Unit 3: Data

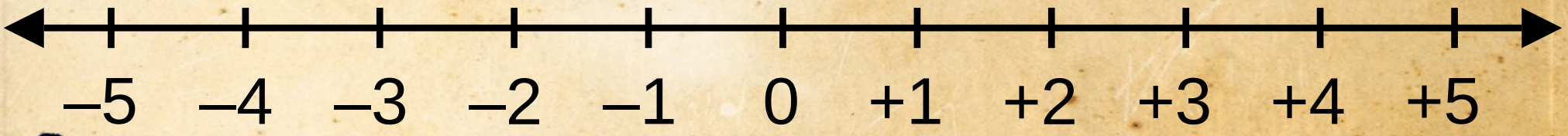
Digital vs Analog

Lecture Contents

- Vocabulary:
  - discrete, continuous, analog, digital
  - transmitter, receiver, repeater

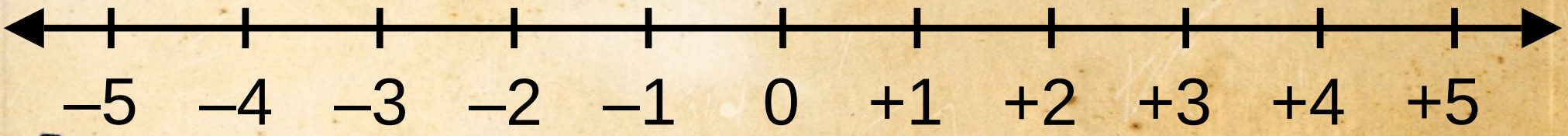
Vocabulary - ***continuous***

- Information that is ***continuous*** can take any value within a range, with no gaps.
  - The real numbers
  - The real numbers between –5 and +5
  - Many natural values: temperature, time, distance, sound volume ...



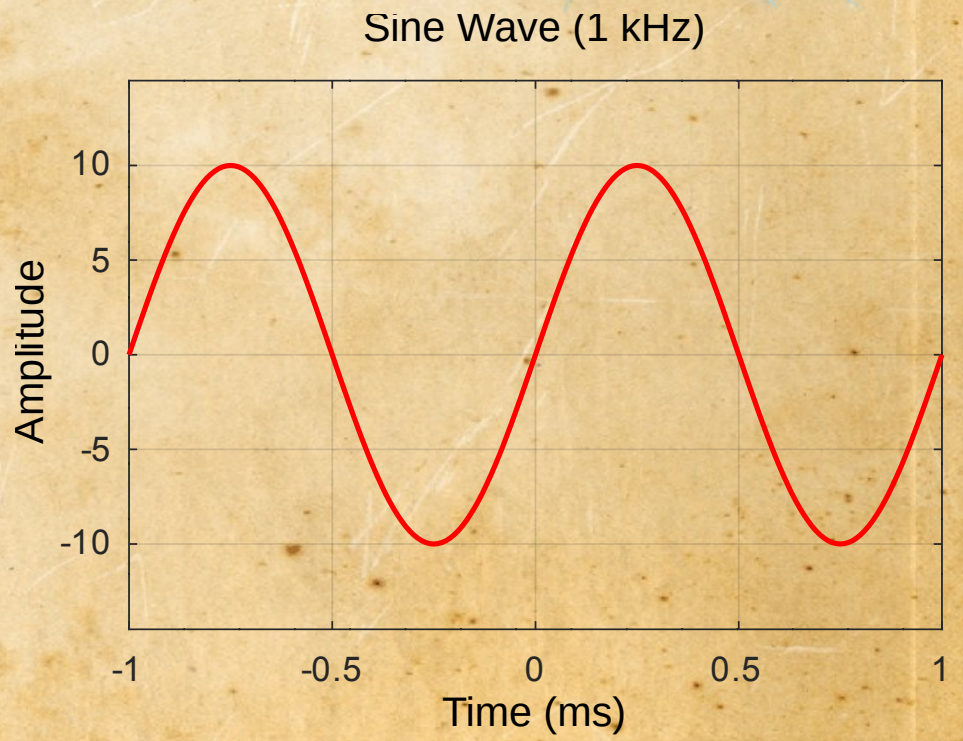
Vocabulary - ***discrete***

- Information that is ***discrete*** takes on only set values within a range, with no gaps.
  - The integers
  - The integers between –5 and +5
  - Things we count: classmates, atomic number, cells, sides on a polygon, …



