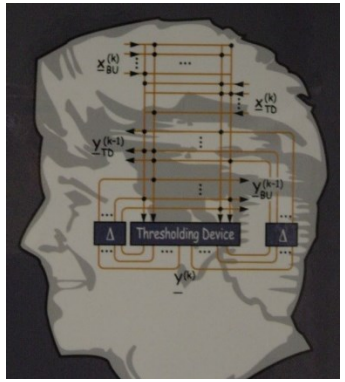
What is Information

- Anything that has some *message to convey*.
- It carries some knowledge, and the recipient shall be to *interpret* it.



We use them daily !?

- **Syntactic information**
  - Related to the *structure of the messages* (characters) that forms the information.
- **Semantic information**
  - Related to the *meaning* of the messages
- **Pragmatic information**
  - Related to the *usage and effect* of the messages
- i). *I eat fish by fork (ii). I use fork to eat fish. (iii). Karnataka reported 200 Covid'19 cases. (iv). In KA, Bangalore reported 200 Covid'19 cases on Dec. 28.*

  - i. and ii. are *syntactically* different but *semantically* & *Pragmatically* equal.
  - iii. and iv. are *syntactically, semantically* & *pragmatically* different (iv. gives more information than iii.)

What is information theory

- It is the *science* that deals with the concept " Information" : Its *measurement* & its *application*.
- The *elementary unit* of information is a *binary* unit: a bit, which can be either 1 or 0; "true" or "false"; "yes" or "no", "black" and "white", etc.

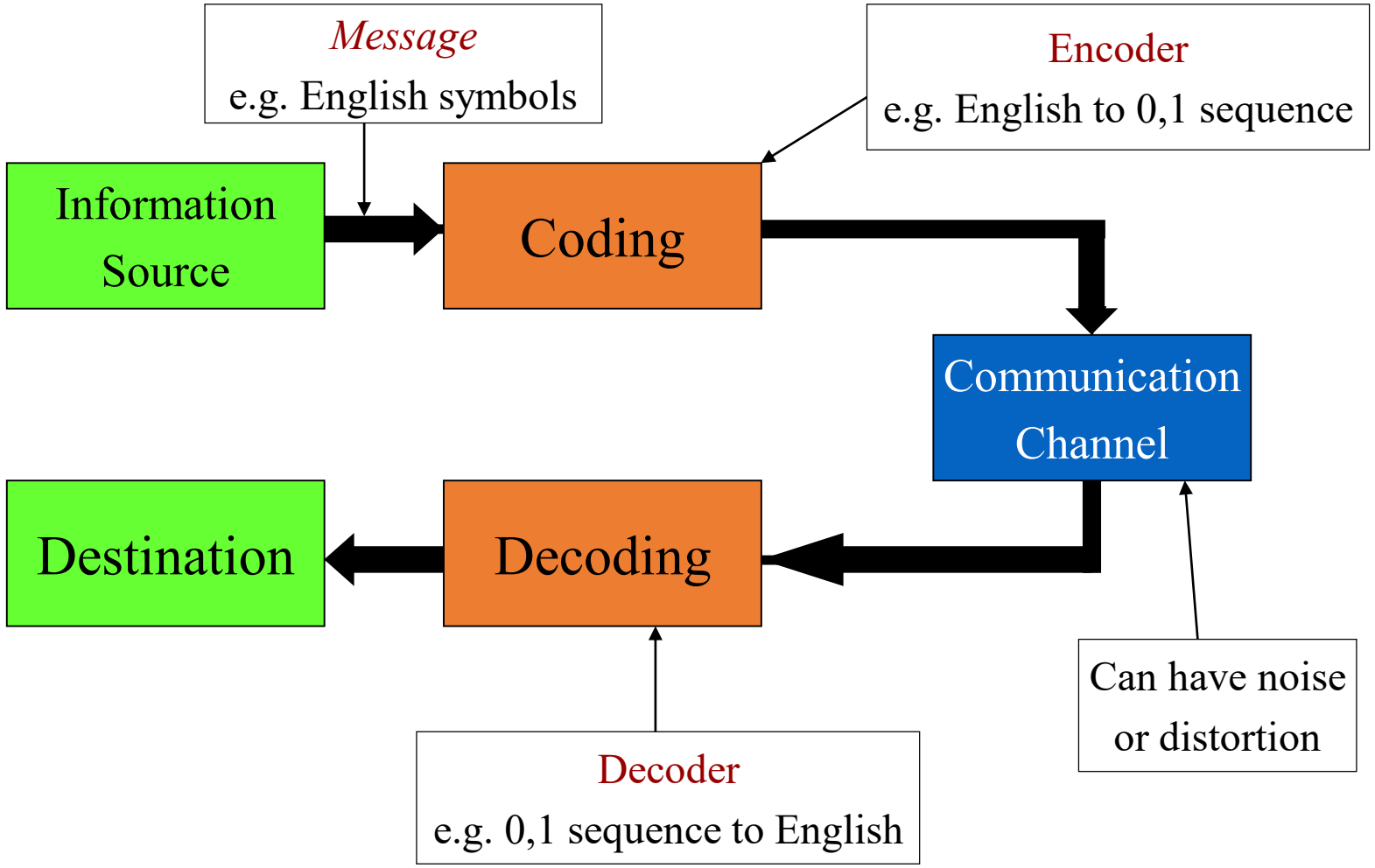
- **What is the purpose** ?
- Transmission of information in an efficient way : *minimum time & space*.
- Today all systems that store, process, or transmit information in ***digital form***, from DVD to Hard disk, from fax machines to Satellites, linguistics, economics, biology, etc., use information theory.

