Migrating from Fedora 3 to 4

Now With More Hydra

Goals for the Session

Understand the basic conceptual models underlying Fedora 3/CMA, Fedora 4, and PCDM

Work through a rudimentary migration exercise with Hydra/Fedora-Migrate

Explore possibilities for enhancing data in Fedora 4

Differences Between Fedora 3 and 4

Conceptual Models of Repository Resources

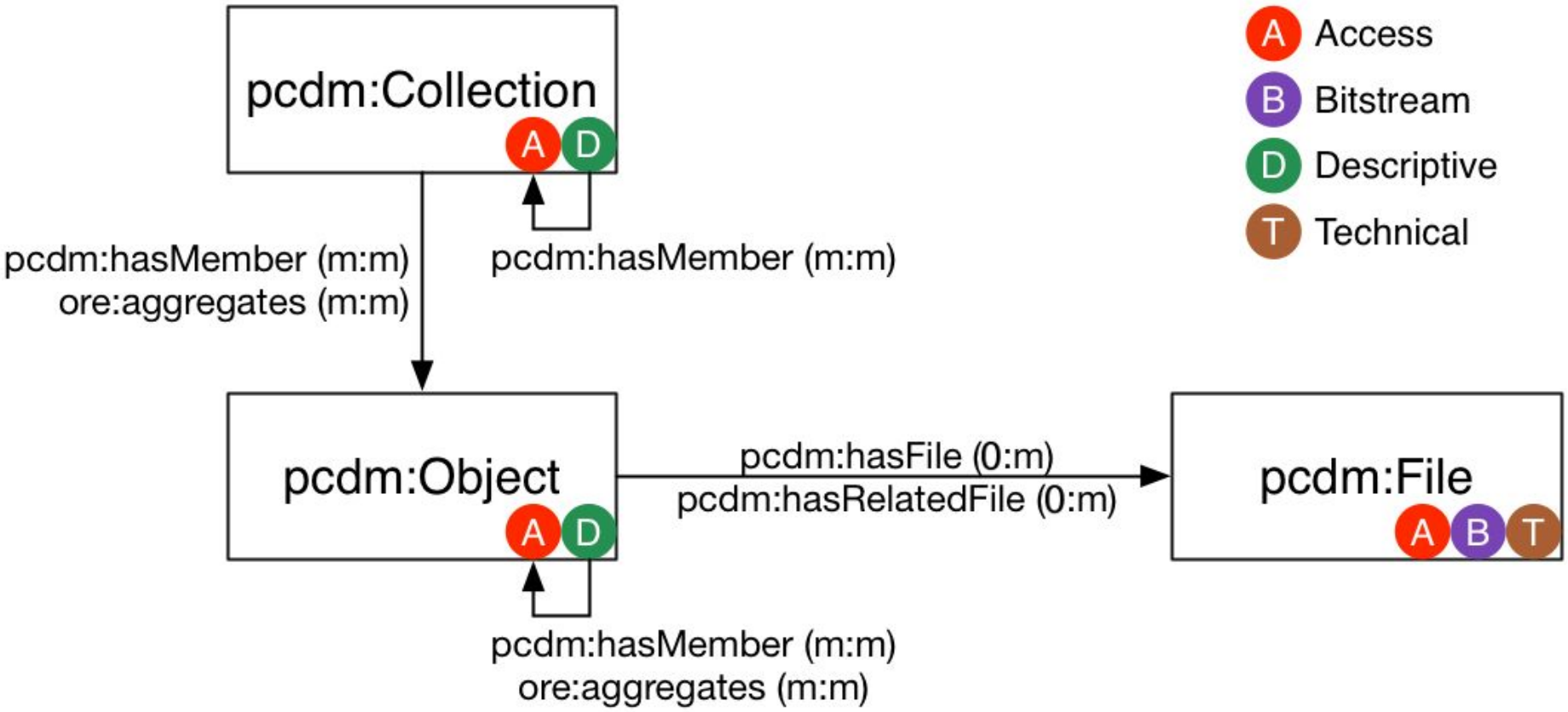
Fedora 3

- Content Model Architecture
- Objects: Collect bytestreams & properties
- Datastreams: Bytestreams in context of an object, with some properties

Fedora 4

- Linked Data Platform
- LDP RDF resources (objects & containers)
- LDP non-RDF binaries (& description)

What About PCDM?



