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VIP Voices

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A Challenger in the Mobile Market

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Special Topic: Mobile Broadband

Cloud Radio:
The Best Choice in the 4G Era

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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

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ZTE Helps CMHK Launch World's First Converged TD-LTE/FDD LTE Network

18 December 2012, Shenzhen — ZTE helped China Mobile Hong Kong Co. Ltd. (CMHK) launch the first commercial converged TD-LTE/LTE FDD network in Hong Kong. The start of Hong Kong's first TD-LTE/FDD LTE converged network ushered in a new age in the city's 4G telecommunications market, and unleashed vital impetus to propel the development of TD-LTE services globally.

Chairman of CMHK, Tiger Lin, Director and Chief Executive Officer, Sean Lee, and ZTE Vice President Zhang Jianguo officiated at a large-scale press conference in Hong Kong today to introduce the new service. Live demonstrations showcasing the high-speed data download capabilities of TD-LTE and LTE FDD networks and the seamless hand-over between TD-LTE and FDD LTE networks for online video transmission were conducted at the event.

ZTE's GoTa Accepted by ITU Report

13 December 2012, Shenzhen — ZTE has announced that the Global open Trunking architecture (GoTa) digital trunking standard submitted by China was accepted by the ITU report on the ITU conference in Geneva. This marks another breakthrough in the field of communications standards for Chinese technology developers.

GoTa, now the digital trunking standard for the next generation, was jointly developed by ZTE and Chinese national research departments. A digital trunking system is a mobile communications network—using network-specific handsets communicating over a network just like a mobile phone system—that provides group scheduling command and communications with a high degree of security. It has been widely used by government organizations to provide scheduling and security for events such as Olympic Games, National Games, the European Cup and other major sporting events, as well as in public security, fire, ports, logistics, construction, transportation, forestry, rental, factories and enterprises as well as for individual requirements.

ZTE 100G Running in Backbone for T-Mobile Austria

20 December 2012, Shenzhen — ZTE has helped T-Mobile Austria (TMA), a Deutsche Telekom subsidiary, to upgrade its optical network from 10G to 100G, increasing its backbone network capacity by a factor of 10.

TMA started to build its 10G backbone network in 2010, but with the continuing growth of its business, faced the combined challenges of traffic growth and capacity limitations. ZTE then carried out the upgrade of the network to 100G, protecting TMA's investment and meeting the operator's requirements for future business development.

ZTE's self-developed 100G technologies utilizing PM-QPSK modulation, coherent detection and SD-FEC have been employed for this network upgrade. Combining wavelength switched optical network/generalized multiprotocol label switching (WSON/GMPLS) control plane and Mesh networking topology, ZTE's solution can enhance network stability and reliability and reduce opex. In June 2012, British business journal *Global Telecom Business* granted TMA and ZTE its Fixed Backbone Innovation award for the application of the ZTE WSON technology and the companies' successful cooperation.

ZTE Announces World Debut of the Thinnest 5.0 FHD Quad-core Smartphone Grand S at CES 2013

9 January 2013, Las Vegas, N.V. — ZTE announced the world debut of the ZTE Grand S—5.0 FHD LTE at the 2013 International Consumer Electronics Show (CES). As the flagship handset in ZTE's high-end Grand Series line of products, the ZTE Grand S is the company's first FHD smartphone and the world's thinnest within 5 inch FHD quad-core smartphones, enabled by the Qualcomm Snapdragon S4 Pro processor, a product of Qualcomm Technologies, Inc., a wholly-owned subsidiary of Qualcomm Incorporated. Developed by ZTE, the ultrathin body and high definition display of the ZTE Grand S offer consumers the latest in style, quality and functionality.

From the full-website display which enables optimal content browsing, to the 4G LTE high-speed network which powers a world-class multimedia experience, the ZTE Grand S offers cutting-edge features for even the most discerning smartphone user. The blazingly fast 4G LTE network allows for top-speed downloading and establishes the handset as a premier gaming and movie-viewing portal. Furthermore, the ZTE Grand S offers smartphone photography mavens advanced functions for more vivid self-photography and video calling effects. With face recognition, anti-shake and a panoramic camera, the ZTE Grand S truly presents a high-quality multimedia option for today's smartphone audience.

ZTE Ranked Among the Top Three "Best ICT products of 2012"

19 December 2012, Shenzhen — ZTE announced that its Gigabit smart switch ZXR 5250 has been ranked among the top three "Best ICT products of 2012" in Funkschau Readers' Choice survey.

The ZXR 5250 for enterprise customers came top in the category for switches. The award-winning ZTE switch with its 1000 Mbps ports offers innovative features and cutting-edge technologies for rapid deployment, maximum energy efficiency and optimal security.

ZTE Wins China Telecom Cloud Computing Tender

4 January 2013, Shenzhen — ZTE announced it won contracts in China Telecommunications Corp.'s tender for cloud computing services.

ZTE was awarded contracts to provide cloud desktop system and server virtualization software for China Telecom, breaking the traditional monopoly of overseas vendors. The winning bids are testament to ZTE's superior cloud computing technology and the company's increasing experience in cloud project deployments.

ZTE developed its proprietary iECS server virtualization software and iRAI cloud desktop system, and owns the underlying intellectual property. iECS combines the ZEN and KVM virtualization engines with ZTE's operating system technology and management software to provide comprehensive virtualization capabilities, while iRAI supports data traffic redirection and virtual applications, providing reliable virtual connectivity. The desktop cloud system supports multiple desktops for a single user, and is compatible with most mainstream terminals.

China Telecom and ZTE have been long-term partners in research and development of cloud computing technologies. ZTE contributed to the standardization and planning of China Telecom's cloud computing technologies, including PASS, and the two companies are collaborating to develop cloud computing standards under the direction of ITU-T.

Peder Ramel (R), CEO of Hi3G, and Jörgen Askeroth (L), CTO of Hi3G

Hi3G:

A Challenger in the Mobile Market

Reporters: Liu Yang and Jin Ping

Hi3G Access was founded in 2001 and is the fourth largest operator in Sweden. The company is based in Stockholm and operates in Sweden and Denmark under the 3 brand. As a late arrival to the market, Hi3G positions itself as a challenger. In Sweden, Europe's most competitive LTE market, Hi3G launched the world's first TDD/FDD dual mode LTE network in 2011, which aroused interest from operators worldwide. *ZTE Technologies* interviewed Peder Ramel, CEO of Hi3G, and Jörgen Askeroth, CTO of Hi3G. They talked about their strategy of being the strongest provider of data services. They shared with us information about the present dual-mode network and their plan for the next stage of network.

Q: Could you introduce Hi3G and its financial performance?

Peder: There are four big operators in Sweden and Denmark, and we are the challenger. We are the smallest operator and latest arrival into the market, but we have the best data network. We have to be the strongest when it comes to providing data services through handsets, dongles, and routers. In terms of finances, we are growing by 10 percent to 20 percent every year and have had a positive cash flow for the past three years. So we are now in a strong financial position.

Q: Hi3G launched the world's first 84 Mbps HSPA+ network in 2010 and the world's first dual-mode LTE network in 2011. Can we say your brand proposition is to always be different?

Peder: Yes definitely. The reason our subscribers choose us is because we have the best data network. We are the challenger and have to do everything differently. It's not just that we have to have the best technology, we have to do marketing and have offers that stand out as well; otherwise, we wouldn't stand a chance against our bigger rivals.

Q: Hi3G has been chosen as the best mobile internet operator for five consecutive years. What has contributed most to your achievements?

Jorgen: You have to focus. You have to be best at what you are doing and select

the right equipment from the supplier. You have to have the right people and run your network better than other operators run theirs. Everything needs to be carefully planned.

Q: Data traffic has increased much faster than data revenue, and operators generally agree that optimized smart pipes are the way out. What is Hi3G's strategy in this respect? How do you increase your mobile data revenue?

Peder: As an operator, you have to realize that the lion's share of the revenue is coming from voice. We have to change that so that revenue is coming from data services. It's a different way of viewing the revenue stream. We have to make sure that we get paid for data services. Of course, on the other hand, customers expect high speed and a huge amount of data, and we must have a network that can distribute this data at decent prices. If we can do that, we can also charge customers on data services. We have to be very innovative and offer different services, not just be a pipe. I don't think we should develop the services ourselves, but we have to make sure that the services are working best on our network and that they are very easy to use. Easiness is very important for customers.

Jorgen: Cost efficiency is very important when looking at mass data usage. Our customers use three to five times more data than the average user.

Peder: We are the most cost-efficient operator in both Sweden and Denmark. Being the smallest operator, we have to be.

Q: Hi3G launched the world's first TDD/FDD dual-mode LTE network in December 2011. How is the network running?

Jorgen: What the customers demand is not a specific technology but high speeds and reliable performance. We don't talk to them about technologies; we just talk about services. TDD or FDD doesn't mean anything to most people, but data plans do. Today, growth in data traffic is more or less being driven by smartphones, whereas it used to be driven by mobile broadband and dongles. That has now changed, but mobile broadband still uses much more data than smartphones. TD-LTE smartphones is still future. The customer take-up of LTE services will be very different/aggressive when iPhone is LTE enabled.

Q: In Sweden, Europe's most competitive LTE market, what are your advantages compared to other operators?

Jorgen: To be able to offer a good network and service to the end customer, you need to have capacity in the network. In Sweden, we have 50 MHz of TDD2600 and 10 MHz of FDD2600 as well as 10MHz FDD800. So we have sufficient spectrum. It gives us the possibilities to offer different types of

services.

Peder: We very much believe that the distinctions between 3G, 4G, TDD, or FDD are not very important. We have to give them a reliable service at a high speed. We focus more on promoting reliability than 4G or 3G technologies.

Q: What is your plan for the next stage of the LTE dual-mode network?

Jorgen: Our plan is have full LTE coverage within two years with a significant focus on dual-mode LTE.

Peder: Today, we are reaching more than 99 percent of households with 3G. We have to have the same coverage with 4G.

Q: What did you think about ZTE's performance throughout the project? Where do you think ZTE could improve?

Jorgen: We are extremely impressed by the fast rise of China and Chinese companies and are very happy to have ZTE as one of our network suppliers. I think that ZTE products are very good. We won the Best Mobile Broadband award on 3G. Next time, it will be a combination of 3G and 4G and it is important to us that we win again.

There are cultural challenges but we are learning from each other.

Culture change has to take place from both sides. An important lesson that both ZTE and Hi3G learnt was how important it is to keep our work teams stable and not change staffing because that means the learning process has to start over again with loss of time and momentum.

Peder: What we are doing now, with this visit to ZTE head office, is very important. We are meeting face to face to discuss and resolve such issues.

Q: The network is significant because it points to a new direction in networking and operation. Could you share some experiences in building the network?

Jorgen: First of all, the different technologies in the network have some challenges. We have the 900 and 2100 on 3G and FDD800, FDD2600 and TDD2600 in the 4G network.

You need to be very efficient in what you are doing to get the right performance and the right services.

Q: TD-LTE is lagging behind FDD-LTE globally. What do you think of the future of TD-LTE?

Jorgen: We expect the same kind of dongles regardless of technology. The efficiency of the TDD spectrum is very important for us.

Q: What are your expectations for the future?

Peder: To have the best 4G network and 3G network in Sweden and Denmark within two years. We want to reach a 25 percent market share of the mobile market, there are four operators, and we should have our share of that.

With the New ZTE Technology We Are a Nose Ahead

An interview with Markus Helferstorfer, vice president of product and core development, and Roman Tiedjens, transmission backbone expert for T-Mobile Austria

By Stephan Scoppetta

Markus Helferstorfer (L), vice president of product and core development, T-Mobile Austria and Roman Tiedjens (R), transmission backbone expert, T-Mobile Austria

T-Mobile Austria is a subsidiary of Deutsche Telekom AG. It has 4.076 million customers and is the second largest mobile operator in Austria. The company is known for driving innovation in the telco business. T-Mobile Austria and ZTE won the 2012 Global Telecom Business award for innovation in fixed backbone. Markus Helferstorfer, vice president of product and core development, T-Mobile Austria, and Roman Tiedjens, transmission backbone expert, T-Mobile Austria, talked about the award, application of ZTE-WASON technology, and their successful cooperation with ZTE.

