ShEx in Reference Quality and Subsetting

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Entity Schemas In The Wikimedia Ecosystem Tutorial

SWAT4HCLS 2022

DATA QUALITY

Quality is a measure of ``fitness for use"

Data quality is a MULTI-DIMENSIONAL concept

Dimensions of the data quality:

- Availability
- Believability
- Completeness
- Relevancy
- Free-of-Error
- …

Most of dimensions are SUBJECTIVE

DATA QUALITY IN LINKED DATA [1]

Category	Dimensions
Accessibility	Availability, Licensing, Interlinking, Security, Performance
Intrinsic	Accuracy, Consistency, Conciseness
Trust	Reputation, Believability, Verifiability, Objectivity
Dynamicity	Currency, Volatility, Timeliness
Contextual	Completeness, Amount-of-data, Relevancy
Representational	Representational-conciseness, Representational-consistency, Understandability, Interpretability, Versatility

QUALITY OF REFERENCING

6

CATEGORIES

21

DIMENSIONS

40

METRICS

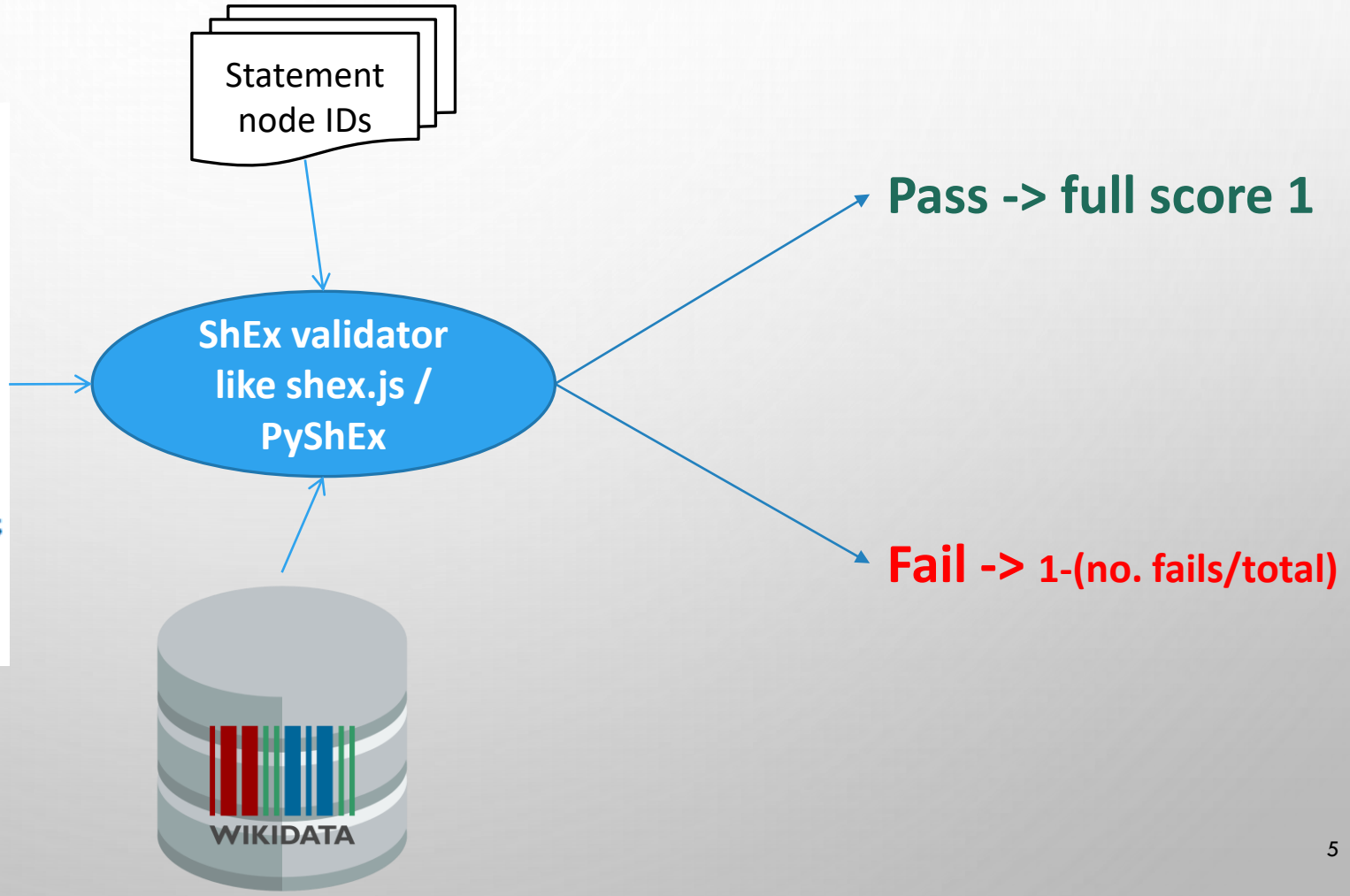
4

SHEX-RELATED METRICS

DIMENSION: ACCURACY

Syntactic validity of reference triples

```
START=@<statement_node>
<statement_node> {
  prov:wasDerivedFrom @<reference_node>* ;
}
<reference_node> {
  <ref-property> xsd:decimal OR xsd:integer OR
  xsd:dateTime OR xsd:string OR IRI* ;
  <ref-property> @<value>* ;
}
<value> {
  wikibase:quantityAmount xsd:decimal OR xsd:integer?;
  wikibase:timeValue xsd:dateTime?;
  #...
}
```



