Towards the Specification and Generation of Time Series Datasets from Data Lakes

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Context

1. Work developed as part of a project with LIS Data Solutions.
2. LIS Data Solution is a software company based in North Spain focused on data collection and data analysis systems.
3. They wanted to organize all data they store by creating a *datalake*.

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2. Nobody knows how these data are going to be analyzed.
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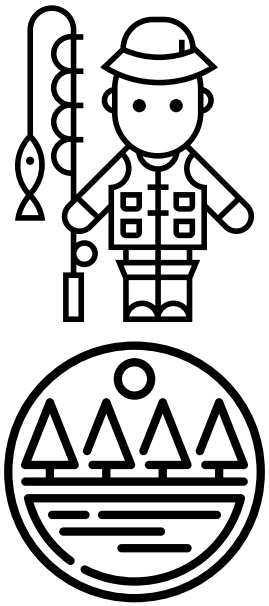
Data Lake Example



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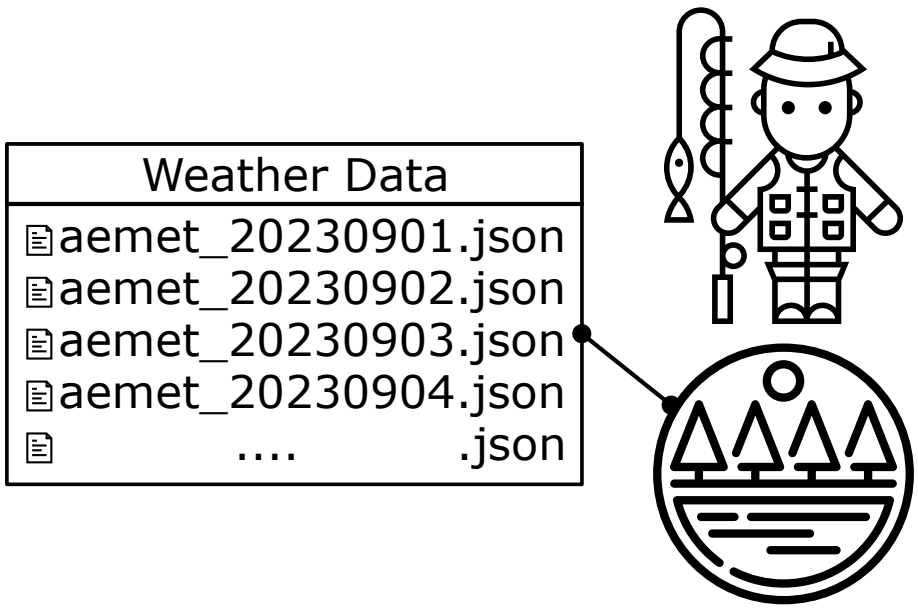

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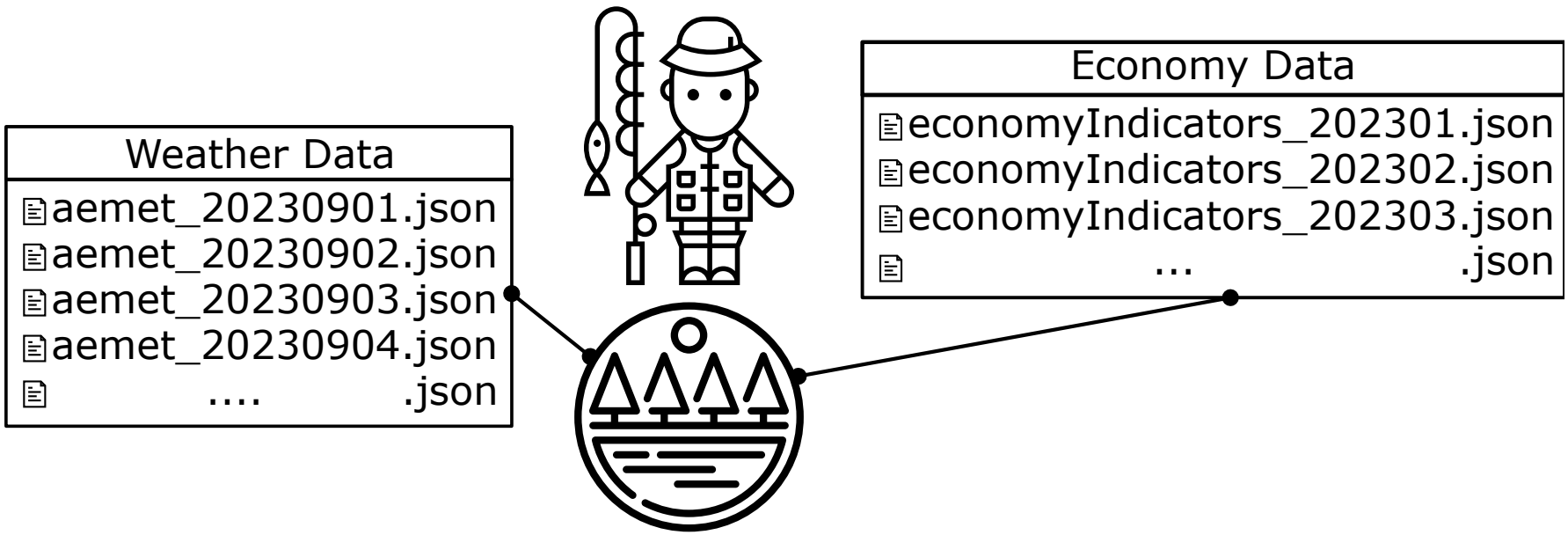

