Introduction to Digital Libraries

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uct cs honours 2003

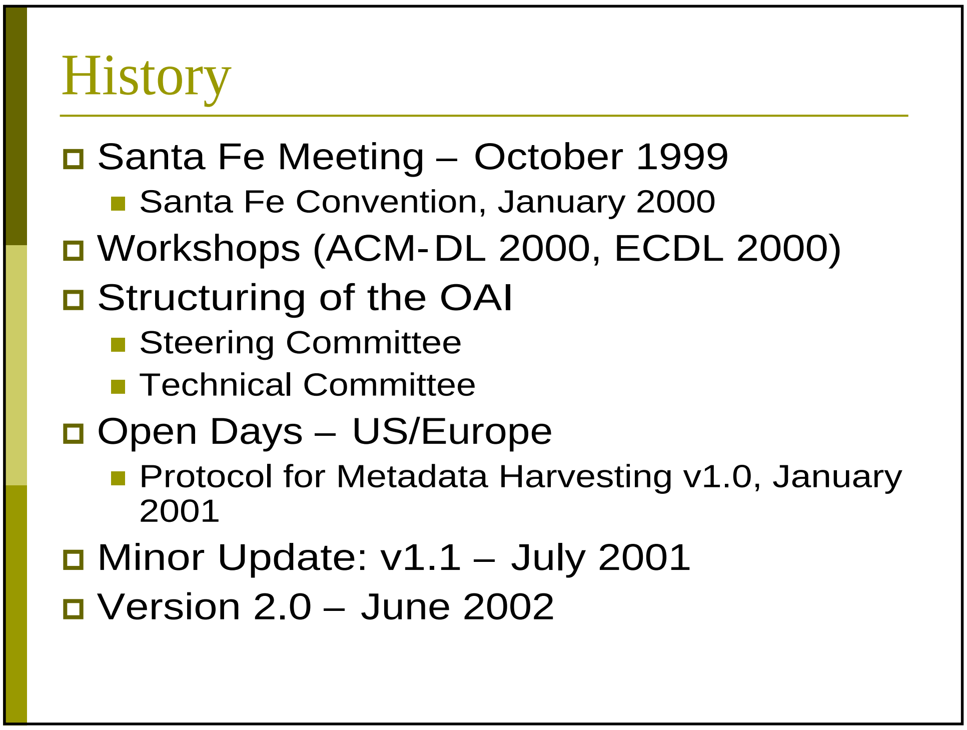
OAI Protocol for Metadata Harvesting

What is the OAI ?

- What is the Open Archives Initiative (OAI)?
  - Organisation dedicated to solving problems of digital library interoperability by defining simple protocols, most recently for the exchange of metadata.
- What is the Protocol for Metadata Harvesting?
  - Protocol to transfer metadata from a source archive to a destination archive.

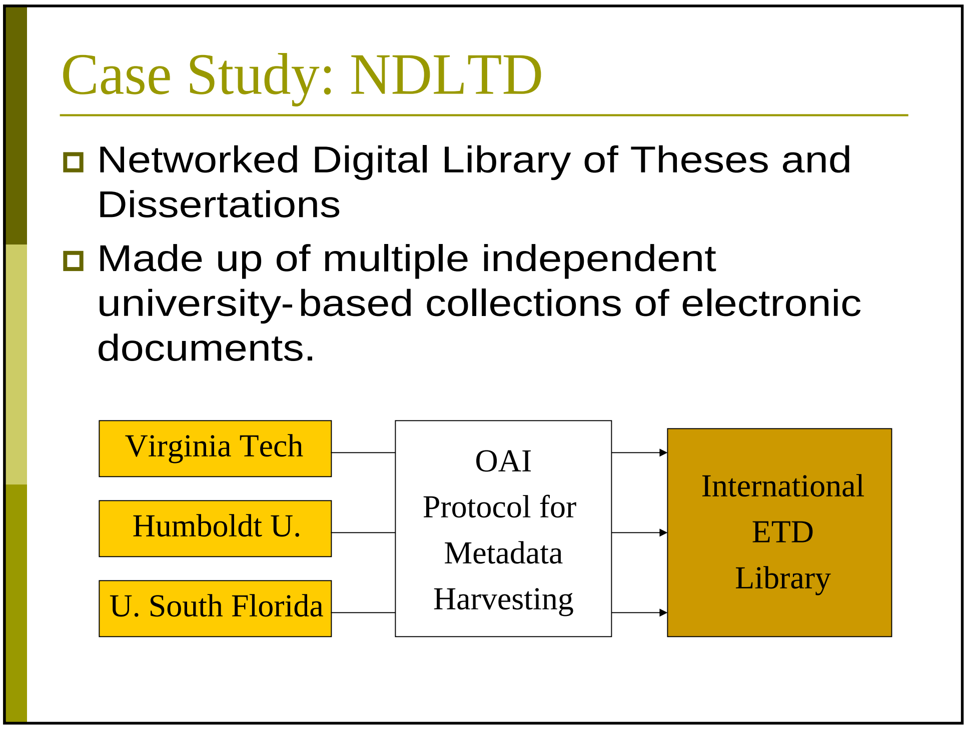
Motivation

- Existence of some established but independent archives.
- Need for cross-archive services (like search engines).
- Lack of low-cost interoperability technology.
- Experience from past projects such as Dienst.



History

- Santa Fe Meeting – October 1999
  - Santa Fe Convention, January 2000
- Workshops (ACM-DL 2000, ECDL 2000)
- Structuring of the OAI
  - Steering Committee
  - Technical Committee
- Open Days – US/Europe
  - Protocol for Metadata Harvesting v1.0, January 2001
- Minor Update: v1.1 – July 2001
- Version 2.0 – June 2002



Case Study: NDLTD

- Networked Digital Library of Theses and Dissertations
- Made up of multiple independent university-based collections of electronic documents.

Virginia Tech

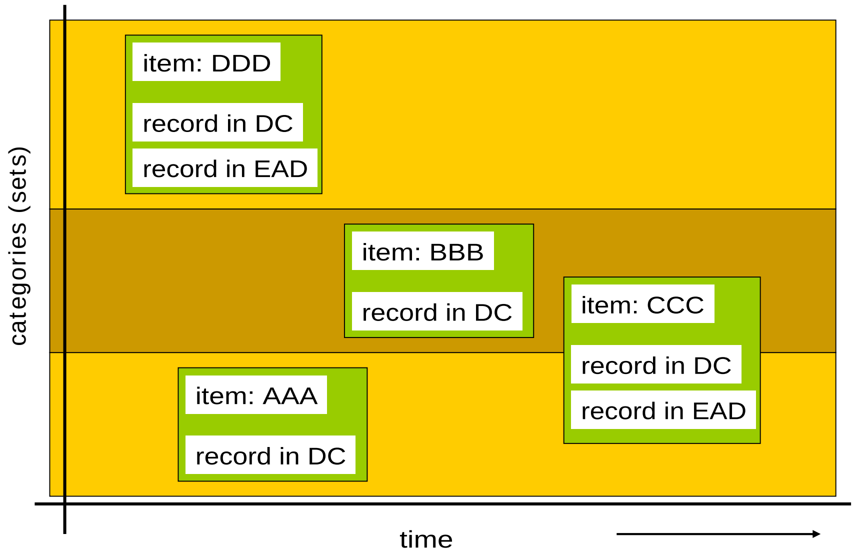
Humboldt U.

U. South Florida

OAI Protocol for Metadata Harvesting

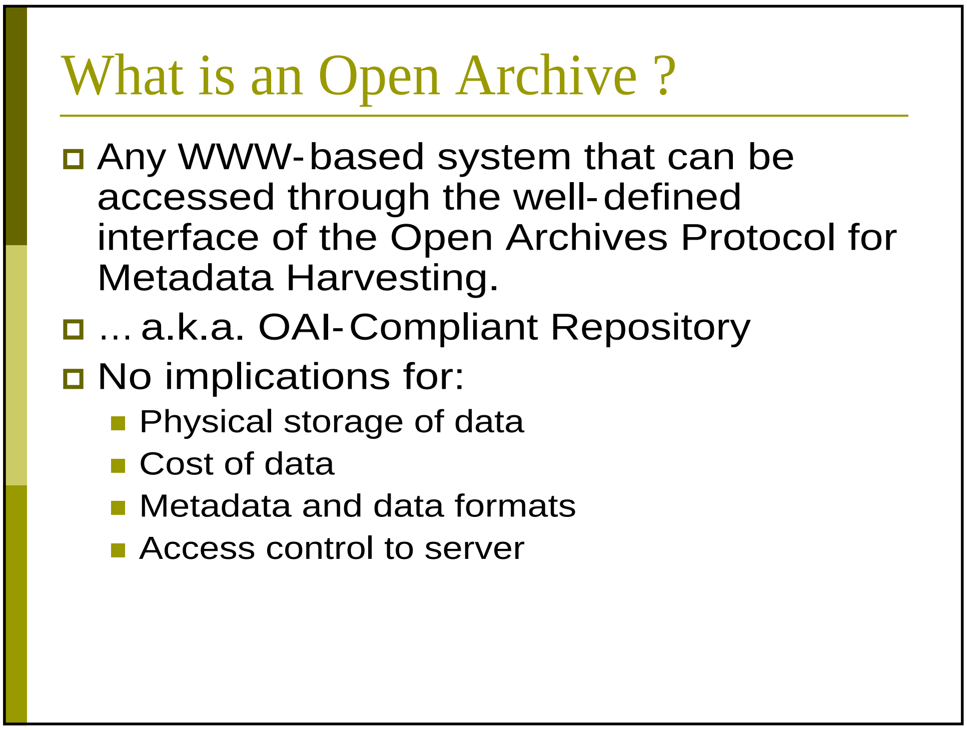
International ETD Library

Multi-dimensional Data Model



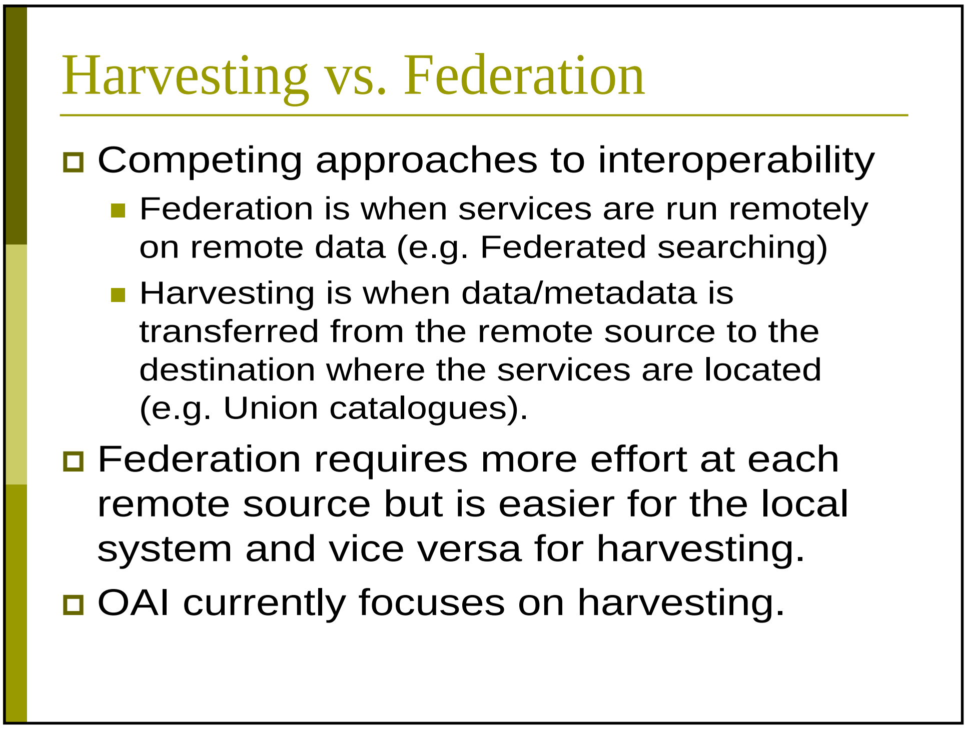
Definitions / Concepts

- Basic Principles
  - What is an Open Archive?
  - Harvesting vs. Federation
  - Metadata vs. Data
  - Data and Service Providers
- Underlying Technology
  - HTTP and XML
  - XML, XML Namespaces and Schema
- Protocol Policies
  - Uniqueness and Persistence
  - What is a record?
  - Multiplicity of Metadata
  - Sets
  - Datestamp, Harvesting and Flow Control



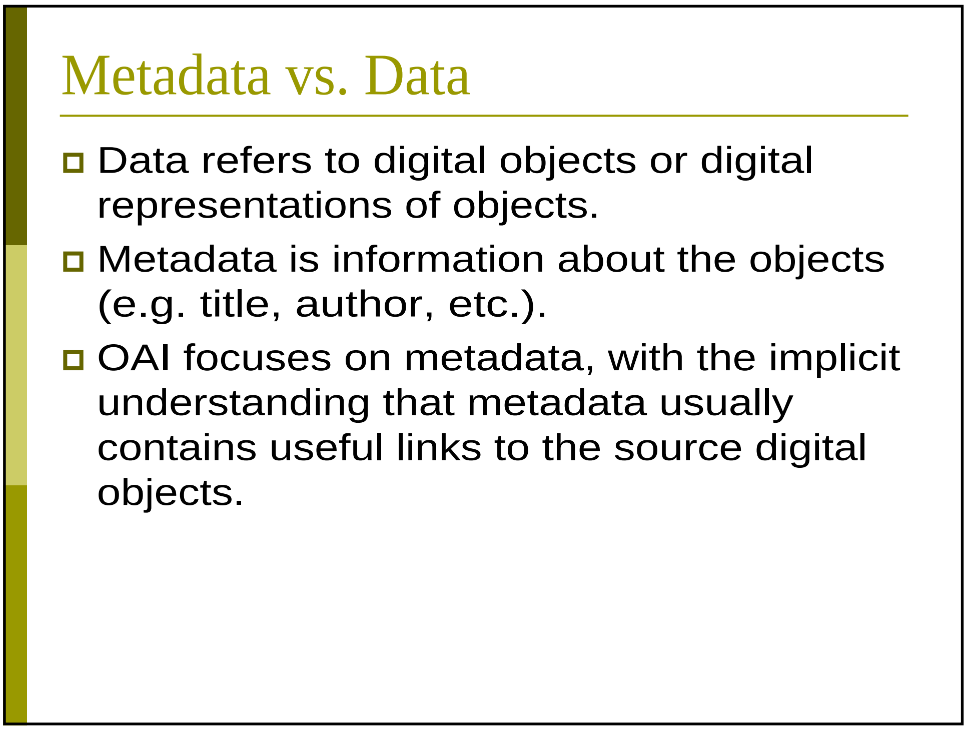
What is an Open Archive ?

