

**ΟΙΚΟΝΟΜΙΚΟ
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ΑΘΗΝΩΝ**



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Multimedia Technology

Section # 1: Introduction

Instructor: George Xylomenos

Department: Informatics

Contents

- Media and Multimedia
- Networked Multimedia
- What makes media interesting / challenging?
- Standards and formats

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Media and Multimedia

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Media characteristics

- Medium (pl. Media): means many things
- Perception media (for people): sense
 - Vision, hearing, touch
- Presentation (for information)
 - Paper, screen, speaker
- Capture media (for information)
 - Mouse, camera, microphone
- Representation media (for information)
 - Text, audio, image, video

Types of media

- Discrete media: text, images
 - Do not change with time
 - No temporal aspects
- Continuous media: audio, video
 - Varies with time
 - Requires a specific “rate” of presentation
 - May require synchronization with other media
 - Due to temporal aspects

What is Multimedia? (1 of 2)

- Multiple media are not enough
 - Is text and an image multimedia?
- Multiple media plus:
 - Both continuous and discrete media
 - Must have a temporal aspect
- Independence
 - Each medium handled separately

What is Multimedia? (2 of 2)

- Computer control
 - Media management
 - Digital representation of media
- Multiple media + independence + control
- Optional: Interactive
 - Not necessary, but common
 - Choose the manner and order of presentation

Multimedia or Digital Media?

- Multimedia used to be a buzzword
 - Very hyped during the 90s
 - Previously, only text and images
 - MS Multimedia PC (MPC): CD-ROM + Sound
- The class is about digital media in general
 - Capture / representation
 - Coding / compression
 - Transport / presentation

Who is who in media (1 of 3)

- Telecom operators
 - Owners of communication networks
 - May also be involved in content
 - IPTV, streaming, media production
- Consumer electronics industry
 - Used to produce CD/DVD/Bluray players
 - Now mostly phones, TVs and game consoles
 - Sensitive to technological costs

Who is who in media (2 of 3)

- Content producers
 - Warner Bros, Universal, Sony, Disney
 - Production and distribution of music / video
 - Publishers of all kinds of media
- Content distributors
 - HBO, Netflix, Amazon, ...
- Gradually, producers = distributors

Who is who in media (3 of 3)

- Market vs. technology
 - What comes first?
 - Technology push
 - Market pull
- What makes a technology dominate?
 - Success depends on market aspects
 - The best technology does not always win

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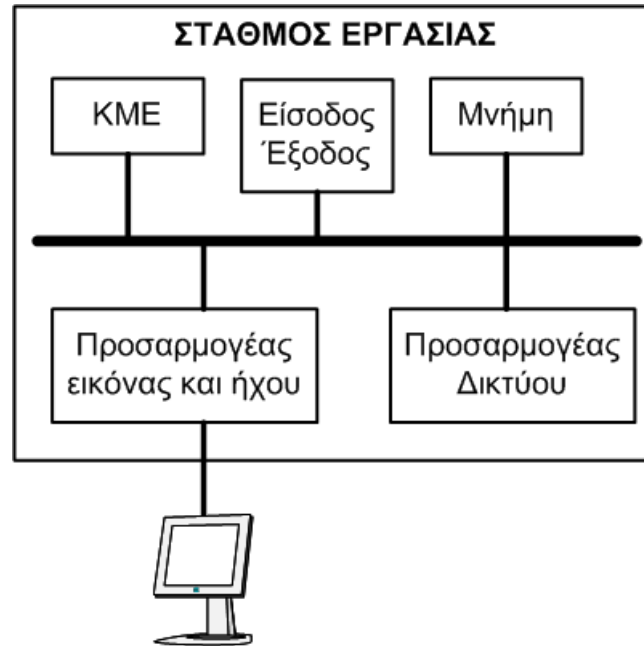
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Networked Multimedia