Journalist: In June 2012, the renowned British business journal *Global Telecom Business* gave you and ZTE Austria an award for fixed backbone innovation. Are you proud of the award?

Helferstorfer: Of course we are proud of this award. When ZTE told us about our nomination and that the award ceremony would be held in London in two days, we were not prepared at all.

Tiedjens: Right after our arrival we were interviewed and in the evening we were already awarded the prize. That was an unbelievable acknowledgement of the work done by everyone involved with the project over the past two years.

Journalist: What was the project?

Helferstorfer: Basically, we optimized our backbone network. Until about a year ago, we placed a backbone-ring through Austria, but then we wanted to turn the ring into an intermeshed network. This would make our network safer, more efficient, and more stable. Our intermeshed network was made possible by the WASON-technology of ZTE.

Journalist: Why did you need to alter your backbone network?

Tiedjens: The last few years have shown that each year we have to anticipate a 100

percent increase in data traffic. This huge amount of data simply made it necessary to further optimize our network. With the extension of LTE, we have to face even more data within the next years. Therefore, we decided to take on this large-scale project.

Journalist: Considering LTE is a radio communication norm, why is further development of the backbone network needed?

Helferstorfer: This network expansion is only loosely connected with LTE, but with LTE, we want to achieve speeds of up to 100 Mbps. To be able to convey the rising amount of data and avoid bottlenecks in the backbone, our network had to be adjusted.

Journalist: With ZTE-WASON technology the network will be failsafe. How was this managed technically?

Tiedjens: The technology was newly invented by ZTE and T-Mobile and leads to a considerably stronger intermeshing of the network. The network was formerly a simple backbone-ring, but it now is a backbone network with many branches. Even if multiple cables were to break, there would be no noticeable breakdowns. Instead, data streams would be quickly and smoothly rerouted without any difficulty.

Journalist: The entire alteration took place without interrupting ongoing operations. How did you manage to do this?

Tiedjens: We had to build in a completely new location and calibrate new fibers in parallel. Afterwards, we moved our network bit by bit. On December 21, 2011 we migrated the last data traffic and finished the second phase of the project. Everything went off without a hitch.

Journalist: In the third phase of the project, the data signaling rate will be raised from 10G to 100G. When will the last phase be finished?

Tiedjens: Right now we are still running a few tests, but we expect our backbone network to be upgraded to 100G in May 2013.

Journalist: How many people from T-Mobile Austria and ZTE are involved in the project?

Tiedjens: The T-Mobile core team comprises about six people. On the ZTE side there are also approximately six people who are constantly working on the project. In addition, there are countless technicians and experts who are called in to the project as the need arises. Their exact number cannot be assessed anymore.

Journalist: ZTE not only appointed the Austrian team but invited experts from China. Did this international, cross-cultural cooperation go smoothly?

Helferstorfer: We took the lead in the project and it was clear from the beginning that ZTE would have to provide a local team.

Tiedjens: Of course both sides had to adjust to cultural differences in the beginning, but in the beginning, most linguistic misunderstandings were quickly overcome. The local project manager of ZTE Austria did a great job in mediating between cultures. Liu Li, a DWDM-expert from ZTE Product Line, also made crucial contributions to the success of the project.

Journalist: Do you think this project was groundbreaking for the telecommunications industry?

Tiedjens: We have a steady exchange of know-how with T-Mobile, and this project will surely be a best practice example for Deutsche Telekom. Our British colleagues were also highly interested in our project.

Helferstorfer: Furthermore, a Pakistani telecom provider asked us how we succeeded in migrating traffic without disrupting operations.

Journalist: With this technology, is T-Mobile Austria a pioneer in Austria and Europe?

Helferstorfer: We don't have any insights into the technology of competitors, but we were granted an award by GTB for this technology. That's why I assume we are a nose ahead.

Journalist: Does the network alteration give you any advantages in the highly competitive Austrian market?

Helferstorfer: We are definitely optimally prepared for the future. The new ZTE-technology gives us the opportunity to add even more customers to our assemblage points.

Journalist: Are you satisfied with the cooperation with ZTE?

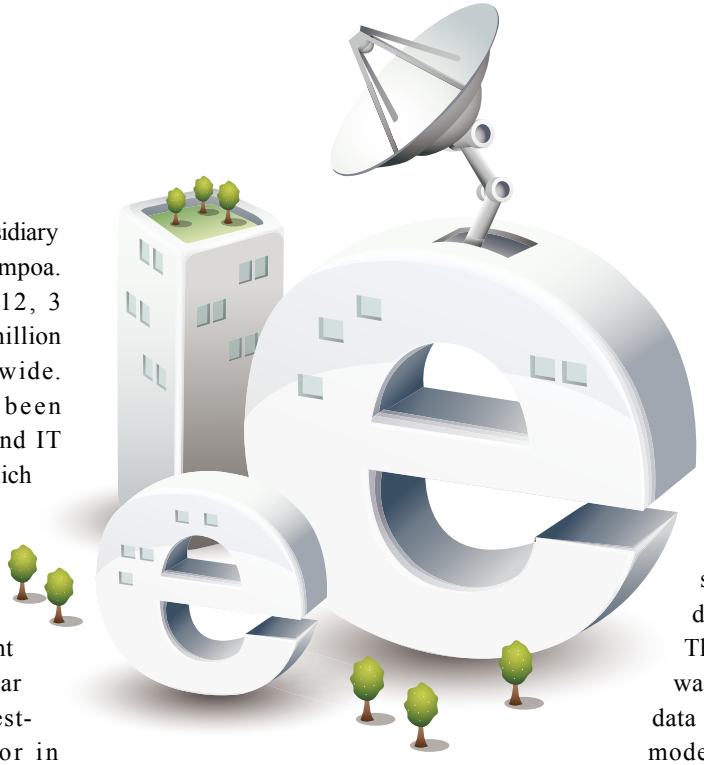
Helferstorfer: Up to now the technology, works perfectly, and ZTE really has the top experts for this project. Nothing stands in the way of further cooperation with ZTE. ZTE TECHNOLOGIES

Bringing True Value to Operators' Business

By Guenther Fischer and Mehrzad Nabavieh

On 18 September 2012, Guenther Fischer, head of network quality and performance management at H3G Austria, and Mehrzad Nabavieh, managed service director at ZTE, gave a joint presentation at Managed Services World Congress (MSWC) 2012 in Berlin. ZTE commenced a modernization project for H3G Austria in 2010, and the presentation focused on this particular project.

Guenther Fischer (R), head of network quality and performance management at H3G Austria, and Mehrzad Nabavieh (L), managed service director at ZTE



Strong Ties Between Hutchison and ZTE

H3G Austria is a subsidiary of Hutchison Whampoa. As of March 2012, 3 Group had served 31.612 million UMTS customers worldwide. 1.2 billion euros have been invested in the network and IT equipment in Austria of which the major investment is from Hutchison. H3G's customer base was 1.496 million in June 2012, which represents 11 percent customer growth year-on-year and makes H3G the fastest-growing mobile operator in Austria.

ZTE professional services have grown tremendously since 2007. ZTE's revenue from services in the past five years has grown 52 percent. ZTE's services cover more than 150,000 sites, 130,000 km of fiber optics, and 100 million end users. ZTE has signed contracts with the tier-one multinational operators such as Telenor, Telia Sonera, MTN, Hutchison, and Telefonica.

ZTE's partnership with Hutchison spans six countries in two continents. In 2005, ZTE signed a contract with Kasapa to provide a CDMA network in Ghana. In 2006, ZTE delivered a GSM network for Hutchison in Sri Lanka; and in 2008, ZTE completed a full turnkey project for HCPT in Indonesia. In 2010, H3G Austria selected ZTE to reconstruct its 3G network. Last year, Hi3G chose ZTE to deploy LTE networks in Sweden and Denmark. In 2010, ZTE commenced a modernization project for H3G Austria.

Drivers for Network Modernization

One of the main reasons for H3G's success in Austria is its services. Only the best smartphones are awarded the 3Superphones quality seal. With 3LikeHome, customers can call and surf the 3networks in Italy, Denmark, Sweden, Great Britain, Ireland and Hong Kong under the same conditions as in Austria without any additional roaming charges. With 3WebCube, subscribers can plug-and-play and find the easiest way to enjoy at home. 3MobileTV provides the biggest choice in terms of entertainment and information. More than 80 mobile TV and radio channels on 3mobiles and 3data modems are available.

H3G provides attractive voice and data tariffs to suit all users. For example, 3Superphones provides unlimited data volume for multimedia fans and heavy users. 3Comfort enables users to explore the world of smartphones without any cost trap. 3Light is only €5 per month and is suited to voice call customers. In terms of data tariffs, the free internet offers 20 MB/day free of charge. The 3Data 10 GB offers 10 GB for €9 basic fee. The 3Data SuperFlat costs €15 monthly with unlimited data volume and transmission rate at 10 MBit/s. The 3Data SuperSpeed Flat costs €24 monthly with unlimited data volume and 30 MBit/s transmission.

Because of the innovative services and good tariffs, H3G's data traffic increased tremendously. The previous network infrastructure was unable to cater for the requested data traffic. Therefore, ZTE needed to modernize the network. H3G started receiving customer complaints from early 2009. Network modernization commenced from the second half of 2010, and towards end of 2011 data traffic surged. By mid 2012, the data traffic was 10 times more than before network modernization in 2009. This showed the success of the network modernization.

Development of Network Quality

After network modernization, all data KPIs improved significantly. A survey by P3 network benchmarking, a third-party surveying company, revealed that H3G provides the best voice network in Austria. From September 2010 to September 2011, the HTTP download rate increased four times; FTP upload rate doubled; and speech quality index improved 10%.

In a test carried out by *CONNECT*, H3G was rated the best network in Austria in 2011. H3G scored a total of 476 points out of 500, the highest score

in the whole German-speaking region. According to *CONNECT*, this result is setting new standards in every respect; it was the first time a pure 3G-network had won the test with the highest ever rating given by *CONNECT*.

Tight management of network KPIs has led to improved figures. The main KPIs are related to: UTRAN availability (based on cell availability), UTRAN performance on cluster basis, core network availability and performance, and operation level agreements on incident handling.

Process and steering models have greatly affected the result as well. For example, KPI reports are provided by H3G Service and Quality Management; incidents and outages breaching the service level agreements are reviewed; and detailed root-cause analyses are done for future improvements. Preventive maintenance cycles are changed to avoid seasonal problems involving air conditions, and this has reduced cost and improved uptime. Architectural changes on the backbone redundancy have been made to resolve repeating incidents.

At H3G, there is a clear relationship between the mean opinion score (MOS), quality of experience (QoE), and customer satisfaction. In order to enhance customer satisfaction, it is necessary to improve MOS. From H3G's statistics, 67% of users require at least 2 Mbit/s throughput. This requirement was satisfied with 80% of all speed tests showing higher than 2 Mbit/s throughput. The statistics showed that customers that are provided with a higher-quality network have higher data usage.

ZTE's Modernization Project

- **Effective network modernization**

The LTE/DC-HSPA+ network provided by ZTE covers 94% of Austria's population. In the full turnkey project, 4000 BTSs were swapped, and the 3G/4G core network was rebuilt. By reusing existing facilities, costs were saved throughout the project. After the modernization project was completed, an all-IP transmission network was built, and converged core and access networks replaced the previous architecture.

