INF1343, Winter 2011

Data Modeling and Database Design

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Week 9

Databases and Objects

(after reviewing old material)

Schedule

Intro	Design	Interfacing	Security
SQL	Design	XML	Storage
SQL	Design	Objects	Scale

April 4: Final exam

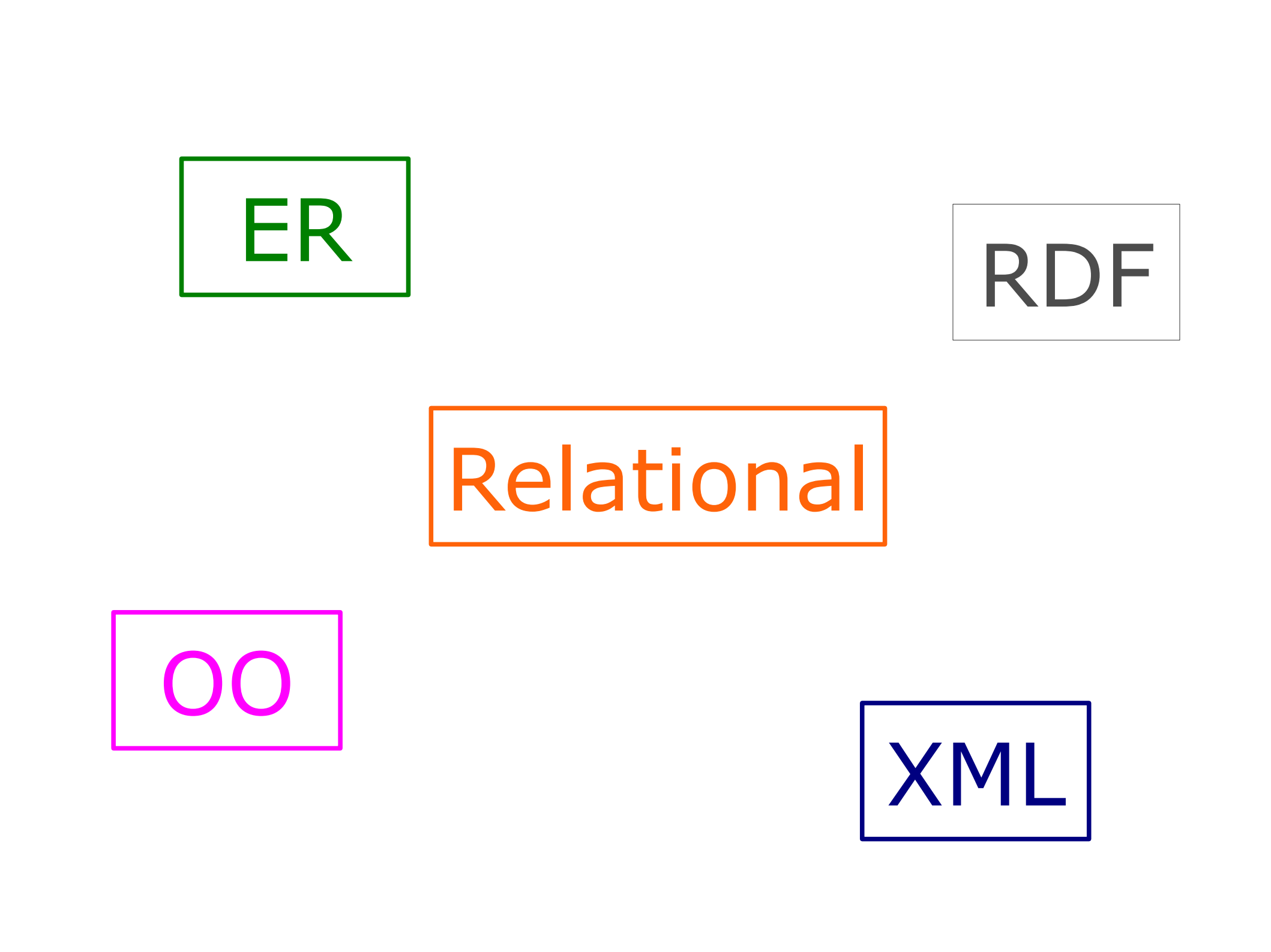
Final Exam

Skills:

weeks 1-6
(SQL, ER, translation, normalization)

Concepts:

weeks 1-12
E.g.: “Why does XML have to do with databases?”


ER
RDF
Relational
OO
XML

Relational vs ER

Relational: relations (tables), records (rows), fields, PKs, FKs.

ER: entities, attributes, relationships.

