Multimedia Systems

WS 2009/2010

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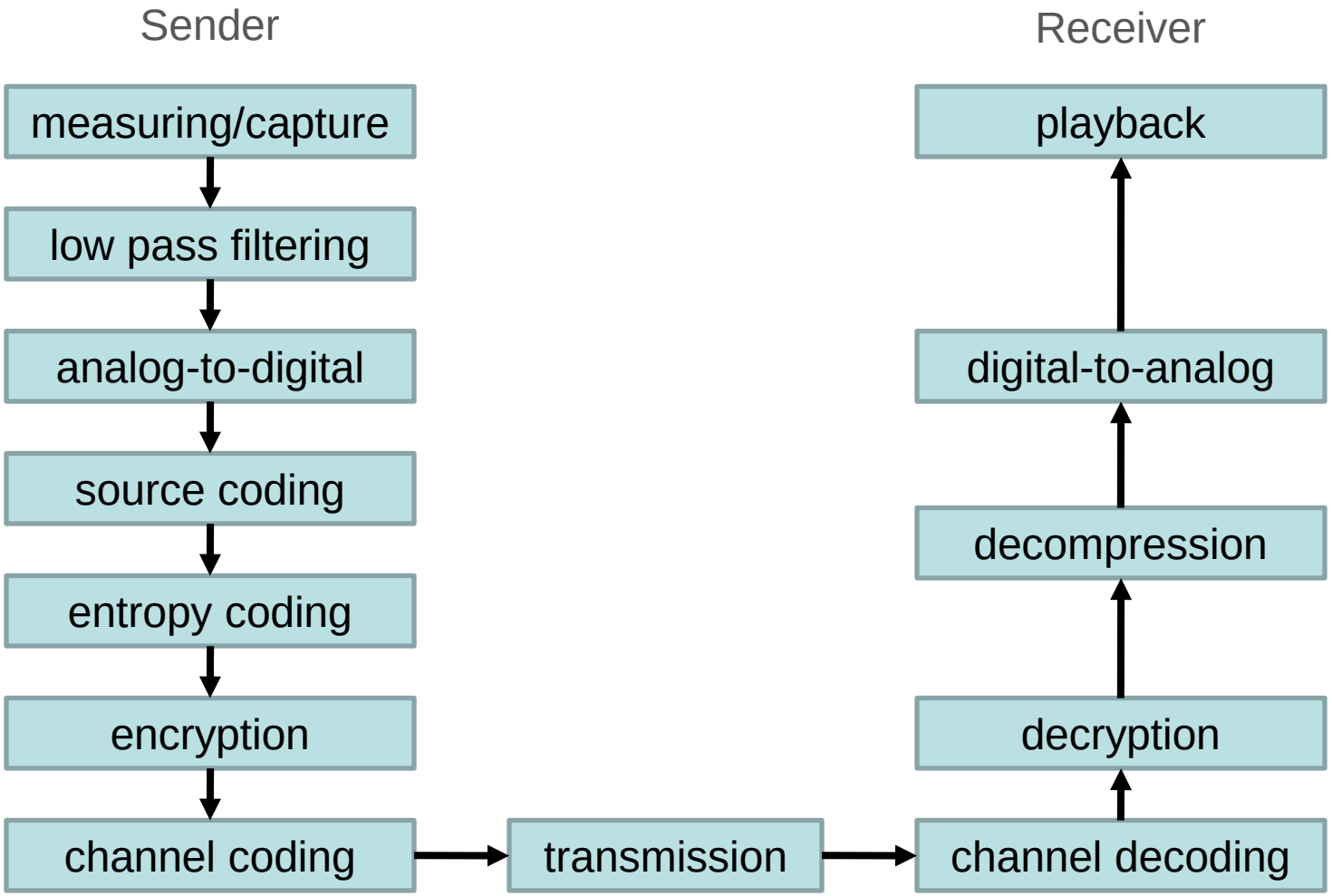
Exercise 8.1

A voice signal is to be transmitted in a digital way. The message is confidential so the transmission has to be encrypted.

