ZTE TECHNOLOGIES
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VIP Voices

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Moving from Voice-Centric to Data-Centric Growth

Digitel:
The Leader in Mobile Data in Venezuela

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Tech Forum

The Art of Maximizing Revenue from Data

Andreas Pfisterer, CTO of E-Plus Group

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E-Plus is the third-largest network operator in Germany in terms of customer base. Since launching its network in 1994, E-Plus has provided customer-focused innovation time and time again. E-Plus has rocked both the residential and commercial sectors with flat rates, and discounted telephone and data services. *ZTE Technologies* recently interviewed Andreas Pfisterer, CTO of E-Plus Group. He talked about E-Plus's challenge, LTE deployments in Germany, and future cooperation 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

ZTE Partners With Omnilogic to Provide Romania and Surrounding Countries with Leading ICT Solutions

29 October 2014, Shenzhen — ZTE has signed a strategic partnership with leading Romanian ICT channel and integrator Omnilogic to provide its customers with ZTE's extensive range of ICT solutions.

ZTE's ICT solutions will be delivered to the Romanian and Adriatic region through Omnilogic's dedicated sales channels for both small to medium businesses and large enterprises.

Founded in November 1992, Omnilogic is the one of the leading companies in the IT and communications industry in the Romanian and Adriatic region. Omnilogic will deploy ZTE's large portfolio of products including data communication networks, unified communication systems, and IT infrastructure. By signing this new partnership contract, Omnilogic and its partners will be able to respond more effectively to the needs of their end-users. The partnership will ensure fast-to-market solutions and the quick implementation of ZTE ICT solutions through existing channels and integrators across the region.

ZTE entered the enterprise business more than 10 years ago. In 2012, it clearly defined its business strategy with the aim of establishing the enterprise business as one of ZTE's three major strategic businesses and a key growth engine for business growth.

ZTE Now Official Smartphone Sponsor of New York Knicks, Houston Rockets and Golden State Warriors

27 October 2014, New York — ZTE USA, the fourth largest smartphone manufacturer in the U.S.A, announced it will become the official smartphone sponsor of the New York Knicks, Houston Rockets and Golden State Warriors. Following a successful sponsorship season with the Houston Rockets, ZTE is continuing its partnership with the Rockets and teaming up with the Knicks and Warriors for the 2014—2015 NBA season. As part of the partnership, ZTE will increase its commitment to local communities by supporting charitable initiatives such as the Rocket's Season of Giving, the Knick's Garden of Dreams, and the Warriors Community Phone Drive, where fans are encouraged to bring their old phones to donate to the Warriors' charity benefiting underserved youth in the San Francisco Bay Area.

In the U.S.A, ZTE is on its way to greater market awareness as one of the fastest growing handset manufactures in the space. ZTE is the fourth largest smartphone brand in the U.S., second largest in pre-paid and third in Android market share and plans to continue building its presence in the U.S. with more branded devices and investments to become a household name in the United States.

ZTE Expands Services Business in Europe

4 November 2014, Düsseldorf, Germany — ZTE Services Deutschland GmbH, a ZTE Group company, announced that it has secured two new managed services contracts with European network operators. One contract was signed with Netherland's largest network operator KPN on voicemail hosting. In Luxembourg, ZTE has won a comprehensive service contract for the operation, maintenance and rollout of the core network of mobile virtual network operator JOIN Experience.

Andreas Pfisterer, CTO of E-Plus Group

E-Plus:

Moving from Voice-Centric to Data-Centric Growth

Reporters: Liu Yang and Zhao Rujing

We chose ZTE because they have a similar market approach to us: they are a challenger in the market and have the same beliefs.

E-Plus is the third-largest network operator in Germany in terms of customer base. Since launching its network in 1994, E-Plus has provided customer-focused innovation time and time again. E-Plus has rocked both the residential and commercial sectors with flat rates, and discounted telephone and data services. *ZTE Technologies* recently interviewed Andreas Pfisterer, CTO of E-Plus Group. He talked about E-Plus's challenge, LTE deployments in Germany, and future cooperation with ZTE.

Q: Can you introduce E-Plus and its main business focus?

A: E-Plus is a mobile operator in Germany with more than 25 million customers. Our focus is predominantly residential customers, and we like all customers to experience the full capacity and capabilities of our network. Last year, we launched a high-speed network for everybody at no additional cost.

Q: What are characteristics of the Germany telecom market and what are some challenges that E-Plus faces?

A: Germany is a very competitive market. We have four main operators: E-Plus, O2, Vodafone and Deutsch Telecom. Prices and revenues have come down predominantly in voice and SMS primarily because of migration but also because of competition. One reason for this trend is regulation on pricing and the other is cannibalization by OTT players, who have taken away a lot of revenue. On the flip side, we have also seen increasing revenue from data. So it is a very challenging market environment. The challenge lies in monetizing data to compensate for the decline in revenue from traditional voice and SMS.

Q: What is the key to E-Plus's sustainable growth and development?

A: The key challenge is to move from voice-centric growth to data-centric growth and to manage investment at the same time. We invested sensibly into our networks and into the market. We have moved from voice-centric to data-centric growth by offering very attractive prices to our customers. This means that we also have to be the leader in terms of pricing and make sure we offer excellent value for money.

Q: What do you think about LTE deployment in Germany?

A: Compared to other markets, such as Hong Kong, Singapore, and Korea, LTE penetration has only been gradual in Germany. This is basically because 3G and HSPA+ was the focus of last year. To be honest, from a customer's perspective, the underlying technology is not of foremost concern, particularly when you can get top speeds of 50 Mbps or 100 Mbps. You can provide good customer experience using existing technology. For us, LTE is pretty much a technology offering additional capacity that not many others can offer. We believe we can monetize it from the customer's perspective, so we offer it at no additional cost wherever and whenever needed. We are now gradually rolling out LTE, and in those areas where we see a necessity in terms of capacity, we provide it to our end customers.

Q: How is the LTE network performing and what still needs to be done to expand LTE coverage?

A: The LTE network we are rolling out on 1800 MHz is performing very well. We will gradually expand the network wherever and whenever necessary. It's also a part of our investment strategy to invest the right technology at the right time. We implement our strategy in cooperation with ZTE, one of our major partners who is helping us roll out our future data network. We will continue to gradually expand the network in line with customer expectations and data usage.

Q: What do you think of ZTE as a strategic partner? Where do you think ZTE could improve?

A: We have been working with ZTE for a very long time, and now we are gradually expanding our partnership with ZTE. Last year, we expanded the partnership by involving ZTE in our managed services. ZTE is also our preferred partner in our program to roll out a data network for the future. We chose ZTE because they have a similar market approach to us: they are a challenger in the market and have the same beliefs. We have similar DNA so to speak. I think we can always improve by becoming more flexible and reducing the time to market for rollout and service delivery. We collaborate with ZTE in these areas.

Q: What do you expect from future cooperation with ZTE?

A: We are prepared to extend the partnership with ZTE. We have partnered with ZTE in order to satisfy increased demand for data services and quality of experience. We are very happy to have come so far with ZTE and we will continue to work with them.

An interview

Q: What are the key factors for this sustainable relationship?

A: First, we have to have sensible priorities. I think we have established a solid foundation that ensures win-win situation for both ZTE and E-Plus. Second, you really need to work as partners. This means you share your risks and benefits and support each other in face of different challenges. The two parties have to go in that way. ZTE had not previously handled managed services at such scale, and it is also challenging for E-Plus to maintain cost leadership in the market and attract customers through low prices and value for money. Being a strategic partner means that you share the risks and benefits in the partnership. ZTE TECHNOLOGIES

Gonzalo Fernandez, vice president of Digitel

Digitel: The Leader in Mobile Data in Venezuela

Reporter: Yue Lihua

*Venezuela is among the few countries in Latin America to offer **4G LTE**, and Digitel is the emerging force in mobile data in Venezuela.*

Digitel is an innovative Venezuelan telecom operator that offers mobile and fixed telephony and high-speed mobile internet services with national coverage. In 2012, Digitel was awarded 30 MHz of extra spectrum in the 1800 MHz and 1900 MHz bands and in 2013, became the first operator to launch 4G LTE services in Venezuela. Digitel has cooperated with ZTE to deploy an LTE network. Recently, *ZTE Technologies* interviewed Gonzalo Fernandez, vice president of Digitel, who talked about the characteristics of Venezuela's telecom market, the experience of building an LTE network, the partnership with ZTE, and Digitel's development strategy for the next five years.

Q: Could you introduce Digitel?

A: Digitel is the most innovative company in Venezuela's telecommunications market. We offer mobile and fixed telephony and high-speed mobile internet services with national coverage. We have also pioneered some advanced communications solutions. Digitel was the first operator to launch 4G LTE in Venezuela.

Q: What are the characteristics of the Venezuelan telecom market?

A: The Venezuelan telecom market is characterized by over 100% mobile penetration and very strong market segmentation between the three leading operators. In Venezuela, there has been great take-up of both voice and data communications, and this has generated ARPU that makes the Venezuelan market one of the most profitable in Latin America. This is a great advantage for us. Our strategies are focused on providing users with the best quality service and attention.

Q: Competition in the telecom market is very tight. What makes Digitel stand out in the industry?

A: Digitel has pioneered technology that sets a worldwide standard and has launched services that accompany these technological innovations. The latest technology is 4G LTE. Venezuela is among the few countries in Latin America to offer this technology, and Digitel is the emerging force in mobile data in Venezuela.

Q: Digitel was the first operator to deploy LTE in Venezuela. How has Digitel overcome the difficulties of deploying LTE?

A: Digitel's LTE deployment plan has been success. A record 800 LTE stations were deployed across the country. The current difficulties lie in the availability of terminals that enable people to fully appreciate 4G. We are currently in discussions with our suppliers and other state-owned telecom companies to supply the market with such terminals.

Q: Could you share some of your experiences of building the LTE network?

A: In the telecommunications industry, operators and manufacturers are writing history. In Venezuela, we have innovated with the deployment of each new technology and have learned from past mistakes so that we improve each new implementation. 4G LTE was no exception. We have learned with our customers to build a network tailored to their needs. Each new cell is a new challenge and commitment to provide stable communications. For us, 4G was special because we not only had to do feasibility studies but also market studies to tell us more about certain areas and how to maximize the use of this network. We have attracted more than 80,000 customers, and the user base continues

to grow one year after the network was commercially launched.

Q: What is Digitel's five-year strategy?

A: We will continue our expansion. Looking at the mobile phone market, growth prospects are limited, but Digitel is projected to become the leader in data communications and can provide the best prices in the market. These competitive advantages are our spearhead for further growth in Venezuela. In the next five years, we will continue to be on par with the rest of the world in terms of technology deployment. Over the past five years, we have deployed 3G and 4G LTE, and we are confident that we will make further progress in the next five years.

Q: What are the future trends in the Venezuelan telecom market?

A: We are committed to the use of social networks and collaborative applications of visual tools. The market requires us to increase capacity, and our commitment is to maintain the quality of services to our more than 6.5 million customers. Our goal is to be one step ahead of trends and enable our customers to define how they want to communicate.

Q: How do you think the partnership between Digitel and ZTE will evolve?

A: We are confident that we will continue working with ZTE to strengthen our network in areas ZTE has already helped us. ZTE is the first partner we trust to modernize the entire technological infrastructure in the east of Venezuela, one of the best-performing areas. We believe we can further develop these implementations with the help of ZTE.

Q: What impressed you most in Mobile Asia Expo 2014?

A: We are quite impressed by the latest generation of wireless technology. There's no doubt that Asia is at the forefront of technology worldwide. We are so sure of it because our LTE infrastructure is made by Chinese manufacturers and we are very pleased with its performance. ZTE TECHNOLOGIES

The Art of Maximizing Revenue from Data

By Muhammad Salman Sami Khan

Muhammad Salman Sami Khan, *chief research analyst, Global Marketing Team, ZTEsoft*

Tablets and smartphones have fundamentally changed the way people use telecommunications services. Today, service providers are no longer the main creators of value and are under siege from OTT players. At the same time, smartphones have vastly improved the web surfing experience, and this has led to an increased consumption of media and content-based services.

In the industrial age, the stream engine overcame human physical limitations. Similarly, in the information age, computers have overcome human mental limitations. At present, we are in the age of convergence, that is, fixed-mobile convergence (FMC), tri-network convergence, and ICT convergence.

Over the past 20 years, telecommunication convergence has implied the convergence of fixed and mobile networks; tri-network convergence has implied the convergence of telecommunication networks, cable TV, and internet; and ICT

The inability to handle high volumes of data with limited network resources has been a major problem for every operator and service provider.

convergence has implied convergence brought about by cloud computing. Over the next 20 years, convergence in the ICT industry will not only be thought of internally, in terms of network convergence, but also in terms of deeper penetration of ICT into public services, industry, agriculture, education, medicine, and transportation. Such convergence will reform every aspect of individual, family, and work of life. The digital and physical worlds will be brought closer together, and ICT will reach a new peak.

