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ZTE Brings 3G TECH Around You

- Based on its advanced experience in the 3G technology research and its profound understanding of your demand on 3G communications, ZTE has developed more advanced and humanized 3G products ranging from 3G technologies to 3G terminals.

- ZTE is one of the few manufacturers in the world that can provide all-mode 3G equipments including WCDMA, CDMA2000 and TD-SCDMA. By close partnership with the mainstream 3G operators around the world, ZTE has its 3G terminals series like WCDMA cell phones and data cards, HSUPA data cards and EVDO data cards widely delivered into developed countries. ZTE is now using a more approachable, quick and direct way to bring the sophisticated 3G technologies to you.

- ZTE is putting the sophisticated 3G technologies in your hand with easiness and will display the 3G charms in front of you anytime you like.

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An Exemplary Transmission Project Built with ZTE's Ultra Long-Haul DWDM System

In the Xinjiang Uygur Autonomous Region, ZTE built an exemplary large capacity and ultra-long-haul WDM transmission project.

Ultra Long-Haul WDM Transmission Solution

Wavelength division multiplexing (WDM) technology is developing towards ultra-long-haul (ULH) and large-capacity transmission to handle ever-increasing traffic demands.

Case Study

An Exemplary Transmission Project Built with ZTE's Ultra Long-Haul DWDM System

In the Xinjiang Uygur Autonomous Region, ZTE built an exemplary large capacity and ultra-long haul WDM transmission project.

Case Study

ZTE Provides Embedded RPR Network for Qinghai-Tibet Railway

The MSTP embedded with RPR has been successfully applied in the video monitoring system of the Qinghai-Tibet Railway.

Case Study

ZTE Builds Network for the 2008 Olympic Games

With the 2008 Olympic Games fast approaching, quickly building a high quality TD-SCDMA network is a great challenge that operators and equipment providers are facing.
ZTE Deploys CDMA2000 1xEV-DO Rev. A Network in Czech Republic

ZTE constructed Europe’s first EV-DO Rev. A. national network in the Czech Republic.

Interworking IMS and TD-SCDMA

By utilizing the TD-SCDMA network, IMS can help operators create new multimedia applications and make the most of the revenue generating opportunities of the PS domain.

CDMA2000 1xEV-DO Rev. A Opens Opportunities for Mobile Broadband Multimedia

Rev. A is a technology that enables operators to introduce a broad range of integrated video, voice and data services over packet networks and can serve as the gateway to mobile broadband multimedia.

ZTE Unveils the 3G Evolution Handset with PEOPLEnet

ZTE is a leading global provider of telecommunications equipment and network solutions. ZTE’s product range is the most complete in the world—covering virtually every sector of the wireline, wireless and handset markets. The company delivers products and services to customers in more than 120 countries.
ZTE Showcases Its Latest Portfolios at CommunicAsia 2007

ZTE brought its latest technologies, solutions, and service demos to CommunicAsia 2007, held June 20-23 in Singapore.

ZTE showed its latest technology achievements in Service Solutions (including 3G VAS, IMS, IPTV and Digital Home), 3G technologies (UMTS, CDMA 2000), Core networks (FMC, IMS, ALL IP), and Integrated MSAN (GPON, EPON, WiMAX). In addition to telecom infrastructures, ZTE showcased its full range of mobile phones and data cards, including 3G handsets.

Besides, ZTE also launched two keynote speeches at CommunicAsia Summits, which were entitled “Just One Solution on how to Profit in 3G era” and “Triple-, Quatruple- and ‘n’-Play: Strategies for Monetising the Multi-Play Proposition” respectively at NGN@CommunicAsia 2007 and Convergence@CommunicAsia 2007.

Thanks to ZTE’s winning of 50% of China Mobile deal for TD-SCDMA, ZTE’s big progress in Indian market and large sales rise in Asia-Pacific regions, just a few days before CommunicAsia 2007, ZTE was awarded the “Most Promising Vendor of the Year” by Frost & Sullivan in its 2007 Asia Pacific ICT Awards.

ZTE Unveils Tiny GSM Base Stations

ZTE released its newest and smallest dual-mode pico BTS-ZXG10 S8001 in the industry during the CommunicAsia 2007, Singapore.

ZXG10 S8001 is a dual-mode pico BTS which is developed by ZTE independently. It looks like a mini box, weights only 0.9 kilogrammes, and can be powered over Ethernet.

ZXG10 S8001 supports 1 TRX, which can be regarded as an indoor wireless gateway also and satisfies indoor mobile coverage and higher speed data communication requirements. It supports all functions of GERAN BTS, including EGPRS function from MCS1 to MCS9, and WiFi access also. ZXG10 S8001 is a good choice for blind area coverage, hot spot coverage and data service expansion, etc. As for its smallest physical dimension and lightest weight, it is easier to deploy, install and swap.

Recently, ZTE puts forward 8000 series base stations and the latest GSM product solutions in succession such as Flex-BTS BBU + RRU and exPower solutions.

(ZTE Corporation)
ZTE Unveils GPON Gear

ZTE USA, Inc. a subsidiary of ZTE Corporation, announced at NXTComm 2007 held June 16-19 the availability of its Gigabit Passive Optical Network (GPON) solution, the ZXA10 product series. The solution enables carriers to cost effectively deliver next-generation services, including Internet Protocol Television (IPTV) and high definition video-on-demand (HDVOD). The ZXA10 is one of the most bandwidth-efficient GPON platforms available to the market today, and provides a quality of service and network availability standard that meets the increasingly stringent needs of the industry. ZTE USA also announced the signing of a multi-year partnership agreement with North American service provider L&W Technologies.

“ZTE offers a complete line of metro and access products that are aligned with our business strategy of driving down operational expenditures,” said Steve Pitit, CEO of L&W Technologies. “We found the ZXA10 to be the platform to best fit our requirements in delivering innovation, efficiency and quality of service.”

ZTE Shows New Generation Multi-Service Transmission Platform at OPTINET China

ZTE launched its brand new optical network transmission architecture—IP over WDM at OPTINET China 2007 held June 13-14 at Presidential Plaza Hotel, Beijing. The Conference brought together specialists and representatives from mainstream vendors like ZTE, Nortel, Nokia and Siemens, and major operators including China Telecom, China Mobile, China Unicom, and China Netcom to explore the global optical network development.

ZTE’s IP over WDM, featuring great reliability, efficiency and flexibility, is based on series of cutting-edge technologies including optical path shared protection ring, ROADM, intelligent EDFA, adaptive dispersion compensation, automatic optical power control and dynamic optical channel gain equalization. It can completely solve subscribers’ ever-increasing requirements for carrier-class bulk transmission.

(ZTE Corporation)
ZTE Wins 3G Contract from Estonia

ZTE announced that PGH, a holding company integrating resources of virtual mobile company Bravocom and fixed line operator ViaTel, has selected ZTE to deploy a commercial nationwide UMTS/HSDPA network.

PGH is pursuing a plan to launch its next-generation network services by Q3, 2007 when it will be the first in Estonia to offer converged fixed/mobile broadband services.

The Estonian operator awarded ZTE the sole vendor contract following discussions and a series of case studies and tests which confirmed ZTE’s ability to offer a solution that was superior to competing offerings.

The nationwide network will provide subscribers with a variety of high-speed mobile and fixed data services like HSDPA-based services. In the first stage, the network will cover five major cities including Tallinn (Capital city), Tartu, Johvi, Narva and Parnu.

ZTE Inks MSAN Deal with Telekom Malaysia

ZTE announced that Telekom Malaysia has selected ZTE to deploy a nationwide Multiple Service Access Network (MSAN) network. The contract win, constituting 70% market share, signifies another great advance for ZTE in the Southeast Asia.

The Malaysian operator awarded ZTE the largest slice of the market share following two years’ strict technical testing.

Malaysia has maintained a high economic growth rate over the past ten years and is a great potential telecom market. Telekom Malaysia ranks 37th globally and is a key all-service telecom player in the region. It is also the largest fixed and mobile operator in Malaysia.