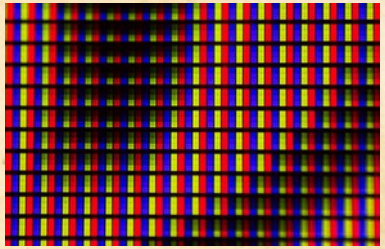
Vocabulary - ***analog***

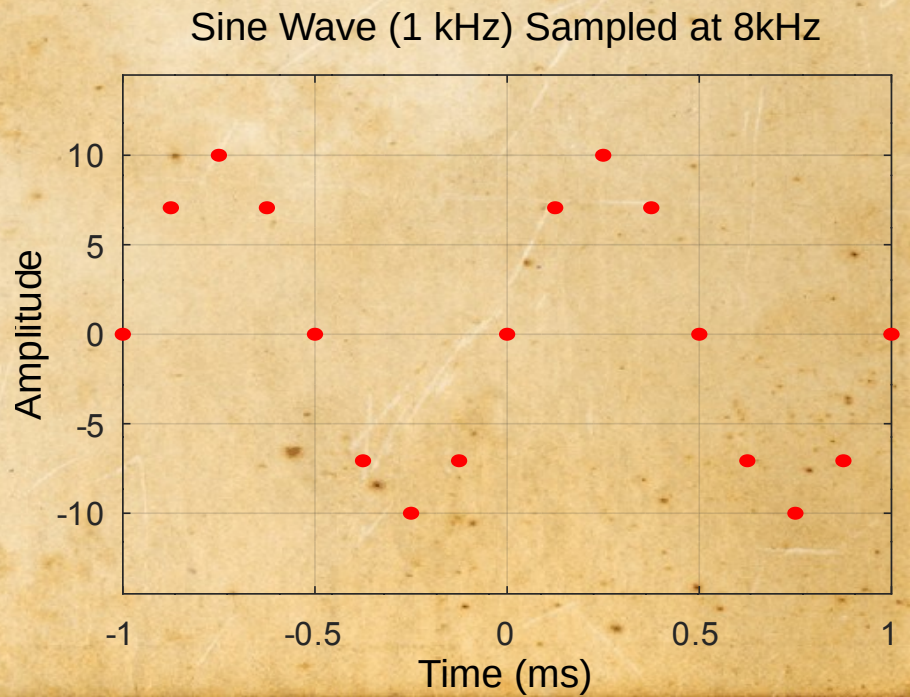
- An ***analog*** signal is represented by values that are ***continuously*** variable.
  - Sound waves (voice), radio waves
  - Electronic voltages and currents
  - Light intensity
  - Paintings, images on film or paper