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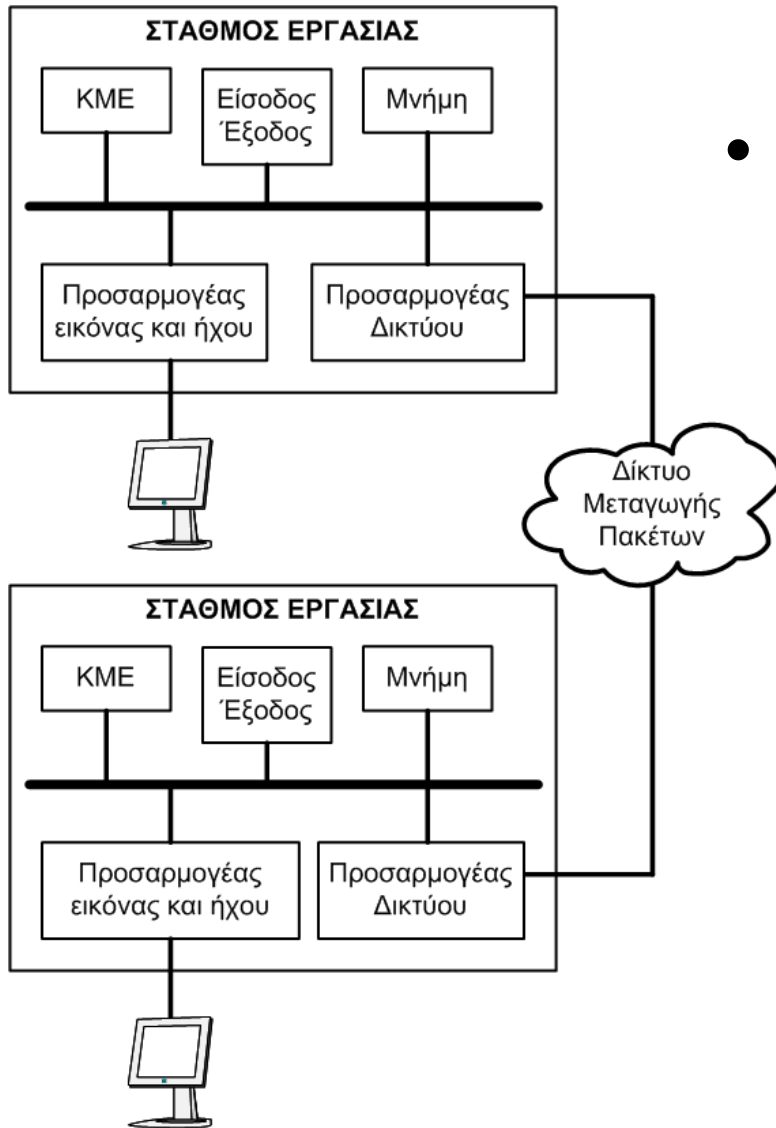
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Networked Multimedia (1 of 5)



- Standalone (non networked) multimedia
 - Content distributed in optical discs
 - Limited by distribution and storage media
 - Hard to update the content

Networked Multimedia (2 of 5)

