Multimedia Technology

A Graduate Course

Winter Semester 2004/2005

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Recommended Reading (1)

(ordered by relevance for this course)

1.   R. Steinmetz: Multimedia-Technologie – Grundlagen, Komponenten und Systeme.
        3. Auflage, Springer Verlag, Heidelberg, Berlin, New York, 2000

2.   R. Steinmetz, K. Nahrstedt: Multimedia Systems. Springer-Verlag, Berlin, Heidelberg,
      New York, 2004

3.   R. Steinmetz, K. Nahrstedt: Multimedia Applications. Springer-Verlag, Berlin, Heidelberg,
      New York, 2004

2.   F. Kuo, W. Effelsberg, J.J. Garcia-Luna-Aceves: Multimedia Communications – Protocols
      and Applications. Prentice Hall, Upper Saddle River, 1998

3.   W. Effelsberg, R. Steinmetz: Video Compression Techniques. dpunkt.Verlag, Heidelberg,
      1998

4.   K. Froitzheim: Multimedia-Kommunikation. dpunkt.Verlag, Heidelberg, 1997 (in German)

5.   W. B. Pennebaker, J. L. Mitchell: JPEG Still Image Compression Standard. Van Nostrand
      Reinhold,
        New York, 1993

Recommended Reading (2)

6. J. L. Mitchell, W. B. Pennebaker, Ch. E. Fogg, D. J. LeGall: MPEG Video Compression Standard. Chapman&Hall, New York, 1996

7. Michael F. Barnsley, Lyman P. Hurd: Bildkompression mit Fraktalen. Vieweg-Verlag, Wiesbaden, 1996

8. All issues of "IEEE Multimedia"

9. All issues of the "Multimedia Systems Journal" (ACM / Springer-Verlag)

10. All issues of IEEE Transactions oin Multimedia.

11. All issues of the Journal on Multimedia Tools and Applications (Kluwer Academic Publishers)

Acknowledgement

We would like to thank our colleagues Jana Dittmann, Thomas Haenselmann, Jörg Liebeherr, Carsten Vogt and Lars Wolf for allowing us to use some of their transparencies in this course. Their support is gratefully acknowledged.

1. Introduction

1.1. What is a multimedia system?

A multimedia system supports the integrated storage, transmission and representation of the discrete media types text, graphics and image and the continuous media types audio and video on a digital computer.
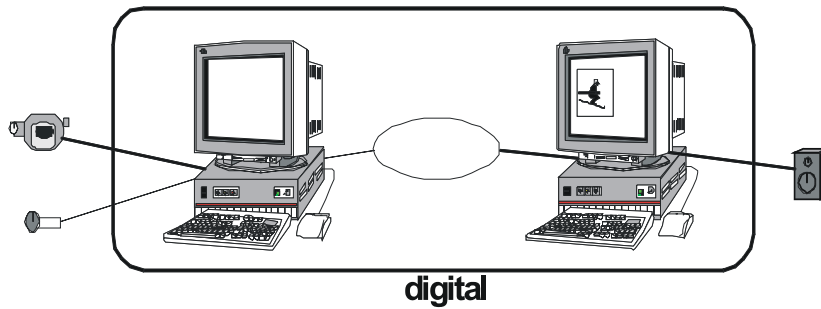
A Hybrid (analog/digital) Multimedia System

Early multimedia system, around 1985

The Eighties:
Analog solutions

digital

Computers control the analog media streams, e.g., via cross-connect switches.

Digital Multimedia System

digital

The media streams are digital. They can be processed (e.g., compressed/decompressed, analyzed) in the computer.

Time-Independent and Time-Dependent Media

Time-Independent Media
- Information is not related to timing of the data stream
- All „classic" media in the computer, such as:
  - **text**
  - **graphics** (line drawings, vector graphic)
  - **image** (photo, pixel graphics).

