VIP Voices

Base:
A Challenger in the Belgian Market

Algeria Telecom
Offering the Best Service

TOT: World-Class Quality

Special Topic: Advanced Architecture

Cloud Radio: Leading the Future of LTE

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TOT: World-Class Quality

TOT Public Company Ltd. is the largest fixed-line telephone operator in Thailand. At ITU Telecom World 2013, held in Bangkok, TOT CEO Yongyuth Wattanasin talked to *ZTE TECHNOLOGIES* about TOT's market development strategies, grand goals, and contributions to Smart Thailand 2020.

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

Success Stories

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ZTE Presented 'Supplier of the Year 2013' Award by E-Plus Group

20 December 2013, Shenzhen — ZTE has been awarded 'Supplier of the Year 2013' by network operator E-Plus—a subsidiary of the Netherlands-based KPN Group.

The award, which was presented to ZTE during the first 'KPN Group Supplier Days', is in recognition of ZTE's outstanding achievements in developing the E-Plus mobile network in Germany. KPN group invited its top 100 suppliers to attend the event which was held at the Amsterdam Rijksmuseum in mid-December.

Since 2009 ZTE has been a strategic partner of E-Plus Group and has supported E-Plus in upgrading its UMTS network. In the spring of 2013, E-Plus Group and ZTE signed an agreement that will see ZTE take over managed services for the E-Plus network. This will come into effect in January 2014.

ZTE Gains World **Top-3** Video-Conferencing Market Ranking in Wainhouse Report

17 December 2013, Shenzhen — ZTE was ranked among the world's top-3 vendors of video-conferencing systems in the latest report by Wainhouse Research, as ZTE's commitment to technology innovation delivers market-leading products and services to customers.

According to the SpotCheck Group Video Conferencing Q3-2013 report by Wainhouse Research, a leading research firm in the industry, ZTE achieved a 12% market share in endpoint units, the third-highest among all vendors globally. In the Asia Pacific region, ZTE was the leading video-conferencing vendor with 27% market share in infrastructure revenue, according to Wainhouse Research.

In 2013, ZTE introduced a series of industry-industry video conferencing solutions. At the 2013 USA Infocomm Expo in June, ZTE launched and demonstrated its first video conferencing terminal that supports the H.265 protocol. At the Beijing Communication Expo In September, ZTE launched its TrueSee T900 terminal, which supports 4 HD 1080p60 simultaneous transmissions. The company also won the Audio/Video Qualification Excellence Award from the China Association of Recording Engineers, becoming the only video conferencing vendor with this qualification.

ZTE and KDDI Offer Smart Multimedia Infotainment System in Japan

2 January 2014, Shenzhen — ZTE is pleased to cooperate with KDDI Corporation to offer a smart multimedia infotainment system to subscribers, bringing a high-quality and enriching user experience to consumers in Japan.

The sleek and stylish PHOTO-U TV system, equipped with a 10.1 inch high-resolution (1024×600) display and front stereo speakers, enables users to watch digital TV broadcasts (full-segment, one-segment), mirror their smartphone screens, view photos and access real-time weather and directory information. PHOTO-U TV comes with 4 GB of internal data storage, and supports as much as 32 GB of external storage, allowing user to make full-segment recordings of TV programs.

Designed for portability, the waterproof PHOTO-U TV supports CDMA 1X WIN and Wi-Fi CERTIFIED Miracast connectivity, allowing users to stream videos from their smartphones. The built-in antenna and a 2,500 mAh rechargeable battery means users can carry the device anywhere, including bathrooms and kitchens.

ZTE Awarded Top Consumer Electronics Brand by IDG

8 January 2014, Las Vegas – ZTE announced it has won three awards from the International Data Group (IDG) and survey company IDC, recognizing ZTE's rapid growth and extraordinary performance around the world. IDG, the world's leading technology media, events and research company, bestowed the "Global Intelligent Interconnection Device Brands Top 10," the "China Consumer Electronics Brands Top 10," and the "Global Consumer Electronics Brands Top 50" medals to ZTE at the International Consumer Electronics Industry Summit & Global Top Brands Awards Ceremony during CES on January 8.

"2013 was a year of extensive development and investment in mobile internet, and reshuffling and restructuring in the global smartphone market," said Michael Friedenberg, CEO of IDG. "We're highlighting ZTE as one of the smartphone vendors that performed particularly well."

"We're honored to have our performance recognized by IDG," said Mr. Zeng Xuezhong, ZTE EVP and Head of the Mobile Devices Division, "At the core, a keen sense of innovation, continuous devotion to research and strategic overseas expansion were essential to our accomplishment."

During CES 2014, ZTE has unveiled a range of high-performance smartphone and consumer electronics products to meet the needs of today's consumer.

ZTE Deploys 4G LTE Network for Aircel

31 December 2013, Shenzhen — ZTE announced it has entered into an agreement with Aircel, the leading telecom service provider in India, to deploy its 4G LTE network. The deployment helps Aircle boost its enterprise and retail business.

In the first stage, the LTE deployment will be initiated in Chennai, Rest of Tamil Nadu (RoTN) and few other business critical circles.

ZTE Releases Magic Radio Spectrum Solution

6 January 2014, Shenzhen — ZTE released its proprietary magic radio spectrum solution. This innovative technology achieves deployment of GSM and LTE within the same band, which significantly enhances spectrum utilization and improves efficiency by up to 50%.

The magic radio spectrum solution achieves GSM/LTE dual mode in 900M/1800M bands through utilization of existing GSM macro sites. Because of this, in-use GSM voice services are not affected while high-rate data services are still available. The solution accelerates commercial LTE deployments and lowers construction, operations and management costs.

The solution contains two sub-solutions: the GSM/LTE spectrum overlay solution and GSM/LTE collaborated spectrum scheduling solution. The former allows GSM and LTE to occupy some identical frequencies simultaneously. This maximizes GSM and LTE capacity. The latter dynamically schedules the amount spectrum resource used by GSM and LTE. When these two sub-solutions are deployed simultaneously, spectrum efficiency can be improved up to 50%.

"We're thrilled to release the new magic spectrum solution," said ZTE Vice President Mr. Zhao Xianming. "We see the solution as a key technology in GSM/LTE co-spectrum scenarios and are confident it will facilitate widespread network deployments and reduce front-end investment."

Base:

A Challenger in the Belgian Market

Reporters: Zhao Rujing and Liu Yang

The Belgian mobile market has become more competitive with the entry of more MVNOs and the implementation of a new telecom law that allows customers to end their contract after six months. Base is the third largest mobile operator in Belgium and a subsidiary of the Dutch operator KPN. To deal with increased competition, Base launched an LTE network in October 2013 and is now Belgium's second operator to offer 4G. *ZTE TECHNOLOGIES* talked to Jos Donvil, CEO of Base, about the challenges it faces and its challenger strategy. Donvil also talked about Base's LTE plan and its partnership with ZTE.

Q: What are characteristics and trends of the Belgian telecom market?

A: If you look over the past two years, the Belgian market has become much

Base CEO Jos Donvil

more challenging. There are a few reasons for this.

First, four MVNOs entered the market and changed pricing in a way that seriously impacted all operators. Prices have decreased across the board.

The second thing is that the new telecom law in Belgium was implemented in October 2012, and this meant some customers finished their contracts early. In most countries, a mobile contract lasts for two years. In Belgium, the maximum term of a mobile contract is now six months. This has stimulated people to look at all the alternatives on the market, and the number of people who have moved from one operator to another has increased. Newcomers to the market have stimulated more people to look at price. This immediately impacted churn, and prices went down. For example, the top tariff plans have halved in price, and the market is shrinking by 10% annually. So clearly these things are challenging. No other country in Europe has been more challenged than the Belgian market over the past year. Saying that, these kinds of events have already happened in other countries, and pressure already exists in those countries. If you really compare the prices, those in Belgium are the lowest in all of Europe.

Q: What makes Base Belgium stand out in the industry? What is the major challenge for Base in the Belgian market?

A: We entered the market about 14 years ago. At that time there were two main players. It was difficult for a newcomer to enter a market dominated by two strong players. The only way to succeed was to do something different. We are always positioned as the challenger. In fact, we are always focused on two things: being the price leader and providing superior customer experience. Being a challenger means trying to convey new things that challenge the market. We now have more than 20% of the market in Belgium, and we are growing fast. Even though the market is decreasing by 10% (our figures are also negative for the moment), we believe that the future will be better.

We have taken a position and worked on three different levels.

First, we are known in Belgium as the price leader, so we decreased our prices and immediately took back leading position on price.

Second, customer experience has always been one of our strong points. We are the only operator with a positive home network score. Customer experience is crucial to get right.

Third, our network gives us a competitive advantage. In the past, Base was seen as an operator with the best price but a lousy network. We put an end to this. In recent years, we have worked with ZTE and can say with confidence that now we are at least on par with the number one network in the market. We have clearly shed our negative image and have turned our weakest point into one of our advantages. To give you an example, in the last few months, we moved into the leadership position after the entry of four players. We have never had so many new customers coming to Base. We win in the market and we win for everybody

in the market. The proportion of new customers as a proportion of churn is extremely high, and we are extremely happy to now be seen as a good player in the Belgium market.

Nevertheless, we aren't growing in terms of revenue or EBDA. So our profit is not increasing. This is a challenge for us, but we believe our business fundamentals are strong and we are on the right track. Our shareholders expect us to deliver good financial results, but to ensure our future, we need the money to invest in our network. We have committed to providing a good network, and to do this, we need to invest. It is extremely challenging to invest when revenues are declining. This is a difficult situation. Luckily, more and more customers are coming on board. We know that if we execute well, we will get there in the end. Of course, we need to be extremely cost-conscious. We need to do everything possible to make sure that our operations are the cheapest in the market because only then can we afford to provide the cheapest price to the customer. These aspects are important for us.

Q: Does Base Belgium intend to provide full LTE coverage in Belgium? Does it have a similar strategy to E-Plus Germany?

A: First, our vision is to be recognized by Belgian customers as a mobile specialist. We have to be focused on mobile. If you want to be a mobile player in today's environment, you will never win wiothout LTE. We will buy an 800 MHz license next week in order to deploy LTE. The objective is

to provide full indoor LTE coverage in Belgium. We are going for deep indoor coverage because at that moment you can compete with fixed. That's also the reason we are in discussions about improving our network. We need to be a mobile-centered player and lead the game. That is only possible if we have a partnership with main suppliers. We believe that ZTE is the right partner to help us achieve our mobile goals.

I think the objective of E-plus is the same, but our starting points are different. Our network is much more developed than that of E-plus. We already provide 81% 3G indoor coverage, and every month this is increasing. Germany is not yet in the game of LTE. They started later and are a bigger country. We are third in the market and also a challenger. The way we decribe our challenger model is the same as E-plus.

An interview

Q: What are the diffculties in providing LTE coverage? How does Base Belgium overcome these difficulties?

A: We have so many difficulties. Radiation is one. Brussels imposes strict regulations in terms of radiation. But we can meet this challenge. Getting building permits is probabaly the biggest chanllenge we have. Over the past few years, we have not been able to easily acquire new sites, and at the sites we have acquired, getting the necessary building permits takes so much time. This is really a big issue.

We will buy an 800 MHz license next week. This helps a lot because the number of sites needed to provide full coverage is lower than what we currently have. So this is an opportunity. We will have discussions with all operators to see if we can do some sharing.

Q: Base is aiming to be the top mobile operator in Belgium. How can ZTE help you achieve this aim?

A: We believe that if you want to be successful you need to have a clear objective. As I said, we want to be recognized by the Belgium mobile consumer as a mobile specialist, and this means we have the best network. If you want to have the best network, you need to have the best partner to support you. We believe ZTE is the best partner for us.

ZTE has knowledge and a lot of expertise. I believe that ZTE can help us demonstrate to Europe how to run a network. ZTE and Base have the same objective of becoming number one. We have the right partnership and the same mindset to achieve our goal.

Q: How will the ZTE-Base partnership evolve in the future?

