

Open Archives Initiative Object Re-Use & Exchange

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OAI Object Re-Use & Exchange: A Status Report
DLF Fall 2007, Philadelphia, PA, November 6th 2007



OAI Object Re-Use and Exchange

- OAI-ORE is a new interoperability effort conducted under the umbrella of the OAI
- Supported by the **Andrew W. Mellon Foundation**; additional support from the **National Science Foundation** and **Microsoft**
- International effort; October 2006 - September 2008:
 - Coordinators: Carl Lagoze & Herbert Van de Sompel
 - ORE Technical Committee: 13 international members
 - ORE Liaison Group: 8 international members
 - ORE Advisory Committee: 16 international members
 - Representing: scholarly publishers and aggregators, eScience, eHumanities, education, search engines, various repository systems, digital library efforts, related standardization efforts, etc.
- See <http://www.openarchives.org/ore/>
- See <http://www.ctwatch.org/quarterly/articles/2007/08/interoperability-for-the-discovery-use-and-re-use-of-units-of-scholarly-communication/> for a paper



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OAI Object Re-Use and Exchange

Core goal of OAI-ORE:

Facilitate Use and Re-Use of Compound Information Objects (and of their component parts)

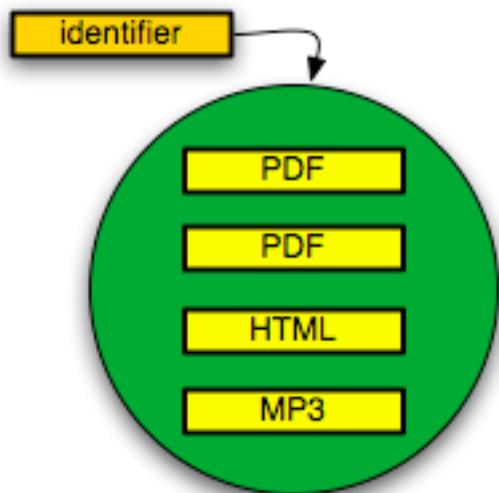


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DLF Fall 2007, Philadelphia, PA, November 6th 2007



Compound Information Objects

Units of scholarly communication are compound information objects:



Identified, bounded aggregations of related information units that form a logical whole.

Components of a compound object may vary according to:

- Semantic type: book, article, software, dataset, simulation, ...
- Media type: text, image, audio, video, mixed
- Media format: PDF, HTML, JPEG, MP3, ...
- Network location
- Relationships: internal, external



Scholarly Examples

The screenshot shows a web browser displaying a scientific article from arXiv.org. The URL in the address bar is <http://arxiv.org/abs/astro-ph/0611775>. The page title is "Accelerating cosmologies tested by distance measures". The authors listed are V. Barger, Y. Gao, D. Marfatia. The text summary discusses testing various cosmological models against supernova data. Below the summary, there are sections for "Comments", "Subjects", "Journal reference", "DOI", and "Cite as". The "Cite as" section includes a DOI link ([10.1016/j.physletb.2007.03.021](https://doi.org/10.1016/j.physletb.2007.03.021)) and a direct arXiv link ([arXiv:astro-ph/0611775v3](http://arxiv.org/abs/astro-ph/0611775v3)). The "Submission history" section lists three versions: v1 (Sat, 25 Nov 2006), v2 (Wed, 6 Dec 2006), and v3 (Tue, 23 Jan 2007). A note at the bottom asks "Which authors of this paper are endorsers?". On the right side, there is a sidebar titled "Download:" with links to PostScript, PDF, and Other formats. Another sidebar titled "References & Citations" lists SLAC-SPIRES HEP, NASA ADS, and CiteBase. At the bottom right are links for "1 trackback (?)", "previous | next", and "Link back to: arXiv, form interface".

<http://arxiv.org/abs/astro-ph/0611775>



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DLF Fall 2007, Philadelphia, PA, November 6th 2007



And more scholarly examples ...

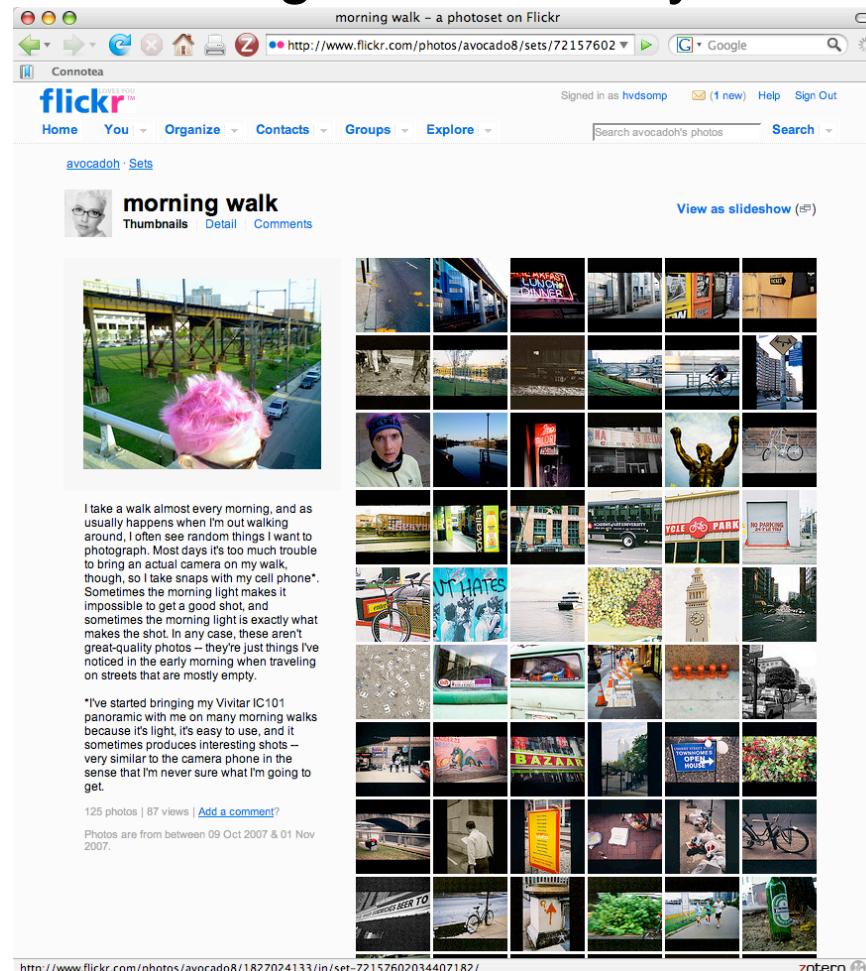
- A scholarly publication stored in an ePrint repository such as arXiv or in a DSpace, ePrints, or Fedora repository. This typically consists of a human readable "splash page", and paper in multiple formats such as LaTeX, PDF, and HTML. In addition, the publication may have citation links to other publications, each existing as one or more resources.
- Published scientific results that, in addition to the features of the scholarly publication described above, incorporate data plus the tools to visualize and analyze that data.
- A semantically-linked group of cellular images - each image available in distributed repositories from research laboratories, museums, libraries, and the like - in the manner implemented in the [ImageWeb Project](#).
- Archaeological assemblies of images, maps, charts, and find lists.
- An ARTstor image object that is the aggregation of various renderings of the same source image.



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DLF Fall 2007, Philadelphia, PA, November 6th 2007



But these things are not only scholarly ...



<http://www.flickr.com/photos/avocado8/sets/7215760203407182/>



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OAI Object Re-Use and Exchange

Core goal of OAI-ORE:

Facilitate Use and Re-Use of Compound Information Objects (and of their component parts)

