DESY Computing Seminar on
Data Management in Climate Research

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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

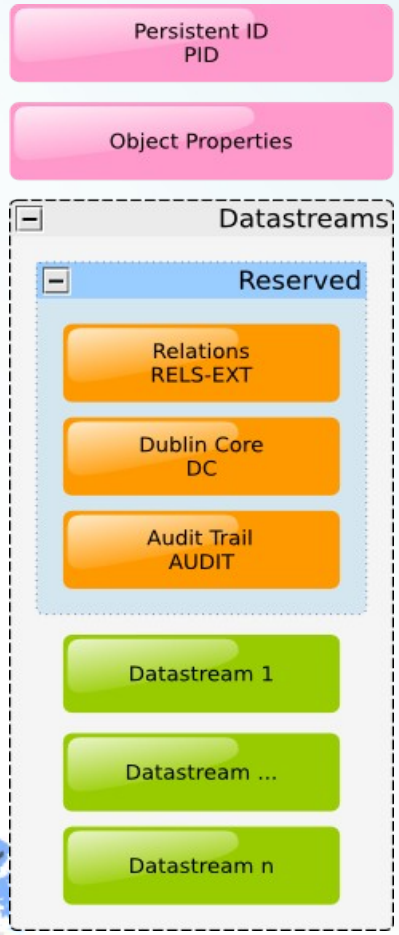
FOXML (Fedora Object XML) is a simple XML format that directly expresses the Fedora Digital Object Model.

