

# Pulse Code Modulation at a glance

The following will give you the PCM concept  
that has been followed to develop the PCM

# COMMUNICATION

By directional Interaction

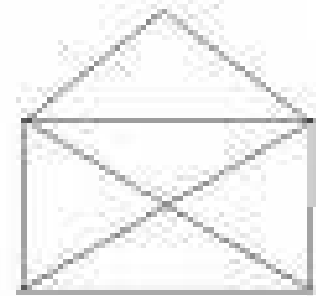
Media 50% efficient

# Public



Flock to hear

# Personal



Only person to  
person

# Technical Characteristic

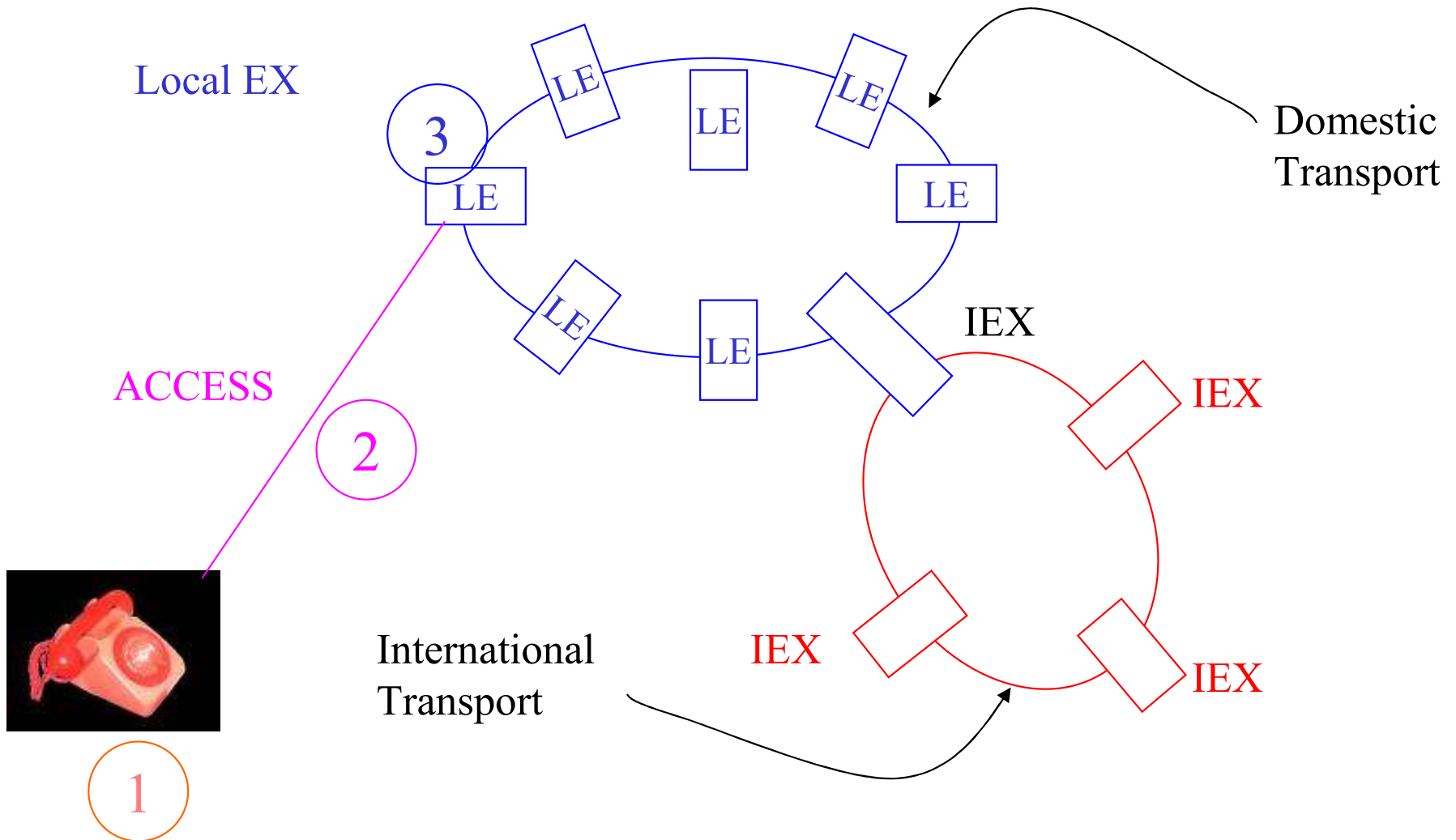
Public

Unidirectional Tx does not know  
how many receivers are ON

Personal

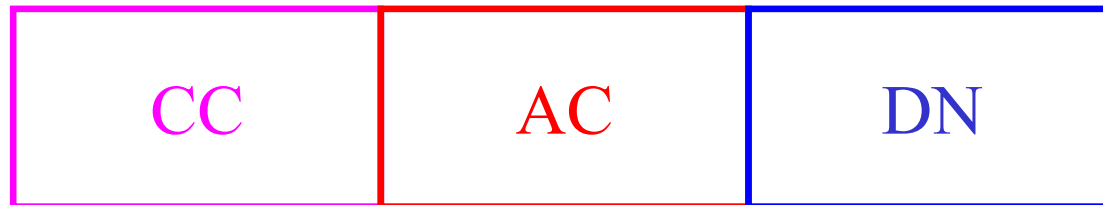
By directional interactive

# Telecom Network in Summary



# Why TELECOM more popular

- Electronically Dist=0
- Answer only charge
- Tell No. 15 Digits (Universal)

