The MPEG-21 Standard

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- The MPEG standards are “open” on two sides
- Methods for generation and consumption are not defined by the standards
MPEG-21 — ISO/IEC (18034) 21000

Goal:
Define the technology needed to support Users to exchange, access, consume, trade and otherwise manipulate Digital Items in an efficient, transparent and interoperable way.

The parts of MPEG-21

1. Vision, technologies and strategies
2. Digital Item Declaration
3. Digital Item Identification
5. Rights Expression Language
6. Rights Data Dictionary
7. Digital Item Adaptation
8. Reference Software
9. File Format
MPEG-21 Part 1 — Vision

Define a multimedia framework to enable transparent and augmented use of multimedia resources across a wide range of networks and devices

1. Provide a vision
2. Facilitate integration and harmonization of technologies
3. Strategy for achieving a framework through collaboration

Digital Item

**What**
- A Digital Item is a structured digital object with a standard representation, identification and metadata within the MPEG-21 framework.

**Who**
- A User is any entity that interacts in the MPEG-21 environment or makes use of a Digital Item.
MPEG-21 Part 2 — Digital Item Declaration (DID)

Index a Digital Item

Purpose: describe a set of abstract terms and concepts to form a useful model for defining Digital Items

Three normative sections:

• Model
  – set of abstract terms and concepts

• Representation
  – normative description of syntax & semantics of DID elements

• Schema
  – normative XML schema comprising the entire grammar of DID
Digital Item Declaration in detail

The scope of the Digital Item Identification (DII) Specification includes, how to ...

• Uniquely identify Digital Items and parts thereof (including resources)
• Uniquely identify IP related to the Digital Items (and parts thereof), e.g., abstractions
• Uniquely identify Description Schemes
• Use identifiers to link Digital Items with related information e.g., descriptive metadata
• Identify different types if Digital Items

MPEG-21 Part 3 — Digital Item Identification
DII example: MPEG-21 music album

MPEG-21 Part 4 — IPMP

- Improvements over MPEG-4 IPMP:
  - Internetworking
  - IPMP tool retrieval & authentication
  - Integration of Rights Expressions (RDD & REL)
- Intellectual Property Management and Protection
  involves the enforcement of REL permissions
- IPMP shall consult REL before any actions are taken in the User’s system
- REL: What is protected? What rights apply?
- IPMP: How is it protected?
MPEG-21 Part 5 — REL

• The Rights Expression Language consists of licenses and grants that give specific permissions to Users to perform certain actions on certain resources, given that certain conditions are met
• Grants can also allow Users to delegate authority to others
• User’s system shall parse and validate the RE
• User’s system shall check permissions before any further action is done
• DID parser is responsible for discovering and identifying where to gather licenses
• REL licenses are wrapped in Digital Items

Rights Expression Language

• REL is seen as a machine-readable language that can declare rights and permissions using the terms as defined in the Rights Data Directory (RDD)

• The principal to whom the grant is issued
• The right that the grant specifies
• The resource to which the right in the grant applies
• The condition that must be met before the right can be exercised
• REL is supported by Rights Data Directory (RDD)
MPEG-21 Part 6 — Rights Data Dictionary

• Set of clear, consistent, structured, integrated and uniquely identified Terms to support REL
• Specification of dictionary structure and methodology to create dictionary
• Dictionary is prescriptive, inclusive, and has audit provisions
• Legal definitions are mapped from other Authorities
• Supports mapping & transformation of metadata from terminology of one namespace (or Authority) into that of another namespace in automated or partially automated way
• Dictionary is based on a logical model, the Context Model, which is the basis of the dictionary ontology

MPEG-21 Part 7 — Digital Item Adaptation

• Goal: achieve transparent interoperable access to distributed multimedia content
• Enable ad hoc formation of User communities in which contents is shared with agreed or contracted
  – Quality
  – Reliability
  – Flexibility
  – Diversity
• Guaranteed user experience
Concept of Digital Item Adaptation

Digital Item Adaptation Engine
- Resource Adaptation Engine
- Description Adaptation Engine