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.

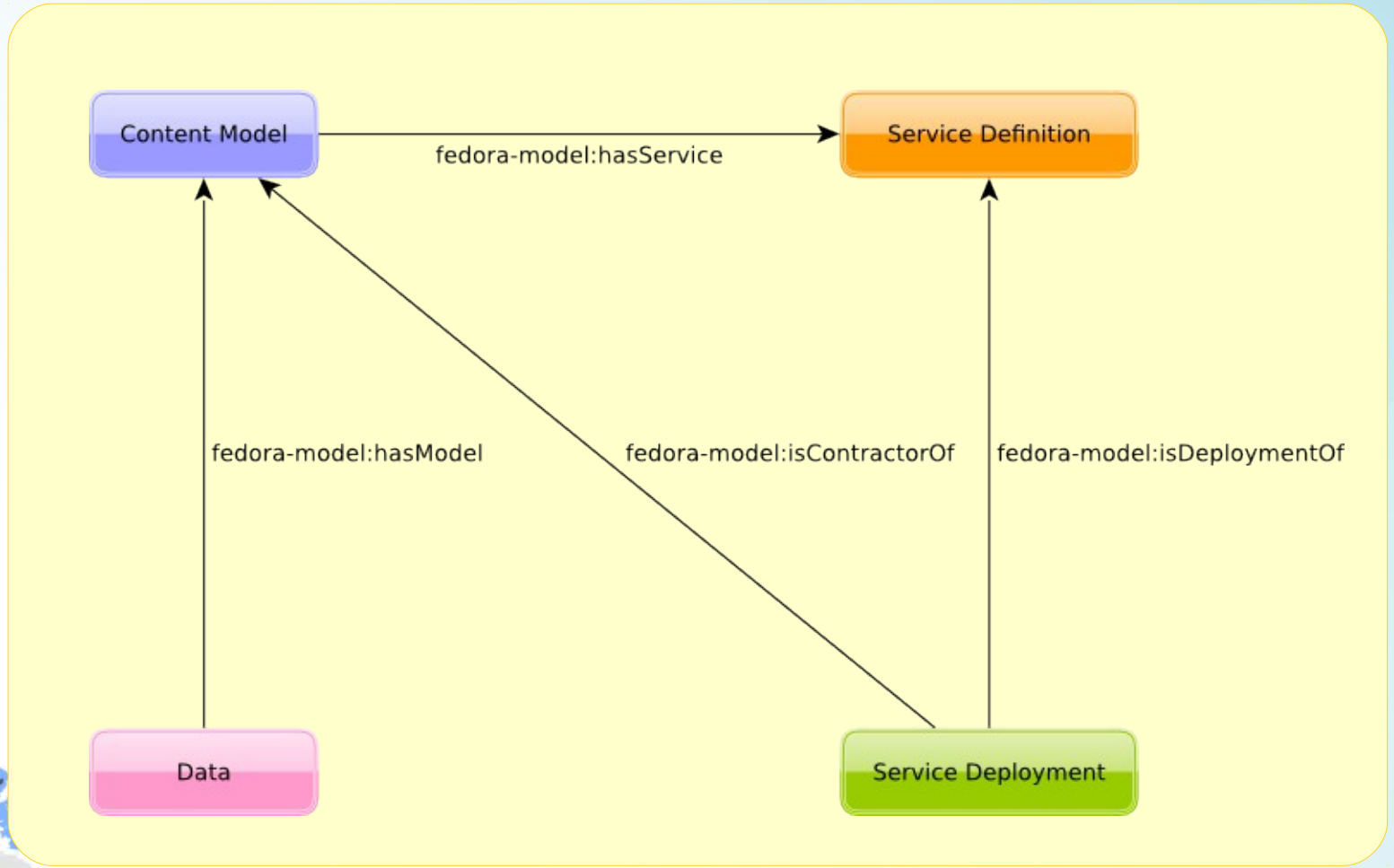
1.4 CMA: Object Types

Fundamental Fedora Object Types

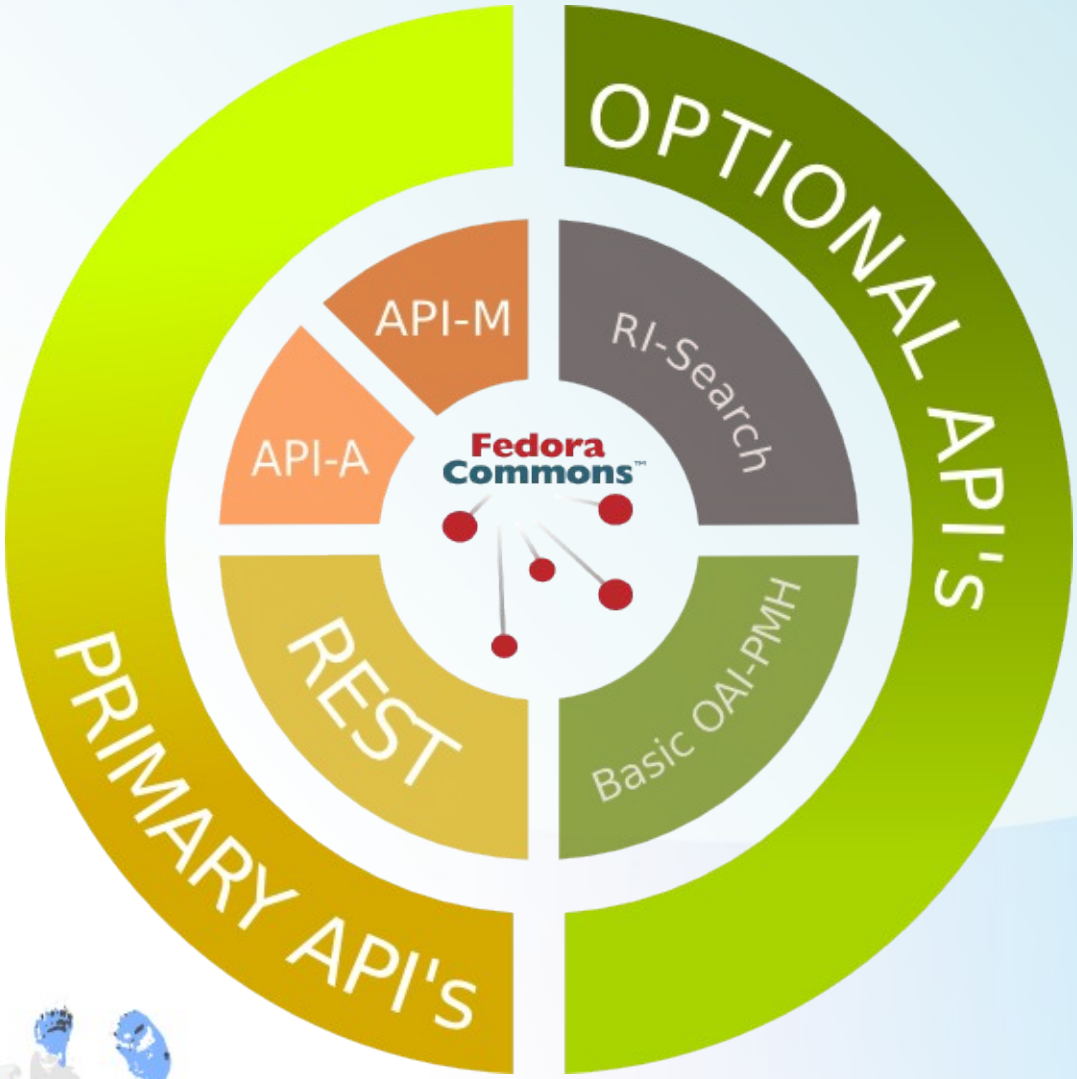
Object Type	Code	Description
Data	Data	A container for content
Service Definition	SDef	A container for the service definitions
Service Deployment	SDep	A container for service deployment bindings
