Outline

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3.	Interactive Web Applications	
4.	Communities, the Web, and Multimedia	
5.	Digital Rights Management	Part II: Content-Oriented Base Technologies
6.	Cryptographic Techniques	
7.	Multimedia Content Description	
8.	Streaming Architectures	Part III: Multimedia Distribution Services
9.	Web Radio, Web TV and IPTV	
10.	Electronic Books and Magazines	
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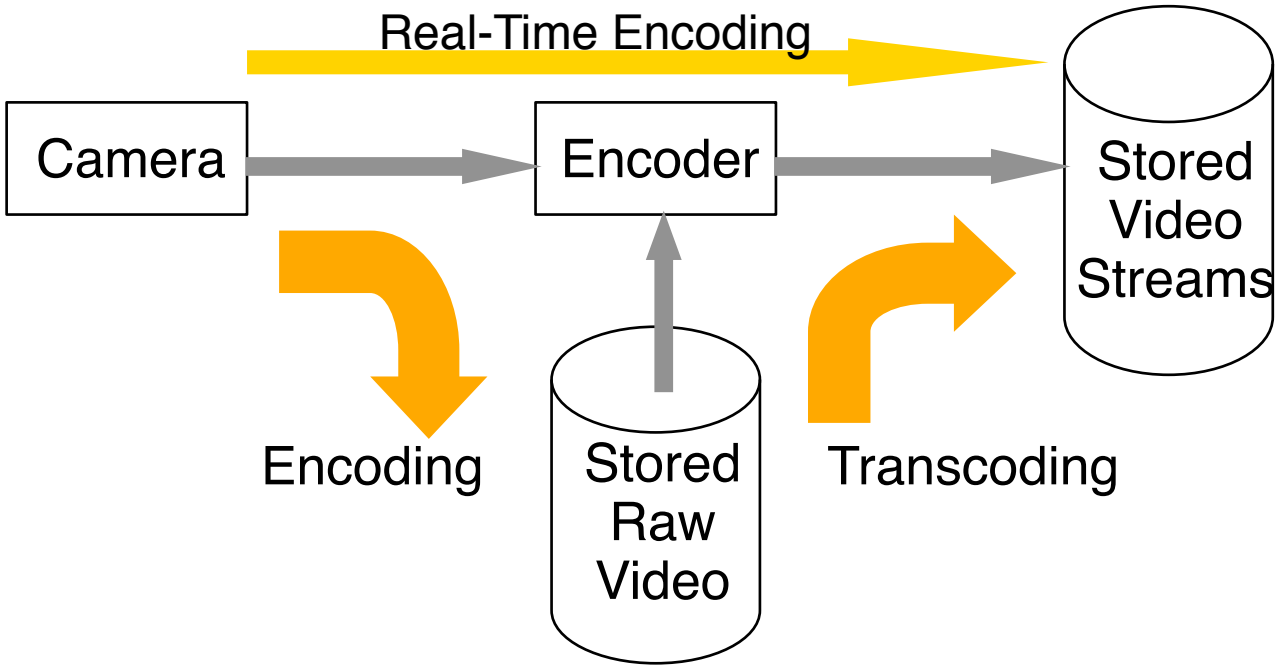
12.	Multimedia Conferencing	Part IV: Conversational Multimedia Services
13.	Signaling Protocols for Multimedia Communication	
14.	Visions and Outlook	

11 Multimedia Content Production and Management

Literature:

Tobias Künkel: Streaming Media – Technologien, Standards, Anwendungen, Addison-Wesley 2001

Encoding and Transcoding



- Audio and video needs to be converted for streaming delivery
  - Compression, proprietary formats
- *Transcoding*: Conversion of media files from one format to another
- *Repurposing:* Using existing content for new purposes
  - e.g. using TV ads as streaming content

