Tales from the road of text to knowledge

From plain text to semantic knowledge graphs
through natural language processing

By Veronika Heimsbakk

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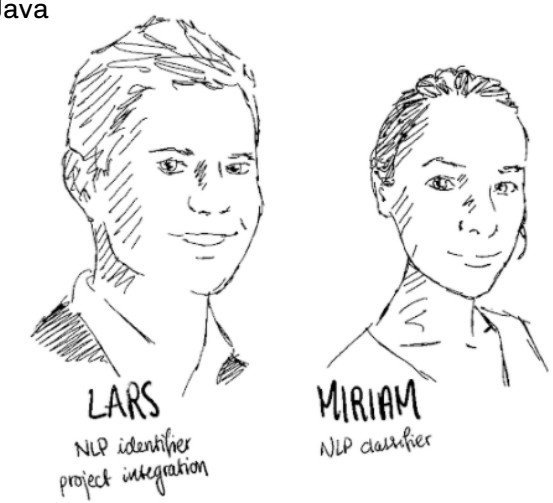
Veronika Heimsbakk

- Senior consultant, Capgemini Norway
- Logic & semantics, University of Oslo
- From kernel modules in C to semtech in Java



Problem

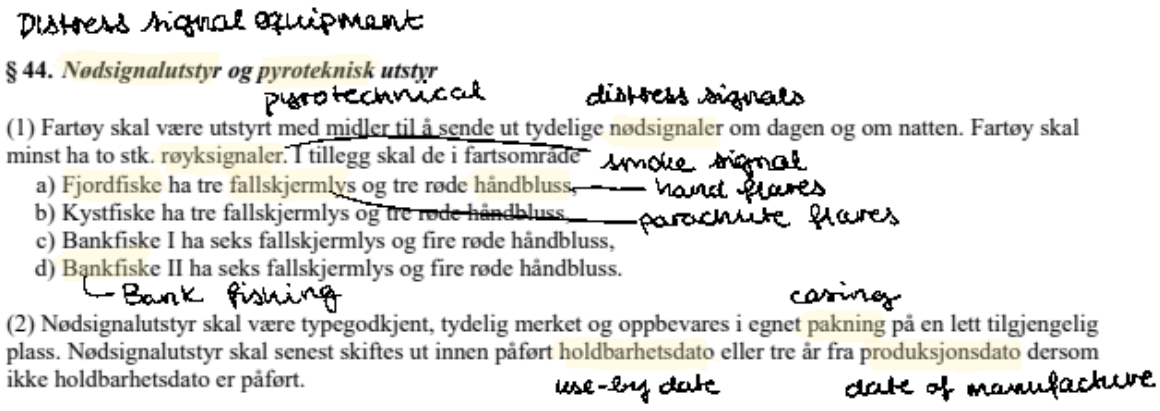
Sjøfartsdirektoratet
Norwegian Maritime Authority

- Connected and findable data in unstructured information.
- Manual modelling of graph == time consuming.

Impact

- Estimated translation time reduced by 10 000 hours.
- Minimize risk of misinterpretation.

Starting point



Distress signal equipment

§ 44. *Nødsignalutstyr og pyroteknisk utstyr*

pyrotechnical distress signals

(1) Fartøy skal være utstyrt med midler til å sende ut tydelige nødsignaler om dagen og om natten. Fartøy skal minst ha to stk. røyksignaler. I tillegg skal de i fartsområde

smoke signal

a) Fjordfiske ha tre fallskjermlys og tre røde håndbluss,

hand flares

b) Kystfiske ha tre fallskjermlys og tre røde håndbluss,

parachute flares

c) Bankfiske I ha seks fallskjermlys og fire røde håndbluss,

d) Bankfiske II ha seks fallskjermlys og fire røde håndbluss.