Network evolution over the past 20 years has gone hand in hand with the evolution of smartphones and tablets to cause a significant increase in the amount of data and bandwidth consumed. The inability to handle high volumes of data with limited network resources has been a major problem for every operator and service provider. According to the research by *Heavy Reading*, by 2020 there will be more than 60 billion devices that will connect every facet of human existence. This will come at a cost for operators, enabling more transactions, data usage, and network events. Operators will have to handle these cheaply and efficiently.

During convergence, operators provide the information flow. From 2G and 3G to LTE, operators seek to improve network quality and throughput, provide numerous value-added services, and improve QoS. Through constant investment in their networks, they expect to increase their customer base and revenue.

In recent years, service providers have also been trying their best to keep up with rapidly changing requirements brought about by mobile internet. The following are the main topics of interest to operators and service providers:

- changing trends in voice. Traffic has been changing from voice to data. Previously, voice was the predominant means of communication, but now there are so many other options. OTT players in the telecommunication industry have largely been responsible for this trend.
- short messaging services. There have been no significant improvements in SMS since it emerged. Smartphones create opportunities for terminal providers and third-party software developers to better integrate phone address lists with SMS and win over users through better experience. The prices of SMS must also be kept low for survival.
- data revenue versus data access. Data access accounts for an increasing proportion of the revenue of mobile communications service providers (CSPs). However, in the mobile industry as a whole, data access accounts for a decreasing proportion of overall revenue. These contradicting trends mean that mobile CSPs are gradually marginalized in mobile internet industry. Mobile CSPs that increasingly rely on data access revenue are considered "pipe liners."
- growth in M2M business models. With the boom in IP-based wireless broadband networks, M2M services have become a factor that CSPs cannot ignore. Rapid service growth continues to force operators to reassess their business models and provide bundled M2M services. Operators are having a hard time keeping up with dynamic M2M services. Connected, readily discoverable devices have helped change user behaviors over the past few years and will continue to do so in the coming years. This means we will see a further (huge) increase in data transactions and traffic.
- devices connected in a home network. Home networking enables internet content to be delivered to multiple devices within a home. SOHO is an example of a home network.

Essentially, these points refer to a transformation from a homogenized approach to meeting communication and information requirements to a more individualized approach. A good network by itself does not provide sufficient services; a network also needs to come packaged with content and information. Much effort has been expended on improving transmission efficiency and quality in telecommunications networks. However, the internet and new user behaviors have become the new focus of development within the industry.

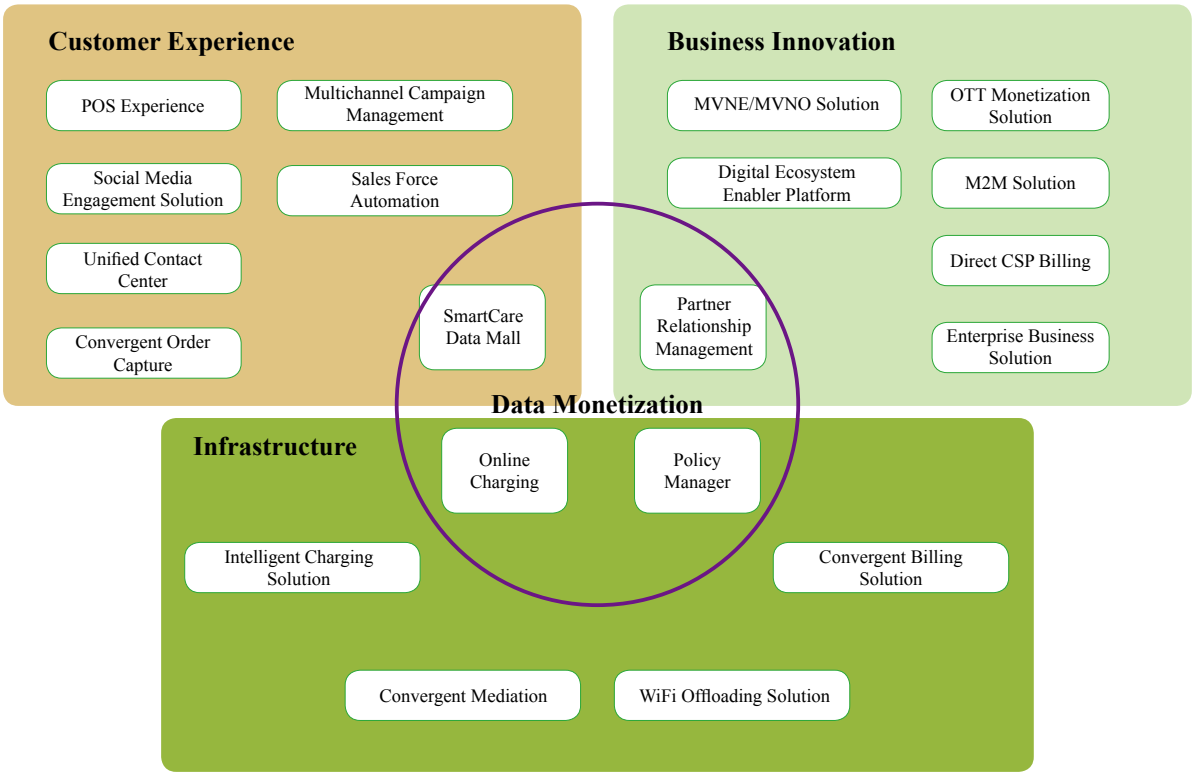


Figure 1. ZSmart data monetization solution.

CSPs really need to transform themselves into information providers in order to overcome current predicament.

CSPs need to adopt three strategies:

1. strengthen pipeline infrastructure, such as online charging system and policy manager, to serve both customers and suppliers. This is the basis of business support.
2. focus on user experience (smart care data mall) so that the creators of information continue to use the CSP platform. This could entail providing an app for smartphones and tablets.
3. strongly create platform value to search business innovation (partner relationship management).

ZSmart data monetization solution helps an operator strengthen its relationships with partners by keeping in mind all important modes, such as "sell with" and "sell to." This makes operators business enablers. The solution enables efficient charging and policy management and provides the subscribers with an app, such as data mall that tells them about hot marketing strategies.

ZSmart data monetization solution is a typical application of ZSmart BSS in the big-data era. With the three strategies employed by ZSmart BSS, the solution can be used to construct intelligent pipelines. The solution introduces a converged policy and charging solution and encourages customer loyalty through a data mall, which is an application that can be installed on mobile terminals. Finally, a partnership can be formed with OTTs and other manufacturers through PRM as a way of dealing with competitors from the same industry.

Building New-Value OAM to Meet the Mobile Internet Challenges

By Wei Hui

According to data released by Ministry of Industry and Information Technology of the People's Republic of China, the volume of text messages sent during the 2014 Spring Festival fell by more than 40% compared to the same period in 2013. This was the first decline in more than a decade. So how are people now extending their New Year's greetings if they are not sending short messages? The answer is certainly not phone calls. Statistics provided by mobile operators shows that the average daily outgoing call duration during the 2014 Spring Festival was only three quarters that of non-holiday periods and shorter than the average daily call duration the 2013 Spring Festival. The answer lies in the use of smartphone apps such as Wechat, QQ, or Laiwang. Eight days after New Year's Eve (according to the lunar calendar), the average daily traffic of a mobile user was 46.6 MB, an increase

of 63% compared with the same period in 2013. Revenue from traditional voice and SMS dropped sharply for operators, and revenue from data has not compensated for this shortfall. At the same time, operators are investing heavily in expanding the capacity of their networks to handle more traffic.

The cost of managing these networks has also increased.

With the evolution of internet services and smart mobile terminals, traditional telecom operators are being squeezed between existing rivals (other operators) and emerging competitors (OTT providers). How can operators succeed in transforming themselves?

Data services have drawn high and wide attention in the internet era. Therefore, operators should focus on the guaranteed QoS of data services, pipe control, QoS-based pricing, and interest sharing. To achieve this goal, priority should be given to the following three aspects.

- **guarantee.** Data service operation is based on a high-quality, high-performance network, which ensures a transparent, manageable, controllable OTT application quality and customer experience on the mobile internet.
- **partnership.** Operators should establish partnerships with OTT providers and content providers to create a competitive environment, promote the development of high-bandwidth and large-data-volume applications, and enhance the central role of the pipe to raise the players' awareness of the importance of service quality.
- **innovation.** Operators should proactively shift their focus from network performance to customer experience. Moreover, operators should exploit the value of the data in the pipes.

As a leading OAM solution provider,

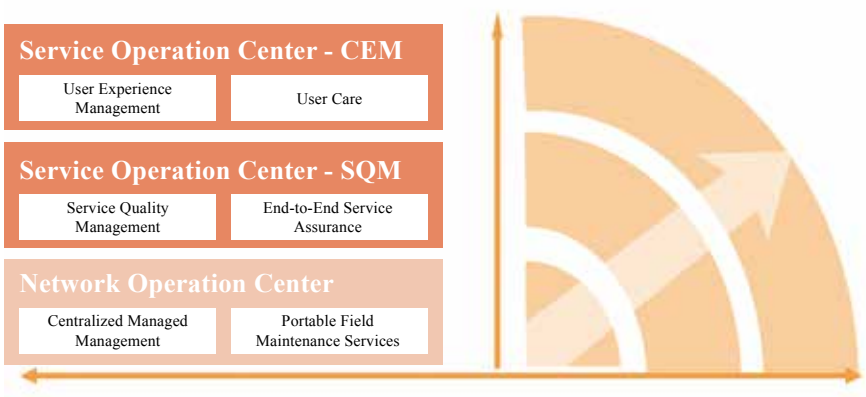


Figure 1. ZTE's Next-generation operation solution.

ZTE offers next-generation operation solution for telecom operators in transition (Fig. 1). This business value-driven and customer experience-centric solution builds a top-down OAM system to make customer experience more transparent, controllable and manageable. It includes a centralized OAM system to promote efficiency and reduce costs as well as a customer experience-centric OAM system to manage service quality and user perception.

Centralized OAM System, Promoting Efficiency

As network technologies develop, increasing networks concentration requires a centralized OAM system. Operators can improve centralization in the following ways to promote efficiency and lower costs.

- optimize the OAM system. This involves building an OAM system capable of centralized monitoring and management. With standard structure and procedures and centralized support system, the OAM system make OAM flat, centralized, intelligent and visible. This improves network quality and OAM efficiency.
- innovate the OAM arrangement. Innovate the OAM arrangement to centralize OAM management, provide remote access to control network statuses in real time, and coordinate with local and remote OAM engineers to improve efficiency and reduce costs.
- re-formulate the OAM processes. Review and optimize core processes to provide standardized, modular, coordinated end-to-end services.
- reconstruct the OSS platform. Reconstruct stovepipe OAM systems provided by third parties and integrate them into a unified OSS platform for end-to-end OAM, so as to satisfy emerging customer requirements and improve efficiency.

In the network layer, the next-generation operation solution launched mobile OAM management service and centralized OAM management service. In addition, it achieved four transitions of flatness, centralization, automation and visualization, and it committed to efficiency promotion and intensive transformation.

Customer Experience-Centric OAM System, Increasing Revenues

In the internet era, traditional network performance-centric OAM systems no longer meet operator OAM requirements. Operators need a new customer experience-centric OAM solution to manage service quality and user perception.

- re-establish an evaluation index system by building a KPI-KQI-CEI index system for effective evaluation on data service quality and user perception.
- build a service operation center (SOC) by restructuring the existing OAM system architecture, the process system, and the management platform for service quality and customer experience, the next-generation operation solution can locate network faults and solve service problems from top to bottom.
- service operation and customer experience management. Implement an end-to-end management mechanism that involves monitoring, analyzing, and handling service quality to transform the original OAM system into a customer experience-centric OAM system and offer transparent, manageable and controllable customer experience.

In the service layer, the next-generation operation solution launched an OAM management service solution and helps operators build an SOC. By transforming from network performance-centric to customer experience-centric, it maximizes business values and increases revenues.

ZTE has collaborated closely with many telecom operators, including China Mobile, China Telecom, China Unicom, Telenor Europe, Hutchison Austria, MTN Nigeria and CMpak, and has helped them to take the initiative in the new round of transformation. ZTE TECHNOLOGIES

OSS: The Midfield Engine in the Next-Generation OAM

By Huang Yuzhu

As mobile internet evolves and multi-network integration accelerates, network classes, service types and operation modes are changing. This is revolutionizing the environment for operation support systems. OAM is no longer confined to device alarms but emphasizes service quality. It is no longer satisfied with wireless indicators but concerned with customer experience. In addition, OAM did not limit to a single service but starts multidisciplinary and multi-service parallel operation.

