VIP Voices

AzQTel:

Transitioning from

WiMAX to TD-LTE

Tech Forum

Development Trends for

Router Technologies

Special Topic Smart Operations

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Big Data Mining for Smart Operations

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Jayhun Mollazade, CEO of AzQTel

AzQTel is an Azerbaijan-based telecom company founded in 2005. The company launched its 4G broadband services in October 2010 under the "Sazz" brand name. *ZTE TECHNOLOGIES* interviewed Jayhun Mollazade, CEO of AzQTel. He discussed AzQTel's latest developments, the Sazz 4G brand, and the progress of AzQTel's LTE transition, and also shared his views on the partnership with ZTE.

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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

Success Stories

Solution

ZTE Solutions Celebrated at BBWF Awards

22 October 2015, Shenzhen — ZTE announced that it won two awards at Broadband World Forum (BBWF) 2015. ZTE's Zandra™ solution was awarded the Best Connected Home Service or Solution Award. TM and ZTE jointly won the Best Broadband Partnership Award.

By introducing a brand-new, interactivity-focused concept to the home monitoring realm, ZTE's Zandra™ solution enables people to surveil their homes from anywhere, anytime. ZTE and TM stared the cooperation to do research on some new technologies in new-generation access, such as TWDM PON optical extender and DWBA. The TWDM-PON system offers 40 Gbps downstream and 10 Gbps upstream data that can support up to 128 users at 40 km fiber distance. An important feature of the system is the coexistence capability to maintain the current ODN network.

ZTE Helps China Mobile Launch VoLTE Services in Hunan Province

29 October 2015, Shenzhen — ZTE is pleased to help China Mobile roll out VoLTE high definition voice services in Hunan province.

ZTE's comprehensive end-to-end capabilities enable China Mobile to deliver the highest-performance VoLTE services and user experience to subscribers by evolving and coordinating the wireless, bearer, signaling, billing, as well as O&M components of the network across circuit switched (CS), IP multimedia subsystem (IMS) and the evolved packet core (EPC) domains. China Mobile and ZTE successfully completed a large-capacity field test in Hunan, exceeding all specifications and requirements. The project in Hunan was China Mobile's first province completed 4G+ commercial network in the country.

"ZTE is excited to work with China Mobile on the successful launch of VoLTE services in Hunan," said Gong Dehua, vice president of core network products at ZTE. "The project demonstrated ZTE's industry-leading capabilities in VoLTE, as we provided innovative solutions that deliver high-quality and robust services to subscribers and enable real-time monitoring of network performance and user experience."

ZTE Releases Industry-First Data Center ToR Switch Series, the BigMatrix™ ZXR10 5960-H

22 October 2015, Shenzhen — ZTE has released the BigMatrix™ ZXR10 5960-H, a product series of next-generation data centre top-of-rack (ToR) switches for use with big data and large-scale cloud computing.

The ZXR10 5960-H series comes in six models, the 5960-52DU-H, 5960-72NL-H, 5960-72DL-H, 5960-64DL-H, 5960-64NL-H and 5960-32LC-H. The 5960-52DU-H supports up to four 100G uplink ports, which is the highest density in the industry. The 5960-32LC-H is the world-first ToR switch with all 40G ports and panel-based optical and electrical 10G combo interfaces, making it the most flexible data center access platform available.

Horizontal scalability is the key to ensuring server access due to the large amount of horizontal services in big data. The ZXR10 5960-H, the data center ToR switch, has a special design for the open service architecture's (OSA) horizontal data, improving big data platforms' ability to capture unstructured and independent data. It uses ZTE's resource operation system ZXCLOUD iROS to efficiently achieve the uniform migration of virtual devices and fast service deployment.

ZTE 9-Month Net Profit Jumps 42% as Carrier Networks Sales Grow

27 October 2015, Shenzhen — ZTE announced that net profit rose by more than 42% in the first nine months, driven by increased sales of optical network products and 4G LTE solutions to carriers.

Net profit attributable to shareholders of the listed company jumped to RMB 2.6 billion (US$409 million) in the first nine months, according to financial results released by ZTE today. Revenue increased by 16.5% to RMB 68.5 billion. Basic earnings per share climbed to RMB 0.63.

Revenue in ZTE's carriers' networks division rose by more than 22% in the first nine months as the company increased sales of 4G LTE infrastructure systems, optical network products, wireline switch and access systems globally. Revenue from telecom software systems, services and other products increased by 45.8%, helped by higher sales of video and network terminal products.

ZTE was the world's fastest-growing provider of wireline broadband equipment, according to latest data by telecom consultant Ovum. ZTE was the world's second-biggest provider of passive optical network solutions, according to Ovum.

Under the M-ICT strategy, ZTE is focused on innovations in converged end-to-end solutions integrating the company's world-leading capabilities in telecommunications and information technology to deliver increased value to customers.

ZTE Opens New R&D Center in Japan to Boost 5G Research

4 November 2015, Tokyo — ZTE opens a new R&D Center in Tokyo to focus on the development of 5G and other next-generation network technologies.

The new R&D center will support ZTE's partnerships with operators and academic institutions in Japan on the deployment of ZTE's proprietary Pre5G technology and ongoing research on 4G and 5G mobile communications.

Qualcomm and ZTE Sign New 3G/4G License, Strengthening Long-Term Partnership

3 November 2015, Shenzhen — ZTE announced that it has signed a new worldwide 3G/4G license agreement with Qualcomm Incorporated. The license includes terms that are consistent with the rectification measures that Qualcomm submitted to China's National Development and Reform Commission (NDRC) in February 2015. Under the terms of the agreement, Qualcomm has granted ZTE royalty-bearing patent licenses to develop, manufacture, and sell 3G and 4G products, such as smartphones, modules, and infrastructure equipment, including 3-mode (LTE-TDD, TD-SCDMA and GSM) smartphones sold for use in China.

"ZTE is glad to have concluded a new agreement with Qualcomm," said Guo Xiaoming, general counsel of ZTE. "This agreement provides a solid foundation for Qualcomm and ZTE to expand and strengthen the long term relationship between the companies in the future."

"Qualcomm is pleased to again have reached an agreement with ZTE that reflects the established value of Qualcomm's patent portfolio, supports future collaboration between Qualcomm and ZTE, and strengthens the relationship between the companies," said Eric Reifschneider, senior vice president and general manager of Qualcomm Technology Licensing. "This agreement with ZTE is another important step for our licensing business in China, and we look forward to continuing our progress in concluding agreements with Chinese device companies."

AzQTel:

Transitioning from WiMAX to TD-LTE

Reporter: Zhang Ying

AzQTel is an Azerbaijan-based telecommunications company founded in 2005. It provides wireless internet, high-speed broadband internet, and other value-added services in Azerbaijan. The company launched its 4G broadband services in October 2010 under the "Sazz" brand name. These services are based on WiMAX technology. At MWC 2015 Shanghai, *ZTE TECHNOLOGIES* interviewed Jayhun Mollazade, CEO of AzQTel. He discussed AzQTel's latest developments, the Sazz 4G brand, and the progress of AzQTel's LTE transition. He also shared his views on the partnership with ZTE.

Jayhun Mollazade, CEO of AzQTel

> *AzQTel has been working with ZTE to develop a plan to migrate the network from WiMAX to the more robust TDD-LTE.*

Q: Could you tell us about AzQTel's latest developments in Azerbaijan?

A: We have recently expanded our wireless broadband network to provincial cities and towns. In the early stages of our network rollout, we focused on building the network in the capital city, Baku, which is situated on the Absheron peninsula. After we completed the network build-out in Baku, Sumgayit and Xirdalan in 2011, we expanded the network to more than 13 regional cities and towns to the north, northwest, and south of the country.

At the same time, we started providing wireless internet and fixed broadband services to corporate clients by utilizing backhaul microwave technologies.

At the BakuTel International Exhibition and Conference held in December 2014, AzQTel, in cooperation with ZTE, introduced TD-LTE technology to Azerbaijan for the first time. Visitors to the Sazz booth observed a demonstration of the TD-LTE technology capability of generating speeds of 80–100 Mbps. Dignitaries who visited the Sazz booth included Ilham Aliyev, President of Republic of Azerbaijan and Ali Abbasov, the Minister of Communications and Information Technologies. They visited the opening of the exhibition and stopped by the Sazz booth. More and more, the BakuTel conference has become an international

event. Representatives from China, Turkey, the United Kingdom, and many European countries now attend.

AzQTel has been working with ZTE to develop a plan to migrate the network from WiMAX to the more robust TDD-LTE. The company's shareholders and board has endorsed the strategy to deploy TDD-LTE in the capital city, Baku, and Absheron Peninsula, providing full mobile coverage. The WiMAX technology equipment will be gradually re-deployed in regional cities and towns in the country.

Many government departments, institutions, energy companies, and banks are located on the Absheron peninsula. This is where a lot of Azerbaijan's commercial and business activities take place. Therefore, the need for mobile broadband is very high in this region. In general, the demand for mobile services and in particular, mobile broadband services, have grown worldwide, and Azerbaijan is no exception.

In that sense, our plan is to build a high-quality mobile broadband network as soon as possible in Baku city and Absheron peninsula. We will upgrade our network capacity rapidly in the capital city and redeploy WiMAX base stations in the towns and villages of the country. In this way, the company can hit two targets with one bullet. One is to upgrade our network capacity and improve QoS in the capital city and Absheron peninsula, where our customers are not

satisfied with the capability of WiMAX technology. The other is to expand our network coverage by redeploying the WiMAX technology to the regions and rural areas of the country where WiMAX technology still performs well. By doing this, we will upgrade our capacity in the capital city and expand our coverage nationwide.

Q: Azerbaijan has been making great progress in developing telecom sector in recent years. How has AzQTel contributed to this?

A: AzQTel is a wireless internet service provider. We provide services in 16 cities and towns across the nation. The financial investment and the construction of the network is a major infrastructure development project for the country.

Even though AzQTel is a private company, we support the government's policy for the fast development of the country's ICT infrastructure. We understand that the broadband, telecom, and IT sectors constantly need to be developed, expanded, and upgraded.

We have negotiated with a number of international investment groups (including Chinese), to raise enough capital to implement our seven-year business plan, which involves migrating from WiMAX to TDD-LTE and TDD-LTE Advanced. We will fully utilize 4G and 5G technologies in order to cover all of Azerbaijan with the best wireless

mobile broadband technologies and provide QoS to the population who have more and more been attracted to the convenience of utilizing the mobile technology.

Q: Could you introduce Sazz 4G? What is the importance of this brand for your overall strategy? How will it evolve in the future?

A: The Sazz brand was introduced into Azerbaijan's telecom market by AzQTel in October, 2010 for the first time. AzQTel is the legal name of our company. We entered the telecom market with the brand name Sazz, a new logo-type which is colorful.

Sazz is directed towards young people. Sazz, in Azerbaijani, means something "good quality". In a way, it's kind of "cool" internet. We have about 50 brand stores which display our logo colors, and the furniture in each store has been designed specifically for our customer services and sales. The Sazz brand is a recognizable brand name, and the demand for Sazz services is

very high.

However, WiMAX is fast becoming a technology of yesterday. At present, many WiMAX operators are migrating to TDD-LTE and FDD-LTE. In 2016, our plan is to come to the market with "Sazz plus" or "Sazz Advanced" and continue to build up our brand name recognition.