Bank fishing

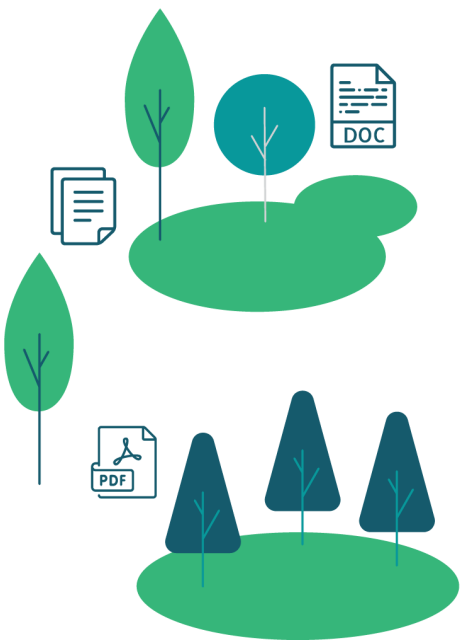
carriage

(2) Nødsignalutstyr skal være typegodkjent, tydelig merket og oppbevares i egnet pakning på en lett tilgjengelig plass. Nødsignalutstyr skal senest skiftes ut innen påført holdbarhetsdato eller tre år fra produksjonsdato dersom ikke holdbarhetsdato er påført.

use-by date date of manufacture

- Approximately 3500 triples of knowledge.
- OWL Lite ontology and SHACL shapes.

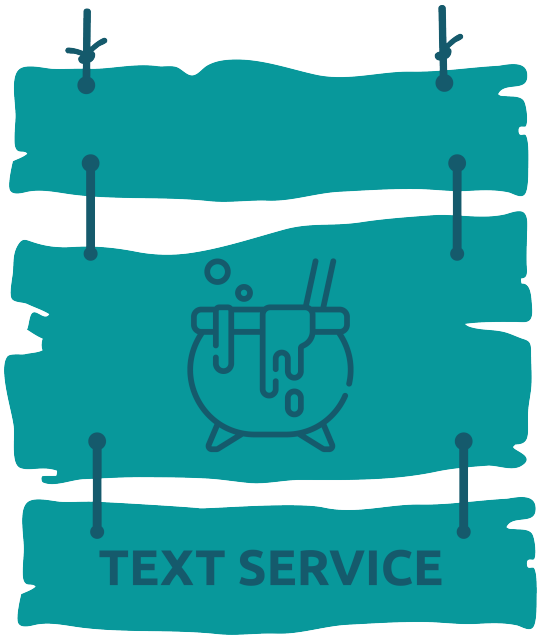
Forest of Information



- Encounter several kinds of information.
- Gather them all!

First Pitstop

- Mix information in a cauldron with a common recipe.
- Extract bits of information through API.