Vocabulary - ***digital***

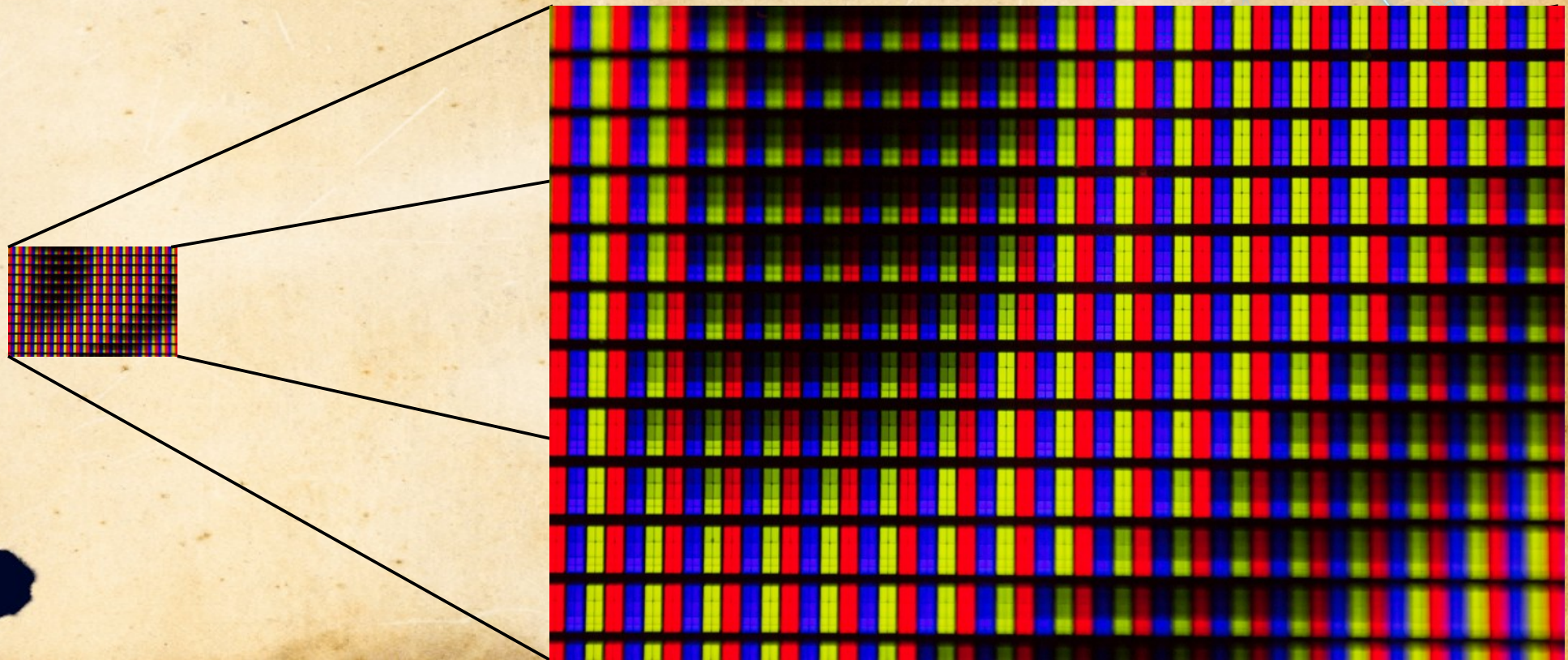
- An ***digital*** signal is represented by a set of ***discrete*** values.
- Real-world analog signals are often converted into digital signals
  - Digital audio, video, photos
    - mp3 audio, mp4 video, jpg, png
  - Digital Computers





Vocabulary - ***digital***

- An ***digital*** signal is represented by a set of ***discrete*** values.



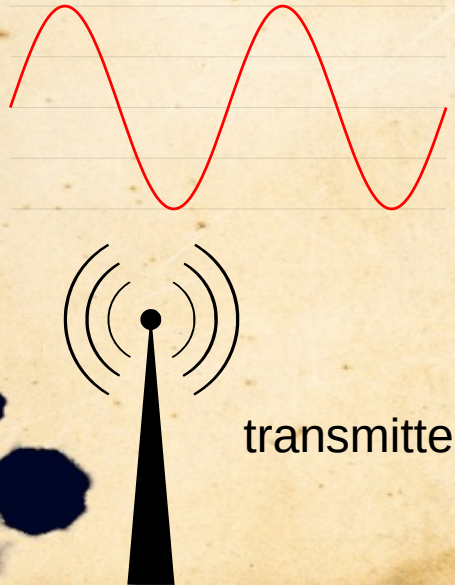
Examples of ***analog*** and ***digital*** devices