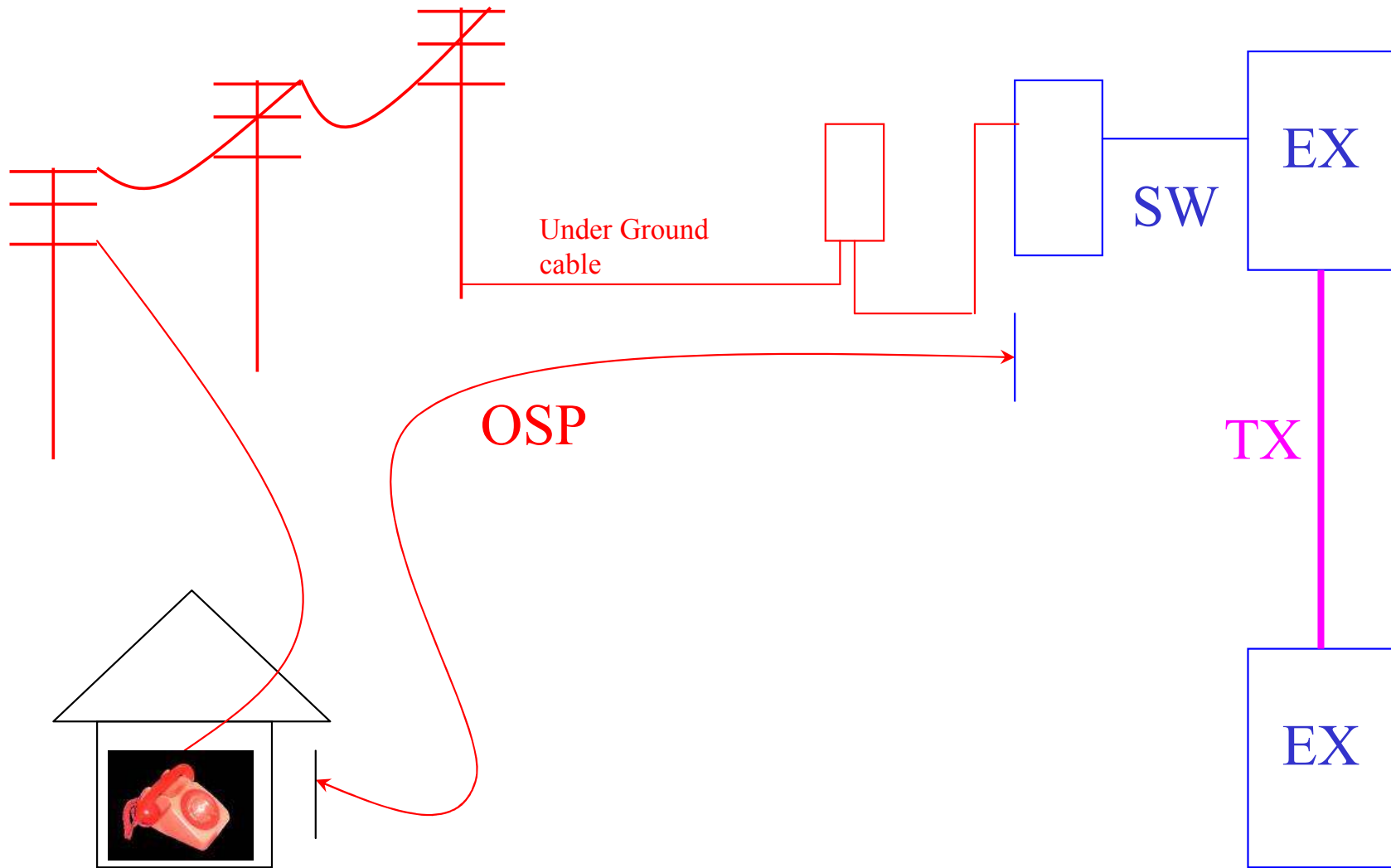


CC – County Code

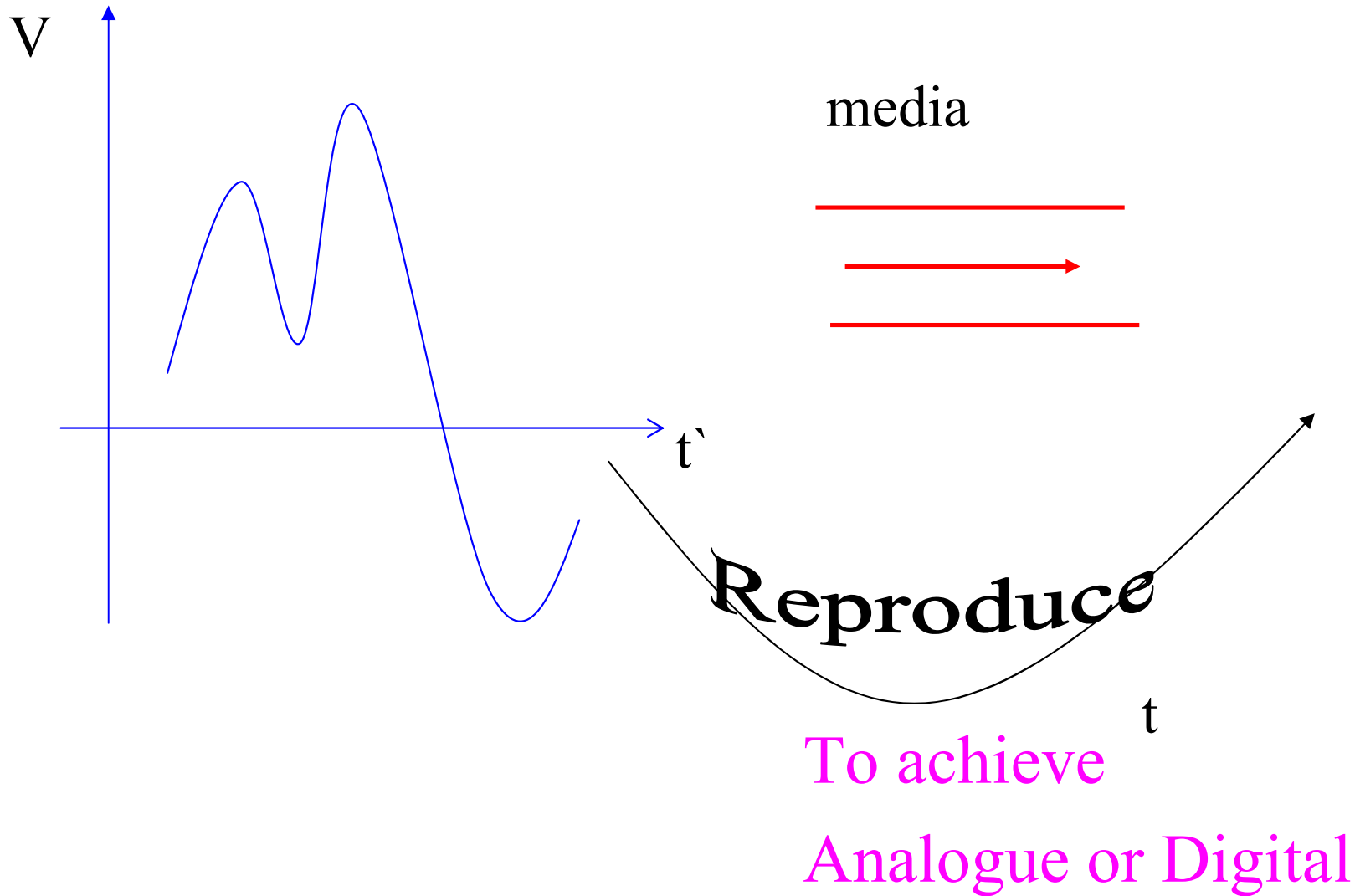
AC – Area Code