1. Put the following steps in an appropriate order:
   - analog-to-digital, decompression, digital-to-analog, entropy coding, decryption, channel decoding, channel coding, measuring/capture, source coding, low pass filtering,transmission, encryption, playback

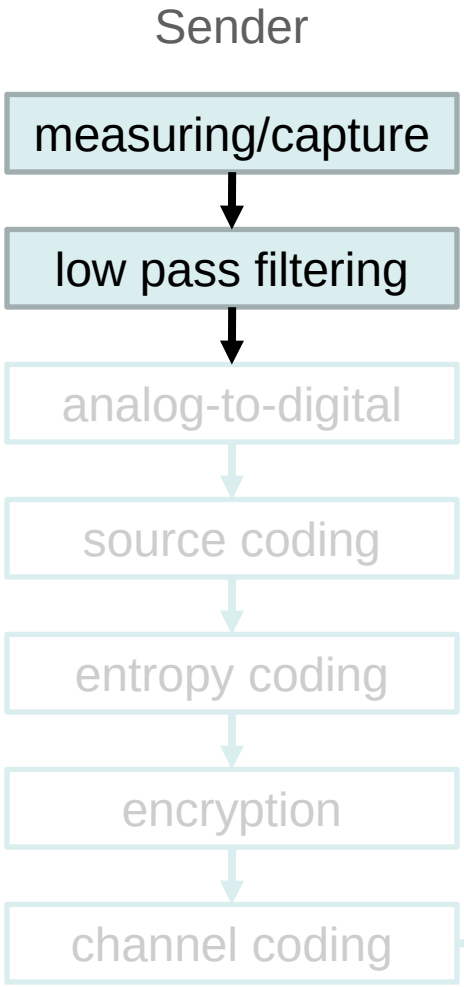
Exercise 8.1



Exercise 8.2

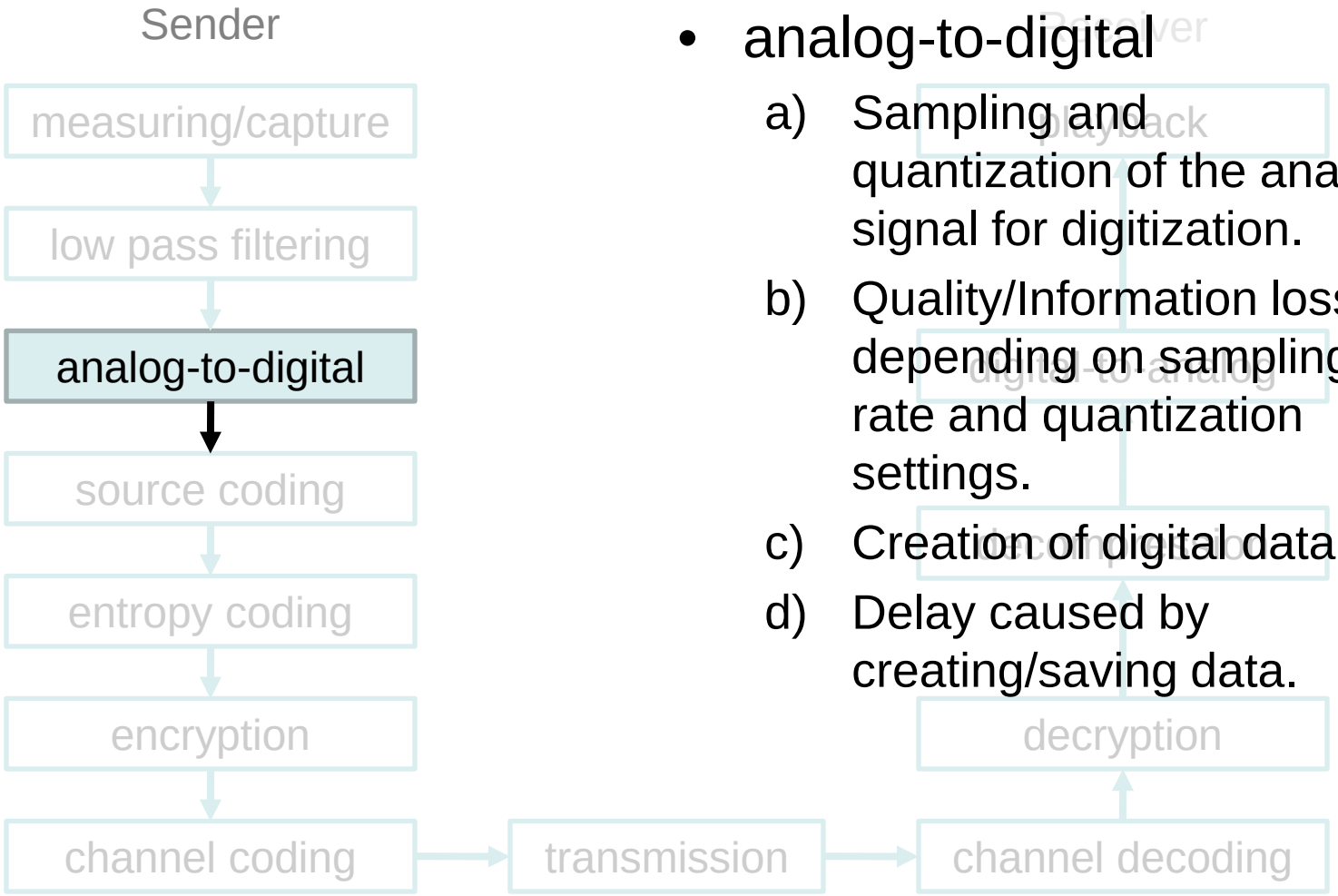
2. For each step:
   a) Describe in one sentence what happens in this step.
   b) Do we have an information/quality loss in this step? Give a short reason.
   c) Does this step change the size of data being processed? Give a short reason.
   d) What is the (qualitative) delay caused by this step?