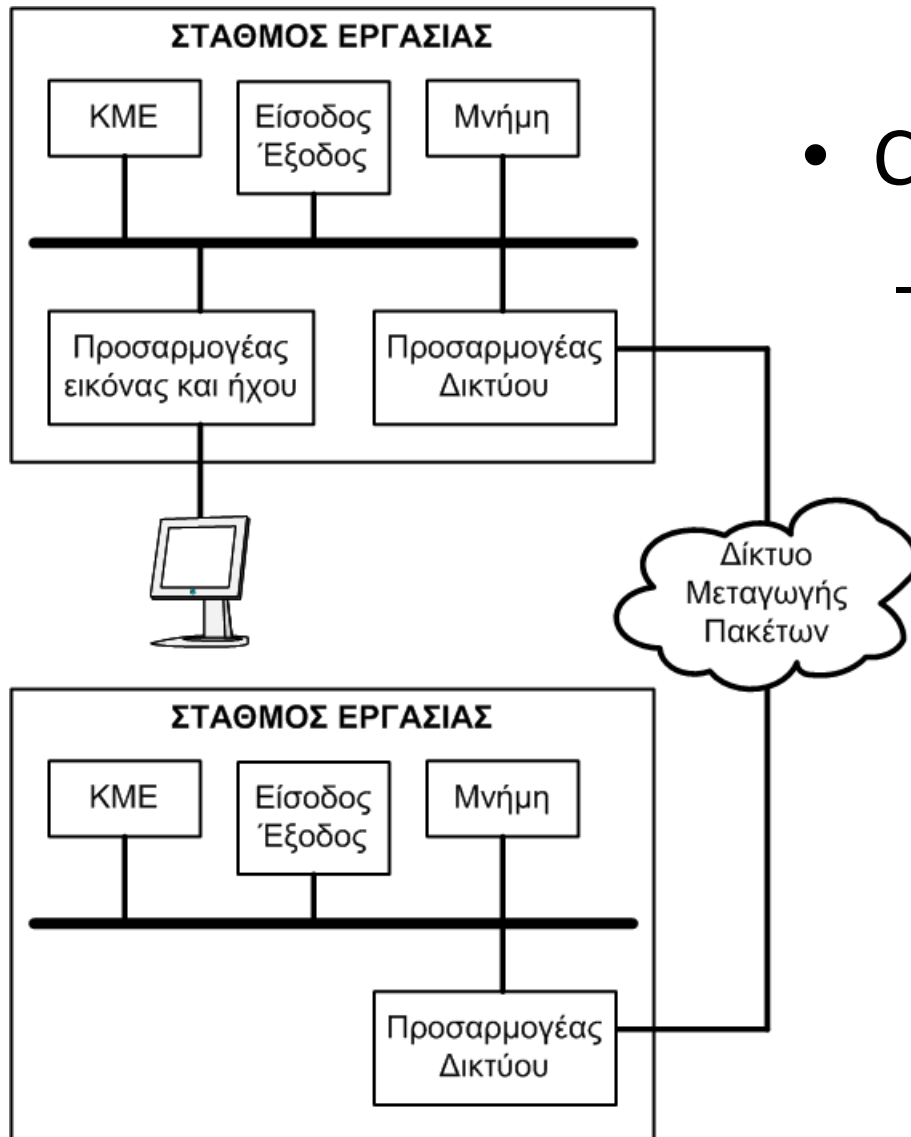


- Peer to peer systems
 - In terms of the app
 - Peers may have roles
 - Floor control in conferencing

Networked Multimedia (3 of 5)

- Peers may be widely different
 - Network connection
 - Processing capability
 - Lots of problems with many peers
- Teleconferencing and group work
 - Impossible without a network
 - Needs little storage space
 - But requires good synchronization

Networked Multimedia (4 of 5)



- Client-server systems

- Server

- Storage and processing
- Media or services
- Expensive, but shared among many clients

Networked Multimedia (5 of 5)

- Client-server systems
 - Clients
 - Workstations, tablets, smartphones
 - Much cheaper, but relying on servers
 - Media distribution, content retrieval
 - Lower operating costs
 - We basically “rent” the server

Multimedia transport (1 of 6)

- Originally: circuit-switched networks
 - Guaranteed, but fixed, level of service
 - Costly, and being torn down
- Now: packet-switched networks
 - Unpredictable level of service
 - Shared, so lower cost
- Multimedia applications
 - Good fit for packet-switched networks

