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VIP Voices

Vodafone Ukraine: Becoming Truly Customer-Centric

Tech Forum

Opportunities and Challenges in Network Transformation

Special Topic: Cloudization

Cloudization and Cloud Native: An Inevitable Road to Deepening Telecom Transformation

Olga Ustynova, CEO of Vodafone Ukraine

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Editorial Director: Liu Yang

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Circulation Manager: Wang Pingping

Editorial Office

Address: NO. 55, Hi-tech Road South, Shenzhen, P.R.China

Postcode: 518075

Tel: +86-755-26775211

Fax: +86-755-26775217

Website: www.zte.com.cn/en/about/publications

Email: yue.lihua@zte.com.cn



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

ZTE Wins Turksat Digital Hybrid STB Contract

27 June 2017, Shanghai, China — ZTE announced that it has won its bid to provide a digital hybrid set-top-box (STB) solution for Turkey's direct-to-home (DTH) and cable operator, Turksat. The contract was confirmed prior to MWC Shanghai 2017 and ZTE is now due to start providing its stable and high performance digital video broadcasting-cable and over-the-top (DVB-C + OTT) hybrid STBs.

Turksat is one of the world's leading DTH and cable operators, providing its customers across Asia and Europe with a full series of services including, but not limited to: voice, internet, TV and radio. It has more than 1.5 million TV subscribers in Turkey alone.

Turksat is purchasing DVB + OTT hybrid STBs for the first time in order to provide stable DVB services and interactive OTT services for its end users. ZTE will help Turksat develop the region's digital TV industry and provide a clearer and more reliable video experience. The large-scale commercial use of ZTE STBs in Turkey will accelerate the development of digital terrestrial TV. Through this cooperation with Turksat, ZTE is able to offer its world leading products and services to families in Turkey.



NetCologne and ZTE Present G.fast@212MHz Angacom

1 June 2017, Cologne/Germany — ZTE and NetCologne GmbH, a leading regional network operator in the great Cologne-Bonn area, jointly announced the G.fast@212MHz profile ultra-broadband solution at Germany's largest broadband exhibition Angacom in Cologne. In the world's first demonstration of G.fast@212MHz being tested over a real network, ZTE and NetCologne showcased the access rate profile of G.fast@212MHz reaching more than 1.8 Gbps (the download rate is over 1.6 Gbps and the upload rate is about 0.2 Gbps). ZTE's G.fast solution will enable NetCologne's FTTB-access network to enter the Gigabit era.

NetCologne is committed to providing the city of Cologne and associated regions with reliable and

future-proof telecom services. It has its own four high-performance data centres and its service portfolio ranges from voice and data services to the distribution of TV services, for both residential and business users, as well as leading business ICT solutions.

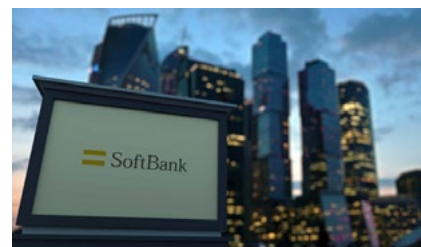
NetCologne and ZTE signed the agreement for this strategic partnership in February 2017. The terms of the agreement say that ZTE will provide NetCologne with advanced network equipment including G.fast distribution point units (DPUs) and terminals. The multiports G.fast DPU supports G.fast@212MHz and flexible uplink selection among PON/P2P/DSL technologies.

ZTE and SoftBank Announce 5G Trial in Tokyo

13 June 2017, Shenzhen, China — ZTE announced it has signed an agreement with SoftBank for a 5G trial over sub-6 GHz spectrum at 4.5 GHz across metropolitan areas in Tokyo.

For this trial, ZTE will provide state-of-the-art 5G end-to-end network solutions and will work together with SoftBank to verify

the performance of 5G technologies under real world conditions.



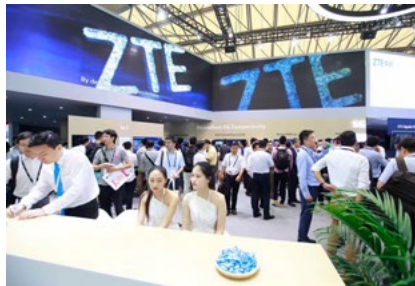
ZTE Unveils Carrier DevOps Builder 2.0 to Accelerate Network Innovations

28 June 2017, Shanghai, China — ZTE unveiled its Carrier DevOps Builder 2.0 solution and demonstrated how customized network slicing can help operators build more powerful and open networks.

ZTE's Carrier DevOps Builder 2.0 uses enhanced carrier-grade Docker container technology to issue thousands of editable end-to-end plug-and-play customized 5G slicing services, to achieve fast network slice customization through a friendly graphical interface. The 2.0 version, unveiled at the MWC Shanghai, is an upgrade of ZTE's pioneering Cloud Native Carrier DevOps Builder, the first such commercially-available solution in the telecom industry globally.

DevOps originally is the concept of industrial production chain in the

IT field, the general designation of a group of processes, methods and systems. Its advantage is that the development and operation will be closely integrated together to promote the on time delivery of new software features and services. This concept played a key role in the development of ZTE's Carrier DevOps Builder 2.0, which is designed to support the high availability and reliability requirements of telecom networks.



ZTE and Ncell Axiata Strengthen Collaboration on Network Virtualization

3 July 2017, Shenzhen, China — ZTE is strengthening collaboration with Ncell Axiata in the field of network virtualization.

Ncell Axiata, an Axiata company in Nepal will leverage ZTE's industry-leading network virtualization technologies to develop a virtual subscriber data management (vSDM) platform. Ncell Axiata's vSDM platform features the latest virtualization technology, advanced distributed architecture, hierarchical storage and multi-

level protection, as well as cloud. With the implementation of the vSDM platform, Ncell Axiata's SDM platform has evolved from a traditional advanced telecom computing architecture (ATCA) to a virtualized architecture seamlessly. This allows Ncell Axiata to increase cost savings on hardware investment and operations, and establish a more intelligent and flexible telecom network with high stability. The vSDM platform also helps accelerate new task deployment and enhances user experience.

ZTE Joins the Big Ride for Africa 2017



June 20 2017, Cologne, Germany — ZTE Benelux took part in Liberty Global's "Big Ride for Africa", a charity cycling tour to raise awareness and funds for Lessons for Life, a charity that funds education projects in some of the toughest parts of the world.

Liberty Global, the world's largest international TV and broadband company, helped established Lessons for life in 2007. Each year, Lessons for Life organizes a charity bike ride to Amsterdam. The participants come from Liberty Global's subsidiaries and suppliers.

This was the first time that ZTE participated in this event. In 2016, Liberty Global's majority-owned Belgian affiliate Telenet and ZTE signed a network modernization deal.

"We and Telenet share a core value in giving back to society, and will deepen our cooperation in the future," said Patric Bin, ZTE Benelux's CEO.

Vodafone Ukraine: Becoming Truly Customer-Centric

Reporter: Liu Yang



Olga Ustynova, CEO of Vodafone Ukraine

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ZTE

In a partnership agreement between MTS and Vodafone, MTS Ukraine is operating under the Vodafone brand. As Ukraine moves to 3G, the company is speeding up the process by utilizing Vodafone's extensive 3G experience. According to Olga Ustynova, CEO of Vodafone Ukraine, the branding deal has not only improved the network but has also changed culture, behavior and people. Her business philosophy is to make both the customers and employees happy.

Could you tell us about your experience at MTS and what has led you to become CEO of Vodafone Ukraine?

I have been working in the telecom industry for more than 20 years. Telecom is my life. I worked as a leader of the Kyiv area office of MTS Ukraine for four years, and then managed the Far East macro-region of MTS for one year. If someone had told me five years ago that I would go to the Far East and then become a CEO, I would have just laughed. But this is what happened. When I realize the excellent potential I have and feel I am quite a genius amongst peers, then at some point, eventually, I reach my ambitions and then the career development stops. What a pleasure it is to realize that your ceiling is someone else's floor! When I start feeling comfortable, I try to leave my comfort zone and try new things. Even my parents sometimes hardly understand the things I do.

How would you describe the Ukraine market and your position in it? What unique dynamics do you see in Ukraine's market?

Ukraine's market is very competitive with three major operators. We have just started construction of a 3G network because we didn't have any license for this before. We are No. 2 but we have huge ambitions to become No. 1 in Ukraine.

With 3G launch in Ukraine, we are now establishing a new phenomenon called app economy. In 2016, users spent nearly 900 billion hours on

their smartphones (analysis excluding China). This means that an average Android user devoted about two hours a day to apps. Vodafone is leading this trend in Europe, and now in Ukraine. Each of our customers has on average about 20 apps installed in his/her smartphone, including our own apps, such as Vodafone TV, Vodafone Music, Vodafone Books, Vodafone Pay mobile wallet and the most convenient self-service app—My Vodafone. Digital content is driving consumption and the industry in general. From December until February alone, the number of Vodafone TV subscribers grew by 1.5 times, and Vodafone Music, which was launched late in November, was downloaded over 50 thousand times.

What are your priorities now?

We are all changing our behavior because we are becoming Vodafone now. The client is central to all of our models. We create our network in European style. We have huge KPIs like those in European countries. We need to provide our customers with the best network at the highest speed. Also, we disrupt the market for roaming tariffs. In 2016, our tariffs for roaming decreased by 19 percent. We are the first in the market to provide unlimited calls abroad for a monthly payment. It has been very successful.

What transformation has taken place since you were rebranded to Vodafone Ukraine?

We are changing our brand in all our shops. It's also a change in culture, people and behavior. We've changed half of the employees in shops. It's absolutely a different logic. The strategy is to make services more open and friendly. We have special tables where you can experience Top 10 mobile phones before you buy one. Our staffs do not sit down at desks. They move around the shop and assist with contracts. We also make our processes faster and simpler. We take the best solution from Vodafone Group.