Exercise 8.2



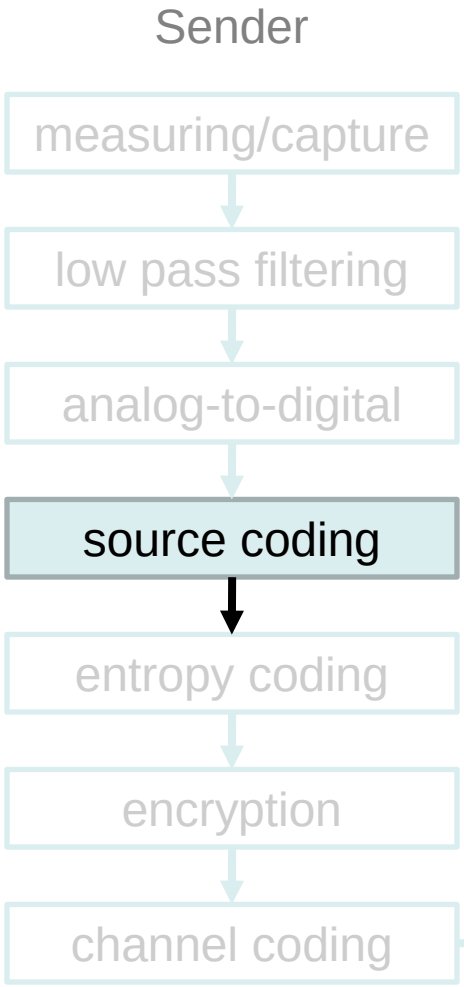
- measuring/capture
  a) Analog capture of an environmental signal.
  b) Quality loss by sensor limitations.
  c) “Data” loss by sensor limitations.
  d) Sensor inertia.
- low pass filtering
  a) Analog filtering of high frequencies.
  b) Information loss of high frequencies.
  c) “Data” is reduced.
  d) None to small by realization.