Factors Determining Video Bandwidth

- Physical resolution (number of pixels)
  - Determines picture size in standard rendering resolution (e.g. 72 dpi)
  - Dependent on playback device
    - » “Set Top Box” for TV set requires full-screen TV signal
    - » Video window on PC can be adjusted in size
- Frame rate
  - Desirable: 25 fps
  - Over low-bandwidth links often only smaller rates possible (e.g. 10 fps)
- Colour (sub)sampling
- Audio quality
  - Sampling rate, resolution (e.g. speech vs. CD quality)
  - Mono, stereo, multi-channel
- Degree of compression
  - Determines appearance of compression artefacts

Network Limitations

- Bandwidth towards receiver is limited:
- Effective bandwidths for various access network technologies:
  - 28.8 modem: 20 – 23 Kbps
  - 56.6 modem: 32 – 35 Kbps
  - ISDN: 45 – 55 Kbps
  - Dual-ISDN: 80 – 100 Kbps
  - DSL: 1000 Kbps and more
  - VDSL: 25 Mbps and more
  - Cable modem: 4 – 36 Mbps
  - LAN: 10 – 100 Mbps
- Compromise between bandwidth limitations and quality:
  - Picture format
    - » E.g. for 28.8 modem picture format 176 x 144 pixel (QCIF)
    - » E.g. for DSL picture format 360 x 288 pixel (CIF)
  - Plus other factors

Example: Multiple Bit Rate Encodings

	Video source	Broadcast (DVB)	DSL/ cable	Modem
Target data rate	(270 Mbit/s)	4 Mbit/s	500 kbit/s	35 kbit/s
Required data reduction		40:1	330:1	4700:1
Frame size	720 x 480 (CCIR 601)	720 x 480	192 x 144	160 x 120
Frame rate	30	30	15	5
Colour sampling	4:2:2	4:2:0	YUV12	YUV12
Uncompressed data rate (Mbit/s)	166	124	5	1.15
Fraction of original data rate		1:1.33	1:33	1:144
Required compression		30:1	10:1	30:1

From: D. Austerberry

Common Video Image Formats

Format	Resolution	Frame rate	Sub-sampling	Application
CCIR 601 (NTSC)	720 x 480	30 interlaced	4:2:2	Broadcast (DVB), DVD
CCIR 601 (PAL)	720 x 576	25 interlaced	4:2:2	
SIF (NTSC) Standard Interchange Format	352 x 240	30 progressive	4:2:0	Videoconference, streaming , CD-ROM
CIF (PAL) Common Intc. Format	352 x 288	30 progressive	4:2:0	Videoconference, streaming, CD-ROM
QCIF Quarter CIF	176 x 144	30 progressive	4:2:0	Videoconference, streaming
4CIF Quarter CIF	576 x 704	15, 30 progressive	4:2:0	Videoconference, streaming

From: D. Austerberry (adapted)

Multiple Bitrate Encoding

- In general, the same content has to be encoded in several qualities/ bitrates
- File allocation:
  - One file multiplexing several qualities, or
  - Several files
- Selection of appropriate quality/bitrate:
  - Dependent on network access technology and dynamic network load
  - Manual selection: Through different alternatives on Web page, or
  - Automatic selection:
    - » Using streaming server software and adequate client
    - » Often access network type stored in user preferences for client software

Example: SMIL and Bandwidth Selection

- Example:

```
<smil>
  <body>
    <par>
      <switch>
        <audio src="http://www.providerxy.com/datei1.rm"
          system-bitrate="250000"/>
        <audio src="http://www.providerxy.com/datei2.rm"
          system-bitrate="100000"/>
        <audio src="http://www.providerxy.com/datei3.rm"
          system-bitrate="40000"/>
        <audio src="http://www.providerxy.com/datei4.rm"
          system-bitrate="1000"/>
       </switch>
    </par>
  </body>
</smil>
```

- RealPlayer supports SMIL
  - Selects first stream which is smaller than bandwidth from user preferences

Combining Media Elements to Compound Media

- Combining video streams, audio streams, text captions, graphics, links to Web locations
  - In space on the screen (e.g. video with banner advertisement)
  - Temporally (e.g. “pre-roll advertisement” with video streams)
- Enhancing interactivity and flexibility
  - E.g. free navigation
  - E.g. language options
- Technological basis:
  - Spatio-temporally structured compound multimedia documents
  - with high degree of interactivity
  - Example technologies:
    - » SMIL in RealPlayer
    - » MPEG-4

Automated Media Composition and Repurposing?

