Lecture-2, DC

ex- an audio signal, translate from the acoustic to the electrical domain using a microphone → radio wave which will carry the audio signal → BC audio over the air from an FM/AM radio

→ what we see around is mostly digital?

DC:- communication in terms of bits - foundations were laid by Prof. Claude E. Shannon (1948)

Two main threads:- 1) Source coding & compression

2) Digital information Tx

1) involves compression, or removal of redundancy in a manner

that exploits the prop. of the src sig. ex. heavy correlation among nearby pixels in an image.

4) once source coding is done, task is to "reliably" transfer bit seq. across space or time

→ Notion of channel capacity

C = 1Kbps

$R \leq C$:- error-free Rx

$R > C$:- error

→ Three factors affecting Tx :-

- → signal strength,
- → noise or interference
- → distortions imposed by channel

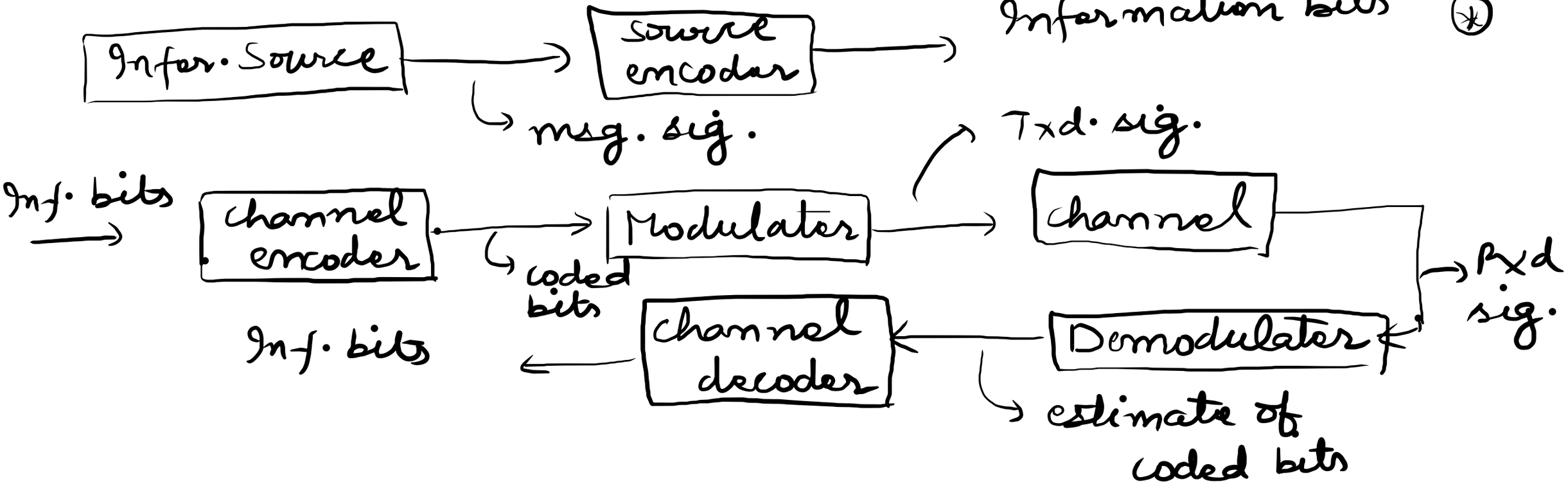
↳ once these three things are fixed for a comm^n chnl, channel capacity gives the max. possible rate of reliable comm.