We are pushing everybody to provide themselves with services now. We believe that shops have to sell

and not provide services. If customers come to our shop and ask for services or complain, for me it means we have not done a good job. We are trying to understand each complaint. We don't have a target, for example, to solve complaints from customers within 24 hours. Our goal is that customers should have zero complaints. If you need support, you can use your smartphones to contact us via social networks like Facebook. We can give answers to any questions very quickly.

Where are you now in the process of digital transformation?

Going digital is not simply a strategy of our company. It's deep in our DNA. We use this term not only for new products—it is the foundation for all interaction inside the company. We have one of the most innovative headquarters in the country with cloud implementations based in our own data center. We switched to the electronic document management a long time ago, and customer relations are increasingly moving to digital channels as well.

How have you improved your 3G network and revenue?

One of the benefits of operating under the Vodafone brand is the new network and business standards. Thanks to our thorough network planning and the higher capacity of 3G network, we meet and even surpass the higher network quality requirements of Vodafone's international standards. The users respond right away with increased consumption. Traffic grows dramatically, along with data revenues—in Q4 2016 we generated 97% higher data income than that during the same period last year. We are the only operator on the market that has increased the OIBDA margin, both in Q4 2016 over Q3 2016 and in 2016 over 2015.



Is there any challenge in your 3G network deployment?

There are a lot of challenges. You know our country is late in technology. We have a very short time for construction. Of course, we are choosing partners that can support us and do the job well. We have to be fast in each question. ZTE supports us well. They solve our problems in a short time. I believe they work 24 hours. I don't understand how they can achieve such a job.

As I said before, we have a deal with Vodafone. They set us a target of network quality. Quality is very important for us. We adopt a different strategy for 3G. The other operators use the 2G/3G co-site



solution. They only have 2G base stations and just bring 3G inside. That's all. We bring an additional 30 percent of 3G base stations to create a wide coverage.

How about the smartphone penetration on your network?

The smartphone penetration now is just 40 percent. It means 60 percent of our customers cannot use data. It is also a challenge for us. Previously we sold mobile phones in chain stores. We've decided to sell smartphones ourselves. We'll even do it without any margin, just in order to get revenue from network usage. We will propose monthly payments to customers so that people will have the possibility of

paying a low monthly amount of money and changing their feature phones to smartphones. Meanwhile, each shop will create zones to show the opportunities people will get with smartphones. For example, they can use their smartphones to pay for electricity, control their financial account, watch TV programs and read books.

What comments do you have on your cooperation with ZTE?

Ukraine is still actively building the 3G network. In some regions, we are launching 3G in cooperation with ZTE. Considering very tight launch timelines and high expectations of our customers in terms of network quality, we are quite happy with our partnership with ZTE. We welcome ambitious market players, as this creates a healthy competitive environment, which ultimately brings value to our customers.

How would you describe ZTE as a partner? What's your expectation for future cooperation?

You know it's the first time that I cooperate with ZTE. In the beginning, I was very careful. My previous experience was with European vendors. We had worries such as "do you ensure good quality?", "if you have problems, how fast will you solve them?" and "what's your reaction in the case of complaints?" But when I came back from Russia and began to cooperate with ZTE, I was a little surprised because the quality is excellent.

In Ukraine, it's easy to change prices and quality but it is very hard to change the brand. We are pushing our technical guys to communicate more deeply with our vendors because if something happens, it is a problem for both the operator and the vendor. Now we have got good experience and we continue to negotiate with ZTE. This year we have decided to give ZTE a larger share of our network

project because we are satisfied by the results. If we compare our network with those of our competitors, I believe we are No. 1 in the market.

Where will the telecom market in Ukraine go in the future?

Although we still have weaknesses in technology we will enter the digital world very soon. The future telecoms will be smart operators that will invest not only in capacity and network but also produce certain special services for customers. This tendency is driven by the ideas such as “we need to increase our capacity, install more equipment and provide higher speed”. As for customers, they need new services, not just a higher quantity of services. We need to be very close to customers, understand them well, and provide them with special products, which they need even if they don't yet understand that they need them. We have to estimate what customers will require in two or three years. We will produce the future for them today.

What special services do you offer?

We are developing financial services. We provide customers with services like Wi-Fi calling. If a Wi-Fi network exists, you can use your mobile phone without additional check-in for Wi-Fi. It's useful in the 3G or LTE network. We also provide IoT tariffs for some products including security and charging. We try to understand the needs of customers and make offers to them in a very detailed way.

Could you tell us more about your IoT efforts?

We are already actively working with IoT. We have special solutions and plans, and not only for business purposes (financial and agricultural enterprises). This year, we have launched a plan for smart devices, which are taking over the mass

market. The alarms, heat and light control devices, kettles, and even toothbrushes are now connected. The smart devices are no longer a fantasy, but products you can order in online stores. The number of these devices in our network is growing daily. For these, we offer pre-paid plans, which are available across the Vodafone retail chain with no need for intermediary devices.

4G is developing fast and 5G is attracting great attention. What's your consideration for 4G and even 5G?

We are very close to implementing 4G in Ukraine. There is now a clear plan for 4G spectrum auction by the end of this year. The credit for this should be taken by both the regulator who has done a lot to resolve the operators' differences in terms of spectrum, and the operators who are ready for a compromise to make the next generation communications happen in our country. However, there are still issues in frequency price, simultaneous bidding for 1800 MHz and 2600 MHz, and implementing technology neutrality and frequency reforming.

Our network is ready for 4G. We are installing the 4G-ready base stations. Last year we successfully tested various solutions in several frequency bands with vendors, and fully switched to procurement of USIM cards that support 4G.

For 5G, we understand that the future is in the internet of things and virtual reality, and we have to prepare the network for the future if we decide to be No. 1. There are also a few issues to be addressed. The first one is the availability of the 5G spectrum. This issue has only been put forward, but not resolved on a global scale. The ITU expects this technology to be standardized by 2020. The second issue is the need for investments in network building. From a business point of view, the normal period for switching from one technology to another is four to five years. This is



Vodafone Ukraine's shops



the period over which investment in the network pays off and, consequently, the business can start investing in new technologies.

What's your vision for your company?

Vodafone Ukraine is primarily focused on our customers, both external—our subscribers, and internal—our employees. A successful business today is not just about money. The essence of today's business is love by customers and staff. This philosophy, still a little unusual for Ukraine, is standard in Europe. In the developed markets, this is called a customer-centric approach, and nowadays we are implementing it in Ukraine. It's reflected in many tiny details—no toxic services, no upselling, clear and simple plans, sincere willingness to help customers. And it already pays off. People feel how the company treats them and vote with their wallets.

We have strongly contested areas. I believe in big data and IoT. In the future traditional voice and data revenues will reduce. Only IoT and big data will help operators grow against that trend. Now we are trying to change our structure. We have to be agile. We have to provide our customers with a lot of new things and products.

Could you tell us about your customer-oriented approach?

In our company we are launching a special management team. We are checking in on processes to understand why there are complaints. There should be zero complaints. If you have such a team that takes all the complaints, divides the complaints by process and finds out from which process a complaint starts, the next time customers will not complain at least for the same question. It's our main goal for our job.

We have also decided that we should be a company that not only makes customers happy. Our employees have to be happy at the same time. It is impossible to make customers happy if our people are not happy. We try to keep a balance between customers and employees. If both of them are happy, it means we provide the best products in the market. A lot of companies just discuss about customers in their customer-oriented approach, we discuss about customers, both external and internal. My team is also my customers. I should understand all their needs. I believe if we understand them and make our services clear and simple to use, they will be more satisfied and loyal. Thus, we will have the best results in the world. **ZTE TECHNOLOGIES**

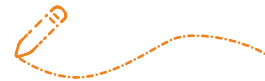


Libyana Outlines Vision for the Future

Reporter: Liu Yang

Mohamed Ibrahim Ben Ayad, CEO of Libyana Mobile Phone

“In 2004, Libyana and ZTE launched the success story together. ZTE is the main reason that makes Libyana lead in technology, get the revenues and become the No. 1 operator in Libya,” said Mohamed Ibrahim Ben Ayad, CEO of Libyana Mobile Phone.



Since Libyana Mobile Phone was introduced as the second mobile operator in 2004, Libya’s mobile penetration has skyrocketed. In an interview with *ZTE Technologies*, Mohamed Ibrahim Ben Ayad, CEO of Libyana Mobile Phone, talks about the company’s 2020 vision, plans and challenges, showing us how the operator is aspiring a big transformation in a rapidly evolving telecom sector.

Could you characterize the Libyan telecom market? How about the internet penetration in Libya?

The Libyan telecom market is divided into different levels. We have a holding company, which takes all the responsibilities of the telecom sector. It controls the major telecom companies. The telecom sector is still not yet privatized and liberalized. We have two mobile operators including Libyana, a fixed operator, an ISP and two MVNO companies related to different services. This is the whole picture of the telecom sector in Libya.

In 2004, the mobile penetration rate was 5%. We developed the telecom sector and tried to provide the best technology and the best services during the following 12 years. We have increased the mobile

penetration rate to 200 percent, which is reaching the highest level in Libya. It is now a saturated market, I can say. For the internet, the penetration rate in Libya is still low. Now we have increased the penetration rate at 1% in 2004 to up to 25%. I mentioned 2004 because 2004 was the year that Libyana became a commercial operator. With Libyana, the other ISPs and some small private ISP businesses in the market, we are reaching 25% penetration rate.

What is your plan to evolve your network?

We have a new plan in 2017, which is divided into two parts. The first part is that we are focusing on building our own network that will be the strongest and offer highest quality services so that we will be ready for the next digitalization of the market. 2017 is the year of preparation. Then it comes 2018. This is the starting year of changing the penetration rate of asymmetric voice and all the telecom services, which is not only about internet but also about internet of everything and machine-to-machine. Service promotion campaigns have to be done at the beginning of 2018. This is our plan for changing the market.