Q: What are your major concerns about TD-LTE?

A: Our main concern is that we need to make our engineers learn more about TDD-LTE. They have visited ZTE's R&D office in Xi'an. For the last year and a half, we have been trying to understand how TDD-LTE could be rolled out on 3.5 GHz because AzQTel holds 142 MHz frequency capacity in the 3.5 GHz and 3.6 GHz frequency bands, which are now Band 42 and Band 43 and are designated by 3GPP as mobile broadband spectrum. So it is a big spectrum for us for rolling out TDD-LTE technology.

We joined the Global TD-LTE

Initiative (GTI) two years ago and it has provided the opportunity to introduce ourselves and the company, to meet with vendors, investors, and other operators in similar situations as us to exchange experiences. We have met with operators that have already made progress in rolling out of TD-LTE technology, such as China Mobile, SoftBank Mobile in Japan, ON Telecom in Brazil, and other bigger and smaller operators that have already succeeded in migrating from 3G to 4G or from WiMAX to TD-LTE.

We have learned about the differences between FDD-LTE and TD-LTE. We believe that TD-LTE is more practical to us as we are a wireless internet services provider, not a GSM voice provider. The download capability of TD-LTE is as strong as that of FDD. The asymmetric nature of TD-LTE technology enables you to design a network in such a way that 70 percent to 80 percent would be dedicated to the downlink, and 20 percent to 30 percent would be dedicated to the uplink. This is in line with our experience today. WiMAX and LTE are both based on

OFDM and time-division technology.

We consider TD-LTE in a way as WiMAX 2 (an advanced version of WiMAX standards which was never implemented). As you may know, the plans for WiMAX 2 were abandoned and TD-LTE will be adopted by about 250 WiMAX operators in 140 countries. The TD-LTE technology also has a roadmap for future development, like TD-LTE advanced. I'm sure that TD-LTE technology will be the technology for the path to 5G. In that sense, our senior management team including the COO, CTO and myself (CEO), are constantly engaged to become more and more knowledgeable about the TDD-LTE technology.

We have already accumulated lots of experience in the wireless nomadic and quasi mobile technology like WiMAX. However, TD-LTE gives us experience for a more robust mobile technology, because it has more advantages over WiMAX, such as dual carrier capability, which WiMAX technology failed to deliver. It has better load balancing, better mobility and better data signal propagation. We really recommend many operators, who still are utilizing WiMAX technology, to adopt TD-LTE technology. Once they have intention to get engaged in this mobile broadband business, they will consider TD-LTE technology as one of the best technologies in the marketplace today.

Q: What is your strategy of transitioning from WiMAX to LTE?

A: Our strategy is to overlay TDD-LTE technology over the existing WiMAX network. We will deploy the TD-LTE base stations adjacent to the existing WiMAX sites. Ultimately, we will add more sites for better coverage, and continue to increase mobile coverage in Absheron Peninsula.

For a certain period of time, the WiMAX and TD-LTE networks will continue to provide services simultaneously. Ultimately, we will encourage our existing customers to migrate to TD-LTE services. We will direct new customers to new Sazz Advanced services.

When our migration has been completed, most of our existing customers can enjoy broadband services with more quality, and their needs for data usage can be satisfied better. We will shutdown the WiMAX network in this region and move the WiMAX base stations to 60 provincial city centers across the nation.

After that, customers can roam from the provinces to the capital city or from the capital city to the provinces. We will be able to provide dual modems that can switch between LTE and WiMAX.

However, we understand that in 2017 and 2018, there will be even more advanced antenna technologies and versions with 8×8 MIMO technology. At that time, we will move our existing base stations in Baku to the regions in order to get rid of the WiMAX technology, and completely deploy more superior TD-LTE advanced technology in the capital city. Then we will have a full TD-LTE coverage nationwide.

Q: What are your top priorities for the next three years?

A: Our priority is sales. We will build the network, market our services, and reach out to the Azerbaijan community, specifically the young people who are very savvy with internet technologies.

Our target is to acquire more customers and become one of the leading mobile operators in the country. We hope to reach and capture 20 percent to 25 percent of the mobile broadband market in order to increase our customer base.

Q: Do you have any popular services for young people? Could you introduce them to us?

A: Well, at the moment, our company specifically is not utilizing its own applications or services for the customers.

Our existing customers are using the internationally known applications and services, such as Facebook, Skype, and WhatsApp. All of these social networking services are available on the internet. They are using these applications now, but we are learning the experience from China Mobile and other Chinese mobile operators.

With the upgrade of our networks, it is also a part of our plan to introduce some customized and tailored services for our customers.

Q: What is your overseas expansion plan?

A: Azerbaijan's market lacks penetration in terms of mobile broadband users. There are only 3G and WiMAX services for wireless and mobile customers. Both technologies are lacking in quality because the growing needs for data

usage exceeds the capability of existing 3G and WiMAX.

I expect the GSM operators to migrate to FDD-LTE technology after testing. So my forecast is there will be two FDD mobile operators and one TDD mobile operator, which is AzQTel.

In the past three to five years, we saw very high growth rates for the mobile services, and the penetration rate for GSM services has reached over 100%. However, the real mobile broadband is not yet on the marketplace. I can say that opportunity is still ahead of us. I think there will be heated competition between existing mobile operators, including us. Customers will take advantage of this competition where each operator is trying to provide better services for lower possible rates.

I would say that three mobile broadband operators will be able to deliver quality mobile broadband services to customers after maybe 5 to 7 years, or 7 to 10 years. At this moment, Azerbaijan's telecom market, like many other markets around the world, is still at an early stage for mobile data services. In my opinion, 3G and WiMAX are not at the level that can satisfy the growing needs for mobile data consumption.

Q: What do you think of MWC Shanghai 2015?

A: First of all, the level of the Asian mobile conference was upgraded to level of MWC in Barcelona. I think this is very positive. Now, this forum is becoming more and more reputable every year. All the vendors, operators, chip makers, bankers and investors are attending. They are discussing technologies, the Asian markets and

services. It's a kind of big market channel for Asia.

Q: How would you assess ZTE's team and solutions, especially 3.5G TD-LTE solutions?

A: I think ZTE has contributed enormously in the R&D of 3.5 GHz. ZTE became one of the biggest vendors and suppliers of SoftBank Mobile in Japan. SoftBank Mobile's standards are very high, and ZTE has done a great job for the last two years to improve their quality of the 3.5 GHz technology. I've been talking to my Japanese colleagues from SoftBank Mobile. They said that ZTE reaches the level that can satisfy the standard requirement of Japanese operators. That's a demonstration of its high standard.

Q: What will be some of the trends in the global telecom market in 2016?

A: The trend for the global market will be, I guess, still the vendors and technology providers working together on the synchronization of TDD and FDD technologies.

In addition, 5G is becoming more and more effective. We are going to understand what frequency is going to be used for 5G. The market hype around 5G is becoming a reality. I think all of the 4G and 5G debates will continue in 2016.

Also there will be more and more companies that come up with different applications, software, services and solutions that can go through the mobile broadband networks. **ZTE TECHNOLOGIES**

Linkem to Expand 4G LTE Coverage

Reporter: Zhang Ying

Rino Buccio, CTO of Linkem

Linkem is a leading provider of wireless broadband services in Italy. Its 3.5 GHz network covers every region of the country. Linkem provides high-speed wireless data services to individuals and businesses. Recently, *ZTE TECHNOLOGIES* interviewed Rino Buccio, CTO of Linkem. He discussed Linkem's business focus, WiMAX challenges and services. He also talked about Linkem's transition from WiMAX to LTE and gave his opinion on GTI 2015.

Q: What is Linkem's main business focus?

A: Our main focus is to create value from our spectrum in Band 42, i.e., 3.5 GHz. When Linkem was established in the late 1990s, we started with WiFi. We were the first company in Italy to provide WiFi services for business travelers in the main Italian airports addressing surging demand for mobile data. Few years later, Linkem expanded its business model, offering broadband services to residential customers by using unlicensed 5.4 GHz spectrum. Finally, in 2008, the 3.5 GHz spectrum was auctioned in Italy, and Linkem was able to acquire a portion of the available 120 MHz. During the years, additional portions of the spectrum were added, as consequence Linkem owns 84 MHz of Band 42 today in most of the country. With this spectrum, we deliver wireless broadband internet access.

Q: How do you position yourself

in the Italian telecom market?

A: Italy is currently in the process towards digital society. In fact, residential broadband penetration in Italy is about 55 percent. The main reason for that is the resistance to technology introduction, in Italy, more than 20 percent of the population is over 65. In addition, the wired infrastructures are not well developed.

The only infrastructure for residential broadband is copper. The evolution to fiber, with exception of Milan city, is slow. As consequence, the wireless technologies due to their flexibility, low capex per user and high deployment speed are an effective alternative for delivering broadband services to Italian families.

Our positioning is very simple: good performance at a convenient price, simple and transparent offers, optional prepaid services avoiding fixed line monthly fee, service installation within one week.

Q: How would you assess your 4G LTE performance?

A: In 2008, we started delivering broadband wireless services on 3.5 GHz using WiMAX mobile technology. This was quite successful; we acquired a significant customer base. In 2013, we decided to evolve our network from WiMAX to LTE.

From a technology perspective, there is not a big difference between LTE and WiMAX, so we can use all our experience. The evolution to LTE will increase the network efficiency by 250%, enabling us to offer services with higher speed, more capacity, lower latency and

enhanced security.

We launched our LTE services in December 2014. Currently, the KPIs are in line with expectations. Both the speed and the capacity have increased more than 50 percent. LTE introduction is fully transparent to our customers, because for the past two years we have delivered dual-mode terminals that are enabling smooth transition.

We are currently focusing on introducing new functionalities and features once we have achieved maximum performance from standard LTE and proper network design. In particular, we plan to commercialize carrier aggregation in the fourth quarter 2015. At the same time, we'll introduce CoMP and beamforming in the main scope for interference reduction on the edge cell to bring spectral efficiency to the final result.

Q: What have been the key factors in your successful transition from WiMAX to LTE?

A: Linkem's transition from WiMAX to LTE is quite peculiar. Normally, other mobile operators use a clean new spectrum to build their LTE network.

Firstly, we need to re-farm our WiMAX networks to free up 20 MHz for LTE, while making sure that the customers receive the same level of service. Then we implement an LTE overlay. Finally, we move WiMAX customers to the LTE layer as quickly as possible.

At present, we have implemented the LTE layer on 50% of the network.

Q: What challenges have you faced in this transition?

A: There are some LTE frame configurations that are fully compatible with WiMAX. Both the networks are TDD, they are fully synchronized. We can run the two networks without losing spectrum in guard band.

However, we are losing a small degree of efficiency because the LTE operates in reuse 1 while WiMAX in reuse 3, as consequence the infrastructure is not optimal for the LTE layer. When we overlay LTE on the infrastructure designed for WiMAX, we have to develop a very accurate planning to limit the interference.

Network security and customer network access are treated differently in WiMAX and LTE. However, with LTE SIM card security, it's much easier to address compared to WiMAX authentication methodology.

We also experienced, differently from WiMAX, full interoperability between the terminals and RAN, and RAN and EPC.

In addition, we are leveraging all the LTE QoS functionality. In fact, we have built a service platform that dynamically set a range of different QoS levels to differentiate applications and dramatically improve user experience. For instance, in LTE network streaming, HD streaming is rapidly increasing in respect to standard definition streaming, which is generally used in WiMAX network. This effect is not only due to increased capacity, the QoS allows more fluid and nice experience in video streaming. It is changing user behavior.

