced, and the network scale is expanded.

- LDP DoD: Because the processing capability and memories of AN devices are not sufficient to handle large amounts of routes and labels, the LDP DoD mode is used to request only necessary labels from the downstream label switching router (LSR). This significantly reduces the number of labels being forwarded.
- BGP LU: Seamless MPLS introduces the BGP LU function. The BGP protocol is used to carry all routes for access network devices. Labels are assigned for these routes, which avoids a large number of routes carried by IGP. RFC 3107 specifies that the BGP protocol is used for assigning labels for unicast routes and is applicable to MPLS L3VPN Option C inter-areas.
- End-to-end rapid protection switching: A seamless MPLS network consists of three parts: LDP DoD interaction between access devices (AN) and convergence devices (AGN), MAN in which IGP and LDP protocols are running and BGP neighbor relationship is established between AGN and ABR, and backbone network in which IGP and LDP protocols are running. The network adopts IGP, LDP, and BGP protocols that can be fast switched to protect network nodes.
- End-to-end OAM: Hierarchical OAM infrastructure is deployed. At the link layer, OAM is used to detect link faults such as IEEE 802.1ag and IEEE 802.3ah. At the tunnel layer, BFD and MPLS OAM (Y.1731) can be deployed for fast tunnel connectivity detection. At the PW layer, BFD or VCCV detection packets are used for real-time check of PW connectivity. End-to-end OAM detection is implemented through OAM detection packets transparently transmitted among users in the network.
- Entropy label: Seamless MPLS packets are forwarded through labels. When there are multiple paths to a destination IP address, load sharing

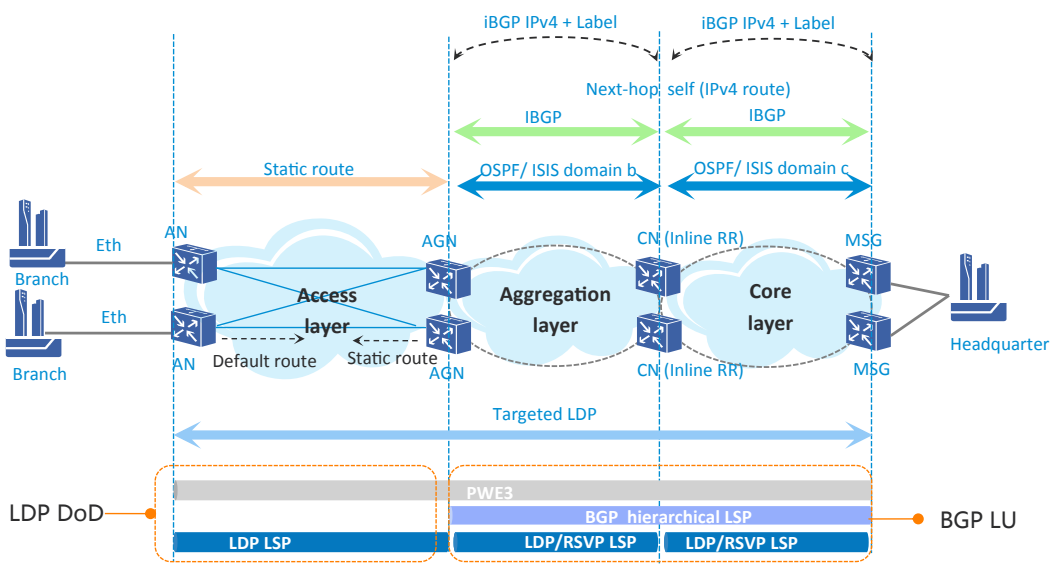


Figure 1. Typical seamless MPLS architecture.

through labels is required. The concept of entropy label is put forward in the RFC 6790 to solve the issue of load unevenly shared by LSR. When a label edge router (LER) performs label negotiation, an entropy label is inserted into a packet. The label value is calculated by the LER according to the source IP address, destination IP address, protocol type, and TCP/UDP port number. Entropy labels are used for traffic load sharing.

Seamless MPLS Application

Seamless MPLS implements connection-oriented services. This greatly increases the efficiency of service deployment and maintenance, helping operators reduce their construction and maintenance costs. Seamless MPLS has been widely applied in mobile backhaul networks and has become the preferred choice for present mobile bearer technology.

ANs only support MPLS LDP functions and a few labels, and do not support the IGP protocol. AGNs, CNs, and MSGs are high-performance MPLS devices. If a default route or a static route of a 32-bit destination IP address is configured on an AN, and a static route whose destination IP address is the AN is configured on an AGN, the route between the AN and AGN is reachable. When the IGP route domain between the convergence layer and the core layer is isolated, AGN and MSG respectively notify their loopback addresses in the form of BGP LU to their peer ends. When receiving the label route and notifications from other neighbors, a CN can set the next-hop of the route to itself. In this way, a one-hop end-to-end BGP LSP can be established between AGN and MSG. ANs use LDP DoD mode to assign labels to service routes. This reduces the number of labels at the access layer and relieves device load. Among AGNs, CNs and MSGs, the LDP DU mode can be implemented or RSVP-TE is used as an outer tunnel. Public routes between AN and MSG are interoperable through static routes and iteration BGP LSPs. In other words, an LDP destination session and end-to-end pseudo wire emulation edge-to-edge (PWE3) can be set up between them.

According to networking and device capabilities at the access layer, there are three solutions for service deployment based on the seamless MPLS concept. When AN devices do not support the BGP LU function, hierarchy of VPN (HoVPN) or route