- Any WWW-based system that can be accessed through the well-defined interface of the Open Archives Protocol for Metadata Harvesting.
- … a.k.a. OAI-Compliant Repository
- No implications for:
  - Physical storage of data
  - Cost of data
  - Metadata and data formats
  - Access control to server



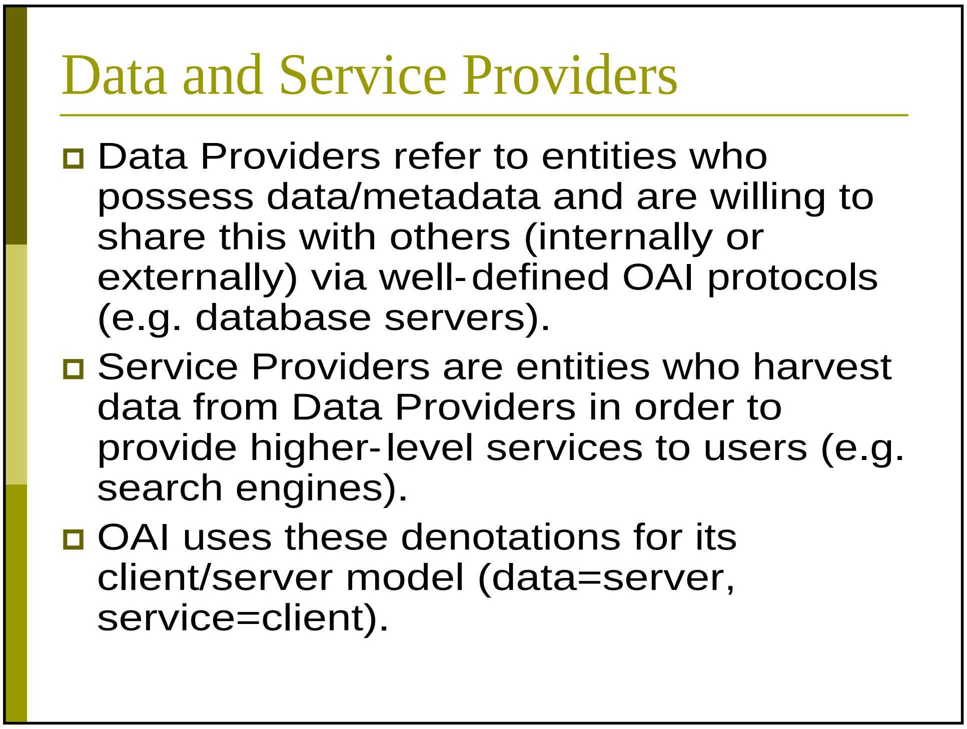
Harvesting vs. Federation

- Competing approaches to interoperability
  - Federation is when services are run remotely on remote data (e.g. Federated searching)
  - Harvesting is when data/metadata is transferred from the remote source to the destination where the services are located (e.g. Union catalogues).
- Federation requires more effort at each remote source but is easier for the local system and vice versa for harvesting.
- OAI currently focuses on harvesting.



Metadata vs. Data

- Data refers to digital objects or digital representations of objects.
- Metadata is information about the objects (e.g. title, author, etc.).
- OAI focuses on metadata, with the implicit understanding that metadata usually contains useful links to the source digital objects.



Data and Service Providers

- Data Providers refer to entities who possess data/metadata and are willing to share this with others (internally or externally) via well-defined OAI protocols (e.g. database servers).
- Service Providers are entities who harvest data from Data Providers in order to provide higher-level services to users (e.g. search engines).
- OAI uses these denotations for its client/server model (data=server, service=client).

HTTP and XML

- Protocol for Metadata Harvesting is an almost stateless request/response protocol.
- Requests and responses are sent via the HTTP protocol.
- Requests are encoded as GET/POST operations.
- Responses are well-formed XML documents.

XML Namespaces and Schema

- Consistency and data quality is ensured by using XML Schema descriptions for each possible response.
- XML Namespaces are used where necessary to clearly define which parts of the responses are actual metadata and which support the Protocol for Metadata Harvesting.

Uniqueness and Persistence

- Each record must be uniquely addressable by a distinct identifier.
- Identifiers must be valid URIs
- Example:
  - oai:<archiveId>:<recordId>
  - oai:etd.vt.edu:etd-1234567890
- Each identifier must resolve to a single record and always to the same record (for a given metadata format).

What is a record ?

- A record refers to an independent XML structure that may be associated with digital or physical objects.
- Records are usually associated with metadata, not data.
- OAI advocates harvesting of records, which contain metadata and additional fields to support the harvesting operation.

Sample OAI Record

(note: schema and namespaces have been left out for clarity)

```
<record>
      <header>
         <identifier>oai:jcdl2002.org:tut1</identifier>
         <datestamp>2002-02-03</datestamp>
         <setSpec>tut</setSpec>
      </header>
      <metadata>
         <dc>
            <title>Oldie-but-goodie example</title>
            <creator>Hussein Suleman</creator>
            <language>English</language>
         </dc>
      </metadata>
      <about>
         <metadataID>oai:jcdl2002.org:tut1md</metadataID>
      </about>
   </record>
```

Multiplicity of Metadata

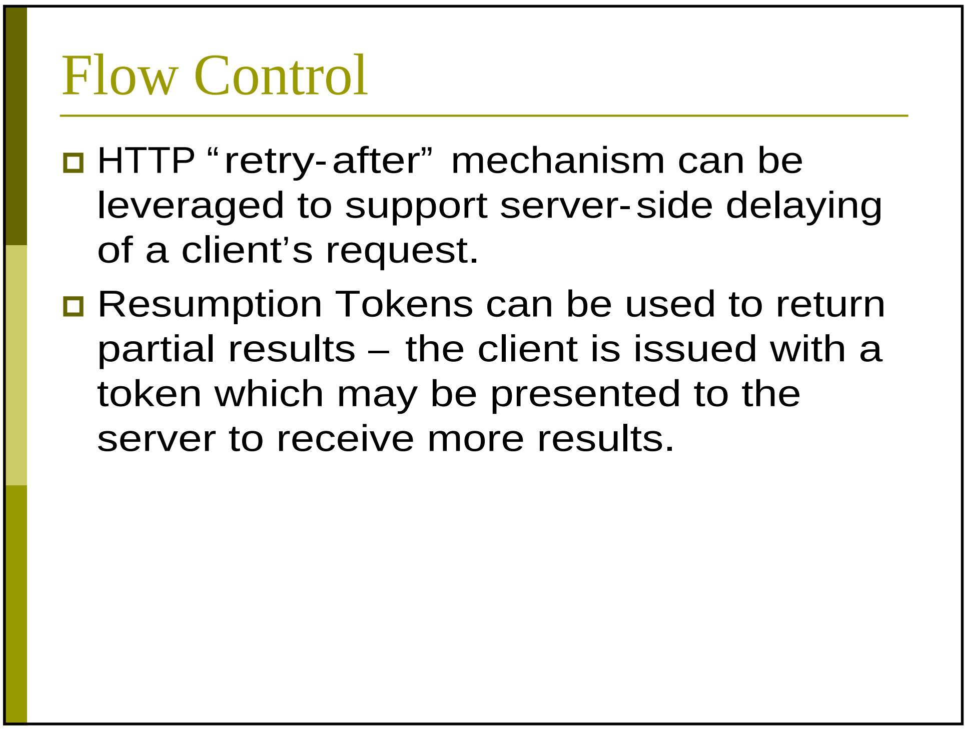
- Multiple formats of metadata allowed.
- Dublin Core is mandatory.
- Any other format allowed as long as it has an XML encoding.
- E.g. MARC (Libraries), IMS (Education), ETDMS (Theses/Dissertations), RFC1807 (Bibliographies)

Sets

- Protocol mechanism to allow for harvesting of sub-collections.
- No well-defined semantics – depends completely on local data providers.
- May be defined by arrangement between data providers and service providers.
- E.g. Subject areas, years, author names, search queries

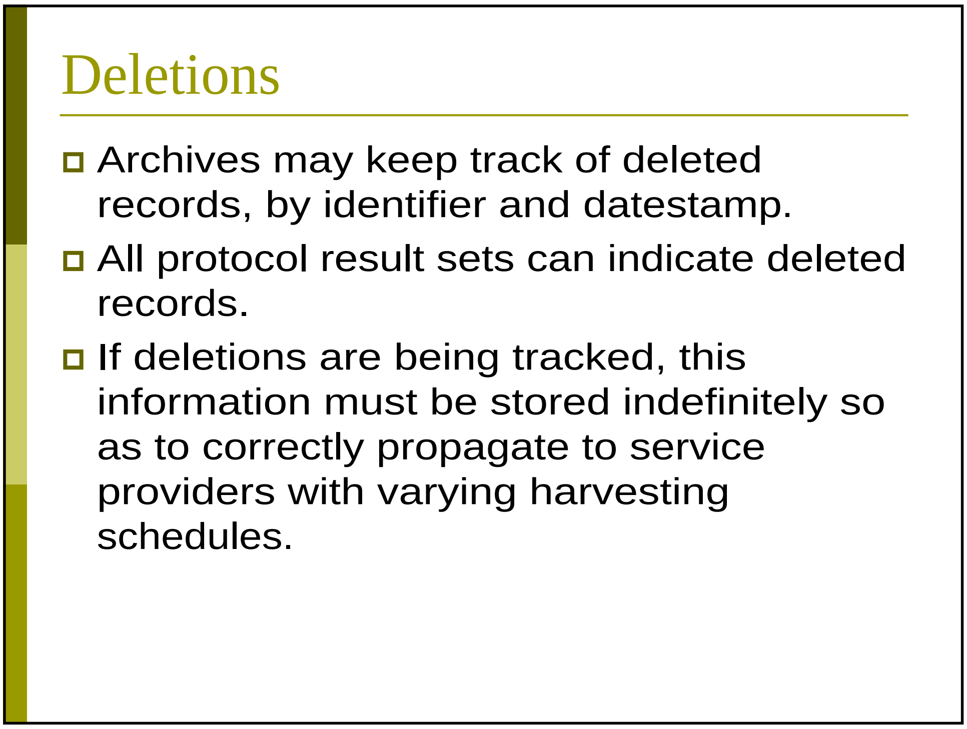
Datestamps & Harvesting

- Each record needs a datestamp that indicates its date of creation/modification/deletion.
- Different from dates within the metadata – this date is used only for harvesting
- Can be either YYYY-MM-DD or YYYY-MM-DDThh:mm:ssZ (must be GMT timezone)
- Dates are used to allow for harvesting by date range, thus allowing incremental and continuous transfer of metadata from a data provider to a service provider.



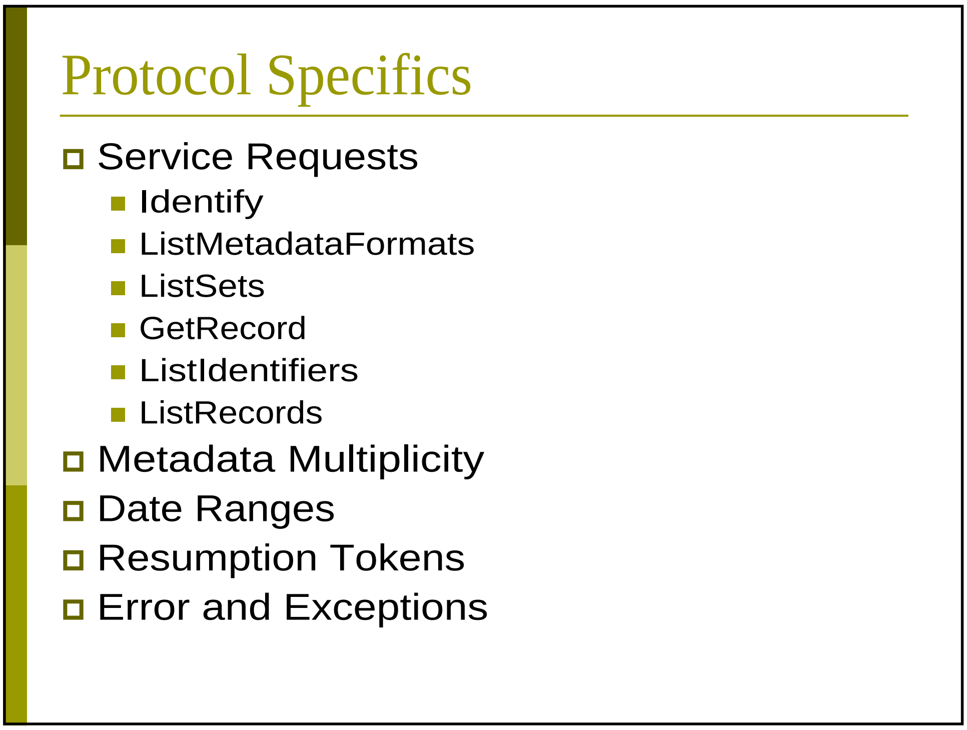
Flow Control

- HTTP “retry-after” mechanism can be leveraged to support server-side delaying of a client’s request.
- Resumption Tokens can be used to return partial results – the client is issued with a token which may be presented to the server to receive more results.



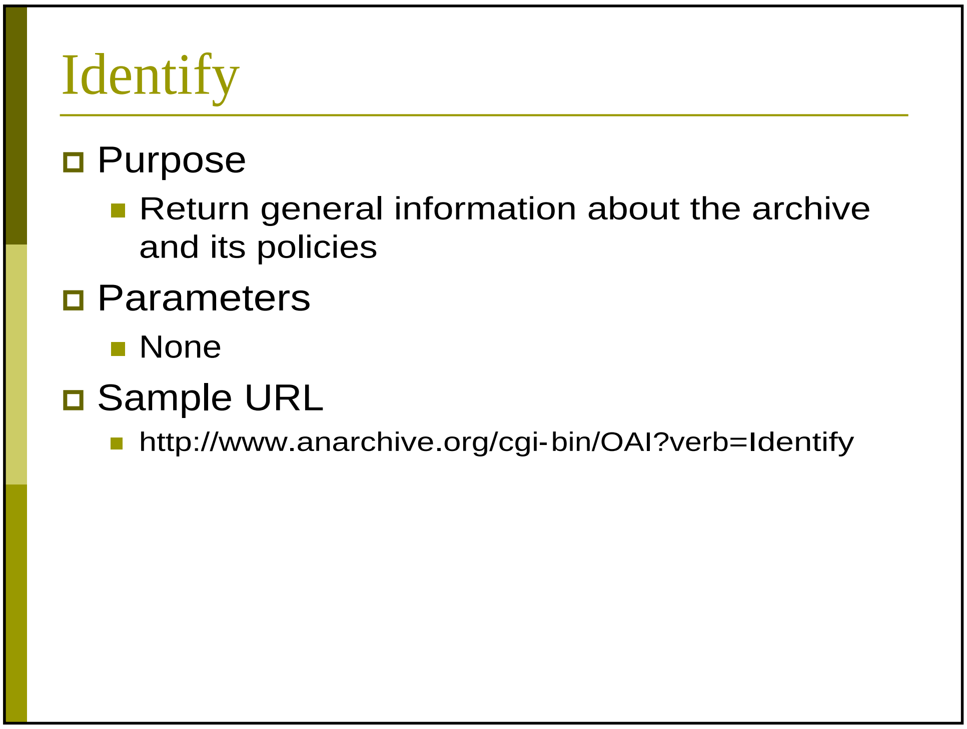
Deletions

- Archives may keep track of deleted records, by identifier and datestamp.
- All protocol result sets can indicate deleted records.
- If deletions are being tracked, this information must be stored indefinitely so as to correctly propagate to service providers with varying harvesting schedules.



