

Multimedia Technology

A Graduate Course

Winter Semester 2002/2003

**Prof. Dr. Wolfgang Effelsberg
University of Mannheim**

**Prof. Dr. Ralf Steinmetz
Darmstadt University of Technology**

A Multimedia Course on Multimedia Technology	© Wolfgang Effelsberg, Ralf Steinmetz	1. Introduction	1-1
---	--	-----------------	-----

Table of Content (1)

1. Introduction

- 1.1 What is a multimedia system?
- 1.2 Fundamentals and terminology

2. Compression Algorithms for Multimedia Data Streams

- 2.1 Fundamentals of data compression
- 2.2 Compression of still images
- 2.3 Video compression
- 2.4 Audio compression
- 2.5 Animations

3. Quality of Service

- 3.1 Motivation
- 3.2 Characteristics of Real-time / Multimedia Systems
- 3.3 QoS – Definition
- 3.4 Resources
- 3.5 Providing QoS
- 3.6 QoS Architectures

A Multimedia Course on Multimedia Technology	© Wolfgang Effelsberg, Ralf Steinmetz	1. Introduction	1-2
---	--	-----------------	-----

Table of Content (2)

4. Multimedia Communication

- 4.1 Network technology, as it is today
- 4.2 Quality of Service in networks
- 4.3 Multicast
- 4.4 Media scaling and media filtering

5. Optical Memory

- 5.1 Overview
- 5.2 History
- 5.3 Fundamentals
- 5.4 Laser Vision
- 5.5 CD-DA: Compact Disk Digital Audio
- 5.6 CD-ROM: Compact Disk – Read Only Memory
- 5.7 CD-ROM/XA: CD-ROM Extended Architecture
- 5.8 Further CD-ROM-based developments
- 5.9 CD-WO: Compact Disk Write Once
- 5.10 CD-MO: Compact Disk Magneto-Optical
- 5.11 DVD: Digital Video Disk

A Multimedia Course on Multimedia Technology	© Wolfgang Effelsberg, Ralf Steinmetz	1. Introduction	1-3
---	--	-----------------	-----

Table of Content (3)

6. Media Server

- 6.1 Media Server Architecture
- 6.2 Storage Devices and Disk Layout
- 6.3 Disk Controller and RAID
- 6.4 Storage Management and Disk Scheduling
- 6.5 File Systems, Video File Servers

7. Operating System Support

- 7.1 Real-time operation
- 7.2 Scheduling algorithms
- 7.3 Device management

8. Automatic Content Analysis

- 8.1 Basic parameters for video analysis
- 8.2 Deriving video semantics
- 8.3 Basic parameters for audio analysis
- 8.4 Deriving audio semantics
- 8.5 Application examples

A Multimedia Course on Multimedia Technology	© Wolfgang Effelsberg, Ralf Steinmetz	1. Introduction	1-4
---	--	-----------------	-----

Table of Content (4)

9. Digital Watermarking

9.1 Security in multimedia systems

9.2 Watermarks: History, types and applications

9.3 Robust watermarks

9.4 Open problems

9.5 Fragile watermarks: Protecting the integrity
of documents

A Multimedia Course on Multimedia Technology	© Wolfgang Effelsberg, Ralf Steinmetz	1. Introduction	1-5
---	--	-----------------	-----

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 (English version to appear soon)
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
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

A Multimedia Course on Multimedia Technology	© Wolfgang Effelsberg, Ralf Steinmetz	1. Introduction	1-6
---	--	-----------------	-----

Recommended Reading (2)

8. All issues of the "IEEE Multimedia Magazine"
9. All issues of the "Multimedia Systems Journal,,
(ACM / Springer-Verlag)
10. All issues of the journal "Multimedia Tools and
Applications" (Kluwer Academic Publishers)

A Multimedia Course on Multimedia Technology	© Wolfgang Effelsberg, Ralf Steinmetz	1. Introduction	1-7
---	--	-----------------	-----

Acknowledgement

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

A Multimedia Course on Multimedia Technology	© Wolfgang Effelsberg, Ralf Steinmetz	1. Introduction	1-8
---	--	-----------------	-----

