

Using the MPEG-21 DID standard to package digital content

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Definition

■MPEG 1 – MPEG 21

■Parts of MPEG-21

Part 2: DID – Digital Item Declaration (ISO/IEC21000-2) – representation digital objects. Provides a model for defining Digital items. DID is the primary unit of transaction in MPEG-21.

Part 3: DII- Digital Item Identification. Provides specifications on how to uniquely identify Digital Items and their constituent resources. DIIs are required to be URIs.

Part 4: IPMP – Intellectual Property Management and Protection – enforcement of rights expressions. Interoperates with existing DRMs.

Part 5: REL – Rights Expression – declaration of rights expressions. Ties together rights, conditions, and obligations associated with resources.

Part 7: DIA – Digital Item Adaptation– transcoding based on contextual information. Goal is to provide “universal media access”

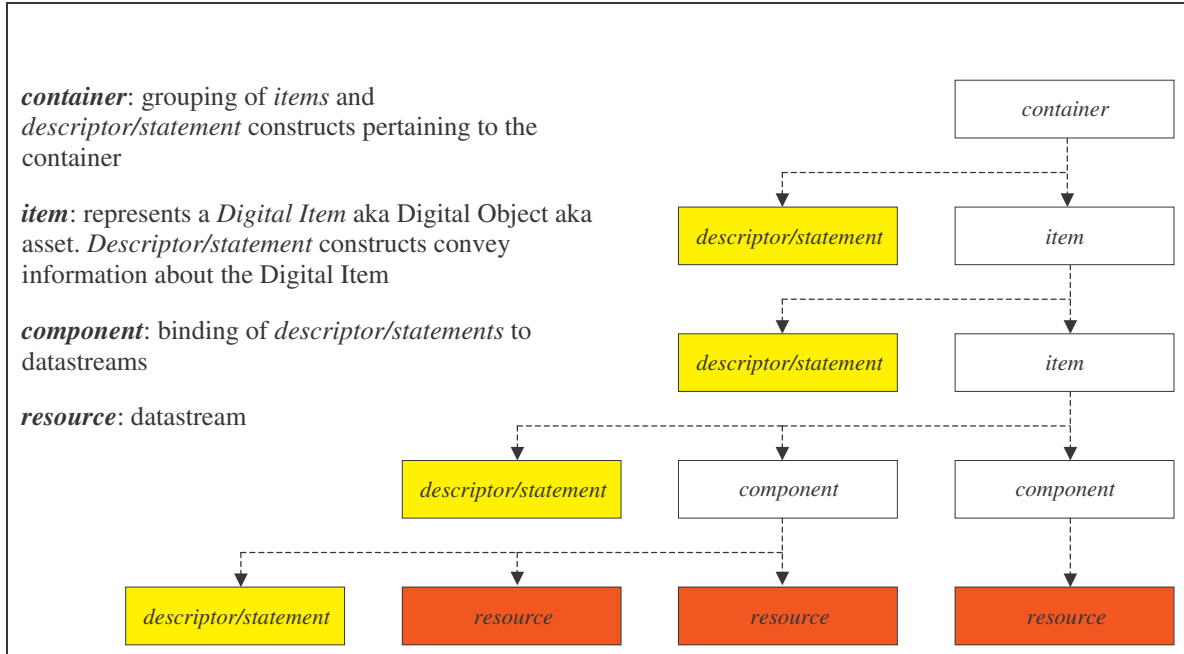
Part 10: DIP – Digital Item Processing. Means to inform user what is intended to be done with content. Allows embedding simple or complex processing tasks along with the content.

Part 16: BF – Binary Format – binary representation of digital objects. Allows XML documents to be transmitted in binary format.

