System and Methods for Big and Unstructured Data – Group 20

Alessio Buda
Leonardo Cesani
Fausto Lasca
Gabriele Munafò
Matteo Paraboschi

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Project presentation & assumptions

Project presentation

Relational tables

Graphs

Documents

Keys

Columns

Project presentation

Graph model

Documental model

Resilient Distributed Dataset (RDD)

Project presentation

dblp
computer science bibliography

- 4.84 millions of publications
- Different types of publication
- Relevant information on each publication

Assumptions

Conference edition

vs

Journal edition

Organizations' affiliations

Unique attributes

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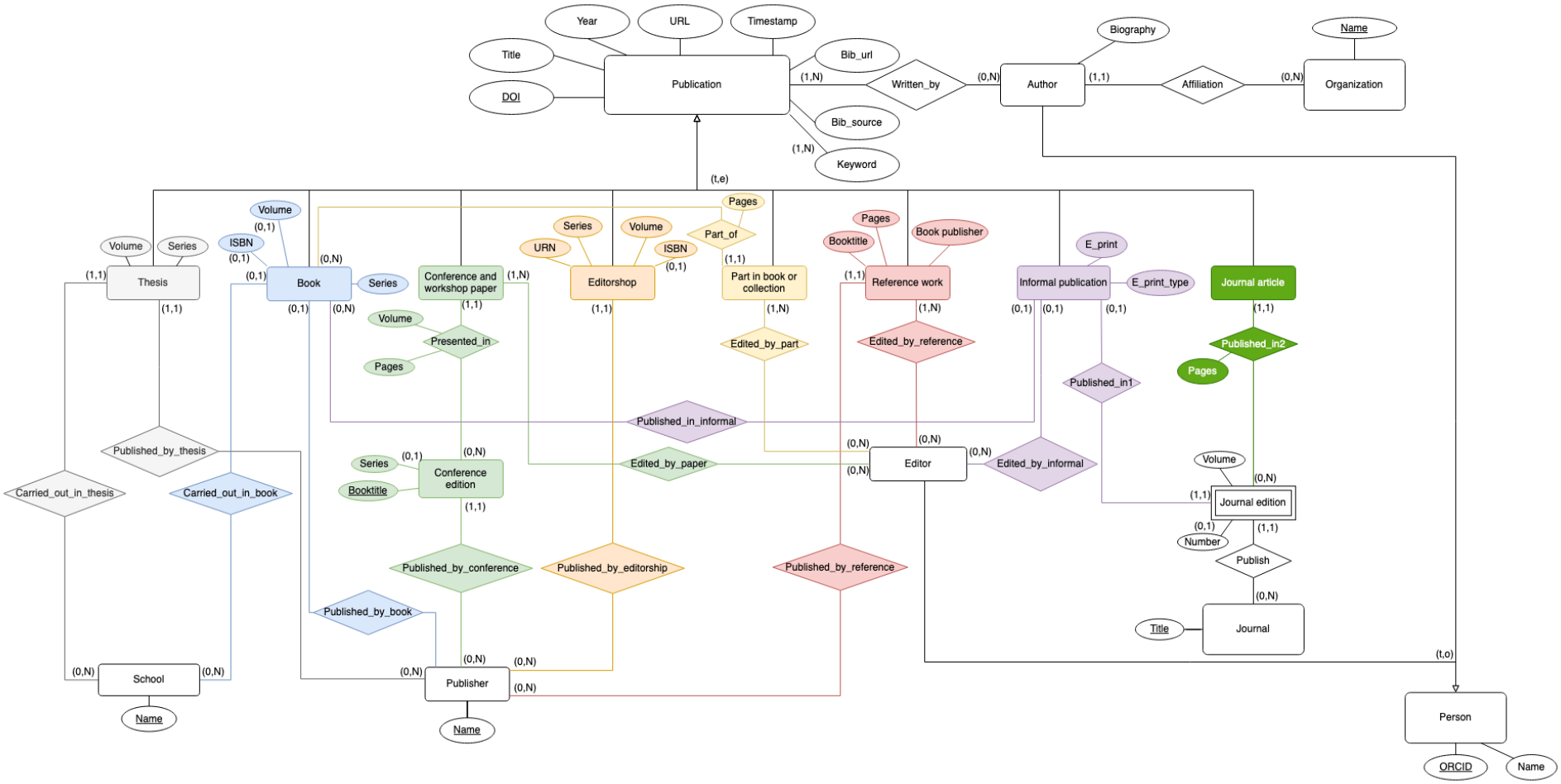
ER model

