CDMA2000 EV/DO

1. OVERVIEW

CDMA (Code-Division Multiple Access), a digital cellular technology that uses spread-spectrum techniques. Unlike competing systems, such as GSM, that use TDMA, CDMA does not assign a specific frequency to each user. Instead, full available spectrum used by every channel. Individual conversations are encoded with a pseudo-random digital sequence. CDMA provides better capacity for voice and data communications than other commercial mobile technologies, and allowing more subscribers to connect at any given time. Nowadays CDMA has most requested evaluation such like EVDO which can compete with UMTS technology and has right to be called as 3G.

ZTE Corporation is the first to launch the EV-DO Rev.0 in China. On June 10, 2002, ZTE demonstrated the wireless data services at the forward rate of 2.4Mbps in the 3G World Congress held in Hong Kong. In October 2003, ZTE deployed an EV-DO pilot network. Since the beginning of 2004, ZTE EV-DO systems have been put into large-scale commercial use all over the world. By Q2 2006, ZTE had built over 40 EV-DO systems for commercial or trial use in more than 30 countries and regions such as Philippine, Vietnam, Sri Lanka, Mongolia, etc.. With the backward compatible 1X system, ZTE EV-DO can implement smooth upgrade on the 1X network, thus greatly protecting the operators' investment.

ZTE EV-DO Rev.0 is developed for Best Effort services, especially for asymmetric high-speed download services. With the growth of EV-DO users and deployment of various services, the market requires the EVDO network to support low-delay, high real-time services such as high real-time online games, videophones, and VoIP. ZTE EV-DO Rev.A with enhanced features and services over ZTE EV-DO Rev.0 emerges as the times require.

2. FEATURES OF ZTE EV/DO REV.A

In view of the limit of ZTE EV-DO Rev.0 in design and combined with the requirements of new services and network functions, ZTE EV-DO Rev.A has made progress in the following aspects:

1. *Spectral efficiency:* ZTE EV-DO Rev.A supports multi-user packets and even smaller packets to implement more flexible service adaptation and encapsulation and to further improve the spectral efficiency.
2. *System capacity:* By using adaptive modulation, higher-order modulation, and H-ARQ mechanism, the reverse link can finish transmitting frames in advance in the wireless environments with variable channels. As a result, the throughput of a single user is improved. Owing to these improvements, the reverse link of the EV-DO Rev.A supports a peak rate of up to 1.8 Mbps. The forward link supports peak rates of 3.1 Mbps at least and 4.8 kbps at least to effectively improve the throughput when the user channels are in good conditions.
3. *Enhanced QoS:* To support end-to-end QoS services, the air interfaces from the physical layer, the MAC layer to the higher layer are improved. ZTE EV-DO Rev.A supports mature QoS management mechanisms including Inter-users and Intra-users.

4. *Cross paging:* To obtain the information of the circuit switched (CS) domain, a connection is set up between the EV-DO and the 1X circuit network. Thus the EV-DO BSC can support the IOS A1/A1p interface of the 1X system and receive the CS domain information such as 1X paging messages and short messages sent by the core network. ZTE EV-DO Rev.A not only saves system resources, but also reduces the power consumption of the terminals.
5. *Quick access and quick paging:* ZTE EV-DO Rev.A improves the system access speed by changing the data encapsulation format of the access channel to reduce the length of the access prefix. By adding a relatively shorter sub-synchronization control period to the control channel to send paging messages, ZTE EVDO Rev.A achieves quick paging for real-time services.
6. *Diversified services:* ZTE EV-DO Rev.A supports gold BCMCS and will support platina BCMCS, videophone, and VoIP in the future. It will be able to provide more abundant IP WA N services.

3. ZTE EV-DO REV.A SOLUTION

In 2004, ZTE started the R&D of EVDO Rev.A in an all-round way. In 2005, ZTE finished system R&D and lab tests successfully. In Q2 2006, ZTE launch the commercial version of the overall EV-DO Rev.A solution, which will offer its operator networks instant service so as to further improve the competitiveness of its operator networks.

ZTE EV-DO Rev.A mobile communications system features full compatibility, large capabilities, high integrity, and full series. It employs the same software and hardware platforms as the 1X and EV-DO Rev. 0 systems. Though the baseband processing module of ZTE EV-DO Rev.A is different from that of the other two systems in hardware, all the three systems can be used together in the same BTS. As a result, the 1X system or the EV-DO Rev.0 can upgrade smoothly and conveniently to the EV-DO Rev.A at a low cost. In addition, the EV-DO Rev.A is allowed to configure and combine with the 1X carrier or the EV-DO Rev. 0 carrier to meet the network construction requirements of users.

3.1 Features and Advantages of ZTE EV-DO Rev.A

3.1.1 Leading All-IP Technology

As an active advocate of All-IP, ZTE takes the lead in launching the All-IP-based CDMA2000 commercial products in the world. The cooperation of the universal and in-expensive All-IP technology and the unified ZTE All-IP hardware platform will greatly slash the CAPEX and the OPEX on the EV-DO network construction.

3.1.2 Very Large Data Throughput

A single BSC rack supports at least 6 Gbps data throughput. With the rapid growth of multimedia services (such as videophone and stream media), the very large capacity of the BSC not only meets the deployment requirement of current wireless broadband services, but also supports smooth expansion for Beyond 3G (B3G) in the future.

