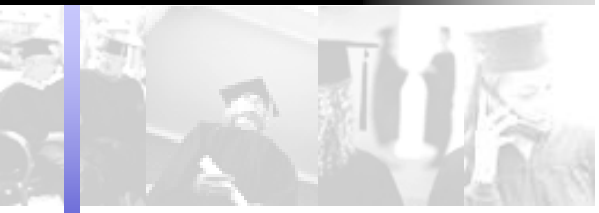

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MPEG Standards Enabling Universal Multimedia Access

Hermann Hellwagner · Christian Timmerer

Dept. of Information Technology, Klagenfurt Univ., Austria

1st Int'l. Conf. on

Automated Production of Cross Media Content for Multi-channel Distribution

~AXMEDIS 2005~

December 1, 2005

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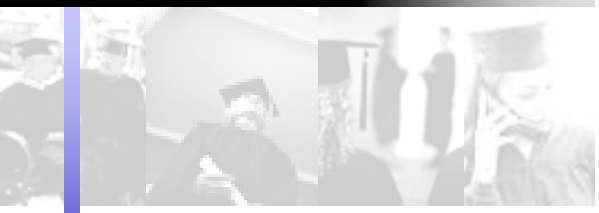
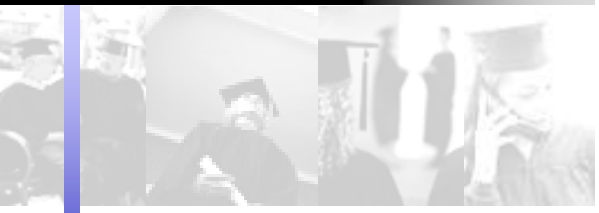


Outline

- Introduction: Universal Multimedia Access (UMA)
- Existing W3C Activities and Standards
  (Partially) Addressing the UMA Challenge
  Relationship W3C and MPEG Activities
- MPEG-7 Multimedia Content Description
- MPEG-21 Multimedia Framework – Overview
- MPEG-21 Digital Item Adaptation (DIA)
- Demos



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Introduction: Universal Multimedia Access (UMA)

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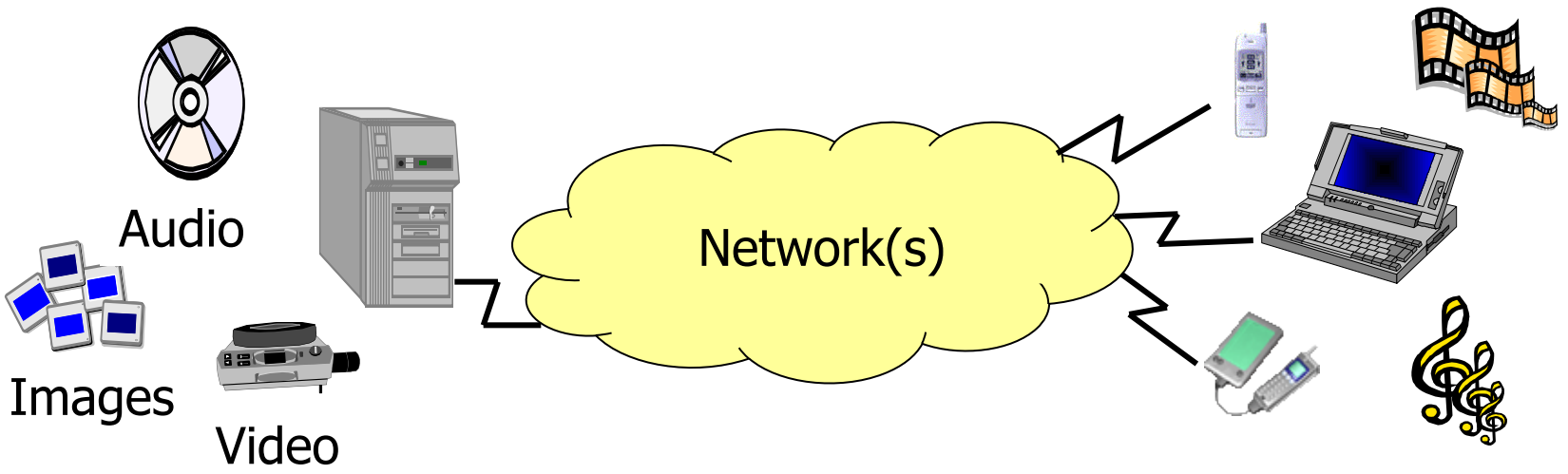
Universal Multimedia Access :=