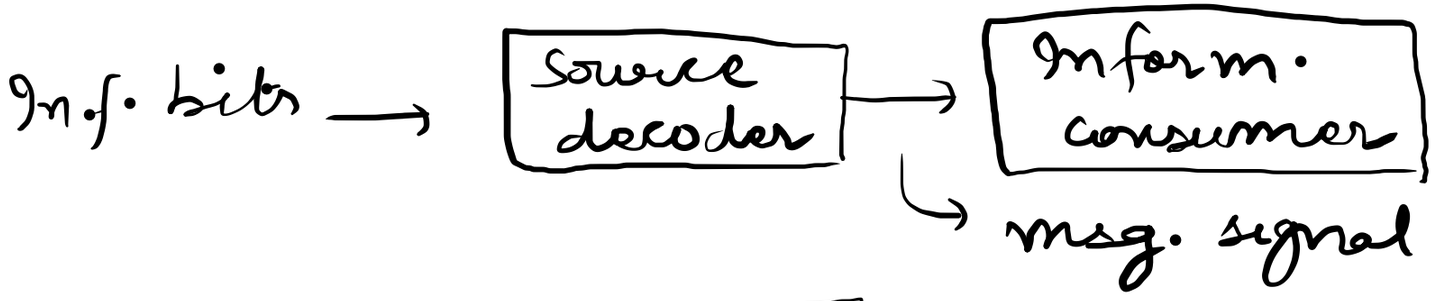
Thomas Cover's book.

let us contrast AC & DC

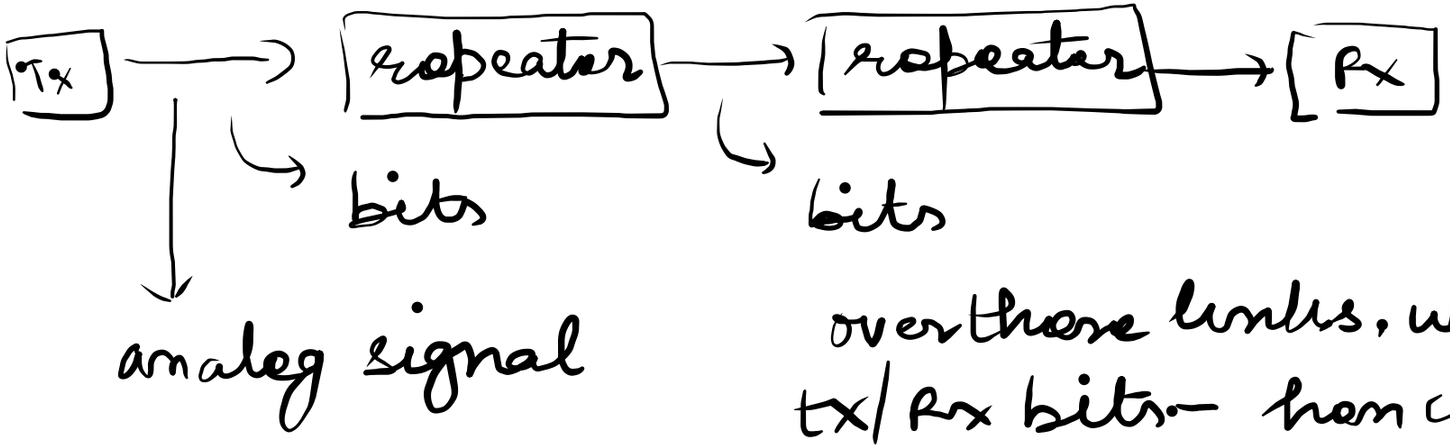
AC: quality of reproduced source signal typically degrades gradually as the channel condition worsens

DC: sharp transition b/w reliable & unreliable comm^{n}.





Source-chnl separation theorem.



over those links, we tx/Rx bits - hence easy to use for multiple source signal

src. coding - remove redundancy

chnl. coding - "controlled" red. addition

IEEE 802.15a/4g

Ques:- redundancy removal by src encoder & red. add. by chnl encoder.

Individual descriptions of each of the blocks in the diag. above - you need to study yourself.

As you can see DC involves far more processing than AC then why DC?

→ This is made possible through 'increase in computational power of low-cost silicon integrated circuits".

Optimality:- for DC source-channel sep. principle is generally sec. indep. & channel optimized.

For AM, waveform Tx depends on the msg sig., which is beyond the control of the link designer; hence no freedom to optimize link perf. over all possible comm^{n} schemes.