Full-Text Search with Sphinx and PHP

SphinxSearch LAMP stack integration, tips and tricks

What is Sphinx

- Free open source search server
- Begins 10 years ago as a full text daemon
- Now powerful, fast, relevant, scalable search engine.
- Dual licensing model, just like MySQL
- Available for Linux, Windows, Mac OS
  - Can be built on AIX, iPhone and some DSL routers

What Sphinx Can Do For You?

- Serve over 16,000,000,000 (yes billions) documents
  - boardreader.com, over 5Tb data on about 40 boxes
- Over 200,000,000 queries/day (craigslist.org)
  - 2,000 QPS against 15 Sphinx boxes
- Also powers NetLog, Meetup, Slashdot, WikiMapia, and a few thousands other sites
  - http://sphinxsearch.com/info/powered/

Powerful FT-query syntax

- And, Or
  - hello | world, hello & world
- Not
  - hello -world
- Per-field search
  - @title hello @body world
- Field combination
  - @(title, body) hello world
- Search within first N
  - @body[50] hello
- Phrase search
  - “hello world”
- Per-field weights
- Proximity search
  - “hello world”~10
- Distance support
  - hello NEAR/10 world
- Quorum matching
  - "the world is a wonderful place"/3
- Exact form modifier
  - “raining =cats and =dogs”
- Strict order
- Sentence / Zone / Paragraph
- Custom document weighting
- Different ranking

Not only Full-Text search

- Geo distance search
- MVA (i.e. page tags or multiple categories)
- UNIX timestamps
- Floating point values
- Strings & Integers
- Built-in expressions, functions, and operators
- UDF support

Few words on architecture

- Daemon
- Indexes
  - Full Text data
  - Non FT attributes

Daemon

- Serve queries
- Works in fork, prefork and threaded modes
- Could act as a proxy for distributed indexes

Indexes

- Actually group of files
- In-memory
  - document attributes
  - MVA data
- On-disk
  - document lists
  - hit lists
- Depends on settings
  - dictionary file

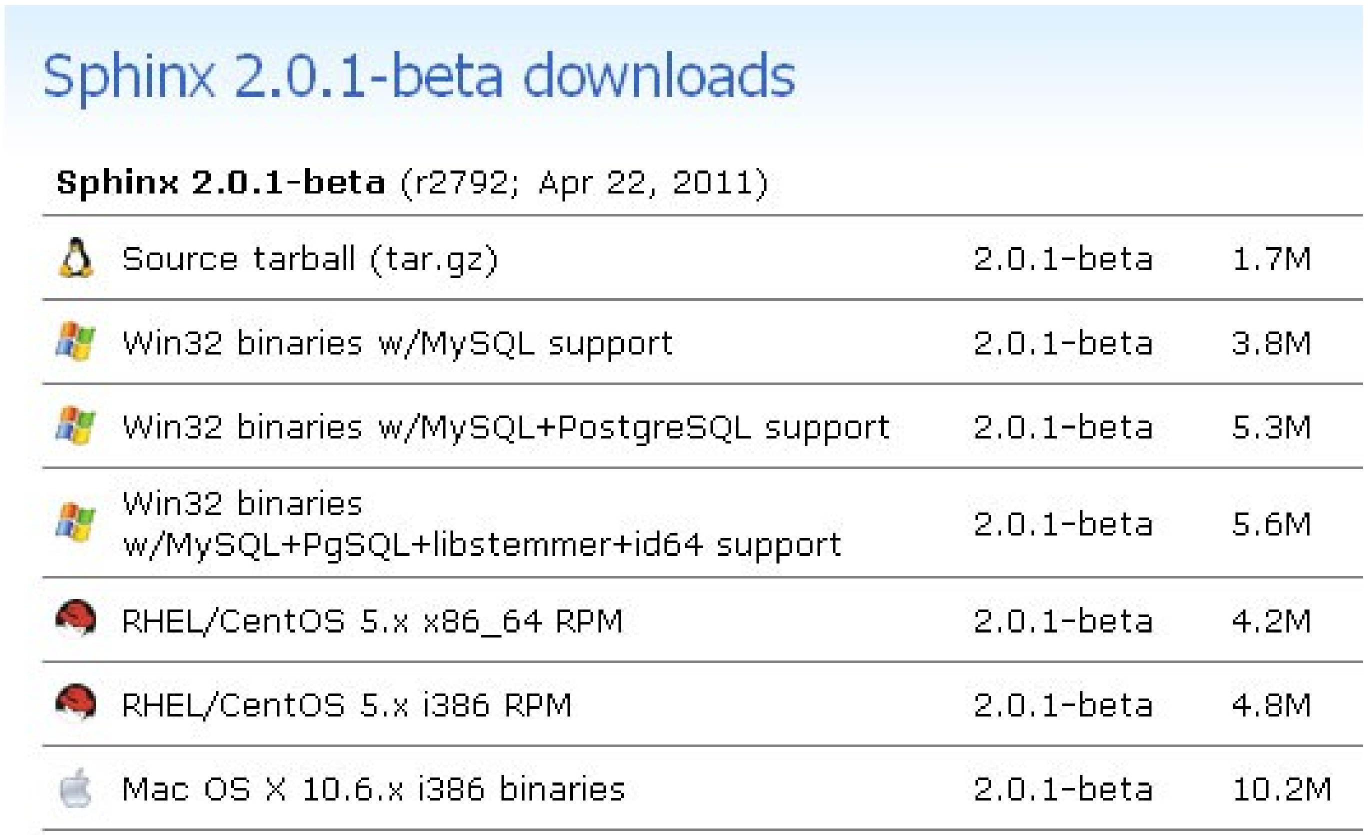
Time for some real work!

