



Metadata

Interoperability

Issues and Approaches

Basic Tutorial – 2.2

Marcia Lei Zeng
DC-2009 "Semantic Interoperability of Linked
Data" Seoul, Korea

Interoperability issues ...

When a project starts:

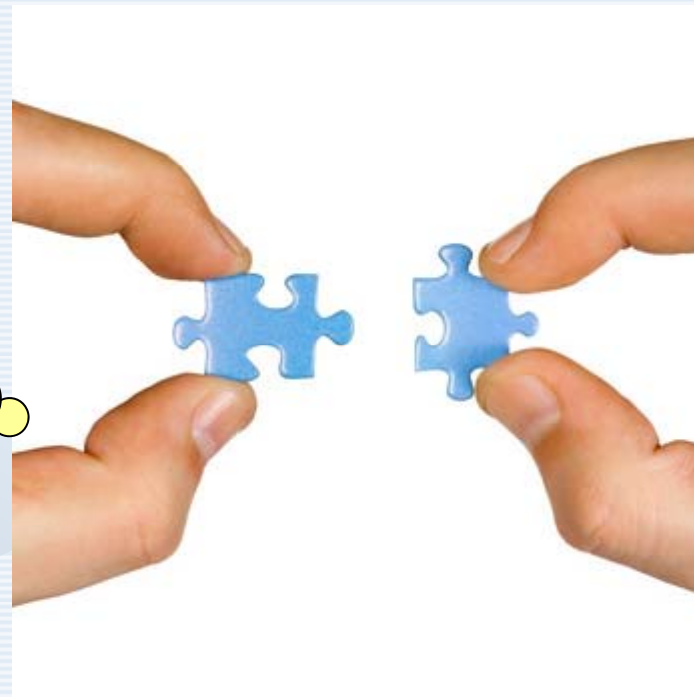


- “Should we adopt a schema or create one?”
- “Which metadata standard should we follow?”
- “Do we need to modify the schema?”
- “Can we reuse existing catalog records in a new digital collection?”

(cont.) Interoperability issues ...

“We would like to merge our records with those from another collection, but they have used a different schema. What should we do?”

**In building
a digital collection:**



(cont.) Interoperability issues ...

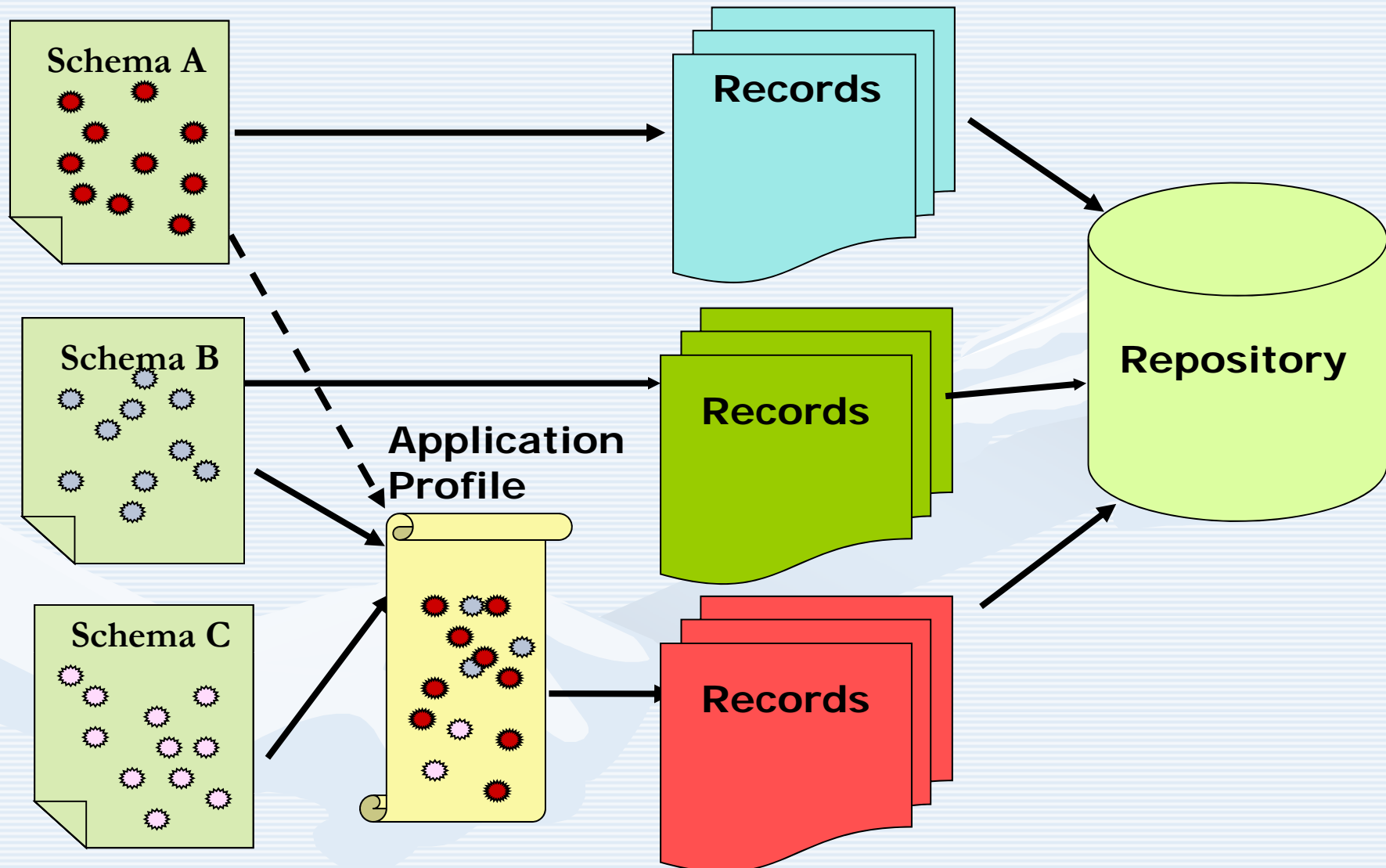
Toward integration:

“A large digital library project has requested that we provide our metadata for its repository. How can we convert our data to their format?”

“All members employ different metadata standards. How might we provide data for federated searching?”



Overview: Ensuring interoperability at different levels



Overview: Ensuring interoperability at different levels

1. schema level

- derivation
- application profile
- crosswalks
- switching-cross
- framework
- schema registry

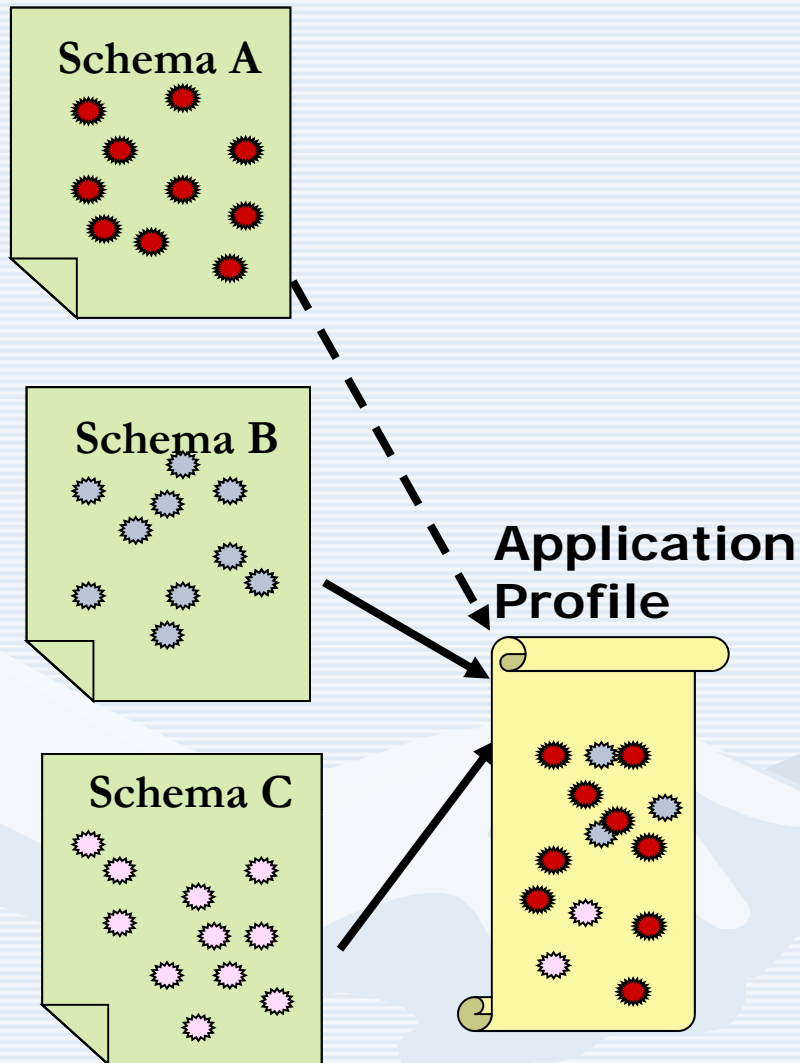
2. record level

- data conversion
- data reuse, integration

3. repository level

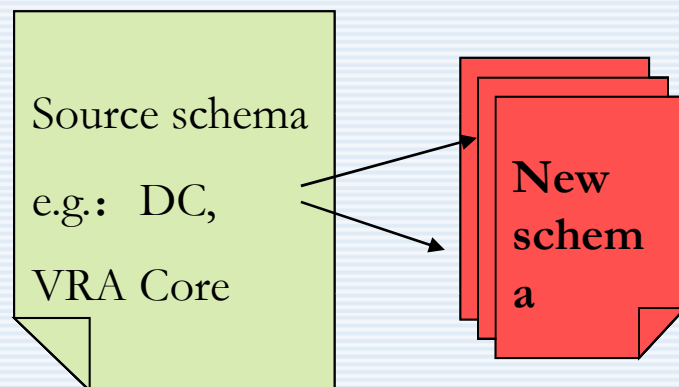
- OAI protocol
- subject authority file mapping
- value co-occurrence mapping
- enriched records

1. Schema level



- Efforts focus on the elements of the schemas that are independent of any applications.
- The results usually appear as:
 - derived element sets,
 - application profile
 - crosswalks
 - switching-cross
 - framework
 - schema registries

1. Schema level

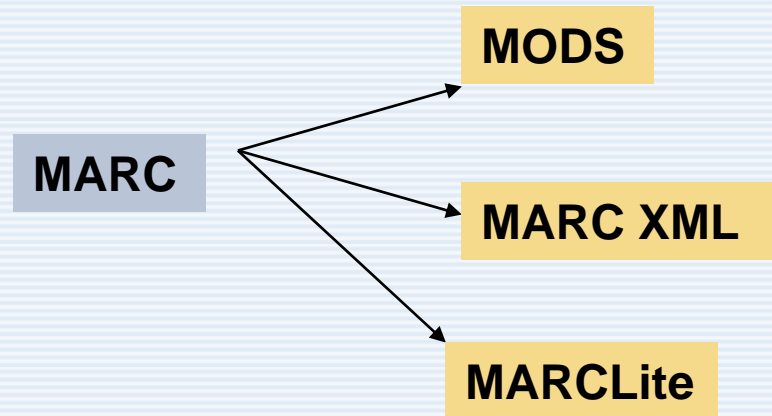


1.1 Derivation

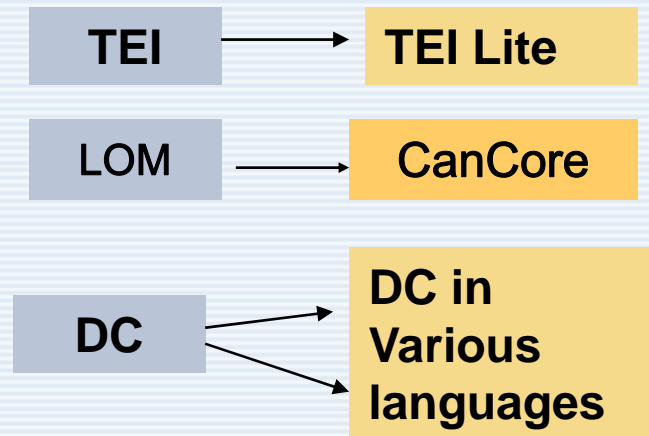
Adaptation, modification, expansion, partial adaptation, translation, etc.