ZTE Uses Mindspeed Technologies

Mindspeed Technologies, Inc. (NASDAQ:MSPD), a leading supplier of semiconductor solutions for network infrastructure applications, announced that ZTE has selected Mindspeed’s two-port DS3/E3 line card-on-a-chip (LoC) for use in ZTE’s Core Network (CN) and Radio Network Controller (RNC) of WCDMA 3G wireless backhaul platforms. The M29312 LoC integrates two independent DS3/E3 line interface units (LIUs) with framers, ATM/HDLC processors, and telecom application package (TAP) driver software.

The CN and RNC platforms are key elements of ZTE’s 3G mobile communication solution.

“Mindspeed’s two-port LoC is a flexible, cost effective solution that enabled us to develop similar designs for both our CN and RNC systems,” said Mr. Fan Ronghu, the HW Director of ZTE.

“Mindspeed is proud to be part of ZTE’s worldwide 3G deployment with our highly integrated LoC family,” said Rammy Bahalul, Director of Marketing for Mindspeed. “Our best in class ATM and IP products continue to play a major role in the 3G and 4G wireless backhaul deployment.”

(ZTE Corporation)
DoCoMo Tests ‘Super 3G’

G pioneer NTT DoCoMo Inc. is taking the lead again in the next phase of mobile infrastructure developments by conducting very early, pre-standards lab tests of technology it calls Super 3G, or 3.9G, but which is best known as Long Term Evolution (LTE).

The carrier says it has already been testing LTE in its labs and is aiming to “achieve a downlink transmission rate of 300 Mbit/s.”

LTE, which is still in standards development work at 3rd Generation Partnership Project (3GPP), is the next step on from the High-Speed Packet Access (HSPA) 3G technology currently being deployed by the world’s GSM operators.

(July 13, Unstrung.com)

BT Pushes Soccer Service

The cost of watching Barclays Premier League football on television took a dive today as BT launched its BT Vision Sport service. This service allows fans to catch up with more matches in full than any other service and for just £4 a month. Fans will be able to choose from Premier League matches just hours after the action—at a time of their choosing—and they can combine the service with a package of live English and Scottish matches from Setanta Sports for only £12 a month.

BT Vision Sport is ideal for fans who have BT Total Broadband but who are unwilling, or unable, to pay high TV sports subscriptions. BT’s “near live” service includes 242 Premier League matches per season and up to 125 Coca Cola League and Carling Cup games.

(July 16, Lightreading.com)

Foxconn to Develop TD-SCDMA Phones

Cell phone maker Foxconn International Holdings, a division of top Taiwan electronics parts maker Hon Hai, said on Friday it will develop handsets based on the TD-SCDMA standard and expects its first orders when the technology is in use next year.

The parent of China Mobile—the world’s largest mobile operator in terms of users, catering to a market of almost half a billion—is spending around US$3.1 billion to build a TD-SCDMA network, which some expect to go into widespread commercial use in late 2007.

(July 13, Reuters)

Reliance Bags Yipes for $300M

Ambitious Indian operator Reliance Communications Ltd. has furthered its international operations by striking a 12 billion rupees (US$297 million) cash deal to buy Ethernet service provider Yipes Enterprise Services Inc.

The carrier, which signaled its international intentions with the acquisition of international backbone network operator FLAG Telecom Ltd. in January 2004, said it sees “enormous potential” to expand Yipes’s coverage in the U.S. and internationally.

Reliance says it will double Yipes’s service coverage in the U.S. and overlay the optical Ethernet specialist’s services on FLAG’s international network, “allowing Yipes to expand its reach worldwide and enabling FLAG to create significantly more value from its network assets in the strongholds of India, the Middle East, and East Asia.”

“We confidently expect this acquisition to significantly enhance the growth rate, profitability and returns of our global data business,” stated Reliance chairman Anil Ambani in a prepared statement.

(July 16, Lightreading.com)
Introduction

Passive optical network (PON) has evolved to provide higher bandwidth in the access network. A PON is a point-to-multipoint optical network, where an Optical Line Terminal (OLT) at the Central Office (CO) is connected to many Optical Network units (ONUs) at remote nodes through one or multiple 1:N optical splitters. The network between the OLT and the ONU is passive because it does not require any power supply.

Various blends of the PON have emerged in recent years, which are defined by two international industry standards—IEEE and ITU-T. The Ethernet PON (EPON) is a relatively new version that is standardized in the IEEE 802.3ah. The Broadband PON (BPON) and Gigabit PON (GPON) are both standardized in the ITU-T G.983 and ITU-T G.984, respectively.

Features and Benefits of xPON

The explosive demand for bandwidth has been mainly generated by the phenomenal growth of the internet. The inclusion of video into this equation further accelerated the pace. This has exerted tremendous pressure on the broadband access network. The key advantage of having a fiber access over copper or co-axial physical access network is to provide higher bandwidth due to deeper fiber penetration. PON is said to be the best option to cater for this requirement. EPON provides bandwidth within 100 Mbps while GPON is capable to reach up to 2.5 Gbps in shared bandwidth among 64 users. In addition, being optically transparent end-to-end, PON allows upgrades to higher bit rates or additional wavelengths in future. The end-to-end capability is viewed as the critical success factor for any FTTX implementation. This can be illustrated with the many successful deployments of PON with ZTE’s state-of-the-art FTTX solutions, offering fully integrated services including OLT, ONT/ONU, ODN and NMS systems, for both EPON and GPON.

With the deployment of PON, broadband service providers are able to minimize the number of optical transceivers, central office (CO) terminations and fiber deployment. This is because there is no active element in the signals’ path from source to destination for remote powering. Without active components at the outside plant, this will translate into significant amount of annual maintenance cost saving for service providers in the long term. Furthermore, PON extends the reach between the CO and customer premises, operating at a distance of over 20 km.

In terms of network maintenance, it is more efficient with lower operational expenditure (OPEX) as the whole access network is controlled centrally. Flexibility in network configuration is another advantage of PON. The small passive optical splitter used in between OLT and ONU offers easy upgrade in terms of number of subscribers and network reconfiguration. One good example is the PON solution from ZTE which is able to provide dynamic bandwidth allocation, priority control, multi-flow classification mechanism and multi-array scheduling technologies. In general, fiber optic network provides higher security than other types of broadband access technology. For service providers deploying PONs using Fiber-to-the-home (FTTH) Fiber-to-the-office (FTTO), Fiber-to-the-building (FTTB), Fiber-to-the-curb (FTTC) or Fiber-to-the-cabinet (FTTCab), the end-to-end connection is fiber. This provides the highest security needed.

Challenges of xPON

The biggest challenge of PON would be the initial high deployment cost for physical fiber connection although equipment cost is in the downward trend. The primary cost...
Many of these implementations include the state-of-the-art FT TX solutions offering fully integrated services to end customers. Typical solutions deployment would include OLT, ONT/ONU, ODN and NMS systems for both GPON and EPON. ZTE’s xPON solutions has passed China Telecom’s stringent testing requirement on top of interoperability test with other vendors. During ITU Telecoms in Hong Kong end of last year, ZTE participated in the interoperability testing of Full Service Access Network (FSAN) and obtained good results with numerous vendors such as Flexlight, CIG, AMCC, PMC and Fujitsu, to name a few. Just a few months back, in May 2007, similar interoperability testing was done in France and the results are satisfactory with more vendors in the list.

A typical FT TX implementation would consist of OLT, ONU and NMS. As of July 2007, ZTE has deployed over 100 OLTs and more than 5,000 ONUs in China alone. A good case study would be deployment of FTTH at Wangfu street garden in Wuhan, Hubei province with OLTs and ONUs using ZTE’s end-to-end PON solutions. In the initial phase of this project, each ONU is installed in each unit with broadband bandwidth between 10 Mbps to 20 Mbps. Besides high speed broadband access services, other value-added-services offered are VoIP and IPTV. Traffics are prioritized based on the real-time nature of the applications. For future expansion to cater for more subscribers and higher bandwidth, the system has the capability to upgrade the number of ONTs to 1,280 (1:64 splitters) and further upgradable to 2,560 ONTs. Another key advantage of ZTE’s GPON system is the ability to provide both uplink and downlink transmission rate of up to 2.5 Gbps.