Any content should be available anytime, anywhere

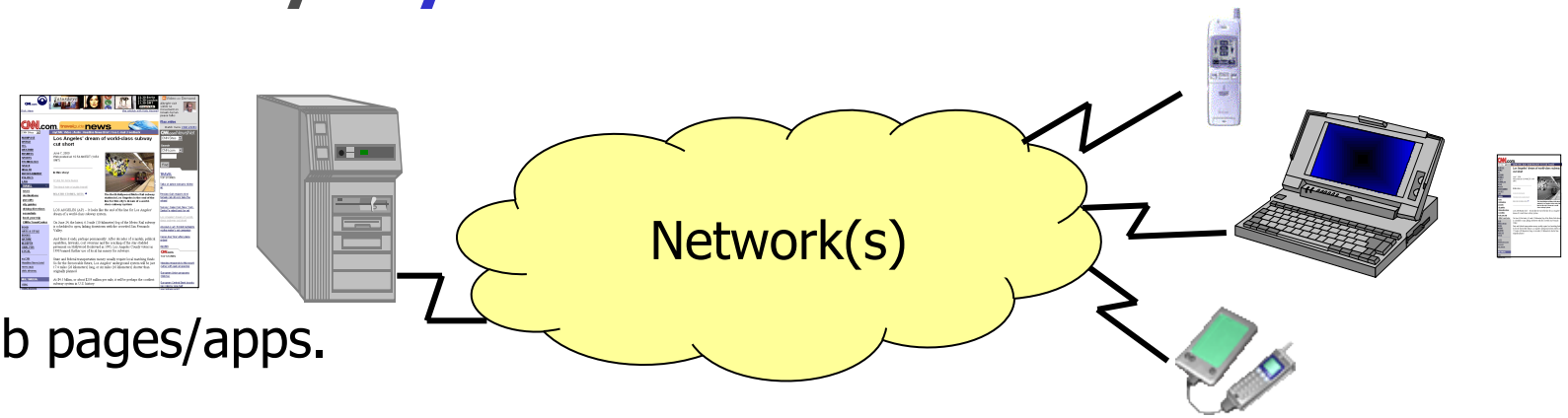


[Universal Multimedia Experiences :=

User should have worthwhile, informative experience anytime, anywhere]

Device Independence (W3C) :=

Access to a unified Web from any device in any context by anyone



[Harmonized User Experience :=

A functional user experience that is sufficiently harmonized with the delivery context to meet the quality criteria of the author]