DN – Directory No.

# Demarcation of TELECOM



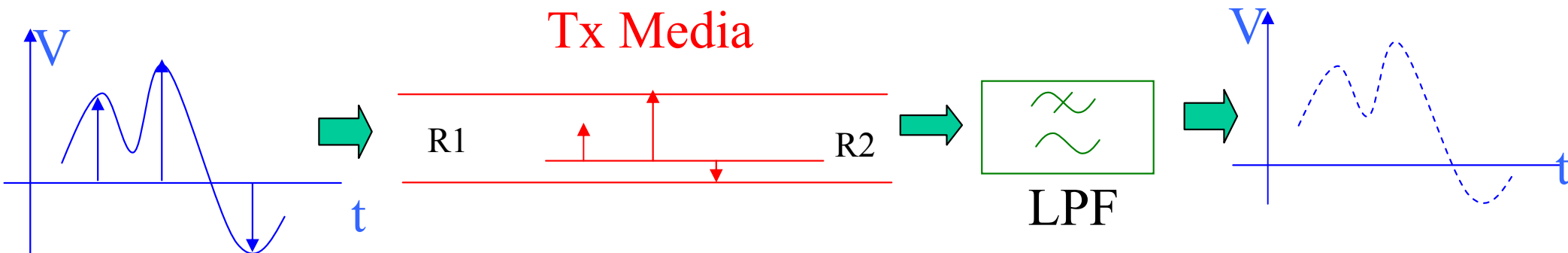
# What is Transmission ?