Conceptual data model

ER Model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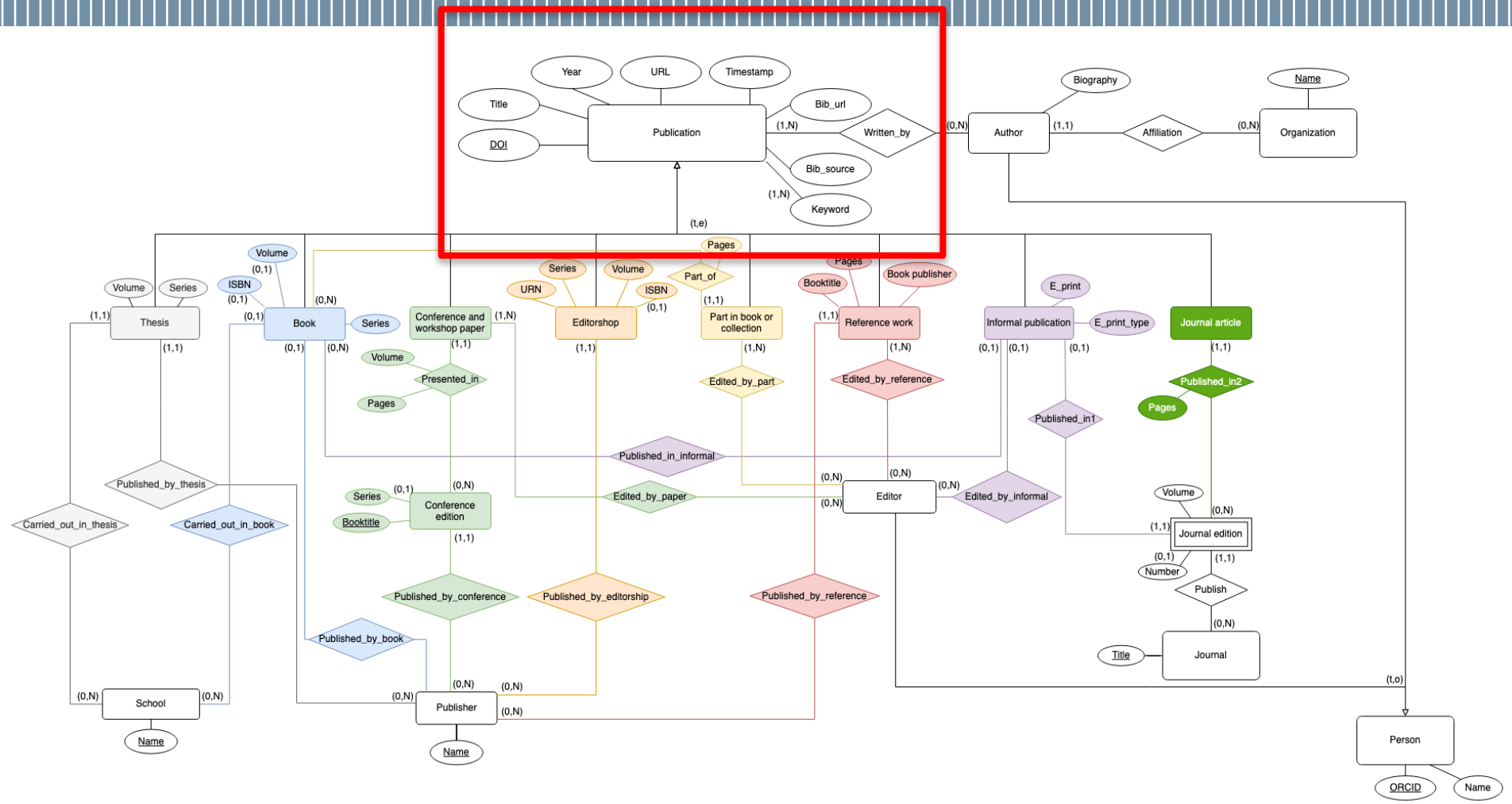
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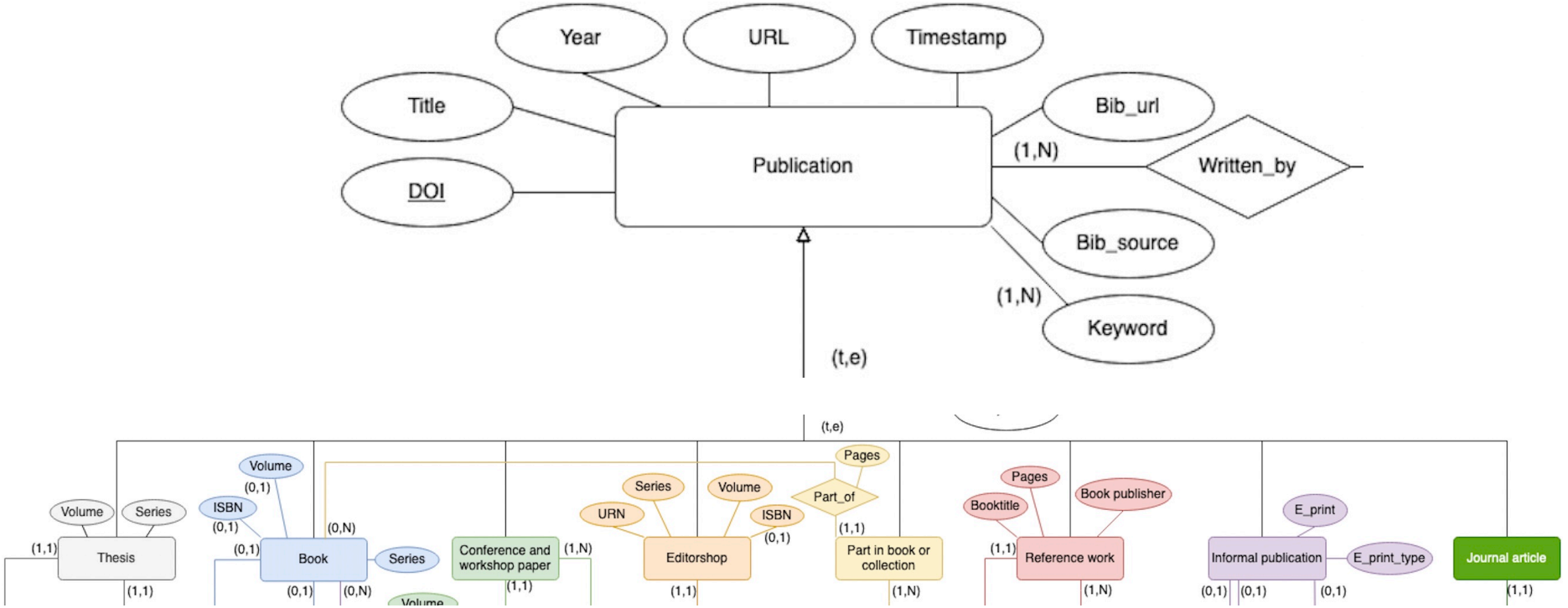
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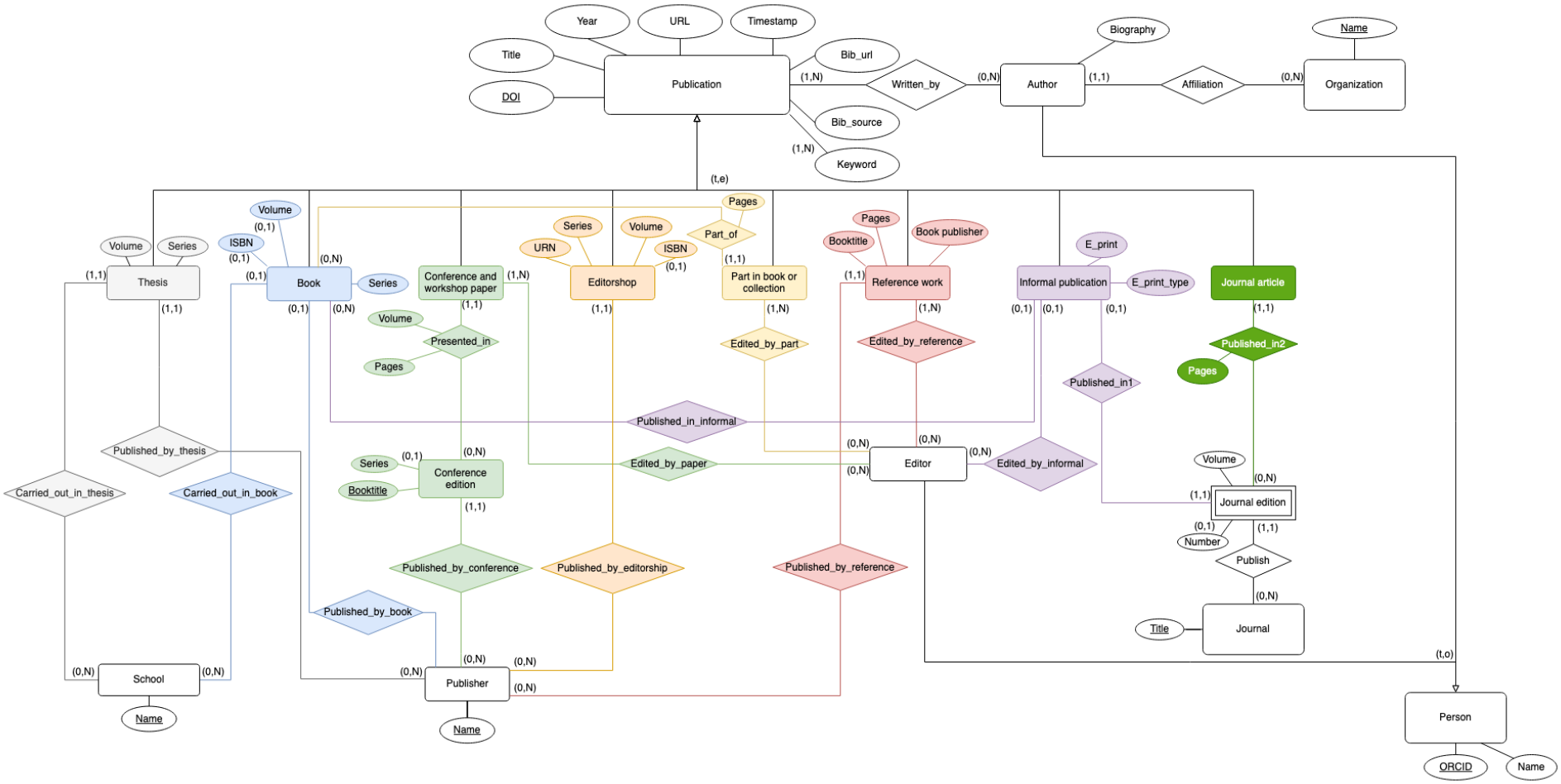