Q: What are Linkem's latest services and how have customers responded to them?

service, and key information collection directly from customers every day, we try to understand how to continuously improve.

To explain this, let's look to streaming application. In the WiMAX network, we are measuring 40 to 45 percent of streaming traffic during peak time. With LTE, we are measuring up to 70 percent of traffic. We can see that customers with LTE service make more than 50 percent of traffic at peak time.

We're convinced that in some way, the offered services change customers' demands, enabling different behaviors and life styles.

Everyone knows the amazing projection of mobile traffic over the next decade. We believe that this traffic refers substantially to mobile terminals that will become more and more pervasive. The question is: which networks will this huge traffic impact?

We tried to understand where the traffic is generated by mobile terminals. We realized that only a small proportion of this traffic goes on the mobile networks, about three quarters of it is being generated on indoor WiFi networks, in the office, venues and events, and generally in people aggregation points.

In conclusion, the increase of traffic generated by mobile terminals will partially impact mobile networks, since most of this traffic will go on WiFi accesses by connecting to internet through a variety of fixed and wireless networks.

Nevertheless, the resulting increase of mobile network traffic will require more spectrum by introducing new technology. This will imply using higher band, such as Band 42 or Band 43.

A: Since we launched WiMAX, Italian customers have responded quite well, and our customer base has been growing rapidly.

With LTE network, the customer growth rate on new LTE sites has doubled compared with the opening of new WiMAX site in the past.
The speed with which customer arrive on new sites indicates the enthusiastic acceptance of our services. Therefore, LTE has improved our brand awareness and customers' confidence in our company and network.

Q: What steps should be taken to improve user experience?

A: We spend all day trying to understand what the customer experience is, how the QoS platform needs to be tuned and which application in the network makes the difference. Through continuous engagement of our internal customer

However, these bands are limited in terms of penetration and propagation. This prevents to deliver the best indoor user experience everywhere especially during peak time. Band 42 and Band 43 will be certainly used to increase the capacity of mobile networks, but it will be challenging and expensive to ensure mobility and seamless service everywhere, as consequence, it will be efficient only in the dense urban areas where most of capacity is demanded.

Another possibility for 3.5 GHz in mobile network will be business district, college, stadium or any place where many people concentrate. However, the use of Band 42 will also depend on the evolution of the mobile terminals. The main challenges are keeping them switched on many radios, thermal dissipation and batteries capacity.

Our idea is to deliver to customers modems that can work on Band 42. In our model, some of these are indoor modems with multiple high gain antenna systems. They can offer better radio performances than mobile terminals. The remaining of these are outdoor modems that receive radio signals not attenuated by walls. They can improve network coverage and spectral efficiency. All modems offer to our customer state of the art WiFi access, enabling connectivity and best performances to any kind of device as long as it has WiFi.

We are trying to leverage Band 42 to offer affordable and inclusive residential broadband services, and give customers the best user experience with any terminal they may have, as complement to mobility.

Q: What products are you going to introduce in the near future?

A: This touches on the subject of the role of telecom operators and monetizes the network's features and functionality.

Our position is based on simplicity. We like to give our customers very clear offers and services. Our main goal is to deliver very good internet access and enable customers to freely use all the applications they like.

In future, maybe eMBMS could add some distinctive content to our offer.

Q: What are Linkem's goals over the next three to five years and how will you achieve them?

A: We intend to expand our network coverage from current 40 percent to about 80 percent of the population, including biggest cities.

We will leverage on LTE technology to deliver as much capacity as possible from the spectrum we have.

We'll also bear in mind that user experience is not only about speed but also enjoying applications in the best possible way; we will keep differentiating traffic by QoS so that everybody can have the best experience.

Finally, we need to keep our model simple and sustainable to offer competitive price and inclusive services. We strongly believe in LTE-TDD technology, which will be the base for next 5G world, and we will further improve the effectiveness of Band 42.

Q: What impressed you most about GTI 2015?

A: GTI is very important to sustain and develop the knowledge and the culture about TDD. I've been working in the European telecom sector all my life, the

last ten years with 3.5 GHz radio. There is a clear perception of cultural heritage that prevents European operators from really understanding the benefits of TDD technology.

Nowadays, it is clear that most of the evolution towards 5G will come through TDD. The number of TDD users and networks will increase dramatically; GTI will be instrumental to keep everyone informed and to communicate effectively about the advantages of TDD.

As telecom operators, we have many challenges. Among others, we need to protect our investment. Sometimes, the technology evolves too fast for the business model, and the potential value of the technology is not fully exploited. We also need to manage complexity arising from managing many spectrums at the same time. This takes away energy and money that would otherwise be directed towards customers and services.

A global standard is essential. A shared vision of the networks in all countries is also important. GTI is intended to help manage network complexity and ensure that telecom networks remains efficient and sustainable despite the continuous investment needed to cope with technology evolution.

I see the importance of GTI is to facilitate a global approach and make sure that the ecosystem is heading in the right direction. An excellent work has been done to develop the ecosystem for TDD up to Band 41. Band 42 will come soon for mobile, and I truly believe we're on the right path. **ZTE TECHNOLOGIES**

Telenor Pakistan and ZTE:
One Goal One Team

Reporter: Pan Xiaolin

Telenor Pakistan announced nationwide network upgrade and expansion in 2012. It is the most comprehensive network swapover in all of the Telenor Group. Both the TP Vega swap and managed services projects turned out to be a big success. Reporter Pan Xiaolin interviewed Khurrum Ashfaque, CTO of Telenor Pakistan, who talked about the projects and their cooperation with ZTE.

Khurrum Ashfaque, CTO of Telenor Pakistan

Q: Telenor Pakistan announced nationwide network upgrade and expansion in 2012. At that time, there were several vendors competing for the project. Why did Telenor Pakistan select ZTE as its partner?

A: Initially we launched our GSM network in 2005 and the infrastructure was built in three or four years. By 2012, our network was already very old. So we thought it was the right time for us to update the network. We wanted to prepare for the data revolution and for 3G and 4G services. We'd looked at different vendors; ZTE was there along with other big international vendors. Apart from the commercial pricing, we were also considering technologies, in terms of what systems are more future-proof and energy efficient, and which systems have a good roadmap for development and investment. We found that ZTE has energy-efficient radio equipment and a strong roadmap for new technologies and platforms. This is one of the main reasons we selected ZTE.

Q: What do you think of ZTE's solution for the project?

A: Energy efficiency is very important to us. A major issue for Pakistan is the availability of electricity for all mainstream industries. We need equipment that requires less energy and is stably powered. This is a very strong value for ZTE. I also think ZTE has a good evolution roadmap for its products moving from 2G to 3G and LTE.

Reporter Pan Xiaolin (L) and Telenor Pakistan's CTO Khurrum Ashfaque (R)

It took us just one year to evolve almost 50% of our network from 2G to 3G.

Q: How do you view the progress of the cooperation so far and how is Telenor Pakistan benefiting from it?

A: One of the reasons for success in TP Vega swap and managed services projects is ZTE's willingness to cooperate with us and learn from our experiences. Some big international vendors may insist on their own established operating style when they come to the market, and expect us to just sit back and wait for everything to happen. However, we have operated here for 10 years and have gained a lot of experience in network rollout and managed services in different kinds of circumstances. We have found ZTE is a really good learner and willing to share their problems with us. This would be one of the reasons why we had successful Vega swap and managed services projects.

Q: Telenor Pakistan and ZTE have a motto "one goal, one team". How have they carried out this motto?

A: If top leaders stick to the motto, it will go all the way to project managers. We are one team not just at the executive level but also at the management level. We have started sharing our strategies of both the Telenor Group and ZTE. We are doing workshops in every region and asking ZTE's product line managers and some team members to come and sit with us. Our directors are also presenting them our strategy, what we want to do in the internet and managed services, and how we want our customers to do. We are not just sharing day-to-day work, but also the vision. If you share the vision for future, you will become more cooperative and feel more like part of the family. The principle of one team has laid a solid foundation for our final success.

Q: What is the main challenge you have faced in the TP project implementation, and how have you dealt with it?

A: The biggest challenge in Pakistan for infrastructure development is subcontractor capabilities. In all sectors, such as network rollout, civil roads, managed services, or security services, the level of subcontractors at the current available market is not very high. Much time has been invested in raising capabilities of subcontractors. These subcontractors have done a lot of routine work that is not highly technical but very important. The management model that ZTE uses has been very successful. It is so difficult to make these subcontractors ready that you

sometimes think whether it's worth doing it ourselves or contracting 200 people to do it. But this is not a sustainable solution. The sustainable solution is to keep engaging with these subcontractors and help them increase their capabilities. ZTE's management team took my advice to enhance their capabilities, and now there are very strong subcontractors in the managed services areas. Of course, there is still room for improvement, but I think through proper training and management, we will make these subcontractors grow and improve continually. It is a challenge, but also an opportunity for us.

Q: How would you describe future telecom market in Pakistan?

A: Pakistan is jumping from no-tech to high-tech. A few years ago we didn't even think about mobile services, but now they are among our most popular services. So I think the future of telecom companies and technologies as a whole is bright in the Pakistan market.

However, there are serious challenges, one of which is fierce competition. Several telecom companies are competing in Pakistan, and prices are very low. In order to maximize their investment returns, operators have to devise a grand scheme for each investment and to be capable enough to offer diverse services.

It is also very important for telecom companies to look far ahead and aim high. We are in a connected world connecting business

and people, so we have to stand on a high vantage point. We have to consider what good services we can offer to our customers and how we can create more customer value. We are seeking partnerships with social media companies such as Facebook and Google, and in other fields like mobile agriculture and education. We are not restricting ourselves to telecommunications, but try our best to be part of people's lives in more ways than just the phone.

Q: What are Telenor Pakistan's goals over the next few years?

A: We have clearly defined our strategy for the next three to four years. We will focus on four important things. The first is the area where we will become part of customers' lives. We will not only offer the cheapest price but also the best quality. Internet for all is our second ambition. In the next three years, we will make at least 53 per cent of our customer base start using internet. We would like to bring internet to all people in this country, whether they are women or men, old or young, students or workers, farmers or engineers. Our third goal is to increase the utilization of mobile financial services. Banking service via a phone will be popular, and e-insurance, e-loan, and e-commence will also be available in this country. The last thing is that we will be more cost efficient and more prudent in investment so that we can work smartly with this country in the next three years. **ZTE TECHNOLOGIES**

Development Trends for Router Technologies

By Fan Chengfa

Over the past 30 years, IP networks with routers and switches have developed according to Moore's Law and have been critical to the emergence of a modern information society. Being a core for WAN and LAN outlets, routers have played a key role and experienced sustained development and numerous upgrades. Router interfaces have developed from a wide variety of narrowband interfaces, such as X.25, E1, ATM, POS, and SDH, to a majority of broadband Ethernet interfaces and a few high-performance and high-speed WDM interfaces. Protocols for the interfaces have also developed into distributed IP/MPLS architecture. Routers and switches now have higher bandwidth and shorter delay, and they are also smaller and cheaper. They have therefore become the basis of almost all networks.

