

Review and history of cdma computer science essay

[Technology](#), [Computer](#)



CDMA technology was used many times ago at the time of world war-II by the English soldiers to stop German attempts at jamming transmissions. English soldiers decided to transmit signals over several frequencies, instead of one, making it difficult for the Germans to pick up the complete signal. CDMA has been used in many military applications, such as anti-jamming (because of the spread signal, it is difficult to jam or interfere with a CDMA signal), ranging (measuring the distance of the transmission to know when it will be received), and secure communications (the spread spectrum signal is very hard to detect).

In 1949, Claude Shannon and Robert Pierce develop basic ideas of CDMA. In March 1992, the TIA (Telecommunications Industry Association) established the TR-45.5 subcommittee to develop a spread spectrum digital cellular standard. In July of 1993, the TIA gave its approval for the CDMA Technology standard.

In September 1998, there were 16 million subscribers on CDMA systems worldwide. Now, 22 countries support CDMA. Verizon, used to be the largest carrier, is now second behind AT&T, is using CDMA. Other Famous companies using CDMA are Sprint, Alltel in abroad, Tata indicom and Reliance InfoComm in India.

2. What is CDMA?

Generally a fixed amount of frequency spectrum is allocated to a cellular system by the national regulator (e. g. in the United States, the Federal communication commission). Multiple-access techniques are then deployed

so that many users can share the available spectrum in an efficient manner. Multiple access systems specify how signals from different sources can be combined efficiently for transmission over a given radio frequency band and then separated at the destination without mutual interference. The three basic multiple access methods currently in use in cellular systems are:

A. Frequency division multiple access (FDMA)

B. Time division multiple access (TDMA)

C. Code division multiple access (CDMA)

A. Frequency division multiple access (FDMA)

The available bandwidth is split into non-overlapping frequencies and these disjoint sub bands are dedicated to the different users on a continuous time basis. Channel bands behave as buffer zones to minimize interference between different users.

B. Time division multiple access (TDMA)

Each user has given the full spectral occupancy to the channel, but only for less time interval. Buffer zones are used as guard times inserted between the assigned time slots. This is done to decrease interference between users by permitting for time uncertainty that arises due to system inadequacies.

C. Code division multiple access (CDMA)

The main Drawback of FDMA and TDMA is that only one subscriber at a time is assigned to a channel. No other conversation can access this channel until the subscriber's call is finished or until that original call is handed off to a different channel by the system. The above drawback is overcome in this third technique. CDMA systems utilize the spread spectrum technique, whereby a spreading code (called a pseudo-random noise or PN code) is used to allow multiple users to share a block of frequency spectrum. Detailed Description of How CDMA work is explained below.

3. How CDMA works?

With CDMA, unique digital codes, rather than separate radio frequencies or channels, are used to distinguish subscribers. The codes are used by both the mobile company and the base station, that codes are called “ pseudo-Random Code Sequences.”

CDMA is a “ spread spectrum” technology, which means that it spreads the information contained in a particular signal of interest over a much greater bandwidth than the original signal. CDMA uses Direct Sequence Spread Spectrum (DSSS) technology. In DSSS technology, Signal is transmitted by adding random data-bits called chip. This addition is done by the direct sequence transmitters. Now signal contains both, a useful signal and a signal that appears to be interference (the chips) is transmitted. The receiver easily identifies the chips and subtracts them, leaving only the useful signal. This means that original signal is spread over several frequencies simultaneously. This can deliver secure communication such that the transmitted signal can

not be detected or recognized easily by unwanted listeners. It can discard interference whether it is the unintentional interference by another user simultaneously trying to transmit through the channel, or the intentional interference trying to jam the transmission.

In TDMA, the original call is transmitted at 9600 bps (9.6 kbps) but when put on the CDMA, the call is spread over a 1.23 Mbps bandwidth, so it can be transmitted at a higher speed. Unique codes are applied to the data bits that make up the telephone call for a particular user. The cellular telephone receiving the call takes off the data codes and the call is converted back to its original 9600 bps. The use of these data codes enables CDMA systems to differentiate data bits from many different calls in the cell.

CDMA networks use a scheme called soft handoff, which minimizes signal breakup as a handset passes from one cell to another. The combination of digital and spread-spectrum modes supports several times as many signals per unit bandwidth as analog modes. CDMA is compatible with other cellular technologies, this allows for nationwide roaming.

4. Factors affecting CDMA functionality

Although CDMA does not have some capacity limitation, no maximum number of calls per single, wide band-width channel is established. The number of calls that a channel can accommodate is based on 3 factors.

A. Total bandwidth

B. Geographical coverage

C. Quality of sound

? The available bandwidth can be increased by decreasing the quality of sound or the area covered by network.

? Channels that primarily carry voice conversation do not use the extra capacity required to deliver CD-quality sound. So, more bandwidth is available to provide longer transmission distance or to accommodate more cellular calls.

? Suppose there are $2N$ users that only talk half of the time then they can be accommodated with the same average bandwidth as N users that talk all of the time.

5. Types of CDMA

Some of the types of CDMA transmission are as under

A. Composite CDMA/TDMA

B. CDMA

C. cdmaOne

D. cdma2000

A. Composite CDMA/TDMA

It is Wireless technology that uses both CDMA and TDMA. It is used for large-cell licensed band and small-cell unlicensed band applications. It uses CDMA between cells and TDMA within cells.

B. CDMA

CDMA is characterized by high capacity and small cell radius, employing spread-spectrum technology and a special coding scheme.

C. cdmaOne

cdmaOne is the first generation narrowband CDMA. It is also called IS-95.

D. Cdma2000

This includes 1XRTT CDMA standard. That is designed to double current voice capacity and support always-on data transmission speeds 10 times faster than typically available today.

6. Advantages of CDMA

A. Capacity:

The capacity of CDMA currently is 8 to 10 times greater than AMPS which uses FDMA transmission (and predicted to be 20 to 40 times greater in future) and 4 to 5 times greater than GSM which uses TDMA transmission (with prediction of being up to 13 times greater).

B. Best for in built system and micro-cell.

As in CDMA transmission, we do not need SIM card it is best for in-built system and micro-cell.

C. Improves the voice quality.

CDMA systems use precise power control that is, the base station sends commands to every mobile phone currently involved in a call, turning down the power on the nearby ones, and increasing the power of those further away. The result is a nice; even noise level across the carrier, with lower overall power levels and no spiky interference.

D. Improves the telephone traffic capacity.

E. It also provides Call privacy.

F. Easily planned and maintained in comparison with FDMA & TDMA

7. Disadvantage of CDMA

The only disadvantage of installing CDMA system is the cost of the base station with its complex communication equipments. A CDMA base station costs approximately \$150, 000, while a similar station for TDMA costs approximately \$50, 000.

8. Referenced Books

A. Business Data Communication – Fourth edition

By Shelly Cashman Serwatka

B. COMPUTER NETWORKS, 3rd Edition

By Andrew S. Tanenbaum

9. Referenced websites

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B. www.wikipedia.com

C. www.wisegeek.com

D. www.palowireless.com

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