# What is Digital Transmission ?

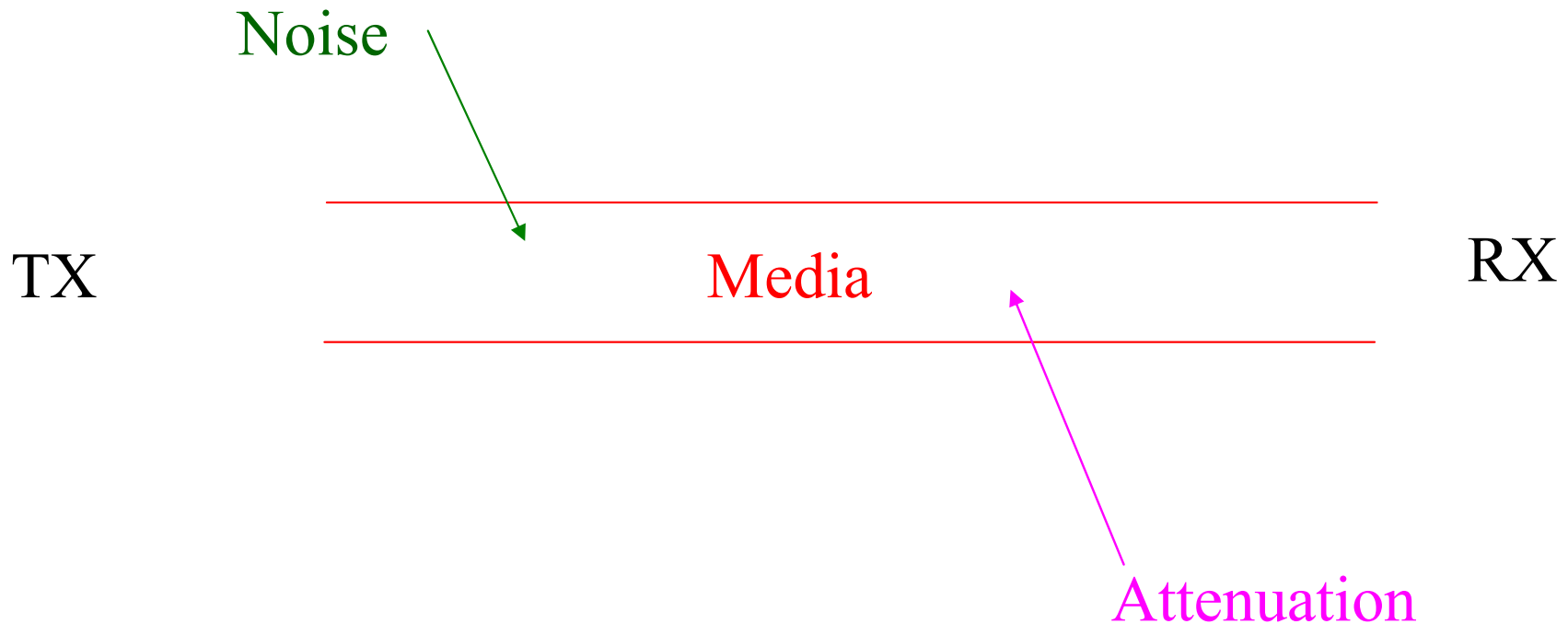
Governed by Sampling Theorem

Sampling Theorem applies for band limited signal, Sample this band limited signal twice the maximum frequency of that signal, reproduce the samples through the transmission media in the other end by low pass filtering you will reproduce the original signal



Difficult to achieve

# Problems to achieve DIGITAL Tx



The samples cannot be REPRODUCED

# Find a technique DIGITAL Tx

(1) TX info

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Tx Media

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(1) RX  
info

(2) Verify  
the Rx  
info

Verification Difficult

# To make verification easy

## Quantising

Equate the sample to a quantise level

Then transmit verification will be easy at the receiver

Quantising noise is inevitable

# Encoding

Convert these quantized level in to  
Binary level

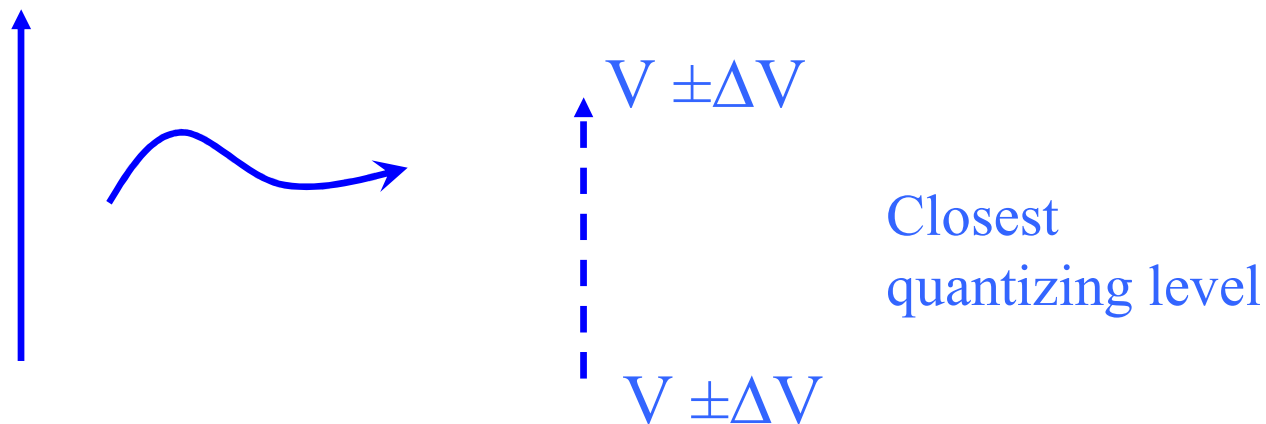
Verification will be more easy

# Quantising

Non-Linear Quantizing Used why ?