Protocol Specifics

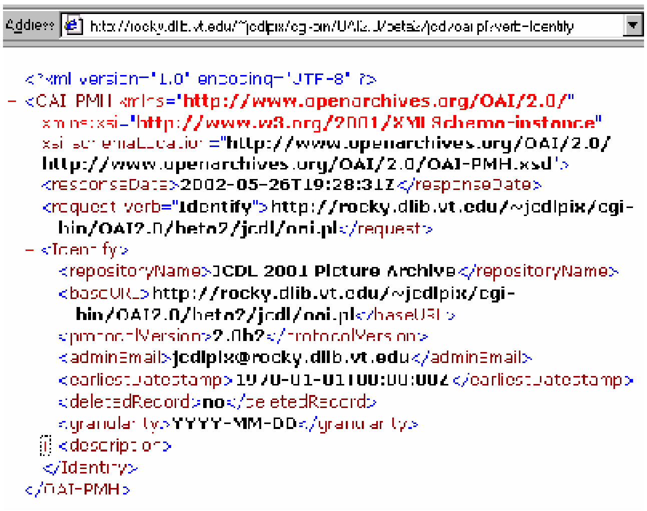
- Service Requests
  - Identify
  - ListMetadataFormats
  - ListSets
  - GetRecord
  - ListIdentifiers
  - ListRecords
- Metadata Multiplicity
- Date Ranges
- Resumption Tokens
- Error and Exceptions



Identify

- Purpose
  - Return general information about the archive and its policies
- Parameters
  - None
- Sample URL
  - http://www.anarchive.org/cgi-bin/OAI?verb=Identify

Identify - Response



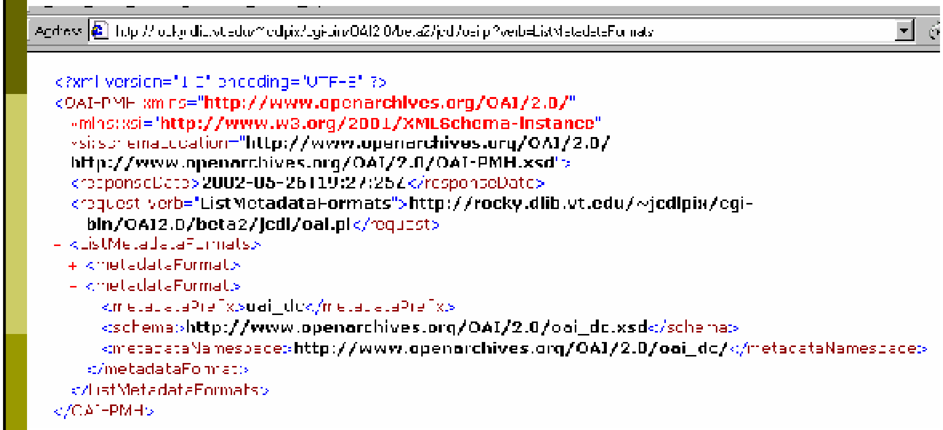
Address http://rocky.dlib.vt.edu/~jcdlpix/cgi-bin/OAI2.0/beta2/jcdl/oai.pl?verb=Identify

```
  <?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>2002-05-26T19:28:31Z</responseDate>
    <request verb="Identify">http://rocky.dlib.vt.edu/~jcdlpix/cgi-
      bin/OAI2.0/beta2/jcdl/oai.pl</request>
  - <Identify>
      <repositoryName>JCDL 2001 Picture Archive</repositoryName>
      <baseURL>http://rocky.dlib.vt.edu/~jcdlpix/cgi-
        bin/OAI2.0/beta2/jcdl/oai.pl</baseURL>
      <protocolVersion>2.0b2</protocolVersion>
      <adminEmail>jcdlpix@rocky.dlib.vt.edu</adminEmail>
      <earliestDatestamp>1970-01-01T00:00:00Z</earliestDatestamp>
      <deletedRecord>no</deletedRecord>
      <granularity>YYYY-MM-DD</granularity>
    + <description>
    </Identify>
  </OAI-PMH>
```

ListMetadataFormats

- Purpose
  - List metadata formats supported by the archive as well as their schema locations and namespaces
- Parameters
  - identifier – for a specific record (O)
- Sample URL
  - http://www.anarchive.org/cgi-bin/OAI?verb=ListMetadataFormats

ListMetadataFormats - Response



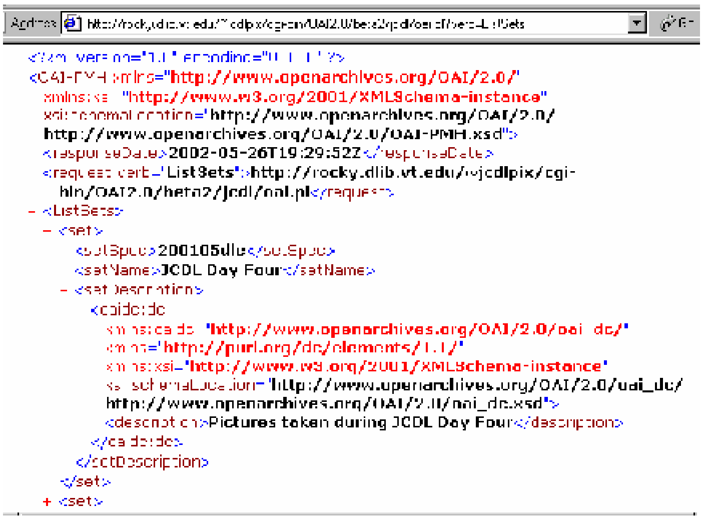
```
http://rocky.dlib.vt.edu/~jcdlpix/cgi-bin/OAI2.0/beta2/jcdl/oai.pl?verb=ListMetadataFormats
```

```
<?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>2002-05-26T19:27:25Z</responseDate>
  <request verb="ListMetadataFormats">http://rocky.dlib.vt.edu/~jcdlpix/cgi-
    bin/OAI2.0/beta2/jcdl/oai.pl</request>
- <ListMetadataFormats>
  + <metadataFormat>
  - <metadataFormat>
      <metadataPrefix>oai_dc</metadataPrefix>
      <schema>http://www.openarchives.org/OAI/2.0/oai_dc.xsd</schema>
      <metadataNamespace>http://www.openarchives.org/OAI/2.0/oai_dc/</metadataNamespace>
    </metadataFormat>
  </ListMetadataFormats>
</OAI-PMH>
```

ListSets

- Purpose
  - Provide a hierarchical listing of sets in which records may be organised
- Parameters
  - None
- Sample URL
  - http://www.anarchive.org/cgi-bin/OAI?verb= ListSets

ListSets – Response

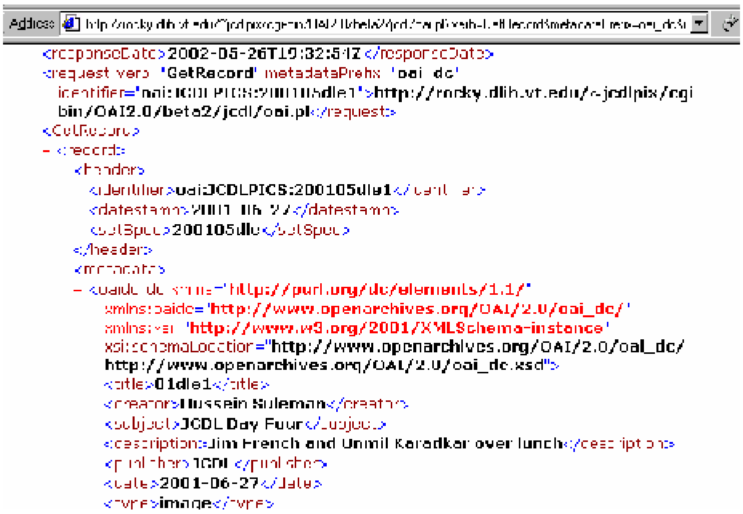

Address
http://rocky.dlib.vt.edu/~jcdlpix/cgi-bin/OAI2.0/beta2/jcdl/oai.pl?verb=ListSets
Go

```
  <?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>2002-05-26T19:29:52Z</responseDate>
    <request verb="ListSets">http://rocky.dlib.vt.edu/~jcdlpix/cgi-
      bin/OAI2.0/beta2/jcdl/oai.pl</request>
- <ListSets>
  - <set>
      <setSpec>200105dle</setSpec>
      <setName>JCDL Day Four</setName>
    - <setDescription>
        <oai_dc:dc
          xmlns:oai_dc="http://www.openarchives.org/OAI/2.0/oai_dc/"
          xmlns:dc="http://purl.org/dc/elements/1.1/"
          xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
          xsi:schemaLocation="http://www.openarchives.org/OAI/2.0/oai_dc/
          http://www.openarchives.org/OAI/2.0/oai_dc.xsd">
          <description>Pictures taken during JCDL Day Four</description>
        </oai_dc:dc>
      </setDescription>
    </set>
  + <set>
```

GetRecord

- Purpose
  - Returns the metadata for a single identifier in the form of an OAI record
- Parameters
  - identifier – unique id for record (R)
  - metadataPrefix – metadata format (R)
- Sample URL
  - http://www.anarchive.org/cgi-bin/OAI?verb=GetRecord&identifier=oai:test:123&metadataPrefix=oai_dc

GetRecord - Response



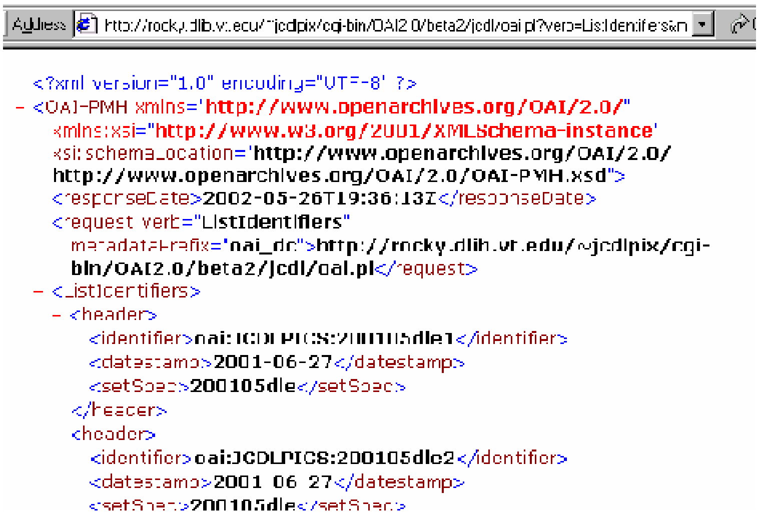
Address http://rocky.dlib.vt.edu/~jcdlpix/cgi-bin/OAI2.0/beta2/jcdl/oai.pl?verb=GetRecord&metadataPrefix=oai_dc&i

```
<responseDate>2002-05-26T19:32:51Z</responseDate>
<request verb='GetRecord' metadataPrefix='oai_dc'
  identifier='oai:JCDLPICS:200105dle1'>http://rocky.dlib.vt.edu/~jcdlpix/cgi
  bin/OAI2.0/beta2/jcdl/oai.pl</request>
<GetRecord>
- <record>
    <header>
      <identifier>oai:JCDLPICS:200105dle1</identifier>
      <datestamp>2001-06-27</datestamp>
      <setSpec>200105dle</setSpec>
    </header>
    <metadata>
    - <oai_dc:dc xmlns:dc="http://purl.org/dc/elements/1.1/"
        xmlns:oai_dc='http://www.openarchives.org/OAI/2.0/oai_dc/'
        xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance'
        xsi:schemaLocation="http://www.openarchives.org/OAI/2.0/oai_dc/
        http://www.openarchives.org/OAI/2.0/oai_dc.xsd">
        <title>01dle1</title>
        <creator>Hussein Suleman</creator>
        <subject>JCDL Day Four</subject>
        <description>Jim French and Unmil Karadkar over lunch</description>
        <publisher>JCDL</publisher>
        <date>2001-06-27</date>
        <type>image</type>
```

ListIdentifiers

- Purpose
  - List headers for all records corresponding to the specified parameters
- Parameters
  - from – start date (O)
  - until – end date (O)
  - set – set to harvest from (O)
  - metadataPrefix – metadata format to list identifiers for (R)
  - resumptionToken – flow control mechanism (X)
- Sample URL
  - http://www.anarchive.org/cgi-bin/OAI?verb=ListIdentifiers&metadataPrefix= oai_dc

ListIdentifiers - Response



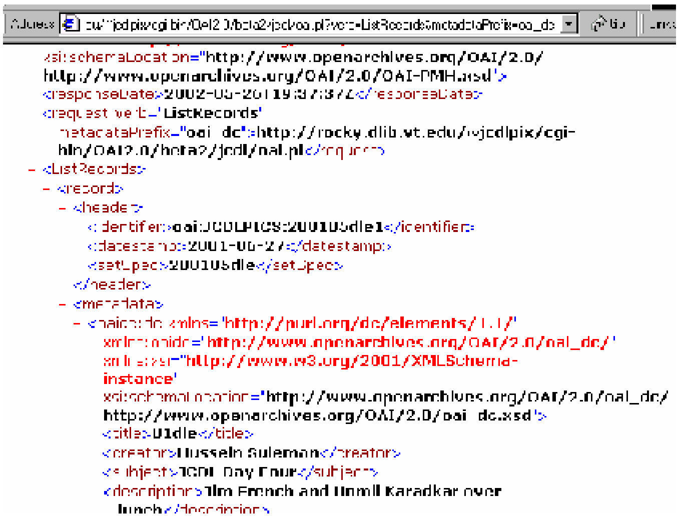
Address: http://rocky.dlib.vt.edu/~jcdlpix/cgi-bin/OAI2.0/beta2/jcdl/oai.pl?verb=ListIdentifiers&m

```
  <?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>2002-05-26T19:36:13Z</responseDate>
    <request verb="ListIdentifiers"
      metadataPrefix="oai_dc">http://rocky.dlib.vt.edu/~jcdlpix/cgi-
      bin/OAI2.0/beta2/jcdl/oai.pl</request>
  - <ListIdentifiers>
    - <header>
        <identifier>oai:JCDLPICS:200105dle1</identifier>
        <datestamp>2001-06-27</datestamp>
        <setSpec>200105dle</setSpec>
      </header>
      <header>
        <identifier>oai:JCDLPICS:200105dle2</identifier>
        <datestamp>2001-06-27</datestamp>
        <setSpec>200105dle</setSpec>
```