- Sufficient metadata annotation enables automated semantic decisions
  - Combination of media elements
  - Repurposing, e.g. creating adequate still picture from video
  - Nack, F. (2004) The Future in Digital Media Computing is Meta.
    IEEE MultiMedia, Vol 11, No. 2, pp. 10-13
- Serious open research issue:
  How to express the overall structure of a composed piece of media?
  - Grammar-like system to express the semantic and aesthetic composition
    - » For movies
    - » For general multimedia productions
  - *"Applied media aesthetics"* (H. Zettl)
  - M. Davis: Media Streams - An iconic language for video representation, 1995

Semantic Gap in Content/Media Management (1)

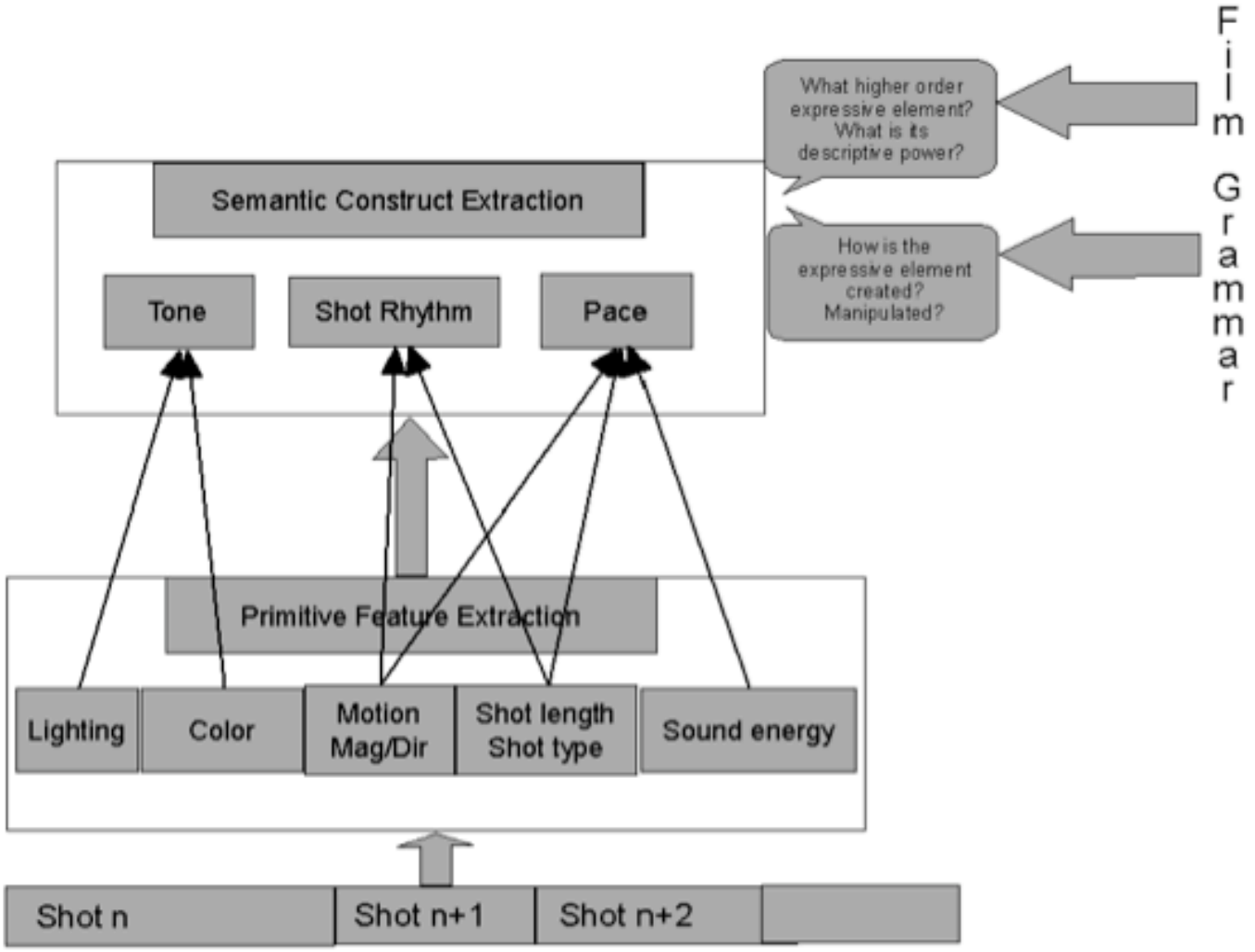
C. Dorai, S, Venkatesh: Bridging the Semantic Gap in Content Management Systems: Computational Media Aesthetics, In Proc. Conf. on Computational Semiotics for Games and New Media, 2001.