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UMA Challenge and Concept

Heterogeneous Networks,
Dynamic Conditions

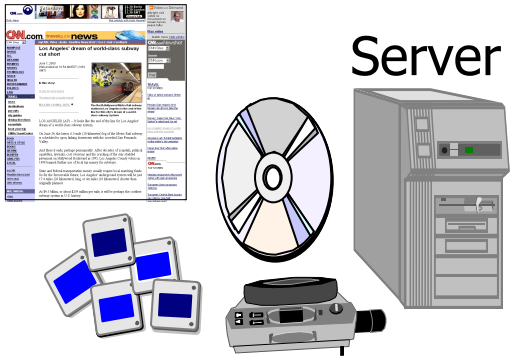
Rich Multimedia
Content

Diverse Set of
Terminal Devices,
User Preferences

Growing mismatch

Need for scalable content, descriptions, negotiation, adaptation

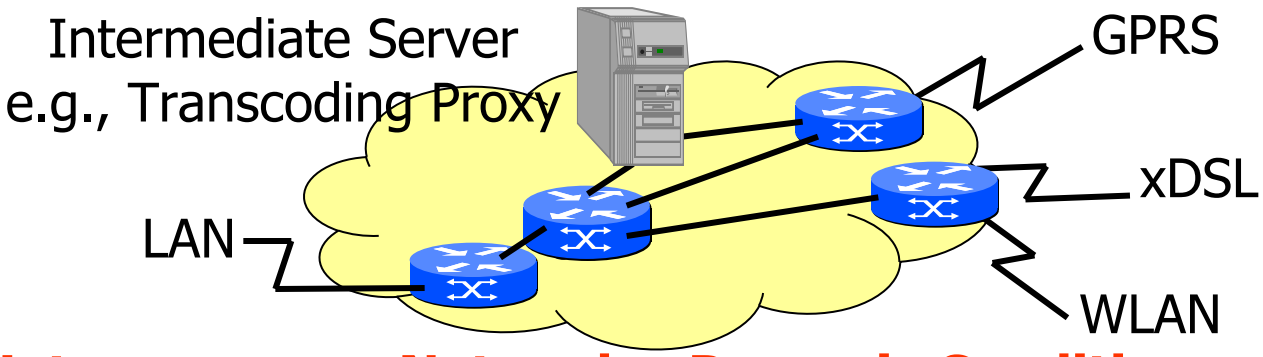
UMA Challenge: Content



Rich Multimedia Content

- **Different media types and formats**
  - **Video:** MPEG-2, -4, AVC, QuickTime, …
  - **Audio:** MP3, AAC, WAV, …
  - **Still images:** GIF, PNG, JPEG[2000], …
  - **Graphics, animation, VR/AR, …**
  - **Text:** .html, .txt, .doc, …
  - **…**
- **Scene descriptions:** how media streams are related, e.g., BIFS
- **Interactive content elements**
- **Metadata:** descriptive information about the actual data, e.g., MPEG-7

UMA Challenge: Networks



Heterogeneous Networks, Dynamic Conditions

- **Heterogeneous network infrastructure:**
  - **Backbones, ISPs, …**
  - **Wired access: LAN, xDSL, Cable, ISDN, …**
  - **Wireless access: WLAN, GSM, GPRS, UMTS, Bluetooth, …**
- **Fluctuating conditions: due to # users, traffic, roaming, …**
- **Different intermediate active nodes: proxy, cache, gateway, …**

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UMA Challenge: Devices

- **Different devices:**
  - **Stationary:** workstation, PC, Web TV, …
  - **Mobile:** notebook, tablet, PDA, smart phone, wearable, appliances in intelligent environment, …
- **Different capabilities:**
  - A/V support: display, speakers, …
  - Multimedia decoders/players
  - Modes of interaction
  - OS, processing, memory, bandwidth, energy, …
  - …

Diverse Set of Terminal Devices

UMA Challenge: User/Usage Prefs.

- **User preferences:**
  - **Personal characteristics:** age, impairment, ...
  - **Content prefs.:** genre, interest, ...
  - **Presentation prefs.:** modalities, quality, ...
  - **Interaction prefs.:** voice, stylus, ...
- **Usage environment (context):**
  - **Localization:** time, place, natural environment, ...
  - **Mobility:** stationary, on the move, speed, ...
  - **Current situation:** office, home, public, meeting, ...
  - **Access:** single- or multi-device / -modal
  - ...

