MPEG-7
MPEG-21

Eine Übersicht

Michael Stepping
FernUniversität in Hagen

Agenda

- Historie
- MPEG-7: Klassifizierung, Meta-Daten
- MPEG-21: Digitales Rechtemanagement

MPEG-Standardisierung

- ISO/IEC JTC 1 SC29
  - WG11 MPEG
    - Liason mit ITU-T (H.261, H.264, ...), IETF, ...
- Entwicklung von Standards für:
  - Komprimierung, Dekomprimierung, Verarbeitung, verschlüsselter Darstellung von beweglichen Abbildungen, Tönen und deren Kombination
- Seit 1988 (Ottawa), 68. in München (03/2004)
- Vorsitzender: Dr. Leonardo Chiariglione (TILAB)

ISO-Standardisierungsprozess

- Requirements → CfP
- VM
- WD
- CD – Abstimmung (Balloting) durch NB
- FCD – Einarbeitung DoC
- FDIS – Einarbeitung DoC
- IS – ja/nein
- Corrigenda, Amendments
- MPEG: Sitzungswoche, MPEG-Meeting, Plenary

MPEG-1 (ISO/IEC 11172)

- Aufhebung der Verzahnung mit Netzen
- Systems (Teil 1): Multiplex, Synchronisation
- Video (Teil 2)
- Audio (Teil 3)
- Bis 1,5 Mbit/s, CD-ROM, VHS-Qualität
- Audio Layer I,II,III: Redundanz, Irrelevanz
  - MDCT (50% Überlappung), Blockgrenzen-Artefakt

MPEG-2 (ISO/IEC 13818)

- Systems: TS (DVB), PS (Speichermedien)
- Video: höhere Auflösung, interlaced
- Audio: Mehrkanal-Audio, MP3
- DSM-CC: Digital Storage Media-Command and Control (Dig. TV, VOD)
- AAC: Mehrkanal
- Real-Time Interface: Set-Top Box
- Verworfen (MPEG-3)

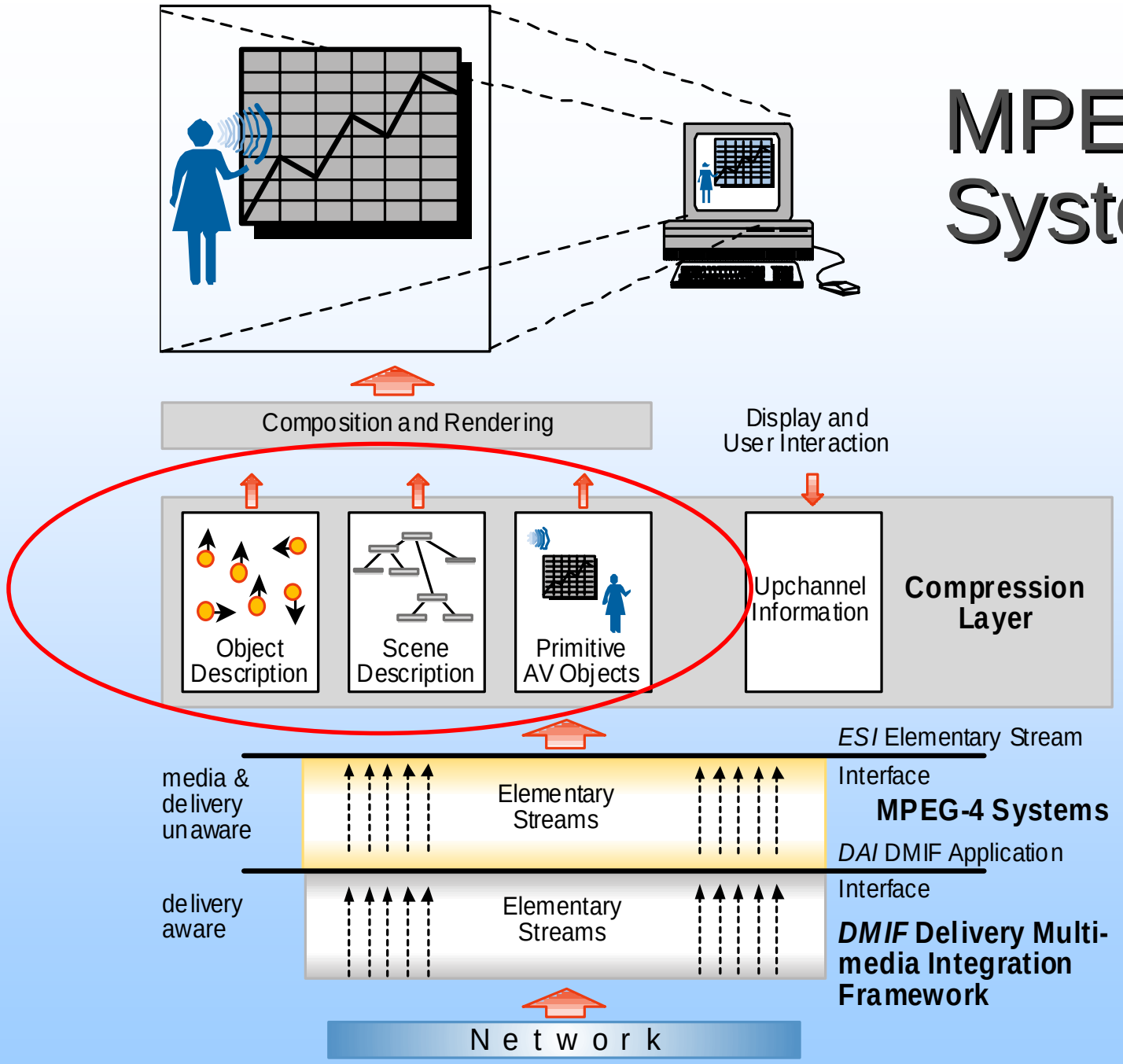
MPEG-4 (ISO/IEC 14496)

Version 1: 1998

Einführung multimedialer **Objekte**

- Systems, Video, Audio
- Conformance
- Reference-Software
- Delivery Multimedia Integration Framework (Transport)

MPEG-4 System



MPEG-4 Video-Nachfolger:

MPEG-4 AVC --- H.264

- Joint Video Team JVT --- ISO/IEC und ITU
- Dr. Thomas Wiegand: HHI, Berlin, [SSW03]
- 35% niedrigere Bitrate (64kb/s - 1Mb/s)
  - Zu MPEG-2 durchschnittlich 65%
- Langzeitprädiktion (bis zu 5 Frames)
- Zusammenfassung MB zu Slices (16*16 - 4*4)
- Slice-spezifische I-, P-, B-Codierung
- DCT→Integertransformation

Agenda

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MPEG-7 (ISO/IEC 15938)

- Multimedia Content Description Interface
  - Meta-Daten
  - Katalogisierung
  - Information Retrieval
- Beginn der Arbeiten 1996

Idee

- provides standardized core technologies allowing the description of audiovisual data content in multimedia environments
- It extends the limited capabilities of proprietary solutions in identifying content that exist today, notably by including more data types

Beispiele

- Visuell
  - shape, size, texture, color, movement (trajectory) and position (‘where in the scene can the object be found?)
- Audio
  - key, mood, tempo, tempo changes, position in sound space
- Hohes Abstraktionsniveau
  - „Eine Szene mit einem braunen, bellenden Hund links und am rechten Rand ein herunterfallender Ball“

Topics

- Description Tools
  - the metadata elements and their structure and relationships, that are defined by the standard in the form of Descriptors and Description Schemes
- create descriptions
  - i.e., a set of instantiated Description Schemes and their corresponding Descriptors at the users will
- efficient access to multimedia content
  - (search, filtering and browsing)

MPEG-7 Hauptelemente (i)

- Description Tools:
  - Descriptors (D), that define the syntax and the semantics of each feature (metadata element)
  - Description Schemes (DS), that specify the structure and semantics of the relationships between their components,
    - that may be both Descriptors and Description Schemes

MPEG-7 Hauptelemente (ii)

- Description Definition Language (DDL)
  - defines the syntax of the MPEG-7 Description Tools and
  - allows the creation of new Description Schemes and, possibly, Descriptors and
  - allows the extension and modification of existing Description Schemes

MPEG-7 Hauptelemente (iii)

- System tools:
  - support binary coded representation for efficient
    - storage and transmission,
  - transmission mechanisms (both for textual and binary formats),
  - multiplexing of descriptions,
  - synchronization of descriptions with content,
  - management and protection of intellectual property in MPEG-7 descriptions,
  - ...