\regulation\chapter\paragraph\part\sub-part

Snakes & Letters

- Identifier
- Classifier

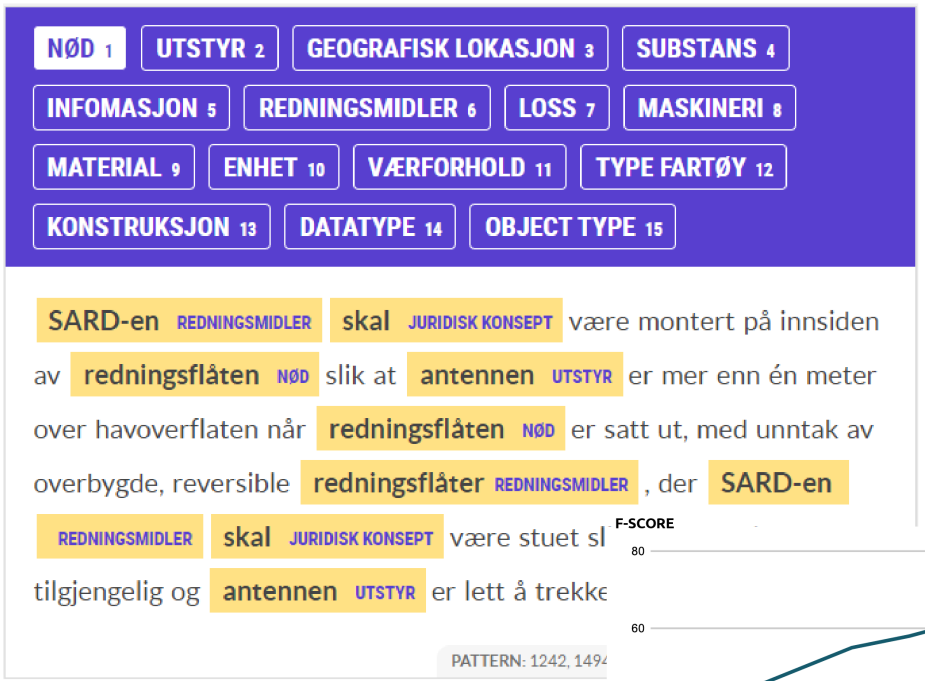
Identifier

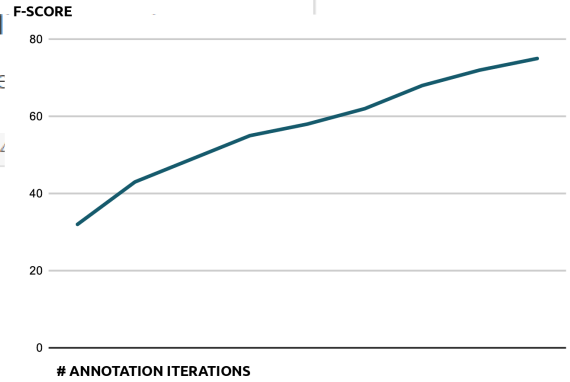
- spaCy pattern matching rules
- legal scope + location in text = regulatory requirement

```
[
  [ {"TEXT":
      {"REGEX": "^([a-zA-Z]+)(skip|fartøy|båt)$"}} ],
  [ {"LOWER": {"IN": ["lekter"]}} ],
  [ {"LOWER": {"IN": ["flyttbar"]}},
    {"LOWER": {"IN": ["innretning"]}} ]
]
```

Classifier

- Extensive annotation on a subset of information

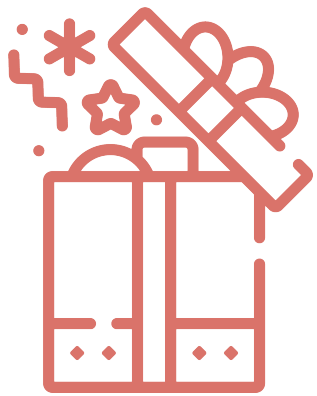




Transformation

Unboxing wonders & generate knowledge!

1. JSON-LD
2. OTTR
3. OTTR + Java
4. Java



Reasonable Ontology Templates

Template[1]

```
o-sdir:Scope[! ottr:IRI ?shape, ! ?path] :: {
    o-sh:PropertyShape(?shape, ?path),
    o-rdf:Type(?shape, sdir:Scope)
} .
```

