

Selected Topics in Information Retrieval

http://www.hpi.uni-potsdam.de/naumann/lehre/ws_0809/ir.html

Master Seminar

Winter Semester 2008/2009

Mohammed AbuJarour

21.10.2008

The Team

2



Prof. Dr. Felix Naumann



Alexander Albrecht



Mohammed AbuJarour



Jens Bleiholder

What is Information Retrieval?

- Information Retrieval (IR) is finding material (usually documents) of an unstructured nature (usually text) that satisfies an information need from within large collections (usually stored on computers).
 - Also semi-structured data.
 - Web pages.

Contents of the Seminar

- Models for document & query representation.
- Indexing.
- XML Information Retrieval.
- Information Filtering / Recommendation.
- Search and Web Information Retrieval.
- Classification.
- Clustering.

Organization

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- Seminar's web page: http://www.hpi.uni-potsdam.de/naumann/lehre/ws_0809/ir.html
- ECTS credit points: 3.
- Time: **Tuesday 15:15 – 16:45.**
- Location: **HPI A-2.1.**
- Registration: email with your favorite **3-topics** to (Mohammed AbuJarour) before **23.10.2008.**
- Prerequisites:
 - Database.
 - Data Structures and Algorithms.
 - Linear Algebra.
 - Probability Theory.
- A session on "Foundations of Information Retrieval" next week.
- Papers will be available / accessed online.

Requirements to pass the seminar:

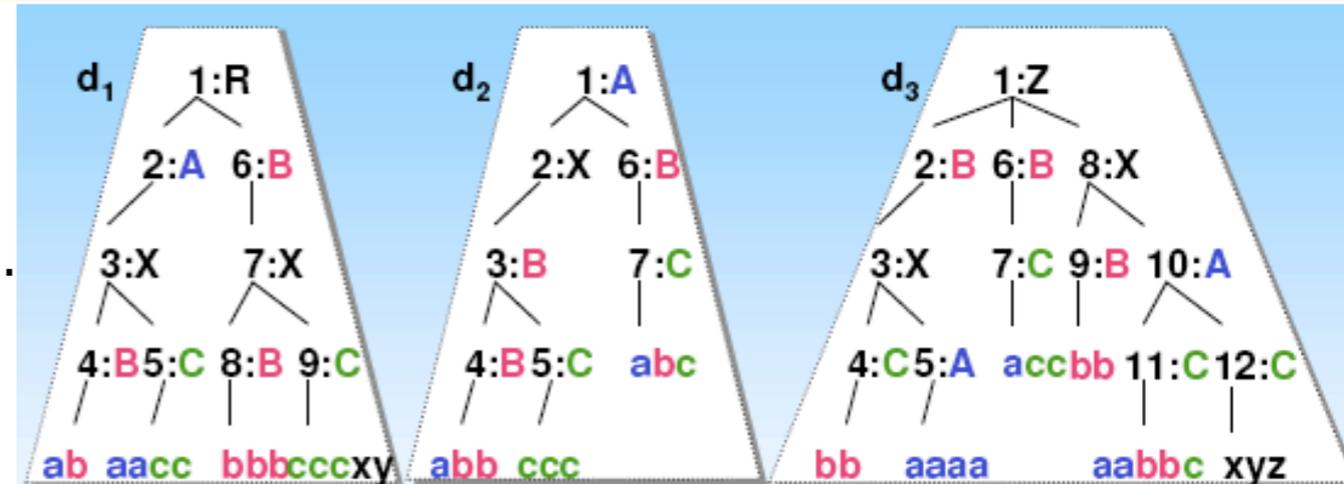
- Attendance:
 - Show up in **all** sessions.
 - If you cannot attend for some reason, let us know per email beforehand.
- Give a talk in **English**:
 - 30-45 minutes: talk.
 - 15 minutes: discussion and comments.
- Participation:
 - In **all** talks.
 - Discussion and challenging questions.
- Report
 - The report should discuss (not summarize) the assigned work/material.
 - Show strengths, weaknesses, suggestions and comments ...
 - Due in 2-3 weeks from the date of the talk.

Topics: Indexing

IO-Top-k: index-access optimized top-k query processing

- Ranked Retrieval & Top-k query processing.
- Index Lists & aggregate scores.
- Based on the family Threshold-Algorithms.
- Disk accesses:
 - Sorted Accesses & Random Accesses.
 - Scheduling problem!

- What's new?
 - The integration view of both kinds of accesses.



Example query: //A [//“a“ //B[//“b“]/C[//“c“]]

Pre-computed index table:

B+ tree supported block-scans:

- ~~(A, a, d3, ...)~~
- (B, b, d1, ...)
- (C, c, d2, ...)
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- ~~(B, b, d3, ...)~~
- (C, c, d3, ...)
- (A, a, d2, ...)
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- (C, c, d1, ...)

	Tag	Term	MaxScore	DocId	Score	ElemId	Pre	Post
1	A	a	1	d3	1	e5	5	2
	A	a	1	d3	1/4	e10	10	9
	A	a	1/2	d1	1/2	e2	2	4
	A	a	2/9	d2	2/9	e1	1	7
2	B	b	1	d1	1	e8	8	5
	B	b	1	d1	1/2	e4	4	1
	B	b	1	d1	3/7	e6	6	8
	B	b	1	d3	1	e9	9	7
	B	b	1	d3	1/3	e2	2	4
	B	b	2/3	d2	2/3	e4	4	1
	B	b	2/3	d2	1/3	e3	3	3
3	C	c	1	d2	1	e5	5	2
	C	c	1	d2	1/3	e7	7	5
	C	c	2/3	d3	2/3	e7	7	5
	C	c	2/3	d3	1/5	e11	11	8
	C	c	3/5	d1	3/5	e9	9	6
	C	c	3/5	d1	1/2	e5	5	2

Sorted Block-Scans & Random Range-Scans

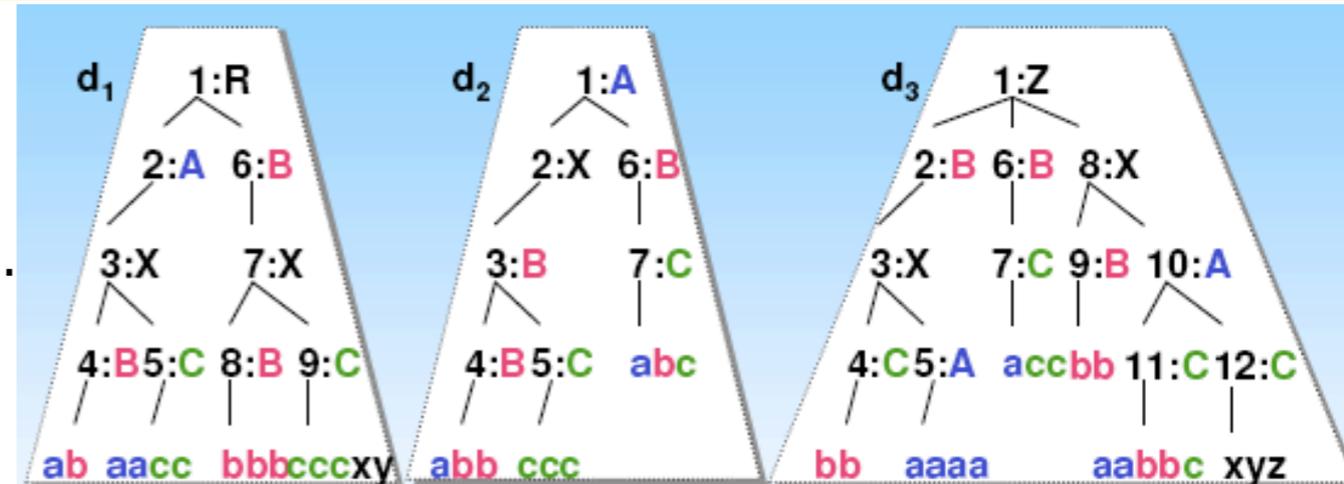
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- Do you want to know more?



