OAI-PMH for Resource Harvesting

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Tutorial Outline

- OAI-PMH for Resource Harvesting: problem statement and conceptual solution
- MPEG-21 DIDL: An XML-based Complex Object Format for OAI-PMH-based Resource Harvesting
- Accurate mirroring the collection of the American Physical Society using OAI-PMH-based Resource Harvesting
- mod_oai: An OAI-PMH-based model for Web Resource Harvesting
- OAIResource: A software tool for OAI-PMH-based Resource Harvesting

Resource Harvesting: Use cases

- Discovery: use content itself in the creation of services
  - search engines that make full-text searchable
  - citation indexing systems that extract references from the full-text content
  - browsing interfaces that include thumbnail versions of high-quality images from cultural heritage collections
- Preservation:
  - periodically transfer digital content from a data repository to one or more trusted digital repositories
  - trusted digital repositories need a mechanism to automatically synchronize with the originating data repository

Resource Harvesting: Use cases

- Discovery:
  - Institutional Repository & Digital Library Projects: UK JISC, DARE, DINI
  - Web search engines: competition for content (cf Google Scholar)
- Preservation:
  - Institutional Repository & Digital Library Projects: UK JISC, DARE, DINI
  - Library of Congress: NDIIP Archive Export/Ingest, e-deposit

OAI-PMH is well-established.
Can OAI-PMH be used for Resource Harvesting?

Existing OAI-PMH based approaches

Typical scenario:

1. An OAI-PMH harvester harvests Dublin Core records from the OAI-PMH repository.
2. The harvester analyzes each Dublin Core record, extracting dc.identifier information in order to determine the network location of the described resource.
3. A separate process, out-of-band from the OAI-PMH, collects the described resource from its network location.

Existing OAI-PMH based approaches : Issue 1

- Locating the resource based on information provided in dc.identifier
  - dc.identifier used to convey a variety of identifier: (simultaneously) URL DOI, bibliographic citation, … Not expressive enough to distinguish between identifier, locator.
    - Several derferencing attempts required
  - URI provided in dc.identifier is commonly that of a bibliographic “splash page”
    - How to know it is a bibliographic “splash page”, not the resource?
    - If it is a bibliographic “splash page”, where is the resource?

Existing OAI-PMH based approaches : Issue 2

- Using the OAI-PMH datestamp of the Dublin Core record to trigger incremental harvesting:
  - Datestamp of DC record does not necessarily change when resource changes

DC record datestamp no change

DC record datestamp change

	no metadata update	metadata update
no resource update	OK	unnecessary resource download
resource update	missed resource update	OK

Existing OAI-PMH based approaches : Conventions

- Conventions address Issue 1; Issue 2 can not really be addressed.
- First dc.identifier is locator of the resource
  - what if the resource is not digital?
- Use of dc.format and/or dc.relation to convey locator

Existing OAI-PMH based approaches : Conventions

```
<oai_dc:dc>
   <dc:title>A Simple Parallel-Plate Resonator Technique for Microwave.
       Characterization of Thin Resistive Films</dc:title>
   <dc:creator>Vorobiev, A.</dc:creator>
   <dc:subject>ING-INF/01 Elettronica</dc:subject>
   <dc:description>A parallel-plate resonator method is proposed for
       non-destructive characterisation of resistive films used in
       microwave integrated circuits. A slot made in one ... </dc:description>
   <dc:publisher>Microwave engineering Europe</dc:publisher>
   <dc:date>2002</dc:date>
   <dc:type>Documento relativo ad una Conferenza o altro Evento</dc:type>
   <dc:type>PeerReviewed</dc:type>
   <dc:identifier>http://amsacta.cib.unibo.it/archive/00000014/</dc:identifier>
   <dc:format>pdf
     http://amsacta.cib.unibo.it/archive/00000014/01/GaAs_1_Vorobiev.pdf
   </dc:format>
</oai_dc:dc>
```