Other than China, ZTE has also had some successes in Europe. May 2006 marked a significant milestone for ZTE which has successfully gained entry in the European PON market. ZTE’s foray into this market began with its contract win with Holland operator ITESS. ZTE became its exclusive EPON provider. The contract also saw ZTE supplying ITESS 50,000 ports of EPON equipment to launch FTTH services as part of Holland broadband initiative. This contract was a good start for ZTE to spread its wing to include Algeria Telecom, Free Internet, PCCW, Telecom Italia, and more to come.

**Summary**

Future broadband access networks should be equipped with the capability of flexible bandwidth provisioning, multimedia multicast, and fast response time, reliable and secure services with remarkable QoS. These end-to-end capabilities form the critical success factor of FT TX solutions. PON architecture provides the capability to fulfill these features. It is a future-proof and technically ready technology that is able to provide higher bandwidth in the last mile access network.
Beijing's Wireless Olympic Games

June 5, 2007

China Mobile and others will try out applications such as video calling on China-grown 3G service during the Beijing Olympics.

The 2008 Olympics in Beijing looks set to become a testbed for a mix of new wireless technologies, both homegrown and foreign.

TD-SCDMA, the locally-raised 3G technology, will take center stage during the Olympics, thanks to the push by the government.

China earlier this year extended pre-commercial testing of the homegrown 3G standard to 10 cities from the original three, in its latest move to push TD-SCDMA in commercial use.

While China Telecom and China Netcom are to expand their respective TD-CDMA networks in Baoding and Qingdao, China Mobile will set up new networks in seven other cities—Beijing, Guangzhou, Shenzhen, Tianjin, Shenyang, Qinghuangdao, and expand the existing in Xiamen.

Hu Jian, deputy director of TD-SCDMA at ZTE, the Chinese equipment vendor which claims has won the biggest slice of China Mobile’s tender for the extension project, says TD-SCDMA technology is ready for commercial service.

However, he admits handsets still face issues of power consumption, network planning and stability. But he is confident that these issues would be resolved before the Olympics.

“TD-SCDMA will play a critical role during the Olympics and the networks will absolutely be up and running before the Olympics,” Hu says.

Hu says ZTE was selected by China Mobile as the sole network supplier for the TD-CDMA network in Beijing, as well as one of the suppliers for the networks in Tianjin, Shenyang, Shenzhen, Xiamen and Qinghuangdao.

The company has already begun shipping equipment for the Beijing network, which will consist of over 3,000 base stations. China Mobile will begin testing applications and services such as video calls, video streaming and mobile TV, following the completion of the network in October.

While the Chinese 3G technology on its own is not likely to be enough to support the telecoms needs of the international community present at the Olympic games, Chinese operators are also looking into WiMAX to supplement their offerings.

China Mobile has announced earlier that it will deploy WiMAX and WiFi in and around Beijing for the Olympics games, after receiving the go-ahead from the Organizing Committee for the Beijing Olympic Games (BOCOG).

Meanwhile, China Netcom is also reportedly conducting trials on WiMAX, as well as a home-grown broadband wireless technology, called McWiLL, or Multicarrier Wireless Internet Local Loop.

Developed by Beijing Xinwei Telecom Technology, a unit under Datang Group, a key supporter for TD-SCDMA, McWiLL is based on SCDMA technology in the 400MHz band.

Local media report that Netcom will use McWiLL in the costal city of Qingdao during Olympic sailing events. It has tested the technology in three other cities—Guangzhou, Nanning and Beijing—for video, voice and data communication.
With the acceleration in the pace of global economic integration, there has been rapid growth in demand for telecoms services. A large-capacity transmission system enabled by optical technologies is needed to offer a common infrastructure to various services. At present, optical communications systems are developing in two directions: one, they are migrating towards higher speed (from 2.5 Gbps and 10 Gbps to 40 Gbps) and denser system (the number of wavelengths carried per fiber increased from 1 to 8 and 40 to more than 160) while implementing longer transmission distance without electrical regeneration; two, they are becoming more resilient and intelligent with features of efficiency, transparency and manageability. For wavelength division multiplexing (WDM) technology, its primary focus is on the former direction.

Ultra long-haul (ULH) and large-capacity optical transmission is the basic optical technology because of its ability to simplify backbone networks, facilitate service dispatch and management, and reduce the need for expensive electrical regenerators, which help reduce network investment and operational expenses, lower space and power requirement and ease system upgrade. Researchers have been interested in increasing the transmission distance without electrical regeneration, the wavelength channels per fiber and bit rate per wavelength channel of the large-capacity and ULH optical transmission systems.

ZTE has made great breakthrough in this field. In the Xinjiang Uygur Autonomous Region, northwest China, ZTE built an exemplary large capacity and ultra long-haul WDM transmission project. This project passed expert appraisal and has been put into operation.

The project is a provincial trunk line transmission network, which has a multiplex section of 1104 km and a total capacity of 40×10 Gbps (160×10 Gbps configuration during factory testing), for a major operator in China. The project adopts a series of advanced and mature technologies such as Advanced Forward Error Correction (AFEC), Electrical Return to Zero (ERZ), Raman amplifier, centralized wavelength monitoring, power management and dispersion management. The success of this project means that ZTE’s high capacity and ULH transmission technology and application has reached a new level.

There had been a large amount of industrial reports on laboratory and field trials. In 2003, ZTE announced its result from laboratory trials: 5490 km transmission distance without electrical regeneration. However, compared to experimental systems, there are many different issues to consider in actual projects, which mainly include:
Equipment aging and project margin
Laboratory or field trials usually do not give considerations or sufficient considerations to the project margin. For example, the actual value of fiber attenuation is in the range of 0.18 to 0.2 dB/km, yet a project should consider the transmission fiber loss of 0.275 dB/km. Therefore, it is hard to directly compare experimental systems (including laboratory and field trials) with practical engineering.

Span uniformity
The experimental transmission line usually consists of uniform spans or quasi-uniform spans, such as the N×20/22dB system. But in the actual ULH project, a large-span transmission link is unavoidable. Reach extension of such a single large span is limited, but its optical signal-to-noise ratio (OSNR) impairment is equivalent to that of several shorter spans, each of the same length, constituting a major barrier to increase the length of a multiplex section.

Standardization of components
(focusing on Optical Amplifier)
The configurations of experimental systems are simple. The indexes of these system components are just right, which seldom occurs in the engineering sites. This will lead to a waste of the system capability and performance degradation in indexes.

The project enables terabit transmission (budgeted according to the project environment and margin in factory testing) with a multiplex section length of more than 1000 km, proving ZTE’s leading position in ULH and ultra high capacity DWDM transport, as well as the maturity of its products.

ZTE has carried out independent and cooperative investigations of relevant technologies in recent years, and made a series of notable achievements with its partners.

Achieved terabit and 1000 km multiplex section transmission in the trunk line network of a major operator under China’s 863 Programme.

Submitted two recommendations to ITU-T. ZTE had been selected to edit recommendation G.665 on the evaluation of Raman amplifiers which was published in January 2005.

Launched the world’s first semi-analytical solutions to two kinds of noise sources in distributed Raman amplifiers (DRA), which include stimulated Brillouin scattering (SBS) and secondary backward Rayleigh scattering. These solutions have been verified.

Proposed that the DRA can also compensate for an Erbium Doped Fiber Amplifier (EDFA) gain profile to flatten the noise spectrum. This has been verified and applied.

Further developed the widely tunable continuous-wave laser, delivering ultra-flat gain spectrum optical amplification in DRA.

The emulation software introduces a modeling method for the atomic function model, demonstrating the inner structure of all kinds of complex models simply and clearly. ZXWM M900 is ZTE’s flagship product used in DWDM transmission in trunk lines. It is a patented and standards-compliant bidirectional WDM system (containing optical terminal, optical relay and OADM), and has become one of the mainstream solutions of the Chinese and international operators in the construction of trunk transmission networks. At present, it has been used to build national level 1 trunk lines and provincial trunk lines by major Chinese operators including China Telecom, China Netcom, China Mobile, China Unicom and China Railcom. In the international market, the ZXWM M900 has successfully entered the markets of countries such as India, Indonesia, the Czech Republic, Bulgaria, Republic of Macedonia and Thailand.