A: The best thing is to look backwards. What we have done recently has been fantastic. We have rolled out 3G, 4G, and LTE together in a very short time. We decided in August 2012 to launch LTE in 2013, and we launched it on time. That doesn't mean we don't have challenges on both sides. We are now close to being number one after we launched LTE in the highest number of cities. Clearly, we are in very good position, and I believe we have the fundamentals to go further. I am convinced that if you do it well, ZTE will be proud to have Base as a customer and we will also be proud to have ZTE as a partner because you enable us to achieve our goal. The key is to have the same view about what we should provide in Belguim and how the partnership should evolve. We have the right people to make it happen on both sides.

Q: What steps will you take

to improve your position in the future?

A: There are three crucial elements. We are now building a very good network. That's the primary goal of any mobile operator. Second, we know what we have to do operationally. We have a brand that is highly appreciated in the market. We are a price leader and we provide good customer experience, so we have the basics to be successful. However, the challenge is to make sure that revenue also pick up. This is crucial because recently another operator announced that it will reduce prices even more. Generating revenue through additional services is something we need to explore with ZTE. We need to identify the services that help us increase consumption. If we are able to do this, then we can achieve our goal.

Q: Could you introduce your multibrand strategy?

A: Base is our main brand, but we believe in partnerships. How can we continue to be successful when we started in Belgium 14 years ago? A mainstream brand takes time to grow. What we have done is to identify specific target groups that can help us grow faster and create different brands for them. If you look at our brands, we currently have BASE for mobile and SNOW for broadband. All the other brands we sell are those of our partners.

We have adopted a multi-brand strategy that involves using our partners' brands on our own network. We draw on the brands and marketing power of our partners to reach specific segments. By doing this, we can be more successful. You don't need to permanently adhere to what you're doing, but at the moment, the brands we are promoting have been successful.

Apart from the brands of three main operators in Belgium, there are the brands of our partners. Establishing partnership is not easy because there may be different mindsets in different companies. You need to develop certain things on both sides. Not every company is able to do this, but we can. In the beginning, this is how we started and it's still the case now. If companies want to learn something in our market, they always come to us first. This is normal because we are open for partnership. We do not establish partnerships for a day. We

only believe in long-term partnerships.

Q: What are the most popular services and applications for your local customers?

A: In Belgium, the services that customers are looking at are still extremely limited. Take data penetration for example. Only 50 percent of custmers are really using data. Half of the people are still using mobile for basic calling or sending SMS. We need to significantly promote the use of data, and this goes hand-in-hand with smartphone penetration. I prefer large screens because we know there is a close

> *ZTE and Base have the same objective of becoming number one. We have the right partnership and the same mindset to achieve our goal.*

relationship between the size of the screen and data consumption. The key point is to make sure that we stimulate data penetration. If everything goes to data, prices go down. Of course, we need to develop services. I believe the opportunity is bigger if we can encourage our current customers to use data on smartphones. On the service side, we will watch very carefully and that's the reason why we are here. What I'm looking at is other kinds of services we can offer to our customers in the near future. We need to get a feeling for what will be successful in the future. On the other hand, we also need to encourage people to use data. **ZTE TECHNOLOGIES**
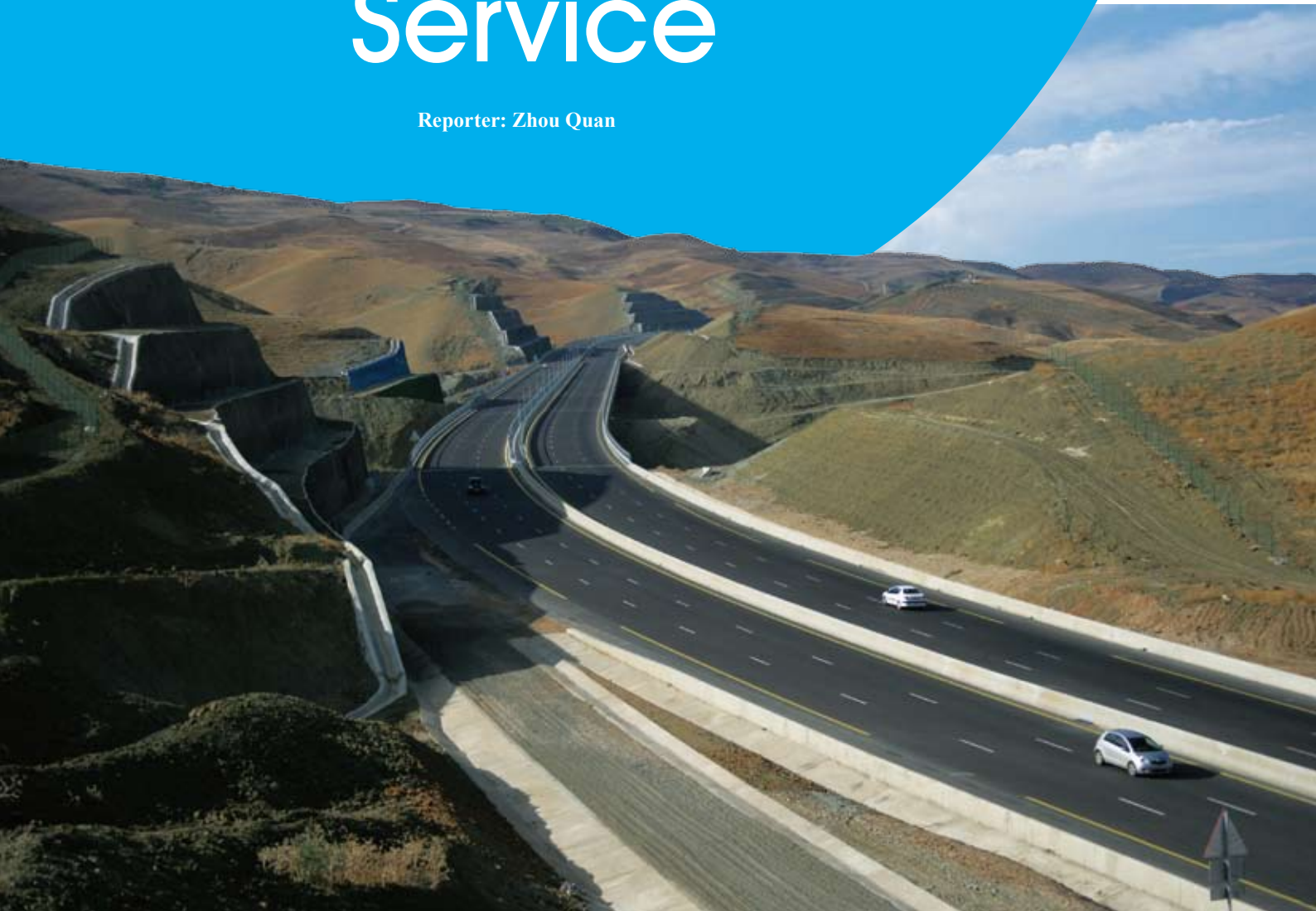
Algeria Telecom

Offering the Best Service

Reporter: Zhou Quan

Algeria Telecom is the leader in the Algerian telecommunications market and is experiencing strong growth. The company offers a full range of voice and data services to residential and business customers. Algeria Telecom's position has been attained through strong innovation policies that are tailored to meet customer expectations and oriented to new users. Azouaou Mehmel, Algeria Telecom CEO, talks about challenges, operational philosophy, future activities, and cooperation with ZTE.

Q: What are the characteristics and trends in the Algerian telecom market?

A: Algeria's telecommunications market is very dynamic and is expected to grow a lot in the years to come. This is a big challenge for Algeria Telecom, the national operator, and also for other stakeholders.

Q: What is your operational and management philosophy in running Algeria Telecom?

A: Algeria Telecom is a public joint-stock company operating capital market networks and electronic communications services. It is a national fixed-line telecom operator that faces the same constraints as other fixed-line operators all over the world. However, Algeria Telecom has not had a period of rest and adaptation in its transition from state-owned "administrative" company to a full commercial company because of the quick opening up of the market to competition. The greatest challenge

Azouaou Mehmel, Algeria Telecom CEO

for Algeria Telecom is to adapt to this new reality by focusing on skills development and human resources. The new situation requires us to adopt a customer-oriented management philosophy.

Q: What challenges have you encountered and are there any stories you would like to share?

A: Algeria Telecom has encountered several challenges since its creation. In particular, we had to deploy and maintain different large network infrastructures and provide broadband for everyone across the country.

Q: What is Algeria Telecom's

> " *The relationship between Algeria Telecom and ZTE is excellent. We consider ZTE a partner, not just a supplier.*

development strategy and next step?

A: Our main development strategy is to transform gradually from a network operator to a services operator centered on clients. For this, quality of service is an essential prerequisite. The next step will be upgrading all network layers to offer the best service quality.

Q: How are you going to develop your broadband services?

A: Algeria Telecom must become a major broadband operator. This is the case for all fixed-line telecom operators around the world. We initially upgraded all our network infrastructures, which was a huge job because of the extent of the network. There is still a lot of work to be done in developing services and content to create added value on this infrastructure.

Q: How does Algeria Telecom position its LTE service, and what will be the key factors driving LTE uptake in Algeria? Do you think the Algerian market is ready for 4G when 3G services are just taking off?

A: Considering the immensity, geographical diversity of the territory, wireless solutions are necessary in some areas. Algeria Telecom deployed a national CDMA wireless local loop network, but with the imminent launch of 3G services, this network has to be stopped for now. Also Algeria Telecom is authorized to build a high-speed LTE wireless network but in fixed mode (no mobility) to offer a variety of wireless services. This broadband network also has to cover the areas where it would be difficult for a wired network to reach.

I believe that the LTE market

is promising, and our LTE network will not address the same needs as the 3G network. Also, launching these two services simultaneously will help our country catch up with telecommunications development in other countries in our region.

Q: What do you think about the cooperation between Algeria Telecom and ZTE? How can ZTE fit into your development strategy?

A: The relationship between Algeria Telecom and ZTE is excellent. We consider ZTE a partner, not just a supplier. ZTE is a major player in the Algerian telecom market, which has to grow strongly.

Q: What are the new trends in the global telecom market? Are there any best practices you would like to apply to your local market?

A: We will follow the same developments and trends as in more mature markets. The internet in particular has standardized usage habits and behaviors throughout the world to some extent. Of course, we will have to adapt solutions to our locale, especially technical solutions, because of geography. We will also have to adapt some services and content. Algerian customers are very fond of new technologies and are very receptive. I do not think they will be very different from other customers across the world. **ZTE** TECHNOLOGIES

TOT:
World-Class Quality

Reporters: Zhao Rujing and Zhong Meixian

TOT Public Company Ltd. (formerly the Telephone Organization of Thailand) is the largest fixed-line telephone operator in Thailand. At ITU Telecom World 2013, held in Bangkok, TOT CEO Yongyuth Wattanasin talked to *ZTE TECHNOLOGIES* about TOT's market development strategies, grand goals, and contributions to Smart Thailand 2020.

Q: How would you describe Thailand's telecom market?

A: Thailand's telecom market is facing new challenges such as the emergence of 3G, high-speed internet, and OTT-based digital TV. In the mobile market, especially the 3G market, the main operators are AIS, DTAC and True BFKT. TOT started developing the 3G market long ago and has completed phase 1 of its network rollout, which involved building 5320 base stations.

In phase 2, TOT plans to find a partner to help expand the network and quickly cover the whole country. TOT wants to become a leading player in the 3G market and hopes that phase 2 will be completed in 2014.

Another market in Thailand's telecom industry is high-speed internet for factories and enterprises. This market has always been very competitive. In 2014, TOT will also strengthen its input in this market. Meanwhile, as network services develop, digital TV will also become popular.

TOT CEO Yongyuth Wattanasin

Q: What is TOT's marketing strategy?

A: At present, TOT needs to increase its revenue. We have a number of marketing strategies and key projects to boost our market performance. These involve

expanding our broadband network to two million ports. We will invest THB 30 billion to build an FTTX network. We will also reduce our ADSL subscriber base in batches and gradually replace all our ADSL networks with optical networks. We believe that the new FTTX network will offer a brand new user experience on the application layer.

replacing telephone exchanges. We are investing in an NGN to reconstruct our existing TDM network, which was built 25 years ago. We will overlay a Softswitch onto our existing network. The NGN will create sustainable revenue but we will retain our existing subscribers. The NGN will also support future-proof technologies. We plan to invest THB 3 billion in this project.

