Multimedia Systems

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Outline

- Note: Introduction
  - Persons and their contribution to the history of multimedia
  - Types of Media
  - Essential Elements of Multimedia
  - Multimedia Advantages: Individuality
- Digitization
- Decibel

Questions

1. Persons and their contributions to the history of multimedia
2. Presentation dimensions
3. General type of media
4. Presentation space and value classes
5. A technical and a content based definition of multimedia
6. Essential elements of multimedia
7. What does simulation mean?

Persons and their contributions to the history of multimedia

- 1945 Vannevar Bush
  - MEMEX (“Memory Expansion”)
  - Pioneer of multimedia
- 1958 Douglas C. Engelbart
  - Visionary of connectivity, accessibility and collaboration
  - Inventor of the computer mouse
  - “Mother of all Demos”
- 1968 Ted Nelson
  - XANADU as first hypermedia concept
- 1989 Tim Berners-Lee
  - Inventor of WWW and HTML

Types of Media

- The term "medium":
  - Medium for perception (Perzeptionsmedium)
    - How does a human perceive information?
    - human sense organs
  - Medium for representation (Repräsentationsmedium)
    - How is the information coded (inside the computer)?
    - ASCII, JPEG, ...
  - Medium for presentation (Präsentationsmedium)
    - How is the information captured by the computer? How is it displayed?
    - keyboard, scanner, speaker, display, …
  - Medium for storage (Speichermedium)
    - Where is the information stored?
    - paper, hard disk, RAM, …
  - Medium for transmission (Übertragungsmedium)
    - How can (continuous) data been transferred?
    - coaxial cable, fiber, …
  - Medium for information exchange (Informationsaustauschmedium)
    - How can information be exchanged between to locations?
    - mobile storage devices, cable, …

Presentation Spaces, Values, and Dimensions

- Presentation spaces (Darstellungsräume)
  - Where is the information displayed?
  - paper, display, …
- Presentation values (Darstellungswerte)
  - text → symbols, voice → pressure waves, …
- Presentation dimensions (Darstellungsdimensionen)
  - Value
  - Spatial
  - Temporal

Essential Elements of Multimedia

Essential Elements

- Immersion
- Interdisciplinarity
- Hypermedia
- Interactivity
- Narrativity

http://www.w2vr.com/

Multimedia Advantages: Individuality

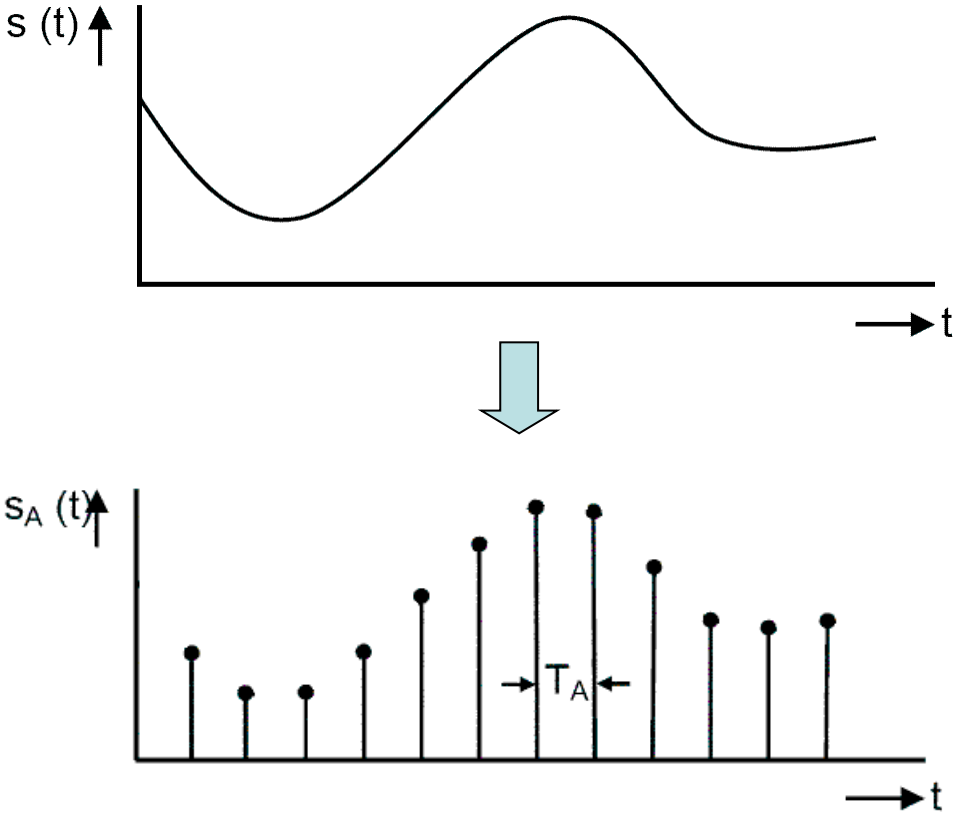
- Google & Amazon vs. New York Times
  - Fictional history report about information development until 2014
  - Only one perspective!
  - http://idorosen.com/mirrors/robinsloan.com/epic/