As change and motion is eternal, development is critically important. Being affected by 100M FTTH broadband, online 4K videos, 4G/4.5G/5G, IoT, the idea of user experience first, as well as the concepts of software-defined networking (SDN) and network function virtualization (NFV), routers are also facing a continuous evolution and change.

Router-based IPWANs are used widely. Because it is expensive to build a new network, most operators focus on network expansion and technical compatibility. Therefore, a basic development trend or competition focus for routers is still an evolution at an appropriate speed. Their capacity and capabilities are continually improved by inheriting existing functions. Currently, a mainstream commercial core router has 16–20 slots in each system

Fan Chengfa, chief engineer of ZTE bearer network products

and can form a 6.4–8T subrack system with 400 GB for each board. In future development, 1T, 2T and 4T boards will be launched to increase capacity without increasing power consumption or price. This sounds simple, but the industrial supply chain has been nearly destroyed and needs to be vertically integrated. In this context, launching products with appropriate capacity and costs at the right time is a big test to a company's overall

strength that involves new technology reservation and IC design capability especially NP design capability. This is almost equated with technical competitiveness of high-end routers.

Another trend is smaller size. Traditional mid-range and high-end routers seem to be bulky iron monsters. As property costs increase year after year, small high-bandwidth routers have become very popular. Some operators even expect outdoor pole-mounted base station routers. It is therefore important to research compact outdoor routers. Such routers will definitely be favored by customers and may bring differentiated competitive advantages in the market dominated by traditional router vendors. Close attention must be paid to smaller size as an important direction of router development.

A third trend is customer experience. MI home gateway routers bring good user experience and their design is quite recommended. The hardware of MI routers is made up of common elements, but its software creates an app-based easy-to-use application chain that can create value and promote sales of more MI smart home appliances. ZTE focuses on mid-range and high-end routers and can also borrow this concept to migrate internet elements to its routers to create a convenient eco-environment and enhance customer loyalty.

The three trends are within the scope of router evolution. With the development of SDN and NFV, router-centric solutions are also undergoing a revolution.

The introduction of SDN is a basic point of the revolution. Deploying IP networks worldwide relies on a distributed protocol system where IP networks can still operate smoothly if one or more routers fail. However, the distributed protocol system makes it difficult to implement global special strategies and lowers the intelligence of IP networks. Moreover, the break in network control between the application layer software and router software also makes it difficult to automatically implement application strategies.

SDN solves these problems. Strategies for introducing SDN into WANs, where routers are widely used, are

comparatively conservative. Few changes are made on forwarding planes of the routers, and control planes should be compatible. A hybrid system uses controllers to gradually centralize operations of the control planes previously distributed on the routers. Through hierarchical controllers and appropriate northbound interfaces, complete software automation is possible. The controllers use original interfaces, such as NETCONF and CLI, or extended interfaces, such as BGP-LS and PCEP, to connect devices. The original PW, L3VPN, and MPLS TE tunnels also remain on routers, but the operation mode is changed. SDN has significantly addressed the low intelligence issue with IP networks. In the longer term, although the current evolution is relatively conservative, the pace of evolution continues and generalizing the forwarding planes will become a new research direction after the control planes become SDN-based.

SDN is just a starting point of the revolution, and NFV brings about more changes. NFV aims to generalize functions. Previously, network service functions such as NAT, firewall, DPI, and load balancing were activated by special devices or boards. These special devices or boards are networked with the forwarding routers to provide intelligence or application layer (layer-7) functions. NFV has dramatically changed networking. Functions at all service layers including IP/MPLS forwarding can be virtualized as software running on the servers, which can completely eliminate routers. Yet these functions can also operate on new routers through accelerated optimization in a virtualized or non-virtualized manner, which provides new routers with an unprecedented and full intelligence and makes them adapt to different application scenarios. This game depends on the depth of thought and practice and will eventually achieve a balance through the deployment on demand. The functions on servers in a data center will be fully virtualized, and enterprise outlets will operate on new integrated routers. These servers and routers can share software between themselves, but they must be deployed for better customer experience, helping customers solve their own problems. Any idea that truly creates value for customers will be respected.

NFV-based routers will also be increasingly important in future network architecture, where data centers are more important. These routers will easily help network outlets of virtual data centers to provide functions for access to public networks or internet.

The development and application of NFV will enable universal services and integrated forwarding hardware on routers. This makes it easier to implement a SFC service chain and also gradually changes SDN forwarding planes and may even lead to the second revolution of IPWAN SDN. Though it is not quite clear when the revolution will occur, what is important is that the thought and practice on SDN and NFV that focuses on applications to truly create value for customers needs to be actively carried out.

Routers will be important in future networks. Focusing on customer value and experience, ZTE will continually evolve and optimize its network solutions, and be actively involved in SDN and NFV innovation to create new value and obtain better ROI.

ZTE TECHNOLOGIES

Big Data Mining
for Smart Operations

By Huang Yuzhu

From the 2G to 3G era, mobile internet has changed user behavior. In the present LTE and SNS era, demand for full connection is driving operators to adjust their business models. The major difficulty in operations is no longer expansion of the operation scale but user experience expectation and challenges posed by innovative technologies such as network function virtualization (NFV).

Operators are seeking all kinds of transformation. However, this transformation cannot be achieved overnight. The evolution of operations

does not mean to deny everything. Operations need to find the value of interconnected information and data while dealing with new technologies. Digging out valuable information is the key to the next-generation operations and is also critical for service providers to help operators address future challenges and transformation.

Operations Data Mining

Operators are eager to gradually break down the constraints of existing stovepipe

operation systems and eliminate private applications. By deploying software-defined networking (SDN) and NFV technologies, operators will have open networking capabilities and obtain global cross-network, cross-layer, cross-domain, cross-technology, and cross-manufacturer information.

During long-term evolution, operations data itself is valuable. Millions of bits carrying key information are flowing through data pipes and can be fleeted away. Improving efficiency on a single link will amplify its effects in repetitive
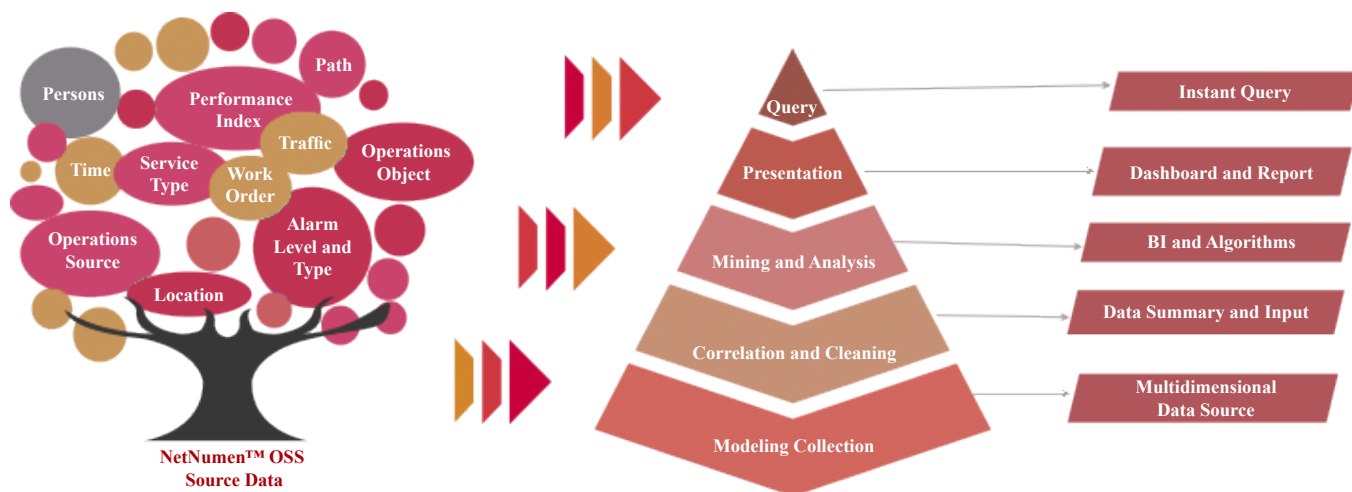
Figure 1. Operations data mining.

operations events. This blue ocean of data is a treasure waiting to be uncovered. To save energy and increase profit, ZTE focuses on operations data source itself. Big data technologies are used to mine the entire value of operations and capture key data among isolated islands of information. Simple, intuitive digital interfaces are used to support special applications, and instant information query quickly improves operational efficiency and resource utilization (Fig. 1).

ZTE's service tools platform provides efficient data support for troubleshooting and has end-to-end, real-time, and multi-dimensional view and analysis capabilities based on both service and user levels. With service-oriented query and mining view, the platform helps operations staff rapidly acquire data, guarantee services and make decisions. Deep operations data mining will become a new engine for operators to develop their business.

NetNumen™ OSS for Smart Operations

ZTE's smart operations solution based on self-developed NetNumen™ OSS platform enables data sharing, integration, and innovation. NetNumen™ OSS is based on the best operations practice, standard capsule prototypes, and cloud environment. NetNumen™ OSS also makes full use of data correlation and analysis in business intelligence (BI) and can customize the best solution as required. The standard prototypes make zero-code development more practial. All these ensure an easy-to-use, smart, and open visual operations support system.

ZTE's NetNumen™ OSS solution contains several tool modules that cover the entire managed services. AOS provides a unified access portal; FMS provides complete alarm monitoring; PMS provides performance management;

eFlow including SPM and WFM supports a complete electronic operation procedure; SLM manages QoS; and NIM and ITNMS provide comprehensive network assets management and integrated IT NE management. When mining operations data, these modules coordinate with each other to help the operator control the overall situation and devise proper business strategies (Fig. 2).

More Practical Smart Analysis

Most operations tools cannot analyze the causes but only present faults or suggest solutions for individual subsystems. Troubleshooting needs to be handled manually with step-by-step inspection. NetNumen™ OSS uses massive databases for correlation analysis of information, data, resources, and terminals. Correlation anslysis involves triggering smart terminals for data

collection or dial test and locating the root node of a fault automatically. With 75 to 100 per cent of causes of faults being located, correlation analysis outperforms a traditional root cause analysis (RCA). NetNumen™ OSS can also classify all problems statistically for data analysis by operations personnel and customer centers, and coordinate with configuration and commissioning management systems for self-healing and optimal configuration. This resolves potential network faults and protects the health and quality of infrastructure. In a closed loop of smart operations, smart monitoring is a basic link that deals with a wide range of complicated

real-time data sources. An appropriate big data solution can increase the processing capacity of this link.