Organization of Repository Entities

Fedora 3: Flat

- Objects and datastreams at the top level
- No inherent tree structure

Fedora 4: Hierarchy Possible

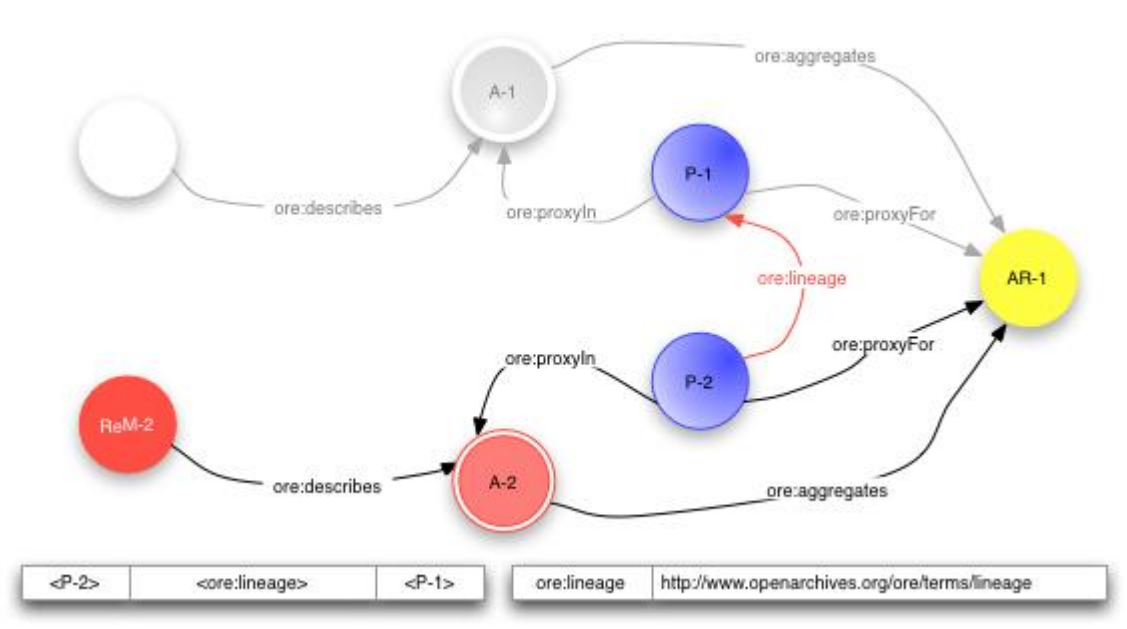
- Containers and binaries in a hierarchy
- All resources descend from a root resource

That's not really even organization

Right, in PCDM we have ORE proxies

"There's really no hierarchy in a bucket." ~ Andrew Woods

"What if you put a bucket in your bucket?" ~ Ben Armintor



Storage of Repository Data

Fedora 3: Akubra

- Objects directory and datastreams directory
- Both objects and datastreams are in a PairTree

Fedora 4: Infinispan & other MODEism

- Containers in a database (e.g. LevelDB)
- Datastreams in a PairTree directory

Identification of Repository Resources

Fedora 3: PID

- Objects have Persistent Identifers (PIDs)
- Uniform structure
- An object's PID can never be altered

Fedora 4: Path

- Resources have a repository path
- This can be user-defined or generated via an ID-minter

How Do These Concepts Correlate?

Fedora 3/CMA	**Fedora 4/LDP**	**PCDM**
Object	RDFSource/Container	AdminSet/Collection/Object
Datastream	NonRDFSource	File
PID	Path	“id”
Akubra (local)	Infinispan (clusterable)	n/a

Data Mapping

Mapping Properties - Objects

	Fedora 3	Fedora 4	Example
PID	PID	dc:identifier	prefix:1234
State	state	fedora-model:state	fedora-model:Active
Label	label	dc:title	Some Title
Created Date	createdDate	fedora:created	2014-01-20T04:34:26.331Z
Modified Date	lastModifiedDate	fedora:lastModified	2014-01-20T04:34:26.331Z
Owner	ownerID	fedora:createdBy	Chuck Norris