Service Perception and Active Services Push OSS to the Front Stage

In the 4G era, as data and applications increase exponentially, the open, sharing, real-time mobile internet poses great challenges to the operator management model of decentralized maintenance and sequential scheduling. To break through barriers in existing operational support systems, traditional OAM is in transition from pure background support to customer experience-centric and service-oriented front end. This helps an operator realize full-service, end-to-end OAM and reduce OAM costs. The forward lead of OSS is an inevitable trend.

Intense competition is pushing operators to improve their service levels, which requires the OSS platform to support process reengineering and resource integration.

Lateral Coupling and Centralized Opening Pave the Way for Flatness and Intensification

A traditional stovepipe OSS individually serves professional networks so that multiple data sources are difficult to share. Lacking correlation of multidisciplinary service processes, it is hard to find faults.

The flatness of networks and organizations strengthened the internal relations between professional networks and services. Intelligent OSS urgently needs unified resource management and full end-to-end service control to achieve the lateral coupling of services and networks. In addition, rising OTT services are leading to de-channel and growing virtual operators begin to slice off traditional operator market share. The open demand of OSS is extending from inside to outside networks. At present, OSS is casting off the shackles of isolated systems and eliminating proprietary applications. With open interfaces, the OSS is being integrated with OTT services flexibly in order to achieve interoperability from pipeline lease to service OAM. Therefore, the relationship between operators, OTT providers, and virtual operators is

moving to cooperation from competition. Interoperability at the OSS layer is the key to good end-to-end customer experience. Interoperability increases the demands of end user for new services, creates traffic, and interprets an OSS as a service. Meanwhile, through the ongoing interconnection between e-Tom and ITIL on the TM-Forum, full professional and full information monitoring, cross-service correlation, and fast scheduling and adjustment will be achieved in the CT and IT domains. Quick access to multiple vendors' networks through a unified platform enables strong centralized access of OSS and provides effective protection for intensification.

Real-Time, End-to-End Presentation Enables Visualization

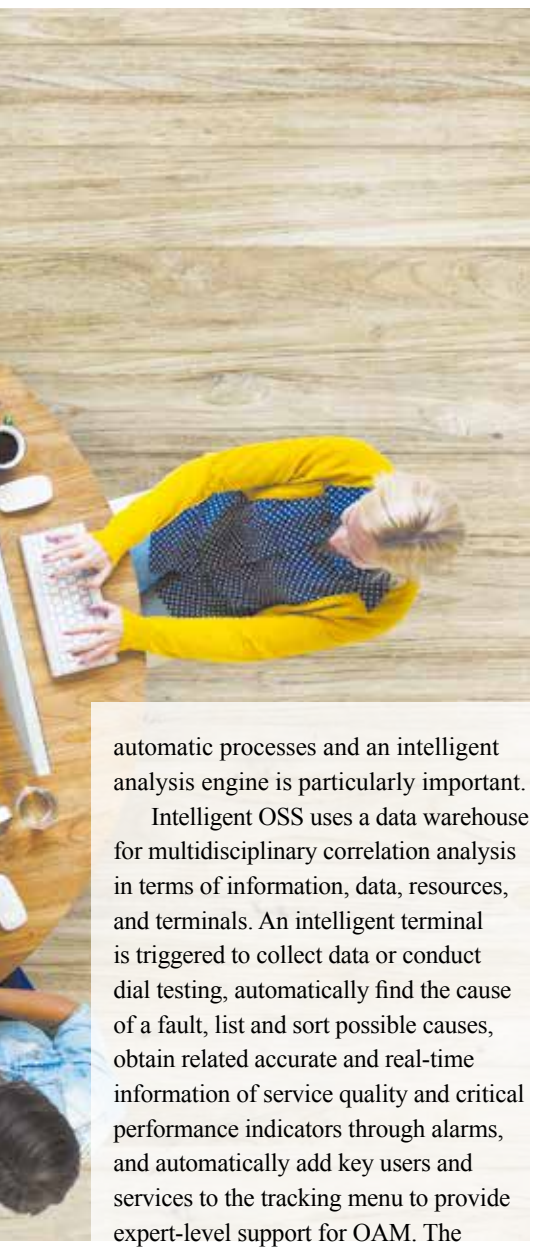
In the mobile broadband era, operators are eager to shift from extensive pipeline operation to customer experience-centric optimized operation. As the foundation of optimized operation, visualization cannot stay on the network alarms and wireless indicators any more. Intelligent OSS makes concrete and digitalizes multiple dimensions indicators in terms of network operation, process status, service indicators, user perception and service quality. It also provides end-to-end visual data, including service data and OAM processes. Visualization establishes a data warehouse based on multiple data sources and encompasses Dashboard, GIS, graphics and tables, so that improve precise OAM and customer experience.

Without strong analysis function, an existing OSS still relies on the DPI analysis control flows in pipelines or service data flows captured by probes. These do not accurately show the real-time status of user and network end-to-end pipelines traffic and are thus unable to support traffic services or troubleshooting. As SDN and NFV are being widely used, OSS not only presents alarm correlation of multiple network devices in the same service chain but also provides user-based, end-to-end, real-time multidimensional views and analysis capabilities. OSS enables intelligible, intuitive, comprehensive views through oriented query and mining functions. This helps OAM personnel obtain information quickly in order to guarantee customer experience.

Visualized OSS simplifies abstract concepts and indicators and resolves physical differences in order to unify remote and local maintenance management. Moreover, by adding mobile OAM intelligent applications, OSS enables material scanning, electronic work order processing, remote fault location, performance tracking and micro knowledge bases. This normalizes remote OAM, and saves manpower, money and space. OSS also enables full space and time control of network operation status to make OAM support become a new area of competitiveness.

Increasingly Intelligent OSS Enables Automation

Most existing OSSs only report faults without displaying causes or provide analysis for a single subsystem. OAM personnel have to troubleshoot the faults. Today, a visual OSS is far from enough. Correlating various processes and services effectively to form



automatic processes and an intelligent analysis engine is particularly important.

Intelligent OSS uses a data warehouse for multidisciplinary correlation analysis in terms of information, data, resources, and terminals. An intelligent terminal is triggered to collect data or conduct dial testing, automatically find the cause of a fault, list and sort possible causes, obtain related accurate and real-time information of service quality and critical performance indicators through alarms, and automatically add key users and services to the tracking menu to provide expert-level support for OAM. The depth of analysis has surpassed what is addressed by the traditional root cause analysis (RCA) process, and 80% to 100% of fault causes can be searched. In addition, intelligent OSS provides statistics so that OAM personnel and customer service center can analyze data in a timely way. It is capable of automatic self-healing, parameter optimization and automatic upgrade by collaborating with configuration management and commissioning management systems to resolve potential network problems and guarantee the quality of the infrastructure. It is also capable of automatic inspection and list dispatching by collaborating with electronic process systems. In addition, by supporting cloud computing management and cloud-based applications, OSS enables intelligent extensions and flexible deployment of system management domains.

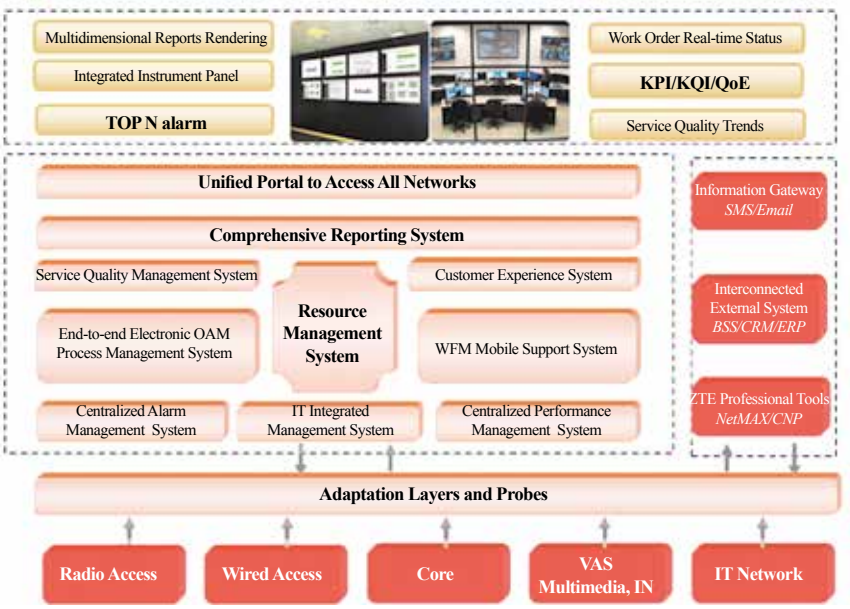


Figure 1. ROSE architecture.

ROSE Ushers in the Next-Generation OAM

ZTE's next-generation OAM solution will be integrated with the self-developed Revolution Operation Support Environment (ROSE), an OAM tool support platform, to achieve innovation.

ZTE has created a full-network, full-service operation support system called NetNumen™ ROSE (Fig. 1). This system has been created through self-development and joint development with industry-leading manufacturers. ROSE covers network planning, operational readiness, service provisioning and OAM management. It also provides customized solutions according to operator's actual operational status. As a convenient, intelligent and open visualized operation support system, ROSE satisfied operator requirements by guaranteeing excellent multidisciplinary end-to-end customer experience based on services. It reduces the maintenance difficulty created by new technologies and services, increases efficiency, and centralizes OAM. ZTE TECHNOLOGIES

SOC: Reforming Network OAM

By Wang Yuanyuan

In the mobile internet era, network operators own the means of transmission; however, the profitability of their transmission pipelines is being squeezed by OTT companies and smart terminal manufacturers. Operators have to invest in their networks to handle more and more traffic, but the revenue from this traffic is declining. Operators must therefore break away from traditional OAM models in order to develop.

At Mobile World Congress earlier this year, ZTE proposed a next-generation operation concept with customer experience as its center. ZTE first implements a service operation center (SOC) to create supporting systems. The SOC encompasses service indicator systems, SOC platform support, SLA management, and organizational restructuring. These create the foundation for the transition from traditional to service OAM models.

Data to Measure Customer Sentiment in the Virtual World

The telecom market is currently in a bind. Why are customer complaints increasing even though network KPIs are being met? The root cause is that traditional KPIs, which are largely based on network performance, are not comprehensive enough to gauge the overall QoS experienced by the end user. If an operator wants to be more than a pipe carrier for OTT companies and terminal manufacturers, they need to get closer to the user. Only by measuring QoS from the perspective of customer experience can an operator really exploit the value-adding potential of OAM.

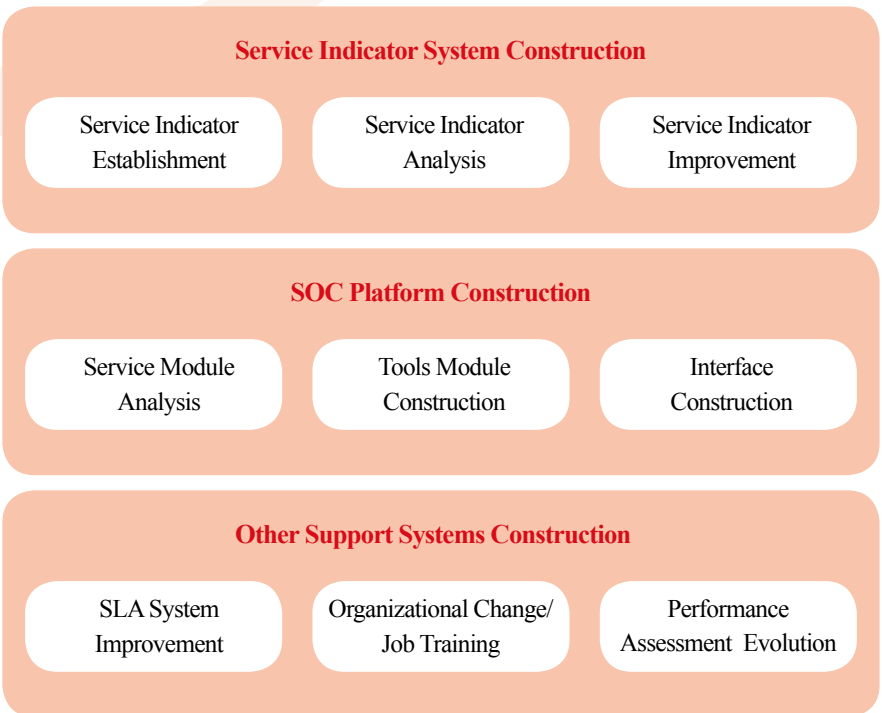


Figure 1. ZTE's SOC integrated services.

ZTE draws on many years of experience with customer experience assurance to propose its SOC solution. SOC is an end-to-end performance assessment system based on customer experience. It converts customer experience into measurable, quantifiable indicators at the application, service, and user layers (Fig. 1).

