RDF and RDB 1

Some slides adapted from a presentation by Ivan Herman at the Semantic Technology & Business Conference, 2012.

Mapping Relational data to RDF

Suppose we have data in a relational database that we want to export as RDF

1. Choose an RDF vocabulary to represent the data
2. Define a mapping from the relational tables to RDF

Then either:

a) Materialize the RDF triples from the database using the mappings

b) Use a server to dynamically access the relational data given a SPARQL query

c) Use a DBMS that directly supports RDF (e.g., Oracle 11g, DB2)

Many RDB systems can handle RDF

- Relational database vendors realize the importance of the Semantic Web market
- Many systems have a “hybrid” view:
  - Traditional, relational storage, usually coupled with SQL
  - RDF storage, usually coupled with SPARQL
  - Examples include Oracle 11g, IBM’s DB2 and OpenLink Virtuoso
- The model involves exporting relational data to RDF

Exporting relational data to RDF

- *Export* does not *necessarily* mean physical conversion
  - for very large databases a “duplication” would not be an option
  - systems may provide SPARQL⇔SQL “bridges” to make queries on the fly
- Result of export is a “logical” view of the relational content

Simple export: Direct Mapping

- Provide a canonical RDF “view” of relational tables
- Only needs the information in the RDB Schema

Direct mapping approach

Each column name provides a predicate

ISBN	Author	Title	Publisher	Year
0006511409X	id_xyz	The Glass Palace	id_qpr	2000
0007179871	id_xyz	The Hungry Tide	id_qpr	2004

