

Outline

1. Introduction and Motivation
 2. Media on the Web
 3. Interactive Web Applications
 4. Communities, the Web, and Multimedia
 5. Digital Rights Management
 6. Cryptographic Techniques
 7. Electronic Payment Systems
 8. Multimedia Content Description
 9. Streaming Architectures
 10. Web Radio, Web TV and IPTV
 11. Multimedia Content Production and Management
 12. Multimedia Conferencing
 13. Signaling Protocols for Multimedia Communication
 14. Visions and Outlook
- Part I:
Web Technologies
for Interactive MM
- Part II:
Content-Oriented
Base Technologies
- Part III:
Multimedia
Distribution Services
- Part IV:
Conversational
Multimedia Services



11 Multimedia Content Production and Management

11.1 Encoding and Transcoding

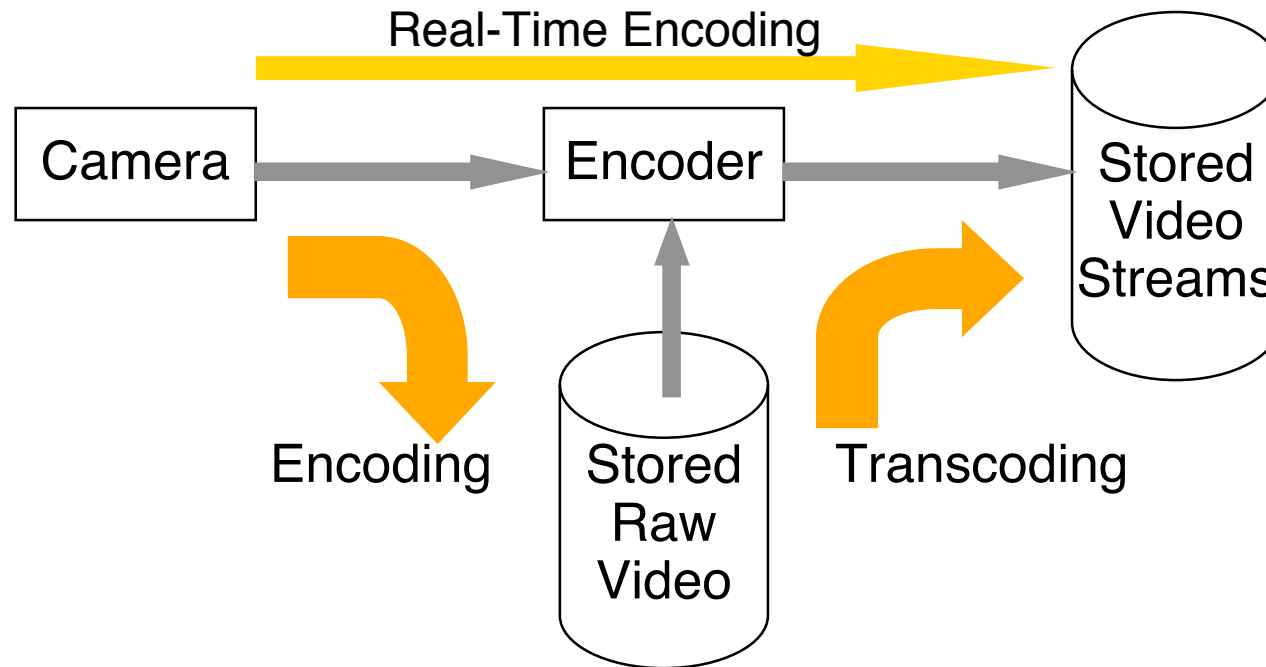
11.2 Media Production Chains

11.3 Media Asset 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	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	CD-ROM
SIF (PAL)	352 x 288	25 progressive	4:2:0	
CIF Common Intc. Format	352 x 288	30 progressive	4:2:0	Videoconference, streaming
QCIF Quarter CIF	176 x 144	30 progressive	4:2:0	Videoconference, streaming