Relational vs ER

ER: Conceptual + a visual language
Relational: Physical / conceptual

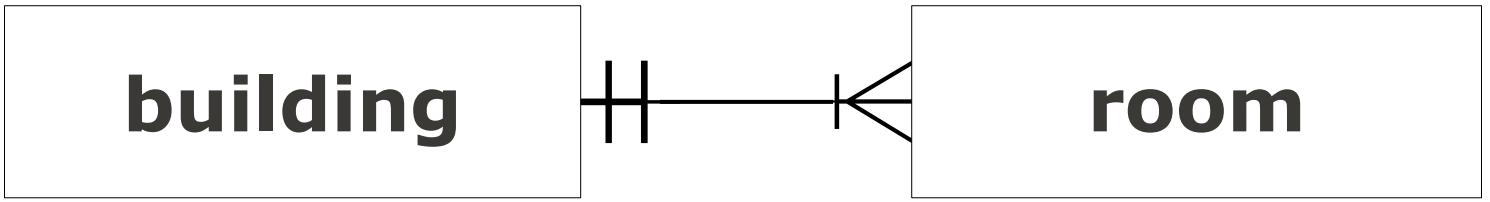
RM is more flexible.
(Not necessarily a good thing!)

Can translate from ER into RM.
(Not always the other way around!)

ER → RM Translation

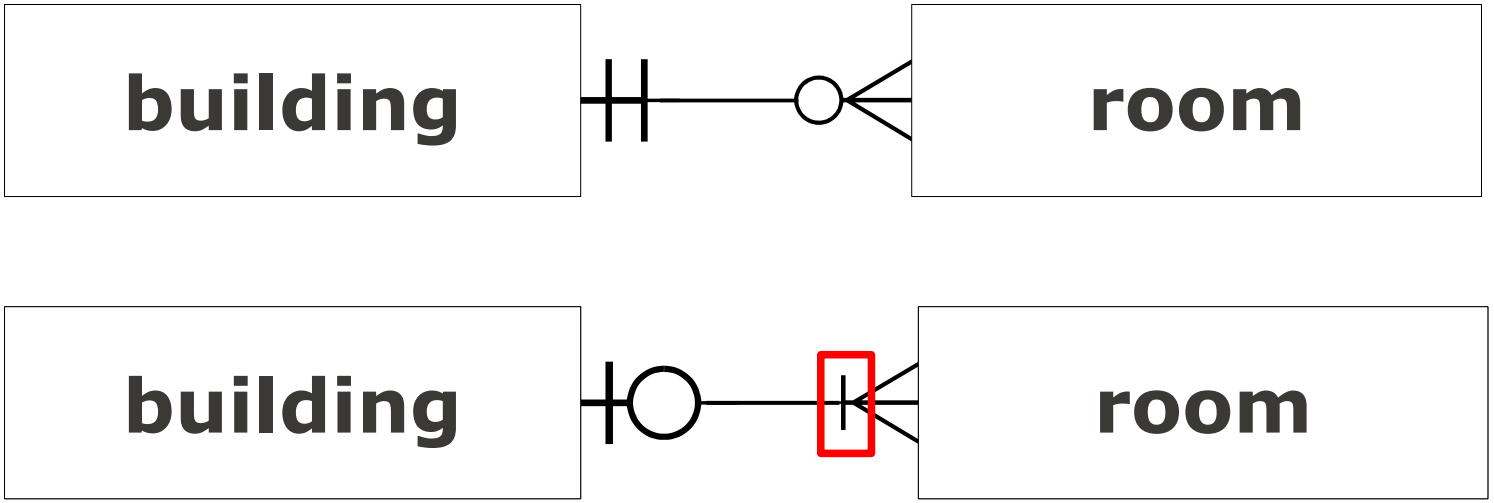
entities	→	relations (tables)
instances	→	records (rows)
attributes	→	fields
relationships	→	PK/FK constraints

Limitations



Dually mandatory relationships become problematic in RM.

Limitations



No easy way to represent the mandatory “many” end.