With this assessment system, an operator can grasp various QoS trends

in real time and make proactive changes for VIPs, very angry persons (VAPs), or even potentially dissatisfied customers. SOC also gives the operator a good overview of each subscriber's network behavior (Fig. 2).

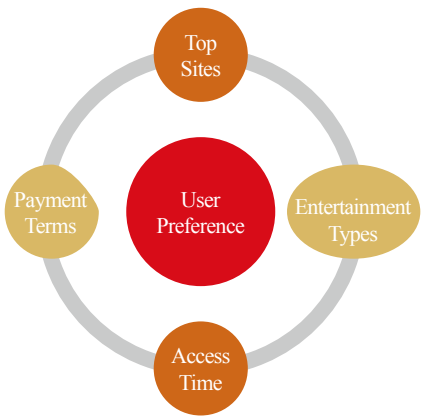


Figure 2. Exploring user behavior through traffic analysis.

Three Steps to Building an SOC Platform

An OAM system that takes into account all fields relies on perfect collaboration between tools. There are three steps to building the SOC platform:

1. Consult expert teams to diagnose the current OAM status. SOC includes standard definitions of critical actions, input and output. It also includes a groundbreaking consultancy assessment process. With these things, SOC can be used to precisely locate problems in the existing OAM system.
2. Use a centralized OAM process to customize target services. ZTE will expand its SOC-based OAM services from alarm management, performance management, and process management to QoS management, VIP/VAP quality management, and VIP/VAP care. In line with process design rules, which defined by scientific aspects such as priority, automation and improvement, ZTE integrates and optimizes current network processes so that an operator can provide the most appropriate services.
3. Map from services to tools. As well as service content design, powerful support tools are necessary. According to the target service modules and scenarios, ZTE provides an operator with tools that match OAM requirement. These tools are used for alarm management, performance management, service quality management, and customer experience management. Analyzing service processes and data direction is necessary for the design and transition from service modules to tool modules. Establishing an OAM environment based on service scenarios minimizes the risks of function modules lying idle and improves the efficiency of tools as well as the input-output ratio of an operator.

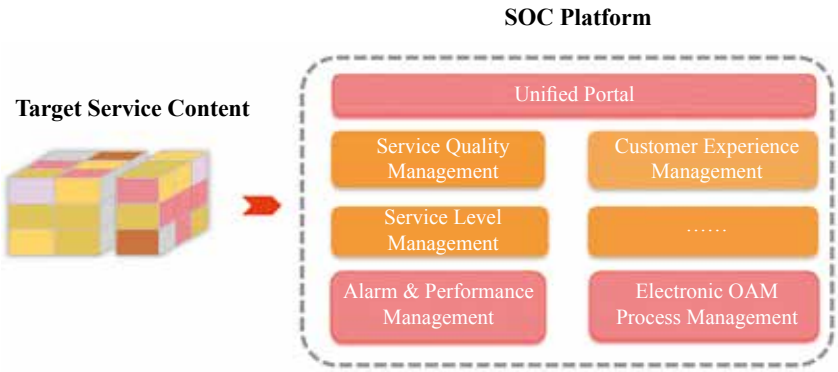


Figure 3. Management tools integrated on the SOC platform.

ZTE has already developed and integrated OAM tools in all areas of its business. ZTE has much experience selecting tools, interconnecting networks, and integrating and testing different architectures. The management tools of the SOC platform have been widely applied and support the implementation of target services (Fig. 3).

SOC Creates a New OAM Experience

What new OAM experience does ZTE's SOC provide? With an end-to-end KPI assessment system, an operator can be guided by changes in customer experience and QoS, not only technical indicators, when making network changes. New relationships between service quality and network resources are established in order to intelligently locate and analyze network faults.

ZTE's SOC also incorporates industry-leading SLA management, integrating customer experience with SLA for intelligent dispatching according to fault priority. The SOC sets service indicator thresholds for alarm, performance, and customer experience systems in order to make network OAM more transparent.

SOC-based service OAM makes customer experience, QoS, and service-level management more transparent, controllable, and open for analysis. SOC also helps an operator identify potential areas of value. Most of all, SOC helps an operator explore new profit growth strategies and provide strong support for OAM and corporate operations. ZTE TECHNOLOGIES

Intensive OAM:

Helping Operators Transform and Improve Efficiency

By Lu Xiaoyan

In the mobile internet era, telecom operators have made traffic operation their strategic goal for service development and profit growth. To support end-to-end services, operators need to gradually build and strengthen their infrastructure network and properly monitor and manage customer experience. They also need to reform the organization, objective and processes of network OAM. Operators have a clear aim for network OAM: create an integrated OAM evaluation system to facilitate the transformation from network-centric operation to operation focused on service quality and customer experience. Also, they seek to reform the existing OAM system and create an OAM model that combines centralized OAM and local OAM. This enables centralized monitoring at the provincial level. OAM transformation is inevitable for the sustainable development of telecom operators.

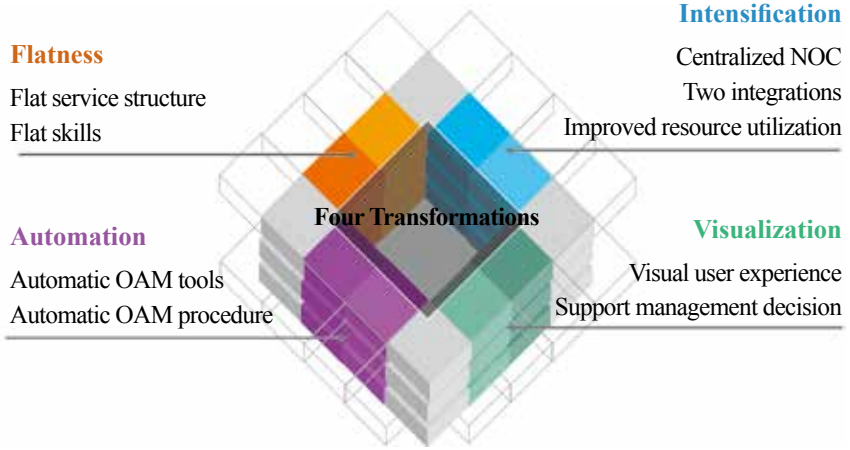


Figure 1. The development trend of network OAM.

To keep up with the development of mobile internet and help operators transform themselves, ZTE has proposed next-generation operation. ZTE has years of experience in management services at home and abroad. In next-generation operation, traditional management services are integrated with ZTE's OAM support platform to create a flat, intensive, automatic, visual OAM system. This system improves efficiency and steers an operator towards intensification (Fig. 1).

Flatness

4G is now commercially available and as a result, networks have become larger and more complicated. Correlation and convergence of technologies and coordination between multiple parties have increased the requirements for network OAM in terms of capability and

model. From a service perspective, the existing OAM model is challenged by diverse services, rapid deployment and application, and customer experience management. Operators are pressing to shift from voice-driven to traffic-centric operations and from the traditional multi-level group, provincial, municipal and county management structure to a flat service structure.

The increasingly flat, IP-based network architecture integrated with ICT technologies is also blurring the boundaries between industries. A unified intelligent delivery platform reduces the need for specialized skills of front-line maintenance personnel.

Intensification

Intensification is the most important way operators can reduce their TCO and greatly improve operational efficiency. Intensification involves:

- centralized network operations center (NOC). Increasingly intelligent BSS/OSS and extensive support methods have strengthened intensive network operations. Previously, monitoring centers were scattered in cities but are now centralized in an NOC. Most of the previous problems that had to be handled on site can now be addressed remotely in the NOC.
- two integrations. New OAM mechanisms based on integrated base stations and integrated equipment and lines are being developed step by step to improve OAM efficiency. Integration in base stations involves integrating maintenance and radio network optimization. Integration in other equipment and lines involves integrating the maintenance of transport devices and transmission lines.
- improved resource utilization. With the help of an E-Flow system, front-line OAM staff can receive and handle work orders in real time through their smart mobile terminals. These work orders can be marked, recorded, and traced end-to-end. Supported by the WFM personnel dispatching system, management staff can determine the workload of front-line OAM staff and adjust resources and tasks in a timely manner. In this way, the efficiency of front-line OAM staff can be maximized.

Automation

Automatic OAM tools greatly reduce the number of front-line OAM staff needed, makes OAM more efficient, and reduces opex. A full range of field-proven automatic OAM tools have been developed for the entire network OAM lifecycle. These are tools for network planning, deployment, configuration, commissioning, and maintenance.

As LTE arrives and self-organizing network (SON) technology matures, networks will be capable of automatically configuring, maintaining, optimizing, healing, and adapting themselves. At this stage, we can truly say that network OAM is intelligent.

Visualization

The ultimate goal of visualization is to make a network more controllable and manageable. Visualization involves visual network or service indicators, visual human resources or dispatching and tracing tasks, and visual managed services or evaluation. All this eventually helps improve OAM efficiency and quality.

Urban or local OAM subsystems always function as nerve endings of an operator's entire OAM system. Information about the number of work orders, time in transit, time to visit sites, time to leave sites, fault handling, barcodes of spare parts, warehouse locations, and maintenance efficiency has always been invisible and unavailable to management personnel. Therefore, there is still plenty of room to improve management efficiency.

The visual mobile OAM solution is used for monitoring, managing, and tracing the whole process of OAM work orders handled by the urban or local OAM subsystems. Field OAM personnel can use mobile apps and terminals for mobility management, which includes GPS-based dispatching, and work order receiving, handling and closing. Apps can be used to trace and handle data in the process of work orders. Apps can also be used for recording and uploading information about time to mark, time to visit sites, and on-site photo shooting. All this provides a data basis for continually improving and optimizing field OAM efficiency.

Telecom operators are in a critical period of OAM transformation, and ZTE is looking forward to working with these operators to rapidly improve OAM efficiency and increase their market competitiveness. ZTE TECHNOLOGIES

ElasticNet OAM:

An New Dawn in Network Maintenance

By Wang Dayong and Kong Min

With the development of 3G, 4G and mobile broadband, users of intelligent terminals and social networking sites are demanding more variety, stability and individuality. This presents many challenges for operators. Traditionally, operators have tended to upgrade existing devices or deploy new ones to meet new demands. However, with frequent upgrading of mass-storage and other network equipment, coordination between all this equipment has become complex and has increased the requirement for network maintenance.

ZTE has deep understanding of the situations operators find themselves in and understand how customers experience the network. In launching ElasticNet, ZTE sets a new trend in network technology. ElasticNet combines the features of software-defined networking (SDN) and network function virtualization (NFV). An essential part of ElasticNet is an OAM solution that breaks the horizontal divide between different network elements, that takes into account various networks, and that makes OAM more transparent. ElasticNet enables unified management of cloud computing facilities, wireless networks, and traditional bearer networks. It can also be connected with other advanced analysis systems (Fig. 1). Most of all, the SDN management function in ElasticNet can be combined with SDN controllers to work as a part of NetNumen U31. This enables the EMS function for SDN domains.

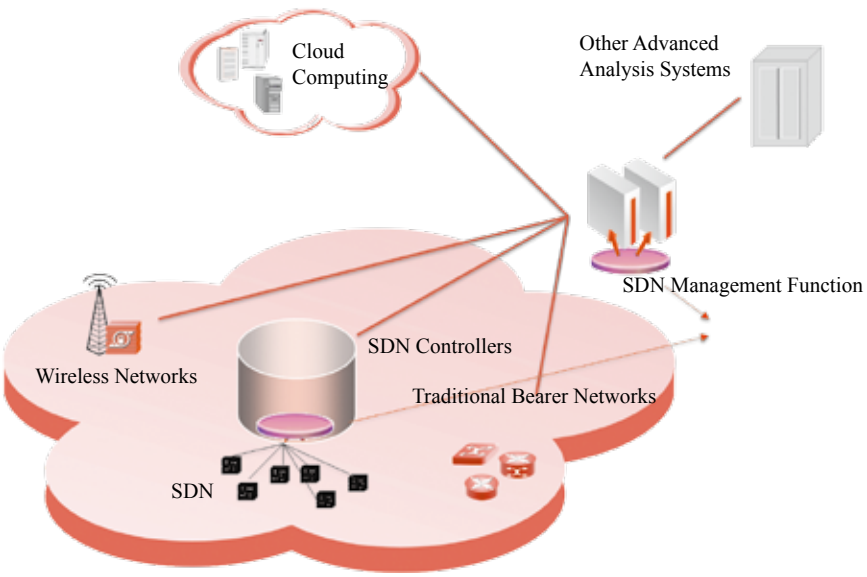


Figure 1. ZTE's ElasticNet OAM.

ElasticNet OAM is a new part of NetNumen U31 and encompasses architecture platform, network maintenance, and service and support.