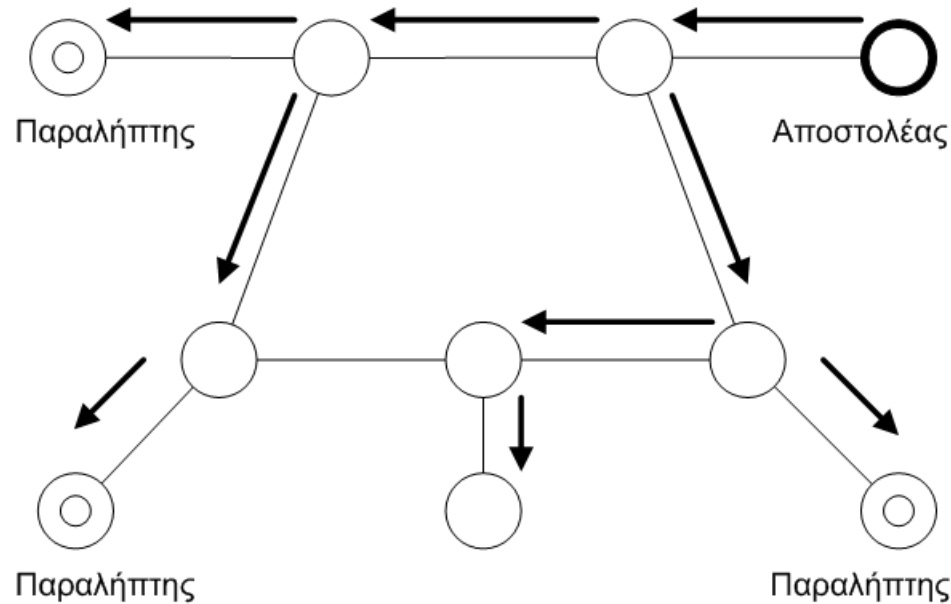
Multimedia transport (2 of 6)

- Media streaming
 - A sequence of media packets
 - Continuous and discrete media
 - Different implementations
- Asynchronous transmission
 - No time limits
 - Incompatible with continuous media
 - Only good for downloads

Multimedia transport (3 of 6)

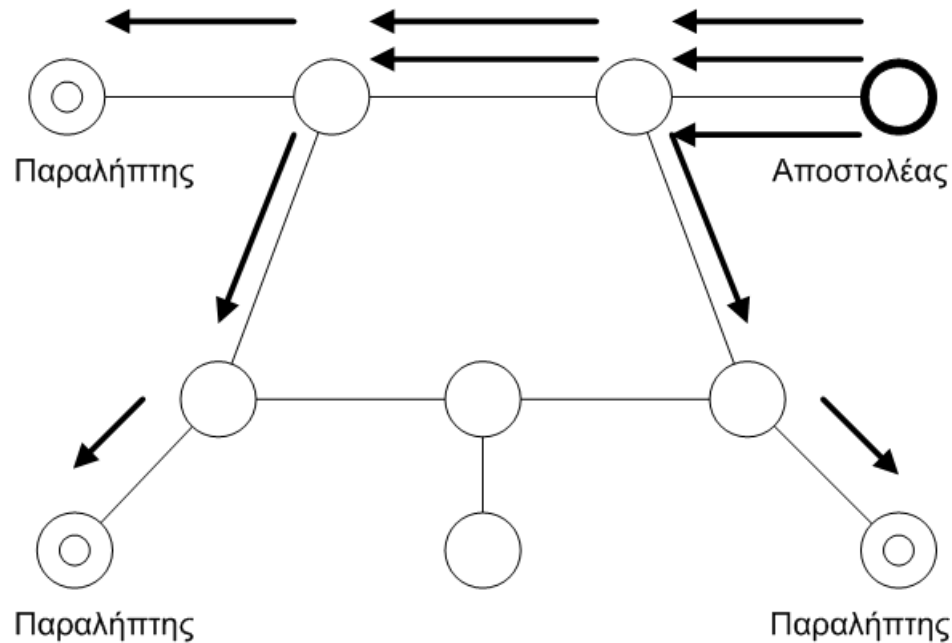
- Synchronous Transmission
 - Upper limit to delay
 - Good for continuous media
 - May overflow receiver with media
- Isochronous Transmission
 - Upper and lower delay limit
 - Smooth transmission rate
 - Best option, when available