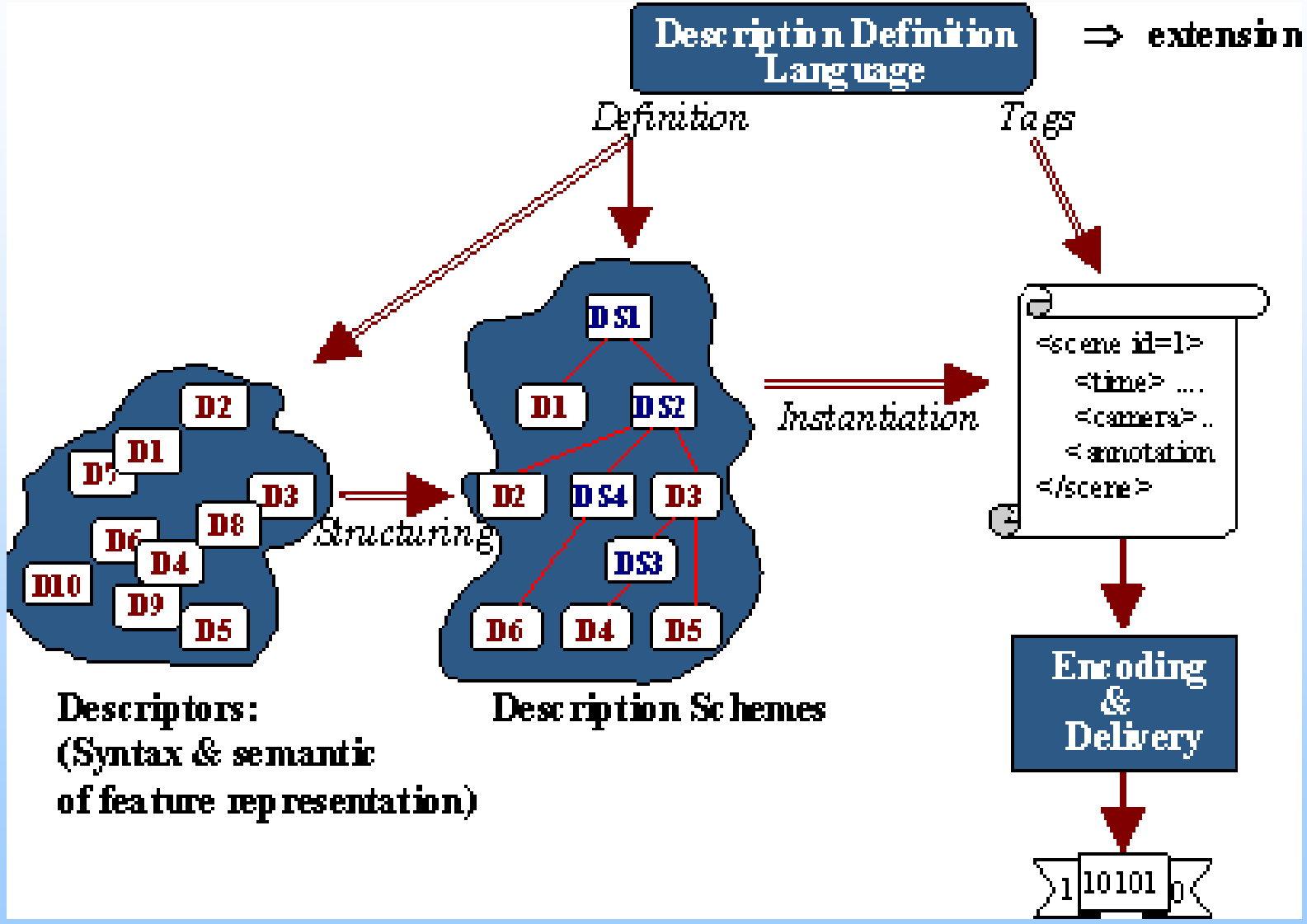
Possible Descriptions:

- creation and production processes of the content (director, title, short feature movie)
- usage of the content (copyright pointers, usage history, broadcast schedule)
- storage features of the content (storage format, encoding)
- information on spatial, temporal or spatio-temporal components of the content (scene cuts, segmentation in regions, region motion tracking)
- low level features in the content (colors, textures, sound timbres, melody description)
- information of the reality captured by the content (objects and events, interactions among objects)
- information about how to browse the content in an efficient way (summaries, variations, spatial and frequency subbands,)
- information about collections of objects
- information about the interaction of the user with the content (user preferences, usage history)

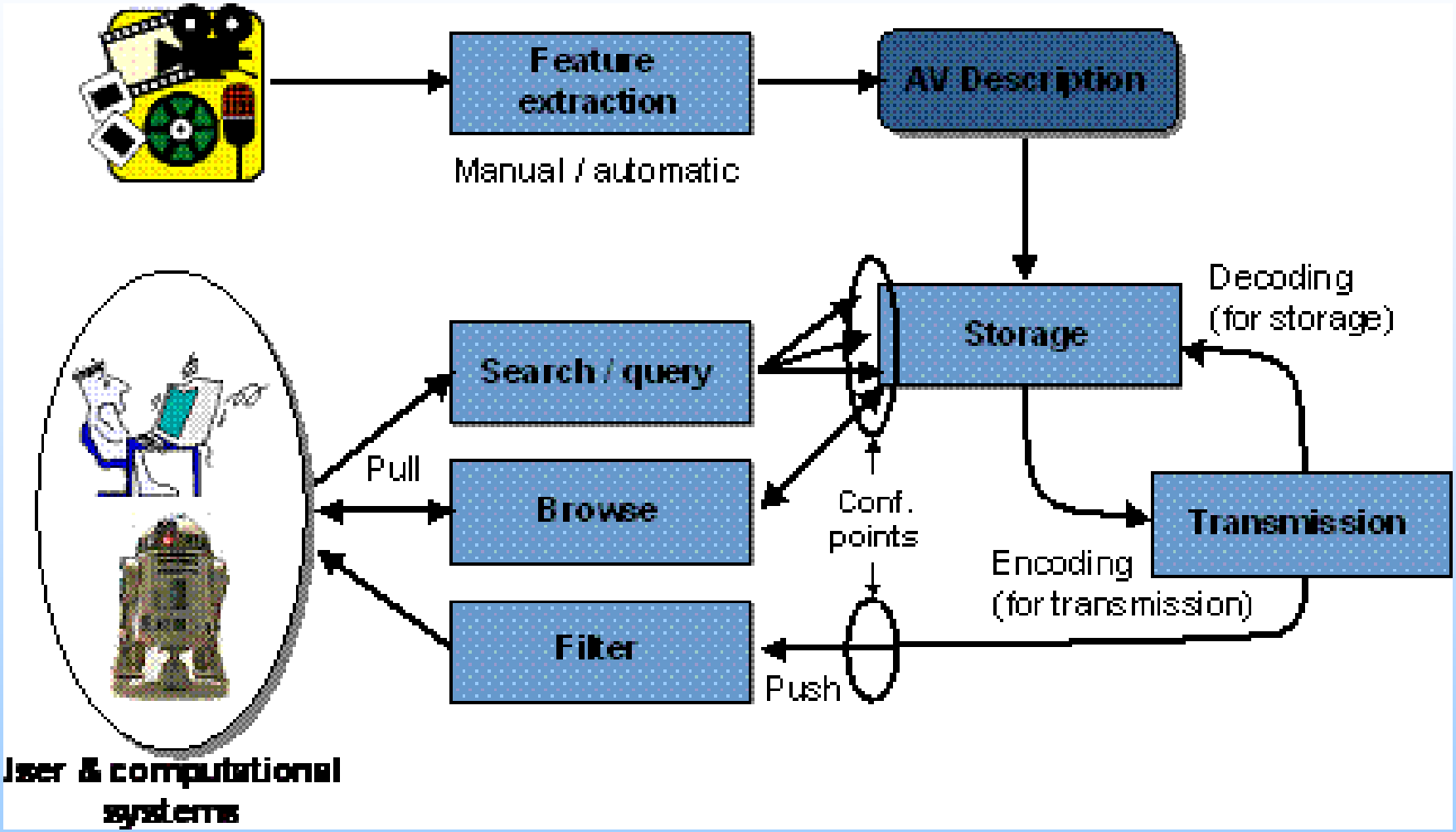
Ziel

- Diese vorgestellten Beschreibungen effizient zu kodieren
- KEIN Ziel des Standards ist es, Methoden und Verfahren zur inhaltlichen ERZEUGUNG zu standardisieren.
  - -> Encoder-Erstellung ist Expertenwissen, bspw. Filterdatenbank von Fraunhofer bei MP3

Description Definition Language



Applications



MPEG-7 Systems

- the tools needed to prepare MPEG-7 descriptions for efficient transport and storage and the terminal architecture.
- MPEG-7 Systems includes currently the binary format for encoding MPEG-7 descriptions and the terminal architecture.