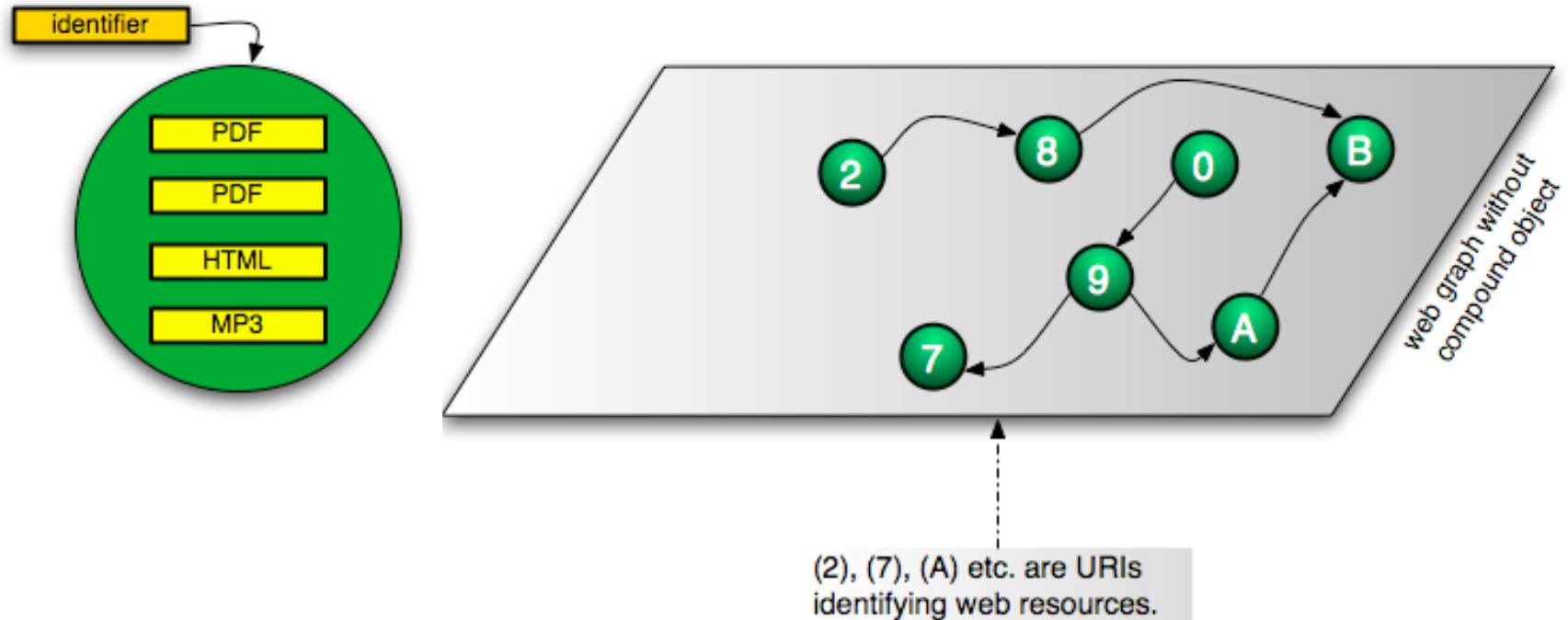
So what again is the problem with compound information objects on the Web?



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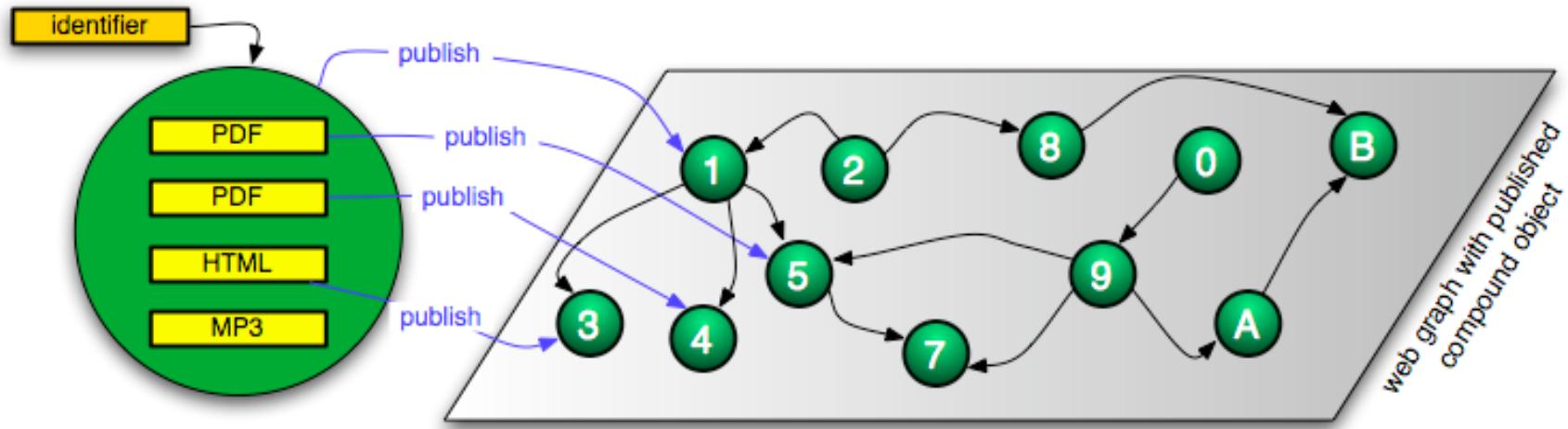
Publishing a Compound Object to the Web



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DLF Fall 2007, Philadelphia, PA, November 6th 2007



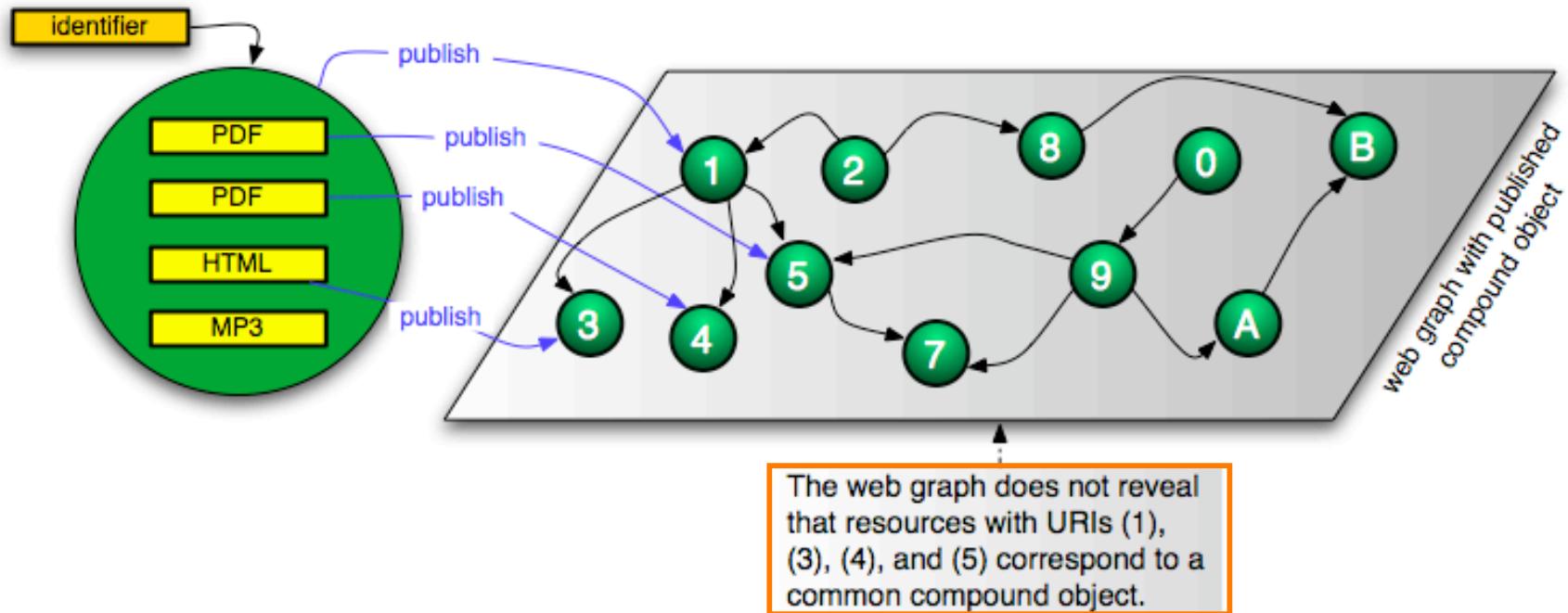
Publishing a Compound Object to the Web



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Publishing a Compound Object to the Web: Issue



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OAI Object Re-Use and Exchange

Core goal of OAI-ORE:

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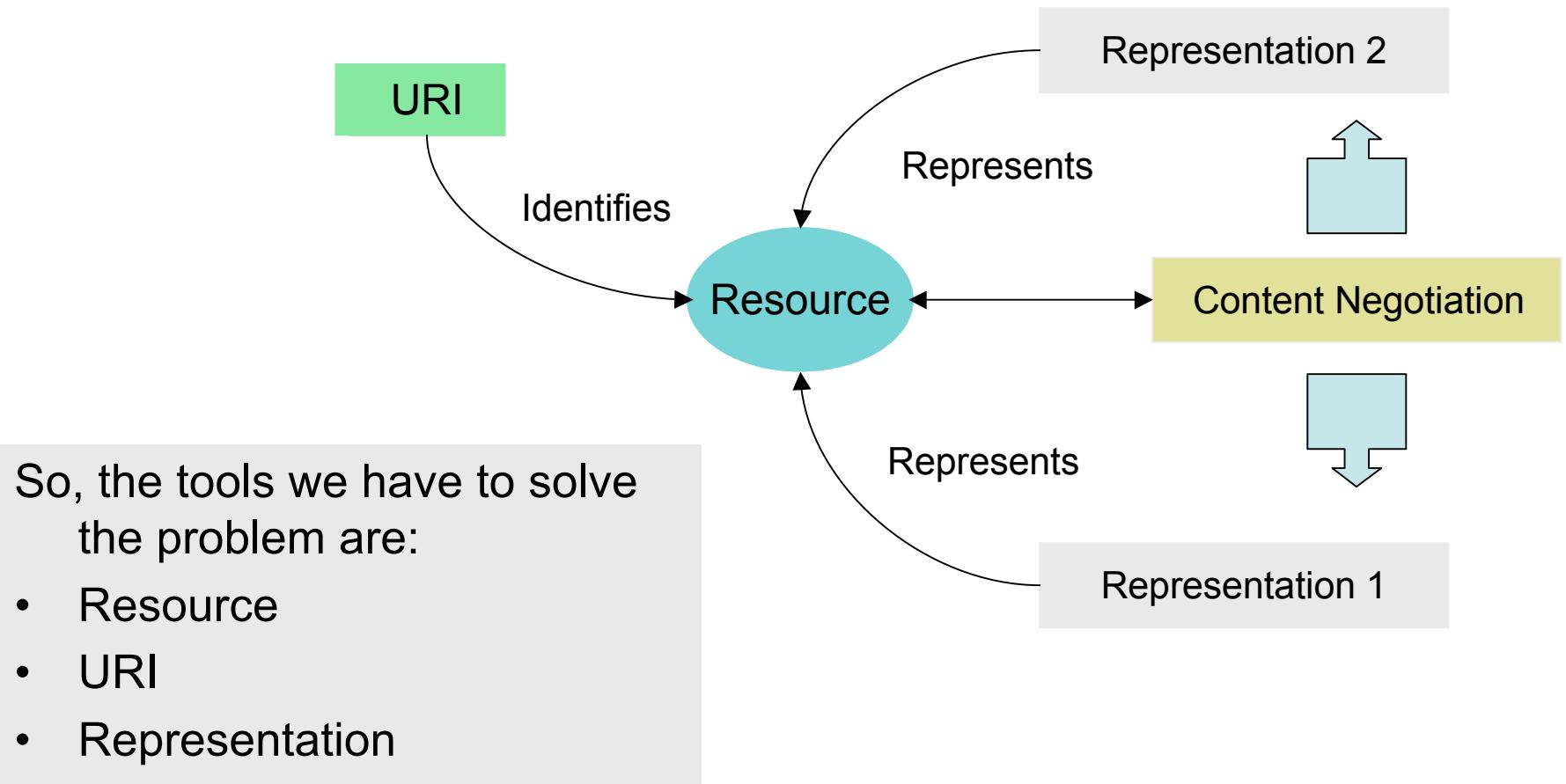
How to deal with compound information objects in a manner that is in sync with the Web architecture?



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W3C Web Architecture



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OAI Object Re-Use and Exchange

Core goal of OAI-ORE:

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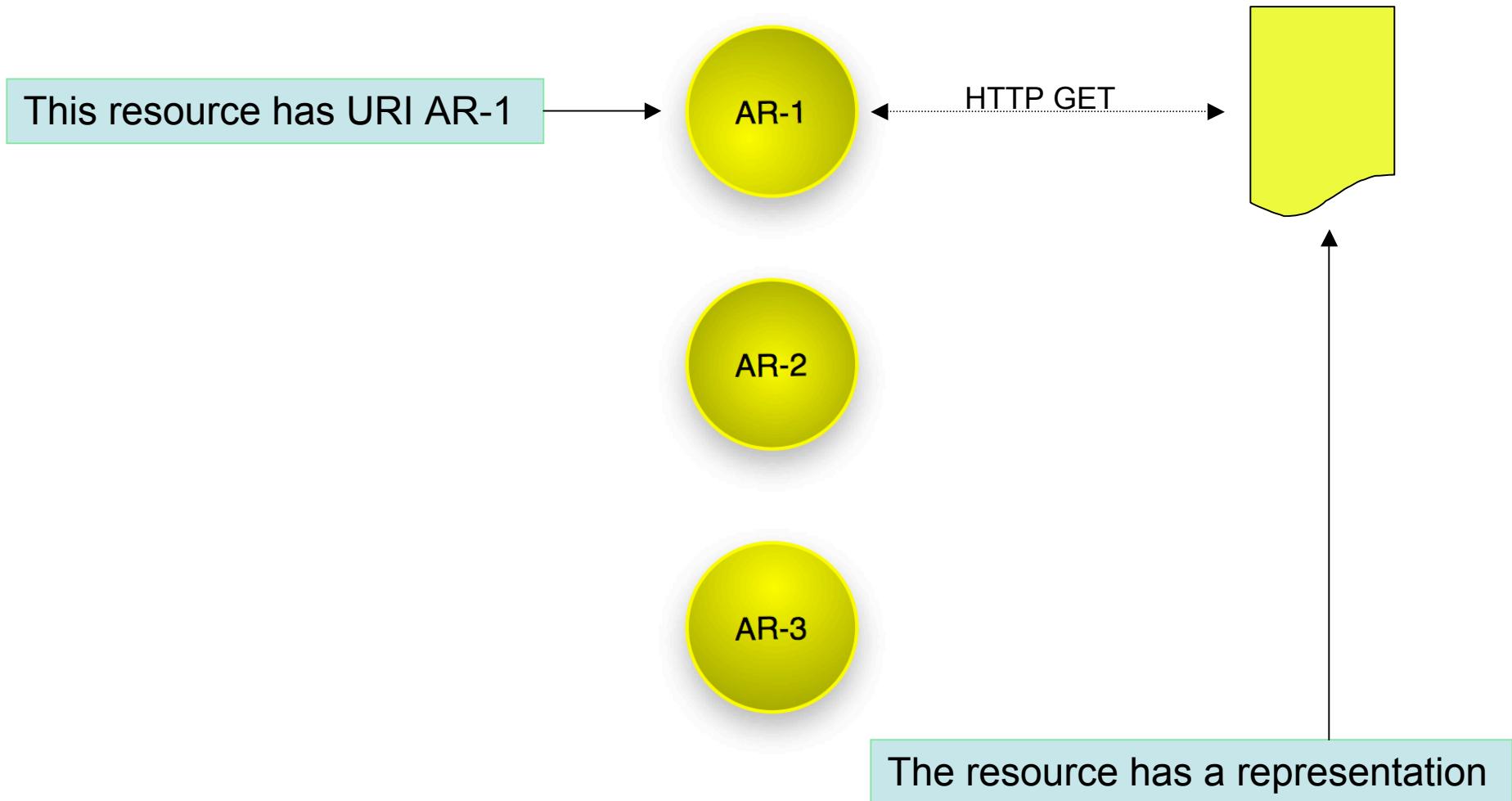
OK, let's work with the Web tools we have.



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It starts with some resources that belong together

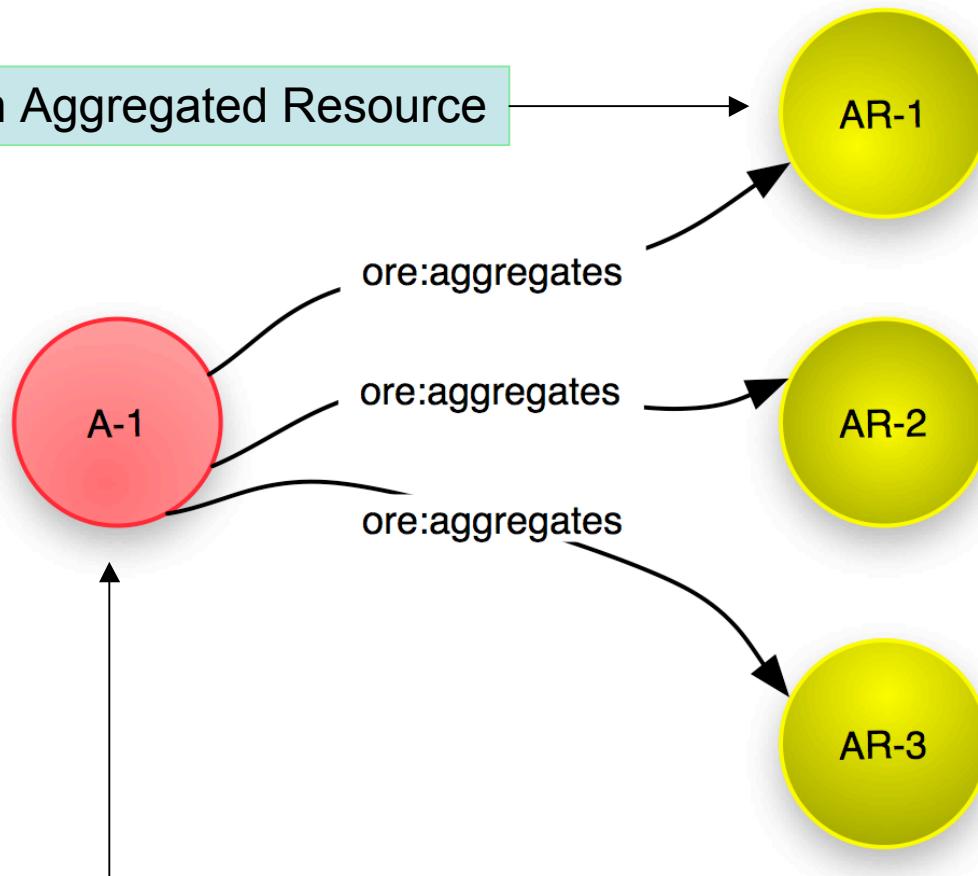


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DLF Fall 2007, Philadelphia, PA, November 6th 2007