Why we need to study information theory

- Because of the revolution of communication *dealing efficiently* with information and *its transmission, storage, process* becomes a necessary requirement for a *computer communication engineer*.

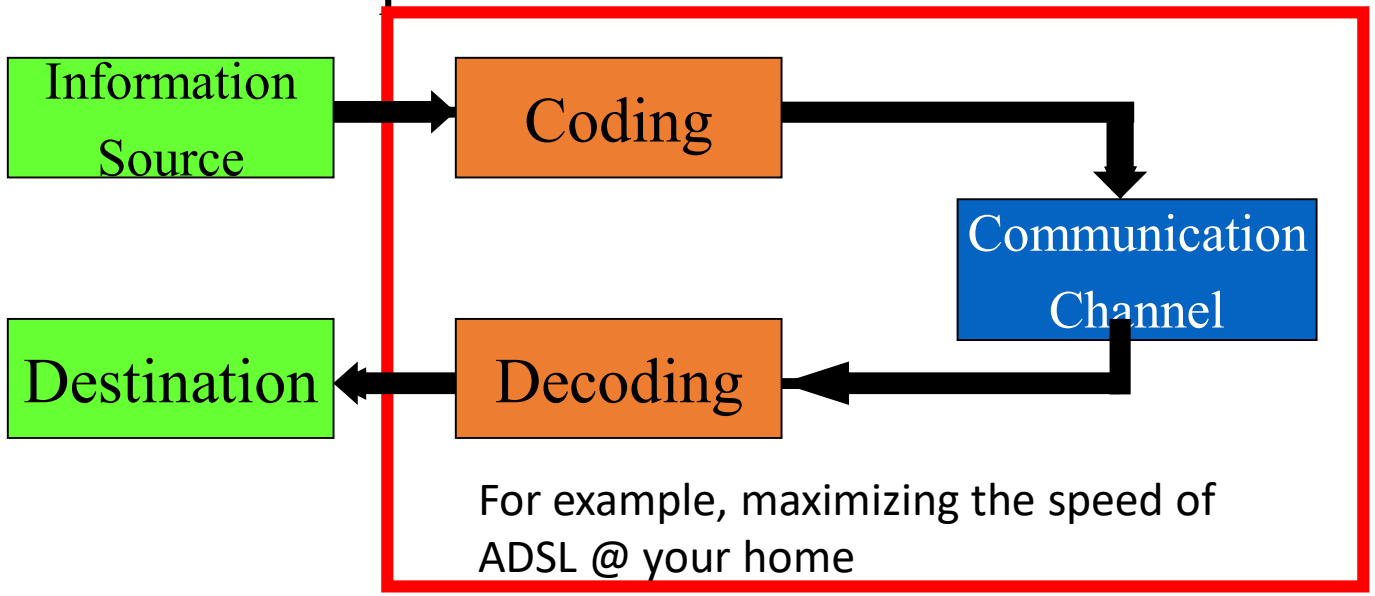
- *Example*: A fair coin, the two possible outcomes, heads and tails, occur with equal probability. [Can we measure it?]
  - Suppose you flip a coin 100000 times and write down the sequence of results. If you want to communicate this sequence to another person, how will you do it?