Wikidata RDF model of references Shape

DIMENSION: COMPLETENESS

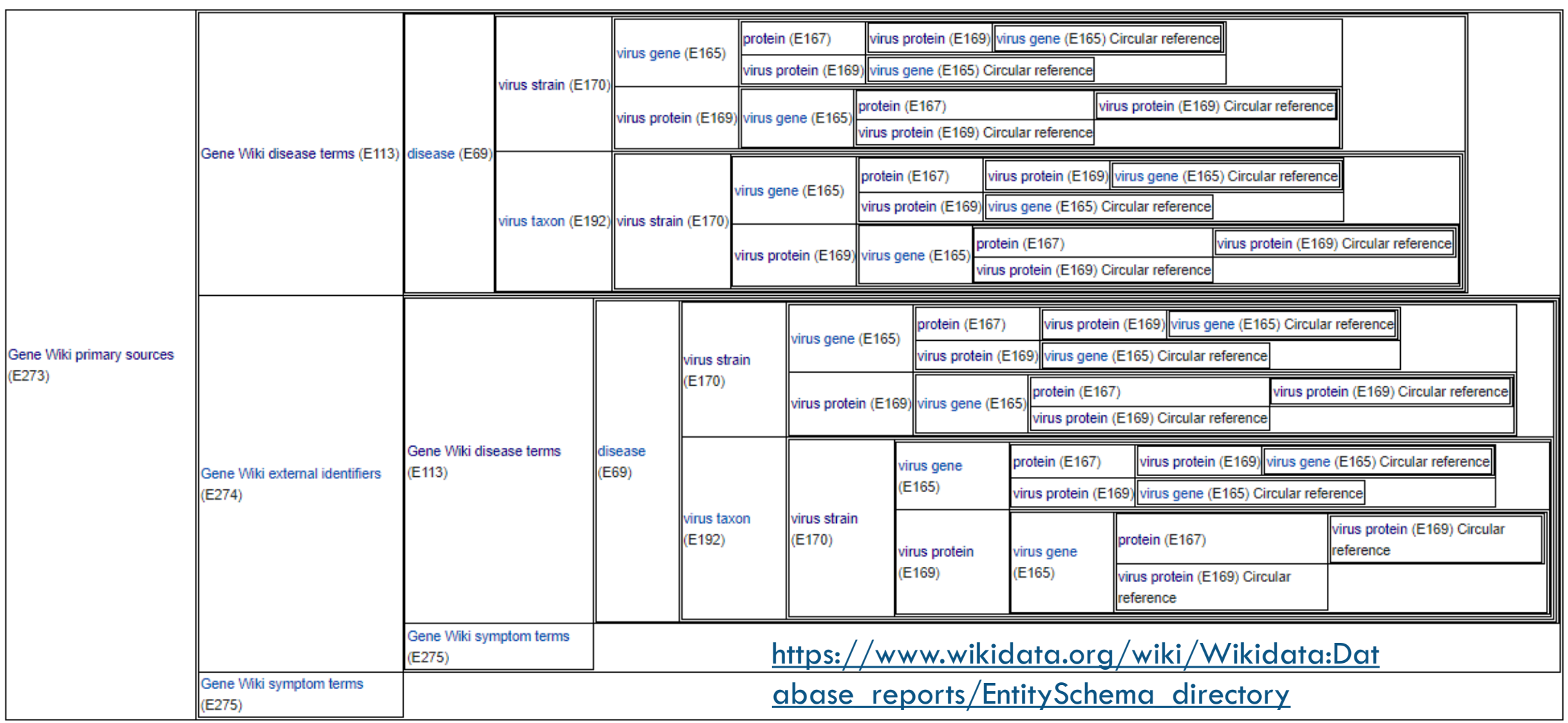
Schema completeness of references

How many classes and properties have a defined Entity Schemas (Eids) for references?

```
<#reference> { } # Any reference will suffice.

<#disease-ontology-reference> { # reference to a term from the disease ontology term
  pr:P248   [ wd:Q5282129 ] ; # stated in [P248] Mondo disease ontology [Q27468140]
  pr:P699   xsd:string ; # Disease Ontology ID
  pr:P813    xsd:dateTime ; # Date of retrieval
}

<#mondo-disease-reference> { # reference to a term from the MonDo ontology
  pr:P248   [ wd:Q27468140 ] ; # stated in [P248] Mondo disease ontology [Q27468140]
  pr:P5270  xsd:string ; # Mondo ID
  pr:P813    xsd:dateTime ; # Date of retrieval
}

<#symptom-ontology-reference> { # reference to a term from the Symptom Ontology
  pr:P248   [ wd:Q5282129 ] ; # stated in [P248] Symptom ontology [Q27468140]
  pr:P8656   xsd:string ; # Symptom Ontology ID
  pr:P813    xsd:dateTime ; # Date of retrieval
}
```

DIMENSION: COMPLETENESS

Schema completeness of references



https://www.wikidata.org/wiki/Wikidata:Database_reports/EntitySchema_directory

DIMENSION: COMPLETENESS

Schema-based property completeness of references

If a reference schema is defined for class/fact of type X, how many instances of X have got a reference with the property mentioned in the schema?

```
<#reference> { } # Any reference will suffice.

<#disease-ontology-reference> { # reference to a term from the disease ontology term
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  pr:P8656   xsd:string ; # Symptom Ontology ID
  pr:P813    xsd:dateTime ; # Date of retrieval
}
```