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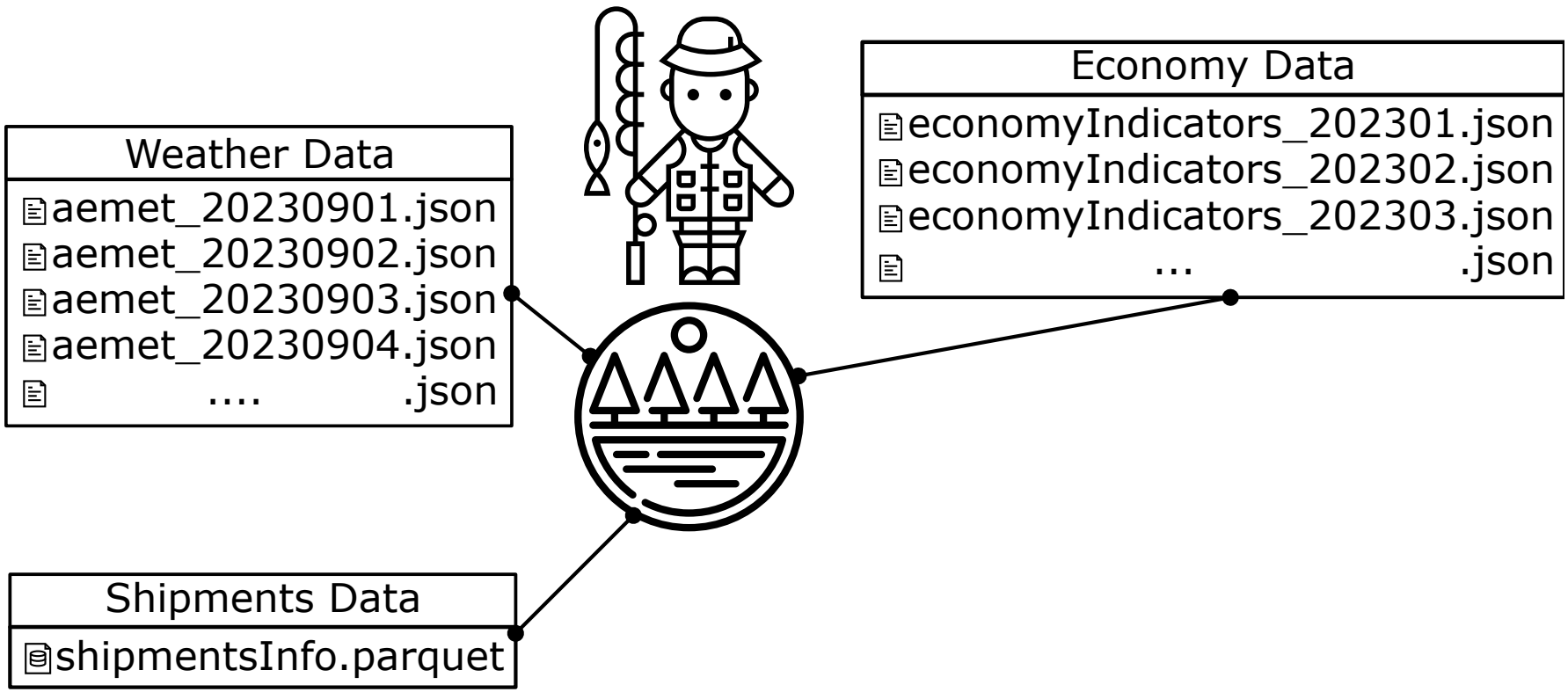

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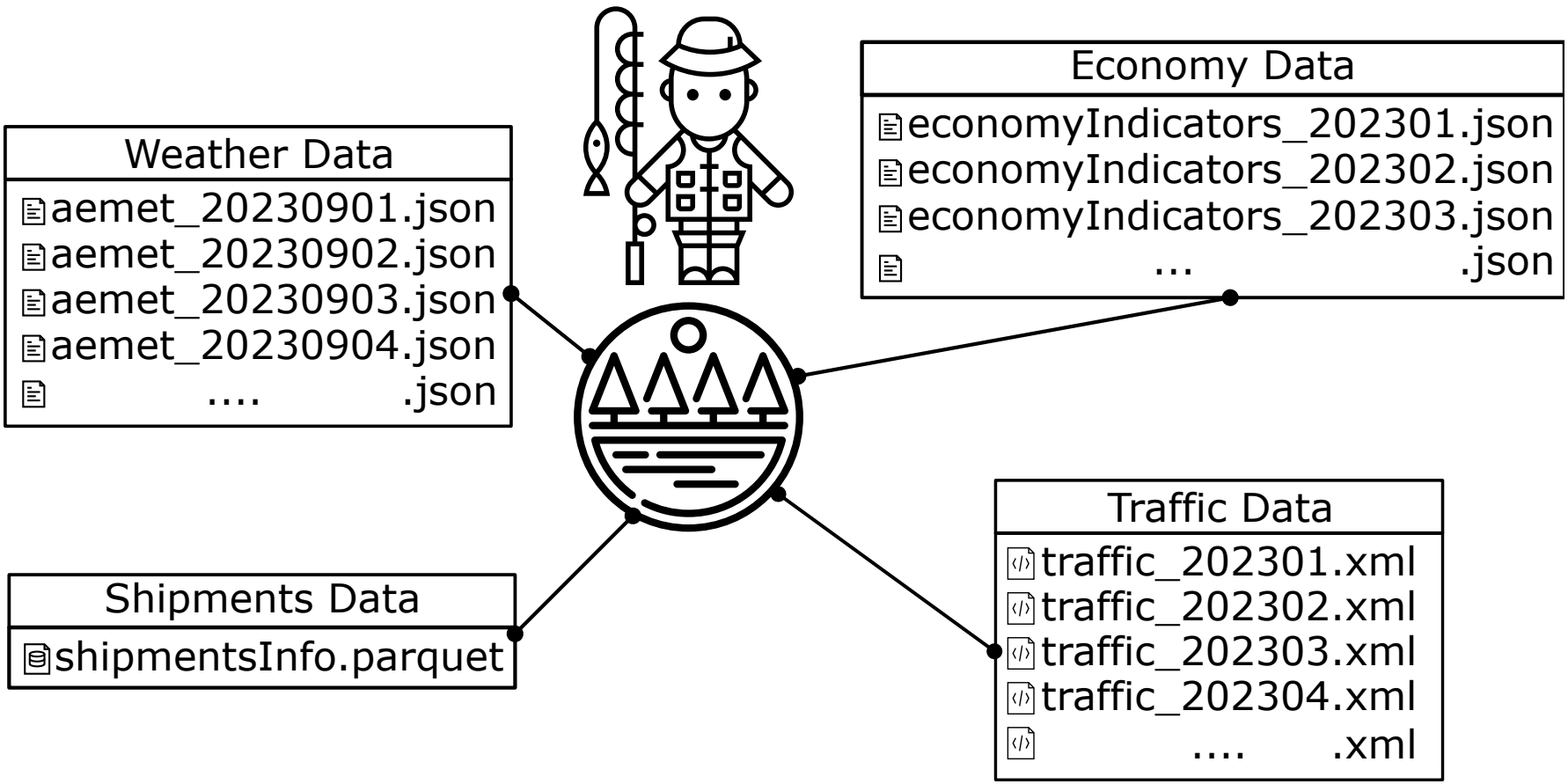

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Running Example

Goal

Forecast the shipment volume and delivery times for some logistics companies using the data stored in the datalake for a specific Spanish city.