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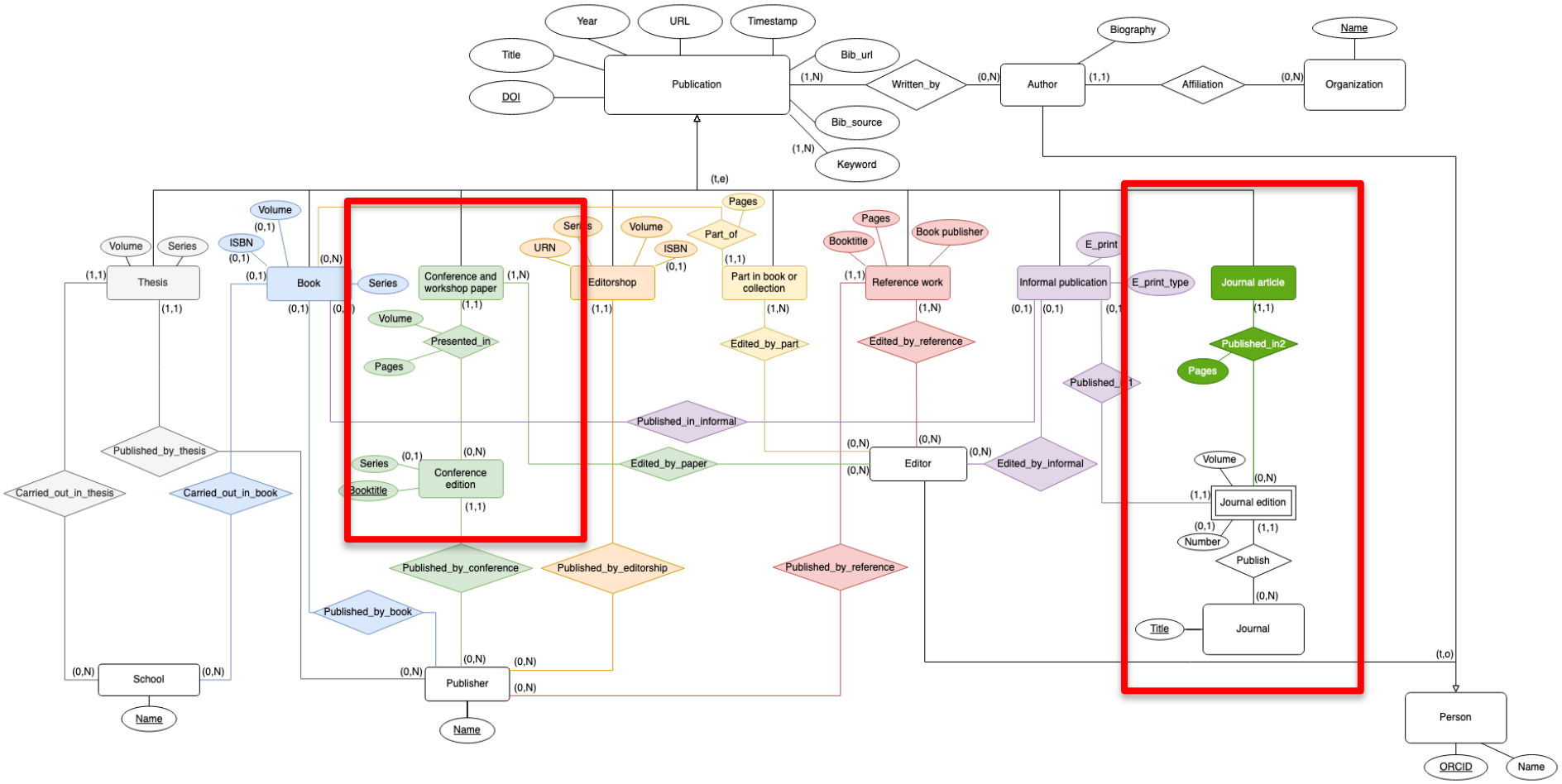
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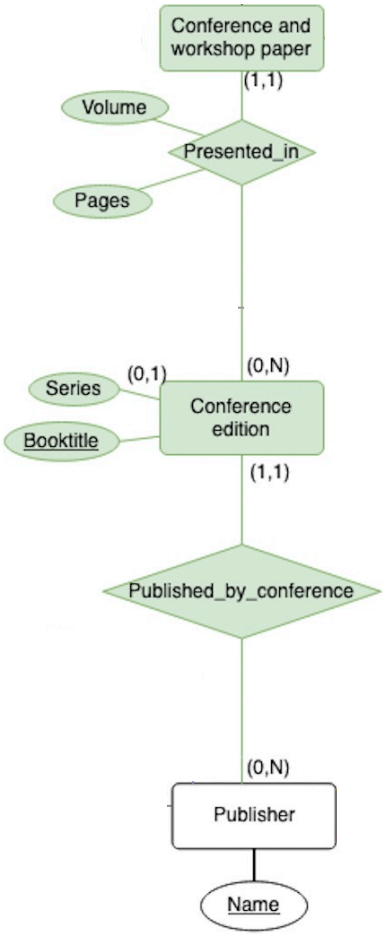
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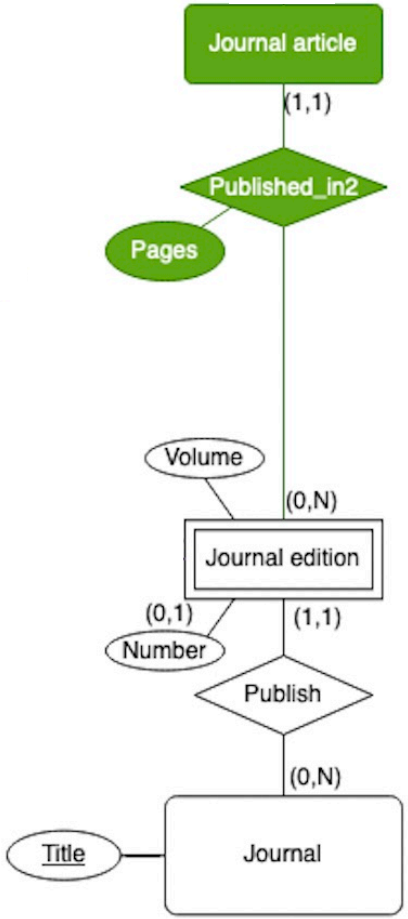
