Course project: wireless technology upgrade

Technology

I plan to upgrade are current network to a fourth generation technology called Code Division Multiple Access (CDMA). This technology will greatly increase the stability and performance of your current network, by allowing better voice and data transfer rates for your current customers while keeping the cost low to deploy to new your customers, but first lets take a brief moment to go over exactly what CDMA is.

Introduction Code division multiple access is a channel access method used by various radio communication technologies. It should not be confused with the mobile phone standards called CDMAOne, CDMA2000 and WCDMA, which are often referred to as simply CDMA, and use CDMA as an underlying channel access method. One of the concepts in data communication is the idea of allowing several transmitters to send information simultaneously over a single communication channel. This allows several users to share a band of frequencies. This concept is called multiple accesses. CDMA employs spread-spectrum technology and a special coding scheme to allow multiple users to be multiplexed over the same physical channel.

By contrast, time division multiple accesses, divides access by time, while frequency-division multiple access divides it by frequency. CDMA is a form of spread-spectrum signaling, since the modulated coded signal has a much higher data bandwidth than the data being communicated. An analogy to the problem of multiple access is a room in which people wish to talk to each other simultaneously. To avoid confusion, people could take turns speaking, speak at different pitches, or speak in different languages.

CDMA is analogous to the last example where people speaking the same language can understand each other, but other languages are perceived as

noise and rejected. Similarly, in radio CDMA, each group of users is given a shared code. Many codes occupy the same channel, but only users associated with a particular code can communicate. CDMA is a spread spectrum multiple access technique. A spread spectrum technique spreads the bandwidth of the data uniformly for the same transmitted power.

A spreading code is a pseudo-random code that has a narrow ambiguity function, unlike other narrow pulse codes. In CDMA a locally generated code runs at a much higher rate than the data to be transmitted. Data for transmission is combined via bitwise XOR with the faster code. The figure shows how a spread spectrum signal is generated. The data signal with pulse duration of $T_{\_}$ When the receiver attempts to decode the signal using sender1's code, the data is all zeros, therefore the cross correlation is equal to zero and it is clear that sender1 did not transmit any data.

Asynchronous CDMA When mobile-to-base links cannot be precisely coordinated, particularly due to the mobility of the handsets, a different approach is required. Since it is not mathematically possible to create signature sequences that are both orthogonal for arbitrarily random starting points and which make full use of the code space, unique " pseudo-random" or " pseudo-noise" sequences are used in asynchronous CDMA systems. A PN code is a binary sequence that appears random but can be reproduced in a deterministic manner by intended receivers.

These PN codes are used to encode and decode a user's signal in Asynchronous CDMA in the same manner as the orthogonal codes in synchronous CDMA. These PN sequences are statistically uncorrelated, and the sum of a large number of PN sequences results in multiple access

interference that is approximated by a Gaussian noise process . Gold codes are an example of a PN suitable for this purpose, as there is low correlation between the codes. If all of the users are received with the same power level, then the variance of the MAI increases in direct proportion to the number of users.

In other words, unlike synchronous CDMA, the signals of other users will appear as noise to the signal of interest and interfere slightly with the desired signal in proportion to number of users. All forms of CDMA use spread spectrum process gain to allow receivers to partially discriminate against unwanted signals. Signals encoded with the specified PN sequence are received, while signals with different codes appear as wideband noise reduced by the process gain.