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Time Series Datasets

Date	Shipments	Temp. (°C)	Rain (mm)	GDP	Traffic (trucks/h)
2019-02-07	31	13.4	1.7	965.6	1230
2019-02-08	28	10.2	0.5	965.6	1320
2019-02-09	34	11.8	0.8	965.6	1280
...	...	...	...	...	...

Dataset Creation Challenges

1. Find the appropriate set of *blobs* or files.
2. Select the correct subset of *blobs* for each data source.
3. Handle multiple and heterogeneous file formats.
4. Extract data from each file or set of files
5. Harmonize of sampling frequencies.

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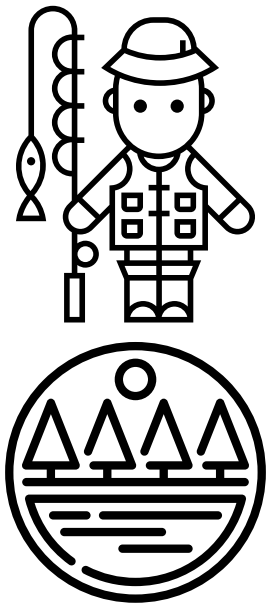

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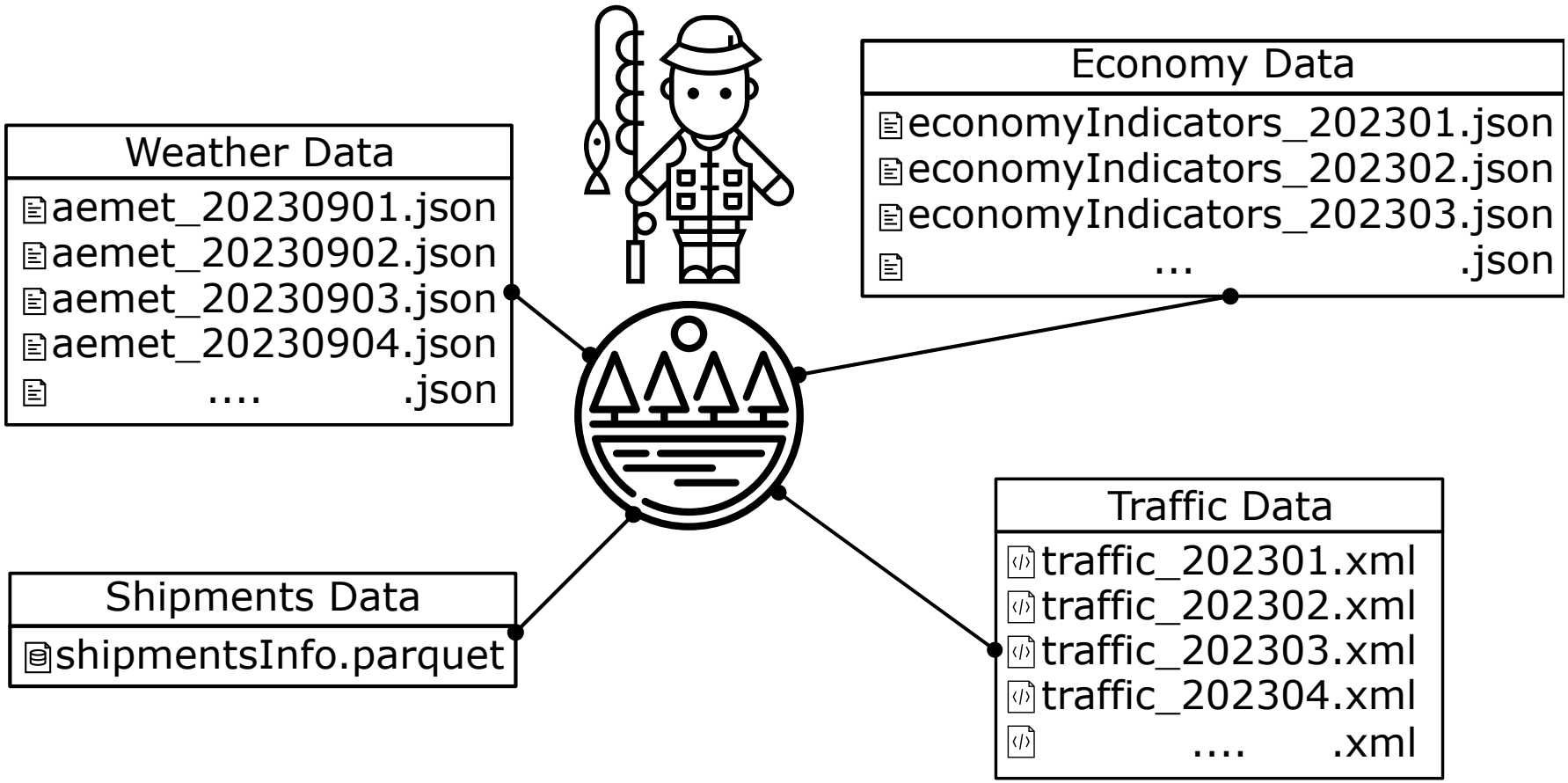