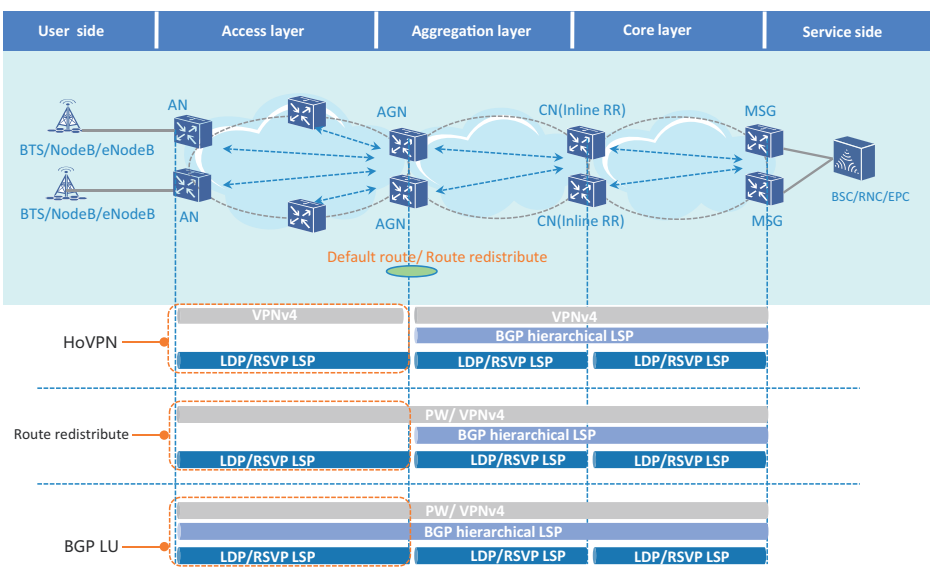


Figure 2. Seamless MPLS application in the network.

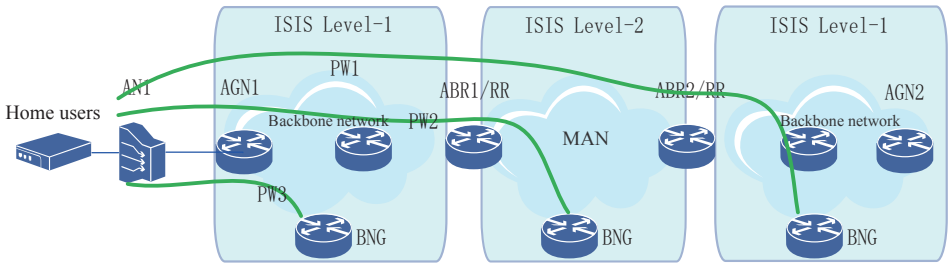


Figure 3. Seamless MPLS applicable to home users.

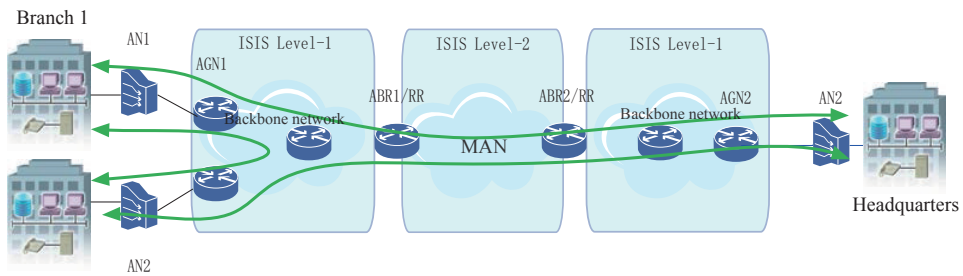


Figure 4. Seamless MPLS applicable to business users

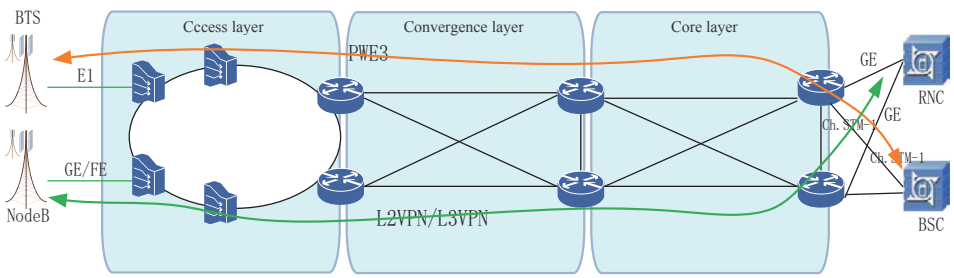


Figure 5. Seamless MPLS applicable to mobile backhaul.

redistribution is deployed at the access layer, and the BGP LU function is enabled only at the convergence layer and core layer. When AN devices support the BGP LU function, the BGP LU function is enabled among the access layer, convergence layer, and core layer to ensure that end-to-end BGP LSPs are set up between ANs and MSGs.

Seamless MPLS can be applied to:

- Home users: Home user services include broadband internet and IPTV services. An AN device can set up multiple PWs as required by services to reach a different BNG in a quick and flexible manner (Fig. 3).
- Business users: Business users require higher security than homer users, and their services can be in or out of MANs. Secure communications are implemented through L2VPNs or L3VPNs (Fig. 4).
- Mobile backhaul: In a mobile network, old base stations use PWE3 to enable packets to be transmitted on the Ethernet. This protects existing investment of operators. For new IP base stations, L2VPNs or L3VPNs can be deployed as required to increase network flexibility for LTE deployment (Fig. 5).

IP RAN O&M Solution

By Wang Chengfeng

With the development of IP RAN networks, IP RAN O&M plays an increasingly important role. As traditional O&M can't satisfy the demands of existing IP RAN networks, operators are paying much attention to optimize O&M.

The challenges of IP RAN O&M

IP RAN O&M faces the following challenges.

- A large number of access devices caused inconvenience to remote debugging. In the IP RAN, a lot of access devices require fast commissioning. They are located on the base station (BS) side in a distributed manner, so the O&M personnel are technically demanding and the manual O&M is costly.
- Weak management of end-to-end services. The end-to-end O&M capability of traditional IP networks is poor, and services at the Layer 2 and Layer 3 can't be fast provisioned. When protection switching occurs, the topology change cannot be displayed in real time.
- Difficult to monitor and locate. Actual network paths are unknown and faults can't be located for lack of visible O&M measures. It is difficult to diagnose a mass of network and service alarms, and monitor key services in real time.
- Limited methods to evaluate network. There are few visual performance evaluation methods in the IP RAN. The performance monitoring of routine network management software can't meet the comprehensive evaluation requirements, so IP RAN needs to provide quality monitoring software that monitors networks in real time and for a long term and to display complete evalution results through visual and multidimensional views.
- Lack of automatic traffic analysis. The IP RAN carries mobile BS services, VIP services, and other high-value services, which set high requirements for network QoS and guarantee as well as resource coordination and planning. Therefore, an O&M solution with automatic monitoring and analysis capability is required in the IP RAN.