Multimedia transport (4 of 6)



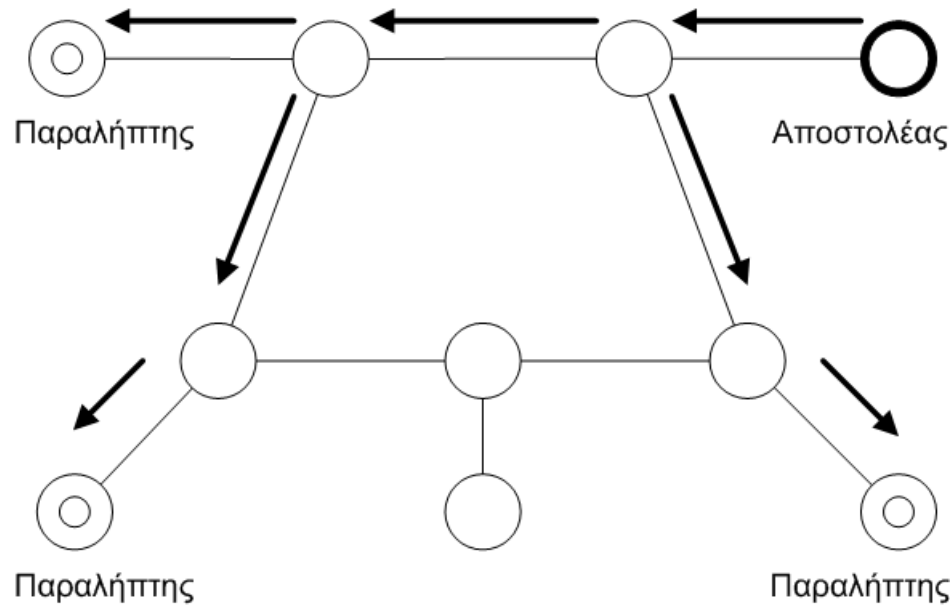
- Multi-party communication
 - Used in teleconference and media distribution
- Broadcast (one to all)
 - Wasteful, but used in TV and radio

Multimedia transport (5 of 6)



- Unicast (one to one)
 - What the Internet supports
 - Wasteful, especially closer to the sender

Multimedia transport (6 of 6)



- Multicast (one to many)
 - Requires (considerable) network support
 - Most economic way to distribute media

IPTV vs. Streaming

- IPTV: “live” content distribution
 - Limited number of channels
 - Multicast to lots of subscribers
 - Needs considerable network support
- Streaming: on demand content viewing
 - Huge content libraries
 - Unicast to individual subscribers
 - Heavily relies on CDNs and adaptive transport

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What makes media interesting / challenging?

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Interesting

- Media are multidisciplinary
 - Physical phenomenon (sound)
 - Perception by humans (hearing)
 - Capture by a device (microphone)
 - Representation in a computer (sampling)
 - Historical sidetrack: analog representation (records)
 - Compression (perceptual coding)
 - Output for humans (playback)

Challenging (1 of 3)

- Data volumes are huge!
 - Example: 4K video at 60 fps
 - Uncompressed bit rate: 11,9 Gbit/s!
 - How fast is your home network?
 - A digital video camera must
 - Capture the video
 - Compress the video
 - Preview the video

Challenging (2 of 3)

- Needs fast hardware
 - Fast communication buses
 - Fast processors and storage
 - Custom hardware for media processing
 - Especially for video
- Synchronization requirements
 - Continuous media are very time dependent
 - Need for real-time scheduling

Challenging (3 of 3)

- End-to-end synchronization
 - Limited network delay
 - Limited network jitter
 - QoS guarantees (if available)
- Dealing with heterogeneity
 - Networking and computing heterogeneity
 - Use of adaptive techniques
 - Layered coding

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Standards and formats

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Format wars (1 of 5)

- Why don't we let the market decide?
- VCR: Video Cassette Recorder
 - Three competing industry standards
 - Betamax (Sony), VHS (JVC), 2000 (Philips)
- Recording time: initially 1 to 2 hours
 - Later, up to 5 or 10 hours
 - Extended time came at a quality cost
- Quality: Betamax was slightly better
 - But the quality was worse than broadcast TV!