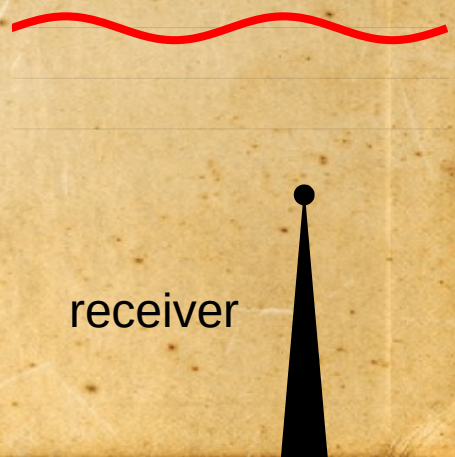
- ***Analog***

- ***Digital***

Noise

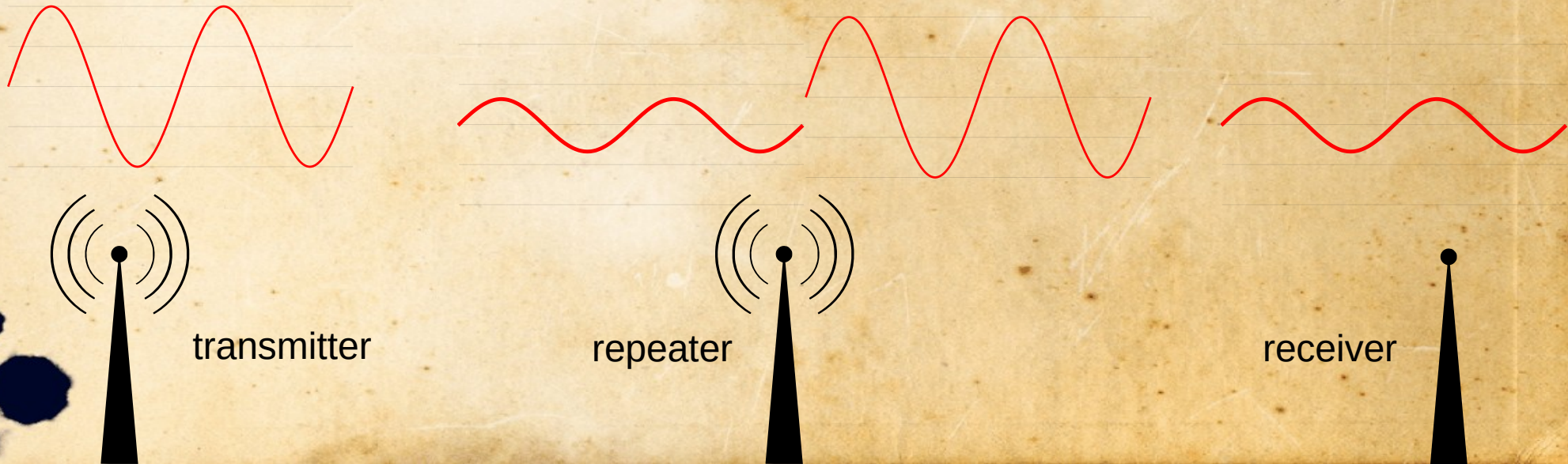
- Transmitted signals lose power as they travel
  - There is a limited distance we can transmit





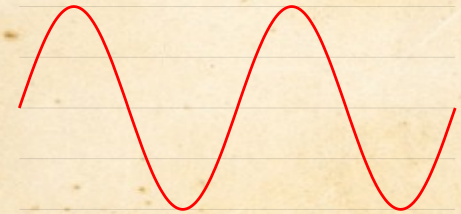
Noise

- Transmitted signals lose power as they travel
  - We can send further by receiving the signal and re-transmitting it.
  - This is done by a ***repeater***.



Noise

- Unfortunately, when we also receive noise.
  - Noise is from weather, outer space, interference, the circuitry, etc...