The Introduction of IP RAN O&M

To overcome O&M challenges in the IP RAN,

Wang Chengfeng
IP RAN O&M Planning Director, ZTE Corporation

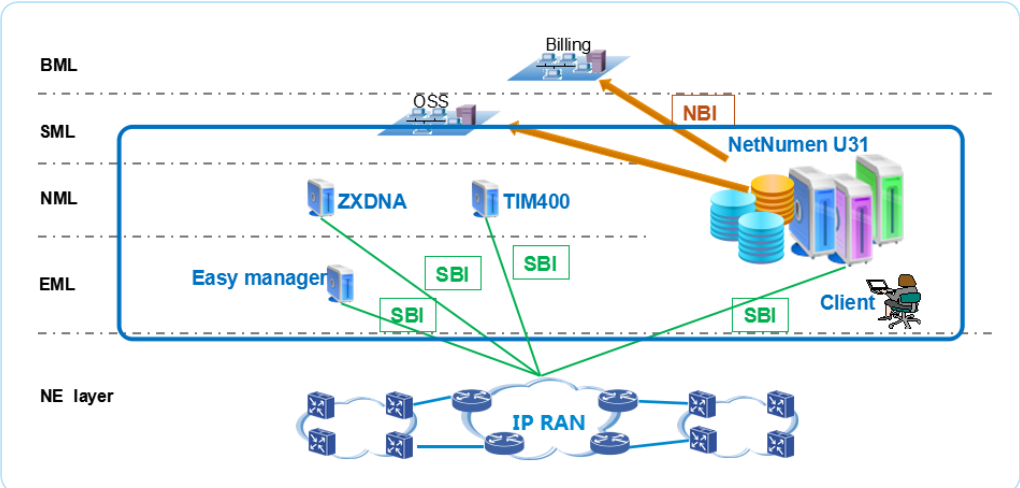


Figure 1. IP RAN O&M architecture.

ZTE proposed an integrated solution based on its rich O&M experience.

As shown in Fig. 1, ZTE's IP RAN O&M includes NetNumenTM U31, ZXDNA, TIM400, and Easymanager. They interconnect with the IP RAN through southbound interface (SBI). Meanwhile, the northbound interface (NBI) can be interconnected to the upper-layer OSS.

- NetNumen U31. As a network management system, it has multi-functions on the EML and NML layers. It also supports NE monitoring management, network commissioning planning, and end-to-end O&M.
- ZXDNA. As a deep network analysis system, it not only monitors and analyzes traffic of the IP RAN, but also detects and evaluates network quality of the RFC 2544/TWAMP-based IP RAN.
- TIM400. As an end-to-end network evaluation system, it monitors end-to-end operational status and evaluates health condition of services.
- EasyManager. As an NE maintenance tool, it evaluates NE operation health and upgrades NE in batch.

The Highlights of IP RAN O&M

ZTE's IP RAN O&M has five core values.

Plannable Commissioning and Deployment

To enhance the deployment and implement DCN auto discovery, the remote access NEs are plug and play. NEs are pre-deployed offline. Once these NEs go online, configurations are automatically distributed after inspections. This ensures security and reliability.

During the commissioning and planning stage, the basic data of NEs can be automatically configured in batch through a self-defined commissioning template without configuring ports VLANs or basic routes. The scripts of the commissioning template are readable and user-defined, which is conducive to implementing flexible on-site customization and improving data configuration efficiency.

Manageable Service O&M

A unified service management view can be used to configure services.

- The end-to-end deployment is supported at three layers: basic configuration, tunnel configuration, and service path configuration. During the service path deployment, the protection, O&M detection, and QoS can be deployed at the same time.

- The GUI related to VLANs, IP addresses, interfaces, and dynamic protocols is applied in the device interface/dynamic protocol configuration, and batch configurations are supported.
- The tunnel end-to-end configuration is applied to dynamic and static tunnels and the explicit path configuration is applied to PWs. For any-to-any MPLS tunnels, the tunnel paths can be displayed, the LSP protection can be supported, and the BFD detection can be conducted for tunnels and PWS.
- The MPLS L2VPN, L3VPN, and H-L3VPN can be end-to-end deployed. In addition, VPN FRR, IP FRR and VRRP services can be protected, and the MPLS O&M and service QoS can be deployed at the same time.

Traceable Network Monitoring

An advanced graphical algorithm is used to display network paths. The physical network topology view, service path topology view, clock source view, optical power view, and resource view are provided.

- The physical network topology view displays physical connections and network topology, and supports layered topologies.
- The service path topology view displays a complete topology of each service and supports service-related O&M. It can monitor the operational status of key services and detect service connectivity.
- The clock source view displays transmission paths of synchronous Ethernet and 1588 clock.
- The optical power view displays the optical power status of networks, and the current optical power of links in the topology. Moreover, it supports the thresholds monitoring.
- The resource view counts and displays network resources. It displays network bandwidth resources, CPU and memory usage, and monitors the network status in real time.

Evaluable Network Status

The ZXDNA service quality management (SQM) module is deployed together with built-in and external probes in ZTE's IP RAN network. ZXDNA can initiate TWAMP and RFC 2544 (measurement protocols) as needed, and monitor time delay, jitter, packet loss ratio, and link throughput in real time, so that network deterioration and faults can be discovered timely.

What's more, ZXDNA can initiate a long-time online measurement for TWAMP to monitor and analyze network quality. Therefore, services can be transmitted rapidly in the IP RAN, deterioration risks can be perceived in advance, and user experience can be improved.

Analyzable Service Traffic

With the automatic network traffic analysis, ZXDNA enables operators to understand the current status and development trends in multiple dimensions and from multiple perspectives. By monitoring and analyzing network traffic, ZXDNA helps operators optimize, plan and construct IP RAN networks.

In view of instantaneity and burstiness of hot network events, ZXDNA is equipped with the real-time traffic monitoring function, so operators can deal with hot events in real time and ensure a stable and reliable network performance.

Moreover, ZXDNA constructs network traffic operation archives to analyze network traffic models and resource load features, which provide data supports for formulating O&M solutions.

Conclusion

ZTE's IP RAN O&M is a customized resolution to address actual O&M difficulties in IP RAN networks. It supports network commissioning, deployment, O&M and monitoring, and provides effective means to network performance evaluation and traffic analysis.