Action plan

1. Download & Install
2. Tell sphinx
    1. Where to look for data
    2. How to process it
    3. Where to store indexes
3. Run sphinx
4. Fire the query
5. Scale the Sphinx out

Download and Install

- http://sphinxsearch.com/downloads/



Sphinx 2.0.1-beta downloads

Sphinx 2.0.1-beta (r2792; Apr 22, 2011)

Source tarball (tar.gz)	2.0.1-beta	1.7M
Win32 binaries w/MySQL support	2.0.1-beta	3.8M
Win32 binaries w/MySQL+PostgreSQL support	2.0.1-beta	5.3M
Win32 binaries w/MySQL+PgSQL+libstemmer+id64 support	2.0.1-beta	5.6M
RHEL/CentOS 5.x x86_64 RPM	2.0.1-beta	4.2M
RHEL/CentOS 5.x i386 RPM	2.0.1-beta	4.8M
Mac OS X 10.6.x i386 binaries	2.0.1-beta	10.2M

Install

- For sources as simple as:
  configure && make && make install
- Make sure to use --enable-id64
  - for huge document collection
  - already included in pre-compiled packages

Where to get data?

- MySQL
- PostgreSQL
- MSSQL
- ODBC source
- XML pipe

MySQL source

```
source lj_source
{
   …
   sql_query = \
       SELECT id, channel_id, ts, title, content \
       FROM ljposts

   sql_attr_uint           = channel_id
   sql_attr_timestamp      = ts
   …
}
```

A complete version

```
source lj_source
{

    type    = mysql
    sql_host    = localhost
    sql_user    = my_user
    sql_pass    = my******
    sql_db      = test

    sql_query_pre = SET NAMES utf8
    sql_query     = SELECT id, channel_id, ts, title, content \
                       FROM ljposts \
                       WHERE id>=$start and id<=$end

    sql_attr_uint       = channel_id
    sql_attr_timestamp = ts

    sql_query_range   = SELECT MIN(id),  MAX(id) FROM ljposts
    sql_range_step    = 1000
}
```

How to process. Index config.

```
index lj
{
   source            = lj_source
   path              = /my/index/path/lj_index

   html_strip         = 1
   html_index_attrs = img=src,alt; a=href,title

   morphology         = stem_en
   stopwords          = stopwords.txt
   charset_type       = utf-8
}
```

Indexer configuration

```
indexer
{
    mem_limit   = 512M
    max_iops    = 40
    max_iosize  = 1048576
}
```

USA

Building index

```
$ ./indexer lj
Sphinx 2.0.2-dev (r2824)
Copyright (c) 2001-2010, Andrew Aksyonoff
Copyright (c) 2008-2010, Sphinx Technologies Inc (http://sph...

using config file './sphinx.conf'...
indexing index 'lj'...
collected 999944 docs, 1318.1 MB
sorted 224.2 Mhits, 100.0% done
total 999944 docs, 1318101119 bytes
total 158.080 sec, 8338160 bytes/sec, 6325.53 docs/sec
total 33 reads, 4.671 sec, 17032.9 kb/call avg, 141.5 msec/call
total 361 writes, 20.889 sec, 3566.1 kb/call avg, 57.8 msec/call
```

Index files

```
$ ls -lah lj*
-rw-r--r-- 1 vlad vlad  12M 2010-12-22 09:01 lj.spa
-rw-r--r-- 1 vlad vlad 334M 2010-12-22 09:01 lj.spd
-rw-r--r-- 1 vlad vlad  438 2010-12-22 09:01 lj.sph
-rw-r--r-- 1 vlad vlad  13M 2010-12-22 09:01 lj.spi
-rw-r--r-- 1 vlad vlad    0 2010-12-22 09:01 lj.spk
-rw-r--r-- 1 vlad vlad    0 2011-05-13 09:25 lj.spl
-rw-r--r-- 1 vlad vlad    0 2010-12-22 09:01 lj.spm
-rw-r--r-- 1 vlad vlad 111M 2010-12-22 09:01 lj.spp
-rw-r--r-- 1 vlad vlad    1 2010-12-22 09:01 lj.sps
$
```