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2	B	b	1	d1	1	e8	8	5
	B	b	1	d1	1/2	e4	4	1
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	B	b	1	d3	1/3	e2	2	4
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	B	b	2/3	d2	1/3	e3	3	3
3	B	b	2/3	d2	1/3	e6	6	6
	C	c	1	d2	1	e5	5	2
	C	c	1	d2	1/3	e7	7	5
	C	c	2/3	d3	2/3	e7	7	5
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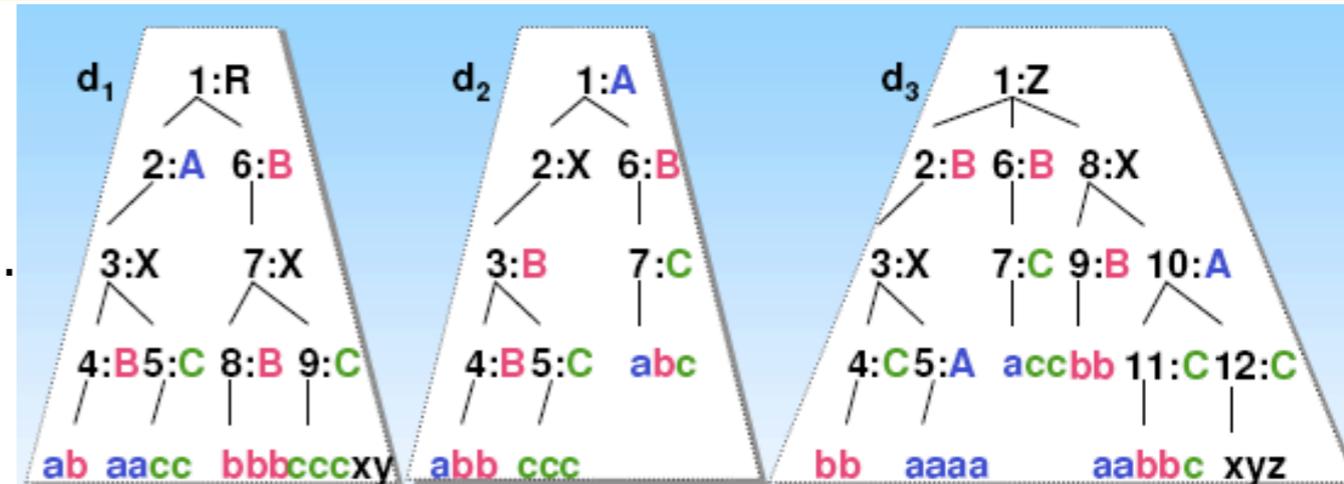
Sorted Block-Scans & Random Range-Scans

Topics: Indexing

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- What's new?
 - The integration view of both kinds of accesses.
- Do you want to know more?
 - On 11.11.2008.



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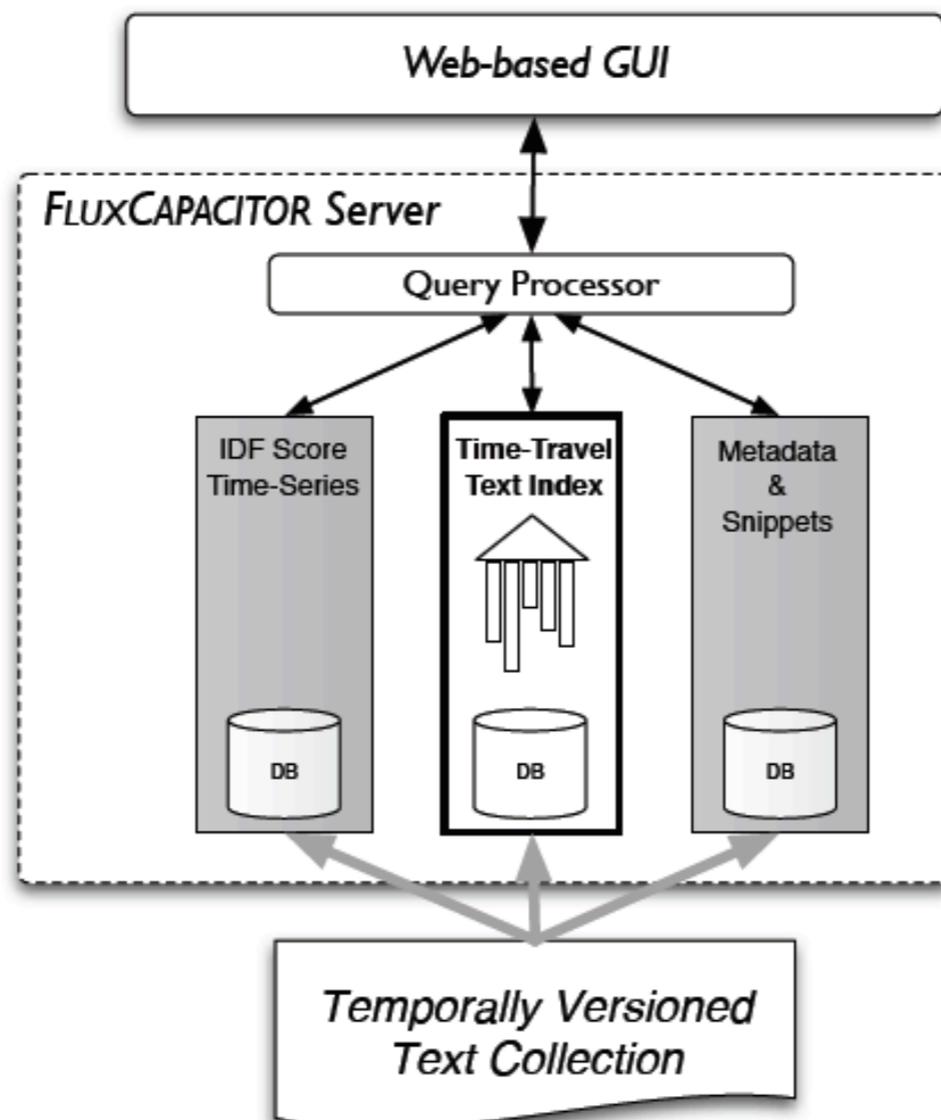
	Tag	Term	MaxScore	DocId	Score	ElemId	Pre	Post
1	A	a	1	d3	1	e5	5	2
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Sorted Block-Scans & Random Range-Scans

Topics: Indexing

A Time Machine for Text Search

- Search web archives.
- Too much data → Huge index size.
- Index compression and other techniques.