Digital Item → Digital Item Adaptation Engine → Adapted Digital Item

DIA Tools

Relation between DIA and other MPEG-21 parts

CDI
- MPEG-21 DID
- MPEG-21 DII
- MPEG-21 IPMP/REL
- Descriptor
- MPEG-21 DIA Tools
- Resource

XDI
- MPEG-21 DID
- MPEG-21 DII
- MPEG-21 IPMP/REL
- Descriptor
- MPEG-21 DIA Tools
- Usage Environment
- Resource level Tools
- Digital Item Level Tools

Adapted CDI
- MPEG-21 DID
- MPEG-21 DII
- MPEG-21 IPMP/REL
- Descriptor
- MPEG-21 DIA Tools
- Resource
MPEG-21 Part 8 — Reference Software

- Success of a standard depends on the availability of reference software
- Plan to use the software developed in Core Experiments (CE) as a basis
- Platform independence
- Future repository (requires membership)
  - http://mpeg.nist.gov/cvsweb/MPEG-21/
- Temporary repository
  - http://www.titr.uow.edu.au/cgi-bin/mpeg-ref-sw.pl
- Current main issue: parsing DID

Digital Item Processing and Terminology

- Digital Items act as a structure for organizing resources and its descriptions
- Need a mechanism for defining a set of operations by which a terminal can process a DI or DID
- Currently considering to specify a set of operations that can be used to process DIs: Digital Item Method
- A DIM defines an intended method for configuring, manipulating and/or validating a DI

- Interoperability of Digital Items means that terminals must handle the DIs in a consistent manner
- Digital Item Methods provide a way to specify a selection of preferred procedures by which the DI should be handled at the DI level
  - a menu of user interaction possibilities
- Digital Item Processing encompasses all aspects of processing a DI from an application perspective
- Applications build DIP environments around a fundamental DIME

- CDI — Content Digital Item
  - a DID containing the actual content
- DIBO — Digital Item Base Operation
- DIM — Digital Item Method
  - method that can be applied to a DID
  - DIME — DIM Engine
  - part of the terminal responsible for executing the DIM
- DML — DIM Language
- DIP — Digital Item Processing
- MI — Method Item
- PI — Processing Item
- XDI — Context Digital Item
MPEG-21 Part 9 — File Format

• Purpose: storing MPEG-21 Digital Items
• all components of the DI within a single file
• Inherits several concepts from MPEG-4
  • (make ‘multi-purpose’ files possible)
Special focus: Digital Rights Management

- Is MPEG trying to tame the hackers?
- DRM is a necessity, not only for industry support, but for a global market
- DRM will refer to the general issue of digital rights management, while Intellectual Property Management and Protection (IPMP) will denote MPEG specifics
- MPEG-21 explains the basic concepts of a machine-interpretable language for expressing the rights of users and content
- Does not provide specifications for security in trusted systems, pose specific applications, or describe the details of the accounting systems required.
- It does describe the language’s syntax and semantics

IPMP using ‘hooks’ approach

- IPMP in MPEG 2 and 4 (version 1) used the ‘hooks’ approach
- Plug-in a proprietary IPMP system
- Embed information into content streams that informs the terminal which proprietary IPMP system to use
- Reason: cost/benefit trade-off, one size did not fit all (e.g. TV and PDA)
- Downside: Limits interoperability, heavier terminal environment, risk many similar MPEG devices being built without inter-working
New IPMP approach

- More generalized architecture
- Provider lists authentication methods, recipient selects one
- Terminal can get IPMP Tools embedded in content or by downloading it
- Still based on hooking but uses Message Routing Service to simplify
- Audit agencies can provide Trust and Security metadata
Conclusion

- Open standard-based framework for multimedia delivery and consumption?
- Enables the use of multimedia resources across a wide range of networks and devices
- Consists of Users that interact with Digital Items
- No technical distinction between providers and consumers
- Glues all kinds of multimedia content together
- Digital Rights Management infrastructure

End of Lecture

Thank you for your attention!