From: D. Austerberry

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

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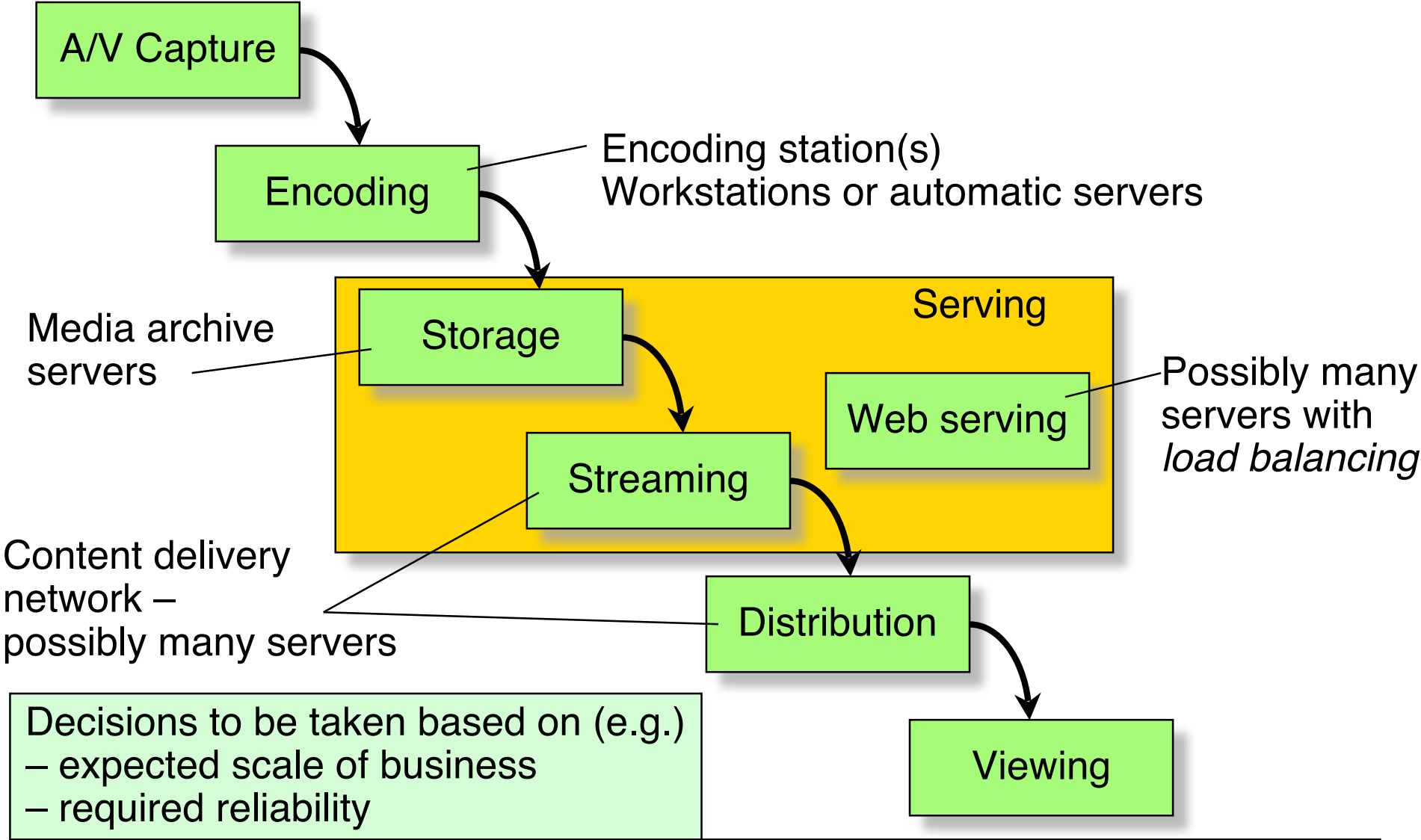
Jürgen Mayer (Hrsg.): streaming media - Internet bewegter, bunter, lauter. Markt&Technik 2001