Comments on ER

- Reality vs representation
- Duplication of information
- Determining an instance vs a set

Comments on RM

- Candidate keys
- Tables without PKs
- 1NF, 2NF, 3NF

  1NF: letter vs spirit; repeated values vs free form

  2NF: dependency on a part the PK

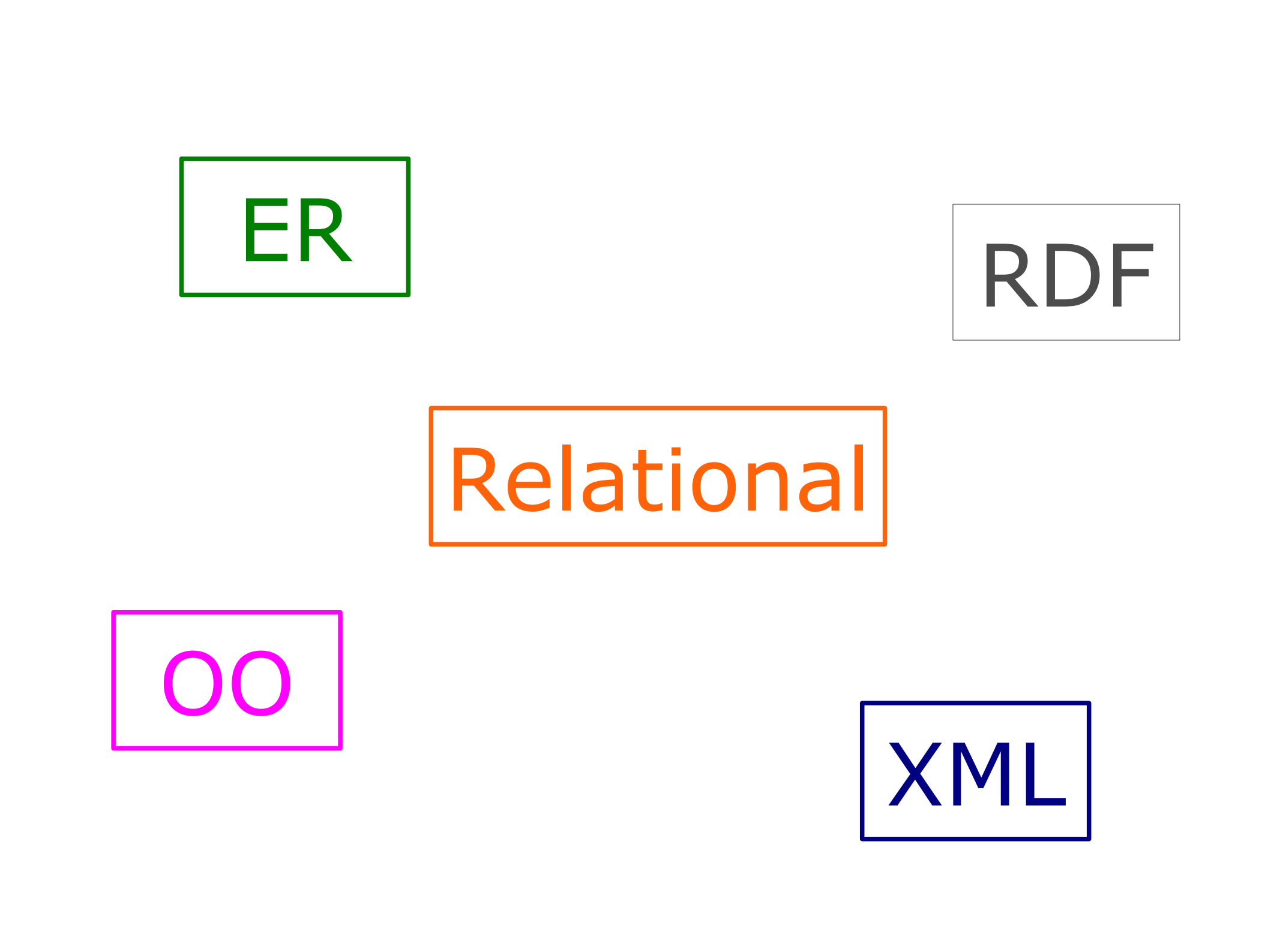
  country_code → country_name

  3NF: dependency on non-key attributes

  series_code → series_name, target, goal

  series_name → target, goal

  target → goal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RM vs XML

RM: simple records

advantage: ease of retrieval, consistency

XML: complex documents

advantage: exchange / serialization

JSON, YAML:

a similar data model to XML,
different serialization syntax

SQL Support in RDBMS

Direct XML export

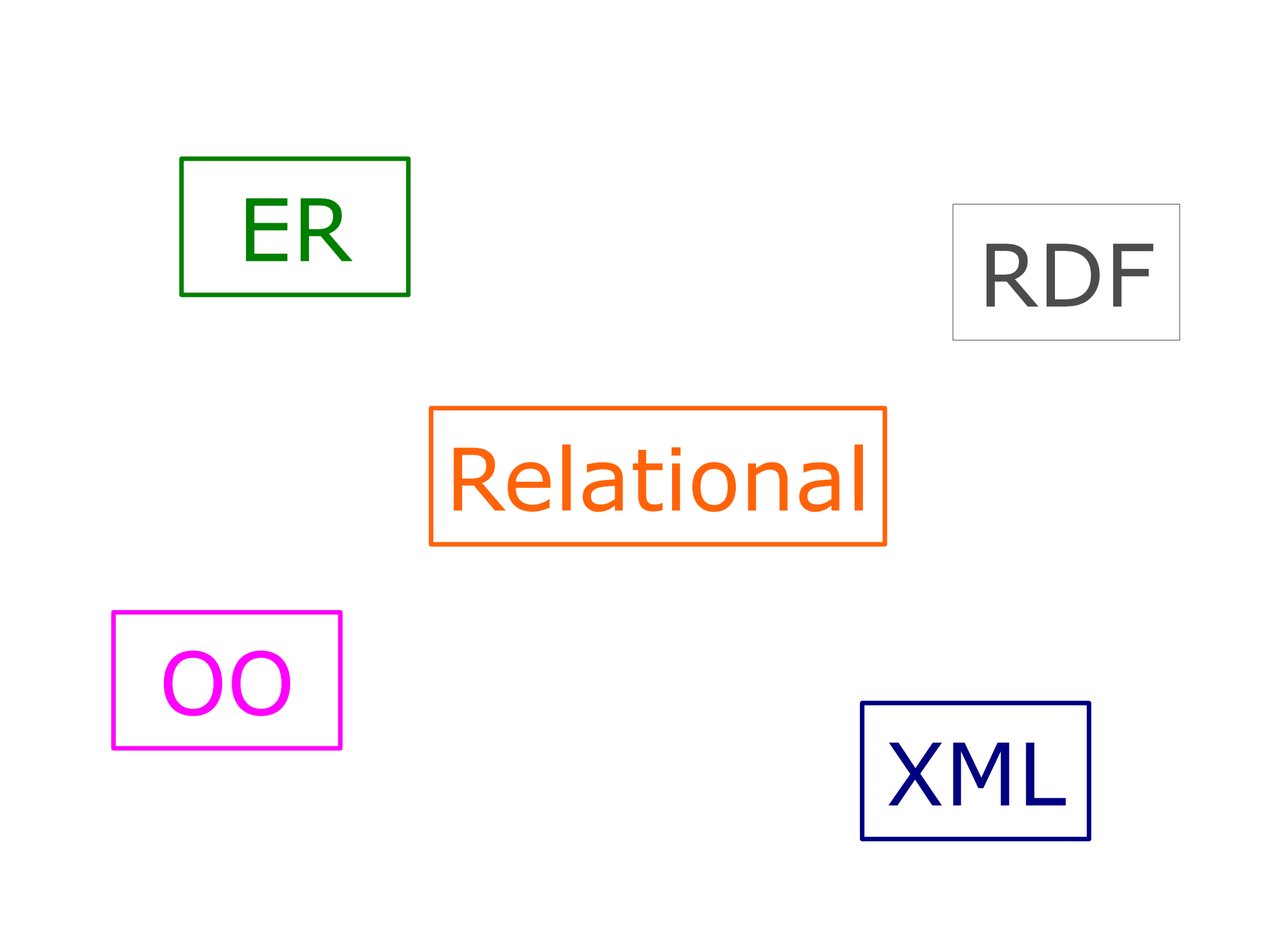
mysql --xml -e "use starwars; select * from persona;"
mysqldump --xml starwars

Direct XML import

LOAD XML command in MySQL 5.1 ~~(to be installed soon)~~.

Storing XML as a data type

Available in some systems, includes (some) XPATH support.
(Not in MySQL 5.1, but you can store XML in a BLOB.)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The Web of Data

Modest:

Exchanging data via HTTP in XML

"APIs", "Open data", e.g.:

http://www.toronto.ca/open/

http://webservices.nextbus.com/service/publicXMLFeed?command=predictions&a=ttc&r=510&s=spadsuss_n

