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RExtractor: a Robust Information Extractor

Recent developments in natural language processing
and corpus Linguistics, 11.9.2015
MFF UK

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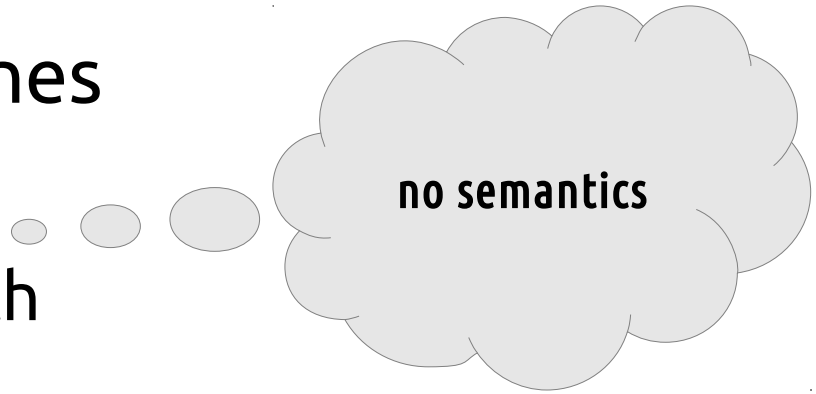
Motivation

- large collections of documents
- efficient browsing & querying
- typical approaches
  - full-text search
  - metadata search



- semantic interpretation of documents → suitable DB & query language → user-friendly browsing & querying

Case study on legislative domain

Legal texts

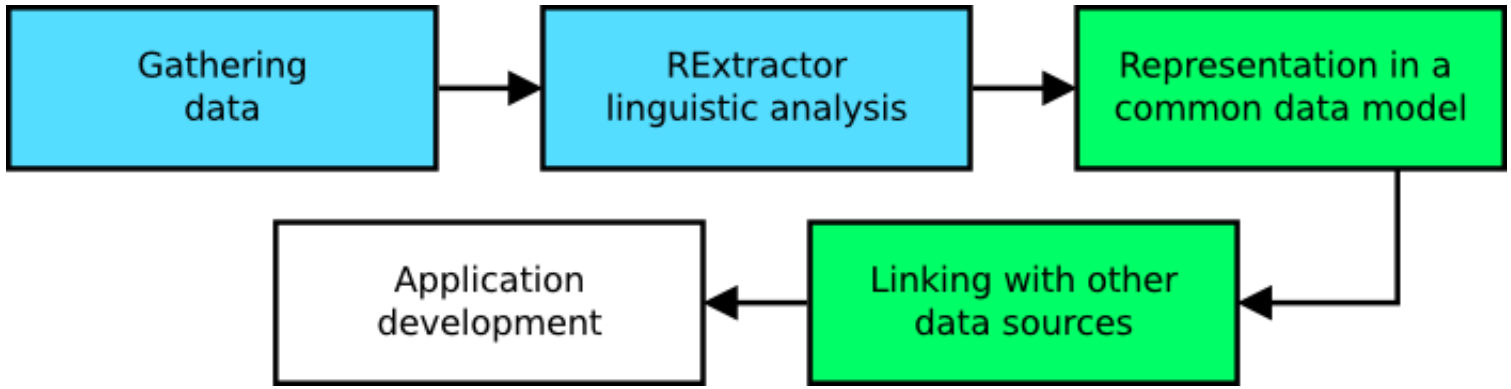
- specialized texts operating in legal settings
- they should transmit legal norms to their recipients
- they need to be clear, explicit and precise

Sentences

- simple sentences are very rare
- usually long and very complex

Legal texts are “generally considered very difficult to read and understand” (Tiersma, 2010)

Scenario



- **Cooperation between**
  - Information Extraction
  - Semantic Web

Scenario

- **Extracting knowledge base** 
  - set of entities and relations between them
  - linguistic analysis (RExtractor)
- **Knowledge base representation** 
  - Linked Data Principles
  - Resource Description Framework (RDF)