Mapping Properties - Datastreams

	Fedora 3	Fedora 4	Example
DSID	ID	dc:identifier	prefix:1234
State	state	fedora-model:state	fedora-model:Active
Versionable	VERSIONABLE	fedora:hasVersions	true
Label	label	ebucore:filename	Some Title
Created Date	createdDate	fedora:created	2014-01-20T04:34:26.331Z
Modified Date	N/A	fedora:lastModified	2014-01-20T04:34:26.331Z
Mimetype	MIMETYPE	ebucore:hasMimeType	image/jpg
Size	SIZE	premis:hasSize	50000

RDF Isn’t Entirely New to Fedora

http://localhost:8080/fedora-3.8.1/risearch

select $p $o from <#ri> where <info:fedora/archives:1419123/descMetadata> $p $o

Fedora 3 Sources of RDF Properties

Fedora Object Property Sources

- profile properties
- RELS-EXT
- DC
- CMA

Datastream Property Sources

- profile properties
- RELS-INT
- CMA

Containment and Structure in FCR 3

- Hints in the core RDFS vocabulary
- Sometimes implemented via Services
- or “Enhanced” content models in FCR 3.4+
- Frequently located in the application layer

Hydra Migration Tools

The Cleverly Named Fedora-Migrate

Learning Outcomes

- Fedora-Migrate Advantages & Disadvantages
- Learn basics of ActiveFedora 9 modeling
- Use fedora-migrate basic features
- Become familiar with fedora-migrate hooks
- Incorporate PCDM via hydra-works

Fedora-Migrate

Advantages, Disadvantages, Example Project

Fedora-Migrate: Advantages

You're soaking in it!

https://github.com/projecthydra-labs/fedora-migrate

- Built around the Rubydora library of Hydra <= 8
- Make data accessible and functional in the new environment
- Run migration on the stack that apps will be built on
- Very customizable
- Simplest use cases have convenient Rake support

Fedora-Migrate: Disadvantages

- Not built for speed
- Makes some assumptions about FCR 3 relationships that may require customization
  - Object-to-Object relations
  - Unidirectionality, not spidering
- No RELS-INT out of box
- No DC out of box
- Only file containment out of box
- Broader difficulty of PID to Path mapping

Fedora-Migrate: Example Project

- Example fixtures available in vagrant VM at http://localhost:8080/fedora-3.8.1
- foxml source from https://github.com/barmintor/usna_demo_hydra8
- Hydra-9 app with “fedora-migrate” at https://github.com/barmintor/fedora-migrate-workshop
  - already cloned on the vagrant
    - vagrant ssh
    - > cd fedora-migrate-workshop
    - > git pull origin # to make sure it's up to date
    - … or clone on your machine if you prefer to edit there

Fedora-Migrate: Example Project

Here's an example rake task for migrating objects by ns:

```
desc "Migrate all my objects"
task migrate: :environment do
  Work.name
  GenericFile.name
  Collection.name
  AdministrativeSet.name
  # a convenient but difficult to extend migration convenience method
  usna = FedoraMigrate.migrate_repository(namespace: "usna",options:{})
  archives = FedoraMigrate.migrate_repository(namespace: "archives",
options:{})
  report = FedoraMigrate::MigrationReport.new
  report.results.merge! usna.report.results
  report.results.merge! archives.report.results
  report.report_failures STDOUT
end
```

Fedora-Migrate: Example Project

It will also be convenient to be able to delete and reset:

```
desc "Delete all the content in Fedora 4"
task clean: :environment do
  ActiveFedora::Cleaner.clean!
end
```

This duplicates the fedora:migrate:reset Rake task. Both of these tasks can be loaded from a file under lib/tasks with the 'rake' extension.

Fedora-Migrate: Example Project

checkpoint branch:

fedora-migrate/master

has no ActiveFedora models

edits lib/tasks/migrate.rake to include clean & migrate tasks

adds some helpful overrides to FedoraMigrate methods to the rake task file

Rudimentary ActiveFedora Modeling

Rudimentary ActiveFedora Modeling

Candidate models are identified by name

Given a CModel info:fedora/afmodel:GenericFile

Fedora-Migrate will look for a model called GenericFile

The model must inherit from ActiveFedora::Base

FCR 3/4 source indicate model in RELS-EXT fedora-model:hasModel

FCR 4 source also indicates types in primaryType and mixinTypes

Datastreams are modeled by File containment

Given a Fedora 3 object that has a datastream ‘content’

Fedora-Migrate will migrate if the Fedora 4 model contains a ‘content’ resource

Assuming the ‘content’ resource class inherits from ActiveFedora::File

Rudimentary ActiveFedora Modeling

Edit app/models/generic_file.rb

```
class GenericFile < ActiveFedora::Base
  contains 'content',
    autocreate: false,
    class_name: 'ActiveFedora::File'
end
```

Consider this very basic model, and look at the Fedora 3 fixtures. What other models do we need to represent? What files ought they contain? Try migrating the descMetadata datastream.