"... An approach that goes beyond representing what is being directly shown in a video or a movie, and aims to understand the semantics of the content portrayed and to harness the emotional, visual appeal of the content seen."

$$P(n) = \alpha(W(s(n))) + \frac{\beta(m(n) - \mu_m)}{\sigma_m}.$$

Pace flow function
n = shot number
s = shot length
m = motion magnitude
μ, σ mean and standard deviation of m

Semantic Gap in Content/Media Management (2)



11 Multimedia Content Production and Management

Literature:

Gregory C. Demetriades: Streaming Media, Wiley 2003

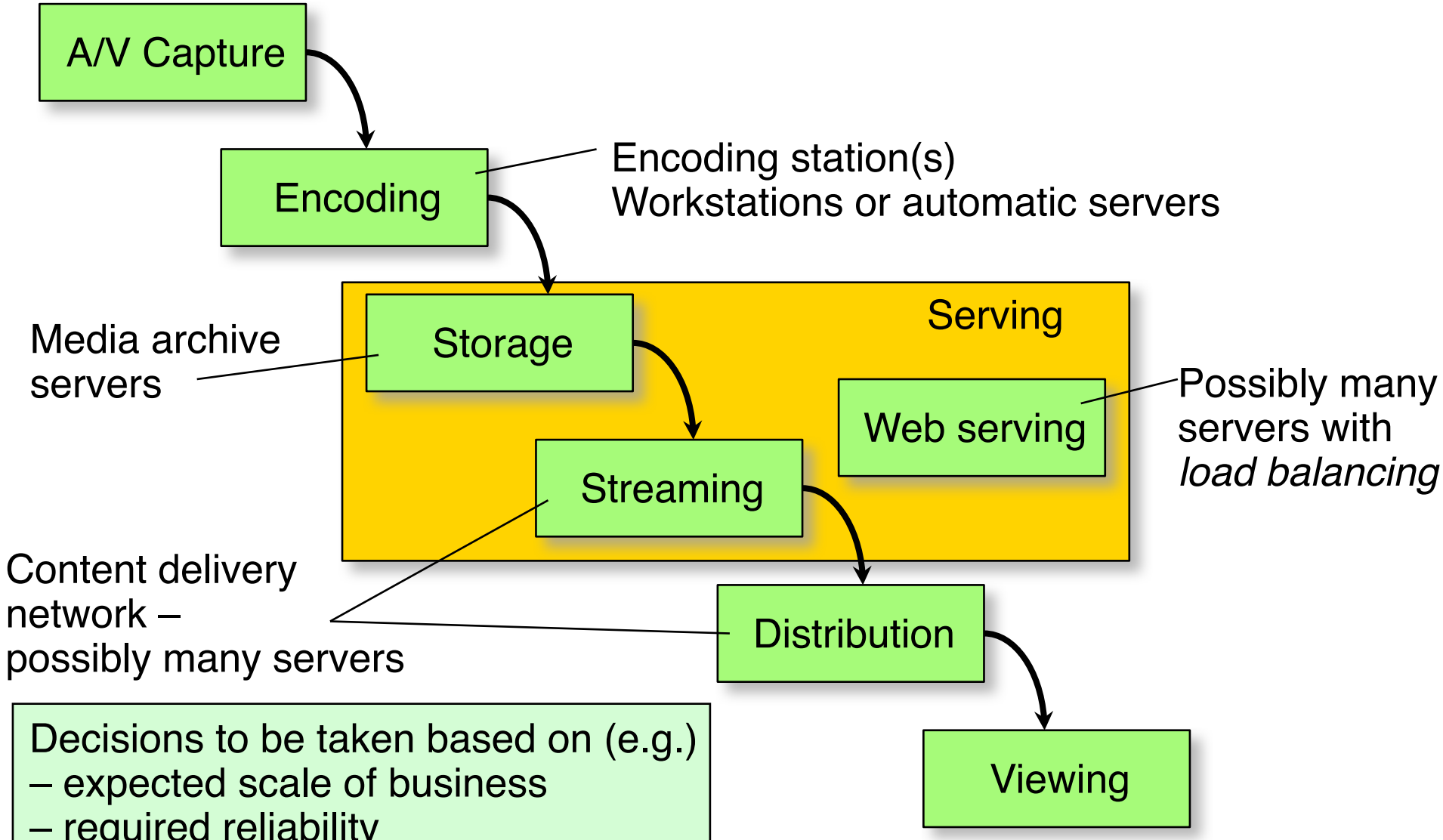
Jürgen Mayer (Hrsg.): streaming media - Internet bewegter, bunter, lauter. Markt&Technik 2001

