Apache Solr

Yonik Seeley
yonik@apache.org

29 June 2006
Dublin, Ireland

ApacheCon
Europe 06

History

- Search for a replacement search platform
  - commercial: high license fees
  - open-source: no full solutions
- CNET grants code to Apache, Solr enters Incubator 17 Jan 2006
- Solr is a Lucene sub-project
- Users: CNET Reviews, CNET Channel, shopper.com, news.com, nines.org, krugle.com, oodle.com, booklooker.de

Lucene Refresher

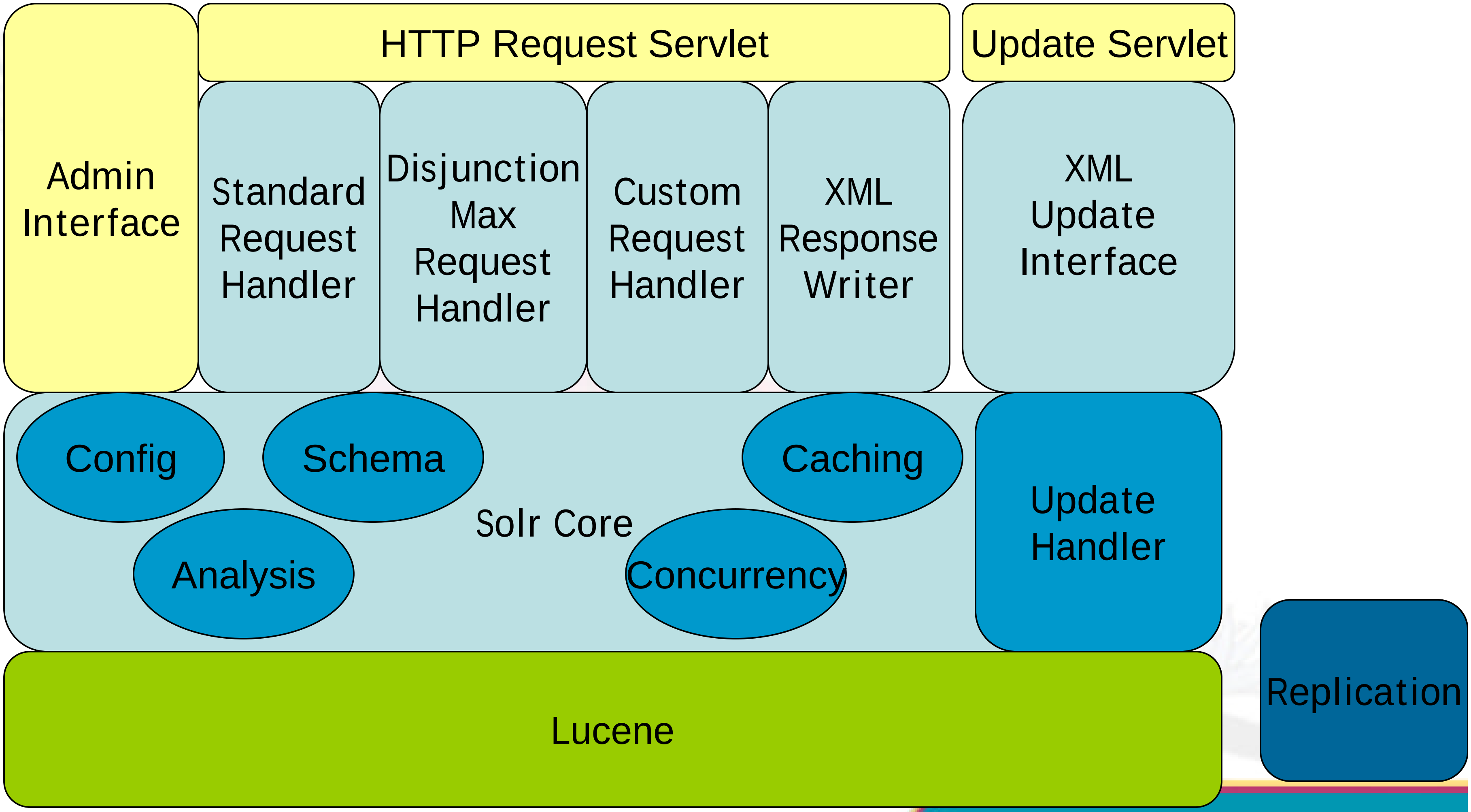
- Lucene is a full-text search library
- Add documents to an index via IndexWriter
  - A document is a a collection of fields
  - No config files, dynamic field typing
  - Flexible text analysis – tokenizers, filters
- Search for documents via IndexSearcher

  Hits = search(Query,Filter,Sort,topN)
- Scoring: tf * idf * lengthNorm

What Is Solr

- A full text search server based on Lucene
- XML/HTTP Interfaces
- Loose Schema to define types and fields
- Web Administration Interface
- Extensive Caching
- Index Replication
- Extensible Open Architecture
- Written in Java5, deployable as a WAR

Architecture



ApacheCon Europe 06

Adding Documents

HTTP POST to /update

```
<add><doc boost=“2”>
  <field name=“article”>05991</field>
  <field name=“title”>Apache Solr</field>
  <field name=“subject”>An intro...</field>
  <field name=“category”>search</field>
  <field name=“category”>lucene</field>
  <field name=“body”>Solr is a full...</field>
</doc></add>
```

Deleting Documents

- Delete by Id

```
<delete><id>05591</id></delete>
```

- Delete by Query (multiple documents)

```
<delete>
  <query>manufacturer:microsoft</query>
</delete>
```

Commit

- <commit/> makes changes visible
  - closes IndexWriter
  - removes duplicates
  - opens new IndexSearcher
    - newSearcher/firstSearcher events
    - cache warming
    - "register" the new IndexSearcher
- <optimize/> same as commit, merges all index segments.