You should be able to run rake clean & rake migrate as you iterate.

Rudimentary ActiveFedora Modeling

In the rest of the workshop, we'll want a little more control over the migration. We'll get this flexibility by calling the Fedora::Migrate movers individually. Edit lib/tasks/migrate.rake to run the movers in an editable Proc:

```
  Collection.name
  AdministrativeSet.name
  migration = Proc.new do |pid|
    source = FedoraMigrate.source.connection.find(pid)
    target = nil # has not yet been migrated!
    options = {}
    mover = FedoraMigrate::ObjectMover.new(source, target, options: options)
    mover.migrate
    target = mover.target
    mover = FedoraMigrate::RelsExtDatastreamMover.new(source, target).
migrate
  end
```

Rudimentary ActiveFedora Modeling

And call the Proc for each of the objects in our example - Edit lib/tasks/migrate.rake:

```
migration = Proc.new do |pid|
  # snipping Proc body for slide
end
assets =
  ["usna:3","usna:4","usna:5","usna:6","usna:7","usna:8","usna:9"]
works =
  ["archives:1408042", "archives:1419123", "archives:1667751"]
collections =
  ["collection:1", "collection:2"]
assets.each { |pid| migration.call(pid) }
works.each { |pid| migration.call(pid) }
collections.each { |pid| migration.call(pid) }
```

Rudimentary ActiveFedora Modeling

The sample data includes 4 FCR 3 CModels:

- GenericFile
- Work
- Collection
- AdministrativeSet*

The example migrations will be smoothest if all of them are at least minimally modeled in ActiveFedora (though workshop doesn't do much with the AdministrativeSet object).

Rudimentary ActiveFedora Modeling

Checkpoint branch:

fedora-migrate-workshop/migrate-simple

includes very simple models corresponding to the sample FCR 3 CModels

these models mix-in Hydra::Works behaviors that will be used later

edits lib/tasks/migrate.rake to run movers individually

Modeling RDF Properties in FCR 3 Datastreams

Modeling RDF Properties in FCR 3 Datastreams

Once you have basic models working with the migration task, try to migrate RDF data as properties rather than files by passing a : convert option to the RepositoryMigrator or the ObjectMover.

Look at the migrated objects to see where the models need to elaborated to support new properties. Also note that DC is not migrated by default.

Modeling RDF Properties in FCR 3 Datastreams

Some of the objects have description stored in a datastream called 'descMetadata'.

We can migrate this data simply as a contained File or, because it is RDF properties, store the properties "natively" on the FCR 4 objects.

Modeling RDF Properties in FCR 3 Datastreams

The target properties must be defined on your models:

```
class Work < ActiveFedora::Base
  property :identifier, predicate: ::RDF::Vocab::DC.identifier do |index|
    index.as :symbol, :facetable
  end
  property :title, predicate: ::RDF::Vocab::DC.title do |index|
    index.as :stored_searchable, :facetable
  end
  property :creator, predicate: ::RDF::Vocab::DC.creator do |index|
    index.as :symbol, :facetable
  end
  property :created, predicate: ::RDF::Vocab::DC.created do |index|
    index.as :stored_sortable, type: :date
  end
end
```

Modeling RDF Properties in FCR 3 Datastreams

Fedora-Migrate will then convert RDF properties if an option is passed for the appropriate datastream.

Edit your rake task:

```
source = FedoraMigrate.source.connection.find(pid)
target = nil # create a new target
options = { convert: "descMetadata" } # map DS as properties
mover = FedoraMigrate::ObjectMover.new(source, target, options)
mover.migrate
```

… then run rake clean && migrate. Make sure the options hash is passed correctly (no {options: …} key should be used).

Modeling RDF Properties in FCR 3 Datastreams

Checkpoint branch:

fedora-migrate-workshop/migrate-metadata

defines properties for all the descMetadata statements on the Work model

edits lib/tasks/migrate.rake to include the convert options

Customizing Fedora-Migrate with Hooks

Customizing Fedora-Migrate with Hooks

Hooks are defined in FedoraMigrate::Hooks

Methods similar to action filters on Rails controllers, or callbacks on ActiveRecord objects.

