



# Multimedia Systems

WS 2009/2010

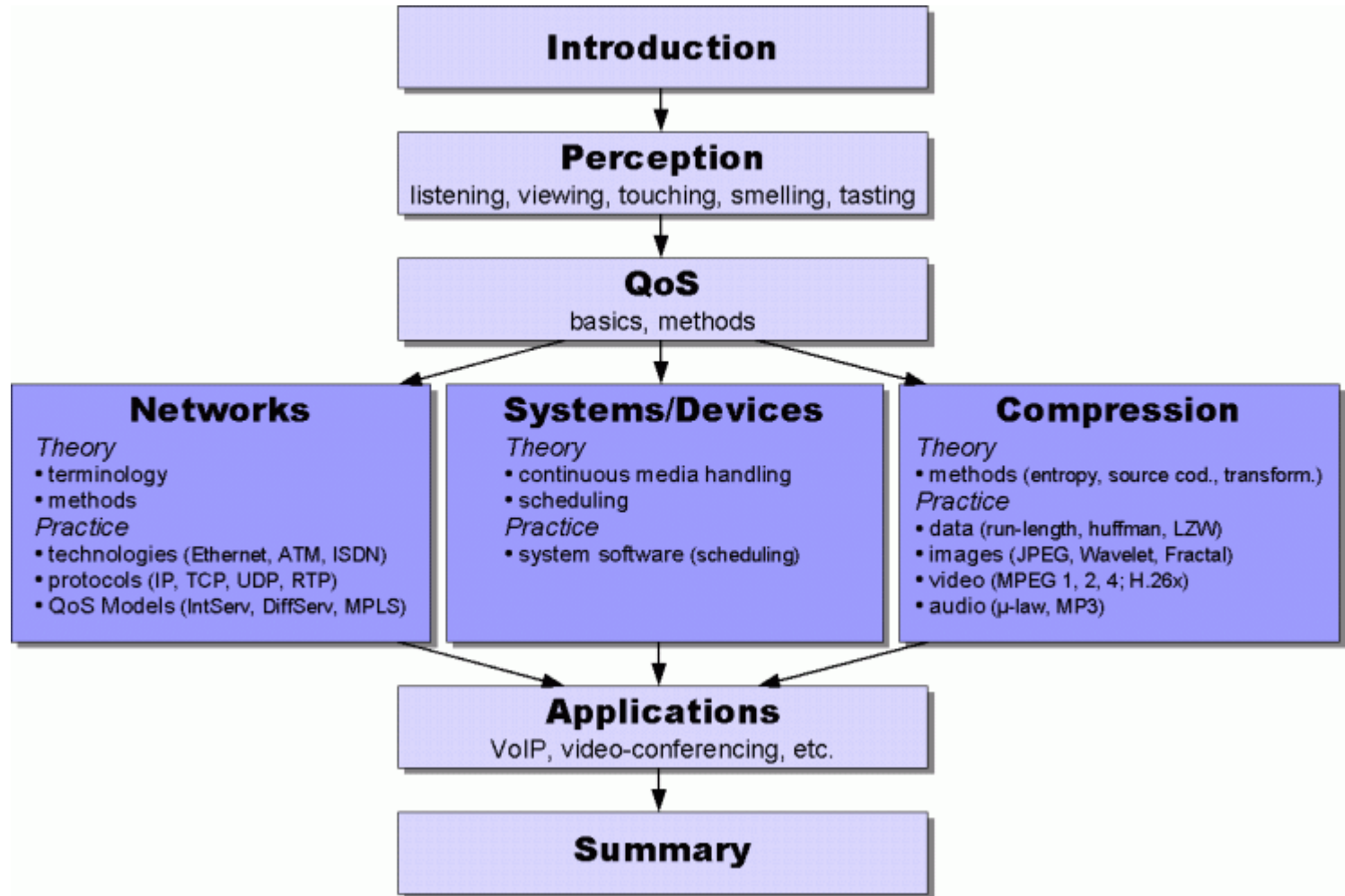
## Applications & Summary

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# Sitemap





# Applications

- **Multimedia systems should be created based on the constituents presented in this lecture:**
  - Multimedia systems need to take into account the characteristics of the human sense system.
  - QoS is required to process media in the intended way (see essential elements of multimedia as goals).
  - QoS-aware networks are used to transport and distribute media.
  - Compression is employed to cope with the amount of data in multimedia applications.
  - Appropriate hardware architecture and system software of endsystems enable in-time processing of media.
- This enables **multimedia applications** like video-conferencing with a sustained positive user experience.