splash page

locator of resource

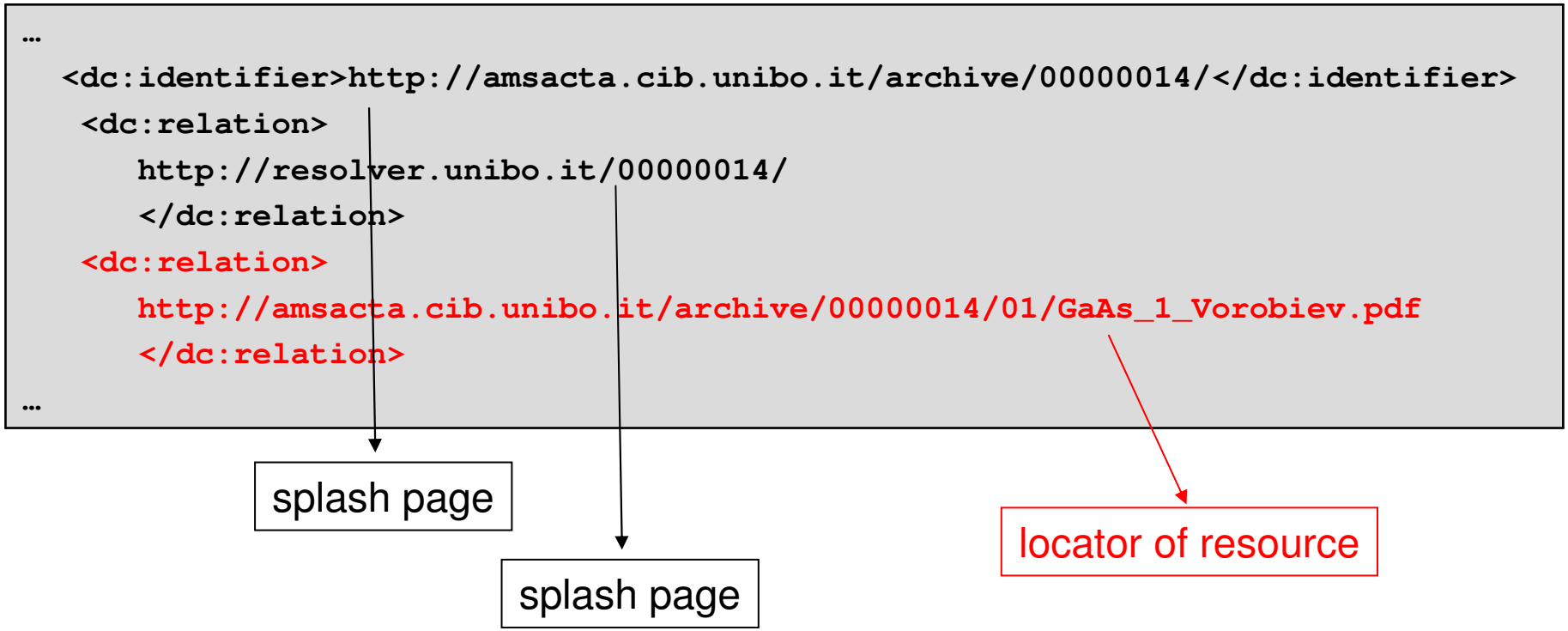
Existing OAI-PMH based approaches : Conventions

```
…
    <dc:identifier>http://amsacta.cib.unibo.it/archive/00000014/</dc:identifier>
    <dc:relation>
      http://amsacta.cib.unibo.it/archive/00000014/01/GaAs_1_Vorobiev.pdf
    </dc:relation>
…
```

splash page

locator of resource

Existing OAI-PMH based approaches : Conventions



Existing OAI-PMH based approaches : Other attempts

- dc.identifier leads to splash page & splash page contains special purpose XHTML link to resource(s)
  - What if there is no splash page?
  - How does a harvester know he is in this situation?
- OA-X: protocol extension
  - OK in local context
  - Strategic problem to generalize
  - How to consolidate with OAI-PMH data model
- Qualified Dublin Core
  - Could bring expressiveness to distinguish between locator & identifier
  - But what with datestamp issue?

Proposed OAI-PMH based approach

- Use metadata formats that were specifically created for representation of digital objects:
  - Complex Object Formats as OAI-PMH metadata formats
  - MPEG-21 DIDL, METS, ..