Exercise 8.2



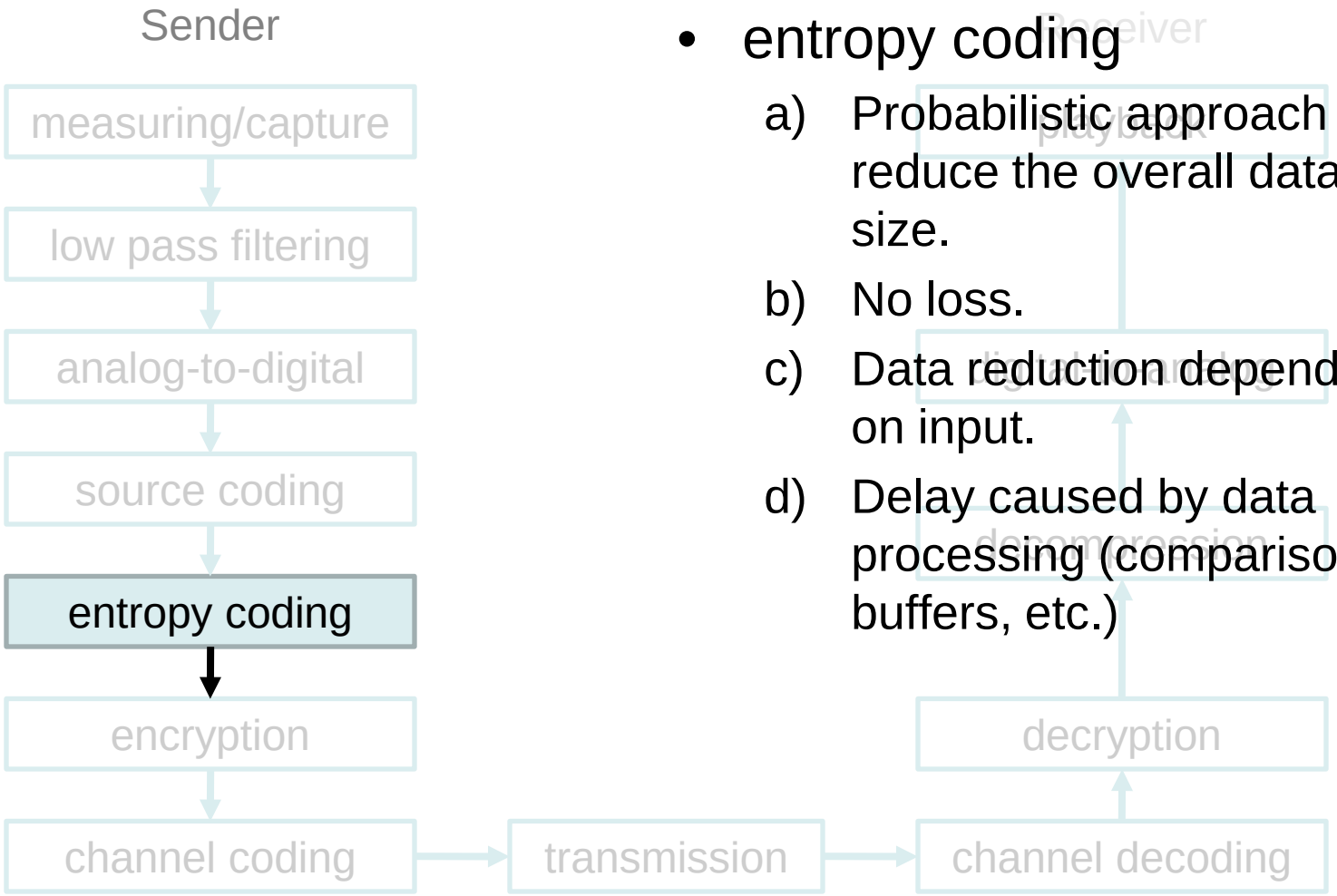
- analog-to-digital
  a) Sampling and quantization of the analog signal for digitization.
  b) Quality/Information loss depending on sampling rate and quantization settings.
  c) Creation of digital data.
  d) Delay caused by creating/saving data.