=>

How many disease has got reference using P248/P699/P813

How many symptoms has got reference using P248/P8656/P813

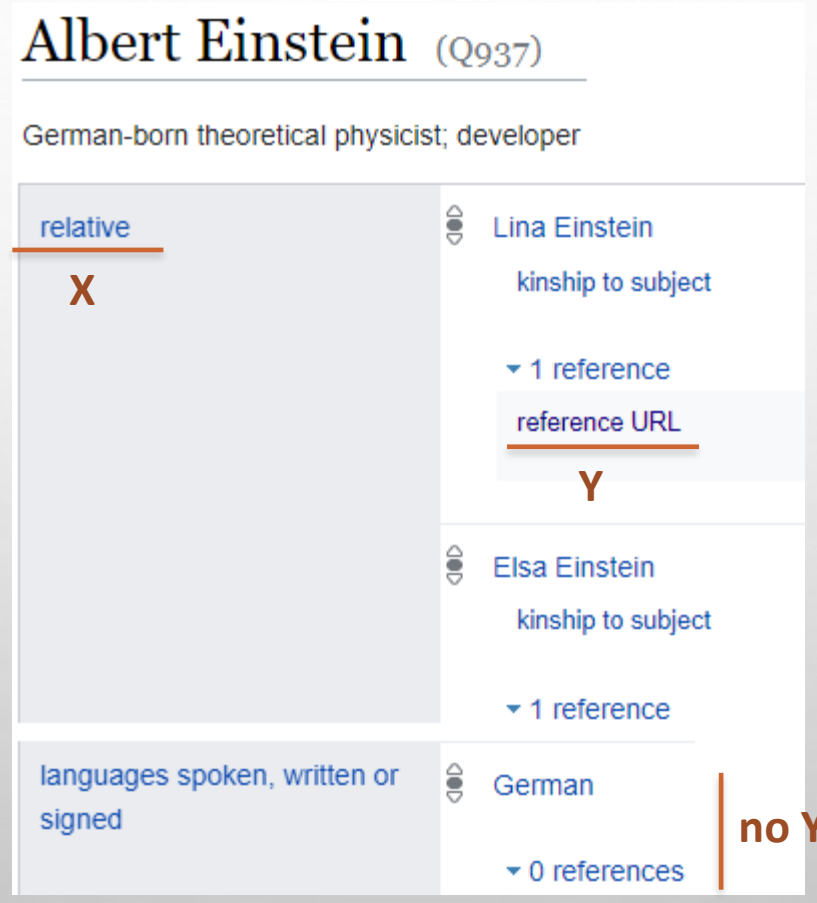
…

https://www.wikidata.org/wiki/EntitySchema:E273

DIMENSION: COMPLETENESS

Property completeness of references

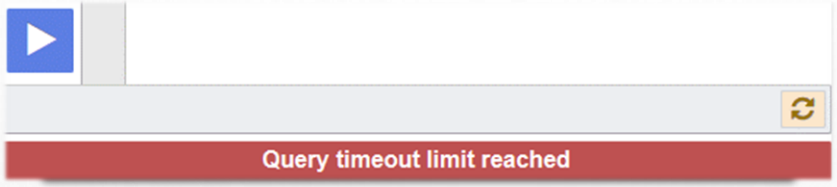
If a fact of type X has a reference using the ref-property Y, how many other type X facts have a reference using property Y?