# Internet telephony - VoIP (1)

- Objective: Use a packet switching network (intranet, Internet) for telephony applications
- Advantage: Saving of costs
  - a single infrastructure is sufficient
  - efficient use of available bandwidth
- Drawbacks:
  - no inherent QoS in Ethernet and IP-based networks
  - high availability, E-911

## Internet telephony - VoIP (2)

- Problem: Guaranteeing QoS
  - no guaranteed minimal throughput
  - loss of data packets possible
  - higher delay than in circuit switched networks
  - jitter
- Additional challenges:
  - protocols for signaling
  - interoperability with firewalls
  - coexistence with current telephony networks and applications
  - making the transmissions tap-proof

# Applications

- Basic Network configuration:
  - ISDN (H.320)
    - several 64kbps channels, each has its own E.164 address
    - caller must know all addresses or the callee may provide all sequential addresses after establishing the first channel
    - Basic rate or primary rate interface (the latter is different in US and EU)
  - IP (H.323)
    - static / dynamic IP Address
    - Netmask, Gateway, DNS
    - IP precedence (and TOS field)
    - Diffserv class
    - RSVP QoS specified explicitly or derived from codecs and video size

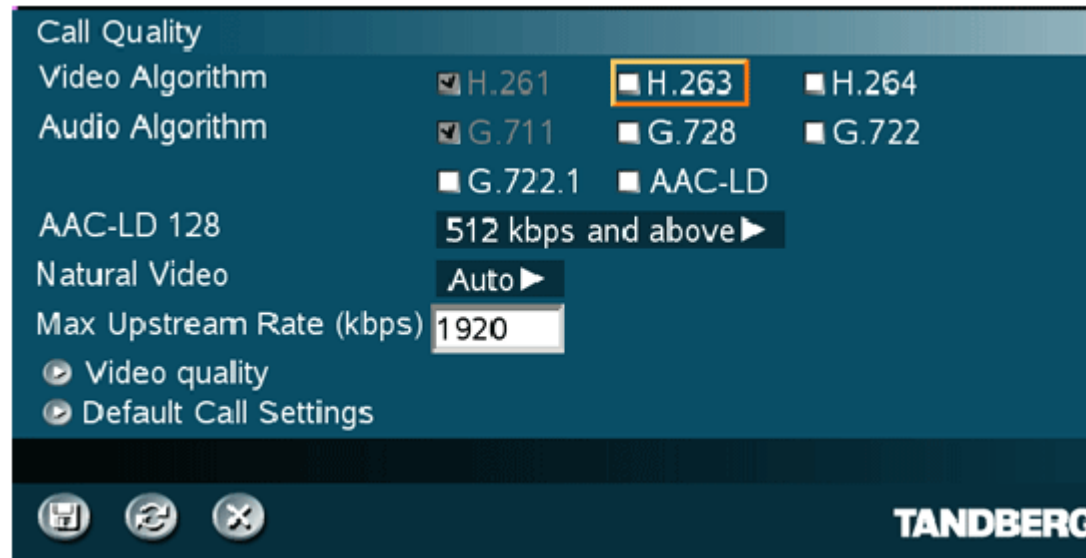


# Applications

- IP streaming
  - destination address, unicast / broadcast
  - TTL
  - requires knowledge about network infrastructure
  - codecs not negotiated so the codecs must be configured

# Applications

- Video and Audio codecs



- are negotiated automatically (optimized for bandwidth or quality?)
- fine tuning requires that the available bandwidth is known



# Applications

- Supported Video Size
  - Native NTSC:
    - 4SIF (704 x 480 pixels), Digital Clarity
    - 400p (528 x 400)
    - iSIF (352 x 480 pixels), Natural Video
    - SIF (352 x 240 pixels)
  - Native PAL:
    - 4CIF (704 x 576 pixels), Digital Clarity
    - 448p (576 x 448)
    - iCIF (352 x 576 pixels), Natural Video
    - CIF (352 x 288 pixels)
    - QCIF (176 x 144 pixels)
    - SQCIF (128 x 96 pixels)
  - Native PC Resolutions:
    - XGA (1024 x 768 pixels), Digital Clarity
    - SVGA (800 x 600 pixels), Digital Clarity
    - VGA (640 x 480 pixels), Digital Clarity
  - Wide (16:9) Resolutions:
    - w288p (512 x 288 pixels)
    - w448p (768 x 448 pixels)
    - w576p (1024 x 576 pixels)
    - w720p (1280 x 720 pixels)

# Applications

- Transmission mode with Motion or Sharpness selections.