The overall strategy for Libya is different. We have been leading the market since we founded Libya in 2004. We are trying to lead the market so as to change the economy and develop the country. We made a plan called “3SC”, that is, to build a smart company, smart city and smart country by 2020.

How do you implement your vision?

We have built our own plan. The one-year plan for 2017 is to build the basic infrastructure. The second plan is a three-year plan, which we call three strategic plans (3SP). 3SC is the vision, and 3SP is the plan to implement that vision. There are two projects. The first project, which is the main project, is building the Libya data center. This could be the biggest data center in North Africa. The second project is to change the complete network to be HSPA+/LTE. With the cooperation

of our partners and city mayors, we are planning to implement a proof of concept for the smart city, for example, education, e-health, e-management, smart traffic management and traffic light management. Everything has to be studied as a proof of concept. We take samples from universities, schools, clinics and hospitals and traffic lights controlling the public security. Then, during the next couple of years, we will implement the whole concept starting from the capital city Tripoli and then move to the other cities. These are high-level projects to be done.

What main challenges do you see for carrying out your strategy?

One of the main challenges is the country situation. Different situations changing the political situation could a little bit delay implementing our strategy. But the country’s safety and security becomes much better. The improved country

situation could help us implement our strategy. The second challenge is building the fiber optic infrastructure, which is FTTx including fiber to the home and fiber to the site. These are the maximum challenges that can hold back our plan.

Are there any new business models under Libya's special situations?

Under today's situations, we still have the basic service business model, the normal business model for operators. We are now developing our billing system with ZTE. We upgrade the billing system so that we are capable of having the new business model. The new business model is a strategic business model. It is about customer orientation, centricity and loyalty. First, building customer loyalty and, second, building customer centricity. This is how all the new business models would be implemented for the customers.

What are the emerging markets you are focusing on?

It would be different if you look at the whole picture. For us as an operator, the emerging market is data services. This is the No. 1. If you look at the government, the city and the country, we think about mobile payment and bring in the concept of e-money. E-money is the first thing in terms of smart city and is part of our social responsibility to the city and the country. We try to learn our Libyan people, looking at how to use the e-banking system based on the e-money. This is one of our solutions to help the people and develop the economy.

Where do you see the Libyan telecom sector going in the future?

The operators in Libya are going to be more united. Today we have different operators and different companies. Every operator is doing some services. It is becoming outdated. We are looking at becoming an FMC operator. There will be two or three FMC

operators. The telecom sector is not to be privatized. We still have the capability to invest more and keep our own resources and revenues inside the country. However, the sector is to be more liberalized, and more flexibility will be given to the operators to enable FMC services. This is the target in the next couple of years.

What will be your role in the North African market?

Libyana led the technology a couple of years ago. In collaboration with ZTE, we became the first 3G operator in North Africa in 2005. Now we are trying to be the first 5G commercial operator in North Africa. So we are looking to be the leading African operator in terms of technology and revenue. Of course, it needs a couple of years. With our "3SP", I am sure that we will be one of the leaders in North Africa.

Could you review the partnership with ZTE? What are your expectations for the future cooperation?

It is a long-time partnership. In 2004, Libyana and ZTE launched the success story together. ZTE is the main reason that makes Libyana lead in technology, get the revenues and become the No. 1 operator in Libya. Also, we became the No.1 operator in Africa in 2005 because of ZTE's support all the time.

We are still expecting more from ZTE. We hope that ZTE can develop Libyana by providing top-quality services and the latest technology and can support our vision about the innovation center. We want to build an innovation center, which could be the first innovation center in North Africa. We are also expecting to build the first smart city in North Africa, possibly in cooperation with our main partner ZTE.

We keep working with ZTE to develop not only Libyana but also the telecom sector and the economy of the country, leading the country to become a state-of-the-art digitalized country. [ZTE TECHNOLOGIES](#)

Transforming Dhaka into a Smart City

Reporter: Zhang Ying



Khan Md. Rezaul Karim, secretary of Dhaka South City Corporation

Dhaka South City Corporation (DSCC) is one of the two municipal corporations in Dhaka, the capital of Bangladesh. As an autonomous local government body, it provides civic services to the residents. Recently, *ZTE Technologies* interviewed Khan Md. Rezaul Karim, secretary of Dhaka South City Corporation. He shared with

us the current status of smart city in Bangladesh, the challenges to deploy smart city in Bangladesh and plans for smart city construction. He also talked about his expectations for ZTE.

What is the current status of smart city in Bangladesh?

Hon'ble Prime Minister Sheikh Hasina has declared the vision Digital Bangladesh with the direct supervision of the Hon'ble ICT affairs advisor to the Hon'ble Prime Minister Mr. Sajeeb Wajed Joy. It is an integral part of the government's Vision 2021—which promises a prosperous and equitable middle-income Bangladesh by its golden jubilee of independence. Bangladesh is striving to establish Digital Bangladesh, and all the cities have to convert to smart cities. In terms of smart city, we are learning experience from other smart city cases and our partners, and we are adopting the smart city technologies, which can make life easier for our citizens.

Currently, Dhaka South City Corporation is committed to transforming Dhaka into a smart city. It means there will be improvements to our services, such as solid waste management, road-footpath-median, street lights, markets, traffic signals, parks, play grounds, graveyards-cemeteries, community centers, gymnasium, library, mosquito control, food



& sanitation, EPI & disinfection activities, city beautification activities. What's more, we are going to introduce some advanced technologies into all aspects of the city.

However, the growing population and transportation in Dhaka are major challenges for us, which make it difficult to build a smart city. Now, we are concerned about the traffic condition and are taking steps to reduce private transport.

As I know, there is a project named “Modernization of Rural and Urban Lives in Bangladesh through ICT”, which is being implemented by Bangladesh’s ICT Division. Could you expand on the importance of that project?

As we know, urbanization in Bangladesh is a growing phenomenon. Bangladesh has a population of about 110 million within a small area of 148,500 sq. kilometers. Approximately 25 percent of Bangladesh’s current population lives in urban areas. Of the urban population, more than half lives in the eight metropolitan cities/divisions: Dhaka, Chittagong, Khulna, Rajshahi, etc.

In my view, there are two reasons for urbanization. The first reason is that in Bangladesh, the agriculture sector is no longer able to absorb the surplus labor

force entering the economy every year, so people have to seek employment outside agriculture. The second one is about employment opportunities existing in the major cities. Most of the industrial enterprises and businesses are concentrated in the large cities.

Modernization of Rural and Urban Lives in Bangladesh through ICT is one of our major projects. It is surely very important. The aim of it is to reduce poverty and improve our lives, and ICT is increasingly recognized as a powerful instrument for promoting sustainable governance. In a word, we believe this project will make a change in Bangladesh, and we have taken some measures to improve infrastructure, health care sector, education and transportation.

Are there any challenges for deploying smart city in Bangladesh?

Yes, we face a number of specific challenges, but I think the major challenges are the following three.

The first challenge is financial mobilization. Smart city is not just about technology, but also about power, water, transportation, solid waste management and sewerage. It’s a long-term project that will need huge financial support. However,

like many cities, Dhaka has less budget and fewer resources to meet the growing needs of its large population. The Dhaka government won't be able to satisfy the finance requirements, so we have to take some measures to spur investment from other sectors.

The second challenge is poor infrastructure. The infrastructural development of Dhaka has lagged behind, and the condition of our infrastructure, such as streets, drainage system, IT facilities, health care systems and education facilities, is unsatisfying. A highly advanced infrastructure is necessary for creating smart city. We will try to build infra projects in the future.

The third challenge is about people's mindset. Creating a smart city is not only about creating the physical infrastructure—roads, clean water, power, and transport, but also about changing people's mindset. Some people are hesitating to accept modernization or smart city, so we need to do more publicity and make our people focus on this project. We have to make people believe that smart cities can create jobs, use resources wisely and develop the living standard of people.

In your view, what are the characteristics of a smart city?

Well, there are some differences from country to country, and civilization to civilization. For me, a smart city means an urban center which is safe, environmentally green and efficient. All utility services, such as power, water, electricity and transportation, are managed and maintained very well by using advanced technologies and networks. What's more, the products and services are integrated with computerized systems. Technology is changing the traditional ways of city development.

In my view, the characteristics of a smart city are: First, it needs a broadband infrastructure, which is widely available and affordable to all, including developed and undeveloped areas. Second, reduce congestion, air pollution and resource depletion, boost local economy, promote

interactions and ensure security. Third, apply smart solutions to infrastructure and services in area-based development in order to make them better. Fourth, preserve and develop open spaces, such as parks, playgrounds, and recreational spaces, to improve the quality of life of citizens. Fifth, promote a variety of transport options.

What are your future plans to build smart cities in your country?

We plan to transform Dhaka into a smart city in 2017. First, we would like to introduce smart city solutions and smart office management system to the government. Second, we are going to establish a service center with a digital service. This is our priority, and I think ZTE is very helpful to us. Third, we will seek more cooperation from our partners. In my opinion, a long-term cooperation in the field of ICT between Dhaka and Chinese companies, like ZTE, would provide a solid foundation for us to build a smart city.

How do you comment on ZTE's smart city solutions?

I think ZTE's smart city solution is the best. As a leader in the establishment of smart city, ZTE is not only an important participant but also a promoter in global smart city construction. I was impressed by ZTE's industry-leading Smart Yinchuan solution. We want to learn the technologies and experience from ZTE, and transplant the successful case of Yinchuan to the Dhaka city.

What are your expectations for ZTE in the future?

ZTE has more than 30 years of experience in network construction. We expect ZTE to support us in terms of network policies, network standards and network deployment. Currently, ICT is a key enabler for the growth of the economy, and it is one of the most promising sectors. By virtue of ZTE's technologies and solutions, we hope to promote the ICT sector in Bangladesh.

