IMPLEMENTATION AND OPTIMIZATION OF XML FULL-TEXT SEARCH

EMIRAN CURTMOLA
University of California San Diego
ecurtmola@cs.ucsd.edu

SIHEM AMER-YAHIA
AT&T Research Labs
sihem@research.att.com

ALIN DEUTSCH
University of California San Diego
deutsch@cs.ucsd.edu

Motivation 1

- Problem:
  - XML is used to represent both text and structure
  - IR studies systems for indexing and searching text
  - All query languages for XML are structure-oriented
- Existing query languages are not powerful enough
  - text search not expressive enough
  - not all XQuery spectrum
- GalaTex is a conformant implementation of XQuery Full-Text language, a W3C extension of XQuery and XPath with full-text search primitives such as phrase matching, Boolean connectives, keyword-distance, ordering, stemming that can be combined with navigation over document structure

Queries in XQuery Full-Text 2

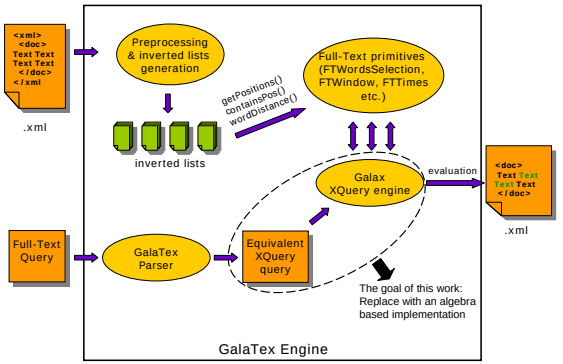
- Context expression:
  - i.e. set of book paragraphs, book chapters as opposed to searching the whole document as in traditional IR
- Return expression:
  - i.e. book titles and paragraphs as opposed to retrieving the whole document as in traditional IR
- Search expression:
  - full-text search primitives: and, or, negation, distance, ordered, window, times etc.
- Score expression:
  - scoring and ranking the results

Full-Text Query Example 3

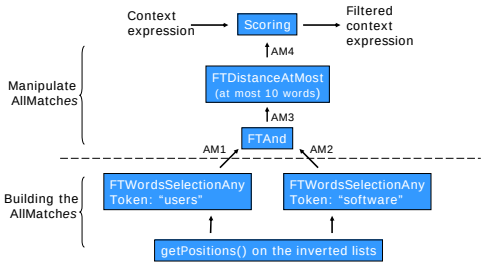
- A query example expressed in natural language:
  find the top 10 book paragraphs that contain "users" and "software" at a distance at most 13 words of each other
- The same query example in XQuery Full-Text:

```
for $result at $pos in
    for $p in //books/book/paragraph
    score $s as $p ftcontains "users" && "software" with
                distance at most 13 words
    order by $s
    return $p
where $pos <= 10
return $result
```

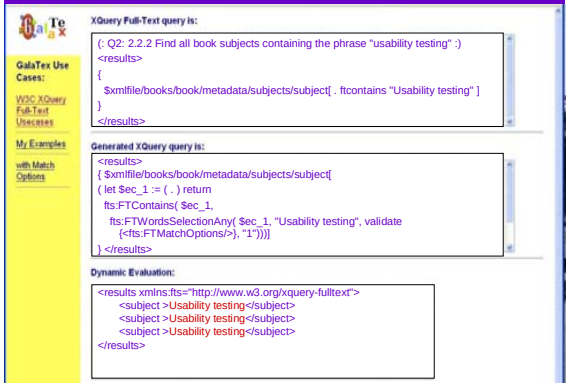
GalaTex Architecture: Present and Future 4



Sample Algebraic Plan 5



GalaTex Snapshot 6



New optimization opportunities 7

- Define what are "good properties" for a score-aware algebra
- Scoring on both content and structure
- Consistent scoring
  - Equivalent query expressions should result in the same scores for any given document fragment
- Consistent ranking
  - Equivalent query expressions should result in the same topK results for any given document fragment

Optimizations 8

- Full integration of XQuery Full-Text algebra into XQuery algebra
- Efficient evaluation algorithms for each full-text primitive
- Prune intermediate results as soon as possible
  - Avoid computing cartesian products
  - Push selections (i.e. distance, ordered, window, scope, times primitive) down in the plan
  - Merge multiple selections with the join into a complex join operator
  - Translate the XQuery Full-Text Boolean operators into XQuery Boolean operators

Current Status & Ongoing Work 9

- Current Status:
  - GalaTex is the first complete implementation of W3C XQuery Full-Text language
  - A web demo including the W3C XQuery Full-Text usecases is available at: ***http://www.galaxquery.com/galatex***
- Ongoing Work:
  - define a good algebra for XQuery Full-Text as a platform for joint optimizations on structure and text that takes scoring information into account