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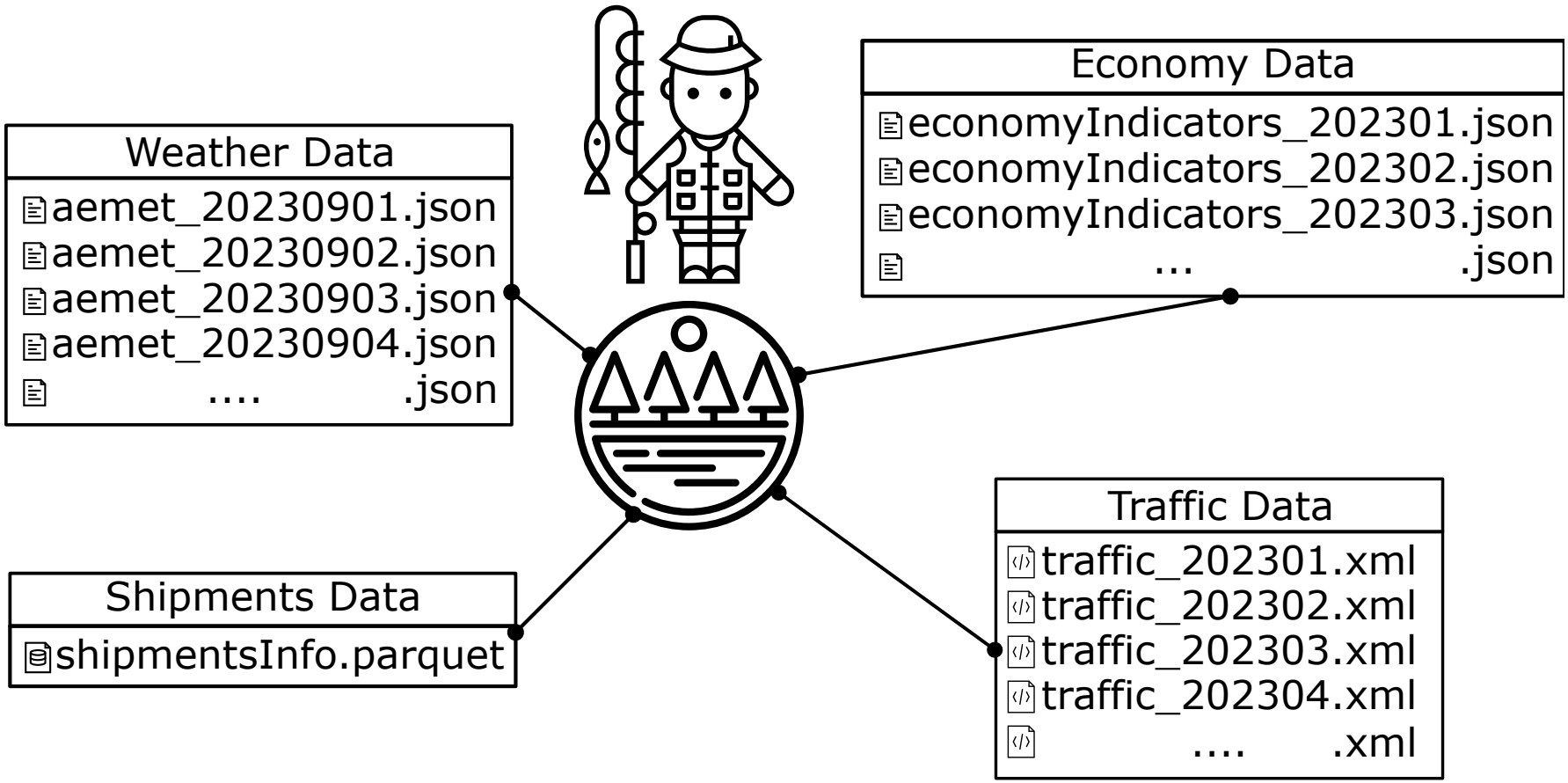

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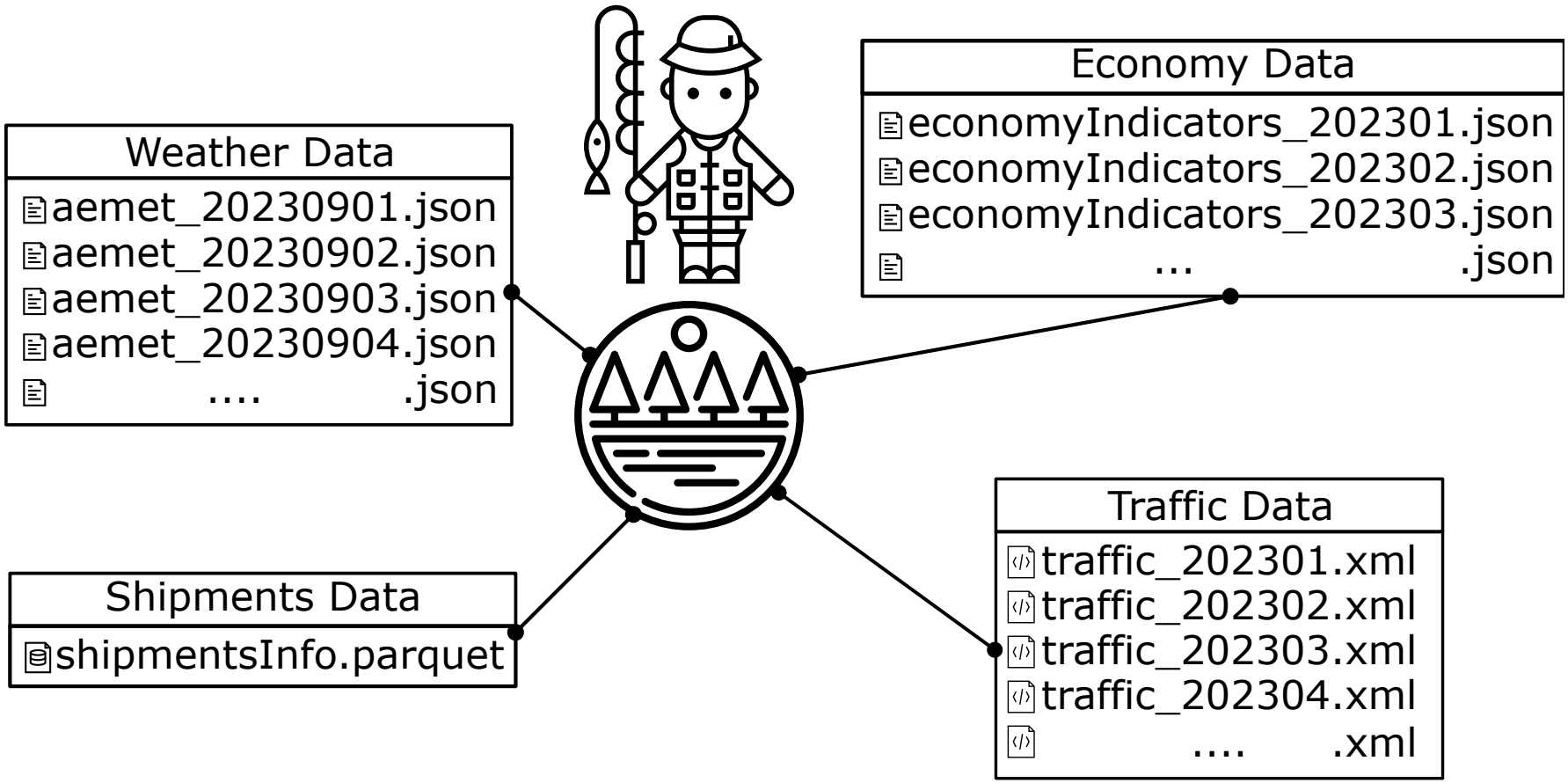