- **OAM efficiency**

OAM was made more efficient as per the managed services contract. ZTE provided a single interface for H3G Austria and managed third-party suppliers on behalf of H3G. This created a clear share of responsibilities that lead to shortened trouble-ticket handling time.

- **Effective performance management**

Improving customer experience is the real key to success for H3G. ZTE supported H3G with best practice performance management that included efficient data collection, enhanced optimization procedures, real-time problem detection and agile solution delivery, and end-to-end optimization with focus on user perceived quality. The improved network quality and end-user satisfaction shows the effectiveness of ZTE's performance-management procedures.

Continuous network capacity and quality enhancement are vital to ensure customer satisfaction. A dependable supplier assists operators build, operate a network that meets desired targets. A strong partnership with ZTE leads to success. ZTE TECHNOLOGIES

News Link

H3G Austria's Mobile Network Constructed by ZTE Ranked No.1 for a Consecutive Second Year in 2012

29 October 2012, Vienna, Austria — ZTE announced that its customer H3G Austria network has come in first place in comprehensive KPI tests that were recently conducted with all the operator networks in Austria by the European telecommunications publication *CONNECT*. The H3G Austria network, which was modernized with RAN and core network equipment by ZTE, was placed in the top position, based on the excellent performance of the network.

ZTE introduced the latest interference cancellation technology, significantly improving the uplink data transfer rate and capacity. Network test results showed that ZTE's technology enabled H3G Austria to offer an average rate of more than 50% faster upload speeds to customers compared with the second-place network. H3G Austria's network also offers average download speeds of up to 11.7 Mbps.

Cloud Radio: The Best Choice in the 4G Era

By Xiang Jiying

Xiang Jiying, CTO of wireless infrastructure, ZTE Corporation

As wireless networks develop, coexistence of 2G, 3G and LTE is inevitable. In an LTE network, base stations are deployed more densely than in 2G and 3G networks. Considering Shannon's Theory, the capacity of a single link has approximated its theoretical limit. To improve performance, operators need to improve system capacity by using a heterogeneous network (HetNet) topology. To relieve the strain on radio spectrum, intra-frequency networking has been introduced into LTE, but this increases interference between cells. Interference can greatly reduce performance at the cell edge and affect resource utilization and cell-edge user experience. As coordination technology has been introduced into 4G, radio performance has become more sensitive to transmission bandwidth and time delay and differs greatly under different transmission scenarios. Operators have limited transmission networks, and reconstructing these networks would be a costly, long-term task. Therefore, matching transmission performance with network performance is a critical issue for operators.

Drawing on years of experience in wireless broadband, ZTE has developed

an innovative cloud radio that can accommodate complex transmission scenarios and improve user experience by using an intelligent algorithm. Cloud radio allows for cloud-based radio access as well as network collaboration and management. This helps mobile operators make the best of their existing resources and optimize their wireless networks for minimal investment. Cloud radio is the best choice for meeting challenges in the 4G era.

The Cloud Radio Concept

Cloud radio is a set of network optimization techniques that eliminate inter-cell interference in time, space, and frequency. It performs optimally in different transmission scenarios. With layer 1, layer 2, and networking technologies, cloud radio can be used in both homogeneous and heterogeneous networks. Cloud refers to the horizontal data connections between eNBs, and there are two possible topologies: star and mesh. The term "cloud radio" is given because many horizontal data connections (cloud) enhance radio performance.

Cloud radio is also a next-generation wireless solution based on ZTE's SDR multimode radio platform and C-RAN solution. Cloud radio involves cloud scheduler and cloud coordination. The cloud scheduler schedules network resources in a unified manner. This enables real-time resource scheduling and allocation according to user distribution, service type, traffic flow, and cell interference. Cloud coordination is used for seamless network coordination. Multilayer coordination enhances transmission gain and improves user experience.

Key Techniques

Cloud radio uses

- enhanced X1 and X2+ interfaces. These are compatible with 3GPP interfaces and can be applied to all kinds of eNBs. X1 is an interface between an eNB and a center scheduler and only exists on the control panel. X2+ is an interface between eNBs and can enhance coordination between eNBs.
- cloud scheduler. This helps each cell gather all its time, space, frequency, and power resources and allocates them in a unified manner. It allows for consistent decision-making and controllable allocation. The cloud scheduler greatly reduces interference between cellular cells and improves cell throughput. Even in peak hours, it can increase the throughput of a cell edge by 30 percent. The cloud scheduler can be used in all kinds of backhaul and HetNet scenarios.

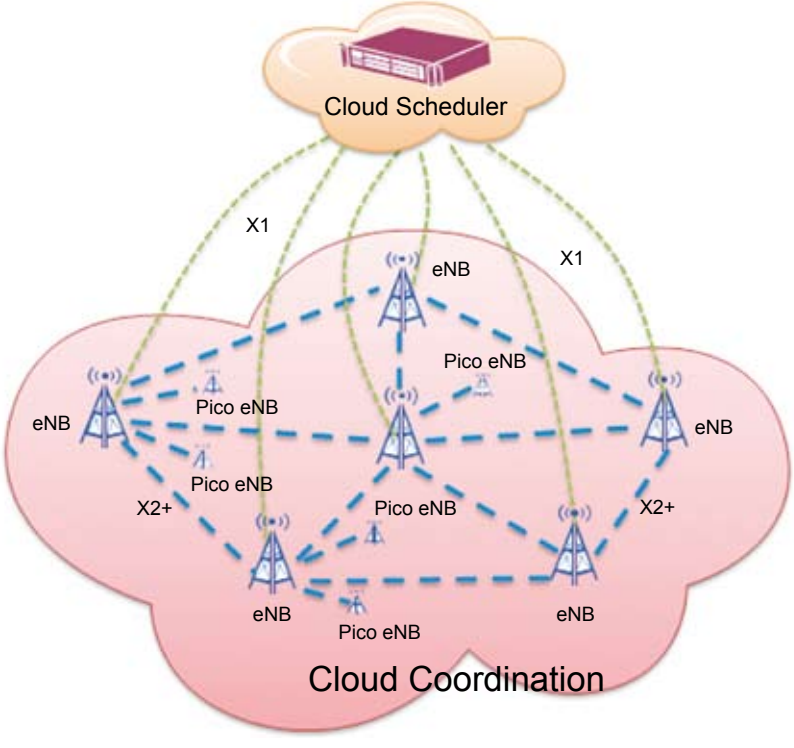


Figure 1. Cloud radio architecture.

The core value of cloud radio lies in its ***adaptability and seamless coordination.***

- lite coordination. Various Lite coordination technologies are used to improve system performance and lower transmission requirements. Soft-combine Lite using ARQ at a retransmission rate of 10 percent can reduce transmission delay tenfold. Cloud IRC can prevent interference in the uplink. This significantly improves the quality of received uplink signals, and the system can perform at half its capacity even if soft symbol data throughput is reduced by a factor of one thousand. JT-Lite and CS/CB/NF Lite can reduce transmission delay by a factor of some dozens by only introducing a delay of 1~N ms.
- super cell. This is formed by traditional neighboring cells that can use a wireless transmission solution. Dedicated resources such as cell ID, master-and-slave synchronization signals, frequency-hopping sequence, and scrambling sequence can be shared between these cells. In the CP, the super cell removes boundaries between macro and micro cells and between individual macro cells. This improves coordination between all cells. With a super cell, the drop rate of a physical downlink control channel is also reduced. When combined with the inter-CP SDMA technology, the super cell does not significantly affect system capacity.
- P-bridge. Advanced CPRI compression lifts fiber resource constraints. Existing Ethernet cables are reused for flexible p-RRU deployment. The photoelectric conversion module converts 10G optical fiber to GE cable. A P-bridge module can carry multiple p-RRUs, and the remote p-RRUs are directly powered by a P-bridge converter. This makes it easy to deploy p-RRUs. ZTE's P-bridge solution uses the Ethernet frame format for data encapsulation so that routing and distance can be flexible expanded via an Ethernet switch.

Core Value

The core value of cloud radio lies in its adaptability and seamless coordination. Cloud radio can adapt to different transmission scenarios and perform optimally. Cloud radio based on ZTE's SDR platform allows for the transmission network to be smoothly upgraded by software, and no hardware need be changed. With cutting-edge multilayer coordination technology, cloud radio considerably improves edge network performance, especially spectrum efficiency and transmission gain. All this helps enhance user experience. Traditional network coordination is based on the cluster. Coordination within a cluster is good, but coordination between clusters is bad. When a user is on the edge of a cluster, coordination is poor or even nonexistent. This results in unstable user experience. Cloud radio allows for dynamic, real-time coordination based on user location. In other words, the cluster being coordinated changes in real time according to the user's location and feedback. With cloud radio, coordination is dynamic and continuous, and a user does not feel any change.

Conclusion

ZTE's innovative cloud radio allows operators to address interference and coordination that affect OAM and arise as a result of the coexistence of multistandard networks. Wireless network performance can be optimized for given bearer resources, and user experience can be significantly improved. Cloud radio also protects investment, increases revenue, and helps operators secure a leading position in the wireless market.

Operators in China, Japan, and India have chosen ZTE's cloud radio to deploy their wireless networks and have benefited from it. In the near future, cloud radio will help more operators improve their wireless networks. ZTE believes cloud radio is the future of wireless networks. ZTE TECHNOLOGIES

Cloud Radio
Opens the Door to Profitable Mobile Broadband

By Liu Liangliang

The downstream rate in mobile networks has increased by a factor of 2000 over the past seven to eight years. This is an enormous technological leap that would have taken 20 years to achieve in fixed-line networks. The volume of mobile data traffic has surpassed that of voice traffic and will double each year over the next five years. By 2015, there will be an estimated four billion broadband users in the world, 80 to 90 percent of whom will be mobile broadband users. This sharp increase in mobile broadband subscribers has led to soaring data traffic, which in turn has caused costs to skyrocket for operators.

Rapidly developing mobile internet requires exponential growth in bandwidth for terminals. Fourth generation (4G) involves creating a bigger "runway" for faster speed and smooth internet. However, building such a high-speed runway is not easy feat. Their first problem is to have enough transmission resources to carry traffic over the runway.

With the rapid development of mobile internet, operators have to focus much more on user experience. Traditionally, networks have been coordinated around the cluster, which ensures good experience for users within the cluster. However, when users move between clusters, network coordination is poor or even nonexistent. This greatly affects user experience. Small cells can be introduced to reduce the effect of heavy traffic on a network. Traditional hexagonal network architecture can be broken down into hierarchical heterogeneous architecture, but operators have to address coordination between macrocells and microcells as well as interference between macrocells.

The rapid development of mobile internet has been twinned with the continual evolution of telecommunication technologies. Communications products are being upgraded in very short intervals. Therefore, coexistence of three-band, four-mode networks such as GSM, UMTS, LTE FDD, and LTE TDD is necessary. Operators need to improve equipment compatibility and enable multinetwork coordination with little or no change to hardware configuration. Innovative radio technologies address these issues.

Cloud radio is a set of innovative techniques developed by ZTE for radio access networks. It comprises over 20 innovative techniques and 200 patents and can dynamically adapt to an operator's network regardless of existing conditions or future evolutions. To date, cloud radio has been considered the most complete, most advanced solution for boosting radio-access network performance.

Cloud radio is adaptable to homogeneous and heterogeneous networks as well as macrocells, microcells, and picocells. More importantly, cloud radio can dynamically adapt to complex transmission scenarios and implement bidirectional transformations between wireline bearer bandwidth and wireless network performance.