ListRecords

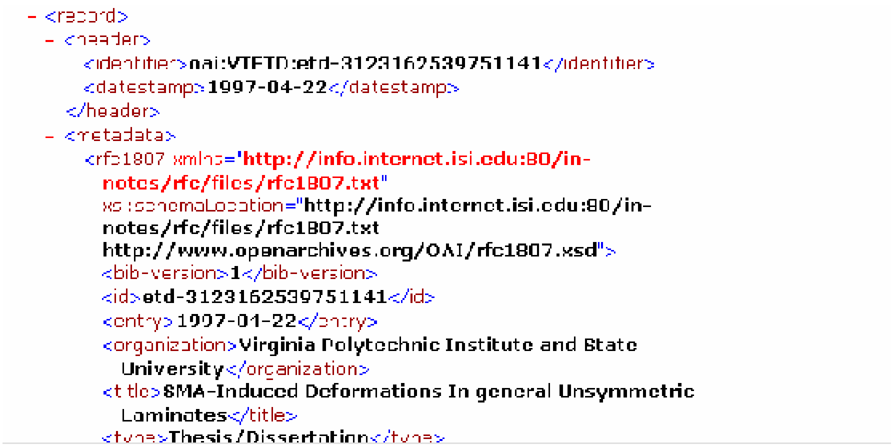
- Purpose
  - Retrieves metadata for multiple records
- Parameters
  - from – start date (O)
  - until – end date (O)
  - set – set to harvest from (O)
  - resumptionToken – flow control mechanism (X)
  - metadataPrefix – metadata format (R)
- Sample URL
  - http://www.anarchive.org/cgi-bin/OAI?verb=ListRecord&metadataprefix=oai_dc&from=2001-01-01

ListRecords - Response


Address
ou/~jcdlpix/cgi-bin/OAI2.0/beta2/jcdl/oai.pl?verb=ListRecords&metadataPrefix=oai_dc
Go
Links

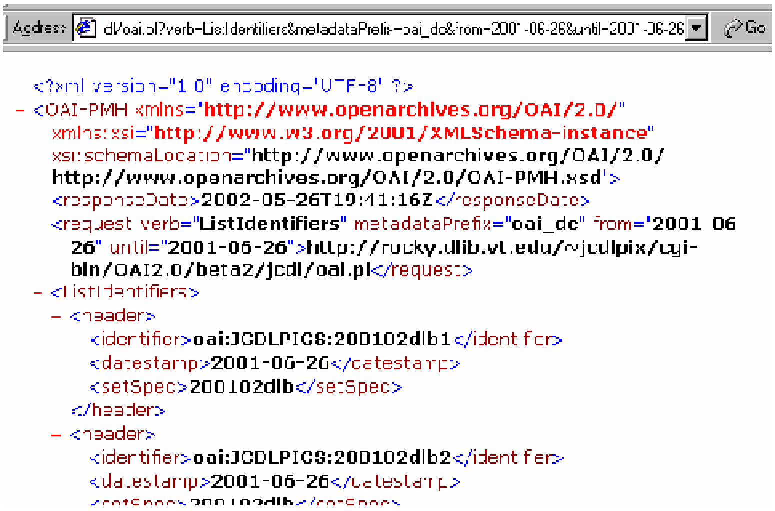
```
  xsi:schemaLocation="http://www.openarchives.org/OAI/2.0/
  http://www.openarchives.org/OAI/2.0/OAI-PMH.xsd">
  <responseDate>2002-05-20T19:37:37Z</responseDate>
  <request verb='ListRecords'
    metadataPrefix="oai_dc">http://rocky.dlib.vt.edu/~jcdlpix/cgi-
    bin/OAI2.0/beta2/jcdl/oai.pl</request>
- <ListRecords>
  - <record>
    - <header>
        <identifier>oai:JCDLPICS:200105dle1</identifier>
        <datestamp>2001-06-27</datestamp>
        <setSpec>200105dle</setSpec>
      </header>
    - <metadata>
      - <oai_dc:dc xmlns="http://purl.org/dc/elements/1.1/"
          xmlns:oaidc="http://www.openarchives.org/OAI/2.0/oai_dc/"
          xmlns:xsi="http://www.w3.org/2001/XMLSchema-
          instance"
          xsi:schemaLocation="http://www.openarchives.org/OAI/2.0/oai_dc/
          http://www.openarchives.org/OAI/2.0/oai_dc.xsd">
          <title>01dle</title>
          <creator>Hussein Suleman</creator>
          <subject>JCDL Day Four</subject>
          <description>Tim French and Unmil Karadkar over
            lunch</description>
```

Metadata Multiplicity



```
- <record>
  - <header>
      <identifier>oai:VTETD:etd-3123162539751141</identifier>
      <datestamp>1997-04-22</datestamp>
    </header>
  - <metadata>
      <rfc1807 xmlns="http://info.internet.isi.edu:80/in-
        notes/rfc/files/rfc1807.txt"
        xsi:schemaLocation="http://info.internet.isi.edu:80/in-
        notes/rfc/files/rfc1807.txt
        http://www.openarchives.org/OAI/rfc1807.xsd">
        <bib-version>1</bib-version>
        <id>etd-3123162539751141</id>
        <entry>1997-04-22</entry>
        <organization>Virginia Polytechnic Institute and State
          University</organization>
        <title>SMA-Induced Deformations In general Unsymmetric
          Laminates</title>
        <type>Thesis/Dissertation</type>
```

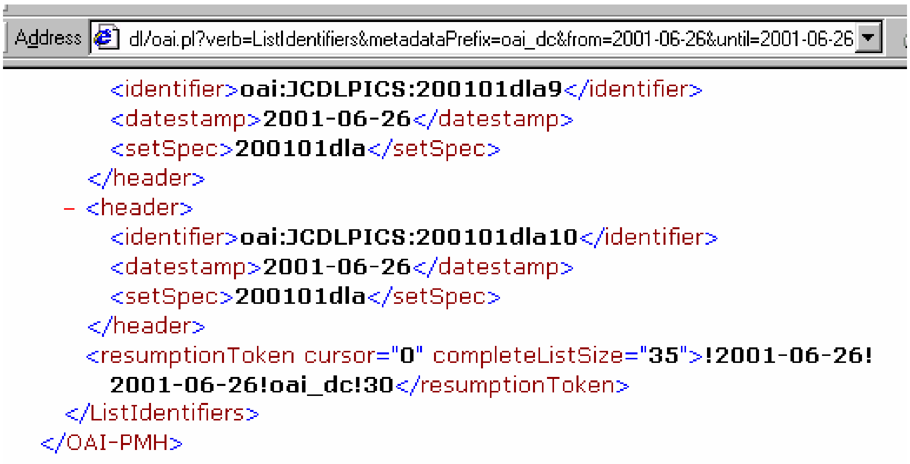
Date Ranges



dl/oai.pl?verb=ListIdentifiers&metadataPrefix=oai_dc&from=2001-06-26&until=2001-06-26

```
  <?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>2002-05-26T19:41:16Z</responseDate>
    <request verb="ListIdentifiers" metadataPrefix="oai_dc" from="2001 06
      26" until="2001-06-26">http://rocky.dlib.vt.edu/~jcdlpix/cgi-
      bin/OAI2.0/beta2/jcdl/oai.pl</request>
  - <ListIdentifiers>
    - <header>
        <identifier>oai:JCDLPICS:200102dlb1</identifier>
        <datestamp>2001-06-26</datestamp>
        <setSpec>200102dlb</setSpec>
      </header>
    - <header>
        <identifier>oai:JCDLPICS:200102dlb2</identifier>
        <datestamp>2001-06-26</datestamp>
        <setSpec>200102dlb</setSpec>
```

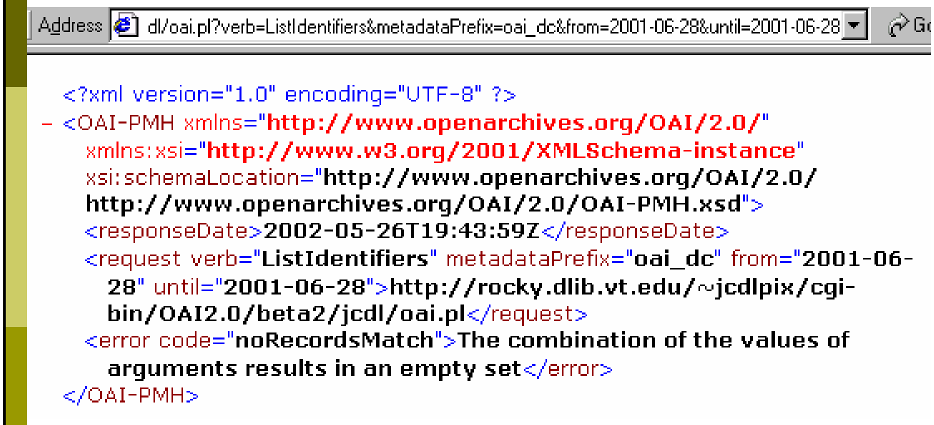
Resumption Token



dl/oai.pl?verb=ListIdentifiers&metadataPrefix=oai_dc&from=2001-06-26&until=2001-06-26

```
        <identifier>oai:JCDLPICS:200101dla9</identifier>
        <datestamp>2001-06-26</datestamp>
        <setSpec>200101dla</setSpec>
      </header>
    - <header>
        <identifier>oai:JCDLPICS:200101dla10</identifier>
        <datestamp>2001-06-26</datestamp>
        <setSpec>200101dla</setSpec>
      </header>
      <resumptionToken cursor="0" completeListSize="35">!2001-06-26!
        2001-06-26!oai_dc!30</resumptionToken>
    </ListIdentifiers>
  </OAI-PMH>
```

Errors and Exceptions

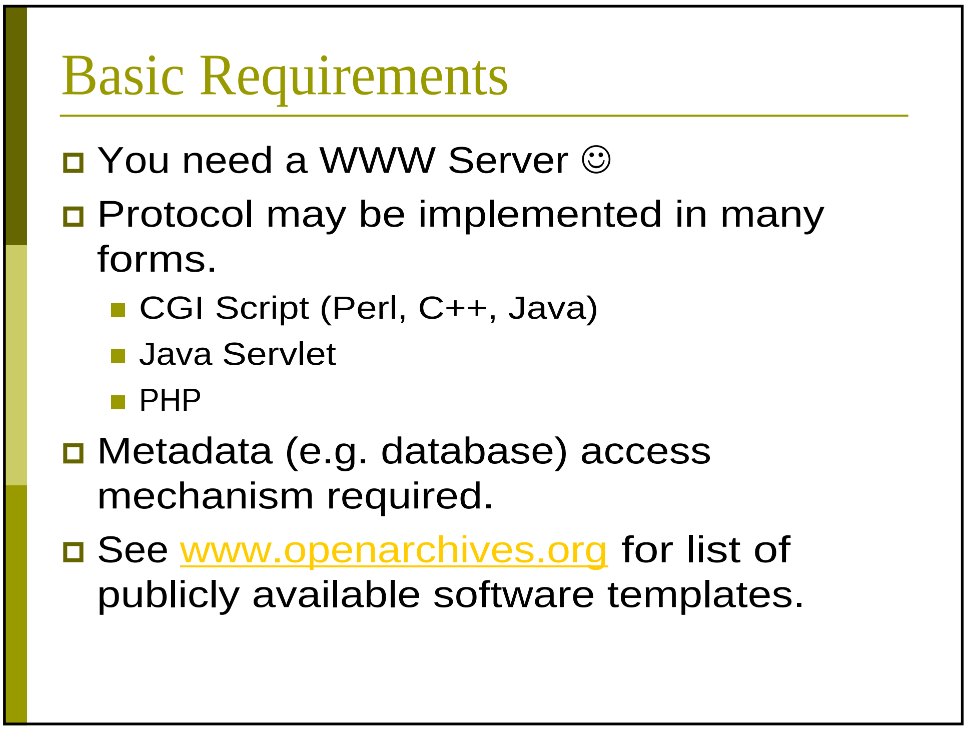


Address dl/oai.pl?verb=ListIdentifiers&metadataPrefix=oai_dc&from=2001-06-28&until=2001-06-28

```
  <?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>2002-05-26T19:43:59Z</responseDate>
    <request verb="ListIdentifiers" metadataPrefix="oai_dc" from="2001-06-
      28" until="2001-06-28">http://rocky.dlib.vt.edu/~jcdlpix/cgi-
      bin/OAI2.0/beta2/jcdl/oai.pl</request>
    <error code="noRecordsMatch">The combination of the values of
      arguments results in an empty set</error>
  </OAI-PMH>
```

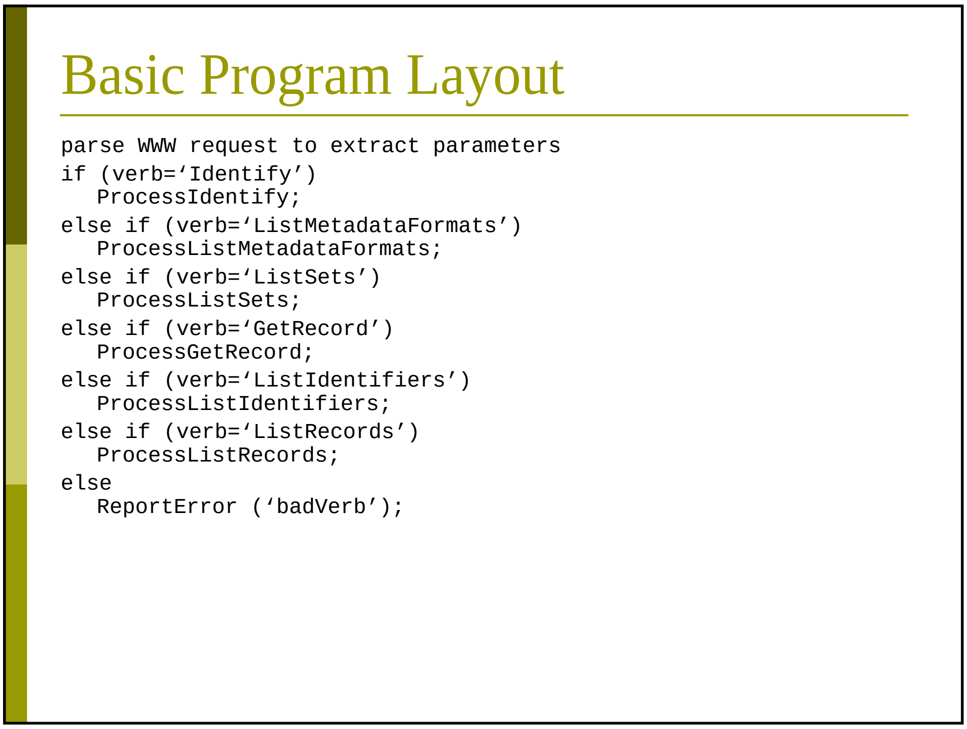
Implementation Details

- Basic requirements
- Basic program layout
- Object-oriented approaches
- Extensible metadata generation
- Data cleaning
- Caching of results
- Error handling
- Denial-of-service prevention
- Creating resumption tokens



Basic Requirements

- You need a WWW Server ☺
- Protocol may be implemented in many forms.
  - CGI Script (Perl, C++, Java)
  - Java Servlet
  - PHP
- Metadata (e.g. database) access mechanism required.
- See www.openarchives.org for list of publicly available software templates.