ZTE is establishing a greater international presence in order to provide cost-effective and highly reliable trunk transmission solutions for more customers.
Ethernet over SDH (EoS), combining Ethernet and SDH, cannot meet the performance and reliability requirements of existing and future bearer networks as it lacks independent QoS, network recovery and protection mechanisms. Resilient Packet Ring (RPR) has thus emerged. RPR is a technology that can provide QoS guarantee per flow, high bandwidth utilization rate and high reliability. The multi-service transport platform (MSTP) embedded with RPR has been successfully applied in the video monitoring system of the Qinghai-Tibet Railway (Qingzang Railway), the world’s highest altitude rail service.

**Application of Embedded RPR Technology**

**Overview of the project**

In the Golmud to Lhasa part of the line that measures 1140 km, 45 stations are open, 38 of which are unstaffed. The video monitoring system uses cameras to monitor the railway line and station bottlenecks, encompassing base stations, repeaters, important bridges and tunnels. After the images are processed at unstaffed stations, they are transmitted to seven staffed stations for analysis, processing and storage. The control centers in Golmud and Lhasa monitor all the staffed stations in their respective areas, while all staffed stations are monitored in the control center in Xining.

**The embedded RPR solution**

The multiplex section shared protection ring requires the number of nodes to be no more than 16. Since the video monitoring system has limited fiber resources, the physical ring network—whether its topology is a single or intersectant ring—will have more than 16 nodes. As there is a large number of distributed services, the ring bandwidth must be fully utilized to save investment cost. Meanwhile, the network has to support TDM-based voice services. Regarding these factors, the video monitoring system adopts the RPR-embedded MSTP solution (Fig. 1).

With the fiber connecting every other station, two intersecting fiber rings (Golmud and Lhasa rings) were formed by using 2.5G equipment with embedded RPR. Tuotuo River is at the intersection of the two rings where two sets of equipment are placed (Tuotuo River 1 and Tuotuo River 2). Each of the two 2.5G rings can be segmented into two inner and outer logic RPR rings, as shown in Fig. 1.

The video monitoring service has stringent QoS requirements, so the service is sent as high priority traffic (class A). With respect to reliability,
the network doesn’t rely on SDH layer protection, but adopts two RPR protection mechanisms: wrapping and steering, to ensure that the protection switching occurs in less than 50 ms from the occurrence of the fault event.

Lhasa logical ring 1 (Fig. 2) is taken as an example here to illustrate the service flows and bandwidth configurations of Nagchu, Damxung and Lhasa stations. The values marked at each station are the amount of traffic transmitted from unstaffed stations to staffed stations. Besides, the traffic transmitted from Nagchu and Damxung stations to the Lhasa control center is 200 Megabits.

This project employed ZTE’s embedded-RPR MSTP equipment–ZXMP S380/S390. The MSTP equipment supports networking flexibility and an upgrade to 10G system. The network has passed the appraisal by China’s Ministry of Railways, and is now operating stably and reliably with easy manageability and maintainability.

**Advantages of Embedded RPR Scheme**

**High bandwidth utilization rate**

The inner and outer rings of the RPR logic rings work at the same time. Different traffic flows from staffed stations to the Golmud or Lhasa control centers won’t overlap with each other through the use of the spatial reuse mechanism, and the traffic flows from unstaffed station to staffed stations are sent on the shortest path and stripped from the rings when they reach staffed sites, thus fully utilizing bandwidth resource. The rings also use statistical multiplexing so that bandwidth can be shared. The network traffic flow is normally 3-4 times that of network bandwidth.

**Support for multiple services including TDM**

MSTP targets integrated transport of multiple services, and supports both TDM service and data service using the same platform.

**Simple service configuration and maintenance**

RPR performs automatic topology discovery by automatically monitoring network status: each node can obtain a picture of the ring topology, which eliminates the need for explicit configuration activity when a node is added or deleted, enabling plug-n-play operation.

**A dual protection mechanism**

Important nodes are configured with backup equipment to avoid network crash due to the failure of a single node. As RPR is not connection-oriented, no additional service protection channels are required, saving ring bandwidth. Similar to SDH, RPR may provide the protection switching time of less than 50 ms.

**Saving fiber resources and reducing node quantity**

The embedded RPR networking scheme cannot only provide protection against network failure, but can also help save fiber resources and reduce node quantity. If the layered networking scheme is adopted, six fibers are required to establish a ring structure in the core layer, and a lot of regeneration nodes need to be added.

**Conclusion**

Due to the various advantages of embedded RPR technology and MSTP, the MSTP embedded with RPR is the best networking solution to the video monitoring network of the Qingzang Railway.
The much anticipated event in China—the Beijing 2008 Olympic Games—is coming. Hosting this event is unprecedented; it is a great opportunity for China to showcase its achievements and culture. The Chinese government and people place great importance on the Olympics preparations. With the Olympic Games more than 300 days away, it has become an urgent task for Chinese operators to quickly and economically build a “green and high quality” network that will comply with the concepts of “Green Olympics, Hi-Tech Olympics and People’s Olympics”.

Currently, China is quickening the pace of building third generation networks based on Time Division-Synchronous Code Division Multiple Access (TD-SCDMA), to facilitate the provisioning of advanced 3G services during the Beijing Olympic Games. Based on its strong TD-SCDMA expertise as well as its excellent engineering capabilities, ZTE is doing its utmost to construct a high quality communications network to ensure advanced services are available in time for the Beijing Olympic Games.

Guaranteeing Quality with Advanced Technologies

The replacement of coaxial cable with fiber optic cable has been regarded by industrial experts as an inevitable trend. With many years of experience in the wireless area, ZTE took the lead in launching the Baseband Unit (BBU) + Remote Radio Unit (RRU) solution, and has developed BBU and RRU equipment series to address various application scenarios. Connecting BBU and RRU via fiber cable not only solves the difficulties of TD-SCDMA network construction, shortening network construction period, but also dramatically reduces the network cost while enhancing the network reliability. Therefore, this solution can realize economical, quick and flexible installation of the network.

A fiber-based macro base station, consisting of the large capacity BBU (ZXTR B328) and the four-channel RRU (ZXTR R04), was launched in the TD-SCDMA trial network in Qingdao City, Shandong Province on July 15, 2006. By replacing coaxial cable with fiber optic cable, the amount of the project work was reduced by 60 percent, and the project period was shortened by 50 percent.

Meanwhile, borrowing the successful experience from the Sydney Olympic Games, ZTE proposed to provide the TD-SCDMA network coverage for the Olympic stadium with its BBU+RRU solution, highlighting the concept of “Green Olympics” in terms of security, service quality, and operation and maintenance costs. In the Olympic village, voice traffic can be dynamically scheduled and the handovers can be reduced. In buildings, the interference level can be lowered. The whole solution can satisfy the capacity and security demands of the Olympic stadium while reducing the difficulties of operation and maintenance.

A microcellular deployment approach is used in addition to a macrocellular planning approach to support even greater densities. As the TD-SCDMA systems transmit and receive on multiple channels, ZTE, based on the traditional idea
of layered coverage, has launched a TD-SCDMA tridimensional coverage solution that makes use of the flexible deployment capabilities of BBU and RRU. Therefore, the solution cannot only provide ordinary coverage, but can also address the special coverage needs without increasing the number of cells.

**Colorful Services**

The Olympic Games, celebrated as a big sport gala around the world, must accommodate the participation of many people. ZTE aims to construct a network that provides secure and convenient access to rich, payable, multi-language, intelligent and individualized communications services to anybody at anytime and in any Olympics venue. The services are listed as follows:

**Basic telecoms services**

The whole network supports the high quality basic voice telephony as well as multiple voice supplementary services.

Video calling is a 3G service differentiator. Circuit-switched video telephony is provided in Olympic venues and some other places to address the demands of some video users.

**Basic data services**

Short Message Service (SMS), which has played a vital role in basic communication, is offered across the network. Meanwhile, short messages can be exchanged between TD-SCDMA, and GSM/CDMA/fixed-line users; SMS Cell Broadcast (SMSCB) will be used as a method for spreading Olympic Games information such as events schedule and results.

