An Update from the OAI

<http://www.openarchives.org>

Herbert Van de Sompel <herbertv@lanl.gov>
Carl Lagoze <lagoze@cs.cornell.edu>
Michael Nelson <mln@cs.odu.edu>
Simeon Warner <simeon@cs.cornell.edu>

CNI Task Force Meeting
December 7th 2004, Portland, OR

Los Alamos NATIONAL LABORATORY CORNELL

Outline

(1) OAI-PMH refresh

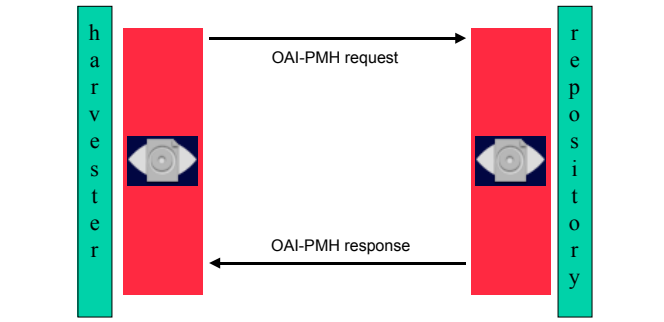
(2) OAI-rights effort

(3) OAI-PMH for Resource Harvesting

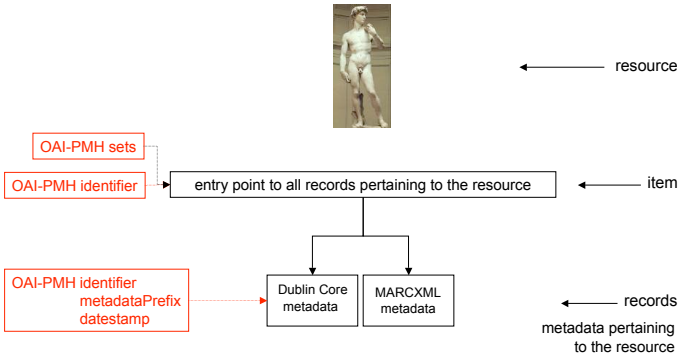
(4) mod_oai

Discussion session : 10:30, same place

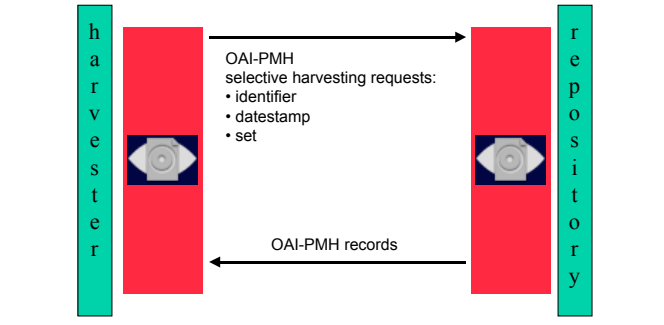
OAI-PMH



OAI-PMH data model



OAI-PMH



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Why OAI-rights?

OAI has matured beyond e-prints and is used to convey metadata about resources for which the ability to express rights is a factor limiting dissemination

⇒ Encourage participation by allowing assertion of rights and restrictions

Even in the open access world it may be important to express permissions

⇒ Work inspired by the RoMEO project (Oppenheim, Probets, Gadd, 2002-2003)

How?

"The usual OAI way":

- Assemble group of knowledgeable and interested parties (the OAI-rights group)
- Distribute first-stab white paper
- Discuss via conference call, scope work
- Email and conference call discussions, develop alpha specification (Jun 2004), revise
- Release beta specification (Nov 2004)
- Release specification (end 2004)

http://www.openarchives.org/OAI/2.0/guidelines-rights.htm

Who?