Instance

```
o-sdir:Scope(scope:FishingVessel, sdir:vesselType) .
```

Serialized RDF

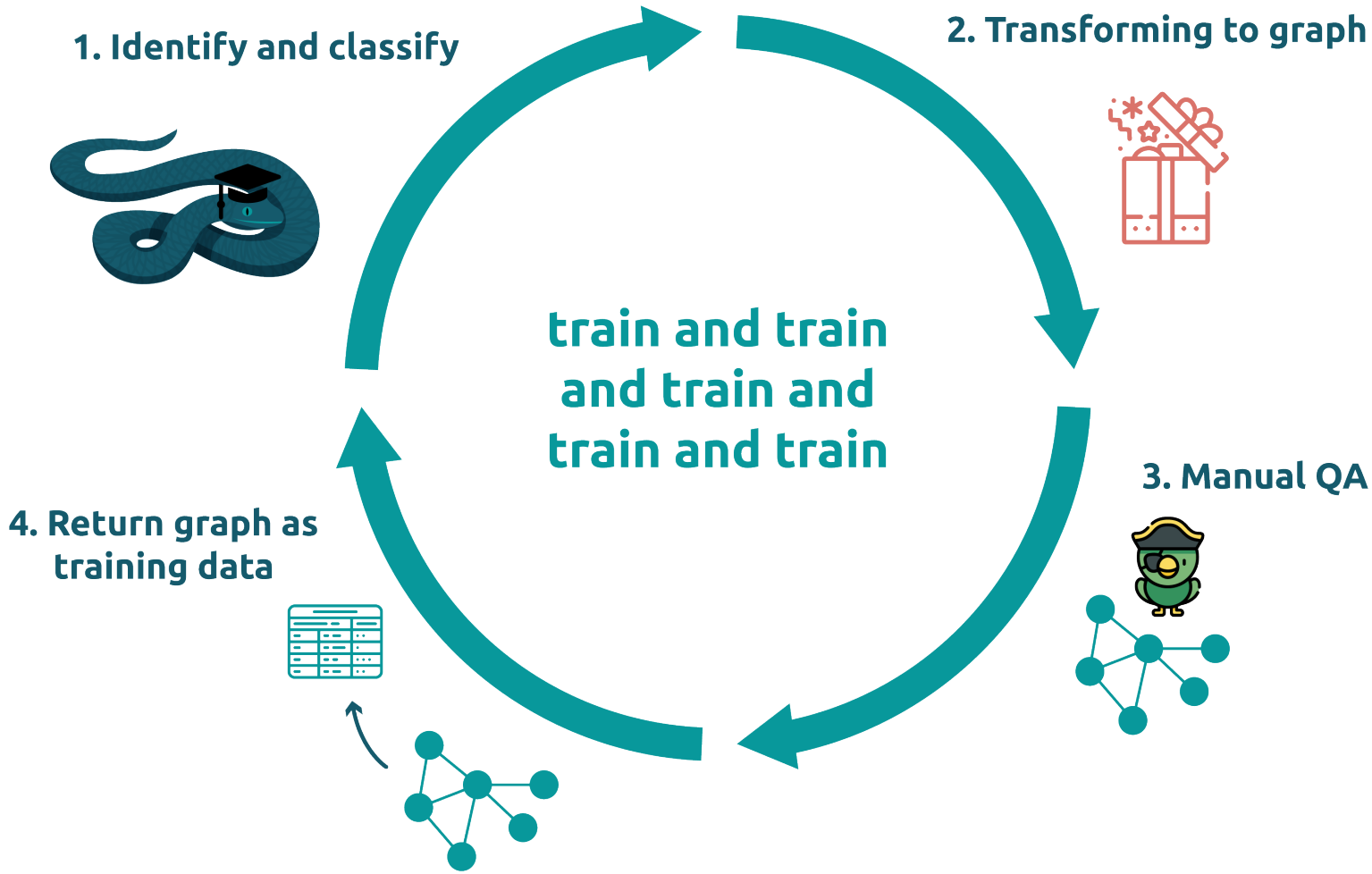
```
scope:FishingVessel a sdir:Scope, sh:PropertyShape ;
  sh:path sdir:vesselType .
```

[1] SHACL templates (`o-sh`) isn't a part of the public template library (yet).

Solution

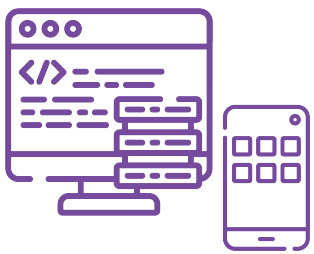
- JSON → Java object → stOTTR → RDF

Continue training



Applications

- Validation and conformance
- Maintenance of regulations
- Creating new regulations
- Search and filtering functionality