ElasticNet OAM is based on the NetNumen U31 platform and benefits from ZTE's years of experience with this system. An advanced cluster architecture is introduced for use in the initial (small-scale) stage of an SDN deployment. As services develop, SDNs will progressively expand and replace existing network infrastructures altogether. This cluster architecture can be horizontally expanded to meet the growing management needs, reduce capex and opex, and mitigate investment risk. ElasticNet OAM uses similar operation procedures for common

network functions so that users can understand new systems, services, and functions quickly.

ElasticNet OAM has basic network management functions that have been refined through the joint efforts of ZTE and its customers. Inevitably, SDNs will be co-managed with existing network infrastructure early on. ElasticNet OAM manages these different networks uniformly and can also manage third-party network facilities on the forwarding plane, which has standard protocols. Performance data from the SDN and other networks can be collected and analyzed in order to devise KPIs and compile reports.

Unlike traditional network-management systems, ElasticNet OAM is deeply involved in network service management. ElasticNet OAM manages network topology in an accurate, timely manner and gives a full view of the network topology as well as the details of a single node. With graphic end-to-end fault diagnosis, ElasticNet OAM helps the administrator locate faults quickly. ElasticNet OAM also has automatic traffic scheduling, which supports manual intervention so that bottlenecks can be located and eliminated in time. The greatest difference between ElasticNet and a traditional network is that SDNs are programmable. With built-in programming interfaces and corresponding northbound interfaces, ElasticNet OAM provides basic network applications. Because these interfaces are compatible with OpenDaylight, applications based on OpenDaylight can be migrated to ZTE environments with little or no modifications. Also, applications developed in ZTE environments can be migrated to third-party environments for lower cost in order to build open ecosystems. All in all, ElasticNet OAM is very adaptable, protects investment, and makes the network operate more efficiently.

Elasticity

At the beginning of network construction, an operator tries to determine the feasibility and market take-up of technologies and solutions. They do this on a small scale and with relatively small investment. An operator expects to achieve the most extensive coverage for the lowest possible deployment cost. ElasticNet OAM can be completely integrated with ZTE's SDN controllers to lower deployment cost and ensure proper functioning. As network grows, all but the service and support functions in ElasticNet OAM can be integrated into NetNumen U31 in order to implement the EMS function for SDN domains. In addition, nodes can be added to support horizontal expansion and large-scale networks.

Flatness

Flatness reduces network complexity. As a flat network management system, ElasticNet can reduce OAM complexity and difficulty. With elasticity and flexible module combining, ElasticNet OAM can integrate multiple systems on a single EMS layer. If controllers need to be deployed at different layers, the controllers can be cascaded. ElasticNet OAM provides strong support for controllers at the upper and lower layers because of the flexible deployment of function modules.

Unified Network Management

ZTE was the first in the industry to facilitate unified network management and has implemented comprehensive data analysis and end-to-end operations across multiple network fields. ElasticNet OAM is used to manage any combination of SDNs, traditional core networks, IT infrastructure, and bearer networks in a unified way and in numerous scenarios.

Various External Interfaces

ElasticNet OAM supports different kinds of external interfaces. Northbound interfaces include REST, which is compatible with the ODL, as well as the widely used SNMP, FTP, and CORBA interfaces, which are supported by NetNumen U31. Southbound interfaces support Netconf, SNMP, OVSDB and other devices on the forwarding plane.

Virtual Data Center Scenario

ElasticNet OAM enables unified management of the control and forwarding planes in an SDN-only virtual data center and can be connected to traditional data communication devices in the Overlay environment. ElasticNet OAM can be connected to traditional forwarding plane devices by transparent transmission and can be integrated with the forwarding plane network management system of NetNumen U31 for unified network management. Furthermore, ElasticNet OAM, virtual computing system and virtual storage management system can be connected to ZTE's intelligent data center management system to form a ZTE virtual data center network management solution.

Bearer Network Scenario

ElasticNet OAM supports unified management of devices on the forwarding planes of the SPTN or traditional PTN. When part of a controller, ElasticNet OAM can be connected to a traditional PTN through NetNumen U31 so that the controller can manage the traditional PTN devices. ElasticNet OAM also supports controller cascading for end-to-end service management in both the intra-domain and inter-domain.

ZTE draws on almost 30 years of technical experience in network development to propose ElasticNet OAM, a solution used to build highly collaborative, customized, flexible next-generation networks in the era of cloud computing and big data. ZTE TECHNOLOGIES

Mobile OAM

Improves On-Site OAM Efficiency and Quality

By Zhang Yipeng

On-site OAM encompasses base station patrols; fault repair; emergency power generation; line inspection; optical fiber cable welding; and installation, removal, relocation, and maintenance of fixed-line broadband. Traditional on-site OAM is low-tech, labor-intensive, and focused on network resources. It determines overall network stability and customer experience; therefore, the quality of on-site OAM is vital to an operator. Because on-site OAM is so important in increasingly complex networks, operators are spending more and more on opex. In the 4G era, changes in network architecture and service models have created many new challenges for on-site OAM. What is the current status of on-site OAM and how should we handle these new challenges?

On-Site OAM: Status and Challenges

There are currently two OAM models: self-maintenance and OAM hosting. Both have the following problems:

- extensive personnel management. On-site OAM is labor-intensive, sometimes involving a large number of OAM personnel who are dispersed and have varying technical skills. It can be difficult to supervise and assess the performance of on-site OAM personnel.
- hard-to-regulate OAM process. Management personnel often fail to monitor on-site OAM processes, keep up with the progress of numerous work orders in real time, or guarantee that tasks are completed on time.
- poor asset management. On-site OAM involves numerous objects of different types. It is easy to lose track of spare parts and materials, and this makes it more difficult to manage assets and expenditure.
- shortage of efficient OAM tools. Traditional OAM lacks unified tools. Work order dispatching is recorded manually and reported via phone calls

and SMS. Thus, reporting may be time consuming, and statistics may be outdated.

ZTE Launches Mobile OAM

The mobile internet has brought to users various new services and experiences. Will its openness inspire network OAM? ZTE has introduced mobile internet to OAM by developing mobile OAM app tools that can be used to solve on-site OAM problems. ZTE analyzed traditional on-site OAM and consulted operators about their specific OAM needs. ZTE then deployed an OAM system and mobile app that can be used together to change organizational structure, improve work process, and optimize human resources (Fig. 1). The mobile OAM service helps operators improve on-site OAM, reduce OAM costs, boost OAM efficiency and quality, and increase user satisfaction.

On-site OAM personnel can use mobile OAM terminals to handle tasks online, obtain information, and report progress anytime, anywhere. Personnel can schedule tasks, manage other personnel, control quality, and report statistics using the mobile OAM system. By analyzing data across the entire OAM process, personnel can also locate weak points and continuously improve quality and efficiency (Fig. 2).

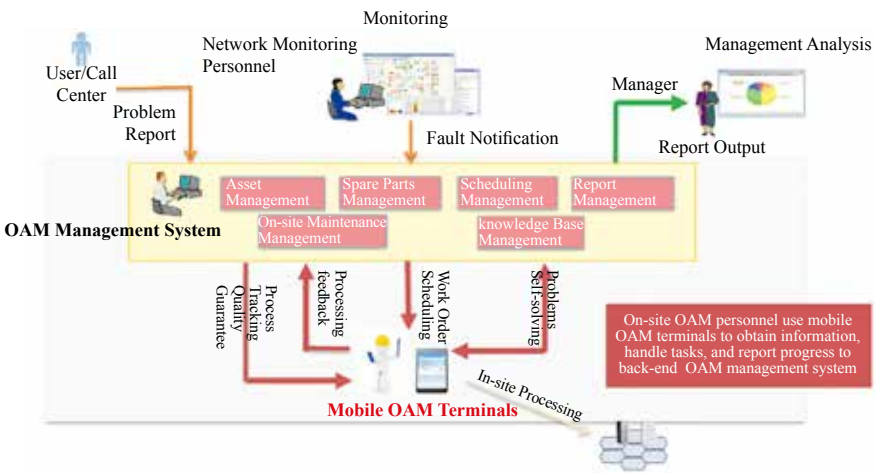


Figure 1. Mobile OAM management service processes.

Scheduling Management: Improving Task Scheduling Efficiency

Work orders are automatically associated with the SLA in order to meet deadlines. There are a number of different ways of scheduling work orders. For example, work orders can be dispatched to the nearest OAM personnel to optimize scheduling and improve efficiency. Shift management also guarantees seamless handover, clear responsibility, and continuous work.

Process Management: Ensuring Task Execution Quality

Visualized on-site management involves on-site OAM personnel using mobile OAM terminals to report on-site handling progress in real time. Scheduling managers can then obtain on-site information in a timely manner.

Automated inspection management is guided inspection management. Inspection personnel follow the requirements specified in the work orders on their mobile terminals and complete tasks. In addition, the inspection processes are recorded on mobile OAM terminals without the need for any paperwork.

Refueling process management involves determining the fuel capacity and oil consumption of oil engines, manage the refueling process, and controlling related costs.

Site security personnel can use mobile OAM terminals while on patrol to increase site security.

Comprehensive Management for Continuous Improvement

Data statistics and reports can be customized. The data generated during OAM is recorded through mobile OAM terminals. Data analysis helps OAM teams improve KPIs, optimize OAM processes, close network vulnerabilities, and optimally allocate human resources.

The routine activities of OAM

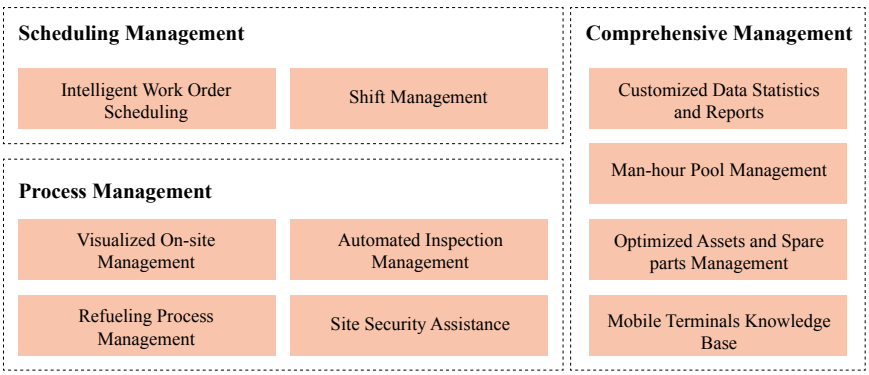


Figure 2. Mobile OAM management service contents.

personnel are also recorded on mobile terminals. This data can be used to analyze performance, create effective assessment systems, and bolster enthusiasm and efficiency.

All assets and spare parts are managed electronically. Asset lifecycle management is supported. Bar code and QR code systems make managing assets and spare parts easier.

On-site maintenance personnel have round-the-clock access to a knowledge base so that they can handle difficult problems by themselves. This reduces dependence on back-end technical support.

Mobile OAM Management Service Improves On-Site OAM Quality and Efficiency

Improving On-Site OAM Management

Mobile OAM enables end-to-end electronic processing of on-site OAM as well as end-to-end tracking of fault work orders. In addition, it integrates the geographic information system (GIS) to visualize the OAM personnel's locations and status. The photographing and dotting function of mobile OAM terminals enables the maintenance process and results transparent. The bar code and QR code systems increase data entry query efficiency and accuracy.

Enhancing OAM Personnel Efficiency

On-site OAM personnel can access the OAM system through mobile terminals anytime, anywhere to handle OAM tasks. Application of terminal OAM experience and knowledge base lowers the skill requirements of maintenance personnel and reduces the need for back-end technical support. Man-hour pool management is introduced to build an effective assessment mechanism and increase work efficiency. Graphical and multi-strategy scheduling enables flexible responses to emergency situations or multitasks to enhance staff scheduling efficiency.

Increasing Assets and Material Utilization

OAM assets are electronically managed so that they can be used optimally. With the assets OAM life cycle management, OAM personnel can be reminded to remove or replace relevant assets before expiration.

Optimizing OAM Process

By analyzing network performance indicators, fault work orders, assets, spare parts, and statistical data of OAM process, OAM teams can improve KPIs and optimize OAM process.

In the mobile internet era, operators have been creating new OAM models that integrate network maintenance management and local maintenance support. Centralized network monitoring enables the network management center to dispatch work orders to on-site OAM personnel when a fault occurs. This speeds up the troubleshooting response. The mobile OAM management service complements the intensive OAM system in on-site OAM. Mobile OAM strengthens OAM transformation and local maintenance support.

ZTE's managed service project team members

Telenor Pakistan Aces Its KPIs

By Chen Zhuqing and Suo Qiming

With 36 million subscribers and 7800 wireless base stations, Telenor Pakistan (TP) is the second largest operator in Pakistan. The biggest problems TP has faced in OAM and network development since 2005 are diesel major overhauling management, OPEX saving, and KPI improvement.