Format wars (2 of 5)

- The end game
 - Philips' 2000 was late to market
 - Only made some headway in Europe
 - Betamax lost after a very long time
 - Even though it was the first to market
 - VHS won in the end
 - Longer recording time
 - Cheaper devices
 - Convenience beat quality

Format wars (3 of 5)

- But why did VHS win?
 - The original market was recording TV
 - Films were to be distributed on Laserdisk!
 - Pre-recorded content came much later
 - The initial market relied on TV recording
 - And Beta had less recording time
 - Sony insisted on smaller cassettes
 - Sony insisted on maintaining image quality

Format wars (4 of 5)

- The successor to DVD
 - BluRay (Sony) against HD-DVD (Matsushita)
 - Initially, nobody sold content
 - Every studio waited for the winner
 - Nobody wanted another VHS/Betamax situation
 - Sony's BluRay won due to PlayStation 3
 - Created a large user base
 - Even though the discs were for games

Format wars (5 of 5)

- The successor to the LP record
 - CD: a common standard (Sony/Philips)
 - Mass production with cheap materials
 - Small size and robust enough to transport
- The successor to the compact cassette
 - DAT: promoted only by Sony
 - The music industry fought it tooth and nail
 - It survived in the studios and in data storage

Why standards? (1 of 4)

- Analog TV was not standardized
- Europe had two analog systems
 - PAL: Western Europe (and West Germany)
 - SECAM: France and Eastern Europe
- Was there a need for a standard?
 - Each country decided on a system
 - There were enough countries to make both cheap
 - East Germans could not see West German TV
 - That was a feature, not a bug!

Why standards? (2 of 4)

- Digital TV standardized around DVB-T
 - Which allows different encodings
 - ERT in Greece started with MPEG-2
 - Digea in Greece continued with MPEG-4
 - ERT then switched, and many decoders were scrapped
- So, not it's hard to move to DVB-T2
 - It does not lead to a large channel gain
 - It does not free up frequencies
 - And nobody wants another decoder

Why standards? (3 of 4)

- Standards and Apps
 - The Internet allows app distribution
 - The apps embed the services
 - Netflix app, JS in Browser
 - Standards are limited to compression
 - H.264/AVC, AAC
 - BUT, you also need a platform to run them
 - Android, iOS, Samsung TV (Tizen), HTML5

Why standards? (4 of 4)

- Who creates standards?
- International Organizations
 - ISO, ITU
- Industry Groups
 - 3GPP, DASH-IF
- Powerful (or lucky) companies
 - Adobe

Regulatory framework (1 of 3)

- What is network neutrality?
 - Treating all packets the same
 - Regardless of source/destination
 - Regardless of content
- The case for
 - Anyone can create the new killer app
 - Small players are not disadvantaged
 - Therefore, good for innovation!

Regulatory framework (2 of 3)

- The case against
 - ISP cannot offer improved services
 - Therefore, bad for innovation!
- The reality is not that simple
 - Can an ISP treat Viber badly?
 - To avoid losing money from voice telephony
 - Can an ISP treat Netflix badly?
 - To avoid draining bandwidth without compensation

Regulatory framework (3 of 3)

- Who decides what is legal?
 - In the US, telecoms are regulated by the FCC
 - But, can it also regulate ISPs?
 - If so, should it enforce net neutrality?
 - So far, changed position 3 times!
 - In the EU there is a positive recommendation
 - But it has many exceptions

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End of Section #1

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