Content Model	CModel	A container for content models

1.4 CMA: Object Types

Fundamental CMA Relationships



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
  - resumeFindObjects
  - getObjectHistory
  - getObjectProfile
- Datastream Access
  - getDatastreamDissemination
  - listDatastreams
- Dissemination Access
  - getDissemination
  - listMethods

1.5 Web Service Interface: API-M

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

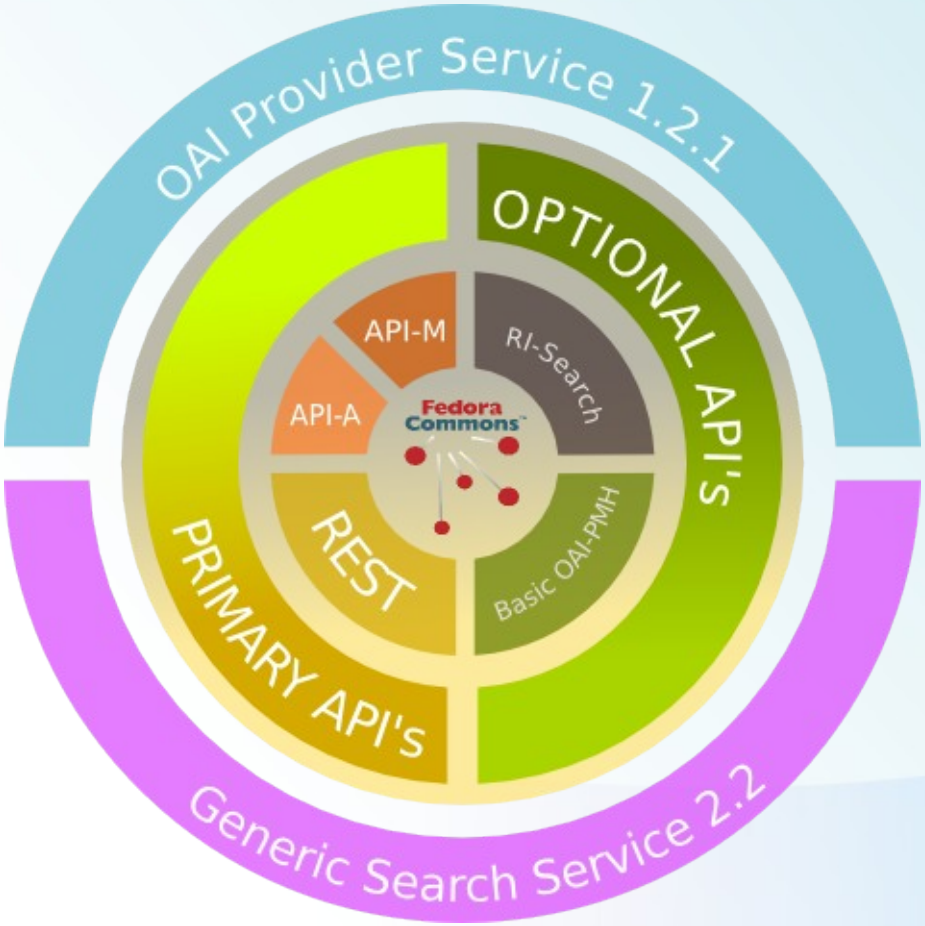
	Find Tuples	Find Triple
Query Language	SPARQL, iTQL	SPO
Response Type	CSV, Simple, Sparql, TSV, count	N-Triples, Notation 3 RDF/XML, Turtle, count

1.5 Web Service Interface: RISearch [2/2]