In linear quantizing S/N is good only for high valued samples and 90% of the samples are within  $\frac{1}{2}$  of maximum voltages.

Hence the samples will be equate to 1/256 levels.



Hence quantizing Noise ( $\Delta V$ ) is inherent in PCM transmission, there is a difference between actual sample to quantized level.

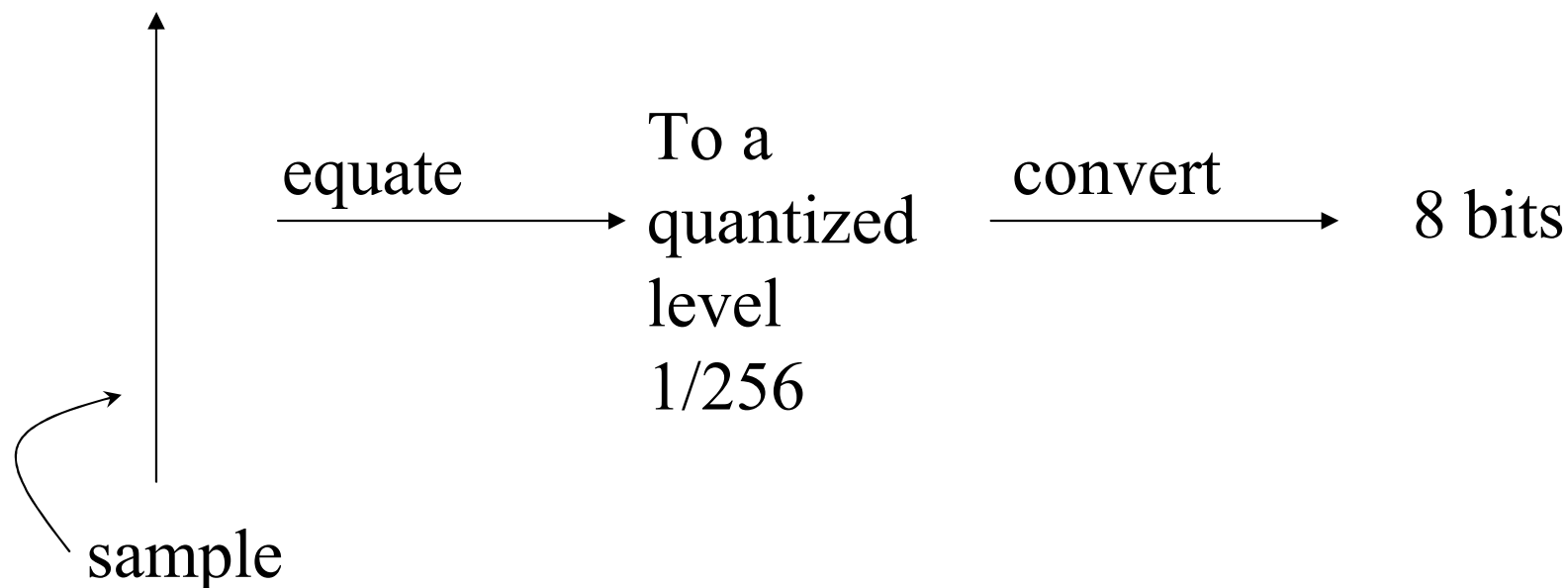
# Encoding

The quantized level is then converted in to 8 bits. This 8 bits represent

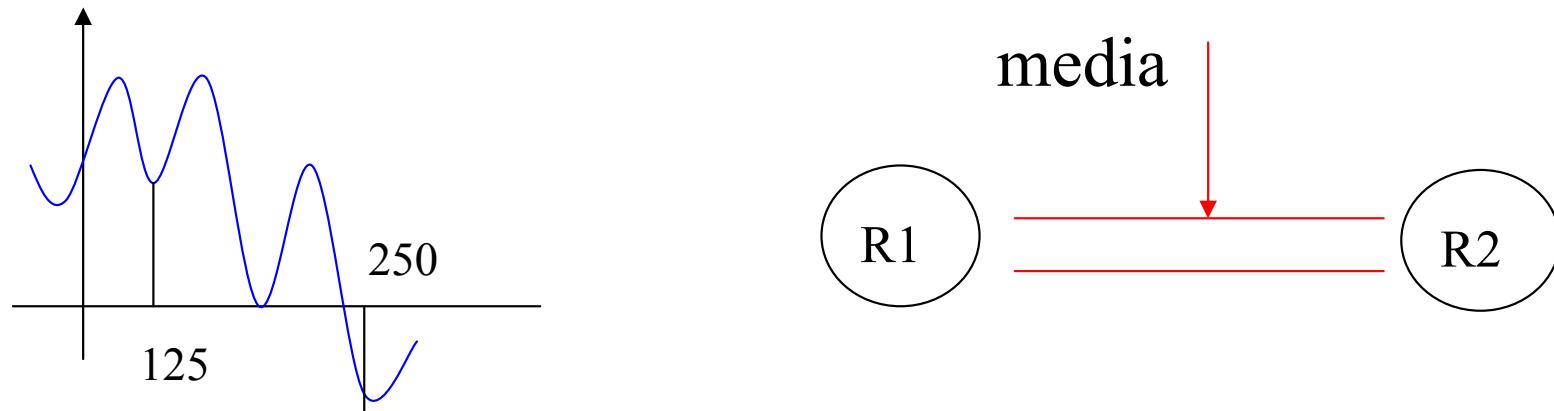
**S ABC WXYZ**

**S - sign + or - , ABC = No of segments**

**WXYZ= No of level in that segments**



# Time Division Multiplexing



For a given signal 125s period of the samples to be send