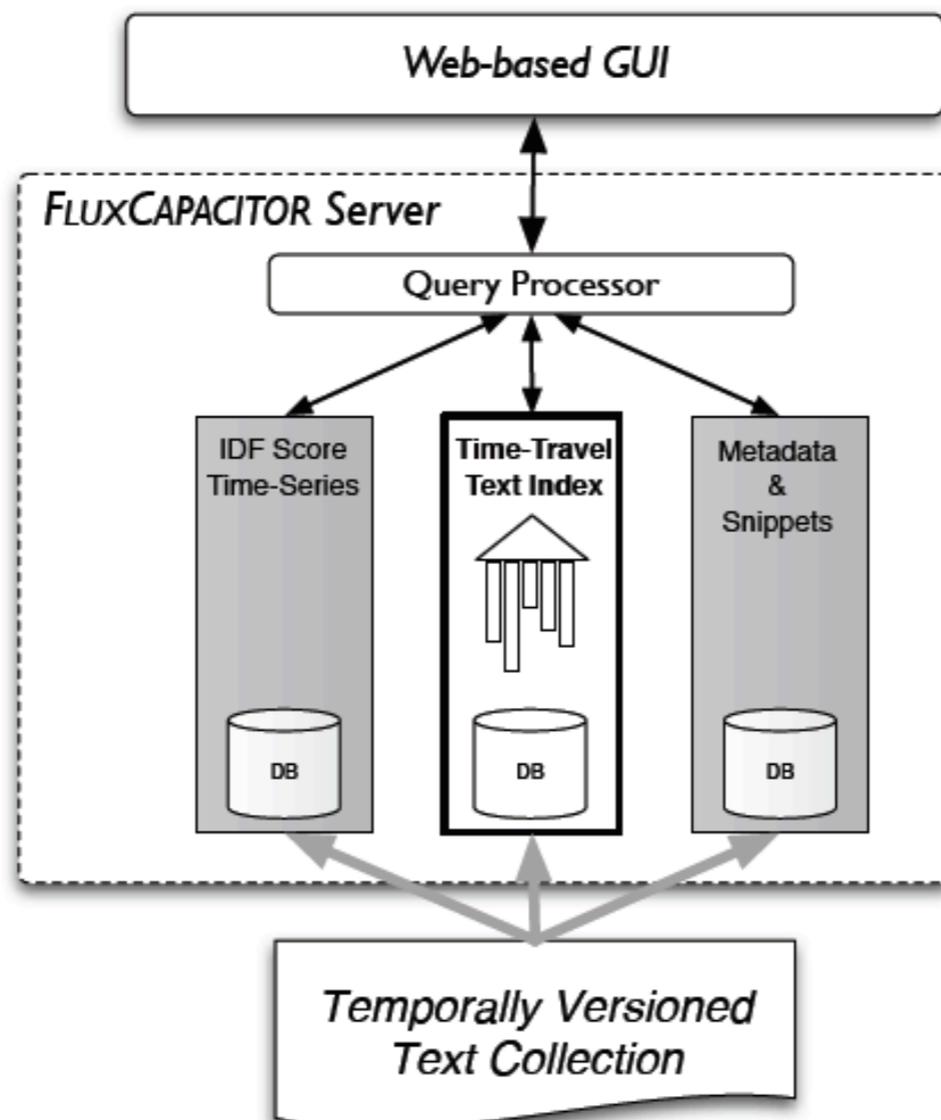
The screenshot shows the FluxCapacitor search interface. At the top is the title **FluxCapacitor**. Below it is a search bar containing the text **iraq war**. Underneath the search bar is a horizontal bar chart showing search results over time from 2001 to 2006. The x-axis is labeled with years: 2001, '02, '03, '04, '05, 2006. The bar chart shows a significant increase in results starting in 2002, peaking in 2003 and 2004, and then declining. Below the chart, the text reads: "Your query **iraq war**@Jun 18, 2002 8:30 PM needed 266ms and has 50 results". There are three search results listed below, each with a title, a snippet, and a score/created date:

- Iran-Iraq War**
The **Iran Iraq War** was a border war between Iran and Iraq that took place between September 22 1980 and August 20 1988 It is also known as the **First Persian Gulf War** and the **Gulf War**
Score: 13,385 | Created: May 27, 2002 5:59 PM
- Gulf War**
The **Gulf War** also known as **Persian Gulf War** **War in the Gulf** **Iraq Kuwait Conflict** **Second Gulf War** or **UN Iraq conflict** was a conflict between Iraq and a coalition force led
Score: 13,343 | Created: Jun 18, 2002 10:10 AM
- History of Iraq**
Ancient Times For most of historic time the city and empire of Babylon occupied parts of the present time region of Iraq There were many dynasties and kingdoms which ruled Babylon and other
Score: 12,76 | Created: Jun 10, 2002 3:01 AM

Topics: Indexing

A Time Machine for Text Search

- Search web archives.
- Too much data → Huge index size.
- Index compression and other techniques. → 18.11.2008



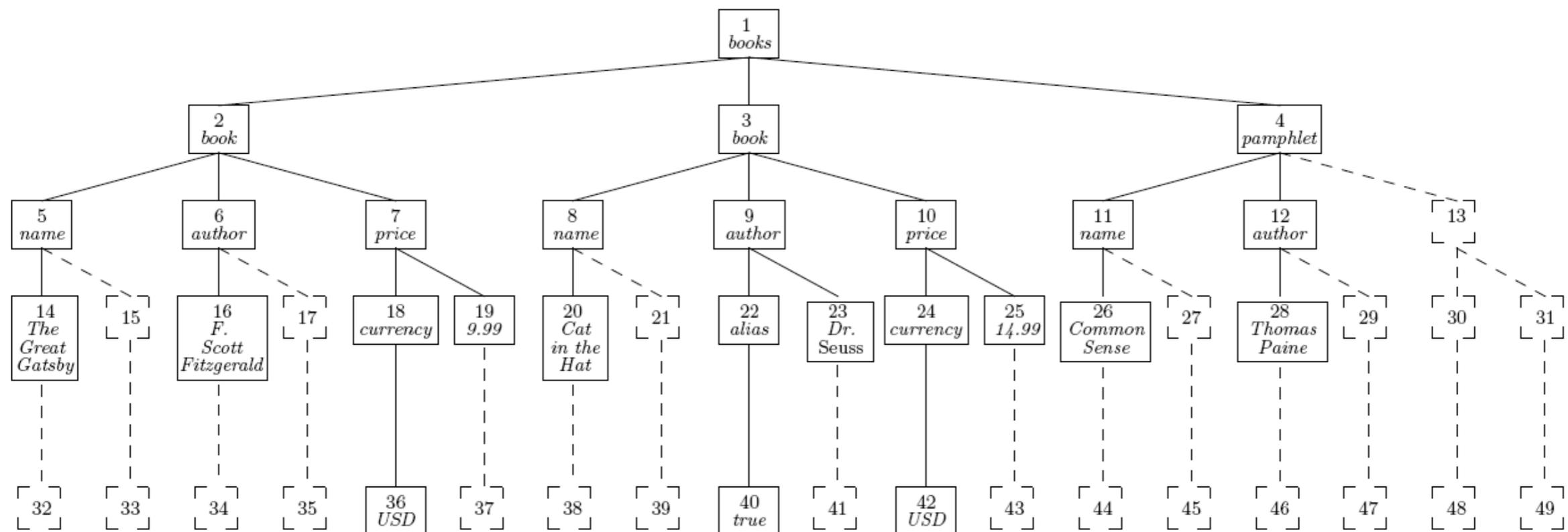
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Topics: XML Information Retrieval