Submarine cable or international internet cable project. We will build a submarine cable across the Gulf of Thailand. This cable will connect Thailand with Singapore, Hong Kong, Japan and America. We have already invested labor and other resources in this project. The other part of the project is to connect Singapore with Europe. This project will connect to the international network through submarine cables, which will better support our services. We plan to invest THB 7 billion in this project.

3G phase 2 expansion project. We plan to invest about THB 30 billion to provide 3G services across the whole of Thailand so that the public can experience fast 3G. To ensure quick entry into the market, we need to find a partner. This is critical at the moment.

Q: What is the standard when you choose a strategic partner?

A: TOT has an R&D center in Pathum Thani. Although we have not yet produced any products, we will find

> **"** *We think that ZTE has a full range of telecom products and very good development prospects in Thailand. ZTE is cooperating with all five operators in Thailand.*

partners in OEM mode. We will also develop new technologies and move towards equipment manufacturing. We hope to change the current equipment purchasing mode in order to reduce our operational costs. This is our preliminary goal.

TOT has recruited 17,000 employees over the past 60 years, but a large number of these employees lack necessary knowledge and skills. Therefore, we need to import many professionals to interact with our existing R&D staff and update our knowledge base in areas such as IP/ MPLS. This is another reason that we need a strong, reliable partner that can help us move forward.

Q: ITU Telecom World 2013 is being held in Bangkok. TOT is a major sponsor and co-organizer of the event. What opportunities do you think ITU will create for TOT?

A: We are honored to be hosting ITU Telecom World 2013. This is a grand meeting in the global telecom industry and allows us to preview inspirational new technologies that will emerge in the next one or two years. Telecom organizations and competitors from all

An interview

over the world have booths that let us see the trends in service development. Of course, TOT has also demonstrated its own 3G technologies. Our phase 2 project will combine 3G and 4G (LTE) so that they share a 2.1 GHz frequency band. On November 18, 2013, TOT showed future applications for a series of products and services that included 3G and payment gateway. This is similar to when China Telecom demonstrated its 4G technologies at Connect Asia. At present, our 3G network has covered most areas in Thailand.

Q: The Thai government is planning a national strategy called Smart Thailand 2020. How will TOT support this plan?

A: Smart Thailand 2020 is a government project aimed at promoting high-speed internet to each household and industry sector. Our goal is to provide this service to 80% of households by 2015 and 95% of households by 2017. TOT has been designated by the Ministry of Information and Communication Technology (ICT) to be the main service provider for this project. The project comprises ICT free Wi-Fi and TOT Wi-Fi. TOT will invest in building about 30,000 access points, and the National Broadcasting and Telecommunications Commission

(NBTC) will provide funding for TOT to build another 150,000 access points. Thus, we will have nearly 200,000 access points that cover most of Thailand. We will have to consider how to use this huge network and what services we can offer.

Q: Could you give ZTE some advices? In your opinion, what can ZTE do to help TOT develop in the future?

A: We think that ZTE has a full range of telecom products and very good development prospects in Thailand. ZTE is cooperating with all five operators in Thailand. ZTE's high-quality products, especially switches and routers, have been widely used in TOT's fixed-line networks. We hope that ZTE continues to focus on 3G and 4G network planning and equipment solutions in Thailand. The mobile market here will grow strongly in the future.

Q: What is TOT's goal in the next three years?

A: Our goal is to become a mainstream service provider and provide network coverage across all of Thailand. In 2015, Thailand will join the Asean Economic Community (AEC). TOT is planning to cooperate with neighboring countries on network construction and share resources with other AEC members. **ZTE TECHNOLOGIES**

> 5G will be a smart network that can integrate multiple wireless technologies and automatically define scenarios or configure services as required by the user.

Preparing to Embrace the
5G Era

By Bo Gang

Industry Expectations for 5G

As 4G wireless technologies mature, research has begun on 5G technology. In terms of architecture, a 5G network will have ultrahigh capacity; it will integrate multiple networks; it will be highly intelligent; and it will use IT and cloud-based technologies. A 5G network will also be energy-efficient. Demand for mobile network capacity is predicted to increase a thousand-fold within ten years.

User demand has also played a part in 5G development. With the proliferation of mobile broadband, users have demanded more in terms of ultrahigh speed, low delay, ubiquitous coverage, and better mobility. In future applications, such as internet of vehicles and smart grid, delay will be less than 1 ms.

5G technologies are needed to deliver many emerging services, such as massive connected devices and wide-range traffic pattern.

5G Research Directions

At present, industry research on 5G is still in its infancy. 5G research will be focused on increasing capacity a thousand-fold, lowering delay to below 5 s, and supporting multiple services, such as MTC, V2V, and D2D. However, the primary goal is achieving a thousand-fold increase in capacity. Another important goal is improving the air interface technology so that 5G networks are highly converged and flexible.

To increase capacity, industry is working hard to expand spectrum, improve spectral efficiency, and deploy dense cells.

More Spectrum

Allocating spectral resources is the first issue that needs to be solved in the evolution to 5G. Making full use of existing spectrum and planning the spread of spectrum are two important research topics in 5G.

Aggregating spectrum bandwidths according to service demand helps optimize the use of existing spectrum. White-space spectrums below 3.5 GHz are very rare, so future 5G spectrums will have to spread to high frequency bands, such as the range from 5 GHz to 50 GHz.

Static or quasi-static spectrum allocation will gradually be replaced by dynamic spectrum allocation so that base stations and terminals can automatically allocate spectrum according to actual scenarios and service demands. This helps maximize spectrum use. Spectrum sharing and dynamic spectrum allocation are focus points in current research.

Bo Gang, *ZTE chief architect and general manager of 5G products*

More Effective Air Interface Channels and Higher Spectral Efficiency

Because spectrum is limited, spectral efficiency needs to be improved in terms of

- modulation, demodulation and coding. Efficient modulation, demodulation and coding technologies are essential for wireless communications. There have already been groundbreaking advances in such technologies for 2G, 3G and 4G networks, but even bigger breakthroughs are expected in the 5G era. Even though many 5G modulation, demodulation, and coding technologies are currently being researched, none can satisfactorily replace existing technologies in the short term.

- canceling interference. Another way to increase efficiency is to reduce interference and maximize the capacity of available channels. In 4G, this has proven to be an effective way of increasing efficiency, and it is promising for 5G networks. Multiple coordination technologies will be introduced to eliminate interference within base stations, between base stations, and across the whole system so that overall system capacity is increased.

- space division for spectrum reuse. When it is difficult to improve system capacity through modulation, demodulation and coding, space-division technology is optimal for maximizing spectrum reuse. Massive MIMO is such a technology and is widely recognized in the industry.

- automatic air interface adaptation. Air interface adaptation is another way of developing 5G technology. Future 5G requires a network that can support diverse services, such

as high-speed telepresence, highly reliable smart grid, M2M, and D2D communication. These services need different air interface technologies that are adaptable to the unique features and coding modes of the service. Therefore, it is important to make one NE that is adaptable to all these services.

Dense Cells

Small cells are an important way of increasing the capacity and improving the performance of a mobile network. In the early years, networks were homogeneous, but they now have heterogeneous macro and micro architectures. Dense picocell coverage will be irreversible for 5G networks. Separate high-frequency bands will be allocated to densely deployed picocells; separate thin-carrier channels will be used for macro cells; and ultra virtual cells will also be used.

Future 5G networks will have converged technology; will be designed for optimal user experience; and will incorporate IEEE wireless access and IT technologies. A 5G network will be a smart, converged ICT mobile platform.

ZTE's Vision for 5G

ZTE believes that cloud-based network architecture, coordinated RAN design, and software-defined multiservice

air interfaces are the future for 5G networks. Cloud-based network architecture means core networks and NEs (such as controllers) use network function virtualization (NFV) and software-defined networking (SDN) to integrate hardware system and software-defined functions. Cloud-based RAN uses NFV to provide cloud-based NEs, and it improves the convergence of multiple systems and coordination between multiple networks. Software-defined multiservice air interfaces enable the network to adapt to diverse services using one network or one NE.

Cloud NF

With its unified cloud telecom platform, ZTE has transgressed the boundary of traditional mobile NEs and has redefined network architecture. According to ZTE, a wireless network architecture comprises three clouds: cloud NF, cloud radio, and cloud service, and these meet the needs of long-term evolution.

Using NFV, cloud NF integrates the functions of mobile core network, controllers, and signaling-based centralized interference suppression. Cloud NF uses virtualization to separate software architecture from hardware architecture and makes all NE functions an organic whole. Cloud NF also uses SDN to separate the forwarding plane of packet gateways from the core network. This improves forwarding efficiency.
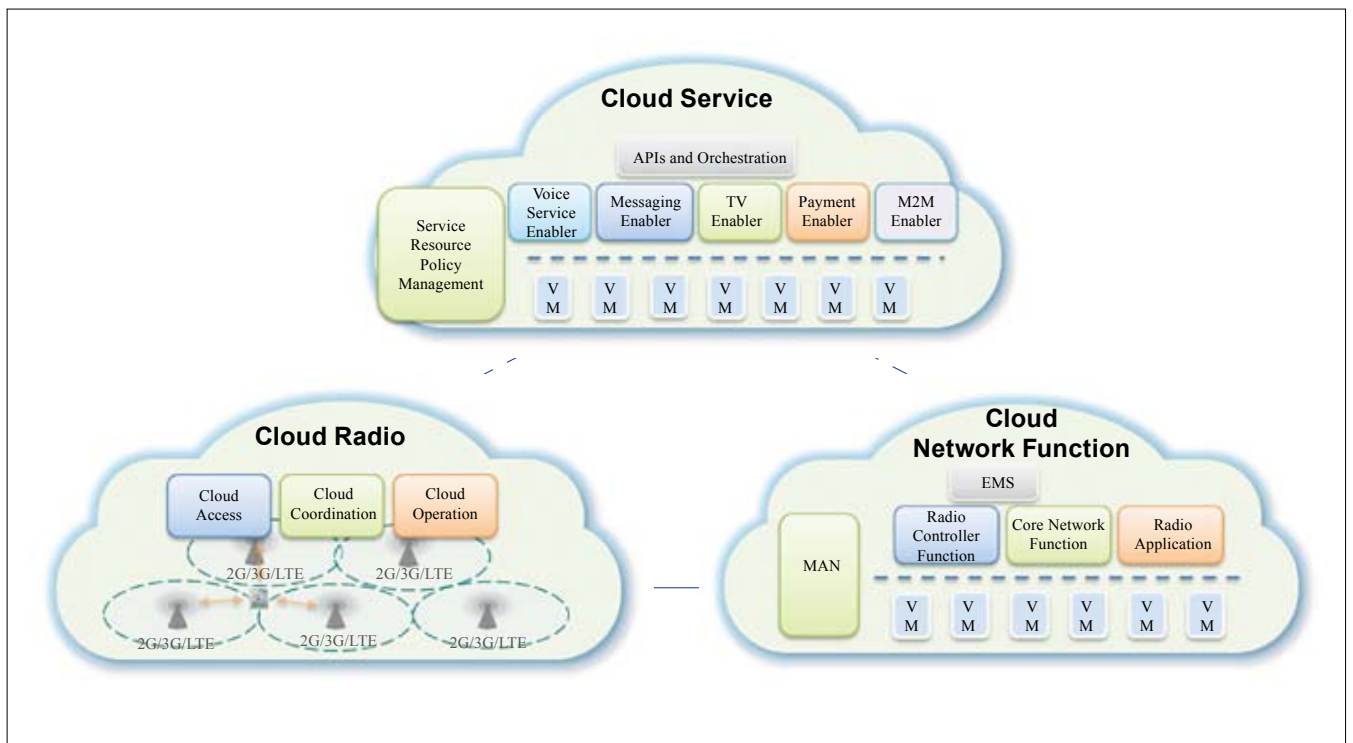

Figure 1. Wireless network architecture.