1. Introduction

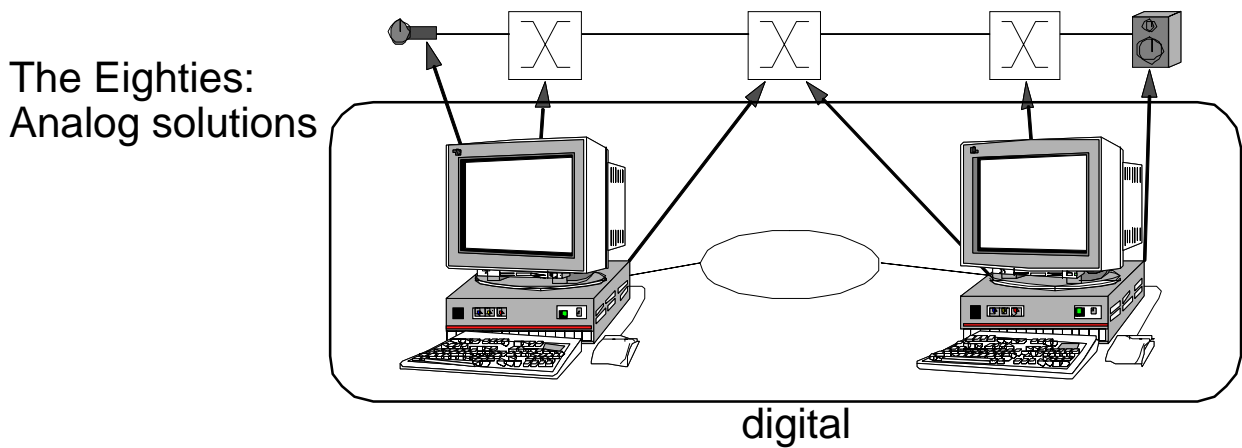
1.1. What is a multimedia system?

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 Multimedia Course on Multimedia Technology	© Wolfgang Effelsberg, Ralf Steinmetz	1. Introduction	1-9
---	--	-----------------	-----

A Hybrid (analog/digital) Multimedia System

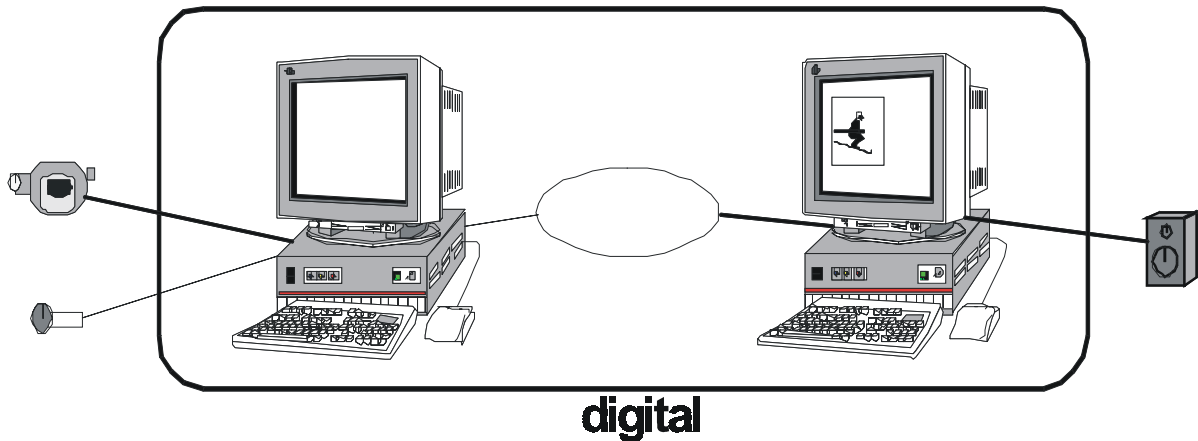
Early multimedia system, around 1985



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

A Multimedia Course on Multimedia Technology	© Wolfgang Effelsberg, Ralf Steinmetz	1. Introduction	1-10
---	--	-----------------	------

Digital Multimedia System



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

A Multimedia Course on Multimedia Technology	© Wolfgang Effelsberg, Ralf Steinmetz	1. Introduction	1-11
---	--	-----------------	------

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)

A Multimedia Course on Multimedia Technology	© Wolfgang Effelsberg, Ralf Steinmetz	1. Introduction	1-12
---	--	-----------------	------