TP and ZTE signed an eight-year contract on multivendor managed services in 2012. The managed services provided by ZTE include first, second and third-line maintenance, site security, diesel management, spare parts management, and diesel generator repair for major and auxiliary network devices. ZTE has provided TP with quick, agile, professional service management, and as a result, TP has experienced the second highest monthly subscriber growth in Pakistan. The percentage of subscribers increased from 24% to 25%. In 2014, TP topped the ranking based on KPI evaluation in Pakistan (Fig. 1).

Save the OPEX on Fueling: Addressing Energy Consumption through Process Optimization and IT Tools

Various economic and social factors cause, on average, about 12 hours of power outage per day across Pakistan. In summer, this average can even exceed 17 hours per day. To ensure stable

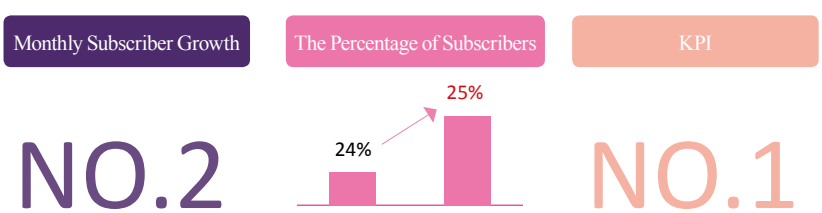


Figure 1. TP's subscriber growth and ranking based on KPI evaluation.

"I am very pleased to report that we saw excellent planning and execution from the managed services engineers and technicians. The RAN outage has been at its lowest ever and customers are now getting improved experience," said Telenor Pakistan CTO Khurrum Ashfaque.

network operation, diesel generators are used, and diesel consumption accounts for a high percentage of OPEX. Diesel theft is a serious problem in poor and undeveloped areas. Some subcontractors in the local telecom market even steal diesel for profit. Energy management has therefore become a prime concern for operators in Pakistan.

ZTE has used IT tools to optimize diesel management processes and implement closed-loop control. This has fundamentally changed the way TP manages its diesel and has helped prevent diesel theft.

Strengthening Diesel Refueling Planning, Management and Review

A diesel refueling plan has been developed to suit the specific power outage cycle. To prevent diesel oversupply, more diesel is supplied when there are more power outages, and diesel supply is cut back when there are fewer power outages. This reduces the need to visit sites and frequently refuel diesel tanks. Most importantly, this makes diesel management transparent, and the root cause of diesel oversupply can be easily identified.

Optimizing Management through IT Tools

Previously, on-site diesel attendants wrote up diesel refueling reports. These reports were manually collected, processed, and reported by security subcontractors on a monthly basis. This meant that diesel refueling statistics were often outdated, and it also left room for diesel attendants and security subcontractors to fake reports. After TP's managed services were handed over to ZTE, a network operations

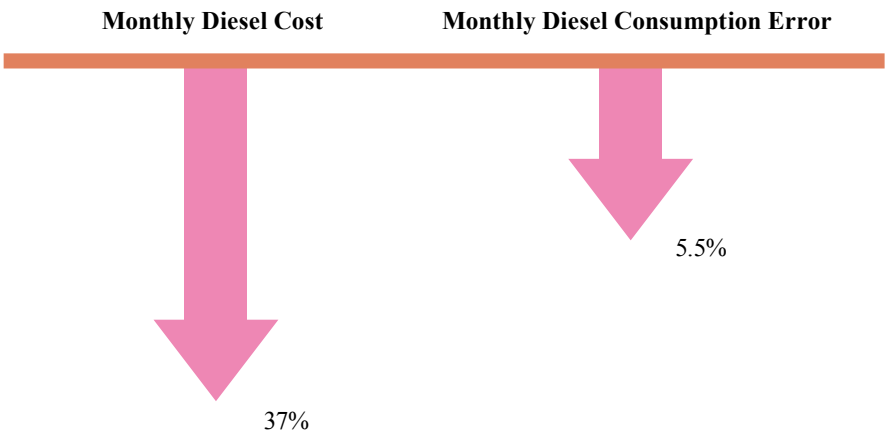


Figure 2. Effective diesel management.

center (NOC) was established. The NOC provides a daily report used to track diesel usage. ZTE has also developed a custom-made diesel management system that requires on-site diesel attendants to report site visit time, refueling time, and amount of diesel used for refueling. The NOC can retrieve data from the management system on a daily basis in order to track diesel usage in real time.

Managing the Whole Process of Diesel Refueling

A joint project review team includes members from TP's project team, personnel from ZTE's OAM team, and supervisors from security subcontractors. This review team periodically inspects diesel usage, transportation, refueling, and FSR signing.

One year on, PT's diesel is being well controlled. TP's monthly diesel consumption error has decreased from 11.1% to 5.5%, and monthly diesel cost has decreased 37% (Fig. 2).

Improve KPIs: Best Ever KPIs Resulting from Quick, Agile, and Professional Project Management

TP's long-standing network performance problems were caused by a few main factors. One factor was TP's network itself, and the other factors were environmental and cultural. There are places where transportation is difficult, tribes are divided, and there is a short supply of diesel and serious security issues. Even local people are not willing to visit certain places at night. This is a big obstacle for network OAM. After taking over TP's managed services, ZTE has greatly improved network performance beyond expectations with its professional project management, quick and agile service response, and multidimensional OAM optimization.

Optimize Network Performance for Agile Response

TP and ZTE have analyzed KPIs on a monthly basis and have monthly strategy meetings. Special project rooms have been set up to enable TP project staff, security subcontractors, and front-line maintenance subcontractors to work together to quickly solve problems. Joint site visits can be arranged to address difficult problems on site.

Optimizing Subcontractor Management

Subcontractors are being more thoroughly managed so that both TP and ZTE know the subcontractor's organizational structure, internal operations, human resources, and ability to provide spare parts. This ensures that subcontractors are well stocked and prepared and can better control their resources. Site inspections are also more thorough to raise the quality awareness of subcontractors.

Solving Severe KPI Problems

Diesel generators account for more than 90% of power supply in TP's existing network, and most of these generators are severely aging. Diesel generator failure is the primary reason that TP was not previously meeting its KPIs. ZTE chose appropriate diesel generator repair subcontractors and strictly controlled repair quality. This not only ensured smooth operation of diesel generators but also paved the way for stable network operation.

Placing Strict Quality Requirements on Demo Sites

Strict quality requirements have been placed on demo sites. One or two demo sites are set up each day to improve the OAM capabilities of subcontractors.

As of August 2014, TP's network KPIs have exceeded target values for ten straight months. According to *Annual Cellular Subscribers (2013),* released by the Ministry of Communications of Pakistan, TP experienced the second highest monthly subscriber growth over a two-year period. TP had 35 million subscribers, a market share of 25.15%. They are second only to Mobilink, which has a market share of 29%. TP now operates the best wireless network in Pakistan and is meeting its KPIs. ZTE TECHNOLOGIES

Wuxi Telecom Trials LTE Evolved Multimedia Broadcast Multicast Service

By Zhang Baoya

Mobile operators across the world are striving to deploy LTE networks. Compared with 2G and 3G networks, LTE networks carry higher bandwidth voice, data, and video services and are favored by mobile operators.

With the increased popularity of smart terminals, mobile broadband applications have developed rapidly, and mobile videos are attracting attention within the mobile industry. Point-to-multipoint (P-T-MP) communication is considered the best way to carry video, and 3GPP has specified the standards for LTE evolved multimedia broadcast multicast service (LTE eMBMS). LTE eMBMS has high bandwidth and low latency, and it is based entirely on IP. Therefore, it can flexibly multicast and broadcast mobile videos. As LTE networks are deployed more widely, the related eMBMS environment is maturing, and eMBMS is becoming the new hot area in mobile services. In 2014, China Telecom obtained a commercial license for TDD-LTE and a commercial trial license for FDD-LTE. China Telecom's LTE networks have been deployed on a large scale. Some operators are turning their attention to feature video services (such as eMBMS) based on their traditional unicast services. At present, these traditional unicast services are dominated by voice and data.

Wuxi Telecom has trialed eMBMS in a college town in Wuxi, China. The IP RAN transmission network carries both multicast voice and data and has ZTE equipment on a layer-2 metropolitan area network (L2 MAN). The LTE core network is located in Nanjing city, and

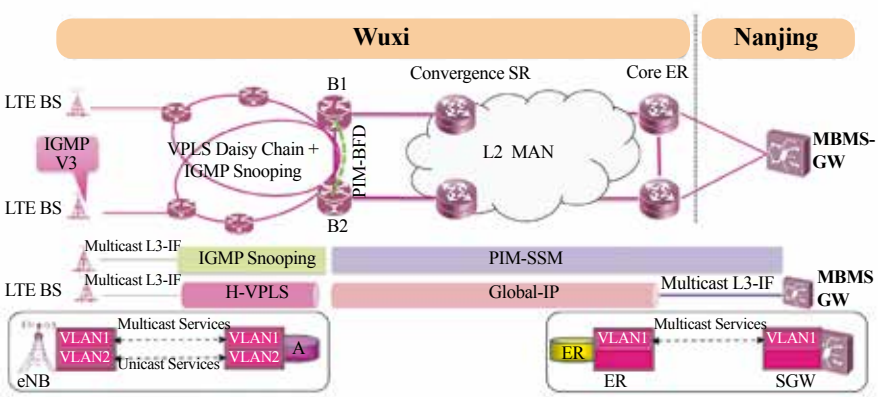


Figure 1. Commercial trial solution for Wuxi Telecom's eMBMS.

LTE unicast services are delivered through CN2. To enable eMBMS, multicast channels are established between MBMS-GW and LTE base stations. The MBMS-GW in Nanjing is connected to the IP RAN network in Wuxi via optical fiber. In this way, multicast services do not need to pass through CN2, and eMBMS only needs to be deployed on the local network, wireless base stations, and MBMS-GW (Fig. 1).

eMBMS deployments have the following features:

- A convergence core layer has protocol-independent multicast-source specific multicast (PIM-SSM) and enables PIM on the L2 MAN. This means that any point in the local network can access multicast services. With this mode, deployment of rendezvous points is avoided, which simplifies IP RAN configuration.
- An access layer multicasts data in H-VPLS daisy chain mode, so only one multicast traffic stream is transmitted on the access link (Fig. 2). This saves bandwidth for the access link.

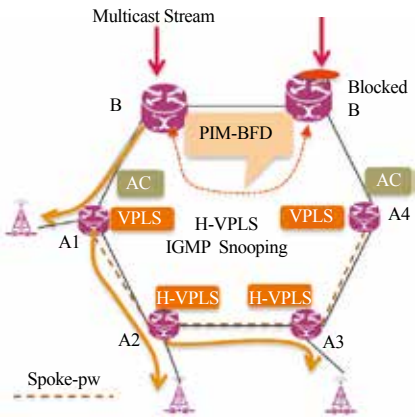


Figure 2. Daisy-chain deployment to improve multicast capability at the access layer.

- IGMP snooping layer-2 multicast is deployed on the access layer. As all base stations on the chain share one multicast gateway; therefore, it is not necessary to provide a separate network segment for each base station. This saves multicast IP addresses.
- Protocol independent multicast bidirectional forwarding detection (PIM-BFD) is deployed on the converged gateway B to improve reliability at the access layer and ensure that multicast services are converged in milliseconds (Fig. 3).

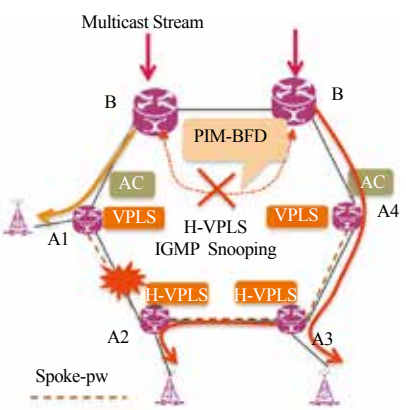


Figure 3. PIM-BFD deployment to improve reliability in multicast switching at the access layer.

- A base station is added into a multicast group through IGMPv3. Unicast data is separated from multicast data by a different VLAN sub-interface between the base station and access equipment.
- The M3/M2 interface shares the same channel with the S1-M interface; that is, the control signaling is carried by a unicast interface, and multicast services are not affected by routing on the control interface.
- The multicast interface on the base station carries only IGMP packets and multicast data streams but not M3/M2 control signaling.

Wuxi Telecom has adopted ZTE's multicast solution to carry eMBMS over its IP RAN. To date, Wuxi Telecom has launched eMBMS at Jiangnan University, Wuxi Business and Vocational School, and Wuxi Technology Institute (New District). On-site tests have shown that the network can deliver high-quality mobile videos, and IP RAN multicast services are reliable to a millisecond level.