For operators with abundant optical fiber, coordination provided by cloud radio can improve average throughput of the whole cell. In areas where demand for capacity is high, intercell baseband can be coordinated to increase uplink transmission gain in the overlay area by more than 3 dB and network capacity by 8.49 percent. Such coordination also improves network handover and makes the network more resistant to interference. Most operators have SDH- and PTN-based transmission, and different transmission equipment provides different bandwidths, even if the same transmission technique is used. By using a patented compression algorithm, cloud radio greatly reduces transmission overhead and saves transmission bandwidth by more than one order of magnitude. As well as reducing the need to invest in transmission, cloud radio also makes it possible to use various bearer techniques. Cloud radio has techniques that can be applied when transmission conditions are not ideal, and time delay is only increased slightly. Cloud radio resolves the fundamental technical and cost issues and helps operators improve the performance of their network.

To ensure good user experience, a traditional network is coordinated using a baseband card and static configuration in the background. When different baseband cards are used for neighboring cells, coordination is poor at the cell edge. Cloud radio lifts this constraint by introducing many thresholds so that dynamic, real-time coordination is possible according to user location. In the LTE era, hard handovers will have the characteristics of 3G soft handovers whereby an end user does not perceive any change in the network environment.

*Telecommunication technology avoids or eliminates interference through subtraction. **Cloud radio**, however, solves the same problems through addition.*

The story of telecommunication development is also a story of anti-interference development. Telecommunication technology avoids or eliminates interference through subtraction. Cloud radio, however, solves the same problems through addition. Cloud radio combines many traditional physical cells into a supercell. This reduces the number of cell edges and handover times and improves user experience. Neighboring terminals are allocated different time or frequency spectra. Even if the two terminals are scheduled to the same time or frequency resource, interference can be inhibited by calculating a beamforming weight. In the age of experience economy, cloud radio is dynamically adaptive to network conditions.

Future networks need to be heterogeneous, and small cells will be critically important for hotspot and indoor coverage. Almost blank subframe (ABS) has been introduced into eICIC to coordinate intercell interference in the time domain and reduce interference between macrocells and microcells. A cloud scheduler coordinates all small cells in the network. This avoids imbalanced or unreasonable resource allocation that occurs as a result of cells scrambling for resources during coordination. The cloud scheduler also optimizes the allocation of ABS to coordinate macrocells and microcells and obscure the border between macrocells. This further reduces interference between macrocells and boosts overall network performance.

Cloud radio maximizes network gain for minimal upgrade cost and helps operators balance cost with quality.

The first TD-LTE network was commercially deployed in South Asia in April 2012. To meet the ever-increasing demand for wireless data services with no change to existing network architecture, a growing number of TD-LTE base stations have to be deployed. The operator began making good use of existing network architecture to resolve the conflict between great demand for transmission bandwidth and network cost.

China Mobile is a strong promoter of TD-LTE. After deploying more than 3000 TD-LTE base stations in Guangzhou, they gave a questionnaire to equipment vendors that would be used to determine how to guarantee user experience and network quality while minimizing changes to network architecture.

Cloud radio encompasses many innovative technologies. The patented compression algorithm reduces transmission overhead. This helps operators maximize network performance and revenue and minimize cost. A cloud scheduler schedules the network as a whole and eliminates restrictions between baseband cards, base stations, and clusters to offer users a seamless, borderless network. Cloud radio opens up a new era for user experience.

Ideas change technology; technology changes behavior; behavior changes culture; culture changes economy; and economy changes business. With a moving cloud, cloud radio is opening the door to profitable mobile broadband. ZTE TECHNOLOGIES

LTE Goes Green with Technical Innovation

By Guo Jin

Power consumption is one of the main expenses of running an LTE network, and energy-efficient network elements have become more and more important.

An LTE wireless network contains two main elements: RRUs and BBUs. With the development of hardware architecture, power consumption in network elements has decreased significantly. Digital predistortion and Doherty technologies have also decreased RRU power consumption lower than ever. In each RRU, the power consumed by a fan can be saved by using natural heat dissipation. With the development of advanced IC technology, high-density circuits can be integrated into an IC to greatly reduce the power consumption and size of the IC. This lowers the overall power consumption in a BBU. Advanced architecture, high-efficiency power amplification, and natural heat dissipation have greatly reduced equipment power consumption and operational cost without impacting normal network operation.

Although energy can be saved through innovative architecture, hardware, and materials, new energy-saving techniques are yet to be tapped. By studying people's usage habits, researchers have found a new aspect to energy saving.

The NGMN Alliance has measured the daily average traffic distribution for

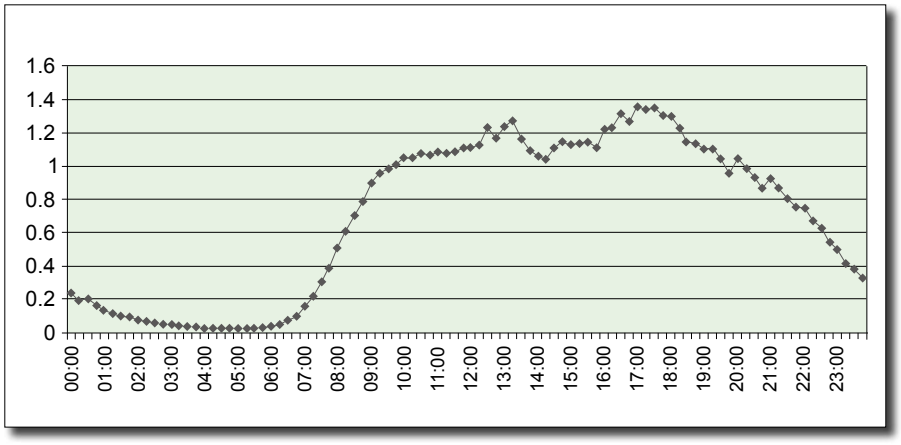


Figure 1. Average traffic distribution in a day.

an urban scenario (Fig. 1). In Fig. 1, there is no communication activity in the cell in the two hours between approximately 04:00 and 06:00, and traffic is lower than 20 percent in the seven hours between approximately 0:00 and 07:00.

Subscribers use more communication services during the day and very few in the small hours of the morning. Knowing such usage habits is useful to determine how resources should be allocated so that the maximum amount of power can be saved.

- **Dynamic PA voltage adjustment**

If the RF power amplifier (PA) works at full power when there is no traffic or the load is very low, then power is wasted.

PA voltage can be dynamically adjusted according to the traffic load and required output power. When the output power is relatively low, the voltage required by a power amplifier is set lower than its maximum output voltage. In this way, power amplification is improved when the traffic load is light, and power consumption is reduced.

- **Intelligent OFDM symbol turn-off**

When there is no traffic, power can be saved by adjusting the PA voltage. Power can also be saved in transmitting LTE OFDM subcarriers. OFDM symbols can be automatically turned off when there is no baseband data transmission. This reduces power in the PA. Turning off PA OFDM symbols is more efficient than keeping them turned on all the time, especially when there is light or no traffic. PAs, cells, and power supply can also be intelligently turned off in the same way as OFDM symbols.

- **SON energy management**

In an LTE system, energy-saving technologies are managed by an SON server regardless of whether they are used individually or together.

All energy-saving functions are controlled by the SON server and can be automatically configured by the operator. The SON server is the central platform where energy is managed according to the operator's strategies.

ZTE's green LTE network solution reduces power consumption in base stations in several ways. A base station can save up to 40% of power usually consumed. The combination of dynamic PA voltage adjustment and intelligent turning off of OFDM symbols is unique in the industry and can save about 32% of power consumption. Suppose the average power consumed by each base station is 1500 W (configured with three sectors). A single station can save up to 5200 kWh each year. This means more than 5.2 million kWh can be saved for a network with 1000 base stations each year, which is a saving of 1730 tons of standard coal and a reduction of 4500 tons of carbon dioxide a year. If base station power consumption is reduced, then less auxiliary power and heat-dissipation devices are required and less network OAM is necessary. The power needed for these devices is also reduced. New energy sources such as solar, wind, and bioenergy can be used in conjunction with these innovative energy-saving technologies. In this way, network energy consumption can be cut by 50%.

ZTE has increased its contributions to LTE and future technologies and has secured a leading position in the LTE industry. The company is dedicated to providing customers with green, energy-saving products and solutions. ZTE aims for harmonious coexistence between networks and the environment. ZTE TECHNOLOGIES

Development Trends of Mobile Communication

By Zhang Jun

Mobile Internet Becomes a Lifestyle

Mobile apps on smart devices are becoming more popular. Whether walking on the street or sitting on a bus, you often see people reading up on restaurants, checking routes, chatting, buying stuff online, or social networking.

In the era of 3G, more people are using their mobile devices for data rather than voice. They surf the web and access video, SNS, games and search engines and they make online payments. Mobile internet is becoming a more important part of people's lives.

Terminal and Cloud Accelerate the Development of Mobile Internet

The boom in mobile internet has been driven by the rapid development of smart terminals, mobile broadband networks, and cloud technology. Today, cloud technology is used in computing and storage, and smart terminals are used for data output. Mobile internet acts as a pipe that combines them. The widespread deployment of 3G networks has prompted the rapid development of smart terminals and cloud computing. For example, Apple's Siri only works on a 3G network.

According to the latest research from Strategy Analytics, the number of

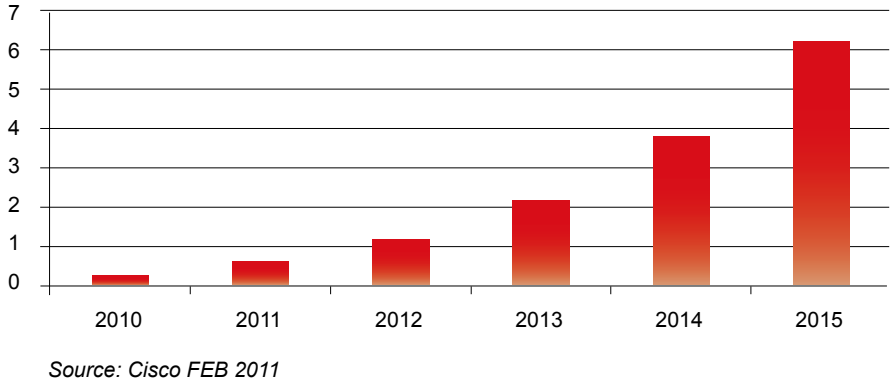


Figure 1. Global mobile data traffic (exabytes/month).

smartphones in use worldwide was 1.038 billion in Q3 2012. It took 16 years for the first billion smartphones to appear, but the next billion will appear in less than three years.

Cloud technology provides a good opportunity for mobile internet innovation, and more mobile applications are emerging and affecting the mobile internet ecosystem. For example, microblogging allows users to acquire fresh information and share their lives. This attracts many users and generates a huge amount of mobile data traffic.

Mobile apps and services contribute much to the explosive growth of mobile data traffic. According to the Cisco Visual Networking Index (VNI) Global Mobile Data Traffic Forecast for 2010 to 2015, worldwide mobile data traffic will increase 2600 percent to reach 6.3 exabytes per month or an annual run rate of 75 exabytes by 2015.

Mobile Data Boom Accelerates Network Upgrade to LTE

A 3G network provides a smooth path between smart terminals and cloud computing; however, as mobile apps become more popular and are continually upgraded, the resulting data traffic is exerting enormous pressure on 3G bandwidth. Take US-based AT&T for example. The rising number of iPhone users has generated remarkable revenue growth (iPhone ARPU is 1.6 times that of other users). However, its network data traffic skyrocketed 50 times in three years, placing a heavy burden on its 3G network and leading to network failures in some regions. O2 is a subsidiary of Telefonica and saw its network data traffic surge 1800 percent in 2010 because of growth in the number of smartphone users. This affected the quality of voice and data services in London and forced O2 to expand its network capacity. Limited network bandwidth will hinder the development of HD video streaming and other high-quality mobile internet services in the future.