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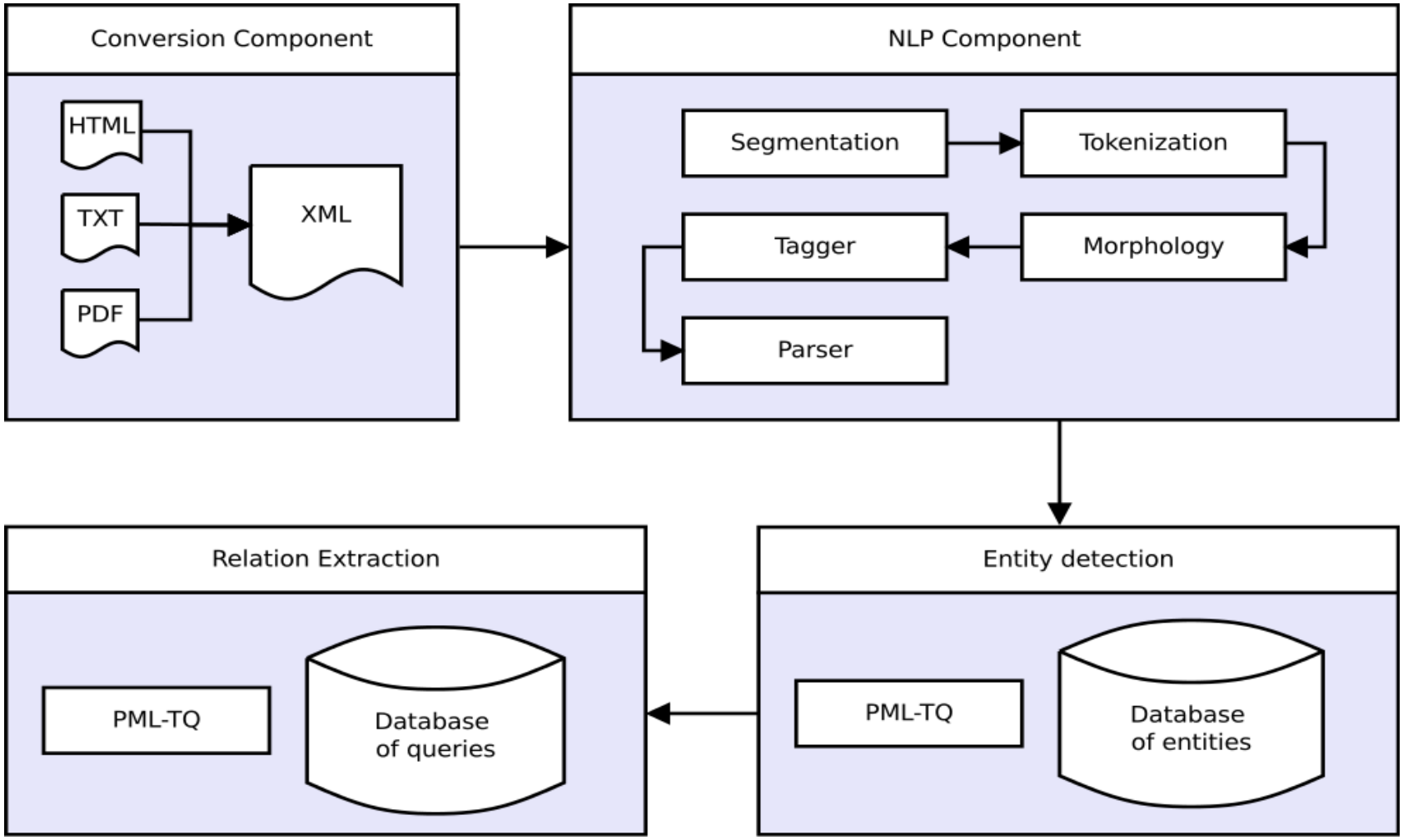