OAI-PMH data model

← resource

OAI-PMH identifier
= entry point to all records pertaining to the resource

← item

metadata pertaining to the resource

Dublin Core metadata	MARCXML metadata	MPEG-21 DIDL	METS
simple	more expressive	highly expressive	highly expressive

← records

Complex Object Formats : characteristics

- Representation of a digital object by means of a wrapper XML document
- Represented resource can be:
  - simple digital object (consisting of a single datastream)
  - compound digital object (consisting of multiple datastreams)
- Unambiguous approach to convey identifiers of the digital object and its constituent datastreams
- Include datastream:
  - By-Value: embedding of base64-encoded datastream
  - By-Reference: embedding network location of the datastream
  - not mutually exclusive; equivalent
- Include a variety of secondary information
  - By-Value
  - By-Reference
  - Descriptive metadata, rights information, technical metadata, …

```
<didl:DIDL>
<didl:Item>
  <didl:Descriptor><didl:Statement mimeType="text/xml; charset=UTF-8">
    <dii:Identifier>
      http://amsacta.cib.unibo.it/archive/00000014/
    </dii:Identifier>
  </didl:Statement></didl:Descriptor>
  <didl:Descriptor><didl:Statement mimeType="text/xml; charset=UTF-8">
    <oai_dc:dc>
      <dc:title>A Simple Parallel-Plate Resonator Technique for
          Microwave. Characterization of Thin Resistive Films
      </dc:title>
      <dc:creator>Vorobiev, A.</dc:creator>
      <dc:identifier>
        http://amsacta.cib.unibo.it/archive/00000014/</dc:identifier>
      <dc:format>application/pdf</dc:format>
      …
    </oai_dc:dc>
  </didl:Statement></didl:Descriptor>
  <didl:Component>
    <didl:Resource mimeType="application/pdf"
   ref="http://amsacta.cib.unibo.it/archive/00000014/01/GaAs_1_Vorobiev.pdf"/>
  </didl:Component>
</didl:Item>
</didl:DIDL>
```


Complex Object Formats & OAI-PMH

- Resource represented via XML wrapper => OAI-PMH **`<metadata>`**
- Uniform solution for simple & compound objects
- Unambiguous expression of locator of datastream
- Disambiguation between locators & identifiers
- OAI-PMH datestamp changes whenever the resource (datastreans, secondary information) changes
- OAI-PMH semantics apply: “about” containers, set membership

OAI-PMH based approach using Complex Object Format

Typical scenario:

1. An OAI-PMH harvester checks for support of a complex object format using the ListMetadataFormats verb
2. The harvester harvests the complex object metadata. Semantics of the OAI-PMH datestamp guarantee that new and modified resources are detected.
3. A parser at the end of the harvesting application analyzes each harvested complex object record:
   - The parser extracts the bitstreams that were delivered By-Value.
   - The parser extracts the unambiguous references to the network location of bitstreams delivered By-Reference.
4. A separate process, out-of-band from the OAI-PMH, collects the bitstreams delivered By-Reference from the extracted network locations.

Complex Object Formats & OAI-PMH : existing implementations

- LANL Repository
  - Local storage of Terrabytes of scholarly assets
  - Assets stored as MPEG-21 DIDL documents
  - DIDL documents made accessible to downstream applications via the OAI-PMH
- Mirroring of American Physical Society collection at LANL
  - Maps APS document model to MPEG-21 DIDL Transfer Profile
  - Exposes MPEG-21 DIDL documents through OAI-PMH infrastructure
  - Inlcudes digests/signatures
- DSpace & Fedora plug-ins
  - Maps DSpace/Fedora document model to MPEG-21 DIDL Transfer Profile
  - Exposes MPEG-21 DIDL documents through OAI-PMH infrastructure
- mod_oai

Complex Object Formats & OAI-PMH : issues

- Which Complex Object Format(s)
- How to Profile Complex Object Format(s) for OAI-PMH Harvesting
- Large “records”
- Compound objects with multiple datastreams. What if only 1 datastream gets updated?
- Because the resource is represented as **<metadata>**, can rights pertaining to the resource be expressed according to the “rights for metadata” OAI-rights guideline?
- Tools:
  - Software library to write compliant complex objects
  - Integration of this library with repository systems (Fedora, DSpace, eprints.org, ….)
  - Software to harvest resources based on OAI-PMH model

Readings

- Herbert Van de Sompel, Michael Nelson, Carl Lagoze, Simeon Warner. Resource Harvesting witin the OAI-PMH Framework. D-Lib Magazine. December 2004. http://dx.doi.org/10.1045/december2004-vandesompel