



Multimedia Systems

WS 2009/2010

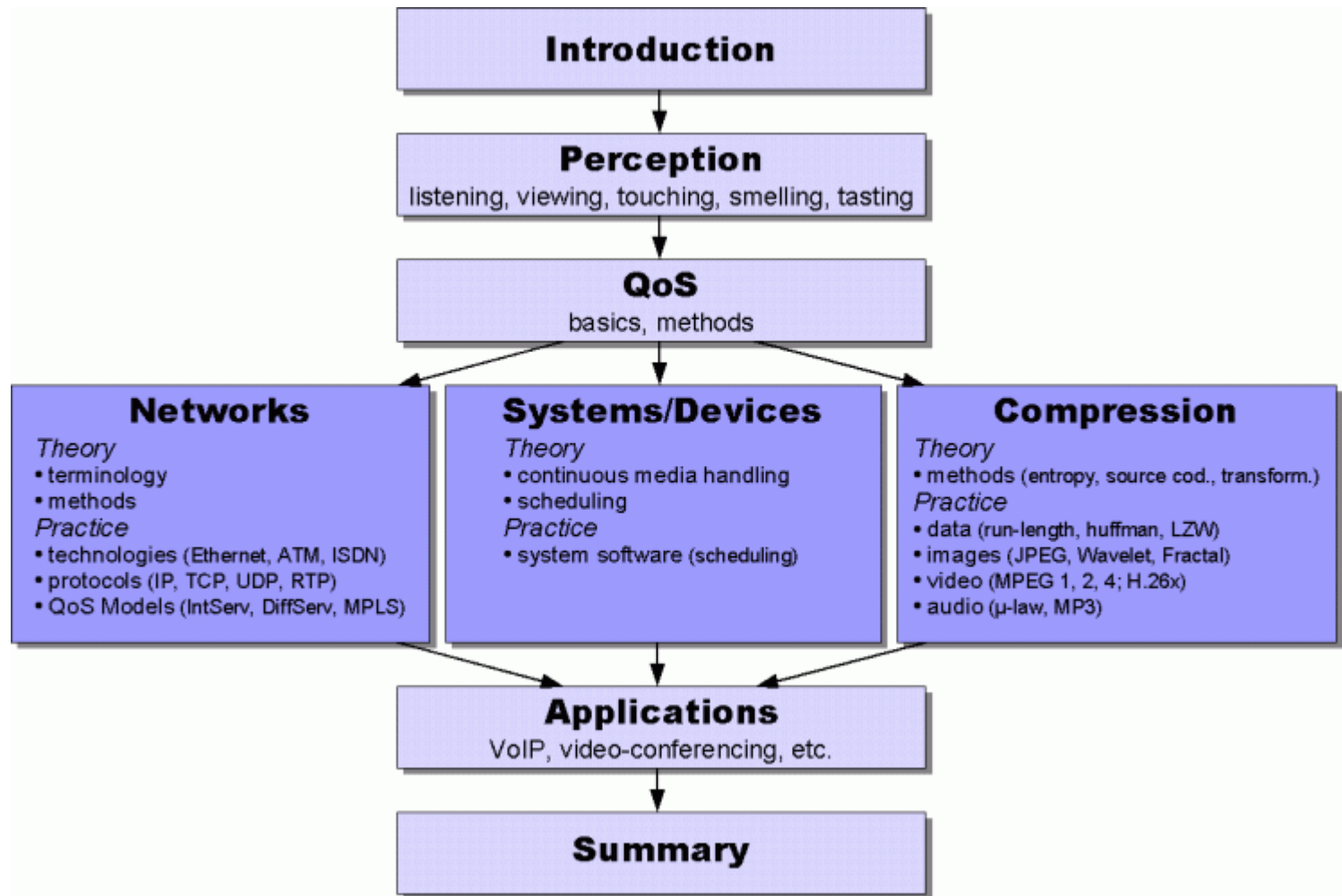
Applications & Summary

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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