Description Definition Language

- the language for defining the syntax of the MPEG-7 Description Tools and for defining new Description Schemes.
- The DDL is based on XML Schema Language:
  - XML Schema structural language components
  - XML Schema datatype language components
  - MPEG-7 specific extensions

MPEG-7 Visual

- the Description Tools deal with (only) Visual descriptions
- basic structures and Descriptors that cover following basic visual features:
  - color, texture, shape, motion, localization, and face recognition.
  - Each category consists of elementary and sophisticated Descriptors.

MPEG-7 Audio

- the Description Tools dealing with (only) Audio descriptions.
- Low-level:
  - spectral, parametric, and temporal features of a signal,
  - high-level Description Tools that are more specific to a set of applications

Multimedia Description Schemes

- the Description Tools dealing with generic features and multimedia descriptions
- Content description
- Content management
- Content organization
- Navigation and access
- User interaction

the eXperimentation Model

- XM - Reference Software
- a software implementation of relevant parts of the MPEG-7 Standard with normative status.
- The eXperimentation Model (XM) software is the simulation platform for the MPEG-7 Descriptors (Ds), Description Schemes (DSs), Coding Schemes (CSs), and Description Definition Language (DDL)

Conformance

- guidelines and procedures for testing conformance of MPEG-7 implementations

Extraction and use of descriptions

- informative material (in the form of a Technical Report) about the extraction and use of some of the Description Tools.

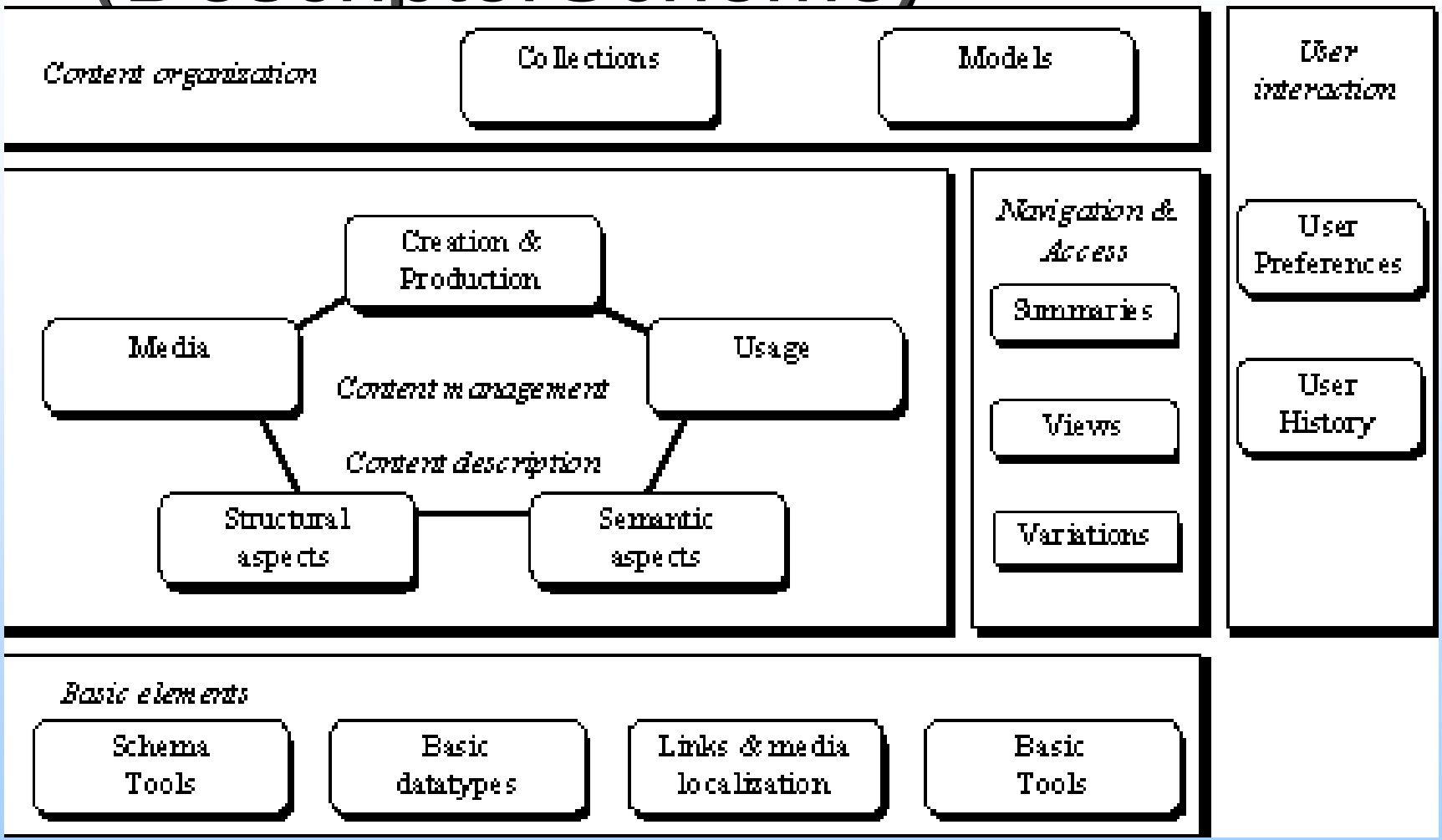
Profiles

- provides guidelines and standard profiles.