Putting the pieces together

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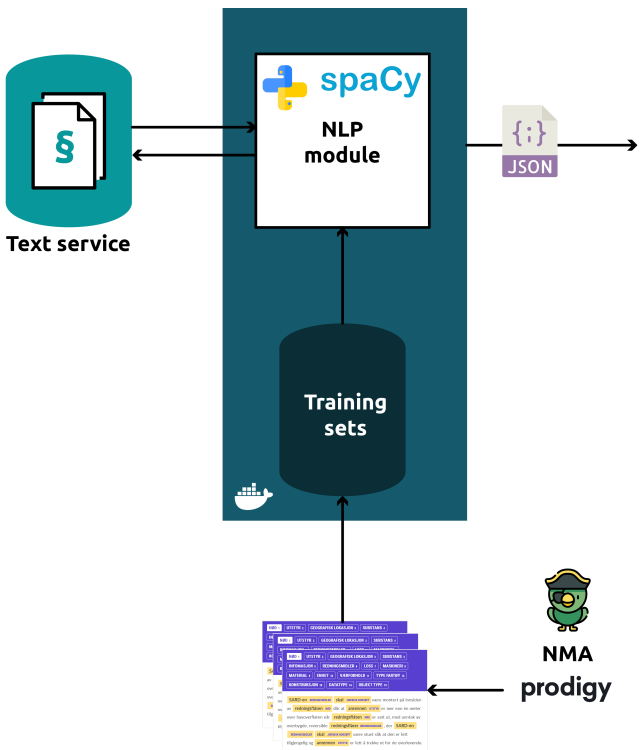

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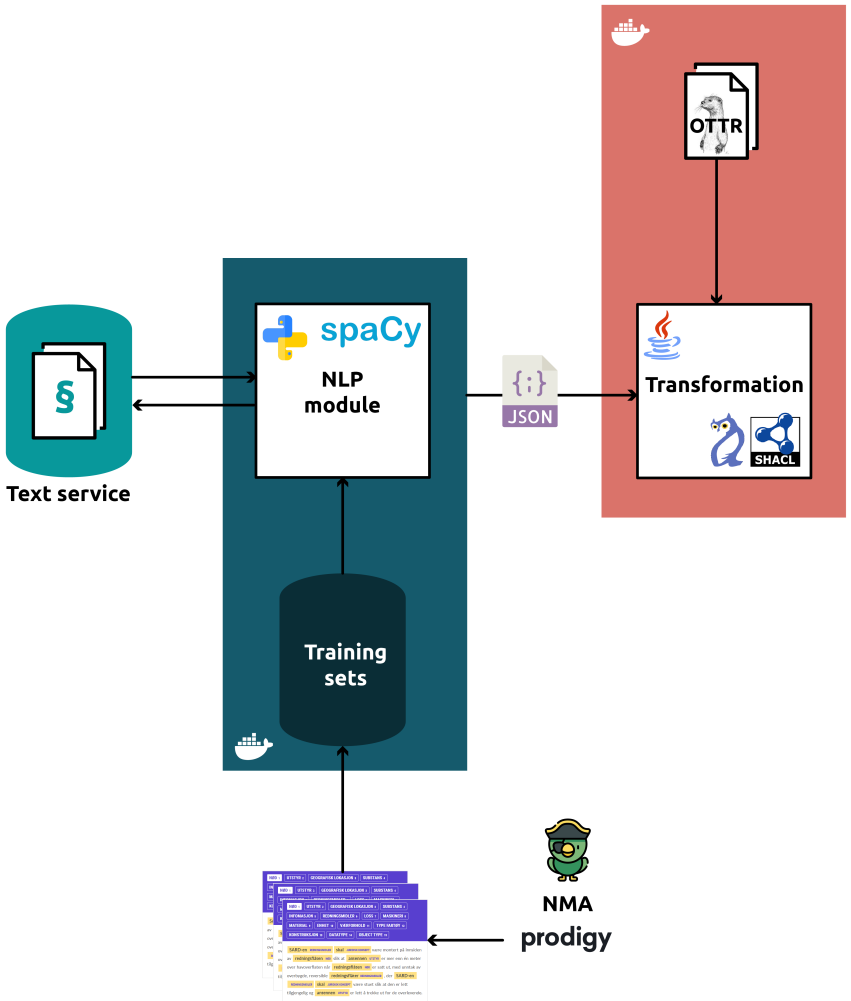

