

MPEG-21 Digital Items in Research and Practice

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<http://www.slideshare.net/christian.timmerer>

Outline

- MPEG-21 Introduction

⇒ more information at <http://slidesha.re/7UB13>

- Digital Item in Research and Practice

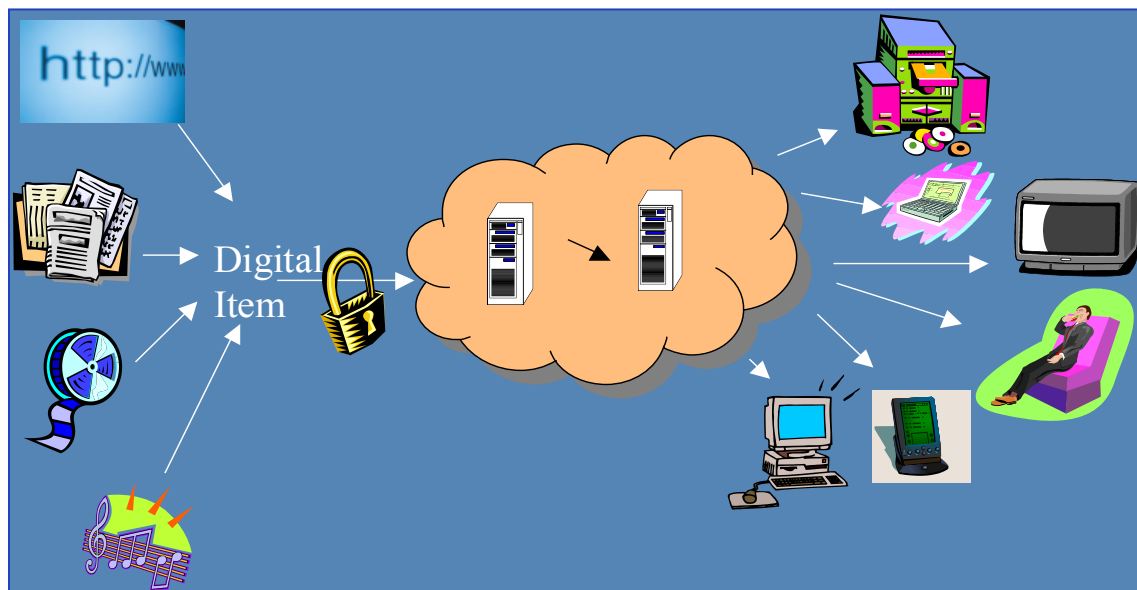
- Practice: DIDL-Lite & LANL

- Research: DANAE, ENTHRONE, P2P-Next

- Conclusions

Introduction to MPEG-21 – Vision

- ... to enable transparent and augmented use of multimedia resources across a wide range of networks, devices, user preferences, and communities, notably for trading (of bits)
- Assumption: every human is potentially a node of a network involving billions of ...
 - content providers
 - value adders
 - packagers
 - service providers
 - consumers
 - resellers