Configuring searchd

```
searchd
{
        listen = localhost:9312
        listen = localhost:9306:mysql4

        preopen_indexes      = 1
        max_packet_size      = 8M

        query_log_format     = sphinxql
        query_log            = query.log

        pid_file             = searchd.pid

}
```

Sphinx

USA

Starting sphinx!

```
$ ../bin/searchd -c sphinx.conf
Sphinx 2.0.2-dev (r2824)
Copyright (c) 2001-2010, Andrew Aksyonoff
Copyright (c) 2008-2010, Sphinx Technologies
  Inc (http://sphinxsearch.com)

using config file 'sphinx.conf'...
listening on 127.0.0.1:9312
listening on 127.0.0.1:9306
precaching index 'lj'
precached 1 indexes in 0.028 sec
```

Integration

- API
- SphinxSE
- SphinxQL

Sphinx API

```
<?php
require ( "sphinxapi.php" ); //from sphinx distro
…
$cl = new SphinxClient();
…

$res = $cl->Query ( "my first query", “my_index" );
var_dump ( $res );

?>
```

Sphinx API complete example

```
require ( "sphinxapi.php" );
$cl = new SphinxClient ();
$cl->SetServer ( $host, $port );
$cl->SetArrayResult ( true );
$cl->SetWeights ( array ( 100, 1 ) );
$cl->SetMatchMode ( $mode );
$cl->SetRankingMode ( $ranker );
$res = $cl->Query ( «I love sphinx», «lj»);
```

SetWeights

- Use SetFieldWeights instead :)

SetFieldWeights("titile" => 100, "content" => 1)

- Document weight = “title” * 100 + “content”
- Works on per-query basis

SetMatchMode

- SPH_MATCH_ALL
- SPH_MATCH_ANY
- SPH_MATCH_PHRASE
- SPH_MATCH_BOOLEAN
- SPH_MATCH_FULLSCAN
- SPH_MATCH_EXTENDED

SetRankingMode

- SPH_RANK_PROXIMITY_BM25 (default)
- SPH_RANK_BM25
- SPH_RANK_NONE
- SPH_RANK_WORDCOUNT
- SPH_RANK_PROXIMITY
- SPH_RANK_FIELDMASK
- SPH_RANK_SPH04

Back to code

- Running the quiery

```
<?php
…
$res = $cl->Query ( "I love Sphinx", “lj" );
var_dump ( $res );
…
?>
```

The results

```
["error"]=> "", ["warning"]=> "", ["status"]=> 0
["fields"]=> array(3) { "title", "content" }
["attrs"]=> array(2) { "channel_id" =>  1, "ts"=> 2 }
["matches"]=> array(20) { … }
["total"]=> string(2) "51"
["total_found"]=> string(2) "51"
["time"]=> string(5) "0.006"
["words"]=> array(2) {
  ["love"]=> {“docs"} =>"227990", "hits"=>"472541"}
  ["sphinx"]=>{"docs"=>”114", "hits"=>"178"}
}
```

Sphinx

Matches

- Document id
- Document weight
- Non-FT attribute values
  - For each attributes

Matches

```
["id"]=> int(6598265)
["weight"]=> string(3) "101"
["attrs"]=>  array(2) {
      ["channel_id"]=> int(454928)
      ["ts"]=> int(1102858275)
}
```

Adding constraints

```
<?php
require ( "sphinxapi.php" );
…
$cl->SetFilter ( "channel_id",  358842 );
…
$res = $cl->Query ( "I love sphinx","lj1m");

var_dump ( $res );
?>
```

Grouping

```
<?php
require ( "sphinxapi.php" );
…
$cl->SetFilter ( "channel_id",  358842 );
$cl->SetGroupBy ( "ts", SPH_GROUPBY_YEAR,
"@group desc" );
…
$res = $cl->Query ( "I love sphinx","lj1m");
var_dump ( $res );
?>
```

Grouping matches

```
["id"]=> 7637682
["weight"]=> 404652
["attrs"]=>
array(4) {
  ["channel_id"]=> 358842
  ["ts"]=>  1112905663
  ["@groupby"]=> 2005
  ["@count"]=> 14
}
```

Grouping matches

```
[0] ["@groupby"]=>2005, ["@count"]=> 14
[1] ["@groupby"]=>2004, ["@count"]=> 27
[2] ["@groupby"]=>2003, ["@count"]=> 8
[3] ["@groupby"]=>2002, ["@count"]=> 1
```

What if query has failed?