The OAI-rights group:

Caroline Arms (Library of Congress), **Chris Barlas** (Rightscom), **Tim Cole** (University of Illinois at Urbana-Champaign), **Mark Doyle** (American Physical Society), **Henk Ellerman** (Erasmus Electronic Publishing Initiative), **John Erickson** (Hewlett Packard & DSpace), **Elizabeth Gadd** (Loughborough University & RoMEO), **Brian Green** (EDItEUR), **Chris Gutteridge** (Southampton University & eprints.org), **Carl Lagoze** (Cornell University & OAI), **Mike Linksvayer** (Creative Commons), **Uwe Müller** (Humboldt University), **Michael Nelson** (Old Dominion University & OAI), **John Ober** (California Digital Library), **Charles Oppenheim** (Loughborough University & RoMEO), **Sandy Payette** (Cornell University), **Andy Powell** (UKOLN, University of Bath), **Steve Proberts** (Loughborough University & RoMEO), **Herbert Van de Sompel** (Los Alamos National Laboratory & OAI), and **Simeon Warner** (Cornell University, arXiv & OAI)

Scope

- No new rights expression language
- Don't restrict to specific language(s)
- Don't get bogged down in rights vs permissions vs enforcement, OAI-PMH is about transferring XML data
- Rights about metadata a separate problem from rights about resources
  - Tackle rights about metadata first
  - Postpone work on rights about resources (note overlap with resource harvesting work)

? Issues with rights expressions for aggregations of items (OAI sets; whole repositories)

? Issues with whether and how changes in rights expressions should be picked up in selective harvesting (datestamps)

Creative Commons as example language

- Felt we should pick one language as an example
  - RoMEO aligned with Create Commons (CC)
  - CC fits well with interests of many of the original OAI participants (e.g. arXiv considering use of CC)
  - CC is a "good thing" to promote
- Picking CC turned out to be a little complicated because of RDF formulation. Schema version may be forthcoming
- CC really is just an example, can use any XML rights expression language (REL)
  - Will likely add appendices with other example languages later
  - Ongoing collaboration with the ODRL community to define ODRL-OAI guidelines document (again, metadata first)

OAI-PMH data model

Data model elements:

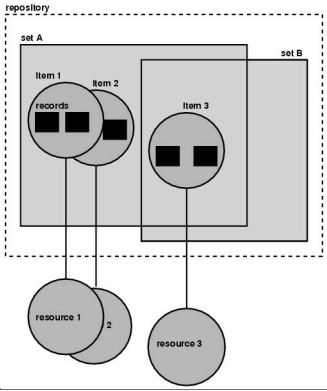
repository

item - all metadata about a resource, has identifier

record - metadata in a particular format, plus header and information about the metadata

set - optional, overlapping, hierarchical groupings of items

resource outside scope of OAI-PMH

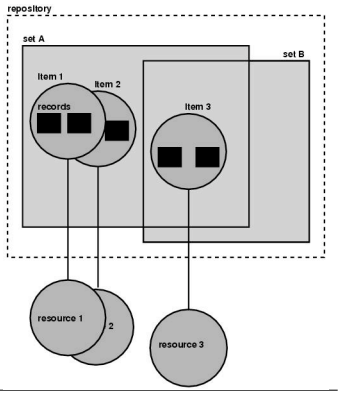


Different aggregation levels

Aggregation levels:

- record - Rights about an individual record
- repository - Manifests of rights about all records (all metadata formats from each item) in a repository
- set - Manifests of rights about all records (all metadata formats from each item) in a set

Record level expression is authoritative. Other levels are optional



record level rights expressions

- W3C XML schema defines format for `<rights>` package to be included in `<about>` container

```
<record>
  <header> id, datestamp, sets </header>
  <metadata> metadata: DC, MARCXML, … </metadata>
  <about> <rights>…</rights> </about>
  <about> provenance, branding etc. </about>
</record>
```


record level rights expressions

- Actual rights expression may be in-line (must be valid XML) or by-reference (at given URL, XML recommended)
- In-line method recommended for truly static rights expressions. Avoids possible ambiguity with delayed de-referencing

```
<record>
  <header> id, datestamp, sets </header>
  <metadata> metadata: DC, MARCXML, … </metadata>
  <about> <rights>…</rights> </about>
  <about> provenance, branding etc. </about>
</record>
```


set and repository level expressions

- These are optional and non-authoritative
- W3C XML schema defines `<rightsManifest>` package which contains a sequence of `<rights>` elements (as used at the record level)
- `<rightsManifest>` included in
  - For repository level: `<description>` in Identify
  - For set level: `<setDescription>` in ListSets response
- Useful when there is a small set of expressions within the particular aggregation
- Should be accurate and complete but this is not enforced by specification