ZTE has rich experience with IP RAN technology, solutions, product planning, and service deployment and maintenance. ZTE's IP RAN products support multicast technologies such as VLAN/VPLS, IGMP snooping, PIM-SM/DM, PIM-SSM, SSM-mapping, PIM-BFD, cross-domain multicast, MVPN multicast, P2MP LSP, and multicast filtering. ZTE has been a part of China Telecom's IPTV construction for years and has a deep understanding of multicast technologies. ZTE also has rich experience in project engineering and deployment. ZTE's IP RAN can help operators worldwide rapidly deploy LTE eMBMS. ZTE TECHNOLOGIES

Intelligent, Converged Bearer Networks

By Ding Wei

Converged Bearer Networks to Meet Diverse Demands

The service structure of telecommunications networks is undergoing big changes, and data is gradually becoming the dominant business. Emerging industries such as smart city, smart grid, M2M, and tri-network convergence are constantly improving, and new applications and services have appeared.

Large-granule services such as TV shopping, HD TV, online video, and high-speed internet are mushrooming, as are enterprise IP services such as IP SAN, multimedia conferencing, and broadband VPN. To develop new services, many countries have begun constructing national broadband networks with 100 Mbps as the starting speed. In many cases, this will gradually be increased to 1000 Mbps. With the rapid deployment of 3G, LTE, and mobile internet, legacy TDM (E1/STM-1) services in backhaul networks have been replaced by IP over FE/GE, and E1/STM-1 has been forced to coexist with FE/GE. The centralized deployment of wireless BBUs has also meant that a vast number of large-granule CPRI signals are being transported between BBUs and RRUs. Co-existence of services and high access bandwidth have become development trends in both fixed and mobile networks.

Emerging services such as financial disaster recovery, IP SAN, bandwidth leasing, and government and enterprise networking have new features and applications. A bearer network has to provide functions ranging from transparency to intelligence, and it

needs to support services ranging from regular Ethernet and GDPS to specific-rate videos and bear-all services.

OTN Solution for Different Scenarios

Full-Service Bearer Network for Operators

More and more operators are turning to full-service networks, so their bearer networks have to follow this trend. Full-service bearing greatly changes the bearer networks in fixed and mobile networks. Therefore, ZTE has launched a compact iOTN product called ZXMP M721 that meets the full-service-bearing needs of operators (Fig. 1).

Full-service bearing involves:

- xPON OLT/MSAG/MSAN uplink service bearing. xPON OLT can be connected to BRAS/SR on the uplink through a single-node or dual-node networking. Typical uplink service ports support 4GE to 8GE, and future uplink ports will support 10GE. New DSLAM is generally IP-DSLAM, and its typical uplink service is GE. Conventional ATM-DSLAM has an STM-1/STM4 interface. The typical uplink service of the MSAN equipment is GE/FE. ZXMP M721 provides high capacity and large bandwidth to reach the requirements of fixed networks for massive bandwidth.
- SDH network transformation. There are a large number of STM-1/4/16 SDH networks at the access layer. The growing bandwidth demand and accelerated IP-centered network construction is putting a strain on optical fiber resources so that existing SDH networks desperately need to be transformed. An OTN based on ZXMP M721 can bear the existing SDH networks. SDH occupies some wavelength of the OTN while releasing occupied optical fiber resources.
- PTN/IP RAN bearing. Similar to SDH networks, PTN/IP RANs occupy many fiber resources when they bear wireless backhaul network services. In a large-scale LTE deployment, fiber resources are strained. An OTN based on ZXMP M721 has sufficient wavelength to bear PTN/IP RAN services. In addition, the OTN based on ZXMP M721 supports 1588V2 and Sync E to meet the clock synchronization requirements of wireless bearing.
- wireless backhaul network bearing. The high-bandwidth backhaul and flat network structure are reasons that the OTN is used to bear backhaul traffic. OTN equipment is deployed at the base station side or at aggregated microwave sites. ZXMP M721 supports L2 functions, E1/T1, STM-1/4/16, FE and GE access, and 1588V2 and Sync E clock synchronization. This meets the bearing demands of backhaul.
- wireless fronthaul network bearing. 3G, LTE and BBU centralized deployment has become more mainstream. The high-speed CPRI signal between the BBU and RRU needs to be transmitted effectively. ZXMP M721 supports the mainstream applied CPRI option 2, 3, 6 and 7 to satisfy the stringent requirements of frequency accuracy and delay jitter. In addition, it can build a star network and ring

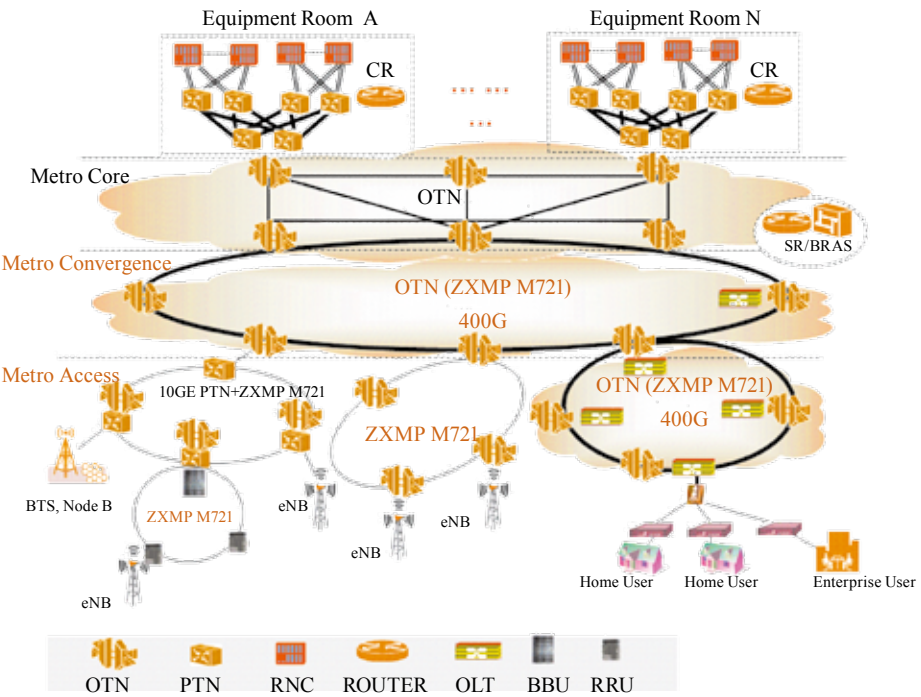


Figure 1. Full-service bearing.

A bearer network has to provide functions ranging from transparency to intelligence, and it needs to support services ranging from regular Ethernet and GDPS to specific-rate videos and bear-all services.

networks according to network deployment needs.

- broadcast. Broadcast services generally use L2 technology. However, with the demand for high-bandwidth and large-granule services, the use of OTN rigid bandwidth has been proposed. ZXMP M721 supports DSS distributed electrical cross-connection as well as ODUk granule-based broadcast.

Government and Enterprise Network Scenarios

Each government or enterprise network scenario has its own unique networking mode for specific needs. These needs include:

- disaster recovery. Finance, taxation, social security center and other institutions require very high data security. They generally transmit services via dedicated fiber channel switches. Remote disaster recovery is the mainstream security requirement. ZXMP M721 supports 1G/2G/4G/8G/10G FC, FICON and Infiniband services. A single-fiber bidirectional mode is usually used for networking, and the two systems operate in 1+1 backup mode.
- data center interconnection. Large internet companies and bandwidth leasing companies need large-granule data interactive transmission and disaster recovery between data centers. 10GE dominates their services. ZXMP M721 supports 40×10G DWDM application to transmit large-capacity data. Moreover, it supports AC and HVDC to make full use of the limited power supply in equipment rooms.

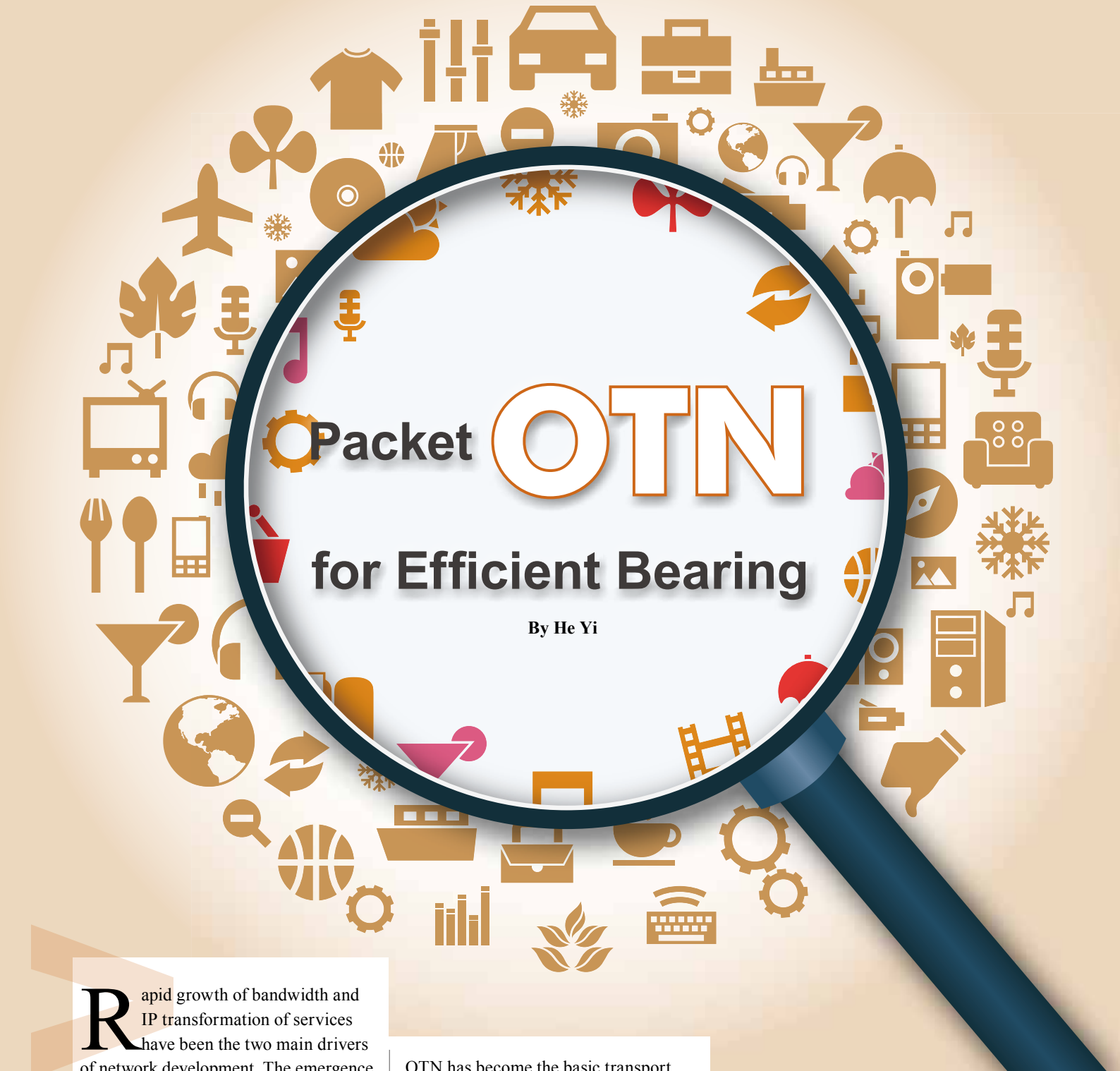
Industry-Leading Performance Indexes

ZXMP M721 has industry-leading performance indicators and has the following features:

- high integration. The subrack height is only 1U, 2U or 3U. It supports the industry's most effective service slots compared to the equal volume of similar devices.
- powerful transmission. It supports the 40×10G DWDM application or 18×2.5G/10×2.5G+8×10G CWDM application. DWDM supports multi-span radio relay (18×22 dB, 7×30 dB, 1×45 dB, etc.). CWDM 2.5G supports up to 28 dB transmission. The target transmission distance of CWDM 10G is 70 km.
- rich service access. It can access any-rate-service (100 Mbps~7.5 Gbps) signals in multiple formats and a variety of 10G services.
- flexible service grooming. It supports the ODU0/1/flex granule-based distributed electrical cross platform. It also supports L2 switching aggregation from 8×GE+2×10GE to 10GE.
- clock synchronization. It supports 1588V2 inband/outband transmission as well as Sync E.
- perfect protection. It supports 1+1 protection for the main control board and power board. In addition, it supports OCh 1+1, OMS1+1, ODUk 1+1, ESR and ERPS protection.
- excellent monitoring information transmission. It supports inband/outband monitoring as well as OSC and ESC.

As new services and applications emerge, service networks trends will change. The OTN bearer network plays an increasingly important role in converging all services, and all the more so for the OTN network closest to the client side.