Digization

- Also known as A/D-Conversion
- Starting basis: amplitude and/or time continuous signal
- Goal: value and time discrete signal
- Steps
  1. Sampling
  2. Quantization
- Claim: minimization of errors

Sampling (Abtastung)

- Capture continuous signal in discrete intervals.



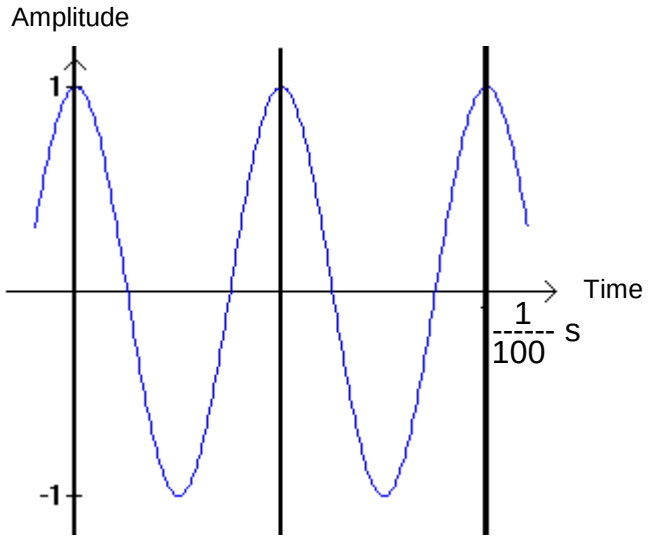
Sampling

- Nyquist–Shannon sampling theorem

  A signal with a maximum frequency (Nyquist-Frequency, Grenzfrequenz) f_{max} has to be sampled with a minimal frequency of $f_a=2*f_{max}$ to allow an accurate reconstruction of the original signal.

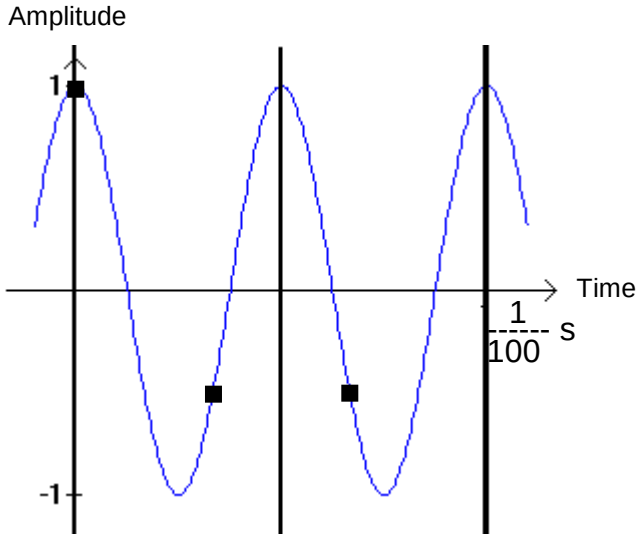
Sampling (Aliasing)

- signal with f_s=200 Hz



Sampling (Aliasing)