New schema depends on the source schema

1. Schema level



Shorter version, translated version



1.1 Derivation

- Adaptation, modification, expansion, partial adaptation, translation, etc.
- New schema depends on the source schema

1. Schema level

Electronic Theses and Dissertations Metadata Set

ETD-MS

Dublin Core

[13 DC elements]

+

thesis.degree

-- name

-- level

-- discipline

-- grantor

Expansion

1.1 Derivation

- Adaptation, modification, expansion, partial adaptation, translation, etc.
- New schema depends on the source schema

Examples from *NLM Metadata Schema*

National Library of Medicine

The key used for "Identifier" is:

DC = Approved Dublin Core elements and qualifiers

NLMDC = Approved Dublin Core elements with NLM-defined qualifiers

NLM = NLM-defined elements

Element: Permanence Level

Name: Permanence Level

Identifier: **NLM.Permanence.Level**

Definition: The extent to which a user can be assured that the resource will remain stable and available

Required: R

Repeatable: N

Comments: N/A

Element: Subject, Class Number

Name: Subject, Class Number

Identifier: **NLMDC.Subject.NLMClass**

Definition: An NLM classification number which represents the topic of the content of the resource

Required: O

Repeatable: N

Comments: N/A

Europeana Semantic Elements

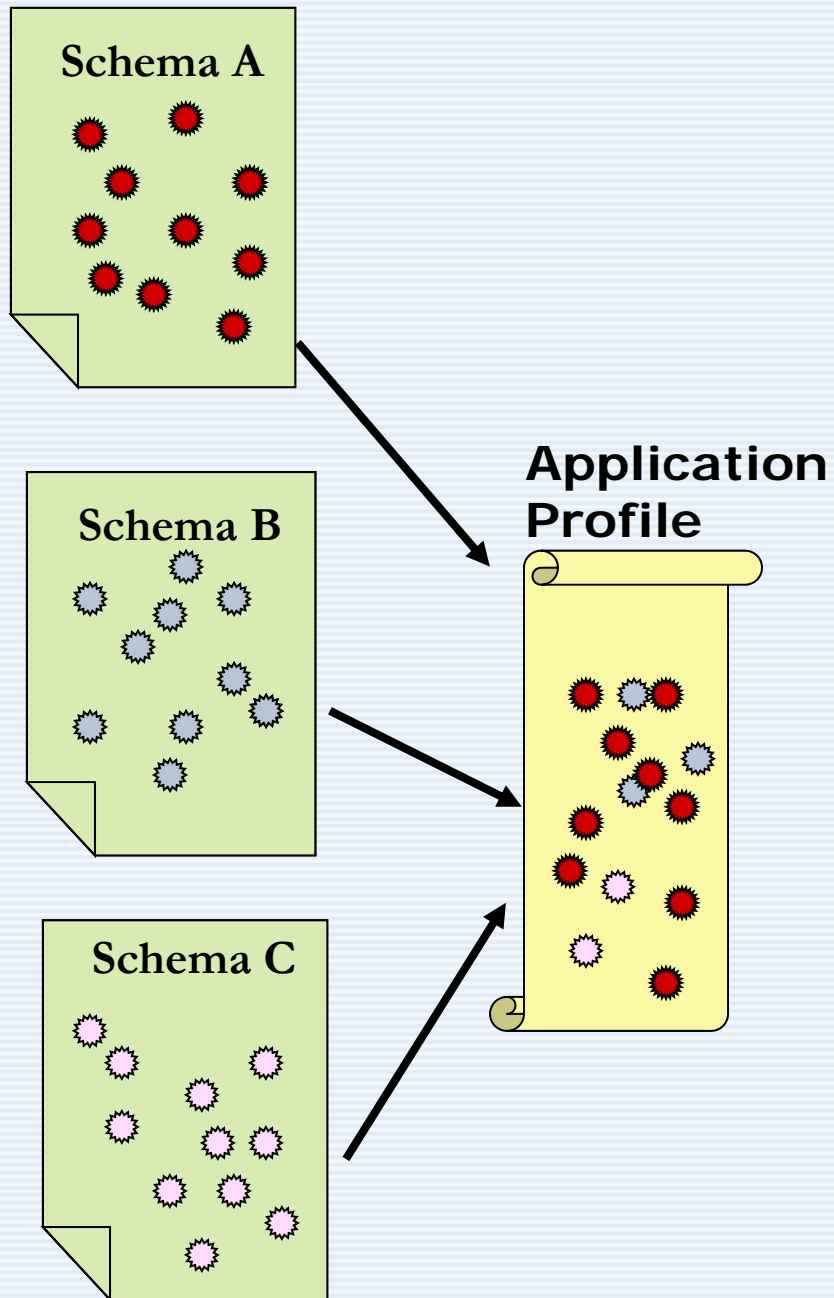
Source	Element	Refinement(s)
DC	title	alternative
DC	creator	
DC	subject	
DC	description	tableOfContents
DC	publisher	
DC	contributor	
DC	date	created; issued
DC	type	
DC	format	extent; medium
DC	identifier	
DC	source	
DC	relation	isVersionOf; hasVersion; isReplacedBy; replaces; isRequiredBy; ...

Source	Element	Refinement(s)
DC	coverage	spatial; temporal
DC	rights	
DC terms	provenance	
Europeana	relation	isShownBy; isShownAt
Europeana	userTag	
Europeana	unstored	
Europeana	object	
Europeana	language	
Europeana	provider	
Europeana	type	
Europeana	uri	
Europeana	year	
Europeana	hasObject	
Europeana	country	LIDA 2009



Source: Concordia: Integration of Heterogeneous Metadata in Europeana
http://dublincore.org/groups/tools/docs/LIDA09WorkshopC_1.pdf

1. Schema level



1.2 Application profiles

- Consisting of data elements drawn from one or more namespaces
- combined together by implementers
- optimized for a particular local application.

Australasian Virtual Engineering Library Metadata Element Set

Metadata

AVEL METADATA ELEMENT LIST

The AVEL Metadata set consisted of nineteen elements. These were based on the [Dublin Core](#) standard.

Dublin Core elements supported by AVEL

- DC.Identifier
- DC.Title
- DC.Creator
- DC.Subject
- DC.Description
- DC.Publisher
- DC.Contributor
- DC.Date
- DC.Type
- DC.Format
- DC.Language
- DC.Coverage
- DC.Relation
- DC.Rights

DC elements

AGLS elements supported by AVEL

- AGLS.Availability

AGLS (Australian Government Locator Service) metadata element

EDNA elements supported by AVEL

- EdNA.Review

EDNA (Education Network Australia) metadata element

Administrative elements supported by AVEL

- AC.Creator
- AC.DateCreated
- AVEL.Comments

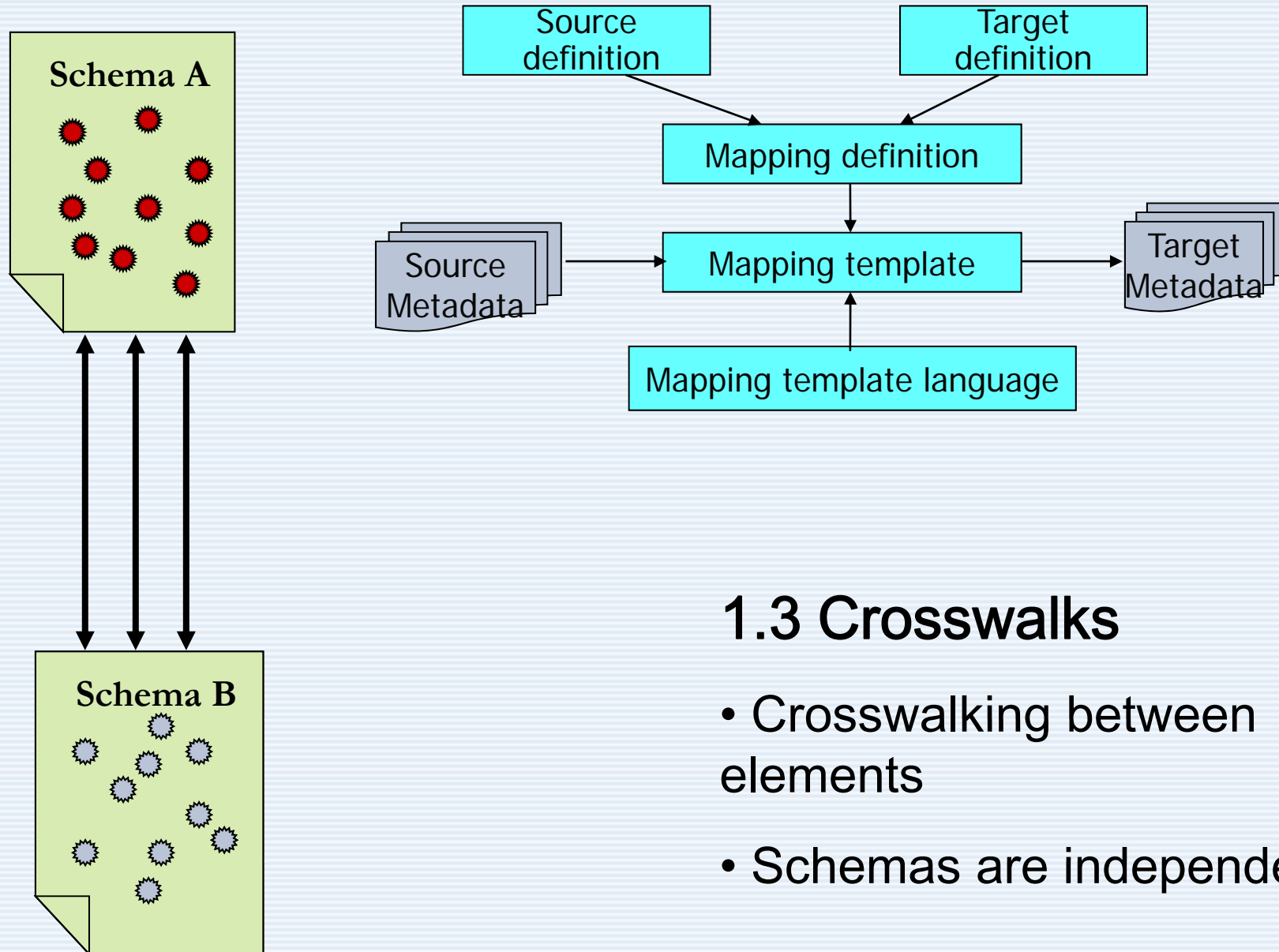
Administrative metadata elements

<http://avel.library.uq.edu.au/technical.html>

Dublin Core Application Profiles

- DC-Library Application Profile (DC-Lib)
 - clarifies the use of the DC metadata element set in libraries and library-related applications and projects
- DC Government Application Profile
 - clarifies the use of DC in a government context
- DC Collection Description Application Profile

1. Schema level



1.3 Crosswalks

- Crosswalking between elements
- Schemas are independent

Common Crosswalking Approaches

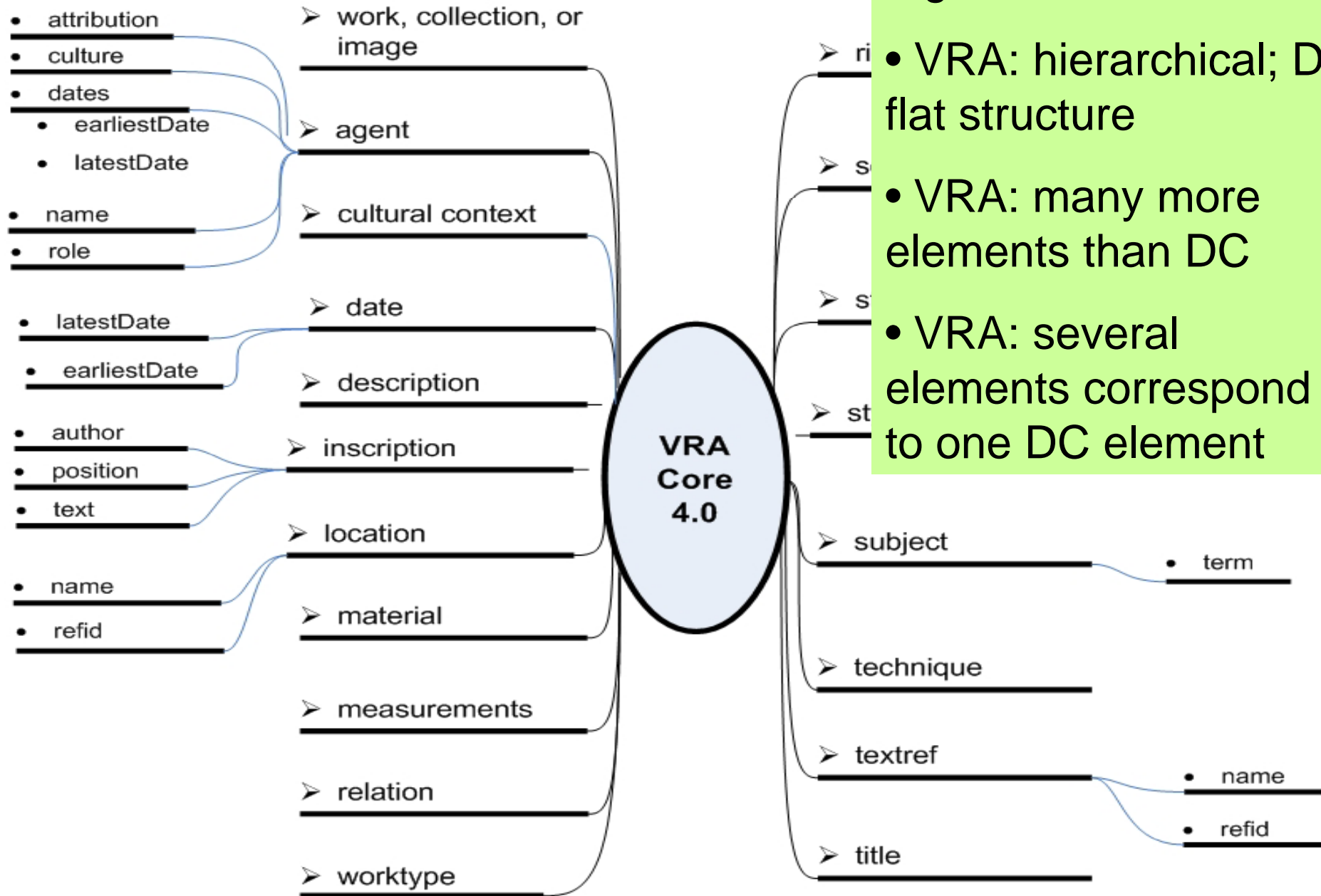
source \ target	<i>Absolute crosswalking</i>	<i>Relative crosswalking</i>
VAR Core (3.0)	Dublin Core	Dublin Core
<i>Technique</i>	-----	<i>Format</i>
<i>Location. Current Repository</i>	-----	<i>Contributor Coverage</i>