Using a Relational Database for Scalable XML Search

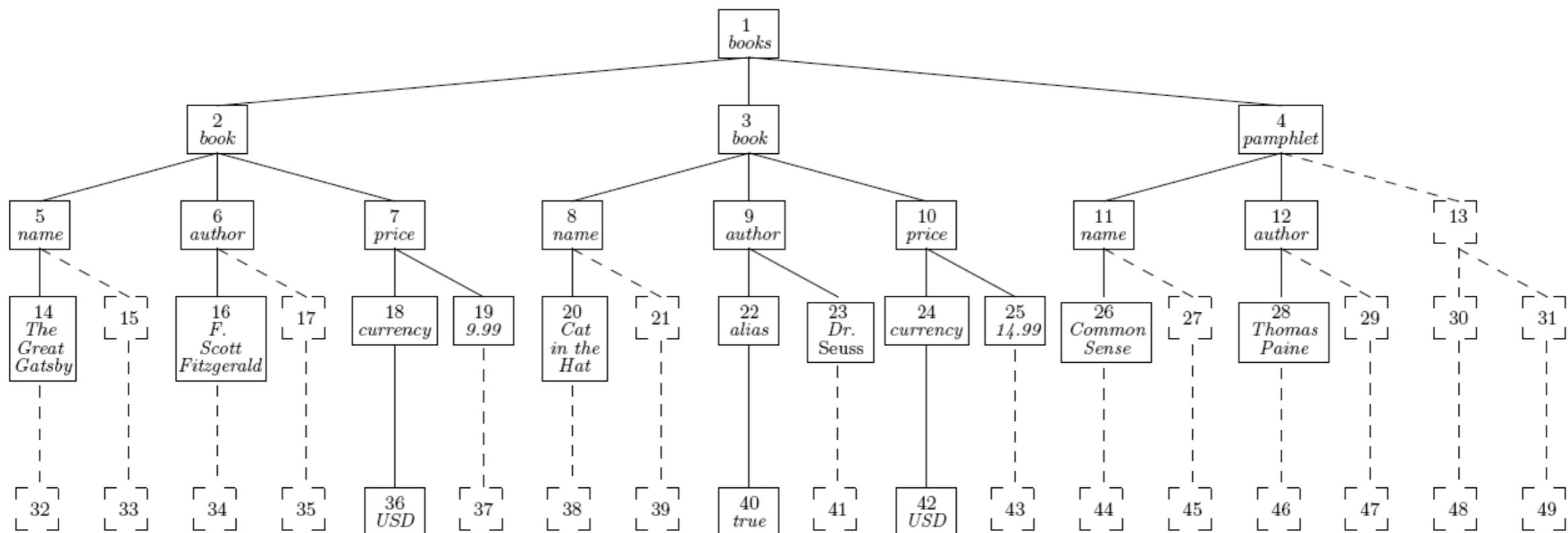
- Growing volumes of XML data everywhere.
- XML storing and searching approaches:
 - Conventional-tree: slow, update-friendly.
 - Relational approaches: fast, redesign relational schema each time XML hierarchy is defined.
- Fixed-schema relational approach: potential longer runtimes, but still faster than tree-based.



Topics: XML Information Retrieval

Using a Relational Database for Scalable XML Search

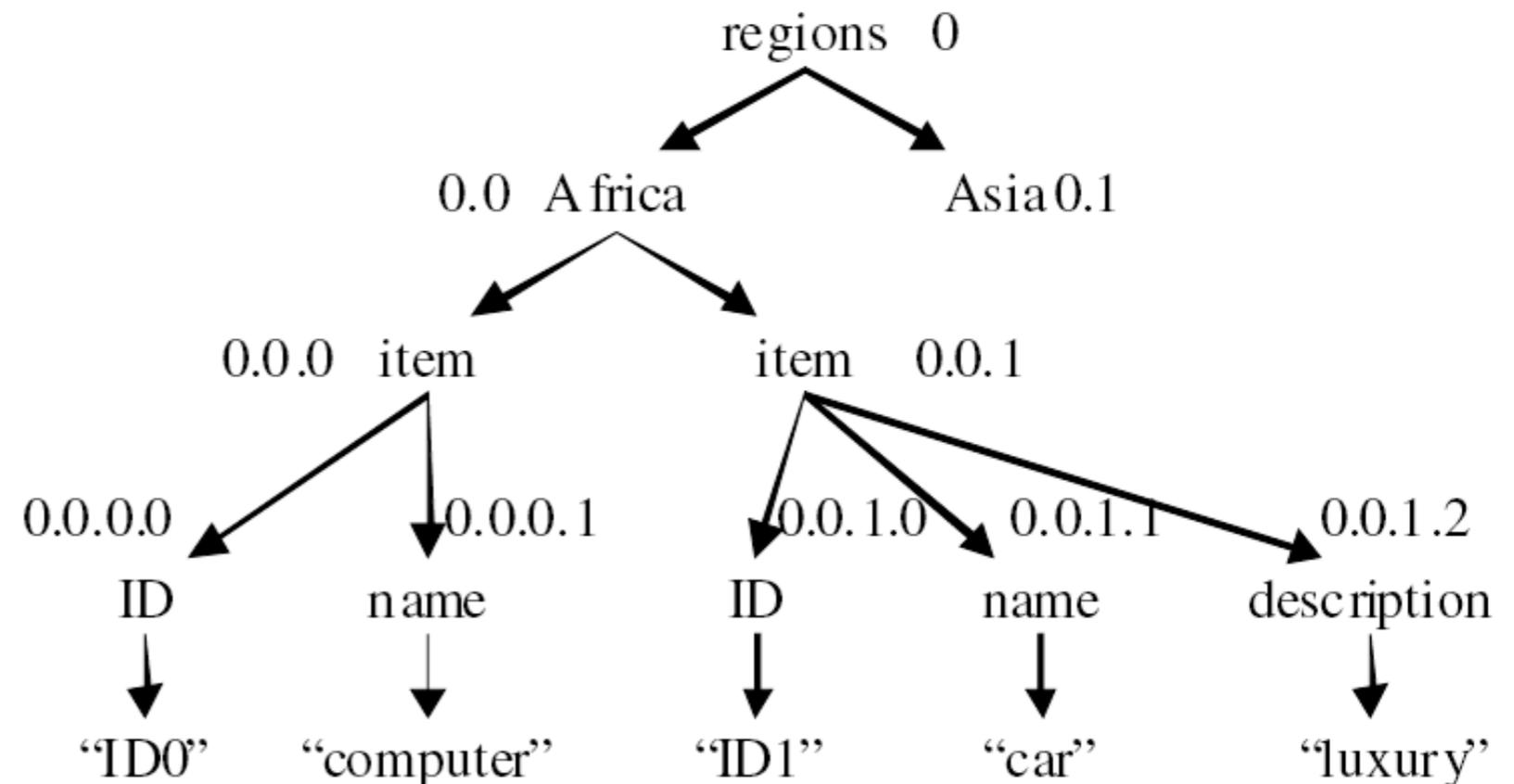
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- Fixed-schema relational approach: potential longer runtimes, but still faster than tree-based.
- Interested? More on 25.11.2008.