Increased data traffic is forcing operators to upgrade their existing networks. Leading operators and TDD spectrum owners are all targeting 4G LTE. The LTE standard, which includes TD-LTE and LTE FDD, was officially released by 3GPP in 2008. The standard is based on new technologies, such as OFDM, and is designed to provide 100 Mbps downlink and 50 Mbps uplink speeds on the 20 MHz bandwidth. It is also designed to support 100 km coverage radius and 120–350 km/h mobility. Mobile bandwidth is measured in kilobits for GSM, tens of kilobits for GPRS, megabits for EDGE, tens of megabits for 3G, and hundreds of megabits for LTE. Future LTE-A will be measured in gigabits and will push mobile broadband to a new level.

LTE has the following advantages over 3G:

- higher spectrum efficiency with 5 bit/s/Hz downlink (3-4 times that of HSDPA) and 2.5 bit/s/Hz uplink (2-3 times that of HSUPA)
- higher bandwidth and speed
- flat network that reduces latency and flexible network deployment
- IP-based network that allows multiple services to be interconnected
- X2 interface and anti-jamming technology that boosts cell-edge user experience
- new technologies, such as small cells, that significantly expand network capacity.

With these advantages, operators can provide higher mobile bandwidth and better user experience. The scale and user base of LTE have been expanding rapidly. According to statistics from the Global mobile Suppliers Association (GSA), global LTE subscriptions grew to 27.7 million in Q2 2012. As of October 1, 2012, 105 operators had launched commercial LTE networks in 48 countries. GSA forecasts that 159 networks will be commercially launched in 68 countries by the end of 2012,

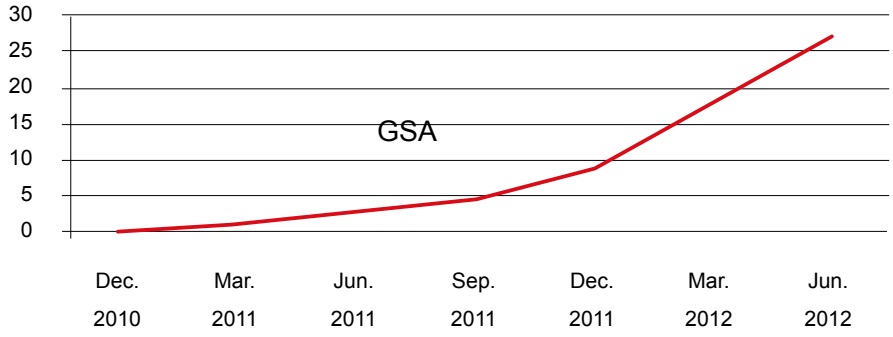


Figure 2. Growth in Global LTE subscriptions.

and this is expected to rise to 195 live networks in 72 countries by the end of 2013.

LTE Promotes Cloud Development and IT/CT Integration

LTE has higher wireless bandwidth and lower transmission latency than 3G and allows more content to be transferred between smart terminals and cloud platforms. Users always want higher-quality HD video calls and image transmission, but these demands cannot currently be met because of the limited bandwidth of 3G networks. LTE will render this problem obsolete and promote the development of cloud technology and smart terminals. LTE adds vitality to mobile internet and will have a far-reaching effect on information technology.

The development of cloud technology and smart terminals has accelerated the shift of conventional information interaction and computing application from traditional PCs to smart terminals. Today, smart terminals can meet most of our daily application needs and support most PC functions. The size of a PC is shrinking, and the post-PC era will soon arrive. Intel and Microsoft's move into the mobile arena is proof of this.

People's demands for communication can never be fully satisfied, but mobile internet delivers a more satisfactory communication experience. In the era of LTE, the boundary between IT and CT is becoming more obscure, and more ICT enterprises will emerge. Traditional IT companies are entering the CT arena; for example, Microsoft acquired Skype and introduced Windows Phone 8, and Google launched Android and acquired MOTO. On the other hand, traditional CT companies are also striving to break into ICT via business innovation; for example, ZTE and Chinese telecom operators are constructing wireless cities. Based on smart terminals and cloud technology, they provide citizens, enterprises and public sectors with mobile information services anytime, anywhere.

ZTE's LTE End-to-End Commercialization Capability

In recent years, ZTE is increasing investment in LTE and future evolution technologies. Now, ZTE is able to provide mature end-to-end solutions, and these solutions have been used in commercial networks.

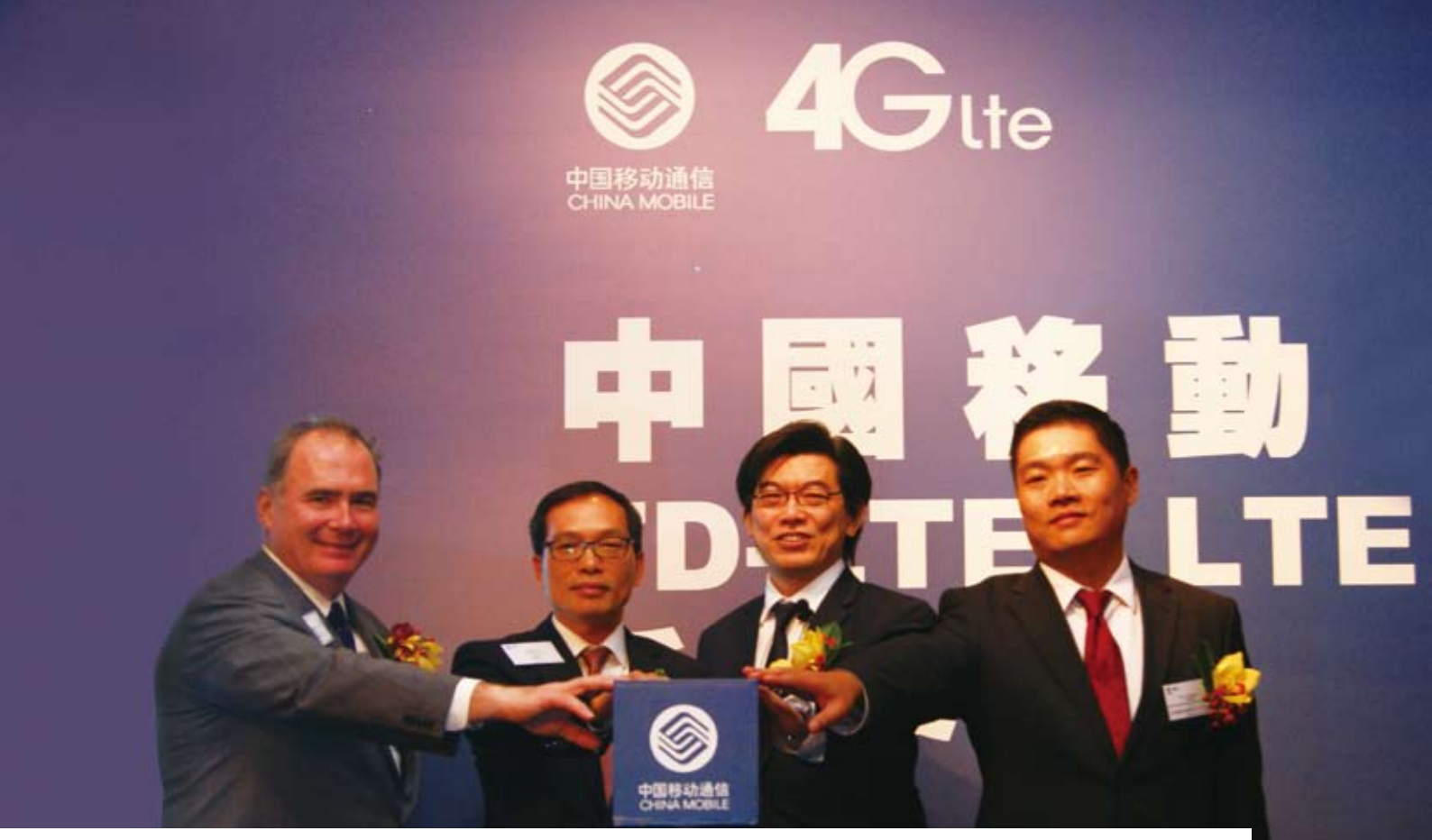
ZTE's self-developed TD-LTE/TD-SCDMA/GSM chipset is the first and only multimode single chipset to have passed the technical requirements of China Mobile's second-phase commercial trial. ZTE has inked 38 commercial LTE contracts and is cooperating with more than 100 operators worldwide to build trial networks. In 2011, ZTE built the first large-scale commercial LTE FDD/TDD dual-mode network for Hi3G Sweden.

As the biggest country in Northern Europe, Sweden has very mature 3G network and mobile user penetration of 1.39 in 2011. Hi3G Sweden determined that its existing network was unable to meet growing demand for mobile data. In 2010, the company launched its 4G strategy.

Given that Hi3G has both TDD and FDD spectrum resources as well as a UMTS network, ZTE devised an LTE TDD/LTE FDD/UMTS multimode networking solution. The LTE TDD and LTE FDD systems share equipment resources, and different products are offered for flexible deployment in different environments.

On December 15, 2011, Hi3G commercially launched its network. Thanks to ZTE's excellent solutions for minimizing TCO, users only need to pay 65c for 1 GB of data traffic. In addition, the integrated solution reduces construction and operation costs by around 20 percent per bit, which helps Hi3G quickly establish its position as a leading mobile operator and provide users with attractive 4G services.

Looking ahead, ZTE will continue with LTE innovation and deliver global users better mobile internet experience. ZTE TECHNOLOGIES



China Mobile Hong Kong: A New Milestone in 4G LTE

By Yang Liangliang and Huang Chang

On July 20, 2012, China Mobile Hong Kong (CMHK) announced that it would cooperate with ZTE and Ericsson to introduce TD-LTE technology into CMHK's existing FDD-LTE network and build a converged, dual-mode network. ZTE would provide network equipment and solutions in the main business districts, including Hong Kong Island and Kowloon. CMHK's network is the first dual-mode LTE network in Asia Pacific and also China Mobile's first commercial TD-LTE network.

Ouvm has predicted that TD-LTE will account for 25 percent of all worldwide LTE connections by 2016. In its 2012 Q1 report, Infonetics predicted that TDD and FDD will account for almost 70 percent of worldwide equipment revenue by 2016. China Mobile is the leader in TD-LTE. At Mobile World Congress in February 2012, Li Yue, president of China Mobile, revealed for the first time the TD-LTE development roadmap in China. He said that China Mobile would expand its TD-LTE trials to 13 cities throughout 2012 and increase the number of TD-LTE base stations to more than 200,000 by 2013. It would do this by building new stations and upgrading existing ones. China Mobile selected the highly competitive Hong Kong market to test its commercial TD-LTE network, which indicates that China Mobile might soon be ready to launch TD-LTE on a large scale.

ZTE won the CMHK project by virtue of its integrated end-to-end solutions, experience in constructing dual-mode commercial networks, and strong after-sales service.

Key Indicators Are Met

Tests showed that the average downlink FTP throughput of a Cat4 terminal used by ZTE is stable at 102 Mbps. A peak throughput of 110 Mbps (the theoretical maximum) is also possible. ZTE connected to Ericsson's existing EPC network architecture to test functionality and

"ZTE is an advanced LTE solutions provider. We are excited to work with the company to construct the TDD/FDD LTE dual-mode network in Hong Kong. We believe the cooperation will allow us to provide more LTE services for the public," said Sean Lee, director and CEO of China Mobile Hong Kong.

performance, and the results were far better than China Mobile expected. ZTE also ran connection tests with more than 30 terminal and chip suppliers.

PS Handover

The redirection method is generally used in the industry to enable handover between LTE and GSM/UMTS networks or between FD-LTE and TD-LTE networks. When switching from one network to another, the user has to release all network resources before accessing the internet on another network. This definitely affects user experience. The ideal solution is PS handover, which guarantees continuity during handover by preserving resources in the target cell before the switch. The user's data session is not interrupted, and the handover is not perceived by the user. In May, ZTE completed the world's first FDD/TDD LTE bi-directional PS handover test, which provides a foundation for seamless communications between 4G and 2G/3G.

