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KORAP

AN OPEN-SOURCE CORPUS-QUERY PLATFORM FOR THE ANALYSIS OF VERY LARGE MULTIPLY ANNOTATED CORPORA

MAIN AIMS OF KORAP

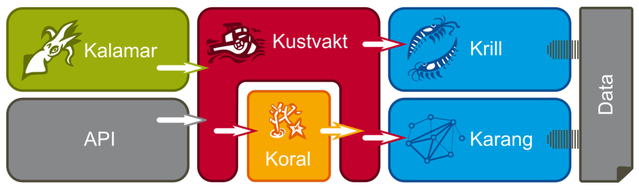
- always meet requirements of a scientific tool [1]
- core-sustainability for 15-20 years
- support for arbitrarily large corpora
- support for any number of potentially concurring annotation layers
- support for virtual corpora / collections definable on internal and external text properties [2]
- extensible also by external developments

MOTIVATION

- German Reference Corpus DeReKo [3] now contains more than 26 billion words
- growing by 1.5 billion words / year
- old query system COSMAS II only supports 8 billion words per archive and only 2 annotation layers

GENERAL ARCHITECTURE

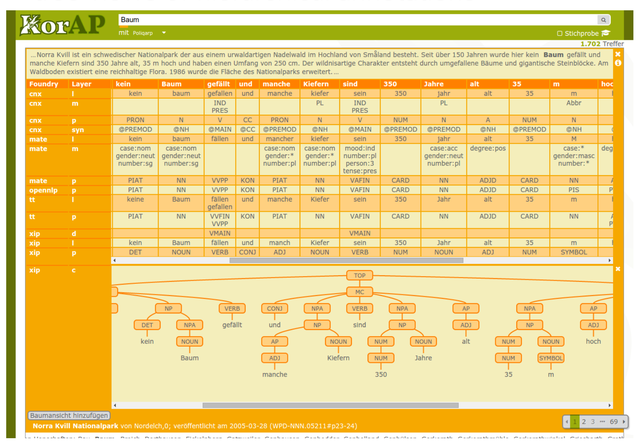
- modular design with replaceable components



- support for multiple specialized backends

KALAMAR (FRONTEND)

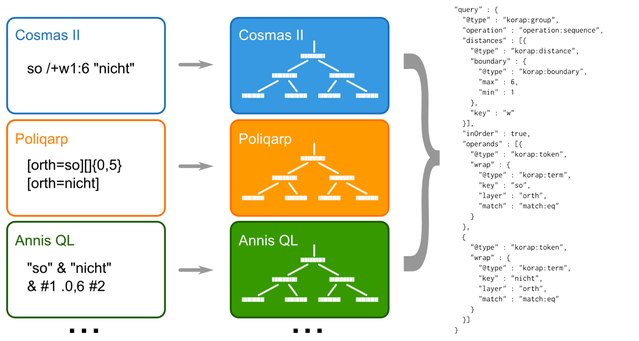
- KWIC views for matches
- table views of morphological annotations
- tree views of hierarchical annotations



- query helper for multiple tag sets
- creation of virtual collections
- embedded interactive documentation

KORAL (QUERY SERIALIZER)

- translates queries into a general query protocol, called KoralQuery [4]



- currently supported query languages:
  - COSMAS II QL
  - Poliqarp QL (CQP-dialect/extension)
  - ANNIS QL
  - CQL 1.2 (Clarin-FCS subset)

KARANG (NEO4J BASED BACKEND)

- complex annotation is represented as an arbitrary multigraph with properties
- vertices correspond to entities (words, …, sentences, …, texts)
- edges represent relations (dependency, domination, sequence, …)
- possible to run hierarchical cross-foundry queries spanning over several degrees of separation

KRILL (LUCENE BASED BACKEND)

- documents are stored as indexed field sets, including primary data, metadata, and annotations
- annotations are indexed as term vectors with additional information
- meta information can be used to narrow the search space by defining virtual collections
- supports a large subset of KoralQuery by utilizing a set of index specific query mechanisms, widely extending the core functionality of Lucene:
  - fulltext search, token-based annotation search, span-based annotation search, distance search, positional search, nested queries, etc.

KUSTVAKT (USER AND POLICY MANAGEMENT)

- takes queries and rewrites them to restrict the scope of a search to documents the user is allowed to access [4], [6]
- may also inject further properties the user has set
- example: injection of a collection constraint and the preferred annotation foundry for the "pos" layer:

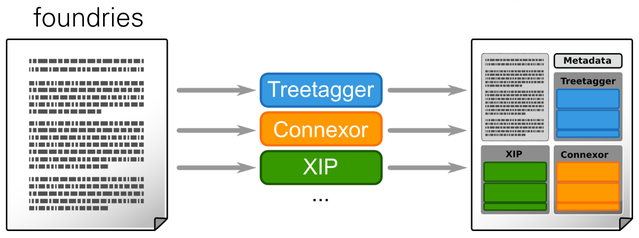
```
{
  "@context" : "http://korap.ids-mannheim.de/ns/
                koral/v0.3/context.jsonld",
  "query": {
    "@type": "korap:group",
    "operation": "operation:position",
    "frames": ["frame:contains"],
    "operands": [{
      "@type": "korap:span",
      "layer" : "c",
      "foundry" : "cnx",
      "key": "np"
    },{
      "@type": "korap:token",
      "wrap" : {
        "@type": "korap:term",
        "layer": "pos",
        "key" : "NE"
      }
    }]
  }
}
```

```
{
  "@context" : "http://korap.ids-mannheim.de/ns/
                koral/v0.3/context.jsonld",
  "query": {
    "@type": "korap:group",
    "operation": "operation:position",
    "frames": ["frame:contains"],
    "operands": [{
      "@type": "korap:span",
      "layer" : "c",
      "foundry" : "cnx",
      "key": "np"
    },{
      "@type": "korap:token",
      "wrap" : {
        "@type": "korap:term",
        "foundry": "mate",
        "layer": "pos",
        "key" : "NE"
      }
    }]
  },
  "collection": {
    "@type": "korap:doc",
    "key": "corpusID",
    "type": "type:string",
    "match": "match:eq",
    "key": "A00"
  }
}
```

- rewrites can be made transparent to the user (traceable, replicable)
- more efficient than filtering query hits
- backends and frontends can be developed without paying attention to authorization
- token-based authorization: OAuth2
- credentials via Shibboleth SSO or plain login

DATA MODEL

- separation of observed primary data and interpretations (annotations)
- arbitrary number of annotation layers organized in foundries



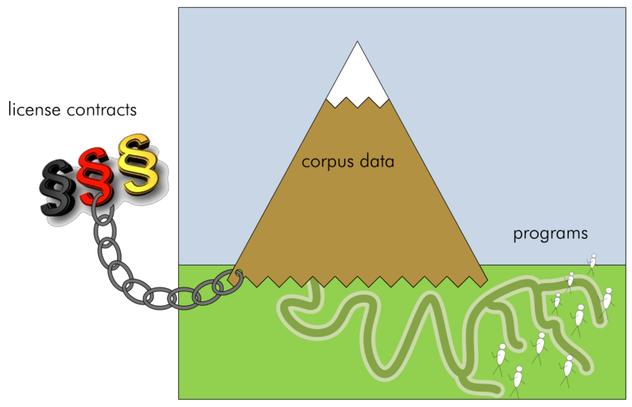
- add new annotation layers by extending KorAP!

HORIZONTAL SCALABILITY

- time critical tasks are distributable among worker nodes
- if the system gets too slow, add another node
- computational problems → financial overhead
- cheaper hardware can be used
- improved failure tolerance

LET THE CODE COME TO THE DATA!

- terabytes of corpus data are too bulky to move
- and by license contracts not allowed to move



- so let the code come to the data!

HOW CAN USER-CODE ACCESS THE DATA?

- via KorAP's REST-API
  - directly accessible for all kinds of clients
  - e.g from an R-script or another UI/frontend
- by contributing KorAP extensions, e.g. API extensions
- by adding completely new or alternative components

SOURCE CODE AND LICENSE

- published under BSD-2-license
- http://github.com/KorAP/
- http://korap.ids-mannheim.de/gerrit/

CURRENT STATE (AS OF 7/2015)

- IDS-internal alpha-version running since 2/2014
- still to be published:
  - Kustvakt
  - Kanalito (distribution layer, part of Krill)
  - Karang
  - example pipeline for ingesting corpora with annotations
- new work item at ISO TC37 SC4: Corpus Query Lingua Franca (CQLF) [5]

SUSTAINABILITY

- 2.5 permanent FTE for further development, maintenance, support
- cooperations desired on:
  - comparable corpora (situated at different places)
  - KorAP development and extension in general

REFERENCES

[1] P. Bański, P. M. Fischer, E. Frick, E. Ketzan, M. Kupietz, C. Schnober, O. Schonefeld, and A. Witt, "The new IDS corpus analysis platform: challenges and prospects", in Proceedings of the Eighth International Conference on Language Resources and Evaluation (LREC'12), ELRA, 2012.

[2] P. Bański, E. Frick, M. Hanl, M. Kupietz, C. Schnober, and A. Witt, "Robust corpus architecture: A new look at virtual collections and data access", in Corpus Linguistics 2013 Abstract Book, A. Hardie and R. Love, Eds., Lancaster: UCREL, 2013, pp. 23–25.

[3] M. Kupietz, C. Belica, H. Keibel, and A. Witt, "The german reference corpus DeReKo: a primordial sample for linguistic research", in Proceedings of the Seventh conference on International Language Resources and Evaluation (LREC'10), 2010.

[4] J. Bingel and N. Diewald, "KoralQuery – a general corpus query protocol", in Proceedings of the Workshop on Innovative Corpus Query and Visualization Tools at NODALIDA 2015, Vilnius, Lithuania, 2015.

[5] ISO, "Standard in development: BS ISO 24623-1 Language resource management – Corpus Query Lingua Franca (CQLF) Part 1: Metamodel", ISO, Geneva, Tech. Rep., 2014.

[6] P. Bański, N. Diewald, M. Hanl, M. Kupietz, and A. Witt, "Access control by query rewriting: the case of korap", in Proceedings of the Ninth International Conference on Language Resources and Evaluation (LREC'14), ELRA, 2014.

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