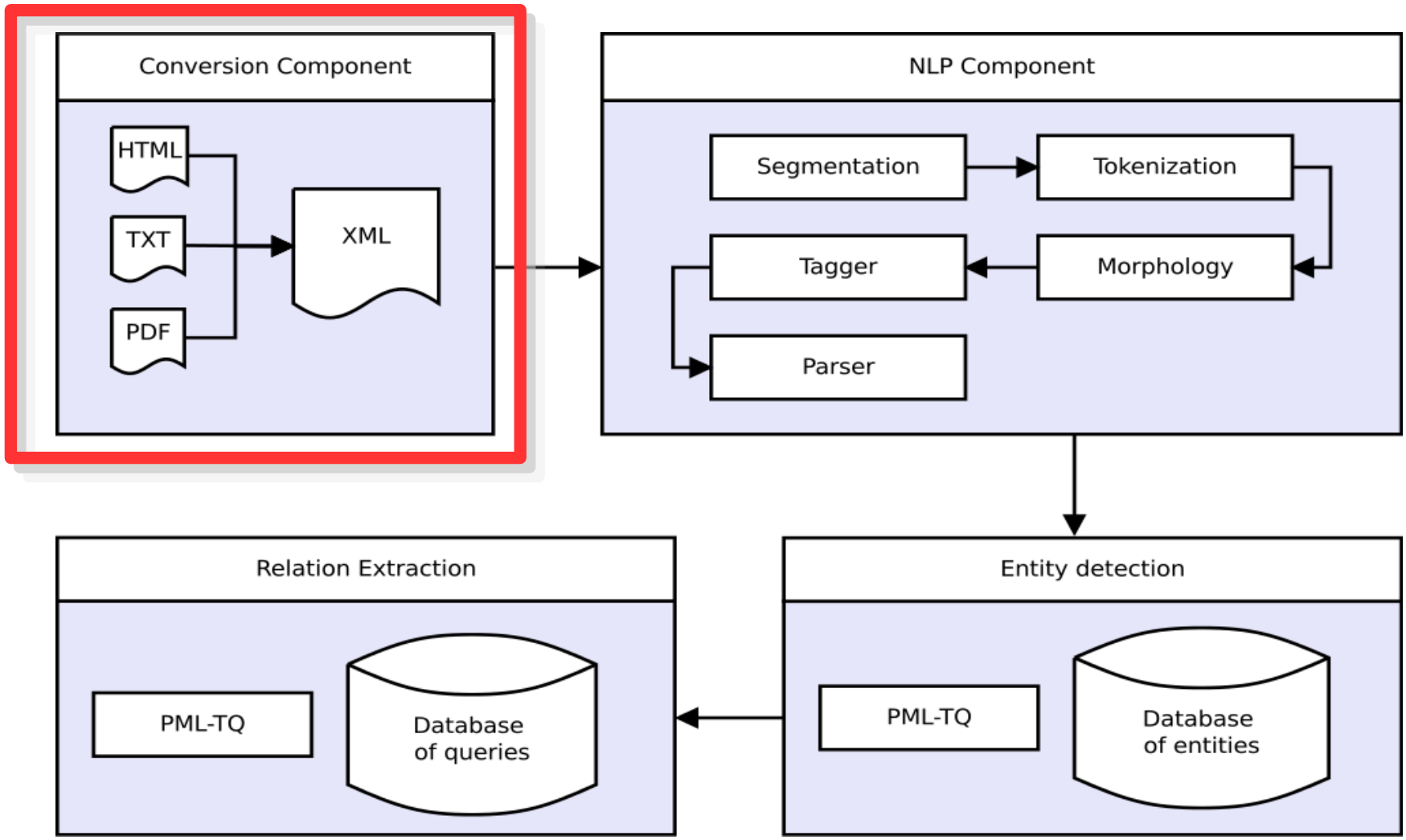
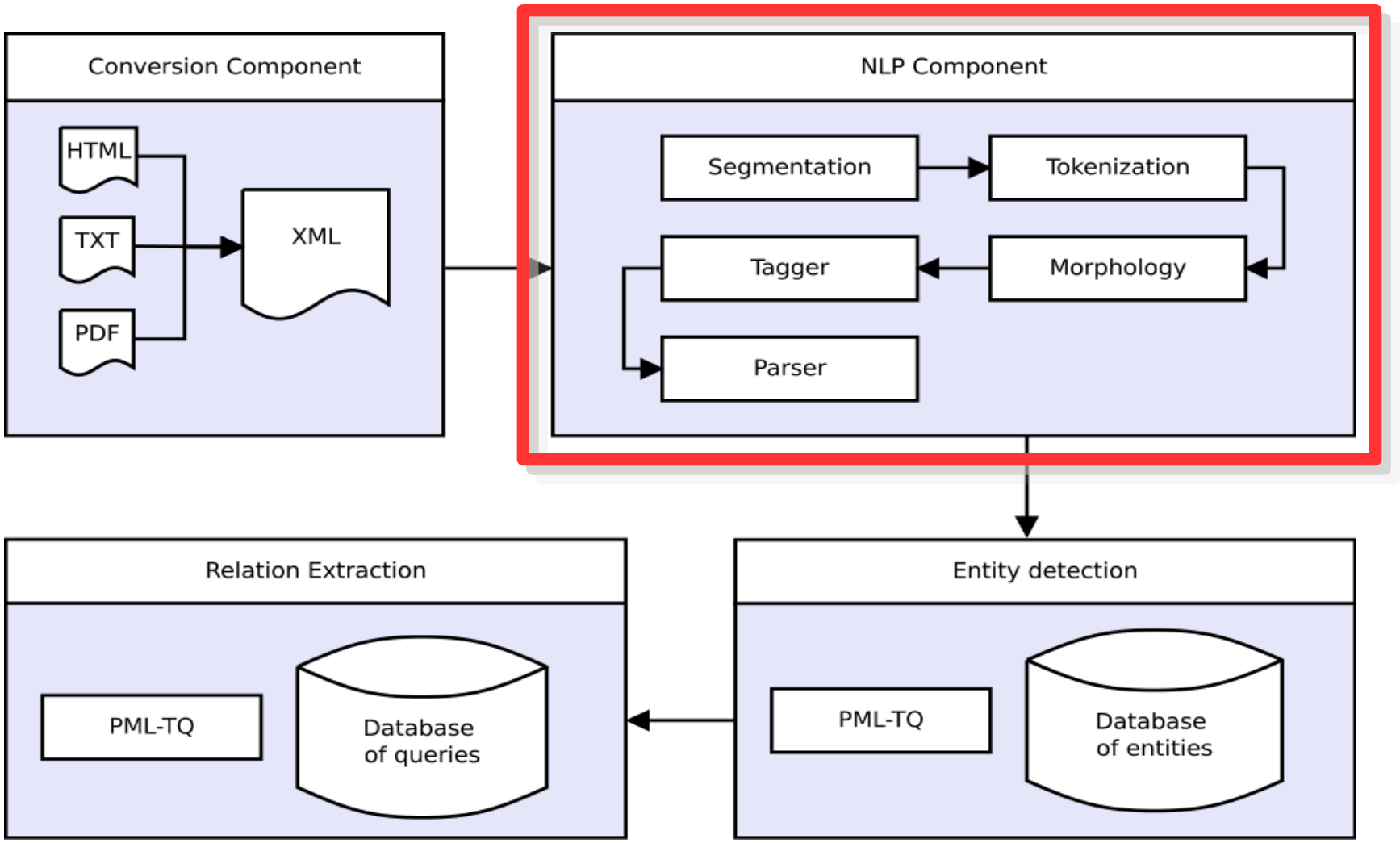
RExtractor Architecture