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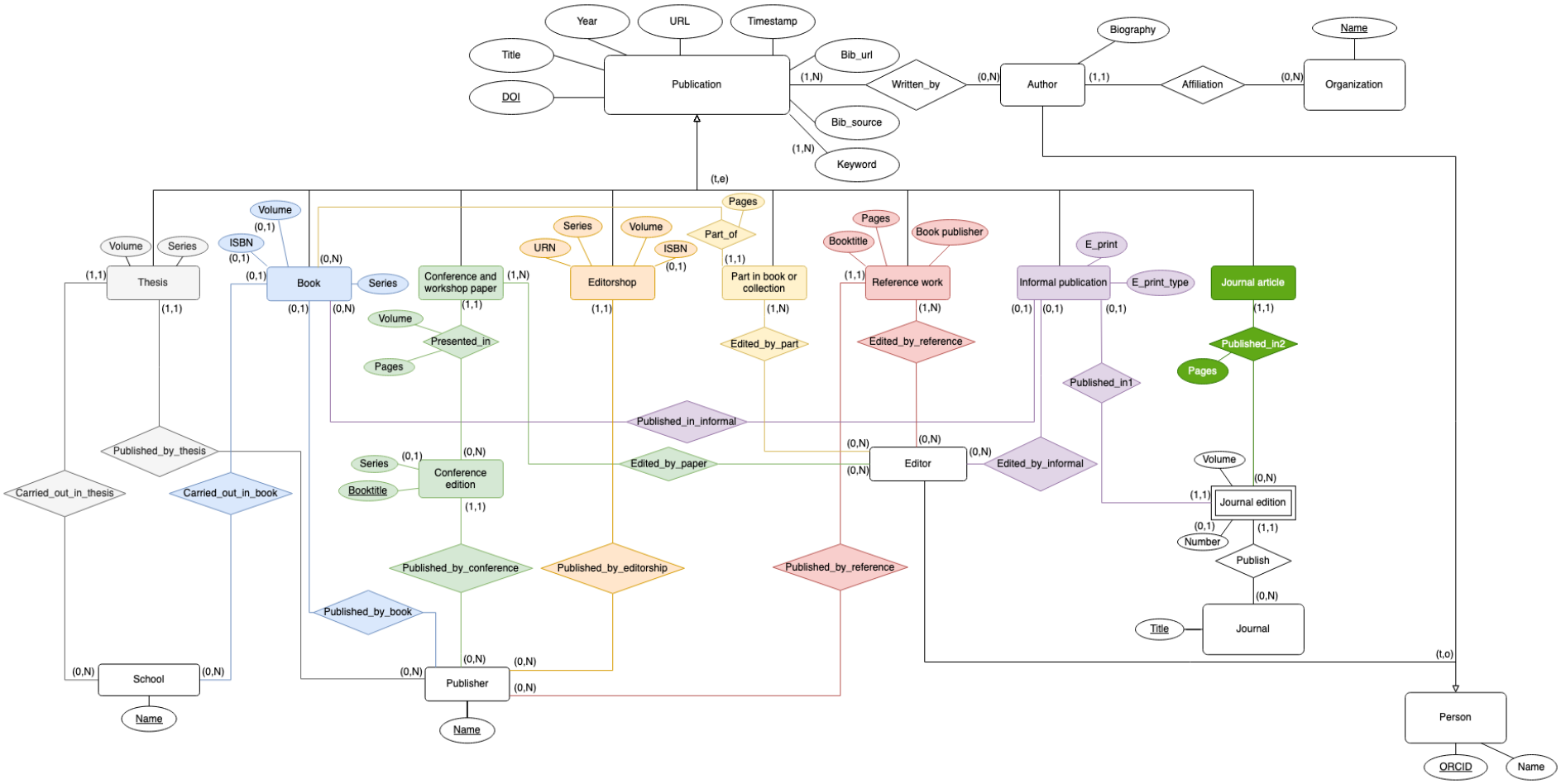
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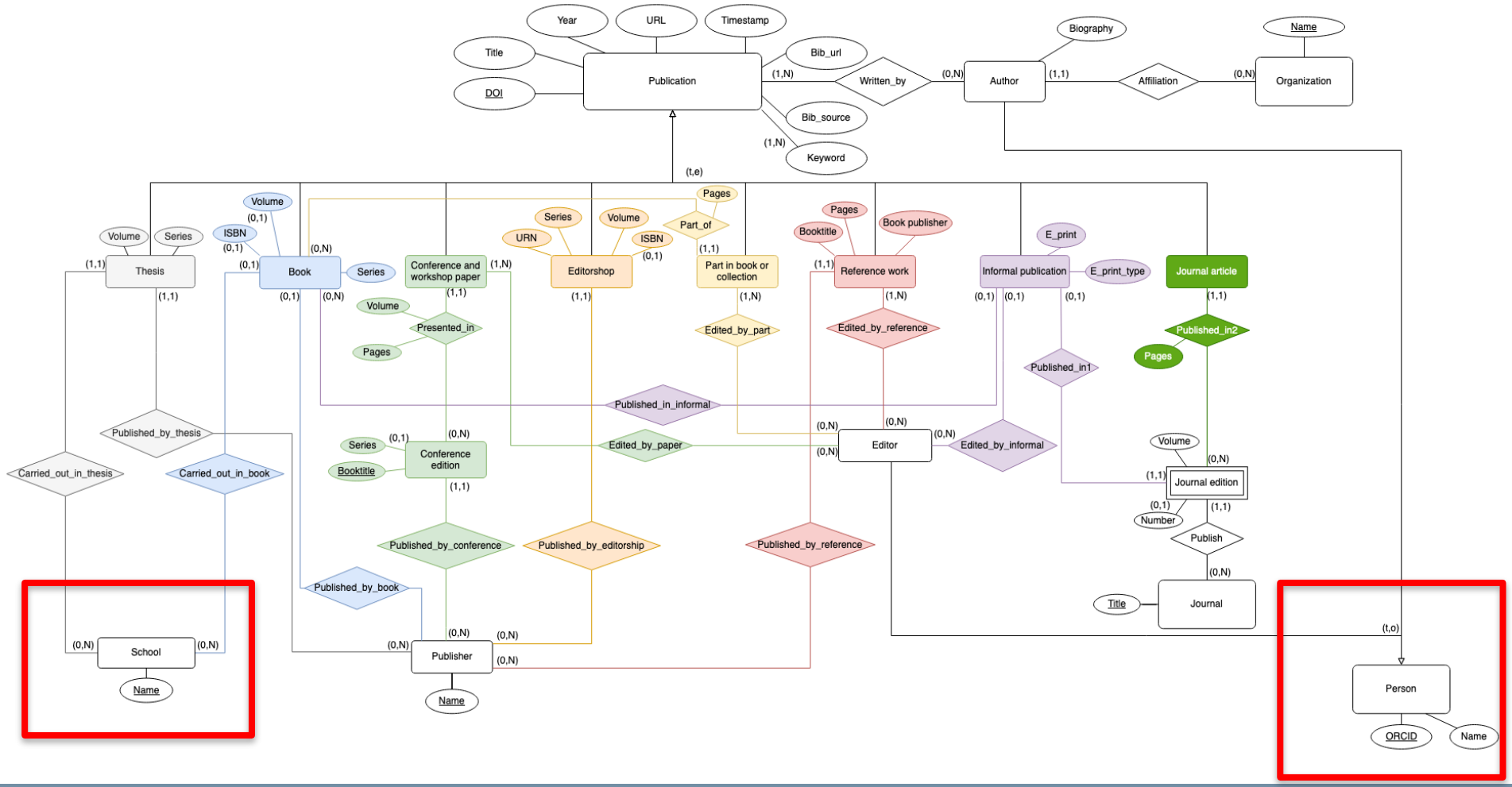
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