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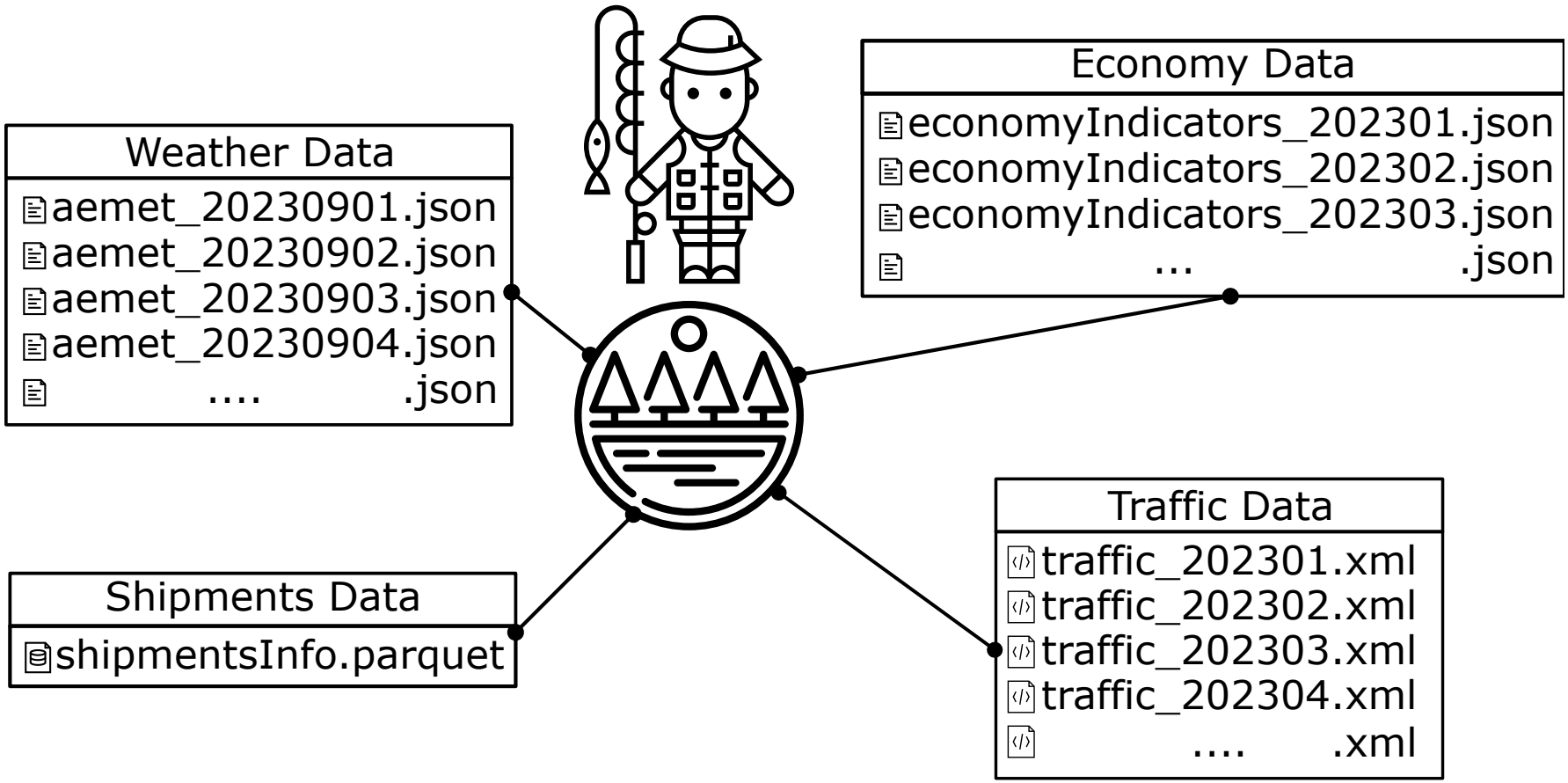

Dataset Creation State-of-the-Art

1. Data scientists write large scripts in languages such as R or Pandas.
2. The script for the running example is $\sim$ 500 lines long.
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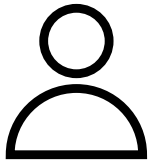
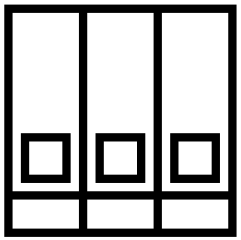
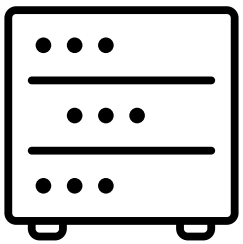


Data Scientist / Stakeholder



Data Catalog



Data Lake

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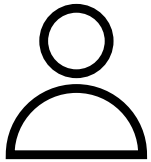

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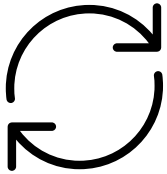
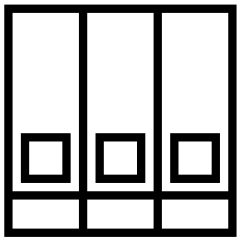


Feature Selection



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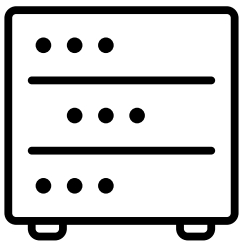