Bring these resources together: Aggregation

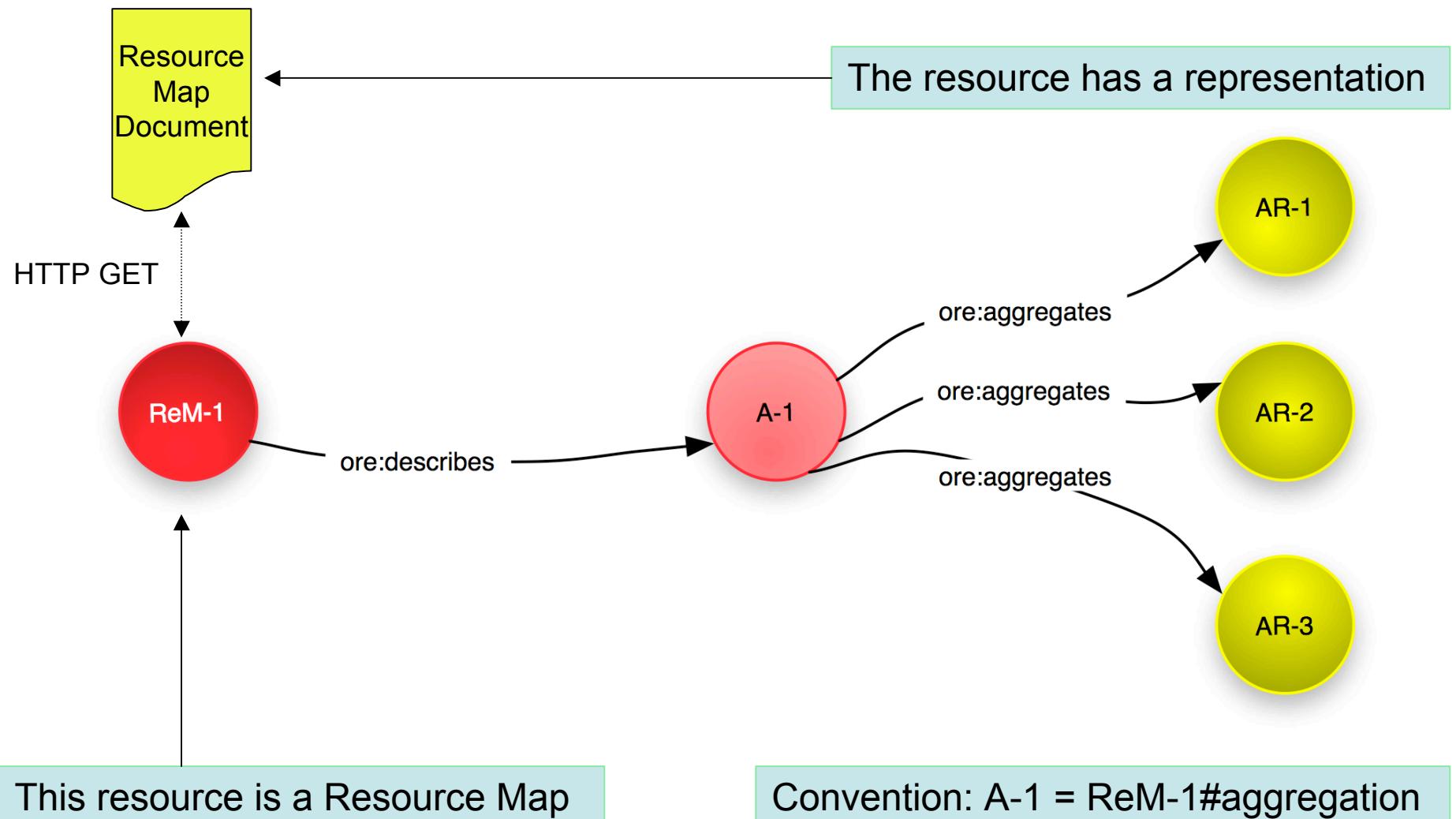
This resource is an Aggregated Resource



This resource is an Aggregation

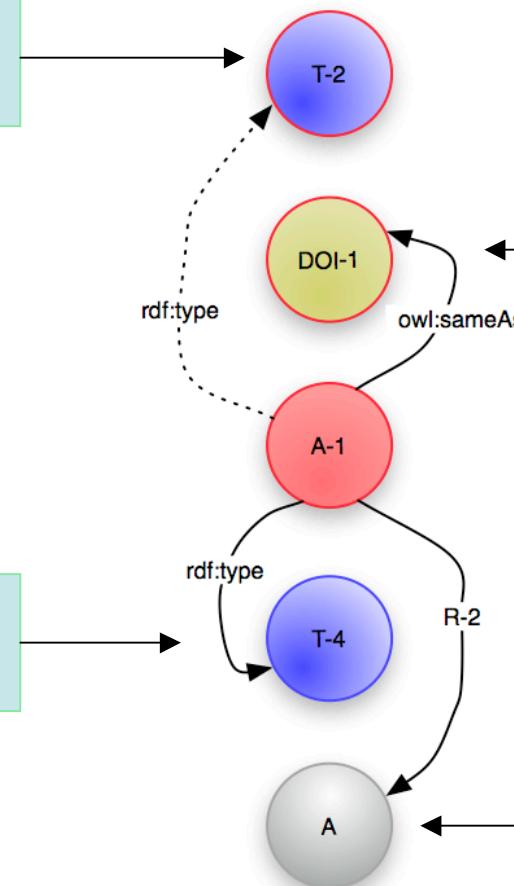


Describe this Aggregation: Resource Map



The Resource Map can describe more

The resource with URI A-1
is an Aggregation



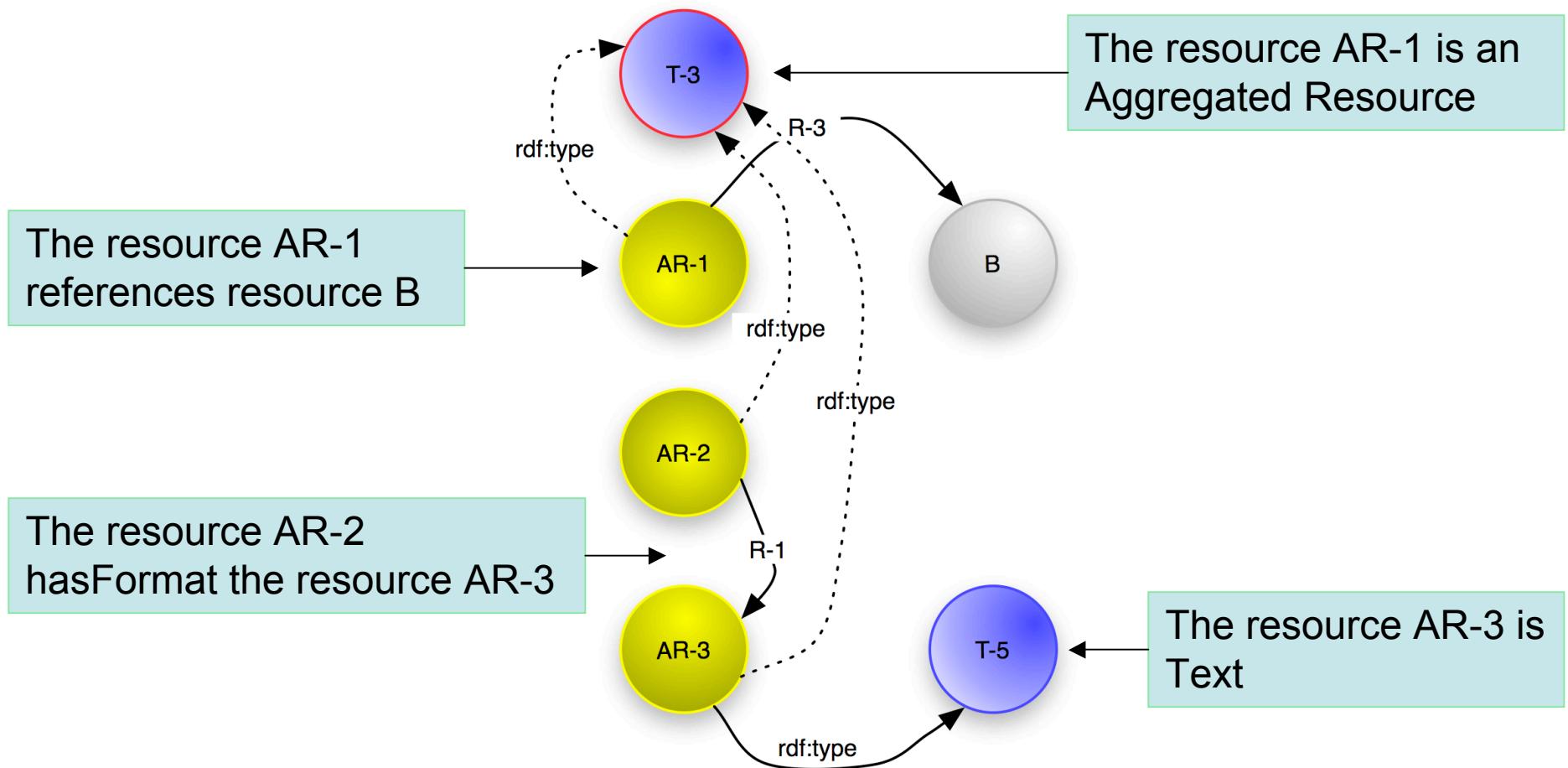
Other identifiers for
the Aggregation

The resource A-1 is a
journal article

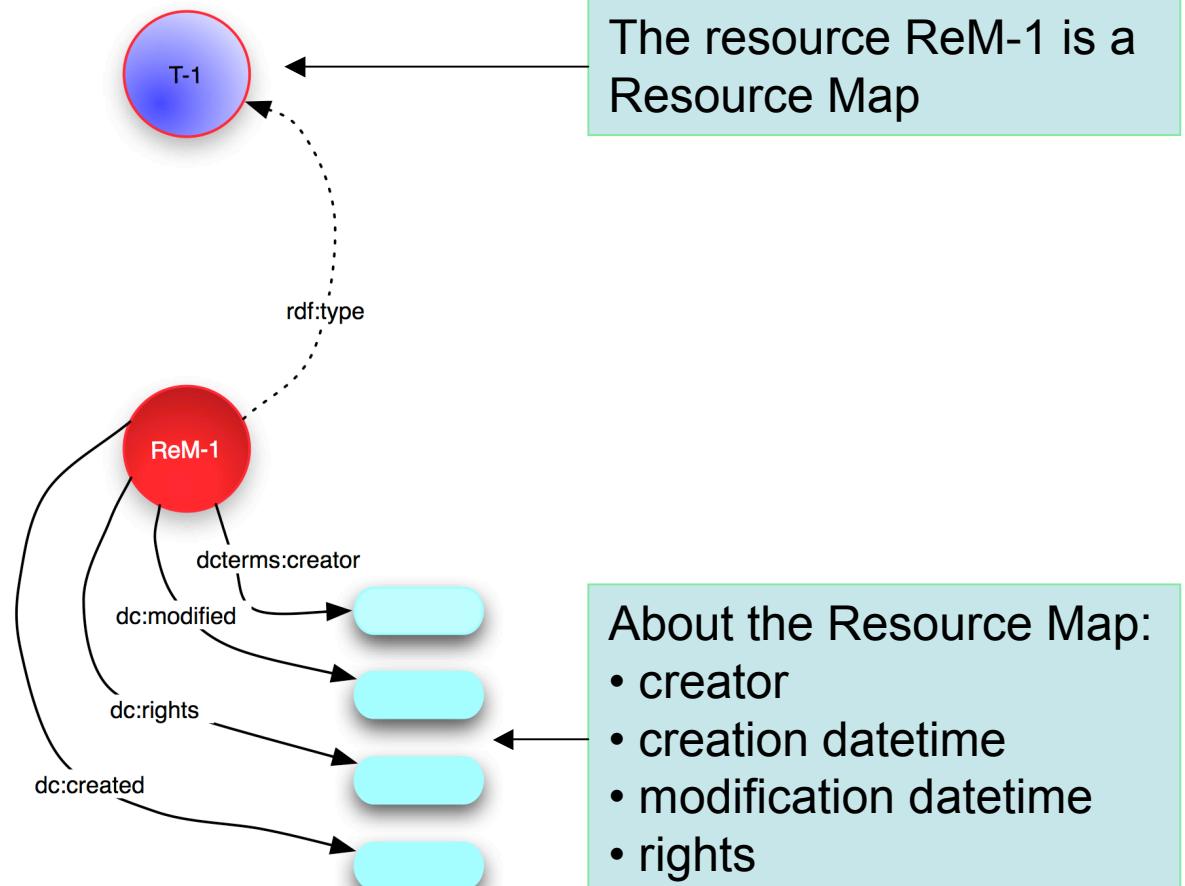
The resource A-1 isPartOf
the resource A