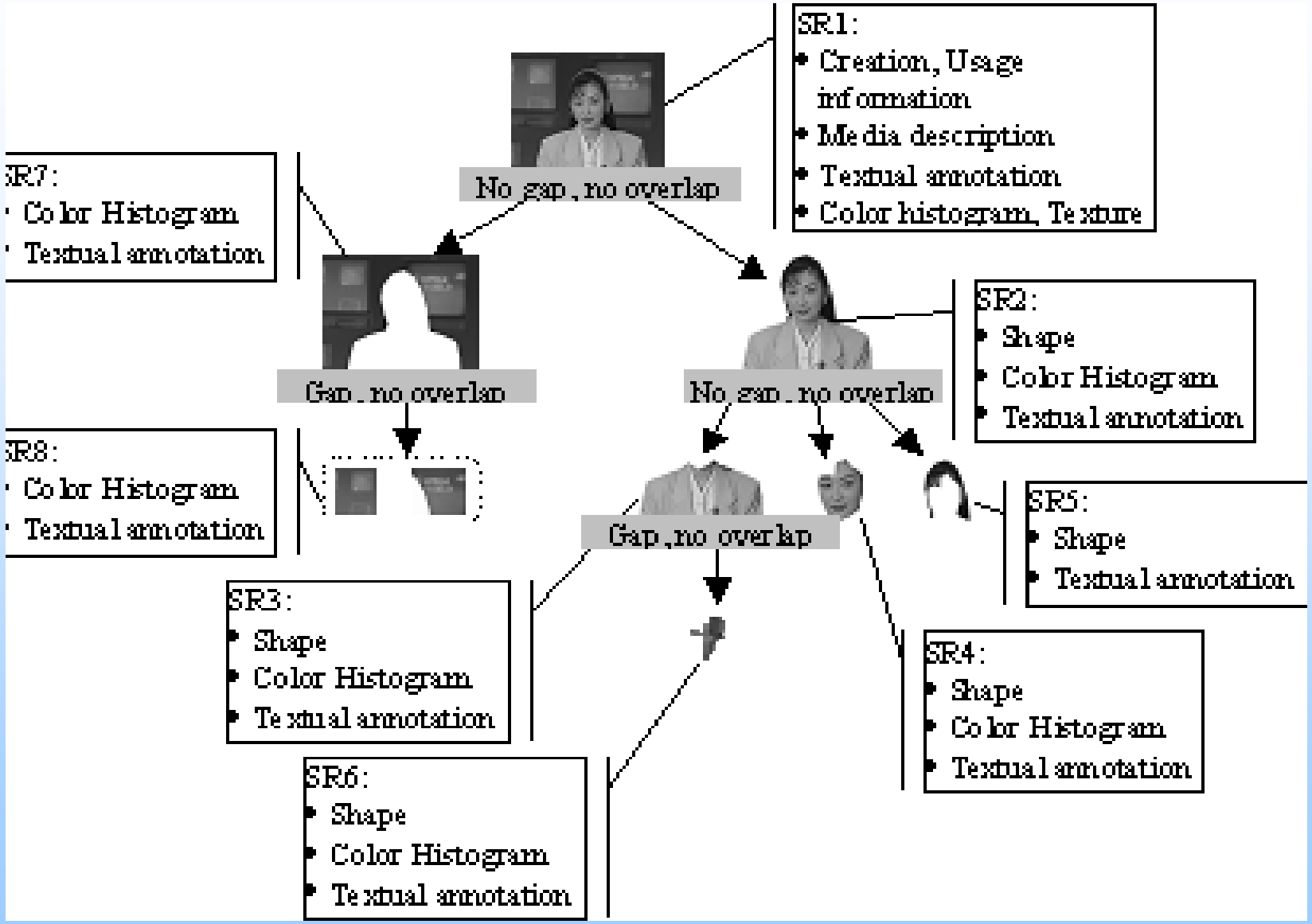
Schema Definition

- specifies the schema using the Description Definition Language

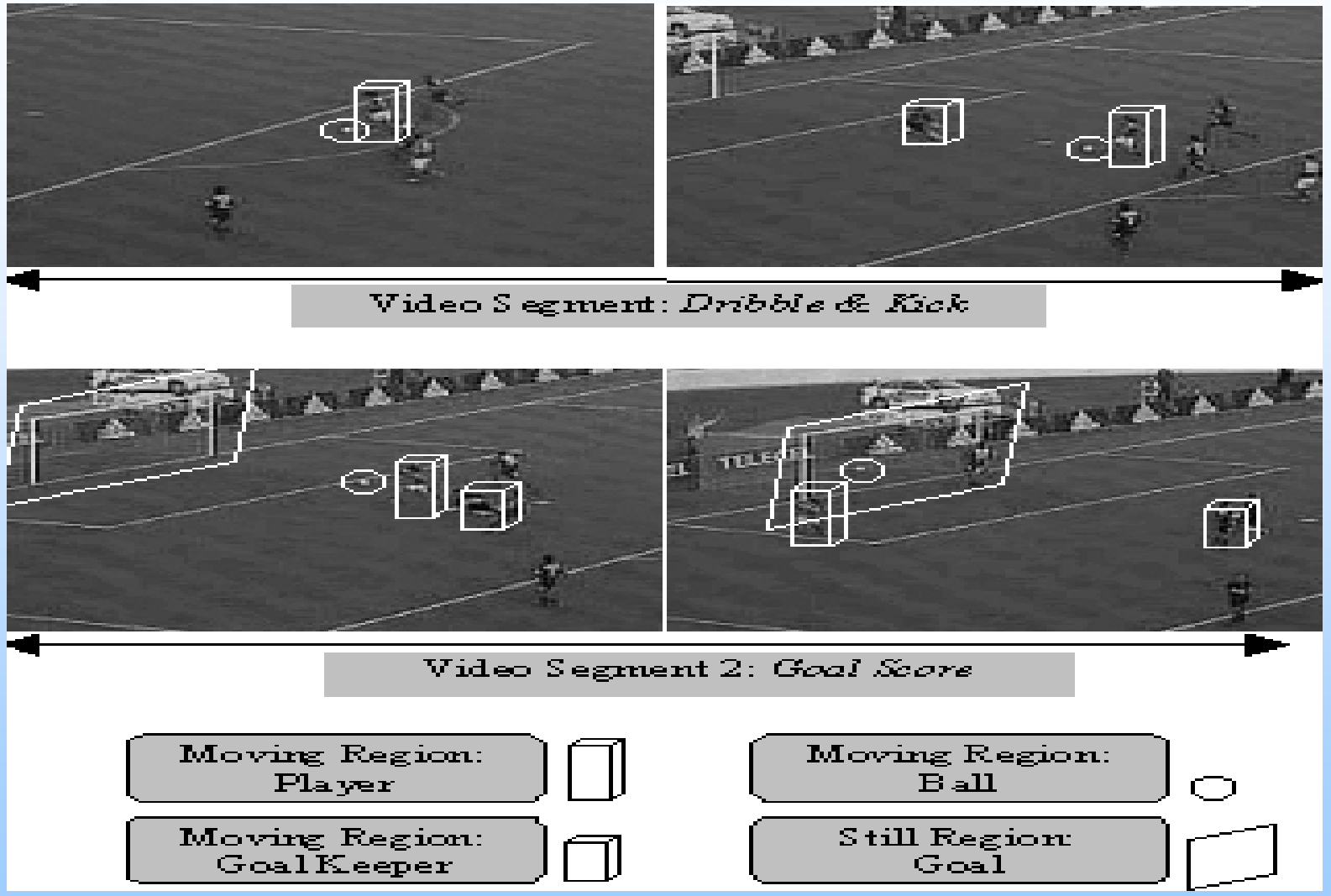
Overview DS (DescriptorScheme)



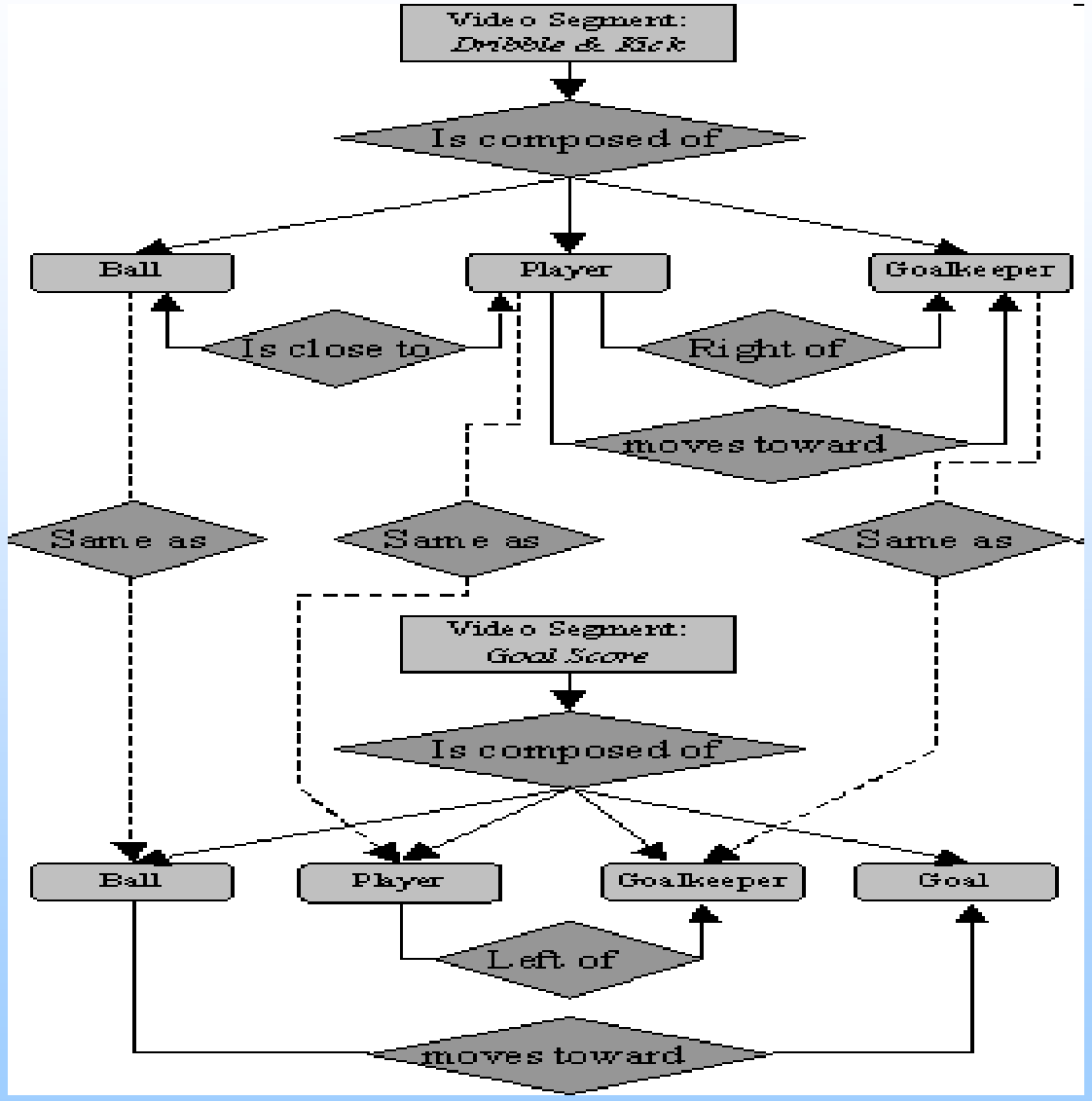
Example Image Description



Example Image Description (ii)