Default Query Syntax

Lucene Query Syntax [; sort specification]

1. mission impossible; releaseDate desc
2. +mission +impossible –actor:cruise
3. “mission impossible” –actor:cruise
4. title:spiderman^10 description:spiderman
5. description:“spiderman movie”~10
6. +HDTV +weight:[0 TO 100]
7. Wildcard queries: te?t, te*t, test*

Default Parameters

Query Arguments for HTTP GET/POST to /select

param	default	description
q		The query
start	0	Offset into the list of matches
rows	10	Number of documents to return
fl	*	Stored fields to return
qt	standard	Query type; maps to query handler
df	(schema)	Default field to search

Search Results

```
http://localhost:8983/solr/select?q=video&start=0&rows=2&fl=name,price

<response><responseHeader><status>0</status>
  <QTime>1</QTime></responseHeader>
  <result numFound="16173" start="0">
    <doc>
      <str name="name">Apple 60 GB iPod with Video</str>
      <float name="price">399.0</float>
    </doc>
    <doc>
      <str name="name">ASUS Extreme N7800GTX/2DHTV</str>
      <float name="price">479.95</float>
    </doc>
  </result>
</response>
```

Caching

IndexSearcher’s view of an index is fixed

- Aggressive caching possible
- Consistency for multi-query requests

filterCache – unordered set of document ids matching a query

resultCache – ordered subset of document ids matching a query

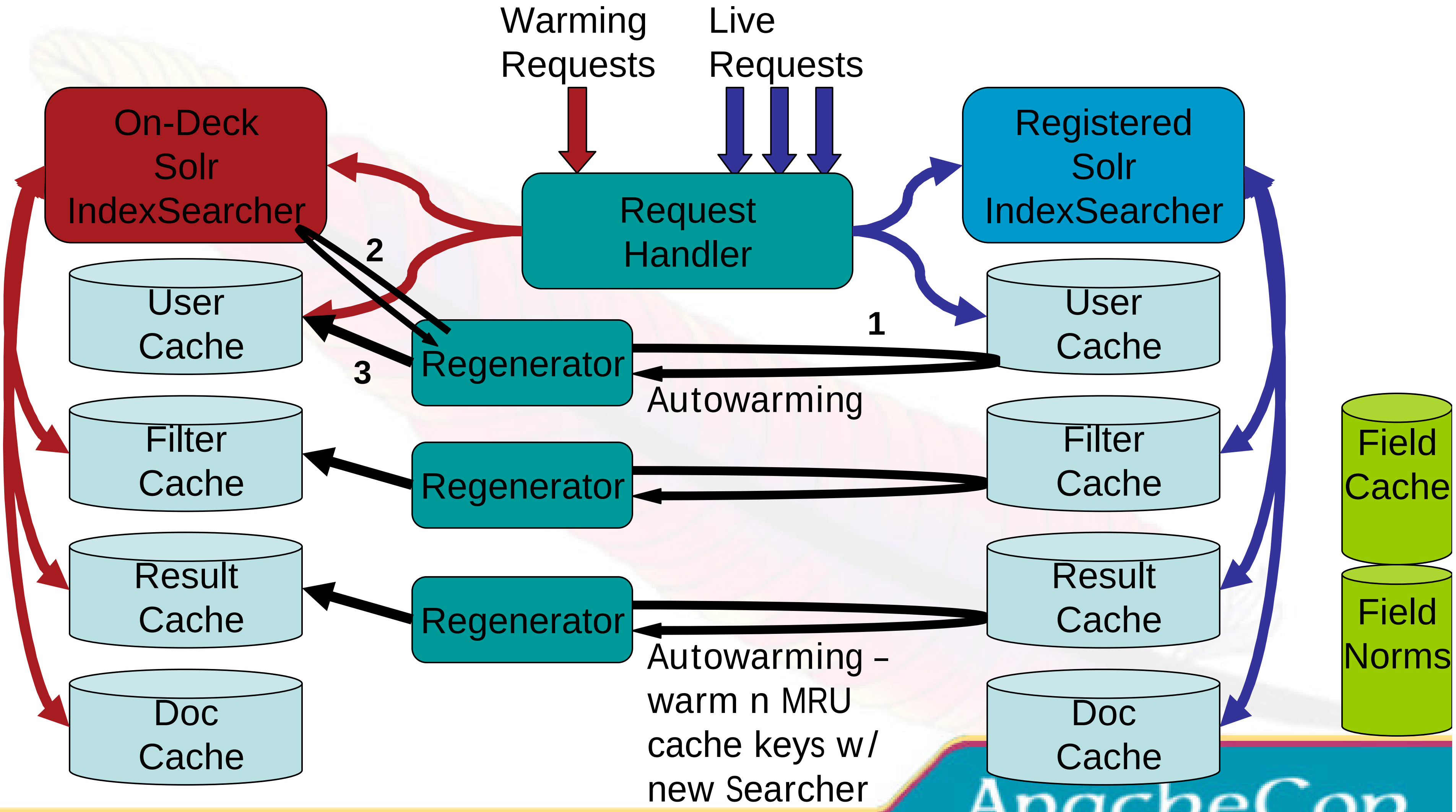
documentCache – the stored fields of documents