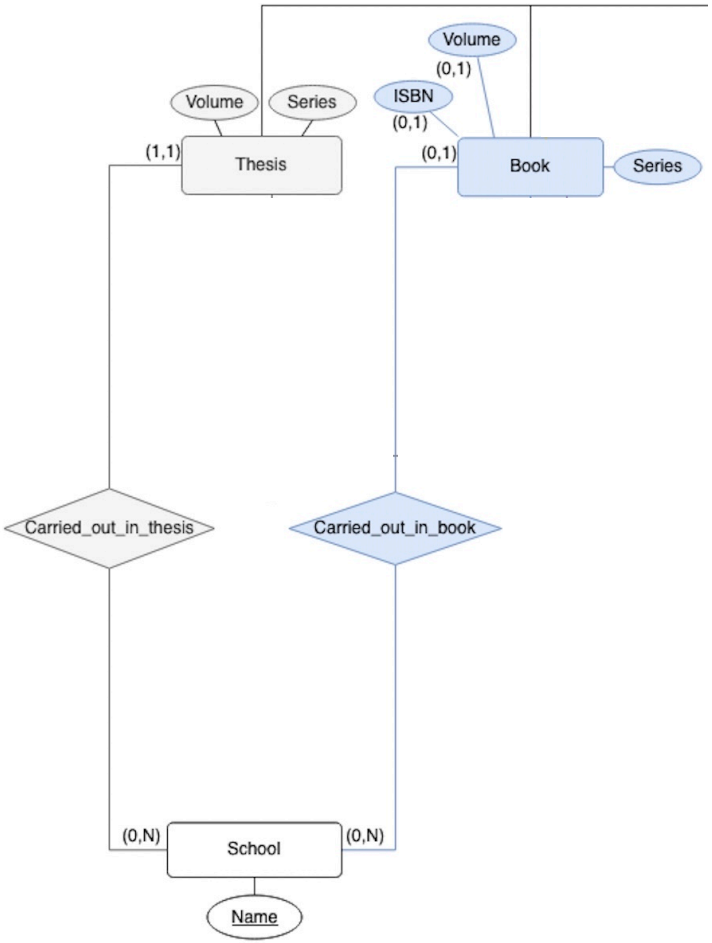
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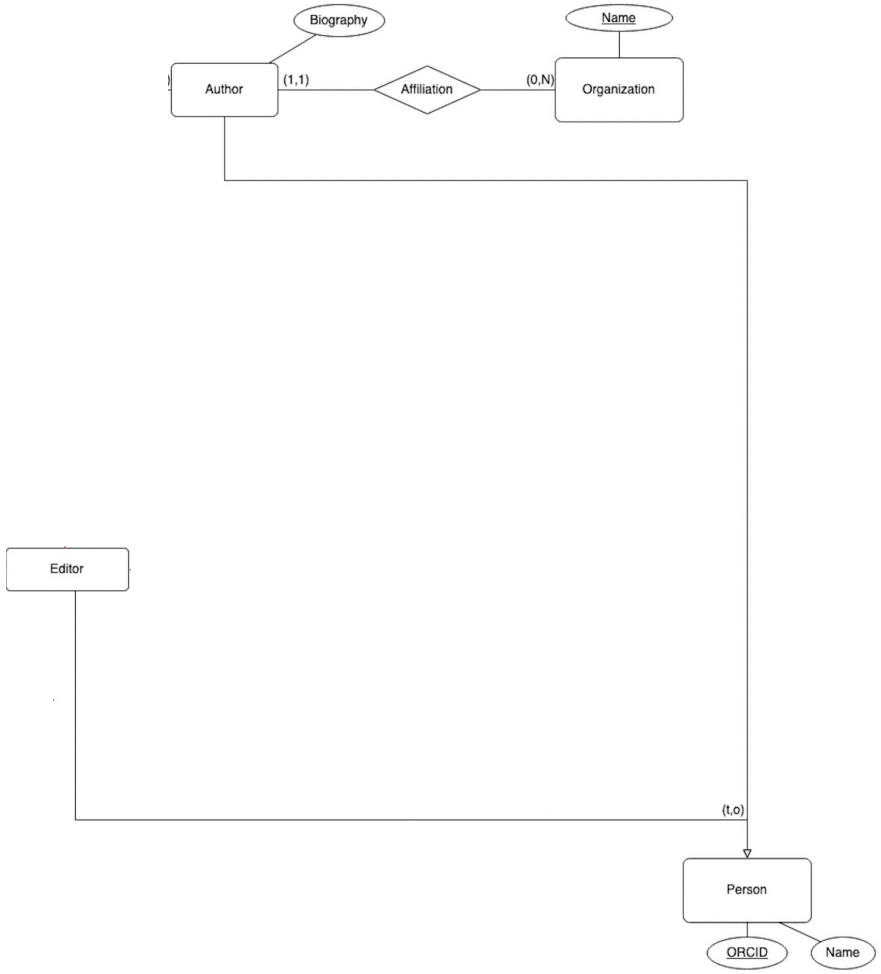
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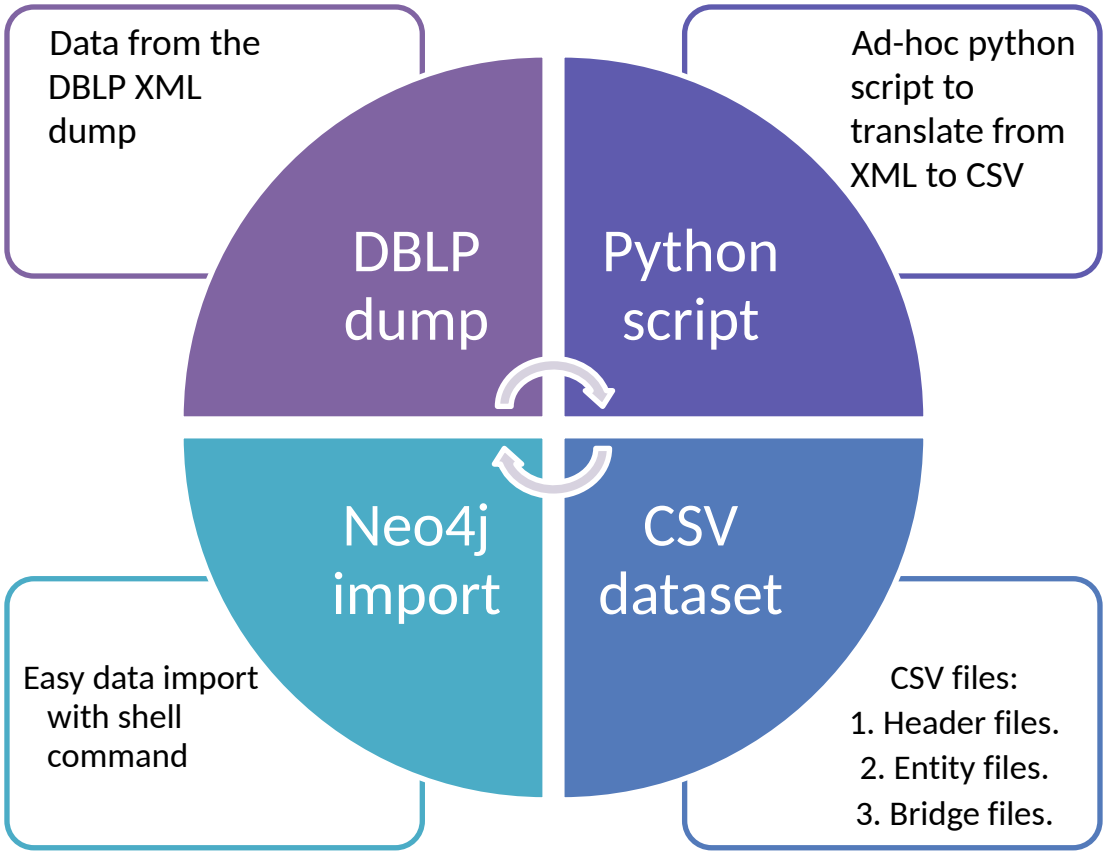
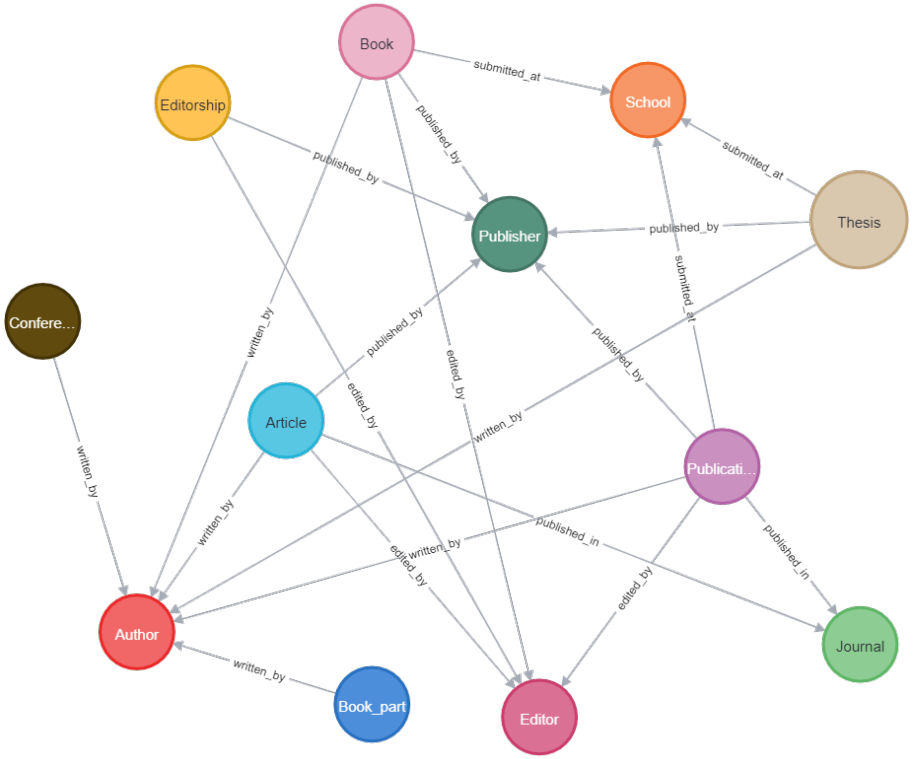
Neo4j