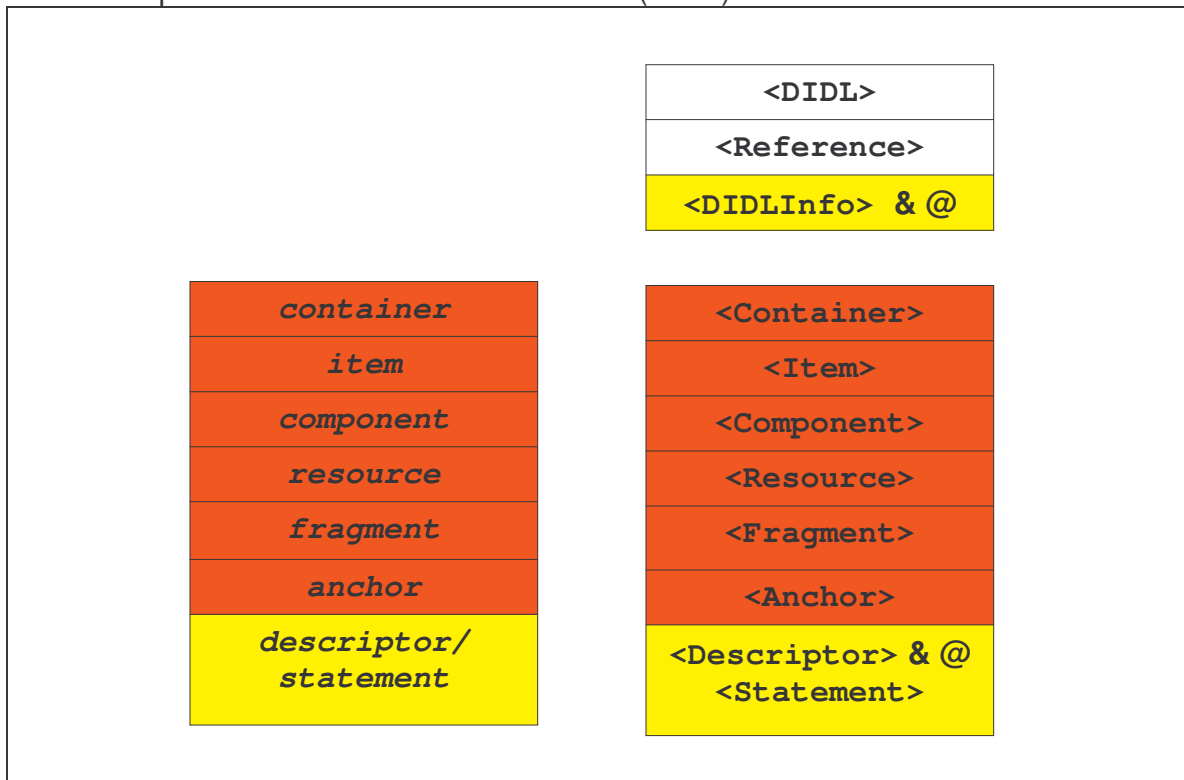
MPEG-21 DID

■Structure

Abstract model (DID)



Representation of the model in XML (DIDL)



W3C XML schema of MPEG-21 DIDL

Other representation of DID may emerge: Binary, RDF, etc.

■ Core entities

Resource

- ♦ individually identifiable asset; a datastream
- ♦ locatable via an unambiguous address
- ♦ defined both by reference and by value

Component

- ♦ binding of a resource to a set of descriptors
- ♦ basic building block of an item
- ♦ can provide multiple versions of the same resource (group bit equivalent resources)

Item

- ♦ Grouping of components bound to a set of relevant descriptors containing information about the item as a representation of an asset

Container

- ♦ Structure that allows items and/or containers to be grouped

Conditionals

- ♦ Predicate – condition – selection – choice

Fragment – Anchor

- ♦ Fragment designates a specific point or range with a resource.
- ♦ Anchor – binds descriptors to a fragment

Statement

- ♦ contains information but not an asset
- ♦ can contain any data format

Descriptor

- ♦ associates information about the parent
- ♦ can attach multiple descriptors to a parent element
- ♦ DIDL elements that can have a descriptor element as a child element allow attributes from any namespace to be included in that element
- ♦ can express relationships

■ Data provision techniques

By value

By reference

■ Comparison with other XML-based packaging formats (charts, etc.)

