Multimedia im Netz

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Vorbemerkung: Deutsch und Englisch

- Viele Materialien sind nur in englischer Sprache verfügbar
    - ...oder in besserer Qualität/Aktualität
- Wissenschaftliches Arbeiten ist international
    - Die Wissenschaftssprache ist englisch
    - Austausch von Materialien zwischen Lehre und Forschung in deutschen Sprache ist schwierig
    - Viele Begriffe sind in englischer Sprache geprägt und schwer zu übersetzen
- Konsequenz:
    - Lehrmaterialien in englischer Sprache!
    - Unterricht in deutscher Sprache.

Organisatorisches

- Unbedingt notwendige Vorkenntnisse:
  - Vordiplom in Medieninformatik oder Informatik
- Empfehlenswerte Vorkenntnisse:
  - Digitale Medien
  - Rechnernetze I
- Ergänzende Vorkenntnisse:
  - Medientechnik
  - Rechnernetze II

Multimedia in the (Inter)net

- Multimedia:
  - Combination of several (perception) media
  - For the purposes of this lecture: Combination of *time-independent* and *time-dependent* media, in particular usage of audio and video
    - » In chapter 2 also digital books (eBooks) partially covered
- "The Net":
  - In the past: Various telecommunication networks (phone, data, cable TV, …)
  - Nowadays and in the near future: Internet as integrating technology for various networking technologies
  - In the future: "next generation networks" – probably derived from Internet
    - » Higher bandwidth, mobile access
- Multimedia in the Net:
  - Services involving a complex combination of perception media, with physically distributed service components
  - Service components: Software and/or hardware subsystems including user interfaces

What we will cover – and what not

- This lecture does *not* cover:
    - Detailed information on networking technologies and protocols (see Networking lectures)

- The focus of the lecture is on:
    - *Application*-level design of networked multimedia systems
    - Content-related base technologies (as a supplement to network-related base technologies)
    - Limited background information on selected network-related base technologies

- The tutorials for this lecture focus on:
    - Practical experience in the development of software which involves media transmission over a network
    - Programming language C/C++ (only) on Linux (only)

Outline

1. Introduction and Motivation

2. Digital Rights Management
3. Cryptographic Techniques
4. Electronic Payment Systems
5. Multimedia Content Description

Part I:
Content-Oriented
Base Technologies

6. Multimedia Content Production and Management
7. Streaming Architectures
8. Commercial Streaming Systems: An Overview
9. Communities, the Web and Multimedia
10. Web Radio and Web TV

Part II:
Multimedia
Distribution Services

11. Signaling Protocols for Multimedia Communication
12. Multimedia Conferencing

Part III:
Conversational
Multimedia Services

Vorkenntnisse & Vernetzung

- Welche Vorkenntnisse bestehen aus anderen Lehrveranstaltungen?
    - Sicherheit / Vertraulichkeit / Verschlüsselung?
    - E-Commerce: Bezahlung, Geschäftsmodelle?
    - Streaming?
    - Conferencing?
    - ...
- Vernetzung mit Lehrveranstaltungen anderer Disziplinen
    - Kommunikationswissenschaft
    - Medienwirtschaft

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1 Introduction and Motivation

1.1   A Recent Example (partially in German)

1.2   Types of Network-Based Multimedia Services

1,65 Milliarden Dollar für ein Unternehmen, das
- keinen Gewinn macht
- ca. ein Jahr alt ist

Spiegel-Online Interview Schindler, Auszüge

- Wir wissen, dass die nächste Evolutionsstufe des Internets auf einer audiovisuellen Basis aufbauen wird.

- Und wir glauben, dass wir, wenn wir das mit unseren St較ken kombinieren - nämlich hochvolumig automatisierte Werbesysteme zu betreiben - einen absolut intelligenten Schritt machen.

- Für uns hat das Wahren der Urheberrechte von Inhalte-Anbietern höchste Priorität.

- So werden bereits heute automatisierte Systeme getestet, die erkennen sollen, ob Inhalte urheberrechtlich geschützt sind - daran wird mit Hochdruck gearbeitet.

- Spiegel-Frage: Die Werbung über Suchworte funktioniert mit Text - wenn ich nach "Handschuh" suche und dann "Handschuh"-Anzeigen gezeigt bekomme, ist das sicher sinnvoll. Wie soll das mit Videos gehen, in denen etwa ein junges Mädchen von ihrem Liebeskummer erzählt?