SUBSETTING KGS

Huge Size of KGs

Wikidata 2021
100 GB

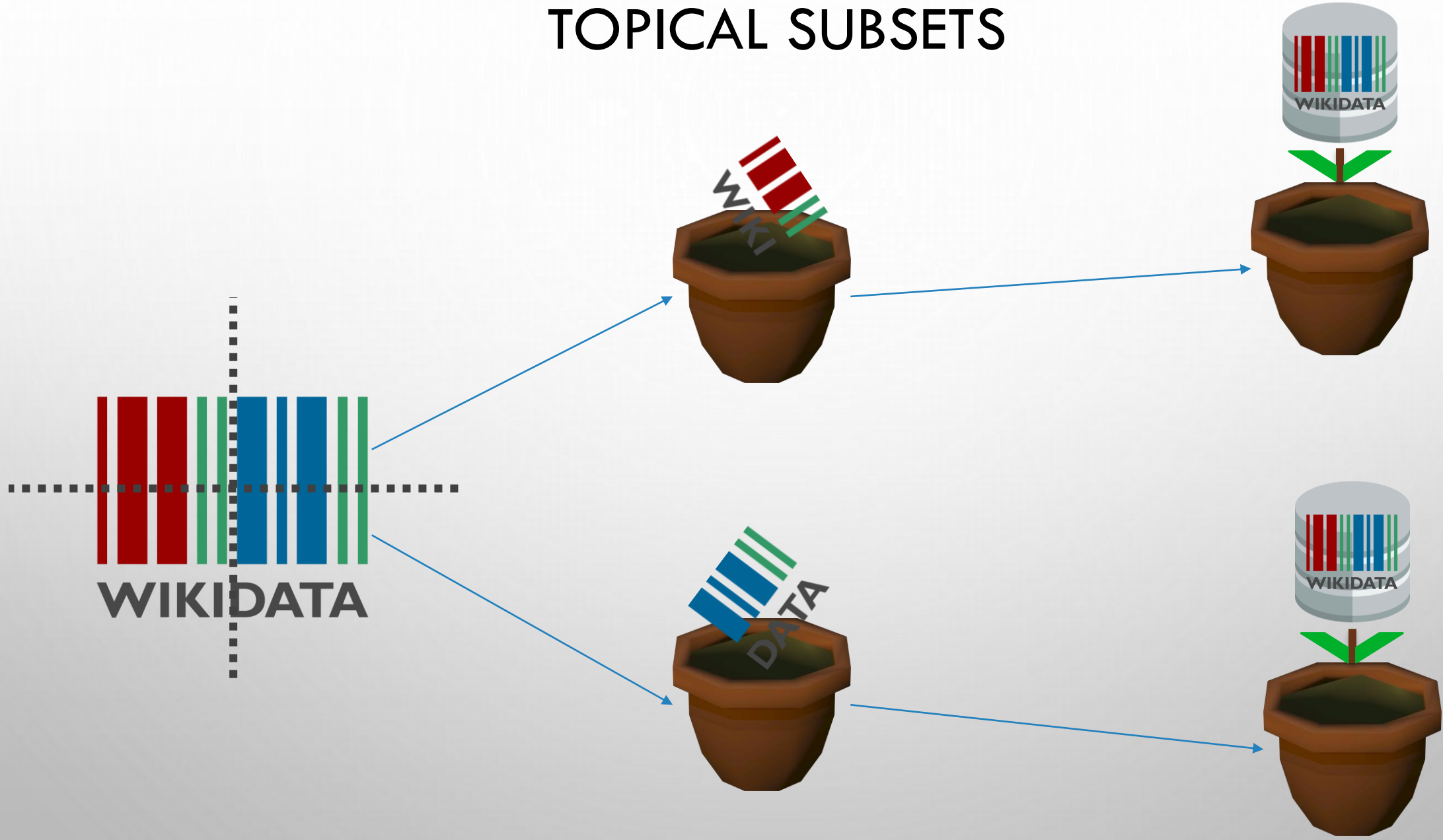


Timed-Out Queries

Reducing the Overall Costs

Reproducible Experiments

TOPICAL SUBSETS



SUBSETTING TOOLS

Configuration phase (Filtering): Defining the subset

- Which Items should be extracted?
- Which statements?
- Which metadata (references, qualifiers, labels, …)?
- Filtering item-based or fact-based?
- Flexibility

Extraction phase: Cutting the defined subset from the main KG

- Be as fast as possible
- Extract accurately (be sure that the output has got what it should got)

DEFINING SUBSET via SHEX

```
PREFIX :    <http://example.com/>
PREFIX wd:  <http://www.wikidata.org/entity/>
PREFIX wdt: <http://www.wikidata.org/prop/direct/>

start=@:lipids

:lipids {
   wdt:P2063 .+;
   wdt:P234 .+;
   wdt:P235 .+;
   wdt:P703 @:taxon +;
}

:taxon {
    wdt:P31 [wd:Q16521];
}
```

A Simple Lipids subset

https://github.com/seyedahbr/biohackathon2021/tree/main/use_cases/lipidmaps