Actually, we have signed an agreement with ZTE for a major project. I hope ZTE can implement this project smoothly. In the future, I believe that ZTE will play a pivotal role in building smart cities in Bangladesh. We would like to cooperate with ZTE more closely and achieve our goals together. **ZTE TECHNOLOGIES**

Cloud Native:

The Application Architecture for Next-Generation Virtual Core Networks

By Liu Jianhua, Zhou Jianfeng

The Evolution of CN Application Architecture

Currently, network operators provide users with voice, SMS, and data services through proprietary hardware and software in their core networks. In traditional core networks, the non-sharing of hardware resources results in inflexible deployment; the closed design of software architectures results in poor scalability; and the independent deployment of stovepipe services results in complex operations and maintenance (O&M).

As emerging IoT services are booming and 5G speeds up its commercialization, new requirements for core networks have been raised such as massive connections, flexible deployment, scenario adaptability, and innovative service capabilities. SDN and NFV are considered in the industry as the key technologies of a core network in the future.

The core network architecture is designed to meet the requirements of flexible NE deployment, open service capabilities, and 5G network slicing. By adhering to microservice, DevOps, and other IT design ideas, cloud native is known as the main architecture for designing and developing core

network applications in the future.

Key Technologies of Cloud Native

The design of core network application architecture should consider the stability requirement specific to telecom applications and introduce many ideas from the IT industry for its own optimization and improvement. Cloud native core network applications have the following four features:

Microservice

An application is built at the granularity of a stateless microservice. Microservices are designed upon the concept of high cohesion and low coupling. Microservices communicate with each other through API or a unified message bus.

Information about user access and session is all stored on the data sharing layer. Although located at different places, each microservice instance can obtain the latest user status through the data sharing layer.

Based on the above design concept, each microservice instance can run, scale up and down, and upgrade separately. The distributed deployment of microservices can



Liu Jianhua

Chief Engineer of Core Network Planning, ZTE



Zhou Jianfeng

System Architect of Core Network Planning, ZTE

also improve application reliability.

Automation

Cloud native applications should be highly automated in multiple phases involving blueprint design, resource scheduling and orchestration, lifecycle management, status monitoring, and control policy update. These phases dovetail with each other through a closed-loop feedback mechanism. This can achieve one-click deployment, full autonomy, and high-effective management. The automated platform enables users to agilely design and quickly deploy NEs and networks for featured services.

Lightweight Virtualization

Compared with a traditional virtual machine (VM), the container virtualization technology provides high scalability, dense deployment, and high performance. The technology is rapidly developed and widely used in the IT industry. In the design of cloud native application architecture, application components must be deployed upon the container virtualization technology. This can improve resource usage and achieve quick service delivery and agile application maintenance.

In an actual deployment, cloud native applications and underlying virtualization technologies are decoupled. They can be deployed in a mixed container/VM environment.

DevOps

Programmability based on telecom network capabilities is essential to service innovation and ecosystem enrichment.

The application capabilities of a core network can be open to a third party through the API/SDK of a microservice for further development and service innovation. A virtualized operation platform can also provide friendly tools and environments for sustainable development and delivery. In this way, developers can develop, release, and upgrade

services in the DevOps mode.

Cloud Native Applications

Helping Operators Transform Network Functions

- Quick delivery and short TTM: Traditionally, a waterfall R&D model must involve requirement acknowledgement, coding, unit test, integration test, and function release. Each module is tested in series, which requires a long time to wait and results in low R&D efficiency. Agile development focuses on development optimization, but has no consideration of O&M. In the microservice mode, service functions can be modified or added at the granularity of a microservice. This reduces the range of revisions, enables microservices to be shared and called by different applications, and avoids repetitive development for different NEs. In the DevOps mode, streamlined tools are used to support large-scale, concurrent, and continual development, and to reduce waiting time. If a requirement is adjusted, quick modifications can be made to achieve continual delivery. A cloud native application can shorten a version release cycle from months to weeks or days to quickly fulfill the needs of operators in an iterative mode.
- Capability openness for service innovation: In a traditional core network, NEs are implemented as defined by standard organizations such as 3GPP, service types are limited, and the advantages of communication pipes cannot be fully leveraged. When coding a program, a third-party developer can call a microservice from a cloud native application through API/SDK. Through the microservices, service applications are bundled deeply with operator network capabilities. Operator capability openness can also serve as a mass innovation platform that can attract more third parties to participate in telecom service innovation. This enriches the ecosystem and creates new types of telecom services.
- Stateless design to enhance application reliability: How to achieve carrier-class reliability (99.999%) through COTS hardware has become a heated topic around NFV. ZTE's core network applications can

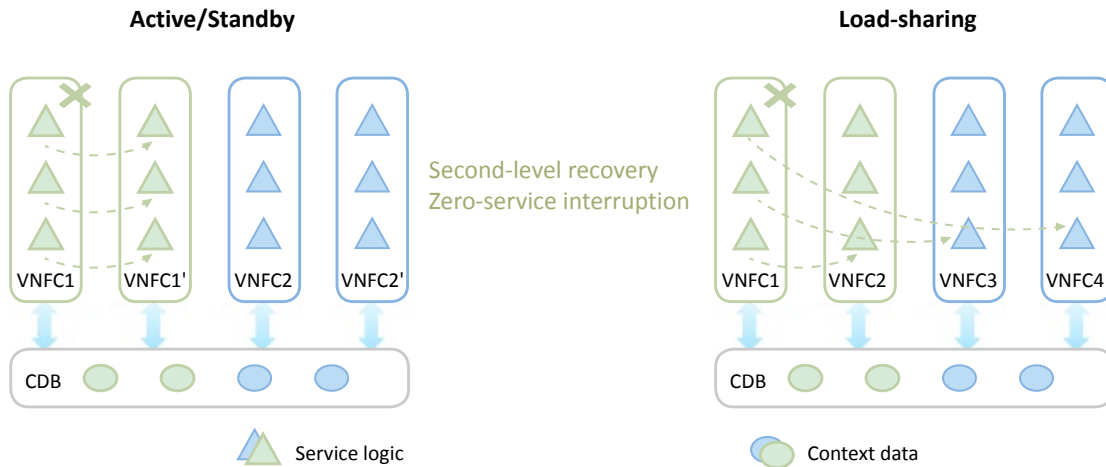


Figure 1. N+M redundancy mechanism.

achieve carrier-class reliability (99.999%) through its stateless, distributed, and N+M redundancy design without depending on the reliability at the NFV infrastructure (NFVI) layer (Fig. 1). On a cloud native application, multiple microservice instances can be distributed on different DCs according to service requirements. This can achieve geographical disaster tolerance and further enhance application robustness.

- **Simplified O&M to improve operation efficiency:** Traditionally, a core network is operated, maintained, or upgraded on an NE basis. To avoid an upgrade failure, it is necessary to perform complex service migration and fallback operations. A cloud native application can be upgraded on a microservice basis—a smaller granularity than an NE. A microservice is characterized by high cohesion and low coupling that can reduce impact on other microservices. When there are multiple microservice instances, some of them can be grayscale-upgraded to verify the validity of a new version. If any problem is found, a quick fallback operation can be implemented to remove the influence.

Meeting 5G Service Requirements

- **Flexible deployment:** NEs are flexibly deployed in a 5G core network. Different parts of an NE can be distributed as required in different locations such as core DCs, edge DCs, or access DCs. In the case of ultra-reliable low latency

communications (URLLC), multiple microservice instances responsible for message forwarding can be deployed near the service network and base stations to meet strict time delay requirements. In the case of massive IoT connections, microservice instances responsible for control-plane and message forwarding can be deployed on a core DC according to the low traffic feature.

- **Meeting service requirements in multiple scenarios:** Network slicing, an essential feature of a 5G core network, can meet the requirements in different network scenarios. In the top-level design of network slicing, operators can flexibly assemble different microservice types or component libraries and work out personalized network slices according to actual service requirements. Different network slices are logically isolated from each other and have no influence on each other. The different network slices can use different SLAs, and different SLAs have different resource allocation algorithms and redundancy. All this helps to achieve the most cost-effective utilization of infrastructure resources.

Conclusion

Cloud native has the advantages of effectiveness, flexibility, and openness over conventional network architectures. It can meet the need of 5G software architecture, and has become the best choice for operators to add or replace their core network devices. **ZTE TECHNOLOGIES**

Cloudization and Cloud Native: An Inevitable Road to Deepening Telecom Transformation

By Yang Lin

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ZTE

The Need for In-Depth Cloudization

After successful tests and trials in 2015, network function virtualization (NFV) has been gradually put into commercialization around the world. More and more operators have decided to introduce NFV solutions when deploying their new service such as VoLTE and IoT or developing existing service such as MBB, so as to achieve the commercial deployment of NFV solutions including vIMS and vEPC.

The introduction of NFV solutions allows telecom software and hardware to be decoupled. In the initial deployment of vIMS and vEPC, the NFV solutions give operators more flexibility in choosing or purchasing hardware types than traditional solutions. This helps operators save hardware investment and reduce the

delivery cycle. However, in the initial commercialization, the NFV solutions triggered by a single service requirement are still similar to traditional networks in terms of hardware configuration, deployment, and O&M model. Therefore, there is tremendous space for improvement in resource sharing and optimization, user experience, and service innovation.

The number of hardware resources is accurately configured to meet the capacity need of a single service, which does not allow the resources to be shared between different types of network services. The peak and valley effect of different services cannot be utilized for resource complementation, so operators are unable to save more investment in resources.

Network infrastructure designed in accordance with traditional network sites cannot fully utilize the characteristics



Yang Lin

Chief NFV Architect, ZTE



of cloud computing to provide higher availability for virtual network function (VNF) applications. Moreover, as infrastructure resources are centralized in traditional sites, a flexible on-demand deployment of VNF applications cannot be realized according to the difference of components in service processing characteristic, regulation requirement and impact on user experience.