Outline Revisited

1.   Introduction and Motivation

2.	Digital Rights Management	Part I: Content-Oriented Base Technologies
3.	Cryptographic Techniques	
4.	Electronic Payment Systems	
5.	Multimedia Content Description	
6.	Multimedia Content Production and Management	Part II: Multimedia Distribution Services
7.	Streaming Architectures	
8.	Commercial Streaming Systems: An Overview	
9.	Communities, the Web and Multimedia	
10.	Web Radio and Web TV	
11.	Signaling Protocols for Multimedia Communication	Part III: Conversational Multimedia Services
12.	Multimedia Conferencing	

Movie Piracy

IT world.com
SITE NETWORK

Go to network sites

Vendor Offer

Top 10 Sci-fi films * 10 best non-existent sci-fi f
Webcams * Top 10 errors Java programmers m
black metal pictures of all time * Top 10 stock p

Home | Webcasts | White Papers | Newsletters | News | Topics | Careers | Voices | ITwhirled

Philips designs watermark system to curb video piracy
IDG News Service 2/21/06

Stealing the Show
Estimated movie studio* losses due to
piracy in 2005, in millions of dollars

U.S.	$1,311
Mexico	483
Russia	266
Spain	253
China	244
Italy	161
Thailand	149
Canada	118

*Only includes MPAA
member-studio losses
Sources: International Intellectual
Property Alliance; WSJ research

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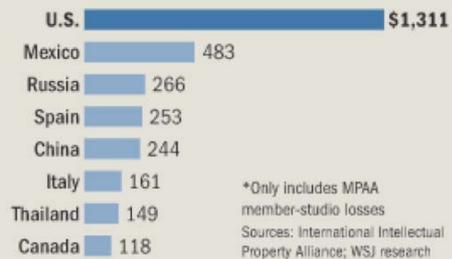
1 Introduction and Motivation

1.1   A Recent Example (in German)

1.2   Types of Network-Based Multimedia Services

Literature:
I. Venieris, H. Hussmann: Intelligent Broadband Networks,
Chapter 1, John Wiley 1998

Term: Multimedia Service

- *Service:* In the context of this lecture, always a telecommunication service, i.e. an offer to users for satisfying communication demands in a physically separated situation.

- *Multimedia service:* [A telecommunication service] that handles several types of media in a synchronized way from the user's point of view. A multimedia service may involve multiple parties, multiple connections, and the addition or deletion of resources and users within a single communication session.
    ITU-T Recommendation F.700 "Framework recommendation for audiovisual multimedia services"

Terms: Party, End System etc.

- *Party:* An organisation or a human being involved in the offer and use of a multimedia service
- *Service Provider:* An organisation which offers some part or the whole of a multimedia service
- *End system:* A physical device which is connected to the network and takes part in a multimedia service by exchanging information with other end systems over the network
- *Terminal:* An end system which is directly operated by a human user Common term in the traditional telecommunication world: Customer Premises Equipment (CPE)
- *Server:* An end system which is operated by a service provider as a part of the service offering. Usually designed to interact with many terminals at the same time.

Terms: Content, Content Provider

- *Content:* Information which is of interest to at least one of the communicating parties. In the case of multimedia services: mostly audio-visual information in digitized form. Often content is associated with copyright restrictions for its distribution.
    – Examples: Live video source of a sports event, recorded piece of music in MP3 format
- *Content Provider:* An organization which takes responsibility for the provision of content for a multimedia service. In the presence of copyright restrictions, and when timeliness of content is an issue, appropriate *content management* can be a major concern for the content provider.
    – Examples: TV broadcast stations, movie distribution companies, news agencies

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Terms: Unicast, Multicast, Broadcast

Unicast: Sending to one single receiver

S ————————➤ **R**
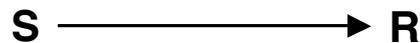
Multicast: Sending to several selected receivers

S ➤ **R1**
R2
(R3)…
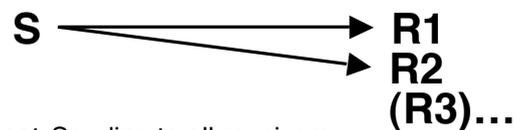
Broadcast: Sending to all receivers

S))) **R1**
R2
R3…

A Classification of Multimedia Services

- According to ITU-T recommendation I.211 "B-ISDN Service Aspects"

Interactive Services	Distribution Services

- Conversational Services
- Messaging Services
- Retrieval Services

- without user-individual presentation control
- with user-individual presentation control
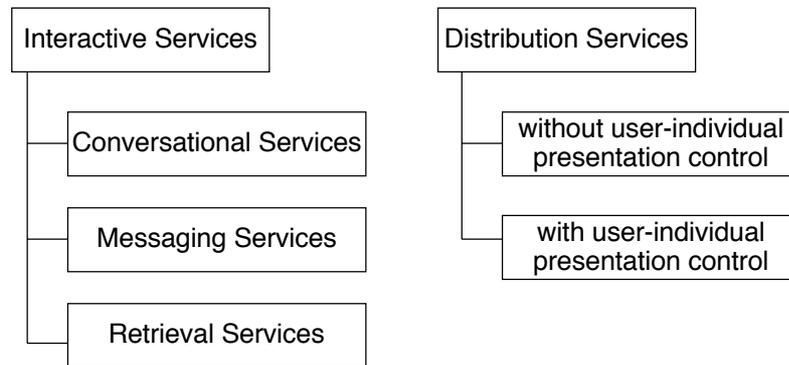
Interactive: Conversational, Messaging, Retrieval