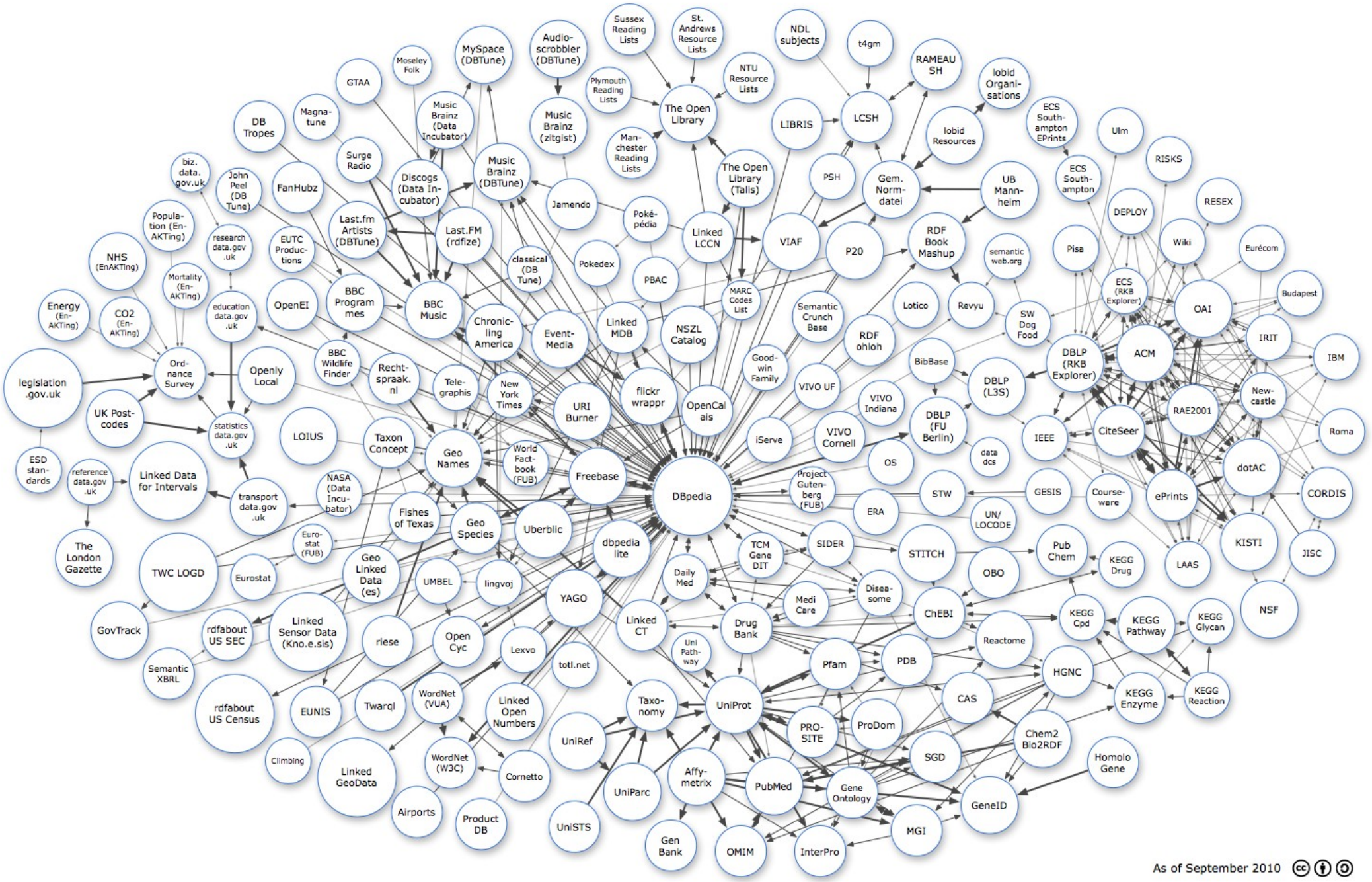
Ambitious:

Same, but interlinked. "Semantic web"