Although traditional NEs are softwarized with NFV, they are still a closed software system that only provides traditional telecom functions. Any new feature or function must be customized by existing VNF vendors, restricting the development of new services.

Therefore, the transformation of traditional telecom based on NFV commercialization still needs further cloudization in aspects ranging from network resources to applications.

Cloudization and Cloud Native Become a Common Demand

Building networks with cloudized and componentized

VNFs over distributive data centers has been the target of big operators around the world.

A unified resource pool for the whole network based on multi-tier distributive data centers provides shared resources for all nodes in a traditional telecom network from fixed to mobile, from voice to data, and from access to core. Combined with the policy-based automated deployment and elastic control functions of MANO, services creation on demand and resources allocation on demand can be realized.

Oriented to distributed data centers, the componentized and cloudized VNF applications are reconstructed as stateless design with separate data layers for all processing logics and also separate control plane processing from user plane processing. Facing different scenarios with different SLA requirements, resource consumption and regulation, each component of VNF can be flexibly deployed onto any place of multi-tier distributive data centers to ensure optimized resource utilization and best user experience.

Due to the homogeneity of public telecom

services, traditional network operators can only compete with each other and attract common subscribers through conventional means such as improving network coverage with increasing investment and saving costs, which, however, reduce the revenue and profitability of public telecom market. Scenario-oriented service provision to industrial customers and segmented markets has become the focus of future business development for operators, which has been added in 5G network standards as one of the most strategic requirements. To adapt to the requirements of the industries and segmented markets in a more flexible and faster manner and to accelerate innovations, cloud native has begun to be the common pursuit of operators for cloud networks. Cloud native shall have the following features:

- **Microservices:** Based on the microservice architecture, VNF can be decoupled into a group of microservices that are independent of each other and implement their own independent business functions. All the microservices are decoupled from each other, and deployed and upgraded independently. With DevOps tools introduced, agile customization and continuous delivery of VNF is achieved. Each common microservice uses open and lightweight API interfaces to allow and facilitate third-party partners to reuse them for new service and application innovation.
- **Container-based deployment:** As a lightweight virtualization technology, containers can save more hardware resources than VMs. The container technology (such as Docker) also delivers applications in a container package (Docker Image), which allows applications to be shared in different teams and deployed in any environment to support continuous iterative development of VNF and accelerate the speed of updating and delivery.
- **Automated maintenance:** Automated lifecycle maintenance is provided for all cloud application instances serving different customers in different scenarios by the MANO platform, which maximally improves maintenance efficiency.

- **DevOps R&D model:** To satisfy the challenge of fast delivery, the DevOps model is used to divide a R&D team according to the service. Compared with the traditional team divided by tasks, the DevOps team is responsible for the service in its entire lifecycle from development to deployment and maintenance. Each DevOps team that is organized to deal with all different tasks focusing on one service operates in an agile model, which means the team upgrades and maintains the service it is responsible for in a more frequent way with minor changes. Compared with the conventional waterfall development model, DevOps allows services to be delivered at a higher update speed due to its higher communication efficiency, minor changes and highly automated environments.

ElasticNet Leads the Network Transformation

ZTE's ElasticNet solution provides unified infrastructure including software and hardware, VNF applications and MANO system, fully supporting telecom networks in transforming to cloudized networks and even in smoothly evolving to be cloud native (Fig. 1).

- **Cloud resource:** As the NFVi/VIM solution, ZTE's Tulip Elastic Cloud System (TECS) platform provides operators with shared cloud resource services for network transformation based on SDN interconnected multi-tier distributive data centers. Oriented to different resource requirements from different applications and the requirement of smooth evolution to cloud native, the TECS platform can support hybrid resource services including virtual machines, containers and bare metal hardware. Based on open source technologies such as Openstack/KVM and Kubernetes/Docker, TECS is enhanced in function, performance and reliability to better meet the telecom needs.
- **Cloud service:** From fixed to mobile and from access to core, ZTE supports operators in

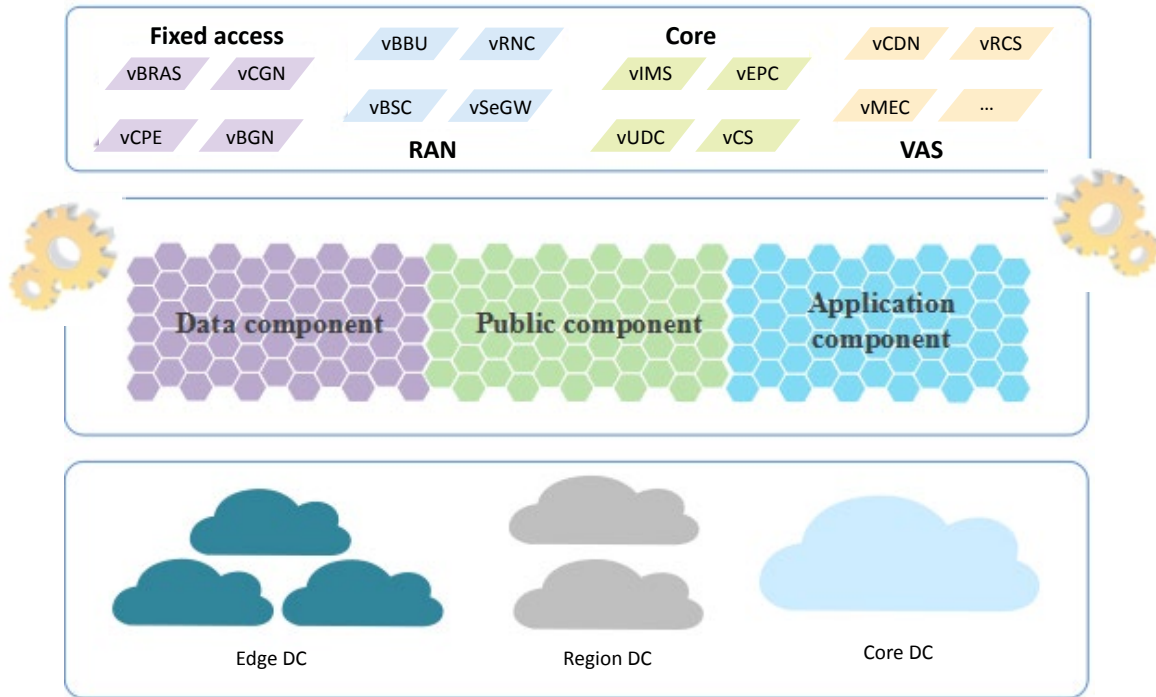


Figure 1. ZTE's ElasticNet solution.

end-to-end transformation of their traditional networks into cloud networks. In addition to inheriting all conventional functions and features, ZTE's VNF software is reconstructed to be stateless and componentized based on telecom cloud software architecture, enabling the separation of control and user planes and the cross-DC deployment. Based on cloudization, ZTE is the first to further decouple VNF components into independent microservices and provide the cloud native VNF solution to support scenario-oriented service customization and continuous delivery, which enables operators to respond to changing business chances and innovations more quickly.

- **Cloud maintenance:** As a MANO solution integrated with the policy-based intelligent assurance system, ZTE's vManager provides policy-based, real-time, and automated lifecycle management for cloud applications. Based on

decoupled microservices, the vManager provides operators with enhanced DevOps services from design, testing to deployment and maintenance at the granularity of a microservice, and with microservice discovery and binding support for cloud native applications.

ZTE's ElasticNet offers an end-to-end cloudization and cloud native solution for operators to deepen their telecom network transformation. Based on distributive data centers, the cloudized and componentized VNF applications help operators maximize resource sharing and utilization efficiency, and implement most efficient cloud network maintenance through the policy-based automated cloud O&M system. With decoupled microservices, the cloud native VNF solution supplied by the ElasticNet not only can support agile development and continuous delivery of new service features but also can be reused by third parties for fast innovation, which gives operators more agility to face challenges of future business expansion.

ZTE's Hyper-Converged Cloud Management Platform

By Niu Jiaohong

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ZTE



Niu Jiaohong

Product Planning Manager of Cloud & CN Product Operation, ZTE

Challenges Faced by Operators

With the development of technologies such as cloud computing and big data, there is a rising demand for personalized services and a large-scale growth of IT cloud services. Elastic networks that are data center-centric, highly reliable, easy to maintain, and quick in response are emerging to meet this trend. Traditional data centers have a number of drawbacks, such as complicated management, high costs, low scalability, low resource usage, and long deployment period. They have to be transformed to prevail in the future.

Businesses are seeking to build flexible, efficient, green and low-cost data centers. ZTE's hyper-converged cloud management platform is based on commercial off-the-shelf (COTS) hardware, and allows for resource sharing and scheduling across data centers. It is a visualized, automatic, scalable, and highly reliable platform, providing businesses with a flexible,

easy-to-deploy and end-to-end solution.

ZTE's Cloud Management Solution

ZTE's tulip elastic cloud system (TECS) director cloud management platform is a multi-DC unified management platform. It centralizes the management of global resources across geographically distributed data centers while guaranteeing safe isolation between resources to facilitate users in resource planning and management. It provides standard IT products and service offerings—which are available to tenants from a self-service portal—and functions like service templates, for rapid definition and deployment of services. It provides intelligent operation and maintenance functions like multi-view topologies and system health monitoring to make operation and maintenance easy.

ZTE's unified cloud management platform consists of a cloud resource domain, an operation domain, an OMM domain, unified portals, and unified APIs (Fig. 1).

Cloud Resource Domain

The cloud resource domain has access to the resources of multiple data centers (or heterogeneous systems), and integrate physical resources across different locations

into a logically unified cloud resource pool. It provides data center management, unified resource management, unified resource orchestration, and resource statistics. It implements infrastructure convergence as well as hierarchical management of both the virtual and physical resources.