MPEG-21: Basic Concepts

DIGITAL ITEM = RESOURCES + METADATA + STRUCTURE

Resources: individual assets, (distributed) content

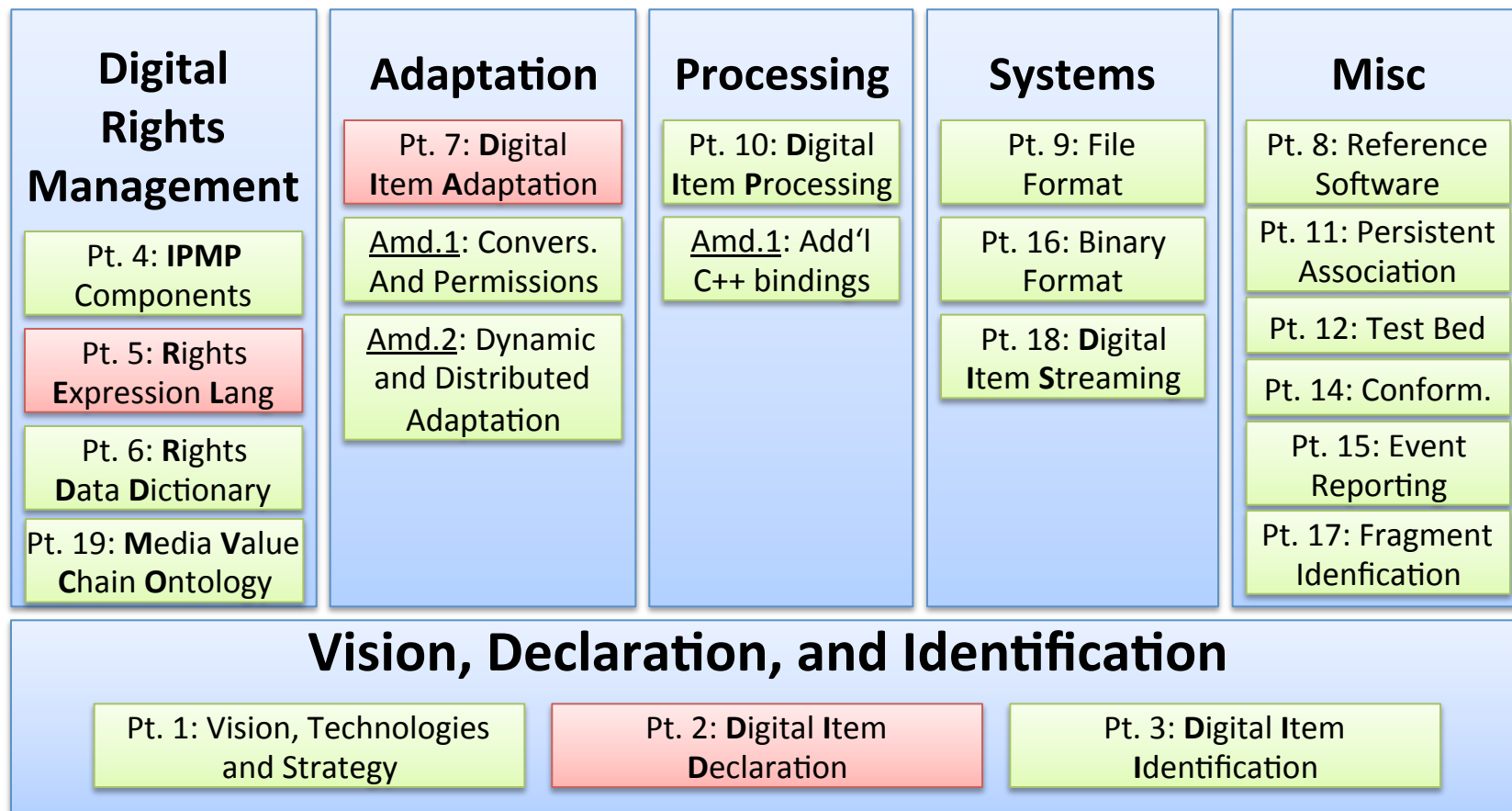
Metadata: (distributed) data about or pertaining to the DI or its resources

Structure: relationships among the parts of the DI

Who ? – Users

- A **User** is any entity that interacts in the MPEG-21 environment or makes use of a Digital Item
- Users will assume **rights and responsibilities** according to their interaction with other Users
- All parties that have a **requirement** within MPEG-21 to interact are categorized equally as Users

MPEG-21 Organisation – Parts



Digital Item in Research and Practice

- Practice

- UPnP: **DIDL-Lite** (dialect of MPEG-21 DIDL)
- Microsoft's **Interactive Media Manager (IMM)**: OWL implementation of DID model
- **Adactus** (www.adactus.no)
- **Enikos** (www.enikos.com)
- **ContentGuard** (www.contentguard.com) and **Rightscom** (www.rightscom.com)