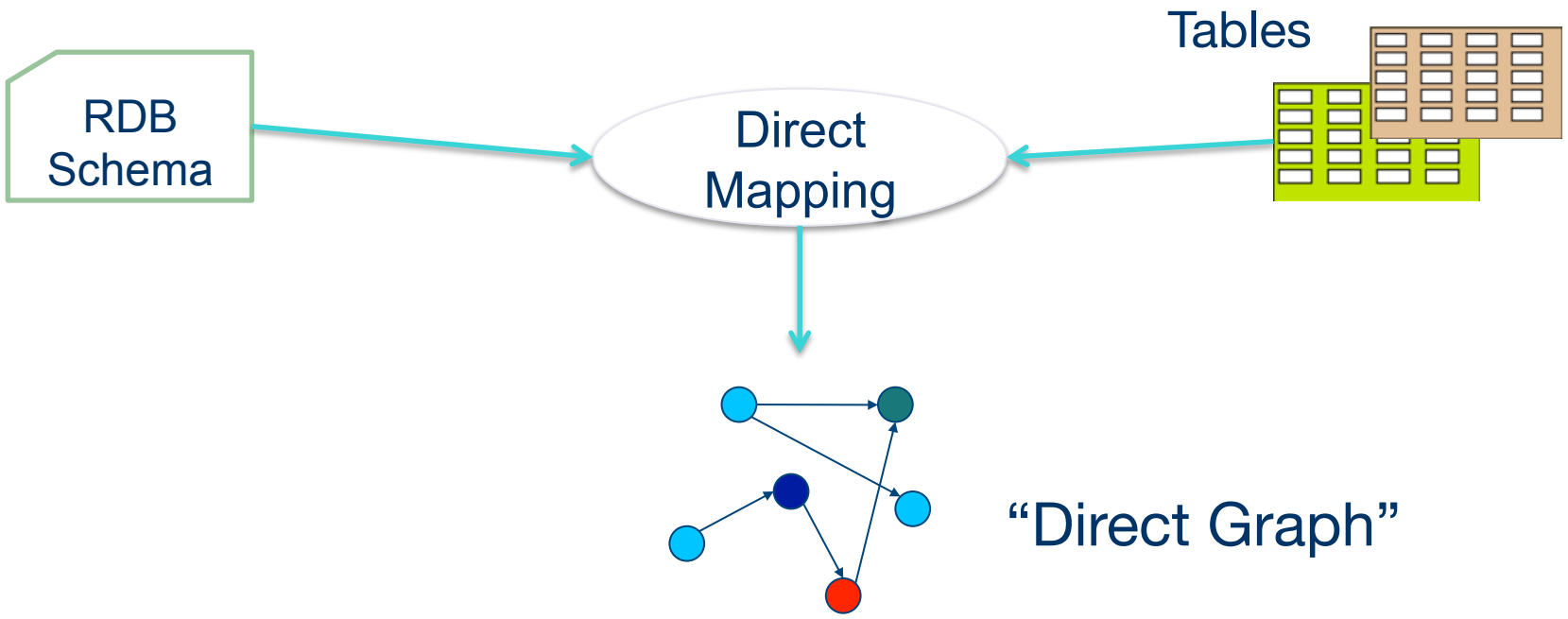
Each row is a subject

foreign keys refer to subjects in another table

Cell values are literal objects

ID	Name	Homepage
id_xyz	Ghosh, Amitav	http://www.amitavghosh.com

Direct mapping approach

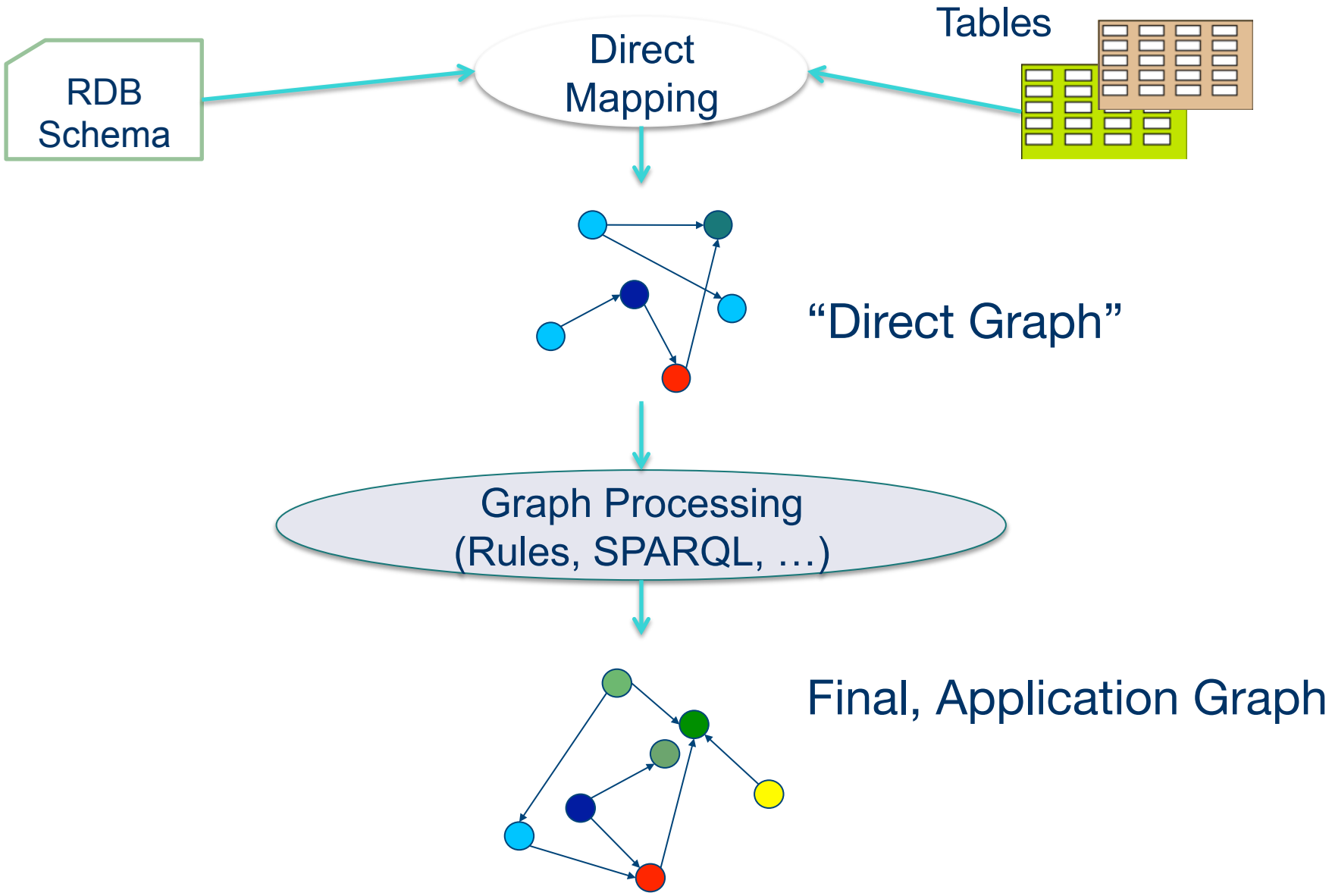


- RDF graph generated from relational database with its schema
- Can automatically generate an SQL query to answer a SPARQL query that directly uses the relational DB

Pros and cons of Direct Mapping

- Advantages of Direct mapping
  - Simple, does not require any other concepts
  - Know schema ⇒ know RDF graph structure
  - Know RDF graph structure ⇒ good idea of schema (!)
- Disadvantages:
  - Resulting may not be what application wants
  - Except for foreign keys, all cell values become literals, i.e. *strings, not things*
  - Don’t want to force the database to be re-designed to expose more cell values as objects