Basic Program Layout

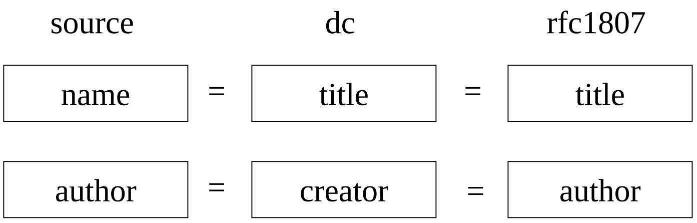
```
parse WWW request to extract parameters
if (verb=‘Identify’)
   ProcessIdentify;
else if (verb=‘ListMetadataFormats’)
   ProcessListMetadataFormats;
else if (verb=‘ListSets’)
   ProcessListSets;
else if (verb=‘GetRecord’)
   ProcessGetRecord;
else if (verb=‘ListIdentifiers’)
   ProcessListIdentifiers;
else if (verb=‘ListRecords’)
   ProcessListRecords;
else
   ReportError (‘badVerb’);
```

Object-Oriented Approaches

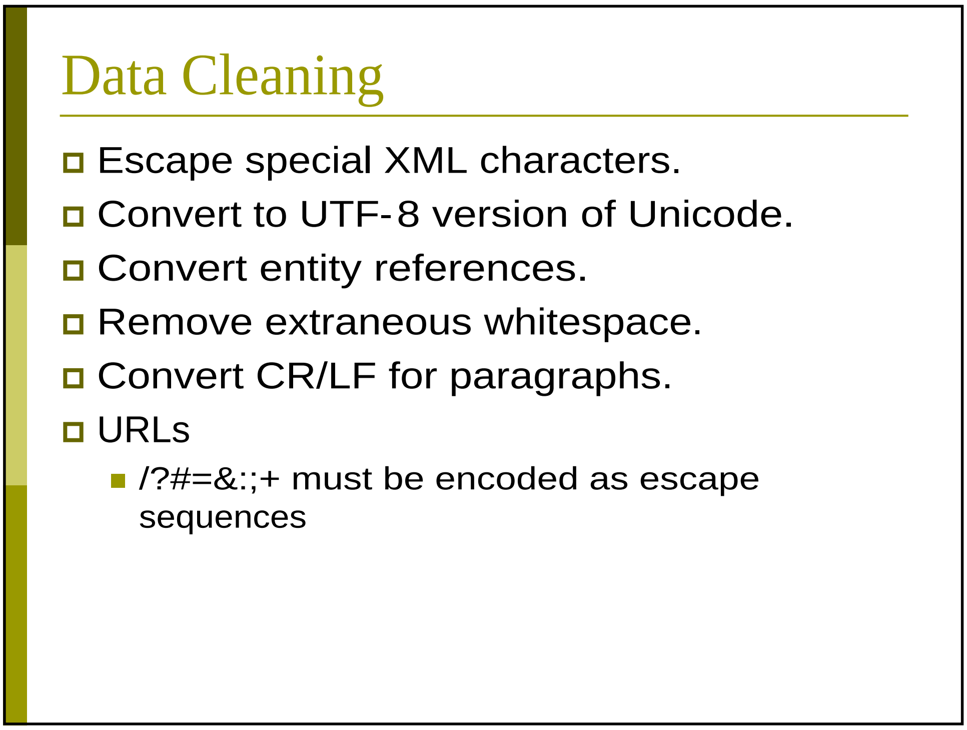
- Cleaner separation of protocol, database access and metadata generation.
- Example approaches
  - Each service request is handled by a object
    - Simpler incremental development
  - Protocol, Database and Metadata are objects
    - Greater portability of code
  - Inheritance from a basic OAI data provider

Metadata Generation

- Approaches
  - Map from source to each metadata format
  - Use crosswalks (maybe XSLT) to generate additional formats.

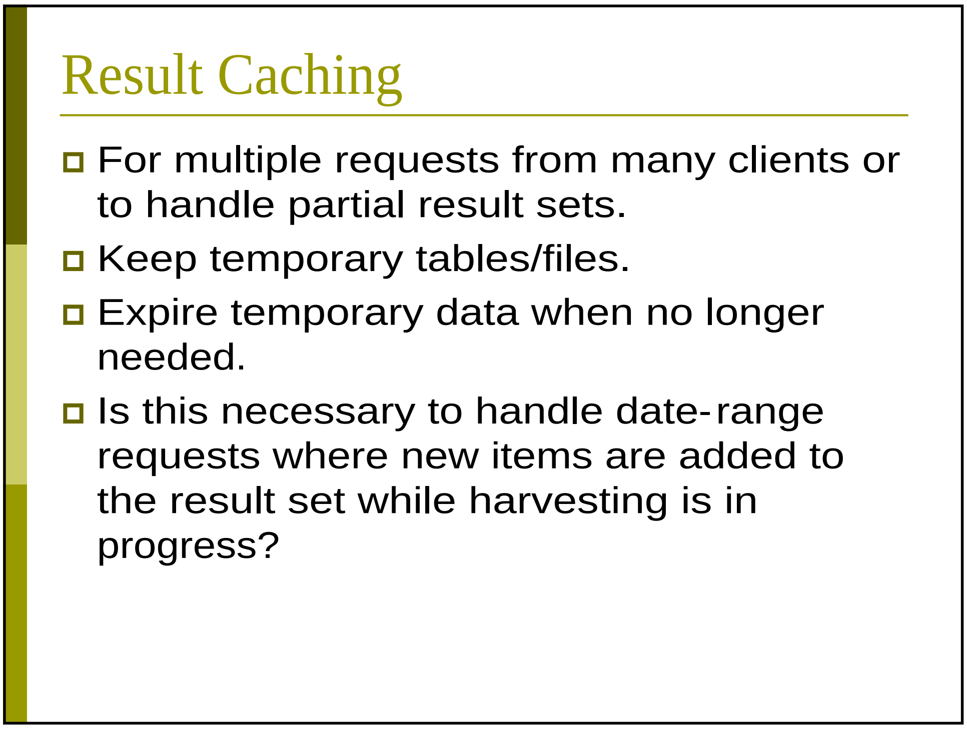


source		dc		rfc1807
name	=	title	=	title
author	=	creator	=	author



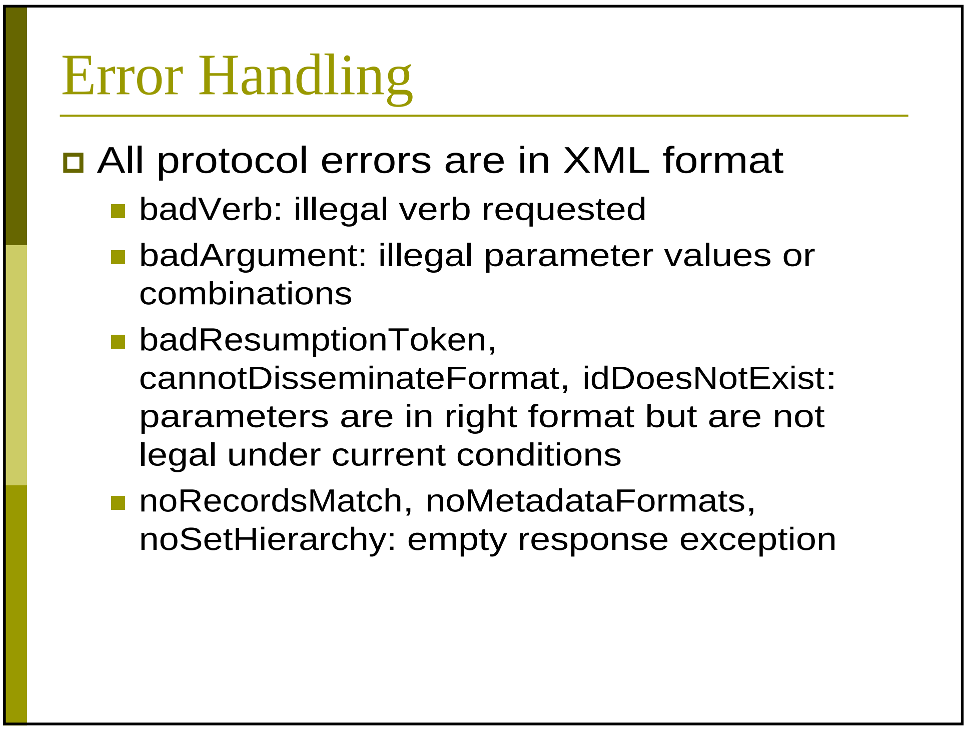
Data Cleaning

- Escape special XML characters.
- Convert to UTF-8 version of Unicode.
- Convert entity references.
- Remove extraneous whitespace.
- Convert CR/LF for paragraphs.
- URLs
  - /?#=&:;+ must be encoded as escape sequences



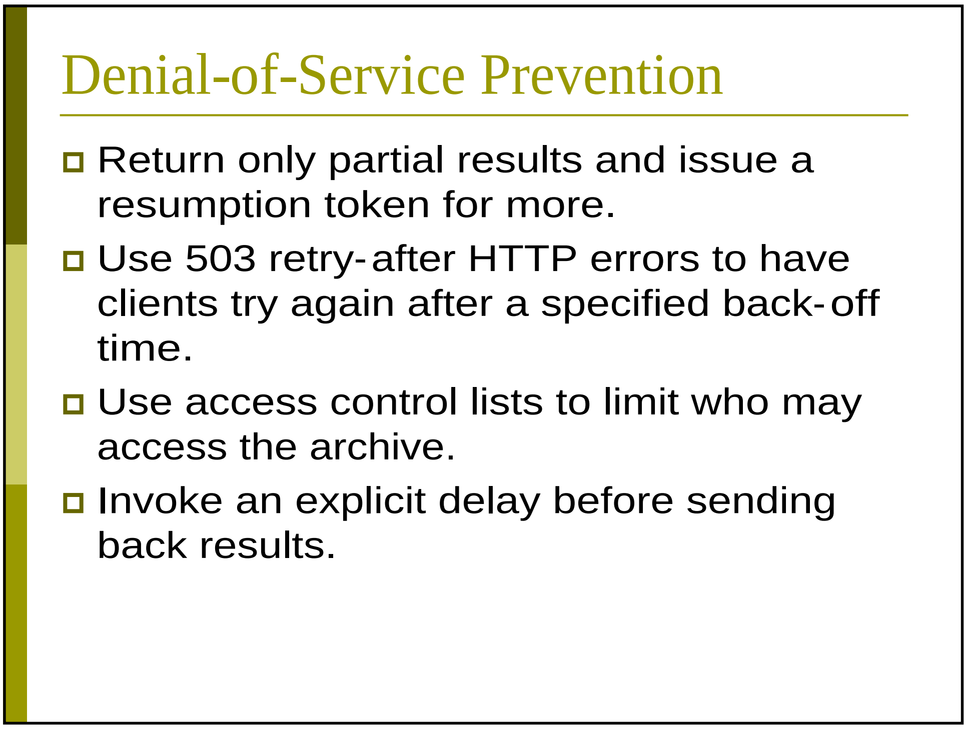
Result Caching

- For multiple requests from many clients or to handle partial result sets.
- Keep temporary tables/files.
- Expire temporary data when no longer needed.
- Is this necessary to handle date-range requests where new items are added to the result set while harvesting is in progress?



Error Handling

- All protocol errors are in XML format
  - badVerb: illegal verb requested
  - badArgument: illegal parameter values or combinations
  - badResumptionToken, cannotDisseminateFormat, idDoesNotExist: parameters are in right format but are not legal under current conditions
  - noRecordsMatch, noMetadataFormats, noSetHierarchy: empty response exception



Denial-of-Service Prevention

- Return only partial results and issue a resumption token for more.
- Use 503 retry-after HTTP errors to have clients try again after a specified back-off time.
- Use access control lists to limit who may access the archive.
- Invoke an explicit delay before sending back results.

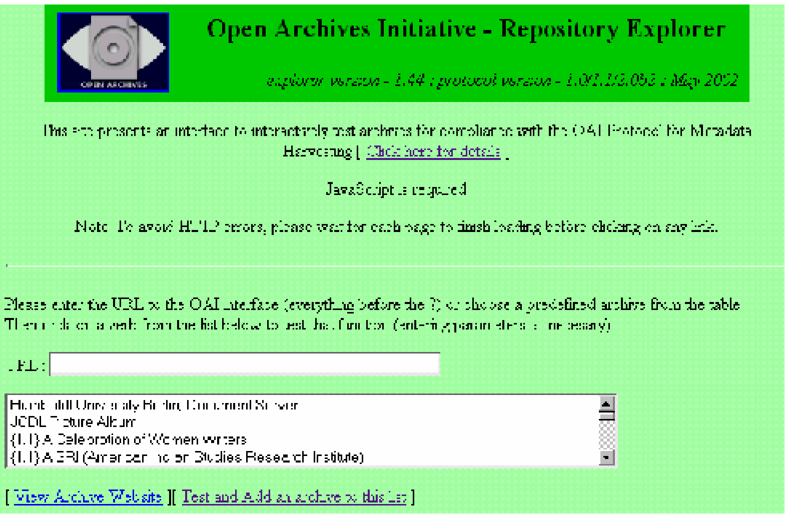
Creating resumptionTokens

- Combine from/until/metadataPrefix/set and a record number indicator with delimiters into a sequential token.
  For example:
  - from!until!metadataPrefix!set!recordnumber
  - 2000-01-01!2001-01-01!!All!100
- Use a session manager with automatic expiry.
  For example:
  - vtetd14june10amsession12

Tools for Testing

- Repository Explorer
  - Interactive Browsing
  - Testing of parameters
  - Multiple views of data
  - Multilingual support
  - Automatic test suite
- OAI Registry
- XML Schema Validator

RE Interactive Browsing



Open Archives Initiative - Repository Explorer

explorer version - 1.44 : protocol version - 1.0/1.1/2.0b3 : May 2002

This site presents an interface to interactively test archives for compliance with the OAI Protocol for Metadata Harvesting [Click here for details]

JavaScript is required

Note: To avoid HTTP errors, please wait for each page to finish loading before clicking on any link.