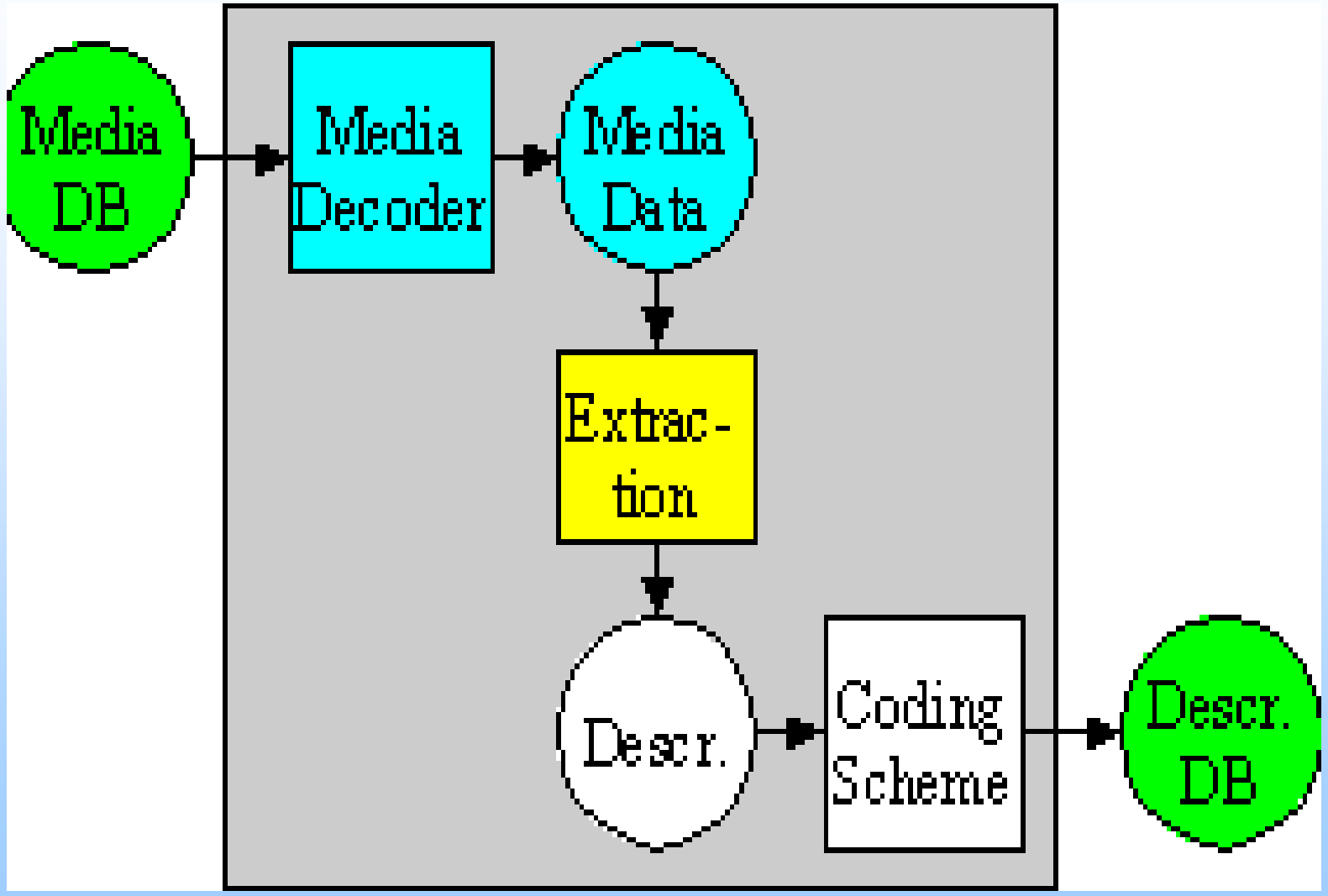
Segment Relationship



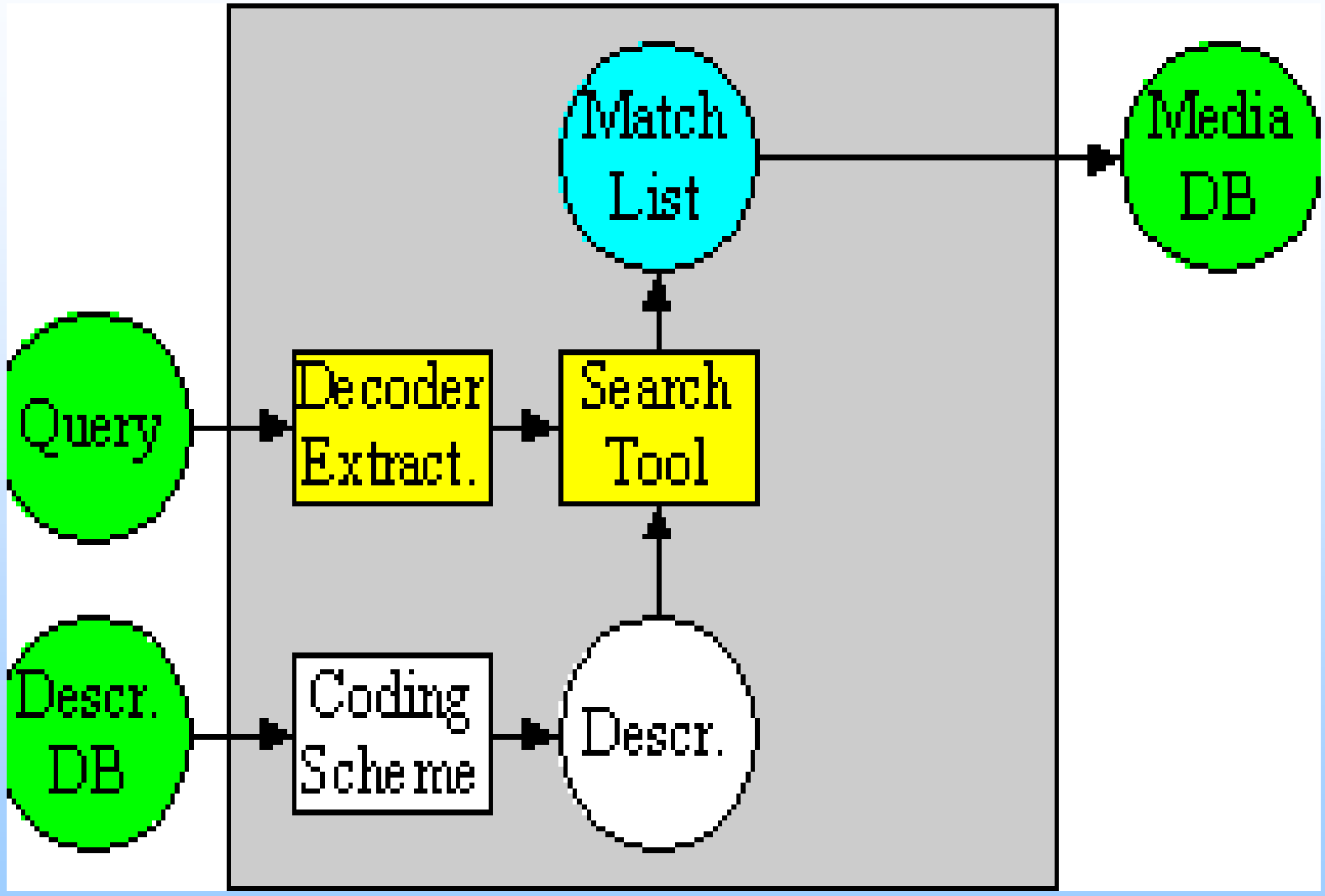
XML-Schema: Structures

- The Schema – the wrapper around the definitions and declarations;
  - Simple type definitions; Complex type definitions; Attribute declarations; Element declarations.
- The secondary components are:
  - Attribute group definitions; Identity-constraint definitions; Named Group definitions; Notation declarations.
- The third group is composed by the "helper" components which contribute to the other components and cannot stand alone:
  - Substitution groups; Annotations; Wildcards.