userCaches – application specific, custom query handlers

Warming for Speed

- Lucene IndexReader warming
  - field norms, FieldCache, tii – the term index
- Static Cache warming
  - Configurable static requests to warm new Searchers
- Smart Cache Warming (autowarming)
  - Using MRU items in the current cache to pre-populate the new cache
- Warming in parallel with live requests

Smart Cache Warming



Autowarming – warm n MRU cache keys w/ new Searcher

Schema

- Lucene has no notion of a schema
  - Sorting - string vs. numeric
  - Ranges - val:42 included in val:[1 TO 5] ?
  - Lucene QueryParser has date-range support, but must guess.
- Defines fields, their types, properties
- Defines unique key field, default search field, Similarity implementation

Field Definitions

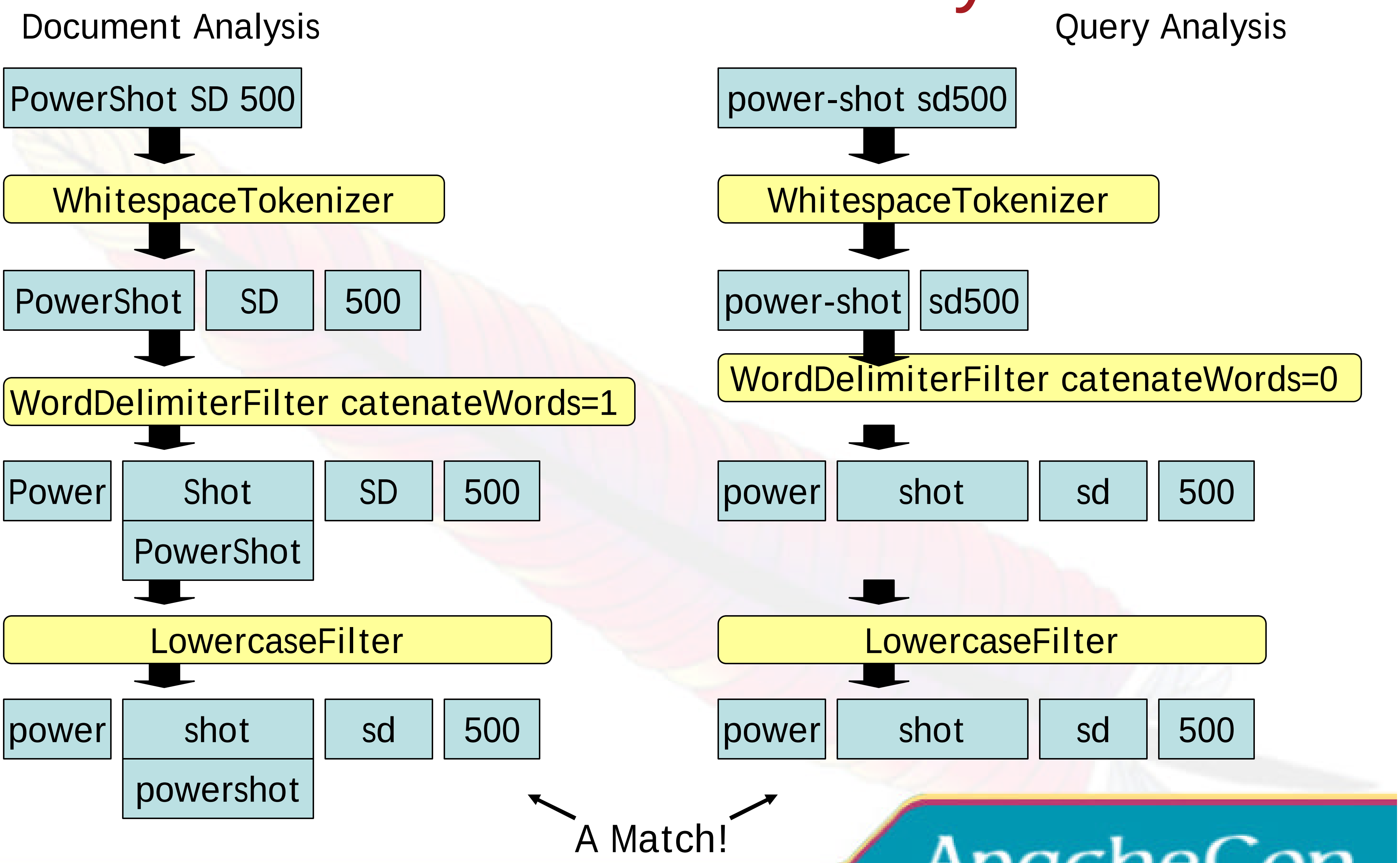
- Field Attributes: name, type, indexed, stored, multiValued, omitNorms

```
<field name="id“         type="string"      indexed="true" stored="true"/>
<field name="sku“        type="textTight”  indexed="true" stored="true"/>
<field name="name“     type="text“         indexed="true" stored="true"/>
<field name=“reviews“  type="text“       indexed="true“  stored=“false"/>
<field name="category“  type="text_ws“  indexed="true" stored="true“
    multiValued="true"/>
```