More Accurate Smart Prediction

Using machine learning and big data techniques, NetNumen™ OSS builds a regular event model to predict and prevent future events. Specifically, for sports events or major exhibitions, NetNumen™ OSS can use historical network indicators and operations data such as information about ticket sales and weather to predict possible network faults and QoS. In this way, NetNumen™ OSS can predict that

lower network and service configurations than expected may raise risk for user experience. This prediction capability can further improve dynamic resource allocation and scheduling capabilities when combined with NFV and SDN. An eFlow energy analysis engine enables power and environments to be intelligently predicted and scheduled. This significantly reduces the duration of a power outage, increases the ratio of effective power generation, and makes the network more adaptive to changes in services and users. By analyzing predicted and actual values, NetNumen™ OSS determines prediction accuracy and accordingly optimizes
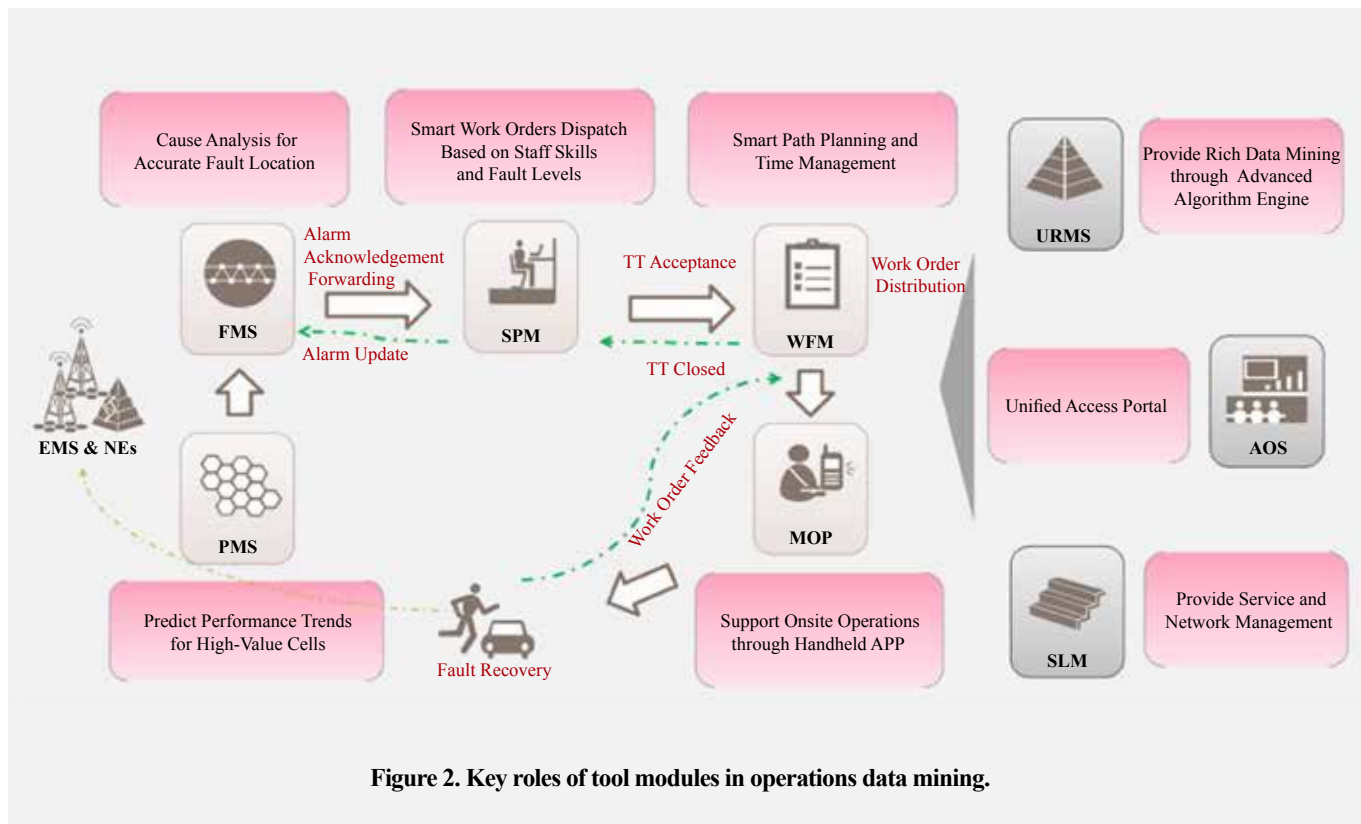

Figure 2. Key roles of tool modules in operations data mining.

Analysis of operation-based big data is only the tip of an iceberg of data value activation, and service data integration and dynamic relationship modeling will be the long-term focus of operators.

prediction algorithms and policies for continuous improvement of prediction accuracy.

Active Operations by Massive Data

Through in-depth data mining and offline analysis, operations are driven by QoS rather than traditional alarm events. NetNumen™ OSS filters high-value cells in advance and presents the volume of business, such as the number of users, voice traffic, SMS and data traffic, and other performance trends for the next week using the prediction function. It also automatically focuses on the cells whose thresholds might be exceeded. According to the specified SLA and future performance trends, NetNumen™ OSS can predict the cells whose SLAs will be affected and will not meet the standards in the next week. Therefore, operational level agreements (OLA) for these cells are further adjusted so that NetNumen™ OSS can prioritize operating high-value base stations and collaborate

with eFlow to automatically inspect and dispatch work orders. Operations data can horizontally connect various sub-network management systems and even service monitoring centers for three-dimensional operations information exchange. In this way, administrators obtain sufficient information for network troubleshooting or optimization.

Openness and Sharing: The Driving Force for Operational Innovation

The traditional OSS has changed a lot within the closed telecom system, which has been unsuccessful. The development of SDN and NFV will bring new operational concepts. With ZTE's open operations platform, cooperative partners can share operations data and participate in development. They can build a complete smart operations system involving smart monitoring, prediction, and guarantee by associating their networks with services. Operations-based big data has become the

key to smart operations. Currently, analysis of operation-based big data is only the tip of an iceberg of data value activation, and service data integration and dynamic relationship modeling will be the long-term focus of operators. Integrating information scattered in an operator' existing charging system, CRM system, terminal information base, signaling monitoring system, and OSS system and mining its value will become a most important direction for the next stage of operations development.

ZTE released its SDN and NFV development strategy in 2014. NetNumen™ OSS is the core operations platform in this strategy, and it meets operator requirements for excellent end-to-end user experience based on the service operations center. NetNumen™ OSS enables operators to have timely access to operations data, reduce maintenance difficulty brought by new technologies and services, rapidly improve digital economy, and transform their operations.

ZTE *TECHNOLOGIES*

NetNumen™ AOS:

A Powerful Platform to Integrate a Unified Portal and Application Virtualization

By Feng Huaxing

Nowadays, telecom operators provide more diverse services, and new applications are emerging to support these services. Those providers offering applications have customized how to use them, how to access them, and what kind of user security model to be created in their own way. This means that operations engineers have to use different accounts to log in to these application systems through different access modes. This complicates system operations, increases the risk of errors, and reduces efficiency. It increases the IT management workload and the potential for security problems.

The traditional PC plus remote access mode has become far from enough in dealing with hundreds of applications. Driven by the transformation towards centralized operations, operators are turning their attention to working on rapid, seamless, and secure ways to access application systems and improve their work efficiency.

Following the next-generation operations idea and riding on the extensive experience in network operations, ZTE has developed the NetNumen™ Advanced Operations Suite (AOS)—a platform with a unified portal and virtualized applications. NetNumen™ AOS is built on ZTE's unified Web development platform and has an advanced, hierarchical and modular software architecture. It consists of two major functional modules:

- unified portal. It provides users with unified portal management and user security management, including application access configuration management, application grouping management, user authorization and role management, user log management, and user monitoring management.
- application virtualization. It virtualizes applications, and provides application clustering and load balancing. NetNumen™ AOS enables multiple application systems to be deployed,

maintained, and managed in a centralized manner. It allows users to access and use these application systems, and perform user management and authentication through a single login UI.

ZTE AOS-Based Unified Portal Solution

ZTE has rolled out unified AOS-based portal solution to provide one single access to multiple application systems, including the legacy ones that do not support Web-based access. The solution is as compatible as possible in order to integrate all kinds of legacy application systems and to improve overall security of the system. The solution boasts:

● powerful system integration.

NetNumen™ AOS is integrates and supports B/S application systems and Windows-based C/S application systems, providing them with an efficient application virtualization environment.

● centralized deployment and reduced IT maintenance cost. Application systems can be centrally installed, managed, and upgraded so that no application program is required on the client. Users can operate and maintain all services easily through a browser, which lowers both the IT maintenance workload and OPEX.

● secure and reliable image data transport. After a user logs into an application system remotely through the GUI, only image data on UIs rather than service data is transferred

to the browser on the client. The data is encrypted during transmission and not stored on the client. This guarantees information security.

● complete security management. NetNumen™ AOS has centralized user management and authentication and provides complete log management. It uses the HTTPS security protocol to ensure secure system access. It also supports the recording function so that user operations are traceable.

Solution Application

ZTE's unified portal solution has been used in a variety of projects, helping customers solve problems that have been around for years and allowing
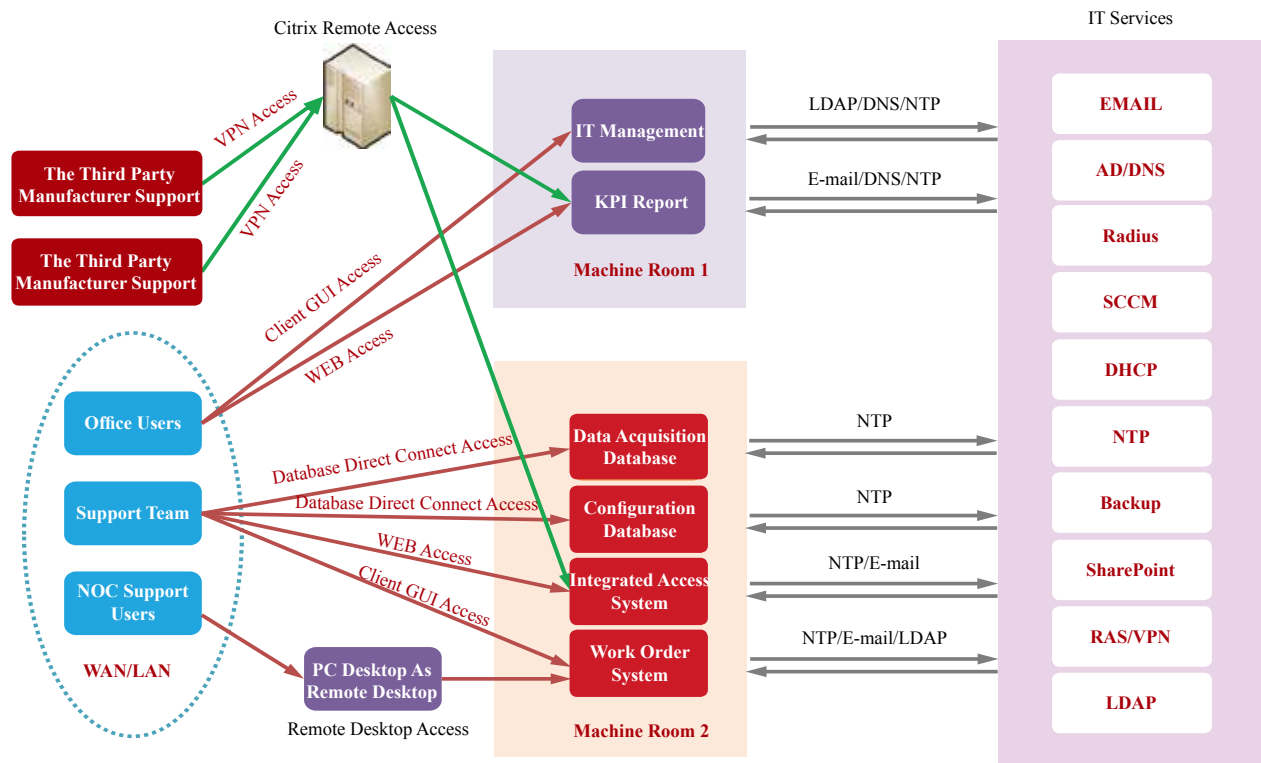