MOTION	PAL	448p → iCIF@50 → CIF → QCIF
MOTION	NTSC	400p → 448p → iSIF@60 → iCIF@60 → SIF → CIF → QCIF
MOTION	VGA	448p → CIF → QCIF
MOTION	SVGA	448p → CIF → QCIF
MOTION	XGA	448p → CIF → QCIF
MOTION	Wide	w448p → w288p → CIF → QCIF
SHARPNESS	PAL	4CIF → VGA → CIF → QCIF
SHARPNESS	NTSC	4SIF → 4CIF → VGA → SIF → CIF → QCIF
SHARPNESS	VGA	VGA → 4CIF → CIF → QCIF
SHARPNESS	SVGA	SVGA → XGA → 4CIF → VGA → CIF → QCIF
SHARPNESS	XGA	XGA → SVGA → 4CIF → VGA → CIF → QCIF
SHARPNESS	Wide	w720p → w576p → w448p → w288p → CIF → QCIF



# Summary

# Essential Elements of Multimedia

- **Essential Elements are**
  - Immersion
  - Interdisciplinarity
  - Hypermedia
  - Interactivity
  - Narrativit

# Properties of a Multimedia System

- **Flexibility:**
  - Provide mechanisms to handle all kinds of media, in particular, discrete and continuous media
  - A VCR and a desktop publishing system for text and graphics are no multimedia systems.
  - An editor with voice annotation is a multimedia system.
- **Integration:**
  - Independent media storage
  - Computer-controlled media combination
- **Definition:**

**A multimedia system is characterized by the integrated computer-controlled handling of independent discrete and continuous media.**

# ▶▶▶ Another Definition of Multimedia

- **Simulation of Human Communication**



# Why Multimedia?

- **Why is Multimedia so important now?**
  - Since the turn up of the WWW, everybody is able to use computer networks for communication.
  - The social development is moving toward an “information age”.
  - Multimedia is enforced by the “National Information Infrastructure (NII)” of Al Gore and similar initiatives.
- **Why is Multimedia possible now?**
  - Different media like text, pictures, audio, and video can be digitized.
  - Input and output devices are digital or have digital controls and interfaces.
  - A system like a computer that is able to handle digital data is able to integrate different media.

[Mind and Machine](#)

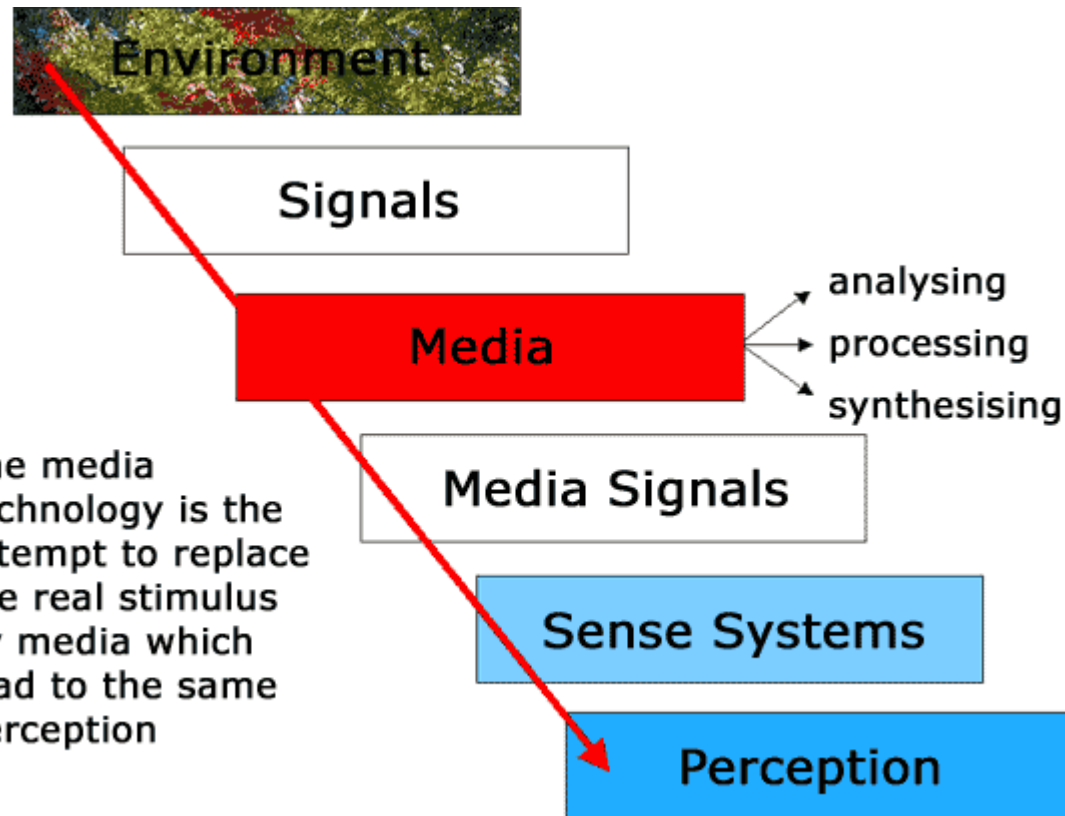


# Multimedia and Sense

Sense of		Mode of Sense	Display
vision hear smell taste balance	"5-sense"	visual auditory olfactory gustatory vestibular	optical acoustic - - -
pressure vibration cold warmth pain	skin touch	tactile	haptic
position power	<u><a href="#">proprioception</a></u>	kinesthetic	