Neo4J : dataset generation and import

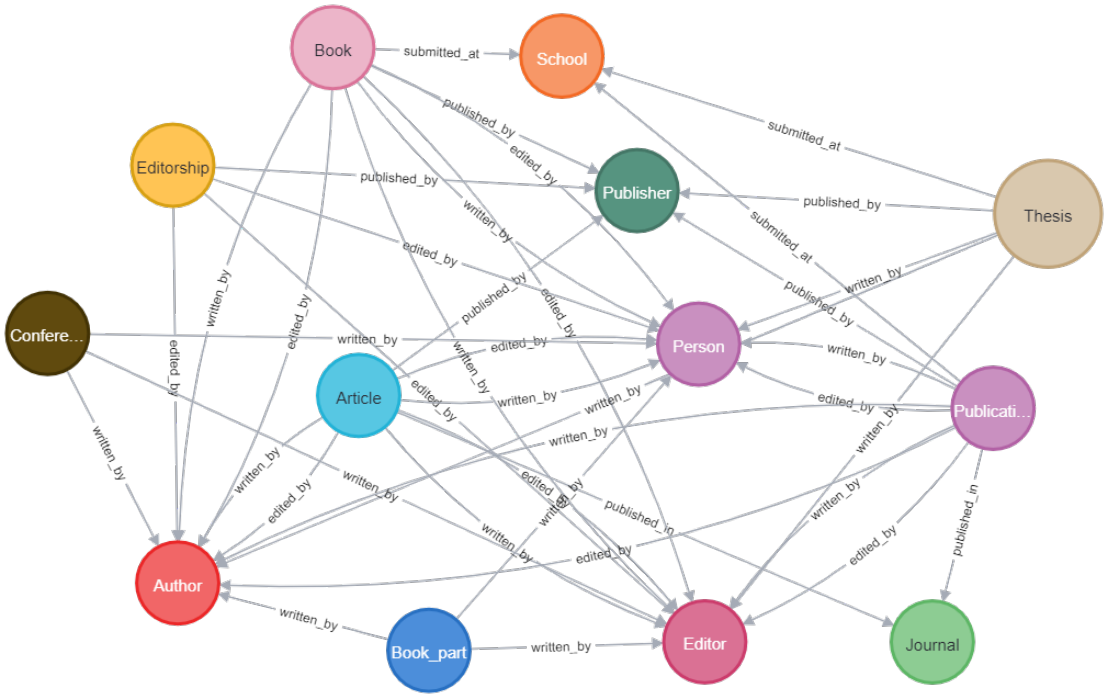


Neo4j: data structure

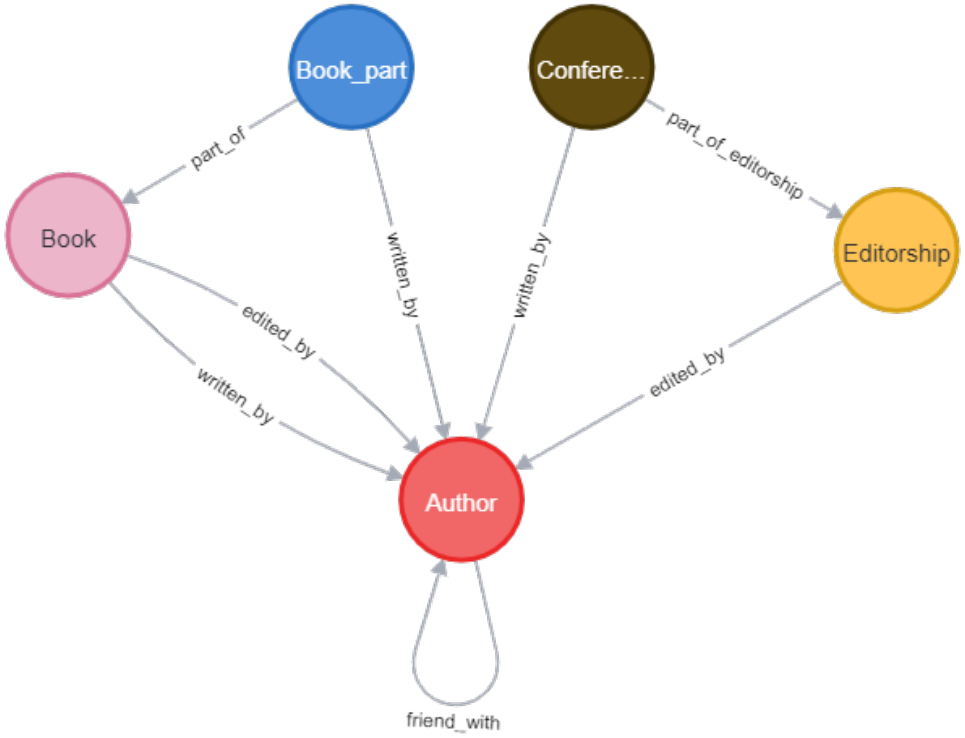
Neo4j: data structure



Neo4j: data structure

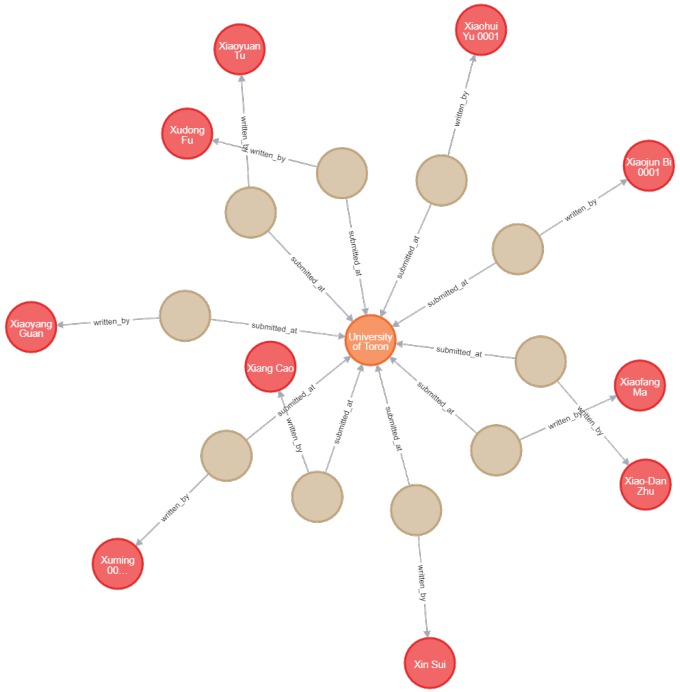


Neo4j: data structure



Neo4j: query

```
1  match (per:Person)<-[]-(pub:Publication)-[s:submitted_at]->(school:School)
2  where per.author starts with 'X'
3  with school, count(s) as submissions, collect(pub) as publications, collect(per) as people
4  return school, people, publications, submissions order by submissions desc limit 1
```