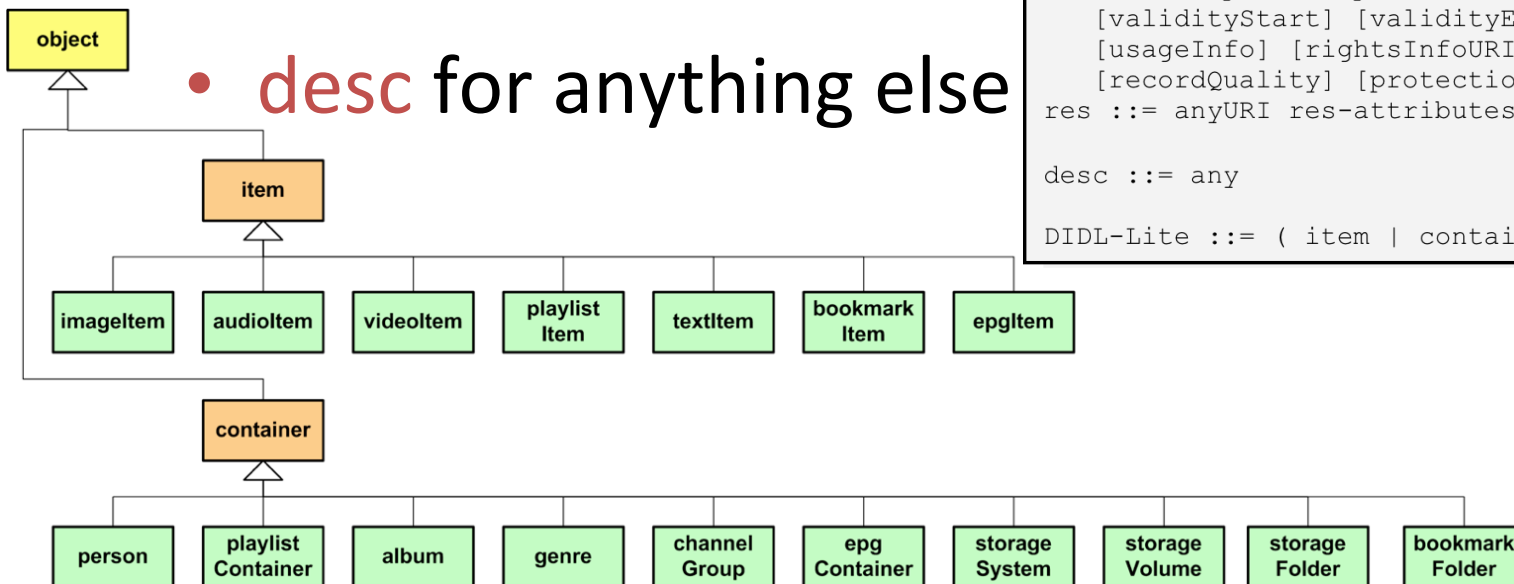
```
container ::= descriptor* container* item*
item      ::= condition* descriptor* choice*
           (item|component)* annotation
component ::= condition* descriptor* resource
           anchor
anchor    ::= condition* descriptor* fragment
descriptor ::= condition* descriptor*
           (component|statement)*
condition ::= predicate+
choice    ::= condition* descriptor* selection+
selection ::= condition* descriptor* predicate
annotation ::= assertion* descriptor* anchor*
assertion ::= predicate*
```

- Research

- DANAE: **Advanced MPEG-21 Infrastructure**
- ENTHRONE: **End-to-End Management** of Heterogeneous Environments
- AXMEDIS: **Automated Production** of Cross-Media Digital Items
- P2P-Next: **Next Generation P2P** Systems
- Los Alamos National Laboratory (LANL): Information Asset Management in a **Digital Library**

