E3-E4 (CM MODULE)

CDMA 2000 1x
&
EV-DO

WELCOME

- This is a presentation for the E3-E4 Technical (CM-Module) for the Topic: CDMA 2000 1x & EV-DO

- Eligibility: Those who have got   the upgradation from E3 to E4.

- This presentation is last updated on 14-3-2011.

- You can also visit the Digital library of BSNL to see this topic.

Agenda

- CDMA 2000 1x: Introduction

- CDMA 2000 1x: Network Architecture

- CDMA 2000 1x: Key Features

- CDMA 2000 1x: Additional Channels

- CDMA 2000 1x EV-DO

- Services in CDMA

The CDMA air interface is used in both 2G and 3G networks. 2G CDMA standards are named as CDMAone includes IS-95A and IS-95B. Systems based on IS-95 standards have lots of the limitations as Spectral efficiency, low data speed, limited roaming, no multimedia, asymmetric data rate etc. Therefore Qualcomm proposed another CDMA standard as IS-2000 with different releases and commonly known as CDMA 2000 1x networks.

CDMA 2000 1x: Introduction

CDMA 2000 1x systems are a major evolution over IS-95 standards where much improvement has been done in radio reverse link. In CDMA 2000 1x systems an attempt has been made to make reverse link more synchronous by adding a pilot in reverse link to reduce interference.

A separate Packet Core Network (PS-CN) is provided to takes care of data calls.

Enhancements of CDMA 2000 1x over IS-95 are

➢Enhanced Voice Capacity

➢Better handling of packet data

CDMA 2000 1x: Network Architecture

CDMA 2000 1x Network Architecture is divided in to three parts.

➢CS-CN (Circuit Switched Core Network)

➢PS-CN (Packet Switched Core Network)

➢RAN   (Radio Access Network)
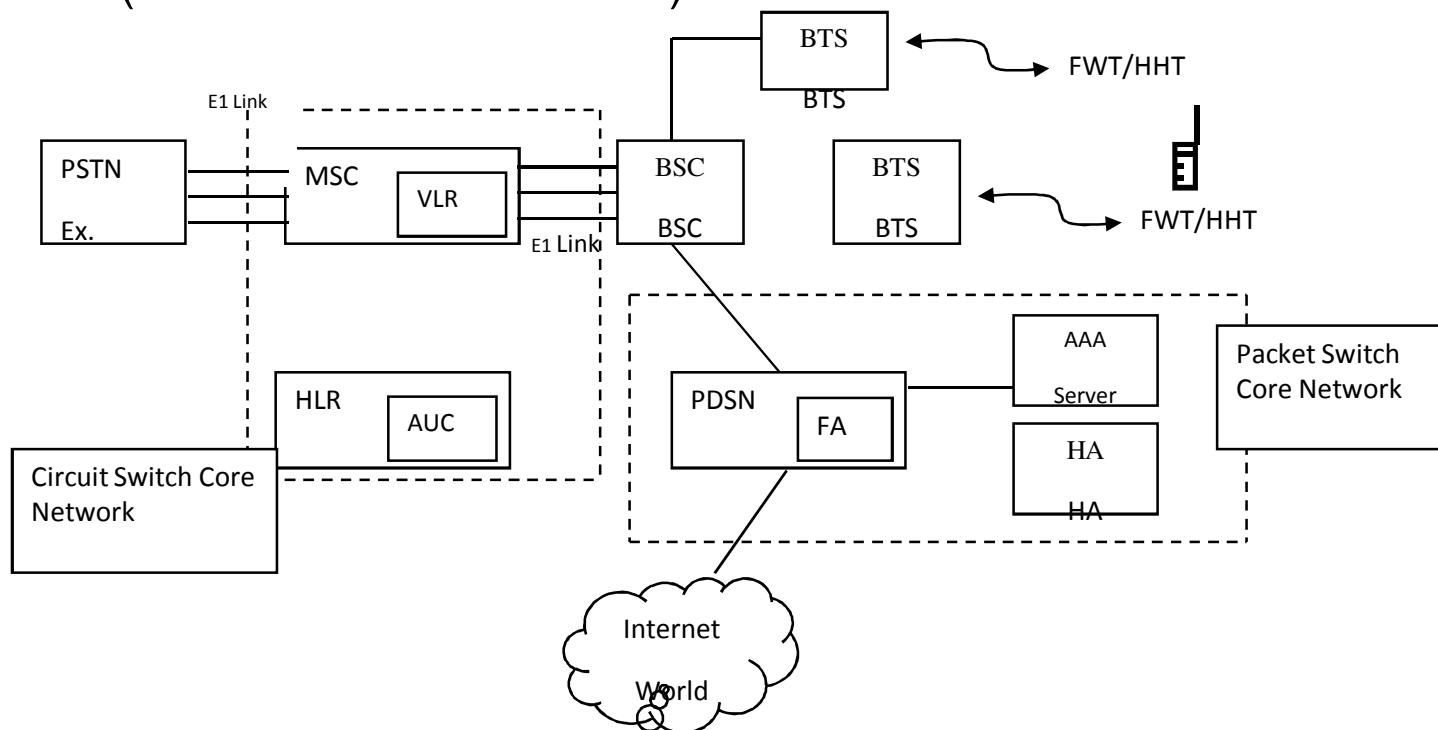
Circuit Switched Core Network: This section is dedicated for voice communication and also for wireless authentication. This section includes four parts