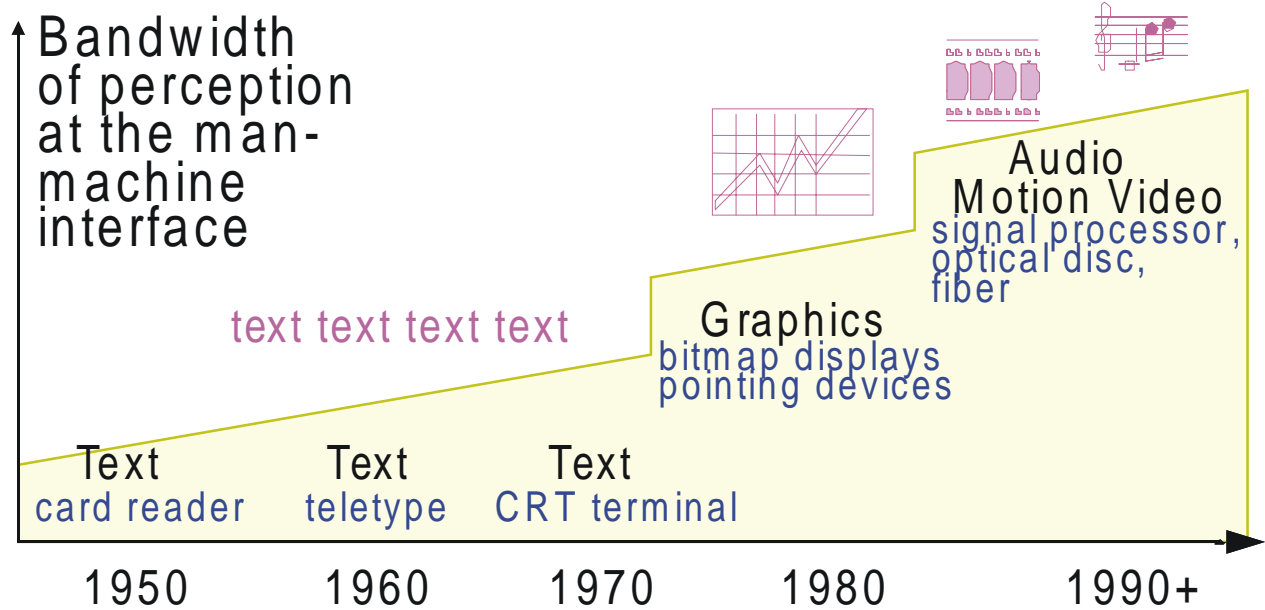
Our Definition of Multimedia

A **multimedia system** is characterized by the

- **integrated**
 - production,
 - processing,
 - storage,
 - representation,
 - and transmission
- **of several time-dependent and time-independent media streams.**

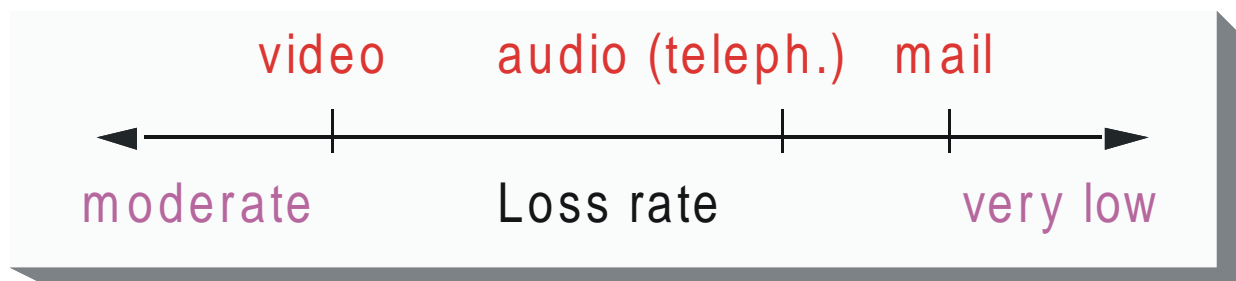
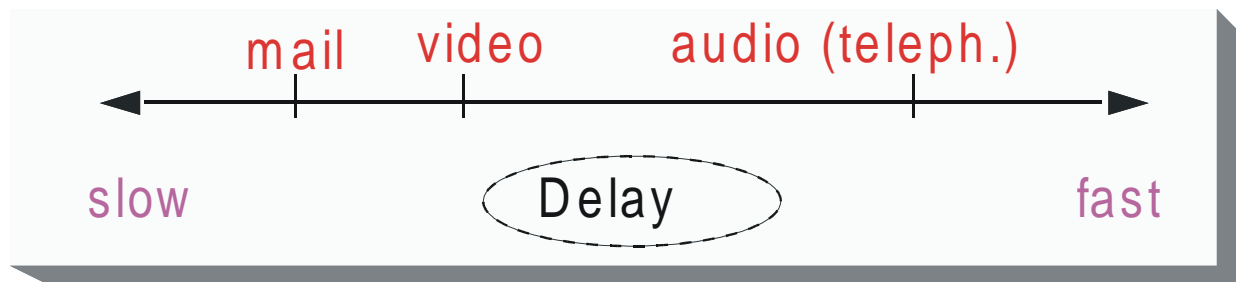
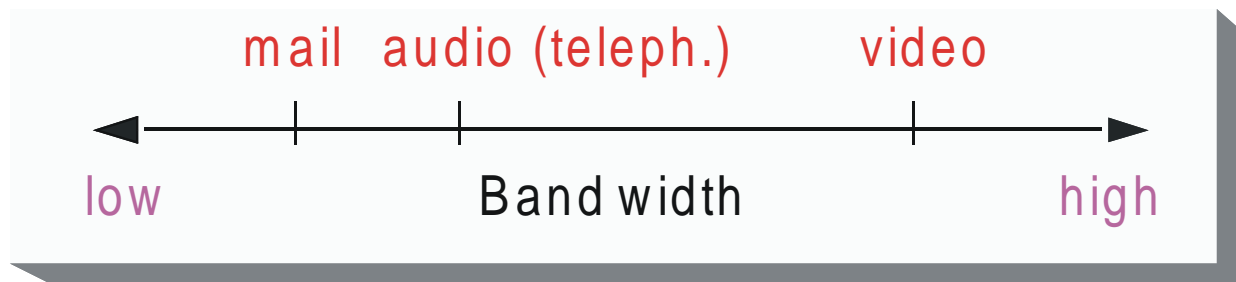
A Multimedia Course on Multimedia Technology	© Wolfgang Effelsberg, Ralf Steinmetz	1. Introduction	1-13
---	--	-----------------	------