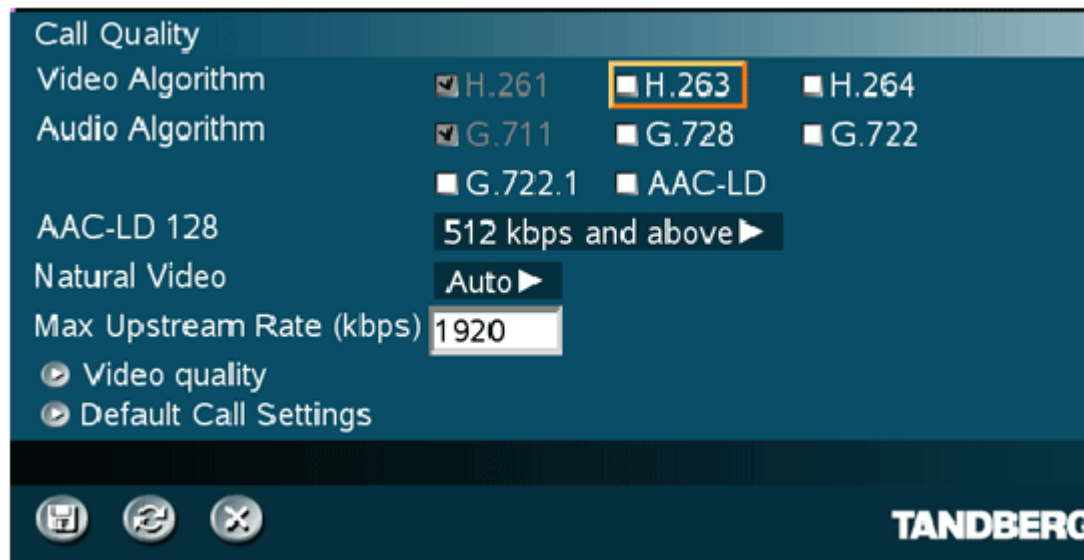


Applications

- 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.

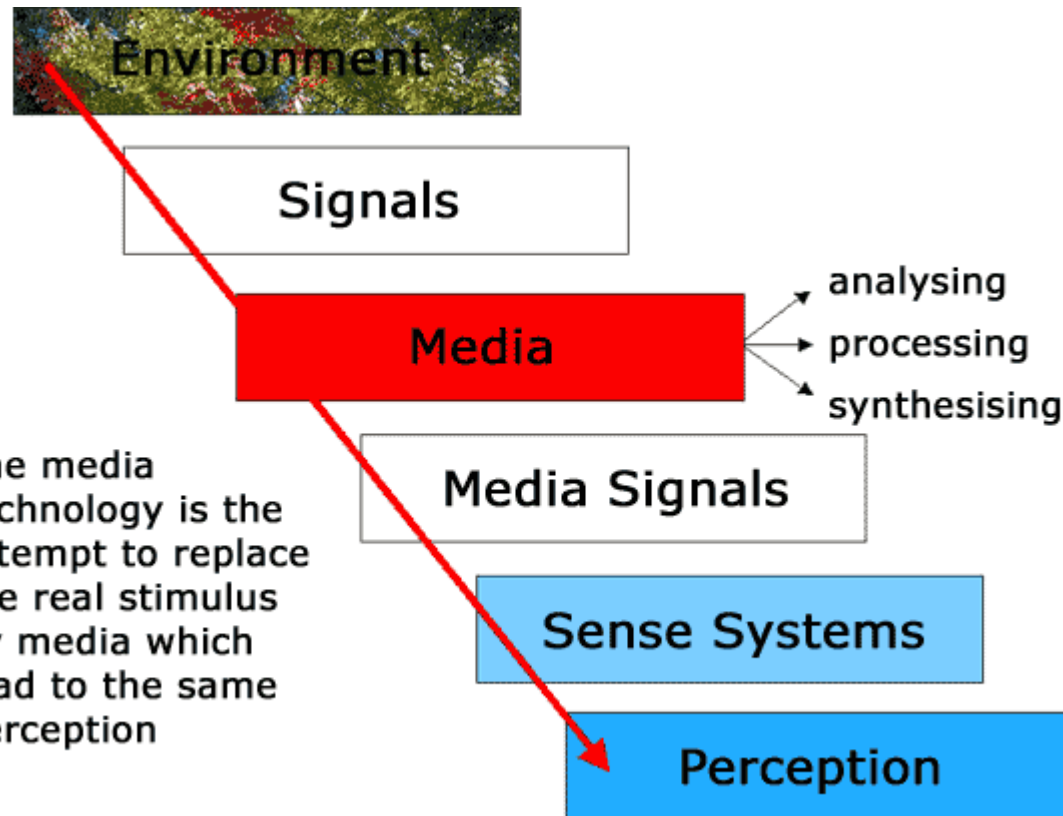
[Mind and Machine](#)