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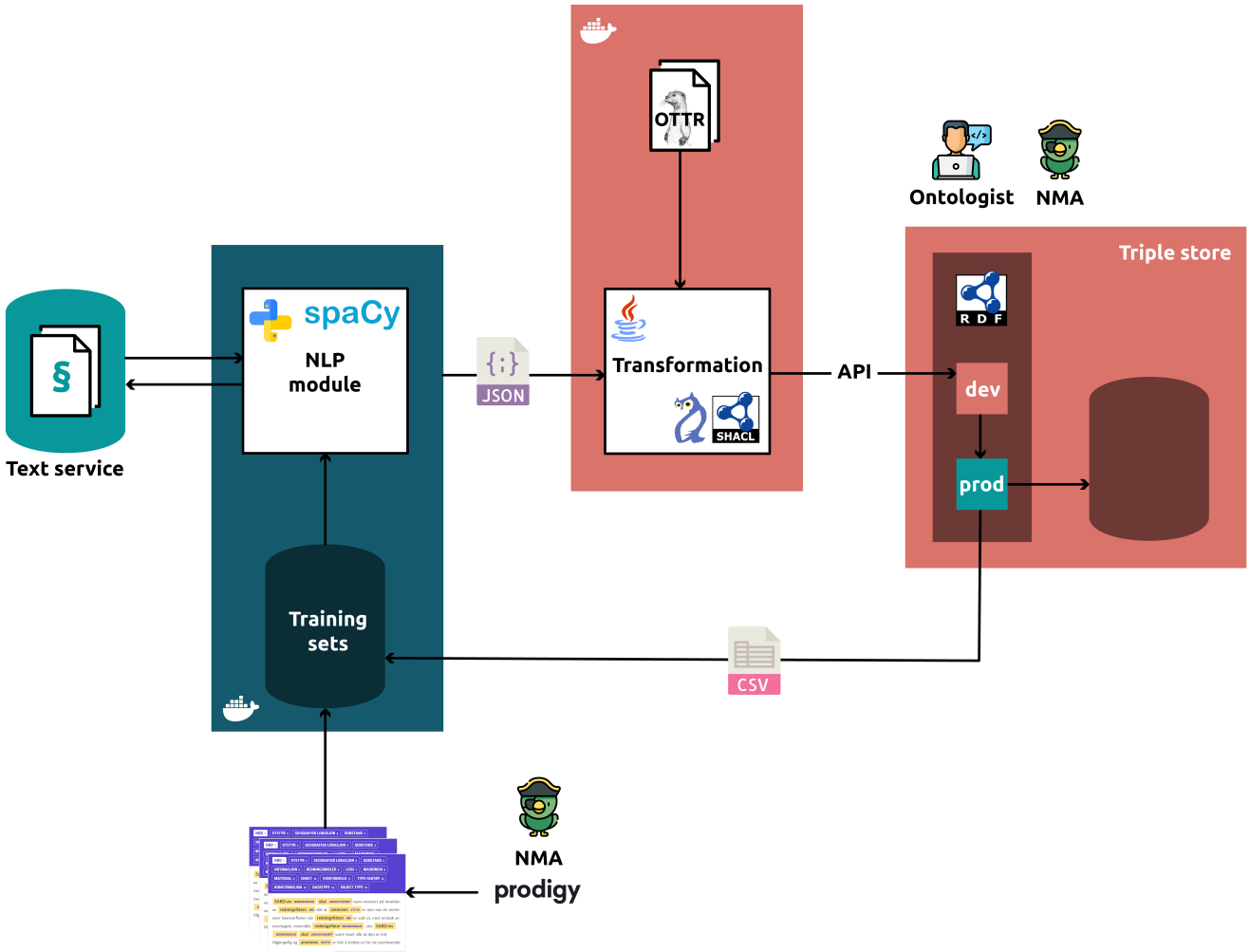