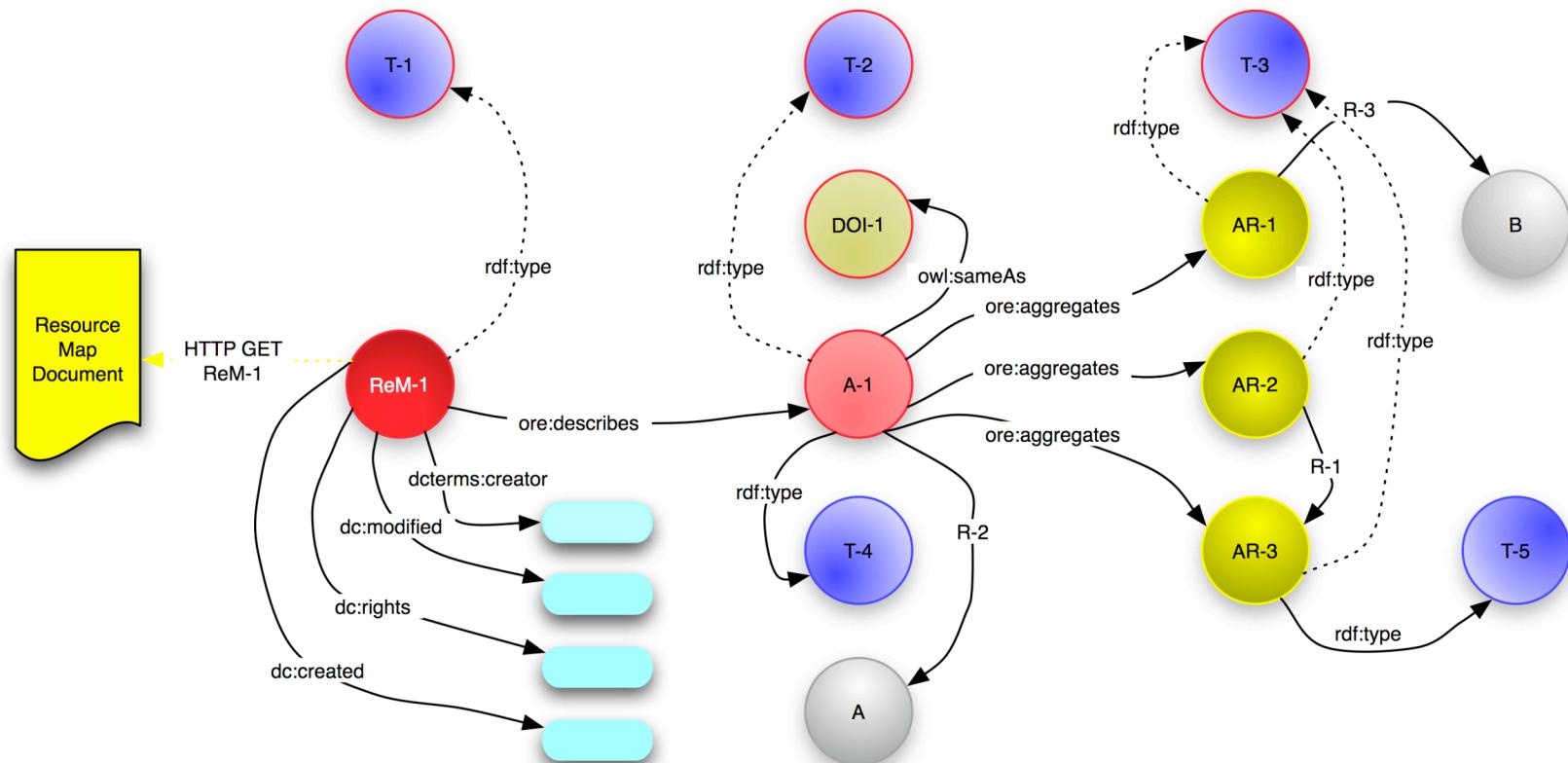
The Resource Map can describe more



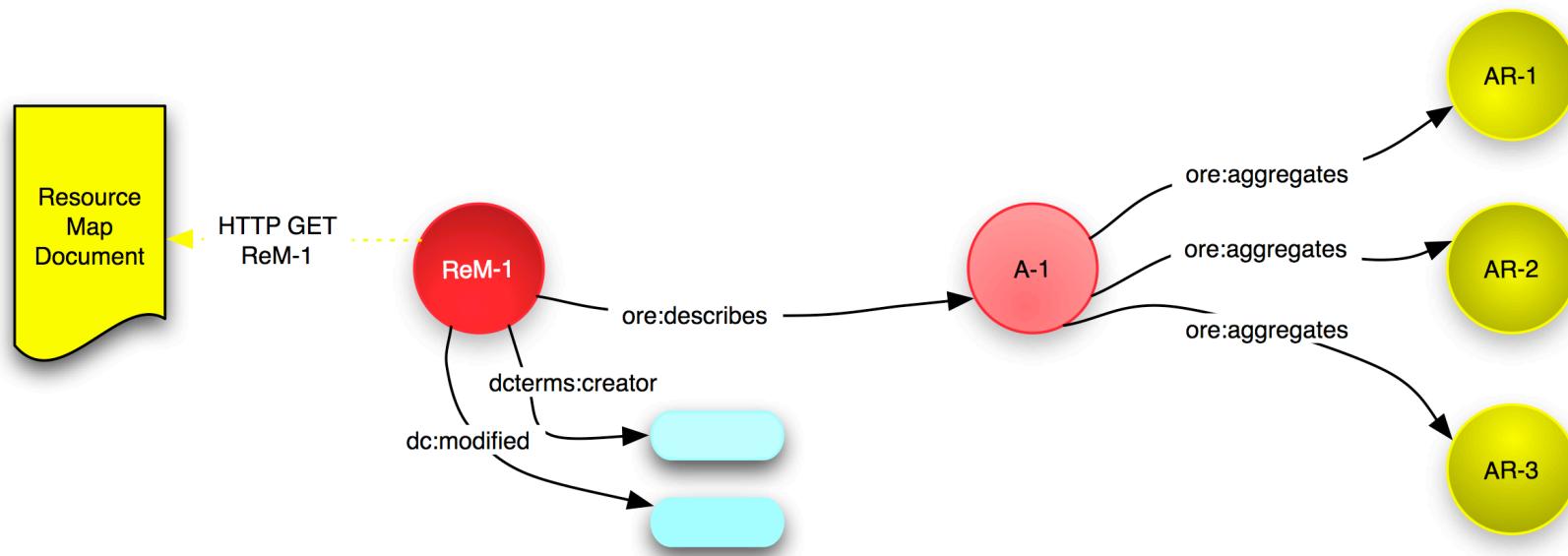
The Resource Map can describe more



So, the Resource Map can describe a lot ...



But it minimally describes this ...



The ORE Data Model

- All of this is formalized in the *ORE Abstract Data Model*
- The Data Model leverages:
 - Web Architecture
 - Semantic Web
 - Named Graphs
- This is explained in a simple manner in the *Data Model Overview User Guide*

The screenshot shows a web browser window displaying the "ORE Specification - Abstract Data Model" document. The page includes the Open Archives Initiative logo, a "Done" button, and a "zotero" watermark.

Open Archives Initiative Object Reuse and Exchange

ORE Specification - Abstract Data Model
15 October 2007

This version: <http://www.openarchives.org/ore/0.1/datamodel>
Latest version: <http://www.openarchives.org/ore/datamodel>
Previous version: none

Editors (OAI Executive)
Carl Lagoze, Cornell University Information Science
Herbert Van de Sompel, Los Alamos National Laboratory

Editors (ORE Technical Committee)
Michael Nelson, Old Dominion University
Robert Sanderson, University of Liverpool
Simeon Warner, Cornell University Information Science

Abstract