e.g., VRA Core → DC

• VRA: hierarchical; DC: flat structure

• VRA: many more elements than DC

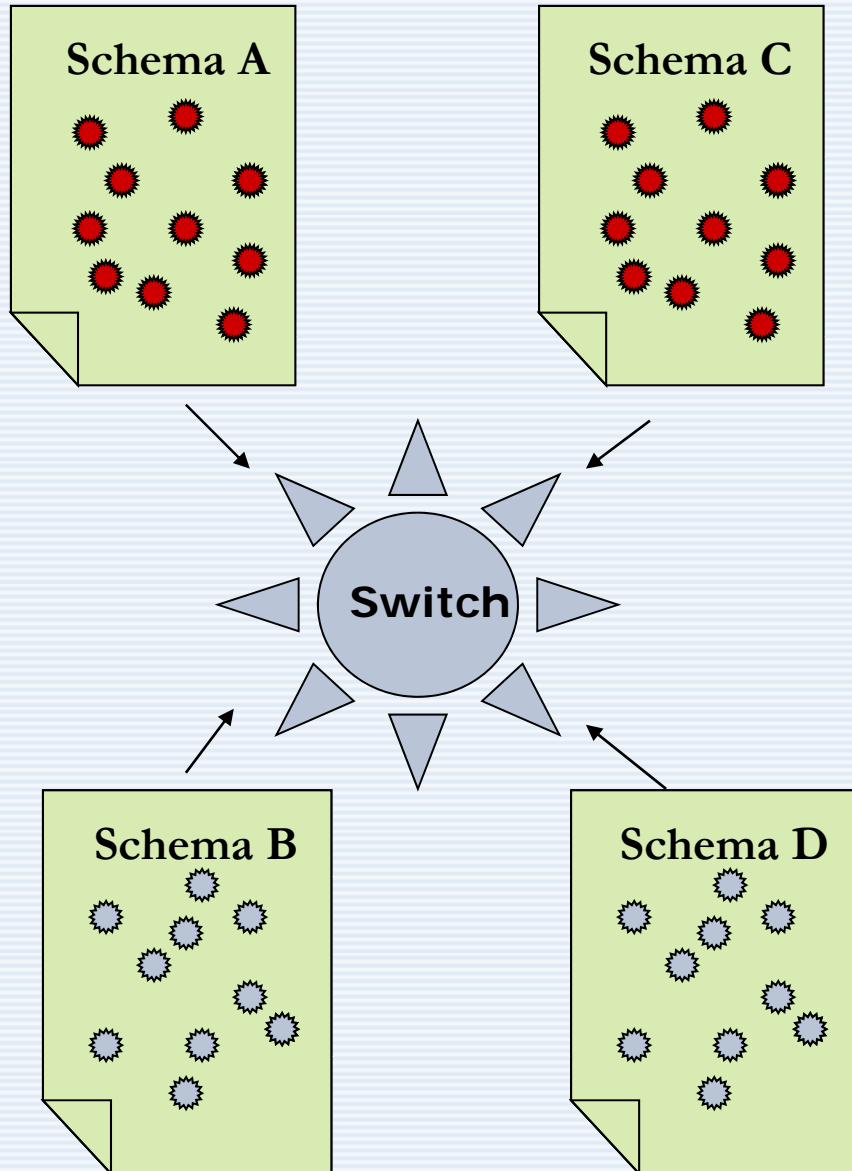
• VRA: several elements correspond to one DC element



Crosswalk issues

- More workable when mapping from complex to simpler schema – “one way street”
- Different degrees of equivalency:
 - One-to-one, one-to-many, many-to-one, one-zero
- Works well when the number of schemas involved is small
- Multiple schema mapping extremely labor intensive, requiring enormous intellectual effort

1. Schema level



1.4 Cross-switching

- One of the schemas is used as the switching mechanism between the multiple schemas.

Getty's Crosswalk from CDWA to multiple schemas

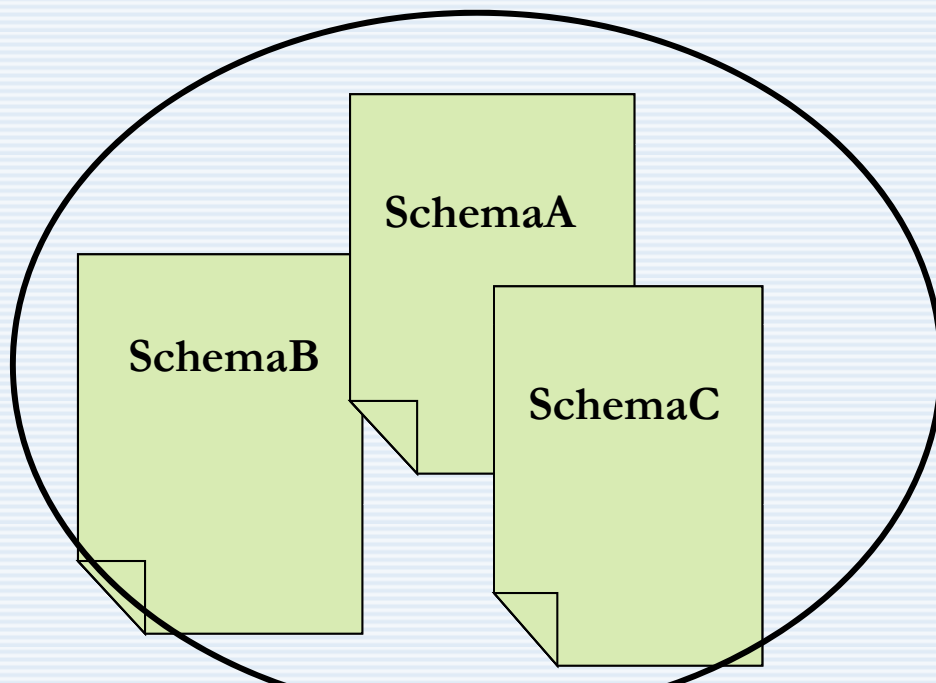
Metadata Standards Crosswalk

The crosswalk below includes only a partial list of the elements for each standard, focusing on the areas of overlap. This crosswalk is for planning purposes only; refer to the original standards if you are creating a technical mapping. For the full list of elements for any one of the standards below, click on the name of the standard at the top of the column. (To print this crosswalk from your Web browser, use the tabloid 11 x 17-inch paper size setting, landscape print format, .25-inch margins. Alternatively, print the PDF from the *Printer Friendly PDFs* link; see left-hand navigation.)

CDWA	CCO [1]	CDWA Lite [2]	VRA 4.0 XML	MARC/AACR	MODS	Dublin Core	DACS	
1. OBJECT/ WORK (core)								
1.1. Catalog Level (core)		<cdwalite: recordType>	<vra: work> or <vra: collection>	655 Genre/Form 300a Physical Description - Extent	<genre> <extent>		1 Levels of Description	LEV
1.2. Object/Work Type (core)	Work Type	<cdwalite: objectWorkType>	<vra: worktype> in <vra: work> or <vra: collection>	655 Genre - Form	<genre>	Type	3.1 Scope and Content	<co <ge (in
1.4. Components/Parts				300a Physical Description - Extent	<extent>	Format, Extent	2.5 Extent 3.1 Scope and Content	<ph (in<
1.5. Remarks							5.4 Accruals	
2. CLASSIFICATION (core)								
2.1. Classification Term (core)	Class	<cdwalite: classification>		050 084 "Other classification number"	<classification>	Subject (classification schema)		
3. TITLES OR NAMES (core)								
3.1. Title Text (core)	Title	<cdwalite:title>	<vra: title> in <vra: work> or <vra: collection>	24Xa Title and Title - Related Information	<title>	Title	2.3 Title	<tit <ea <ur (in<
3.2. Title Type	Title Type	<cdwalite:title> type	<vra: title type= > in <vra: work> or <vra: collection>					

http://www.getty.edu/research/conducting_research/standards/intrometadata/crosswalks.html

1. Schema level



1.5 Framework

- Building a framework based on existing schemas
- Or establishing a framework first to guide the schema development

- Metadata home
- ADN
 - Admin. fields overview
 - Creator-cataloger fields
 - Educational overview
 - General fields overview
 - Geospatial overview
 - Relation fields overview
 - Rights overview
 - Technical fields overview
 - Temporal overview
- Version 0.6.50
- Annotation
- Collection building
- Collection
 - Contribute to DLESE
- Controlled vocabularies
- DCS/OAI tool users
- DLESE-IMS
 - Glossary
- News-Opps
- Objects
- Other services & issues
- Presentations
- Site map

ADN framework

ADN (ADEPT/DLESE/NASA)

Framework purpose

The purpose of the ADN (ADEPT/DLESE/NASA) metadata framework is to describe resources typically used in learning environments (e.g. classroom activities, lesson plans, modules, visualizations, some datasets) for discovery by the Earth system education community.

Current version

[Version 0.6.50 is the current version](#) and is the version collection builders should use in order to contribute a news an opportunities collection to DLESE.

Required metadata

Because each version of this framework has different required metadata, please refer to the specific framework version of interest for appropriate information.



Tool support to create required metadata

Because each version of this framework has different tool support for creating required metadata, please refer to the specific version of interest for appropriate information.

Framework features and constraints

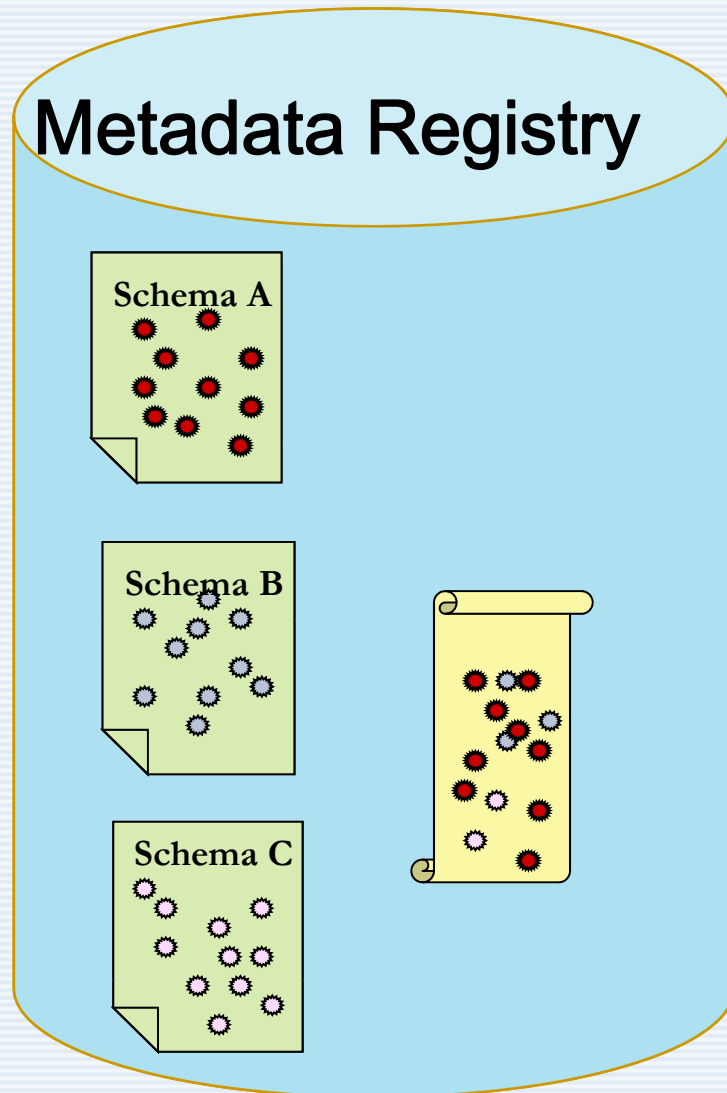
Because each version of this framework has different framework features, please refer to the specific version of interest for appropriate information.