UPnP: DIDL-Lite

- DIDL dialect
- UPnP-specific objects
 - class, container, res-attr.
- Dublin Core metadata
- desc for anything else



```

upnp:forContainer ::= <some properties>
upnp:forItem ::= upnp:forContainer
allowed-under-container ::= upnp:forContainer | dc
                           | desc | item | container | res
allowed-under-item ::= upnp:forItem | dc | desc |
                      res
upnp:class ::= [object.item]
              [object.item.imageItem] ...
              [object.container] [object.container.person] ...
              [object.container.bookmarkFolder]

container ::= dc:title allowed-under-container*
              upnp:class allowed-under-container*
item ::= dc:title allowed-under-item* upnp:class
         allowed-under-item*

res-attributes ::= protocolInfo [importUri] [size]
                 [duration] [bitrate] [sampleFrequency]
                 [bitsPerSample] [nrAudioChannels] [resolution]
                 [colorDepth] [tspec] [allowedUse]
                 [validityStart] [validityEnd] [remainingTime]
                 [usageInfo] [rightsInfoURI] [contentInfoURI]
                 [recordQuality] [protection]
res ::= anyURI res-attributes

desc ::= any

DIDL-Lite ::= ( item | container | desc ) *
  
```

Information Asset Management in a Digital Library

- **DID:** representing (and serializing) complex digital library objects
- **DII:** identification of DIDs and assets therein
- **DIP:** dynamically add processing information to DIDs

```
<?xml version="1.0" encoding="UTF-8"?>
<didl:DIDL xmlns:didl="urn:mpeg:mpeg21:2002:02-DIDL-NS">
<didl:Container>
  <!-- Item containing a MARCXML metadata record -->
  <didl:Item>
    <!-- Component containing the MARCXML datastream -->
    <didl:Component>
      <!-- The actual MARCXML datastream -->
      <didl:Resource mimeType="text/xml; charset=UTF-8">
        <record xmlns="http://www.loc.gov/MARC21/slim">
          <leader>01142cam 2200301 a 4500</leader>
          <controlfield tag="005">19930521155141.9</controlfield>
          <datafield tag="010" ind1=" " ind2=" ">
            <subfield code="a">92005291</subfield>
          </datafield>
          ...
        </didl:Resource>
      </didl:Component>
    </didl:Item>
    <!-- Item containing a full-text document -->
    <didl:Item>
      <!-- Component containing the full-text datastream -->
      <didl:Component>
        <!-- The actual full-text (PDF) datastream -->
        <didl:Resource encoding="base64" mimeType="application/pdf">
          Ij5jMTk5My48L3N1YmZpZWxkPg0KICAgIDw9uIHhtbG5zSjodHgK...
        </didl:Resource>
      </didl:Component>
    </didl:Item>
  </didl:Container>
</didl:DIDL>
```