ZXCTN 9000-E Series:

High-End IP RAN Helping Operators Thrive in the Pre5G Era

By He Ping

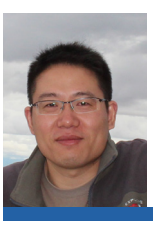
IP RAN offers not only IP network features such as statistical multiplexing and flexible expandability but also RAN features such as high reliability, easy management, clock synchronization, and QoS. Therefore, in the current 3G and LTE stage as well as the future Pre5G stage, many operators have chosen IP RAN as their bearer solution for mobile backhaul.

To meet the trend of widespread IP RAN applications, ZTE has launched a customer-made high-end IP RAN ZXCTN 9000-E series with each slot supporting 400 Gbps or 1 Tbps (Fig.1). While remaining in the leading position in bandwidth infrastructure, ZTE is more than ever committed to deploying its smart pipe concept in bearer infrastructure and helping to optimize IP RAN mobile backhaul operation.

Figure 1. High-end IP RAN ZXCTN 9000-E series.

ZXCTN 9000-E series can flexibly meet the requirements of the core, convergence, and access layers for switching capacity and slot quantity in different network architectures, as shown in Table 1.

ZXCTN 9000-2E series is applicable to access or small convergence nodes in IP RANs using the E2E L3 VPN solution. The product series is highly-integrated and has a height of 220 mm. It can be easily installed in a transmission cabinet of 300 mm in height and is more properly placed in a base station or an office device cabinet that occupies small space. Among the ZXCTN 9000-2E series, 9000-2E4 and 9000-2E10 can respectively provide



He Ping
Product Planning Engineer of BN Product Team, ZTE

Table 1. ZXCTN 9000-E series meets various requirements for slot quantity and switching capacity.

Specification	9000–18E	9000–8E Plus	9000–8E	9000–5E	9000–3E	9000–2E10	9000–2E4
Height	41U	22U	14U	DC: 7U, AC: 8U	DC: 4U, AC: 5U	DC: 5U, AC: 6U	3U
Slot Quantity	18	8	8	5	3	10	4
Switching Capacity	28T	12.4T	12.4T	5.8T	2.32T	640G	480G

access capacity of 120 Gbps and 240 Gbps, supporting 2M IPv4, 1M IPv6, and 8K VRF. Both of them are small in size but large in capacity. ZXCTN 9000-3E and ZXCTN 9000-5E are applicable to small and medium convergence scenarios, while ZXCTN 9000-8E and ZXCTN 9000 8E Plus are suitable for large convergence and core-layer devices. ZXCTN 9000 8E Plus supports 1 Tbps/slot. ZXCTN 9000-18E is the best choice for a super core, since it has 18 service slots in total and supports 1 Tbps/slot. Since ZXCTN 9000-3E, ZXCTN 9000-5E, ZXCTN 9000-8E, ZXCTN 9000-8E Plus and ZXCTN 9000-18E have universal service cards, operators can significantly reduce their costs in spare parts.

ZXCTN 9000-E series provides customer-made functions for IP RAN:

- Strong adaptation: To meet the requirements of IP RANs for wide coverage in complex environments, the 9000-2E4 has the capability to run outdoors for a long time at a temperature of –40°C to 65°C. ZXCTN 9000-E series lowers the requirement for equipment room and helps operators reduce their network construction costs.
- Leading clock technology: ZXCTN 9000-E series provides the innovative SyncE+IEEE1588v2 clock synchronization solution with industry-leading clock synchronization precision and a comprehensive clock synchronization that can traverse third-party networks.
- Multiservice bearing capacity: ZXCTN 9000-E series supports not only high-density 10GE and 100GE Ethernet interfaces but also POS, ATM, and TDM interfaces. The PWE3 technology can be adopted to support ATM and TDM emulation, satisfying the need for access to various services during the IP RAN evolution.
- Supporting seamless MPLS: Seamless MPLS uses unified end-to-end bearing technologies to carry traffic from home and business users as well as mobile base stations, aiming to achieve fixed mobile convergence (FMC) and carry all services over one network. Seamless MPLS implements MPLS encapsulation for all services at the access layer and builds a unified MPLS control plane that covers the core, metropolitan area network (MAN), and access network. This greatly reduces difficulties in network planning and O&M. Moreover, unified MPLS O&M is used for network and service protection. This enhances end-to-end network reliability. Seamless MPLS also improves service provisioning efficiency by reducing the number of service provisioning points and related static configurations and by obviating coordination between different departments.
- Fast service provisioning and adjustment: ZXCTN 9000-E series provides plug and play (PnP) and easy commissioning so that NMS software debugging engineers can quickly activate each site after hardware engineers finish device installation, cable connection, and power-on. The graphical NMS provides wizard-like service, which means services can be provisioned quickly as long as key parameters are selected. When there is a need for expanding or reducing transmission links , the NMS can automatically increase or reduce nodes through complete network protection without

affecting existing services.

- Accurate network quality measurement: IP RAN carries services from base stations and carrier-class government and enterprise networks. As these services are sensitive to delay, jitter, and packet loss, an end-to-end service measurement method must be provided to verify whether the services meet SLA guarantees. Traditional measurement for delay, packet loss, and jitter is not accurate enough to meet the KPI measurement requirements of IP RAN. Therefore, hardware-based measurement is introduced to determine real service KPIs and network QoS and enable visual O&M. In the SDN era, network quality can be optimized based on KPI measurement to ensure that SLA requirements for service bearer are met at all times. IP RAN has higher requirements for KPI measurement. Based on RFC 2544, ITU-T Y.1564, TWAMP, and ITU-T Y.1731 protocols, ZXCTN 9000-E series provides the hardware-based KPI measurement solution that can accurately measure delays and jitters with a precision of up to 100 us level, and measure packet loss with a precision of up to 1E-6 level. The measurement solution can be used to measure end-to-end L2 VPN and L3 VPN services, and can also offer segmented measurement at the network layer to quickly locate KPI faults.
- SDN evolution: ZTE's SDN IP RAN solution based on hierarchical controller architecture can implement end-to-end centralized control, fast service provisioning, and real-time optimization for IP networks. The SDN controller acquires network topology, computes and chooses paths, and builds service channels, so that there is no need to configure services on each device and technological threshold is thus lowered. Through the ZXDNA, NMS, and third-party traffic analysis, the performance monitoring system triggers network optimization and offers multiple optimization modes such as interactive optimization, automatic optimization, and manual optimization as required by the user policy. Visual network topology, visual service paths, and visual LSP traffic are also supported for smart and efficient network O&M including service management, performance monitoring and network optimization apps. ZXCTN 9000-E series fully supports SDN functions, evolution-based PCEP, BGP-LS, SNMP, and Netconf/Yang interface protocols, as well as the future-oriented OpenFlow protocol.