Media Application Type



Search & Retrieval application



XML Schema: Datatypes

- simple types
  - simple data types
- complex types
  - may carry attributes and have children elements or be derived from other simple or complex types a set of built-in primitive datatypes;
- a set of built-in derived datatypes;
- mechanisms by which users can define their own derived datatypes.
- DDL Specification, ISO/IEC 15938-2 or the XML Schema: Datatypes Specification.
- Extensions ...

BiM – Binary format for MPEG-7

- due to the schema knowledge, structural redundancy (element name, attribute names, aso) is removed from the document.
  - Therefore the document structure is highly compressed (98% in average).
- elements and attribute values are encoded according to some dedicated codecs (IEEE 754, UTF_8, compact integers, ...)

BiM - TeM

- BiM is a schema oriented encoding scheme
- BiM is a pre-parsed format
- BiM is a typed binary format
- ...
- Textual format for MPEG-7: TeM
  - Nodes, Scenes, ...

Glossar

- CD Committee Draft
- CE Core Experiment
- CS Coding Scheme
- D Descriptor
- DDL Data Description Language
- DS Description Scheme
- FCD Final Committee Draft
- FDIS Final Draft of International Standard
- IS International Standard
- MDS Multimedia Description Schemes
- MPEG Moving Pictures Experts Group
- NB National Body
- WD Working Draft
- XM eXperimentation Model

MPEG-7 Standard

- 1 : Systems
- 2 : Description Definition Language
- 3 : Visual 4 : Audio
- 5 : Multimedia Description Schemes
- 6 : Reference Software 7 : Conformance
- 8 : Extraction and Use of MPEG-7 Descriptions
- 9 : Profiles 10 : Schema definition

Zusammenfassung

- MPEG-7 stellt Werkzeuge und Methoden zur Verfügung, um multimediale Inhalte zu beschreiben.
- Diese Beschreibung ist erweiterbar, herstellerunabhängig und
- binär komprimierbar.
- IBM, Telekom Italia, ENST/Telekom France

Agenda

- Historie
- MPEG-7: Klassifizierung, Meta-Daten
- MPEG-21: Digitales Rechtemanagement

MPEG-21 Multimedia Framework

- Digital Item
  - elemental piece of content (a single picture, a sound track)
  - complete collection of audiovisual works
- User
  - deals with a Digital Item
  - from producers to vendors to end-users
- Starts March 2000, Nordwijk

Topics

- Digital Item Declaration
  - a concise and powerful XML-based schema for declaring Digital Items
- Digital Item Identification and Description
  - uniquely identifying digital content in a global way, and giving a resolution mechanism along with the unique identification
- Rights Expression Language, REL
- Rights Data Dictionary, RDD

Ziel

- Definition der Technologie für die Interaktion, Distribution und Transmission des
- „What“ – Digital Item

  und des
- „Who“ – User.

User Model

- Entität, die interagiert oder benutzt DI
- Beispielsweise:
  - Inhalte erzeugen, anbieten, archivieren, bewerten, erweitern, liefern, zusammenfassen, wiederverkaufen, konsumieren, abonnieren (subscribe), ...

Digital Item Declaration

- DID - Representation of a „work“ with DI
- Higher level of abstraction:
  - IPMP, Identification & Description
- Model
- Representation
- Schema

DID Model

- The Digital Item Declaration Model describes a set of abstract terms and concepts to form a useful model for defining Digital Items. Within this model, a Digital Item is the digital representation of “a work”, and as such, it is the thing that is acted upon (managed, described, exchanged, collected, etc.) within the model.

DID Representation

- Normative description of the syntax and semantics of each of the Digital Item Declaration elements, as represented in XML.

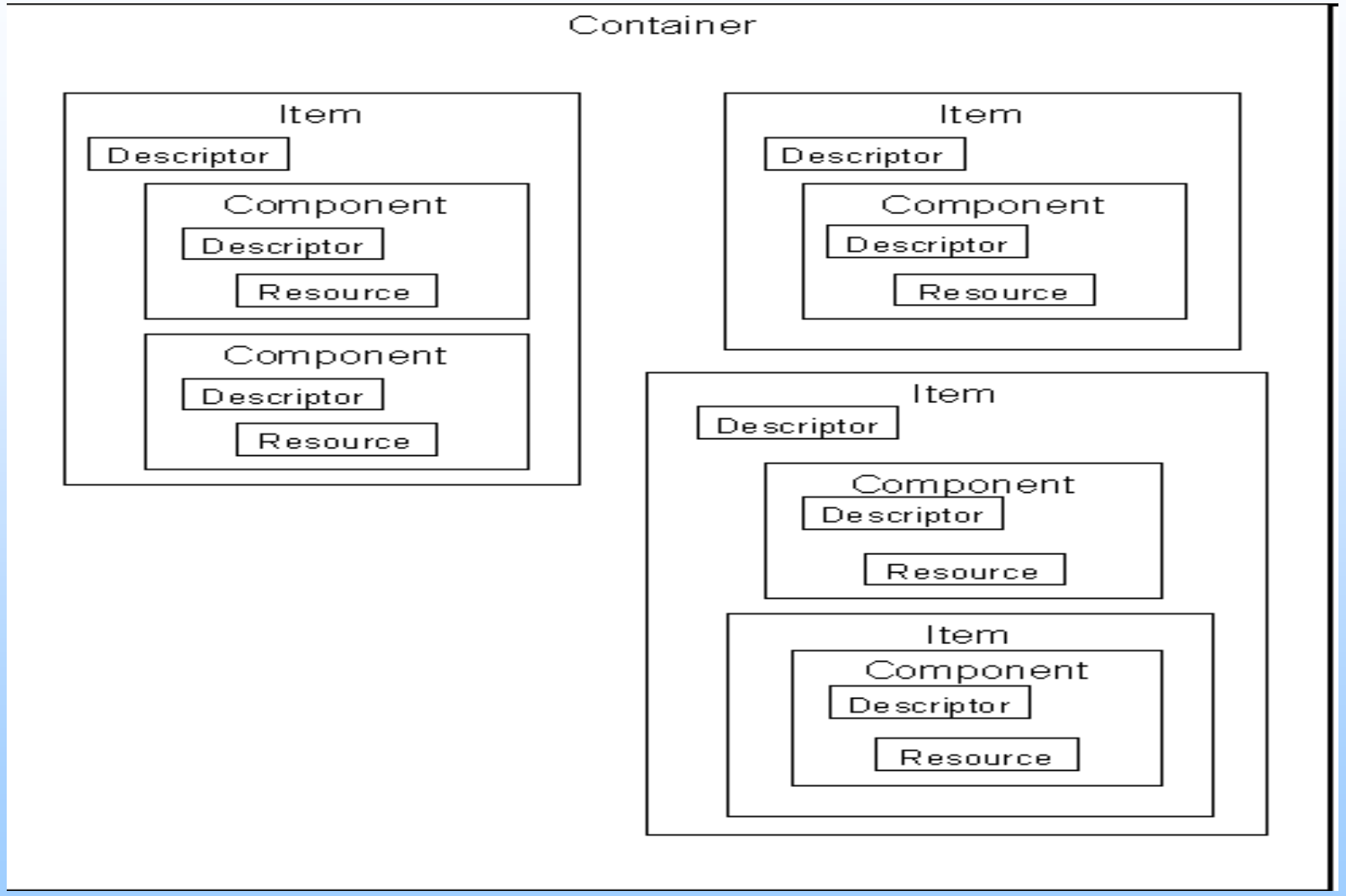
DID Schema

- Normative XML schema comprising the entire grammar of the Digital Item Declaration representation in XML.