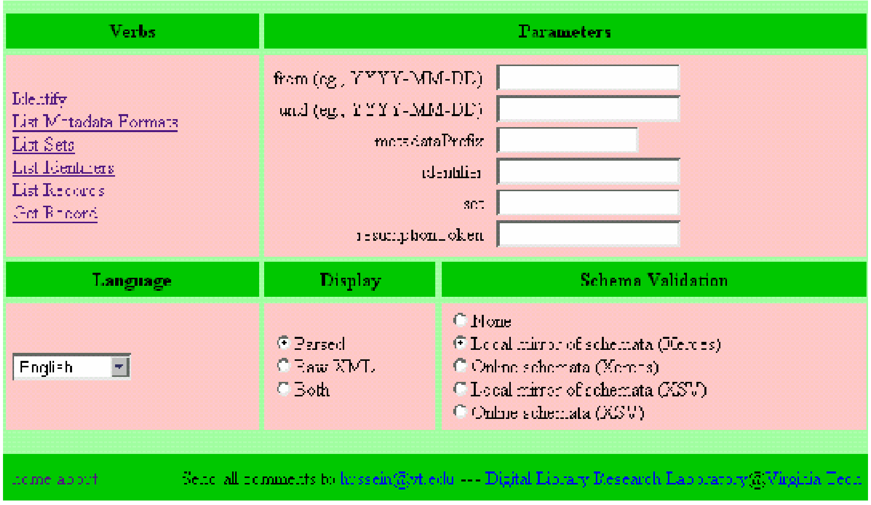
Please enter the URL to the OAI interface (everything before the ?) or choose a predefined archive from the table
Then click on a verb from the list below to test that function (entering parameters if necessary)

URL:

Humboldt University Berlin Document Server
JCDL Picture Album
{1.1} A Celebration of Women Writers
{1.1} AISRI (American Indian Studies Research Institute)

[View Archive Website][Test and Add an archive to this list]

RE Parameter Testing

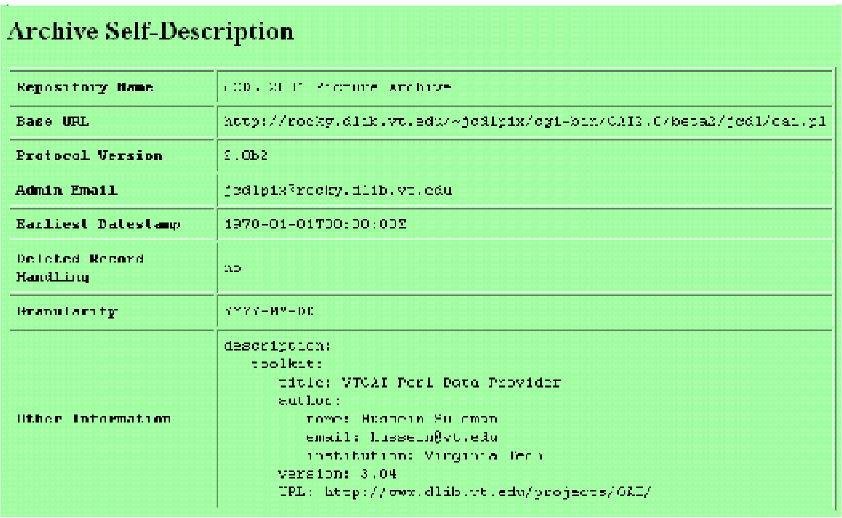


Verbs	Parameters
Identify List Metadata Formats List Sets List Identifiers List Records Get Record	from (eg., YYYY-MM-DD) until (eg., YYYY-MM-DD) metadataPrefix identifier set resumptionToken

Language	Display	Schema Validation
English	● Parsed ○ Raw XML ○ Both	○ None ● Local mirror of schemata (Xerces) ○ Online schemata (Xerces) ○ Local mirror of schemata (XSV) ○ Online schemata (XSV)

home about Send all comments to hussein@vt.edu --- Digital Library Research Laboratory@Virginia Tech

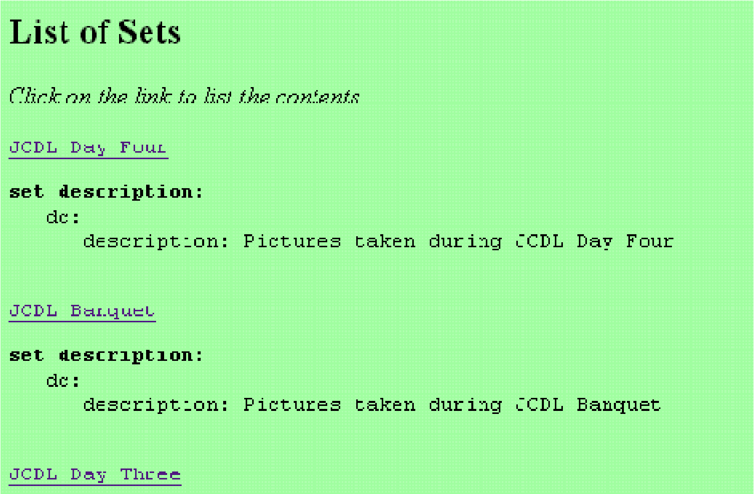
RE Browsing



Archive Self-Description

Repository Name	JCDL 2001 Picture Archive
Base URL	http://rocky.dlib.vt.edu/~jcdlpix/cgi-bin/OAI1.0/beta2/jcdl/oai.pl
Protocol Version	1.0b2
Admin Email	jcdlpix@rocky.dlib.vt.edu
Earliest Datestamp	1970-01-01T00:00:00Z
Deleted Record Handling	no
Granularity	YYYY-MM-DD
Other Information	description: toolkit: title: VTOAI Perl Data Provider author: name: Hussein Suleman email: hussein@vt.edu institution: Virginia Tech version: 3.04 URL: http://www.dlib.vt.edu/projects/OAI/

RE Browsing



List of Sets

Click on the link to list the contents

JCDL Day Four

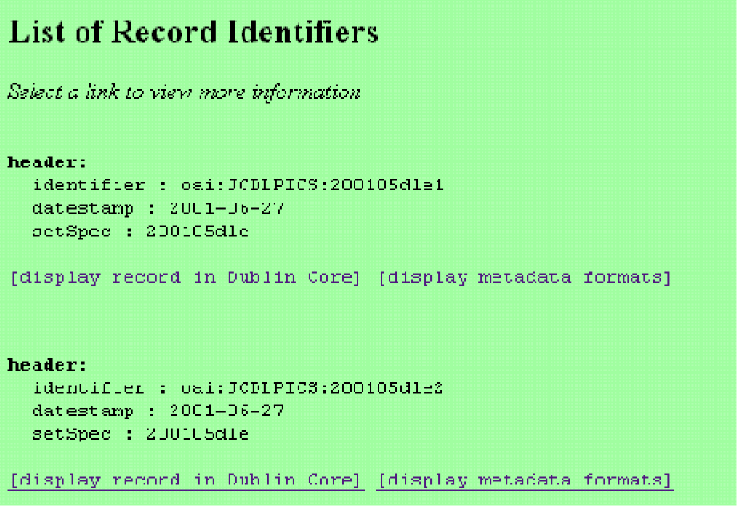
```
set description:
    dc:
        description: Pictures taken during JCDL Day Four
```

JCDL Banquet

```
set description:
    dc:
        description: Pictures taken during JCDL Banquet
```

JCDL Day Three

RE Browsing



List of Record Identifiers

Select a link to view more information

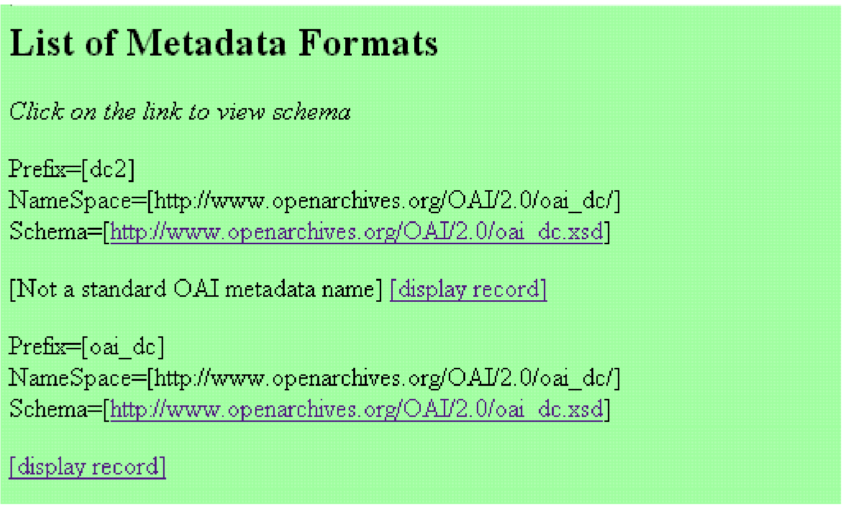
```
header:
   identifier : oai:JCDLPICS:200105dle1
   datestamp : 2001-06-27
   setSpec : 200105dle

[display record in Dublin Core] [display metadata formats]


header:
   identifier : oai:JCDLPICS:200105dle2
   datestamp : 2001-06-27
   setSpec : 200105dle

[display record in Dublin Core] [display metadata formats]
```

RE Browsing



List of Metadata Formats

Click on the link to view schema

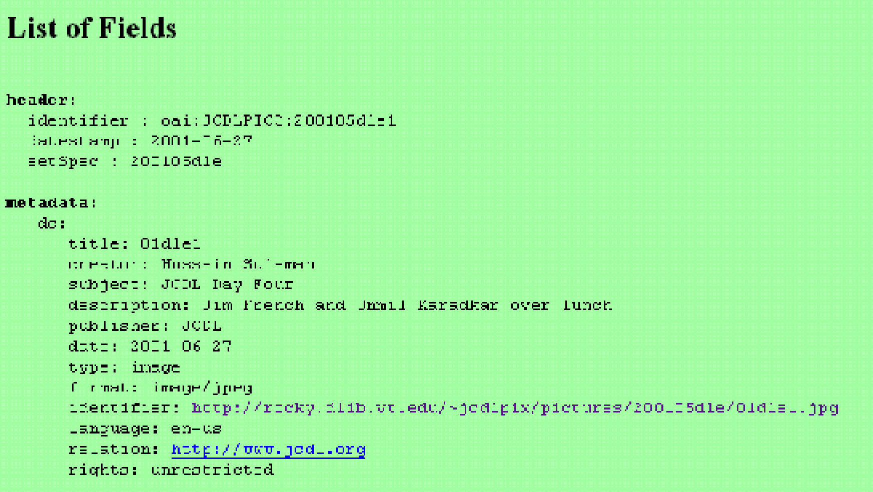
Prefix=[dc2]
NameSpace=[http://www.openarchives.org/OAI/2.0/oai_dc/]
Schema=[http://www.openarchives.org/OAI/2.0/oai_dc.xsd]

[Not a standard OAI metadata name] [display record]

Prefix=[oai_dc]
NameSpace=[http://www.openarchives.org/OAI/2.0/oai_dc/]
Schema=[http://www.openarchives.org/OAI/2.0/oai_dc.xsd]

[display record]

RE Browsing

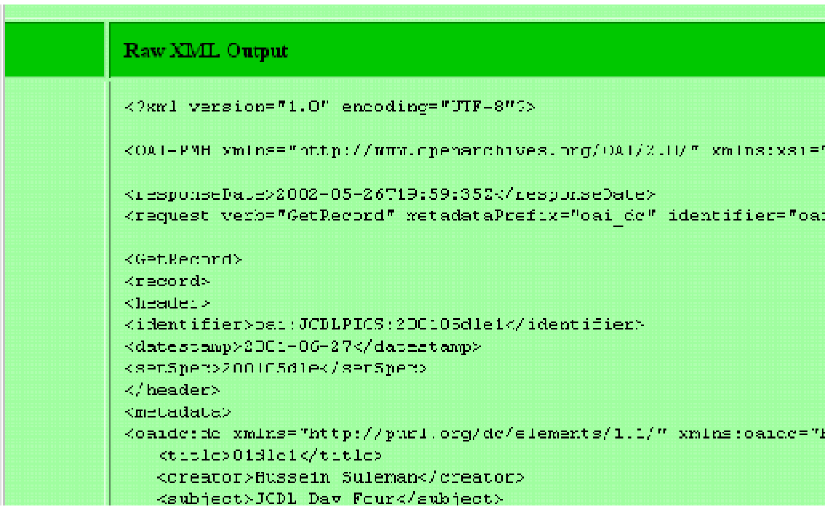


List of Fields

```
header:
  identifier : oai:JCDLPICS:200105d1e1
  datestamp : 2001-06-27
  setSpec : 200105d1e

metadata:
    dc:
        title: 01d1e1
        creator: Hussein Suleman
        subject: JCDL Day Four
        description: Jim French and Jamil Karadkar over lunch
        publisher: JCDL
        date: 2001 06 27
        type: image
        format: image/jpeg
        identifier: http://rocky.dlib.vt.edu/~jcdlpix/pictures/200105d1e/01d1e1.jpg
        language: en-us
        relation: http://www.jcdl.org
        rights: unrestricted
```

RE Multiple views of data



Raw XML Output

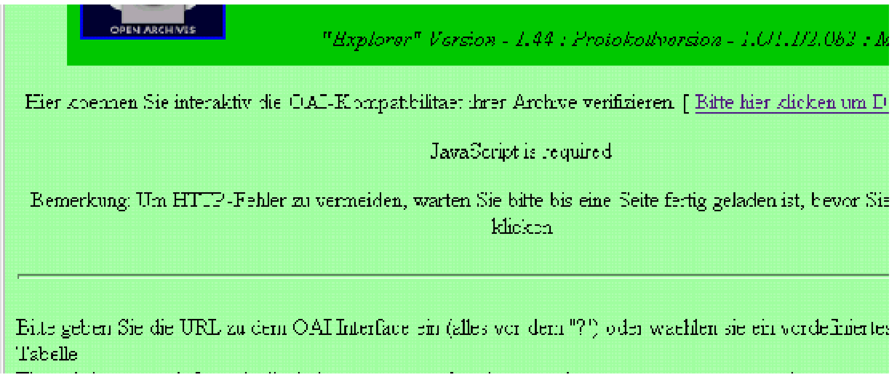
```
<?xml version="1.0" encoding="UTF-8"?>

<OAI-PMH xmlns="http://www.openarchives.org/OAI/2.0/" xmlns:xsi="

<responseDate>2002-05-26T19:59:35Z</responseDate>
<request verb="GetRecord" metadataPrefix="oai_dc" identifier="oai

<GetRecord>
<record>
<header>
<identifier>oai:JCDLPICS:200105d1e1</identifier>
<datestamp>2001-06-27</datestamp>
<setSpec>200105d1e</setSpec>
</header>
<metadata>
<oaidc:dc xmlns="http://purl.org/dc/elements/1.1/" xmlns:oaidc="h
   <title>01d1e1</title>
   <creator>Hussein Suleman</creator>
   <subject>JCDL Day Four</subject>
```