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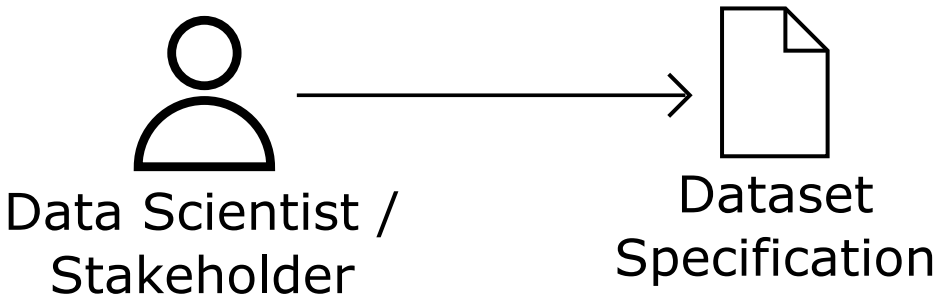
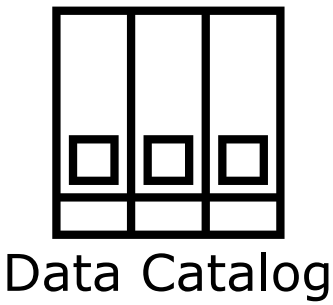
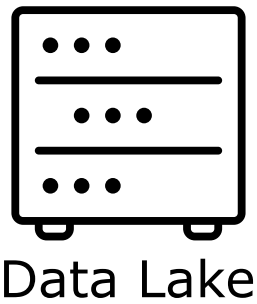


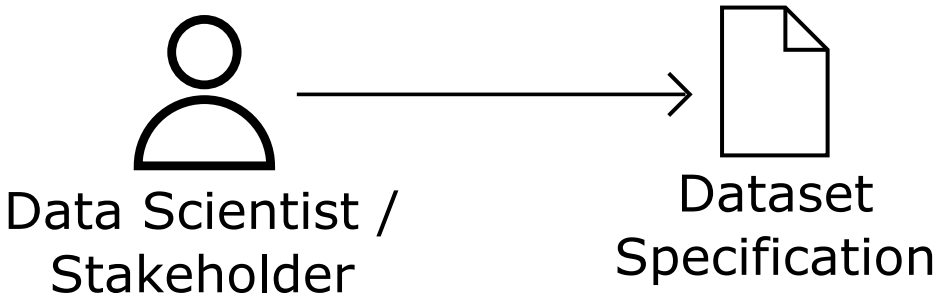


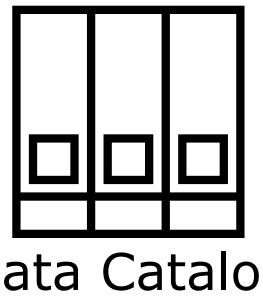


The Hannah Language

```
1  dataset ShipmentForecasting
2      sampling daily
3      from 2023/01/01 to 2023/06/30
4      with currentDay as index
5      with features
6        from ShipmentInformation {
7            shipments is count(id[orderDate=currentDay])
8        }
9        from WeatherData[city='Santander'] {
10           temperature;
11           rain;
12       }
13       from EconomyData {
14           gdp expanded by linear_interpolation;
15       }
16
```

The Hannah Framework





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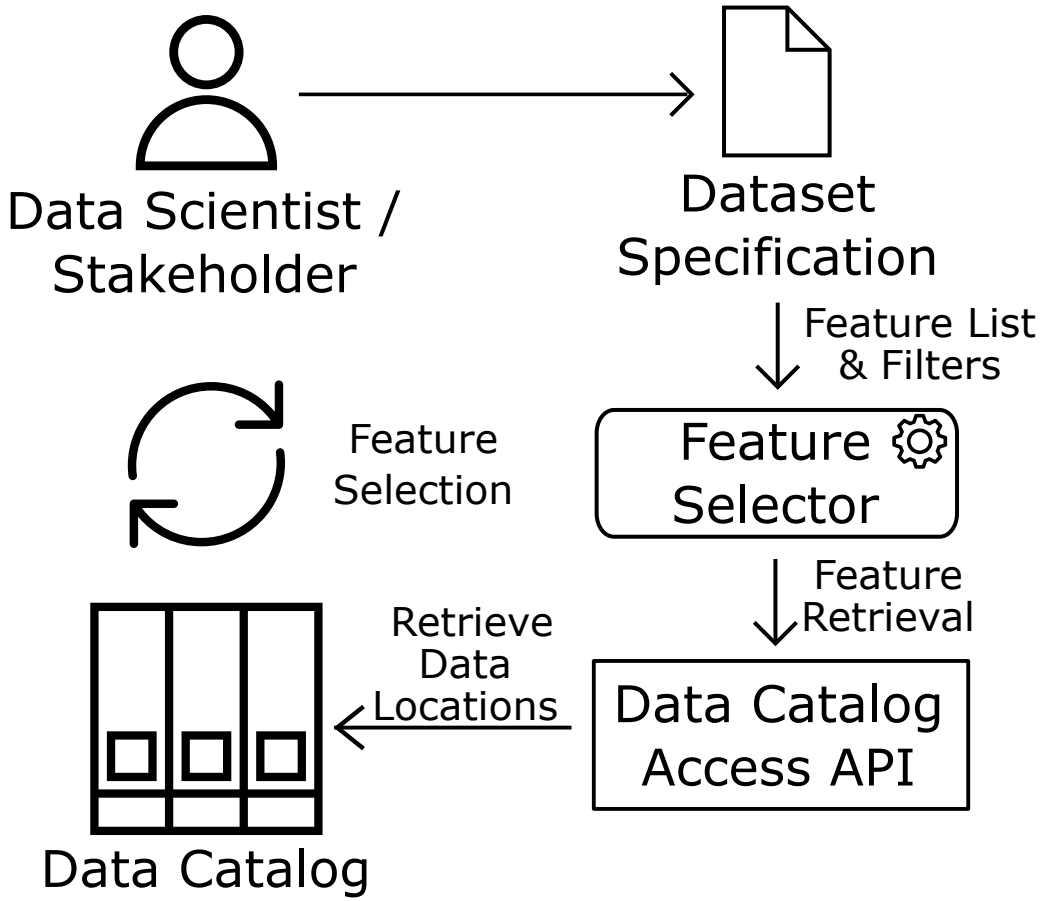

