Boosting Documents in Solr by Recency, Popularity, and User Preferences

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LUCENE REVOLUTION

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Lucene

Apache Solr

What I Will Cover

- Recency Boost
- Popularity Boost
- Filtering based on user preferences

My Background

LUCENE REVOLUTION SAN FRANCISCO 2011

- Timothy Potter
- Large scale distributed systems engineer specializing in Web and enterprise search, machine learning, and big data analytics.
- 5 years Lucene
  - **Search solution for learning management sys**
- 2+ years Solr
  - **Mobile app for magazine content**
    - *Solr + Mahout + Hadoop*
  - **FAST to Solr Migration for a Real Estate Portal**
  - **VinWiki: Wine search and recommendation engine**

Boost documents by age

- Just do a descending sort by age = done?
- Boost more recent documents and penalize older documents just for being old
- Useful for news, business docs and local search

Solr: Indexing

In schema.xml:

```
<fieldType name="tdate"
           class="solr.TrieDateField"
           omitNorms="true"
           precisionStep="6"
           positionIncrementGap="0"/>

<field name="pubdate"
       type="tdate"
       indexed="true"
       stored="true"
       required="true" />
```

```
Date published =
   DateUtils.round(item.getPublishedOnDate(),Calendar.HOUR);
```

FunctionQuery Basics

- FunctionQuery: Computes a value for each document
  - **Ranking**
  - **Sorting**

constant	pow	**recip**
literal	abs	max
fieldvalue	log	**min**
ord	sqrt	**ms**
rord	map	sqedist - Squared Euclidean Dist
sum	scale	hsin, ghhsin - Haversine Formula
sub	query	geohash - Convert to geohash
product	linear	strdist

Solr: Query Time Boost

- Use the recip function with the ms function:

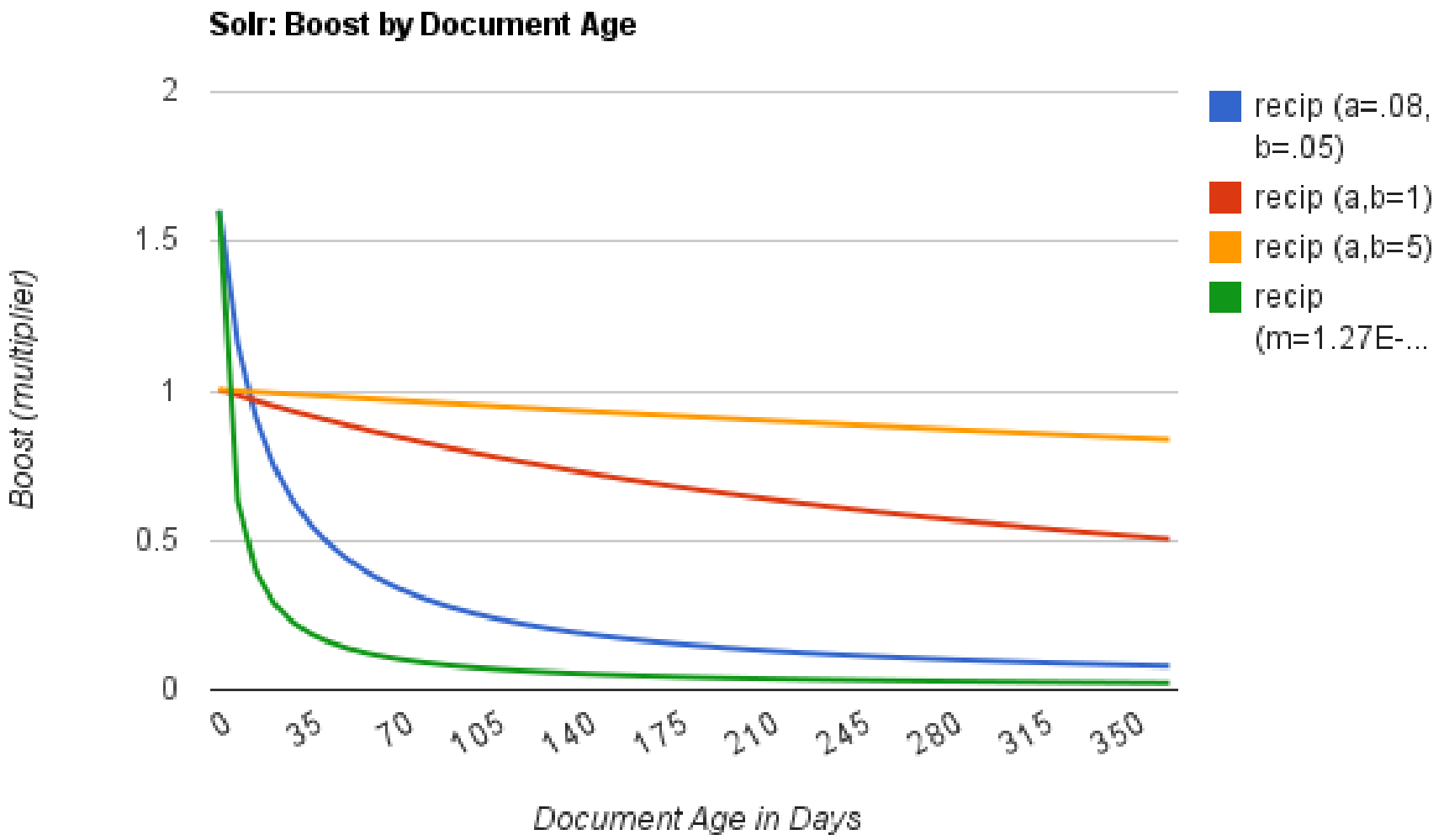
```
q={!boost b=$recency v=$qq}&
 recency=recip(ms(NOW/HOUR,pubdate),3.16e-11,0.08,0.05)&
 qq=wine
```