Exercise 8.2



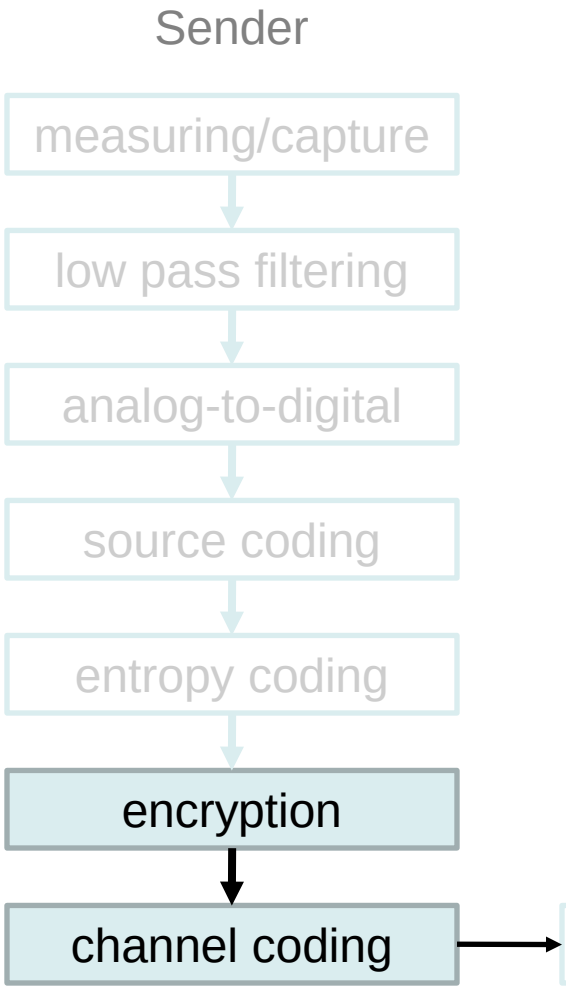
- source coding
  a) Coding the raw data based on it's specific properties.
  b) Possible quality/information loss by
     - sub sampling
     - quantization
     - rounding errors
  c) Resulting data size depends on technique and information loss.