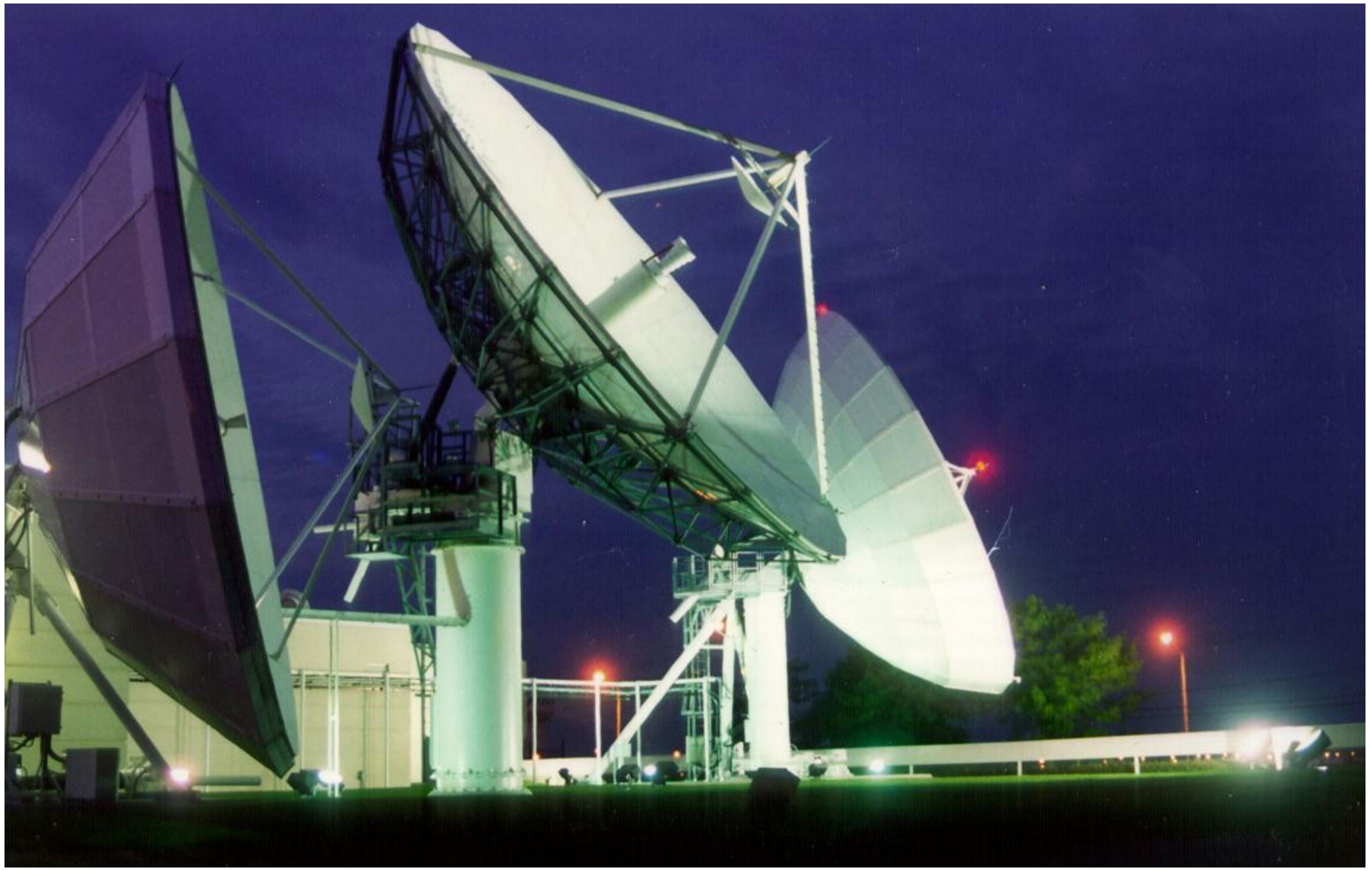
```
$res = $cl->Query ( $q, $index );

if ( $res===false )
{
	$sph_error = $cl->GetLastError();
	…
} else {
	if ( $cl->GetLastWarning() ) { … }
}
```

Sphinx

More functionality?

- SetFilter & SetFilterRange
- SetGeoAnchor
- SetSortMode
- SetIndexWeights
- Multiquery support
- BuildExcerpts

Any other ways to call Sphinx?



Sphinx

SphinxSE

```
SELECT *
FROM sphinxsetable s
JOIN
     products p ON p.id=s.id
WHERE
     s.query='@title ipod'
ORDER BY
     p.price ASC

// or better!
... WHERE s.query='@title ipod;sort=attr_asc:price';
```

SphinxQL

Our own implementation of MySQL protocol

- Our own SQL parser
- **MySQL not required**!
- Any **client** library (eg. PHP's or .NET) should suffice
- All new features will initially appear in SphinxQL

Same search with SphinxQL

```
mysql> SELECT *
    -> FROM lj1m
    -> WHERE MATCH('I love Sphinx')
    -> LIMIT 5
    -> OPTION field_weights=(title=100, content=1);
+---------+--------+------------+------------+
| id      | weight | channel_id | ts         |
+---------+--------+------------+------------+
| 7637682 | 101652 |     358842 | 1112905663 |
| 6598265 | 101612 |     454928 | 1102858275 |
| 6941386 | 101612 |     424983 | 1076253605 |
| 6913297 | 101584 |     419235 | 1087685912 |
| 7139957 |   1667 |     403287 | 1078242789 |
+---------+--------+------------+------------+
5 rows in set (0.00 sec)
```