RExtractor Architecture



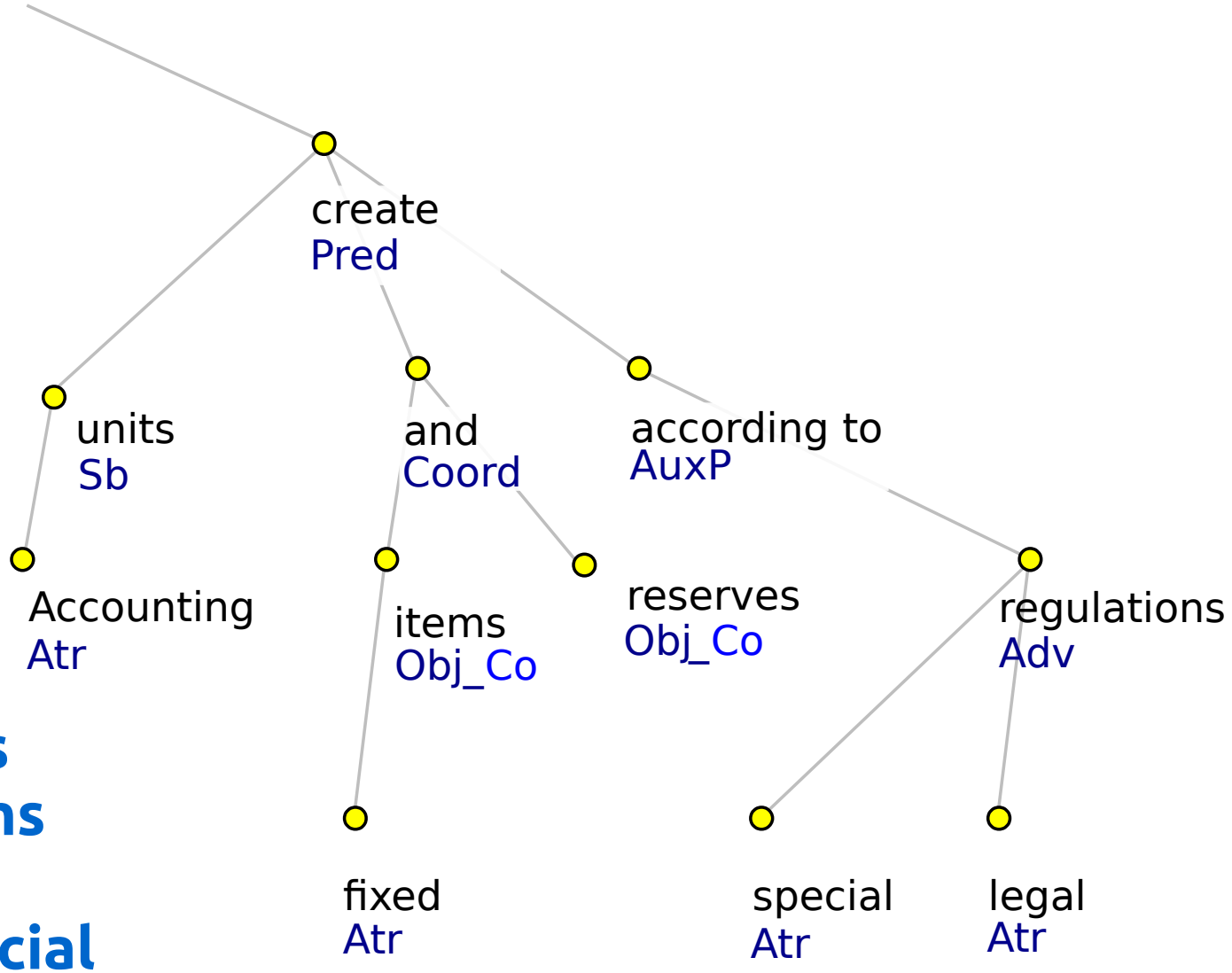
RExtractor Architecture



NLP Component

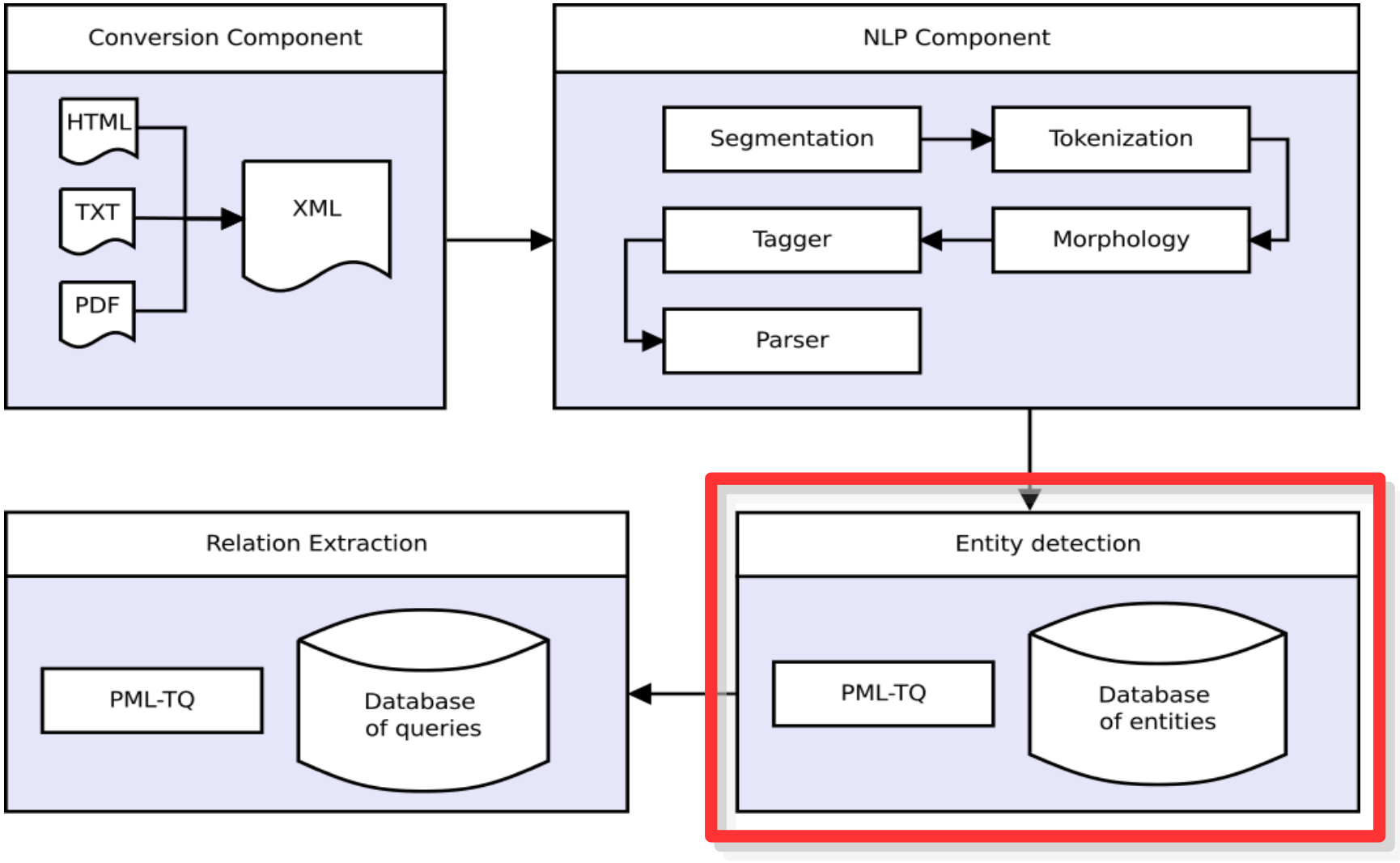
- **Prague Dependency Treebank** framework
  - http://ufal.mff.cuni.cz/pdt3.0
- **Tools**
  - segmentation & tokenization
  - lemmatization & morphology
  - syntactic parsing
  - Treex (http://ufal.mff.cuni.cz/treex)