<http://www.dlese.org/Metadata/adn-item/>

1. Schema level

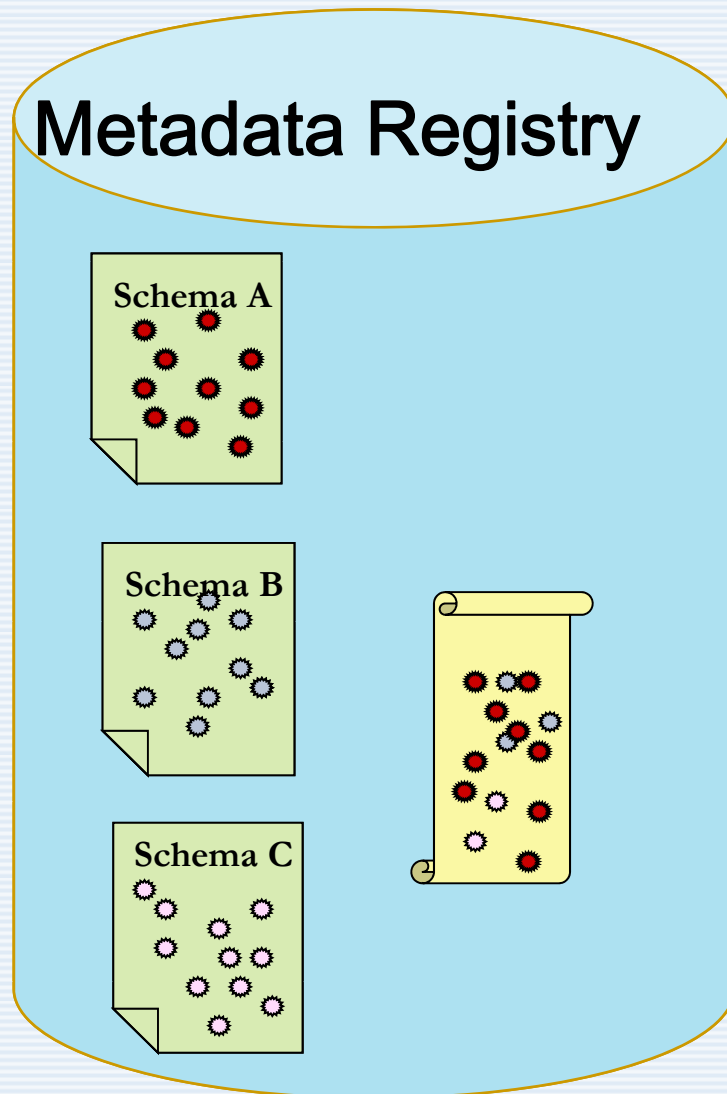
Functionalities of MR

- registration and publishing of schemas and application profiles
- management
- search and retrieval
- crosslinking and crosswalking



1.6 Metadata Registries

2.1 Schema level



Fundamental components of MR

- Data models
- Element identification
- Element set identification
- Encoding scheme identification
- Application profile identification
- Element usage identification
- Element crosswalking identification

1.6 Metadata Registries

Metadata Registry Examples

- Cross-domain and cross-schema registries,
 - e.g., UKOLN's SCHEMAS Registry → [CORES Registry](#)
 - [JISC IE Metadata Schema Registry \(IEMSR\)](#)
- Domain-specific, cross-schema registries,
 - e.g., UKOLN's [MEG \(Metadata for Education Group\) Registry](#)
 - [Australian Institute of Health and Welfare - Metadata Online Registry \(METeOR\)](#)
- Project-specific registries,
 - e.g. [The European Library \(TEL\) metadata registry](#), whose purpose is recording all metadata activities associated with TEL
- Standard-specific registries
 - e.g., [DCMI Metadata Registry](#)

http://www.cores-eu.net/registry/

Google SCHEMAS Registry

Address http://cores.dsd.sztaki.hu/

CORES Registry

Download schema creation tool you are
 Help on using the registry

Index

Agencies: [Browse](#) - [Search](#)

Element Sets: [Browse](#) - [Search](#)

Elements: [Browse](#) - [Search](#)

Encoding Schemes: [Browse](#) - [Search](#)

Application Profiles: [Browse](#) - [Search](#)

Element Usages: [Browse](#) - [Search](#)

[Sandbox registry](#) - [Index](#) - [Agencies](#) - [Element Set](#)
[Application Profiles](#) - [Element](#)

© 2002 MEG Registry Project, ILRT If y
 and UKOLN
 © 2002, CORES Project, MTA
 SZTAKI DSD

Elements

Name	Element Set	
Abstract	The Dublin Core Terms Element Set	Detail
Access Conditions	The RSLP Collection Description	Detail

Element:: Abstract@en-US

ID	http://purl.org/dc/terms/abstract	Detail
Name	Abstract	Detail
Definition	A summary of the content of the resource.	
Comment		Detail
Data type	string	
Obligation	optional	Detail
Maximum Occurrence	unbounded	Detail
Refines	Description	
Element Set	The Dublin Core Terms Element Set	Detail
Annotations	There are no annotations for this resource. Add new annotation.	Detail
Administrative metadata	List administrative metadata for this resource. (0)	

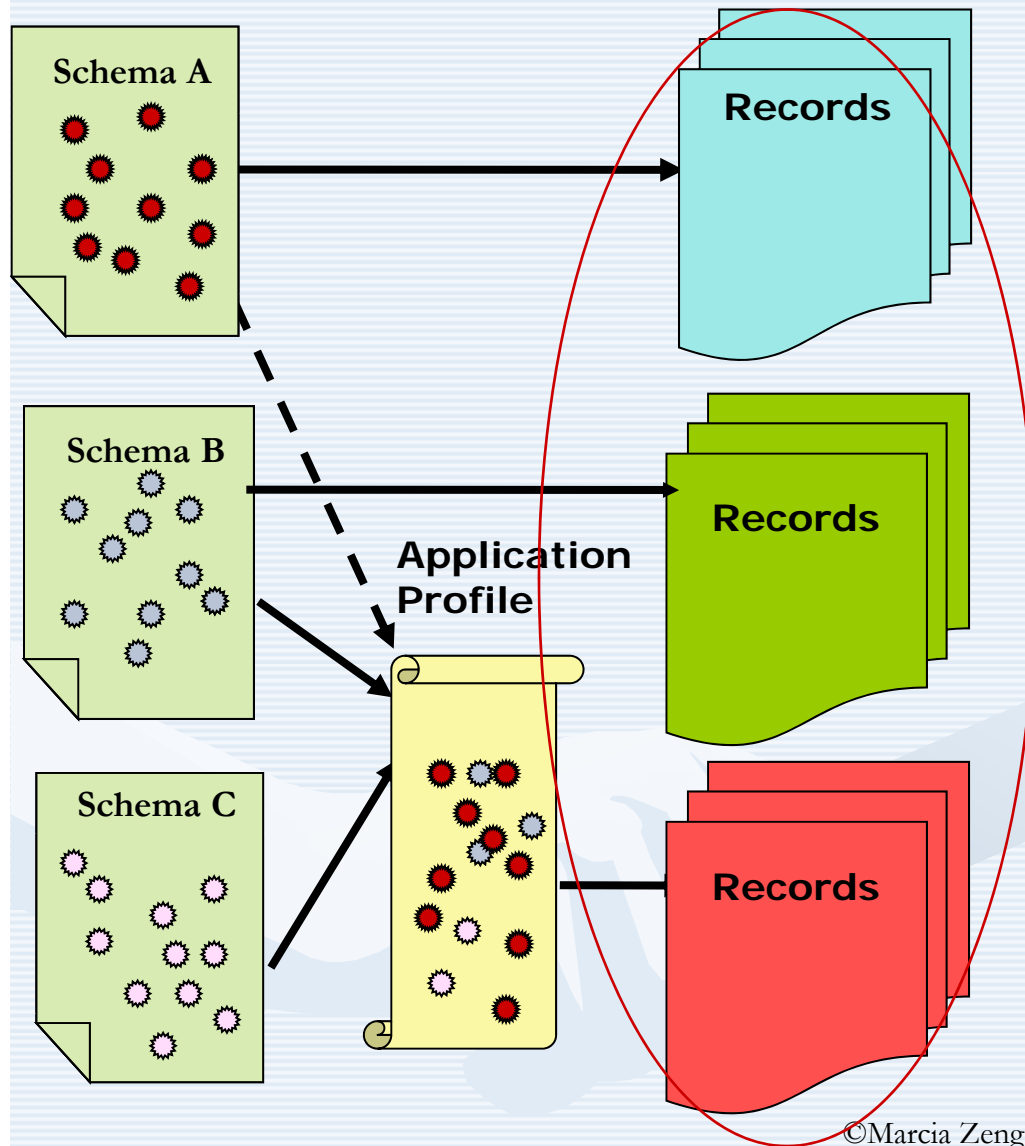
Element Usages

Name	Application Profile	
Abstract	The Qualified Dublin Core Application Profile	Detail
Abstract	The British Library Application Profile	Detail

Refines

Name	Element Set	
Description	The Dublin Core Element Set v1.1	Detail

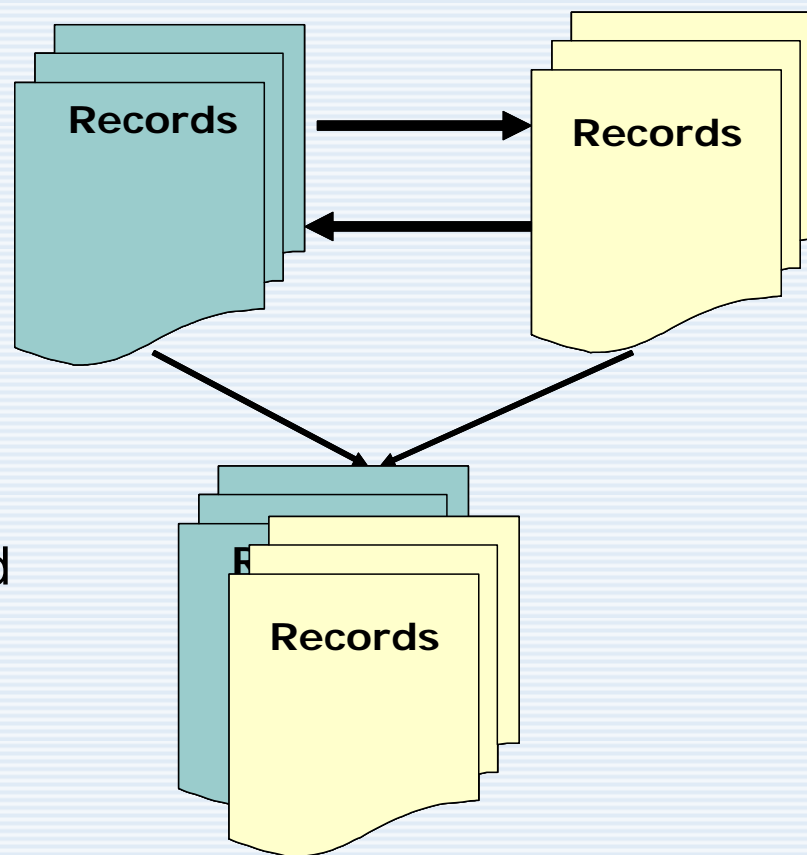
2. Record level



- Efforts attempt to integrate metadata records through mapping
- Common results include:
 - converted records,
 - new records that combine the values of existing records.

2. Record level

2.1 Conversion of records



e.g.:

MARC record → MODS record

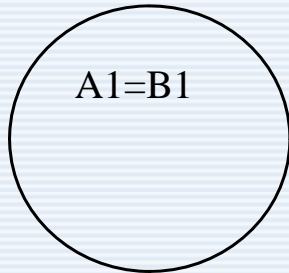
MARC record → DC record

LOM record → DC record

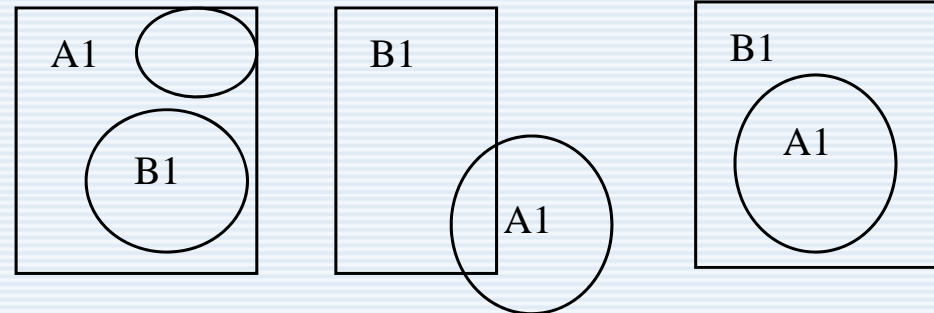
○ ○ ○

Data Conversion Challenges

How they are mapped
in crosswalks:



How they may exist in real schemas:



Complicated mapping relationships

- One-to-One
- One-to-Many
- Many-to-One
- One-to-Zero
- Overlapping horizontally or vertically
- Controlled vs. uncontrolled value spaces

Examples of Incorrect element mapping

before ...