- Example iTQL Query:

```
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

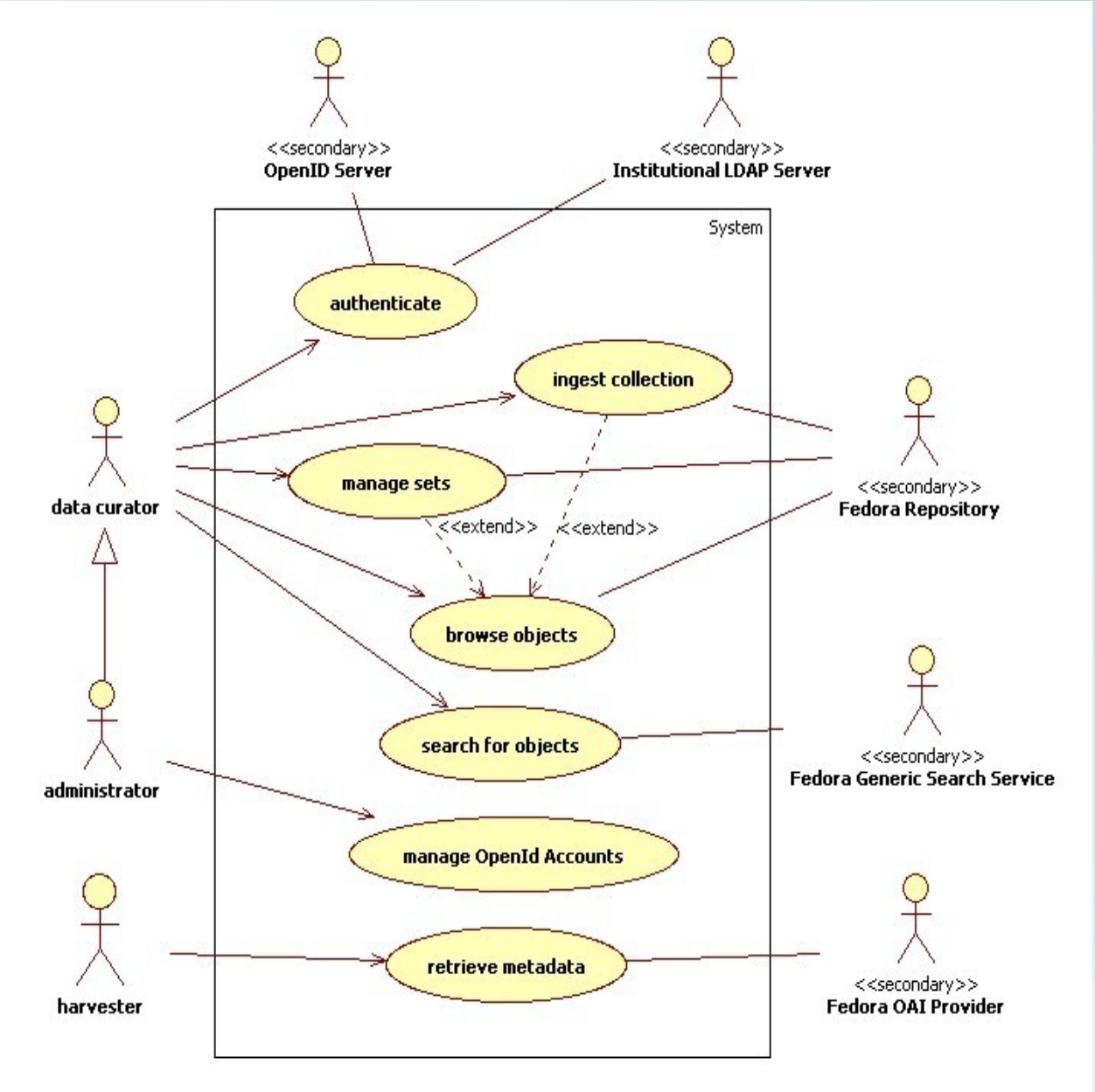
- Linux Distribution with X Window System
- Java JDK 1.6
- 3 MySQL Databases for Fedora Commons, Fedora OAI Provider, and openID accounts

2.2 System Requirements [2/2]

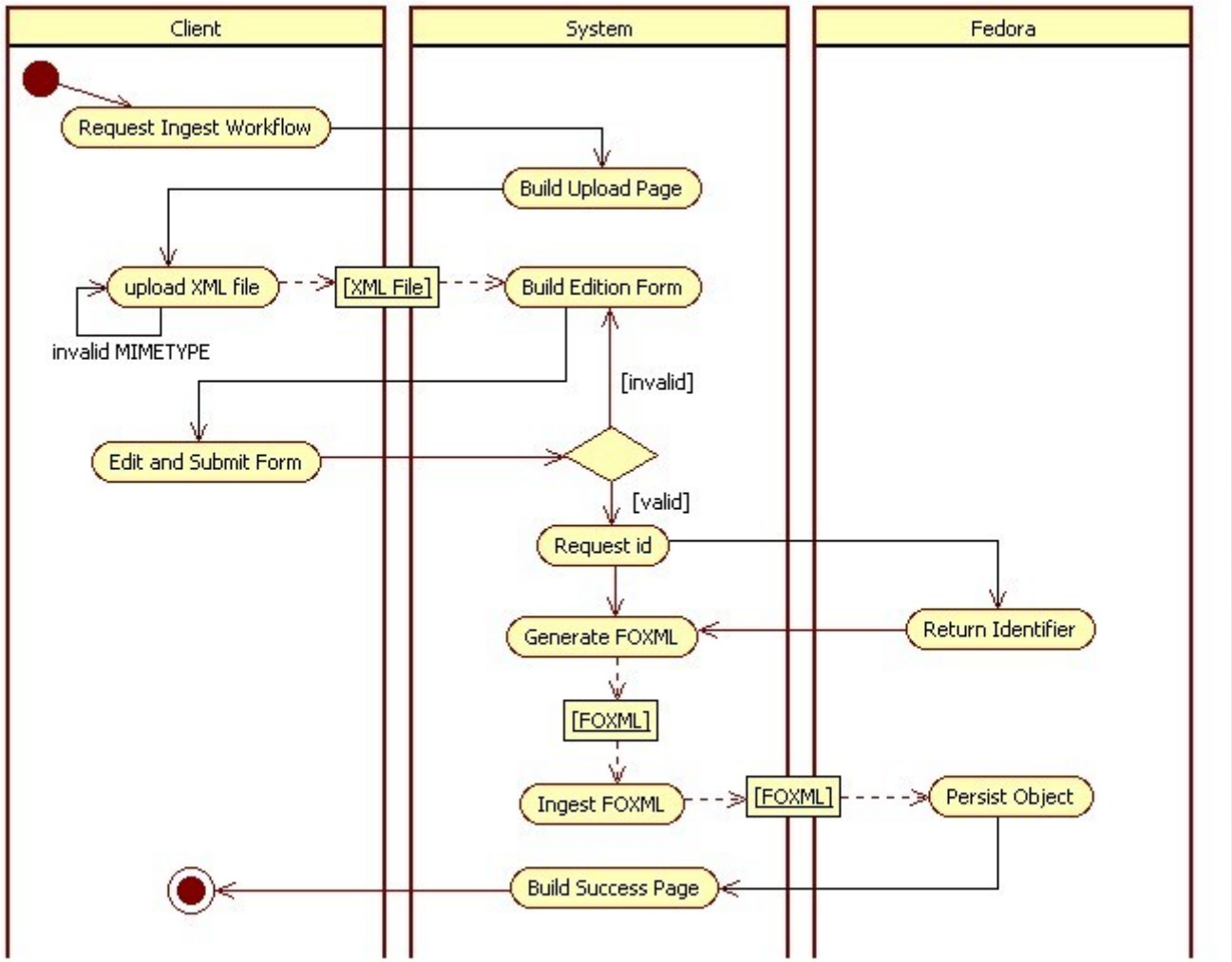