Cloud NF enables the efficient deployment of 2G, 3G and 4G multilayer networks and accommodates the needs of both legacy and future 5G networks.

Cloud Radio

Cloud radio includes cloud access and cloud coordination. The key to cloud access is to integrate and optimize independent 2G, 3G, 4G, and Wi-Fi access networks in order to enable vertical multisystem convergence and horizontal three-dimensional coverage by NEs. In this way, end users receive the best data and voice services at any time and in any place. They do not need to know about the specific wireless access mode or differences between wireless technologies. Complicated access authentication is also unnecessary.

Cloud coordination has two core aspects: dynamic adaptation and dynamic seamless coordination. Dynamic adaptation means using multilayer coordination and a resilient bandwidth mechanism to adapt to different bearing conditions. An optimal coordination solution provides suitable transmission regardless of whether the bearer network is based on microwave, SDH, MPLS, or PTN. With this solution, idle bandwidth in the bearer network is utilized to improve wireless performance. The resilient bandwidth mechanism enables good cloud coordination even when the transmission performance of networks fluctuates widely.

Software-Defined Air Interface

A single air-interface technology is not fully adaptable to all 5G services. Flexible air interface technologies are needed for automatic service adaption and optimal performance. In 2009, ZTE proposed a software-defined air interface in which the hardware architecture at the access side is unified, and specific air interfaces are software-programmed under the unified air interface framework in order to satisfy the requirements of various application scenarios. These scenarios include wireless LAN, high-speed data communication, LTE-Hi, various backhaul connections, varying frequency bands, and M2M communication that supports massive low-rate access terminals. Software-defined air interface technology can be used for 5G evolution but also supports mature 2G, 3G, and 4G access technologies.

Conclusion

5G may not be a brand-new technology. Research on 5G will focus more on user demands and scenario adaptation. 5G will be a smart network that can integrate multiple wireless technologies and automatically define scenarios or configure services as required by the user.

Drawing on years of experience in network deployment, ZTE has made significant contributions on cloud architecture, cloud radio coordination, and multiservice air interface adaptation (SDA) for 5G. ZTE has carried out relevant R&D in these areas. No matter what new technologies are applied in 5G, ZTE's SDA, cloud radio, and cloud NF solutions will fully support them. 5G is an open ecological system that will allow mobile technology to color our daily lives. ZTE is working closely with its partners to contribute to 5G development. **ZTE** *TECHNOLOGIES*

Cloud Radio
Leading the Future of LTE

By Liu Liangliang

Challenges of the Mobile Broadband Era

Back in 2010, the number of mobile broadband users worldwide soared to 940 million, more than the number of fixed broadband users. The next decade will see a tenfold increase in mobile broadband users and more than 500-fold growth in mobile data consumption.

LTE is a next-generation mainstream mobile broadband technology that is being commercialized at an unprecedented pace. According to the report "Evolution to LTE," by the Global mobile Suppliers Association (GSA), as of October 2013, 222 operators worldwide had commercially launched LTE services. Currently, 474 operators worldwide are investing in LTE networks. LTE will not only improve network speed but also revolutionize people's lifestyles. However, telecom operators face two challenges in the LTE era: high requirements on bearer networks and complex interference.

In terms of bearer network requirements, the throughput of a 4G network is much higher than that of a 3G network; therefore, a 4G network requires much more wireless bandwidth (more than 50 Mbps uplink and 100 Mbps downlink). This is more than 10 times that of 3G networks. Mobile bearer networks must be upgraded or transformed before LTE networks can be constructed. The 3rd Generation Partnership Project (3GPP) protocol is based on ideal transmission; that is, when bandwidth and latency fully meet coordinated multi point (CoMP) transmission requirements. However, in actual networks, only dedicated fibers can meet these requirements. If coordination technologies defined in the LTE Advanced standard are used, investment in a bearer network may be too costly for the operator. Transmission is currently the biggest bottleneck in LTE deployment.

In terms of complex interference, LTE networks provide high-speed internet access, so both signal coverage and network capacity need to be considered when addressing this problem. LTE is deployed in high spectrum bands, so sites are dense in order to ensure signal quality. This causes greater interference. Compared with GSM and WCDMA, OFDMA-based LTE does not have an inter-cell interference-suppression mechanism.

The 3GPP standard provides some coordination solutions for suppressing inter-cell interference and improving network performance; however, the requirements these solutions place on transmission networks are too high, and they cannot be applied under current bearer conditions.

Furthermore, co-frequency networking and hierarchical heterogeneous network deployment make interference in LTE networks more complex. Network performance, especially cell-edge performance, relies heavily on the level of inter-cell interference suppression. With the rapid increase in the number of 4G users, interference in LTE networks may become more severe, but telecom operators are not fully aware of this. In the future, more than half of the performance problems in LTE networks could be caused by severe interference, not poor coverage.

Bearing capacity can be improved

by transforming and upgrading transmission networks and increasing investment in networks. Solving the interference problem requires an advanced, all-round technical solution that greatly improves the performance of commercial LTE networks. With commercial use of LTE networks and number allocation, interference may be much more severe than expected, and standard inter-cell interference suppression technology or evolved technology may not be solely relied on to deal with the problem.

How are these two challenges to be addressed in the LTE era? Is there solution that significantly improves network performance using the legacy bearer networks so that minimal extra investment is needed?

ZTE's Innovative Solution Cloud Radio

Based on the legacy mobile bearer network, Cloud Radio solves the interference problem in LTE networks. The solution improves cell-edge performance and enables seamless inter-site coordination using the available bandwidth. This greatly improves access performance.

Cloud Radio uses a two-level scheduling mechanism that comprises a central cloud scheduler and distributed cloud schedulers. The central scheduler collects information (reported by base stations) about interference, load, user distribution, and interference location. The scheduler then determines the optimal resource allocation policy and gives cell-level macro scheduling instructions. Upon receiving these instructions, the base stations start scheduling at the local user level. This is the most efficient way of allocating resources and coordinating interference. The inter-cell interference problem can be solved almost without increasing the bandwidth of the bearer network.

Cloud Radio improves interference coordination from a macro perspective, and improves user-level coordination from a micro perspective. Cloud Radio supports IP-based data transmission and intelligent coordination. In this mode, the optimal coordination solution is selected according to the conditions of the bearer network. Cloud Radio is no longer limited to one site or BBU pool and is a truly dynamic, seamless method of coordination across sites. Cloud Radio improves radio networks and user experience, significantly

reduces the amount of investment needed in a 4G network, and ensures that LTE networks have radio access performance that is as good as that of LTE Advanced.

Cloud Radio allows an LTE access network to be constructed without having to upgrade the bearer network. Wireless coordination can be optimized using available bearer resources. In the initial stage of LTE deployment, operators wish to avoid investing heavily in upgrading their bearer network to achieve a standard level of coordination. With ZTE Cloud

> " *Cloud Radio is considered the most complete, most advanced solution for improving RAN performance.*

Radio, operators can even use the PTN to achieve a level of coordination that is comparable to that when bare fibers are used.

Cloud Radio Deployment in Guangzhou

In February 2013, ZTE introduced its Cloud Radio solution for 4G optimization at Mobile World Congress in Barcelona. Meanwhile, ZTE and China Mobile were jointly conducting a Cloud Radio field test in Guangzhou.

Cloud Radio enables real-time scheduling and allocation of resources according to the actual needs of the network. The field test in Guangzhou

showed that Cloud Radio significantly reduces inter-cell interference and improves cell throughput. As the network load increased, and when the network load changed dynamically, Cloud Radio is more useful. Cloud Radio requires only a few megabytes per second of transmission bandwidth. Without being transformed, the legacy transmission network met the requirements of a commercial deployment.

Cloud Radio improves cell-edge user experience by increasing throughput and improving inter-site coordination. This enables users to experience seamless, borderless networks. In the LTE-A era, CoMP is a key technology for improving user experience. The Cloud Radio network in Guangzhou provides coordinated multipoint joint transmission (CoMP JT), coordinated multipoint coordinated scheduling (CoMP CS), and CoMP JT/CoMP CS self-adaptation. Cloud Radio is deployed in the Tianhe business district of Guangzhou. With an area of 1.5 million square meters, this is the largest business district in China. It is a complex wireless environment with a large number of tall buildings and a dense population. This will be the most common scenario in the future commercialization of Cloud Radio.

The Cloud Radio network makes

use of the idle PTN transmission resources of China Mobile Guangzhou, and no hardware resources are added. Data from the live network shows that Cloud Radio improves network performance significantly. In a scenario where users are stationary at cell edges, cell-edge performance is improved by nearly 100% when CoMP CS is used and by more than 100% when CoMP JT is used.

In a scenario where users are on the move, CoMP JT, CoMP CS, and CoMP JT/CoMP CS self-adaptation all eliminate inter-site interference. The probability of throughput less than 2 Mbps drops from 8% to less than 1%. The probability of throughput less than 4 Mbps drops from 20% to 8%.

With the debut of Cloud Radio in Guangzhou, the industry has witnessed the first example of trans-site coordination, coordination based on PTN, and trans-site CoMP CS, CoMP JT and CoMP CS/CoMP JT self-adaptation on a live network. This is the point where LTE commercialization moves into a new stage.

Future mobile broadband networks will be designed to provide superior service experience. They will be ultra-wideband, have zero latency, and provide full coverage. Cloud Radio involves more than 200 patents and more than 20 innovations, and it is considered the most complete, most advanced solution for improving RAN performance. With continuous evolution, Cloud Radio will help operators reduce TCO and open up new business models. **ZTE** *TECHNOLOGIES*

ElasticNet
Bringing Network Closer

By Xue Yuhong

In the big data and cloud computing era, traditional telecom networks can no longer meet the demand for more services and higher bandwidth. Networks are becoming more and more complex. In specific fields, telecom technologies have developed considerably, yet networks are still being constructed in the traditional way. As a result, these new technologies cannot be quickly deployed and applied.

ElasticNet is ZTE's next-generation network solution. It uses software-defined networking (SDN) and network function virtualization (NFV) technologies, both of which enable elastic network configuration. This helps an operator meet the changing demands of customers and quickly implement new business models.

SDN/NFV: Driving Network Evolution

SDN originates from the GENI project in the United States. In March 2011, Verizon, Deutsche Telekom, Google, Facebook, Yahoo, and Microsoft founded the Open Networking Foundation (ONF). Many manufacturers joined ONF to promote the development of SDN, a network architecture where the control plane is decoupled from the data-forwarding plane. This makes network control is programmable.

NFV uses IT virtualization technologies to evolve legacy network equipment to standardized servers and interactive equipment. NFV enables CT network reconstruction through

IT technologies. Even without SDN, networks still support and need NFV. SDN can help improve network performance, simplify compatibility requirements on legacy networks, and make it easier to operate and maintain a network. NFV can help make SDN architecture more elastic, controllable, and programmable. Networks with both SDN and NFV are the future choice of operators.

By separating the control layer from the forwarding layer and encapsulating network resources and interfaces, hardware constraints can be overcome. Such decoupling standardizes network

OS and specifically divides the industry chain. Standardized, open interfaces lower the entry threshold for equipment providers, which helps invigorate the industrial chain and integrate IT and CT. Elastic networks can easily evolve to cloud architecture.

Centralized control improves management efficiency and quality, and a programmable network provides endless possibilities for innovation. It also enables operators to provide services more quickly and increases their competitiveness.

As SDN and NFV are used in networks, operators will be able to construct a low-TCO network with elastic network architecture and more open network environment that provides better user experience.

Figure 1. ZTE's ElasticNet solution.

An Elastic Network Solution

ElasticNet integrates SDN and NFV technology to create a flat network that suits diverse functions and demands. With cloud computing technology, ElasticNet provides functions and systems for network control. It decouples the control and forwarding functions so that network control is centralized, and it makes the network comply with open, standard protocols. ElasticNet provides a programmable environment, which makes the network visible to applications and promotes network innovation. The solution also solves problems with automatic network configuration and flexible service deployment.