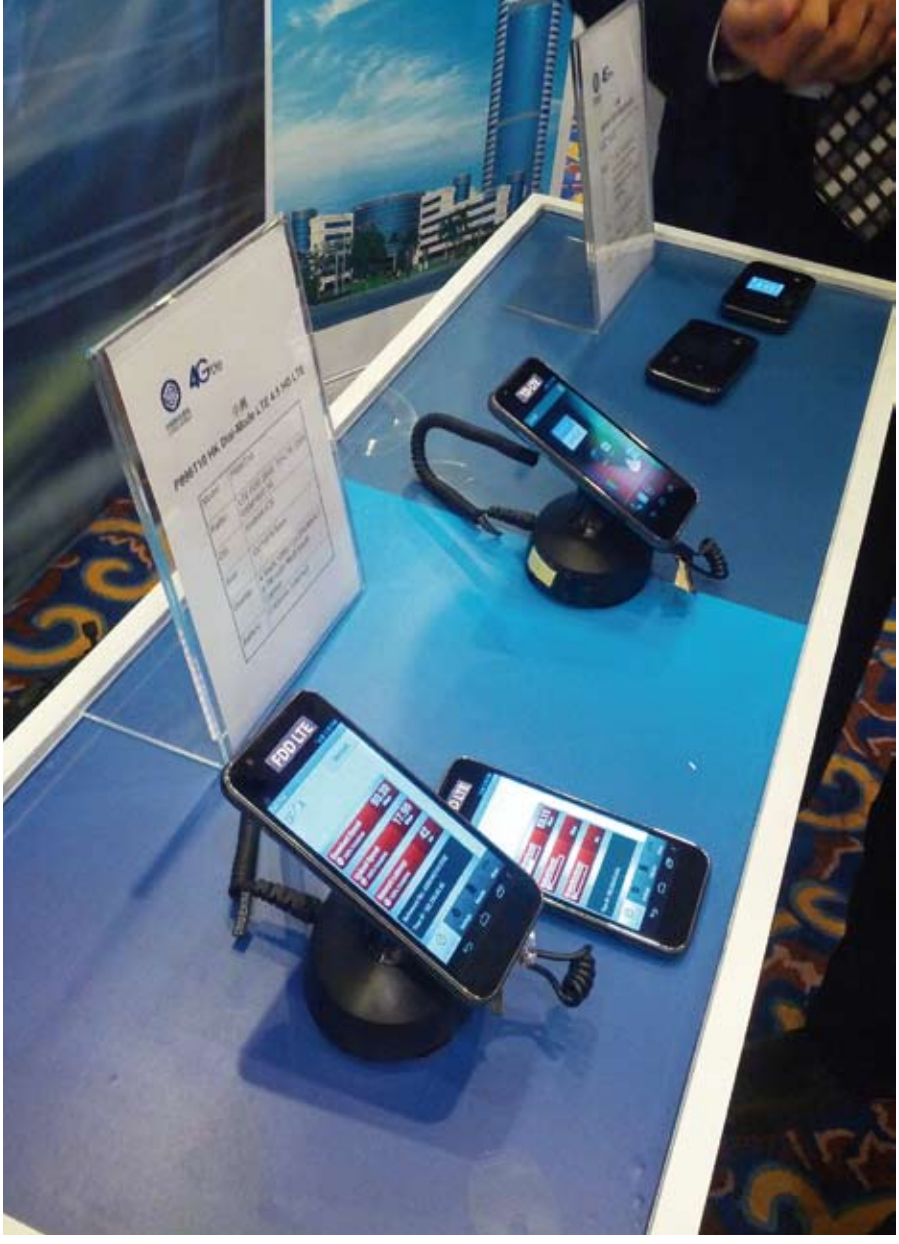
World's First Broadband, Multicarrier, Super-High-Output-Power Base Station

The distributed base station provided by ZTE comprises a baseband unit and RF unit. The baseband unit is based on the advanced SDR platform and supports TD-LTE and FD-LTE. It has highly integrated, large-capacity baseband process boards, each of which supports up to six 20 MHz, 2 × 2 MIMO cells. A base station supports a maximum of 36 cells, the highest capacity in the industry. To coordinate with multiple carriers, the transmitting power of an RF unit is increased 25 percent (100 W for every two channels). The base station supports an operational bandwidth of 60 MHz and up to four carriers. This provides hardware support for the RAN-sharing solution.

Mature RAN-Sharing Solution

The RAN-Sharing solution has received much attention from operators over the years. Limited spectrum resources and the boom in data services have meant that operators are trying to maximize spectrum use by integrating spectrum resources. They may flexibly allocate bandwidth within 60 MHz, share the mobile network, or use different core networks and charging systems to provide customized services. The RAN-sharing solution requires network equipment to support multiple carriers.

The TD-LTE base station provided by ZTE supports up to four carriers and has super-high output power, which meets the requirements of RAN sharing.



Multimode Networks Share Antenna Feeders

ZTE uses existing GSM and FD-LTE machine rooms and antenna feeders in order to avoid building new sites. Base stations can be installed indoors or outdoors. If baseband and RF units are fixed on L racks, an indoor TD-LTE base station only takes up a space of 40 cm^2. If an existing shelter is being used and space is limited, the RF unit can be installed outdoors and can be connected with the baseband unit through optical fiber. This reduces feeder loss. CMHK's GSM and FD-LTE networks use broadband antennas, so TD-LTE base stations share antennas and feeders with FD-LTE and GSM base stations to make the most of existing resources. This ensures a stable network and speeds up network construction.

Multiple Clock Solutions

Precision synchronization between TD-LTE base stations is very important. A high-precision clock puts high requirements on the transmission network and base station installation. ZTE has a number of clock synchronization solutions for different scenarios. In typical scenarios, a common solution for synchronizing GPS clocks is connecting the feeder with GPS antenna. This is the most mature and most widely used solution. In atypical scenarios, where feeder construction is difficult or the baseband module is too far from the GPS antenna, ZTE connects the GPS antenna via optical fiber. This makes construction easier and eliminates loss caused by a long feeder. The solution supports 1588V2 clock transmission so that many base stations can share one clock source. Also, the clock can be shared via the existing transmission network, which saves network construction cost.

Rich Local Delivery Experience

ZTE has much experience in delivering big projects in Hong Kong. In a large turnkey project, ZTE provided CSL Hong Kong with solutions for network planning, site design, land acquisition, site construction, site debugging/opening, project maintenance, and network OAM. More than 2000 3G base stations were put into service within 12 months, which was a record in Hong Kong. In a third-party evaluation, CSL was found to have the highest network quality in Hong Kong and the third-highest network quality in the world. This proves ZTE's strength in LTE planning, design, and network optimization.

ZTE is capable of highly efficient logistics. The company has a 2000 m^2 warehouse in Kwai Chung, Hong Kong; and equipment production lines in Shenzhen, which neighbors Hong Kong. These allow fast delivery and convenient custom clearance. ZTE has experience implementing large mobile projects in Hong Kong and maintains close partnerships with many Hong Kong and overseas outsourcers. ZTE also has hundreds of engineering teams. ZTE TECHNOLOGIES

Telenor Constructs a Digital Hungary

By Wang Botao

Hungary has mobile penetration of more than 100 percent and is one of the fastest growing telecom markets in Europe. In the mobile broadband era, Hungary represents a huge opportunity for operators, but customers there also have high requirements and market competition is intense.

New Challenge, New Opportunity

Telenor Hungary is the second largest mobile phone operator in Hungary. With the coming of mobile broadband and 4G, Telenor Hungary has launched a "digital Hungary" program. Telenor's existing network was modernized so that it could smoothly evolve to HSPA+ and LTE. This modernization has improved network performance and market competitiveness and helped Telenor meet the growing need for simple-to-use, value-for-money mobile communications. Customers have been provided with faster, more reliable services.

ZTE's Uni-RAN Solution

On August 23, 2010, ZTE announced it had signed a contract with Telenor Hungary to build a GSM/UMTS/LTE network in Hungary. ZTE agreed to provide radio and core infrastructures that include its industry-leading end-to-end and Uni-RAN solutions. The deployment for Telenor was the first GSM/UMTS/LTE co-networking deployment in the telecom industry.

ZTE's SDR-based Uni-RAN meets all of Telenor's requirements. With the software-defined radio (SDR) technology and unified hardware platform, different baseband processing boards can work together in a BBU. A single site can support multiple modes and same-band networking, for example, GSM 900 MHz and UMTS 900 MHz. ZTE provided a unique 2T4R dual-PA radio unit that supports different modes and cross-sector configuration (a radio unit supports two sectors at the same time) to save capex and opex. It also supports MIMO without needing new radio units. This reduces equipment cost, and the service network is not affected. Telenor did not need to alter the cost-effective configuration of its network at the beginning of swap and had control over its investment throughout the network evolution. Because ZTE iBSC has large capacity, the number of BSCs used in the mobile network was reduced from 42 to 14, which significantly saves capex. ZTE's Uni-RAN also enhances user experience for Telenor's customers.

Highly Efficient Network Management

Telenor Hungary operates a triple technology network on four spectrums at the same time. As a result of intense market competition, increased demand for services at low prices, and frequent technology changes in an ever-changing environment, Telenor needs to continuously upgrade its network. This requires investment and leads to a decrease in ROI.

ZTE's RAN OSS can manage radio equipment such as RNC, Node B, BSC, BTS, and eNode B. RAN OSS manages faults, configuration, inventory, performance security, topology, and an integrated analysis system. It supports centralized management, monitoring, and statistical analysis. It also supports SON, which has many intelligent, automatic management functions, such as self-configuration, self-optimization, and self-healing. SON can automatically configure and optimize the network with less human intervention.

ZTE's RAN OAM has a flexible architecture and uses independent modules. This allows for fast deployment and flexible management and reduces capex and opex for Telenor Hungary.

Hybrid Transmission

Depending on site transmission requirements, before the swap, 2G BTSs were using E1, and 3G sites were using E1 and IP. Telenor Hungary did not upgrade its transmission network to all-IP until 2012. ZTE's base stations support TDM and IP hybrid transmission; TDM is used for 2G sites, and IP is used for 3G and LTE sites. Therefore, the existing transmission resources can be effectively used in the new network.

ZTE's SDR base stations have an all-IP switch architecture so that they can evolve to all-IP transmission. Furthermore, 2G, 3G and LTE networks can share existing transmission resources, and this improves transmission efficiency and reduces operation costs.

Advanced Network Security Solution

There are transmission challenges when a network evolves to all-IP architecture. Base station data is transmitted in plain text, which means that it can be easily deciphered,

intercepted, counterfeited, and tampered with. Most base station nodes are located in unsecured environments and are open to attack. In addition, backhaul transmission is usually on a third-party network, which implies a degree of risk. IP protocol does not take these security factors into account. ZTE's base stations support IPSec solution from BTS, NodeB and eNodeB to BSC, RNC and CN. ZTE's RAN network issues and manages the certificate through CA. A certificate is automatically managed; the certificate status can be checked, updated, and cancelled in real time. IPSec ensures transmission security in the IP layer. By using encryption, authentication, and other security technologies in the IP layer, TCP/IP protocols and network are more secure. IPSec is flexible and efficient. It improves network safety and reduces maintenance.

Customized Service

During the network swap, more than 40 percent of outdoor power supply cabinets were reused. This reduced costs and hastened project progress. ZTE has all types of base stations for outdoor, indoor, and street scenarios. ZTE BBUs can be installed in existing outdoor cabinets; standard 3U, 19-inch BBUs meet installation and heat dissipation requirements. ZTE engineers tested installation design, simulated thermal scenarios, and performed other practical tests on-site to ensure that BBUs installed in power supply cabinets would work normally and not affect the cabinets themselves. ZTE's professional, customized services pushed forward Telenor's network modernization.