Open Archives Initiative Object Reuse and Exchange (OAI-ORE) defines standards for the description and exchange of aggregations of Web resources. This document describes the abstract data model that is the foundation for these standards. This model is conformant with the Architecture of the World Wide Web [Web Architecture] and leverages Named Graphs [Named Graph] as a mechanism for encapsulating RDF descriptions [RDF Concepts] about aggregations. This specification is one of several documents comprising the [OAI-ORE specification and user guide](#).

Table of Contents

- 1. Introduction
 - 1.1 Notational Conventions
 - 1.2 Namespaces
- 2. Architectural Foundations
 - 2.1 Web Architecture
 - 2.1 Semantic Web and RDF
 - 2.2 Named Graphs
- 3. Aggregation
- 4. Resource Map (ReM)
 - 4.1 Identification of a Resource Map (URI-R)
 - 4.2 Identification of an Aggregation (URI-A)
 - 4.3 Semantics of URI-A and URI-R
- 5. RDF Graph of a Resource Map
 - 5.1 Relationship between a Resource Map and an Aggregation
 - 5.2 Metadata about the Resource Map
 - 5.3 Other identifiers and properties of the Aggregation
 - 5.4 Aggregated resources and the Aggregation Graph
 - 5.5 Internal Relationships
 - 5.6 External Relationships of an Aggregation
 - 5.7 Lineage Relationships
 - 5.7.1 Reference in context
 - 5.7.2 Recursive nesting of Aggregations
 - 5.7.3 Expressing lineage of a nested Aggregation
- 6. References

Done zotero



OAI Object Re-Use and Exchange

Core goal of OAI-ORE:

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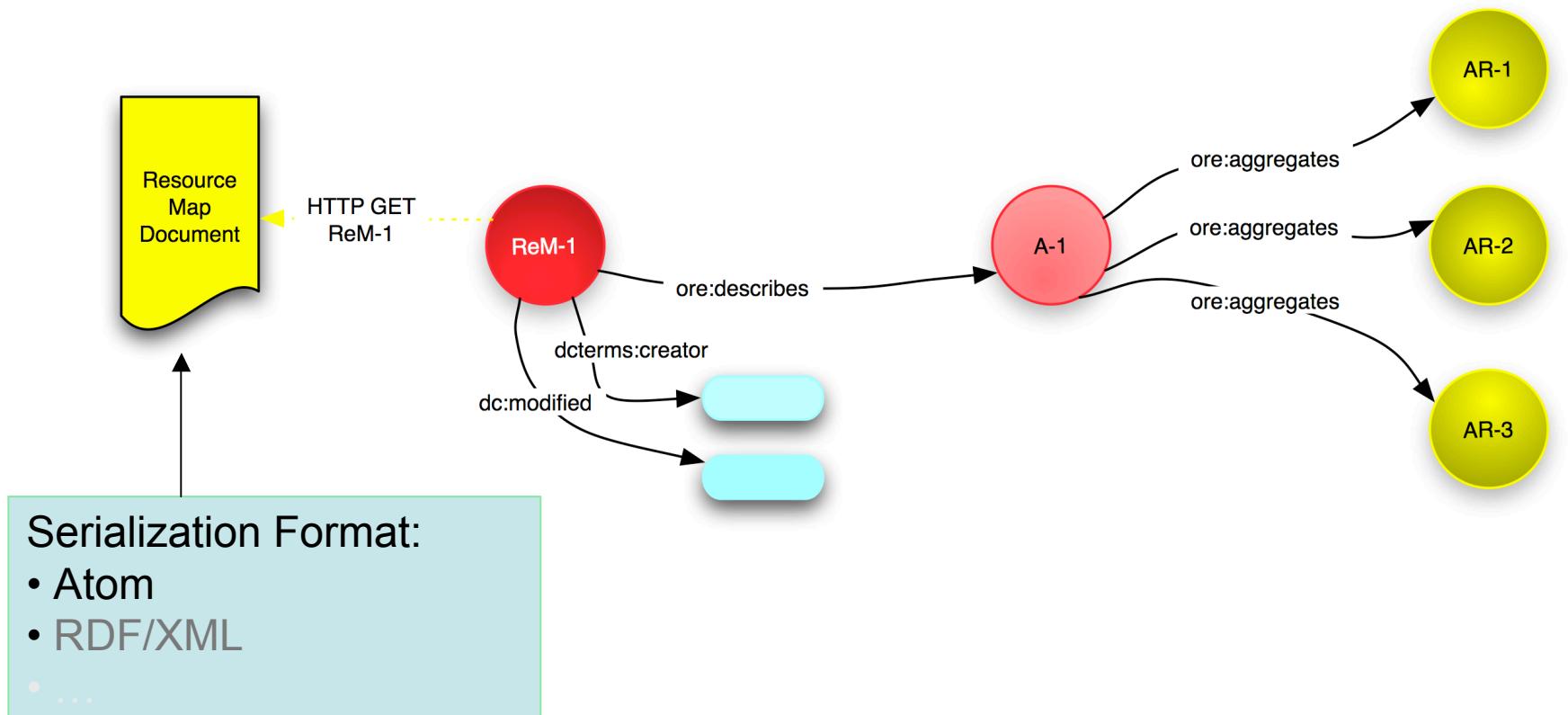
We still need real Resource Map Documents.