NLP Component



Accounting units create fixed items and reserves according to special legal regulations

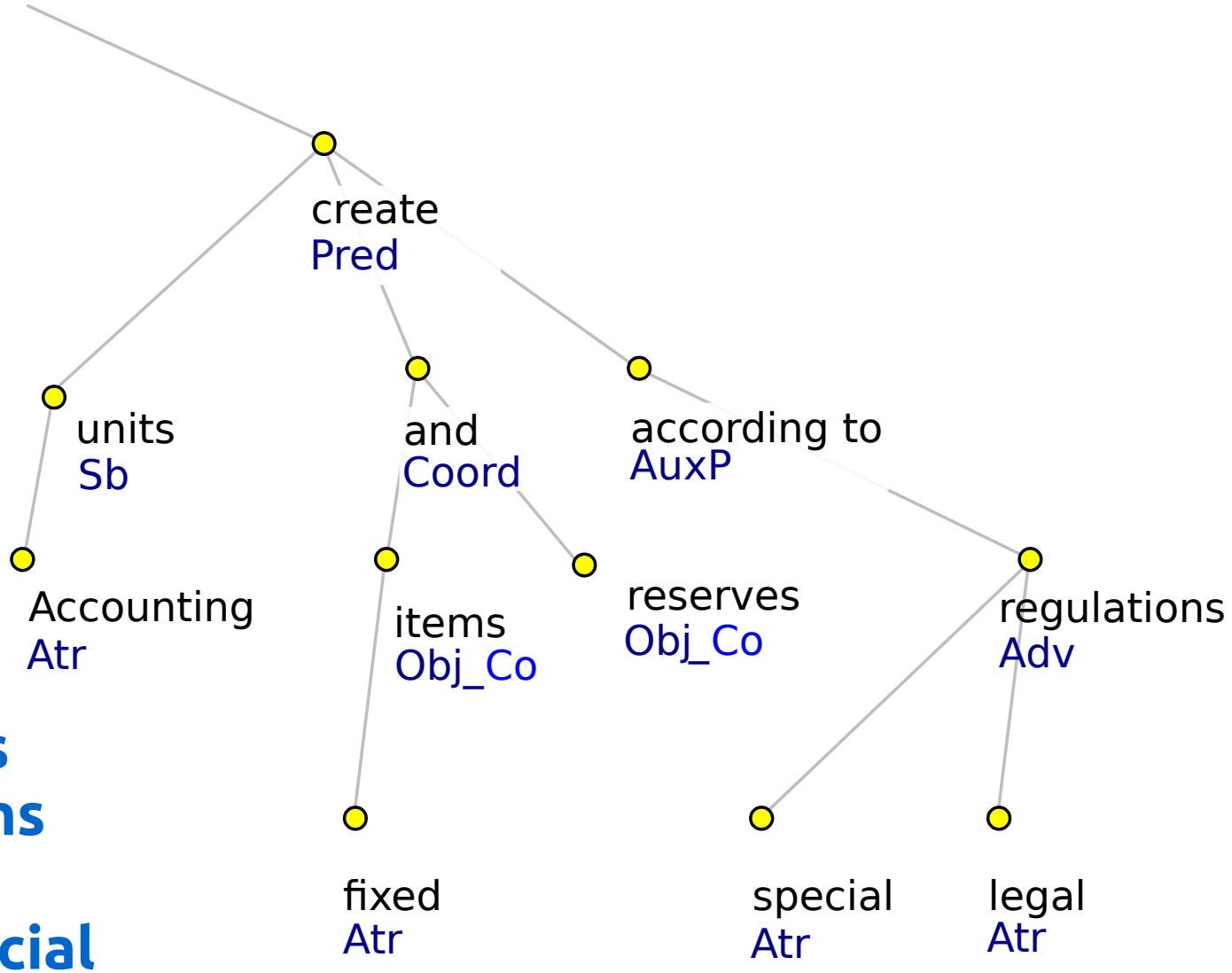
RExtractor Architecture



Entity Detection Component

- **Database of Entities**
  - entities specified by domain experts
- **PML-TQ** (http://ufal.mff.cuni.cz/pmltq)
  - tree queries better than regular expressions
    - coordination
    - several word forms in inflective languages