MSC (Mobile Switching Center): It is responsible for setting up, managing and clearing connections as well as routing the calls to the proper user & provides the network interfaces, the charging function and the function of processing the signaling. MSC gets data for call handling from 3 databases: VLR/HLR/AUC.

HLR (Home Location Register): It is a static database. When a user applies for mobile service, all data about this subscriber will be stored in HLR. It has information of a subscriber like ESN, MDN, IMSI, MIN, service information and valid term. It also stores the mobile subscriber location (MSC/VLR address), to set up the call.

VLR (Visitor Location Register): VLR is a dynamic database used by MSC for information index. It stores all related information of mobile subscribers that enter its coverage area. It stores the subscriber parameters which includes subscriber number, location area identity (LAI), user's status, services which subscriber can use and so on.

AUC (Authentication Center): It is an entity to prevent illegal subscribers from accessing CDMA network. It can generate the parameter to confirm the subscriber's identity. At the same time it can encrypt user's data according to user's request. AUC can be built separately or together with HLR

Packet Switched Core Network: To provide better connectivity to the internet a new core network i.e. PS-CN is introduced to the CDMA 2000 1x network. This section includes four parts.

PDSN (Packet Data Serving Node): Packet Data Serving Node (PDSN) provides the function of routing of data between Radio Access Network (RAN) and internet. It does all the processing related to the data services.

Home Agent/ Foreign Agent Server: HA & FA server is used when mobile IP services are supported by CDMA 2000 PDSN.

AAA Server: PS-CN also has the responsibility to authenticate, authorise and account for the CDMA 2000 subscribers wishing to obtain packet data services & to fulfil these task PDSN requires support of AAA server.

Authenticate: verifying that the user is valid & allowed to use packet data services.

Authorization: subscription to the service being offered is valid.

Accounting: Accounting for the service used.

Some of the key features of CDMA 2000 are as follows.

Faster Forward Power Control: CDMA 2000 1x standard has a faster power control compare to IS-95 counterpart. The power control is done every 1.25 ms.

Variable length Walsh Codes: CDMA 2000 uses variable length Walsh codes of length 4 to 128 to support variable data rate. Higher data rate channels uses shorter length walsh codes and vice versa.

CDMA 2000 1x: Key Features

New Radio Configurations (RC): Provide new digital coding options for improved efficiency over radio channel. It support Radio configuration RC1 to RC9 in Forward Link and RC1 to RC6 in Reverse link. Radio configuration define Rate Set, Spreading Rate, Channel Coding (Turbo or convolution), channel coding rate, transmit diversity for forward or reverse traffic channel.

Efficient use of spectrum: CDMA2000 technologies offer the higher voice capacity and data throughput using the least amount of spectrum, lowering the cost of delivery for operators and delivering superior customer experience for the end users.

Seamless Evolution Path: CDMA2000 has a solid and long-term evolution path which is built on the principle of backward and forward compatibility.

Flexibility: CDMA2000 systems have been designed for urban as well as remote rural areas for fixed wireless, wireless local loop (WLL), limited mobility and full mobility applications. It also supports R-UIM for open market handsets.

High-Speed Data: Release 0 supports bi-directional peak data rates of up to 153 kbps and an average of 60-100 kbps in commercial networks in a 1.25 MHz channel. Release A can deliver peak data rates of up to 307 kbps.

