

### Chapter 1

Error Control consists of error detection and error correction. Error control plays a vital role for an effective communication between human to human or between equipment to equipment. Communication essentially needs a transmission media where the information sent will be subjected to be affected by noise or any interference of the media.

#### 1.1 Error Control of a telephone conversation

An effective human-to-human communication over a telephone needs the following phases to be satisfied.

- (i) Establishment of the connection from one telephone to another telephone.  
(done by equipment)
- (ii) Identifying each other; caller and called subscriber – (done by human).
- (iii) Inter active communication with each other - (done by human)
- (iv) If there is a difficulty in understanding due to either technical or human error, request is made -(done by human – Error Control).
- (v) Terminating the conversation. – (done by human).
- (vi) Releasing the circuit from one telephone to another telephone.

The above (ii) and (iii),(iv) are done by the subscribers with out (some times) their knowledge. However instead of human to human if the dialogue is from machine to machine, the above 6 phases have to be carried out by machine. Example from one fax machine to another fax machine, the above (i) and (vi) will be carried out by telephone network; other phases will be handled by the two fax machines through their own protocols (reference CCITT recommendation T series).

#### **Importance of Error Control**

For any communication system error control plays an important role. Error control essentially will have two phases. i.e.

- (i) Detection of Errors.
- (ii) Correction of Errors.

## 1.2 Detection of Errors

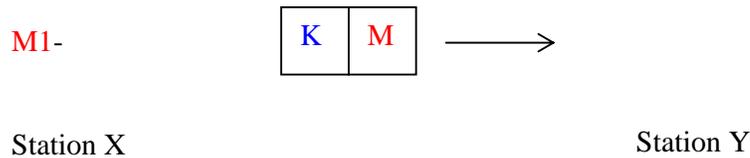
Say a transmission of message  $M$  from station  $X$  to station  $Y$  is taking place.

### Case 1



If we transmit this message  $M$ , station  $Y$  cannot verify whether there are any errors introduced during transmission. Hence some error detection code has to be identified, and has to be formulated at station  $X$ , and then appended to the message before transmitting to station  $Y$ .

### Case 2



At station  $Y$ , check these  $K$  bits and if they are correct only the message  $M$  is taken for analysis otherwise not.

## 1.3 The Effect of adding more bits to the message

### Case 3

If the information  $M$  is transmitted at a given speed, then the station  $X$  has to append the error correction bits  $K$  so that,  $M + K$  bits say  $M1$  to be transmitted at the same time span of  $M$  bits length.

### Case 4

Code rate efficiency is defined as 
$$= \frac{M}{M1} = < 1$$

$$R = \frac{\text{Information bits}}{\text{Total number of bits transmitted}}$$

### Case 5

The length of the error detection code will limit bandwidth and power characteristics of the transmitter.