High-Level View of Media Production

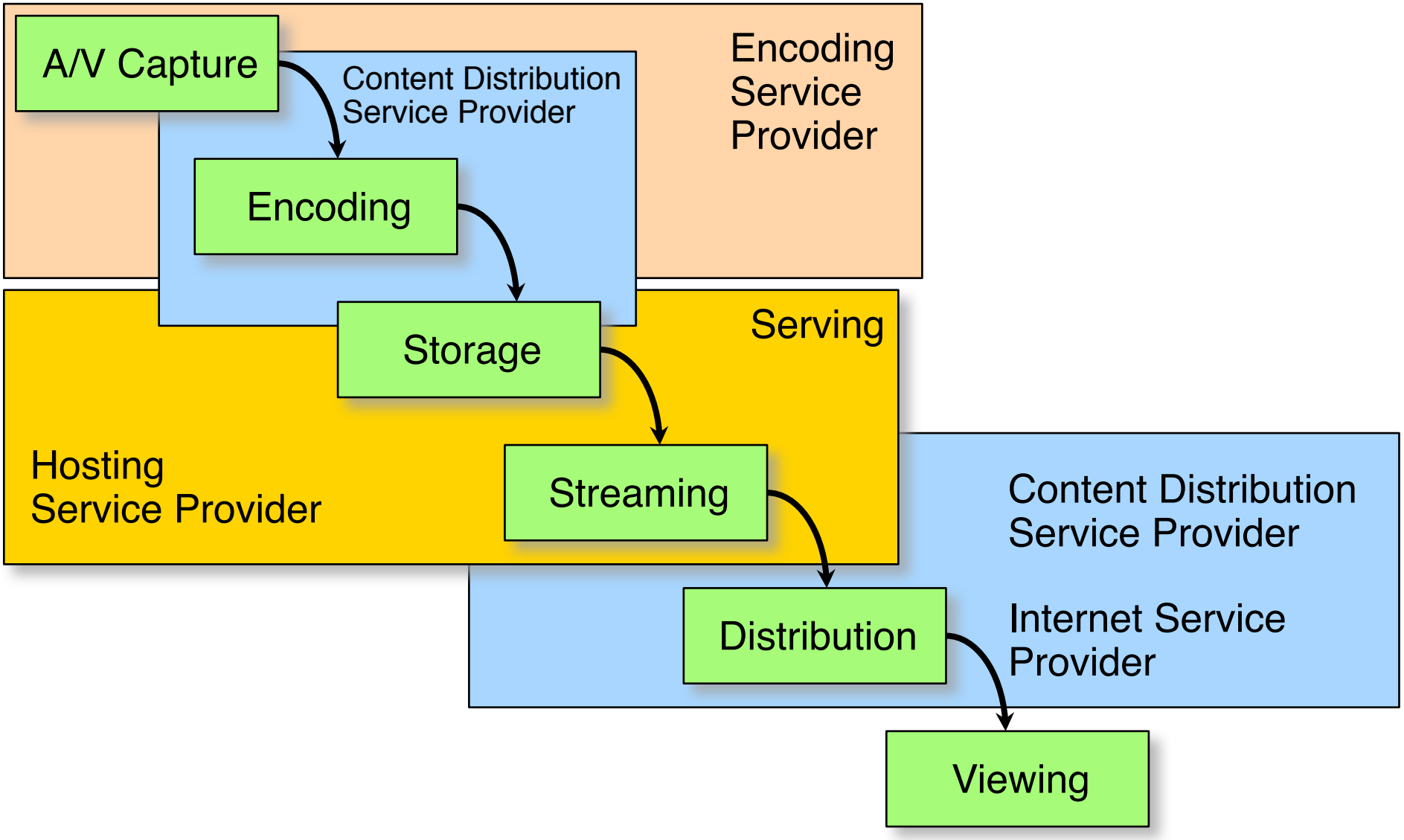
- Premeditate
- Capture
- Archive
- Annotate
- Query
- Message Construction
- Organise
- Publish
- Distribute