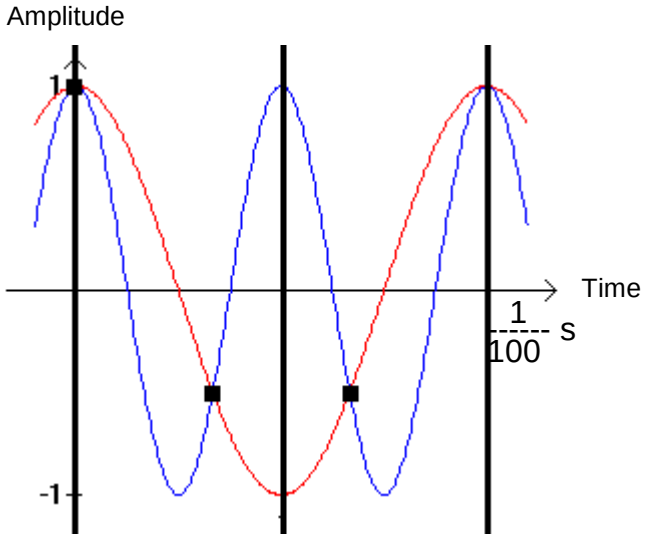
- signal with f_s=200 Hz
- sampling rate of f_a=300 Hz



→ Maximum frequency of chosen sampling rate is $f_g = f_a/2 = 150$ Hz

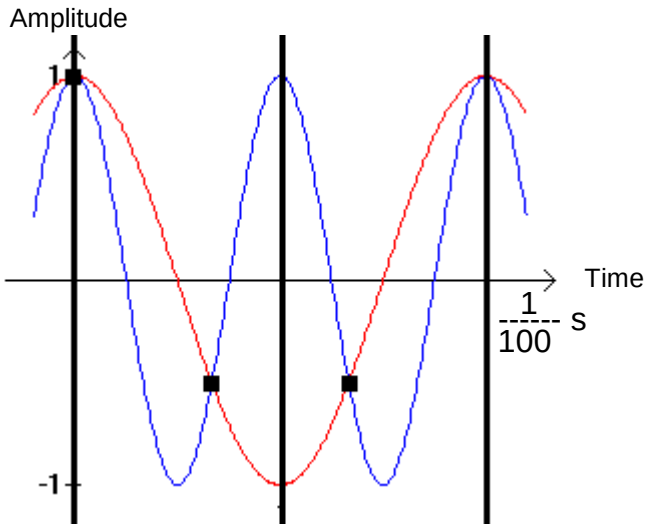
Sampling (Aliasing)

- signal with f_s=200 Hz
- sampling rate of f_a=300 Hz

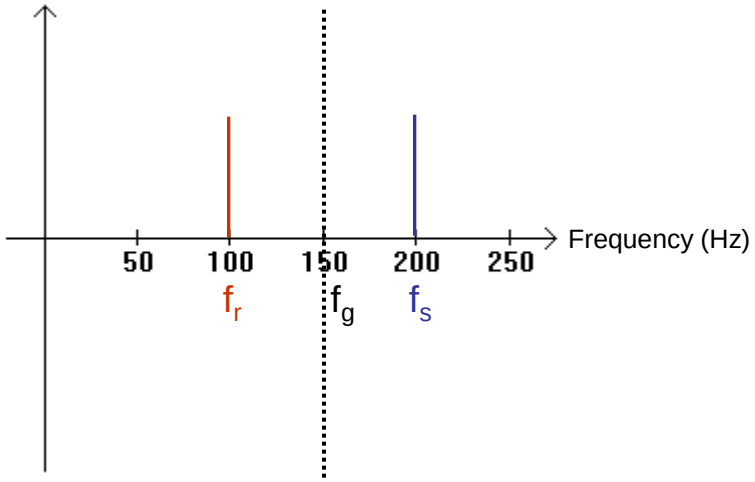


→ Maximum frequency of chosen sampling rate is $f_g = f_a/2 = 150$ Hz
→ Reconstruction results in a the signal with $f_{s'} = 100$ Hz

Sampling (Aliasing)