In short, ElasticNet makes a network dynamic. The network can be scaled to meet increased service demands, reduce the cost of network construction, and maximize network

utilization. The network evolves from a fixed, complicated system to a flexible, reconfigurable software-based system.

ElasticNet includes SDN forwarders, an SDN controller, various VNFs, a VNF composer, and an OpenStack cloud management system.

The SDN controller provides a network-wide view and dynamically dispatches all network resources to meet the requirements of upper-layer applications. It also provides an open, programmable network environment.

ElasticNet integrates SDN and NFV technologies in order to break the isolation between NEs and make the network elastic, horizontally compatible, open to services (instead of the traditional chimney style). This gives customers a better experience in terms of management, services, and support for new business models. It

also greatly reduces the cost of network construction and maintenance.

Because the network is programmable, network management and configuration are simpler. With ElasticNet, the network can evolve in line with demand. Automatic configuration enables the network infrastructure to quickly adapt to changes in service demands.

Traditional network equipment has relatively independent network functions, which makes collaboration between multiple NEs difficult. ElasticNet uses service chaining to support new network services.

Traditional network planning and design are based on existing business models. Any changes in business model results in network reconstruction and transformation, which requires heavy investment. ElasticNet supports
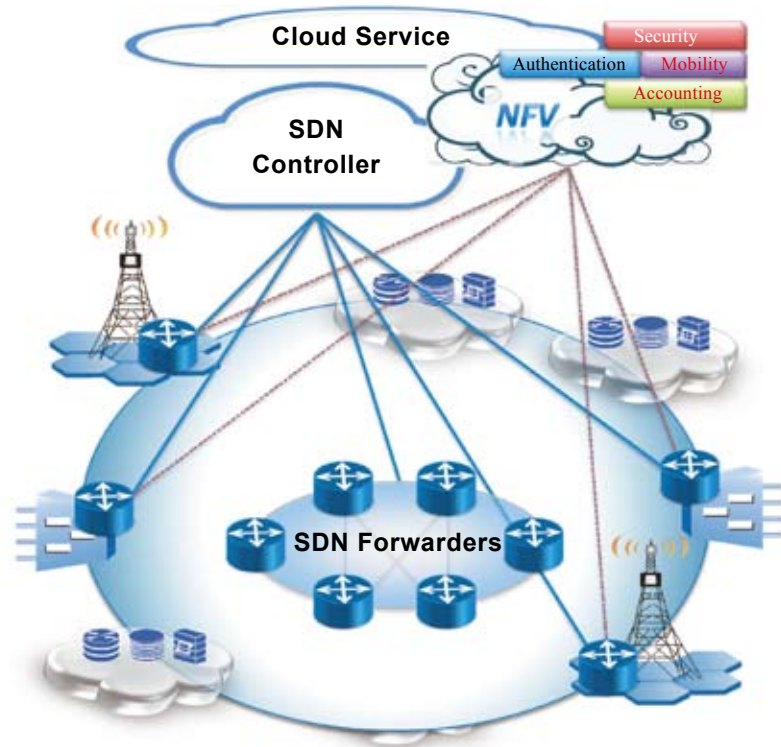
standard network programming protocols and open codes and allows the network to adapt easily to evolving business models.

ElasticNet has a general hardware architecture that extends the lifecycle of network equipment reuse, simplifies network management, and reduces capex and opex.

Because ElasticNet also makes the network more efficient and network capacity can be flexibly adjusted, carbon emissions are reduced across the entire network.

Applications of ElasticNet

ElasticNet can be applied in operator networks, data center networks, enterprise networks, and campus networks. It is capable of network virtualization within data centers, traffic dispatching and collaboration between data centers, centralized management, security control and OAM optimization of government and enterprise networks, multilayer and multidomain optimization within operator networks, and centralized control of IP RAN/ PTN virtualization.

Data Center

When applied in an internet data center (IDC) network, ElasticNet optimizes the performance of cloud services and improves resources utilization within the data center. The IDC adjusts its internal horizontal traffic through flexible policy configurations. This enables faster real-time VM migration, more network redundancy, and better traffic dispatching because application QoS and bottom-layer network load are sensed. In this way, SLAs can be guaranteed, and bandwidth use can

be optimized across the entire network.

Government and Enterprise Networks

An enterprise network has complex functions. New enterprise applications have resulted in increased demands for network customization in areas such as security, OAM, and flexible application overlapping. With its SDN architecture, ElasticNet can optimize enterprise networks. It is the first choice for scenarios where service demands at

creates a flat network based on cloud computing and enables network functions to be flexible configured. Through centralized control and virtualization, ElasticNet provides operators with a more open network and makes the network more flexible, extensible, and self-configurable. It also reduces the cost of network construction and OAM. ElasticNet can be deployed in data centers, wireless core networks, MANs, converged networks, and access networks.
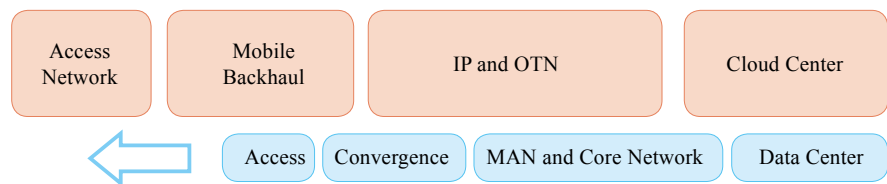

Figure 2. Application of ElasticNet in an operator network.

a single site change frequently. In such a scenario, the network topology needs to be frequently adjusted. ElasticNet enables rapid changes to services and fine network management and control in scenarios where traffic has to be frequently optimized in order to meet the demands of different services.

In a campus network, ElasticNet makes the network easier to manage and scale. Network traffic can be finely adjusted using policies and templates. New features and functions can be conveniently added, and faults can be easily located and troubleshooted in an abstract software environment. ElasticNet helps create a software-based network that facilitates the deployment of IPv6 and IPv4 dual stack/DS-LITE. It makes the evolution from IPv4 to IPv6 easy.

Operator Networks

In operator networks, ElasticNet

ZTE: A Promoter of SDN and NFV

ZTE plays an active part in standardizing and promoting SDN and NFV. The company has cooperated on technical projects with many domestic and international operators and research institutions. ZTE is an important member of ONF, ETSI, CCSA and OpenDayLight.

At the Global Open Networking and SDN Conference 2013, ZTE's ElasticNet successfully connected with the SDN equipment of multiple vendors. The ElasticNet SDN controller passed the OpenFlow 1.0 basic function tests in various networking scenarios. In September 2013, ZTE formally presented the SDN/NFV ElasticNet solution at PT/ EXPO COMM CHINA 2013 and gave on-site demonstrations. This was one of the highlights of the Expo. **ZTE TECHNOLOGIES**

ZTE UBR
Leading RRU Technological Revolution

By Shen Yang

In 2006, ZTE proposed the first BBU+RRU distributed base station architecture and applied it to the TD-SCDMA network of China Mobile Qingdao. At the time, it was a revolution in wireless base station architecture. Now, the BBU+RRU distributed base station has become mainstream. It has the following advantages:

- A series of RRUs enables indoor and outdoor coverage in different scenarios.
- RRUs are small and light and can be installed flexibly. This speeds up network deployment.
- RRUs can be installed close to the antenna site. This reduces feeder loss and increases site coverage.
- The BBU has a subrack structure that leaves no footprint.

- Baseband can be shared for flexible traffic scheduling.

With these advantages, BBU and RRU are playing an increasingly important role in 2G, 3G and 4G network deployment. A state-of-the-art RRU is an important factor when an operator chooses an equipment supplier.

According to a report published by the GSA in November 2013, the number of commercial LTE networks worldwide totaled 222 in 2013, and the number of operators that had invested in LTE worldwide in 2013 was approaching 400. Operators are facing the difficulty of coexisting network standards and frequencies. To expand their existing networks or build new ones, an operator has to find extra room on an antenna site in order to install

base stations or RRUs. Renting new sites for antennas is costly; therefore, operators seek to make full use of the limited site space they already have. Drawing on its rich experience with optical remote distributed base stations, ZTE has launched an ultra broadband RRU (UBR) that enables operators to use only one RRU instead of the traditional two (which operate on two frequency bands). This saves TCO.

Ultra Broadband

By using a broadband GaN power amplifier, UBR is capable of single-channel, ultra-broadband transmission. UBR also uses advanced ultra-broadband DPD architecture and algorithms to provide industry-leading transmission bandwidth of 365 MHz. A traditional RRU can only work on a single frequency band with the general bandwidth of 30–40 MHz. Therefore, six conventional RRUs are needed to cover the six major frequency bands of an operator, that is, DD, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, and 2600 MHz. The first ZTE UBR model covers both DD and 900 MHz frequency bands with the bandwidth up to 170 MHz (790–960 MHz); the second model covers both 1800 MHz and 2100 MHz frequency bands with the bandwidth up to 365 MHz (1805–2170 MHz); the third model that is under planning will cover both 2300 MHz and 2600 MHz with the bandwidth up to 390 MHz (2300–2690 MHz). By using the UBR solution, three RRUs are needed
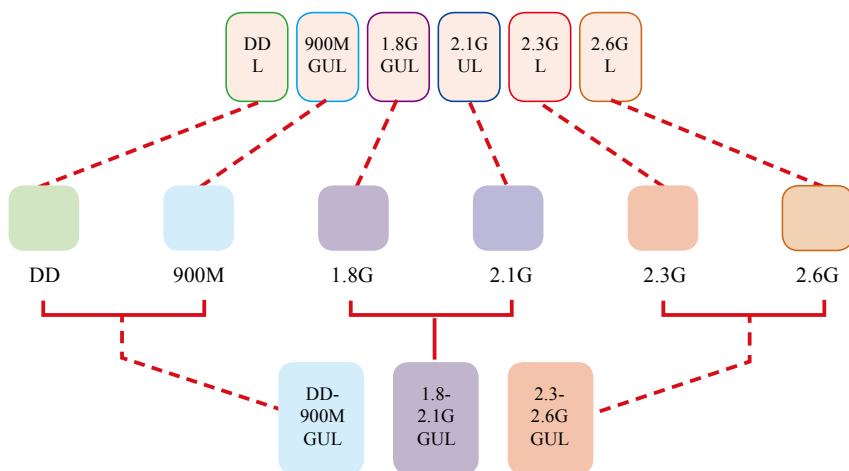

Figure 1. Frequency bands covered by UBRs.

to cover the six main frequency bands that were covered by six conventional RRUs. This greatly reduces the number of RRUs and antenna sites and saves an operator's investment.

Compact Architecture

By using advanced cooling and internal structure interconnection technologies, ZTE's new-generation UBR is the smallest and lightest base station in the industry. It has a 2T2R structure and transmitting power of 2 × 80 W. It is 12 L and 12 kg, so it can be installed by a single person.

Efficient Cooling System

ZTE's new-generation UBR has a cooling mode that increases cooling efficiency by 50%, and the size of a radiator is reduced by 40%. The UBR is lighter and quieter and has a longer lifespan than a conventional RRU.

Active Duplexer

ZTE is the first equipment vendor to introduce active duplexer technology into its UBR. This reduces the size of a duplexer by 25%.

Dynamic Power Sharing

The 2 × 80 W transmitting power can be adjusted on two frequency bands, and GSM, UMTS, and LTE modes are supported on the same frequency band. This means UBR can be used in different scenarios. Table 1 lists a typical power configuration for a UBR operating at 1800–2100 MHz. The UBR can be configured in different modes according to traffic and an operator's requirements. This saves the cost of duplicated investment.

SiteWeb

The new-generation UBR also includes a high value-added SiteWeb solution

Table 1. A typical power configuration for a UBR (1800–2100 MHz).

Typic Conf.	1800M	2100M
Conf.1	2 × 40W(G)	2 × 40W(U)
Conf.2	2 × 40W(L)	2 × 40W(U)
Conf.2	2 × 20W(G) + 2 × 40W(L)	2 × 20W(U)
Conf.3	2 × 20W(G)	2 × 20W(U) + 2 × 40W(L)

with intelligent maintenance, ambient intelligence, and video application.