- Dynamic Fields, in the spirit of Lucene!

```
<dynamicField name="*_i"  type="sint“    indexed="true"  stored="true"/>
<dynamicField name="*_s"  type="string“  indexed="true"  stored="true"/>
<dynamicField name="*_t"  type="text“    indexed="true"  stored="true"/>
```

Search Relevancy



Document Analysis

PowerShot SD 500

WhitespaceTokenizer

PowerShot | SD | 500

WordDelimiterFilter catenateWords=1

Power | Shot | SD | 500
PowerShot

LowercaseFilter

power | shot | sd | 500
powershot

Query Analysis

power-shot sd500

WhitespaceTokenizer

power-shot | sd500

WordDelimiterFilter catenateWords=0

power | shot | sd | 500

LowercaseFilter

power | shot | sd | 500

A Match!

Configuring Relevancy

```
<fieldtype name="text" class="solr.TextField">
 <analyzer>
  <tokenizer class="solr.WhitespaceTokenizerFactory"/>
  <filter class="solr.LowerCaseFilterFactory"/>
  <filter class="solr.SynonymFilterFactory"
           synonyms="synonyms.txt“ />
  <filter class="solr.StopFilterFactory“
           words=“stopwords.txt” />
  <filter class="solr.EnglishPorterFilterFactory"
           protected="protwords.txt"/>
 </analyzer>
</fieldtype>
```