Sphinx

Grouping example

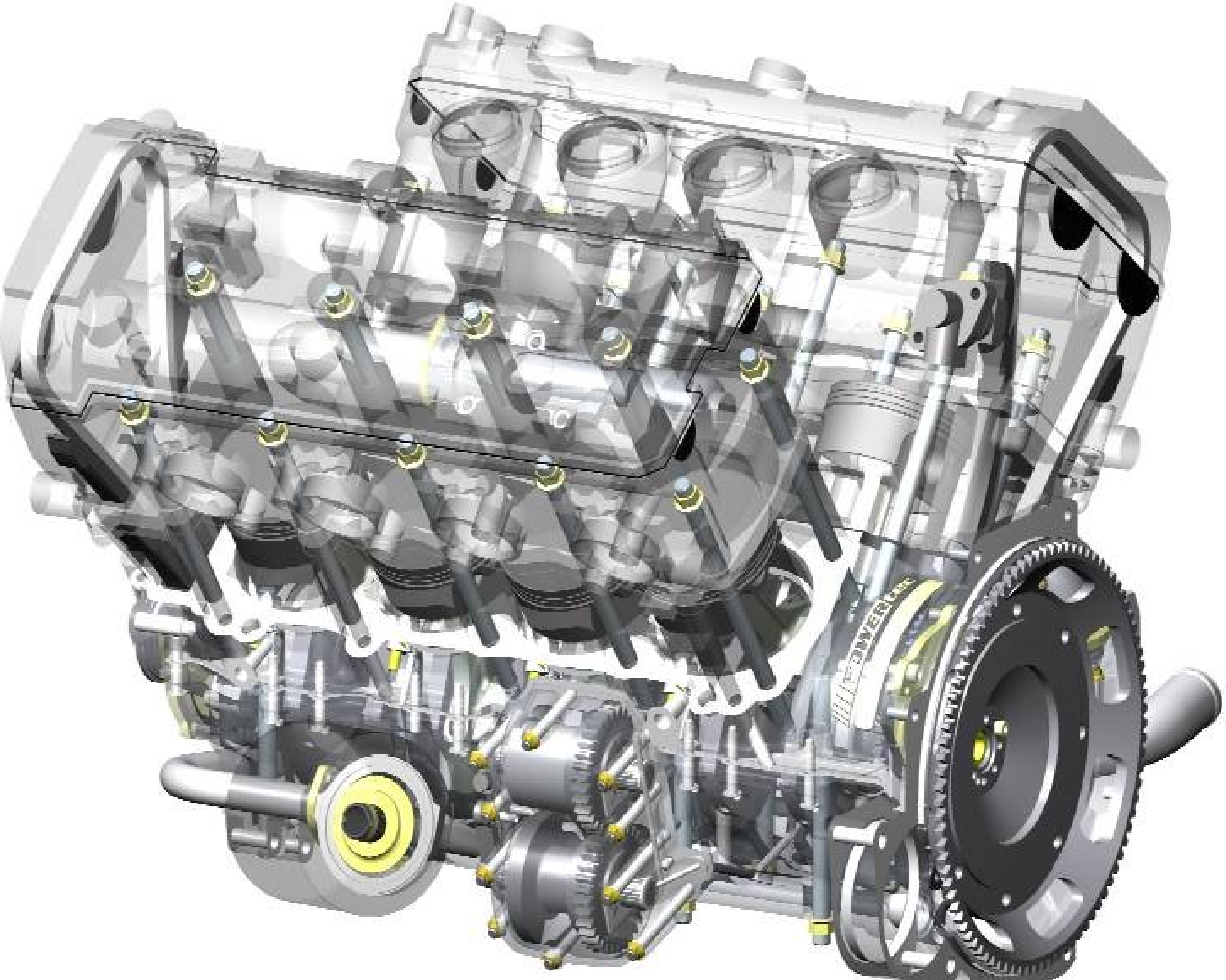
```
mysql> SELECT *, YEAR(ts) as yr
    -> FROM lj1m
    -> WHERE MATCH('I love Sphinx')
    -> GROUP BY yr
    -> ORDER BY yr DESC
    -> LIMIT 5
    -> OPTION field_weights=(title=100, content=1);
+---------+--------+------------+------------+------+----------+--------+
| id      | weight | channel_id | ts         | yr   | @groupby | @count |
+---------+--------+------------+------------+------+----------+--------+
| 7637682 | 101652 |     358842 | 1112905663 | 2005 |     2005 |     14 |
| 6598265 | 101612 |     454928 | 1102858275 | 2004 |     2004 |     27 |
| 7139960 |   1642 |     403287 | 1070220903 | 2003 |     2003 |      8 |
| 5340114 |   1612 |     537694 | 1020213442 | 2002 |     2002 |      1 |
| 5744405 |   1588 |     507895 |  995415111 | 2001 |     2001 |      1 |
+---------+--------+------------+------------+------+----------+--------+
5 rows in set (0.00 sec)
```

