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Assessing Knowledge Graphs Accountability

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What is the accountability of an RDF graph ?

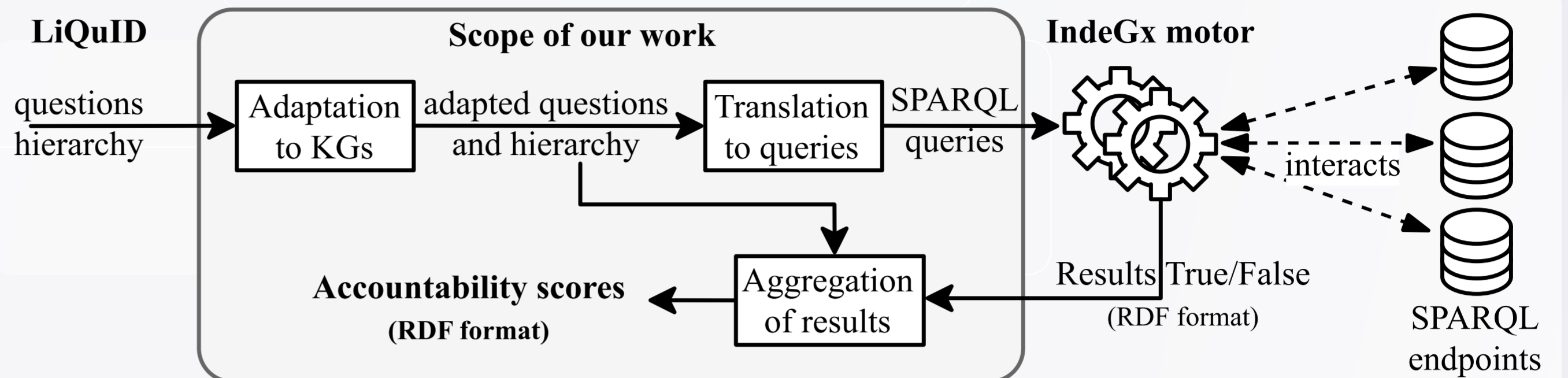
There must be "sufficient information to justify and explain the actions" on the dataset and "descriptive information and information on the people responsible for it" [1].

How to measure it?

What meta-information is required?



Methodology



A work based on the LiQuID metadata model [1]

The LiQuID metadata model enables to express information about the accountability of datasets in general, following a **hierarchical structure** with three levels (steps of the dataset's life cycle, WH-questions, information level). The model, validated based on a real-world workload, allows a systematic approach and is therefore described by **precise questions** expressing what information is required to **be accountable**.

Adaptation to Knowledge Graphs (KG)

LiQuID provides numerous and detailed questions but not all of them apply to RDF graphs nor can be expressed with existing vocabularies.

LiQuID questions and hierarchy

Filtering
Not expressible:
- Too specific
- Too similar

Too specific: Why is it ethical to create a dataset for this cause?

Adaptation & Clarification

Who has used/can use the published dataset?
- Who has the right to use the KG?
- Who is intended to use the KG?
becomes

Adapted questions and hierarchy

Translation into SPARQL queries

These questions are then translated into SPARQL queries, covering **all possible ways** to express the question using the following vocabularies: Dublin Core, FOAF, schema.org, VOID, DCAT, SPARQL-SD, DataID, DQV, PROV-O, PAV.

Our demanding interpretation of accountability requires that the information be **linked to the IRI of the KG**.

Example: Who publishes the KG?

```
ASK {  
  {?kg a void:Dataset . }  
  UNION {?kg a dcat:Dataset . }  
  ?kg ?endpointlink <endpointURL> .  
  
  {?kg dct:publisher ?publisher . }  
  UNION {?kg dce:publisher ?publisher . }  
  UNION {?kg schema:publisher ?publisher . }  
  UNION {?kg schema:sdPublisher ?publisher . }  
  UNION {?kg prov:wasGeneratedBy ?act . }  
  ?act a prov:Publish . }  
  ?act prov:wasAssociatedWith ?publisher . }  
}
```

Evaluation

Querying KGs with IndeGx [2]

IndeGx framework proposes an extensible **SPARQL-base test suite**. It enables to submit multiple queries to many endpoints. It is used with our own set of queries. They are **ASK queries**: a True result means the information required is present and accessible and a False means it is not.