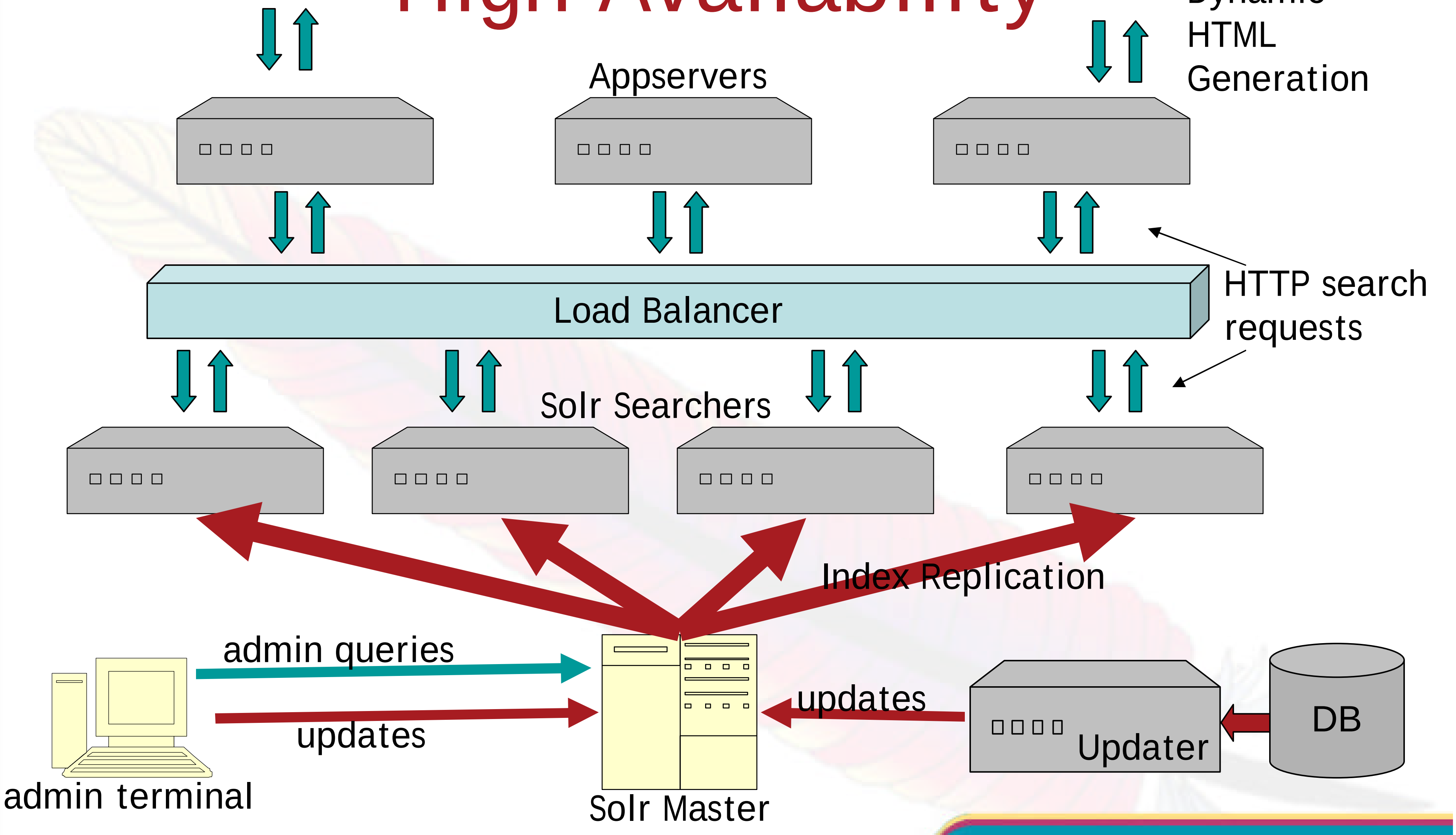
copyField

- Copies one field to another at **index time**
- Usecase: Analyze same field different ways
  - copy into a field with a different analyzer
  - boost exact-case, exact-punctuation matches
  - language translations, thesaurus, soundex

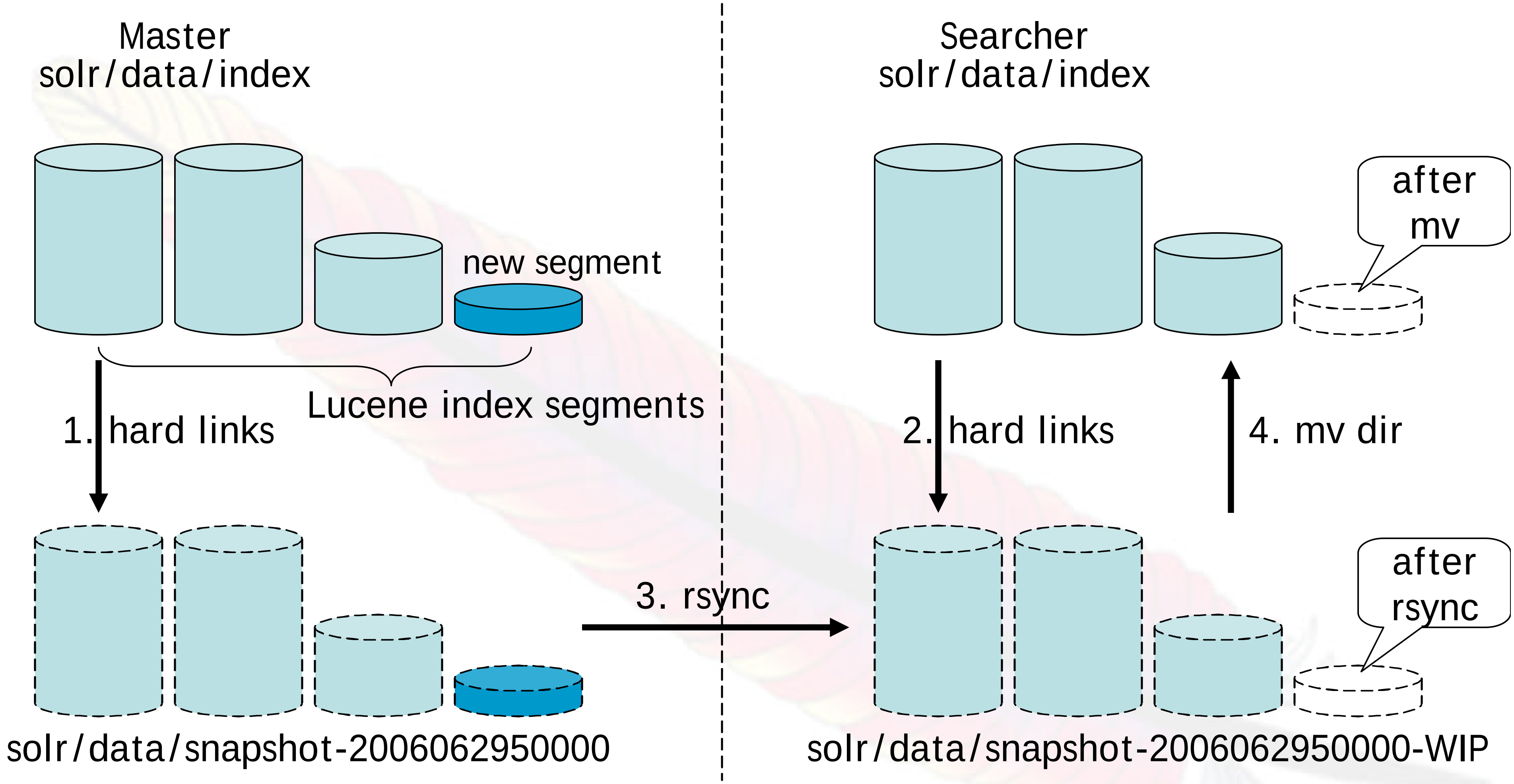
```
<field name=“title” type=“text”/>
<field name=“title_exact” type=“text_exact” stored=“false”/>
<copyField source=“title” dest=“title_exact”/>
```