Type of Document	Dissertation										
Author	Pivovarov, Eugene										
URN	etd-05302002-130637										
Persistent URL	http://resolver.caltech.edu/CaltechETD:etd-05302002-130637										
Title	Aspects of non-Fermi-liquid metals										
Degree	PhD										
Option	Physics										
Advisory Committee	<table border="1"> <thead> <tr> <th>Advisor Name</th> <th>Title</th> </tr> </thead> <tbody> <tr> <td>John Preskill</td> <td>Committee Chair</td> </tr> <tr> <td>Chetan Nayak</td> <td>Committee Member</td> </tr> <tr> <td>Michael Cross</td> <td>Committee Member</td> </tr> <tr> <td>Nai-Chang Yeh</td> <td>Committee Member</td> </tr> </tbody> </table>	Advisor Name	Title	John Preskill	Committee Chair	Chetan Nayak	Committee Member	Michael Cross	Committee Member	Nai-Chang Yeh	Committee Member
Advisor Name	Title										
John Preskill	Committee Chair										
Chetan Nayak	Committee Member										
Michael Cross	Committee Member										
Nai-Chang Yeh	Committee Member										
Keywords	<ul style="list-style-type: none"> • phase transitions • Hubbard model • strongly correlated electrons • charge-density wave • superconductivity • electronic conductance 										
Date of Defense	2002-05-22										
Availability	unrestricted										
Abstract	We consider several examples of metallic systems that exhibit non-Fermi-liquid behavior. We consider several examples of metallic systems that exhibit non-Fermi-liquid behavior. The primary models are density-density models with broken spin symmetry. In the first model, the same-time correlation function is non-zero at the nodes. We derive the phase diagrams and study the thermodynamic phase diagram when the underlying microscopic interaction is repulsive.										

OPTIONS mapped to **SUBJECT**, missing all **KEYWORDS**

after ...

dc:title	Aspects of non-Fermi-liquid metals
dc:creator	Pivovarov, Eugene
dc:subject	Physics
dc:description	We consider several examples of metallic systems that exhibit non-Fermi-liquid behavior. The primary models are density-density models with broken spin symmetry. In the first model, the same-time correlation function is non-zero at the nodes. We derive the phase diagrams and study the thermodynamic phase diagram when the underlying microscopic interaction is repulsive.
dc:publisher	California Institute of Technology
dc:contributor	Nai-Chang Yeh
dc:contributor	Chetan Nayak
dc:contributor	John Preskill
dc:contributor	Michael Cross
dc:date	2002-06-03
dc:type	Text
dc:format	application/pdf
dc:identifier	http://resolver.caltech.edu/CaltechETD:etd-05302002-130637
dc:source	http://etd.caltech.edu/etd/available/etd-05302002-130637/
dc:language	en
dc:rights	unrestricted

missing keywords

Examples of Incorrect element mapping

before ...

AUTHOR mapped to **DESCRIPTION**

Title: Investigation of technical considerations in a proposed "Live from Lincoln Center" pay television service

Authors: Ward, John Erwin.

Issue Date: 1976

Publisher: Electronic Systems Laboratory, Dept. of Electrical Engineering and Computer Science, Massachusetts Institute of Technology

Series/Report no.: Report (Massachusetts Institute of Technology. Electronic Systems Laboratory) ; ESL-R-650.

Description: M.I.T. Project DSR 82300. Research supported by Lincoln Center for the Performing Arts.

URI: <http://hdl.handle.net/1721.1/1259>

Appears in Collections: [LIDS Technical Reports](#)

after ...

no **CREATOR**

DC: Elements: 14

dc:title	Investigation of technical considerations in a proposed "Live from Lincoln Center" pay televis
dc:subject	Subscription television
dc:subject	TK7855.M41 E386 no.650
dc:description	John E. Ward.
dc:description	M.I.T. Project DSR 82300. Research supported by Lincoln Center for the Performing Arts.
dc:publisher	Electronic Systems Laboratory, Dept. of Electrical Engineering and Computer Science, Mass
dc:contributor	Ward, John Erwin.
dc:date	2002-06-21T03:39:57Z
dc:date	1976
dc:format	v, 49, [31] leaves
dc:format	application/pdf
dc:identifier	http://hdl.handle.net/1721.1/1259
dc:language	eng
dc:relation	Report (Massachusetts Institute of Technology. Electronic Systems Laboratory) ; ESL-R-650.

3357 records !

Problems exist in direct mapping when:

- converting from a *less inclusive* to a *more inclusive* format
- Converting between flat and hierarchical structures
- converting from an *uncontrolled* vocabulary content to a *controlled* vocabulary content
- converting to fields where there are indirect impacts on the *corresponding* fields and values, (e.g., 043 and 6xx #z)
- data contents use *different* controlled vocabularies
- data being converted into *non-searchable* fields

Examples of Missed Data Values during converting

- When a group of elements map to a single one, there could be missed data values.

RightsManagement

Role

Copyright Holder

Description

No copyright notice. Copyright 2001 Rainer Dick presumed.

Contact

arXiv.org e-Print archive. <http://xxx.arxiv.cornell.edu/>

Conditions



dc:rights

From a LOM record:

1- GENERAL

- o 1.1 Identifier
 - Catalog : NEEDS
 - Entry : 49FEC5AD-7B27-4540-B0F7-EF20AB5126D9
 - Catalog : POND
 - Entry : lui236ADF369D304FCEB5BDA8A572F31B13
- o 1.2 Title
 - The Mini Board Technical Reference

3- META-METADATA

- o 3.1 Identifier
 - Catalog : NEEDS
 - Entry : 49FEC5AD-7B27-4540-B0F7-EF20AB5126D9
 - Catalog : x-ims-plirid-v0
 - Entry : urn:x-ims-plirid-v0:liceftelugu.quebec.ca:sys:lorix:4

4- TECHNICAL

- o 4.1 Format
- o 4.2 Size (bytes)
- o 4.3 Location
 - <http://lcs.www.media.mit.edu/people/fredm/papers/mb/>
- o 4.4 Requirements

three
identifiers

dc:identifier

- multiple elements should map to dc:identifier element

Examples of Missed Data Values

	Converted Record
Title	Game Theory Simulation
Author	Stephan Waner
Category	Game Theory
Subject	Game Theory
Type	Interactive Tutorial → missed?
Description	Here is a little on-line Javascript utility for game theory (row and column player). It is also designed to play against a mixed strategy most of the time... Notes: This will only work in Internet Explorer, version 3 or later. You need only enter the non-zero probabilities for the row strategies. (The computer does not know your mind...)
URL	http://people.hofstra.edu/faculty/Stefan_Waner/RealWorld/

DC: Elements: 8	
dc:title:	Game Theory Simulation
dc:creator	Stephan Waner
dc:subject	Game Theory
dc:description	Here is a little on-line Javascript utility for game theory (row and column player). It is also designed to play against a mixed strategy most of the time... Notes: This will only work in Internet Explorer, version 3 or later. You need only enter the non-zero probabilities for the row strategies. (The computer does not know your mind...)
dc:date	2003-01-01
dc:identifier	http://www.econport.org:8080/econport/request?page=web_or_summary&contentMetadataID=116
dc:source	http://people.hofstra.edu/faculty/Stefan_Waner/RealWorld/
dc:language	en

- These records' TYPE values were not converted to the repository.
- These resources are excluded when users search by resource type.

SEARCH

Search By Resource Format

Text

Image

Audio

Video

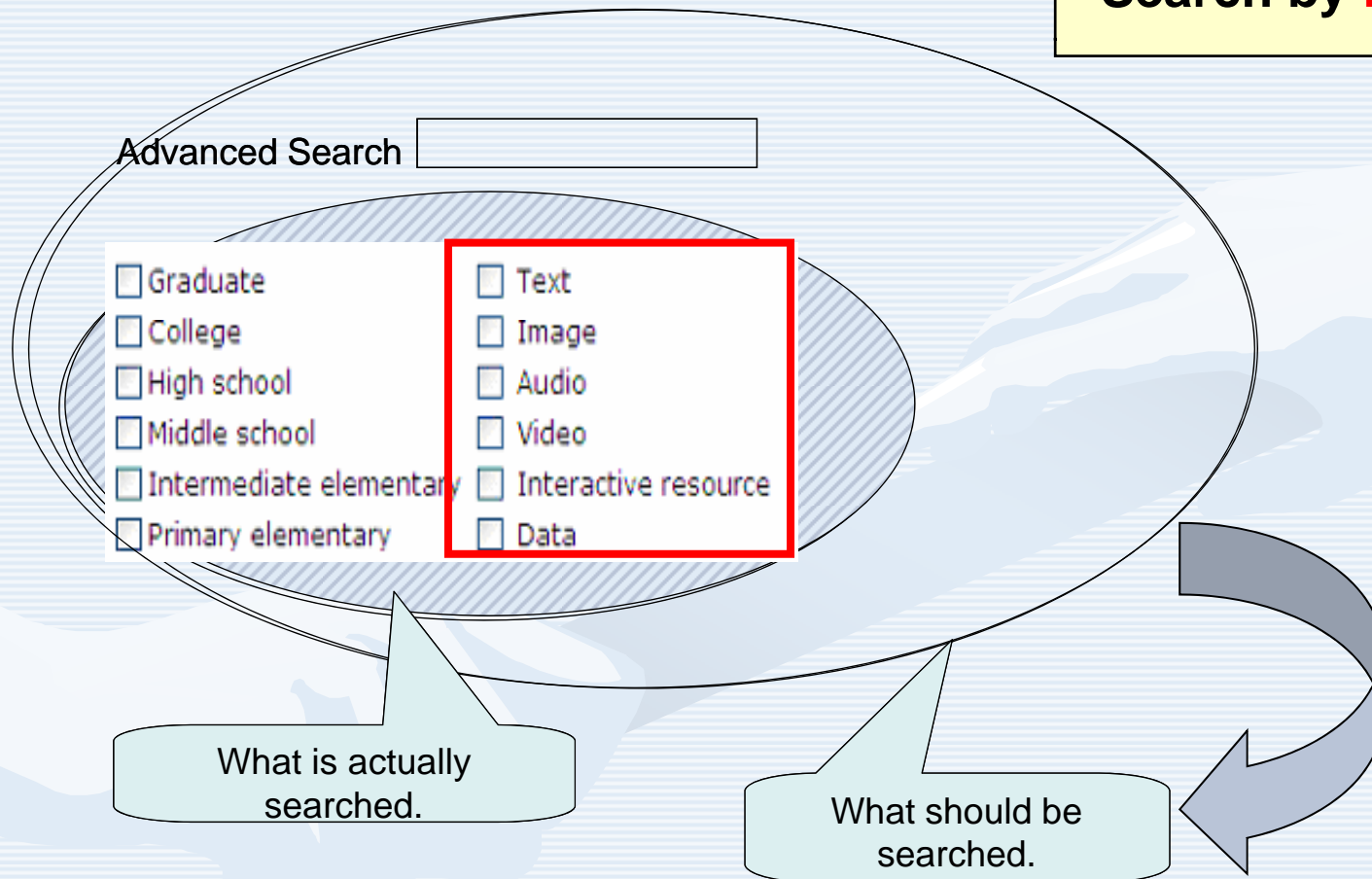
Interactive resource

Data

Avoid Missing Data Values in Conversion !

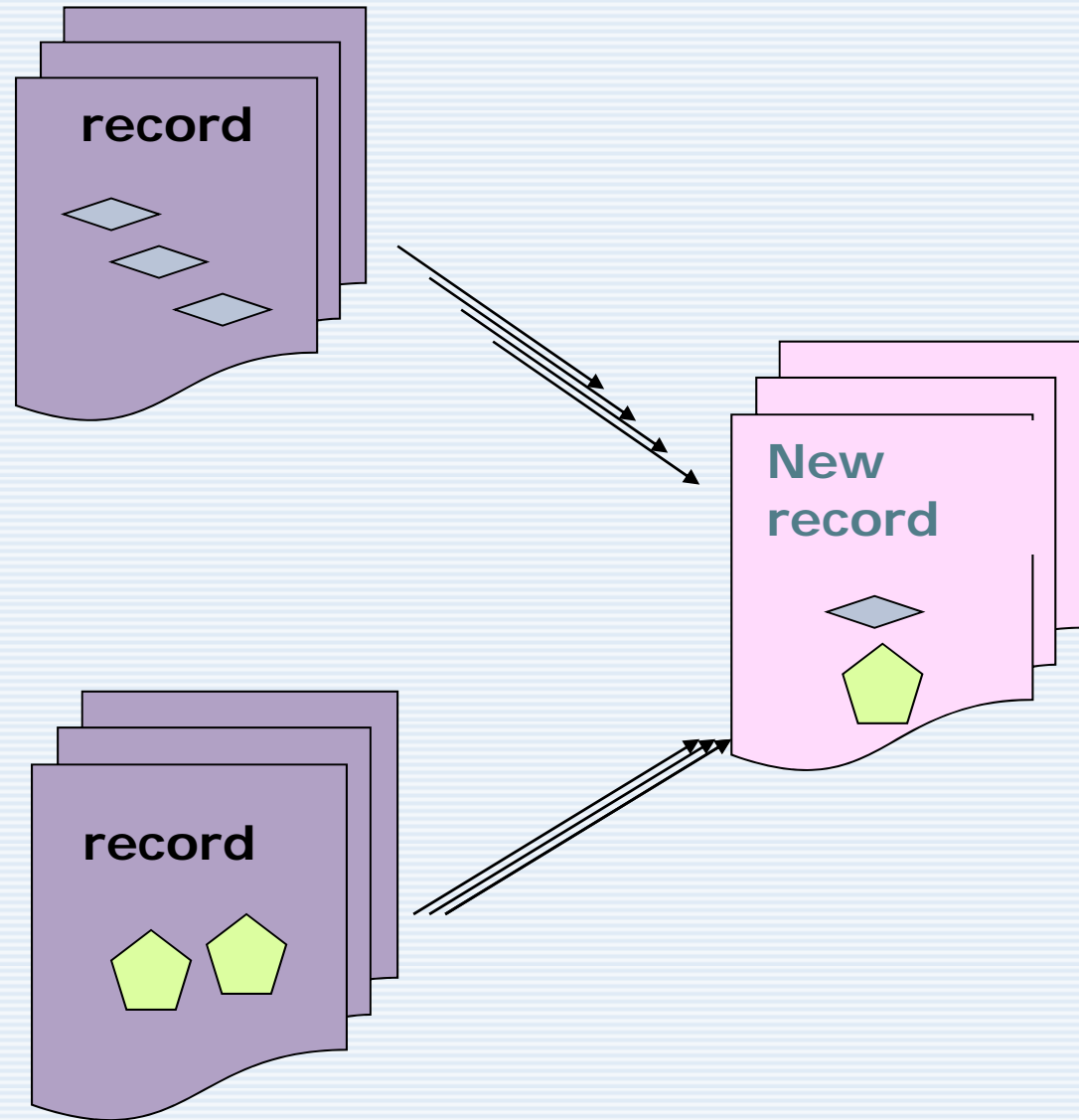
- Collections which did not provide **FORMAT** information are excluded from being searched