R1 is idling too long. To make it efficient 32 value signals are sampled and send within 125s.



Practically TS0, TS16 not used for normal voice signal.

But for synchronizing + signaling respectively

R1  $\longrightarrow$  R2 the speed is 2.048Mb/s

Signaling  $\Rightarrow$  analog

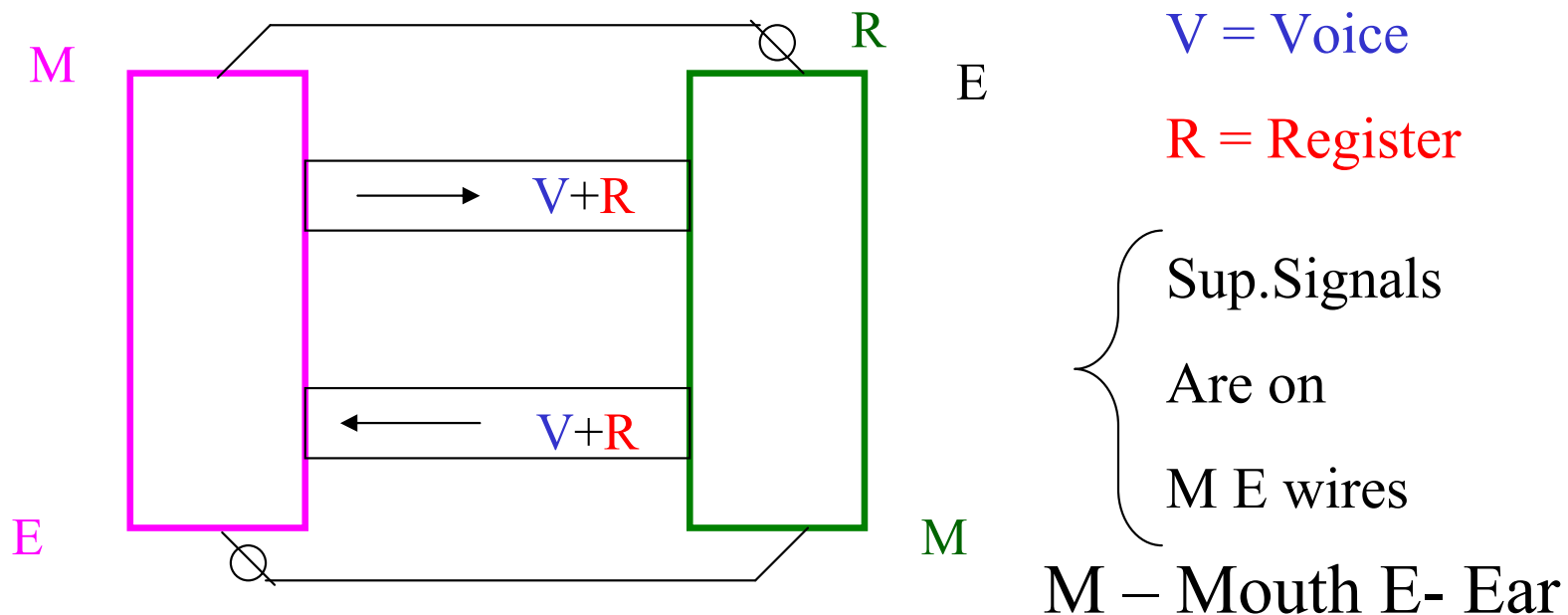
Register

supervisory

Characteristics

Supervisory is always present with voice

Register is always prior to voice Hence analogue Channel from exchange to another exchange will be as follows