● **Intelligent Maintenance**

In the past, a network cable was used to connect a computer to a conventional RRU during commissioning or debugging. If the RRU was installed on a tower, a maintenance technician would have to climb the tower. The SiteWeb intelligent maintenance solution uses a Wi-Fi module embedded in a UBR. This allows a maintenance technician to start the UBR maintenance application installed in a smart phone. In this way, RRUs under a tower can be commissioned or maintained. This solution greatly improves the efficiency of RRU commissioning and maintenance, and reduces OAM costs.

● **Ambient Intelligence**

ZTE's new-generation UBR is a traditional 2G, 3G or 4G network element, but it also integrates M2M devices into a network in order to create more added value for operators. The ambient intelligence function enables a UBR to integrate environmental monitoring M2M devices in the cell the UBR covers. These M2M devices report the environmental information to the UBR in a timely manner, and then the UBR uploads it to the network management center for further forwarding or analysis. The environmental monitoring M2M devices

that a UBR can integrate include (but are not limited to) thermometers, hygrometers, ultraviolet sensors, anemometers, and PM2.5 sensors.

● **Video Application**

ZTE's new-generation UBR can also provide video service for video display devices in the cell it covers. The video display devices include outdoor advertising screens. Through network management control or intelligent terminal control with a specific application, a display device can update its content at any time as required by users.

Figure 2. UBR (1800–2100 MHz).

ZTE has always focused on operator needs and is dedicated to providing high-performance, superior products and services. The new UBR helps operators address the coexistence of multiple networks and frequency bands in the 4G era, and will become another sharp weapon of quality 4G networks for operators. **ZTE TECHNOLOGIES**

Cloud NF

The Way to Efficiency and Simplicity

By Xia Hao and Liu Qin

With the rapid development of mobile internet and the widespread use of smart terminals, global data traffic has increased exponentially. Even though mobile networks are evolving to 4G, legacy 2G and 3G networks will still be around for some time. In a traditional network, equipment is usually designed with a dedicated architecture and specific function. Therefore, there are a variety of network elements (NEs) in the network. This complicates network OAM and also increases OAM costs. In addition, the ARPU of telecom operators is being eaten away by OTT players. Challenges facing operators include:

- costly expansion and replacement. To cope with the exponential increase of signaling and data traffic, it is necessary to expand or even replace NEs located in different areas. One of the foremost concerns of an operator is smooth, flexible expansion in response to unpredictable traffic fluctuation.
- difficult OAM. Every function or NE requires dedicated hardware and software. This increases OAM complexity. The capacity of a single system is also limited. The only way to increase capacity is to replace hardware or add extra NEs. This makes OAM difficult and increases the workload of OAM personnel.
- high power consumption. Operators usually run all their NEs at maximum capacity to ensure QoS. However, for direct communication and dynamic capacity scaling between these NEs, a lot of power is needed.
- Closely coupled hardware and software that restricts innovation. The equipment used for a service might have latent capabilities that are unrealized but locked because of the close coupling with software. It is difficult to protect investment because additional hardware and software needs to be deployed for each new services and application.
- long R&D cycle and high customization cost. Network evolution and standardization of new functions is a long process. The R&D cycle is long, and frequent service customization is costly.

Exponential growth in data traffic increases the requirements on network architecture in terms of capacity, delay, power consumption, and new service deployment. If we look at the history of mobile network architecture, from layered vertical architecture in the 2G era to flat, open architecture in the 4G or even 5G era, the goal of mobile network evolution has been simplicity and efficiency.

The evolution of mobile networks to flat, cloud-based networks is inevitable and will improve operator competitiveness and simplify OAM. In response to this trend, ZTE has developed cloud network function (Cloud NF).

Cloud NF is based on network function virtualization (NFV) and integrates mobile core networks and controllers. It uses virtualization technology to separate software architecture from hardware architecture and combines all NE functions into an organic whole. Cloud NF also uses software defined
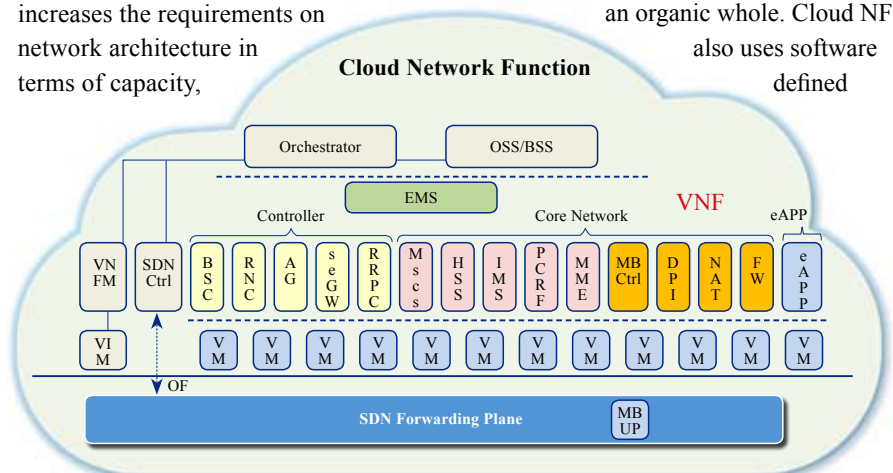

Figure 1. Cloud NF architecture.

networking (SDN) to separate the forwarding plane of packet gateways from the core network. This improves forwarding efficiency.

Based on the universal infrastructure platform, Cloud NF uses a cloud management system to integrate computing, storage, and network resources and enables all NE functions to be deployed as one function on the unified underlying platform. Cloud NF can function as the radio network controller, core network, and eAPP. Controllers comprise 2G/3G RNC and BSC, small cell AG (Femto GW), security access gateway (SeGW), and radio resource policy controller (RRPC). Core network contains control plane NEs and the control and complex data processing functions of user plane NEs. A user plane NE can separate the forward part, based on the SDN architecture, to form a forwarding plane. eAPP refers to wireless-related applications.

Cloud NF architecture can be flexibly deployed according to network scale and coverage, and it manages cross-regional resources in a unified way. Traditionally, NEs were independently planned and deployed, but now they are horizontally planned and deployed. The entire mobile network is planned uniformly and can dynamically adapt to changes in services. In other words, the number and capacity of NEs is determined by actual network capacity and planning parameters, such as traffic model. The internal processing model of NEs determines the demand for virtual machines (VMs), storage, and network resources. VM resources are allocated by each NE. Once the software of an NE has been loaded, resources are automatically fed to the NE. Cloud NF architecture is a solution for efficient 2G, 3G and 4G deployment and takes into account the demands of both legacy and future networks. It has open capabilities that enable third-party applications to be deployed on the telecom elastic cloud platform and that enable virtual network function (NFV) to be deployed on a third-party platform.

Cloud NF has the following features that help operators cope with their challenges:

- universal hardware platform. Cloud NF uses an industry-leading universal hardware platform that has distinct advantages in terms of extensibility, flexibility, evolution, and decoupling of software and hardware.
- virtual network function. Software and hardware can be decoupled. Virtualization makes software deployment more convenient. Cloud NF enables mobile network equipment to be quickly deployed, and this reduces costs during network commissioning. Cloud NF also supports frequent version changes, and this greatly lowers the risk associated with equipment upgrade. It also improves network stability.
- automatic OAM. Cloud NF supports automatic shelf installation, software installation, and service configuration. This facilitates network OAM and greatly improves deployment efficiency and quality. Cloud NF also has remarkable advantages in terms of plug and play and flexible capacity configuration.
- flexible service scalability. Services can be provisioned only through remote software configuration, and provisioning time is greatly shortened. Cloud NF supports network-based sharing so that different dedicated services can be deployed on the same network. It can also provide greater openness so that innovative third-party applications can be quickly deployed.
- carrier-class reliability. To meet the need for highly reliable telecom equipment, Cloud NF provides backup modes for multiple layers, including node, VM and service layers. It also supports 1+1, N+1, and pool backup modes.
- energy conservation. Cloud NF uses an energy-conserving multicore CPU. Each computing node can automatically power-off in order to conserve energy. The energy-conservation mechanism involves shutting down unused processing cores, decreasing the number of occupied physical machines (by concentrating VMs onto less physical machines), and shutting down unused physical machines.

As the NFV and SDN industry chain matures, future mobile networks will become more open, flexible, controllable, and intelligent. As networks evolve to 4G, existing 2G, 3G and 4G networks will continue to coexist for quite some time. As a key device in 2G and 3G networks, controllers must be evolvable. To maximize profits, operators need to provide LTE networks while addressing the issue of 2G and 3G coexistence. A cloud solution in which the controllers and core network share the same platform is therefore inevitable. ZTE's Cloud NF is such a solution. **ZTE** *TECHNOLOGIES*

CSL:
Setting the Standard for 4G Network Performance

By Li Jingtao and Liu Jianming

CSL is the leading mobile communications operator in Hong Kong, and operates three networks: GSM, WCDMA and FDD LTE. Rapid increase in LTE subscribers has imposed higher requirements on its network performance. In March 2013, CSL launched a network optimization project to boost overall performance of its LTE network. Comparative test results by an independent network testing company showed that the overall network performance increased significantly after optimization, ranking towards the top among all mobile operators in Hong Kong. This monthly comparative test, lasting nearly seven months, used the same test equipment and procedures to collect network performance data of all Hong Kong's mobile operators via drive tests, call quality tests and MTR tests. Test results showed a substantial improvement in the network KPIs of CSL's LTE network during the seven months.

CSL's LTE network started commercial operation in September 2011. Network performance kept on a high level in the beginning when the customer base is small. However, in the later half year of 2012, CSL started to witness a rapid growth of its LTE subscribers. In the highly competitive telecommunications market of Hong Kong, network performance is vital of customer experience.

In March 2013, CSL chose ZTE, amongst other competitors, to undertake the overall optimization project of its LTE network, aiming to improve network performance for metro lines and outdoor sites. Upstream/downstream rates and cell switch performance were in urgent need of improvement for metro lines, while outdoor sites faced more complex challenges: improving benchmark test rates, enhancing load balance between different frequencies and systems, shortening the delay for opening a website, and increasing network performance in areas of weak coverage.

Network Optimization for Metro Lines

The cells that cover Hong Kong's metro lines are simple: 10M bandwidth cells that operate at the 1.8 GHz frequency. The ticket hall, platform and railways are all covered by the same cell. All operators lease the same POI system of MTR Corporation Limited, therefore the wireless coverage of all telecom operators is very close, since signals

are transmitted and received through the same single-input and single-output (SISO) antenna.

To achieve best optimization results, a typical metro line was tested, analyzed and optimized, and the optimization plan was then applied to all metro lines. Fine-tuning of physical channel parameters (PUCCH/PHICH parameters) and mobility parameters (same frequency handoff parameters, inter-system handoff reselection parameters, and inter-frequency measurement parameters) helped to significantly increase network speeds. Tests showed that after optimization, the uplink speed increased by 175%, and the downlink speed increased by 50%.

Performance Optimization of Outdoor Sites

The optimization involved the following aspects to improve performance of outdoor sites:
- uplink/downlink speed. Handoff parameters, PA and RS transmission power parameters, and RLC transmission mode parameters

were optimized.
- interoperability strategy. The optimization aimed at ensuring load balance at the 1.8 GHz frequency and 2.6 GHz frequency bands and increasing the chances of a mobile terminal residing in the LTE network. To achieve this goal, parameters of inter-frequency (2.6 GHz and 1.8 GHz) and inter-system (LTE and 3G) reselection, handoff, redirection measurement and event triggering were optimized. Both idle cell reselection parameters and active cell handoff parameters could be optimized.
- delay for opening a website. The delays for opening a website through CSL's network and its rivals' networks were compared and evaluated. Drawing on experience in data analysis, an analytical method was developed for the delay analysis. This helped CSL locate the problems from benchmark test data and eventually solve serious delay issues through software upgrade.
- random PRB allocation mechanism. The initial position of a PRB was allocated at random. This helped to reduce interference between neighbor

cells and improve network performance, especially the performance in areas with weak coverage.