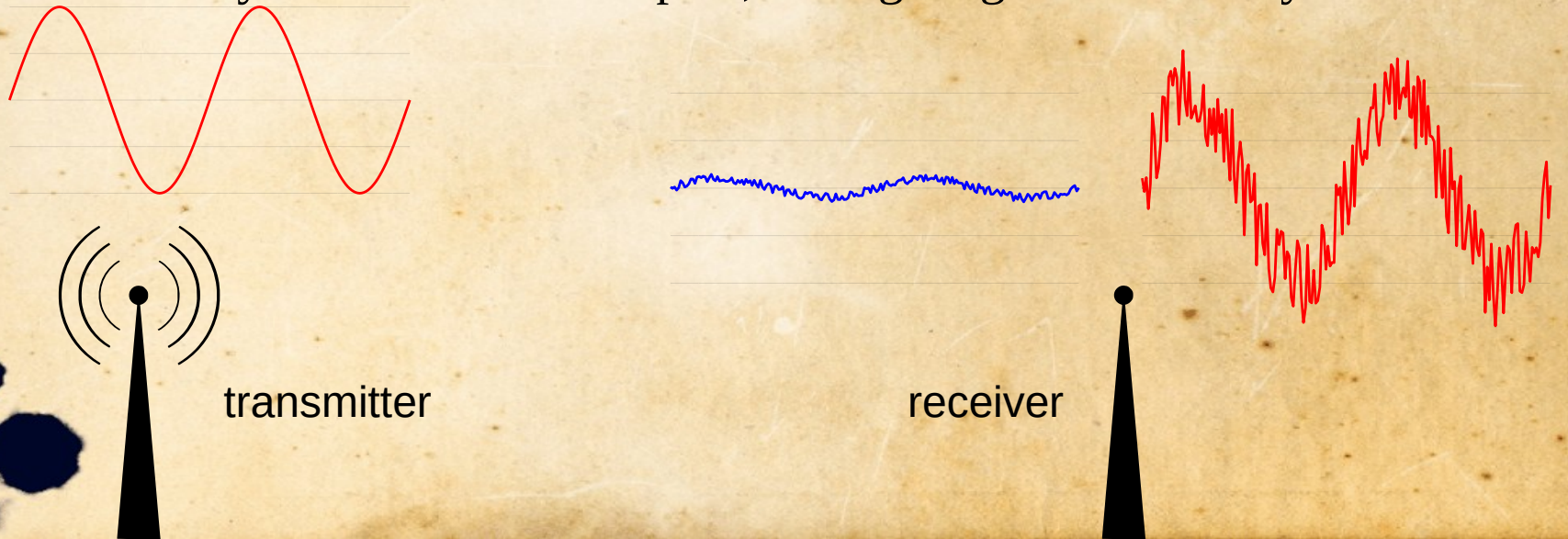


transmitter

receiver

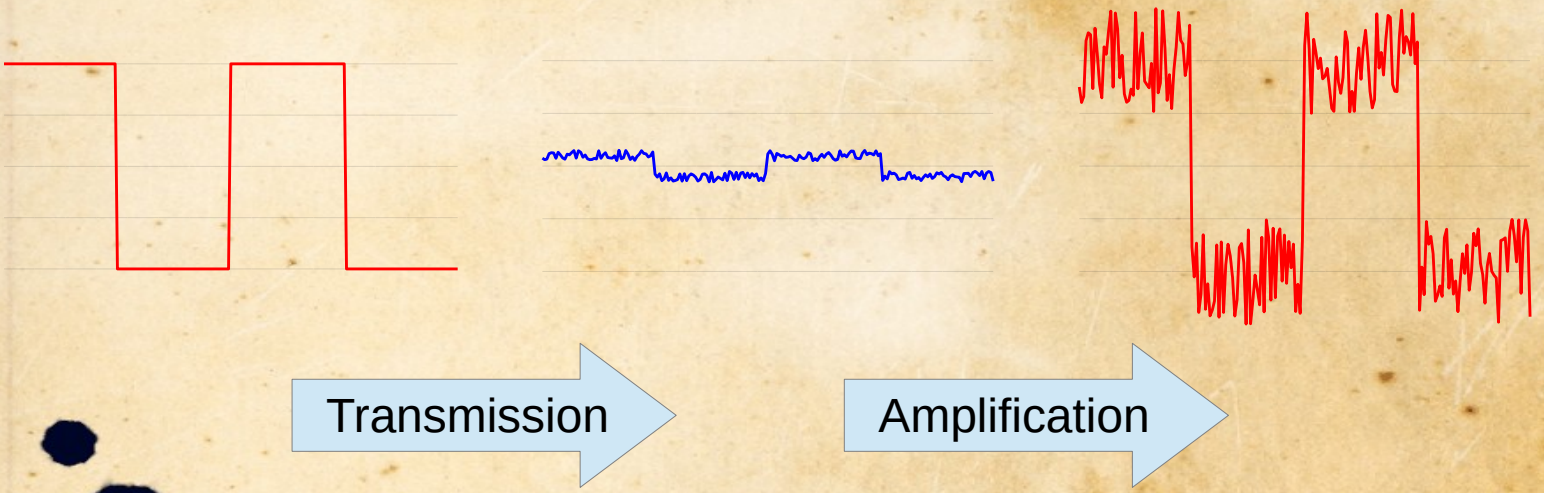
Noise

- Unfortunately, when we also receive noise.
  - Noise is from weather, outer space, interference, the circuitry, etc...
  - When we amplify the signal, we also amplify the noise.
  - Every time we need to repeat, the signal gets more noisy.