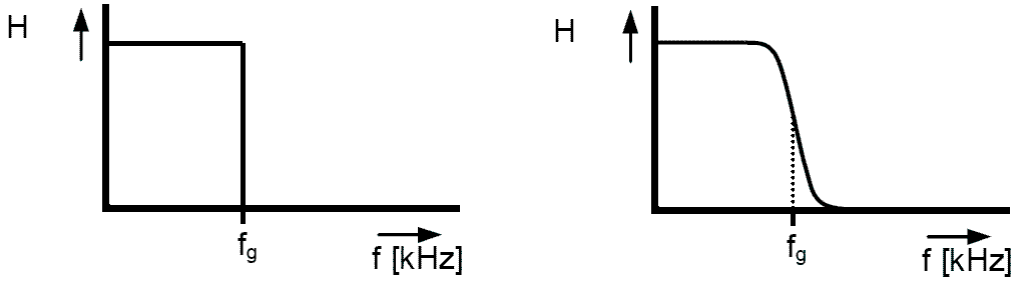
Time Domain



Frequency Domain

Sampling (Oversampling)

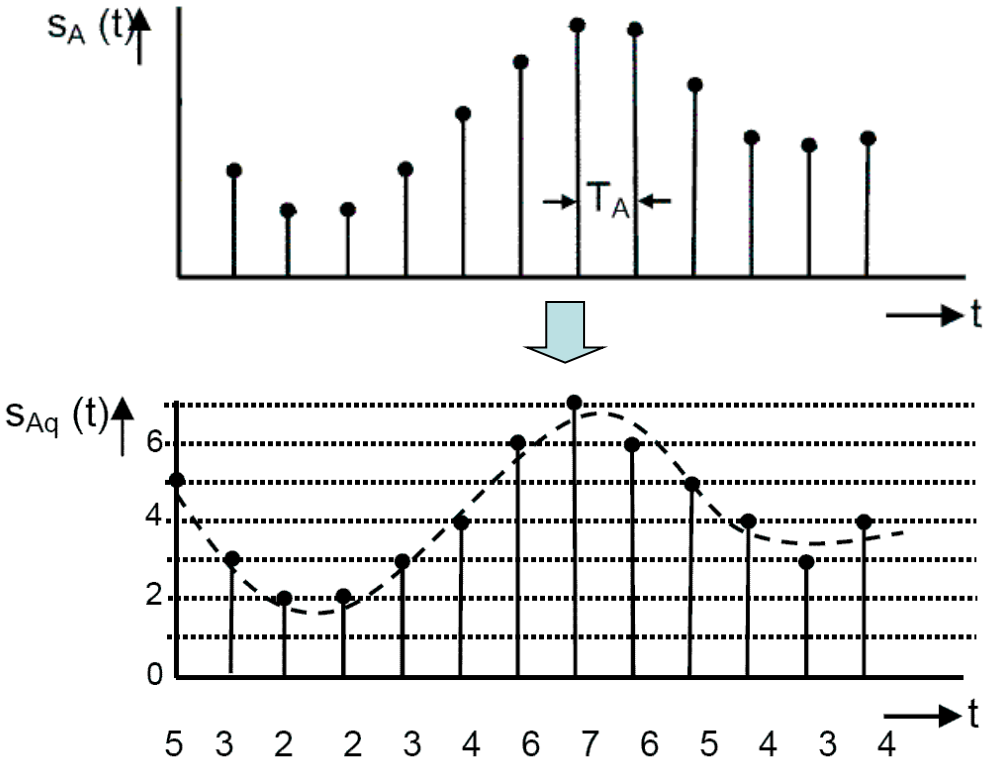
- Theoretically no advantages
- Usage scenario: Non-optimal filters
  - Ideal vs. real low-pass filter



- Disadvantages
  - no quality gain
  - more storage space & higher data rates are required