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Serializing a Resource Map: the Resource Map Document



Atom Syndication Format

- RFC 4287
- XML-based Document Format
- Describes a list of related information known as a **feed**
- Feed consists of items known as **entries**
- Atom defines metadata for feed and entries
- Atom allows extensibility for feed and entries



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DLF Fall 2007, Philadelphia, PA, November 6th 2007



Atom Resource Map Document Skeleton

```
<?xml version="1.0" encoding="utf-8"?>
<feed xmlns="http://www.w3.org/2005/Atom">

  <id>tag:arxiv.org,2007:astro-ph/0601007v2</id>
  <category scheme="http://www.openarchives.org/ore/terms/"
    term="http://www.openarchives.org/ore/terms/ResourceMap" label="Resource Map" />

  <entry>
    <id>tag:arxiv.org,2007:astro-ph/0601007v2:pdf</id>
  </entry>

  <entry>
    <id>tag:arxiv.org,2007:astro-ph/0601007v2:ps</id>
  </entry>

  <entry>
    <id>tag:arxiv.org,2007:astro-ph/0601007v2:e-print</id>
  </entry>

</feed>
```



OAI Object Re-Use & Exchange:A Status Report
DLF Fall 2007, Philadelphia, PA, November 6th 2007



Resource Map URI ; Aggregated Resource URI

```
<?xml version="1.0" encoding="utf-8"?>
<feed xmlns="http://www.w3.org/2005/Atom">

  <id>tag:arxiv.org,2007:astro-ph/0601007v2</id>
  <link href="http://arxiv.org/rem/astro-ph/0601007" rel="self" type="application/atom+xml"/>
  <category scheme="http://www.openarchives.org/ore/terms/" term="http://www.openarchives.org/ore/terms/ResourceMap" label="Resource Map" />

  <entry>
    <id>tag:arxiv.org,2007:astro-ph/0601007v2:ps</id>
    <link href="http://arxiv.org/ps/astro-ph/0601007" rel="alternate" type="application/postscript"/>
  </entry>

  <entry>
    <id>tag:arxiv.org,2007:astro-ph/0601007v2:pdf</id>
    <link href="http://arxiv.org/pdf/astro-ph/0601007" rel="alternate" type="application/pdf"/>
  </entry>

  <entry>
    <id>tag:arxiv.org,2007:astro-ph/0601007v2:e-print</id>
    <link href="http://arxiv.org/e-print/astro-ph/0601007" rel="alternate"/>
  </entry>

</feed>
```



Resource Map Metadata

```
<?xml version="1.0" encoding="utf-8"?>
<feed xmlns="http://www.w3.org/2005/Atom">

  <id>tag:arxiv.org,2007:astro-ph/0601007v2</id>
  <link href="http://arxiv.org/rem/astro-ph/0601007" rel="self" type="application/atom+xml"/>
  <category scheme="http://www.openarchives.org/ore/terms/" term="http://www.openarchives.org/ore/terms/ResourceMap" label="Resource Map" />
  <title>Resource Map http://arxiv.org/rem/astro-ph/0601007</title>
  <author>
    <name>arXiv.org e-Print Repository</name>
    <uri>http://arxiv.org/</uri>
    <email>www-admin@arxiv.org</email>
  </author>
```



OAI Object Re-Use & Exchange:A Status Report
DLF Fall 2007, Philadelphia, PA, November 6th 2007



Aggregation Properties

```
<?xml version="1.0" encoding="utf-8"?>
<feed xmlns="http://www.w3.org/2005/Atom">

  <id>tag:arxiv.org,2007:astro-ph/0601007v2</id>
  <link href="http://arxiv.org/rem/astro-ph/0601007" rel="self" type="application/atom+xml"/>
  <category scheme="http://www.openarchives.org/ore/terms/" term="http://www.openarchives.org/ore/terms/ResourceMap" label="Resource Map" />
  <title>Resource Map http://arxiv.org/rem/astro-ph/0601007</title>
  <author>
    <name>arXiv.org e-Print Repository</name>
    <uri>http://arxiv.org/</uri>
    <email>www-admin@arxiv.org</email>
  </author>
  <updated>2007-10-10T18:30:02Z</updated>
  <link href="info:arxiv/astro-ph/0601007v2" rel="related"/>
  <dc:title>Parametrization of K-essence and Its Kinetic Term</dc:title>
  <dc:creator>Hui Li</dc:creator>
  <dc:creator>Zong-Kuan Guo</dc:creator>
  <dc:creator>Yuan-Zhong Zhang</dc:creator>
```



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DLF Fall 2007, Philadelphia, PA, November 6th 2007



Entry Metadata

```
<entry>
  <id>tag:arxiv.org,2007:astro-ph/0601007v2:ps</id>
  <link href="http://arxiv.org/ps/astro-ph/0601007" rel="alternate" type="application/postscript"/>
  <title>Aggregated Resource http://arxiv.org/ps/astro-ph/0601007</title>
  <updated>2006-05-31T12:52:00Z</updated>
</entry>

<entry>
  <id>tag:arxiv.org,2007:astro-ph/0601007v2:pdf</id>
  <link href="http://arxiv.org/pdf/astro-ph/0601007" rel="alternate" type="application/pdf"/>
  <title>Aggregated Resource http://arxiv.org/pdf/astro-ph/0601007</title>
  <updated>2006-05-31T12:52:00Z</updated>
</entry>
```



OAI Object Re-Use & Exchange:A Status Report
DLF Fall 2007, Philadelphia, PA, November 6th 2007



Aggregated Resource Properties

```
<entry>
  <id>tag:arxiv.org,2007:astro-ph/0601007v2:oai-opmh</id>
  <link href="http://export.arxiv.org/oai2?verb=GetRecord&metadataPrefix=oai_dc&identifier=a
  rel="alternate"/>
  <title>Aggregated Resource Dublin Core Metadata</title>
  <rdf:type>info:eu-repo/semantics/DescriptiveMetadata</rdf:type>
  <updated>2006-09-27T00:00:00Z</updated>
</entry>

<entry>
  <id>tag:arxiv.org,2007:astro-ph/0601007v2:ps</id>
  <link href="http://arxiv.org/ps/astro-ph/0601007" rel="alternate" type="application/postscript"/>
  <title>Aggregated Resource http://arxiv.org/ps/astro-ph/0601007</title>
  <updated>2006-05-31T12:52:00Z</updated>
  <dcterms:hasFormat>http://arxiv.org/pdf/astro-ph/0601007v1</dcterms:hasFormat>
</entry>
```



Re-Use: Atom source

```
<!--other entries of the overlay journal-->

<entry>
  <id>tag:arxiv.org,2007:astro-ph/0601007v2:pdf</id>
  <link href="http://arxiv.org/ps/astro-ph/0601007" rel="alternate" type="application/postscript"/>
  <title>Aggregated Resource http://arxiv.org/ps/astro-ph/0601007</title>
  <updated>2006-05-31T12:52:00Z</updated>
  <source>
    <id>tag:arxiv.org,2007:astro-ph/0601007v2</id>
    <link href="http://arxiv.org/rem/astro-ph/0601007" rel="self" type="application/atom+xml"/>
    <category scheme="http://www.openarchives.org/ore/terms/" term="http://www.openarchives.org/ore/terms/ResourceMap" label="Resource Map" />
    <title>Resource Map http://arxiv.org/rem/astro-ph/0601007</title>
    <author>
      <name>arXiv.org e-Print Repository</name>
      <uri>http://arxiv.org/</uri>
      <email>www-admin@arxiv.org</email>
    </author>
    <updated>2007-10-10T18:30:02Z</updated>
    <link href="info:doi/10.1142/S0217732306019475" rel="related"/>
    <link href="info:arxiv/astro-ph/0601007v2" rel="related"/>
    <link href="http://jp.arxiv.org/abs/astro-ph/0601007" rel="related"/>
  </source>
</entry>
```



Re-Use: Atom via

```
<!--other entries of the blog100-->

<entry>
  <id>tag:arxiv.org,2007:astro-ph/0601007v2:pdf</id>
  <link href="http://arxiv.org/ps/astro-ph/0601007" rel="alternate" type="application/postscript"/>
  <title>Aggregated Resource http://arxiv.org/ps/astro-ph/0601007</title>
  <updated>2006-05-31T12:52:00Z</updated>
  <link href="http://blog99.toadscience.com/entry742.atom" rel="via" type="application/atom+xml"/>
  <source>
    <id>tag:arxiv.org,2007:astro-ph/0601007v2</id>
    <link href="http://arxiv.org/rem/astro-ph/0601007" rel="self" type="application/atom+xml"/>
    <category scheme="http://www.openarchives.org/ore/terms/" term="http://www.openarchives.org/ore/terms/ResourceMap" label="Resource Map" />
    <title>Resource Map http://arxiv.org/rem/astro-ph/0601007</title>
    <author>
      <name>arXiv.org e-Print Repository</name>
      <uri>http://arxiv.org/</uri>
      <email>www-admin@arxiv.org</email>
    </author>
    <updated>2007-10-10T18:30:02Z</updated>
    <link href="info:doi/10.1142/S0217732306019475" rel="related"/>
    <link href="info:arxiv/astro-ph/0601007v2" rel="related"/>
    <link href="http://jp.arxiv.org/abs/astro-ph/0601007" rel="related"/>
  </source>
</entry>
```



OAI Object Re-Use & Exchange:A Status Report
DLF Fall 2007, Philadelphia, PA, November 6th 2007



A Resource Map Document in RDF/XML?

```
<?xml version="1.0" encoding="utf-8"?>
<feed xmlns="http://www.w3.org/2005/Atom"
      xmlns:grddl="http://www.w3.org/2003/g/data-view#"
      grddl:transformation="http://www.openarchives.org/ore/atom-grddl.xsl"
      xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
      xmlns:dc="http://purl.org/dc/elements/1.1/"
      xmlns:dcterms="http://purl.org/dc/terms/">
```



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DLF Fall 2007, Philadelphia, PA, November 6th 2007