METS <<http://www.loc.gov/standards/mets/>>

RDF - <<http://www.w3.org/RDF/>>

PRISM - <<http://www.prismstandard.org/>>

■ Primary rules for DIDL creation

1. For each “object” with a native identifier, create one item
2. Items can be nested
3. For each datastream, a resource is created.
4. Components group bit-equivalent resources
5. Resources are provided by reference
6. MARCXML resources are provided by value
7. DIDL root element is provided

■ Secondary rules for DIDL creation

1. Each DIDL document gets a document identifier and a creation date. DII specifies the usage of descriptors for the identification of DIDs.
2. For each resource, a format identifier is provided.
3. For each item, a format identifier is provided.
4. For each item that has native identifier, copyright information and collection information are provided.
5. Descriptor statement elements can only have one child element.
6. Descriptor provides information about its parent except for component, in which case it describes the resource.

■ Creating DIDLs

- ♦ Build a DIDL with a Los Alamos technical report.
- ♦ Appendix one: LANL_TechReport-DIDL.xml
- ♦ Appendix two: ltr-iam-did-model
- ♦ Walk through revisions made to the LANL DIDL structure.
- ♦ Validation with stylesheets.

■ Theory vs. practice

- ♦ Blending prototype efforts with production systems is a delicate balance.
- ♦ Extensibility has proven itself; addition of semantic formats; addition of digital signatures; use of xlink (not covered here)

■ Tips and tricks

- ♦ JHOVE for content validation
- ♦ XSL library for DIDL creation by profile type

■ The future of DID at LANL RL

- ♦ Extend, flex, shape
- ♦ Signatures

■ Useful resources

Bekaert, Jeroen and Patrick Hochstenbach, Herbert Van de Sompel. Using MPEG-21 DIDL to Represent Complex Digital Objects in the Los Alamos National Laboratory Digital Library. D-Lib Magazine, November 2003, 9(11). <<http://www.dlib.org/dlib/november03/bekaert/11bekaert.html>>

Bekaert, Jeroen and Lyudmila Balakireva, Patrick Hochstenbach, Herbert Van de Sompel. Using MPEG-21 DIP and NISO OpenURL for the Dynamic Dissemination of Complex Digital Objects in the Los Alamos National Laboratory Digital Library. D-Lib Magazine, February 2004, 10(2). <<http://dlib.org/dlib/february04/bekaert/02bekaert.html>>

Bekaert, Jeroen and Herbert Van de Sompel. A Standards-based Solution for the Accurate Transfer of Digital Assets. D-Lib Magazine, June 2005, 11(6). <<http://dlib.org/dlib/june05/bekaert/06bekaert.html>>

Bekaert, Jeroen and Emiel De Koning, Rik Van de Walle. Packaging models for the storage and distribution of complex digital objects in archival information

systems: a review of MPEG-21 DID principles. *Multimedia Systems*, 2005, 10(4):286-301.

Cover Pages: MPEG-21 Part 2: Digital Item Declaration Language (DIDL)
<http://xml.coverpages.org/mpeg21-didl.html>

MPEG-21 DIDL Approach (i-Tor)

http://www.itor.org/oa_x/retrieving_objects/mpeg_21_didl_approach/

Burnett, Ian S. et al. *The MPEG-21 book*. Wiley, 2006.<

[http://www.amazon.com/gp/product/0470010118/sr=8-](http://www.amazon.com/gp/product/0470010118/sr=8-1/qid=1156369131/ref=pd_bbs_1/102-0584380-0614569?ie=UTF8)

[1/qid=1156369131/ref=pd_bbs_1/102-0584380-0614569?ie=UTF8](http://www.amazon.com/gp/product/0470010118/sr=8-1/qid=1156369131/ref=pd_bbs_1/102-0584380-0614569?ie=UTF8)>

MPEG-21 Overview v.5. <<http://www.chiariglione.org/mpeg/standards/mpeg-21/mpeg-21.htm>>