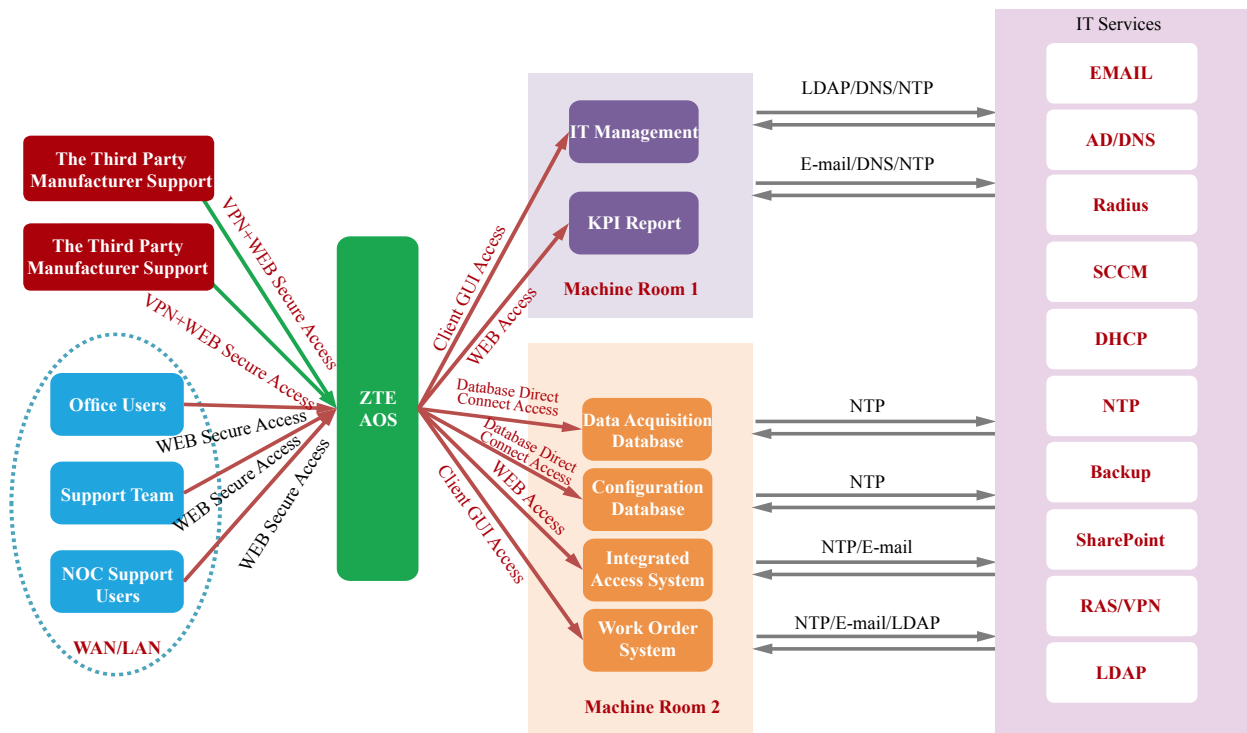**Figure 1. Logical application system access model before upgrade.**

Figure 2. Logical application system access model after upgrade.

applications and tools to be deployed and made available rapidly. The solution greatly reduces IT maintenance workload and cost. Users don't have to install and configure the application program for each tool on the client, and the security of the overall system is strengthened.

This solution is available for creating new projects and upgrading existing ones. It supports multiple security mechanisms to meet the demanding security requirements in the telecom industry. Figure 1 and Figure 2 show the logical network architectures before and after upgrade using the ZTE unified portal solution.

In the solution, ZTE makes creative use of the application virtualization

and virtual IP technologies supported by NetNumen™ AOS to virtualize the C/S application systems and their runtime environments. The Web-based access mode replaces all the ways we access and use these systems now. As such, the costs for deploying access resources are lowered; the network topology is simplified; and security risks are reduced. Clients for all application systems can be centrally installed and maintained, resulting in much less IT maintenance workload and effort.

Evolution

Application virtualization has changed the traditional PC and remote

system access mode. It separates the interaction layer from the computing layer and clusters the computing layer, to provide simple system deployment and a highly secure system. NetNumen™ AOS also has single sign on (SSO), operations recording, load balancing, and clustering, all of which make the solution and system more flexible, reliable, and secure.

As the mobile internet and cloud technologies evolve, ZTE's NetNumen™ AOS has been re-designed to serve as a cloud portal and a mobile portal, which will inevitably become a powerful tool for mobile operations management on a global scale. **ZTE** TECHNOLOGIES

NetNumen™ FMS:
Improving Operational Efficiency

By Yin Qiaozhi

As telecom networks become increasingly sophisticated and new services emerge, the number and complexity of network alarms has increased. This has led to more difficult network operation and higher operational costs. Therefore, operators urgently need to shift from distributed management to centralized maintenance and management. Drawing on years of experience in equipment R&D and manufacturing, ZTE has launched NetNumen™ FMS—an integrated alarm management system to meet operator demands.

NetNumen™ FMS provides an open alarm management platform for operators to centrally manage alarms from different dedicated networks or different vendor equipment. It also helps operators improve the management of integrated alarms and operate their networks rapidly, flexibly, and cost-effectively.

Various Operation Scenarios

A typical telecom network consists of dedicated networks, such as wireless network, core network, transport network, and auxiliary power supply network, supplied by different vendors. When alarms occur on network devices, the element management systems (EMSs) of different vendors and different dedicated networks may report the alarms. It is difficult for an operator to centrally manage these alarms because they are distributed on different EMSs and vary greatly with network mode, vendor, and device type.

NetNumen™ FMS acts as an alarm management center for the entire network. It can obtain alarms from EMSs and PMSs, process these alarms, and then create trouble tickets that are sent to a trouble ticket system (TTS) for troubleshooting and tracing. This allows all faults to be properly handled end-to-end in a closed loop. NetNumen™ FMS can be used in the following scenarios:

- Operations engineers or administrators view alarms generated in certain regions, dedicated networks, sites, or other specified areas. They can view in different modes or at different angels according to their respective duties and purposes.
- Operations engineers handle the alarms within their administrative areas. They can acknowledge or un-acknowledge alarms, clear alarms, forward SMSs or emails, and assign trouble tickets, so that alarms are handled in a timely and effective way.
- System administrators configure and manage authorities, rules, views, and EMS access modes to ensure the FMS system operates smoothly and meets user needs.

Centralized Alarm Management

With ZTE's self-developed adapters, NetNumen™ FMS centrally manages alarms reported by devices of major vendors and that relate to mainstream technologies in the wireless, core, fixed, and transport networks as well as the auxiliary power supply. This eliminates the differences between equipment of different vendors and differences in network modes (Fig. 1).
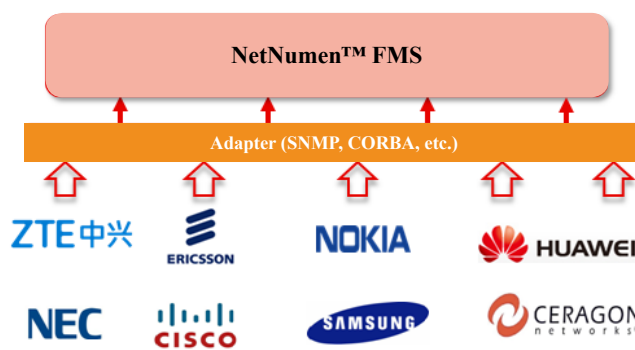

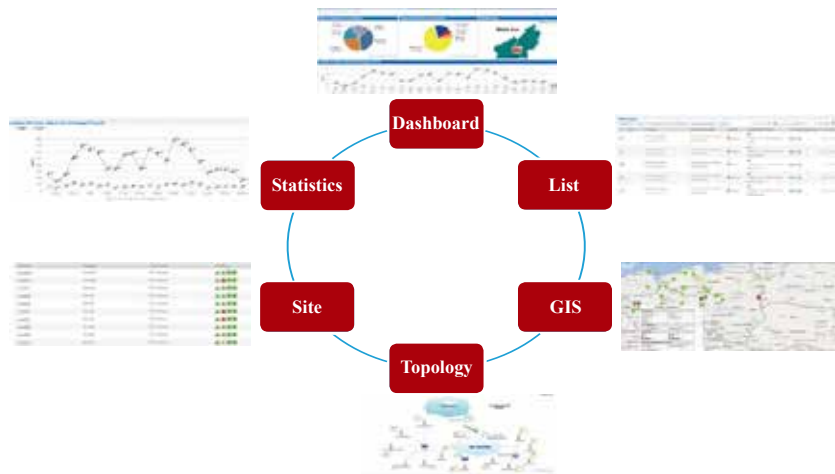**Figure 1. Centralized cross-vendor alarm management.**

Figure 2. Six alarm viewing modes provided by NetNumen™ FMS.

Diverse Alarm Viewing Modes

NetNumen™ FMS provides six alarm viewing modes—list, dashboard, topology, statistics, site, and GIS—for different kinds of scenarios (Fig. 2). Engineers can choose the viewing mode according to application scenarios and their own duties. In list view, alarms are displayed in a list. Engineers can use this view to handle alarms. In dashboard view, multiple views are integrated on a single user interface in different layouts so that engineers can view the entire network from all angles. In site view, engineers can view the operations of certain sites.

With the user interfaces provided by NetNumen™ FMS, an engineer can easily customize the scope and mode of viewing.

Automatic Alarm Processing, Filtering, and Root Cause Analysis

NetNumen™ FMS provides automation policies for:

- automatic alarm handling. Automatic operations are defined by rules for clearing alarms, acknowledging alarms, assigning trouble tickets, and forwarding emails and SMSs. NetNumen™ FMS uses these rules to automatically handle alarms.
- alarm filtering. Alarm filtering rules such as flash, high frequency, and blocking are used to filter out alarms that are of no interest so that engineers can handle fewer alarms and focus only on important ones.
- root cause analysis (RCA). Troubleshooting experience is converted into automatic operation rules to help engineers rapidly find the root cause of an alarm. This improves troubleshooting efficiency and helps increase operational experience in a standardized way. NetNumen™ FMS provides an independent platform to run and manage the RCA rules. Users can analyze and locate the root cause of an alarm simply by configuring rules on the graphical interface.

Alarm Priority Policy

The priority of traditional operations is only based on the network itself. This may mean that alarms in low-value regions or with low service priorities are given a higher priority. However, an alarm priority policy should rapidly determine the importance of an alarm according to where it is generated and the extent to which it affects the service. The importance and priority of an alarm depends on two dimensions: alarm influence including outage, service degradation and no impact, and site influence including VIP users; governments, institutions, schools, hospitals; CBD; urban areas; rural areas; traffic routes; unknown areas; and sparsely-populated areas. The priority is indicated by a star rating of the above two dimensions. The more stars, the higher the priority. The alarm priority policy ensures that important alarms are handled first and operational resources are assigned properly.