After the optimization, the performance of outdoor sites was significantly improved. Statistics from May to October 2013 showed that the delay for opening a Yahoo website was reduced by 34% and 33% for a Apple Daily website, while FTP upload and download speeds increased by 120% and 106% respectively.

Improving Network Performance for Better Subscriber Experience

The seven months of efforts paid off: the project was a huge success, and CSL ranked towards the top in LTE performance in Hong Kong, as evidenced by benchmark test results. CSL had a big growth in LTE active users and 120% growth in LTE traffic in the period of project. The improved network performance also significantly improved user experience.

The success of this project is a historic event in LTE performance optimization for both CSL and ZTE. The solution implemented in this project proved effective, and it will lay a solid foundation for further optimizing CSL's LTE network in the future. **ZTE** TECHNOLOGIES

ZTE Assists BASE in Rolling out 4G Network in Belgium

By Yao Shuangwu

BASE Company, also known as KPNGB, is a subsidiary of Netherlands-based Koninklijke KPN, which is one of the most important telecom operators in Belgium and across Europe. BASE Company has 4.1 million customers under brands such as JIM Mobile, AY Yildiz, and BASE. BASE has the best voice network in Belgium and is investing heavily to become the top mobile operator in Belgium. ZTE was selected as the primary vendor for BASE's 3G and 4G mobile network.

Long-Term Partner

BASE and ZTE have a long-term partnership that began with the 3G access network. Over the past four years, ZTE 3G base stations have been deployed across BASE's network, and the 3G network now covers 99.54% of the Belgian population. In recent years, BASE has been upgrading its network to dual carrier, which can reach speeds of up to 42 Mbps (double that of 3G). 3G dual carrier was launched in April
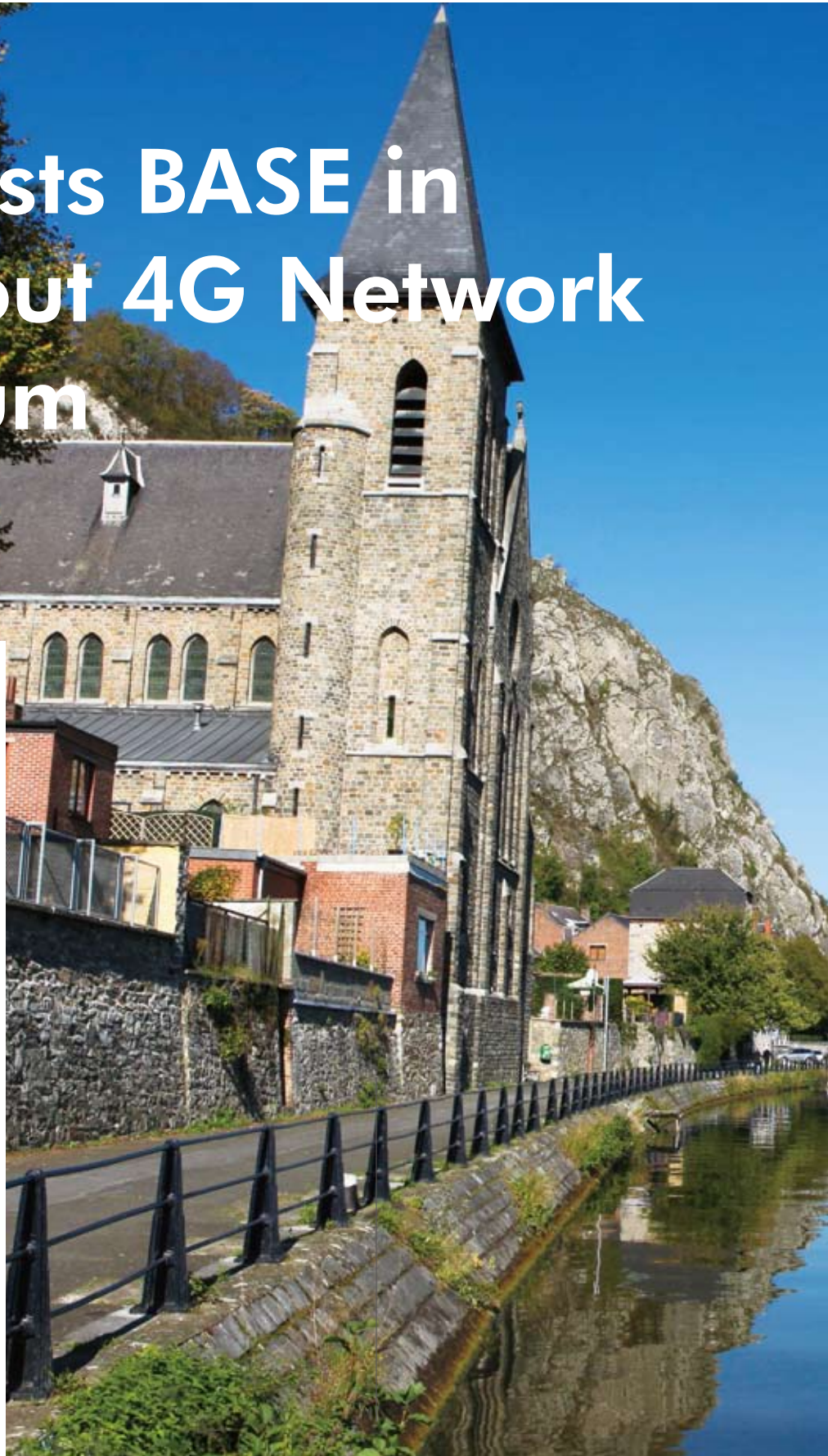
Jos Donvil, CEO of BASE

> *Jos Donvil, CEO of BASE, said, "Rolling out 4G as the second operator in Belgium is important in order to meet the new needs of our customers. In recent years, we've seen the number of smartphones and data usage on these devices skyrocket. Customers use their mobile phones for much more than just calling and sending text messages, and that evolution is continuing. As a challenger in the mobile market, we always want to give our customers the ultimate user experience."*

2013 and now covers 83% of the Belgian population. With a Uni-RAN solution that ensures smooth evolution and good equipment performance, ZTE was selected as BASE's 4G radio equipment supplier. ZTE's engineering team helped BASE construct a high-quality 4G network.

Fast Rollout

ZTE provides BASE with an end-to-end 4G access network solution that includes base stations, core network, and unified network management system. ZTE helped BASE quickly launch a high-performance 4G network that works smoothly with BASE's existing 2G/3G network.

Today, BASE is recognized as the leader in Belgium in terms of speech quality and is on par with other operators in terms of data quality. With the launch of 4G in more than 15 cities, BASE

demonstrates its ambition in rolling out 4G.

Li Jun, general manager of ZTE Benelux and Germany, said, "I am very pleased that ZTE has been able to help BASE roll out its 4G services. I am confident that with this new 4G network ZTE can help BASE attain an even stronger position in the Belgian mobile market. For ZTE, the successful launch of another 4G network with a European operator is a milestone and confirms our 4G footprint in Europe."

High Performance

BASE is the second operator to launch 4G in Belgium; however, with ZTE's advanced LTE solution, BASE's 4G network performs better than its competitor's. ZTE's wideband, multichannel RU with high output power and high-capacity, multimode BBU are both based on the Uni-RAN platform and were widely deployed

in BASE's 4G access network. These provide higher spectral efficiency and make the best use of BASE's 10 MHz spectrum in the 1800 MHz band. BASE customers can use the new 4G network immediately provided they have a 4G device, 4G coverage, and a subscription that offers 4G. With 4G, customers can quickly share photos, watch movies, download apps, and much more at a realistic speed of around 20 Mbps (theoretical speed of up to 86 Mbps). This is 10 times faster than 3G.

BASE's 4G access network is also ready for smooth evolution. The hardware platform can support LTE-Advanced features, such as carrier aggregation, eICIC, and CoMP. This provides the potential to significantly increase network performance over the long term. BASE provides a great user experience across its network, and has an edge over its competitors in Belgium. **ZTE TECHNOLOGIES**

ZSmart MCCM Leads mCel Marketing Campaigns into a New Era

By Sun Junzhong

Customer Requirements	ZSmart MCCM	Customer Benefit
For a long time, mCel had simple, inaccurate marketing modes. Lack of real-time marketing capability, inefficient response collecting mechanisms, and limited customer contact channels prevented mCel from achieving its marketing goals.	ZSmart MCCM supports multiple marketing modes, including single-wave marketing, multiwave marketing and event-based marketing. It also supports various data sources and multiple marketing channels. With a modular design, ZSmart MCCM can be easily integrated with other systems and deployed very quickly for operators.	With ZSmart MCCM, mCel creates an automatic marketing campaign that shortens time to market, improves marketing efficiency, realizes more accurate and in-time marketing and therefore enhances customer satisfaction.

Mozambique is located in Southeast Africa and has a population of 25 million. In recent years, the political and economic environment in Mozambique has stabilized and the standard of living has greatly improved. As Mozambique's economy has developed, the telecom industry has flourished. mCel is the largest mobile operator in Mozambique and has 4.5 million active users. The company faces fierce competition from other operators. mCel's OSS/BSS systems are relatively isolated, and the interfaces between different systems are complex. This makes data synchronization and interaction very difficult, and a huge amount of data appears to be an information silo. How can mCel capitalize on market opportunities latent in its mass data? How can mCel identify potential customers and target an effective marketing campaign to them? How can mCel improve customer satisfaction and loyalty and increase ARPU? mCel has been asking these questions for a long time.

Seeking Strategic Partners to Increase Competitiveness

Since the second half of 2012, mCel has been seeking vendors that can help the company improve its marketing efficiency. mCel has held several technical exchanges with ZTEsoft, which has 20 years' of experience in OSS/BSS software services and products, and chose ZTEsoft as its multiple channel campaign managment (MCCM) vendor. ZTEsoft provides mCel with ZSmart MCCM products that have multiple marketing modes for different target customer groups. These modes include one-wave marketing, multiwave marketing, and event-based marketing and support various data resources and multiple marketing channels. ZSmart MCCM can manage the entire lifecycle of a marketing campaign and evaluate the

effectiveness of the campaign. ZSmart MCCM products have a modularized design and can be flexibly and rapidly integrated with mCel's other systems.

Delivering a System Smoothly with a Well-Designed, Integrated Solution

mCel's existing BOSSs come from dozens of different vendors and do not have a unified interface. This results in bad interaction and much integration work. mCel is eager to launch MCCM. Deploying MCCM in limited time and interfacing with other systems has been a big challenge for ZTEsoft.

ZTEsoft and mCel signed a contract in 2013 and established a special project team. After a month of careful analysis of mCel's requirements, the team confirmed software requirement specifications (SRS) of the MCCM system. The team achieved full system interoperability and satisfied UAT tests only two months after MCCM equipment had been installed. Soon after this, mCel's MCCM was launched for commercial use.

Stepping into a New Era

Since launching MCCM, the system has run stably. With MCCM, mCel has also improved its marketing capabilities. In the past, it took almost a month for mCel to design, audit, and trial a marketing campaign prior to launch. Now, this process only takes several days. With the help of an MCCM customer insight system, mCel can target customers more precisely and deliver services to these customers in time. This greatly improves the take-up rate, increases ARPU, and increases customer satisfaction.

Customer trust and recognition is the best driver of growth. ZTEsoft will continue to make valuable contributions to mCel in the future. **ZTE TECHNOLOGIES**

Hybrid TD/FDD LTE Networking Solution

By Hu Hai

Maximizing Spectrum Efficiency

Cisco predicts that global mobile data traffic will reach 11.2 EB per month in 2017, and compound annual growth rate (CAGR) will be 66% from 2012 to 2017. Fast-growing demand for mobile data speed has been the impetus for LTE commercialization. According to GSMA, as of July 2013, 194 commercial LTE networks had been launched in 75 countries. Eighteen of these networks are commercial TD-LTE networks, and nine are combined TD-LTE and LTE FDD networks.