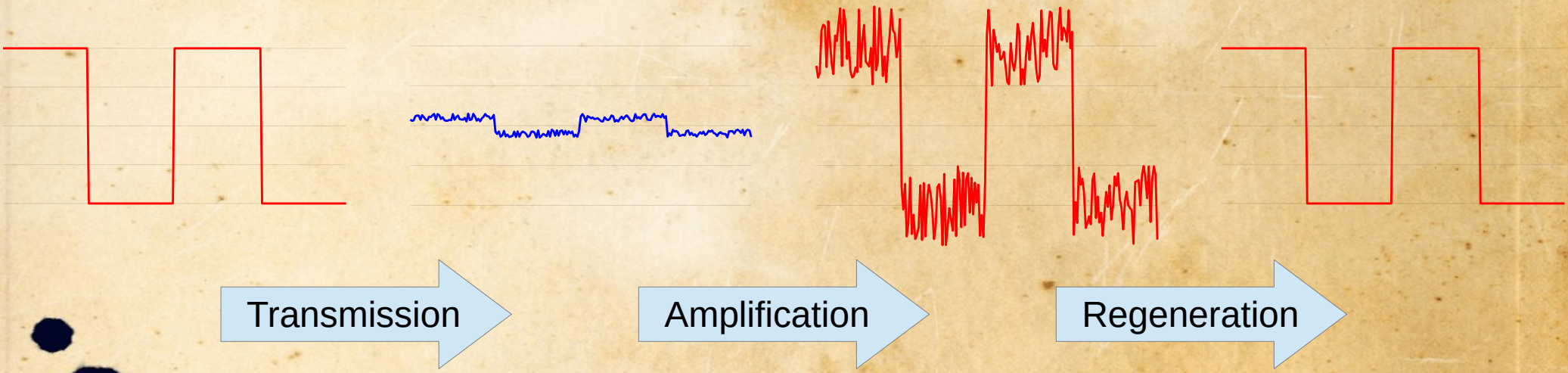
Noise

- Digital signals also pick up noise…



Noise

- Digital signals also pick up noise…
  - But with a ***digital repeater***, we can ***regenerate*** the original signal because only certain values are valid.



With a ***digital repeater***, we get a clean, fresh copy of the original signal!

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