Rights about resources

- Can already be done: use an appropriate metadata format as one of the parallel metadata formats from an item. But:
  - Too much choice: need profile
  - Issues with identification of resources
- Overlap with resource harvesting work

http://www.openarchives.org/OAI/2.0/guidelines-rights.htm

Outline

(1) OAI-PMH refresh

(2) OAI-rights effort

→ (3) OAI-PMH for Resource Harvesting

(4) mod_oai

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

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

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

splash page

splash page

locator of resource

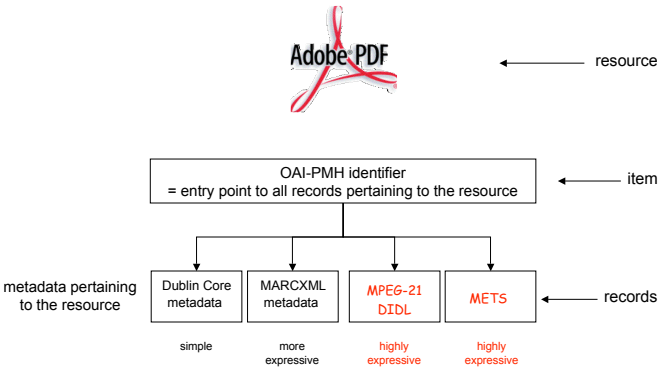
Existing OAI-PMH based approaches : Other attempts