By October 2012, ZTE had swapped more than 2800 sites and commercialized more than 500 new sites. ZTE provided strong support to Telenor Hungary to deliver high-speed data services on high-quality GSM, UMTS and LTE networks.

A Wonderful Digital Life

Telenor Hungary built a separate brand called "Hipernet" for its broadband network. All services, included LTE services, are marketed under the Hipernet brand without reference to 3G or 4G. Telenor has a mobile internet package suitable for completely replacing fixed-line internet in several locations in Hungary. Telenor has completely overhauled the networks of 671 towns and villages, and similar upgrades are in progress throughout the rest of Hungary. Users can now enjoy a mobile internet network that offers faster data and better quality than ever before. Telenor is now offering a maximum nominal download speed of 60 Mbps in 76 towns. According to the company, Hipernet MBI will bring information services and business opportunities to people in rural areas where the internet has traditionally been difficult to access. Working with large files is now possible. The latest addition to Telenor's range of mobile internet services allows HD-quality video conferencing, transfer of large graphics files, and remote management of distributed databases. Popular cloud services are also faster and more convenient to use with Hipernet MBI.

Financial Improvement

Telenor Hungary disclosed its financial results for the first quarter of 2012; revenue, EBIT, and ARPU had increased year-on-year in Q1 2012. "For the first time in a long while, this quarter we can report an increase in voice and non-voice revenues alike. In recent years, we have been badly hit by the economic crisis, the gradual reduction of termination fees, and a tax crisis. This improvement demonstrates not only the attractiveness of our commercial offers but also the quality of our new network. We are very proud that last year's very fast network modernization program now allows us to offer high-quality mobile internet services. In addition, we also enhanced the quality of our voice services. These improvements are appreciated by new and existing clients alike," said Christopher Laska, CEO of Telenor Hungary.

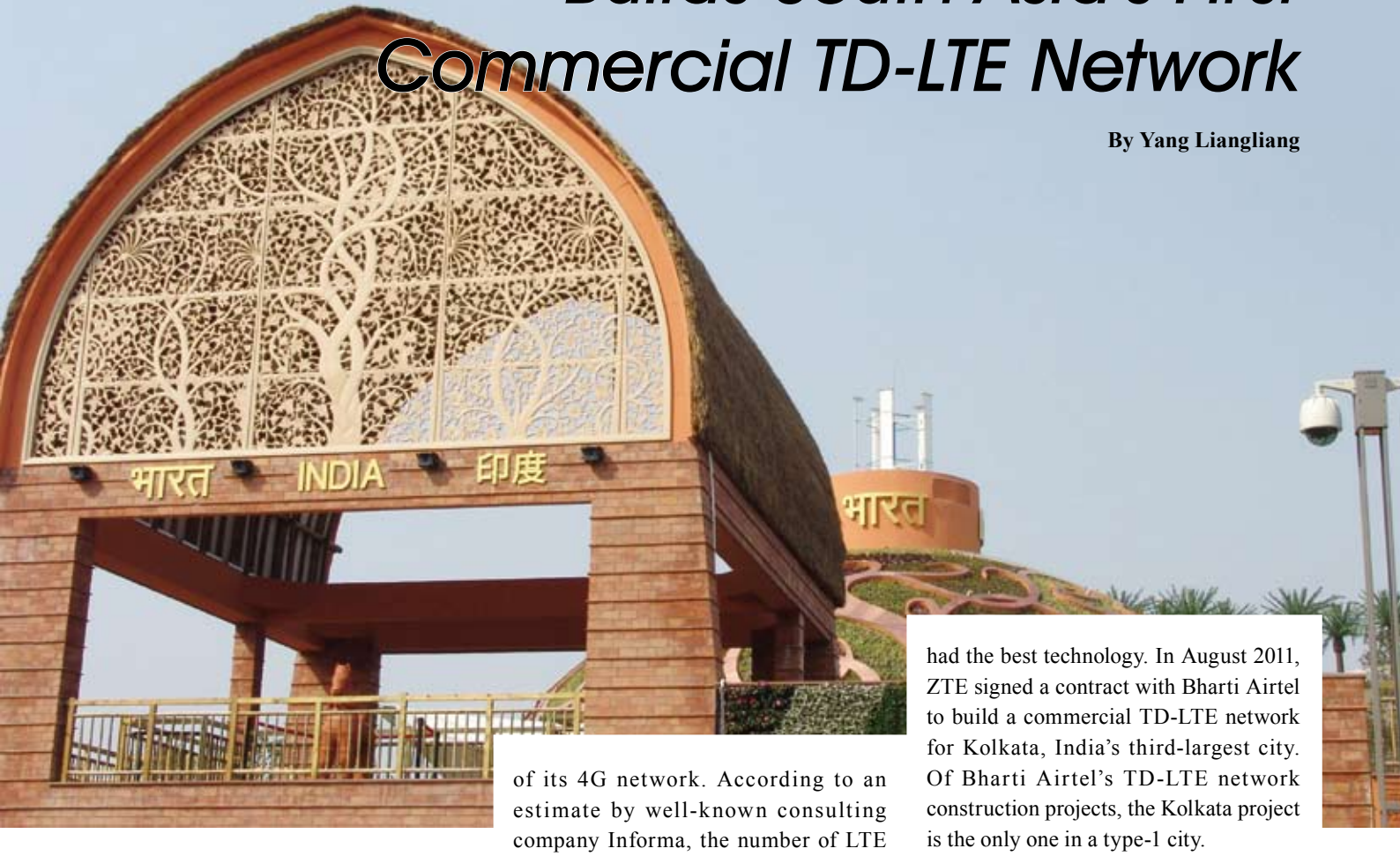
Milestones

- August 2010: Telenor Hungary signed the GSM/UMTS/LTE contract with ZTE.
- December 2010: Test bed verification finished.
- September 2010: LTE 2.6 field test finished.
- December 2010: LTE 1.8GHz sites prepared.
- October 2011: LTE network was pre-commercialized.
- April 2012: Swap project completed three months ahead of schedule.
- July 2012: LTE network was commercially launched on 1800 MHz spectrum. ZTE TECHNOLOGIES

Bharti Airtel

Builds South Asia's First Commercial TD-LTE Network

By Yang Liangliang



India-based Bharti Airtel is a leading multinational telecommunication company with more than 200 million users across 20 countries in Asia and Africa. It is the biggest mobile operator in India. In June 2010, with a bid of 33.14 billion rupees ($US655.6 million), the company obtained a 2.3 GHz broadband spectrum license. In the same year, Bharti Airtel chose to use TD-LTE technology in the construction of its 4G network. According to an estimate by well-known consulting company Informa, the number of LTE users in India will reach 18.83 million by 2016, and revenue from data will reach $US11.446 billion by 2016. This represents a huge opportunity for the mobile market and is an incentive for Bharti Airtel to invest in a TD-LTE network.

In November 2010, several telecom equipment manufacturers were invited to conduct TD-LTE tests over a six month period. The tests items covered basic functionality, reliability, network coverage, and performance. ZTE passed more tests than any other company and had the best technology. In August 2011, ZTE signed a contract with Bharti Airtel to build a commercial TD-LTE network for Kolkata, India's third-largest city. Of Bharti Airtel's TD-LTE network construction projects, the Kolkata project is the only one in a type-1 city.

2G Site Sharing Saves Installation Costs

To save installation costs, ZTE thought carefully about site design and equipment installation. Existing 2G sites were used, and TD-LTE distributed baseband modules were positioned on the same racks as 2G equipment so that power supply and 2G transmission could be shared. To guarantee reliable power supply and reduce power costs, ZTE used DPD + Doherty technology to achieve a power amplifier efficiency of 30–40%.

Bharti Airtel President and CEO Sunil Mittal said, "I would like to thank ZTE who has built this network for Bharti Airtel here in Kolkata. It is actually the first relationship that we have set up with ZTE who are one of the leading providers of broadband services and mobile network, and I would like to express my thanks to ZTE for having put up this wonderful network in a very short time expectation."

This greatly reduced the system's power consumption.

In India, the base station antenna is usually installed on an iron tower; however, the cost to build an iron tower is five to ten times the cost in China under the same conditions. Also, land is very expensive in India, and towers are built very slim to accommodate three antennas only. This meets the minimal requirement of three sectors for a base station. There is no other choice but to build new iron towers for the antennas of a new network.

ZTE solved this problem by providing broadband multiport antennas that support both 2G and TD-LTE. These antennas replace the existing 2G antennas. A broadband multiport antenna has two ports for 2G RF modules, and the remaining ports are for TD-LTE RF modules. The ingenious structure of the multiport antenna saves the cost of building new iron towers and is an excellent example of how to use site space efficiently during multinetwork construction. The replaced 2G antennas can even be reused to further save costs.

Exclusive Cell Splitting Technology Saves Equipment Costs

During the network construction for Bharti Airtel, ZTE used universal distributed macro base stations with four-channel RF modules. Generally speaking, one RF module can only support one sector; however, the four-channel RF module from ZTE supports cell splitting. By configuring backstage network management software, a four-channel RF module can be split into two two-channel RF modules to support two sectors. Compared with a two-channel RF module, a four-channel RF module increases the average capacity by 20% to accommodate more network users.

In the early stage of network construction, data services are developed differently in different regions. For example, residential areas demand more data services and suburbs demand fewer. If all regions use two-channel base stations, network congestion may occur in busy regions. If all regions use four-channel base stations, equipment installation and maintenance costs would be high, and power would be wasted in idle regions with fewer users.

In India, ZTE combined two-channel and four-channel base stations according to user demands in different regions. A four-channel RF module was used to support one sector in high-capacity regions, and a four-channel RF module was split into two two-channel RF modules to support two sectors in low-capacity regions. A base station has three sectors, so it only needs two four-channel RF modules for full network coverage. This saves 30% of equipment purchase, construction, and maintenance costs. When low-capacity regions become high-capacity regions, network capacity can be expanded by combining cells and increasing the number of RF modules.

Diverse Terminals for Commercialization

As a multinetwork operator, Bharti

Leaders from ZTE and Bharti Airtel present at the 4G LTE network launch ceremony

Airtel has always used different companies to supply equipment and construct networks. This means that equipment of different suppliers needs to be connectable with base stations. There are also numerous TD-LTE terminal manufacturers, and connectivity between different terminals is a test of the maturity of base station equipment. ZTE's open and standard base station port design ensures that different equipment can be connected. The diversity of terminals is a prerequisite for successful network commercialization. During the process of building the network for Bharti Airtel, ZTE conducted connectivity tests with devices from more than 40 manufacturers and laid a good foundation for network commercialization. ZTE has five terminals that can be used on Bharti Airtel's commer cial TD-LTE network, including TD-LTE single-mode data card, TD-LTE/FDD-LTE/UMTS/GSM multimode data card, indoor CPE, outdoor multimode CPE, and TD-LTE/UMTS/GSM multimode uFi that supports Wi-Fi signal conversion.

Highly Efficient Network Delivery

During the Bharti Airtel's TD-LTE project, ZTE strictly monitored shipment, installation, network optimization, and debugging. ZTE provided professional project management teams throughout the entire project, from site selection to construction and installation. On September 28, 2011, ZTE transported the equipment to the site in Kolkata and began installation. On October 28, 2011, the first call was made. On March 1, 2012, the first 500 sites were installed. On April 10, 2012, South Asia's first TD-LTE network was commercialized in Kolkata.

On April 10, 2012, Bharti Airtel launched the TD-LTE network and demonstrated it to the media, government officials, and users. The high download speed and HD video streaming provided by TD-LTE was impressive. Kapil Sibal, minister of human resource development and minister of communications and information technology of India, was present and addressed the ceremony. Bharti Airtel President and CEO Sunil Mittal said, "I would like to thank ZTE who has built this network for Bharti Airtel here in Kolkata. It is actually the first relationship that we have set up with ZTE who are one of the leading providers of broadband services and mobile network, and I would like to express my thanks to ZTE for having put up this wonderful network in a very short time expectation."