Operation Domain

The operation domain provides operational support with services at its core. Based on the idea of “resources as service”, the operation domain refines the resource requirements and integrates the resources into a standard product. Requests for resources or resource provisioning can be done per service. The operation domain provides service management, service directory, service metering, order management, policy management and work order management.

OMM Domain

The OMM domain provides unified management,

scheduling, and maintenance of resources from all the data centers. It provides OMM and monitoring staff with problem-locating methods such as centralized alarming and log analysis. The monitoring staff can view the operating status of the cloud platform on the performance dashboard. The domain also provides statistical reports for construction and management staff so that they can perform capacity planning and asset audits. It manages configurations, assets, alarms, performance, logs, topologies, and reports.

Unified Portals

The administrator and self-service portals have a unified Web interface to display operation and O&M data. The administrator portal allows O&M staff to manage resources, services, tenants, and work order. It also displays the monitoring data and alarms in a centralized way. The self-service portal allows tenants to view their available resources. It is a one-stop portal where tenants can request,

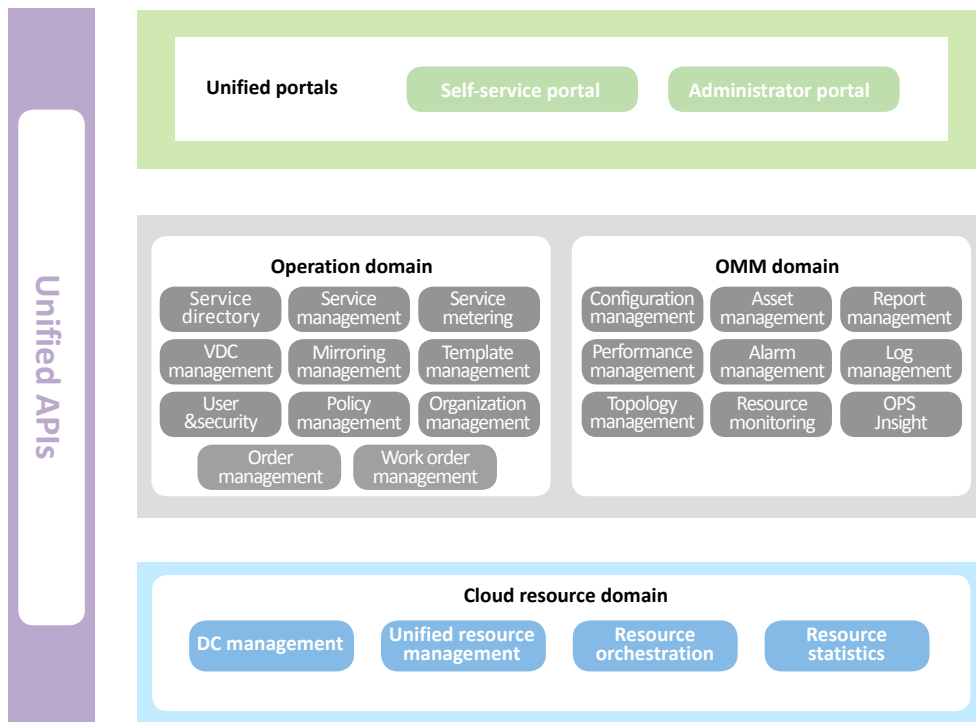


Figure 1. ZTE's TECS director hyper-converged cloud management platform.

manage, and monitor resources.

Unified APIs

Resources from distributed cloud pools are allocated using virtual data center (VDC) services and the primitive OpenStack programming interfaces.

Advantages of ZTE's Cloud Management Platform

ZTE's TECS director unified data center management solution enables hyper-converged infrastructure to improve management and profits for operators. It has the following advantages.

Intelligent Management

This solution provides health analysis. It uses algorithms to identify the health ratings, risk ratings and other indicators of the network equipment and physical servers so that the administrator can identify potential risks to avoid faults.

Unified Management

This solution unifies the management of private, public, and hybrid clouds. It allows L2/L3 interoperability between public and private clouds to accommodate multi-DC networks of enterprises. It centralizes management and scheduling across multiple geographically distributed data centers. It centralizes management and orchestration across heterogeneous resource pools—including third-party OpenStack resource pools and VMware—to realize heterogeneous resource sharing and build an open ecosystem for resource pools.

Easy O&M

This solution supports graphic navigation-style installation, deployment and upgrade, and automatic discovery and management of devices. It greatly simplifies the deployment and upgrade of cloud infrastructure.

It provides a unified performance analysis and problem-locating platform that allows the administrator to detect a trend change on the performance indicators and evaluate and avoid potential risks.

It enables topology-based visualization of network-wide resources. It demonstrates the connections between system resources and the dependency relationships between services and resources in a multi-view multi-layer manner.

It monitors both the virtualized and non-virtualized resources, including alarms, performance data, and device status information. It allows the maintenance staff to understand the operation status of the system in real time and respond quickly to abnormalities.

Conclusion

Operators have increasing demands for unified cloud management platforms. ZTE's hyper-converged cloud management platform is a convenient, efficient, and intelligent data center management platform. It provides service-centric management that helps operators accelerate service innovation, quickly deploy new services, and reduce time-to-market; and it automates deployment of services so that operators can focus on new profit growth points. The platform brings great value to operators with improved infrastructure usage, increased investment return, and reduced Opex. **ZTE TECHNOLOGIES**

What is the Future of O&M?

By Wang Rui, Liu Junjie

The Transformation Trend

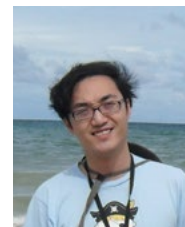
Carriers need to answer the market demand for network transformation. Customers always ask for better services and lower prices. SDN/NFV development offers carriers the opportunities to create intelligent and automated networks. With continuous innovations occurring in the telecom industry, new technologies and concepts such as big data analysis, artificial intelligence (AI), centralized, policy-driven management and user experience management have become a focus of the O&M.

With the cloudification of networks, resources can be orchestrated and scheduled flexibly, and network element equipment can become virtualized and carried by virtualized machines. The cloud platform aggregates computing, network and storage resources, delivering unified management, that is, infrastructure as code (IaC). Through cloudification, NFV decouples hardware from software, network functions from dedicated hardware. It allows for flexible

resources sharing and fast service creation and deployment, and supports auto deployment, elastic scalability, fault isolation, and self-healing based on actual service demands. Considering the telecom service trends, standards making progress and major global operators' service trials, cloudification, digitization, automation, and intelligentization technologies have bright prospects. But they are also facing new challenges.

According to a report published by Technology Business Research (TBR) in 2016, the main challenges to NFV O&M include: adapting process methods and procedures for hybrid, physical and virtual systems; deepening models for proactive network assurance; developing new SLAs that feature real time, contextual and location-aware assurance methods; creating traffic visibility between and within physical and virtual network; and navigating a more complex multivendor environment.

Based on the trends and challenges mentioned above, ZTE has put forward the next-generation cloud-based O&M solution vMaster. This solution focuses



Wang Rui

GI Product Manager, ZTE



Liu Junjie

GA Product Manager, ZTE



on automated user experience while taking into consideration carriers' experience. It aims to improve O&M efficiency and quality.

Cloud-Based Intelligence

The vMaster global information (GI) system provides cloud-based centralized management. The unified information model management encompasses policy, service, and resources models and enables network-wide, multi-vendor, and end-to-end management. The unified portal management provides a centralized view of alarms, performance, and resources.

The vMaster global assurance (GA) system is an open service assurance management platform that helps carriers centrally manage different vendors and SDN/NFV networks. It provides centralized alarming, unified performance management, unified O&M process, and unified portal management to implement network O&M quickly, flexibly, and efficiently and at a low cost.

All the functional components of the

vMaster solution are based on microservices and operate in virtual PaaS environments for easy scalability and agile and flexible deployments. Through the centralized network management, the vMaster solution provides carriers with complete analysis and visibility of end-to-end faults and performance and one set of data to save resources and facilitate correlation analysis. It helps carriers achieve closed-loop management from orchestration to service assurance by utilizing the O&M, and orchestration and scheduling policies in the policy center.

Through AI-based big data analysis, the vMaster solution realizes intelligent analysis. It adjusts policies in real time, monitors the effectiveness of the policies, and continuously optimizes them. Based on the big data collected from a large number of historical events, the AI analyzes rules and forms policies. Driven by events, the policies automatically optimize network settings (including automatic scale-out, scale-in and automatic bandwidth scheduling). This O&M method has evolved from decision-making based on analyzing and computing real-time data to proactive network

maintenance, from planning to prediction. Through empirical analysis, the AI learns from the operators' instructions and improves its future actions. This can help carriers automate network configuration and monitoring, reduce operation expenditures, and improve network usage and maintenance.

In an O&M scenario, alarm filtering and root cause failure analysis are the core tasks of alarm handling. Because of the complexity of the network and the large amount of alarm data, a lot of manpower is needed in traditional O&M to analyze root cause failures. This problem is solved after the AI is introduced. Historical alarms are analyzed, and rules of root cause failures are identified through machine learning. Alarm recovery verifies the effectiveness of the rules, and the manual inspection after unsupervised machine learning ensures the accuracy of the rules.

By working with a carrier, ZTE collected 10 million historical alarms in the carrier's network, and performed alarm filtering and alarm correlation analysis through unsupervised machine learning. The high-performance big data cluster formed by several servers needs a few hours at the beginning to generate 100 rules (including many invalid rules); and then it only needs 10 minutes to generate 62 valid alarm correlation patterns after delimiting the algorithm parameters and continuously tuning them. The patterns cover many fields including the bearer network, core network, and wireless access. Traditionally six experts are required to work several weeks to create alarm correlation patterns, and there is great difficulty in developing cross-field alarm correlation. ZTE's next-generation O&M system reduces the time to 10 minutes, and can be quickly introduced into the existing network to improve the efficiency greatly.