ZXCTN 9000-E series is designed for IP RANs. With its customer-made hardware and software functions, ZXCTN 9000-E series will surely be able to help operators survive the competition in the Pre5G era. ZTE TECHNOLOGIES

Key Technologies of IP RAN

By Zhang Baoya

Based on dynamic IP/MPLS, an IP RAN network is built with packet-switched routers that can provide high bandwidth, high reliability, low delay, low cost, full services, and E2E QoS. IP RAN has become a mainstream networking solution for mobile backhaul. It is used to carry not only mobile voice and broadband multiservices to meet the need for 2G, 3G, and LTE/LTE-A base station access, but also carrier-class government and enterprise network services to satisfy operator needs for fixed mobile converged (FMC) full-service operation. Compared with traditional packet-switched networks, an IP RAN network introduces BFD, FRR, tunnel protection, and rapid route convergence technologies to ensure millisecond-level reliability, support IEEE 1588 and synchronous Ethernet, and meet the clock synchronization requirement of base stations and TDM traffic. The IP RAN network also simplifies service deployment through graphical E2E network management system. This guarantees large-scale networking and reduces O&M costs.

IP RAN Bearer

SDH/MSTP is used to bear traffic between 2G/3G base stations and a core network, where E1 interface rates are relatively low and the cost is high. As mobile broadband evolves to LTE and LTE-Advanced, it has been agreed in the industry that RAN must be IP-based, and packet mobile backhaul will be inevitable. LTE features all IP, multipoint-to-multipoint, high bandwidth, high reliability, low delay, and high-precision time synchronization. IP RAN has therefore become the primary choice for an operator's LTE mobile backhaul.

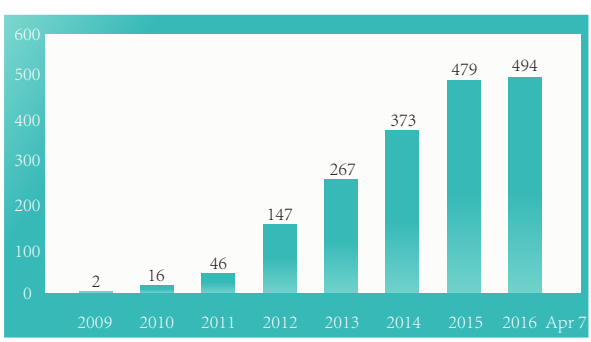


Figure 1. LTE network commercial launches.

The *Evolution to LTE* report published by the Global Mobile Suppliers Association (GSA) in April 2016 confirmed that in190 countries around the world, 691 operators have launched and 26 operators are deploying LTE networks. This figure includes 494 operators that have commercially launched their LTE networks (Fig.1). It is estimated that 550 LTE networks will be put into commercial use at the end of 2016.

Because of insufficient resources, high cost, and difficulty in hardware maintenance, SDH/MSTP cannot satisfy the requirements for Ethernet-based high bandwidth and low cost of government and enterprise businesses. With widespread deployments of IP RAN, mobile operators are pressing to migrate their services from SDH/MSTP to IP RAN.

IP RAN Key Technologies

IP RAN carries 2G, 3G, and LTE/LTE-A mobile traffic that can meet the bearer needs of government and

For its high bandwidth, high reliability, low delay, low costs, full services and E2E QoS, IP RAN has become a mainstream bearer solution for mobile backhaul.

—**Zhang Baoya,** Chief Engineer of IP RAN Product Planning, ZTE

enterprise networks. To evolve to fixed and mobile convergence (FMC), IP RAN needs key technologies such as large-capacity routers, MPLS VPN-based multiservice bearer, high reliability, effective O&M, high-precision KPI measurement, clock synchronization, and QoS.

High-Capacity Routers

As radio networks evolve from 2G to 3G, LTE and 5G, base stations are more densely deployed. Especially in this mobile broadband era, a metropolitan area network (MAN) covers several hundreds of, thousands of, or even hundreds of thousands of base stations. In the LTE age, a single-eNodeB generally reaches a peak rate of over 100 Mbps, while in the LTE-A stage, the eNodeB that uses the carrier aggregation (CA) technology can reach a peak rate of up to 1 Gbps. In the 5G era, the peak rate can even reach 20 Gbps. Wide coverage, high density, and high bandwidth of radio networks impose higher requirements on bandwidth of bearer equipment.

The core IP RAN equipment is required to provide a switching capacity ranging from hundreds of Gbps to tens of Tbps, and a single slot is required to support a throughput of 100GE, 200GE, or 400GE. As chip technologies develop to meet 5G requirements, there is a pressing need for a single slot to support 10GE/40GE/100GE ports. With the research into ultra-100G technologies, higher-density ports will be supported in the future. In a flat network, core routers need to support high-density 10GE/40GE/100GE cards, and a single card needs to support more slots.

MPLS VPN-Based Multiservice Bearer

To migrate 2G, 3G, as well as government and enterprise network traffic from the original SDH/MSTP to IP RAN, it is necessary to provide E1, cStm-1, FE, GE, and 10 GE access capacity for carrying multiservices including 2G, 3G, LTE, LTE-A, and government and enterprise network services. MPLS has good QoS capability, supports point-to-point, point-to-multipoint, and multipoint-to-multipoint communication, and provides abundant service models. Therefore, adopting end-to-end MPLS technologies in backhaul IP RAN has become a consensus in the industry. A large IP RAN network can use VPN technologies such as MS-PW, HoVPN, OptionA, and seamless MPLS to improve its networking capability. The number of network nodes can be up to thousands or even hundreds of thousands.

High-Reliability

As IP RAN chiefly carries radio traffic as well as government and enterprise network services, millisecond-level carrier-class reliability has become the basic requirement. The high-reliability requirement of IP RAN includes fast fault awareness, fast forward switching, fast routing recovery, and BGP-PIC.

IP RAN detects faults through BFD that includes PW-BFD, IGP-BFD, BGP-BFD, peer-BFD, static route BFD, VRRP-BFD, PIM-BFD, LSP-BFD, and link-BFD. IP RAN also supports CFM detection. Continuity detection on the forwarding plane is based on hardware that can meet the requirement of millisecond-level failure switching. Some faults such as optical deterioration and link splitting can also be detected through CRC and EHT-LM. This triggers

network switching, and the faults can be mapped through BFD and PW O&M-mapping.