Topics: XML Information Retrieval

An Effective and Efficient Approach for Keyword-Based XML Retrieval

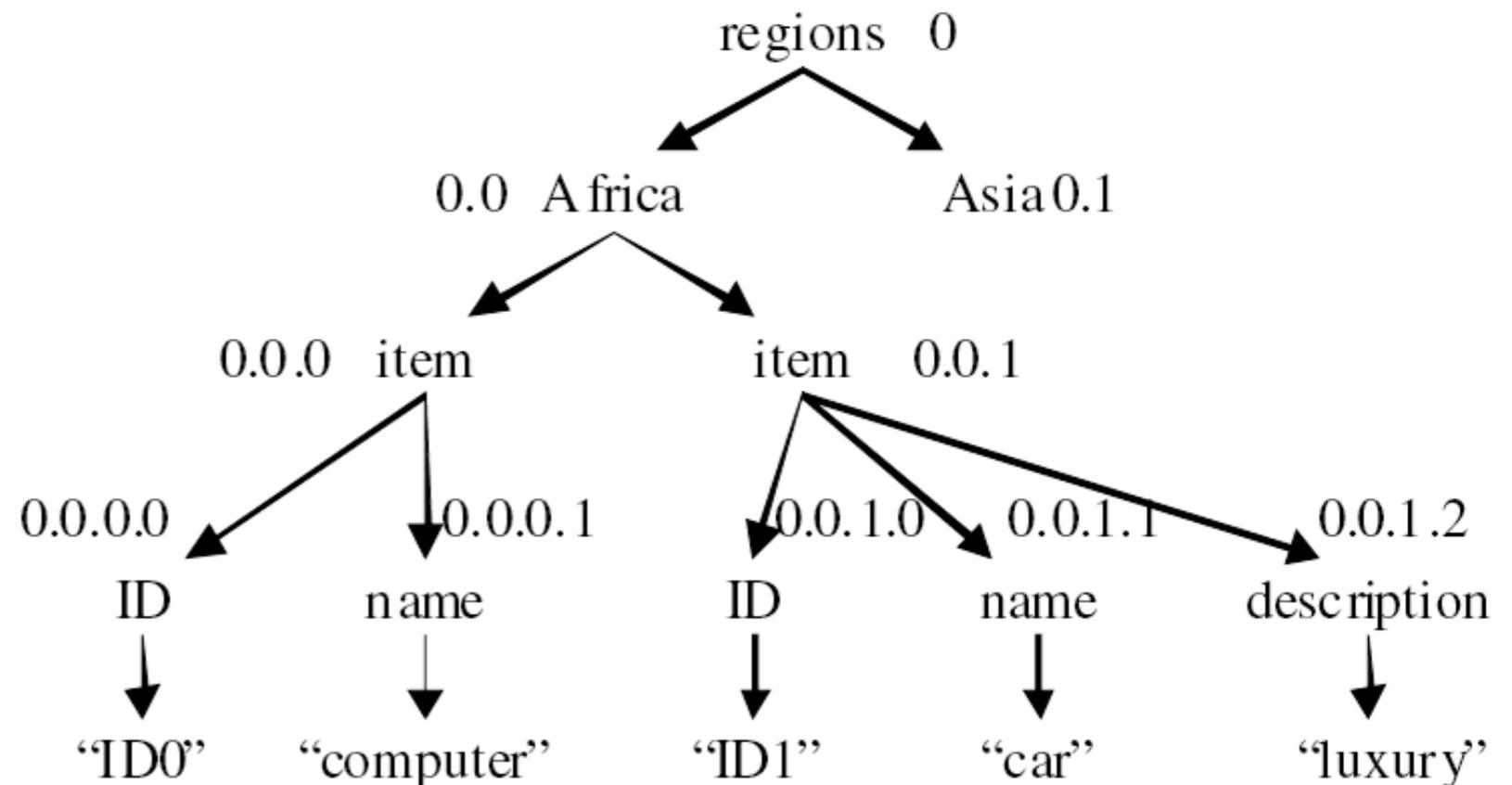
- IR-style keyword-based search on XML document.
- How to return the result as a representation of meaningful related nodes to the user?
 - Store the relationship of each pair of nodes in each XML document to an index → overhead.
- Enhanced inverted index structure that stores path information in addition to node ID.



Topics: XML Information Retrieval

An Effective and Efficient Approach for Keyword-Based XML Retrieval

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- How to return the result as a representation of meaningful related nodes to the user?
 - Store the relationship of each pair of nodes in each XML document to an index → overhead.
- Enhanced inverted index structure that stores path information in addition to node ID.
- Do you like it? On 02.12.2008.



Topics: XML Information Retrieval

Semantic search via XML fragments: a high-precision approach to IR

- A need to a high precision search strategy.
 - E.g.: Nuclear analysts.
- Semantic search using the XML Fragments query language.
- Four query-time semantic needs:
 - Specify target information type.
 - Disambiguate keywords.
 - Specify search term context.
 - Relate select terms.

President Clinton was born William Jefferson Blythe IV on August 19, 1946, in Hope, Arkansas, three months after his father died in a traffic accident. When he was four years old, his mother wed Roger Clinton, of Hot Springs, Arkansas. In high school, he took the family name.

Clinton was graduated from Georgetown University and in 1968 won a Rhodes Scholarship to Oxford University. He received a law degree from Yale University in 1973, and entered politics in Arkansas.