Lynda Hardman: Canonical Processes of Media Production, CWI Amsterdam, REPORT INS-E0512 SEPTEMBER 2005

Hardware in the Streaming Delivery Chain



Organisations in the Streaming Delivery Chain



Automated Transcoding

- Example 1: Publishing Multiple Formats
  - Broadcaster is creating 8 hours of content per day
  - Repurposing into streaming media for Web-based Video-on-Demand
  - Live capturing, encoding (e.g. MPEG)
  - After program end: transcoding to different bitrates, delivery to streaming server
- Example 2: Flipping on Demand
  - Media archive for a cable channel to be made available through Web
  - Media kept in single, high-quality format
  - On demand (request), files are transcoded, watermarked, streamed
- Example 3: Collaboration Distribution
  - Large company working on marketing materials
  - One rough cut of a new commercial to be distributed to 100 clients with varying quality expectations and platforms
  - *Content distribution service* transcodes according to client requirements
- Example product: Telestream FlipFactory (www.telestream.net)

11 Multimedia Content Production and Management

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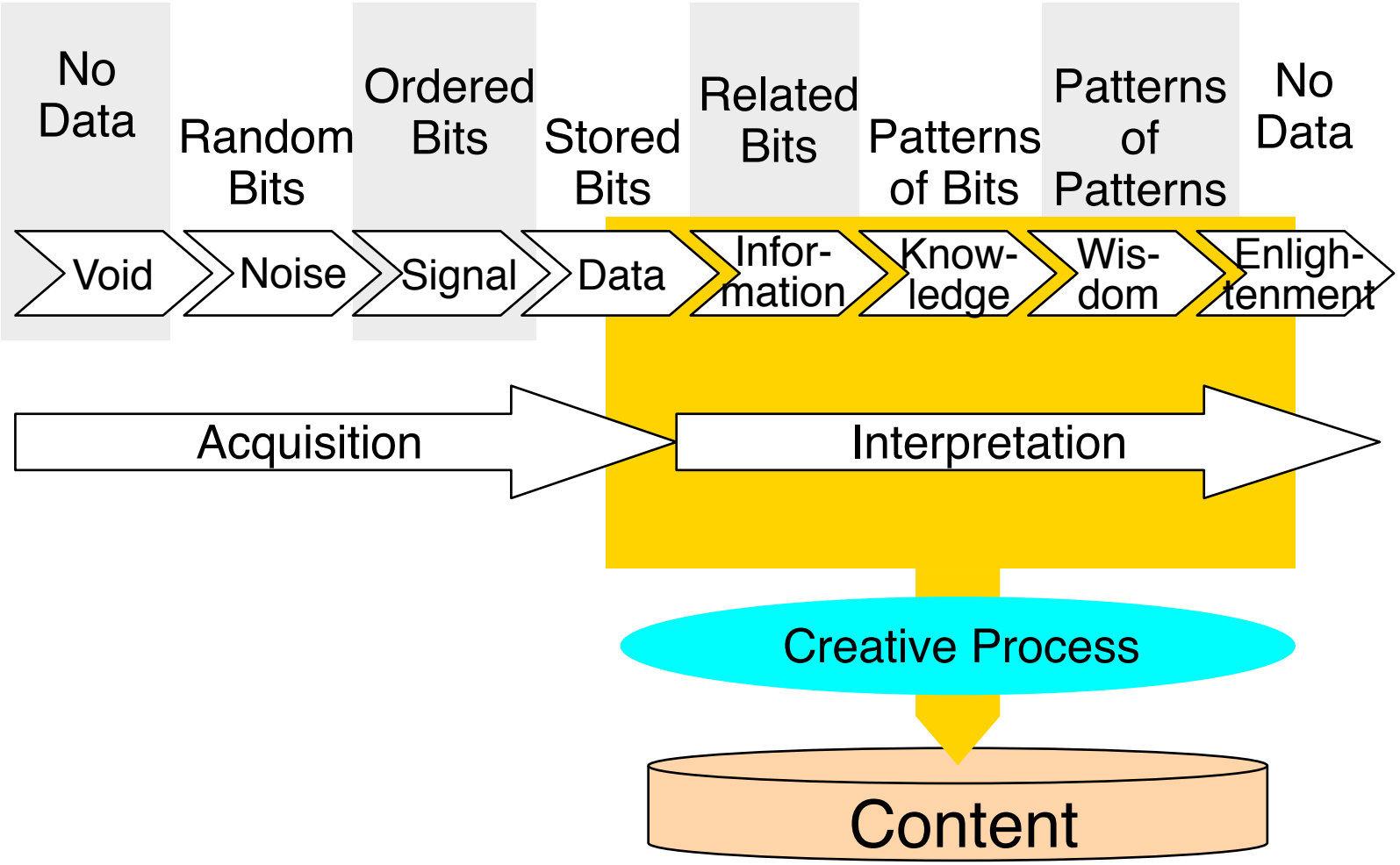
Gregory C. Demetriades: Streaming Media, Wiley 2003