RE Multilingual Support



"Explorer" Version - 1.44 : Protokollversion - 1.0/1.1/2.0b2 : M

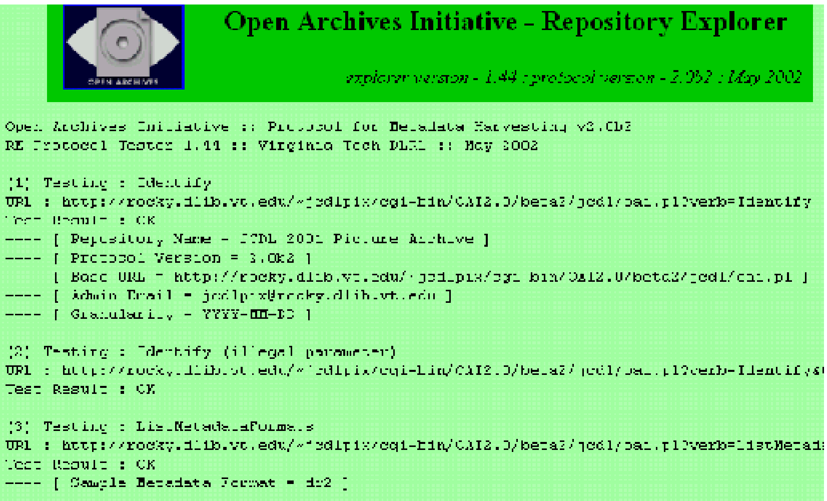
Hier koennen Sie interaktiv die OAI-Kompatibilitaet ihrer Archive verifizieren. [Bitte hier klicken um D

JavaScript is required

Bemerkung: Um HTTP-Fehler zu vermeiden, warten Sie bitte bis eine Seite fertig geladen ist, bevor Sie klicken

Bitte geben Sie die URL zu dem OAI Interface ein (alles vor dem "?") oder waehlen sie ein vordefiniertes Tabelle

RE Automatic Test Suite



Open Archives Initiative - Repository Explorer

explorer version - 1.44 : protocol version - 2.0b2 : May 2002

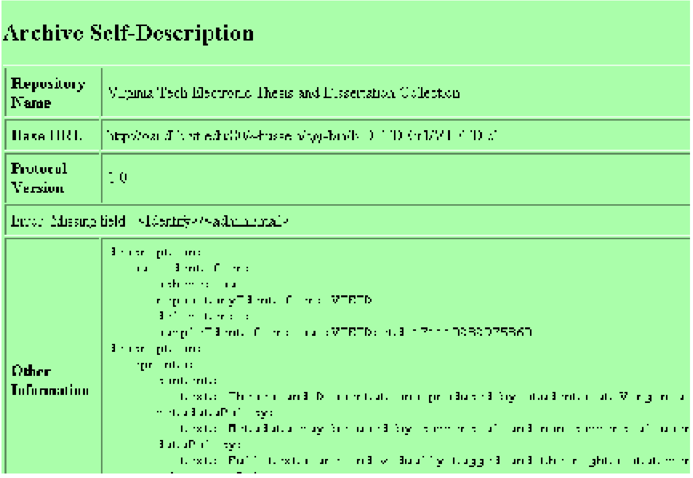
```
Open Archives Initiative :: Protocol for Metadata Harvesting v2.0b2
RE Protocol Tester 1.11 :: Virginia Tech DLRL :: May 2002

[1] Testing : Identify
URL : http://rocky.dlib.vt.edu/~jcdlpix/cgi-bin/OAI2.0/beta2/jcdl/oai.pl?verb=Identify
Test Result : OK
---- [ Repository Name = JCDL 2001 Picture Archive ]
---- [ Protocol Version = 2.0b2 ]
     [ Base URL = http://rocky.dlib.vt.edu/~jcdlpix/cgi-bin/OAI2.0/beta2/jcdl/oai.pl ]
---- [ Admin Email = jcdlpix@rocky.dlib.vt.edu ]
---- [ Granularity = YYYY-MM-DD ]

[2] Testing : Identify (illegal parameter)
URL : http://rocky.dlib.vt.edu/~jcdlpix/cgi-bin/OAI2.0/beta2/jcdl/oai.pl?verb=Identify&
Test Result : OK

[3] Testing : ListMetadataFormats
URL : http://rocky.dlib.vt.edu/~jcdlpix/cgi-bin/OAI2.0/beta2/jcdl/oai.pl?verb=ListMetada
Test Result : OK
---- [ Sample Metadata Format = dc2 ]
```

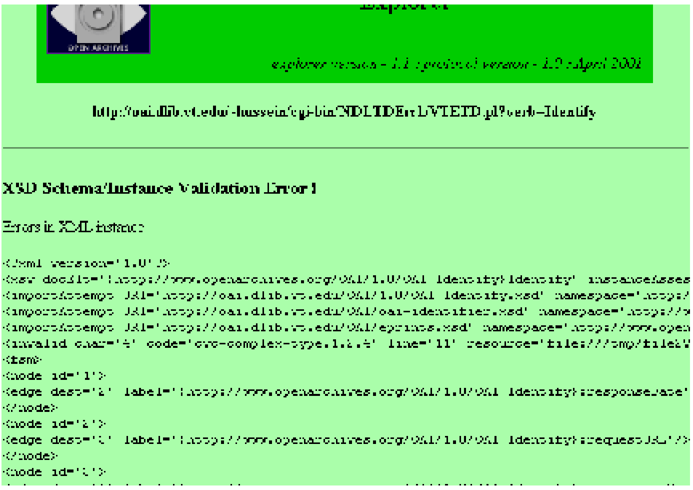
RE Error in Response



Archive Self-Description

Repository Name	Virginia Tech Electronic Thesis and Dissertation Collection
Base URL	http://oai.dlib.vt.edu/~hussein/cgi-bin/NDLTDErr1/VTETD.pl
Protocol Version	1.0
Error: Missing field <Identify>/<adminEmail>	
Other Information	[illegible]

RE Error in XML



explorer version - 1.1 : protocol version - 1.0 : April 2001

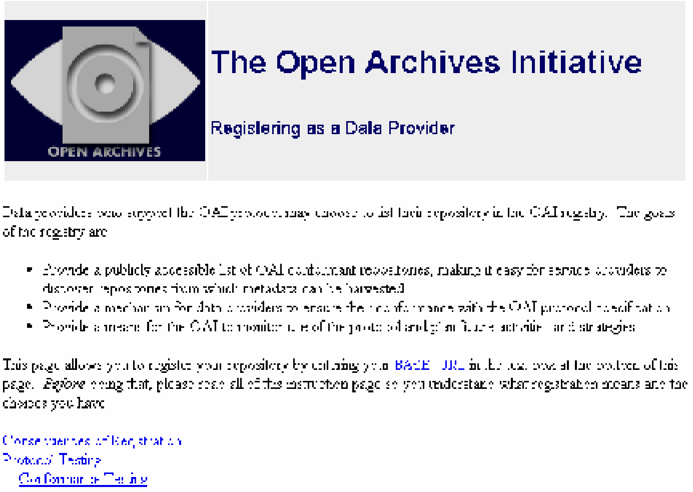
http://oai.dlib.vt.edu/~hussein/cgi-bin/NDLTDErr1/VTETD.pl?verb=Identify

XSD Schema/Instance Validation Error !

Errors in XML instance

```
<?xml version='1.0'?>
<xsv docElt='{http://www.openarchives.org/OAI/1.0/OAI_Identify}Identify' instanceAsses
<importAttempt URI='http://oai.dlib.vt.edu/OAI/1.0/OAI_Identify.xsd' namespace='http:/
<importAttempt URI='http://oai.dlib.vt.edu/OAI/oai-identifier.xsd' namespace='http://w
<importAttempt URI='http://oai.dlib.vt.edu/OAI/eprints.xsd' namespace='http://www.open
<invalid char='4' code='cvc-complex-type.1.2.4' line='11' resource='file:///tmp/fileV
<fsm>
<node id='1'>
<edge dest='2' label='{http://www.openarchives.org/OAI/1.0/OAI_Identify}responseDate'
</node>
<node id='2'>
<edge dest='3' label='{http://www.openarchives.org/OAI/1.0/OAI_Identify}requestURL'/>
</node>
<node id='3'>
```

OAI Registry



The Open Archives Initiative

Registering as a Data Provider

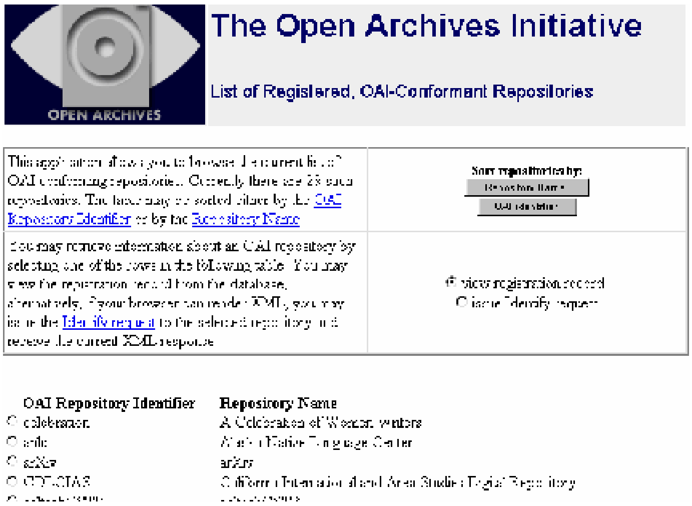
Data providers who support the OAI protocol may choose to list their repository in the OAI registry. The goals of the registry are

- Provide a publicly accessible list of OAI conformant repositories, making it easy for service providers to discover repositories from which metadata can be harvested
- Provide a mechanism for data providers to ensure their conformance with the OAI protocol specification
- Provide a means for the OAI to monitor use of the protocol and plan future activities and strategies

This page allows you to register your repository by entering your BASE URL in the text box at the bottom of this page. *Before* doing that, please read all of this instruction page so you understand what registration means and the choices you have

Consequences of Registration
Protocol Testing
Conformance Testing

OAI Registry



The Open Archives Initiative

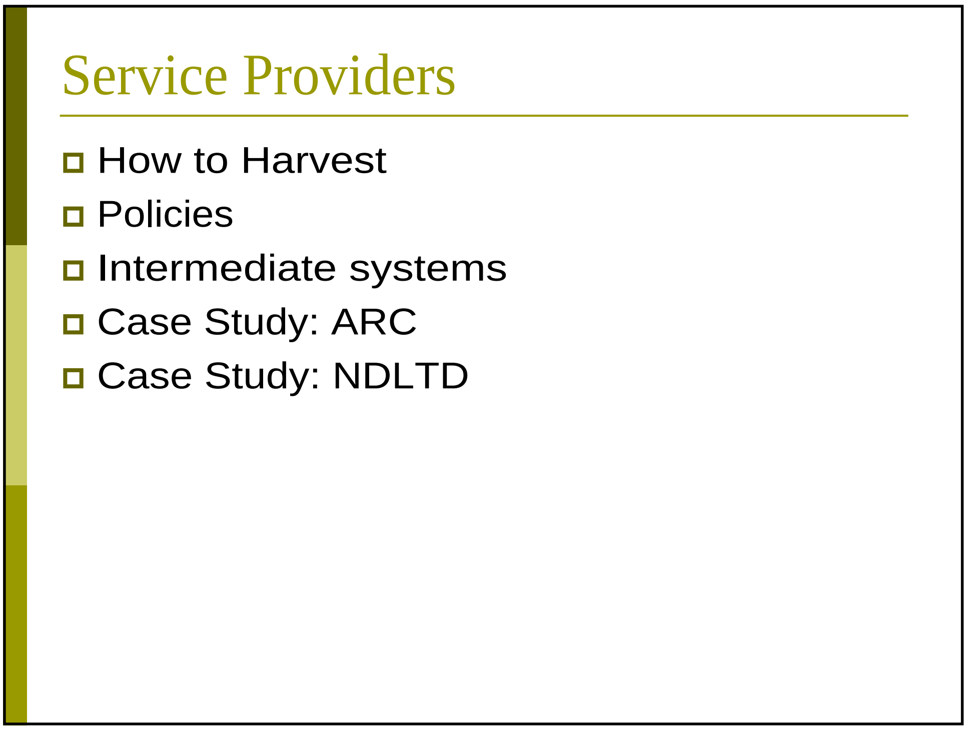
List of Registered, OAI-Conformant Repositories

This application allows you to browse the current list of OAI conforming repositories. Currently there are 23 such repositories. The latter may be sorted either by the OAI Repository Identifier or by the Repository Name

You may retrieve information about an OAI repository by selecting one of the rows in the following table. You may view the registration record from the database, alternatively, if your browser can render XML, you may issue the Identify request to the selected repository and receive the current XML response

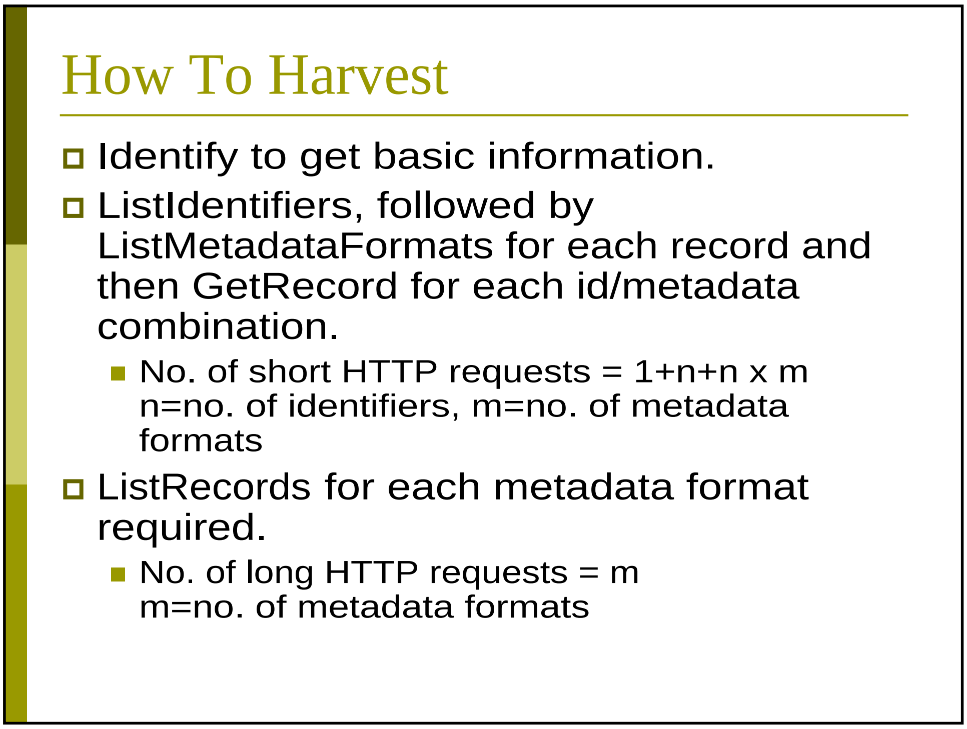
● view registration record
○ issue Identify request