Topics

- Container
- Item
- Component
- Anchor
- Descriptor
- Condition
- ...

Topics (ii)


Container
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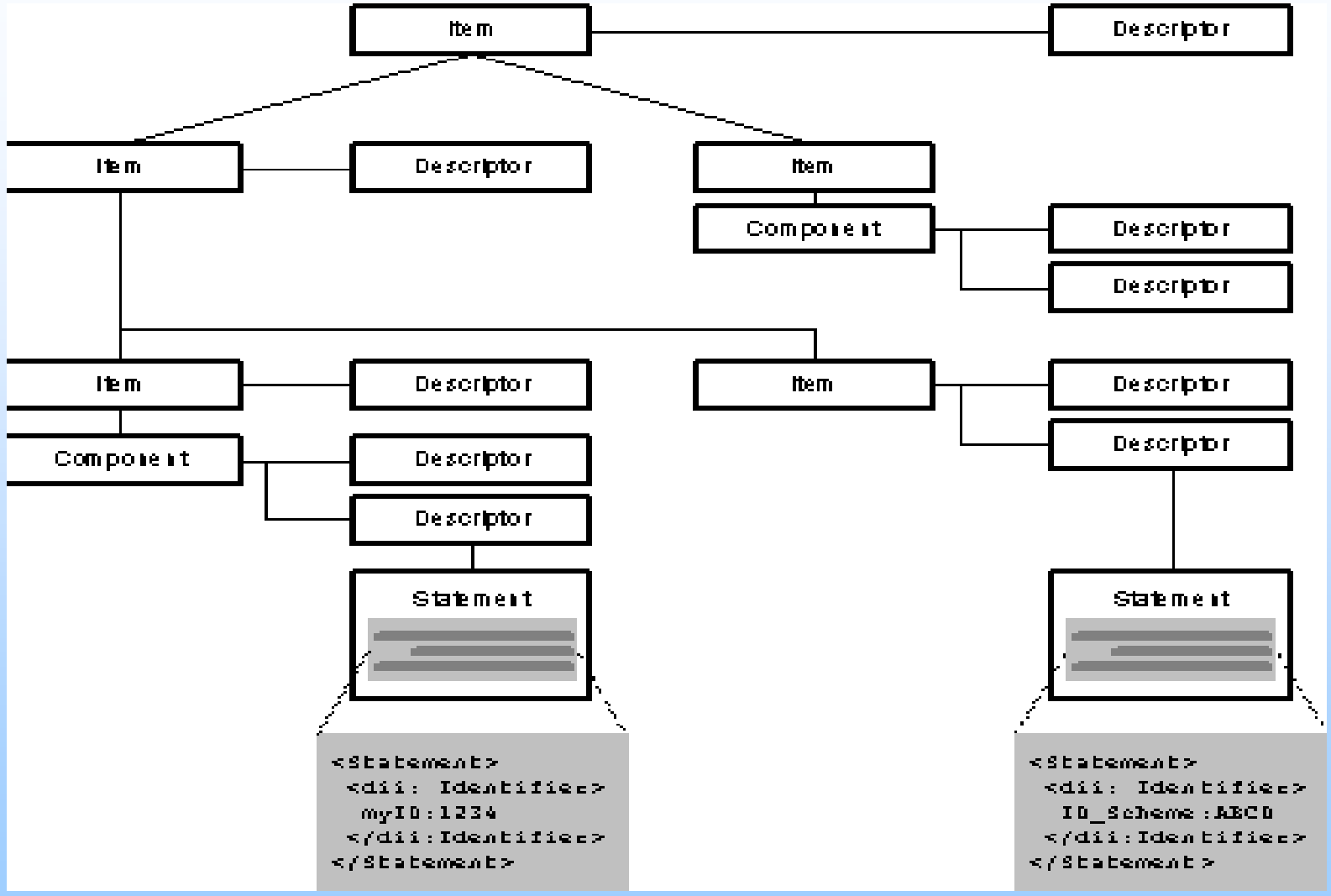
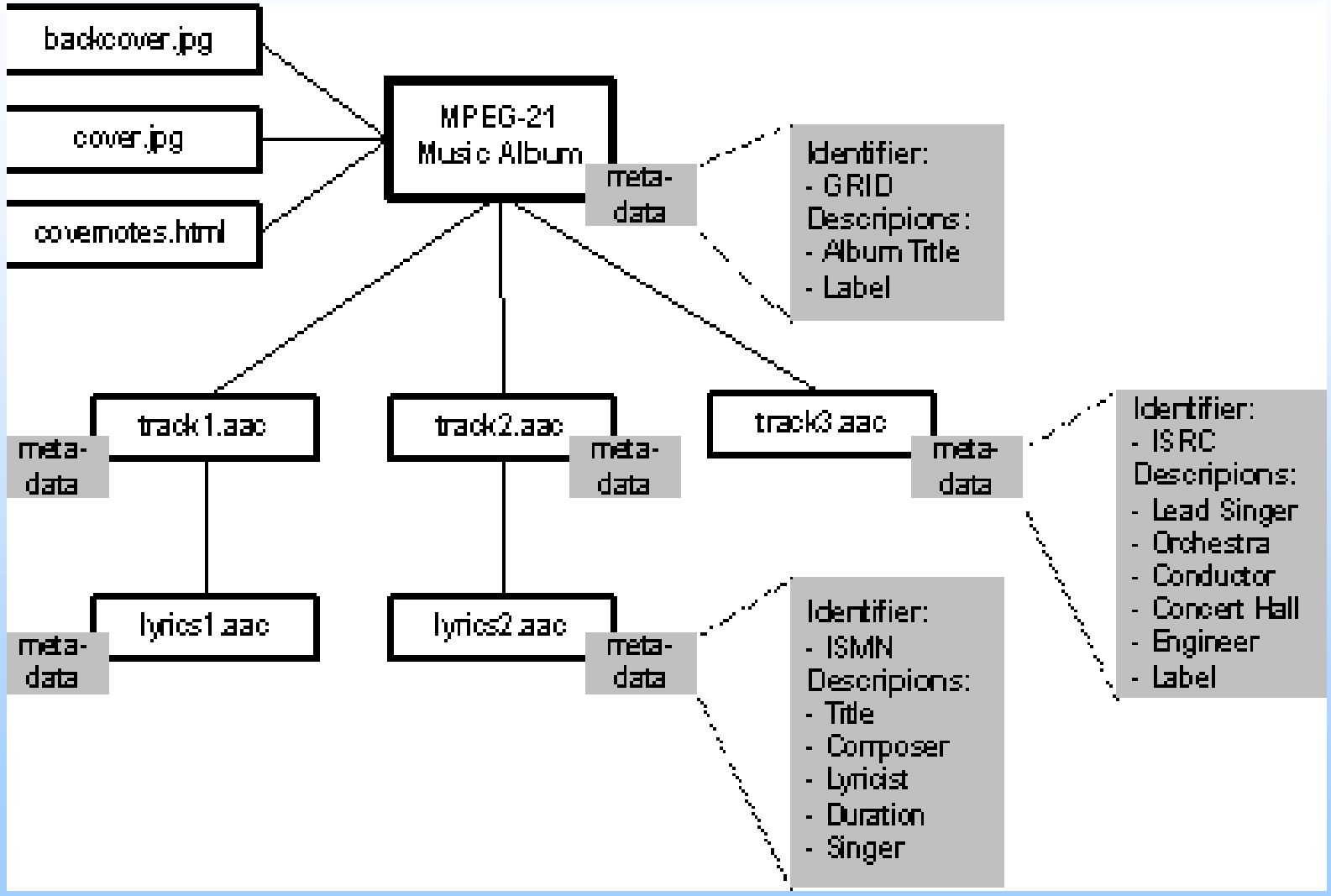
Resource