A Resource Map Document in RDF/XML!

```
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF xmlns:dcterms="http://purl.org/dc/terms/"
           xmlns:dc="http://purl.org/dc/elements/1.1/"
           xmlns:xs="http://www.w3.org/2001/XMLSchema"
           xmlns:xhtml="http://www.w3.org/1999/xhtml"
           xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
           xmlns:atom="http://www.w3.org/2005/Atom"
           xmlns:ore="http://openarchives.org/ore/terms/"
           xmlns:owl="http://www.w3.org/2002/07/owl#">
    <rdf:Description rdf:about="http://www.dlib.org/dlib/february06 smith/02smith/rem/">
        <rdf:type rdf:resource="http://openarchives.org/ore/terms/ResourceMap"/>
        <ore:describes rdf:resource="http://www.dlib.org/dlib/february06 smith/02smith/rem/#aggregation">
            <dcterms:modified>2007-09-22T07:11:09Z</dcterms:modified>
            <dc:creator rdf:resource="http://www.dlib.org"/>
            <dc:creator>D-Lib Magazine</dc:creator>
            <dc:creator>dlib@cnri.reston.va.us</dc:creator>
            <dc:rights rdf:resource="http://creativecommons.org/licenses/by-nc-sa/2.5/"/>
        </rdf:Description>
        <rdf:Description rdf:about="http://www.dlib.org/dlib/february06 smith/02smith/rem/#aggregation">
            <rdf:type rdf:resource="http://openarchives.org/ore/terms/Aggregation"/>
            <ore:aggregates rdf:resource="http://www.dlib.org/dlib/february06 smith/02smith.html"/>
            <ore:aggregates rdf:resource="http://www.dlib.org/dlib/february06 smith/pg1-13.html"/>
            <ore:aggregates rdf:resource="http://www.dlib.org/dlib/february06 smith/pg1-13.pdf"/>
            <ore:aggregates rdf:resource="http://www.dlib.org/dlib/february06 smith/MLN_Google.png"/>
            <ore:aggregates rdf:resource="http://www.crossref.org/openurl?url_ver=Z39.88-2004&rfc_id=5200&rft_val_fmt=info%3Aofi%2Ffmt%2F1.1&rft.genre=article"/>
            <owl:sameAs rdf:resource="info:doi/10.1045/february2006-smith"/>
            <rdf:type rdf:resource="http://purl.org/eprint/type/JournalArticle"/>
            <dcterms:isPartOf rdf:resource="http://www.dlib.org"/>
        </rdf:Description>
    </rdf:RDF>
```



Resource Map Profile of Atom

- All of this is described in the *ORE Resource Map Profile of Atom*
- And explained for implementers in the *Resource Map Implementation in Atom User Guide*

The screenshot shows a web browser window with the title 'ORE Specification – Resource Map Profile of Atom'. The URL in the address bar is <http://www.openarchives.org/ore/0.1/atom>. The page content includes the Open Archives Initiative logo and the OAI-ORE logo. It provides links to the specification document, editors, and abstract. The abstract describes OAI-ORE's Resource Map as a specialization of a named graph for aggregating Web resources. The table of contents lists sections such as Introduction, Correspondence between the ORE Model and the Atom Model, Use of Atom Constructs, and Use of Atom Elements.

ORE Specification - Resource Map Profile of Atom
15 October 2007

This version:
<http://www.openarchives.org/ore/0.1/atom>

Latest version:
<http://www.openarchives.org/ore/atom>

Previous version:
none

Editors (OAI Executive)
Carl Lagoze, Cornell University Information Science
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Abstract

Open Archives Initiative Object Reuse and Exchange (OAI-ORE) defines standards for the description and exchange of aggregations of Web resources. OAI-ORE introduces the notion of a Resource Map, which is a specialization of a named graph that asserts a finite set of resources (the Aggregated Resources), their types, intra-relationships, and relationships with resources external to this finite set (the external resources). A Resource Map Document is a machine-readable representation of a Resource Map. A Resource Map Document can be serialized in different formats, and the purpose of this document is to specify a serialization based on, and compliant with, the Atom syndication format. Hereto, a Resource Map Document is an Atom feed Document with some ORE-specific ingredients. An Atom-based format to serialize Resource Map Documents may be referred to as the Resource Map Profile of Atom. This specification is one of several documents comprising the [OAI-ORE specification and user guide](#).

Table of Contents

1. [Introduction](#)
 - 1.1 [Notational Conventions](#)
 - 1.2 [Compliance](#)
 - 1.3 [Example](#)
2. [Correspondence between the ORE Model and the Atom Model](#)
3. [Use of Atom Constructs in the Resource Map Profile of Atom](#)
 - 3.1 [Text Constructs](#)
 - 3.2 [Person Constructs](#)
 - 3.3 [Date Constructs](#)
4. [Use of Atom Elements in the Resource Map Profile of Atom](#)
 - 4.1 [Container Elements](#)
 - 4.1.1 [The "atom:feed" Element](#)
 - 4.1.2 [The "atom:entry" Element](#)
 - 4.1.3 [The "atom:content" Element](#)
 - 4.2 [Metadata Elements](#)
 - 4.2.1 [The "atom:author" Element](#)
 - 4.2.2 [The "atom:category" Element](#)
 - 4.2.3 [The "atom:contributor" Element](#)
 - 4.2.4 [The "atom:generator" Element](#)
 - 4.2.5 [The "atom:icon" Element](#)
 - 4.2.6 [The "atom:id" Element](#)

Done zotero



OAI Object Re-Use and Exchange

Core goal of OAI-ORE:

Facilitate Use and Re-Use of Compound Information Objects (and of their component parts)

How are Resource Maps discovered?



OAI Object Re-Use & Exchange:A Status Report
DLF Fall 2007, Philadelphia, PA, November 6th 2007



Resource Map Discovery

```
<?xml version="1.0" encoding="UTF-8"?>
<urlset xmlns="http://www.sitemaps.org/schemas/sitemap/0.9">
    <url>
        <loc>http://www.foo.edu/objects/object1.atom</loc>
        <lastmod>2007-01-06</lastmod>
    </url>
    <url>
        <loc>http://www.foo.edu/objects/object2.atom</loc>
        <lastmod>2007-08-11</lastmod>
        <changefreq>weekly</changefreq>
    </url>
    <url>
        <loc>http://www.foo.edu/objects/object3.atom</loc>
        <lastmod>2007-03-15T18:30:02Z</lastmod>
        <priority>0.3</priority>
    </url>
    ...
</urlset>
```

- Harvest type discovery
 - Expose Resource Maps via OAI-PMH, Atom, RSS, Sitemaps



Resource Map Discovery

```
<html>
<head>
<title>Hello World.</title>
<link href="http://example.net/hw.atom" type="application/atom+xml" rel="resourcemap" >
</head>
<body>


</html>
```

```
<html>
<head>
<title>Chapter Twelve.</title>
<link href="http://mybook.com/toc.html" type="text/html" rel="indirectresourcemap" >
</head>
<body>
Welcome to chapter twelve...
</body>
</html>
```

- Resource Embedding
 - HTML link element points at Resource Maps



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Resource Map Discovery

```
(request)      HEAD http://www.example.net/hello.jpeg HTTP/1.1
               Host: www.example.net
               Connection: close

(response)    HTTP/1.1 200 OK
               Date: Sat, 26 May 2007 22:43:10 GMT
               Server: Apache/2.2.0
               Last-Modified: Sat, 26 May 2007 19:32:04 GMT
               ETag: "c3596-816-92123500"
               Accept-Ranges: bytes
               Content-Length: 2070
               Link: <http://example.net/hw.atom>; type="application/atom+xml"; rel="resourcemap"
               Content-Type: image/jpeg
               Connection: close
```

- Response Embedding
 - HTTP Link Header points at Resource Map



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Resource Map Discovery

- All of this is described in the *Resource Map Discovery User Guide*

The screenshot shows a web browser window displaying the 'ORE User Guide – Resource Map Discovery' at <http://www.openarchives.org/ore/0.1/discovery>. The page features the Open Archives Initiative Object Reuse and Exchange logo (an eye icon) and the OAI logo (a network of nodes). The title is 'ORE User Guide - Resource Map Discovery' from 15 October 2007. It includes links for the current version (<http://www.openarchives.org/ore/0.1/discovery>), latest version (<http://www.openarchives.org/ore/discovery>), and previous version (none). It lists editors for the OAI Executive and ORE Technical Committee, along with their names and institutions. The 'Abstract' section explains that crawlers or harvesters must discover **Resource Maps (ReMs)** before the aggregations described by them can be understood. The 'Table of Contents' lists chapters such as Introduction, Batch Discovery, Resource Embedding, Response Embedding, and References. Appendices include Acknowledgments and a Change Log. A 'Done' button is at the bottom left, and a Zotero toolbar is at the bottom right.



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Next Steps

- Currently: Draft ORE Specifications are being revised by ORE Technical Committee and ORE Liason Group
- Early 2008: Public Release of Alpha ORE Specifications
 - Community feedback
 - Experiments
- March 3rd 2008, John Hopkins University: USA ORE Open Meeting
 - Register at <http://www.regonline.com/oai-ore>
- April 4th 2008, University of Southampton: European ORE Open Meeting
- September 2008: Public release of stable ORE Specifications



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