- Conversational Services:
  - Multimedia information exchanged between terminals in synchronous style (reception temporally coupled with sending)
  - Source of multimedia information: terminal
  - May use intermediate servers or may be realized on terminals only
- Messaging Services:
  - Multimedia information exchanged between terminals in an asynchronous style (reception temporally decoupled from sending)
  - Source of multimedia information: terminal
  - Servers involved for intermediate storage of messages
- Retrieval Services:
  - Multimedia information available on servers for download or streaming
  - Source of multimedia information often external (from content providers)
  - Usually a star-shaped configuration: One server provides content to many terminals
  - Recent development: Communities sharing content

Content Delivery: Quality of Service

- Content Delivery can be performed in varying *Quality of Service (QoS)* depending on the capabilities of the underlying network technology
  - Bandwidth, delay, jitter
  - Buffer sizes
- Mainly relevant for conversational, retrieval and distribution services
- Live-Content Service:
  - Source information (e.g. from cameras) transmitted with minimal latency
- Buffered-Content Service:
  - Source information (e.g. from cameras) transmitted with latency acceptable for a human end-user
  - Higher latency possible in retrieval services than conversational services
- Stored-Content Service:
  - Source information (from an arbitrary source) downloaded completely from storage before consumption, no consideration of the temporal relationship between content creation and consumption

Non-Interactive: Distribution

- Without user-individual presentation control:
  - Simple broadcast (or multicast) of information
  - Replacement of other distribution media (e.g. radio) by digital networks
- With user-individual presentation control:
  - Limited interactivity realized by broadcast/multicast
  - Example: "Near Video-on-Demand"
    » Staggered broadcast of multiple transmissions of the same content
      (Similar concepts in Digital TV, e.g. Premiere in Germany)
    » User can switch between transmission instances

Network Classes: Single Technology vs. Internet

- Single-Technology Network
  - Usually run by a single network operator and interworking with other networks of the same technology
  - Traditional telecommunication networks: POTS, ISDN, X.25, SDH, ...
  - Advanced multi-service telecommunication networks:
    » Broadband ISDN (B-ISDN): ATM technology

- Inter-Network:
  - Virtual overlay network across various technologies
  - Most famous: IP-based global inter-network = The Internet

Other Network Classifications

- Fixed vs. wireless network
- Personal-area, local-area, metropolitan-area, wide-area network
- Data communication, speech communication, multi-service network
- Public network vs. private network

End System Classification

- General purpose end system
    - PC, PDA (Personal Digital Assistant)
- Special purpose end system
    - Mobile phone
    - IP telephone
    - Set Top Box (STB)
    - IP radio? IP TV set?
- Hybrid end system
    - E.g. multimedia mobile phone (with camera and music player)

- Services may address a single class of end systems or several groups

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A "SIP Phone"

- IP-based phones, connected e.g. over Ethernet
- SIP = Session Initiation Protocol (see chapters 10, 11)

Mitel 5055 SIP Phone

The Mitel 5055 SIP Phone is a full-featured, standards-based business telephone that delivers superior audio quality and session initiation protocol (SIP) services to the end-user's desktop. The 5055 SIP Phone is a versatile, highly interoperable phone that can function as a standalone product connected to a hosted solution, as part of a Mitel communications solution, or in PBX environments that support SIP. As a SIP-compliant appliance, it is interoperable with all voice, data, video and Internet applications and services that are SIP-enabled and/or provide full SIP protocol support.

"History" of Networked Multimedia

- **1964**: AT&T introduces Picturephone at the World's Fair, New York
- **1983**: The Internet as we know it is created on January 1st when a standard networking protocol (TCP/IP) is adopted by all ARPANET users.
- **1984:** ITU-T recommendation I.120 about ISDN
- **1986:** ITU defines ATM as the basis for Broadband ISDN
- **1986**: PictureTel's $80,000 VC system, $100 per hour lines
- **1990**: CCITT standard H.320 for ISDN conferencing
- **1990-1997:** Experimental multimedia services over Broadband ISDN (ATM)
- **1991**: The World Wide Web makes its debut on the Internet.
- **1992**: World's first MBone audio cast (vat), 23rd IETF, San Diego
- **1993**: CU-SeeMe v0.40 for Macintosh (with multipoint conferencing)
- **1995:** RealAudio brings streaming audio to Web users. Streaming video soon follows.
- **1996:** VocalTec Internet phone
- **1999**: Napster debuts, allowing users to download (and share) their favorite MP3s