  d) Delay caused by data processing (e.g. space transformations, buffers).

Exercise 8.2



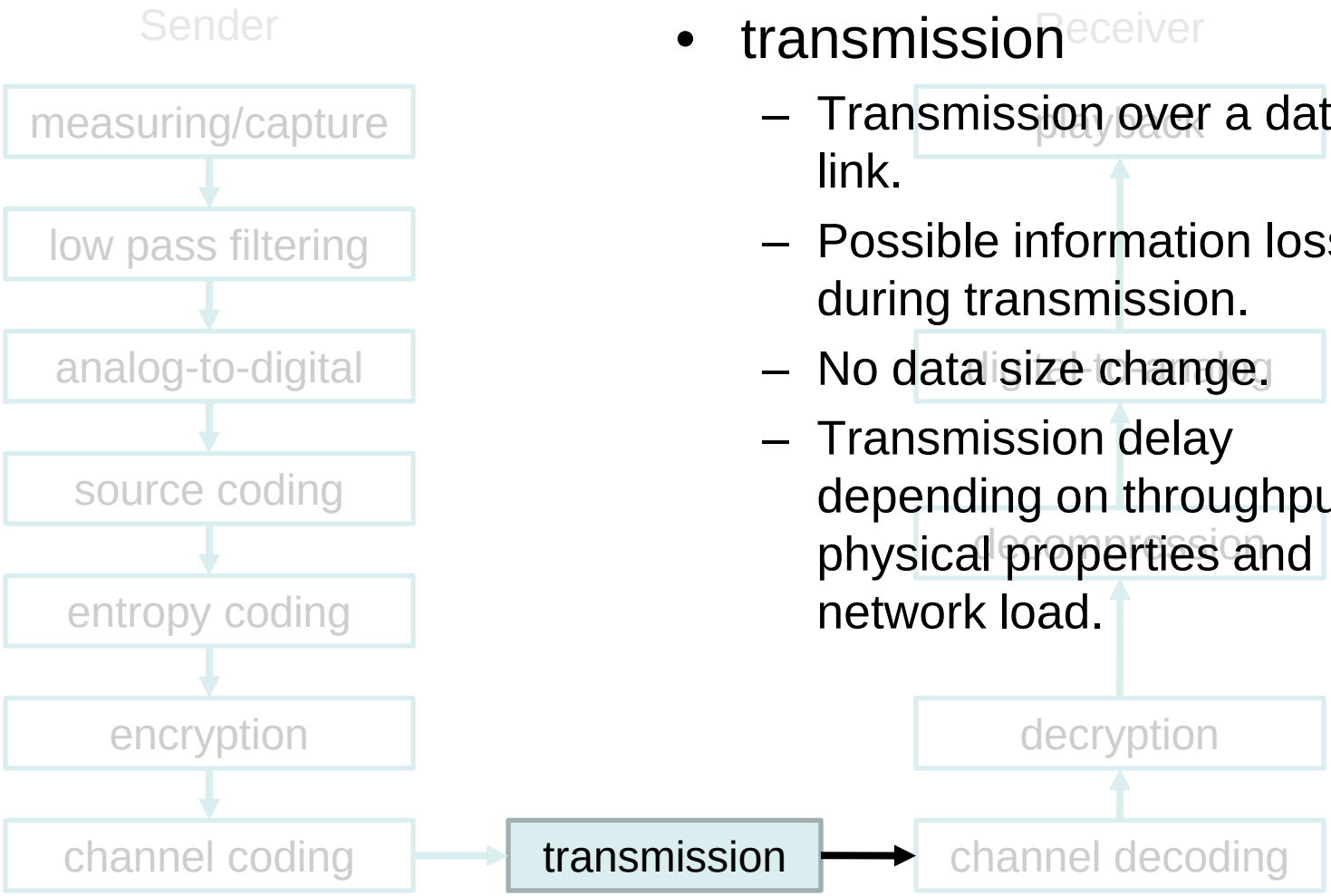
- entropy coding
  a) Probabilistic approach to reduce the overall data size.
  b) No loss.
  c) Data reduction depending on input.
  d) Delay caused by data processing (comparisons, buffers, etc.)