DEFINING SUBSET via SHEX

```
PREFIX wd: <http://www.wikidata.org/entity/>
PREFIX wdt: <http://www.wikidata.org/prop/direct/>

<#chemical_compound> EXTRA wdt:P31 {
  wdt:P31  [ wd:Q11173 ] | wdt:P279 @<#chemical_compound> + ;
}

<#disease> EXTRA wdt:P31 {
  wdt:P31   [ wd:Q12136 ] | wdt:P279 @<#disease> + ;
}

<#gene> EXTRA wdt:P31 {
  wdt:P31   [ wd:Q7187 ] | wdt:P279 @<#gene> + ;
}

<#protein> EXTRA wdt:P31 {
  wdt:P31  [ wd:Q8054 ] | wdt:P279 @<#protein> + ;
}
```

Part of GeneWiki subset definition with considering sub-classes using recursive

https://github.com/seyedahbr/Wikidata_Reference_Statistics/blob/main/ShEx%20schemata/genewiki.shex

REFERENCES

- [1] A. Zaveri, A. Rula, A. Maurino, R. Pietrobon, J. Lehmann, S. Auer, Quality Assessment For Linked Data: A Survey, Semantic Web. 7 (2016) 63–93.
- [2] Beghaeiraveri, S. A. H., Gray, A. J., & Mcneill, F. J. (2021, October). Reference Statistics In Wikidata Topical Subsets. In 2nd Wikidata Workshop.