Multimedia and Sense

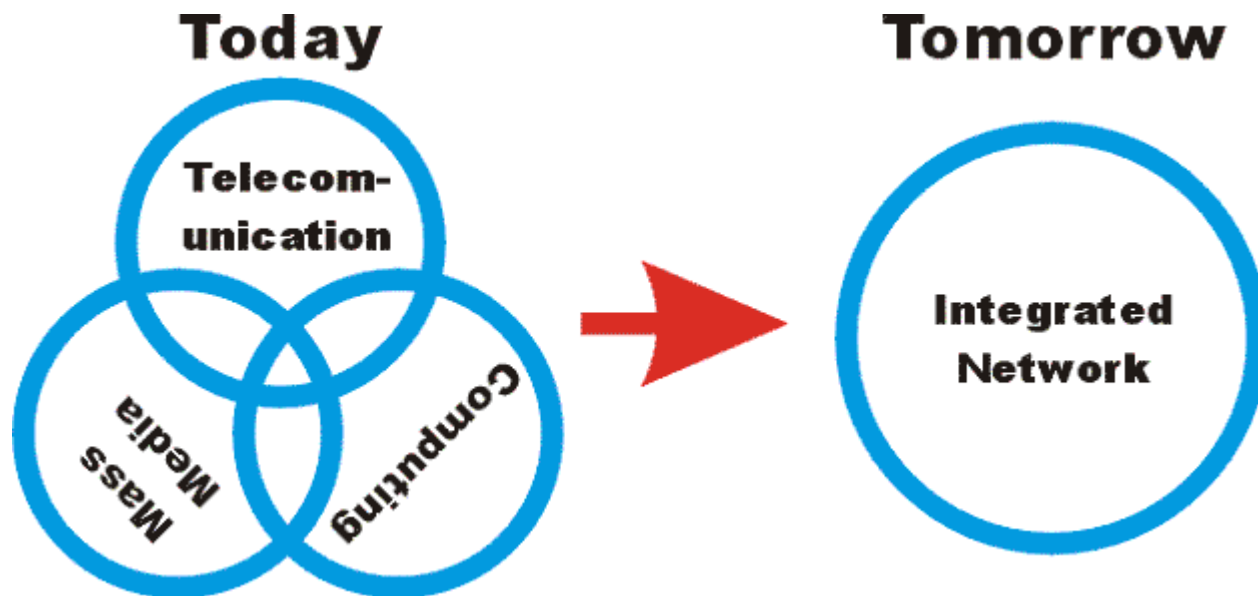
Sense of		Mode of Sense	Display
vision hear smell taste balance	"5-sense"	visual auditory olfactory gustatory vestibular	optical acoustic - - -
pressure vibration cold warmth pain	skin touch	tactile	haptic
position power	<u>proprioception</u>	kinesthetic	

Environment Mediated by Media



QoS-aware Integration

- **Combination of three areas:**



- **Technological outlook:**
 - Networked computers as the information tools of the 21st 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>