Rosenblatt et al., Chapter 10

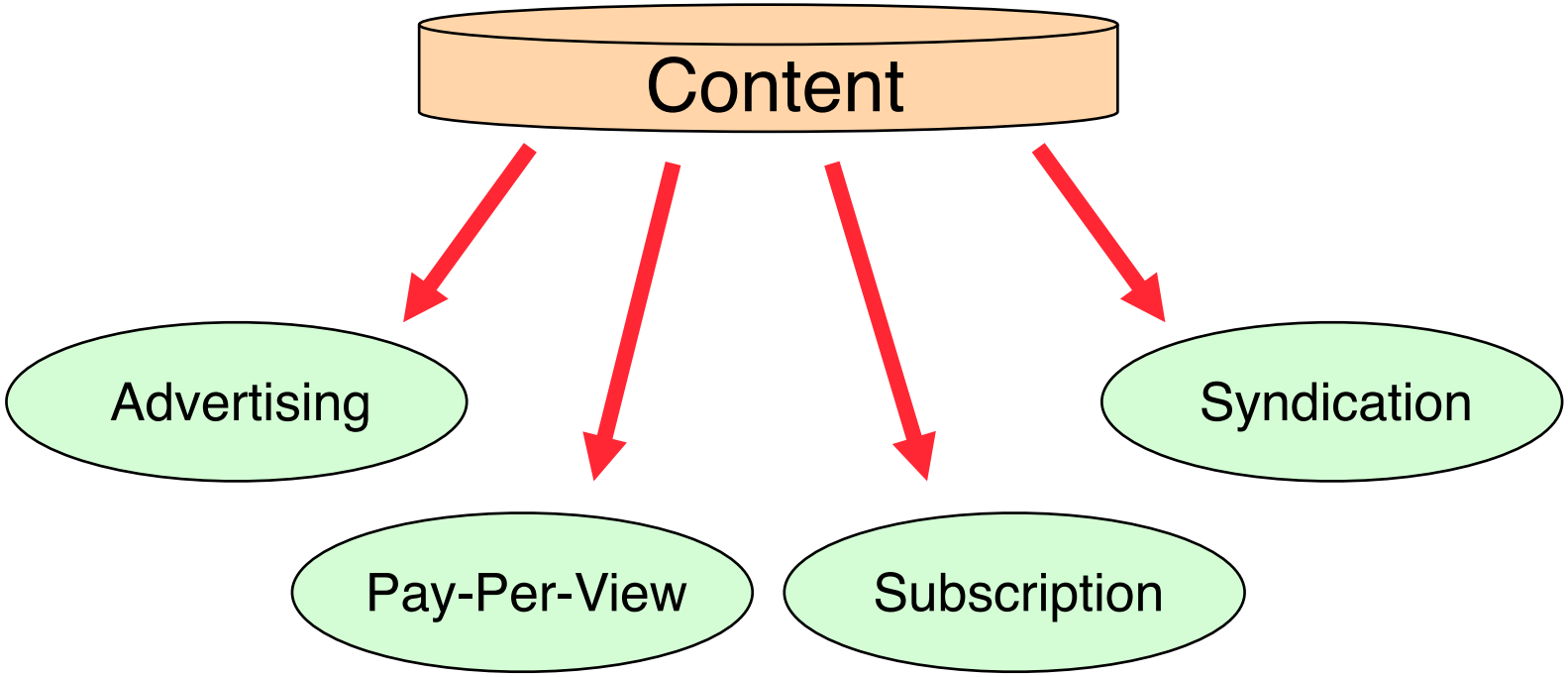
Information Progression and Content

- A holistic view according to Demetriades (p. 189) and Virage Inc.:



Content Monetization

- There are several traditional models for gaining a return on investment on content
  - Network-based media enable the integration of all models



Digital Asset Management

- Very similar acronyms:
  - Digital Asset Management DAM
  - Media Asset Management MAM
    - » Rich Media Asset Management RMAM
  - Digital Media Management DMM
- Basic idea:
  - To make the right media material *(media assets)* available for each specific use, in the right version and the right format
- Integration technology:
  - Workflow integration
  - Integration with various media processing tools
  - Integration with content management and syndication solutions
- Broad range of product offerings
  - From large IT companies (IBM, EMC) to niche vendors

Example: OpenText Artesia DAM

- Digital Asset Management product, see www.opentext.com
- Media ingestion:
  - Various import tools, e.g. hot folders, email
- Media file storage, access and delivery
- Complete workflow coverage:
  - Individual activities of team members
  - Group projects
- Individual view:
  - “Inbox” – What are the tasks I am assigned to, which dates, which assets
- Project view:
  - Participants, status, associated assets, events (milestones, new versions)
- Asset management view:
  - Asset-centric, navigation to various projects
  - History: “where used”, “who used”, “how used”

Asset Management, Rights and Metadata

- Quotations from Artesia White Paper “The Essential Characteristics of Enterprise Digital Asset Management”:
  - “The defining characteristic of a digital asset is that it is an asset.”
  - “There is general agreement that an asset is the asset’s content plus metadata (or data about the content). Metadata include information about ... rights and permissions ...”