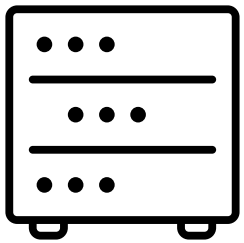

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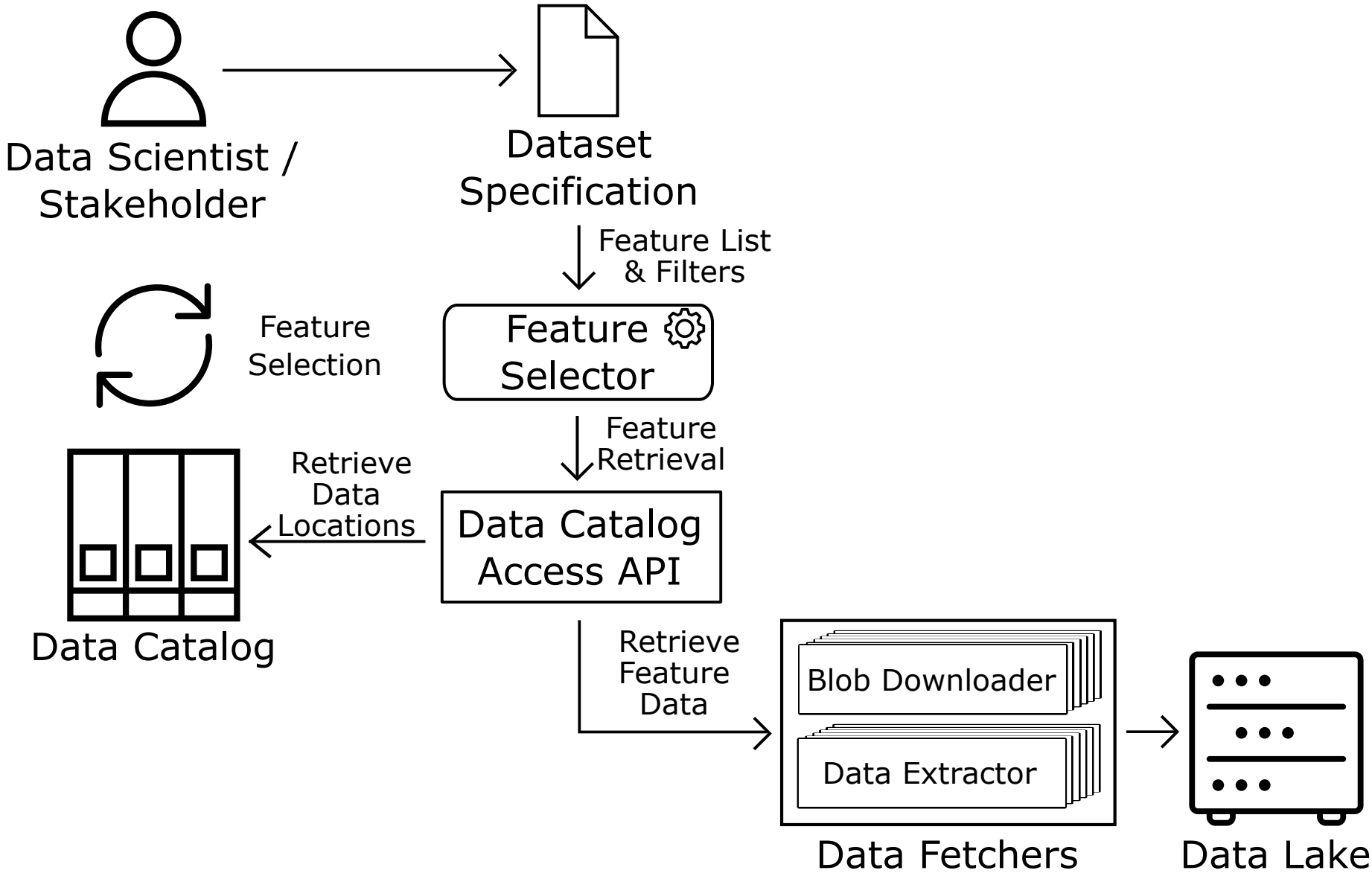