The video quality on mobile phones has been gradually upgraded to HD. The improvement

of video quality increases the network traffic. When the next-generation O&M system becomes aware of the increased forwarding load on the pre-deployed virtualized network elements and predicts that the I/O throughput of the network elements will exceed the baseline, its policy center will automatically determine that it is necessary to scale out and instruct the orchestration system to scale out. Within a time window after sending the instruction, the O&M system checks whether the KPIs of virtualized network elements are reduced to a proper range. If scale-out fails, scale-out is continued, and the system instructs technicians to check the scaling policies manually.

An automatic closed-loop is capable of automatic service recovery but not capable of solving hardware-related faults automatically. When a hardware fault occurs during O&M, the vMaster identifies the fault and assigns a trouble ticket to the technicians. Automated ticketing and resource scheduling, designing policies like O&M path, when combined with the AI, allows the efficiency of a manually controlled closed-loop to be improved.

The Future Road

The age of intelligence has arrived when AlphaGo beat a human. The AI will play a greater role in more fields. In the telecom field, the development of cloud, SDN/NFV, and 5G is accelerating. We can foresee that the related O&M will also be optimized for improved cost savings and efficiency. The AI has begun to show effects in O&M. ZTE's next-generation O&M system will further improve the O&M experience and give more value to users. ZTE is actively participating in the development of 5G standards and related technologies. When new technologies such as cloudification and SDN/NFV are triggering the rapid development of new types of networks, ZTE will continue to take the lead in this technology tide. **ZTE TECHNOLOGIES**

Opportunities and Challenges in Network Transformation

By Wang Weibin

Network Transformation: The Consensus Among Operators

In the internet of everything (IoE) era, driven by 5G service requirements and SDN/NFV technologies, the transformation to a full cloud network has become the focus of attention in the industry. According to the IHS report in 2016, almost all operators over the world will start deploying SDN/NFV, and the period 2016–2020 will see large-scale SDN/NFV commercial launches. Network transformation has become the consensus among all operators. Here are

the detail ideas and plans for network transformation from famous operators.

- AT&T: AT&T has launched a series of transformation plan named Domain1.0, Domain2.0 and Intigo3.0. The plan introduces SDN/NFV technologies to build a new network centered on cloud data centers (DCs), sets up a cloud platform (UDNC) with open, standard, and unified infrastructure, and puts the next-generation operation platform (ECOMP) as a core control of the network. AT&T aims to evolve from carrier-defined services to user-defined services, from central offices (COs) centered networks to DCs

Transformation to a full cloud network has become the consensus among operators worldwide. The transformation involves restructuring infrastructure, service functions, and operation and maintenance.

—**Wang Weibin**, Chief Architect of Telecom-Cloud & Core Network Products, ZTE



centered networks, and from tier-1 carrier to super carrier.

- **Telefonica:** Telefonica has rolled out its UNICA transformation solution to construct a cloud data center platform with unified architecture, which supports hierarchical configurations and resource sharing through the distributed data plane and centralized control plane. Telefonica aims to build low-cost cloud networks that support public clouds, private clouds, and network function virtualization.
- **China Mobile:** China Mobile has released its NovoNet—the next-generation innovative network development concept that incorporates new IT technologies to construct a new-generation network with globally managed resources, open capabilities, elastic capacity, and adjustable architecture to satisfy the communication needs of internet+, IoT, and 5G.

Network Cloudization: The Needs for Experienced Partners

Network transformation involves restructuring infrastructure, service functions, and operation and maintenance (O&M). In actual implementation, the requirements at different stages such as network planning, design, integration, deployment, O&M and optimization should be considered. Due to its large integration workload, long period, and high complexity, the implementation faces many challenges.

At the stage of network planning and design, the challenges include planning data centers, selecting an appropriate hierarchical decoupled mode, networking and assuring security. According to the complexity as well as the deployment strategy, the possible choices can be single-vendor mode, hardware-

independent mode, shared virtual resource pool mode, or fully-decoupled mode. Selecting a proper decoupled solution is the most key factor in a successful project. For example, in deploying vEPC in five branches of VEON (formerly VimpelCom Ltd.), the hardware-independent mode was selected in consideration of mature interfaces at both the hardware resource layer and virtual resource layer. A quick integration and commercial operation launch helps VEON quickly address the issues of insufficient capacity and future network evolution.

At the integration and deployment stage, the major challenges are how to integrate multiple vendors' software components and hardware into a stable and efficient system, and how to assign SLA agreements between different components. As to the hardware, blade or rack servers can be a choice. But in addition to unified infrastructure, other factors such as reliability, networking, and installation should also be considered for hardware. The available virtualization software includes VMware and OpenStack. The open-source OpenStack is usually adopted to avoid vendor lock-in, and the native OpenStack API facilitates integration.

At the O&M and optimization stage, the challenges are how to achieve an optimal price to performance ratio, and how to quickly locate faults in a multi-component environment. To achieve the best price to performance ratio, component-based performance indicators at various layers such as hardware, virtualization software, service application software, and MANO software should be considered. The component at each layer has its own optimization method. In the core network swap project of Telekom Austria Group (TAG), a full virtual core network with different optimization techniques such as hardware BIOS parameters setting, virtual machine affinity deployment policy,



and DPDK forwarding acceleration are used to achieve better performance and lower cost than the swapped legacy system.

In addition to the above challenges, operators also face the pressure of rapid upgrade of IT technologies. Thus, an experienced vendor partner is helpful in network transformation progress.

ZTE: An Expert on Network Transformation

ZTE has released its Elastic Net solution for network transformation. Based on SDN/NFV, big data, and AI technologies, the solution includes end-to-end cloud components and services, covering the cloud infrastructure (NFVI), cloud services (Apps), cloud bearer (SDN), cloud management (MANO)

and cloud integration. It provides unified bare metal, virtual machine and container resources management, integrates software and hardware components of multiple vendors, and helps operators build an agile and open ecosystem with sustainable innovation capabilities.

So far, the Elastic Net solution has had more than 240 deployments for mainstream operators worldwide including China Mobile, Telefonica, VEON and TAG. ZTE is one of the main contributors of standards organizations and open-source communities such as ETSI, 3GPP, ONAP, OPNFV, OpenStack, ODL and ONOS. It has been recognized by OVUM, Current Analysis and IHS as one of the best and reliable partners in the age of network transformation. **ZTE TECHNOLOGIES**

Editor's Note:

The article is adapted from a presentation and panel discussion by ZTE's Senior Services Director Thierry Langlais at a conference on "Network Analytics and Machine Learning" during Mobile World Congress 2017.

On the Road to **Zero Touch** Operation

By **Thierry Langlais**

Building Scale and Agility in the 5G /IoT Era

Telecom operators must rapidly adapt to protect or increase their pivotal role in the digital transformation of our society and economy. They need to consider end-to-end digitalization to provide their own customers with the experience of a digital company, to boost operational efficiency, and create new capabilities. The most significant implications and current market

trends are:

- Customer centricity: Customer experience and global service experience move to the heart of telecom networks and infrastructure operations in order to maximize customer added value, whilst coping with new usages resulting from massive broadband availability, IoT, etc.
- Cloudification: The introduction of NFV/SDN architectures in 5G and FTTx networks leads to redefine the operations architecture, tools and

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ZTE combines the VMAX experience with its leadership position in pre-5G and 5G technologies and architectures to further develop the AI architecture and platforms, paving the road towards zero-touch operation.

—**Thierry Langlais**, Senior Service Director, ZTE Corporation

organization.

- Automation: The need for increased agility, flexibility and the necessity to cope with huge amount of data call for increased automation and usage of machine learning (ML) with strong analytics capabilities.

These trends explain the increasing investment in analytics and related machine learning technologies from operators, service providers, cloud providers and enterprises around the world. This paper introduces ZTE VMAX big data solution, describes the lessons learned from existing use cases, and shares the vision for the forthcoming steps of zero-touch evolution.

The Case for Network Analytics and Machine Learning—Where to Start

The journey to customer centricity and zero-touch operations requires a well thought-through business case, which shall identify those priority areas with short term, measurable return on investment (ROI) to fuel a “virtuous circle”, where savings generated can be used to develop new use cases with longer-term impact on top and bottom line.

ZTE experience suggests to start with optimization and network performance improvement, then move into the value chain and approach topics

such as customer behavior prediction, agile fulfillment, assurance automation (together with the introduction of MANO/Orchestration) and personalized revenue creation—where in-depth knowledge of the customer behavior, usages, location can be monetized to define new customized solutions (Fig. 1).

To support such roadmap it is essential to create a common “big data” repository which captures and provides the 360° view for each user, service, and element in the network. At the core of the VMAX solution, the highly scalable big data platform allows you to, for instance, collect all customer experience touch points and interactions, whether from a point of sale (POS), on-line, or via hotline call, social media, etc.

Use Cases/Lessons Learned

The ZTE VMAX solution includes three main components: omni-channel customer experience management (CEM), enhanced service quality management (SQM) and revolutionary optimization and network performance management (RoNPM).

CEM analyzes data collected from customer touch points, B/OSS systems and the network elements to precisely evaluate the customer experience when using a given service at a given location. SQM combines artificial intelligence (AI) algorithms with comprehensive and highly granular data collection (both space and time wise) to monitor in real time the quality of service and experience for top users/services/locations, automated error detection and root cause analysis.