History of Bandwidth in Computer Networks



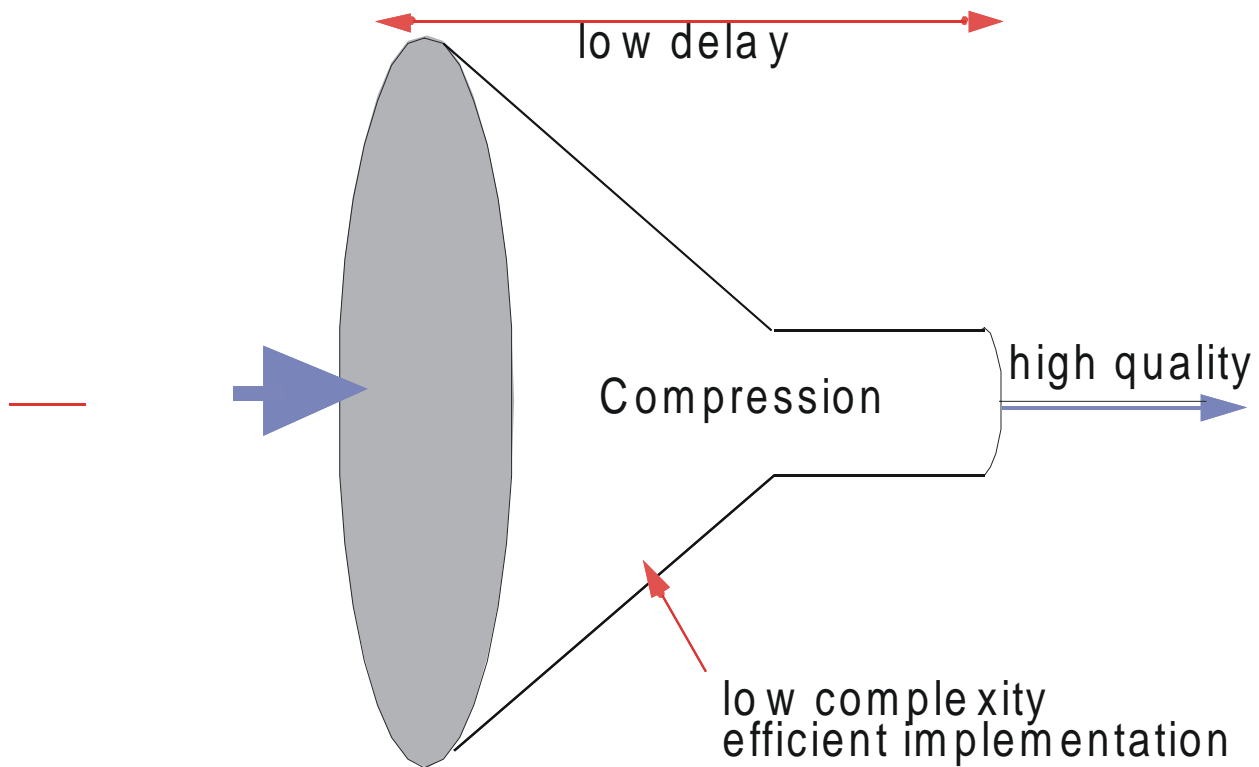
A Multimedia Course on Multimedia Technology	© Wolfgang Effelsberg, Ralf Steinmetz	1. Introduction	1-14
---	--	-----------------	------

Network Requirements of Different Types of Data Streams



A Multimedia Course on Multimedia Technology	© Wolfgang Effelsberg, Ralf Steinmetz	1. Introduction	1-15
---	--	-----------------	------

Goals of Compression



The compression of multimedia data streams saves

- storage space
- transmission bandwidth.

A Multimedia Course on Multimedia Technology	© Wolfgang Effelsberg, Ralf Steinmetz	1. Introduction	1-16
---	--	-----------------	------

Architecture of a Multimedia Workstation