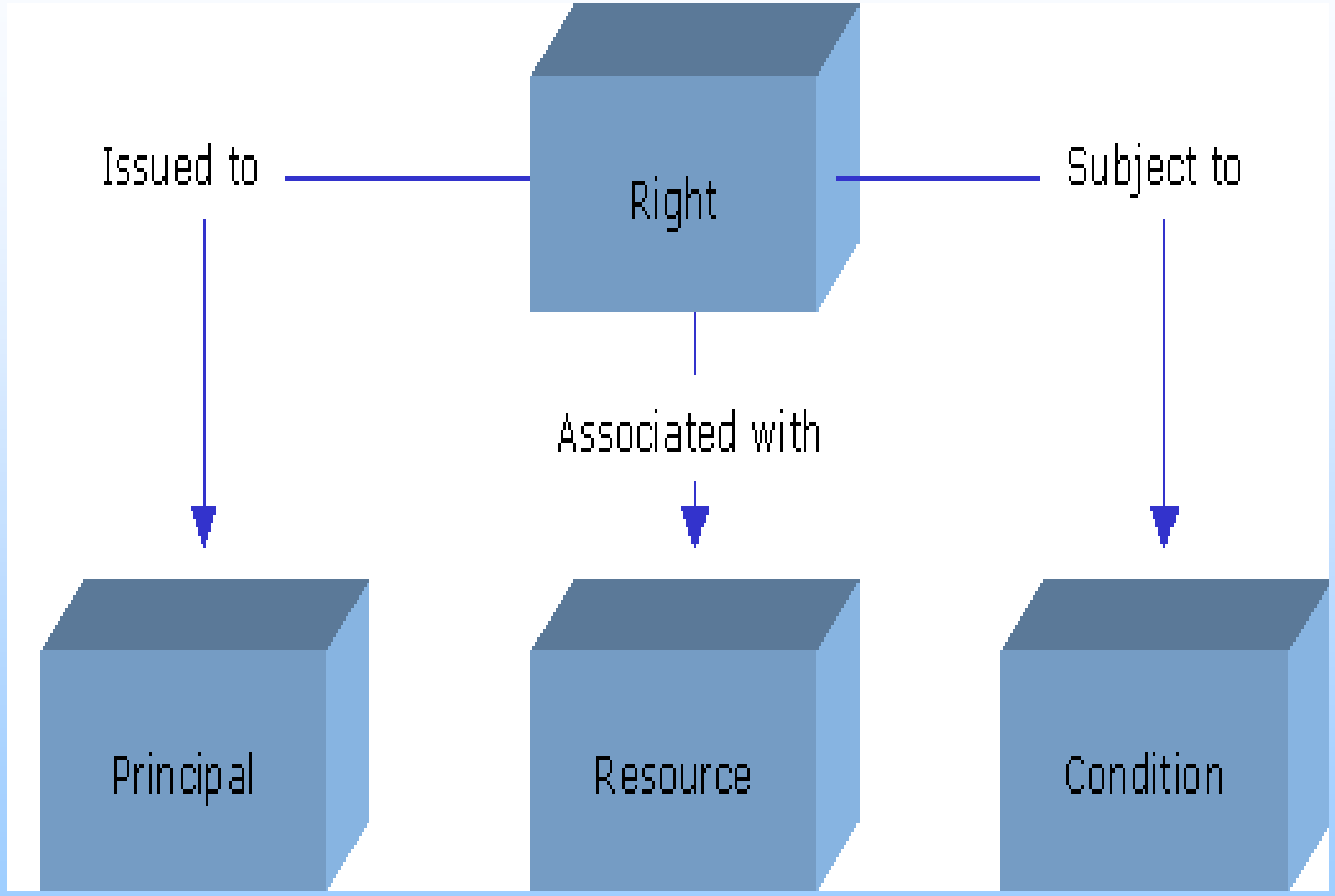
Digital Item Identification DII



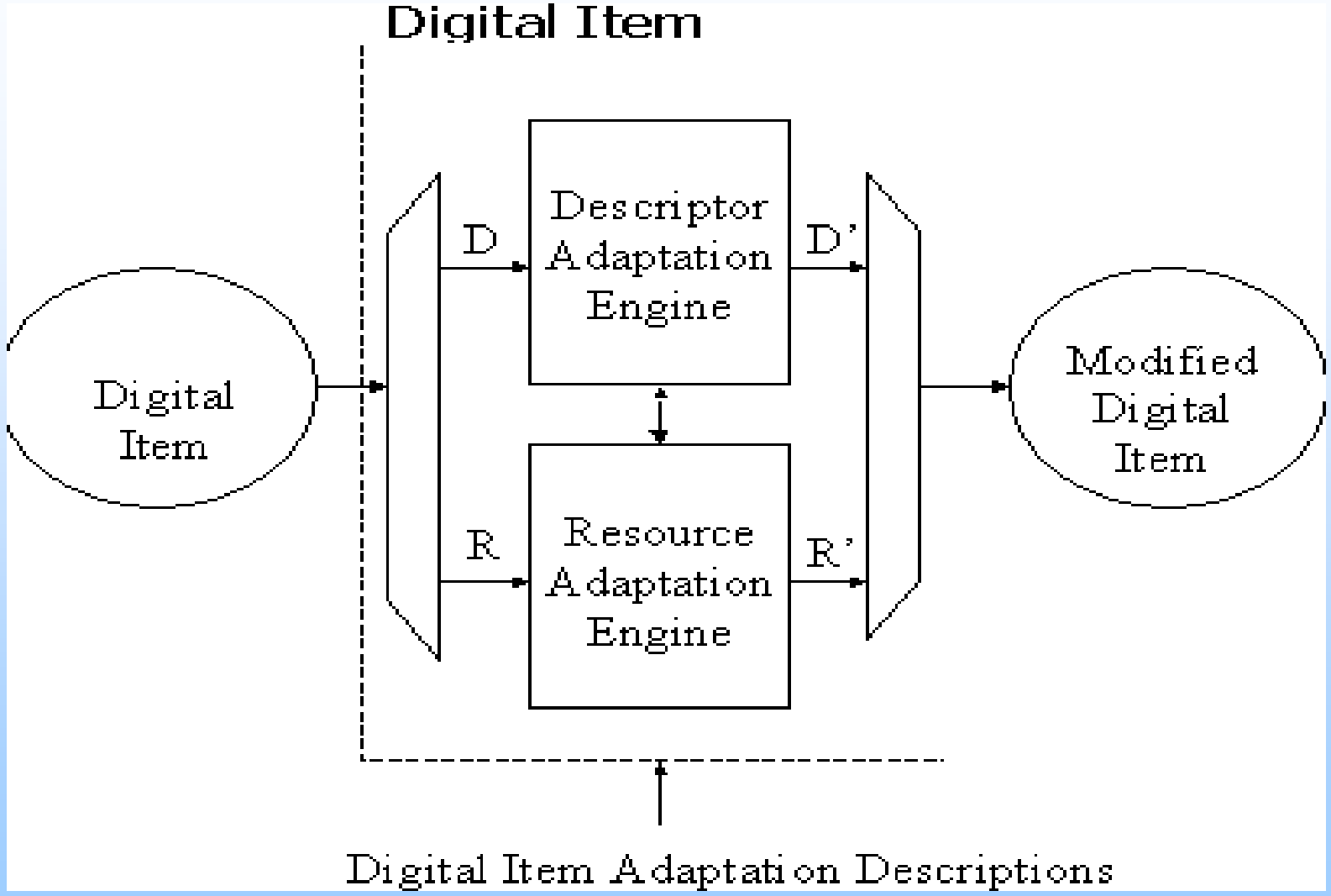
Example Metadat und DII



Rights Expression Language



Digital Item Adaptation



MPEG-21 (ISO/IEC 21000)

- *Digital Item Declaration*
- *Intellectual Property Management and Protection*
- *Digital Item Representation*
- *Terminals and Networks*
- *Digital Item Identification and Description*
- *Event Reporting*
- *Digital Item Management and Usage*

Zusammenfassung MPEG-21

- MPEG-21 bietet ein mächtiges Framework zur Verwaltung, etc. von digitalen multimedialen Inhalten.
- Vorteil wird werden, dass die vielfältigen heutigen inkompatiblen DRM Systeme vereinheitlicht werden können.

Zusammenfassung

- Die MPEG-Standards bieten neben der Kompression reiner Audio- und Video-Datenströme mittlerweile auch reichhaltige Werkzeuge, um Datenströme zu beschreiben und zu verwalten.
- Vorteile sind herstellerunabhängige Standards und geistige Vorarbeiten für die Verwaltung feingranularen Inhalts in jeder Hinsicht.

Agenda

- Historie
- MPEG-7: Klassifizierung, Meta-Daten
- MPEG-21: Digitales Rechtemanagement
- Ausblick: MPEG-A

Danke für die Aufmerksamkeit

Dr.-Ing. Michael Stepping

FernUniversität in Hagen