Appendix one – LANL-TechReport-DIDL

```
<didl:DIDL xmlns:didl="urn:mpeg:mpeg21:2002:02-DIDL-NS"
xmlns:diext="http://library.lanl.gov/2004-04/STB-RL/DIEXT"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" diext:DIDid="info:lanl-
repo/i/b99ec88a-315f-11db-b090-fe74e4523d80" diext:DIDcreated="2006-08-
21T21:55:14Z" xsi:schemaLocation="urn:mpeg:mpeg21:2002:02-DIDL-NS
http://purl.lanl.gov/STB-RL/schemas/2004-11/DIDL.xsd http://library.lanl.gov/2004-
04/STB-RL/DIEXT http://purl.lanl.gov/STB-RL/schemas/2004-04/DIEXT.xsd">
<didl:Container id="uuid-b9a5d1f2-315f-11db-b090-fe74e4523d80">
<didl:Descriptor>
<didl:Statement mimeType="text/xml; charset=utf-8">
<diadm:Admin xmlns:diadm="http://library.lanl.gov/2004-01/STB-RL/DIADM"
xsi:schemaLocation="http://library.lanl.gov/2004-01/STB-RL/DIADM
http://purl.lanl.gov/STB-RL/schemas/2004-01/DIADM.xsd">
<dc:format xmlns:dc="http://purl.org/dc/elements/1.1/"
xsi:schemaLocation="http://purl.org/dc/elements/1.1/
http://dublincore.org/schemas/xmls/qdc/2003/04/02/dc.xsd">info:lanl-
repo/pro/publication</dc:format>
</diadm:Admin>
</didl:Statement>
</didl:Descriptor>
<didl:Item id="uuid-b9a7a374-315f-11db-b090-fe74e4523d80">
<didl:Descriptor>
<didl:Statement mimeType="text/xml; charset=utf-8">
<dii:Identifier xmlns:dii="urn:mpeg:mpeg21:2002:01-DII-NS"
schemaLocation="urn:mpeg:mpeg21:2002:01-DII-NS http://purl.lanl.gov/STB-
RL/schemas/2003-09/DII.xsd">info:lanl-repo/ltr-iam/LA-UR-04-4702</dii:Identifier>
</didl:Statement>
</didl:Descriptor>
<didl:Descriptor>
<didl:Statement mimeType="text/xml; charset=utf-8">
<diadm:Admin xmlns:diadm="http://library.lanl.gov/2004-01/STB-RL/DIADM"
xsi:schemaLocation="http://library.lanl.gov/2004-01/STB-RL/DIADM
http://purl.lanl.gov/STB-RL/schemas/2004-01/DIADM.xsd">
<dc:format xmlns:dc="http://purl.org/dc/elements/1.1/"
xsi:schemaLocation="http://purl.org/dc/elements/1.1/
http://dublincore.org/schemas/xmls/qdc/2003/04/02/dc.xsd">info:lanl-
repo/pro/metadata</dc:format>
<dcterms:isPartOf xmlns:dcterms="http://purl.org/dc/terms/"
xsi:schemaLocation="http://purl.org/dc/terms/
http://dublincore.org/schemas/xmls/qdc/2003/04/02/dcterms.xsd">info:sid/library.lanl.go
v:ltr-iam</dcterms:isPartOf>
</diadm:Admin>
</didl:Statement>
</didl:Descriptor>
```

```
<didl:Component id="uuid-b9a9765e-315f-11db-b090-fe74e4523d80">
<didl:Descriptor>
<didl:Statement mimeType="text/xml; charset=utf-8">
<diadm:Admin xmlns:diadm="http://library.lanl.gov/2004-01/STB-RL/DIADM"
xsi:schemaLocation="http://library.lanl.gov/2004-01/STB-RL/DIADM
http://purl.lanl.gov/STB-RL/schemas/2004-01/DIADM.xsd">
<dc:format xmlns:dc="http://purl.org/dc/elements/1.1/"
xsi:schemaLocation="http://purl.org/dc/elements/1.1/
http://dublincore.org/schemas/xmls/qdc/2003/04/02/dc.xsd">info:lanl-
repo/fmt/3</dc:format>
<dc:type xmlns:dc="http://purl.org/dc/elements/1.1/"
xsi:schemaLocation="http://purl.org/dc/elements/1.1/