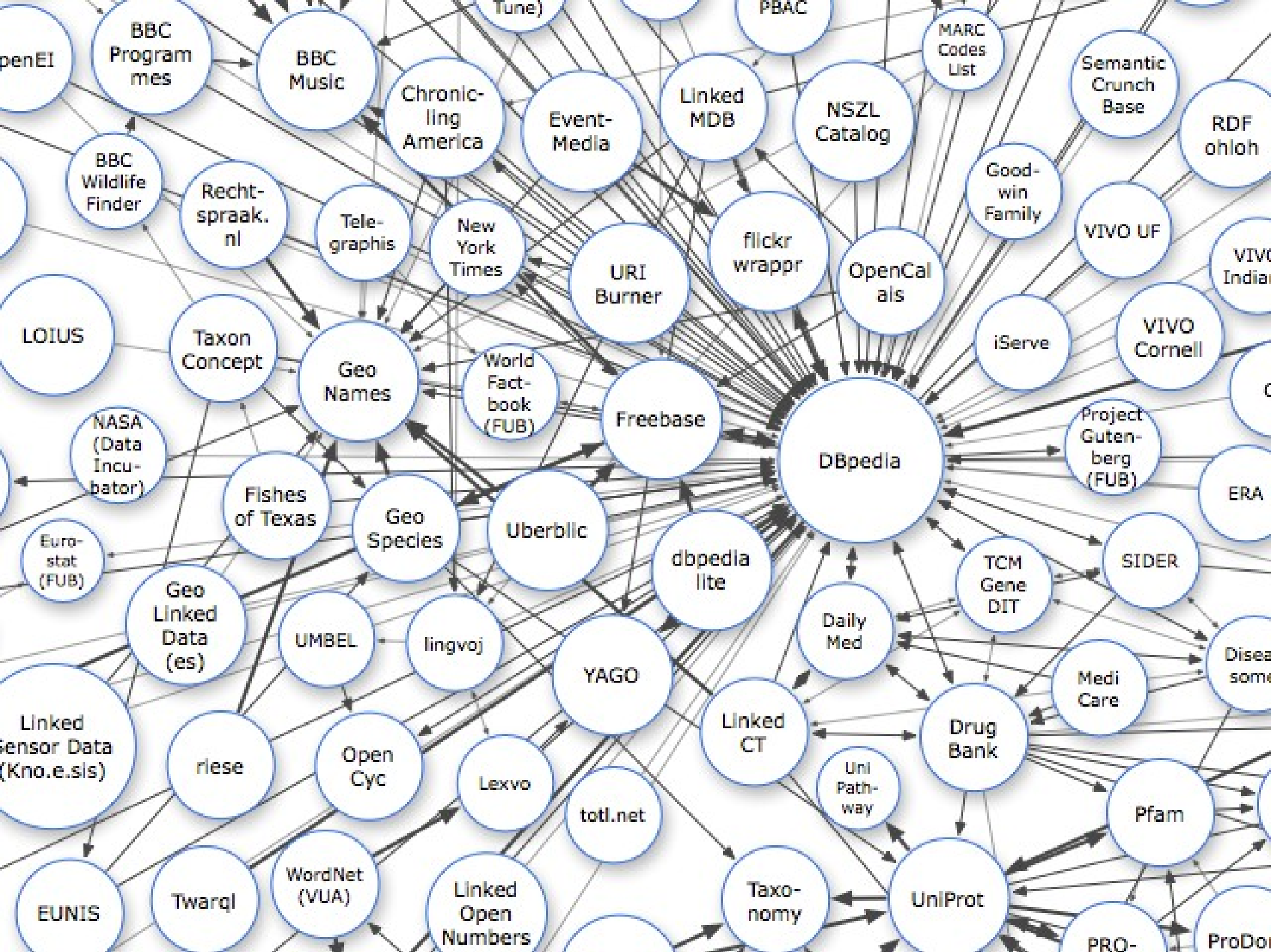
RDF: metadata in "triple" form:

```
@prefix foaf: <http://xmlns.com/foaf/0.1/>
ObiWan a foaf:Person
ObiWan foaf:knows Yoda
```

SPARQL – a bit like SQL adapted for RDF



Linking Open Data cloud diagram, by Richard Cyganiak and Anja Jentzsch. http://lod-cloud.net/