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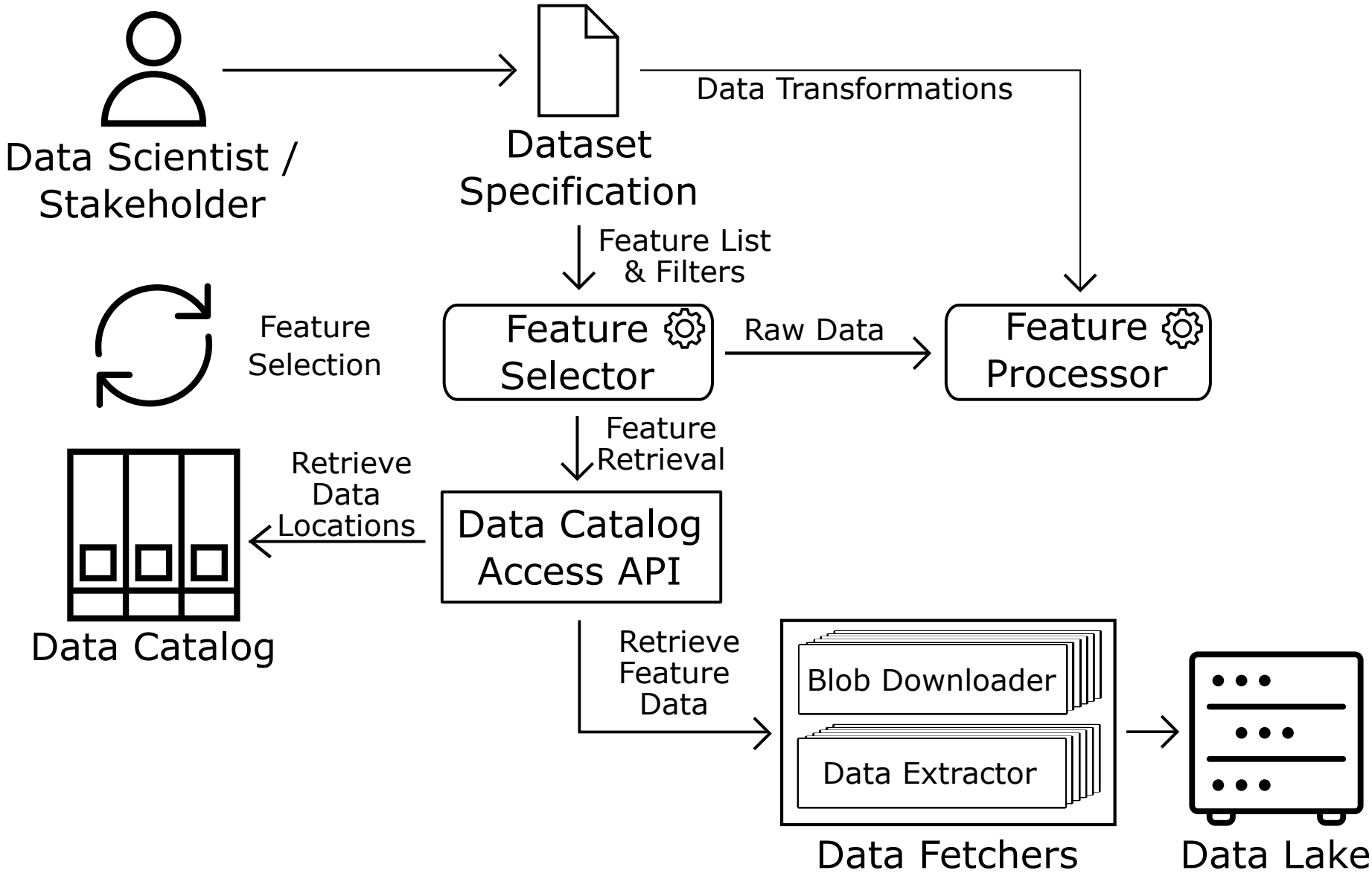

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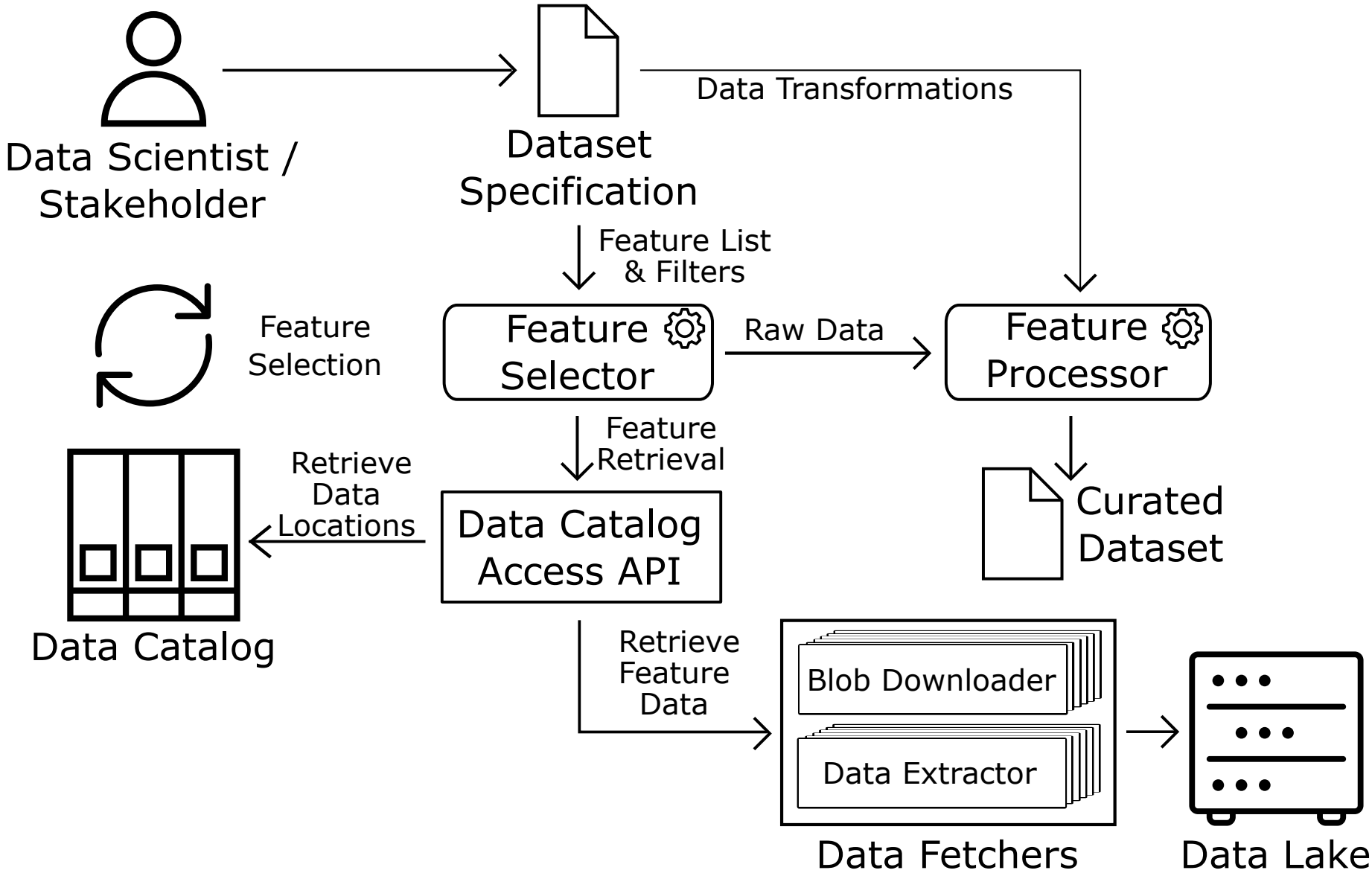

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3. This work proposes *Hannah*, a high-level declarative language for specifying datasets for time series analysis, plus a framework for automatically processing these specifications.
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Thanks for your attention.

Acknowledgments

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- Server, Gear Wheels in slide 18 by SVG Repo.
- Cycle Arrows in slide 18 by IconPark of SVG Repo.