The best way for fast traffic switching on the forwarding plane is to switch multiple redundant active/standby paths generated in advance by the forwarding table to other redundant paths for fast traffic recovery after fault detection. The related protection techniques involve smart-group, MC-LAG, MSP 1:1/1+1, PW-FRR, IP-FRR, r-LFA, LDP-FRR/ECMP, VPN-FRR/ECMP, hot-standby, TE-FRR, and VRRP. If these techniques are unavailable, it is necessary to adopt the routing/LSP convergence mechanism on the protocol layer. The prefix independent convergence (PIC) and the shortest path first (SPF) algorithm are used to refresh the next hop of relative routes via IGP and recover services in case of network failure. In this way, millisecond-level protection can also be achieved.

Effective O&M

An IP RAN network generally contains hundreds to thousands of nodes. If these nodes are all commissioned on site one by one manually, there would be a large amount of work. If traditional network management and O&M is used, services might be provisioned with low efficiency and maintained with difficulty.

An effective network O&M is therefore quite important. Equipment plug and play must be supported without the need of on-site manual commissioning. During service deployment, work orders are generated through E2E graphical user interfaces or special tools, and are automatically distributed through the network management system. During service O&M, services are viewed through a graphical network management system. This helps to improve visual O&M capability, rapidly locate faults, significantly enhance large-scale network maintenance, and reduce O&M costs.

Clock Synchronization

TDM services must be frequency synchronized, while 3G or LTE traffic requires high-precision phase synchronization. Synchronous Ethernet technology has been widely used in the industry. Synchronization at the physical layer can provide high frequency precision, ensure that E1 traffic restores frequency through a synchronous Ethernet, and implement accurate BIT stream transmission at a low error rate. The synchronous Ethernet plus 1588 v2 technology must also be supported to improve high-precision phase synchronization.

QoS

In the evolution from 2G/3G to LTE, more than 90% of radio sites are reused, and 2G/3G will coexist with LTE for a long term. IP RAN for government and enterprise networks has developed rapidly in recent years. In the future, FMC will be deeply developed. Transport networks must therefore meet the quality requirement for various service bearing. Multiservice convergence and bearing requires that IP RAN provide hierarchical QoS ability and ensure QoS of key services in case of network congestion.

There are two key requirements on QoS. One is to ensure that services with a higher QoS are first forwarded to reduce the delay. This is a traditional Differ-Serv concept. The other is to ensure that important services especially radio voice and critical government and enterprise network services are available in the event of network congestion. A bearer network must support hierarchical QoS processing and hierarchical queue scheduling for different base stations and services, so as to ensure important base stations never drop off.

SDN/5G Evolution

As the SDN technology is getting mature, manufacturers and operators have worked out their own SDN roadmaps. The introduction of SDN into IP RAN can simplify service deployment and reduce O&M costs. E2E service deployment and O&M can also be implemented easily in cross-domain scenarios. IP RAN uses dynamic IP/MPLS technology. At present, tenders of operators including Vodafone, AT&T, and China Telecom have specified that SDN IPRAN is based on the ODL architecture. In this

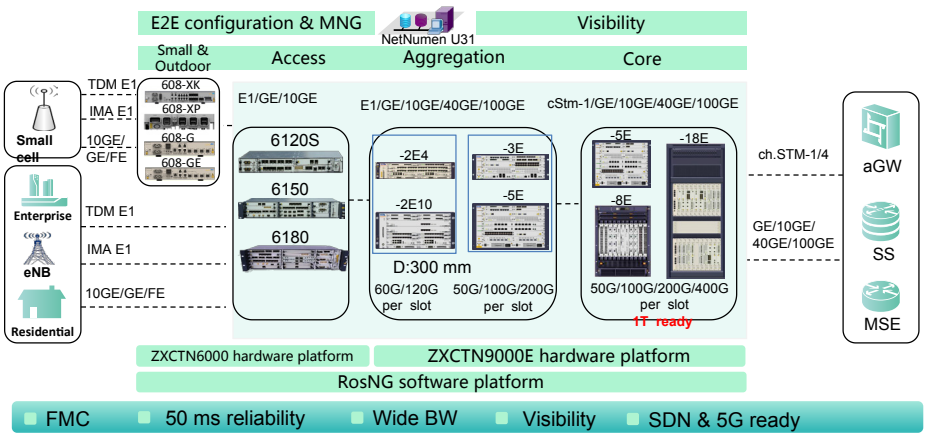


Figure 2. ZTE's IP RAN solution.

architecture, southbound interfaces use BGP-LS, PCEP, and NETCONF protocols, and the equipment layer still keep IP/MPLS protocol to maintain network continuity. The deployment of RSVP-TE allows PCE to control service paths on the forwarding plane and thus provide IT-based northbound interfaces.

5G technical requirements have been well defined, and the work on 5G standardization will be finished in 2018. The key requirements for 5G backhaul networks include large-capacity switching equipment, ultra-100GE applications, 40GE/100GE networking at the access layer, 10GE (or as high as 25G) access ports on the eNodeB side, and cloud-based SDN for unified management of IP RAN and radio networks. In the 5G era, as the core network will move close to the user end and video services develop rapidly, the era of mobile distributed CDN will arrive. At that time, IP RAN will accommodate DCI technical requirements and eMBMS will further develop.

ZTE's IP RAN Solution

ZTE's IP RAN products cover ZXCTN 9000-18E/-8E/-5E/-3E/-2E10/-2E4 series serving as the IP RAN core for large, medium, small-sized radio access convergence, ZXCTN 6180/6150/6120S used for macrocells, indoor cells, and government and enterprise network service access to meet the needs of various ports, ZXCTN 608 used for outdoor and indoor access, and NetNumen U31 EMS used for visual and end-to-end effective operation and maintenance (Fig.2).

ZTE's IP RAN solution based on router technologies has powerful IP/MPLS capability and supports LSP (such as RSVTP-TE and LDP), MPLS VPN, and seamless MPLS. The solution also carries full services and provides high bandwidth, 50 millisecond-level carrier-class reliability, and visual E2E service configuration and management. Some operators have conducted lab tests on SDN IPRAN. ZTE's IP RAN solution has been widely deployed by China Telecom, China Unicom, and operators outside China.