Entity Detection Component



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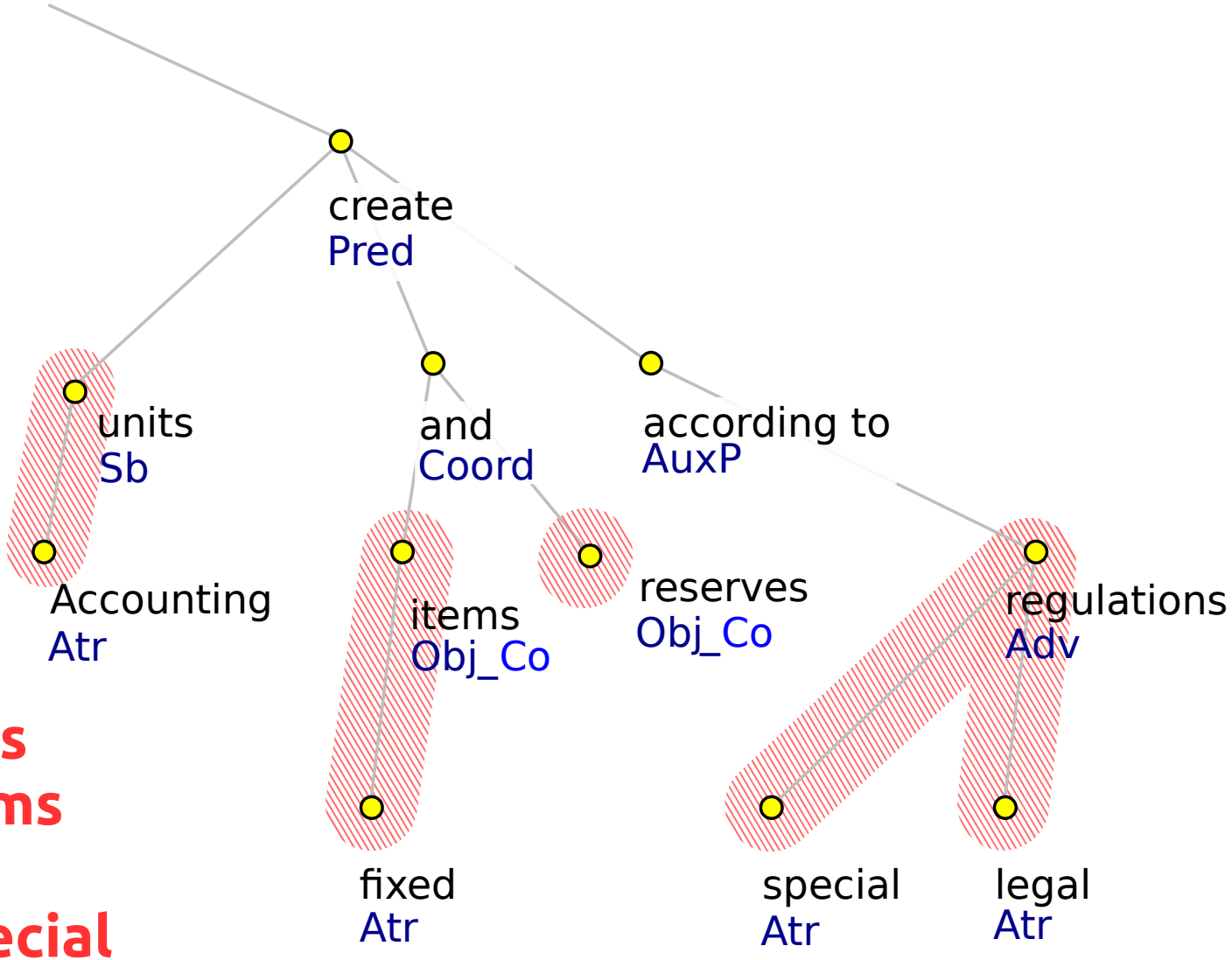
Entity Detection Component