High-Level View of Media Production

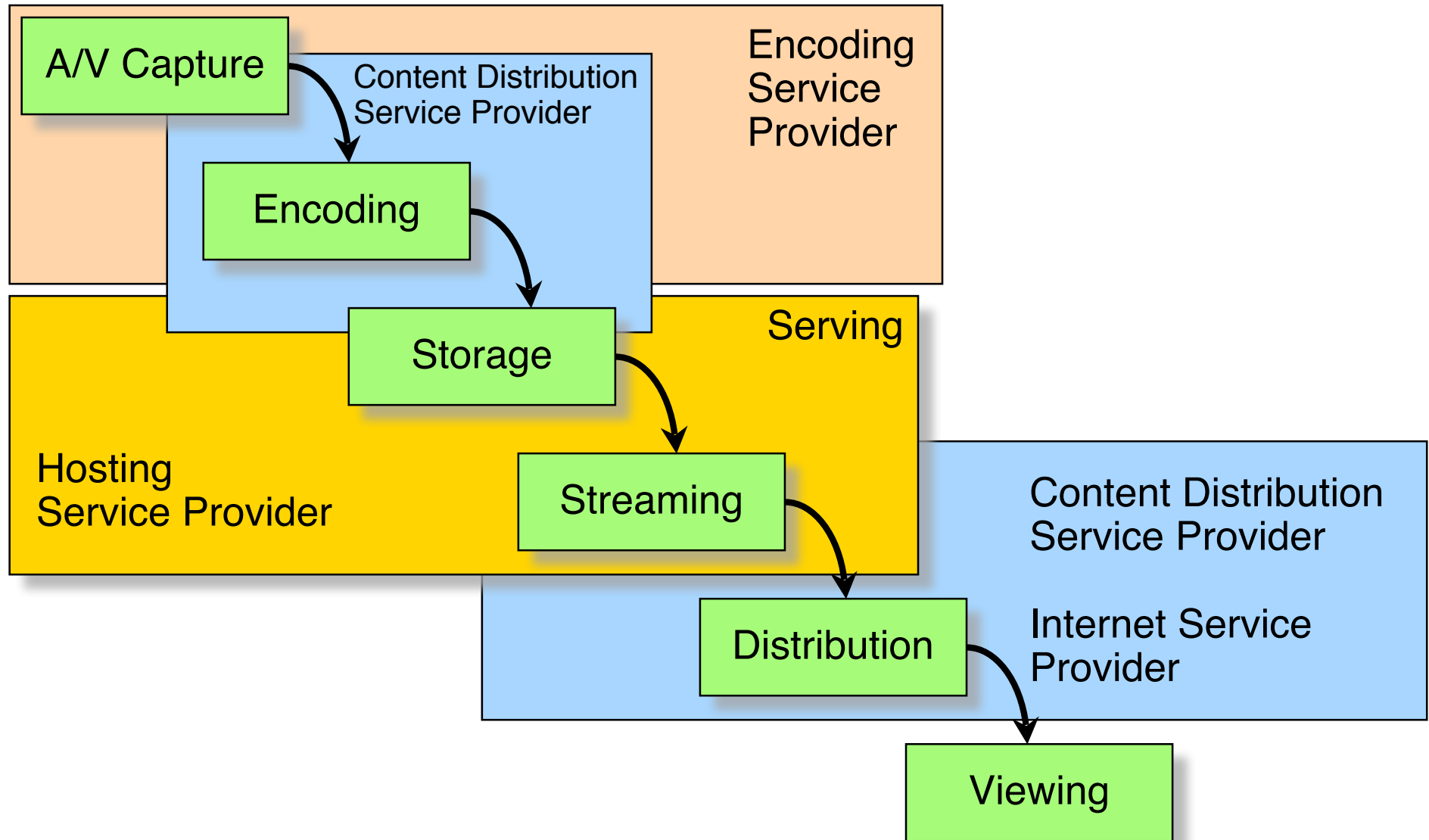
- Premeditate
- Capture
- Archive
- Annotate
- Query
- Message Construction
- Organise
- Publish
- Distribute

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)