Time-Dependent Media
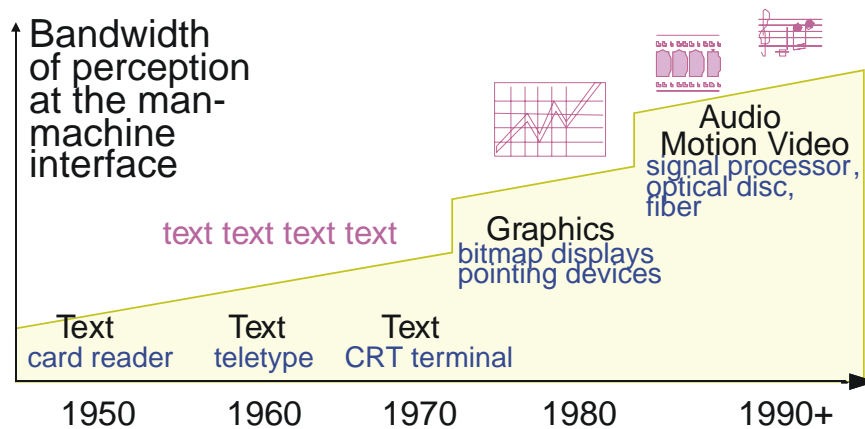- Information is time-related, must be shown to the user at specific points in time
- **Continuous data streams**
  - Data appears in regular intervals
- Examples:
  - **Audio** (continuous)
  - **Video** (continuous)
  - **An animation** (not a continuous stream, but time-dependent)
  - An **interactive game** on the Internet (not a continuous stream, but has real-time requirements)
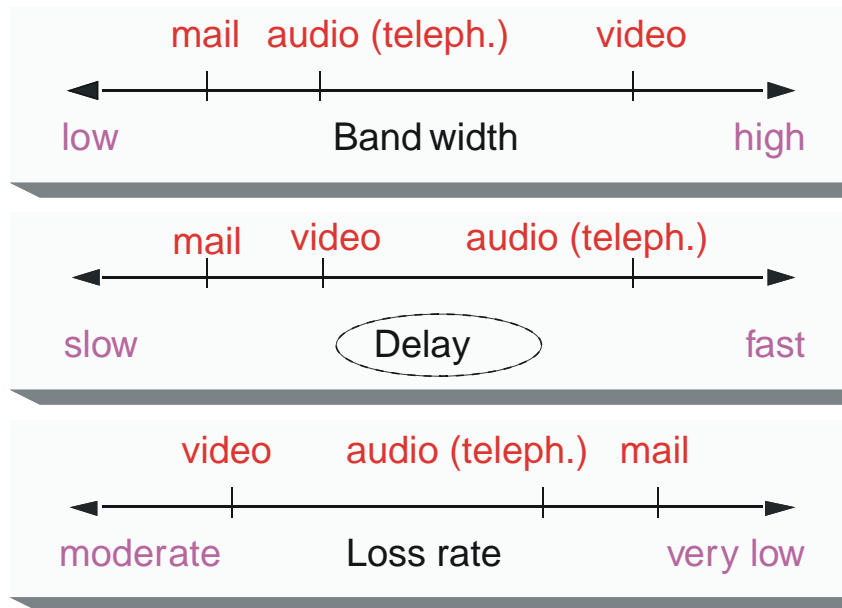
Our Definition of Multimedia

A **multimedia system** is characterized by the
- **integrated**
  - production,
  - processing,
  - storage,
  - representation,
  - and transmission
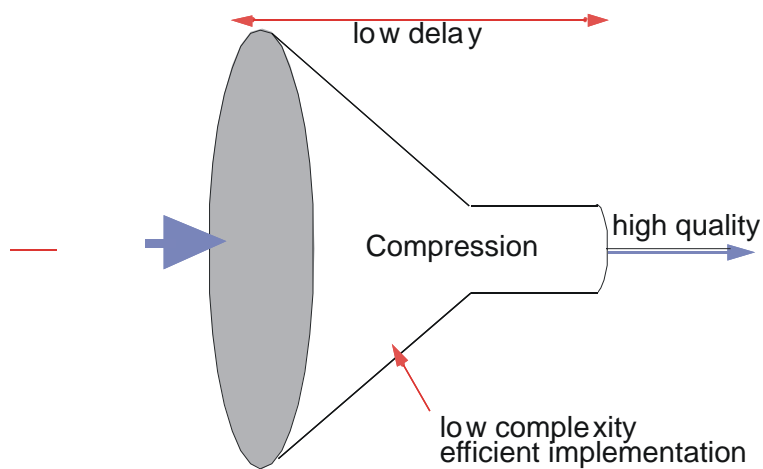- **of several time-dependent and time-independent media streams.**

History of Bandwidth in Computer Networks

Network Requirements of Different Types of Data Streams

```
        mail  audio (teleph.)    video
    ◄────────┼────────┼──────────┼────────►
    low            Band width            high
```

```
        mail   video      audio (teleph.)
    ◄────────┼───────┼──────────┼────────►
    slow          ( Delay )             fast
```

```
        video     audio (teleph.)   mail
    ◄────────┼──────────┼──────────┼────────►
    moderate        Loss rate         very low
```

Goals of Compression

low delay

Compression

high quality

low complexity
efficient implementation

The compression of multimedia data streams saves
- storage space
- transmission bandwidth.

Architecture of a Multimedia PC