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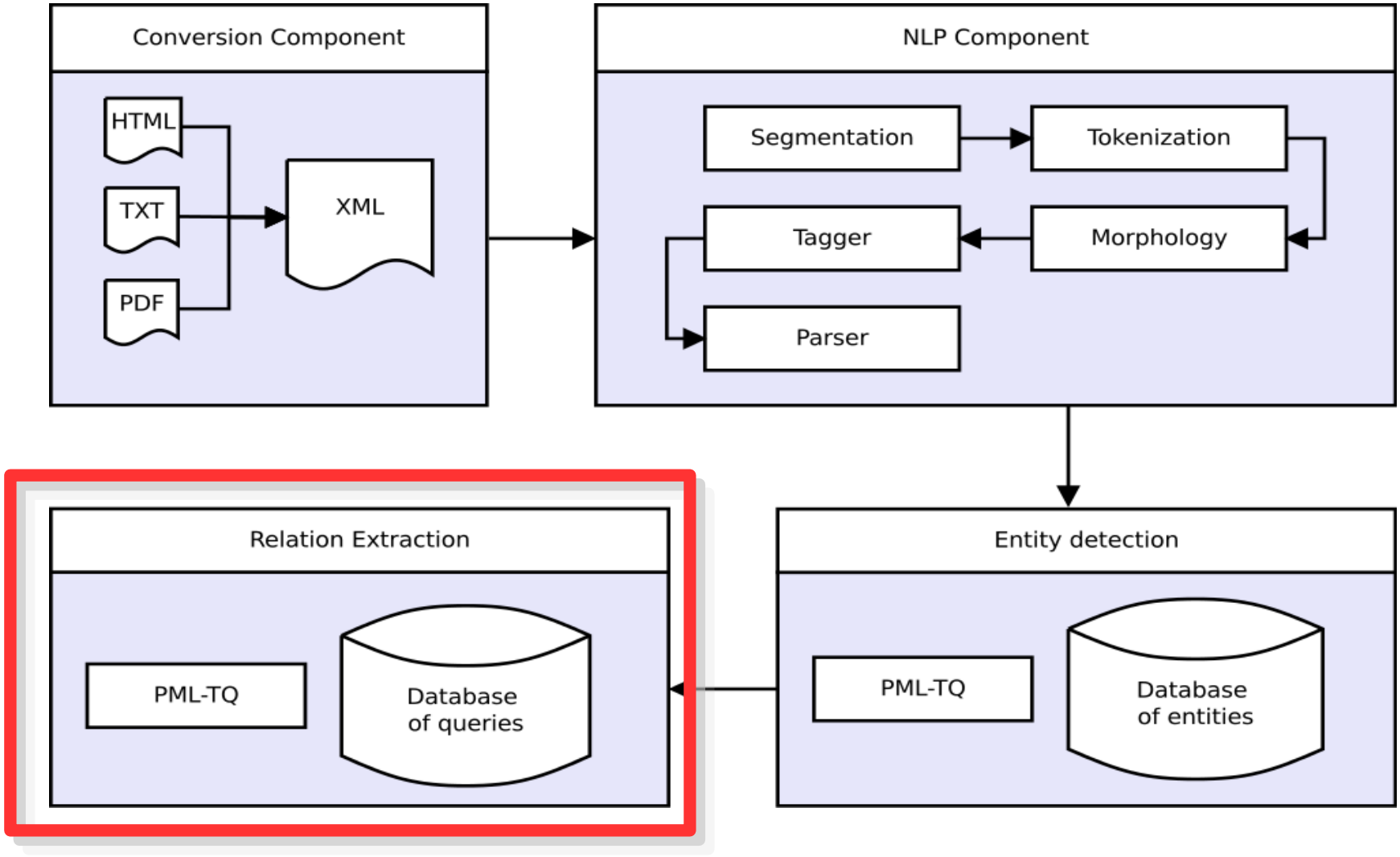
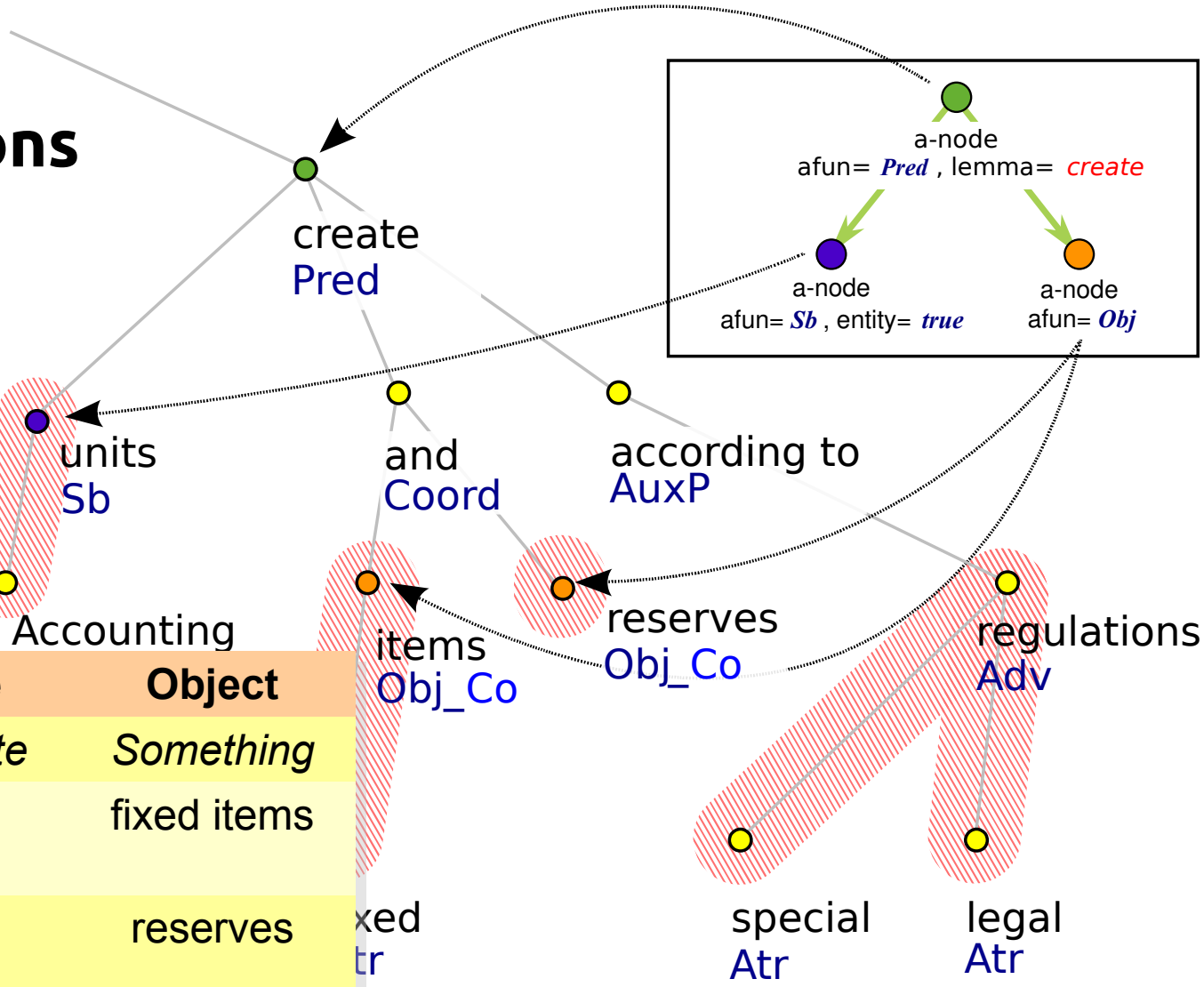