- Usecase: Index multiple fields into single searchable field

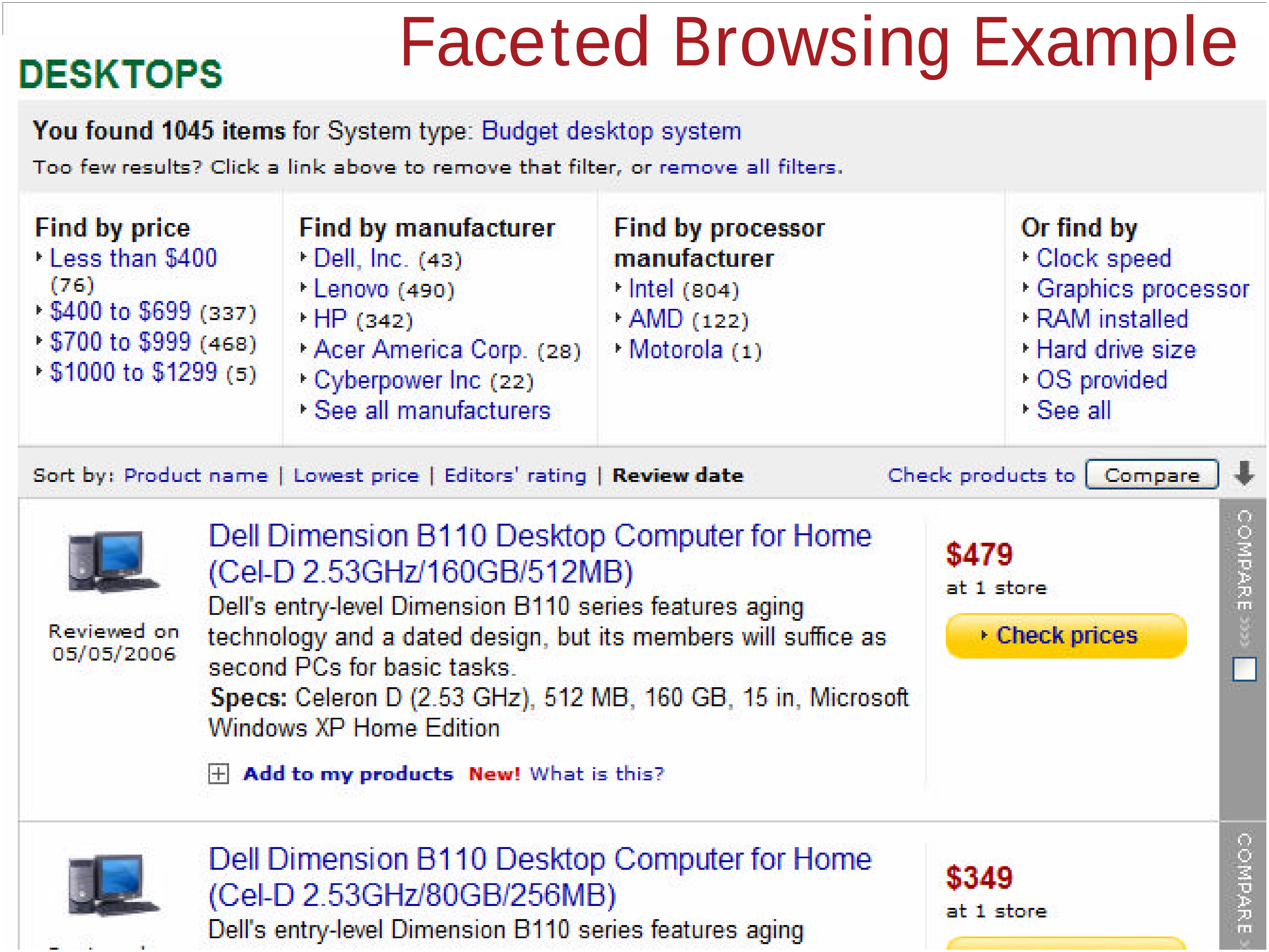
High Availability



Replication



Faceted Browsing Example



DESKTOPS

You found 1045 items for System type: Budget desktop system

Too few results? Click a link above to remove that filter, or remove all filters.

Find by price
- Less than $400 (76)
- $400 to $699 (337)
- $700 to $999 (468)
- $1000 to $1299 (5)

Find by manufacturer
- Dell, Inc. (43)
- Lenovo (490)
- HP (342)
- Acer America Corp. (28)
- Cyberpower Inc (22)
- See all manufacturers

Find by processor manufacturer
- Intel (804)
- AMD (122)
- Motorola (1)

Or find by
- Clock speed
- Graphics processor
- RAM installed
- Hard drive size
- OS provided
- See all

Sort by: Product name | Lowest price | Editors' rating | **Review date**

Check products to Compare

Reviewed on 05/05/2006

Dell Dimension B110 Desktop Computer for Home (Cel-D 2.53GHz/160GB/512MB)

Dell's entry-level Dimension B110 series features aging technology and a dated design, but its members will suffice as second PCs for basic tasks.

