Code Division Multiplexing

Code division multiplexing (CDM) is a multiplexing technique that uses spread spectrum communication. In spread spectrum communications, a narrowband signal is spread over a larger band of frequency or across multiple channels via division. It does not constrict bandwidth's digital signals or frequencies. It is less susceptible to interference, thus providing better data communication capability and a more secure private line.

Code Division Multiple Access

When CDM is used to allow multiple signals from multiple users to share a common communication channel, the technology is called Code Division Multiple Access (CDMA). Each group of users is given a shared code and individual conversations are encoded in a digital sequence. Data is available on the shared channel, but only those users associated with a particular code can access the data.

Concept

Each communicating station is assigned a unique code. The codes stations have the following properties −

- If code of one station is multiplied by code of another station, it yields 0.
- If code of one station is multiplied by itself, it yields a positive number equal to the number of stations.

The communication technique can be explained by the following example −

Consider that there are four stations w, x, y and z that have been assigned the codes c_w , c_x, $c_y$and c_z and need to transmit data d_w , d_x, d_y and d_z respectively. Each station multiplies its code with its data and the sum of all the terms is transmitted in the communication channel.

Thus, the data in the communication channel is $d_w . c_w + d_x . c_x + d_y . c_y + d_z . c_z$

Suppose that at the receiving end, station z wants to receive data sent by station y. In order to retrieve the data, it will multiply the received data by the code of station y which is d_y.

$$\begin{aligned} data &= (d_w . c_w + d_x . c_x + d_y . c_y + d_z . c_z) . c_y \\ &= d_w . c_w . c_y + d_x . c_x . c_y + d_y . c_y . c_y + d_z . c_z . c_y \\ &= 0 + 0 + d_y . 4 + 0 = 4d_y \end{aligned}$$

Thus, it can be seen that station z has received data from only station y while neglecting the other codes.