Figure 2: Sample Excerpt From Clinton's Biography

<BirthPlaceOf> *<BirthDateOf>* *<Alias>*
<Person> President Clinton *</Person>* was
born *<Person>* William Jefferson Blythe IV
</Person></Alias> on *<Date>* August 19,
1946 *</Date>* *</BirthDateOf>*, in *<City>*
Hope, Arkansas *</City>* *</BirthPlaceOf>*,
three months after his father died in a traf-
fic accident. When he was four years old,
<SpouseOf> *<Person>* his mother *</Person>*
wed *<Person>* Roger Clinton *</Person>*
</SpouseOf>, of *<City>* Hot Springs, Arkansas
</City>. In high school, he took the family name.
<AlmaMater> *<Person>* Clinton *</Person>*
was graduated from *<College>* Georgetown Uni-
versity *</College>* *</AlmaMater>* and in
<Date> 1968 *</Date>* won a Rhodes Scholar-
ship to *<College>* Oxford University *</College>*.
<AlmaMater> *<Person ref="Clinton">* He
</Person> received a law degree from *<College>*
Yale University *</College>* *</AlmaMater>* in
<Date> 1973 *</Date>*, and entered politics in
<UsState> Arkansas *</UsState>*.

Figure 3: Sample Annotations of Text in Figure 2

Topics: XML Information Retrieval

Semantic search via XML fragments: a high-precision approach to IR

- A need to a high precision search strategy.
 - E.g.: Nuclear analysts.
- Semantic search using the XML Fragments query language.
- Four query-time semantic needs:
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 - Disambiguate keywords.
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 - Relate select terms.
- More on 09.12.2008.

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```

Figure 3: Sample Annotations of Text in Figure 2

Topics: Search and Web Information Retrieval

The Happy Searcher: Challenges in Web Information Retrieval

- Challenges in building a web search engine:
 - Web graph analysis.
 - Statistical methods for inferring meanings in text.
 - Retrieval in newsgroup postings, images, and sounds
- Open research problems in the field!



Topics: Search and Web Information Retrieval

The Happy Searcher: Challenges in Web Information Retrieval

- Challenges in building a web search engine:
 - Web graph analysis.
 - Statistical methods for inferring meanings in text.
 - Retrieval in newsgroup postings, images, and sounds
- Open research problems in the field!
- Looks amazing to know secrets about Google! → 06.01.2009

The screenshot shows a Google Images search for the word "apple". The search bar contains "apple" and "Moderate SafeSearch is on". The search results are displayed in a grid of 16 items, each with a thumbnail image, a title, and a URL. The results include:

- A real red apple: "We assume here a hundred-grams apple ..." (www.waterfootprint.org)
- The silver Apple logo: "Apple just launched their first ..." (greenwhite.org)
- A black Apple logo: "Can apple actually 'do' wrong?" (www.briansolis.com)
- Another real red apple: "Red Apple" (www.h4x3d.com)
- An iPhone 1.0: "Apple iPhone 1.0" (blogs.zdnet.com)
- A green apple: "... few weeks about Apple - no doubt ..." (blogs.msdn.com)
- The rainbow Apple logo: "While Gartner's estimates show Apple ..." (www.crunchgear.com)
- Another green apple: "How do you like them apples?" (www.ecosherpa.com)
- A black Apple logo: "Apple will 100% be announcing a new ..." (www.boygeniusreport.com)
- The rainbow Apple logo: "Legend has it that he planted apple ..." (seashellseller.blogspot.com)
- A photo of a stage presentation: "Apple's surprise announcement of a ..." (www.roughlydrafted.com)
- A photo of a computer mouse: "No 7 - Apple Pippin" (www.newlaunches.com)
- The silver Apple logo: "Apple Computer Inc." (communities.canada.com)
- Various mobile phones: "... shots from both Apple and Sony." (www.engadget.com)
- A green apple: "Green Apple ..." (www.boreas-online.com)
- A photo of a person: "... to look like Apple's own site, ..." (www.greenpeace.org)

- A novel context-based technique for the ad-hoc retrieval of web documents.
- Dynamic generation of a measure of document term's significance during retrieval.
- Document term significance based on term frequency. What about context?
- Term context in document reflects document's significance.

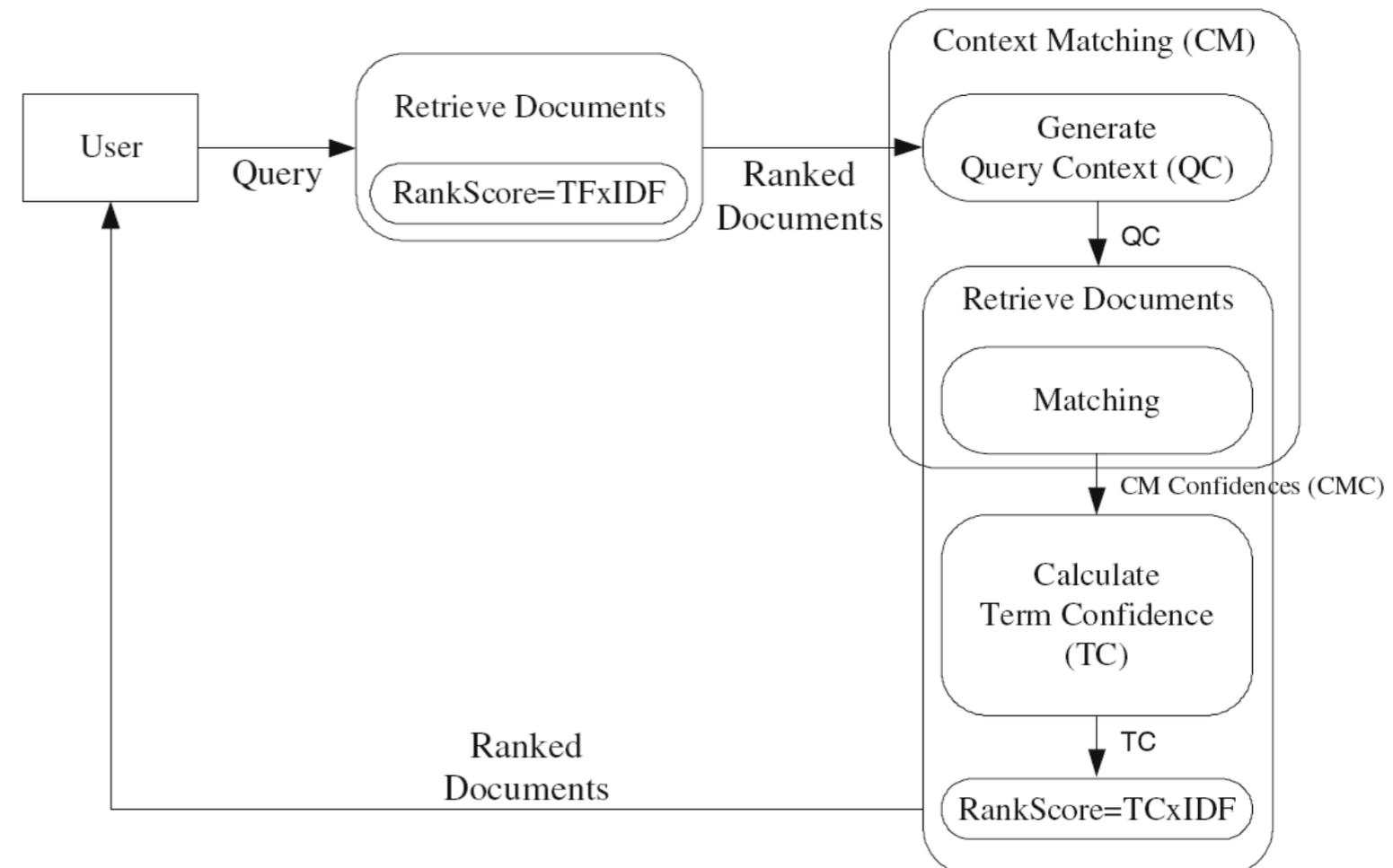


Figure 1 Overview of context matching as part of the retrieval process.