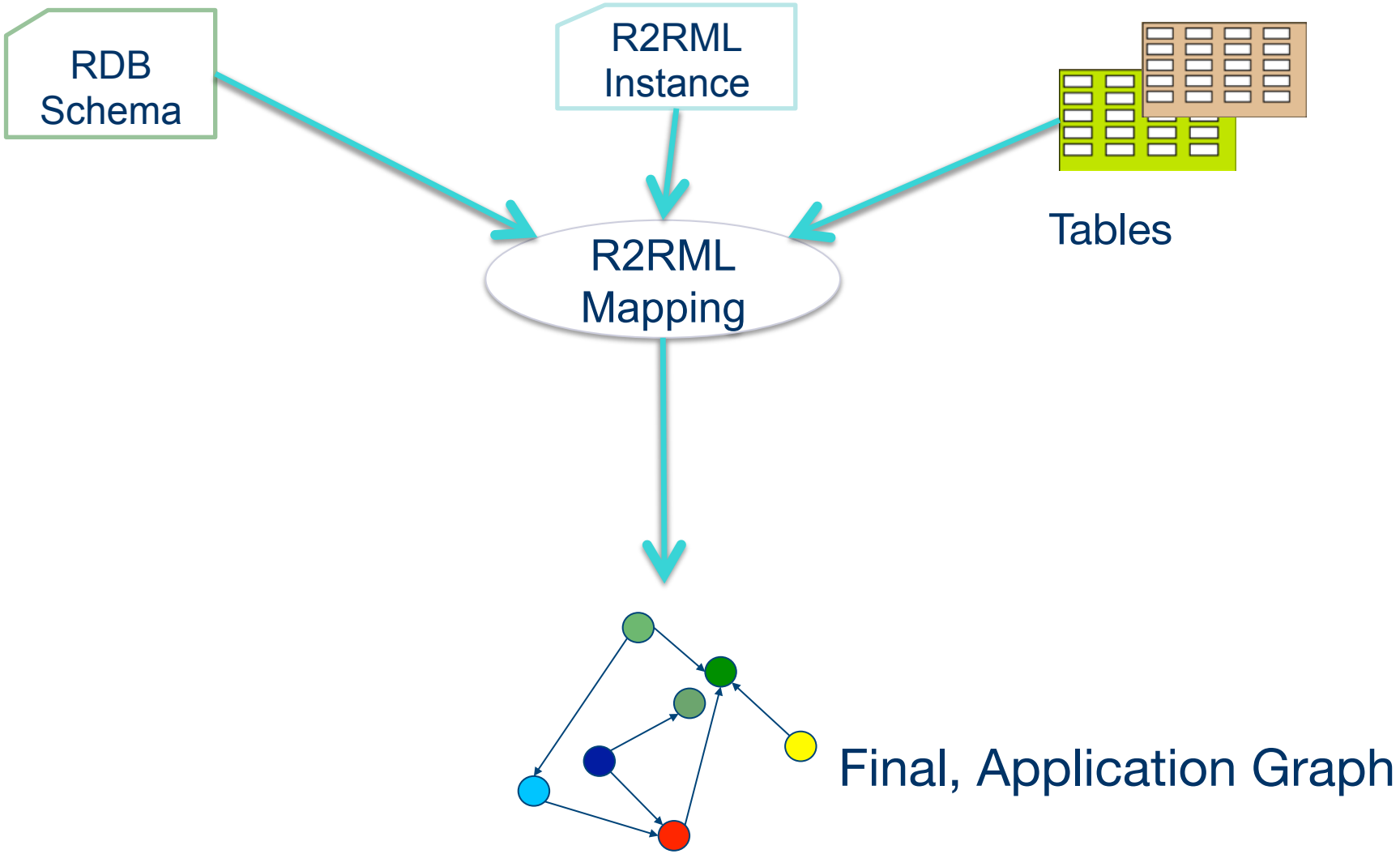
Extended mapping approach



Beyond Direct Mapping: R2RML

- R2RML: RDB to RDF Mapping Language
  - W3C recommendation 9/2012 link
- Separate vocabulary to control the details of the mapping, e.g.:
  - finer control over choice of the subject
  - creation of URI references from cells
  - predicates may be chosen from a vocabulary
  - datatypes may be assigned
  - etc.
- Produce final RDF graph in one step

Beyond Direct Mapping: R2RML



Relationships to the Direct Mapping

- Fundamentals are similar:
  - Each row => set of triples with common subject
- Direct mapping is a “default” R2RML mapping
- Which approach?
  - depends on local tools, personal experiences and background,…
  - You can begin with a “default” R2RML, and gradually refine it

R2RML

- D2RQ was a practical system first developed in 2004 that is widely used
- W3C formed a RDB2RDF working group in 2009 to develop a standard
- R2RML: RDB to RDF Mapping Language is a W3C recommendation since 2013-09-27
- Several implementations are available