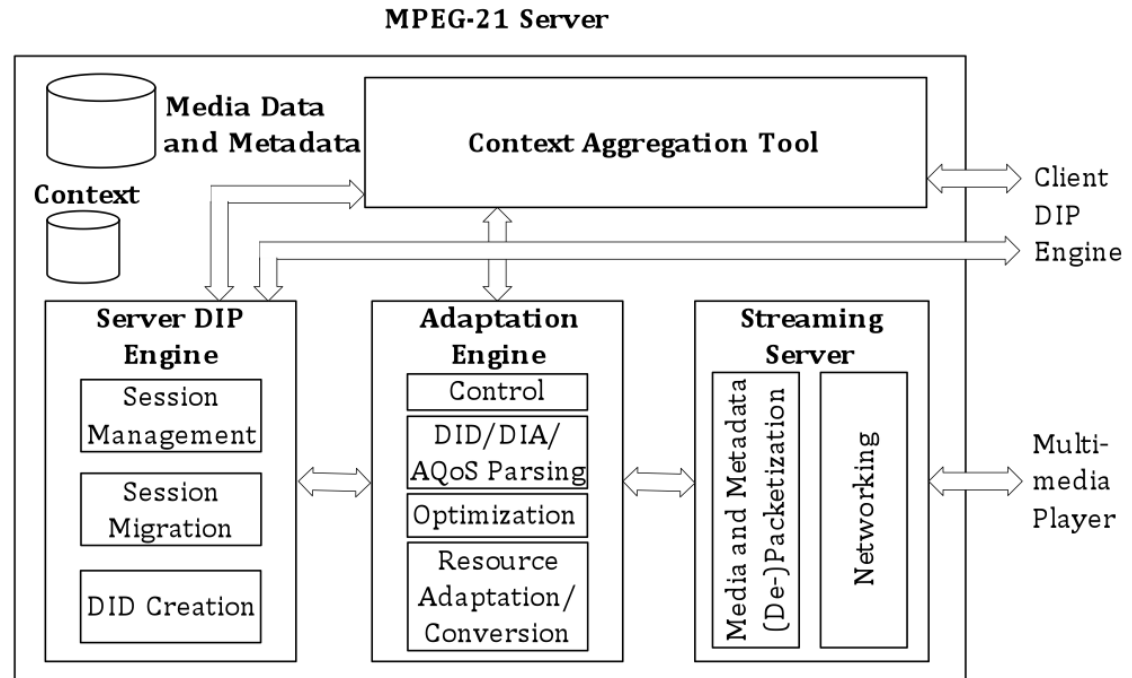
DANAE: Advanced MPEG-21 Infrastructure

- DID + DIA + DIP**

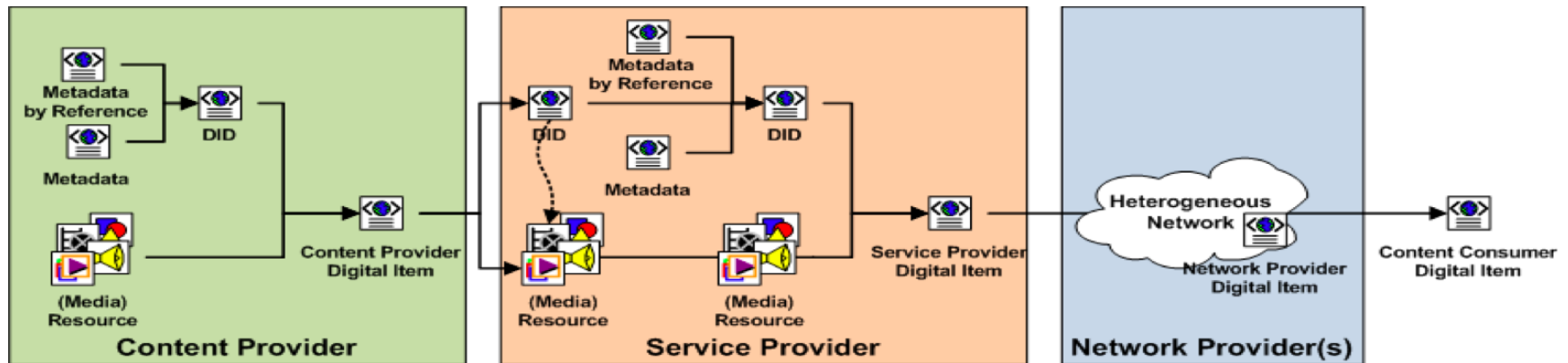
End-to-end representation
of *The Content*

Usage Environment Description
Adaptation Quality of Service
Universal Constraints Description
generic Bitstream Syntax
Description

Manages the **open sessions**, **retrieves** or **generates** and **customizes** museum catalogue and **content DIDs** according to the context of a user, **delivers** the DIDs, and **invokes** the adaptation engine if required. Clearly, the server side DIP engine is also involved in **session migration** activities.