OAI Repository Identifier	Repository Name
○ celebration	A Celebration of Women Writers
○ anlc	Alaska Native Language Center
○ arXiv	arXiv
○ CDL-CIAS	California International and Area Studies Digital Repository



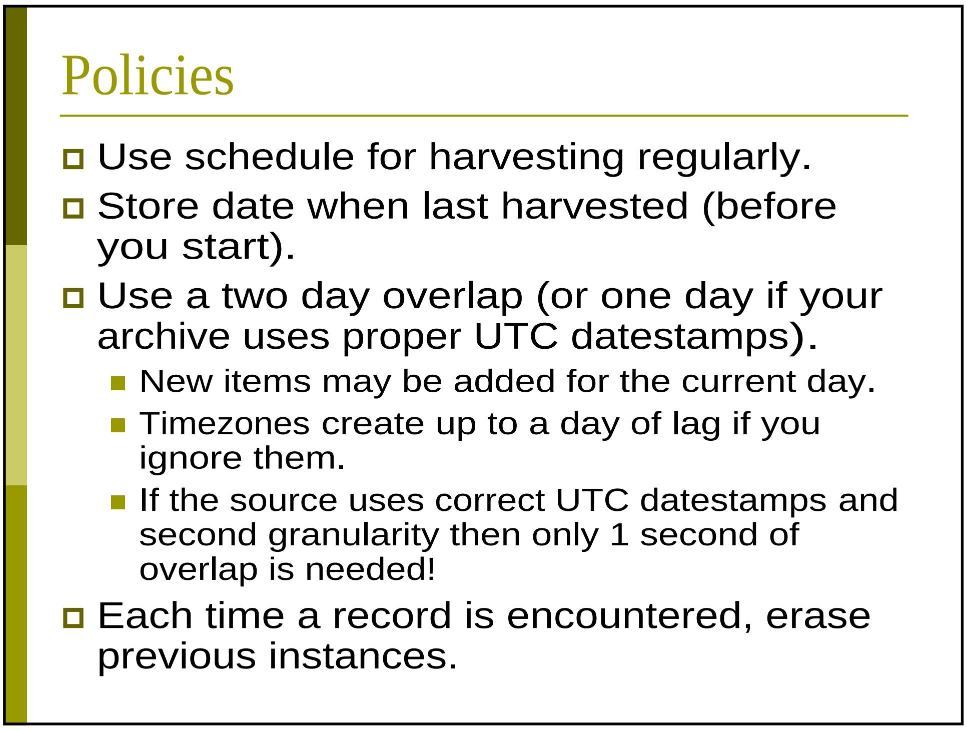
Service Providers

- How to Harvest
- Policies
- Intermediate systems
- Case Study: ARC
- Case Study: NDLTD



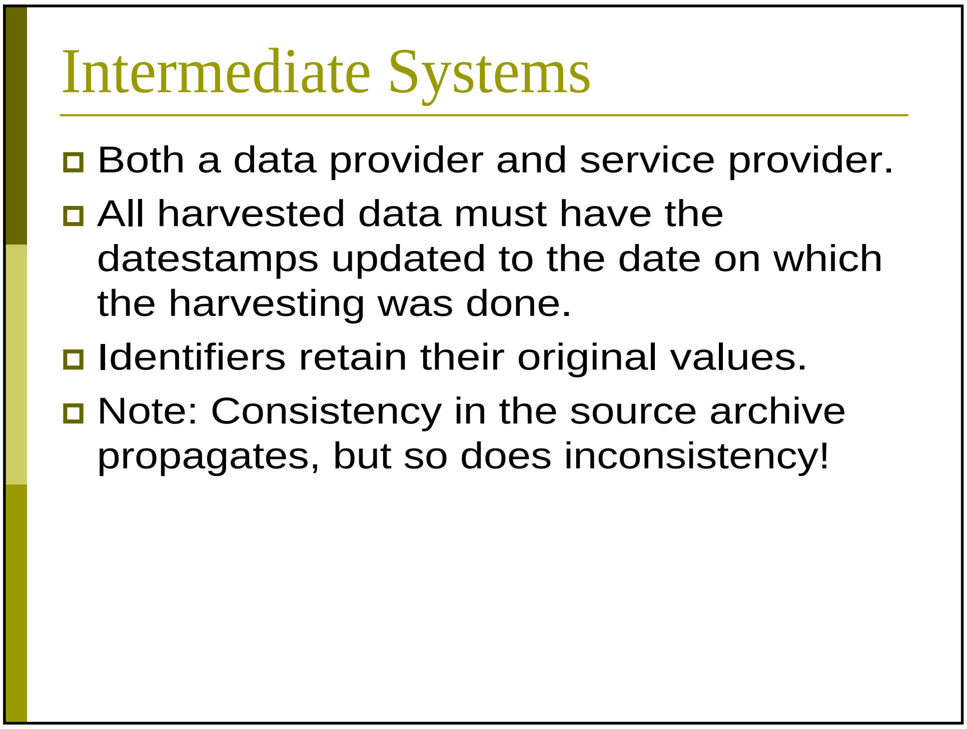
How To Harvest

- Identify to get basic information.
- ListIdentifiers, followed by ListMetadataFormats for each record and then GetRecord for each id/metadata combination.
  - No. of short HTTP requests = 1+n+n x m
n=no. of identifiers, m=no. of metadata formats
- ListRecords for each metadata format required.
  - No. of long HTTP requests = m
m=no. of metadata formats



Policies

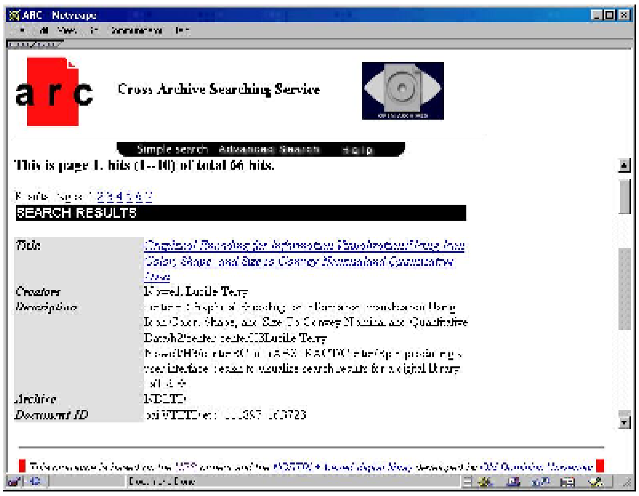
- Use schedule for harvesting regularly.
- Store date when last harvested (before you start).
- Use a two day overlap (or one day if your archive uses proper UTC datestamps).
  - New items may be added for the current day.
  - Timezones create up to a day of lag if you ignore them.
  - If the source uses correct UTC datestamps and second granularity then only 1 second of overlap is needed!
- Each time a record is encountered, erase previous instances.



Intermediate Systems

- Both a data provider and service provider.
- All harvested data must have the datestamps updated to the date on which the harvesting was done.
- Identifiers retain their original values.
- Note: Consistency in the source archive propagates, but so does inconsistency!

8.5. Case Study: ARC



Cross Archive Searching Service

This is page 1. hits (1--10) of total 64 hits.

Result Pages: 1 2 3 4 5 6 7

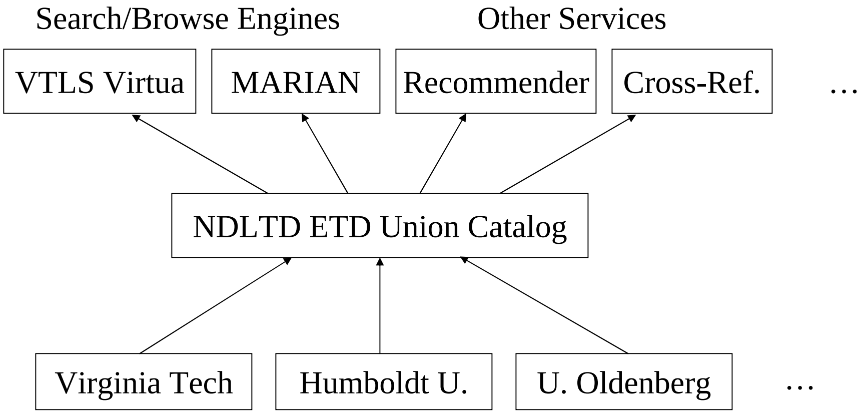
SEARCH RESULTS

Title	*Graphical Encoding for Information Visualization: Using Icon Color, Shape, and Size to Convey Nominal and Quantitative Data*
Creators	Nowell, Lucile Terry
Description	[illegible] Icon Color, Shape, and Size To Convey Nominal and Quantitative Data [illegible] Lucile Terry [illegible] user interface [illegible] to visualize search results for a digital library [illegible]
Archive	NDLTD
Document ID	oai:VTETD:etd-[illegible]

[illegible]

Document: Done

Case Study: NDLTD



Search/Browse Engines

Other Services

VTLS Virtua

MARIAN

Recommender

Cross-Ref.

…

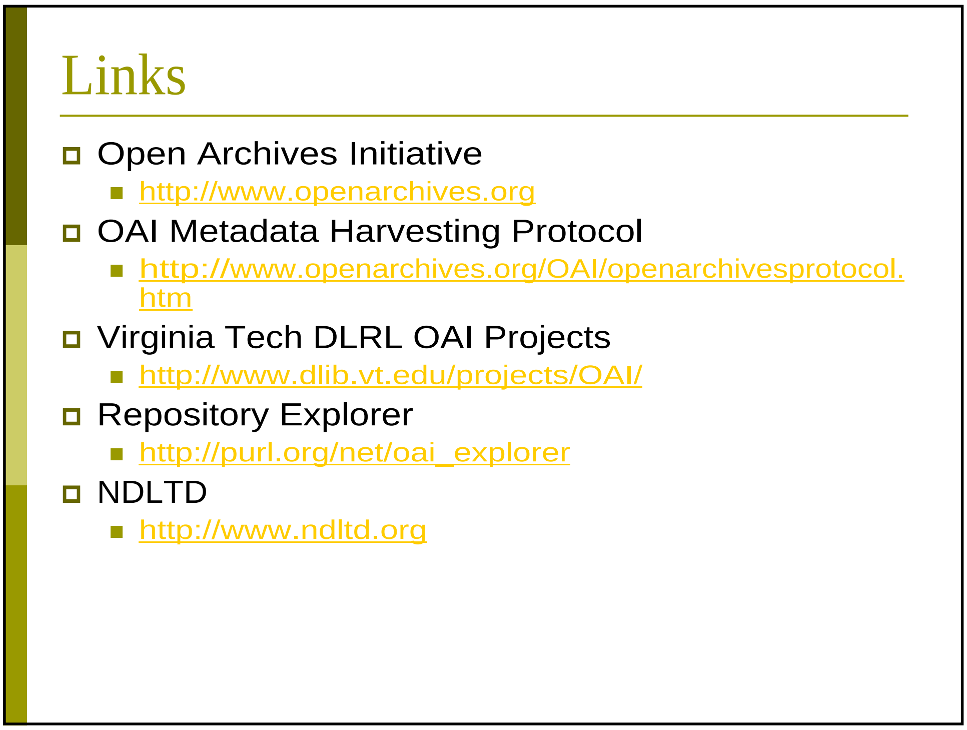
NDLTD ETD Union Catalog

Virginia Tech

Humboldt U.

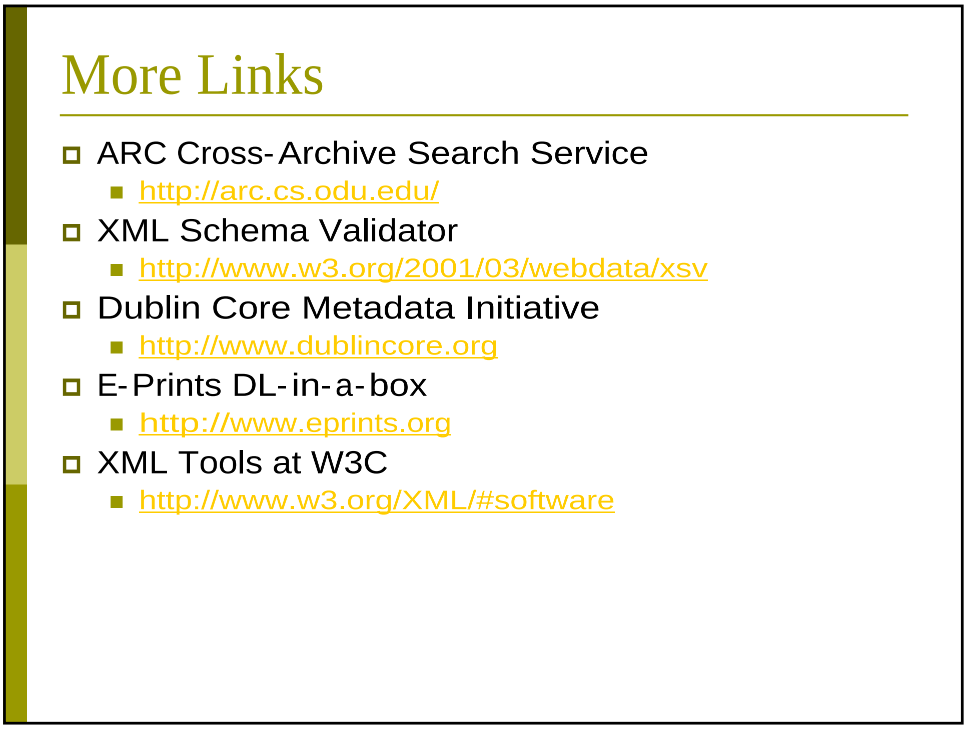
U. Oldenberg

…



Links

- Open Archives Initiative
  - http://www.openarchives.org
- OAI Metadata Harvesting Protocol
  - http://www.openarchives.org/OAI/openarchivesprotocol.htm
- Virginia Tech DLRL OAI Projects
  - http://www.dlib.vt.edu/projects/OAI/
- Repository Explorer
  - http://purl.org/net/oai_explorer
- NDLTD
  - http://www.ndltd.org



More Links

- ARC Cross-Archive Search Service
  - http://arc.cs.odu.edu/
- XML Schema Validator
  - http://www.w3.org/2001/03/webdata/xsv
- Dublin Core Metadata Initiative
  - http://www.dublincore.org
- E-Prints DL-in-a-box
  - http://www.eprints.org
- XML Tools at W3C
  - http://www.w3.org/XML/#software