Summary

For its high bandwidth, high reliability, low delay, low cost, full services, high-precision clock synchronization, and graphical O&M capability, IP RAN has become a mainstream bearer solution for radio backhaul networks. IP RAN is also evolutionary and can be used to carry radio voice, mobile broadband, and government and enterprise network services. It is agreed in the industry that IP RAN has gradually replaced traditional SDH/MSTP. Integrated fixed and mobile service bearing is a new trend for the development of IP RAN. Therefore, the evolution of IP RAN to SDN and 5G has become a research focus in the industry.

VIVO LEADS THE LTE MARKET IN BRAZIL WITH IP RAN

By Wang Quanzhong

Wang Quanzhong
BN Product & MKT Planning Engineer, ZTE Corporation

Brazil, the largest country in South America, has a reputation as "the Kingdom of Football," and is one of the BRIC countries. There are four major mobile operators in Brazil. Vivo, one of the four operators, seized the opportunities of 3G and LTE development to expand its networks, boosted its presence in the market, and outperformed its rivals in Brazil.

Background

Vivo was established in 2002 as a wholly-owned subsidiary of Telefonica, which is a multinational telecommunications giant. Boasting TDMA, CDMA, GSM, WCDMA, and FD-LTE, Vivo is a well-known mobile brand in Latin America with a market share of 30.36 percent.

Vivo built a nationwide GSM network and a WCDMA network in 2006 and 2008 respectively. In 2010, it developed a marketing strategy of "providing high-speed and innovative data services" , and gradually dominated the 3G market. In 2014, Vivo began to deploy LTE networks.

Challenges

In 2006, Vivo deployed nationwide 2G (GSM) mobile networks, and leased a large quantity of bandwidth to launch mobile backhaul services. The evolution of 3G technologies increased the cost of bandwidth, so Vivo began to deploy its transmission backbone and Metro-Ethernet (ME) in 2010. From 2010 to 2013, Vivo cooperated with ZTE to construct the transmission backbone and ME networks. In addition, it chose ZTE to build a large number of PTNs in the southern and northern states of Brazil to provide high-value services, such as 2G, 3G, and leased line.

With the large-scale commercial deployment of LTE worldwide in 2013,

in view to be consistent with the TEF headquarters in technical concepts, Vivo opened a tender for IP/MPLS-based IP RAN/ME networks to carry LTE services.

Vivo has many PTNs that have just been put into commercial use, but they can't meet LTE or fixed broadband requirements. By analyzing the existing network and forecasting further trends, Vivo determined to upgrade the PTNs and build IP RANs so as to reduce investment.

Requirements

To upgrade the existing PTNs and build new IP RANs, the major requirements are as follows:

- Smooth evolution: The existing commercial PTNs can be utilized and appropriately transformed to reduce the CAPEX and OPEX. In addition, the PTNs can be upgraded to IP/MPLS to keep pace with technological changes.
- Multi-service bearer: Vivo mainly provides mobile services. With the withdrawal of SDH/MST from existing networks and the evolution of PTN to IP/MPLS, IP RAN networks will carry high-value and multi-service voice, data traffic, and leased line services.
- High reliability networks: In a competitive market, network quality is the top priority to win a good reputation from customers. As a market leader, Vivo tried to improve KPIs, guarantee voice, big data and high-priority services, and meet carrier-class switching requirements for bearer networks in case of any failure.
- Efficient time transfer: MBH sets clear requirements for clock and time performance. Currently, GPS is still the mainstream. However, labor costs and equipment room rentals are rising, and GPS is not available in some scenarios, such as subways, skyscrapers, and outdoor CSG. Therefore, operators are desperate for clock and time synchronization on mobile backhaul networks.

Proposal

In 2013, Vivo invited a bid for IP/MPLS-based ME networks. To select a strategic partner, Vivo took part in the PTN + CE test for LTE, which was initiated by ZTE. Meanwhile, it studied ZTE's IP RAN products, such as 6120S, 6150 and M6000-S, and major solutions, such as the IP/MPLS L3VPN to edge and IP RAN solution. These solutions not only fully satisfy the requirements of LTE, but also protect the investment of Vivo. Finally, Vivo chose ZTE as its partner to upgrade the commercial PTNs.

Features and Advantages

With the PTN technology, which features low cost, easy O&M and high availability, Vivo constructed a large number of PTNs to carry 2G/3G services, and prevailed in the 3G era. As LTE evolves, Vivo set an IP/MPLS technology roadmap. In this context, ZTE developed new products, guided Vivo in PTN + CE transformation and upgrade, which eventually evolved to IP/MPLS, and built new IP RANs for Vivo.

- Mature and sound L3VPN (HoVPN): The L3VPN solution is deployed on IP RANs worldwide. With ZTE's support, Vivo has deployed nearly 100,000 terminals on mobile backhaul networks globally, meeting customer requirements for narrowband and broadband services access. This solution enables Vivo to take a huge lead in the 4G era to further expand its market share by deploying networks rapidly.
- Flexibly evolving PTN + CE: To win the competition in the market, Vivo brought massive LTE services to PTN networks. Without affecting the existing 2G and 3G bearing services, Vivo adopted the PTN + CE solution for LTE service by introducing the M6000-S as the CE and core device in the IP RAN network. This network architecture ensures a smooth upgrade from PTN to IP/MPLS.
- Comprehensive protection against faults: ZTE's IP RAN solution detects optical link and equipment faults through BFD for everything, implements LDP FRR in ring networks through remote-LFA, and troubleshoots equipment through VPN/PW FRR. Therefore, Vivo takes this solution to reduce the fault convergence time to less than 500 ms, and perform carrier-class switching protection on all services.

Conclusion

With ZTE's professional team and rapid deployment, the IP RAN gained recognition from Vivo. Currently, this solution has been widely used by Vivo in the southern and northern states of Brazil and has won customers' trust due to its high-speed and excellent performance. What's more, Vivo adopted this solution to transform from a mobile operator to a full-service operator.