CDMA 2000 1x: Additional Channels

In the Forward link Pilot, Sync, and Paging Channels are available in CDMA 2000 1x same as in IS-95 systems. Several new channels are added to provide more spectral efficiency, higher voice capacity & data rate over the same RF bandwidth. Some of the new channels are as follows.

➢ **Forward Fundamental Channel**

➢ **Forward Supplemental Channel (valid for Radio Configuration 3 through 9)**

➢ **Forward Quick Paging Channel (QPCH)**

➢ **Reverse Supplemental Channel (valid for Radio Configuration 3 through 6)**

Although IS-2000 is already capable of meeting the 3G data rate requirement of 2 Mbps, Qualcomm proposed a new standard 1xEV-DO in March of 2000 as another option that supports high-rate data services.

1x EVDO (1x Evolution for Data Optimized) is optimized for delivering high speed IP wireless data to many mobile and stationary terminals running multiple applications. EVDO is designed for an always on user experience. The standards for Ix EVDO are defined as IS-856.

In a classical CDMA 2000 system base station controls its power by using the power control algorithms to provide the mobile a constant data rate and a quality of service for voice applications

Power

Mobile Received Power

Data rate

Distance from the Base Station
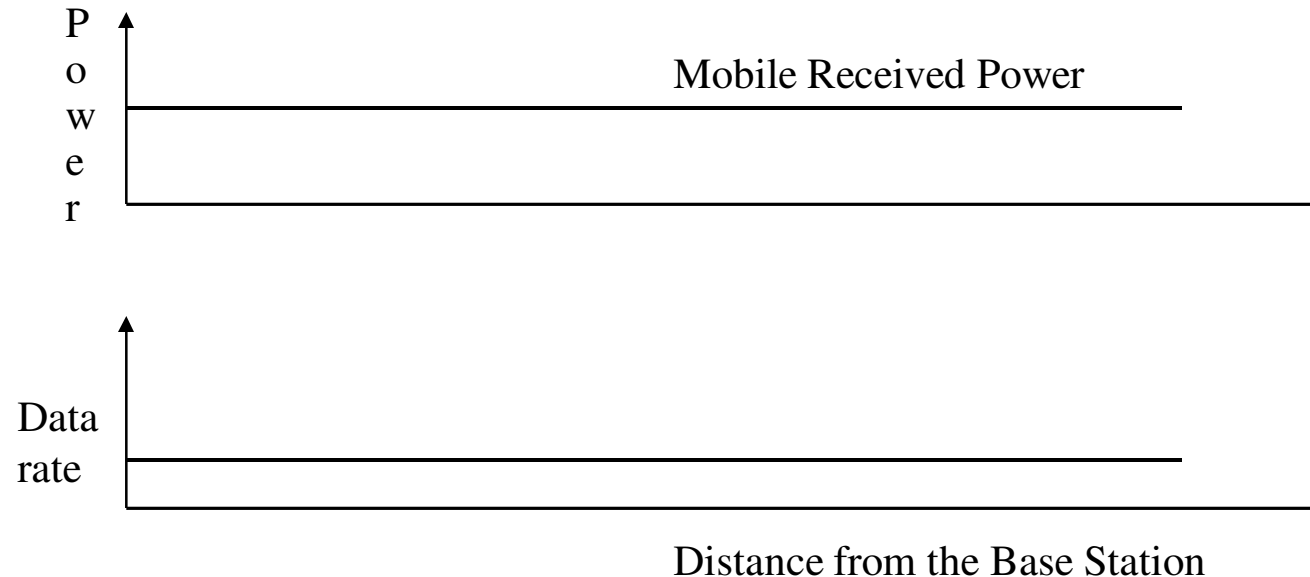
In a Classical Spread Spectrum, the base station controls the power to maintain a constant data rate & Quality of service