Query Sphinx via mysql client

```
$ mysql -h 0 -P 9306
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 1
Server version: 2.0.2-id64-dev (r2824)

Type 'help;' or '\h' for help. Type '\c' to clear the current
   input statement.

mysql> SELECT * FROM lj WHERE MATCH('Sphinx')
    -> ORDER BY ts DESC LIMIT 3;
+---------+--------+------------+------------+
| id      | weight | channel_id | ts         |
+---------+--------+------------+------------+
| 7333394 |   1649 |     384139 | 1113235736 |
| 7138085 |   1649 |     402659 | 1113190323 |
| 7051055 |   1649 |     412502 | 1113163490 |
+---------+--------+------------+------------+
3 rows in set (0.00 sec)
```

Typical Sphinx applications

- Shopping items and goods search
- Forums & blogs search
- Data mining application
- News search
- Search against ~~torrents~~ list of files
  - Prefix & infix search in action
- Dating websites
- Local content search
  - Embedded Sphinx



Multi-valued attribute (MVA)

- Several values attached to the document
  - Designed for 1:M relations
- Useful for
  - Page tags
  - Item belongs to several categories
- SQL join optimization
  - Avoid joins at all
  - group_concat emulation for non MySQL sources
  - As simple as:

    ```
    sql_joined_field = tags from query;
    SELECT docid, CONCAT('tag',tagid)
    FROM tags ORDER BY docid ASC
    ```

Sphinx

MVA in action

```
mysql> SELECT mva_field FROM sphinx_index \
    -> WHERE MATCH('test') AND mva_field IN (1,2,3,4) LIMIT 1;
    -> SHOW META;
+----------+--------+----------+
| id       | weight | mva_field|
+----------+--------+----------+
| 20034267 |   4647 | 1,4      |
+----------+--------+----------+
1 row in set (0.05 sec)

+---------------+-------+
| Variable_name | Value |
+---------------+-------+
| total         | 1000  |
| total_found   | 29925 |
| time          | 0.057 |
| keyword[0]    | test  |
| docs[0]       | 30590 |
| hits[0]       | 61719 |
+---------------+-------+
6 rows in set (0.01 sec)
```

Geodistance search

- A pair of float attributes
  - In radians
- Can be used in sorting
- “between” is also available
- GEODIST(lat1,long1,lat2,long2) is available in SphinxQL
  - returns results in meters

Geodistance in action

```
mysql> SELECT location_id, latitude, longitude,
    -> GEODIST(latitude, longitude, 0.651137, -2.127562) as geodist
    -> FROM sphinx_index ORDER BY geodist ASC LIMIT 10;
+----------+--------+-------------+-----------+----------+----------+
| id       | weight | location_id | longitude | latitude | geodist  |
+----------+--------+-------------+-----------+----------+----------+
| 81875993 |      1 |       16316 | -2.127562 | 0.651137 | 2.859948 |
| 81875994 |      1 |       16316 | -2.127562 | 0.651137 | 2.859948 |
| 81875996 |      1 |       16316 | -2.127562 | 0.651137 | 2.859948 |
| 81875997 |      1 |       16316 | -2.127562 | 0.651137 | 2.859948 |
| 81875999 |      1 |       16316 | -2.127562 | 0.651137 | 2.859948 |
| 81876000 |      1 |       16316 | -2.127562 | 0.651137 | 2.859948 |
| 81876001 |      1 |       16316 | -2.127562 | 0.651137 | 2.859948 |
| 81876002 |      1 |       16316 | -2.127562 | 0.651137 | 2.859948 |
| 81876003 |      1 |       16316 | -2.127562 | 0.651137 | 2.859948 |
| 81876004 |      1 |       16316 | -2.127562 | 0.651137 | 2.859948 |
+----------+--------+-------------+-----------+----------+----------+
10 rows in set (0.20 sec)

mysql>
```

Unix timestamps

- UNIX timestamp basically
  - sql_attr_timestamp = added_ts
- Time segments + relevance sorting is available
  - results would change over time
- Time fragmentation
  - last hour/day/week/month/3 months
  - everything else
- Grouping by time segments are available

Numeric attributes

- Integer
  - sql_attr_uint
  - 32bit unsigned, a simple integer value.
- Bigint
  - sql_attr_bigint
  - 64-bit signed integer
  - Available for mysql, pgsql, mssql sources only
- Floating point attributes
  - sql_attr_float
  - Single precision, 32-bit IEEE 754 format
- Just like in MySQL

