DESY Computing Seminar on Data Management in Climate Research

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1. Fedora Commons

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1.1 What is Fedora Commons?

- **Fedora** stands for *Flexible Extensible Digital Object Repository*.
- Fedora is a **general-purpose, open-source** digital object repository system.
- Java based conceptual framework using a set of abstractions about digital information to provide the basis for software systems that can manage digital information.
- The Fedora software distributed by **Duraspace** (http://www.duraspace.org) is available from http://fedora-commons.org under the terms of the Apache License, version 2.0.
1.2 Key Features [1/2]

- Store all types of content and its metadata
- Scale to millions of objects
- Access to data via Web APIs (REST/SOAP)
- Provides RDF based Resource Index search
- Rebuilder Utility (for disaster recovery and data migration)
- The entire repository can be rebuilt from the digital object and content files.
1.2 Key Features [2/2]

- Content Model Architecture (define "types" of objects by their content)
- Many storage options (database and file systems)
- JMS messaging provider (your apps can "listen" to repository events)
- OAI-PMH Provider Service
1.3 Digital Object Model

- All content in Fedora is managed as **data objects**
- Data objects are made up of **datastreams** that store the content or metadata about it.
- Each datastream can be managed directly by the repository or left in an external, web-accessible location to be delivered through the repository as needed.
- A data object can consist of any number of data and metadata components, combining managed and external datastreams in any desired pattern.
1.3 Digital Object Model: FOXML

FOXML (Fedora Object XML) is a simple XML format that directly expresses the Fedora Digital Object Model.

FOXML 1.1 XSD Schema on: http://fedora-commons.org/definitions/1/0/foxml1-1.xsd

```
<digitalObject PID="uniqueID">

  <!-- there are a set of core object properties -->
  <objectProperties>
    <property/>
    <property/>
    ...
  </objectProperties>

  <!-- there can be zero or more datastreams -->
  <datastream>
    <datastreamVersion/>
    <datastreamVersion/>
    ...
  </datastream>

</digitalObject>
```
1.3 Digital Object Model: Datastreams

Fedora reserves three datastreams for its use, namely “DC” (Dublin Core), “AUDIT”, and RELS-EXT.

Basic Datastream Properties

- Datastream Identifier
- State: Active, Inactive, or Deleted
- Created Date
- Modified Date
- Versionable: true/false
- Label
- MIME Type
- Format identifier (optional)
- Alternate Identifiers (Handlers or DOI)
- Checksum
- Bytestream Content
- Control Group
  - Internal XML Content
  - Managed Content
  - Externally Referenced Content
  - Redirect Referenced Content
1.4 Content Model Architecture

- The **Content Model Architecture** (CMA) describes an integrated structure for persisting and delivering the essential characteristics of digital objects in Fedora.
  - Structural, behavioral, and semantic information.
  - Description of the permitted, excluded, and required relationships to other digital objects or identifiable entities.

- The content model is expressed in a modeling language.
## 1.4 CMA: Object Types

### Fundamental Fedora Object Types

<table>
<thead>
<tr>
<th>Object Type</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data</td>
<td>Data</td>
<td>A container for content</td>
</tr>
<tr>
<td>Service Definition</td>
<td>SDef</td>
<td>A container for the service definitions</td>
</tr>
<tr>
<td>Service Deployment</td>
<td>SDep</td>
<td>A container for service deployment bindings</td>
</tr>
<tr>
<td>Content Model</td>
<td>CModel</td>
<td>A container for content models</td>
</tr>
</tbody>
</table>
1.4 CMA: Object Types

Fundamental CMA Relationships

- Content Model
  - Has Service: Service Definition
  - Has Model: Data
  - Is Contractor Of: Service Deployment
  - Is Deployment Of: Service Deployment

- Service Definition
  - Has Service: Content Model
1.5 Web Service Interface

- **Primary API's**
  Allow the creation, reading, modification, and deletion of Fedora digital objects.