Parallel streams: Telephony, specialized networks (ATM), Internet

- **2001:** Apple iTunes, the first successful commercial online store for digital music files
- **2003:** Apple iChat AV (video conferencing), AOL AIM with video support
- **2004:** Broad use of Voice over IP with the popular software *Skype*
- **2005:** YouTube video exchange Web site

Service Examples (1)

- Interactive, conversational services (live or minimally buffered)
  - Over single-technology, fixed/wireless, wide-area, speech communication network: telephony and phone conferencing
  - The same over Internet: "IP telephony"
  - Over single-technology multi-service network "ISDN", covering audio-visual information: ISDN videoconferencing (H.320)
  - Over Internet, covering audio-visual information: IP multimedia conferencing (H.320-based or SIP-based)
    - » May include more than just audio-visual communication channels, e.g. shared "whiteboard", application sharing or even more advanced collaboration (e.g. joint editing of 3D models)
- For all conversational services:
  - Number of participants ≥ 2
  - Complex star configurations for participants ≥ 3

Service Examples (2)

- Interactive, messaging services:
  - Over single-technology, wireless speech/multi-service network GSM:
    Multimedia Messaging Service MMS
  - Over Internet, based on E-Mail standards (SMTP, POP, IMAP, MIME etc.):
    Multimedia E-Mail attachments
  - Over Internet, based on Web technology:
    Digital photo print service

Service Examples (3)

- Interactive, retrieval services:
  - Over single-technology, wireless speech/multi-service network GSM:
    download of ringing tones or games
  - Over Internet, buffered content:
    » Web-based video surveillance service
  - Over single-technology, multi-service network B-ISDN (=ATM):
    » Early prototypes of Video-on-Demand
  - Over Internet, stored content:
    » Picture databases and exchange sites
    » Music download (P2P networks, iTunes Music Store etc)
    » Video-on-Demand (e.g. T-Online Vision)

Advanced Multimedia Services for Residential Users

Feldversuch

München

Mai-Juli 1996

Video-on-Demand

ATM over TV cable network

Video on Demand

2004
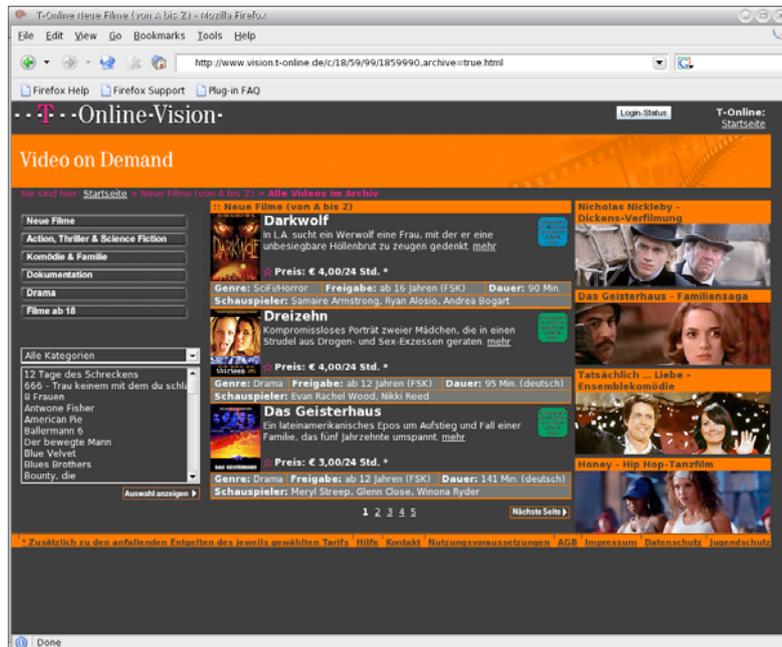
Service Examples (4)

- Distribution of live content (no presentation control):
    - Over Internet:
        - » Video streaming from sport events, speeches, concerts, ...
        - » Web radio and Web TV
    - Over broadcast network:
        - » Handheld/mobile phone TV (DVB-H, DMB)
- Distribution with presentation control / limited interaction:
    - Web radio with interactive playlists

Convergence of Networks and Services

- Migration of originally single-technology services towards IP-based Internetworks
    - E.g. GPRS service for GSM networks
    - E.g. IP services over DSL
    - Single-technology services only relevant for QoS reasons
- Integration of network technologies
    - E.g. multiple network interfaces in laptop: WLAN, Ethernet, Modem, GPRS/UMTS Modem, plus local interfaces (USB, FireWire) and periphery (CD, DVD, ...)
    - High-level services bridge across the various ways of network access
        - » E.g. music download service
        - » Complex issue: Synchronization among used devices (e.g. computers and portable music players)
- Final goal: User perceives service as *ubiquitous*, and does not have to care about access technologies