In EV-DO networks the base station transmits at a fixed power at all the times and controls the rate of data transmission given a constant transmit power.
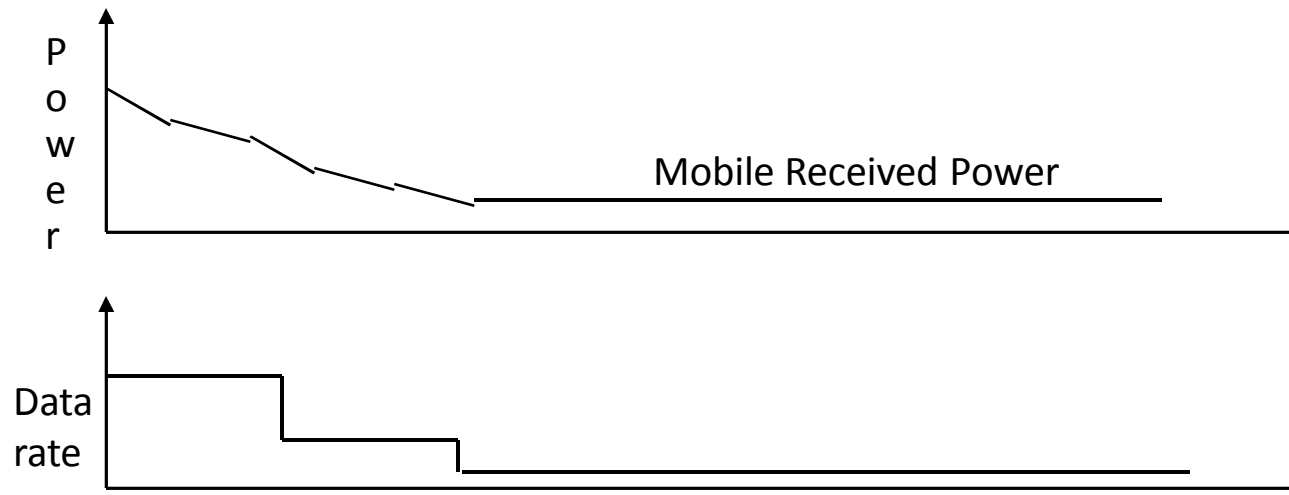
In an 1x EV-DO system, the base station controls the rate of data transmission given a constant transmit power

CDMA 2000 1x EV-DO

Salient features of EV-DO

➢ EV-DO uses both CDMA and TDMA.

➢ Uses its own dedicated 1.25 MHz carrier.

➢ No power control on forward link is required.

➢ EV-Do has two versions as Rel. 0 & Rev. A.

➢ RF system components may be shared with CDMA 2000 1x RTT.

EV-DO Reverse Link and Forward Link Data Rates

➢IS-856 Rel. 0 Forward Link

Variable Data Rates ranges from 38.4 Kbps to 2.4 Mbps

IS-856 Rev-A extends this to 3.1 Mbps

➢IS-856 Rel. 0 Reverse Link

Data Rates ranges from 9.6 Kbps to 153.6 Kbps

IS-856 Rev-A extends this to 1.8 Mbps.

1xEV-DO Forward Link: Some of the important characteristics of the forward link of 1xEV-DO are:

•There is no power control of the forward link. The AN transmits at constant power. So instead of requesting variable power on the forward link, the AT requests variable rates on the forward link. The AN delivers different data rates on the forward link based on feedback received from the ATs.

•The forward link uses Time Division Multiplexing (TDM) to multiplex different channels (in addition to CDMA). This is done to take advantage of the bursty nature of data transmissions.

Different channels that are used on the forward link of a 1xEV-DO system:

➢Pilot channel.

➢Forward traffic channel/control channel.

➢MAC channel

❑ Reverse activity (RA) channel;

❑ Reverse power control (RPC) channel;

❑ DRC Lock channel.

1xEV-DO Reverse Link: Following are the two channels used on the reverse link of a 1xEV-DO system.

➢Reverse traffic channel

➢Access channel

Reverse Traffic channel have following channels.

✓Data channel

✓Pilot channel

✓Reverse rate indicator (RRI) channel

✓Data Control Channel

✓ACK channel

BSNL is providing the following services using CDMA technology.

➢Voice

➢SMS

➢Packet data (144 Kbps / 2.4 Mbps) – NIC and EV-DO cards: Provided by P200 PDSS installed at Noida, Vadodara, Bangalore and Kolkatta.

➢CRBT: Provided by CRBT Platform installed at Vadodara.

➢Prepaid: Provided by Wireless Intelligent Network installed on zonal basis at Vadodara, Bangalore and Kolkatta.

Services in CDMA

➢Bank ATM / Branch ATM Connectivity: A very good business opportunity form bank ATMs and provided by using CDMA network with MPLS backbone together.

➢R-UIM (Removable User Interface Module): It is like a SIM card as in GSM and used for open market handsets. It makes the subscriber independent to the operator's handset. R-UIM is both 1x and EV-DO enabled.

➢Now BSNL is going to provide full mobility using CDMA network for voice. Full mobility has been already implemented for data services on zonal basis. The 10 digit numbering scheme has also been allotted to BSNL.

Thank You