To meet the huge demand for mobile data, more spectrum resources are required. However, paired spectrum resources used for LTE FDD are increasingly scarce, and operators often refarm their 2G and 3G spectrum for 4G services. In contrast, asymmetric TD-LTE spectrum resources are more abundant. As TD-LTE is mature and the industrial chain gradually improves, there will be more and more networks operating in TD-LTE and LTE FDD dual mode. In China, TD-LTE is allocated with 190 MHz in the 2.6G band while LTE FDD is allocated with 2 × 30 M in the 1.8G and 2.1G bands. To cope with the flood of data, hybrid TD/FDD LTE is the trend to maximize spectrum use.

Hi3G Sweden's hybrid TD/FDD LTE network, built exclusively by ZTE, is the world's first commercial dual-mode 4G network. Compared to single LTE FDD, dual-mode TD-LTE/FDD increases costs by 25–35%, but total network capacity doubles. Hi3G won the honor of "Best Mobile Network" during third-party testing. The benefits of a hybrid network are many.

ZTE's hybrid TD/FDD LTE solution enables full convergence of TD-LTE and LTE FDD. Key issues, such as sharing a common platform and seamless roaming, are properly addressed. In 2013, ZTE won the Global TD-LTE Initiative (GTI) Innovation Award for its FDD/TDD converged solution at the Mobile World Congress in Barcelona. The solution has been widely accepted by operators worldwide.

Hybrid TD/FDD LTE Networking Solution

ZTE's hybrid TD/FDD LTE networking solution is based on cutting-edge SDR platform that supports dual-mode TD-LTE and LTE FDD. The solution has the following features:

- core network EPC sharing. Core network construction costs are reduced. Multiple networks including GERAN, UTRAN, HSPA, E-UTRAN, EV-DO and eHRPD are converged, accessed and managed.
- BBU sharing. A single BBU supports both TD-LTE and LTE FDD. The main control board can also be shared. Channel elements of TD-LTE and LTE FDD share the same hardware and can be reconfigured through software.
- RRU series. A series of TD-LTE and LTE FDD RRUs are provided. The Magic RRU series has the RF module that features the largest output power in the industry and can meet different application scenarios.
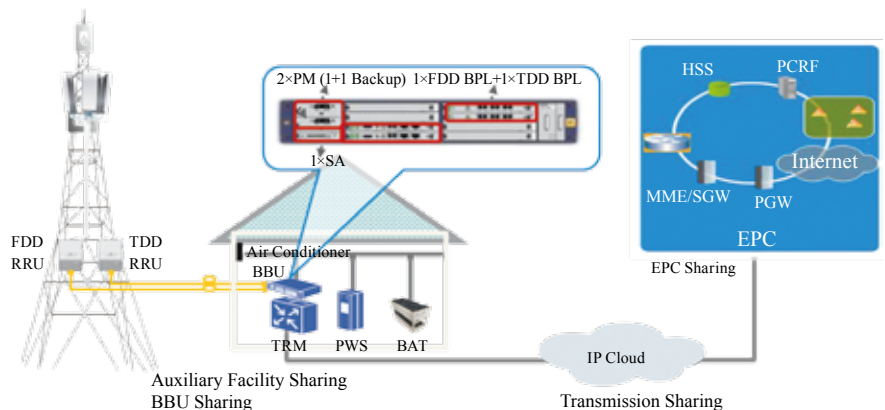- clock sharing. Multiple clock

Figure 1. Hybrid TD/FDD LTE networking solution.

synchronization modes such as GPS, Big Dipper and IEEE 1588v2 are supported. Sharing a GPS with CDMA base stations is also supported.

- transmission sharing. The unique dynamic bandwidth scheduling algorithm enables dynamic transmission sharing between TD-LTE and LTE FDD systems and makes full use of transmission resources.

- network sharing. A unified platform is built up for network management, optimization and maintenance. The platform also enables converged management for 2G, 3G and 4G networks. This dramatically reduces OAM costs for multiple networks.

TD-LTE and FDD LTE Interoperability

TD-LTE and LTE FDD networks do not synchronize coverage because they operate on different spectrums and have different positions. To ensure consistent user experience, the two networks must be fully interoperable with each other. The principles for TD-LTE and LTE FDD interoperability are as follows:

Idle State

- Depending on the quality of detected cell signals and the network search strategy, a UE resides in either an LTE FDD network or a TD-LTE network with good signal quality.

- Based on an operator's policies, a UE is guided to preferentially reside in an LTE FDD network or a TD-LTE network by setting frequency priorities and re-selection thresholds for the two networks.

Connection State

- Data traffic is carried over an LTE FDD network or a TD-LTE network which a UE resides in.
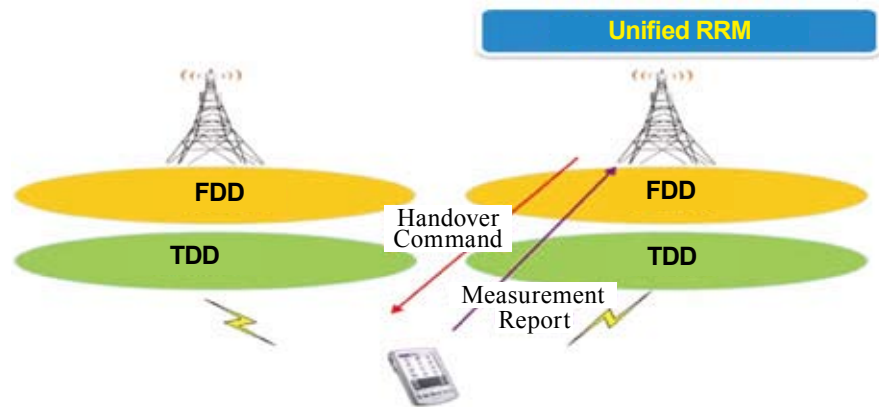

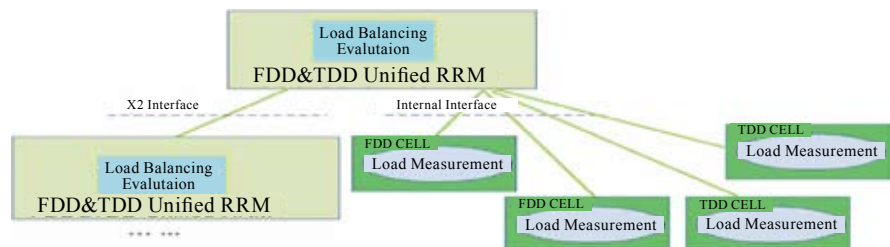**Figure 2. TD-LTE and LTE FDD mobility management policy.**

Figure 3. TD-LTE and LTE FDD load balancing policy.

- Data traffic can also be carried over a specific LTE FDD network or a TD-LTE network depending on the type of services.

- When there is a heavy traffic load in an LTE FDD network or a TD-LTE network, load balancing is used to share the load between the two networks.

A TD/FDD LTE mobility management policy takes into full account LTE FDD or TD-LTE target cell selection from the perspective of base stations. Priority handover to LTE FDD or TD-LTE is implemented by configuring carrier frequency offset and cell offset. Using TD/FDD LTE signal quality as a benchmark, the neighboring cell with the same frequency is selected as the target cell for PS handover, the neighboring cell with a different frequency and a different coverage is a secondary option, and then the neighboring cell with a different frequency and the same coverage is the last choice for PS handover.

A TD/FDD LTE load-balancing policy takes into account the base station load of both serving and neighboring cells in TD-LTE and LTE FDD networks. The X2 interface is used to interact with other base stations for the corresponding load information in the LTE FDD and TD-LTE neighboring cells. The load balancing module makes a policy decision and selects an appropriate cell from the LTE FDD and TD-LTE neighboring cells as the target one for load balancing.

ZTE is the first in the world that has completed the TD-LTE and LTE FDD packet domain switching and load balancing tests. Its outstanding performance in the tests has given a guarantee for excellent LTE user experience. **ZTE** TECHNOLOGIES

NETWORK

Adding Value:
PON Optimization Services

By Chen Lei

PON: A Rising Star in the Broadband Market

A large-capacity, high-speed passive optical network (PON) is an ideal solution to last-mile bandwidth bottlenecks. PON is a rising star in the broadband market because it is economical, simple, and scalable.

China has 513 million internet users, the highest number in the world. By 2017, China is expected to have the world's largest number of fixed bandwidth households. However, network speed in mainland China is 1.4 Mbps, which is far slower than the world average. FTTH coverage in China also lags far behind that of developed countries. In addition to existing high-bandwidth services—including Mega Eyes, video on demand (VOD), large file downloading, interactive games, online video entertainment, online virus scanning, and network hard disks—IPTV will drive broadband demand in China. The Broadband China strategy was devised to resolve the conflict between growing broadband demand and limited network speed. With its technical advantages, PON boosts broadband speeds.

PON: The Broadband Battlefield

The Broadband China strategy, which was devised by the Ministry of Industry and Information Technology (MIIT), has greatly promoted broadband. China Telecom, China Unicom, and China Mobile have the goals of increasing broadband speed

and transitioning from copper to fiber networks. This PON battle has brought to the fore the strengths of each of the big three carriers.

China Telecom is the biggest broadband provider, with broadband comprising 25% of its total revenue. As well as increasing broadband speeds, China Telecom is also providing high-bandwidth services to attract broadband subscribers and strengthen its existing base of subscribers who rely on reliable, high-speed optical networks.

China Unicom is the second-largest carrier in China. It has kept up with the broadband competition by attracting new FTTH subscribers and launching projects quickly. China Unicom has relied on flexible fixed-mobile packages and a high-bandwidth, low-price strategy to increase its market share. China Unicom has invested RMB 100 billion in 3G and optical broadband deployment and improving the capabilities of its existing networks in order to support its market expansion.

China Mobile is fighting for broadband market share by offering flexible, low-priced services. It sparked a price war by cutting broadband tariffs by 50% without compromising service quality.

Intensified competition has delivered to subscribers faster, cheaper, more stable network services, and the

operational quality of PON has become the carriers' main battlefield.

Optimizing PON for Market Expansion and Network Efficiency

Network quality and capabilities are the focus of the big three carriers. Only a high-quality network can attract and retain subscribers. Fast FTTH deployment lays a solid foundation for market expansion; however, challenges, including OAM difficulty and maintaining QoS, when rapidly deploying complex networks. A scientific system needs to be developed to evaluate and optimize network operations. This would improve network quality and help in service development.

PON optimization is a comprehensive, customized technical service that includes network evaluation, customization, and optimization. A PON carries a variety of services, including broadband access, IPTV, and VoIP. Therefore, service quality needs to be guaranteed through reasonable planning and technologies. PON optimization involves identifying weaknesses in a network or service. These weaknesses may affect reliability, security, or compliance. PON optimization allows an operator to take immediate action on congested or malfunctioning devices and links so that further problems are avoided. A systematic, standard PON optimization

service can help carriers build a stable, high-quality, cost-effective PON.

ZTE's PON optimization service can enhance network health, traffic and resources, QoS, and network security. Professional tools, such as health check and analysis system, NetNumen U31, and easy traffic platform, are used for precise insights that are standards-compliant. ZTE's PON optimization service supports network planning, network deployment, and marketing. Traffic detection and analysis provides the required data for network planning and deployment. Analysis of real network traffic and resource utilization is helpful for identifying highly effective network devices and fast-growing areas. This helps an operator plan for investment, capacity expansion, and network deployment. Identifying high-traffic ports also helps an operator pinpoint valuable customers. Areas of low resource utilization can be detected for further market segmentation and strengthening regional marketing. The extended features of ZTE's PON optimization services allow an operator to expand more smartly and aggressively.

In the burgeoning broadband market, PON optimization services will improve network efficiency, reduce capex and opex, and ensure network operability, scalability, profitability and sustainability. **ZTE TECHNOLOGIES**

CLOUD**R**ADIO
Deliver 4G Promise

**Commitment,
as steadfast as mountains.**

Cloud Radio™ enables optimal radio performance adaptive to a variety of network availability. Through a series of key technologies breakthrough, Cloud Radio™ realizes sophisticated radio coordination empowering higher network performance for operators and better QOE for users. Operators win with Cloud Radio™ two core values: diversity and boundlessness. Cloud Radio™, delivers 4G promise and helps you to excel in 4G era.

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