User

- PC with graphical interface and network card
- Keyboard and mouse
- Browser (preferably Mozilla Firefox) with Javascript enabled

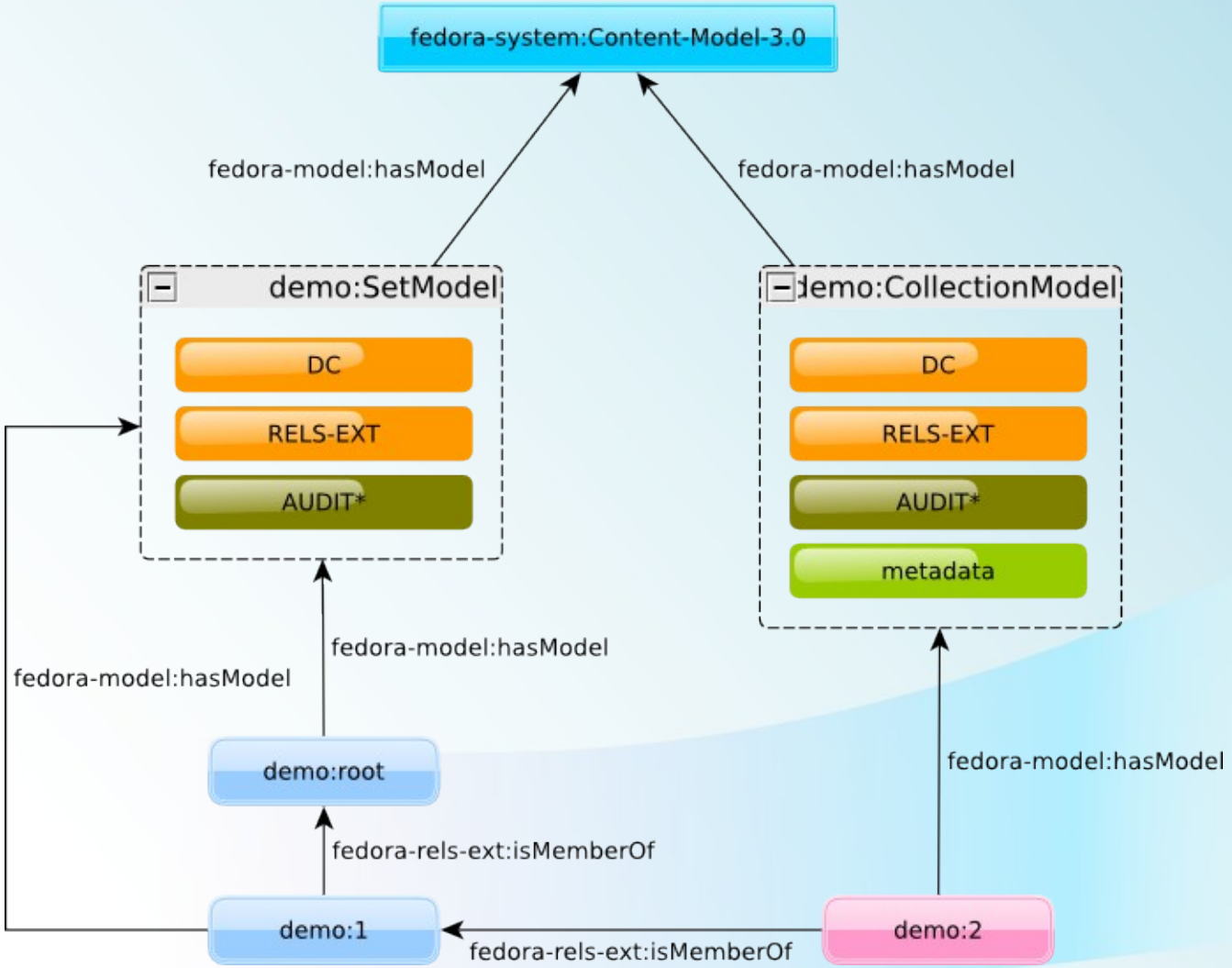
2.3 Federico Use Case



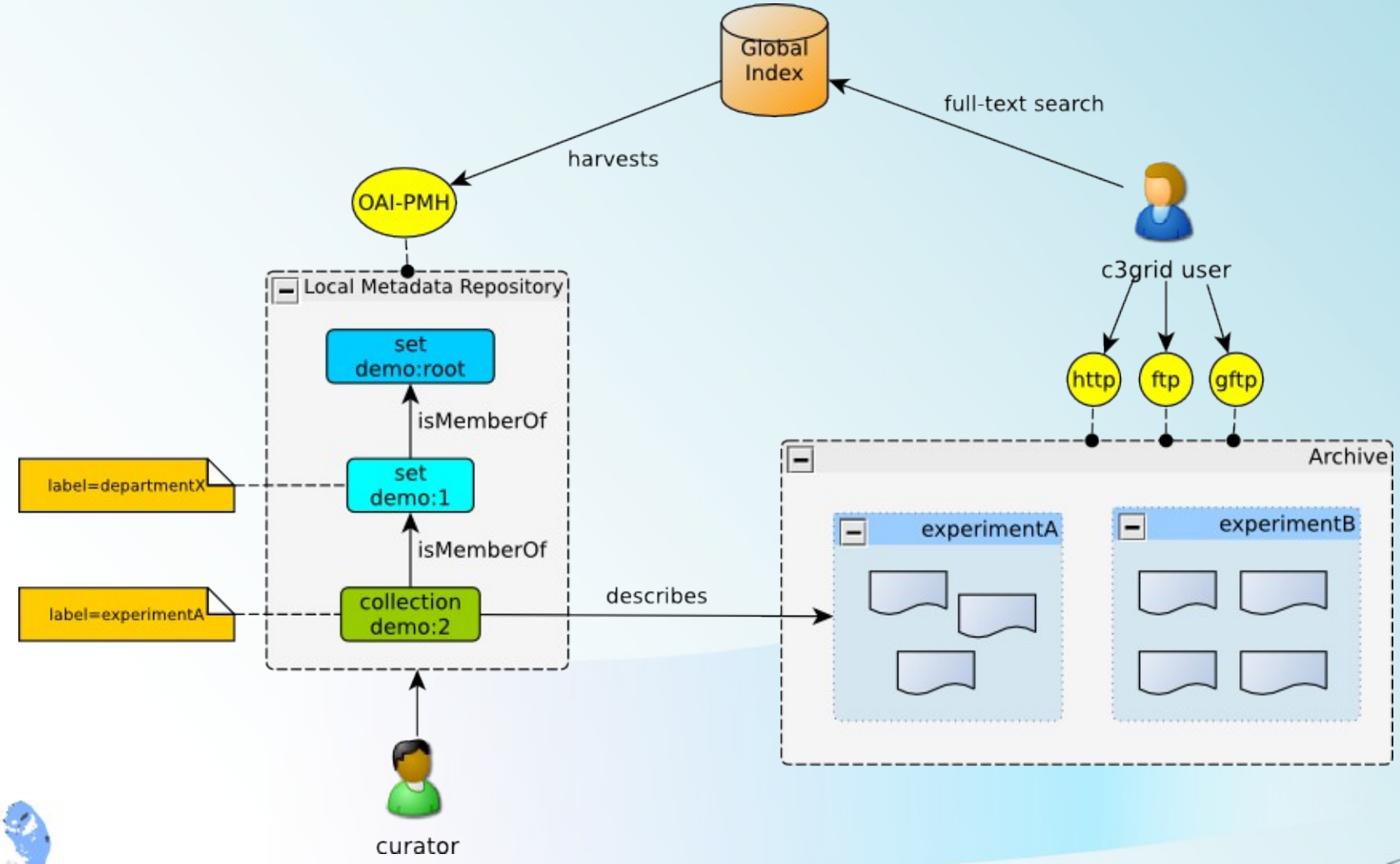
2.3 Activity Diagram – Ingest Collection



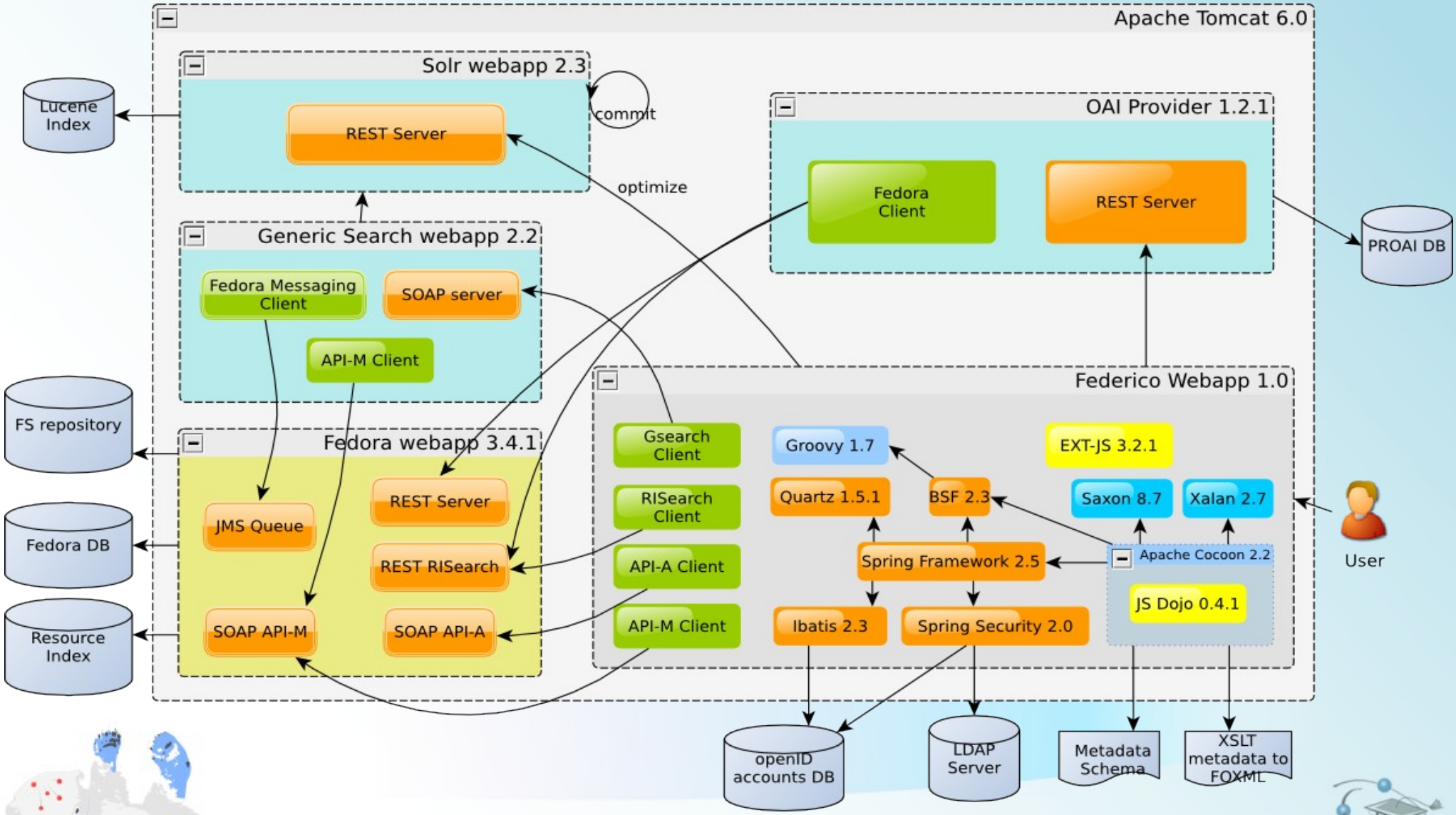