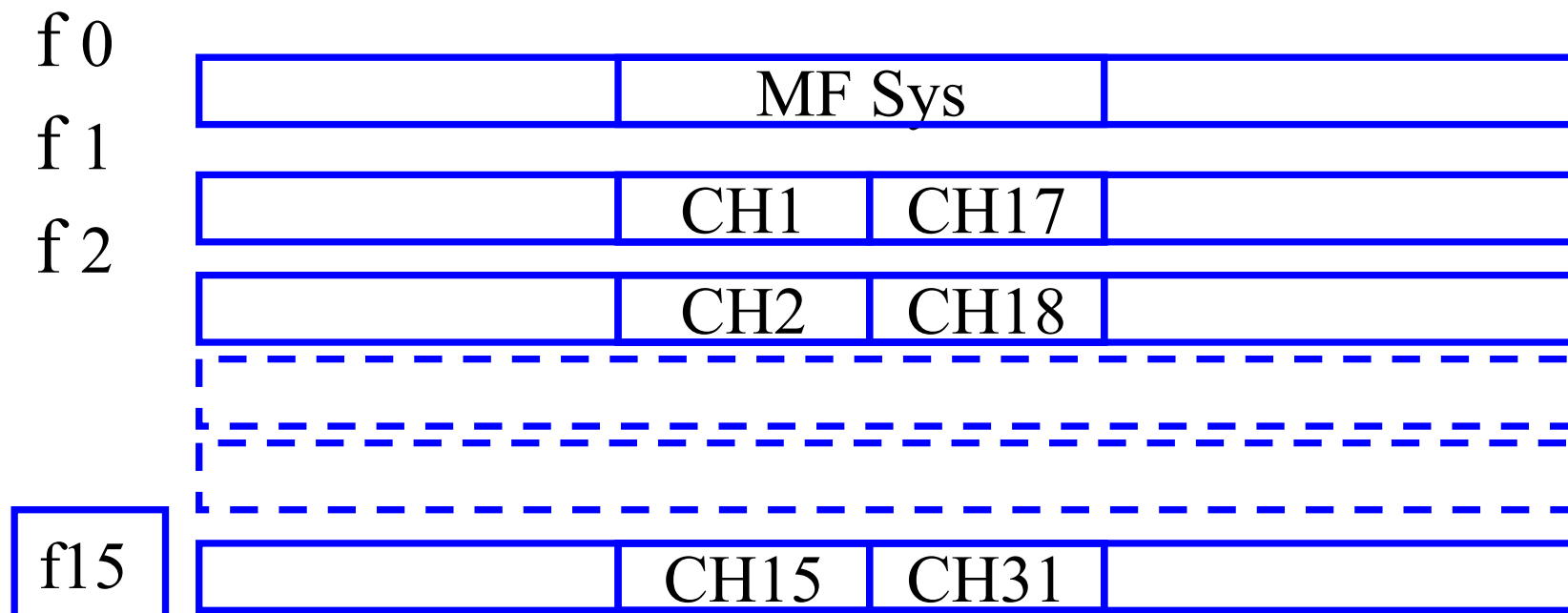


Multiframe in a PCM SYSTEM for supervisory signals only TS 16 is available CCITT has allocated 4bits for each channel.

To send 30 channels supervisory signals on TS16, You need 15 frames.

To alliaigh SIG TR module to SIG RX module one TS16 is used.

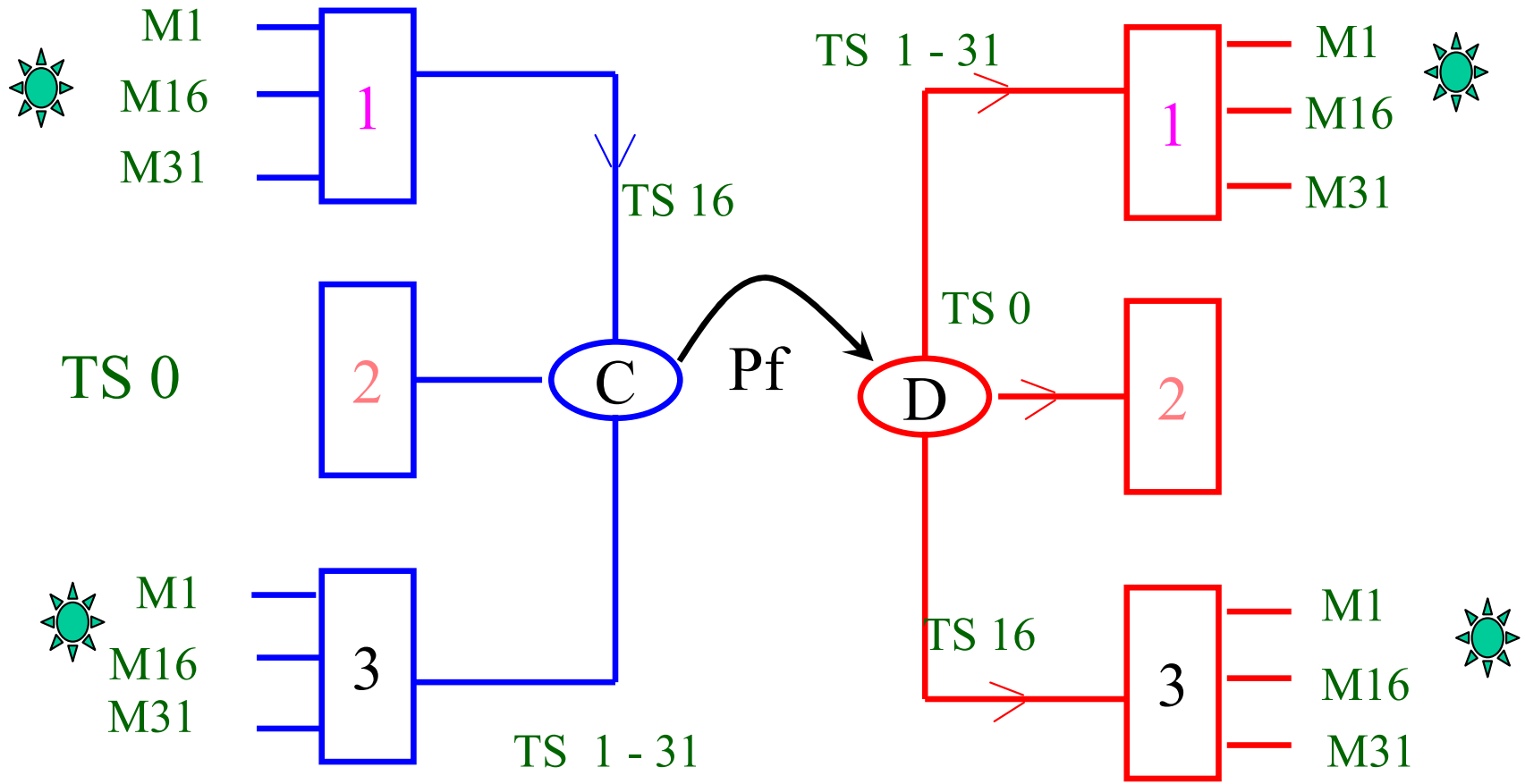
Hence multiframe consist 16 frames.