Exercise 8.2



- encryption
  - Encryption of the data to prevent unauthorized access/manipulation.
  - No loss.
  - Possible increase of data depending on algorithm.
  - Delay caused by data processing
- channel coding
  - Prepare the data for transmission, e.g. by FEC and bit interleaving.
  - No loss.
  - Operational overhead increases data size.
  - Delay caused by data processing

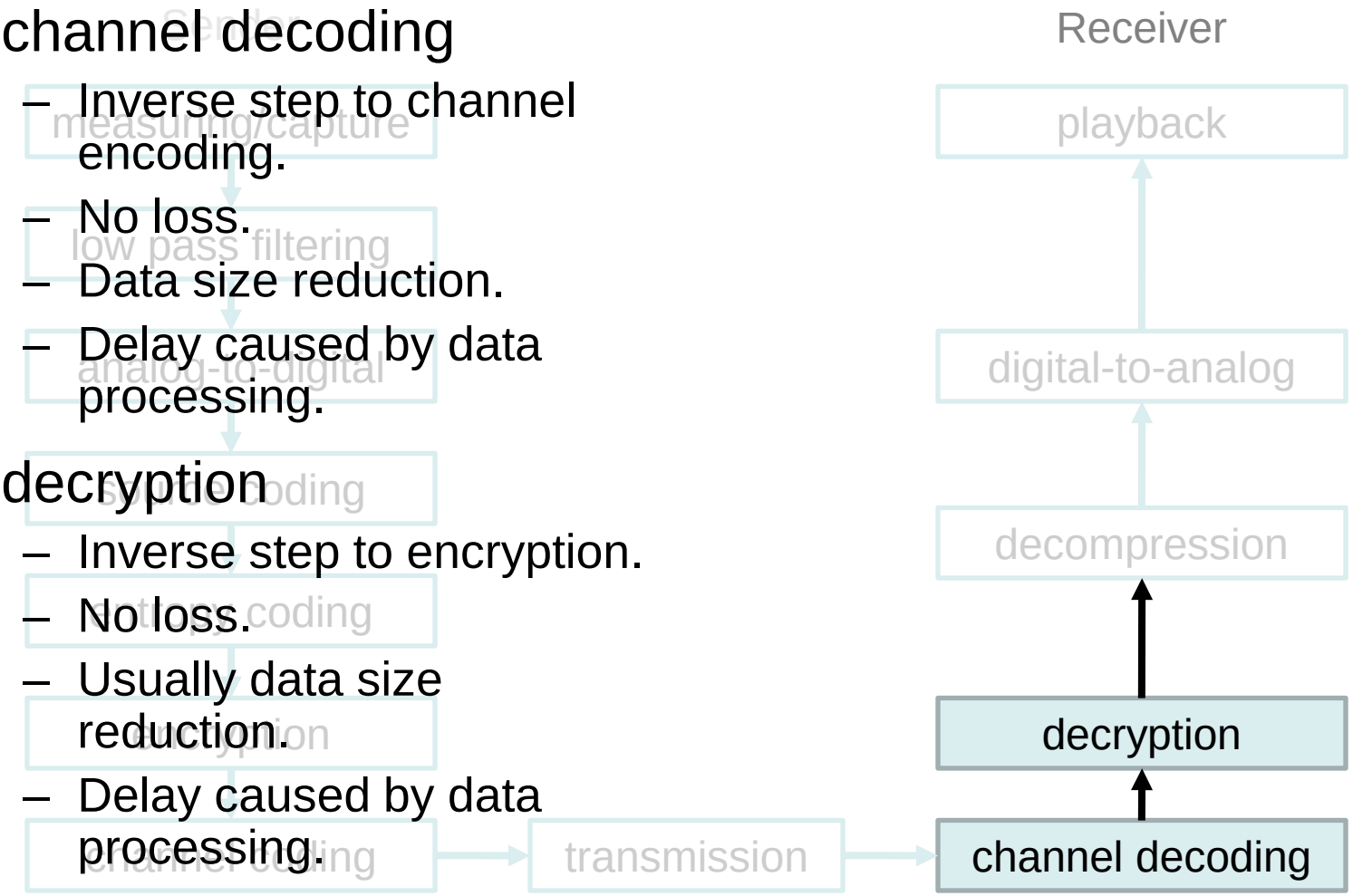
Exercise 8.2



- transmission
  - Transmission over a data link.
  - Possible information loss during transmission.
  - No data size change.
  - Transmission delay depending on throughput, physical properties and network load.