As a way to enrich user experience, Multimedia Messaging Service (MMS) is introduced throughout the network. Mobile newspaper–MMS-based services using the newspaper content will become one of the vehicles to deliver Olympics-related information.

Wireless Application Protocol (WAP) service, which brings the Internet to mobile devices, is also supported.

These three basic types of data services will fully meet the basic communication demands of users.

**Entertainment multimedia services**

Anticipating heavy demand for entertainment multimedia services during the Olympic Games, a mobile video service platform based on streaming servers will be set up to provide the following services:
- Olympic video on demand
- Olympics on mobile TV
- Mobile video blog
- Mobile video monitoring

A common download platform will be built to offer users access to entertainment and information applications including Olympic mobile games, Olympic guessing games and Olympic lottery.

Color Ring Back Tone (CRBT) and location-based services are delivered across the whole network.

**Project Implementation**

3G network construction poses great challenges on human resources, technology expertise and project management capabilities of equipment vendors. ZTE has accumulated extensive experience in network planning and optimization, and has pooled abundant TD-SCDMA talents. ZTE has also developed its own WINOM serial network planning and optimization tools and software packages.

Meanwhile, vendors are required to have the capability to quickly roll out 3G networks. Based on its rich experience in implementing GSM, PHS and CDMA projects, ZTE has shown distinguished performance in TD-SCDMA network design, project execution and equipment supply. ZTE was the first to supply telecom equipment in Qingdao; it only took ZTE one month to establish all base stations in Xiamen.

**Conclusion**

With the 2008 Olympic Games fast approaching, quickly building a high quality TD-SCDMA network is a great challenge that operators and equipment providers are facing. Based on its powerful technical ability, complete solutions and excellent engineering services, ZTE is going to install a mature and high quality network to serve the 2008 Olympic Games.
ZTE Deploys CDMA2000 1xEV-DO Rev. A Network in Czech Republic

Kong Jia

Background

Penta Investment Limited (hereafter referred to as "Penta") registered in Cyprus deals with acquisitions and restructuring of large and mid-sized Czech and Slovak enterprises. The total asset of Penta amounted to US$1.07 billion by the end of 2005. Its total sales from April to December 2005 amounted to US$290 million.

MobilKom, owned by Czech investment group, Penta, is a leading operator in the Czech Republic. MobilKom planned to launch a CDMA450 network nationwide across the Czech Republic, providing broadband, Wireless Local Loop (WLL), Push to Talk (PTT) and voice services. ZTE was selected to build the Czech CDMA network in 2006 and commenced construction of this commercial network in early 2007. The network has been put into commercial use by May 2007.

Capturing Market Through Rich Services

In the Czech Republic where the economy is relatively advanced, the mobile voice penetration is standing at over 100%. However, its total broadband penetration by population was only 3.5%, while its total broadband penetration by households was 9% at the end of 2005, far less than the household broadband penetration rate of 30% in West European countries. Therefore, the Czech broadband market has a great potential.

The Czech telecommunication market was liberalized in 2001, and it is the second largest market in Eastern Europe. The competition in the Internet market has intensified since liberalization. As the major telecom operator, Cesky Telecom dominates the markets for public fixed-line telephone networks and services; new entrants can only compete for the fixed-line Internet access services for group users.

Under such background, ZTE helped MobilKom build a nationwide CDMA2000 1xEV-DO Rev. A network, which offers 1X voice and data service, Rev. A high-speed data service, PTT, SMS, voice mailbox, and etc. This CDMA450 network is Czech Republic’s first national—as well as the most advanced—PTT network, which provides significant QoS enhancements for PTT services compared to the existing trunking networks. Meanwhile, ZTE has introduced several PTT terminals that incorporate its Global open Trunking architecture (GoTa) technology, offering PTT function and some special functions, as well as network access, SMS, and location-based services.

The network operates at an average download speed ranging from 2 Mbps to 2.16 Mbps, and at an average upload speed ranging from 1.6 Mbps to 1.68 Mbps. MobilKom planned to exploit the growth opportunities in the potentially large Czech broadband market by utilizing its network coverage and performance advantages,
as well as its experience in PTT operation and existing customer base. The operator aimed to attain a PTT customer base of 30,000 users in the next five years, with a market share of 20%.

### Building the Network

The Rev. A network solution was customized according to the situations of the country and MobilKom. This is the first time a CDMA2000 1xEV-DO Rev. A network is commercially deployed in Europe, which marks a major breakthrough for ZTE in the CDMA EV-DO field and in the European market, after signing the contract to install the world’s first Rev. A network in Mongolia.

During phase one of the project, 360 base stations have been installed to cover the whole of the Czech Republic. The network is based on the ZXC10-CBTS, which is a highly integrated compact base station supporting EV-DO Rev. A. The ZXC10-CBTS is only 80 cm long but provides a maximum capacity of 4 carriers/3 sectors, easing installation and maintenance, as well as reducing floor space requirements, thus lowering CAPEX and OPEX.

Besides, the network adopts an all-IP architecture, offering a good platform for a smooth transition to the next technological step.

### High Quality, Low Cost Services

As a highly recognized investment company in the Czech Republic, Penta has made joint investments with internationally famous investors in many projects. With the involvement of the investment company, there was sufficient capital to complete the entire project. Several local operators were bounded together to create a common operating platform, offering the possibilities of further strategic cooperation and market expansion to other European countries. The project sets an example of the successful cooperation between an equipment vendor and an investment company, injecting new ideas into the cooperation modes in the industry.

With a peak data transmission download speed of 3.1 Mbps, CDMA EV-DO Rev. A technology enables broadband access in cellular networks. By using Rev. A technology, the network will meet a rapidly growing demand for access to high-speed internet services and address the problem that the properties of copper wires limit the distance of high-speed ADSL services, thus bringing a quick change to the competition pattern of the Czech broadband access market. The network is also the only PTT network serving national users of construction and transportation, which, when coupled with the low cost advantage of CDMA, will enable MobilKom to achieve a dominant position in the future competition.

“By using advanced technologies, the all-IP CDMA2000 network, supplied by ZTE, greatly decreases the network construction costs, and allows us to deliver high quality, low cost services to users,” said Lubos Borik, General Manager of Mobilkom.

As a leading developer in EV-DO Rev. A technology, ZTE has built more than 50 CDMA2000 1xEV-DO networks for commercial and trial use in over 40 countries and regions such as the Philippines, Vietnam, Norway, Sri Lanka, and Mongolia.
Ultra Long-Haul WDM Transmission Solution

Wang Taili

The technical solutions provided for ULH transmission consist of technologies for both the transmission lines and terminals. The terminals use modulation technology to lower OSNR threshold and the transmission lines use relevant technologies to increase the OSNR value after LH transmission. These two types of technologies may be used jointly.
Types and Applications of ULH Transmission

In recent years, wavelength division multiplexing (WDM) technology is developing towards ultra long-haul (ULH) and large-capacity transmission to handle ever-increasing traffic demands.

The ULH transmission includes multi-span transmission without electrical regeneration and long reach single-span transmission. The former refers to the point-to-point transmission over 1000 to 3000 km without Optical/Electronic (O/E) conversions, while the latter refers to point-to-point transmission over 100 to 300 km without active amplification or regeneration (see Fig. 1).

The multi-span long-haul transmission has to solve a series of problems like Optical Signal to Noise Ratio (OSNR), Chromatic Dispersion (CD), Polarization Mode Dispersion (PMD), Nonlinear (NL) effects, power balancing, and etc., while the single-span transmission only has to combat OSNR and NL effects. In terms of network application, the former is usually applied to common environments, where the number of electrical regeneration points can be reduced; the latter is applied to areas between islands, deserts, no man’s land, and etc., where the installation or maintenance of active equipment is restricted.

The multi-span LH transmission has another important application scenario—dynamic optical networks. In dynamic optical networks based on reconfigurable optical add/drop multiplexer (ROADM) and photonic cross connect (PXC), the optical channel may constantly change its status. Such a situation (illustrated in Fig. 2) will happen when the routing lengths and connection relations of optical channels change because of wavelength grooming, protection/restoration. The problem of dynamically compensating physical impairments such as OSNR and chromatic dispersion will be encountered when the route changes to A→D→F→I.