Search by **format**



2. Record level

2.2 Data-reuse
-- creating new
metadata records
based on existing
records



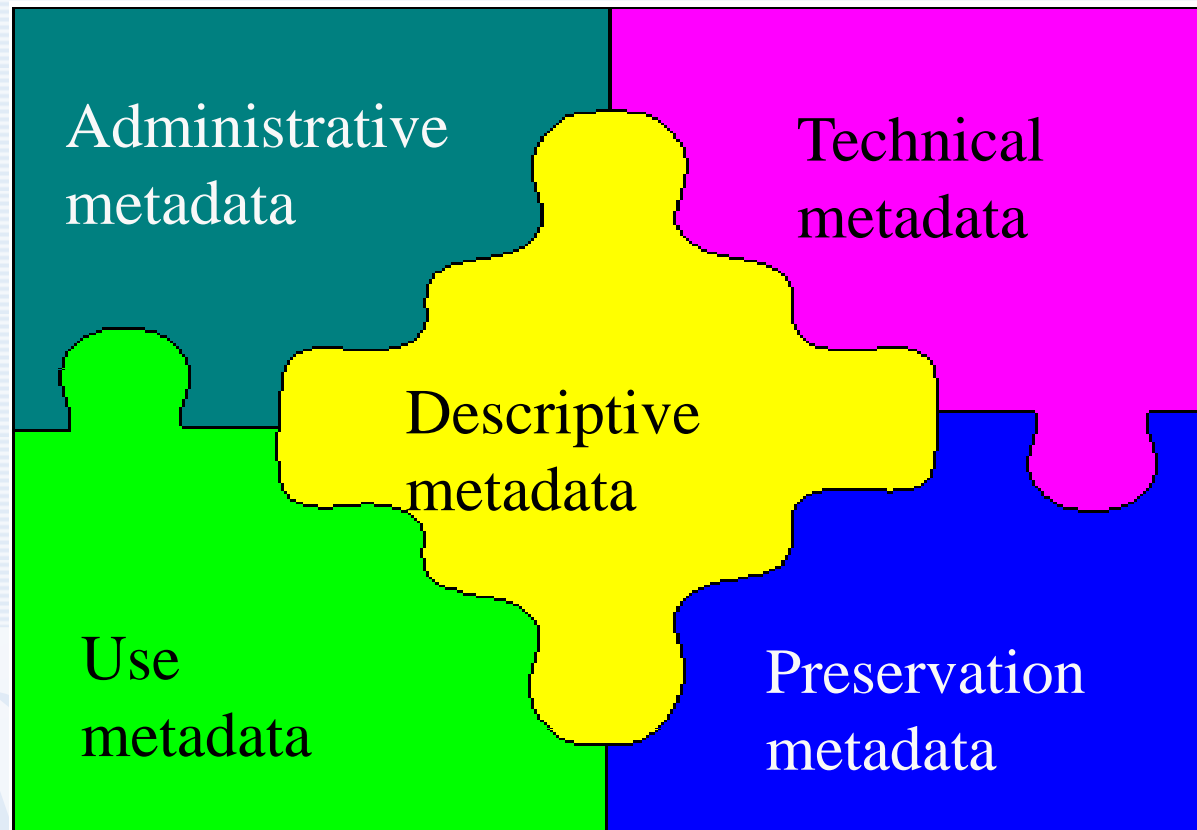
2.2 Data-reuse

Combining and recombining (the twin aspects of reuse) metadata descriptions

- 1) Creating basic metadata descriptions can be a combined effort of machine and human processing
- 2) Existing metadata descriptions can be reused for any appropriate projects
- 3) Quality of metadata can be enhanced through recombinant metadata
- 4) Integrated records can be generated for better access and sharing.

Metadata Principles revisited

Simplicity
Modularity
Reusability
Extensibility
Interoperability



METS

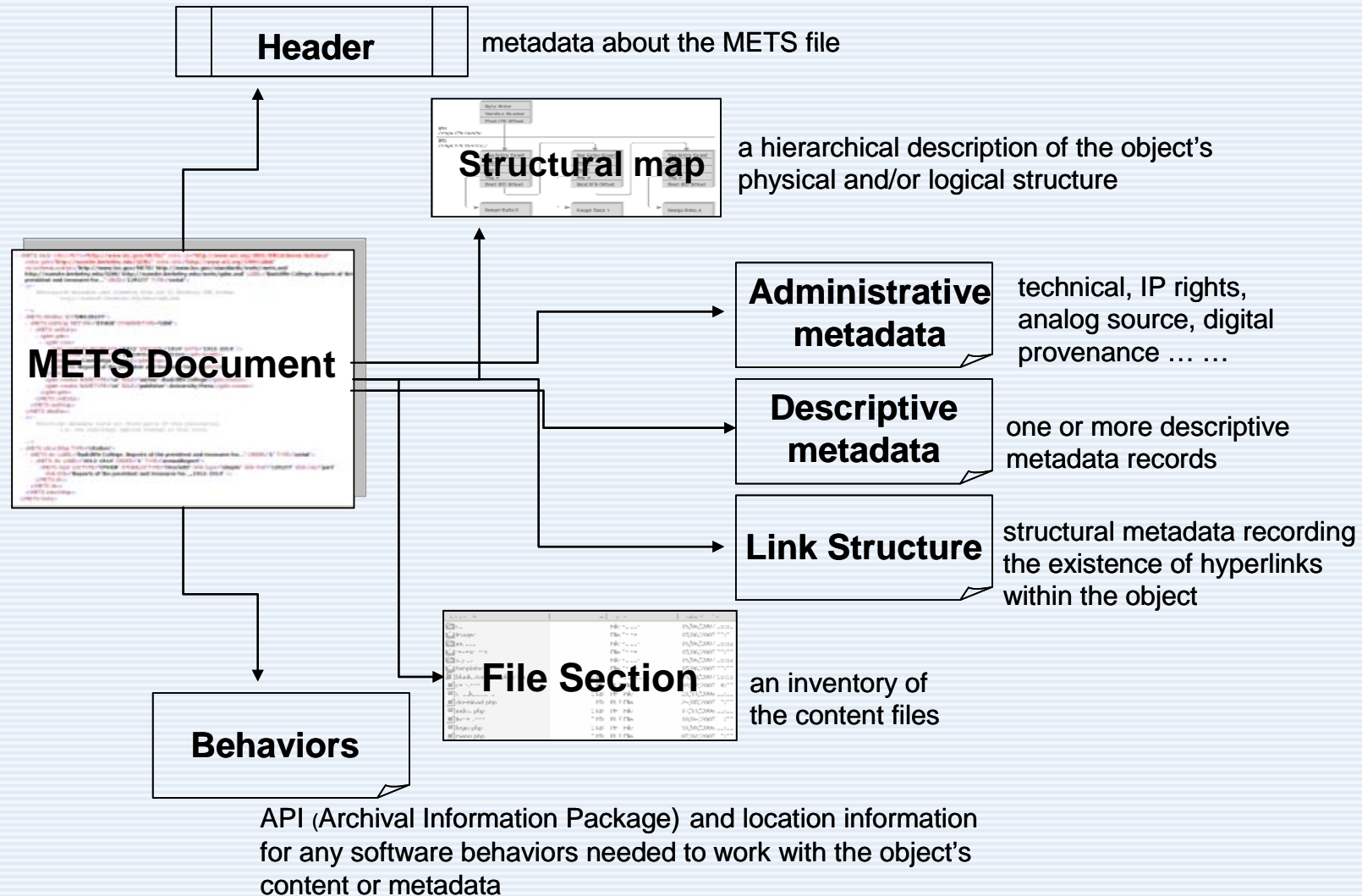
(Metadata Encoding and Transmission Standard)

- A standard for packaging descriptive, administrative, and structural metadata into one XML document
- A framework for combining several internal metadata structures with external schemas (such as MODS or MIX)
- The descriptive metadata section may point to descriptive metadata external to the METS document