BBC Programmes
BBC Music
BBC Wildlife Finder
Chronicling America
Event-Media
Linked MDB
NSZL Catalog
MARC Codes List
Semantic Crunch Base
RDF ohloh
Recht-spraak.nl
Telegraphis
New York Times
URI Burner
flickr wrappr
OpenCalais
Goodwin Family
VIVO UF
LOIUS
Taxon Concept
Geo Names
World Factbook (FUB)
Freebase
DBpedia
iServe
VIVO Cornell
NASA (Data Incubator)
Fishes of Texas
Geo Species
Uberblic
dbpedia lite
Project Gutenberg (FUB)
ERA
Eurostat (FUB)
Geo Linked Data (es)
UMBEL
lingvoj
YAGO
Daily Med
TCM Gene DIT
SIDER
Linked Sensor Data (Kno.e.sis)
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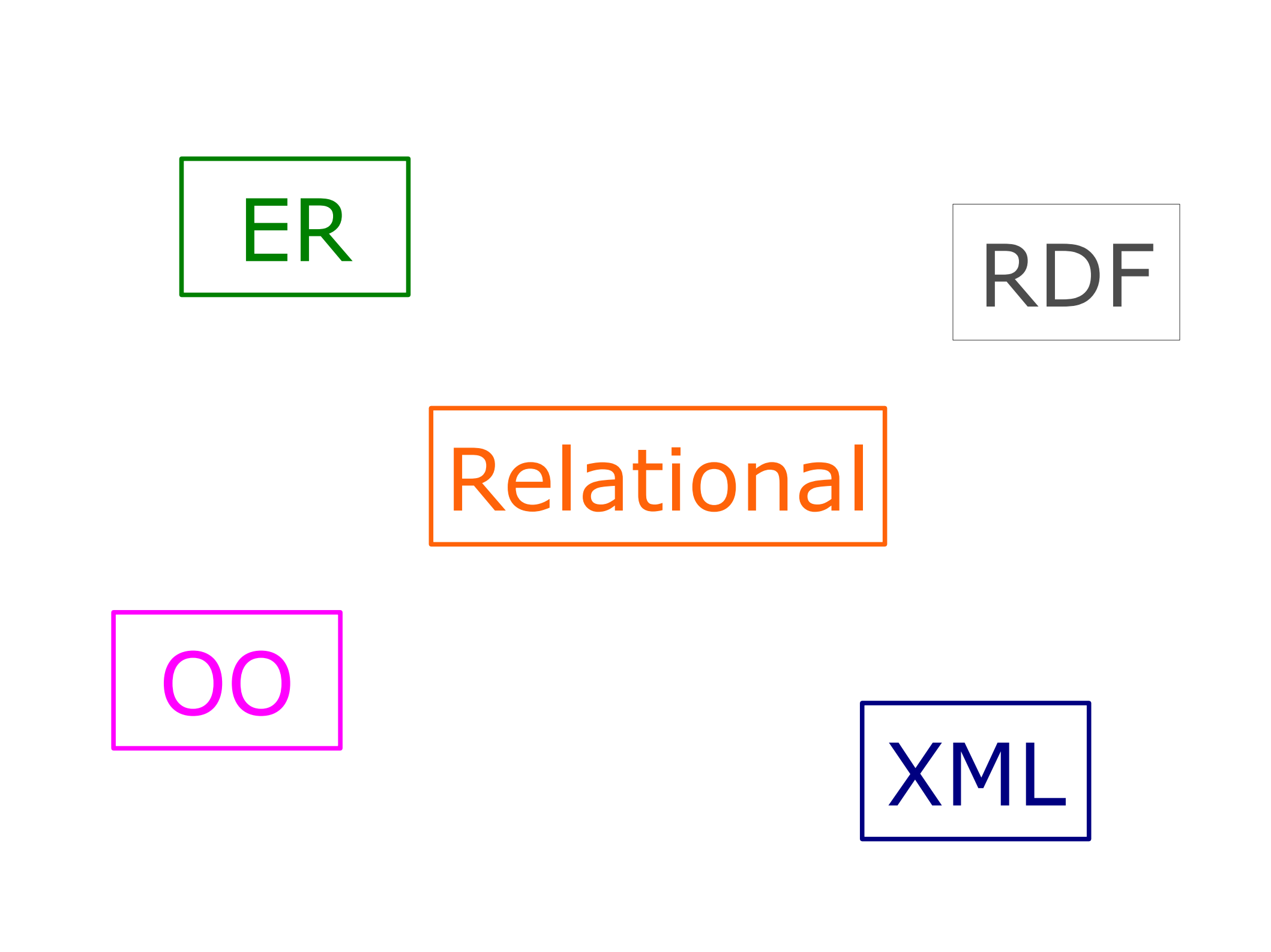
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Objects

The “native” data format for many programming languages.

Classes vs instances (cf. ER)

Attributes vs Methods

```
student.email_address
student.send_email(message)
```

Encapsulation

DB the "Dumb" Way

```
cursor=db.cursor()
query = TEMPLATE % species
cursor.execute(query);
rows = cursor.fetchall()
print "<table>"
for row in rows:
  print "<tr>"
  for x in [0,1,3]:
    print "<td>", row[x], "</td>"
  print "</tr>"
print "</table>"
```