Physical restrictions on ULH transmission

When an optical signal transmits over a fiber, it suffers from impairments such as NL effects, CD, PMD and OSNR. NL effects include Self Phase Modulation (SPM), Cross Phase Modulation (XPM), Four-Wave Mixing (FWM), Simulated Raman Scattering (SRS), Simulated Brillouin Scattering (SBS), and etc.

The methods for overcoming CD include improving the dispersion tolerance of a terminal transmitter, deploying dispersion compensating fibers in line and employing the electronic dispersion compensation at the receiver. As there are no commercially available PMD compensators, good PMD performance fiber (less than 0.1ps/km1/2) may be used to realize LH transmission. To reduce the OSNR, the OSNR threshold at the transmitter can be lowered.

Modulation at terminals

Optical modulation has three forms: intensity modulation, phase (or frequency) modulation and polarization modulation.
Intensity modulation is widely used in the high-speed fiber communication systems; phase modulation has attracted much attention. However, polarization modulation needs stable and reliable polarization management. Polarization of optical signals may randomly change during fiber transmission, resulting to increased complexity in the receiver, thus making it difficult to apply polarization modulation in the commercial optical communication systems.

The commonly used pulse modulation formats in optical systems are return-to-zero (RZ) and non-RZ (NRZ). The RZ modulation format has a better OSNR tolerance with a smaller pulse duty ratio, and a more concentrated signal energy in the time domain. Meanwhile, it is relatively insensitive to the fiber nonlinearities, PMD, and etc.

According to the frequency utilization mode, the modulation can be divided into binary modulation and Multi-level (M-ary) digital modulation. M-ary signaling can improve spectral efficiency, reduce bit rate and limit the impairments caused by CD and PMD, but raises the OSNR threshold. Pseudo-multilevel modulation doesn’t aim at improving spectral efficiency but introducing the correlated coding so as to achieve spectral reshaping and improve tolerance against system impairments. It includes carrier-suppressed RZ (CSRZ), duobinary (DB), alternate-mark-inversion (AMI), and etc.

Tab. 1 compares the performance of different modulation modes with the conventional NRZ modulation mode as the reference. An OSNR threshold is represented in relative difference, and dispersion tolerance and Differential Group Delay (DGD) tolerance are represented in relative multiples.

From Tab. 1, it can be seen that for the LH transmission, the RZ differential phase-shift keying (RZ DPSK) modulation format has the lowest OSNR threshold, capable of implementing the longest transmission without electrical regeneration. The DB modulation format has the highest dispersion tolerance, which is especially useful in dynamic optical routing for LH networks. The RZ differential quaternary phase-shift keying (RZ DQPSK) modulation format has the highest DGD tolerance, which is very important to LH 40 Gbps transmission. In actual applications, the proper modulation mode can be chosen according to the specific application scenario.

Electrical signal processing

When a system is required to provide dynamic optical routing and LH transmission at the same time, it is not enough to carry out all the dispersion compensation at the terminals. Therefore, electrical dispersion compensation can be implemented to improve the tolerance to chromatic dispersion of the systems.

Electrical dispersion compensation means compensating for optical dispersion in the electrical domain. By adopting the finite impulse response (FIR) filtering, it enables equalization of electrical signals converted from the optical signals. The most common electrical compensation techniques are feed forward equalizer (FFE), decision feedback equalizer (DFE) and maximum likelihood sequence estimator (MLSE). FFE and DFE can be used in combination.

Among these electrical dispersion compensation methods, MLSE is

<table>
<thead>
<tr>
<th>Modulation mode</th>
<th>OSNR requested</th>
<th>Dispersion tolerance</th>
<th>DGD tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRZ</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>50% RZ</td>
<td>-3dB</td>
<td>0.5</td>
<td>1.5</td>
</tr>
<tr>
<td>67% CSRZ</td>
<td>-2dB</td>
<td>0.7</td>
<td>1.2</td>
</tr>
<tr>
<td>DB</td>
<td>+1dB (100GHz spacing)/-1dB (50GHz spacing)</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>50% RZ AMI</td>
<td>-3dB</td>
<td>0.7</td>
<td>1.5</td>
</tr>
<tr>
<td>NRZ DPSK</td>
<td>-3dB</td>
<td>1.5</td>
<td>1.2</td>
</tr>
<tr>
<td>50% RZ DPSK</td>
<td>-6dB</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>50% RZ DQPSK</td>
<td>-3dB</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
ZTE Technologies

and Europe. ZTE’s mature and excellent ULH DWDM transmission solution can not only meet the current demands from the network application, but can also provide higher quality and longer reach transmission systems by continually incorporating new transmission technologies.

In the field of ULH transmission, ZTE can provide an integrated solution covering modulation technology, electrical signal processing, line technology, transmission performance, and etc. ZTE’s ULH transmission solution has already been applied in the Xinjiang Uygur Autonomous Region, and Europe. ZTE’s mature and excellent ULH DWDM transmission solution can not only meet the current demands from the network application, but can also provide higher quality and longer reach transmission systems by continually incorporating new transmission technologies.

Technologies for transmission lines

To enable LH transmission, it is practical to apply technologies in the optical transmission line to extend the amplified-span distance such as the remotely pumped optical amplification (RPOA) and the distributed Raman amplifier (DRA). Fig. 3 shows the working principle of RPOA: an erbium-doped fiber disposed in an optical transmission line is activated by the pump beam sent from the terminal. It can extend the amplified span length by about 100 km.

Conclusion

The technical solutions provided for ULH transmission consist of technologies for both the transmission lines and terminals. The terminals use modulation technology to lower OSNR threshold and the transmission lines use relevant technologies to increase the OSNR value after LH transmission. These two types of technologies may be used jointly. For dynamic LH transmission systems that require higher dispersion tolerance, modulation technology and electrical processing can be used in combination.

Fig. 3 RPOA structure

In the field of ULH transmission, ZTE can provide an integrated solution covering modulation technology, electrical signal processing, line technology, transmission performance, and etc. ZTE’s ULH transmission solution has already been applied in the Xinjiang Uygur Autonomous Region, and Europe. ZTE’s mature and excellent ULH DWDM transmission solution can not only meet the current demands from the network application, but can also provide higher quality and longer reach transmission systems by continually incorporating new transmission technologies.

DWDM

Short for Dense Wavelength Division Multiplexing, an optical technology used to increase bandwidth over existing fiber optic backbones.

DWDM works by combining and transmitting multiple signals simultaneously at different wavelengths on the same fiber. In effect, one fiber is transformed into multiple virtual fibers. So, if you were to multiplex eight OC-48 signals into one fiber, you would increase the carrying capacity of that fiber from 2.5 Gb/s to 20 Gb/s. Currently, because of DWDM, single fibers have been able to transmit data at speeds up to 400Gb/s.

A key advantage to DWDM is that it’s protocol- and bit-rate-independent. DWDM-based networks can transmit data in IP, ATM, SONET/SDH, and Ethernet, and handle bit rates between 100 Mb/s and 2.5 Gb/s. Therefore, DWDM-based networks can carry different types of traffic at different speeds over an optical channel.

From a QoS standpoint, DWDM-based networks create a lower cost way to quickly respond to customers’ bandwidth demands and protocol changes.

(www.webopedia.com)
Development Trend of IP Network

Since the global information industry transitioned from peak growth to stable growth, the market competition got fiercer than ever. Faced with the changing competition patterns, operators need to adjust their strategies in a timely manner to achieve successful transformation. Service transformation is vital to operators’ transformation, whereas developing new services is a key driver of service growth. Service transformation will drive network transformation since networks are required to implement more competitive intelligent services. Therefore, new network models (3G, NGN, IPTV, and etc.) have become the focal points that guide operators’ research and investment.

Currently, 3G, NGN and IPTV services can be carried by the IP-based multi-service platform. As there is an increasing trend towards IP technologies, the present IP network has played a role that is totally different from what it was several years ago. The earlier stage IP network was mainly used to bear Internet services and was characterized by small scale, low QoS and security requirements, and the best-effort transport.