Diverse User and Usage Preferences

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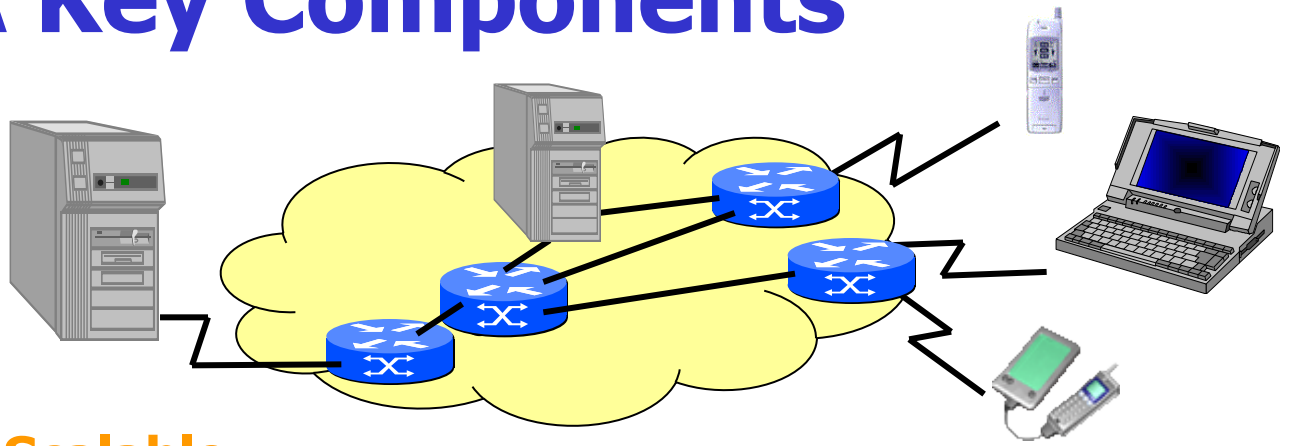
UMA Key Components



Rich, Scalable Multimedia Content

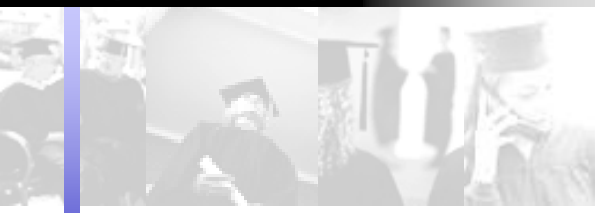
Delivery, User, and Usage Environment Descriptions

Metadata: Multimedia Content Description

Content Negotiation, Re-purposing, Adaptation, App. Personalization

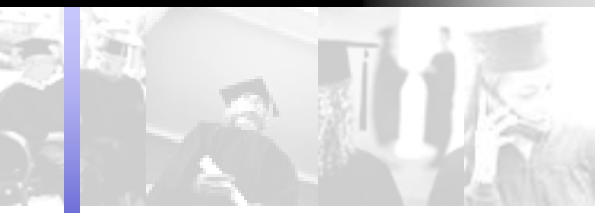
Digital Rights Expression and Management

INTEROPERABILITY



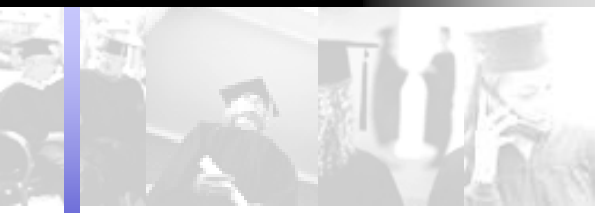
UMA Components: Content

Supporting technologies/specs.	ISO/IEC	...	W3C
Authoring rich, multimodal, scalable content	JPEG2000 MPEG-2/-4 scal. codecs MPEG-4 XMT, BIFS MPEG-21 SVC		XHTML XForms SMIL, SVG VoiceXML ATDI .....
Metadata / semantics	MPEG-7		RDF
Structure and presentation of content and metadata	MPEG-21 Digital Items (DIs)		All markup techniques