Specs: Celeron D (2.53 GHz), 512 MB, 160 GB, 15 in, Microsoft Windows XP Home Edition

⊞ **Add to my products** **New!** What is this?

$479

at 1 store

Check prices

COMPARE >>>> □

Dell Dimension B110 Desktop Computer for Home (Cel-D 2.53GHz/80GB/256MB)

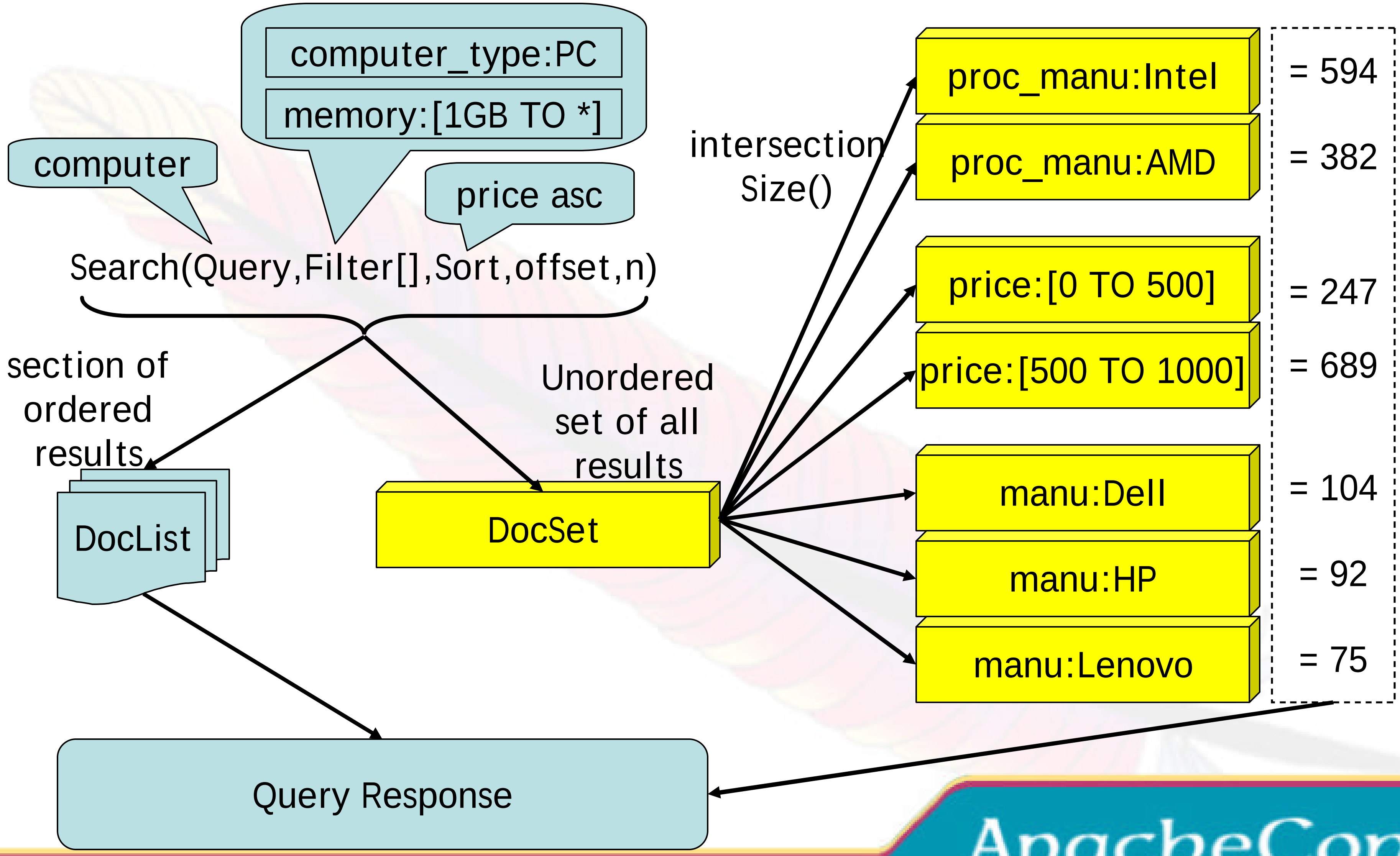
Dell's entry-level Dimension B110 series features aging