Bharti Airtel recognized the quick delivery, outstanding performance, and perfect end-to-end solution demonstrated by ZTE in the Kolkata TD-LTE project. On November 2012, ZTE secured another two contracts to build TD-LTE networks in Punjab and Haryana, becoming Bharti Airtel's biggest TD-LTE equipment supplier. In the future, ZTE will work closely with Bharti Airtel to bring better and faster mobile internet to Indian users. ZTE TECHNOLOGIES

Small Cells: Expanding Mobile Broadband Network Coverage

By Liu Min

With the emergence of smart terminals and internet apps, people are depending more and more on mobile broadband services in daily life. From 2011 to 2012, mobile internet traffic increased 850 percent. As smart terminals become more powerful and LTE networks are commercialized in more fields, mobile data traffic will continue to grow in the future. Therefore, traffic density will be much higher in some regions, and applications scenarios will be more complicated. In this case, even LTE may struggle to meet such demand for data services through only macro cells.

Small cells improve network capacity in hotspots and provide coverage for blind spots and indoor places. Operators predict that small cells will play an important role in future communications. Fundamentally, a small cell must be cheap and easy to deploy and it must accommodate compact equipment.

ZTE's Pico RRU meets all of these requirements and incorporates a small cell backhaul solution.

Industry Leading Pico RRU Solution

The main challenges in deploying a small cell network are:

- keeping construction costs to a minimum
- reducing impact on existing networks
- saving scarce transmission resources and finding good alternatives
- enabling macro and small cells work together well (interference between them should be considered)
- high-precision clock synchronization and the very high requirement it places on the transmission network and base station installation.

To address these challenges, ZTE has introduced a Pico RRU solution that includes Pico RRU, BBU and P-Bridge. The Pico RRU shares the same BBU resource pool with the macro base station, and the BBU provides baseband resources. The Pico RRU can be flexibly deployed in various scenarios and supports installation modes for blind spots, hotspots, and indoor coverage. The P-Bridge provides cable conversion and connection between the BBU and Pico RRU; it connects with BBU via 10G optical fiber; the P-Bridge allows Pico RRUs on floors or in specific areas to be converged and managed. Through the P-Bridge, the 10G CPRI optical interface is converted into a CAT5 cable interface and connected to the Pico RRU via a CAT5 twisted pair. Because the length of a CAT5 cable is limited, the Pico RRU solution supports P-Bridge relay for Pico RRUs that are relatively far apart. This allows for more flexible Pico RRU deployment.

ZTE's Pico RRU includes outdoor Pico and indoor Pico, both of which are multimode and support UMTS/LTE/WiFi. The Pico RRU provides indoor and outdoor blind spot and hotspot coverage and improves network capacity and quality.

Advantages of ZTE's Pico RRU solution:

- A Pico RRU is small, easy to install, and consumes less power. It is

suitable for various scenarios.

- P-Bridge connects to the RRU via a CAT5 cable. Existing cables are used, and this reduces network deployment costs.
- A Pico RRU uses a twisted pair for IQ data transmission, which facilitates cabling.
- Pico RRU can use remote power supply. This makes it easier to cable AC power to active equipment. It also makes equipment installation and maintenance easier and reduces cabling costs.
- Synchronization is simple. Pico RRUs and macro base stations can use the same clock for synchronization.
- Interference between Pico RRUs and outdoor macro base stations can be coordinated.

Forward-looking Backhaul Solution

With large-scale deployment of small cells, backhaul network construction will be a major challenge. Small cells and traditional macro base stations place similar demands on backhaul networks. However, small cells create many new challenges to backhaul networks:

- The industry has predicted that the scale of small cell deployment will be nearly 10 times that of traditional macro cell deployment. Using old backhaul network construction methods for small cells will have heavy investment and burden.
- A variety of backhaul solutions are needed for the various small cell scenarios and different network situations of operators.
- Small cell equipment is deployed outdoors on streets, lamp posts, and walls—places where there are probably no cable transmission resources and where it is impractical to lay fixed cables. Therefore, it is necessary to use wireless.
- Small cells are deployed outdoors on a large scale, which involves renting sites and establishing support facilities. These add to the difficulty and costs of deployment.

Therefore, operators need to select backhaul transmission mode flexibly. Available backhaul transmission solutions include packet bearer network, fixed network broadband, WiFi, LTE, and microwave.

ZTE has introduced an integrated backhaul solution in which transmission devices are made into modules and integrated into small cell equipment. This makes network construction and deployment easier and greatly reduces investment and maintenance costs. A DSL module, cable module, PON module, WiFi module, and TD-LTE module can already be integrated into small cell equipment. In addition, outdoor microwave units with antennas can also be combined with small cells.

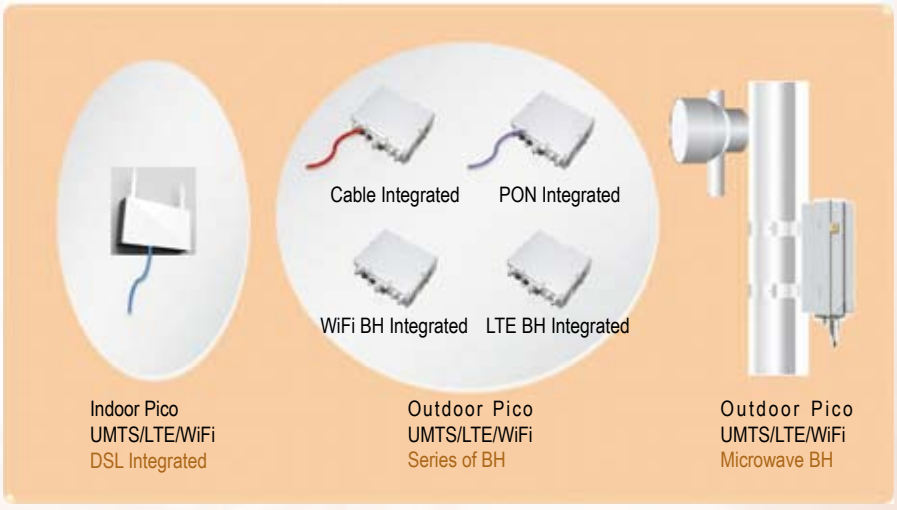


Figure 1. Integrated backhaul solution.

Advantages of ZTE's integrated backhaul solution:

- Operators can flexibly select their backhaul solution and are not limited to the traditional packet bearer network. This reduces cost and facilitates deployment.
- Transmission modules are integrated into small cell equipment, which makes network construction much easier. Installation and debugging is simplified, and operator investment is reduced.
- It is unnecessary to lease other sites to accommodate transmission modules. This saves costs in leasing, support facilities, and operation and maintenance.

In the fast developing information era, ever-changing market demands call for continuous innovation. ZTE is dedicated to innovative research and development in TD-LTE. ZTE has invested heavily in small cell research and has introduced industry-leading concepts and solutions. ZTE continually pushes forward the development of mobile networks. ZTE TECHNOLOGIES

All-Outdoor Microwave Backhaul Solution

By Wang Jiaqi

Quasi-4G long term evolution (LTE) makes spectrum very flexible and provides ultra-broadband speeds. It is slated to be widely deployed by 2014, but it is difficult to construct mobile backhaul networks that meet the requirements of the LTE era.

Evolution Requirements

LTE has higher peak data rates and better spectrum efficiency than 3G. It also has the distinct advantage of packet-based switching. To accommodate LTE, a mobile backhaul requires

- scalable transmission capacity. A 3G base station transmits at tens of megabits per second, whereas an LTE base station transmits at hundreds of megabits per second. Large-capacity transmission links are necessary for developing microwave equipment for mobile backhaul.
- densely deployed small-cell solution. Traditional macro cellular base stations, which provide wide coverage, cannot meet the explosive demand for data access. Mobile operators have had increasing difficulty acquiring sites for base stations; therefore, small cells have been used in busy areas to extend signal coverage, offload data traffic, and enhance network capacity. Limited coverage and densely deployed small cells are key issues for LTE mobile backhaul.
- smooth evolution with low TCO. Reducing network construction and maintenance costs is always of great concern to operators. To reduce costs, a network can be constructed that meets existing transmission requirements and supports smooth evolution and upgrade.

Features of Microwave Transmission

Large-capacity transmission, dense coverage by small cells, and low TCO are major requirements of LTE mobile backhaul. To address these requirements, microwave transmission equipment must have the following features:

- **Zero-footprint installation**

All-outdoor microwave equipment has brand-new system architecture. Traditional split-mount microwave equipment comprises an indoor unit and an outdoor unit. The two units are connected by intermediate frequency cable. The indoor unit is used for baseband modulation, and the outdoor unit is used for receiving and transmitting RF waves. However, all-outdoor microwave equipment integrates these two units into one outdoor unit. An all-in-one integrated design makes the equipment smaller and lighter so that the unit can be mounted on an antenna pole. An all-outdoor, zero-footprint installation makes site rental unnecessary and is an ideal backhaul solution for small cells in the LTE era.

Low power consumption and low TCO are the biggest highlights of the all-outdoor system architecture.

- **Outstanding system functionalities**

All mainstream microwave equipment supports 256-QAM. Higher-order modulation and demodulation schemes, such as 512-QAM or 1024-QAM, can be used to greatly improve spectrum efficiency and meet the fast-growing need for capacity in LTE mobile backhaul. Highly reliable link transmission is also necessary for microwave transmission equipment. Diverse protection modes, such as hot standby protection, space diversity, and frequency diversity, and switching within 50 ms can make link transmission more reliable.

- **Excellent user experience**

Optimal design makes microwave equipment small and light so that engineers can carry it up towers with one hand. This alleviates difficulties during construction and installation. Advanced power-over-Ethernet technology is also used to reduce cabling between devices, reduce construction costs, and accelerate deployment. Complete performance statistics and an integrated network element management system help staff carry out remote maintenance in the background and lighten their workloads.

- **Universal equipment platform**

In mobile backhaul, there are access, relay and convergence scenarios, and each scenario has different transmission requirements. Therefore, it is very important to provide a universal equipment platform that can cover all application scenarios. This platform can greatly reduce the number of spare parts, equipment maintenance cost, and the difficulty of performing maintenance.

- **Low TCO**

Optimizing hardware cost and system power consumption can reduce capex and opex. This protects an operator's investment.

ZTE's All-Outdoor Microwave Backhaul Solution

ZTE has developed an all-outdoor microwave backhaul solution with ZXMW NR8950 as its core. ZXMW NR8950 has a complete set of functions and supports smooth evolution from 2G to LTE.

ZXMW NR8950 uses highly integrated all-outdoor system architecture that can cover all application scenarios. It is a low-cost, all-outdoor, zero-footprint access solution at the end node and allows for multidirectional transmission convergence at the convergence node. Low power consumption and low TCO are the biggest highlights of the all-outdoor system architecture.

ZXMW NR8950 supports 1024-QAM, the highest-order modulation in the industry. Compared with mainstream 256-QAM, 1024-QAM can increase transmission capacity by 25 percent. This improves spectrum efficiency and saves bandwidth. With advanced multilayer Ethernet header compression, physical layer link aggregation, and cross-polarization interference cancellation technologies, ZXMW NR8950 enables a single carrier to reach a transmission bandwidth of 2 Gbps. ZXMW NR8950 also transmits at high power to increase system gain and transmission distance of the link. High-order modulation and high transmitting power improve equipment performance and satisfy the transmission requirements of LTE mobile backhaul.

Operators seek to improve spectrum efficiency and reduce costs through smooth migration and reducing the footprint. To this end, ZTE's all-outdoor microwave backhaul solution is invaluable. ZTE TECHNOLOGIES

Building value together

New solutions and opportunities are results of teamwork and commitment.
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