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MongoDB

MongoDB: Dataset generation

MongoDB: Dataset generation

We started by defining the structure of the document

MongoDB: Data structure


```
0:
  _id:                  "63776ddd297f4328218ebc59"
  title:                "On the Penrose process for rotating black holes"
  authors:
    0:
      name:             "Salinas Bauer"
      affiliation:      "Geekol"
      email:            "salinasbauer@geekol.com"
      bio:              "Veniam ea velit in nulla…trud exercitation sunt."
    1:                  {…}
    2:                  {…}
    3:                  {…}
    4:                  {…}
    5:                  {…}
  keywords:
    0:                  "Information Technology/Informatics"
    1:                  "Research Networking/GRID"
    2:                  "Process automation"
  journal:
    name:               "Optim. Lett."
    volume:             11
    number:             58
    date:               "1987-05-\t\t\t\t\t23"
    pages:              "197 - 388"
  abstract:             "  Penrose described a pr… of 1-1/sqrt{2} =29%.\n"
  sections:
    0:                  {…}
    1:                  {…}
    2:
      title:            "Chain enumeration of $k$…s of classical\n  types"
      paragraphs:
        0:              "Went here for brunch tod… or beer in the future."
      figure:           […]
      subsections:
        0:
          title:        "Green-Tao theorem in function fields"
          paragraphs:   […]
          figure:       {…}
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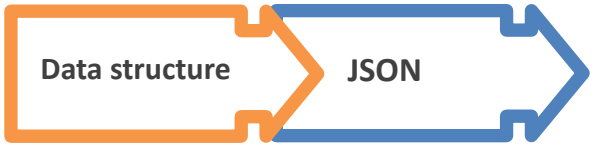
MongoDB: Dataset generation

We started by defining the structure of the document

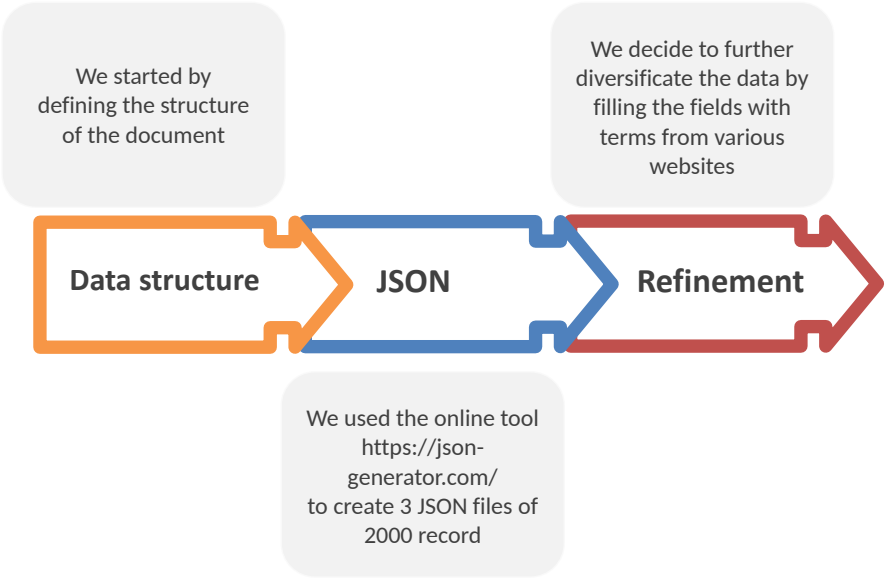
MongoDB: Dataset generation

We started by defining the structure of the document



We used the online tool https://json-generator.com/ to create 3 JSON files of 2000 record

MongoDB: Dataset generation



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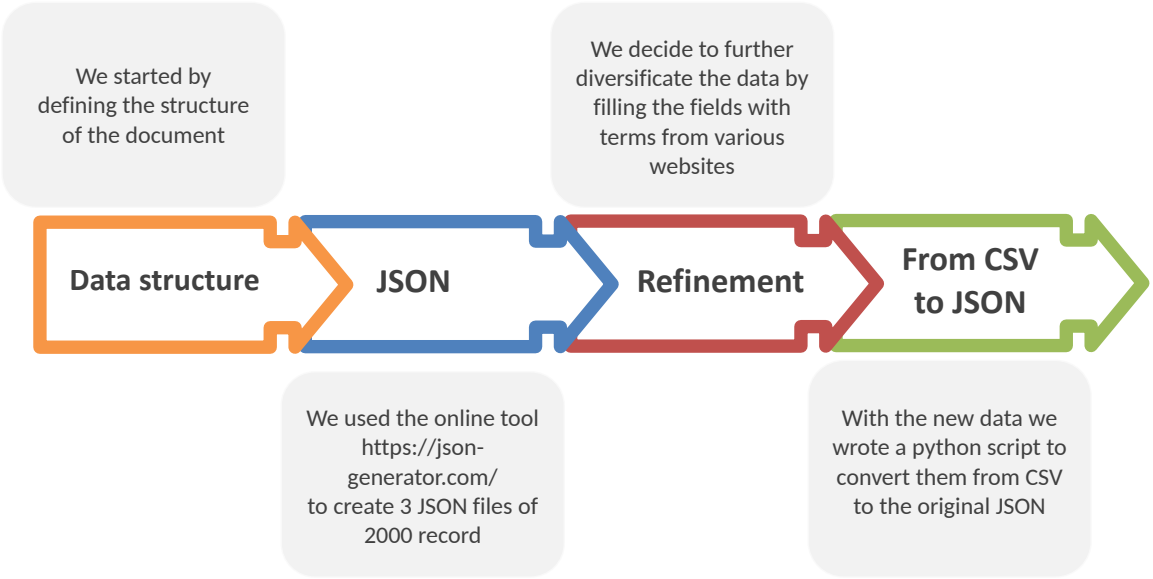

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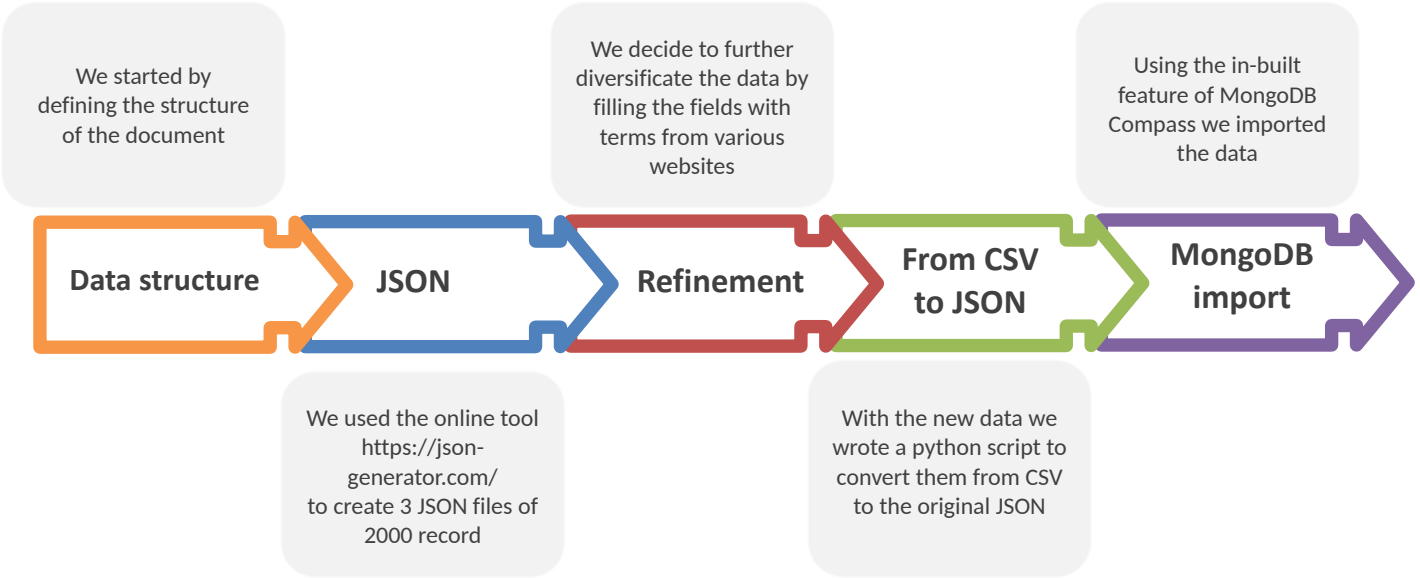


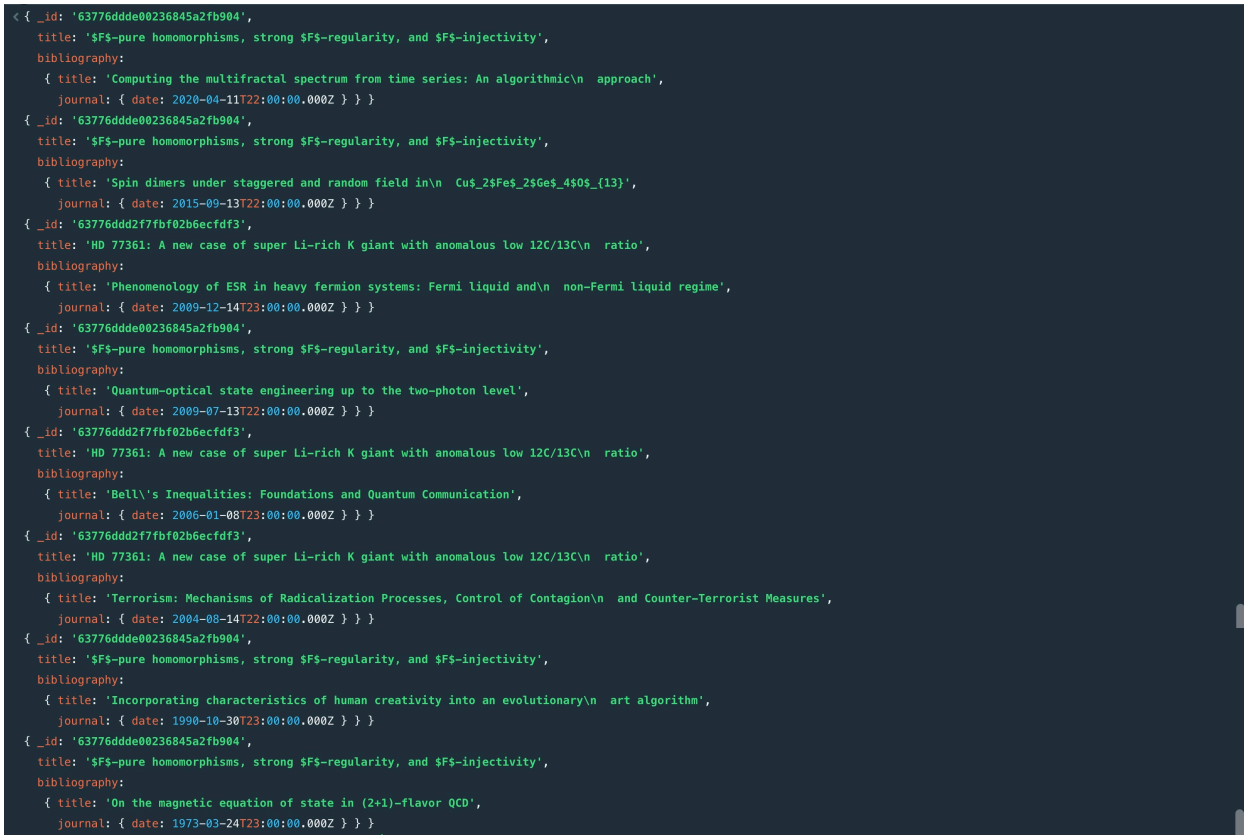
MongoDB: Query