With the move towards IP-based services and transport, the IP network has to accommodate the increased volume of Internet usage as well as to bear advanced services like 3G, NGN, IPTV and VPN. More and more challenges for IP network come forth accordingly, such as how to bear high quality services, how to transform itself into a telecom-level integrated service platform, and etc. The requirements for the IP network are listed as follows:

- Accommodate the geometric growth in bandwidth and the increasing granularity of services.
- Incorporate carrier-class reliability and security.
- Minimize network construction costs and resource consumption.

As telecoms infrastructure is entering the new era of IP, more emphasis will be placed on constructing an IP bearer network that can carry carrier-class services.
IP Bearer Network for Carrier-Class Services

Defects of IP over Fiber

Regarding the current network transformation and service demands, an IP over Fiber network cannot take the role of a carrier-class multi-service IP bearer network due to the following reasons:

- The routing convergence time, which totally depends on core router recovery, may be in the order of several hundred milliseconds, so that it can’t meet carrier-class protection demand of less than 50 ms.
- Network QoS can’t be planned from end to end; thus, QoS-sensitive services (e.g., VoIP, VOD and VPN) can hardly be implemented.
- There is a lack of effective mapping between the requirements of QoS and the resources.

To be a carrier-class IP bearer network, the IP over transmission network should reposition itself and take the following situations into consideration: bandwidth-intensive applications put high requirement on network capacity; services interfaces are switched to Gigabit (GE) and 2.5G Packet over SONET (POS), as the granularity of services increases; facilitated by the data network, there are decreasing requirements on the network’s service dispatching capability; and the networking requirement is not high as the network structure is flatter.

Comparison Between IP over WDM and IP over ASON/MSTP

There has been a bit of controversy over which technology should be applied in the IP over transmission network. Tab. 1 shows the comparison between IP over MSTP/ASON and IP over WDM.

From Tab. 1, it can be seen that interfacing IP directly over WDM has irreplaceable advantages in terms of available bandwidth, service granularity and bearing efficiency. Today, 10GE (providing speeds of 10 GE per second) services are widely used, and the advantages of IP over WDM will become more apparent when applied in the metro core layer.

The networking and capacity expansion schemes of IP over WDM technology will also be demonstrated. Tab. 2 illustrates the traffic distribution in a network built on a dual-homing six-node data service model (A and F are core nodes in the expansion scheme).

There can be three approaches to build the network based on the traffic distribution in Tab. 2: using data equipment, WDM, or ASON/MSTP. The comparisons between these three approaches are shown in Tab. 3.

### Tab. 1 A comparison between IP over MSTP/ASON and IP over WDM

<table>
<thead>
<tr>
<th></th>
<th>IP over MSTP/ASON</th>
<th>IP over WDM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available bandwidth</td>
<td>10 Gbps</td>
<td>1.6 Tbps</td>
</tr>
<tr>
<td>Service granularity</td>
<td>VC4</td>
<td>Wavelength or subwavelength</td>
</tr>
<tr>
<td>Transmission transparency</td>
<td>Rather high</td>
<td>High</td>
</tr>
<tr>
<td>Bearing efficiency</td>
<td>Low (8×GE)</td>
<td>High</td>
</tr>
<tr>
<td>CAPEX</td>
<td>High investment in early- and late-stages</td>
<td>High initial investment and low late-stage investment</td>
</tr>
</tbody>
</table>

### Tab. 2 Traffic distribution in a dual-homing six-node data service network

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>GE</td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
<td>●</td>
<td>●</td>
</tr>
<tr>
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<td></td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
On condition that the same service demands should be met, the IP over WDM networking has evident comparative advantages. If the network adds a GE service and the network capacity needs to be expanded, there will be three possible expansion schemes as shown in Tab. 4.

In the WDM networking mode (IP over WDM technology), the network capacity can be expanded by adding more boards without having to use additional fiber resource. As services multiply and the network construction scale increases, the advantages of IP over WDM, with respect to capacity expansion, will become more pronounced.

Therefore, IP over WDM technology is the first choice to construct an IP bearer network for bearing telecom-level service.

Tab. 3 Networking schemes comparison

<table>
<thead>
<tr>
<th>Networking scheme</th>
<th>Fiber needed</th>
<th>Router port</th>
<th>Protection mode</th>
<th>Scalability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data equipment networking</td>
<td>10</td>
<td>20 long-haul</td>
<td>On the order of seconds</td>
<td>Weak</td>
</tr>
<tr>
<td>WDM networking (working with routers)</td>
<td>6</td>
<td>20 short-haul</td>
<td>50 ms level</td>
<td>Strong</td>
</tr>
<tr>
<td>ASON/MSTP networking</td>
<td>12</td>
<td>20 short-haul</td>
<td>50 ms level</td>
<td>Common</td>
</tr>
</tbody>
</table>

Tab. 4 Expansion schemes comparison

<table>
<thead>
<tr>
<th>Expansion scheme</th>
<th>Fiber needed</th>
<th>Router port</th>
<th>GE board</th>
<th>10G optical board</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data equipment networking</td>
<td>2</td>
<td>4 long-haul</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>WDM networking (working with routers)</td>
<td>0</td>
<td>4 short-haul</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>ASON/MSTP networking</td>
<td>1</td>
<td>4 short-haul</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

ZTE’s IP over WDM Solution

ZTE’s IP over WDM solution supports full-service access, and SDH or low-rate data traffic aggregation.

Flexible dispatching: ZTE’s WDM dispatching scheme

- ZTE’s ROADM system allows operators to implement a variety of network topologies like chain, ring, mesh and multi-ring, thus satisfying their varying demands.
- The DWDM General Service Switch Platform (GSS) is composed of customer-side aggregation, line-side aggregation, and clock/cross-connect units. The client-side aggregation unit can offer eight simultaneous tributary channels with each channel supporting a variety of client-side signals including GE, FC, DVB and FICON. The line-side aggregation unit has four STM-16 signals with each signal having one working and one protection channel (1+1). These signals are connected to the clock/cross-connect unit after transmission through the backplane, realizing the eight-channel traffic access, convergence and cross-connection.
- GSS, which supports subwavelength dispatching, when coupled with the ROADM, which supports wavelength dispatching, enables the WDM equipment to implement X-ADM functionality.

Reliability: leading optical layer protection schemes

Since 2001, ZTE has installed long-haul backbone, regional backbone and metropolitan networks, transporting IP services with various service

Highly-efficient bearing capability: multi-service convergence and access
other to enable even distribution of traffic. When the traffic load on the network tends to get evenly distributed, a channel shared protection ring will give fuller play to its wavelength saving advantage.

ZTE’s IP over WDM Application Models

ZTE’s IP over WDM solution has found many applications. It has two main application models as demonstrated below:

Application model 1 is a dual-homing architecture with two adjacent core nodes (Fig. 1).

Application model 2 is a dual-homing architecture with two non-adjacent core nodes (Fig. 2).

Widely deployed in current metro networks, ring typologies are proven to have inherent survivability. Meanwhile, the ring-based network ensures a high level of reliability with mature protection technologies at the optical layer. The IP over WDM network planning solution should try to locate these two core nodes away from each other to enable even distribution of traffic. When the traffic load on the network tends to get evenly distributed, a channel shared protection ring will give fuller play to its wavelength saving advantage.
Compared with the other two international 3G standards, WCDMA and CDMA2000, Time Division-Synchronous Code Division Multiple Access (TD-SCDMA) is more spectrally efficient as it is based on Time Division Duplex (TDD) mode operation; it also increases system capacity and reduces overall system cost by adopting smart antennas and joint detection. It is well known that TD-SCDMA will be first put into commercial use in China.

IP Multimedia Subsystem (IMS), initially defined in 3GPP Release 5, is an overlay to the packet-switched (PS) domain. IMS uses the Session Initiation Protocol (SIP) for call control, and it can achieve access independence. Since IMS is access independent, TD-SCDMA can access the IMS network as an IP connection. Based on this, TD-SCDMA can provide rich multimedia services, such as instant messaging, presence, multimedia ring back tone and multimedia conferencing, and etc.