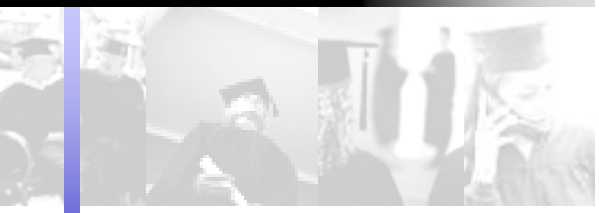
UMA Components: Descriptions

Supporting initiatives/specs.	ISO/IEC	...	W3C
Network characteristics	MPEG-21 DI Adapt.		Delivery Context
Device capabilities	Usage Environment		CC/PP, UAProf
User preferences	Descriptions (UEDs)		Web Accessibility
Usage environment			Internationaliz'n
			Markup elements
			.....



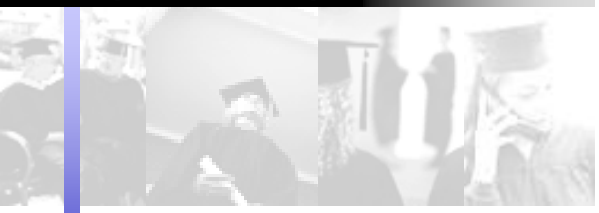
UMA Components: Adaptation

Supporting technologies/specs.	ISO/IEC	...	W3C
Selecting content	MPEG-21 DI *choice/ selection* mechanism		Markup (e.g., SMIL *switch*; SVG cond. proc.; CSS Media Queries)
Modality conversion	MPEG-21 DIA Amd.		Markup (e.g., EMMA)
Scaling/transcoding content (signal level)	MPEG-21 DIA (e.g., format inde- pendent using gBSD)		Markup (e.g., SVG) XSLT ATDI .....
Transcoding (semant. level)	MPEG-7		



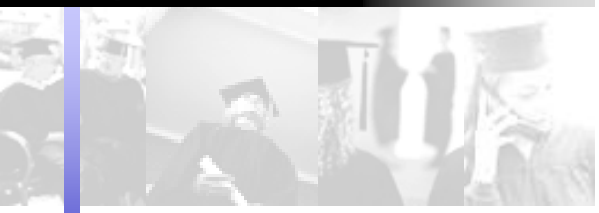
Content Selection Example in MPEG-21: Choice/Selection in a DI

```
<DIDL .....>
  <Container>
    <Item>
      <Choice minSelections="0" maxSelections="1">
        <Descriptor><Statement mimeType="text/plain">
           Select prefered content modality:
        </Statement></Descriptor>
        <Selection select_id="video">
          <Descriptor><Statement mimeType="text/plain"> Video </Statement></Descriptor>
          .....
        </Selection>
        <Selection select_id="image"> ..... </Selection>
        <Selection select_id="audio"> ..... </Selection>
        .....
      </Choice>
      <Component>
        <Condition require="video"/>
        <Resource mimeType="video/mpeg" ref="rtsp://myvideoserver.org/video.mpg"/>
      </Component>
      .....
    </Item>
    .....
  </Container>
</DIDL>
```



Content Selection Example in SMIL: `switch` Markup Element and Test Attributes

```
<par>
   <video src="video.mpg" ... />
   <switch>
     <audio src="audioHQ.aiff" systemBitrate="56000" ... />
     <audio src="audioMQ.aiff" systemBitrate="28800" ... />
     <audio src="audioLQ.aiff" ... />
   </switch>
</par>
```



References

- **Adopted MPEG standards → ISO/IEC**

  http://www.iso.org

- **MPEG standards under development and working documents → MPEG Website**

  http://www.chiariglione.org/mpeg/index.htm

- **Fernando Pereira, Ian Burnett: "Universal Multimedia Experiences for Tomorrow", *IEEE Signal Processing Magazine*, March 2003 (Special Issue on UMA).**