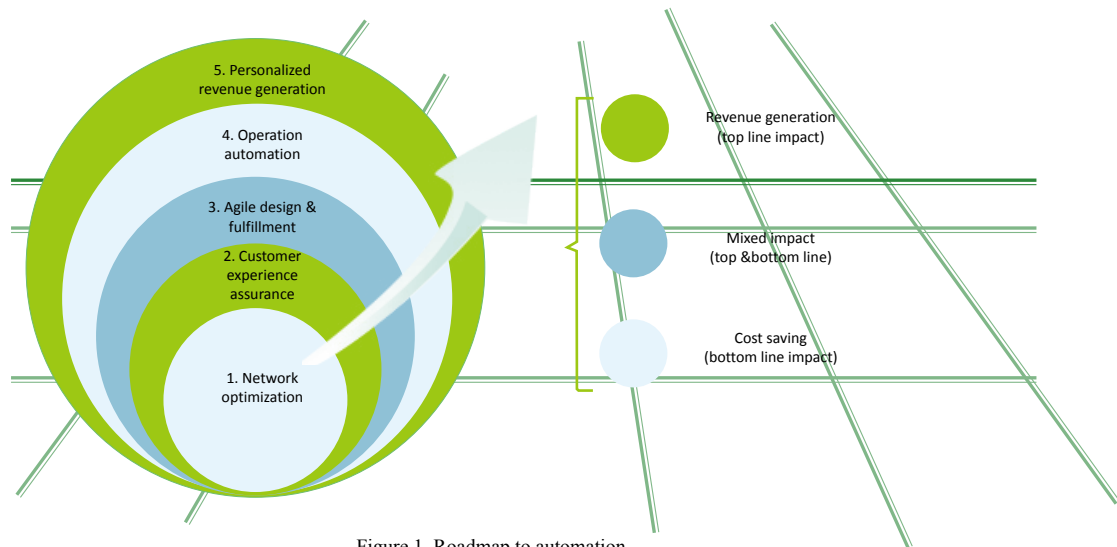


Figure 1. Roadmap to automation.

RoNPM combines high accuracy location data together with granular network quality information to automate network optimization tasks.

The VMAX big data central repository is then associated with AI algorithmic modules to develop multiple use cases, along the lines set forth in previous sections. In the section below we discuss two use cases, namely “virtual drive test (VDT)” and “customer experience evaluation and churn prediction”.

VDT uses measurement records, advanced GPS data, call details traces and user records, coupled with fingerprint and fitting algorithms, to precisely identify user locations (less than 20 m accuracy) and simulate drive tests in real time across the network. This provides real-time identification of road sections with coverage issues or low service quality at virtually no cost. Furthermore, using the LTE inter-frequency measurement capability, VDT provides inter-operator benchmarking analysis. Third, the same information can also be monetized to develop personalized advertising.

Sichuan Telecom serves more than 18 million subscribers in the Chinese central province of Sichuan. Using VMAX since 2014, the operator has saved in excess of \$1.2mn per year on drive test campaigns, improved overall optimization efficiency by a factor of 8 (problem resolution leadtime reduced from 48 hours on average to less than 6 hours), whilst reducing network optimization headcount by 40% thanks to VDT and RoNPM.

Customer experience evaluation uses a common repository to build the 360° view on customer experience, which can then be used consistently by the customer-facing teams within the operators—such as customer service, operations and marketing. Customer interactions via hotline, web, social media and point of sale, are collected and combined with network performance and service quality data points. This provides enhanced interaction capabilities at individual levels or for targeted groups of customers, segmented by age, type of contract, user profiles, preferences, etc. With K-means clustering algorithms, PCA, Spearman and feature correlation analysis, it is possible to predict and anticipate customer behaviors, such as likelihood for churn (using logistic regression technique), or simulate the results of targeted marketing initiatives.

Since May 2016, ZTE has been helping Hubei China Telecom on their journey towards customer centricity. The operator formed a customer perspective operation center,

using VMAX and underlying automation to achieve a consistent understanding of customer experience, flatten the organization, remove traditional silos, reducing churn and increasing customer satisfaction.

These use cases and others around the world contribute to enrich the VMAX platform and confirm the pertinence of the roadmap. They also highlight and confirm the critical importance of granularity when acquiring the data. The relevance of network analytics and associated model directly depends on the level of accuracy and the frequency of data points acquisition.

Looking Forward: ZTE AI platform

ZTE combines the VMAX experience with its leadership position in pre-5G and 5G technologies and architectures to further develop the AI architecture and platforms, paving the road towards zero-touch operation. The ZTE mind insight platform uses big data infrastructure, massive storage capability, distributed computing framework, and AI visual development modules, to develop “intelligent applications”. Consistent with the AI roadmap, our priorities cover:

- Intelligent assurance applications: Nfv infrastructure and SDN automatic troubleshooting, threat detection and prevention
- Intelligent elasticity applications: SDN intelligent routing, smart elasticity policy for sliced network infrastructure
- Intelligent business support: Churn prediction, targeted advertising and data monetization

The ZTE mind insight platform is based on a modular architecture. The platform features visual development module where AI algorithms can be called for, to formulate the machine learning processes needed to develop real-time decision and policy management use cases, greatly reducing development time.

Typical use cases include automatic restoring following virtual machine (VM) creation failure, automatic labeling of test failures, on-demand service automatic fulfillment, resource usage optimization, elasticity policy framework in sliced network architecture. Together they illustrate the ZTE way—zero-touch evolution towards zero-touch operations.

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Все на velcom

TAG VELCOM STARTS NEW JOURNEY TO CLOUD TRANSFORMATION

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By Wu Guangwei



Wu Guangwei
CCN Product Solution
Manager, ZTE

Velcom, the subsidiary of Telecom Austria Group (TAG), is a leading mobile operator in Belarus, with over 40% market share and about 5 million mobile users. As NFV technologies mature and have been put into commercial use, velcom hopes to reconstruct traditional networks in cooperation with ZTE by deploying all its legacy core networks onto the unified cloud, so as to achieve smooth digital transformation.

Challenges from the Legacy Network

To meet the increasing demands of data and multimedia services, 4G services are emerging in Belarus, and all operators start

to plan their 4G service development. The strategic target for velcom is deploying evolved packet core (EPC) service to quickly deliver 4G services with low costs and improving its competitiveness to secure a dominate position in the market.

As velcom's legacy network equipment operated for a very long time, its reliability showed an increasing failure rate. Its high operating costs also brought a huge burden to velcom: the complex network with too many NEs made network maintenance more difficult and time-consuming. Besides, as the legacy network used private hardware platforms of multiple vendors, it is very difficult to upgrade it to a 4G network. The upgrade might result in

high expense, and the evolution to IMS, VoLTE and cloud would be impossible. All this greatly hindered velcom from achieving its strategic target.

Building a Full Cloud Core Network with ZTE's Cloud UniCore

TAG has chosen ZTE as a long-term strategic partner, and they have cooperated widely in many fields. After in-depth discussions and exchanges with ZTE in the NFV field, velcom finally selected ZTE to deploy a full cloud core network for its rich NFV deployment experience and advanced cloud UniCore solution.

ZTE's cloud UniCore solution based on ETSI reference architecture utilizes open source technologies to decouple software from hardware and provide a full array of core network solutions that are highly reliable, easy to manage and easy to integrate, enable carrier-grade enhancements, and can cover 2G/3G/4G/5G core networks. ZTE takes a leading position in the industry. In the NFV-based core network project, velcom adopted ZTE's cloud UniCore solution to build a unified telecom cloud that was distributed in three data centers and deployed with all core network elements such as vEPC, vSDM, vIMS, and vCS. All traditional core network elements were smoothly migrated to a fully virtualized platform (Fig. 1).

Also, velcom used ZTE's tulip elastic cloud system (TECS)—a carrier-grade cloud platform based on OpenStack. With performance optimization and distributed geographical redundancy, TECS could meet

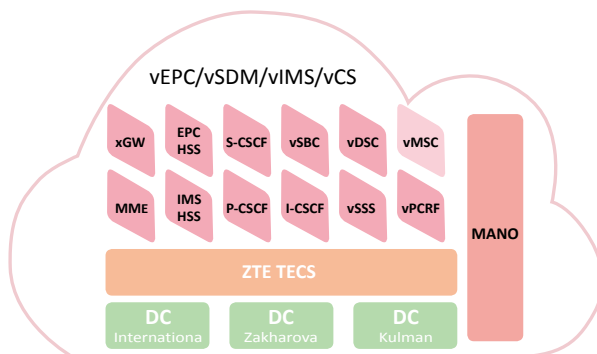


Figure 1. velcom's full cloud core architecture.

the requirements of high performance and carrier-grade reliability (99.999%), offering second-level elasticity and zero service loss. Through a virtual infrastructure, TECS implemented centralized scheduling and management to reduce operating costs, allowing velcom to regain flexibility through easy configuration of new services and improve the security as well as reliability.

By transforming and virtualizing its core network into vCore, velcom managed to abolish its legacy silo-based network and significantly cut service running costs, while ensuring higher flexibility, feature richness and reliability for velcom's customers of voice and data services. This project provides velcom with one of the most innovative telecom core architectures worldwide. It is also the only project of a size of more than five million subscribers.

"With this major step towards the next generation network architecture, we are able to significantly reduce our opex spending, benefit from massive economies of scale for further growth and provide highest flexibility and service value to our customers on the way towards a fully cloud-based network architecture," said Sascha Zabransky, Director Technology, Telekom Austria Group.

Benefits to velcom

ZTE's cloud UniCore solution creates a more simple, reliable, cost-effective, and open core network for velcom, greatly promoting internet service innovation and flexible deployment based on IT and CT converged architecture. The solution is compatible with future-oriented 5G core network architecture to improve customer value:

- The efficiency of new products and services release can be improved by 42%.
- Multiple DCs share basic resources, so that resource efficiency can be increased twofold.
- With the full cloudization, TCO can be reduced by over 50%.

In cooperation with ZTE, velcom successfully built the first and most complete virtual core network in Belarus or even in the world. As a result, velcom not only gains the leading position in the telecom market in Belarus, but also serves as a model for global operators in their network transformation. **ZTE TECHNOLOGIES**



Leading 5G Innovations