- 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



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>
```

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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

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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.

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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

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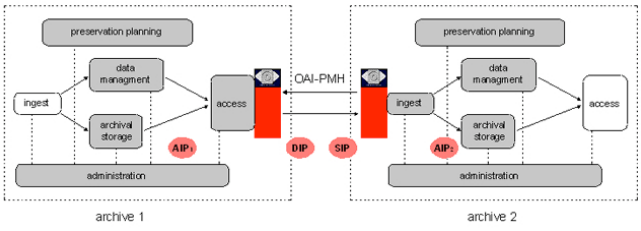
Complex Object Formats & OAI-PMH : archive export/ingest



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Complex Object Formats & OAI-PMH : issues

- Which Complex Object Format(s)
- How to Profile Compex Object Format(s) for OAI-PMH Harvesting
- Large records
- Making resources re-harvestable
- 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, ….)

Launch OAI effort
OAI proposal to Library of Congress NDIIP submitted

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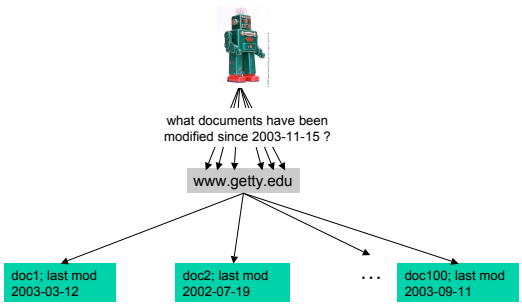
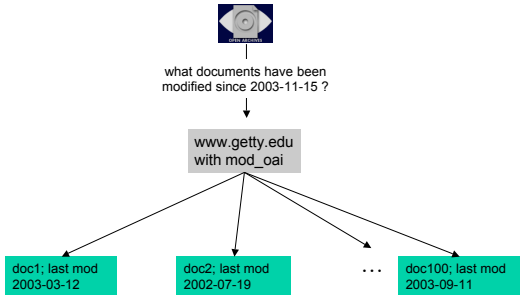
Web crawlers



robot image from: http://www.q-design.com/toy/ToyArt/robots/55.JPEG

A more efficient way



mod_oai approach

- Goal: integrate OAI-PMH functionality into the web server itself…
- mod_oai: an Apache 2.0 module to automatically answer OAI-PMH requests for an http server
  - written in C
  - respects values in .htaccess, httpd.conf
- Result: web harvesting with OAI-PMH semantics (e.g., from, until, sets)
  - http://www.foo.edu/modoai?
    verb=ListIdentifiers &
    metdataPrefix=oai_dc &
    from=2004-09-15 &
    set=mime:video:mpeg

mod_oai approach

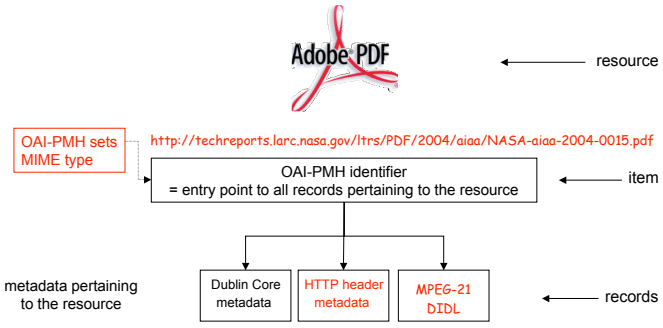
- Install on an Apache 2.0 server
  - compile & edit httpd.conf

http://www.foo.edu/

now has an OAI-PMH baseURL of:

http://www.foo.edu/modoai

OAI-PMH data model



mod_oai : OAI-PMH concepts

concept	mod_oai implementation
OAI-PMH Identifier	URL of resource
set	MIME type of resource
datestamp	change time of resource
deleted records	“no” deleted records

OAI-PMH concepts : typical repository

OAI-PMH Entity	value	description
Resource	URL	PDF, PS, XML, HTML or other file
Item		
identifier	OAI Identifier	DNS-based name of metadata about resource
set membership	LCSH	Library of Congress Subject Heading
Record		
metadataPrefix	oai_dc	bibliographic metadata in Dublin Core
datestamp	2004-10-18	modification date of DC record
Record		
metadataPrefix	oai_marc	bibliographic metadata in MARC
datestamp	2004-07-31	modification date of MARC record

OAI-PMH concepts : mod_oai empowered Apache

OAI-PMH Entity	value	description
Resource	URL	HTML, GIF, PDF or other web file
Item		
identifier	URL	same URL as the resource
set membership	MIME type	MIME type of the resource
Record		
metadataPrefix	http_header	the http headers that would have been returned via HTTP GET/HEAD
datestamp	2004-07-31	modification date of resource
Record		
metadataPrefix	oai_dc	a subset of http_header in DC
datestamp	2004-07-31	modification date of resource
Record		
metadataPrefix	oai_didl	MPEG-21 DIDL: base64 encoded resource + http_header metadata
datestamp	2004-07-31	modification date of resource

http_header

