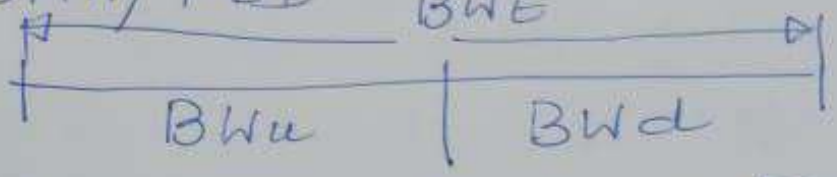
SMCN

1. Code division Multiple Access
   - CDMA
     - 3rd Generation
     - 4th generation
     Mobile software.

2. CDMA/FDD



Uplink downlink created in Frequency division;

$$BWup = BWd = \frac{BWt}{2}.$$

3. Here in the uplink/downlink channels are created in code

4. In uplink/downlink channels
   - Neither frequency is divided
   - Time is divided.

5.

05 uplink/downlink communication take place using uplink and downlink codes

06 uplink and downlink communication can go simultaneously as they are divided in Frequency — FDD.

07. In CDMA/FDD, a logical 1 is spread into m subbit
m = 64, 128 ...
In our case we shall assume
m = 8

08. Each subbit is known as chip

09. With m = 8, a logical one is spread into 8 chip Code

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For $m = 8$, 2^8 chip codes can be created $(0 - 2^8 - 1)$

(i) uplink time shall be 256 codes (0 - 255)

(ii) In downlink also 256 Codes (0 - 255)

(iii) Same code can be used in uplink and downlink codes

11. Not all uplink/downlink codes shall be valid

- (i) only a subset of 256 codes shall be valid

(ii) A valid uplink code/channel can be used by a mobile for transmission

- (iii) A valid downlink code/channel shall be used for listening

12 -(i) For uplink to transmit each station is allocated a code/channel by base station.

Let a station (Mobile, laptop) is allotted a uplink code S of 8 chip valid code

(ii) To transmit logical 1 S station S shall transmit code $\bar{S}$ say S = 10110100. i.e to transmit logical one S shall transmit 8 chip code - 10110100

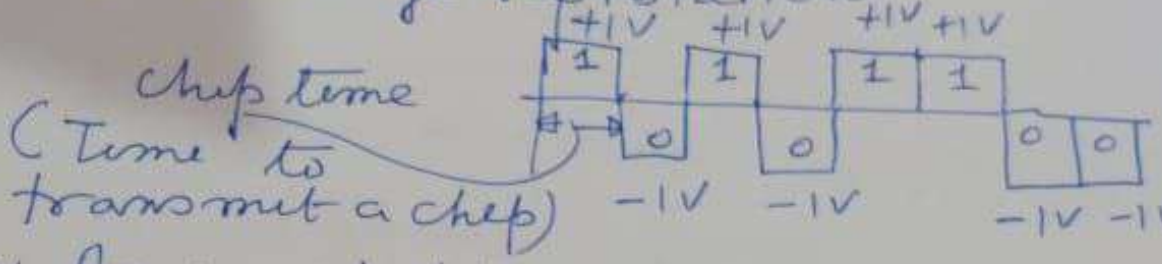
(iii) To transmit logical 0, S shall transmit complement of S - $\bar{S}$ of S (= $\bar{S}$) = 01001011.

13. (i) Of 8 chip code or its complement of a chip 1 is represented by +1 volt during transmission.

(ii) 0 chip is represented by -1 volt

(iii) Sup a chip code S = 10101100

Its voltage representation



14. (i) Any station can send its chip code (logical 1, or logical 0) only when it gets a tick or synchronization signal from Base station.

15. (i) Suppose station A, B, C, D (four station transmit their chip codes (all for logical 1)

15(ii) Let Sum code S (Received by base station

$= S_1 S_2 S_3 S_4 \ldots S_8$

(S_i ($i = 1, \ldots 8$) are chips in the Sum code

(iii) With four station

$\text{Max}(S_i, i = 1 \text{ to } 8) = +4V$

$\text{Min}(S_i, i = 1 \text{ to } 8) = -4V$

16 (i) Now purpose of chip code is of m chips.

(ii) Total 2^m chip codes.

(iii) All chip codes are not valid code or channel

17 (i) To become a valid chip code, each chip code shall follow the orthogonality principle.

(ii) Say two m length chip codes S and T are valid then S & T shall hold the following orthogonality principle

$$S \cdot T = \sum_{i=1}^{m} S_i T_i = 0$$

this is enforced

$$\begin{array}{r} +1+1+1+1 \quad +1+1+1+1 \\ -1-1-1-1 \quad +1+1+1+1 \\ \hline -1-1-1-1+1+1+1+1 \end{array}$$

$$S \cdot T = 0$$

(iii) For (ii) it follows

$$S \cdot \bar{T} = 0$$

(iii) is corolory of (ii)

(iv)
$$\left.\begin{array}{l} S \cdot S = 1 \\ S \cdot \bar{S} = -1 \end{array}\right\} \text{Identity}$$

i) How valed codes are generated

ii) Suppose $\mathbb{C}$ = Set of all m chip codes.

iii) take a code S from $\mathbb{C}$ (First Code / Next Code

(iii) Let Set $C' = C - \{S\}$

(iv) Set V = Null

(v) Now Say code $\wedge T \in C'$

So for all $T \in C'$

{ If $S \cdot T = 0$ then

{S is a valid code

$V = V + \{S\}$ }

else ~~after wise~~ invalid }

(20i) go to 18(ii)

(20ii) If $m = 128$ then to find set V it will take very long time

(20iii) But this calculation need only be done once by using a super computer.

(19) Decoding of logical 1 & logical 0 by base station.