Relation Extraction Component

- **Database of Queries**
  - queries formulated by domain experts
  - their formulation in the form of PML-TQ queries on dependency trees
- **RDF ready output**
  - triples (*subject, predicate, object*)
  - each position
    - is annotated in a text (*text chunk)*
    - has a specific **ontological concept** *(RDF Class)*

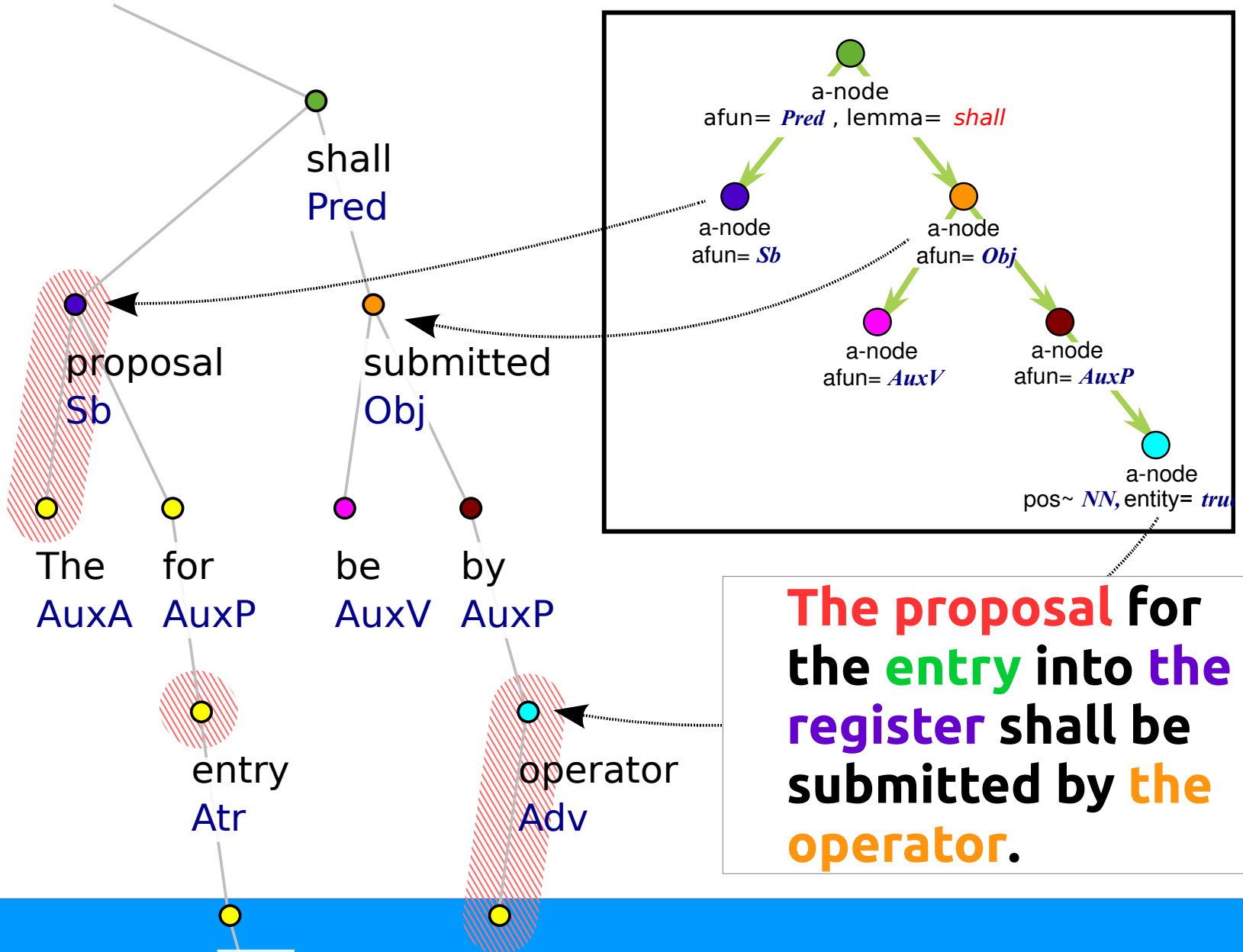
Relation Extraction Component

- **Accounting units' obligations**



Subject	Predicate	Object
Entity	*hasToCreate*	*Something*
Accounting units	create	fixed items
Accounting units	create	reserves

Relation Extraction Component



Relation Extraction Component

Types of relations

- **Definitions** **D**
  - entities are defined or explained
- **Obligations** **O**
  - an entity is obligated to do something
- **Rights** **R**
  - an entity has right to do something

Relation Extraction Component

Results

	D	R	O	Total
# of queries	5	4	2	11
Goldstandard	97	308	62	467
Extracted	70	255	41	366
True positive	53	206	36	295
False negative	44	102	26	172
False positive	17	49	5	71
Precision (%)	**75.7**	**80.8**	**87.8**	**80.6**
Recall (%)	**54.6**	**66.9**	**58.1**	**63.2**

Relation Extraction Component

Error analysis

Error	# of errors	Ratio
Parser	145	59.7%
Query	93	38.3%
Entity	5	2.1%

Results

- errors in automatic parsing
- query design

Conclusion

- general pipeline for **extraction** and **representation** of information that is presented in raw texts
  - processes input texts by linguistically-aware tools
  - extracts entities and relations from dependency trees
  - Linked Data principles
- **Legal documents** as a pilot domain