```
<?xml version="1.0" encoding="UTF-8" ?>
- <OAI-PMH xmlns="http://www.openarchives.org/OAI/2.0/" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.openarchives.org/OAI/2.0/ http://www.openarchives.org/OAI/2.0/OAI-PMH.xsd">
  <responseDate>2004-09-21T04:29:06Z</responseDate>
  <request verb="ListRecords" metadataPrefix="http_header">http://whiskey.cs.odu.edu/modoai</request>
- <ListRecords>
  - <record>
    - <header>
      <identifier>http://whiskey.cs.odu.edu/apache_pb2_ani.gif</identifier>
      <datestamp>2001-05-03T04:30:35</datestamp>
      <setSpec>mime:image/gif</setSpec>
    </header>
    - <metadata>
      - <http:header xmlns:http="http://www.openarchives.org/OAI/2.0/http_header/" xmlns:xsi="http://www.w3.org/2001/
        XMLSchema-instance" xsi:schemaLocation="http://www.openarchives.org/OAI/2.0/http_header/ http://purl.lanl.gov/
        STB-RL/schemas/2004-08/HTTP-HEADER.xsd">
        <http:Content-Length>2160</http:Content-Length>
        <http:Server>Apache/2.0.50 (Unix)</http:Server>
        <http:Content-Type>image/gif</http:Content-Type>
        <http:Last-Modified>Thu, 03 May 2001 04:30:35 GMT</http:Last-Modified>
        <http:Date>Tue, 21 Sep 2004 04:29:06 GMT</http:Date>
      </http:header>
    </metadata>
  </record>
  - <record>
    - <header>
      <identifier>http://whiskey.cs.odu.edu/apache_pb2.gif</identifier>
      <datestamp>2001-05-03T04:30:35</datestamp>
      <setSpec>mime:image/gif</setSpec>
    </header>
    - <metadata>
      - <http:header xmlns:http="http://www.openarchives.org/OAI/2.0/http_header/" xmlns:xsi="http://www.w3.org/2001/
        XMLSchema-instance" xsi:schemaLocation="http://www.openarchives.org/OAI/2.0/http_header/ http://purl.lanl.gov/
        STB-RL/schemas/2004-08/HTTP-HEADER.xsd">
        <http:Content-Length>2414</http:Content-Length>
        <http:Server>Apache/2.0.50 (Unix)</http:Server>
        <http:Content-Type>image/gif</http:Content-Type>
        <http:Last-Modified>Thu, 03 May 2001 04:30:35 GMT</http:Last-Modified>
        <http:Date>Tue, 21 Sep 2004 04:29:06 GMT</http:Date>
      </http:header>
```

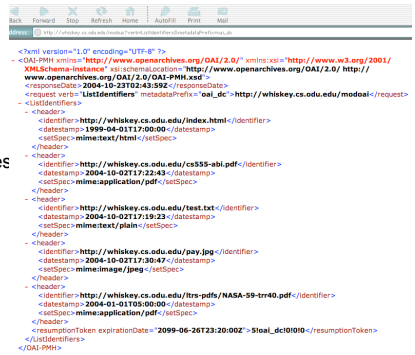
mod_oai use cases

- Regular Web Crawling
  - use ListIdentifiers to discover URLs
  - add new URLs to the list of URLs to be crawled
- Harvesting Resources with OAI-PMH
  - use ListRecords to extract the entire resource as an MPEG-21 DIDL AIP

Regular Web Crawling : ListIdentifiers

harvester

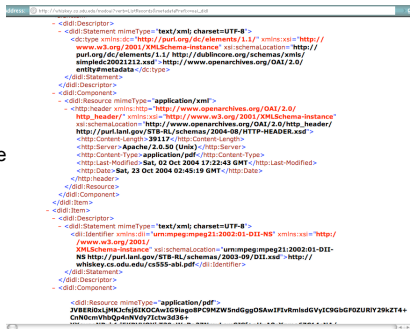
- issues a ListIdentifiers,
- finds URLs of updated resources
- does HTTP GETs updates only
- can get URLs of resources with specified MIME types



OAI-PMH Resource Harvesting

harvester

- issues a ListRecords,
- Gets updates as MPEG-21 DIDL documents (HTTP headers, resource By Value or By Reference)
- can get resources with specified MIME types



mod_oai

is:

- a simple way to more efficiently harvest web pages
- a possible impact on robots.txt
- fully OAI-PMH compliant
  - works with existing harvesters
- Funded by the Andrew W Mellon Foundation

is not:

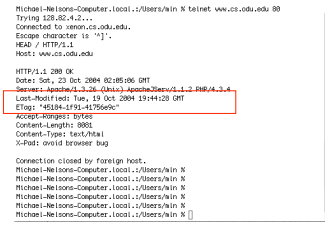
- yet suitable for dynamic files
- a replacement for
  - DSpace
  - Fedora
  - eprints.org
  - other digital libraries / repositories / cms

info: http://www.modoai.org/
demo : http://whiskey.cs.odu.edu/

Datestamps and Etags

L. Clausen, "Concerning Etags and Datetsamps",
4th International Web Archiving Workshop, ECDL 2004
http://www.netarchive.dk/website/publications/Etags-2004.pdf

- Procedure
  - 16 harvests over 1 month of 465,374 .dk domains
  - 5,543,470 possible downloads
  - 5,182,034 successful downloads
  - 599,143 changes



Datestamp and Etag Example

Discussion : at 10:30, here

(*) OAI-rights effort

(*) OAI-PMH for Resource Harvesting

(*) mod_oai

(*) NSDL validation effort

(*) DLF OAI Best Practice

(*) …