Mover#migrate implementations follow this pattern:

1. before hook
2. migrate action
3. after hook
4. save

Customizing Fedora-Migrate with Hooks

Define a state property on your models:

```
class Work < ActiveFedora::Base
  include Hydra::Works::WorkBehavior
  property :state,
    predicate: ActiveFedora::RDF::Fcrepo::Model.state,
    multiple: false do |index|
      index.as :symbol, :facetable
    end
end
```

You'll need to add this property to all 4 models!

Customizing Fedora-Migrate with Hooks

Modules like this represent RDF vocabularies:

```
class Work < ActiveFedora::Base
  include Hydra::Works::WorkBehavior
  property :state,
    predicate: ActiveFedora::RDF::Fcrepo::Model.state,
    multiple: false do |index|
      index.as :symbol, :facetable
    end
end
```

The URI objects for the RDF properties and instances are accessible as properties (above) or as a hash (::Model[:state]).

Customizing Fedora-Migrate with Hooks

Override a hook to migrate object state:

```
module FedoraMigrate::Hooks
  def after_object_migration
    states = {'A' => :Active, 'I' => :Inactive, 'D' => :Deleted }
    if states.has_key? source.state
      state = states[source.state]
      target.state =
        ActiveFedora::RDF::Fcrepo::Model[state]
    end
  end
end
```

rake clean && migrate

Customizing Fedora-Migrate with Hooks

Checkpoint branch:

fedora-migrate-workshop/migrate-hook

defines a state property in the 4 ActiveFedora models

edits lib/tasks/migrate.rake to set the state property in an after_object_migration hook