```
Atlas atlas-l7mawr-shard-0 [primary] journal_articles> db.articles.aggregate([
                                                       {
                                                         $match: {$or: [{"_id": ObjectId("63776ddde00236845a2fb904")},{"_id": ObjectId("63776ddd2f7fbf02b6ecfdf3")}]}
                                                       },{
                                                         $lookup: {
                                                         from: "articles",
                                                         localField: "bibliography",
                                                         foreignField: "_id",
                                                         as: "bibliography" }
                                                       },{
                                                         $unwind: "$bibliography"
                                                       },{
                                                         $sort: {"bibliography.journal.date": -1}
                                                       },{
                                                         $project: {"title": 1, "bibliography.title":1, "bibliography.journal.date": 1}
                                                       }])
```

```
{ _id: '63776ddd2f7fbf02b6ecfdf3',
  title: 'HD 77361: A new case of super Li-rich K giant with anomalous low 12C/13C\n  ratio',
  bibliography:
   [ '63777073bc1aeb06de1b7492',
     '63776dde07a64b8cb303d4e9',
     '63776dde6a9de277c1ce0ae1' ] }
{ _id: '63776ddde00236845a2fb904',
  title: '$F$-pure homomorphisms, strong $F$-regularity, and $F$-injectivity',
  bibliography:
   [ '63776dde84264e473ba7c413',
     '63776dde697c3f791c68642d',
     '63776dde6efbe362b4909aba',
     '637770ac8fdfb72787bb6363',
     '63776ddef5d187cd65b423b2' ] }
```

MongoDB: Query

MongoDB: Query



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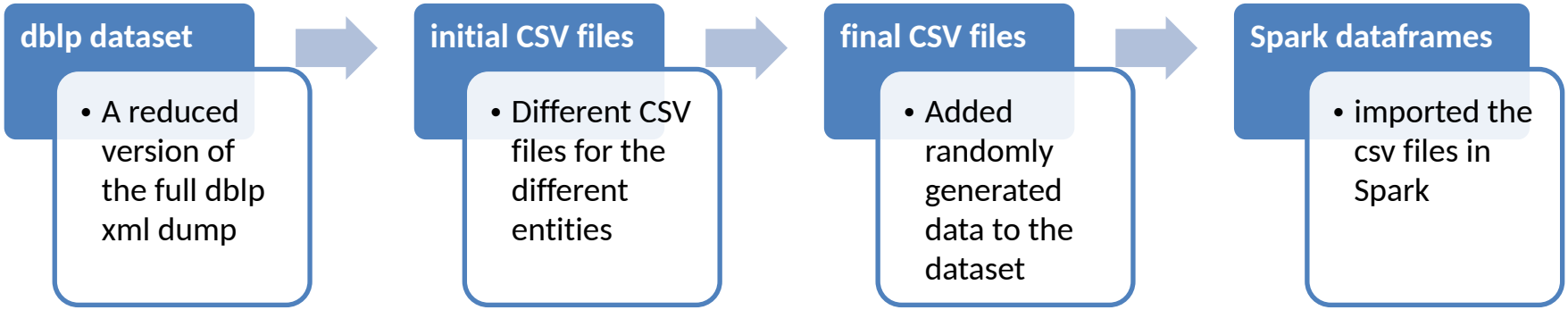
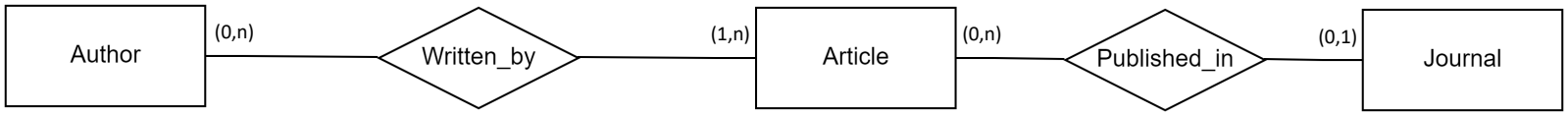
Apache Spark

Spark: dataset generation and import

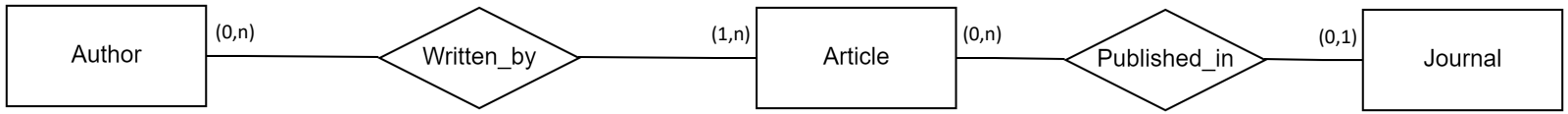
Similar process as for the Neo4j dataset



Spark: data structure



Spark: data structure

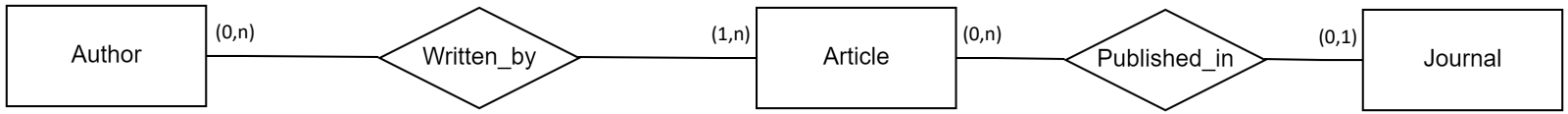



```
root
 |-- ID: integer (nullable = true)
 |-- Name: string (nullable = true)
 |-- BirthDate: date (nullable = true)
 |-- Nationality: string (nullable = true)
```

```
root
 |-- ID: integer (nullable = true)
 |-- Authors: string (nullable = true)
 |-- Journal: integer (nullable = true)
 |-- Key: string (nullable = true)
 |-- Date: date (nullable = true)
 |-- Publisher: string (nullable = true)
 |-- Type: string (nullable = true)
 |-- Title: string (nullable = true)
```

```
root
 |-- ID: integer (nullable = true)
 |-- Name: string (nullable = true)
 |-- FoundationDate: date (nullable = true)
 |-- Type: string (nullable = true)
```

Spark: data structure




```
root
 |-- ID: integer (nullable = true)
 |-- Name: string (nullable = true)
 |-- BirthDate: date (nullable = true)
 |-- Nationality: string (nullable = true)
```

```
root
 |-- Article: integer (nullable = true)
 |-- Author: integer (nullable = true)
```

```
root
 |-- ID: integer (nullable = true)
 |-- Authors: string (nullable = true)
 |-- Journal: integer (nullable = true)
 |-- Key: string (nullable = true)
 |-- Date: date (nullable = true)
 |-- Publisher: string (nullable = true)
 |-- Type: string (nullable = true)
 |-- Title: string (nullable = true)
```

```
root
 |-- ID: integer (nullable = true)
 |-- Name: string (nullable = true)
 |-- FoundationDate: date (nullable = true)
 |-- Type: string (nullable = true)
```

Spark: query

```
authors.filter(col("Name").like("L%")) \
    .join(written_by, written_by.Author == authors.ID, "inner") \
    .groupby(col("Name")).count() \
    .select(col("Name"), col("count").alias("#Articles")) \
    .sort(col("#Articles").desc()) \
    .show(10)
```

```
+--------------+---------+
|          Name|#Articles|
+--------------+---------+
|   Lajos Hanzo|      124|
|    Leo Storme|       41|
|Lie-Liang Yang|       21|
| Lothar Breuer|       17|
|  Lin Cai 0001|       16|
|      Lijun Ji|       16|
|     Lian Zhao|       13|
|   Luca Benini|       13|
|     Luxi Yang|       13|
|Ludger Humbert|       12|
+--------------+---------+
only showing top 10 rows
```

The query returns the Authors with the name that start with an «L», ranked in descending order w.r.t. the number of articles they wrote