2.4 Content Model [1/2]



2.4 Content Model [2/2]



2.5 Architecture



3. Federico's Live Demo

3.1. User Interface

3.2. Authentication

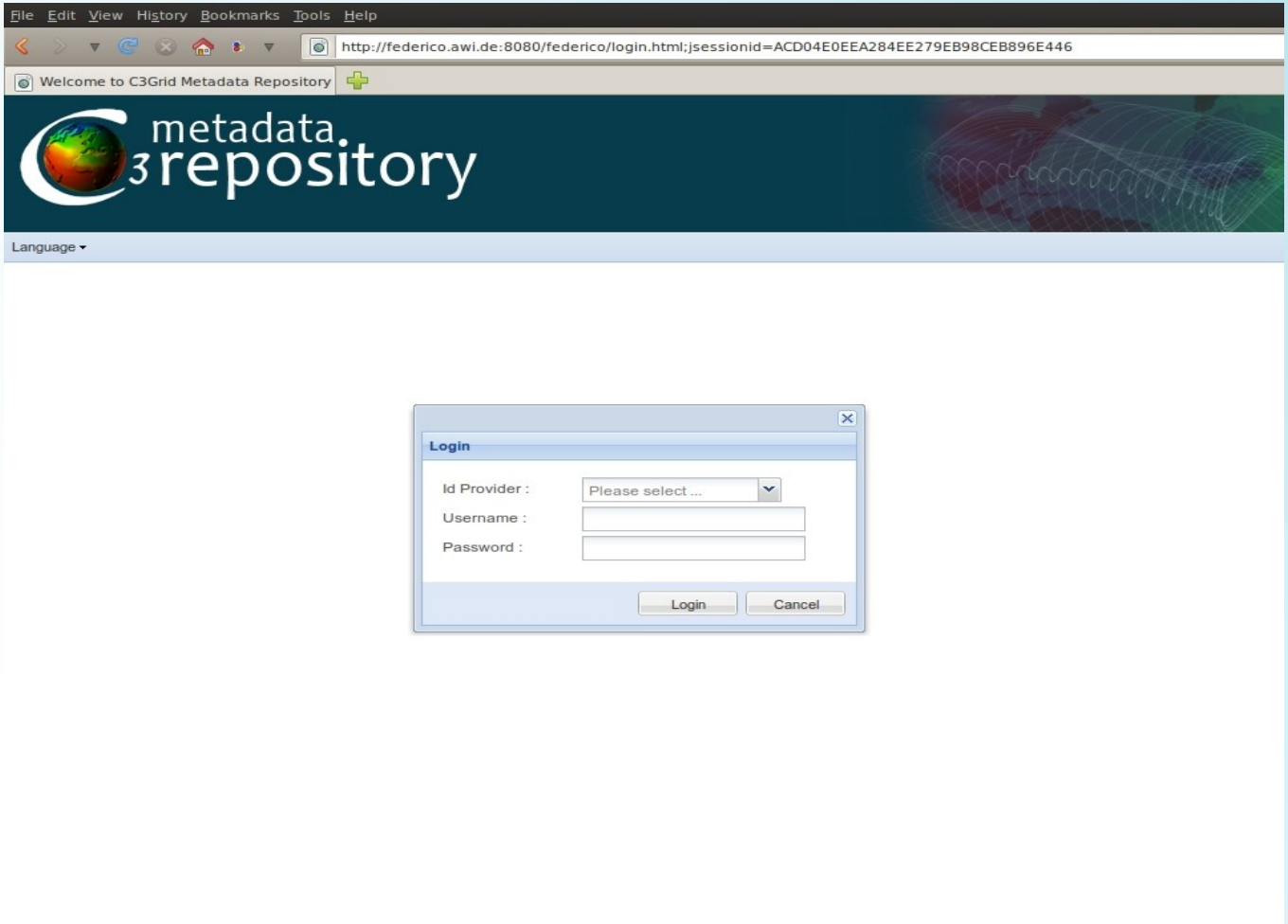
3.3. Ingest Collections

3.4. Full-text Search

3.5. OAI-PMH

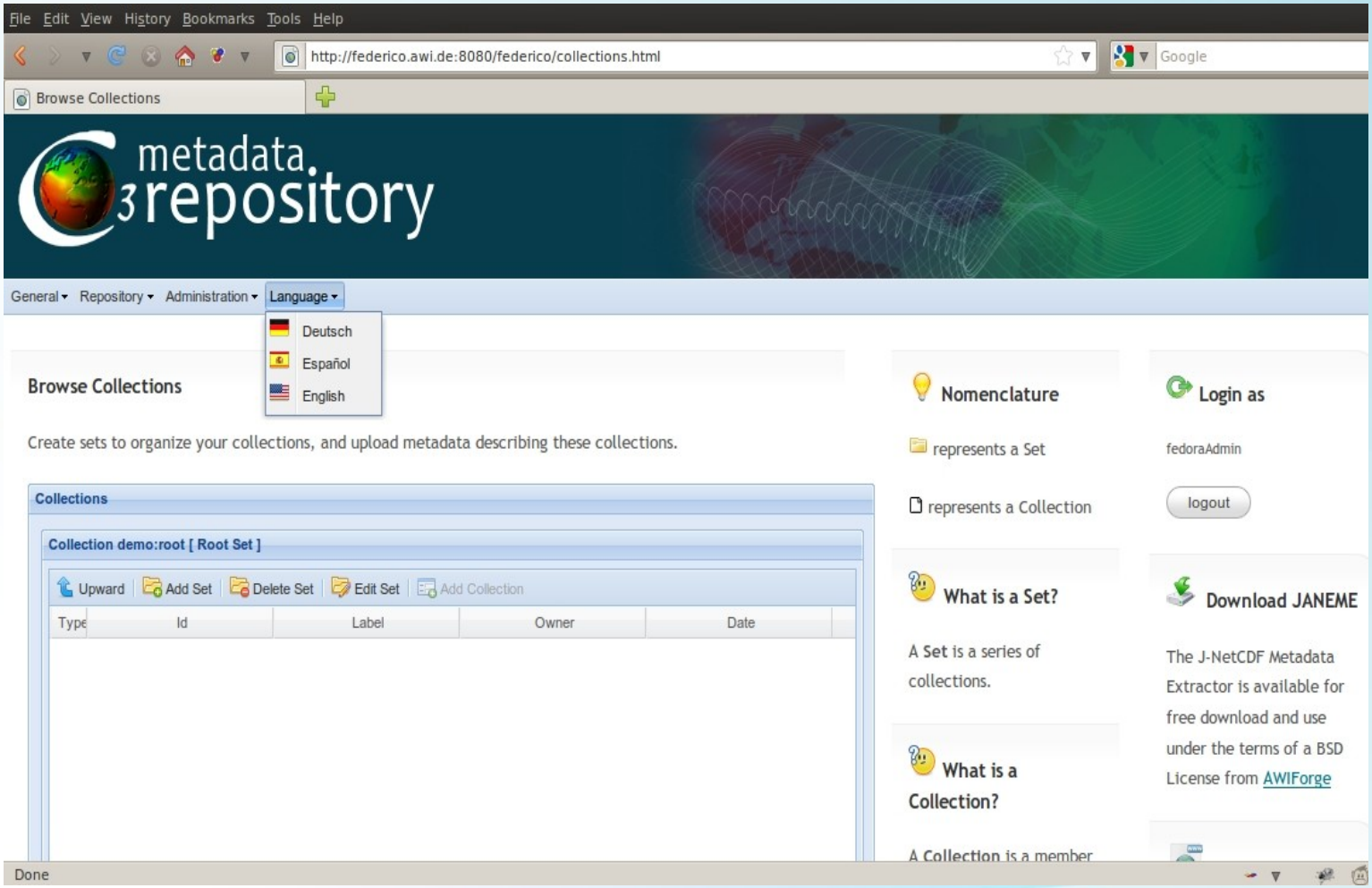
3. Federico's Live Demo: Screenshots

Login Form