ENTHRONE: End-to-End Management for QoS



Business entities

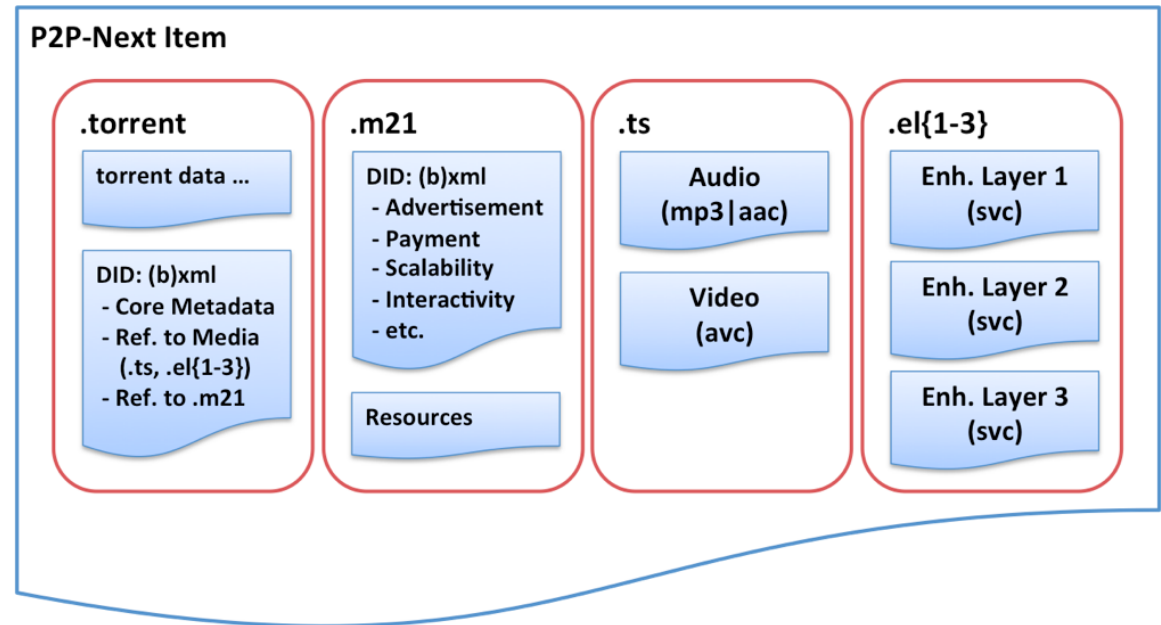
- **Content Provider:** prepares the actual multimedia content as MPEG-21 Digital Items
- **Service Provider:** MM services to end-user wrt SLAs
- **Adaptation Provider:** QoS of content delivery; optimizing available system and network resources across the end-to-end chain
- **Network Provider:** QoS-based network connectivity services at its autonomous domain level

```
DIDL
Declaration(s) (referable descriptors)
Container
Descriptor(s) (top-level container descriptors)
Item (composed item)
Descriptor(s) (top-level item descriptors)
Item (final item)
Descriptor(s) (item-level descriptors)
Component(s)
Descriptor(s) (component-level descriptors)
Resource

Item(s) (further composed or final items)
Item(s) (further composed or final items)
```

Next Generation Peer-to-Peer Networks

- P2P networks:
Distribution
cost shared
amongst the
peers



- Key requirement
 - Backwards compatibility with BitTorrent
- DID: declaration of P2P-Next Items
- DII: identification and type setting
- DIA: adaptation and scalability metadata

Conclusions

- MPEG-21: **powerful**, **generic**, and **flexible** for a plethora of use cases and application domains
- **Deployment issues**
 - **Interoperability** on a large (end-to-end) scale in practical settings is **difficult to achieve**
 - **Complex middleware** and intricate interplay between various layer and levels (e.g., application, transport, network, system, etc.)
 - Benefits for a **single stakeholder** in the multimedia chain?
 - Potential users might still be **insufficiently aware** of the MPEG-21 family of standards
- There is still hope ⇨ **MPEG Extensible Middleware (MXM)**, a comprehensive middleware comprising application programming interfaces (APIs) and protocols
 - ⇨ **See <http://mxm.wg11.sc29.org/> for details**

Thank you for your attention

... questions, comments, etc. are welcome ...

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