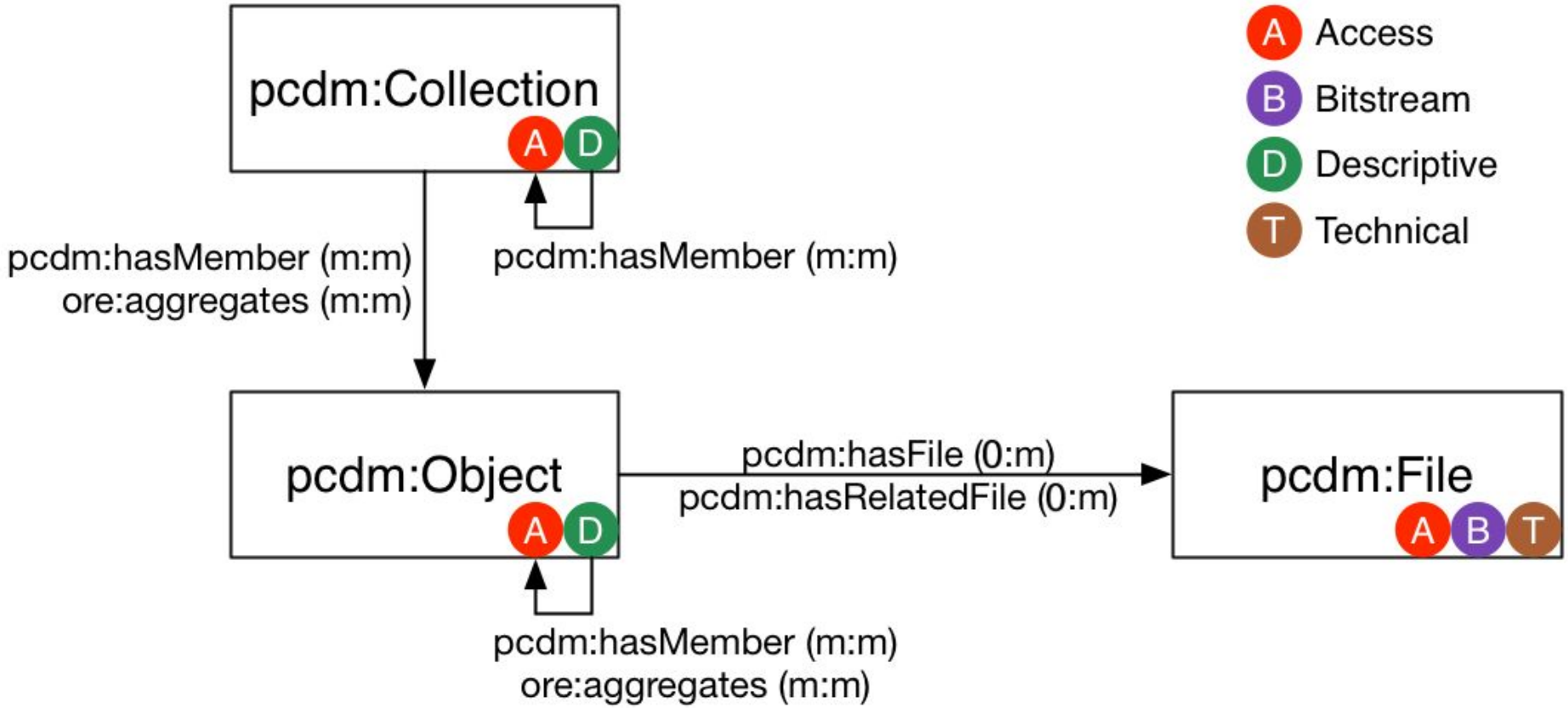
PCDM via Hydra-Works

PCDM via Hydra-Works

Hydra-Works brings an implementation of PCDM to ActiveFedora. This impacts the way that membership and structure are modeled: It introduces LDP DirectContainers for the former and Proxies for the latter.

PCDM via Hydra-Works

If we were starting from scratch, we would add Hydra:: Works model mixins to our models, identifying their PCDM role as appropriate.



PCDM via Hydra-Works

Collection maps to pcdm:Collection

Work and GenericFile are both types of pcdm: Object

AdministrativeSet was borrowed directly from PCDM

PCDM via Hydra-Works

A pcdm:FileSet is a group of related Files, typically a single master File and its derivatives. These Files can be immediately contained, or be aggregated FileSets. Our corresponding model is GenericFile.

A pcdm:Work is intended to represent "intellectual entities" or "objects". Its members may be FileSets or other Works. This corresponds to our Work model.

PCDM via Hydra-Works

Hydra::Works::FileSetBehavior

- adds directly contained Files via properties "original_file", "thumbnail" and "extracted_text"
- adds a derivative generation mixin that you may use to create thumbnails

```
class GenericFile < ActiveFedora::Base
  include Hydra::Works::FileSetBehavior
  property :state, predicate: ActiveFedora::RDF::Fcrepo::Model.
state, multiple: false do |index|
    index.as :symbol, :facetable
  end
end
```

PCDM via Hydra-Works

We need to implement a FedoraMigrate::Mover that is aware of this mixin:

```
module FedoraMigrate::Works
  class FileSetMover < FedoraMigrate::ObjectMover
    def migrate_content_datastreams
      super
      if target.is_a?(GenericFile) && (ds = source.datastreams['content'])
        ofile = target.build_original_file
        mover = FedoraMigrate::DatastreamMover.new(ds, ofile, options)
        target.original_file = ofile
        save
        report.content_datastreams << ContentDatastreamReport.new(ds.id, mover.
migrate)
      end
    end
  end
end
```

PCDM via Hydra-Works

Once the content DS is migrating to the original_file property, we can generate derivatives in the rake task, for example:

```
source = FedoraMigrate.source.connection.find(pid)
target = nil
options = { convert: "descMetadata" }
mover = FedoraMigrate::Works::FileSetMover.new(source, target, options)
mover.migrate
target = mover.target
mover = FedoraMigrate::RelsExtDatastreamMover.new(source, target).migrate
target.create_derivatives if target.is_a?(GenericFile)
```

Be advised that this is somewhat slow- you may want to restrict the migration to a single object for expediency.

PCDM via Hydra-Works

With suitable libraries installed, Hydra-Works can create derivatives for more than images- but it requires characterization:

```
source = FedoraMigrate.source.connection.find(pid)
target = nil
options = { convert: "descMetadata" }
mover = FedoraMigrate::Works::FileSetMover.new(source, target, options)
mover.migrate
target = mover.target
mover = FedoraMigrate::RelsExtDatastreamMover.new(source, target).migrate
if target.is_a?(GenericFile)
  Hydra::Works::CharacterizationService.run(target)
  target.save
  target.create_derivatives
end
```

PCDM via Hydra-Works

The characterization service does basic format analysis via FITS, and adds some technical metadata to our FileSet objects based on original_file.