3.1.3 Full-Service Support

The development of 3G consists in services. ZTE provides diversified services, including stream media service, WAP service, Multimedia Messaging Service (MMS), short message service, short message cluster service, Broadcast Multicast

BSS Series

BSC BTS BTS AE

CBTS CBTS Outdoor MBTS RFS
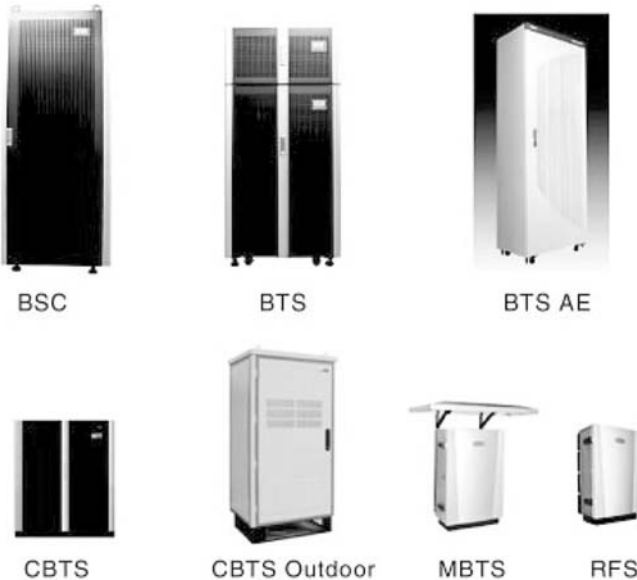
Service (BCMCS), location service, color ring back tone (CRBT) service, and push-to-talk (PTT) service. In addition, ZTE has signed a strategic cooperation agreement with the world service giant Converse and reached mutual supplement in service development.

3.1.4 Perfect EV-DO and 1X Dual-Network Operation

The dual-network operation means that both the 1X network and the EVDO network support the operation of 1X and EV-DO dual-mode terminals (MS/AT), including cross paging, location update, data service changeover, and the changeover between VoIP and CS domain.

For a large-scale 1X network, ZTE puts forward the construction solution by phases:

• Phase 1 will support cross paging. In hardware, connect the DO-BSC to the MSCs in the existing network and add an IWS to the DO-BSC. At the same time, upgrade the software of the MSCs in the existing network. The cross paging function is achieved.

• Phase 2 will support the voice hard changeover between VoIP and CS domain. In hardware, add the IMS core network with SIP function, add the signaling interface between DOBSC and 1X-BSC or between MSCs. In software, upgrade the software of the 1X-BSC or MSC or DO-BSC. Thus VoIP changeover is achieved.

3.1.5 Continuous R&D and Innovation Capability

With ten years of experience in CDMA R&D and six years in CDMA network construction, ZTE keeps the leading position in the industry from the IS95 system to CDMA2000 1X system, EV-DO Rev.0 and even EVDO Rev.A.

ZTE is now positively taking part in technology research on EV-DO Rev. B and B3G. The EV-DO Rev. A can be upgraded to the EV-DO Rev. B smoothly. ZTE has been devoting itself to satisfying user demands and protecting network investment of each operator, and hence ensures smooth evolvement among various CDMA2000 standards.

3.2 System Components

ZTE EV-DO Rev.A consists of BSC, BTS, PDSN, and AN-AAA. Designed on the basis of an All-IP platform, the EV-DO Rev.A can be upgraded to the next generation network smoothly. ZTE provides a series of BTS solutions to lower the investment cost and to satisfy coverage requirements from different layers. ZTE provides the following BTSs in series:

A series of indoor/outdoor macro-BTSs

ZTE provides indoor/outdoor macro-BTSs that can be configured flexibly and large-capacity macro-BTSs in which a single rack supports 24 carrier-sectors. Micro BTSs and RF remote sites with different powers. The transmitting powers are 10W, 20W, and 40W. These micro BTSs and RF remote sites can be expanded flexibly to multi-carrier and multi-sector configurations.

PDSN

The Packet Data Serving Node (PDSN), serving as the access gateway, provides Simple IP access and Mobile IP access. The PDSN enables the CDMA2000 MSs to access Internet or Intranet access.

AN-AAA

The access network-authentication, accounting, authorization server (AN-AAA) acts as the authentication server in the access network, responsible for access authentication at AN level, check and authentication of EV-DO subscribers.

To enable the dual-mode terminals to access the network without changing cards, China Unicom, Qualcomm, ZTE, and Samsung jointly launch the dual-mode authentication solution based on the CAVE algorithm. This solution introduces a CS domain interface between the AN-AAA and the HLR. Now this solution has been accepted by the 3GPP2 as an international standard. ZTE AN-AAA supports the HRPD and dual-mode authentication based on the CAVE algorithm at the same time.

The AN-AAA can be implemented with the AAA or as a stand-alone node.

4. CONCLUSION

ZTE EV-DO Rev.A is a member of the CDMA2000 family of standards. Compared with the EV-DO Rev.0, the EV-DO Rev.A is improved and enhanced in many aspects so that it can better support low-delay and high real-time services, and provide abundant services such as BCMCS, VoIP, and videophone.

Following the global large-scale commercial use of the 1X and EV-DO systems, ZTE has launched an overall solution of the EV-DO system based on the All-IP platform to ensure perfect forward compatibility and backward smooth evolvement of the system and to protect operators' investment as well. In full consideration of the operators' requirements, ZTE also provides a series of BTS products to satisfy various coverage requirements, and provides the most economical net-work-construction solution for each operator.

At present, mobile operators all over the world have begun deploying the next generation networks. ZTE actively takes part in the deployment and tries to cooperate with other operators. Based on powerful integrated strength in the CDMA mobile communications area and advanced, economical, and reliable overall EV-DO Rev.A solution, ZTE recently has cooperated with an American mobile operator. ZTE provides the EV-DO Rev.A solution and carries out the trial test in the existing network of the mobile operator. With the deployment of the trial network, EVDO Rev.A solution will surely become the first choice for the operators to construct their next generation network owing to the lower construction cost and higher network performance.