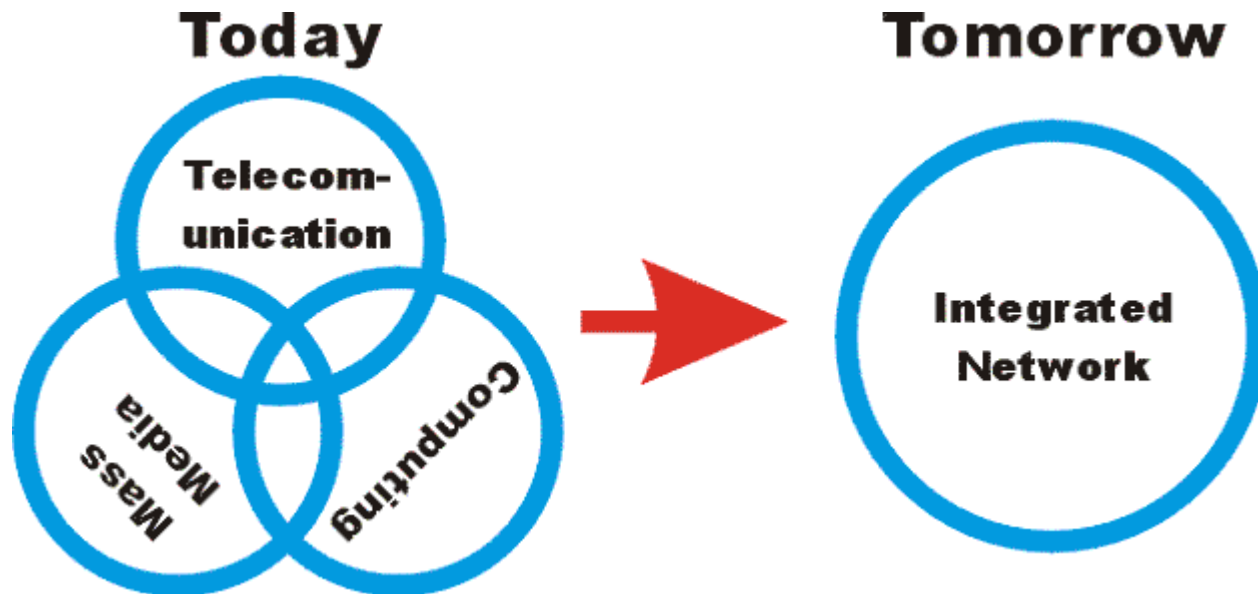


# Environment Mediated by Media



# QoS-aware Integration

- **Combination of three areas:**



- **Technological outlook:**
  - Networked computers as the information tools of the 21<sup>st</sup> century



# Networks

- **One of the most promising aspects of multimedia is communication over (long) distances, therefore the capabilities of the transport technology are important.**
- **Basics:**
  - Connectivity on Layer 1 – 3
  - Circuit switching vs. Packet switching vs. Cell switching
- **Criteria for usability for multimedia data**
  - level of performance guarantees
  - level of flexibility
  - multicast capability
  - level of efficiency and costs

# Network Technologies + Protocols

- **Technologies**
  - Ethernet + new variants
  - ISDN
  - ATM
- **Protocols**
  - TCP/IP Suite + IPv6
  - QoS in data networks
    - DiffServ
    - IntServ / RSVP
    - MPLS
  - RTP



# Compression

- **Raw digitized data is much too large and contains more information than necessary. Compression techniques are used to reduce the data size.**
  - Entropy coding: loss-less compression techniques; take into account the statistical occurrence of symbols within a stream:
    - Run-Length, Lempel-Ziv, Huffman, Arithmetic coding
  - Source coding: (often) lossy compression techniques; take into account specific data characteristics and the human sensitiveness to the given type of data:
    - Discrete Cosine Transform
    - Wavelet + Fractal
    - also image preparation: YUV
  - Hybrid coding: combination of source coding and entropy coding:
    - JPEG
    - MPEG-1 / 2 / 4, H.261, H.263
    - MPEG-Audio

# System Architecture

- **The hardware architecture and the system software of endsystems (desktop computers) are not adapted for handling continuous media:**
  - Hardware support for handling continuous media will increase its quality. Especially the replacement of a single asynchronous bus is required.
  - System software must be adapted to take into account some real-time aspects of data processing.
  - Avoid handling of continuous media by applications directly.



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# The End

<http://www.icsy.de>