ns001: **state**
info:fedora/fedora-system:def/model#Active
ns003: **hasFile**
http://localhost:8080/fcrepo/rest/dev/6/files/586e7
http://localhost:8080/fcrepo/rest/dev/6/files/7a033
ns005: **exifVersion**
9.06
ns005: **orientation**
normal*
ns005: **software**
Adobe Photoshop 7.0
ns006: **hashValue**
b8a86a3750e1dfae7700cb6ffdbe6638
ns007: **compressionScheme**
JPEG (old-style)
premis: **hasCreatingApplicationVersion**
0.6.2
premis: **hasFormatName**
JPEG File Interchange Format

PCDM via Hydra-Works

Hydra::Works::WorkBehavior implements ordered versions of membership properties: ordered_members, and filtered accessors like ordered_file_sets & ordered_works

```
class Work < ActiveFedora::Base
  include Hydra::Works::WorkBehavior
  property :state, predicate: ActiveFedora::RDF::Fcrepo::Model.
state, multiple: false do |index|
    index.as :symbol, :facetable
  end
end
```

PCDM via Hydra-Works

The sample FCR 3 Work objects have ordered lists in a METS structMap, stored in a datastream called 'structMetadata'. For the membership to reflect this order, we need a new FedoraMigrate::Mover implementation.

```
class Work < ActiveFedora::Base
  include Hydra::Works::WorkBehavior
  property :state, predicate: ActiveFedora::RDF::Fcrepo::Model.
state, multiple: false do |index|
    index.as :symbol, :facetable
  end
end
```

PCDM via Hydra-Works

```
module FedoraMigrate
  module Works
    class StructureMover < FedoraMigrate::Mover
      def migrate
        before_structure_migration
        migrate_struct_metadata
        after_structure_migration
        save
        super
      end
      def migrate_struct_metadata
        ds = source.datastreams['structMetadata']
        if ds
          ns = {mets: "http://www.loc.gov/METS/"}
          structMetadata = Nokogiri::XML(ds.content)
          members = {}
```

PCDM via Hydra-Works

```
class FedoraMigrate::Works::StructureMover < FedoraMigrate::Mover
  def migrate; … end
  def migrate_struct_metadata
    ds = source.datastreams['structMetadata']
    if ds
      ns = {mets: "http://www.loc.gov/METS/"}
      structMetadata = Nokogiri::XML(ds.content)
      members = {}
      structMetadata.xpath("/mets:structMap/mets:div", ns).each do |node|
        members[node["ORDER"]] = node["CONTENTIDS"]
      end
      members.keys.sort {|a,b| a.to_i <=> b.to_i}.each do |key|
        member_id = id_component(members[key])
        member = ActiveFedora::Base.find(member_id)
        target.ordered_members << member
     end
    end
  end
end
```

PCDM via Hydra-Works

```
class FedoraMigrate::Works::StructureMover < FedoraMigrate::Mover
  def migrate; … end
  def migrate_struct_metadata; … end
  # borrowed from FedoraMigrate::RelsExtDatastreamMover
  def migrate_object(fc3_uri)
    id_comp = id_component(fc3_uri)
    base_uri = ActiveFedora::Base.id_to_uri(id_comp)
    RDF::URI.new(base_uri)
  end
end
```

PCDM via Hydra-Works

With the mover implemented, you can add it to the migration in the rake task (remember to stub the hooks as well):

```
    if target.is_a?(GenericFile)
      Hydra::Works::CharacterizationService.run(target)
      target.save
      target.create_derivatives
    end
    if target.is_a?(Work)
      FedoraMigrate::Works::StructureMover.new(source, target, options).
migrate
    end
```

PCDM via Hydra-Works

After running "rake clean" and "rake migrate", you should now see different contained resources for the works:

Constitution of the United States

Home / dev / 1667751

UUID

Created at

2016-03-05T19:20:44.494Z by fedoraAdmin

Last Modified at

2016-03-05T19:20:58.91Z by fedoraAdmin

Children 2

1. http://localhost:8080/fcrepo/rest/dev/1667751/members
2. http://localhost:8080/fcrepo/rest/dev/1667751/list_source

PCDM via Hydra-Works

Checkpoint branch:

fedora-migrate-workshop/migrate-works

uses Hydra::Works to order the FileSets belonging to a Work via Proxies in DirectContainers

edits lib/tasks/migrate.rake to create derivatives of GenericFiles with the FileSetBehavior mixin

Questions? Ideas?

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