Story of Information journey

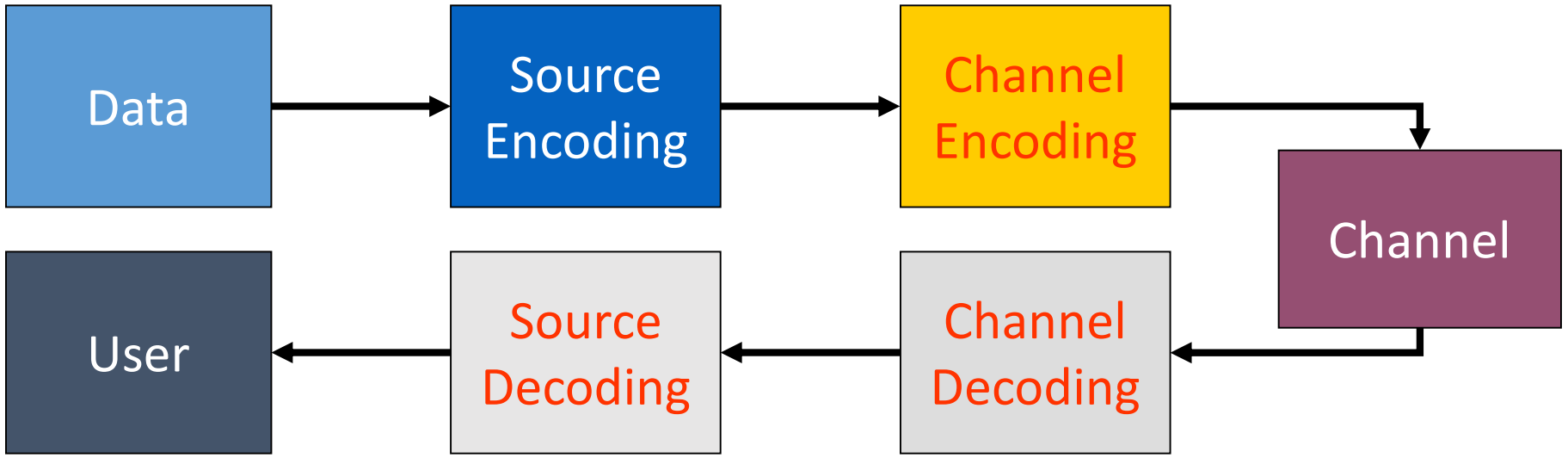


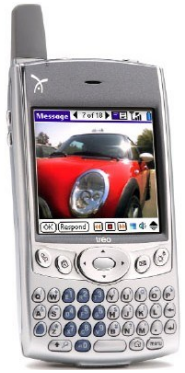
Claude Elwood Shannon

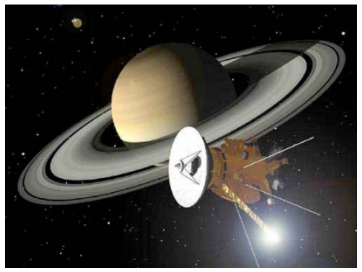
- The *fundamental problem* of communication is that of reproducing at one point either exactly or approximately a message selected at another point.
- Shannon wanted to find a way for "*reliably*" transmitting data throughout the channel at "*maximal*" possible rate.