DB the "Dumb" Way

```
cursor=db.cursor()
query = TEMPLATE % species
cursor.execute(query);
rows = cursor.fetchall()
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  print "</tr>"
print "</table>"
```
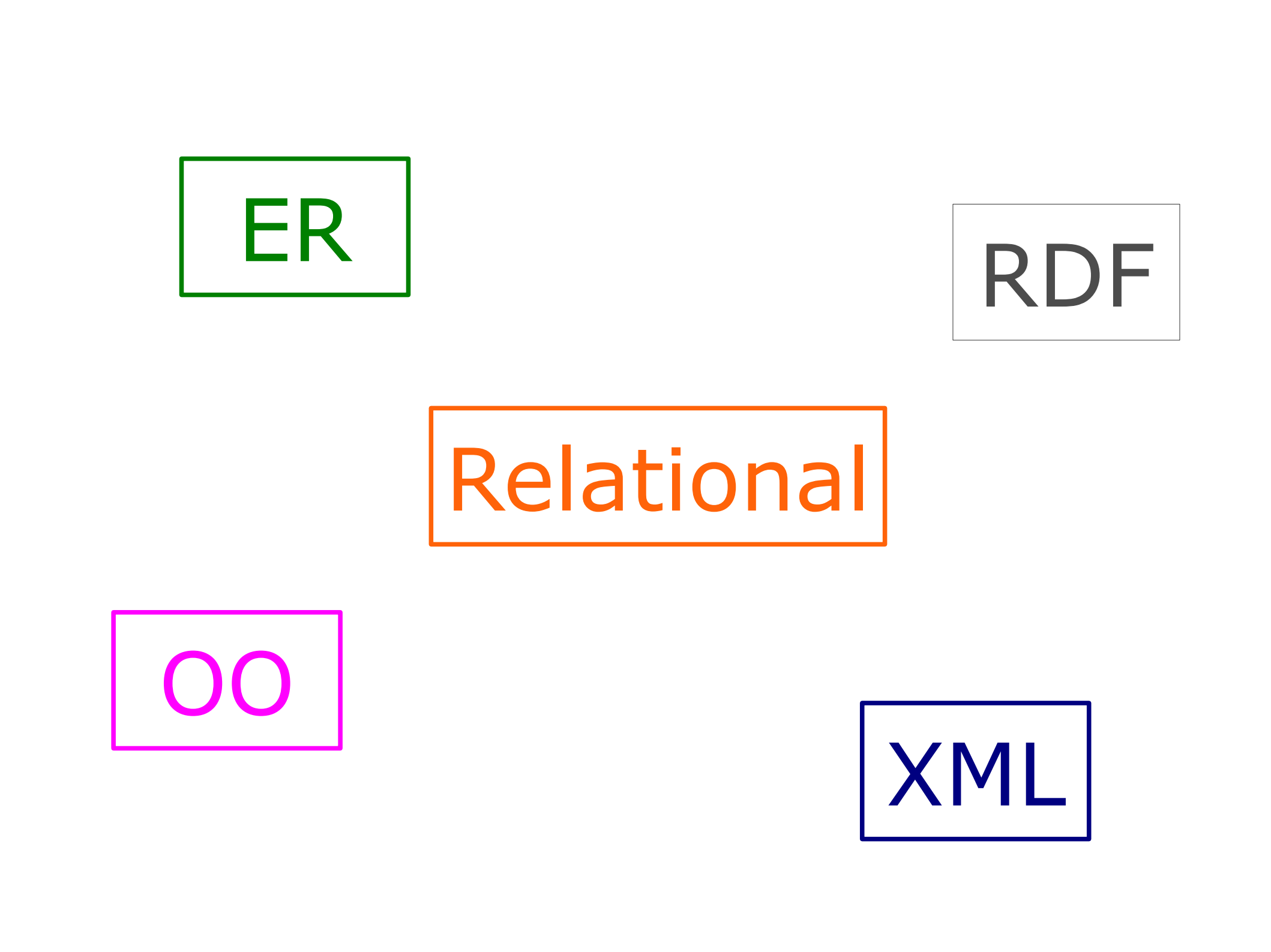

DB the OO Way

```
results=db.find_species(species)
print "<table>"
for result in results:
  print "<tr>"
  print "<td>", result.name, "</td>"
  print "<td>", result.size, "</td>"
  print "<td>", result.gender, "</td>"
  print "</tr>"
print "</table>"
```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Object-Relational Mapping

Option 1:

Map objects to relations (code → database)

Option 2:

Map relations to objects (database → code)

Option 2

Manual:

We setup a mapping
pet.name → getName($name)
setName($name)

Automatic:

The software figures it out
("introspection")

Examples

Rails / ActiveRecord (Ruby)

Django (Python)

Hibernate (Java)

Doctrine (PHP)

Django

Defining the model in Python:

/django/mysite/books/models.py

Django

Using the model:

```
cd /django/mysite
python manage.py shell
```

In the Python console:

```
from books.models import Publisher
p = Publisher(name="U of T Press",
    city="Toronto", country="Canada")
p.save()
```

Django

```
from books.models import Publisher
p = Publisher(name="Spadina Press",
    city="Toronto", country="Canada")
p.save()

results = Publisher.objects.filter(
          country="Canada")
for x in results :
   print "%s (%s)" % (x.name, x.city)
```

Questions?