- A novel context-based technique for the ad-hoc retrieval of web documents.
- Dynamic generation of a measure of document term's significance during retrieval.
- Document term significance based on term frequency. What about context?
- Term context in document reflects document's significance.
- The whole story on 13.01.2009.

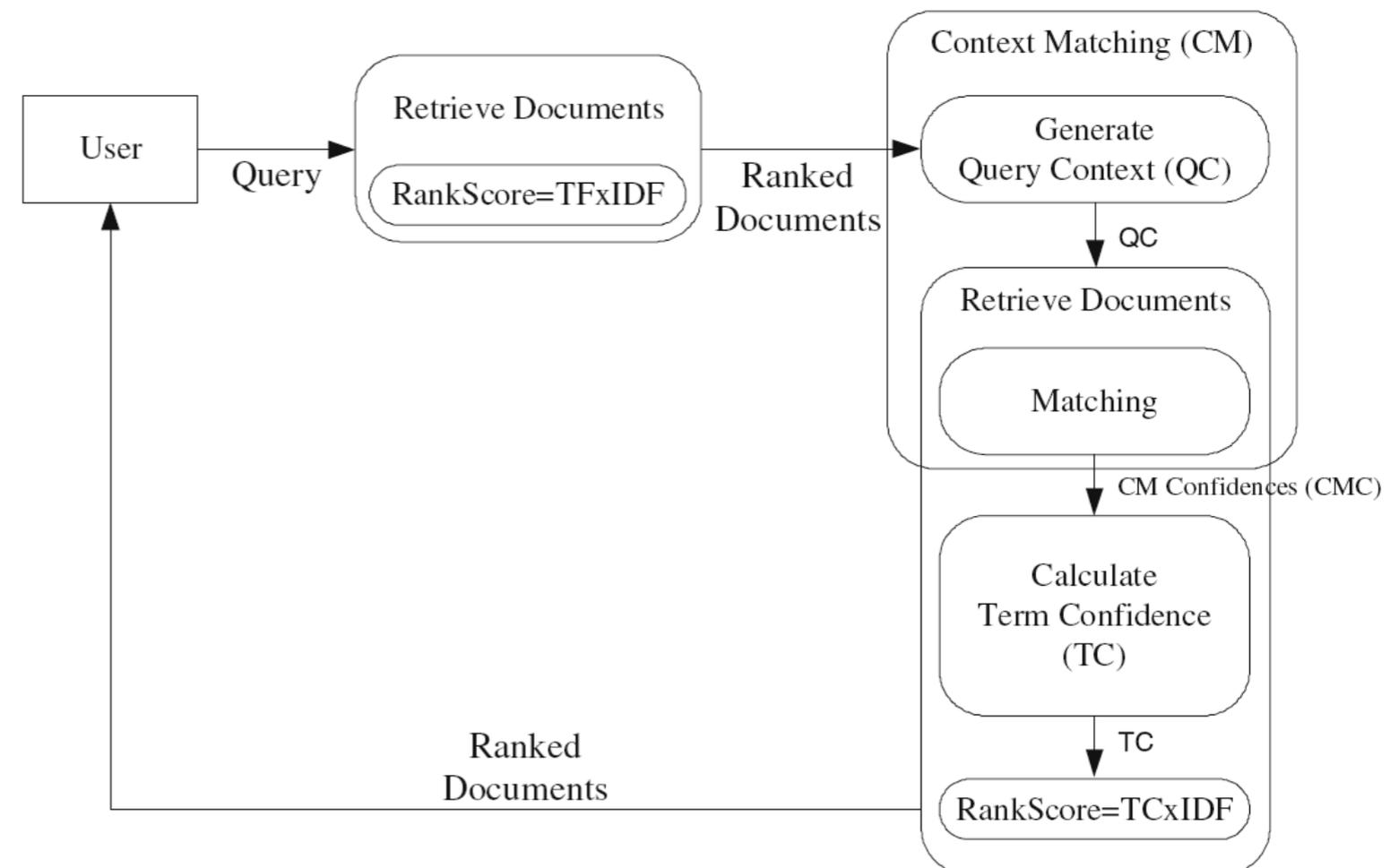


Figure 1 Overview of context matching as part of the retrieval process.

Topics: Search and Web Information Retrieval

Fast generation of result snippets in web search



13

- What are result snippets?
- Are result snippets important?
- What are the algorithms and data structures needed to generate these snippets efficiently in a search engine?
- On 20.01.2009.

The screenshot shows a Google search interface with the query 'Hasso-Plattner-Institut'. The search results are categorized under 'Web' and include several entries:

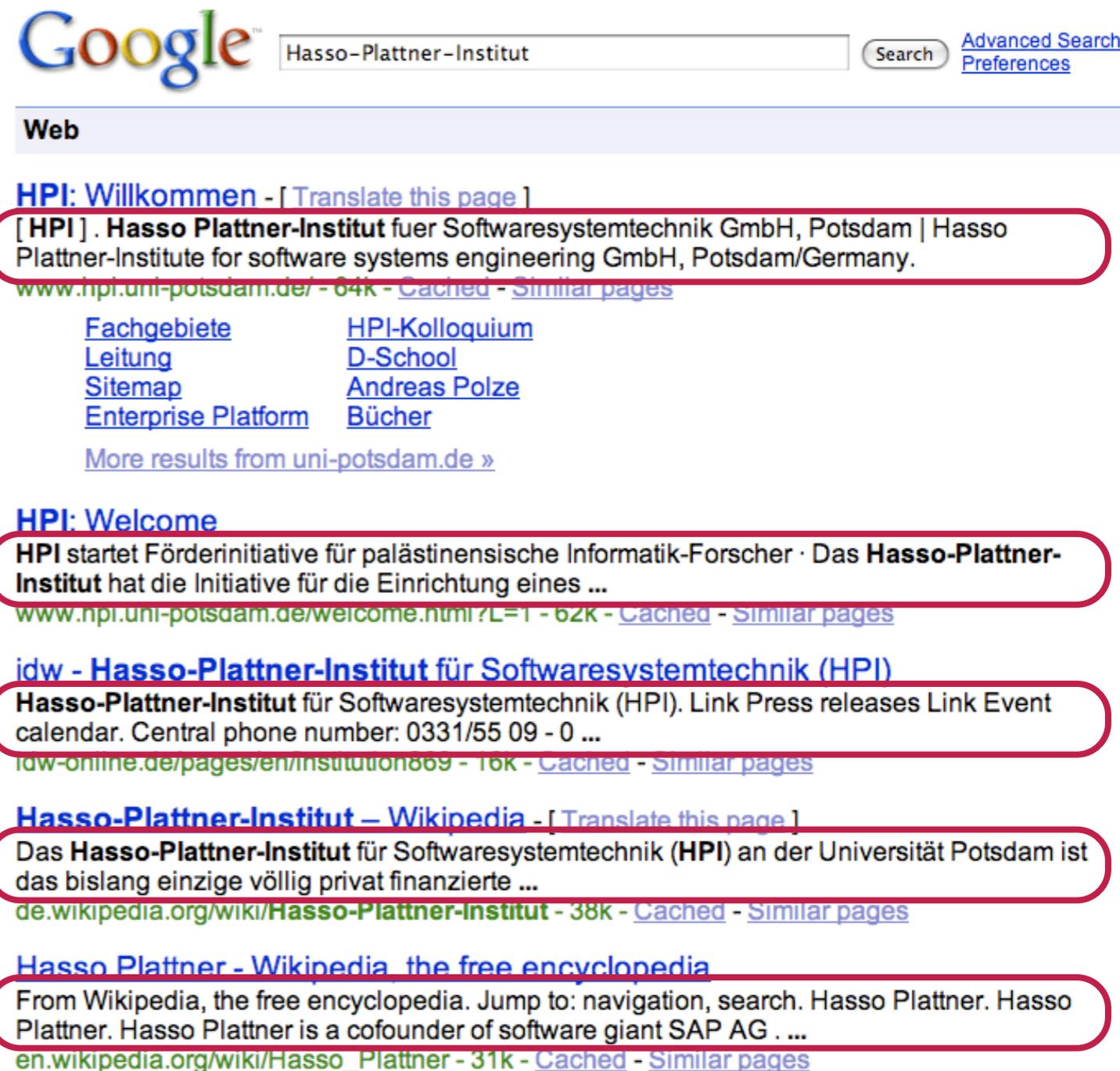
- HPI: Willkommen** - [Translate this page]
[HPI] . **Hasso Plattner-Institut** fuer Softwaresystemtechnik GmbH, Potsdam | Hasso Plattner-Institute for software systems engineering GmbH, Potsdam/Germany.
www.hpi.uni-potsdam.de/ - 64k - [Cached](#) - [Similar pages](#)
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[Enterprise Platform](#) [Bücher](#)
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- HPI: Welcome**
HPI startet Förderinitiative für palästinensische Informatik-Forscher · Das **Hasso-Plattner-Institut** hat die Initiative für die Einrichtung eines ...
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- Hasso-Plattner-Institut – Wikipedia** - [Translate this page]
Das **Hasso-Plattner-Institut** für Softwaresystemtechnik (**HPI**) an der Universität Potsdam ist das bislang einzige völlig privat finanzierte ...
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From Wikipedia, the free encyclopedia. Jump to: navigation, search. Hasso Plattner. Hasso Plattner. Hasso Plattner is a cofounder of software giant SAP AG
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Topics: Search and Web Information Retrieval

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Google Hasso-Plattner-Institut Search [Advanced Search](#) [Preferences](#)

Web

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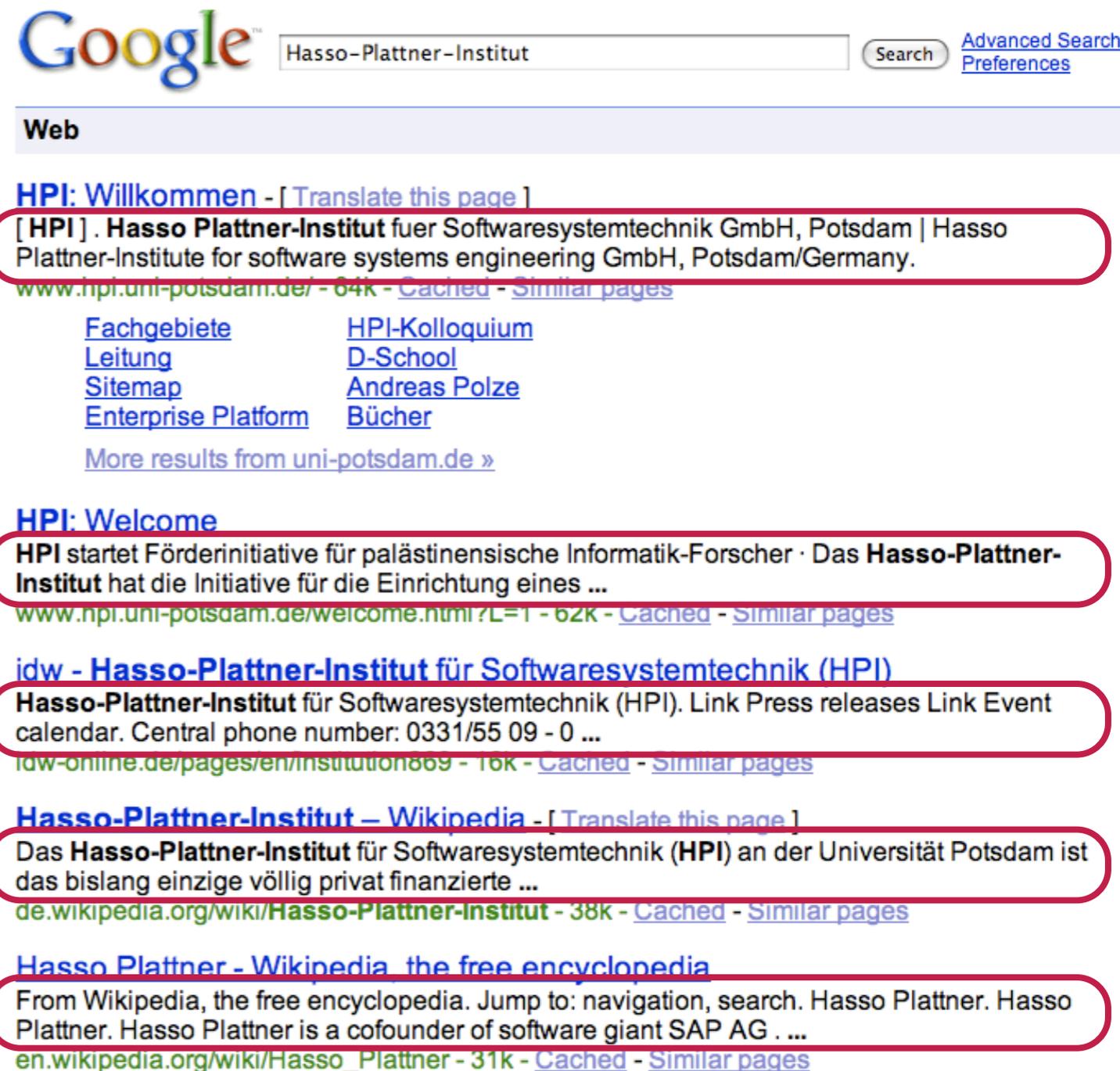
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