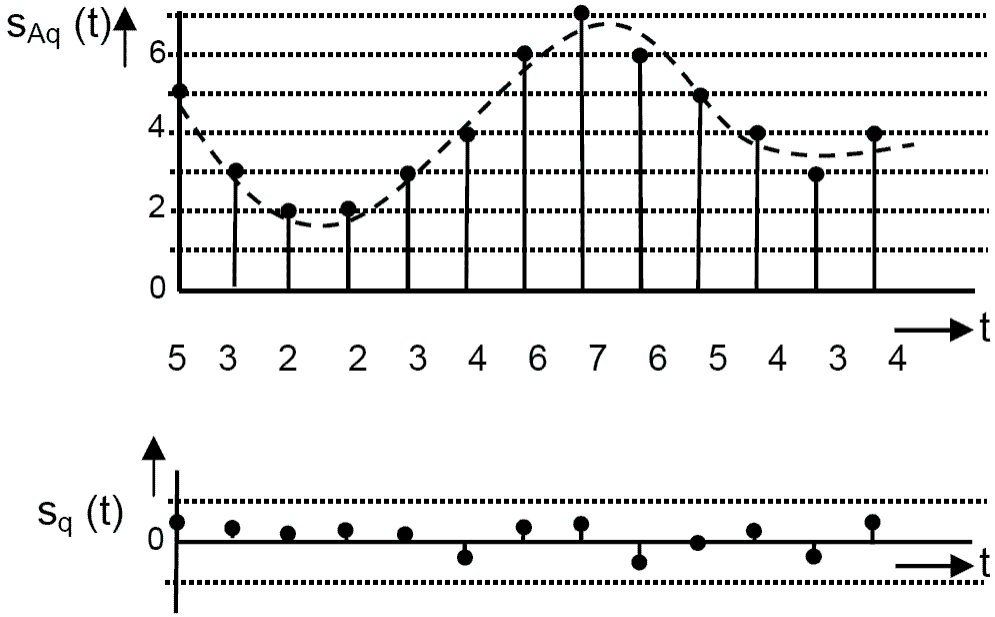
Quantization (Quantisierung)

- Transform signal with continuous values into a signal with discrete values



Quantization Error

- Quantization error



Quantization Error

- Balance between low & high quantization error
  - Low quantization error
    - high bit rate & storage consumption
    - high quality
  - High quantization error
    - low bit rate & storage consumption
    - low quality

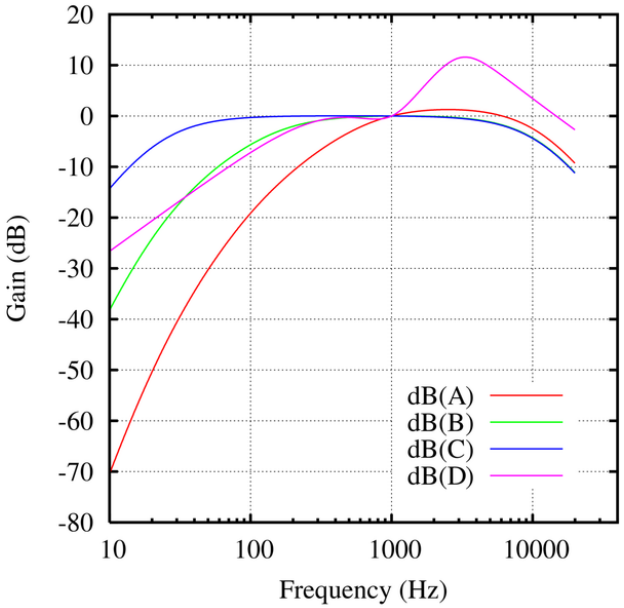
Decibel

$$dB = 10 \log_{10}\left(\frac{I}{I_0}\right)$$

- Tenfold of the common logarithm on the ratio of intensities (on an area) or powers.
- A specification in decibel is always related to a reference value!
- Comfortable unit for acoustics
  - Scale of sound pressure is strongly related to human loudness perception.
  - Well suited for proportions in the technical area.
  - Amplification (Verstärkung) and damping (Dämpfung) can be calculated with addition and subtraction.

Decibel (Examples)

- dB(SPL)
  - often simplified: dB
  - sound pressure level
    - Measurement unit: pascal (Pa)
    - relative to 20 micropascals (μPa) = 2×10^{-5} Pa
- dB(A), dB(B), dB(C), dB(D)
  - unit adapted to the sound level perception of human hearing
  - A-, B-, or C-Filter for weighting
- dBm, dBmW
  - electrical power
    - Measurement unit: milliwatt
    - Relative to 1 milliwatt
- dBi
  - Transmission power of antennas
    - Relative to hypothetical perfect isotropic antenna



Questions?

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