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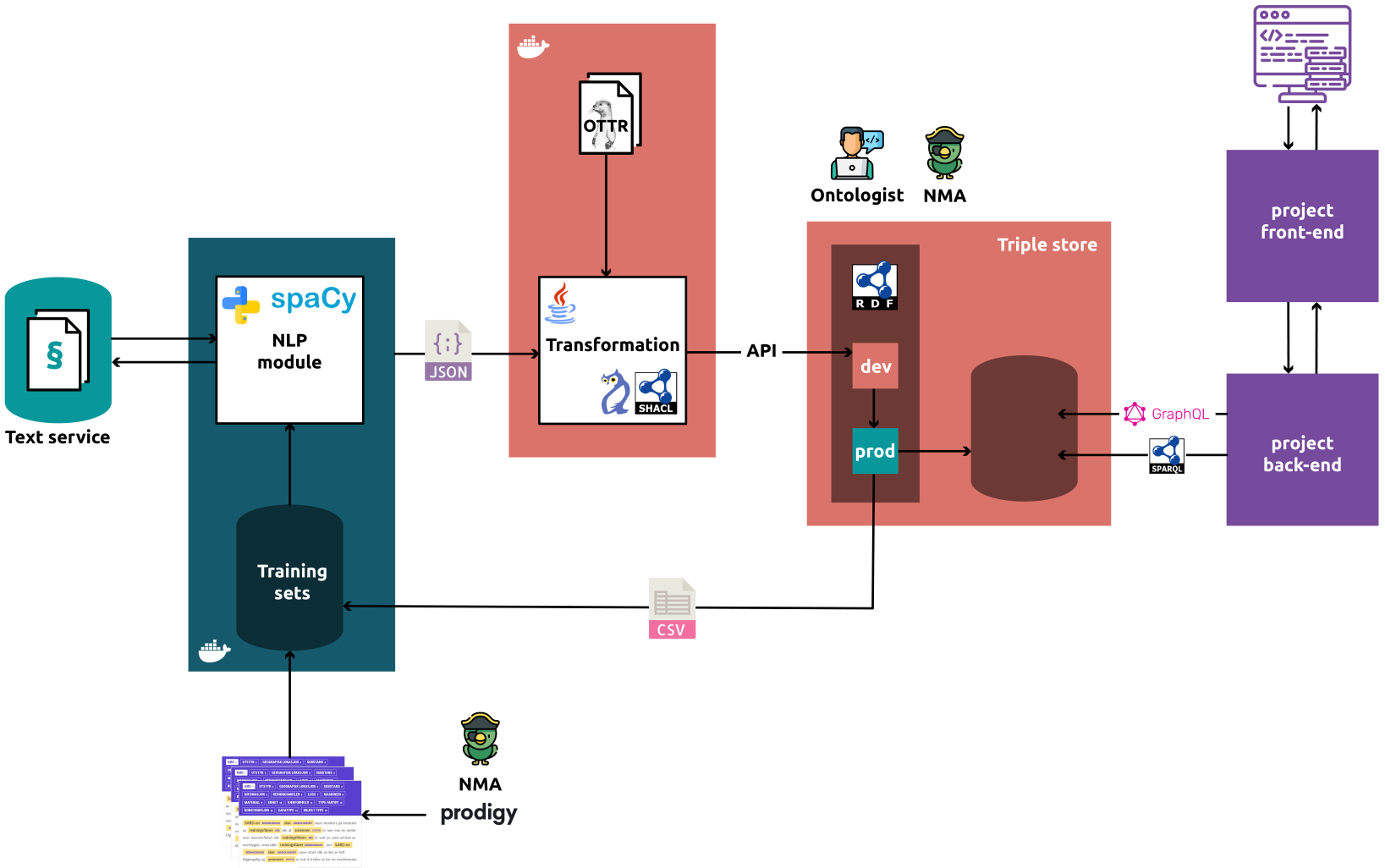

References

- Illustrations: freepik.com, flaticon.com, Veronika Heimsbakk
- OTTR, https://ottr.xyz/
- SHACL, https://www.w3.org/TR/shacl/
- spaCy, https://spacy.io/
- prodigy, https://prodi.gy/

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