http://dublincore.org/schemas/xmls/qdc/2003/04/02/dc.xsd">info:lanl-
repo/sem/1</dc:type>
<dcterms:created xmlns:dcterms="http://purl.org/dc/terms/"
xsi:schemaLocation="http://purl.org/dc/terms/
http://dublincore.org/schemas/xmls/qdc/2003/04/02/dcterms.xsd">2006-08-
10T16:18:21Z</dcterms:created>
<dc:creator xmlns:dc="http://purl.org/dc/elements/1.1/"
xsi:schemaLocation="http://purl.org/dc/terms/
http://dublincore.org/schemas/xmls/qdc/2003/04/02/dcterms.xsd">info:lanl-
repo/creator/LANL-RTF</dc:creator>
</diadm:Admin>
</didl:Statement>
</didl:Descriptor>
<didl:Resource mimeType="application/marc+xml; charset=utf-8">
<marc:record xmlns:marc="http://www.loc.gov/MARC21/slim"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.loc.gov/MARC21/slim
http://purl.lanl.gov/vendors/schemas/MARC/2006-02/MARC21slim.xsd">
<marc:leader>00000nam 2200000zu 4500</marc:leader>
<marc:controlfield tag="001">LA-UR-04-4702</marc:controlfield>
<marc:controlfield tag="005">2006-08-10T16:18:21Z</marc:controlfield>
<marc:controlfield tag="008">060810s2004 xx |||||||||||lengld</marc:controlfield>
<marc:datafield tag="035" ind1=" " ind2=" ">
<marc:subfield code="a">LA-UR-04-4702</marc:subfield>
</marc:datafield>
<marc:datafield tag="040" ind1=" " ind2=" ">
<marc:subfield code="a">LTR-IAM</marc:subfield>
</marc:datafield>
<marc:datafield tag="041" ind1="0" ind2="7">
<marc:subfield code="a">eng</marc:subfield>
<marc:subfield code="2">ISO639-2</marc:subfield>
</marc:datafield>
<marc:datafield tag="088" ind1=" " ind2=" ">
<marc:subfield code="a">LA-UR-04-4702</marc:subfield>
```

```
</marc:datafield>
<marc:datafield tag="245" ind1="0" ind2="0">
<marc:subfield code="a">Unified user interface for multiple independently developed
instruments.</marc:subfield>
</marc:datafield>
<marc:datafield tag="260" ind1=" " ind2=" ">
<marc:subfield code="c">[2004]</marc:subfield>
</marc:datafield>
<marc:datafield tag="300" ind1=" " ind2=" ">
<marc:subfield code="a">[19] p.</marc:subfield>
</marc:datafield>
<marc:datafield tag="700" ind1="1" ind2=" ">
<marc:subfield code="a">Marks, Tom Jr.</marc:subfield>
<marc:subfield code="5">LAUR</marc:subfield>
<marc:subfield code="e">Author</marc:subfield>
<marc:subfield code="u">Los Alamos National Laboratory ; N-4</marc:subfield>
</marc:datafield>
<marc:datafield tag="710" ind1="2" ind2=" ">
<marc:subfield code="a">Los Alamos National Laboratory</marc:subfield>
<marc:subfield code="e">Other</marc:subfield>
</marc:datafield>
<marc:datafield tag="856" ind1="4" ind2=" ">
<marc:subfield code="d">la-pubs</marc:subfield>
<marc:subfield code="f">LA-UR-04-4702sc.pdf</marc:subfield>
<marc:subfield code="s">3.33 MB</marc:subfield>
<marc:subfield code="u">http://library.lanl.gov/cgi-bin/getfile?LA-UR-04-
4702sc.pdf</marc:subfield>
<marc:subfield code="x">GOVT</marc:subfield>
<marc:subfield code="x">Provider: IAM</marc:subfield>
<marc:subfield code="y">Item URL</marc:subfield>