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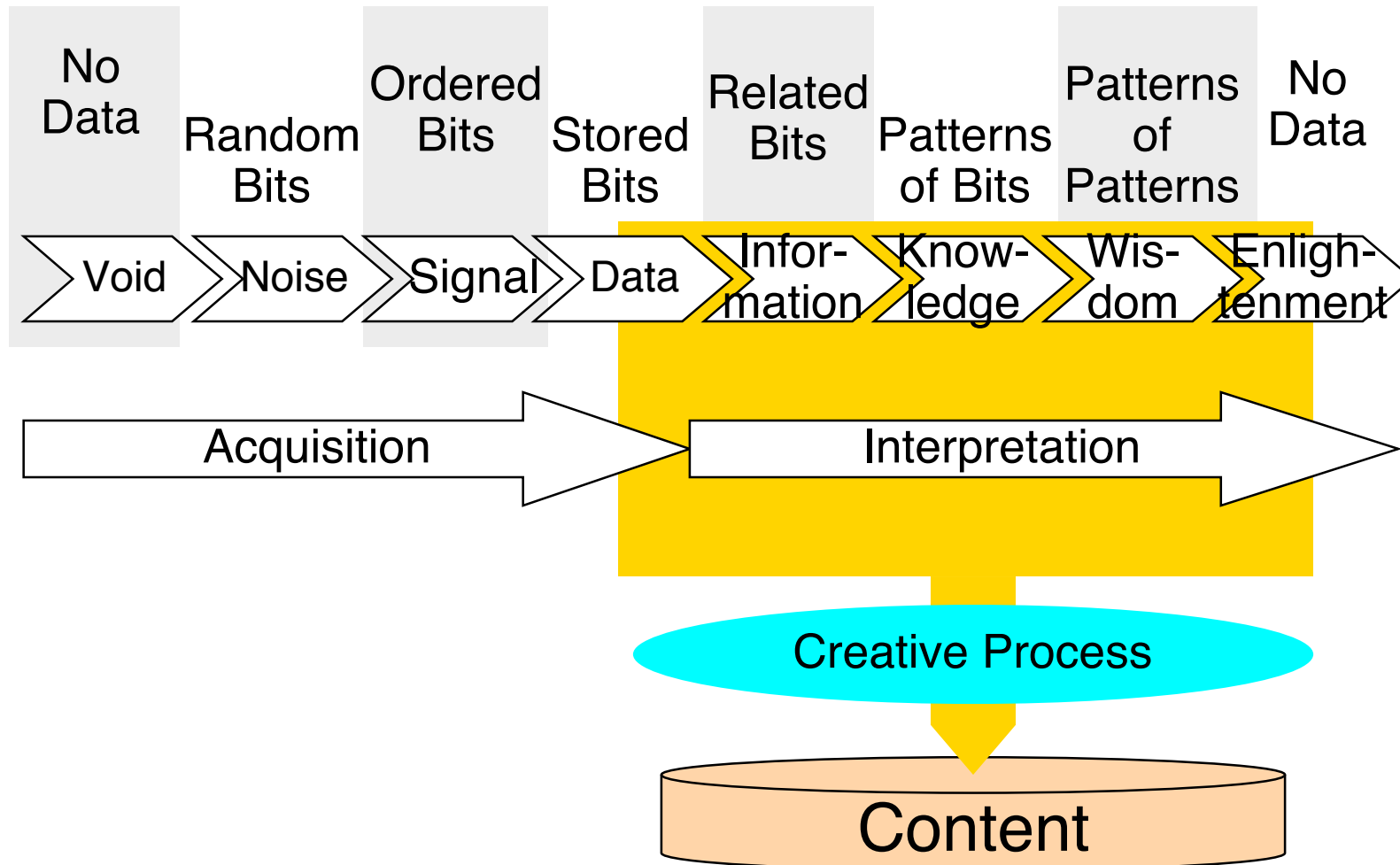
Literature:

Gregory C. Demetriades: Streaming Media, Wiley 2003

Rosenblatt et al., Chapter 10

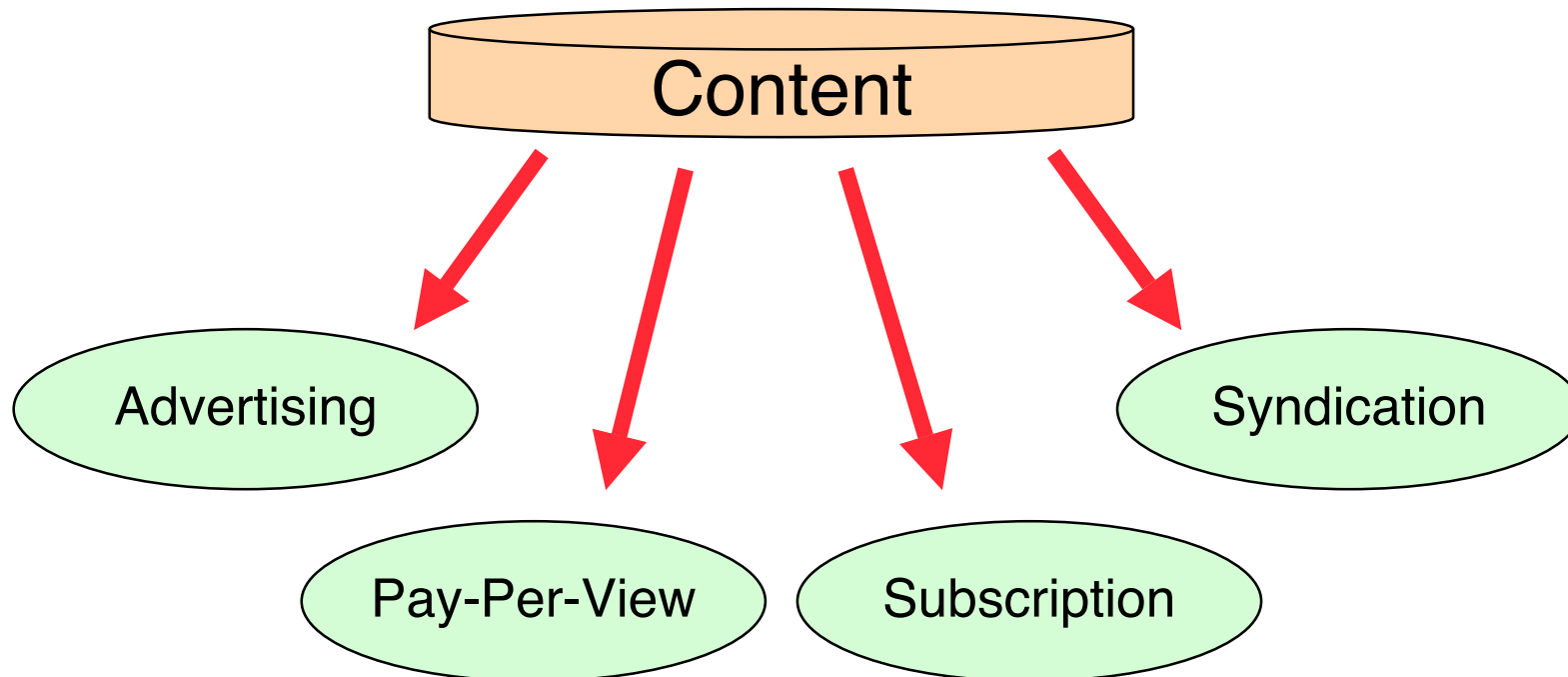
Information Progression and Content

- 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

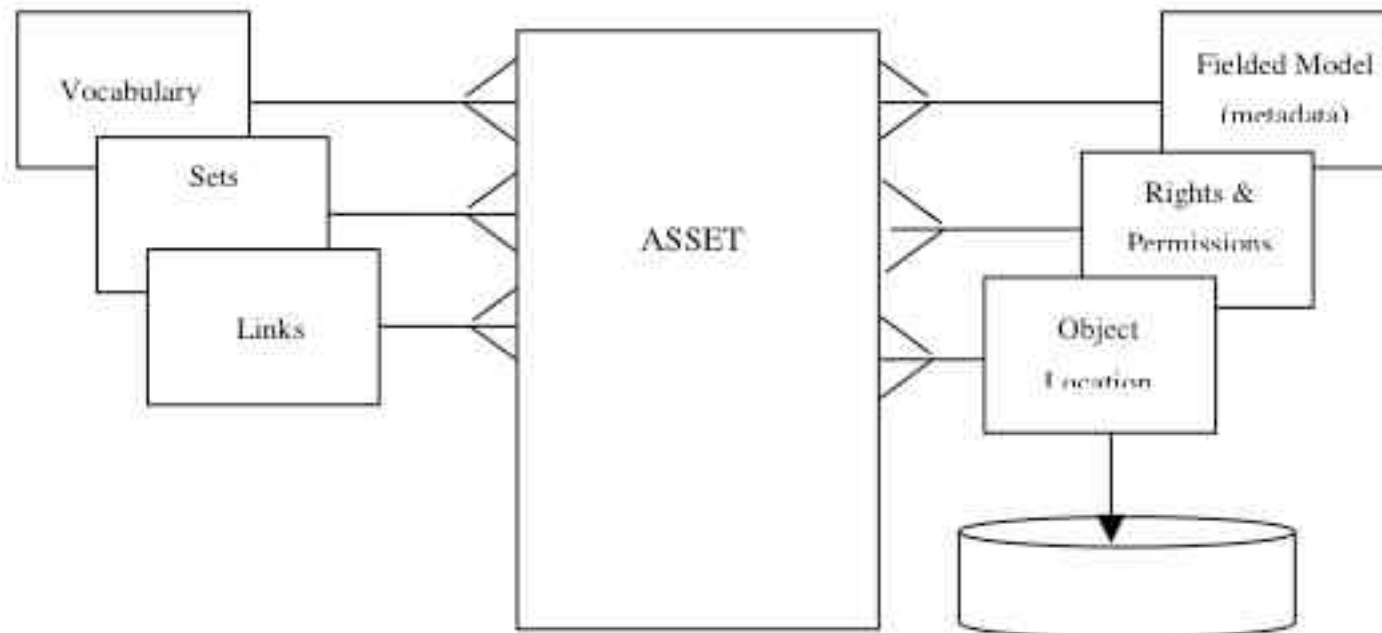
- Very similar acronyms:
 - Digital Asset Management DAM
 - Media Asset Management MAM
 - » Rich Media Asset Management RMAM
 - Digital Media Management DMM
- Basic idea:
 - To make the right media material (*media assets*) available for each specific use, in the right version and the right format
- 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 ...”



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)