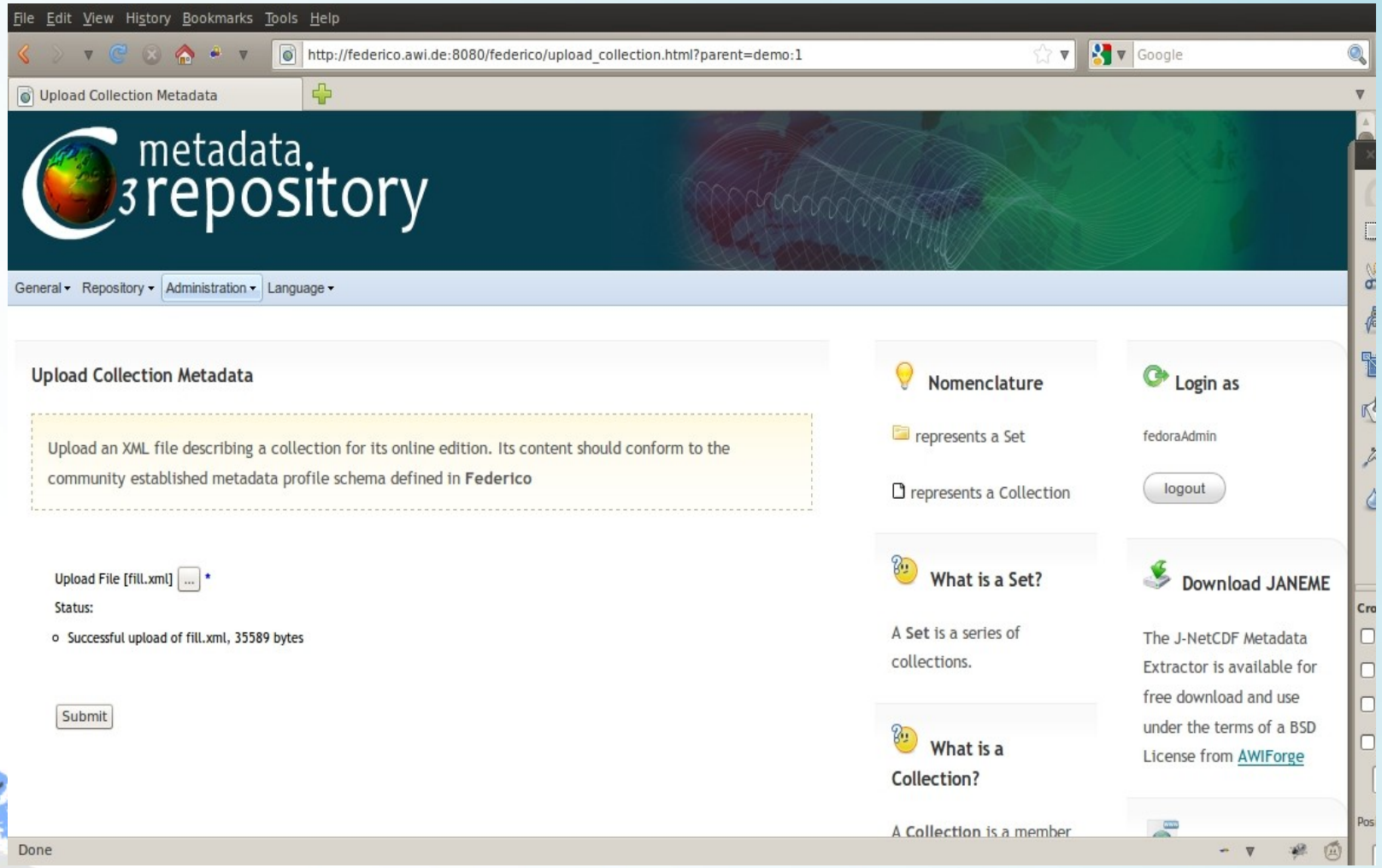
3. Federico's Live Demo: Screenshots

Browse Collections Form



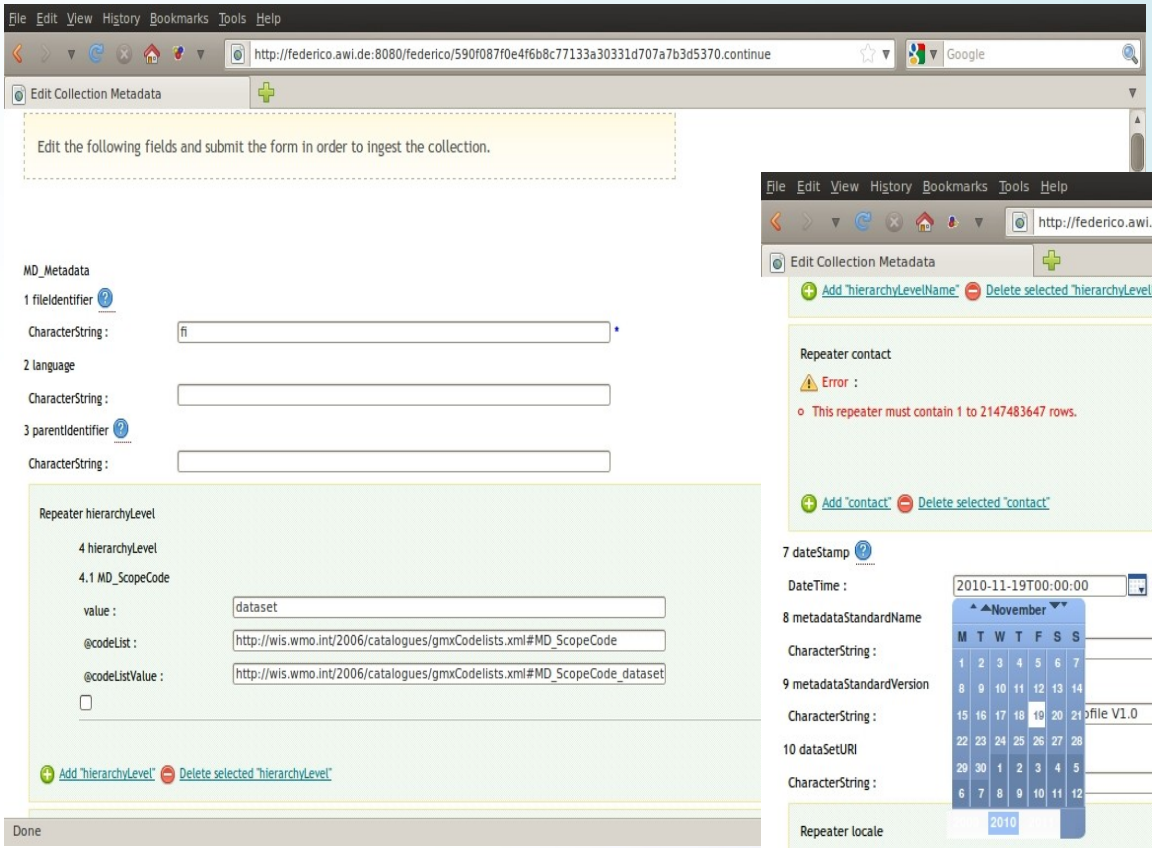
3. Federico's Live Demo: Screenshots

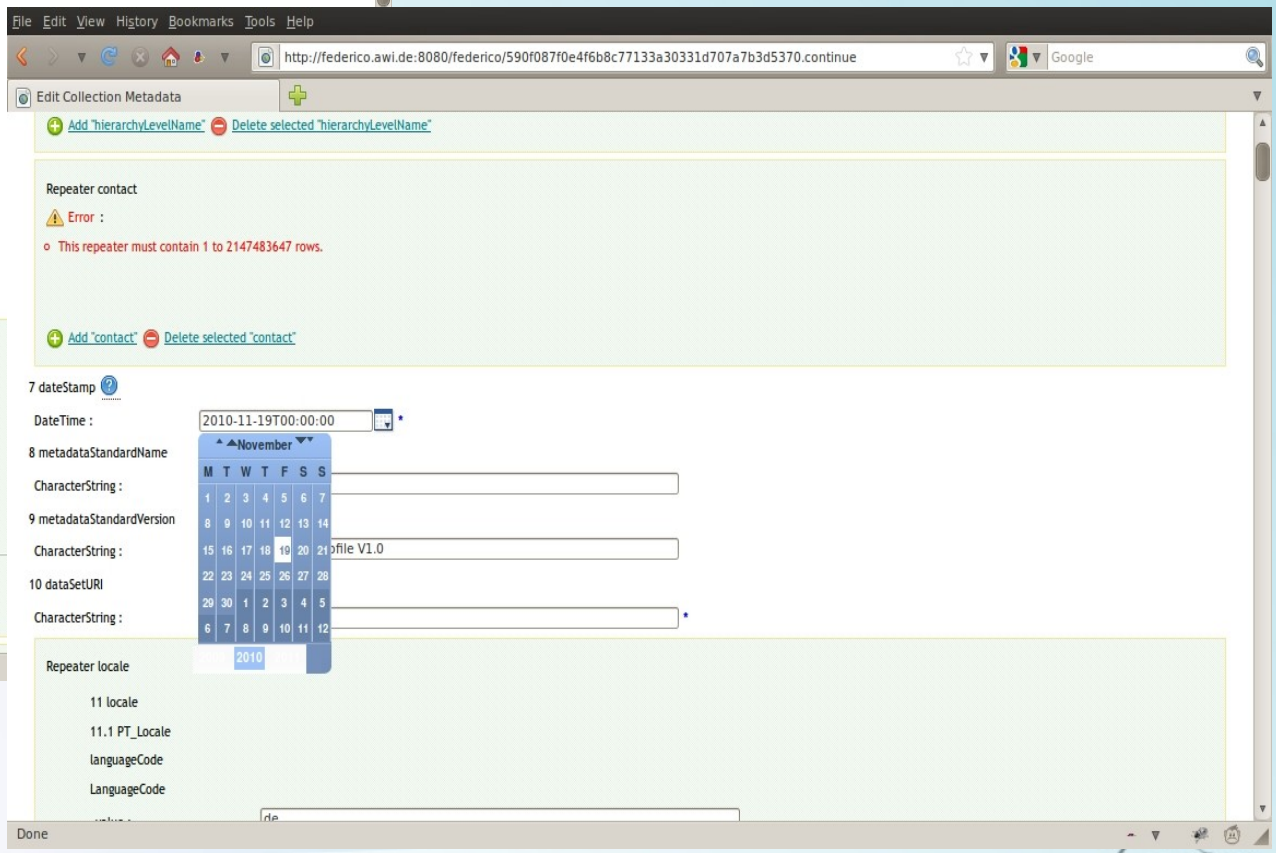
Metadata Upload



3. Federico's Live Demo: Screenshots

Metadata Edition





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