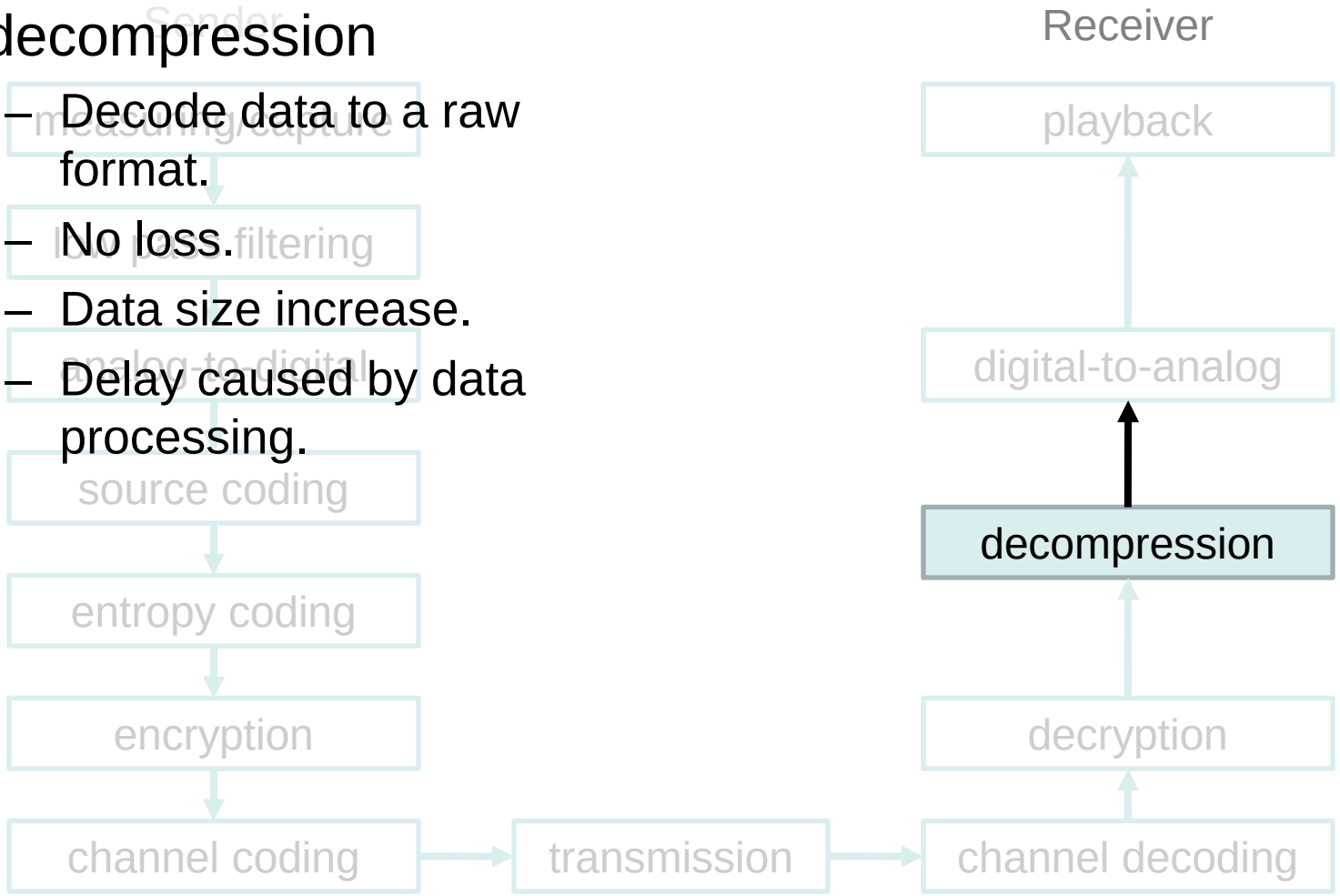
Exercise 8.2

- channel decoding
  - Inverse step to channel encoding.
  - No loss.
  - Data size reduction.
  - Delay caused by data processing.
- decryption
  - Inverse step to encryption.
  - No loss.
  - Usually data size reduction.
  - Delay caused by data processing.



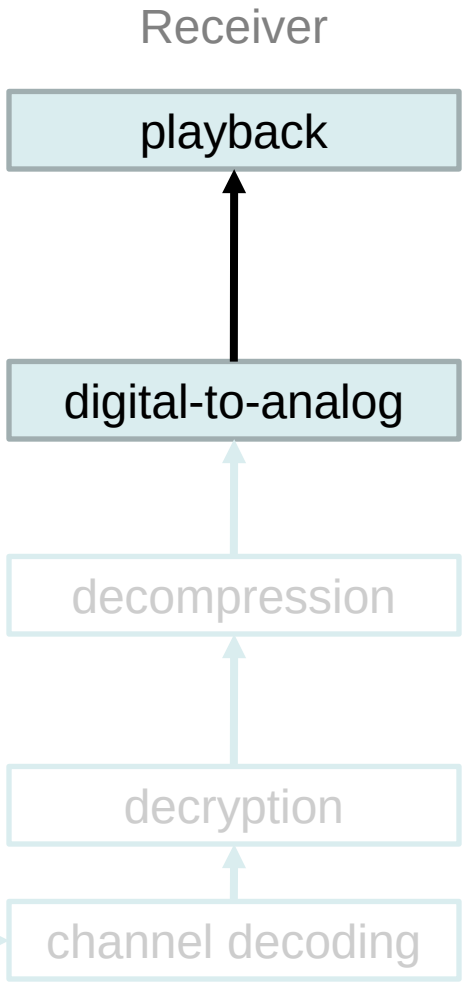
Exercise 8.2

- decompression
  - Decode data to a raw format.
  - No loss.
  - Data size increase.
  - Delay caused by data processing.



Exercise 8.2

- digital-to-analog
  - Create a analog signal based on the given input.
  - Possible quality loss depending on technical limitations.
  - Creation of analog signals.
  - Possible small processing delay.
- playback
  - Create an environmental signal based on analog input.
  - Quality loss depending on playback hardware.
  - Transformation to sound pressure.
  - None.



Questions