ZTE TECHNOLOGIES

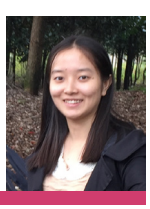
SLT'S SUCCESS IN FIXED LTE IMPLEMENTATION

By Gao Qin

With the popularity of smart phones and rapid growth of the mobile broadband (MBB) market, fixed-line network operators are facing challenges from mobile operators in their fixed broadband businesses. Sri Lanka Telecom (SLT) is a state-owned telecom operator that provides ICT solutions and advanced broadband and backbone facilities. It has achieved a dominant position in Sri Lanka's fixed-line market, having over 600,000 fixed-line subscribers and a market share of nearly 90%. In the mobile communication era, how has SLT made new breakthroughs in services to turn crises into opportunities? Let's read through SLT's success story to learn how it has been revitalized in the mobile communication era.

The MBB market has grown very rapidly in Sri Lanka. From 2010 to 2015, Sri Lanka's MBB penetration increased from 2.4% to 18.1%, but its fixed broadband (FBB) penetration increased slowly to only 2.3% in 2015. Of the three local fixed-line operators in Sri Lanka, SLT is overwhelmingly predominant in the FBB market while Dialog Axiata and Lanka Bell are aggressive in TD-LTE deployment. In the first quarter of 2013, Dialog Axiata secured a sustained growth in subscribers through TD-LTE wireless broadband access (WBA) service. By the end of 2014, the number of Dialog Axiata's TD-LTE subscribers had exceeded 50000.

In Sri Lanka, the application period of fixed broadband installation is about three to four weeks, and the access fees are high. Therefore, SLT's existing XDSL and FTTH services only cover large-scale enterprises, government, and some high-end customers. Meanwhile, because WiMAX failed to be promoted worldwide, SLT's WiMAX network has not been put into commercial use. The best way out is to transition WiMAX to TD-



Gao Qin
Product and Solution Manager of TDD Product Team, ZTE

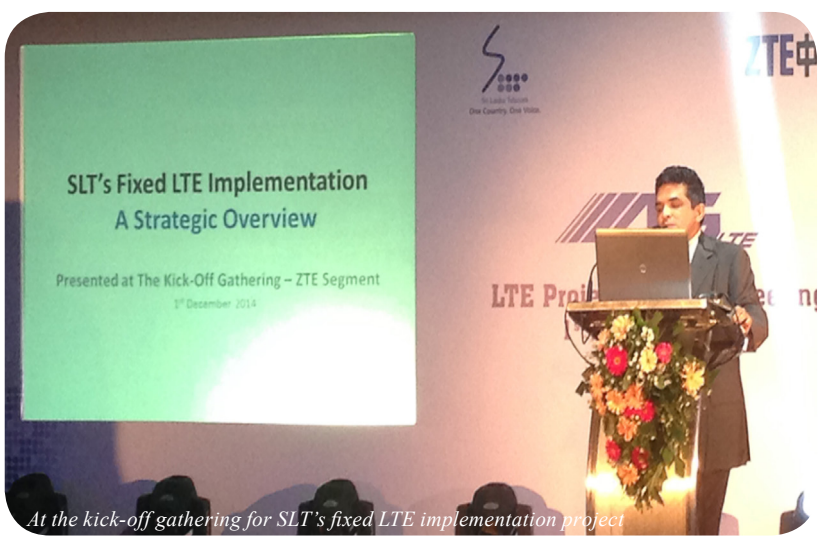
LTE. As the mainstream 3GPP technology, TD-LTE beats WiMAX in chips, terminals, test instruments, and commercial scale. To date, global telecom giants in USA, China, Japan, and India have chosen TD-LTE as their development priorities.

Making the best use of the TD-LTE network has become a major concern for SLT. Because of high costs, FBB services have been applied mostly in urban areas. SLT has to adopt different strategies for commercial TD-LTE business in different areas. In the areas concentrated with government offices and large enterprises, SLT provides excellent and high-speed fixed broadband services for these high-value customers. For small and medium-sized enterprises, low- and middle-income families, and individual mobile subscribers, SLT provides convenient wireless broadband services through TD-LTE+CPE. In the countryside not covered by fixed networks or FTTH infrastructure due to land privatization, and also for those users who cannot afford for fixed access, SLT uses the TD-LTE network to provide cheap wireless broadband services.

In addition to the business strategies, SLT also adopts integrated 4-channel RRUs and 8-channel RRUs deployment to balance network coverage and capacity. In urban areas, 4-channel RRUs are used to support remote electrical tilt (RET) antennas for considering the initial network construction speed and cost control. Ultra-wideband and high-power 8-channel RRUs not only apply to urban hot-spot areas for traffic absorption but also satisfy the need for wide coverage in suburb and rural areas. This helps SLT reduce network construction costs. With rich experience in network construction and on the basis of precise field survey, ZTE has assisted SLT in deploying a TD-LTE network with simpler structure, faster speeds, and lower costs that can satisfy service requirements in the coming five to eight years.

SLT also has distinct advantages in supporting future LTE-A technology. Currently, SLT has a 30 MHz bandwidth at the 2.6 G band that enables two-carrier aggregation (20 MHz and 10 MHz). In the future, 20 MHz bandwidth will be added to implement three-carrier aggregation with a theoretical peak data rate of 275 Mbps. The RRUs deployed by SLT support three-carrier aggregation in hardware. This helps SLT greatly save CAPEX, ensure smooth evolution, and improve TD-LTE performance.

Since the kick-off gathering for SLT's fixed LTE implementation project was held in December 2014, the test team has worked closely with the delivery team to ensure that SLT's roll and pay policy can be implemented with the best network performance and the fastest time to market. The roll and pay policy refers to the commercial mode where network construction and service charging are implemented simultaneously. At first, SLT didn't require to build a national wireless broadband network. Instead, SLT divided the areas in the country and deployed the network in hot-spot areas. When broadband services were provided in these areas, SLT began to gain revenue which SLT could use to deploy the network in other areas. This commercial mode used for data services provides a fast return on operator investment. SLT put its TD-LTE network into commercial use in June 2015, and attracted 5000 new subscribers within one month. By the end of 2015, its subscriber base had reached 14000.



At the kick-off gathering for SLT's fixed LTE implementation project

In the mobile communication era, fixed-line operators concern more about how to leverage wireless technologies to offer innovative broadband access services. TD-LTE is a preferred choice for operators to expand their coverage within a short period of time and grab more market share with flexible pricing modes. TD-LTE also provides diverse value-added services and excellent user experience. The success of SLT has once again proved that adopting ZTE's TD-LTE as broadband access is the best choice for fixed-line operators in their business transition.


ZTE
Tomorrow never waits