NetNumen™ FMS is an effective tool for centralized alarm management. It supports devices from major vendors and for dedicated networks. It also has six alarm viewing modes for various operational scenarios. Its smart alarm filtering and RCA policies help an operator reduce the number of alarms to be handled and rapidly and precisely determine root causes. The alarm priority policy determines the importance and priority of an alarm according to affected alarm code and affected region. This ensures that important alarms are prioritized. NetNumen™ FMS has been commercially deployed for operators in Europe, Asia, and Africa and is helping them improve their operational efficiency. **ZTE TECHNOLOGIES**

NetNumen™ eFlow

Enables Operational Visibility and Intelligence

By Yang Yang and Liu Junjie

Rapidly developing services and increasing network complexity are increasing the workload and difficulty of network operations. Users are also more demanding on QoS, and field engineers have to respond to user requests immediately with standardized and specialized services. Remote real-time scheduling and control strengthen the control efforts at the operation end, ensuring that standardized service processes are carried out, to instantly spot personnel, tools, and to find out their moving direction as well.

ZTE's NetNumen™ eFlow hand-held operations management platform uses electronic and smart means to support comprehensive daily operational activities. The eFlow system has a flexible process engine and software architecture that supports both traditional PC access and mobile terminal app access to meet the demands of mobile operation. In the mobile terminal, customized and optimized functions are introduced to help operations teams standardize their processes, manage inspection tasks, control operations assets and spare parts inventory, and output operations reports. This improves operational efficiency.

Figure 1. eFlow interface.

NetNumen™ eFlow handheld operations management platform enables operations visible and analyzable through electronic data, accurate geographical positioning, abundant interaction capabilities and rich interfaces.

Multi-Scenario Mobile Operations Management Platform

ZTE's NetNumen™ eFlow operations management platform has a flexible architecture that integrates the management of processes, assets, spare parts, and accessories. It can be used in multiple operations scenarios.

- NetNumen™ eFlow MOP (Mobile Operation Platform): A handheld operations platform with an application used by on-site operations engineers to check and handle tasks, record the work track, and collect and report work results at any time and place. The platform assisting the operations team analyzes how efficiency can be improved and how factual inspection results can be output.
- NetNumen™ eFlow WFM (Workforce Management): This tool provides regional operations management, including management of assets, spare parts, accessories, shifts, tools, instruments, and vehicles. It also manages tasks and vehicles to improve efficiency of regional operations.
- NetNumen™ eFlow SPM (Service Problem Management): This tool is used to manage network failure work orders, change requests, and inspection plans to assign tasks and record purposes in ways other than the traditional manual, call-making

and paper-work approaches.

Efficient Service at Any Time and Place

By extending operations tasks to the handset terminals, the eFlow platform breaks the limitations of time and space, which are faced by desktop computers, to deliver real-time operations services. The handheld operations system provides GPS and two-dimensional code scanning to make man-machine interactions possible. Mobile assignment and fulfillment of tasks make operations more efficient and tasks more apparent. In addition, the eFlow system can trace and control the entire operations process, which makes assets reception, positioning, repair and analysis more convenient. Figure 1 shows the interface of the handheld operations platform.

Intelligent Scheduling of Work Order and Reasonable Allocation of Resources

It used to take a long time to schedule an assignment manually because engineers have their own specialties. Managers have to know engineers well enough or make multiple phone calls to match an assignment with to the correct person. The drawbacks of the traditional mode are low resource utilization and disproportionate workload and personnel.

With the intelligent eFlow terminal and GIS system, resource availability is controlled in real time, and a task can be matched with the right engineer and resources. In this way, a work order can be issued quickly, the proper amount of work can be assigned to every engineer, and scheduling is automatic.

Intelligent Navigation of the Task Path to Make Work Easy

operations engineers used to arrange their own work, which tends to result in delayed assignment of work orders and piling up of workload. However, the mobile operations application can help plan a task path intelligently according to the task level, engineer location, and task priority. This helps operations engineers perform their tasks according to the recommended path, which not only saves time on transportation but also improves work efficiency.

ZTE's eFlow platform enables operations visible and analyzable through electronic data, accurate geographical positioning, abundant interaction capabilities and rich interfaces. The eFlow platform is now widely used by China Mobile, China Unicom, China Tower, and other overseas customers. It is pushing telecom operators into a lower-cost, higher-efficiency "handheld" operations era. **ZTE** *TECHNOLOGIES*

ETHIO TELECOM BUILT AN END-TO-END NETWORK O&M MANAGEMENT SYSTEM

By Wen Jun

The African Union is headquartered in Ethiopia, the political center and aviation hub of Africa. As the sole telecom operator in Ethiopia, Ethio Telecom (ET) is operating a full portfolio of wireless, fixed-line and ISP services. It supports the annual Assembly of the African Union with reliable telecom equipment and services. In recent years, the Ethiopian economy has developed rapidly, and the Ethiopian government has started constructing highways and urban light railway on a large scale. The telecom industry, as a national important foundation industry, has developed considerably as well. Nowadays, more and more Ethiopian are using apps on smartphones, such as Facebook, WeChat, and Whatsup, to communicate with others and enjoy the social life of pleasure.

ET has wireless 2G, 3G and CDMA networks. Its five-year plan, which commenced in 2014, emphasizes the project to cover the capital city with 4G networks and the whole country with 3G networks. To achieve this goal, ET selected ZTE, Ericsson, and Huawei to undertake its network capacity expansion project. However, a large amount of equipment and high complexity of services and networks posed a huge challenge to the O&M of ET.

To overcome this challenge, in the course of project implementation, ZTE provided end-to-end wireless, core network, transmission, and fixed-network equipment to ET. In addition, ZTE constructed the National Network Operation Center (NNOC), which is the central system for the O&M of the entire network. The NNOC, which owned by ET, is located at the Ethiopian Ministry of Defense building. It provides ET's end-to-end network with intelligent, efficient, and convenient O&M solutions.

Precise Management of Complicated Networks

The Ethiopian NNOC system monitors all ZTE, Ericsson and Huawei networks in real time and from end to end. It analyzes the network connections and topology carefully to spot key information from massive alarms. By doing so, network maintenance can be made more efficient.

The complex networks of ET comprises the previous, 2G mobile and fixed network products, the newly implemented LTE, 3G, microwave, optical transmission, data communications, fixed network, VAS, energy infrastructure, and environment monitoring products from different suppliers. However, every product has its own management system, so there are more than 50 independent systems all together.

"The cooperation between ET and ZTE has led to the success of ET's network-capacity-expansion project and has aroused the passion and morale of our team as well. We thank ZTE for its passionate team and cutting-edge technologies," said Amare Asefa Herpie, deputy CTO of ET.

To address the management issues of complex networks, ET chose ZTE's NetNumenTM UNMS. It has been deployed in the NNOC. The huge number of independent network management systems is connected to NetNumenTM UNMS for information integration and resource management, thus centralized handling and managing of mass data, including the alarms, performance indicators, and assets of different manufacturers and professions.

Moreover, the unified data processing platform analyzes mass data according to multidimensional information, such as NEs, topology and end-to-end hierarchical relations, to intelligently identify key alarms. Through alarm merging and root failure analysis algorithm, the NNOC system identifies less than 600 key alarms from a collection of 300,000 and then dispatches lists automatically. Therefore, NNOC O&M engineers only need to handle key alarms for accurate and efficient management.

Process Optimization

ET has long suffered from

isolated organizations, decentralized management, and long decision-making processes. With professional consulting services and world-class platform tools, ZTE helped ET streamline its internal processes.

With the assistance of ZTE, ET released Enterprise Development Blue Book, which optimizes and re-defines its internal processes. In accordance with the Blue Book and based on the industry-leading platform of the NNOC, ZTE customized a set of ITIL-based workflows for ET, including service desk, event management, problem management, asset management, change management, order management, and knowledge base management.

With the support of the NNOC workflows and customized resource aggregation, ET has significantly improved process efficiency. Order management, for example, used to take at least two weeks to open an account for a broadband subscriber, as it involved manual confirmation assignment and document review. Now, the administrative regions and port resources are integrated, and available ports can be found automatically.

The period for end-to-end service subscription has been shortened to no more than three days, which greatly improves user satisfaction.

Customized GUIs

The NNOC system not only provides satisfactory functions but also features perfect Web GUIs thanks to one month of communication between ZTE's service customization specialists and a dozen of Ethiopian senior maintenance engineers of the NNOC.

ZTE customized the GUIs for every page of the NNOC system. Design ideas are used in the visual effects covering the framework, background, images, fonts and colors, and operation convenience covering the menu order, right-click function, and topology drag. Factors that may affect operation experience and efficiency are discussed in detail. The whole O&M department of ET is satisfied with ZTE's interface customization scheme. It perfectly reflects ZTE's service philosophy of "serving with dedication and being committed to our customers."

ZTE *TECHNOLOGIES*

INTERNEXA
BUILDS A WDM BACKBONE NETWORK IN PERU AND COLOMBIA

By Chen Yizhou

Headquartered in Medellin, Colombia, Internexa is a multinational telecom service provider that owns the largest cable telecom network in South America. Its optical cable stretches more than 29,000 km and connects Venezuela, Colombia, Ecuador, Peru, Chile, Argentina and Brazil. Internexa provides Latin American operators with data transmission and fiber lease services.

With LTE deployment, higher bandwidth is required for home use, and data services of operators are growing exponentially. Therefore, Internexa is deploying new 100G WDM networks in Latin America to take the place of original 10G WDM backbone networks. The goal is to improve overall network capacity and meet the needs of large data volume.

Facing the Challenge with 100G Networks

100G OTN is the most sophisticated high-capacity optical transmission technology. It enables a transmission rate of 100 Gbps with a single wavelength and a transmission capacity of 8 Tbps with a single fiber. This saves a huge number of optical fibers. The 100G OTN standard and technology have matured, and ZTE's 100G solution has been commercially used by many operators in the global market.

In 2015, Internexa adopts ZTE's ZXONE 8000 100G OTN solution for its optical networks in Peru and Colombia. With this solution, the existing bandwidth is 10 times higher than the original one. Moreover, the networks

enable super-large capacity point cross-connection and intelligent traffic scheduling. This enables Internexa to manage large bandwidth demand.

Customized Solution to Create Values

After fully understand the WDM backbone network needs in Peru and Colombia, ZTE proposed the ZXONE 8000-based 100G OTN + Muxponder integrated solution to help Internexa rapidly increase network bearing capacity. The 100G OTN + Muxponder solution has the following advantages:

- A combination of OTN and Muxponder to fit with network needs.
  The WDM backbone network in Colombia required existing services to be migrated to the new network. The service matrix is very complicated with numerous small-particle services (GE and 2.5G). The solution enables Internexa to reduce total cost of ownership (TCO), especially floor space and power consumption.
  With this solution, the existing small-particle services use the CX21/CX31 OTN cross-shelf for access,

which reduces the number of relays and optical fibers. It also enables flexible service scheduling, which reduces network construction cost. The 10GE/100GE large-particle services use the Muxponder board card for access, which minimizes the power consumption and reduces the maintenance cost.

- Industry-leading dispersion tolerance and polarization mode dispersion (PMD) tolerance.
  Internexa's project in Peru is special because of its large geographical span, many long sections, and long transmission distance. The ZXONE 8000 has a dispersion tolerance of +/-70000 ps/nm and a maximum differential group delay (DGD) tolerance of 180 ps, which is the best in the industry (that is, the least cost for the same PMD). Because no dispersion tolerance compensation or PMD compensation is needed for a transmission distance of 3500 km, the solution is very reliable for long-distance backbone transmission.
- Optimized dispersion compensator module (DCM) solution to improve the long-distance transmission performance.
  Internexa's project in Peru needs

one 10G lambda to be deployed. Therefore, the ZXONE 8000 uses the single-wavelength DCM solution to avoid 10G/100G mixed transmission, so as to improve the system's transmission performance.