<marc:subfield code="z">Access restricted to selected government
agencies</marc:subfield>
</marc:datafield>
</marc:record>
</didl:Resource>
</didl:Component>
<didl:Component id="uuid-b9a141d2-315f-11db-b090-fe74e4523d80">
<didl:Descriptor>
<didl:Statement mimeType="text/xml; charset=utf-8">
<diadm:Admin xmlns:diadm="http://library.lanl.gov/2004-01/STB-RL/DIADM"
xsi:schemaLocation="http://library.lanl.gov/2004-01/STB-RL/DIADM
http://purl.lanl.gov/STB-RL/schemas/2004-01/DIADM.xsd">
<dc:format xmlns:dc="http://purl.org/dc/elements/1.1/"
xsi:schemaLocation="http://purl.org/dc/elements/1.1/
http://dublincore.org/schemas/xmls/qdc/2003/04/02/dc.xsd">info:lanl-
repo/fmt/528</dc:format>
```

```
<dc:type xmlns:dc="http://purl.org/dc/elements/1.1/"
xsi:schemaLocation="http://purl.org/dc/elements/1.1/
http://dublincore.org/schemas/xmls/qdc/2003/04/02/dc.xsd">info:lanl-
repo/sem/4</dc:type>
<dc:creator xmlns:dc="http://purl.org/dc/elements/1.1/"
xsi:schemaLocation="http://purl.org/dc/terms/
http://dublincore.org/schemas/xmls/qdc/2003/04/02/dcterms.xsd">info:lanl-
repo/creator/LTR-IAM</dc:creator>
</diadm:Admin>
</didl:Statement>
</didl:Descriptor>
<didl:Resource mimeType="application/ltr-iam+xml"
encoding="base64">PHJIY29yZCB4bWxucz0iaHR0cDovL3d3dy5sb2MuZ292L01BUk
MyMS9zbGltIiB4bWxuczp4c2k9
Imh0dHA6Ly93d3cudzMub3JnLzlwMDEvWE1MU2NoZW1hLWluc3RhbmNlIiB4c2k
6c2NoZW1hTG9j
YXRpb249Imh0dHA6Ly93d3cubG9jLmdvdi9NQVJDMjEvc2xpbnSBodHRwOi8vd3d3L
mxvYy5nb3Yv
c3RhbmRhcmlzL21hcmN4bWwvc2NoZW1hL01BUkMyMXNsaW0ueHNkIj4gCjxsZ
WFkZXI+MDAwMDBu
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</didl:Resource>
</didl:Component>
<didl:Component id="uuid-b9ac3312-315f-11db-b090-fe74e4523d80">
<didl:Descriptor>
<didl:Statement mimeType="application/pdf">
<diadm:Admin xmlns:diadm="http://library.lanl.gov/2004-01/STB-RL/DIADM"
xsi:schemaLocation="http://library.lanl.gov/2004-01/STB-RL/DIADM
http://purl.lanl.gov/STB-RL/schemas/2004-01/DIADM.xsd">
<dc:format xmlns:dc="http://purl.org/dc/elements/1.1/"
xsi:schemaLocation="http://purl.org/dc/elements/1.1/
http://dublincore.org/schemas/xmls/qdc/2003/04/02/dc.xsd">info:lanl-
repo/fmt/5</dc:format>
<dc:type xmlns:dc="http://purl.org/dc/elements/1.1/"
xsi:schemaLocation="http://purl.org/dc/elements/1.1/
http://dublincore.org/schemas/xmls/qdc/2003/04/02/dc.xsd">info:lanl-
repo/sem/4</dc:type>
<dc:creator xmlns:dc="http://purl.org/dc/elements/1.1/"
xsi:schemaLocation="http://purl.org/dc/terms/
http://dublincore.org/schemas/xmls/qdc/2003/04/02/dcterms.xsd">info:lanl-
repo/creator/LTR-IAM</dc:creator>
</diadm:Admin>
</didl:Statement>
</didl:Descriptor>
```

```
<didl:Resource mimeType="application/pdf"
encoding="base64">JVBERi0xLjQNJeLjz9MNCjI2NCAwIG9iag08PCANL0xpbmVhc
ml6ZWQgMSANL08gMjY5IA0vSCBb...
</didl:Resource>
</didl:Component>
</didl:Item>
</didl:Container>
</didl:DIDL>
```

Appendix two: Itr-iam didl model (Excel spreadsheet)