- Use edismax vs. dismax if possible:

```
 q=wine&
 boost=recip(ms(NOW/HOUR,pubdate),3.16e-11,0.08,0.05)
```

- Recip is a highly tunable function
  - **recip(x,m,a,b) implementing a / (m*x + b)**
  - **m = 3.16E-11 a= 0.08 b=0.05 x = Document Age**

Tune Solr recip function



Tips and Tricks

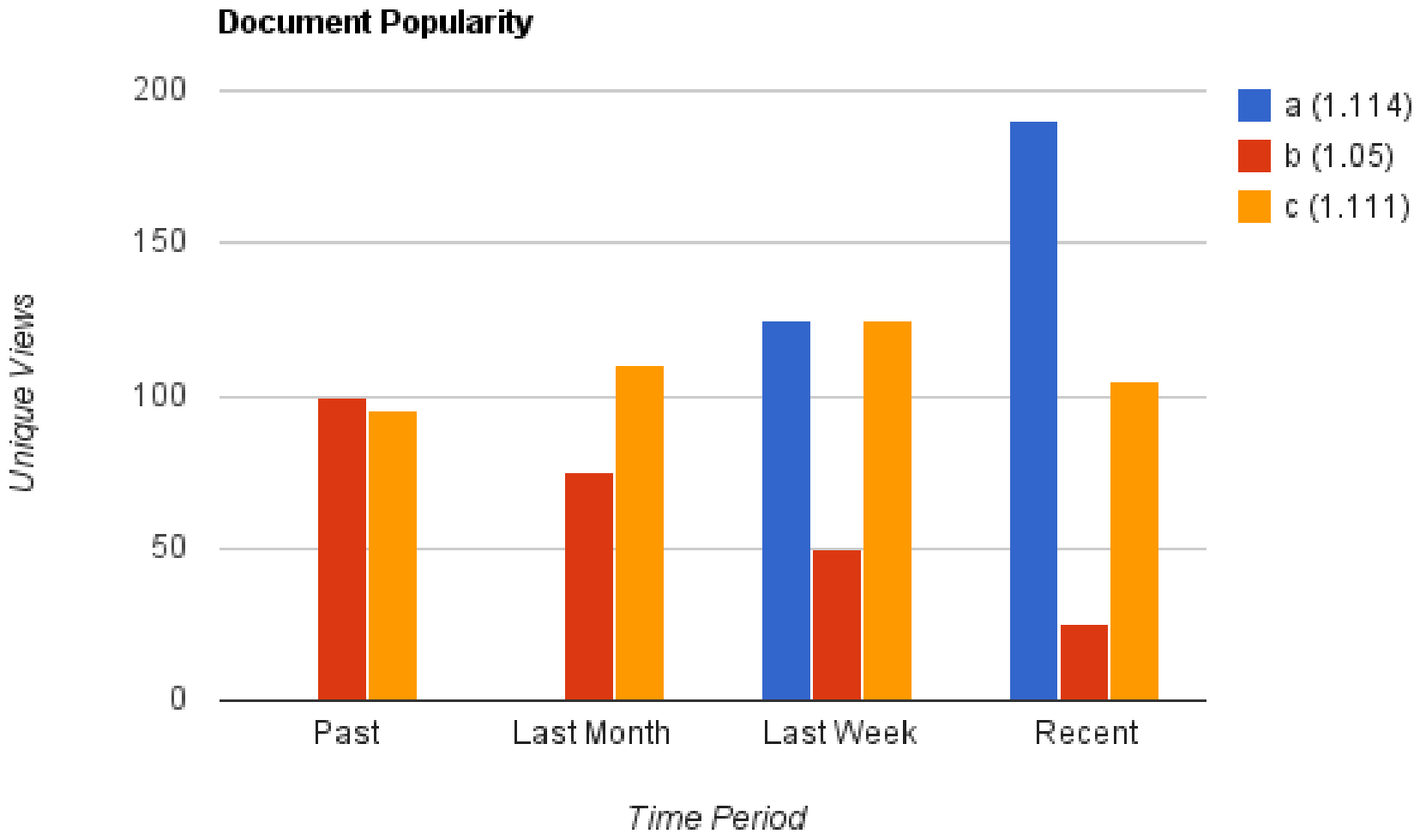
- Boost should be a multiplier on the relevancy score
- {!boost b=} syntax confuses the spell checker so you need to use **spellcheck.q** to be explicit

  q={!boost b=$recency v=$qq}&spellcheck.q=wine
- Bottom out the old age penalty using min:
  - **min(recip(…), 0.20)**
- Not a one-size fits all solution – academic research focused on when to apply it

Boost by Popularity

- Score based on number of unique views
- Not known at indexing time
- View count should be broken into time slots