Non numeric attributes

- String attributes
  - sql_attr_string
  - Not included into full-text index, stored in memory
  - Available since 1.10-beta
- Wordcount attribute
  - sql_attr_str2wordcount
  - A separate attribute that counts number of words inside the document
  - mysql, pgsql, mssql sources only
  - Since 1.10-beta

File field

- sql_file_field = <path_column_name>
- Reads document contents from file system instead of database.
  - Offloads database
  - Prevents cache trashing on database side
  - Much faster in some cases
- mysql, pgsql, mssql sources only
- Since 1.10-beta

Sphinx-based services

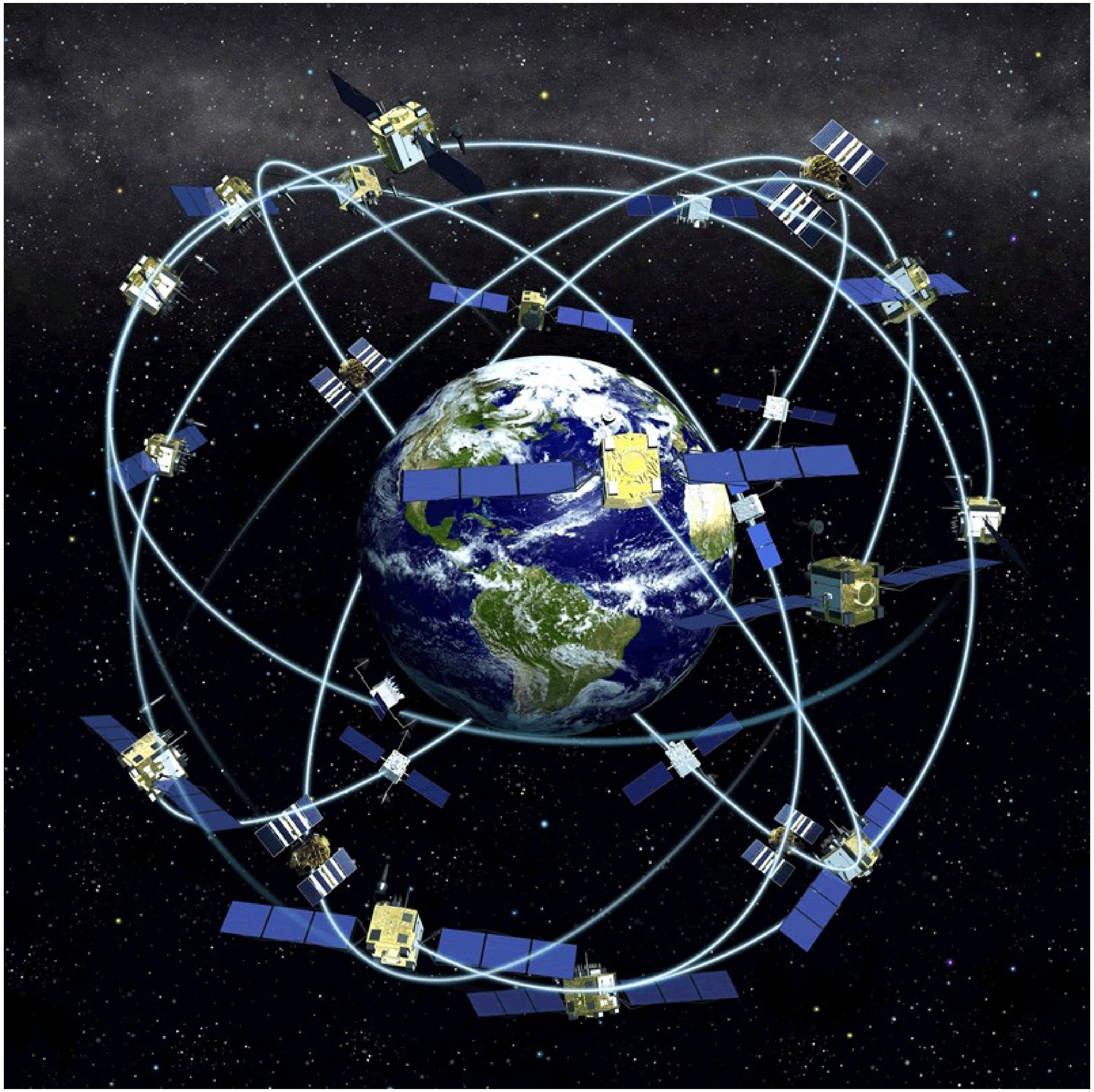
- "Similar items/pages" service
  - Using quorum & custom weighting
  - Can do news aggregation with some tuning
- Misspelling correction service
  - By external script (included in distribution)

RT indexes

- Push model instead of Pull for on-disk indexes
  - via INSERT/UPDATE/DELETE
- Update data on the fly
- Formally “soft-realtime”
  - As in, most of the writes are very quick
  - But, not guaranteed to complete in fixed time
- Transparent for application

RT indexes, the differences

- Indexing is SphinxQL only
  - mysql_connect() to Sphinx instead of MySQL
  - mysql_query() and do INSERT/REPLACE/DELETE as usual
- Searching is transparent
  - SphinxAPI / SphinxSE / SphinxQL all work
  - We now prefer SELECT that we have SphinxQL :)
- Some features are not yet (!) supported
  - MVA, geosearch, prefix and infix indexing support to be implemented



Scale!