- Comprehensive service accesses. The ZXONE 8000 100G OTN system boasts the most comprehensive access capabilities in the industry. It is able to meet various access needs.
- Service protection and system protection.
  To satisfy the protection needs of different services, Internexa uses ZTE's optical path 1+1, optical multiplex section 1 + 1, and ODUk 1+1, with the switching time of less than 50 ms. In addition, the ZXONE 8000 provides cross-connection units with M: N shared protection to tolerate greater system damage.

Cooperation for a Win-Win Future

In 2015, Internexa invited bids for its 100G WDM backbone networks in Peru and Colombia. With its competitive products, optimum network solutions and superior technical supports, ZTE won the bid from a field of ten international mainstream optical communications suppliers. ZTE will be the sole company building the 100G WDM backbone networks in Peru and Colombia. When the networks are completed, the single-link capacity will increase from 400G/800G to 4T/8T.

At the same time, Internexa has chosen ZTE as one of its regional strategic partners and is about to cooperate with ZTE in building WDM networks in Brazil and Argentina. The cooperation between Internexa and ZTE will definitely create a win-win future.

AIS LEADS FTTX DEPLOYMENT IN THAILAND

By Xue Ming

AIS is Thailand's largest mobile operator. By the end of 2013, AIS had a more than 4.1 million subscribers, which is about 44% of the Thai mobile market. AIS leads the mobile market in terms of technology development and deployment.

Competition is fierce in Thailand telecom market and is even fiercer in the wireless sector. To maintain the leading position, AIS began tapping into the fixed-line broadband market in 2014. AIS has been involved in FTTx construction and is transitioning to become a full-service operator, with the hope of enhancing its competitiveness in the market.

Tapping into the Fixed-Line Broadband Market

Thailand's mobile penetration is more than 120%, and mobile operators are fighting each other on price. This has led to slower user growth for AIS and profit decline in recent years. What's worse, congested mobile data traffic during rush hours, is denigrating user experience and there have been more frequent user complaints. Since users can switch mobile networks in Thailand without changing their existing phone number, decline in user satisfaction may directly increase their churn rate.

Facing severe market challenges, AIS entrusted a consulting firm to investigate surfing habits of mobile users. The consultancy found that smartphone users preferred much more stable and faster fixed-line broadband than mobile data, and they also demanded high-speed hotspot video download and viewing. Therefore high-quality broadband experience has become the key to attracting and retaining customers.

However in Thailand, the number of fixed-line broadband users is less than five million, home broadband penetration rate is less than 20%, and ADSL is the most common mode of broadband connection. In 2014, AIS announced its fixed-line broadband strategy, which is designed to exploit the potential in the fixed-line broadband market. The strategy immediately triggered the competition for fast broadband connection in Thailand.

Leading Broadband Development

In 2013, AIS started researching GPON-based FTTx and also traced market-leading VDSL vectoring, the next-generation high-speed copper access technology. Mainstream broadband equipment vendors were invited to conduct vectoring tests and GPON system tests. After this testing, AIS devised a GPON-based FTTx network reconstruction plan. The plan has been devised to build a national FTTx network with two million lines within three years. AIS will adopt FTTH for major business and high-end users and next-generation VDSL vectoring for home users. AIS will leverage technological and bandwidth advantages to simplify network architecture and reduce opex.

AIS chose to cooperate with ZTE, who has leading fixed-line network technologies and years of experience in network construction, to deploy fixed-line broadband networks in core areas of Bangkok and other major cities in Thailand. The networks will offer ultra-broadband access services with a download rate of 1 Gbps and an upload rate of 200 Mbps.

Rapid Service Provisioning

Since AIS announced its march into the fixed-line broadband market in 2014, Thailand has sped up its broadband development and AIS has also quickened its step to build FTTx networks. AIS urgently needed a customized OSS to support rapid network deployment, reduce time to market for its new services, and make operations easier. In deploying next-generation fiber access networks, AIS was concerned about changing original operations of wireless broadband services, offering fixed-line broadband services at existing mobile business sites, and allocating subscriptions to end users.

These OLTs are also compact that save equipment room. AIS can place them in an outdoor shelter without renting an extra room. This saves network construction costs.

Full-Service Strategy to Lead the Competition

In April 2015, AIS formally announced its new brands in the FTTH, video, and smart home sectors and began to implement its full-service strategies.

"AIS Fibre" is a dominant brand of AIS in the fixed-line optical access sector. It delivers 1 Gbps access broadband services to enterprise and end users. "AIS Playbox" is a video brand that provides up to 100 live TV channels and 12,000 MP3 songs. "Quad-play" is a brand for smart home products that provides integrated mobile, home VoIP, and high-speed internet surfing services.

With the three FTTx brands and a good reputation as the largest mobile operator in Thailand, AIS has taken the lead and created a new competition pattern in the country's broadband access market. AIS used ZTE's QRUN solution to build an OSS platform for broadband access within four months and deployed FTTx networks that cover 100 thousand homes within half a year.

AIS is a GPON-based FTTx operator with the fastest network construction and service provisioning time in Thailand. By leveraging FTTH large-bandwidth and next-generation VDSL vectoring technologies, AIS offers a wide variety of broadband services to Thai people. In return, AIS will continue to benefit from network construction, operational cost, service revenue and network evolution for a long time and will outperform its rivals with superior network and service quality. **ZTE TECHNOLOGIES**

A proper OSS is directly connected with AIS's fixed-line broadband service provisioning. ZTE has been chosen by AIS for its industry-leading QRUN OSS solution that could help AIS rapidly deploy fixed-line broadband service at existing mobile business sites and transit from pure mobile operator to full-service provider.

Before national FTTx networks were constructed, AIS had built an OSS platform within four months using ZTE's complete suite of OSS QRUN solution. The platform simplified FTTx service provisioning and supported 6000 new FTTx subscribers per month. Compared with other operators who need at least half a month to deliver broadband services based on a manual or half-manual service provisioning system, AIS takes one step ahead to seize the market opportunity with the QRUN solution.

Opex Savings for More Profit

In FTTH mode, plenty of ONTs are deployed at user homes and passive devices used at the user side. This dramatically reduces operating costs. Terminals are managed uniformly via TR069. This enables plug and play and also reduces operating costs.

ZTE's energy-efficient OLT design ensures that power consumption per PON port is 42% lower than the EU standard. The innovative OLTs ensure that a broadband access network consumes half the energy of a conventional broadband access network, significantly saving electricity costs for operators and users.

Qcell: Helping Operators Provide Indoor Coverage

By Zhang Yuehong

According to the ITU, 70 per cent of all mobile voice connections and 80 per cent of all mobile data connection occurs indoors. Indoor coverage is a huge part of future wireless development. However, in the 4G era, deep indoor coverage is difficult because networks are extremely complicated and are operated in different scenarios. Deep indoor coverage creates challenges for operators:

- High LTE frequency bands increase free space loss, penetration loss, and feeder loss.
- The three types of cellular network—2G, 3G and 4G—need to be converged in a cost-effective way.
- Products need to be easy to install and provide good coverage.
- Networks need to be easily expandable and have high capacity.

Qcell: New-Generation Digital Indoor Coverage Solution

Recently, Chongqing Unicom and Sichuan Telecom built their own next-generation digital indoor coverage systems that address the issues related to indoor coverage.

Chongqing Unicom deployed an indoor 4G network in SM City Mall, a high-end commercial center in Yubei district, Chongqing. The network makes use of ZTE's Qcell system. In a testing, the peak indoor rate was 149.6 Mbps and the peak uplink rate was 49.2 Mbps. According to on-site users, HD videos and on-demand HD movies were played smoothly on smart phones, and large data file download and other FTP services could be completed at an extremely high rate.

Coverage area of the 4G network in the SM City Mall reached 150,000 m^2, meeting the criteria of China Unicom for class-A scenarios. Performance and capacity of the network were also up to the standard for hotspot coverage. ZTE's Qcell indoor coverage solution provides high capacity and performance and is easy to implement. The digital indoor coverage system was deployed for only one week, covering the entire SM City Mall. Its deployment is far less difficult and complicated than that of a traditional distributed indoor antenna system.

Sichuan Telecom has also commercially deployed its Qcell indoor coverage system that provides 4G carrier aggregation. The acceptance tests have shown that in an indoor area of 10,000 m^2, when the 1.8 GHz frequency with a 15 MHz frequency bandwidth and the 2.1 GHz frequency with a 20 MHz frequency bandwidth are used, the highest 4G traffic rate can reach 3 Gbps. This means the rate for each user can be maintained at 3 Mbps when 1000 users are using 4G services simultaneously in the area. CDMA voice quality is quite good, and the EV-DO peak data rate is on a par with that of a traditional solution. The system provides 2G, 3G and 4G services that

can reach peak rates simultaneously. This enables operators to implement traffic management strategies. Sichuan Telecom was very satisfied with the acceptance tests.

In May 2015, ZTE and China Telecom were jointly awarded the Wireless Network Infrastructure Innovation award for their close collaboration on the macrocell-small cell coordinated Qcell digital indoor coverage system at the Global Telecom Business (GTB) Innovation Awards 2015. In June 2015, the Qcell digital indoor coverage system also won the Best Innovation in Heterogeneous Networks award at the LTE World Summit organized by Informa.

Qcell: Small Size and Large Capacity

The Qcell indoor coverage system consists of Pico RRU, pBridge and BBU. Pico RRU supports FDD LTE, CDMA, UMTS, and TD-LTE. It is small, high-capacity, attractive, and easy to install.

pBridge provides power over Ethernet (PoE) and data compression. It enables LTE carrier aggregation and CDMA networks through a single UTP cable. Another advantage of Qcell is that it can merge or split cells so that operators can adjust network capacity and distribution as required. The system takes into account the future business development while reducing initial investment. Therefore, it can adapt to development in the mobile internet era.

Compared with traditional indoor coverage solutions, Qcell significantly shortens the construction period. Usually it takes four workers one week to install, debug, and optimize a Qcell system in a campus dormitory of 50,000 m^2.

By using standard Ethernet cables for Pico RRU networking and power supply, the new-generation Qcell carries 2×20 MHz LTE cells through an Ethernet cable and can be combined with UMTS, CDMA, and other wireless systems to simplify the deployment of multi-mode indoor networks.

Qcell can share one network management system with 4G macrocells. Each node is visible, manageable, and controllable so that network O&M costs can be significantly lowered. Qcell uses indoor and outdoor cloud collaboration technologies to eliminate indoor signal leakage and outdoor signal interference and to finally optimize performance of the entire network. Qcell can also provide precise local access and indoor location based services to expand business and attract new users.

Network operators in China are in a critical stage of transition from 2G and 3G to 4G. Qcell not only supports rapid deployment of 4G networks, it is also compatible with existing 2G and 3G systems. When all 2G and 3G users transit to 4G in the future, Qcell can evolve existing 2G and 3G networks into 4G through software upgrade. This will protect operator investment. This is also particularly important in the current transition, where VoLTE has not been completely built and voice can only be carried through 2G and 3G networks.

Qcell is favored by customers for its superior performance. It has been used in more than 20 cities and regions in China, and the total shipment has reached several tens of thousands units.

ZTE TECHNOLOGIES

Pico RRU

ZTE
Tomorrow never waits