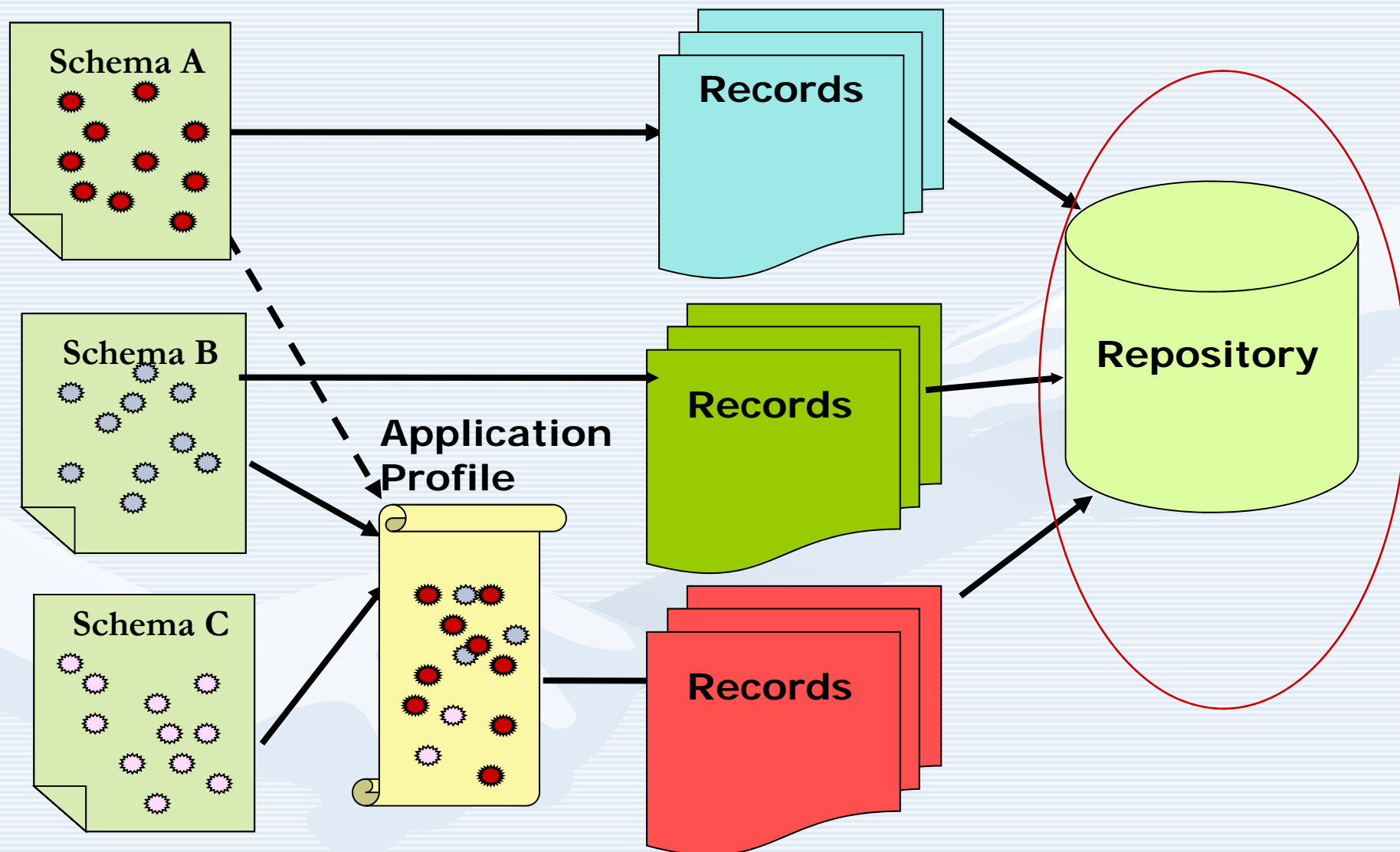
<http://www.loc.gov/standards/mets/>

2. Record level

Using METS – a ‘glue’ or ‘hub’ of metadata

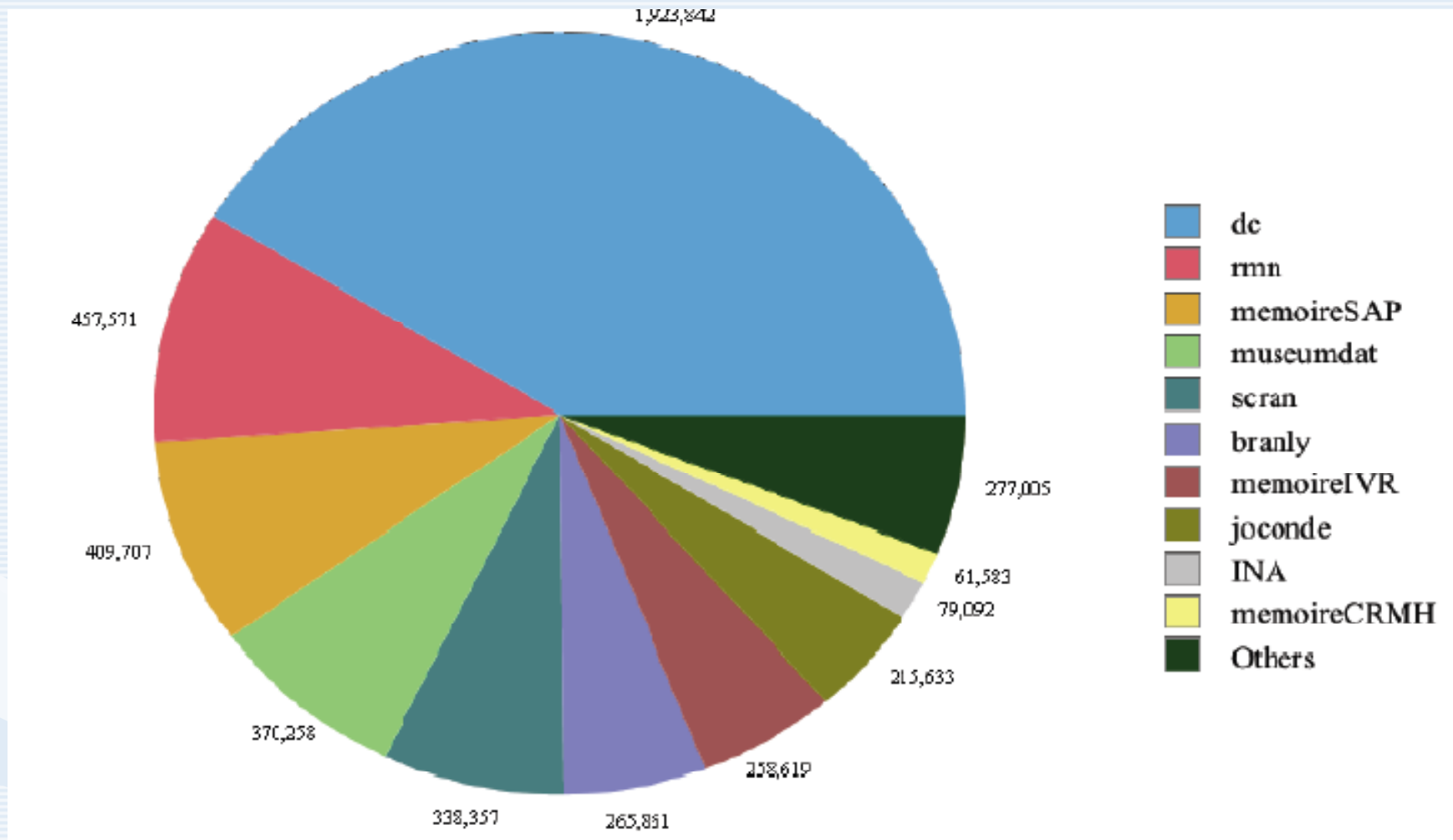


Review: Ensuring interoperability at different levels



Europeana

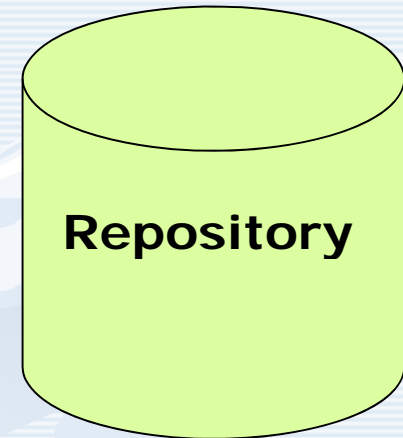
Heterogeneity: records grouped by metadata format



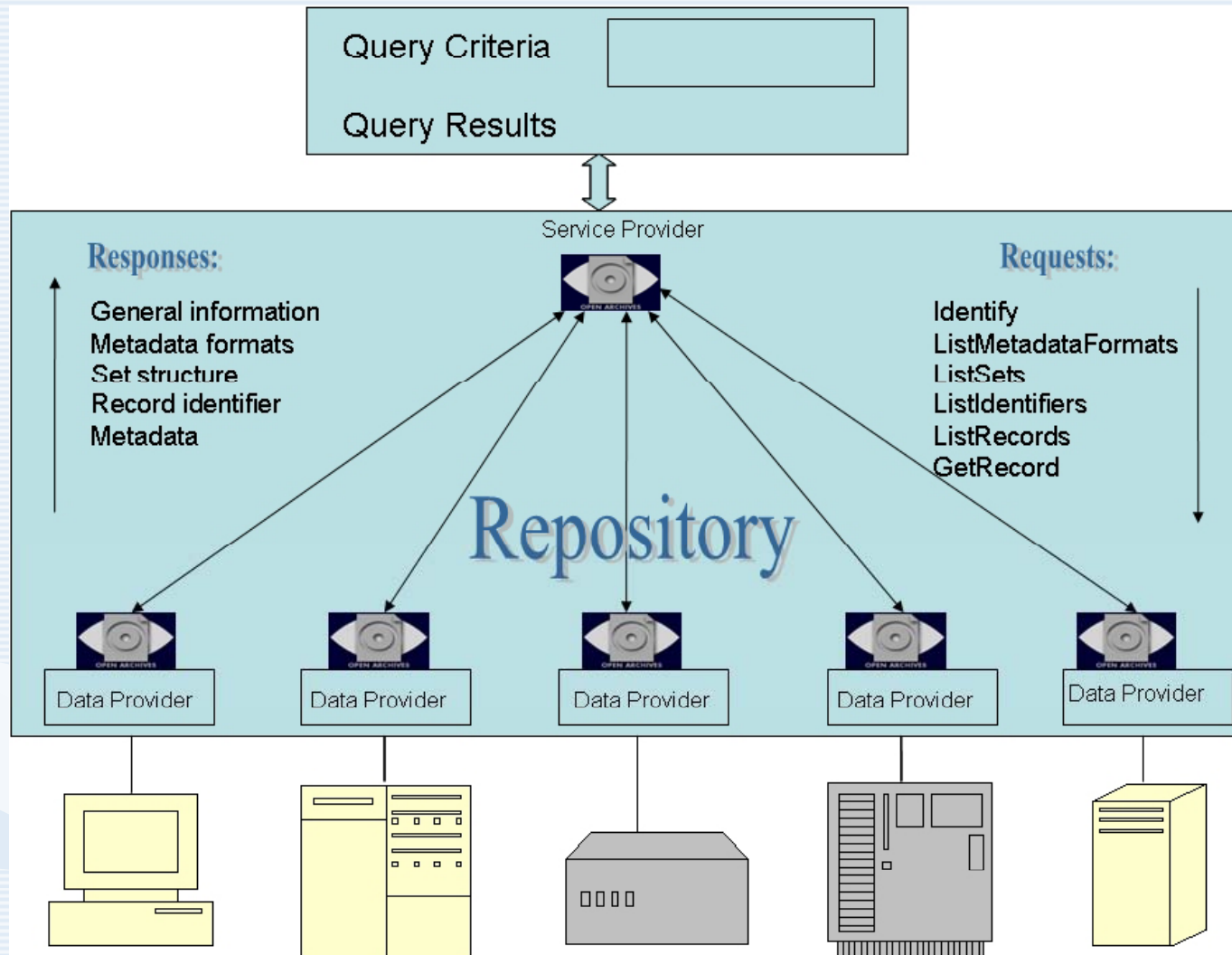
Source: Concordia: Integration of Heterogeneous Metadata in Europeana
http://dublincore.org/groups/tools/docs/LIDA09WorkshopC_1.pdf

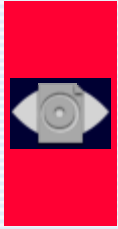
3. Repository level

- With harvested or integrated records from varying sources, efforts at metadata repository level focus on mapping value strings associated with particular elements (e.g., terms associated with *subject* or *format* elements).
- This enables cross-collection searching.



3.1 Open Archives Initiative (OAI)





Benefits of the OAI approach

- Material can be accessed more widely;
- Material can be exploited for purposes different from those that originally motivated the creation of the repositories;
- New and improved services can be constructed because of the possibility of accessing multiple repositories; and
- There is potential for cost-saving inherent in new models of the scholarly communication process that could be realized through an open archives approach.

Summarized by Carpenter (2003)

3. Repository level

3.2 Value-Based Mapping for Cross-Database Searching



e.g., mapping between values of subject authority files

[Home](#)

	English (LCSH)	Deutsch (SWD)	Français (RAMEAU)
<input type="checkbox"/>	All terrain cycling	Mountainbiking or Geländeradsport	Vélo tout terrain or Vélo tout terrain
<input type="checkbox"/>	All terrain cycling -- Training	Training and Geländeradsport	Entraînement and Vélo tout terrain
<input type="checkbox"/>	Cycling	Radsport or Radfahren	Cyclisme or Cyclisme
<input type="checkbox"/>	Cycling accidents	Sportverletzung and Radsport	Cyclistes -- Lésions et blessures
<input type="checkbox"/>	Cycling for women	Frauensport and Radsport	Cyclisme féminin
<input type="checkbox"/>	Cycling -- Law and legislation	Sportrecht and Radsport	Droit and Cyclisme
<input type="checkbox"/>	Cycling -- Records	Rekord and Radsport	Records and Cyclisme
<input type="checkbox"/>	Cycling -- Safety measures	Unfallverhütung and Radsport	Mesures de sécurité and Cyclisme
<input type="checkbox"/>	Cycling -- Training	Training and Radsport	Entraînement and Cyclisme



multilingual access to subjects

Your search results in the libraries...

[Home](#) | [Browse translations](#)

British Library: 30 hits.

1. [The complete book of mountain biking; Brant Richards and Steve Worland;](#)
2. [The mountain bike book; David Leslie; photographs by Tim Woodcock;](#)
3. [Mountain bike racing; Tim Gould and Simon Burney;](#)
4. [Mountain biking; Brant Richards;](#)
5. [Learn mountain biking in a weekend;](#)
6. [Fat tire; a celebration of the mountain bike; Amici Design;](#)
7. [Pro mountain biker; the complete manual of mountain biking - bikes accessories and techniques; Jeremy Evans and Brant Richards;](#)
8. [Mountain biking; Paul Skilbeck;](#)
9. [The ultimate mountain bike book;](#)
10. [Advanced mountain biking;](#)

[Show more records](#)

Bibliothèque nationale de France: 66 hits.

1. [La Consultation médicale du cycliste; D J.-P. de Mondenard;](#)
2. [Le Peloton de tÅete; Jean-Baptiste Bellone;](#)
3. [Les Cyclistes en questions; D J.-P. de Mondenard; dessins de Albert...;](#)
4. [Médecine du cyclisme; par H. Judet,... et G. Porte,...; \[avec la collaboration de P. Miserez\];](#)
5. [La Consultation du médecin; 30 nouvelles consultations; par le D J.P. de Mondenard;](#)
6. [La Santé des cyclistes; du loisir à la compétition; Dr J.-P. de Mondenard...;](#)
7. [Le Cyclisme, de l'école à la compétition; route et piste, à l'usage des jeunes cyclistes, coureurs, dirigeants, entraîneurs, cadres techniques, préparation aux diplômes fédéraux et bevet d'état, Daniel Clément...;](#)
8. [Les Femmes à bicyclette à la Belle époque; présenté par Claude Pasteur;](#)
9. [Les Petites reines du Tour de France; Rémy Pigois;](#)
10. [Pratique du cyclisme; Peter Konopka;](#)

[Show more records](#)

Swiss National Library: One hit.

1. [Schwyzerland; \[Kartenmaterial\] ; Rigi - Vierwaldstättersee : Wanderkarte;](#)

Die Deutsche Bibliothek: 62 hits.