As part of the ZTE iOTN product family, ZXMP M721 has an access/aggregation-layer network that can be connected to terminal networks. In the face of complex and diverse applications and networking requirements, ZXMP M721 provides unified bearing. What's more, it provides flat networking and confirms to the trend of converged bearer network. ZTE TECHNOLOGIES



Packet OTN for Efficient Bearing

By He Yi

Rapid growth of bandwidth and IP transformation of services have been the two main drivers of network development. The emergence and development of high-bandwidth data services has caused the transport network to evolve from TDM to WDM; from 2.5G and 10G to 100G; and from VC to ODUk switching. By combining the advantages of SDH and WDM, OTN provides huge bandwidth; quick, flexible service scheduling; and complete OAM functions. In the era of huge bandwidth, OTN has become the basic transport platform for multi-service. It has been widely deployed in trunk line networks and at the metro core network and aggregation layer. As large-bandwidth OLT fades away and large-granularity private line service emerges, compact OTN is being deployed at the access layer. IP transformation of services has meant that the focus of OTN bearing is packet services. OTN mainly carries interconnection services between routers, OLT uplink services of the fixed-line broadband network, and large-granularity private-line packet services. The physical interfaces of these services are Ethernet of various rates. Efficient bearing of packet services is the new hot

topic in OTN.

Operators have to invest in their networks in order to increase bandwidth; however, revenue from large bandwidth services is declining. This problem is plaguing operators. A key concern of operators is how to efficiently use network bandwidth to handle large volumes of traffic and increase the intelligence of channels.

As the basic platform of the transport network, traditional OTN provides a rigid channel that carries packet services that may not occupy all the bandwidth. This is inefficient. Packet OTN optimizes packet transport, provides some new packet functions in OTN, and increases efficiency across the whole bearer network. It packet services with high port bandwidth utilization ensures efficient pass-through in fixed-line broadband uplink. Packet services with low bandwidth utilization can improve bearing efficiency by adopting statistical multiplexing. Expensive core routers are overburdened by huge bandwidth, and most services are only forwarded. However, these services can be bypassed at the optical layer to improve overall efficiency. With the development of mobile internet, the rise of the content providers, and the emergence of virtual network operators, high value-added private line services have gradually become important revenue sources for operators. Bearing private lines in OTN can simplify the network layer and speed up service provisioning time. This helps an operator stay ahead of the competition.

There is a consensus within the telecom industry about the benefits of enhanced packet service in OTN, and mainstream equipment providers have already released OTN pocket equipment for all parts of the network.

Packet OTN

There are two types of packet implementation in OTN: 1) adding a service card that supports packet switching and processing to the existing OTN equipment, and 2) providing a centralized packet switching plane in OTN. With the former, the packet switching matrix is built on the traffic board so that the matrix can only be implemented on the board. With the latter, packet switching between cross-service boards is made more flexible.

A board-level packet OTN may have separate branch lines or integrated branch lines. With separate branch lines, packet services can be encapsulated into ODUk or ODUflex upon completion of packet processing and switching. Packet services then enter the OTN cross-connect matrix. With integrated branch lines, packet services can be encapsulated into OTUk upon completion of packet processing. Packet services are then transmitted through the line.

Board-level packet OTN with separate branch lines is used in compact OTN equipment and is widely applied at the aggregation and access layers in metro areas. This enables flexibility through OTN cross-connect, and it also enables smooth upgrading. Packet boards can easily be added to OTN equipment in the existing network. Packet OTN strikes a balance between increased packet flexibility and protecting investment in the existing network.

The existing OTN can be upgraded to packet OTN by taking a dual-plane approach, which involves two independent cross-connect matrixes for one device. This increases cost and power consumption, and cross-connect boards need to be replaced. Therefore, universal cell switching is the mainstream technology for implementing packet OTN. All of the standout OTN products from equipment providers are based on universal cell switching. Universal cell switching is also defined in ODUk over packet fabric (OPF) protocol of OIF. The core of this technology is a universal cell-switching matrix. Services such as ODUk and packets are sliced into cells on the traffic boards. These cells enter the universal

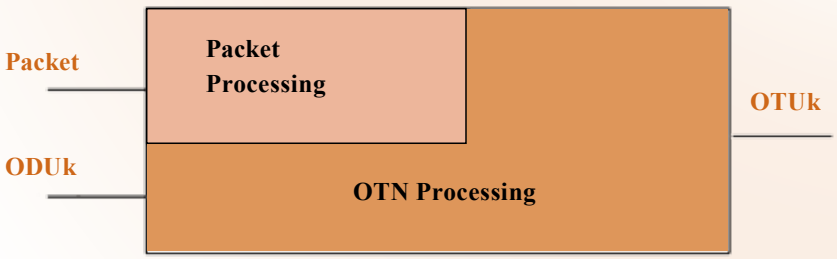


Figure 1. Hybrid line boards.

cell-switching matrix, get switched to line side boards, are encapsulated into OTUk, and are transmitted through the line. With OPF, OTN equipment can more flexibly switch large-capacity packet services and can switch services of any size from packet to OTN.

Hybrid line boards for both packet and OTN processing are used in the packet OTN application (Fig. 1). Packet service and OTN service are aggregated on one line board for hybrid transmission. This significantly improves OTN bandwidth utilization, reduces line-side board types, and simplifies OAM.

Packet OTN Applications

Packet OTN can be implemented in any scenario where traditional OTN is used (Fig. 2). When packet OTN is deployed in the network, an operator can select service bearing or transport mode depending on service needs. At the backbone core layer, OTN pass-through or OTN packet processing can be selected according to the router load to bypass traffic for router interconnection services. At the core and aggregation layers, OTN pass-through or OTN packet processing can be selected according to broadband network traffic so that bandwidth is converged and ports are converted. For private line service, OTN pass-through or OTN packet processing can be selected according to service level, service granularity, or bandwidth utilization. For mobile backhaul service, OTN pass-through or OTN packet can be used to ensure interoperability with PTN, IPRAN, and MSTP in the existing network. This guarantees good end-to-end service performance.

As the basic platform of the transport network, the main function of OTN is to bear multiple services. By introducing packet processing into OTN, packet services can be processed more flexibly and efficiently, and efficiency can be increased across the whole network.

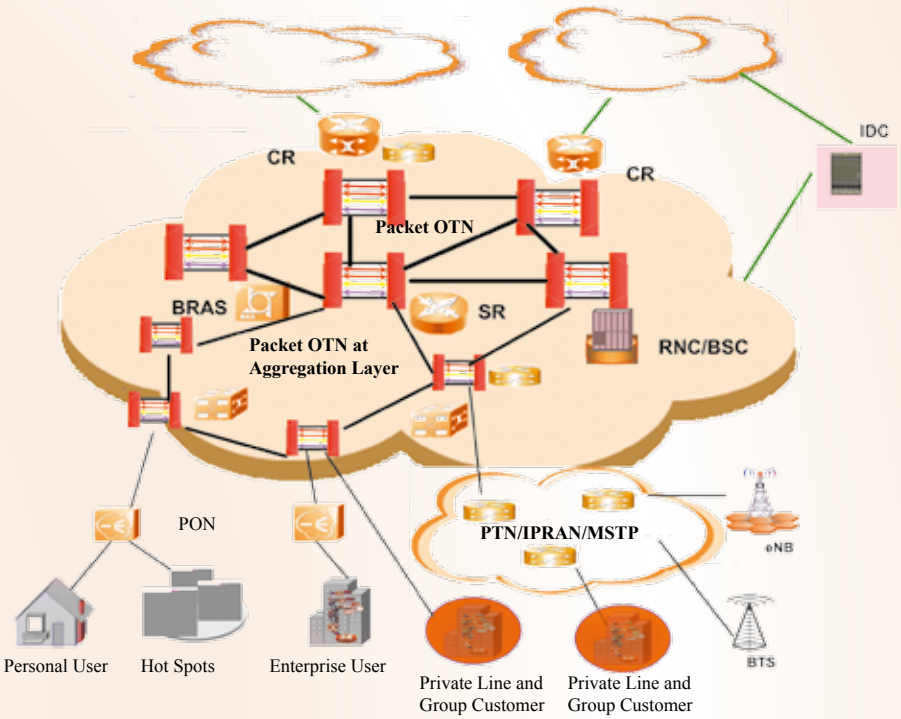


Figure 2. Packet OTN application.

Evolution and Deployment of Packet OTN

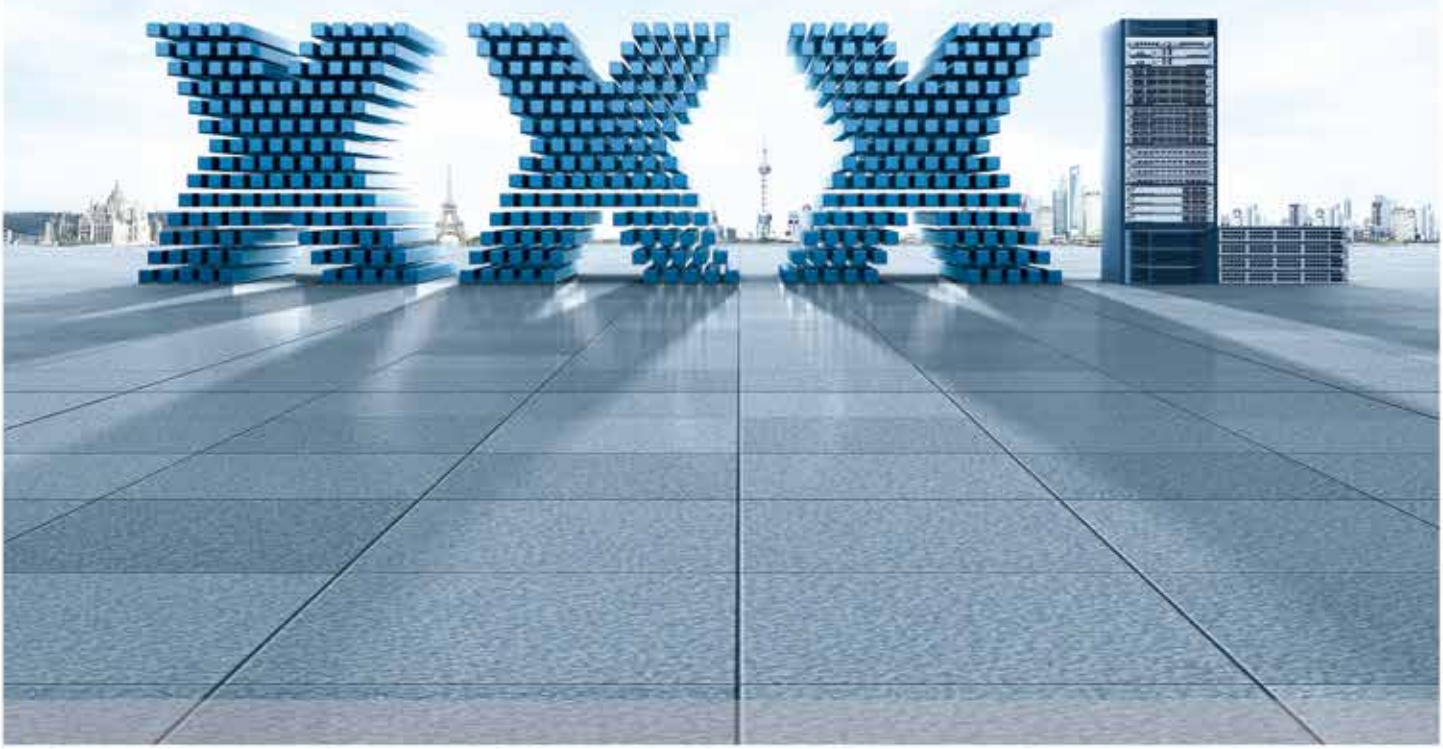
Different packet OTN technologies have their own pros and cons in a newly built network or in an evolved existing network.

A large amount of OTN equipment based on timeslot cross-connect has been deployed in existing networks. Such equipment can easily support OTN functions through the addition of packet boards to the OTN in the existing network. This upgrade is an efficient way of supporting router bypass and broadband uplink. In a newly built OTN network, OTN equipment with universal cell switching can be used. If packet OTN is needed in the future, packet boards or hybrid line boards can be added so that the network supports various packet application scenarios.

At the backbone core layer in a newly built packet OTN, packet OTN equipment with universal cell switching can be used for large-capacity packet processing. At the edge access layer, board-level compact packet OTN equipment can be used to provide low-cost, energy-efficient solutions. ZTE TECHNOLOGIES

VIRTUALIZATION IS NOTHING WITHOUT POWER

Getting More from the Unprecedented Capability of 204.8T



ZTE's BigMatrix portfolio is the next-generation switching fabric designed to meet the challenges of big data. Based on industry-leading "MACSec+" technology, ZTE has constructed a suite of industry-leading, large capacity switching products.

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