$349

at 1 store

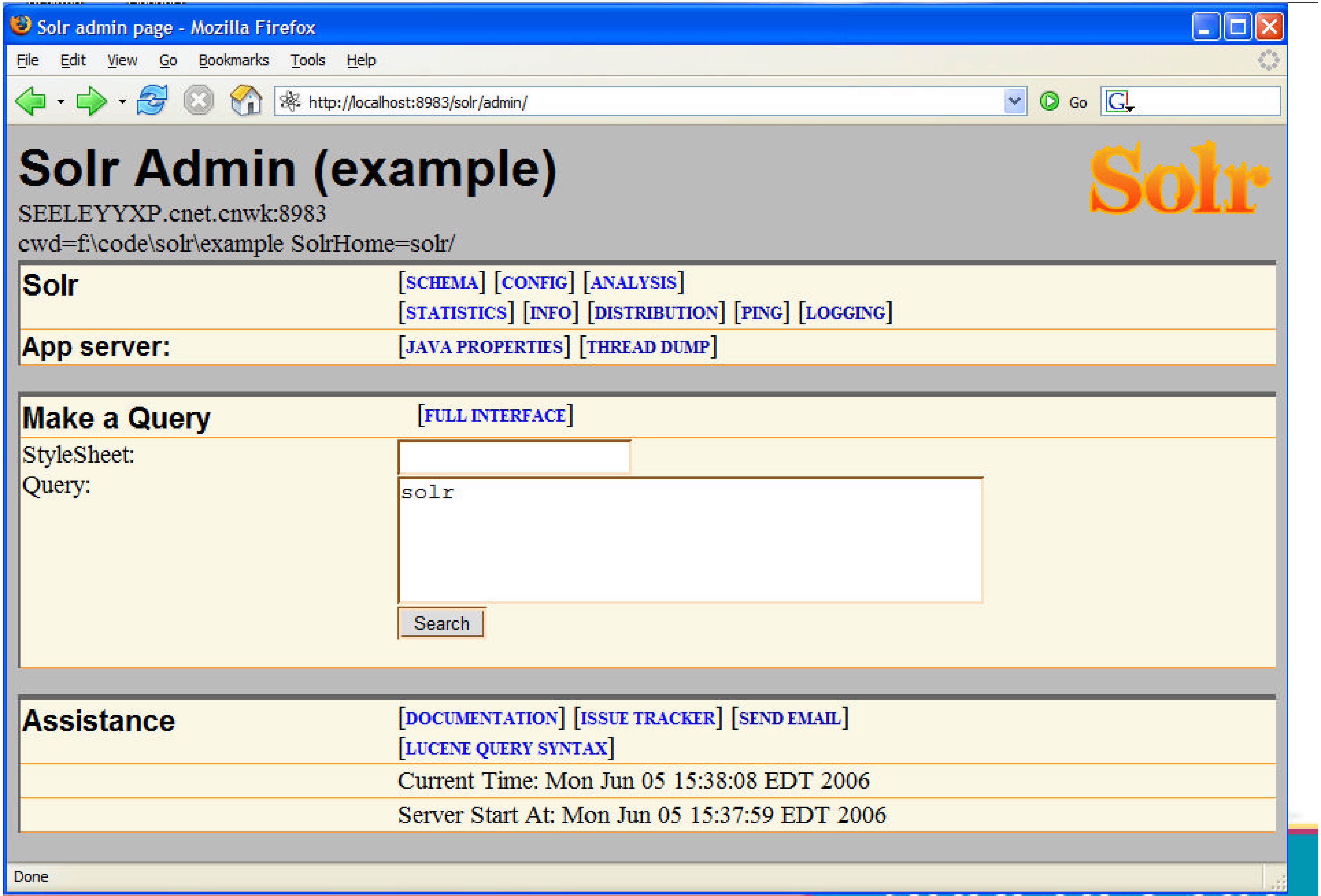
COMPARE

Faceted Browsing



Web Admin Interface

- Show Config, Schema, Distribution info
- Query Interface
- Statistics
  - Caches: lookups, hits, hitratio, inserts, evictions, size
  - RequestHandlers: requests, errors
  - UpdateHandler: adds, deletes, commits, optimizes
  - IndexReader, open-time, index-version, numDocs, maxDocs,
- Analysis Debugger
  - Shows tokens after each Analyzer stage
  - Shows token matches for query vs index



Solr admin page - Mozilla Firefox
File Edit View Go Bookmarks Tools Help
http://localhost:8983/solr/admin/
Go

Solr Admin (example)

SEELEYYXP.cnet.cnwk:8983
cwd=f:\code\solr\example SolrHome=solr/

Solr	[SCHEMA] [CONFIG] [ANALYSIS] [STATISTICS] [INFO] [DISTRIBUTION] [PING] [LOGGING]
App server:	[JAVA PROPERTIES] [THREAD DUMP]

Make a Query	[FULL INTERFACE]
StyleSheet:	
Query:	solr
	Search

Assistance	[DOCUMENTATION] [ISSUE TRACKER] [SEND EMAIL] [LUCENE QUERY SYNTAX]
	Current Time: Mon Jun 05 15:38:08 EDT 2006
	Server Start At: Mon Jun 05 15:37:59 EDT 2006

Selling Points

- Fast
- Powerful & Configurable
- High Relevancy
- Mature Product
- Same features as software costing $$$
- Leverage Community
  - Lucene committers, IR experts
  - Free consulting: shared problems & solutions

Where are we going?

- OOTB Simple Faceted Browsing
- Automatic Database Indexing
- Federated Search
  - HA with failover
- Alternate output formats (JSON, Ruby)
- Highlighter integration
- Spellchecker
- Alternate APIs (Google Data, OpenSearch)

Resources

- WWW
  - http://incubator.apache.org/solr
  - http://incubator.apache.org/solr/tutorial.html
  - http://wiki.apache.org/solr/
- Mailing Lists
  - solr-user-subscribe@lucene.apache.org
  - solr-dev-subscribe@lucene.apache.org