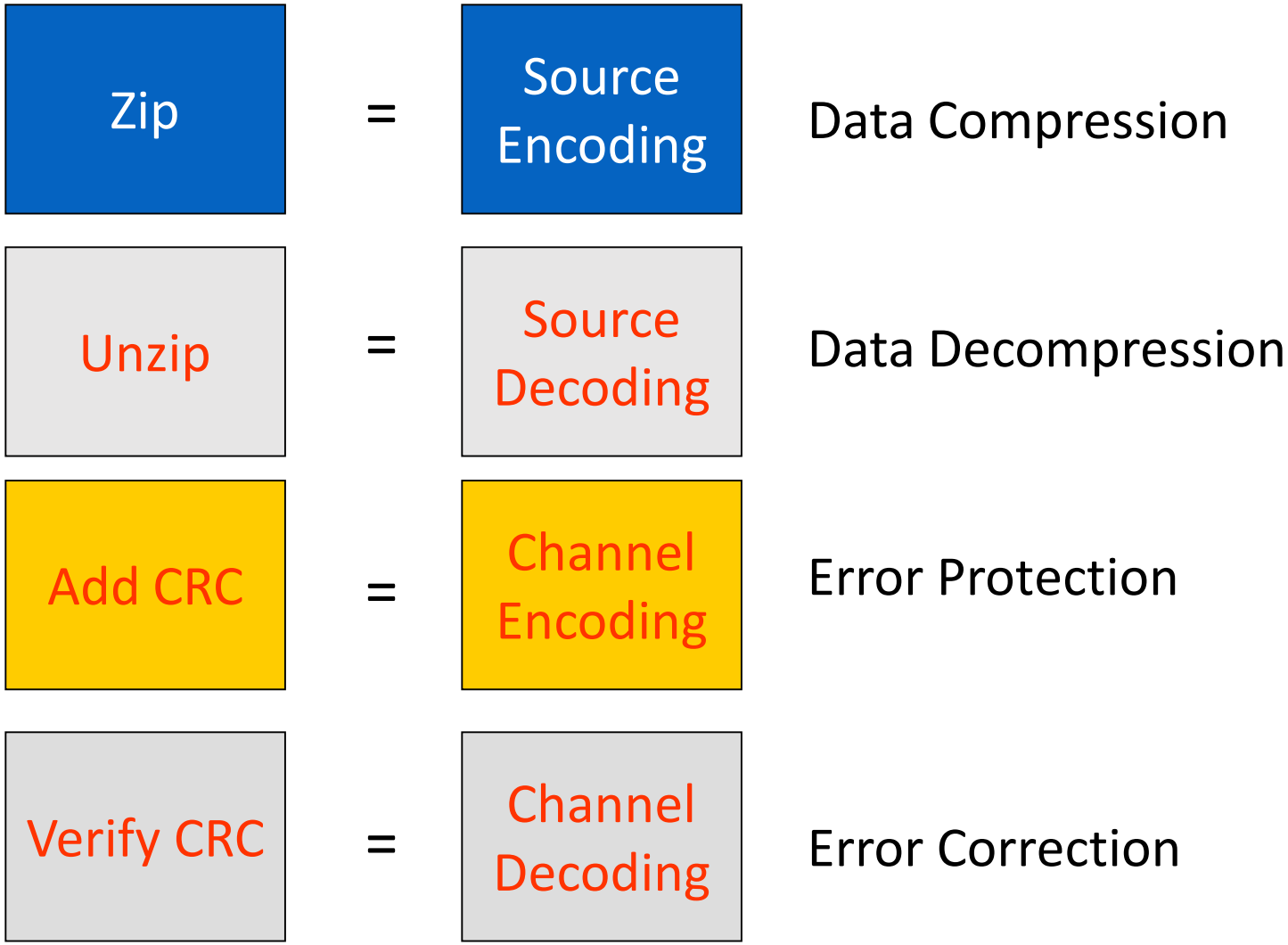
Scenario of Information Theory

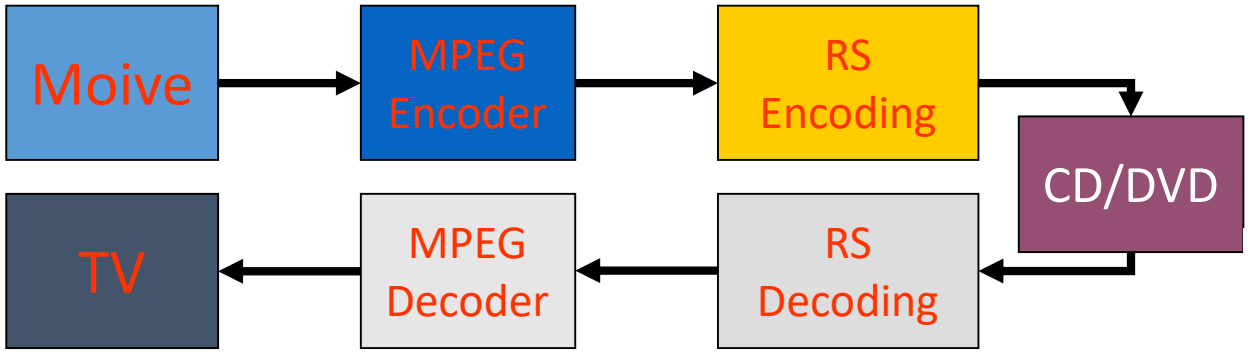


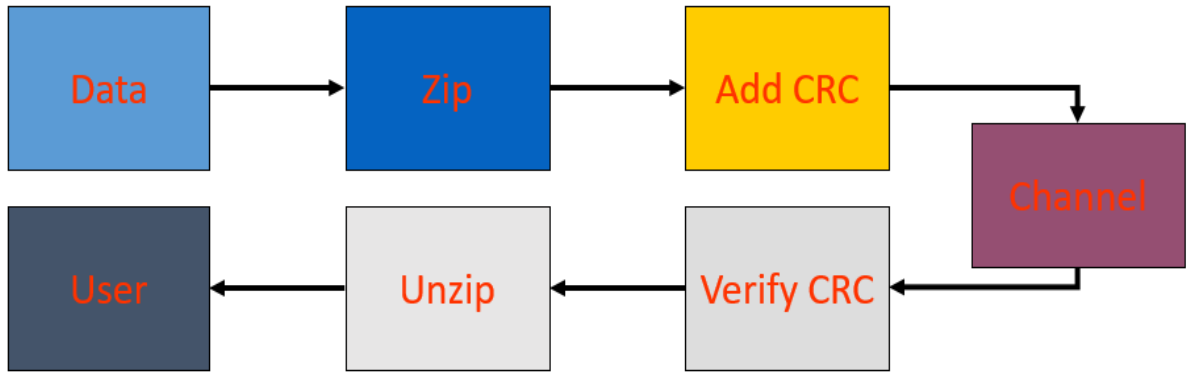

Message
7 of 19
OK
Respond

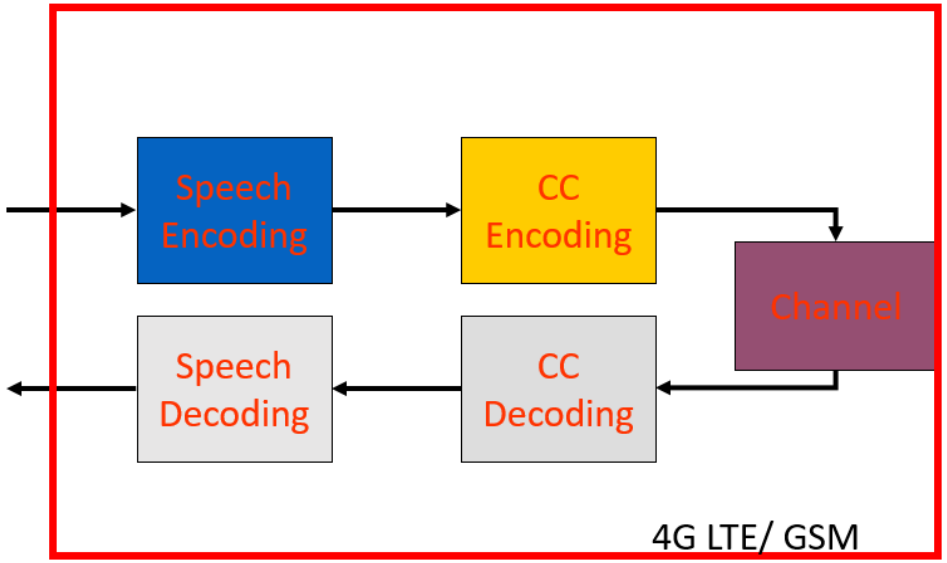


Information Theory Terminology



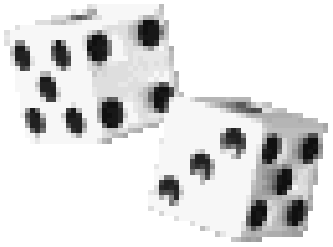

Moive
MPEG Encoder
RS Encoding
CD/DVD
TV
MPEG Decoder
RS Decoding


Data
Zip
Add CRC
Channel
User
Unzip
Verify CRC


Speech Encoding
CC Encoding
Channel
Speech Decoding
CC Decoding
4G LTE/ GSM

Measurement of Information

- "How to measure information in terms of bits?" –Shannon

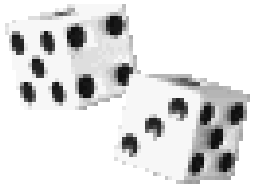


- Are these events digitizable? (can we measure them in 'bits')

Yes ! Let's measure it..

- Shannon showed that there is only one way to measure information in terms of number of bits- using **Probability Theory**.

- *Example*:
- Tossing a dice:
  - Outcomes are 1,2,3,4,5,6
  - Each occurs at probability 1/6



- Tossing a fair coin
  - Outcomes are H, T
  - Each occurs at probability 1/2

- Shannon's theory told engineers how much information could be transmitted over the channels of an ideal system.

- He also spelled out mathematically the principles of data compression, which recognize what the end of this sentence demonstrates, that "only infrmatn esentil to understadn mst b tranmitd".

- He also showed how we could transmit information over noisy channels at error rates we could control.