1. [Bike-Events ... : die Höhepunkte der Saison ; Bike plus](#)

The full record

[Home](#) | [View raw record](#) | [Set](#) | [Next](#) | [Previous](#)

Record # 4/30

Title Mountain biking; Brant Richards;
Author Richards Brant
Subjects All terrain bicycles
All terrain cycling
ISBN 0713647183 m

The full record

[Home](#) | [View raw record](#) | [Set](#)

Record # 1/1

Title Schwyzerland; [Kartenmaterial] :: Rigi - Vierwaldstättersee : Wanderkarte;
Subjects Mountainbiking Schwyz Karte SWD
Wandern Schwyz Karte SWD
Mountainbiking Vierwaldstätter See Karte SWD
Wandern Vierwaldstätter See Karte SWD
ISBN 3259003711 : Fr. 14.-
Publication date 1998

The full record

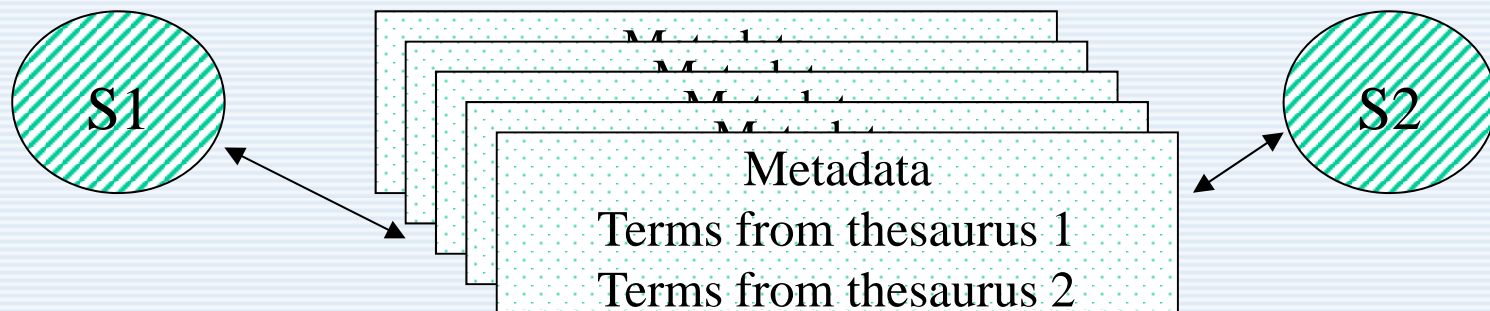
[Home](#) | [View raw record](#) | [Set](#) | [Next](#) | [Previous](#)

Record # 9/66

Title Les Petites reines du Tour de France; Rémy Pigois;
Author frBN001225256 Pigois Rémy
Subjects frBN001525556 Coureurs cyclistes frBN001573782 Biographies
frBN00247521X Cyclisme féminin frBN001557696 Histoire
frBN001968110 Sportives frBN001573782 Biographies
frBN001646910 Tour de France (course cycliste)
frBN003888225 1970-....
ISBN 145 F

3.3 Value-Based Co-Occurrence Mapping

In metadata records, where the group of subject terms can actually result in loosely-mapped terms.



Gazetteer Standard Report
Alexandria Digital Library

Reports: [Standard Report](#) | [Standard XML](#) |

Feature Name:

Display name:

Cold Boiling Lake - Shasta County - California - United States

Geographic name:

Cold Boiling Lake

Variant name:

Soda Lake

Feature Class:

lakes from *ADL Feature Type Thesaurus*

LAKE from *GNIS Feature Classes*

Spatial Reference:

Bounding Coordinates:

Long: -121.4825 Lat: 40.4561

Long: -121.4825 Lat: 40.4561

Footprints:



Geometry Type: Point

Long: -121.4825 Lat: 40.4561

Identification Code: adlgaz-1-6202475-58

Reference Codes:

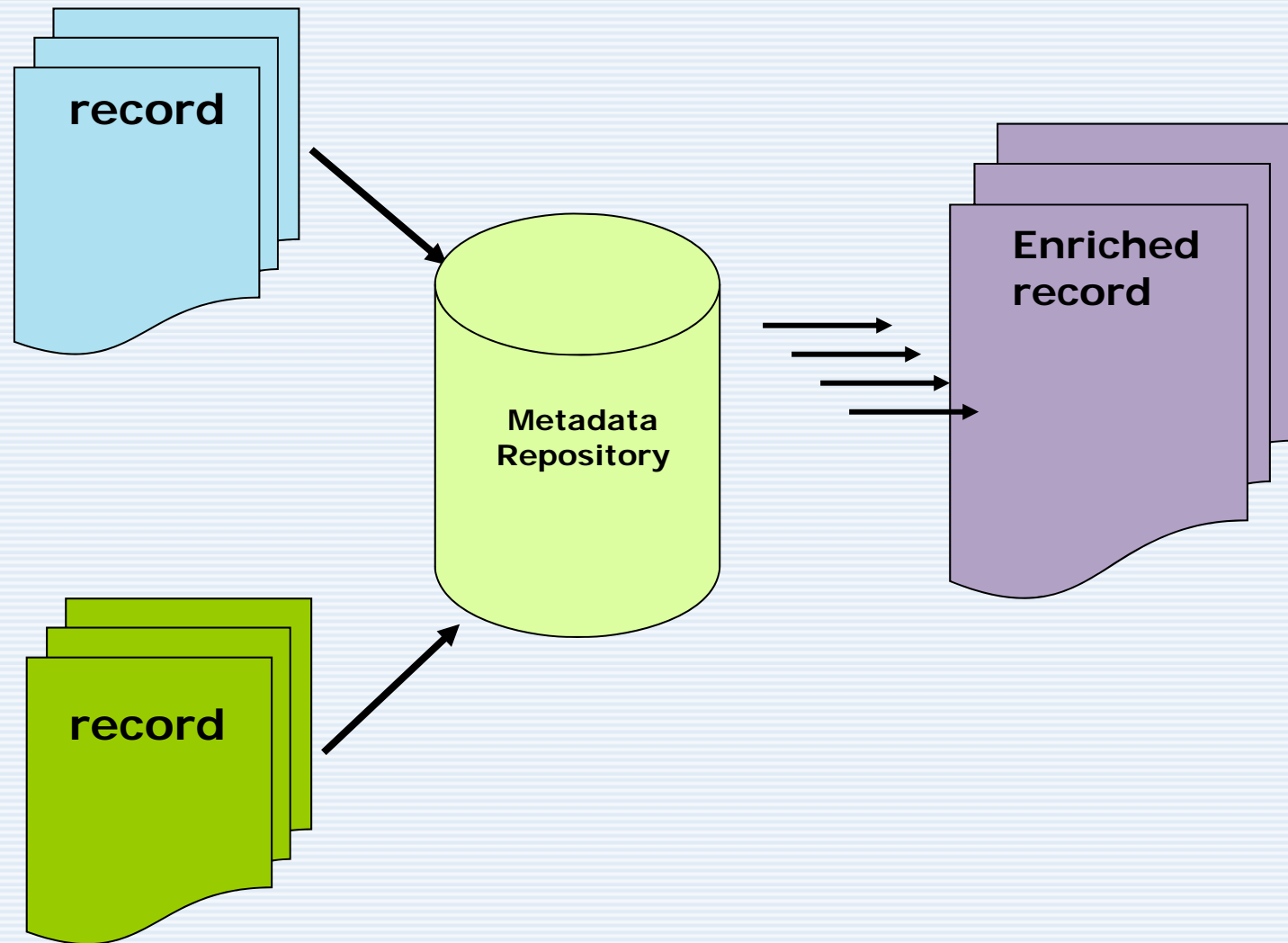
GNIS Feature ID Number: 254759

ADL Feature Thesaurus term: lakes

GNIS *GNS Feature Class*: LAKE

3. Repository level

3.4 Aggregation and Enriched Records in a Repository



3.4 Aggregation and Enriched Records in a Repository

Hillmann, et.al. (2005) identified four categories of problems that limit metadata usefulness:

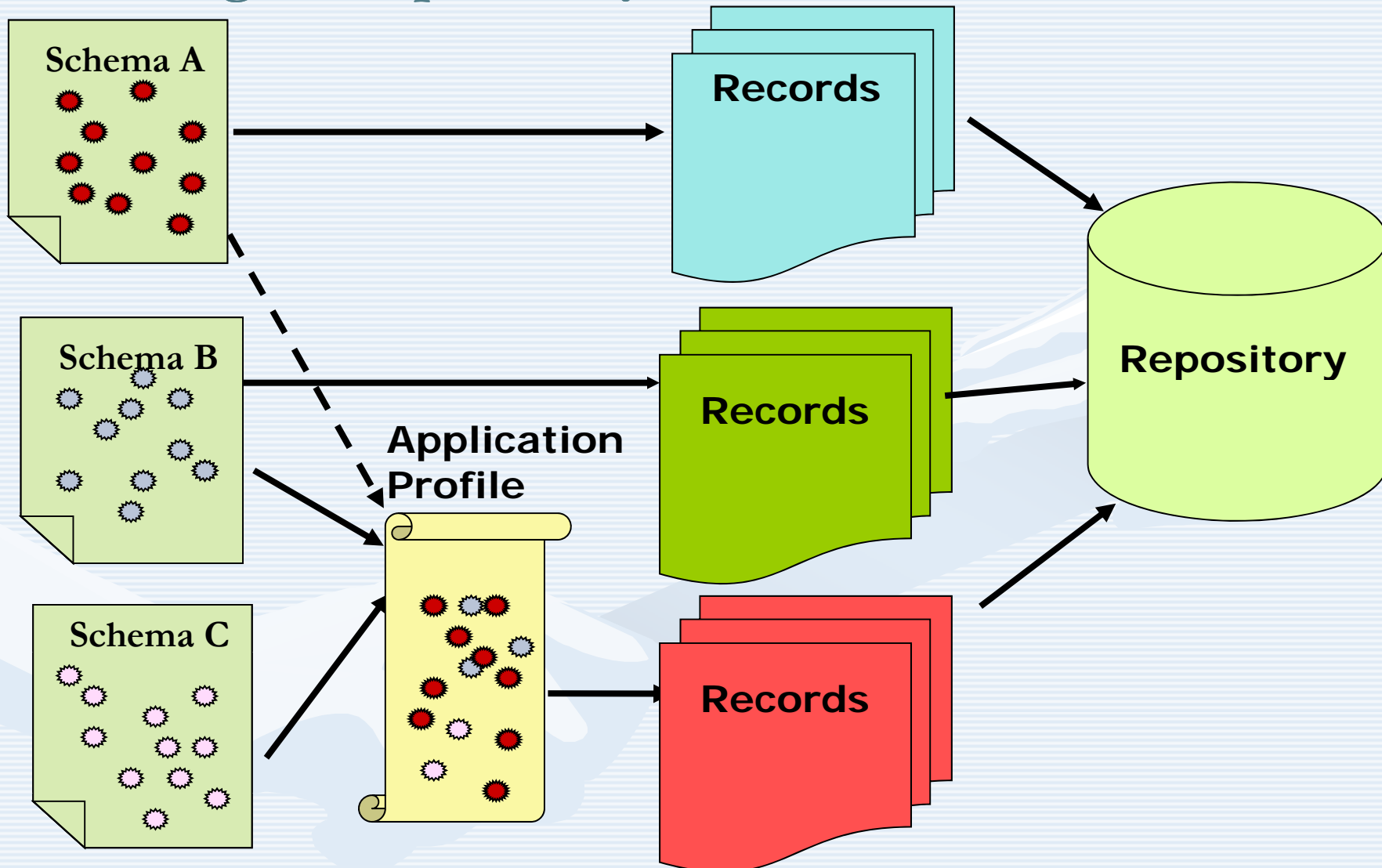
- Missing data: elements not present
- Incorrect data: values not conforming to proper usage
- Confusing data: embedded html tags, improper separation of multiple elements, etc.
- Insufficient data: no indication of controlled vocabularies, formats, etc.

It is possible that these problems be eliminated to certain level through a process called ‘aggregation’ in a metadata repository.

The notion behind this process is that a metadata record, “a series of statements about resources,” can be aggregated to build a more complete profile of a resource.

Summary:

Ensuring interoperability at different levels



Summary:

Ensuring interoperability at different levels

1. schema level

- derivation
- application profile
- crosswalks
- switching-cross
- framework
- schema registry

2. record level

- data conversion
- data reuse, integration

3. repository level

- OAI protocol
- subject authority file mapping
- value co-occurrence mapping
- aggregation and enriched records

Conclusion

- Interoperability – an over-riding issue in the digital, networked environment
- Requiring enormous effort, both human and mechanical
- Need for the highest feasible level of interoperability among metadata schemas in order to facilitate and improve federated searches

Questions?
mzeng@kent.edu

Thank You!

This tutorial is based on the full paper (with Prof. Lois Chan), published in *D-Lib Magazine*, June, 2006. <http://www.dlib.org/dlib/june06/06contents.html>

&

Textbook *Metadata* (with Jian Qin) published in 2008.

ISBN: [9781555706357](#) (US) | [9781856046558](#) (UK)