- Utilize multicore servers
- Spread load across several boxes
- Shard the data

Scaling part one: data sources

```
source lj_source
{
   …
   sql_query            = SELECT id, channel_id, ts, title,
   content FROM ljposts WHERE id>=$start and id<=$end
   sql_query_range      = SELECT 1, 7765020
   sql_attr_uint        = channel_id
   sql_attr_timestamp = ts
   …
}

source lj_source2 : lj_source
{
    sql_query_range     = SELECT 7765020, 10425075
}
```

Part two: local indexes

```
index ondisk_index1
{
  source          = lj_source1
  path            = /path/to/ondisk_index1
  stopwords       = stopwords.txt
  charset_type    = utf-8
}

index ondisk_index2 : ondisk_index1
{
  source          = lj_source2
  path            = /path/to/ondisk_index2
}
```

Part two: local indexes

```
index my_distribited_index1
{
   type        = distributed
   local       = ondisk_index1
   local       = ondisk_index2
   local       = ondisk_index3
   local       = ondisk_index4
}
…
   dist_threads = 4
…
```

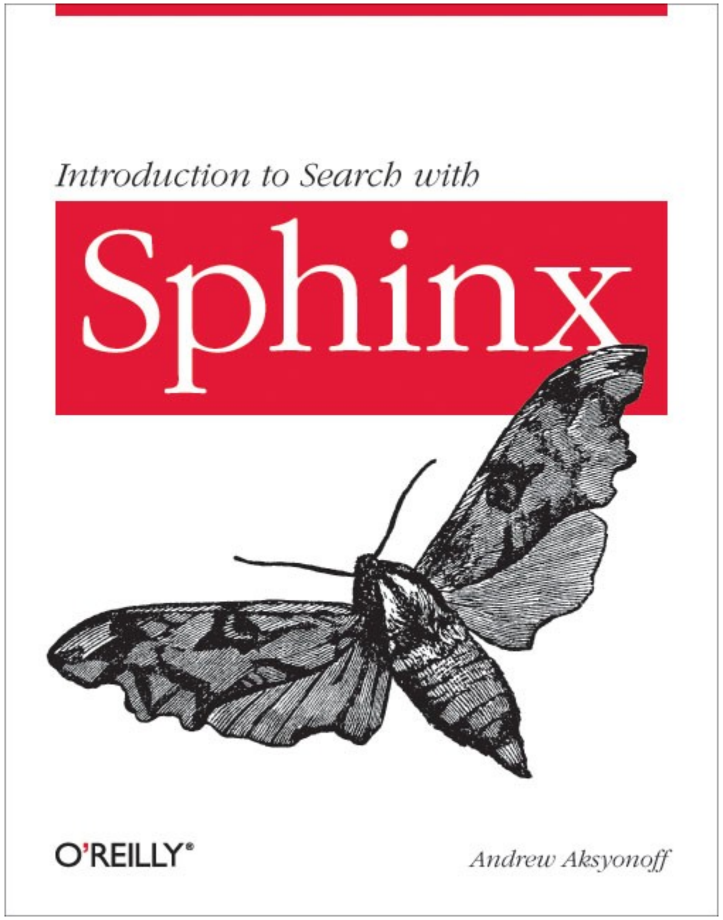
Part three: distributed indexes

```
index my_distribited_index2
{
  type     = distributed
  agent    = 192.168.100.51:9312:ondisk_index1
  agent    = 192.168.100.52:9312:ondisk_index2
  agent    = 192.168.100.53:9312:rt_index
}
```

Distributed indexes explained

- Query a few indexes on the same box
  - dist_threads option tell Sphinx how many cores to use for the single query
- Query indexes across the servers
  - Transparent for application
  - Master node performs only aggregation
    - Can be combined with local indexes on the same box!

More about Sphinx


Introduction to Search with

Sphinx

O'REILLY®

Andrew Aksyonoff

2.0 release

- SphinxQL improvements
  - multi-query support
  - more SphinxQL functions and operators
- "keywords" dictionary
  - improves substring indexing a lot
- Zones, sentences, paragraphs support
- Multi-threaded snippet batches support
- UDF support (CREATE/DROP FUNCTION)
- Extended support for strings
  - ORDER BY, GROUP BY, WITHING GROUP ORDER BY
- 35+ more new features

Sphinx today

We're hiring!

Consultants, support engineers,

Q/A engineer and technical writer wanted!

http://sphinxsearch.com/about/careers/

Just let me know or

mail us at job2011@sphinxsearch.com

Questions?

Sphinx

http://sphinxsearch.com