# Block diagram of PCM System

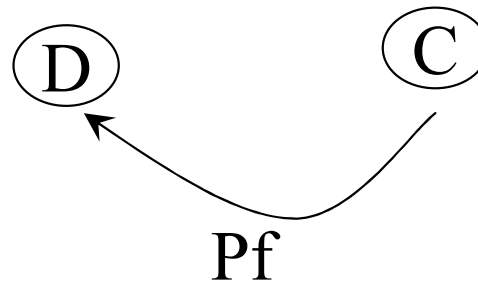
A - SIDE

B - SIDE



 - Except 16

1. Signalling Compartment
2. SYNC Compartment
3. (V+R) Compartment

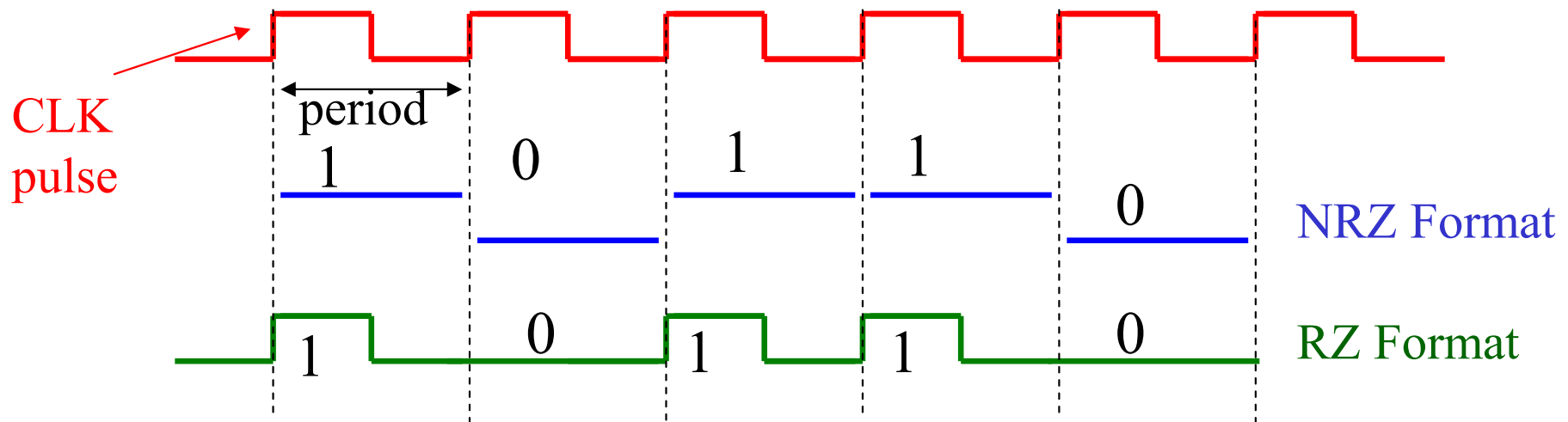


C – Combiner

D - Distributor

# Transcoding

Code Conversion to suit for the Transmission media.  
Output of a PCM System either RZ, NRZ



‘1’ bit named as “mark” NRZ means, Mark will return to zero before the period of CLK pulse, but at the period of the clk pulse.

RZ, means mark will NOT come to zero before the period of the CLK pulse, but at the period of the CLK pulse, but at the period of the CLK pulse if the following is not a ‘MARK’.

# Practical Transcoding wave forms

## High Density Bipolar 3, HDB3

### Rules:

1. Don't allow more than 3 consecutive zero's to be present in the wave form (media). Introduce a violation bit, Violation bit has to be of the same polarity of the previous 'Mark'.
2. Two Consecutive violation bits has to be of opposite polarity.
3. Between two consecutive Violation bits, If there are even number of MARKs the format of last Violation will be boove .

Where B is the stuffing BIT, And will be of opposite polarity to the previous "MARK"

### Process Involved