- **Optional API's**
  - Basic OAI-PMH
  - RI-Search
1.5 Web Service Interface: API-A

Fedora Access service methods

- Repository Access
  - DescribeRepository
- Object Access
  - findObjects
  - resumeFindObject
  - getObjectHistory
  - getObjectProfile

- Datastream Access
  - getDatastreamDissemination
- Dissemination Access
  - getDissemination
  - listMethods

- Object Access
Fedora Management service methods

- Datastream Management
  - addDatastream
  - compareDatastreamChecksum
  - getDatastream
  - getDatastreamHistory
  - getDatastreams
  - modifyDatastreamByReference
  - modifyDatastreamByValue
  - setDatastreamState
  - setDatastreamVersionable
  - purgeDatastream
- Relationship Management
  - addRelationship
  - getRelationships
  - purgeRelationship
- Object Management
  - modifyObject
  - purgeObject
  - export
  - getNextPID
  - getObjectXML
  - ingest
  - validate
1.5 Web Service Interface: RISearch [1/2]

The Resource Index Search Service (RISearch) is a web service that exposes the contents of a repository's Resource Index guide for outside use.

**RISearch Service Functionality**

<table>
<thead>
<tr>
<th></th>
<th>Find Tuples</th>
<th>Find Triple</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Query Language</strong></td>
<td>SPARQL, iTQL</td>
<td>SPO</td>
</tr>
<tr>
<td><strong>Response Type</strong></td>
<td>CSV, Simple, Sparql, TSV, count</td>
<td>N-Triples, Notation 3 RDF/XML, Turtle, count</td>
</tr>
</tbody>
</table>
1.5 Web Service Interface: RISeach [2/2]

- Example iTQL Query:

```sql
select $object $label $description $owner $date $type from <#ri>
where $object <fedora-model:label> $label
and $object <fedora-model:ownerId> $owner
and $object <dc:date> $date
and $object <dc:description> $description
and $object <dc:type> $type
and $object <fedora-rels-ext:isMemberOf> <info:fedora/demo:1>
order by $label asc limit 15 offset 12
```
1.6 Framework Services

- Generic Search Service
- OAI Provider Service
2. Federico

2.1. What is Federico?
2.2. System Requirements
2.3. Use Cases
2.4. Content Model
2.5. Architecture
2.1 What is Federico?

- Fedora-Enabled Repository with Cocoon
- **AJAX**-based frontend for a C3Grid local repository of metadata
- Transparent Integration of Fedora with the Framework Services GSearch and OAI Provider
- Developed in the scope of the work package #3, *Long-term Preservation of Digital Archives of Wissgrid*, sponsored by the *German Federal Ministry of Education and Research*
2.2 System Requirements [1/2]

Hardware

- PC with a 1 gigahertz (GHz) processor or faster and network card
- 2 GB RAM
- 800 MB free disk space for the installation

Software

- Linux Distribution with X Window System
- Java JDK 1.6
- 3 MySQL Databases for Fedora Commons, Fedora OAI Provider, and openID accounts
2.2 System Requirements [2/2]

User

- PC with graphical interface and network card
- Keyboard and mouse
- Browser (preferably Mozilla Firefox) with Javascript enabled
2.3 Federico Use Case
2.3 Activity Diagram – Ingest Collection
2.4 Content Model [1/2]
2.4 Content Model [2/2]
2.5 Architecture
3. Federico's Live Demo

3.1. User Interface
3.2. Authentication
3.3. Ingest Collections
3.4. Full-text Search
3.5. OAI-PMH
3. Federico's Live Demo: Screenshots

Login Form
3. Federico's Live Demo: Screenshots

Browse Collections Form

The image shows a screenshot of a metadata repository interface where users can browse collections. The interface includes options to create sets and upload metadata describing these collections. The repository appears to be in a language setting, with options for 'Deutsch', 'Español', and 'English'. The repository's name is 'metadata3repository'.

The screenshot also includes a table that displays the types of metadata available: 'Nomenclature', 'What is a Set?', 'What is a Collection?', and 'Login as', with corresponding descriptions and access options.
3. Federico's Live Demo: Screenshots

Metadata Upload

Upload Collection Metadata

Upload an XML file describing a collection for its online edition. Its content should conform to the community established metadata profile schema defined in Federico.

Upload File [xml.xml]  *
Status:
- Successful upload of xml.xml, 35589 bytes

Submit

Done
3. Federico's Live Demo: Screenshots

Metadata Edition

# 32
Summary

- Fedora as repository for digital information in research environment
  - Well defined API's
  - Content Model Architecture for the definition of “types” of objects
  - Harvesting through OAI-PMH
- Knowledge of XML is crucial
- Difficult UI implementation