Popularity Illustrated



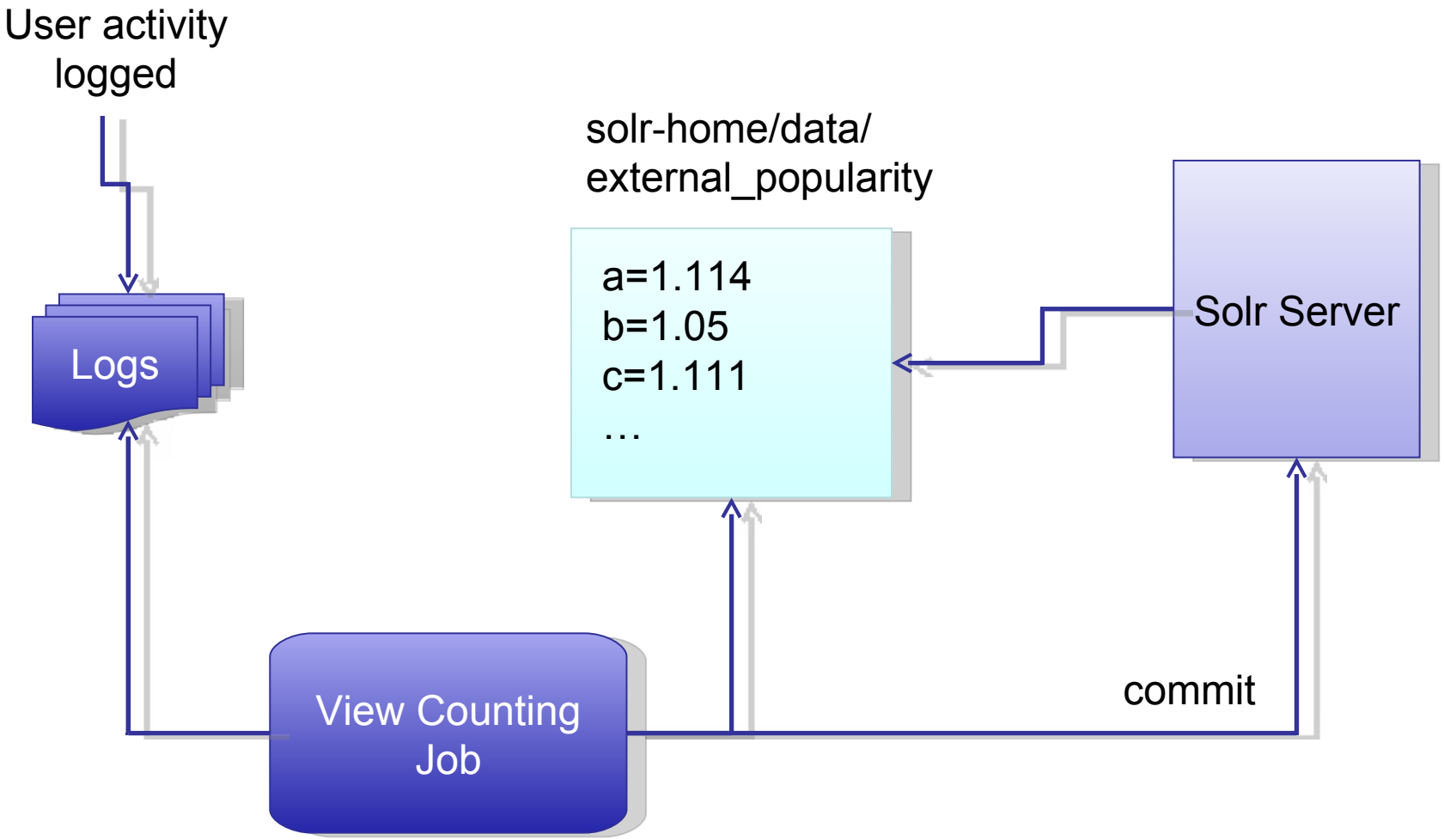
Solr: ExternalFileField

In schema.xml:

```
<fieldType name="externalPopularityScore"
           keyField="id"
           defVal="1"
           stored="false" indexed="false"
           class="solr.ExternalFileField"
           valType="pfloat"/>

<field name="popularity"
       type="externalPopularityScore" />
```

Popularity Boost: Nuts & Bolts



Popularity Tips & Tricks

- For big, high traffic sites, use log analysis
  - **Perfect problem for MapReduce**
  - **Take a look at Hive for analyzing large volumes of log data**

- Minimum popularity score is 1 (not zero) … up to 2 or more
  - **1 + (0.4*recent + 0.3*lastWeek + 0.2*lastMonth …)**

- Watch out for spell checker “buildOnCommit”

Filtering By User Preferences

- Easy approach is to build basic preference fields in to the index:
  - **Content types of interest – content_type**
  - **High-level categories of interest - category**
  - **Source of interest – source**

- We had too many categories and sources that a user could enable / disable to use basic filtering
  - **Custom SearchComponent with a connection to a JDBC DataSource**

Preferences Component

- Connects to a database
- Caches DocIdSet in a Solr FastLRUCache
- Cached values marked as dirty using a simple timestamp passed in the request

Declared in solrconfig.xml:

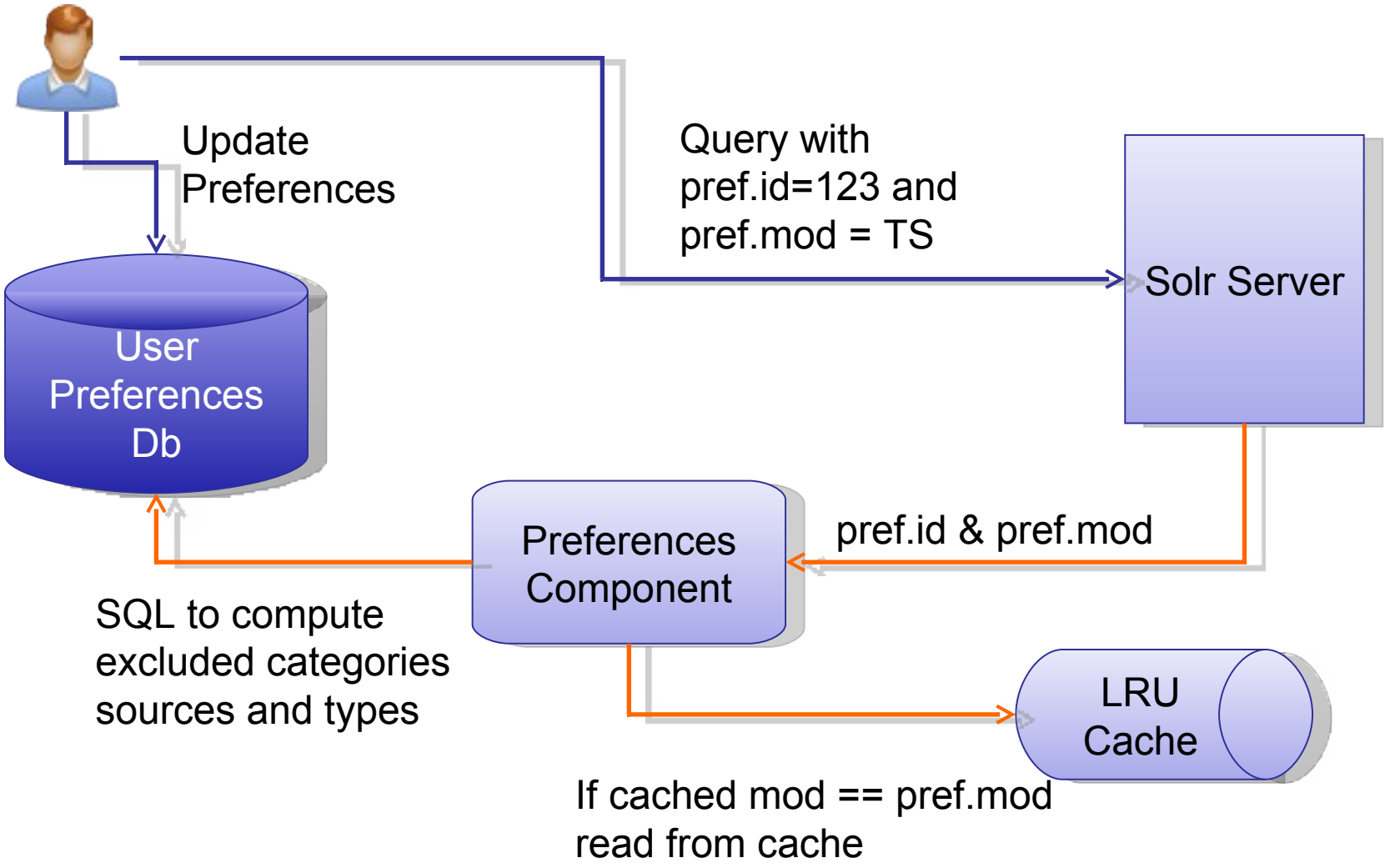
```
<searchComponent
    class="demo.solr.PreferencesComponent"
    name="pref">
  <str name="jdbcJndi">jdbc/solr</str>
</searchComponent>
```

Preferences Filter

- Parameters passed in the query string:
  - **pref.id = primary key in db**
  - **pref.mod = preferences modified on timestamp**
    - *So the Solr side knows the database has been updated*
- Use simple SQL queries to compute a list of disabled categories, feeds, and types
  - **Lucene FieldCaches for category, source, type**
- Custom SearchComponent included in the list of components for edismax search handler

```
<arr name="last-components">
  <str>pref</str>
</arr>
```

Preferences Filter in Action



Wrap Up

- Use recip & ms functions to boost recent documents
- Use ExternalFileField to load popularity scores calculated outside the index
- Use a custom SearchComponent with a Solr FastLRUCache to filter documents using complex user preferences

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