670 endpoints are queried in three different timepoints each. These endpoints were identified by IndeGx and listed on the LOD Cloud, Wikidata, SPARQLS, Yummy Data and Linked Wiki.

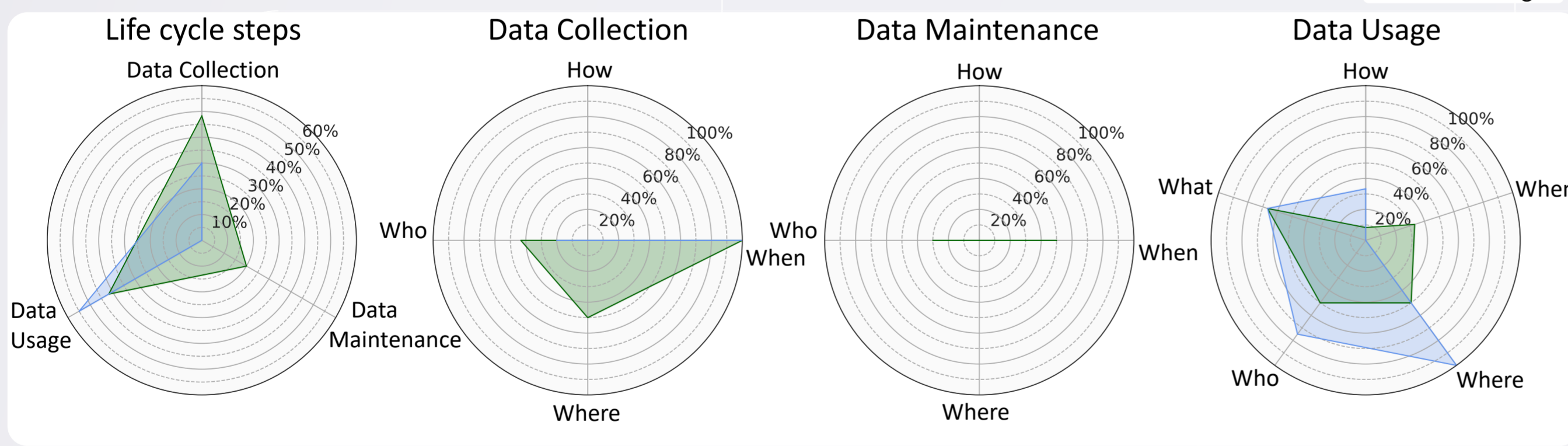
Only 29 provides accountability information linked to the IRI of the KG.

Computing accountability scores

Results are stored in RDF using DQV (Data Quality Vocabulary). **Accountability score** is computed as follows. For a leaf of the LiQuID hierarchy, the score of accountability on that aspect is the average of the score obtained on each question. For the other elements of the hierarchy, the score is the average of the scores on the elements underneath.

Results

Among the 29 successful KGs, global accountability scores vary **between 2.2% and 44%**, with a mean of 22%. Knowledge graphs are usually better on Data Usage than on Data Collection, and on Data Collection than on Data Maintenance. Following the hierarchy provided by LiQuID, results may be studied **in detail**. In the following figure, the scores of accountability of two KGs are compared along the different aspects of the hierarchy.



Conclusion

This work shows how to evaluate accountability of KGs in detail. It also highlights the **weaknesses of many KGs** regarding accountability. However, presence of good scores shows that linked data is very suitable for accountability.

Our measurement is **detailed enough** to help any KG producer to precisely **identify missing information** and therefore to improve on these aspects.

Future work: Introduce gradations to relax some queries, introduce some weights to aggregate results differently...

Further information

Please see our Github repository for the whole list of questions and queries, and for the results.
https://github.com/Jendersen/KG_accountability

Acknowledgments

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References

- [1] Oppold, S., Herschel, M.: Accountable data analytics start with accountable data: The liquid metadata model. In: ER Forum/Posters/Demos. pp. 59–72 (2020)
- [2] Maillot, P., Corby, O., Faron, C., Gandon, F., Michel, F.: IndeGx: A model and a framework for indexing RDF knowledge graphs with SPARQL-based test suits. Journal of Web Semantics p. 100775 (2023)