ZTE is leading both the fields of IMS and TD-SCDMA. As a leading supplier of IMS technology, ZTE has launched its new-generation IMS-based solution (ZIMS), covering a full series of IMS network elements and supporting multiple access types. As an important force in TD-SCDMA, ZTE developed its own integrated TD-SCDMA solutions including service platform, system equipment, terminals, and network planning and optimization services.

ZTE’s capabilities to provide end-to-end solutions into two of the hottest technology sectors—IMS and TD-SCDMA—will help operators build competitive IMS and TD-SCDMA interworking solutions.

Fig. 1 shows the ZIMS-based network convergence solution, which includes support for TD-SCDMA. In this architecture, the TD-SCDMA PS domain, as a bearer layer, can directly access the IMS domain. The IMS core provides functions such as session control, service triggering, and storing subscriber and service data; the TD-SCDMA PS domain bears signaling and media stream. Moreover, the ZIMS-based network convergence solution can provide an end-to-end QoS. With an open and unified service platform over the common IMS framework, end-users can access all IMS applications anywhere, any time, with any kind of device and using a unified address book.

By utilizing the TD-SCDMA network, which is mature enough to be commercialized, IMS can help operators create new multimedia applications and make the most of the revenue generating opportunities of the PS domain. ZTE’s IMS client, Soft Digital Assistant (SoftDA), integrates multiple IMS applications like instant messaging, presence, group list management, multimedia conferencing, application sharing, and etc.

Interworking IMS and TD-SCDMA is one of the important fields in the evolution of 3G networks. With strong customized ability and cost-effective product portfolio, ZTE is a reliable partner in the 3G network deployment.
As the world’s first commercialized 3G standard, the CDMA2000 1xEV-DO Release 0 (Rel. 0) technology has been deployed successfully in countries such as Japan, South Korea and America. It provides a peak data rate of 2.4 Mbps in the forward link, which enables operators to offer a wide variety of broadband data applications, raising their data average revenue per user (ARPU) and buttressing their sagging voice ARPU. CDMA2000 1xEV-DO Rev. A is an evolution of CDMA2000 1xEV-DO Rel. 0, and is currently available from major operators’ networks.

The reason why Rev. A is widely accepted and supported by operators is because it gives better support for real-time services. Rel. 0, as a wireless broadband solution, offers efficient support for best-effort applications such as file downloads, but is insufficient to support real-time services such as voice. For this reason, the focus of EV-DO Rev. A has shifted to guaranteeing QoS, apart from delivering higher bandwidths. The Rev. A network supports multiple concurrent application flows with different QoS requirements; legacy circuit-switched voice traffic can be converted to VoIP. Rev. A technology lays a sound basis for the development of mobile broadband multimedia networks.

**Rev. A Features**

Rel. 0, the original version of Rev. A, was designed for efficient delivery of best effort, asymmetric traffic. With the developments in wireless broadband services, end-users are increasingly not satisfied with merely gaining access to the Internet; they expect to make VoIP calls, play on-line games and use video to communicate. Moreover, with the core network gradually migrating towards IP-based convergence, more and more circuit-switched services will be offered from the packet domain. These two factors have accelerated the introduction of the 1xEV-DO Rev. A.

To overcome the limits of Rel. 0 and meet new services and network performance requirements, Rev. A provides the following enhancements:

**Increase the air link capacity, especially the reverse link capacity**

Rel. 0 provides a peak data rate of 2.4 Mbps in the forward link and 153 Kbps in the reverse link. The asymmetric bandwidth can become a bottleneck for symmetrical services like VoIP. However, Rev. A provides a peak data rate of 3.1 Mbps in the forward link and a peak data rate of 1.8 Mbps in the reverse link.

**Lower system latencies or network round-trip time**

As we know, latency is one of
the most important parameters for real-time services; long delays will make the conversation unintelligible, or impossible to be carried on. To reduce latency, Rev. A incorporates multifaceted improvements including smaller packets and shorter packet formats, hybrid automatic repeat request (HARQ) operation on the reverse link, and etc.

**Enhanced QoS support**

In order to deliver QoS at the application level, the Rev. A network introduces the concept of flow. A flow means that packets with the same or similar QoS requirements are grouped into a class. Rev. A supports multiple concurrent flows per user with different QoS requirements; the network can allocate resources accordingly to efficiently maximize resources while satisfying the users’ requirements. and broadcast services, operators can achieve the best system resource usage and increase their operating revenues.

With the above mentioned improvements in place, the Rev. A system will be more than merely a bit pipe, as it can support a variety of interactive real-time services such as:

- **VoIP**
  - Rev. A brings carrier-grade IP telephony over a mobile network into life. Under the precondition of guaranteeing voice quality, phone calls can be delivered at a lower cost than the conventional circuit-switched technology.
- **Video Telephony**
  - Video Telephony (VT) enables a user to share live video while discussing what she or he sees (voice) with one or more people all at the same time.
- **Push to Talk (PTT)**
  - Push to Talk (PTT) is a half duplex mode of voice communication (one-way-at-a-time) that allows a user to start talking to one or many users at a push of a button; Instant Multimedia Messaging (IMM), as an extension of PTT service, allows users to share voice, video text and pictures and video with multiple recipients.
- **Online gaming**

Some online gaming applications have been successfully rolled out over Rel. 0, but Rev. A can offer much more interactive online gaming.

It can be seen that Rev. A is a technology that enables operators to introduce a broad range of integrated video, voice and data services over packet networks and can serve as the gateway to mobile broadband multimedia.

**Conclusion**

CDMA2000 1xEV-DO Rev. A is a member of the CDMA2000 set of standards. Compared with Rel. 0, Rev. A can better support real-time and delay sensitive applications such as BCMCS, VoIP and VT. Rev. A technology will help operators build mobile broadband multimedia networks.

Following large-scale commercial deployment of ZTE’s CDMA2000 1X and EV-DO Rel. 0 technologies in over 60 countries worldwide by more than 100 operators, the company launched a complete all-IP based CDMA2000 1xEV-DO Rev. A solution that has the abilities of backward compatibility and smooth upgrade. Moreover, taking operators’ needs into full consideration, ZTE has developed a series of BTS products to address various application scenarios, providing operators the most economic network construction solutions. Since ZTE deployed the world’s first commercial EV-DO Rev. A network in Mongolia in June 2006, the company has successively set up Rev. A systems in countries like the Czech Republic, Estonia, America, Libya and the Philippines.
ZTE announced the availability of the award-winning ZTE Evolution handset through PEOPLEnet, the first national provider of communications of third generation (3G) in Ukraine. The ZTE Evolution is a slim, feature-rich 3G consumer-centric flip phone. It features a dual level, multilingual Fastap keypad based on Digit Wireless’ Fastap Keypad Global Language Platform.

Via the ZTE Evolution handset, PEOPLEnet can offer an estimated 37.5 million Ukrainian speakers unparalleled access to advanced messaging and mobile data services. Mobile users will have the possibility to use the ZTE Evolution to simply and easily input text using their native language based on the Cyrillic alphabet. The Latin-based raised letter keys enable easy entry of Romanized Ukrainian, English, or other Latin based languages. In addition, the ZTE 3G Evolution handset can be used by international operators for authoritative certificates and assurances to overseas markets.

“The ZTE Evolution is an innovative multilingual handset that is opening up opportunities for new mobile experiences to our customers,” said Vitaliy Vorozhbit, CEO of PEOPLEnet. “We are sure that this handset will empower our users to realize more functionality out of their phone, ultimately enabling them to enjoy the PEOPLEnet 3G mobile messaging and value added services with simplicity, efficiency and ease.”

“As 3G services continue to proliferate in emerging markets and with multiple language needs, mobile operators are demanding appealing and simple-to-use handsets that increase the use of 3G wireless data services,” said He Shiyou, senior vice president of ZTE and general manager of ZTE’s handset division. “We are confident that ZTE handsets equipped with Fastap keypad technology will help usher in 3G mobile services to millions of mobile consumers worldwide, including the Ukrainian market.”
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