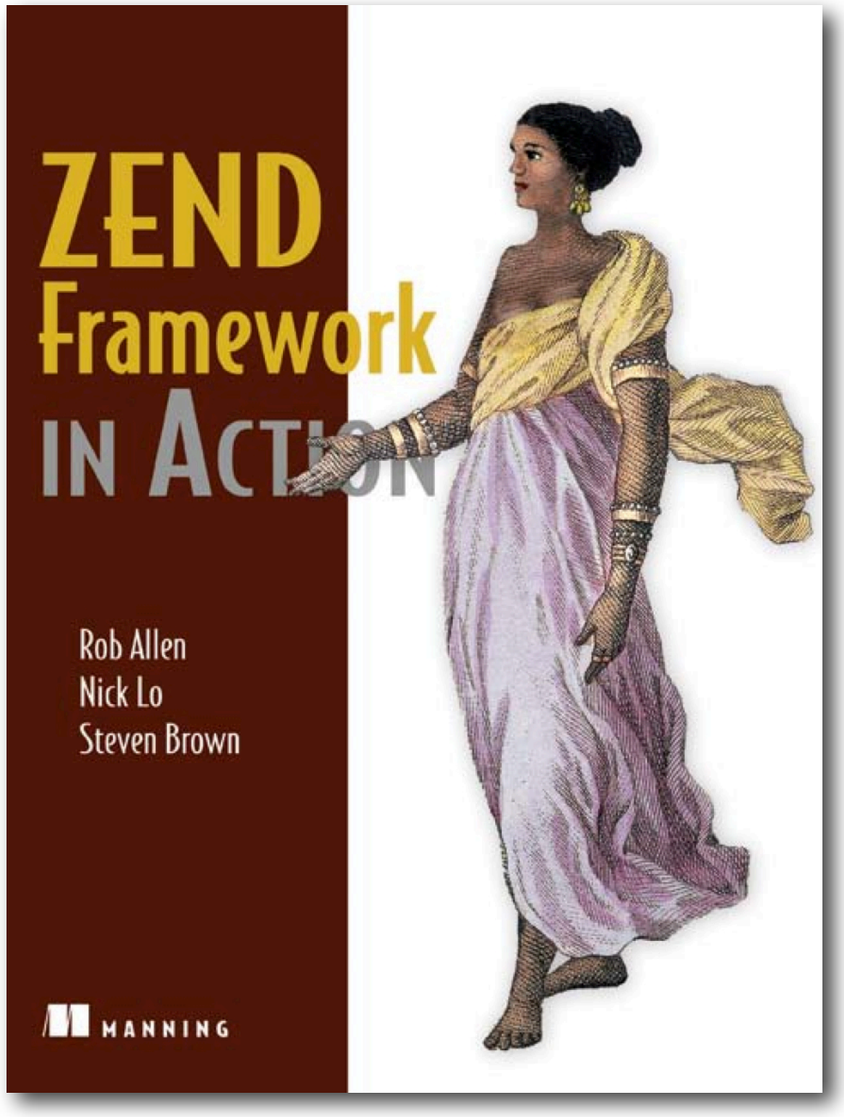
Caching for performance

Rob Allen

Rob Allen?


php


ZEND
Framework
IN ACTION
Rob Allen
Nick Lo
Steven Brown
MANNING

Caching for performance?

Measuring performance

Siege

http://www.joedog.org/index/siege-home

edit ~/.siegerc

verbose = false

logging = false *or* logfile=~/siege.log

concurrent = 5

benchmark = true

Running siege

```
siege -t 30s http://localhost/info.php
```

Time based: `-t NUMx` where `x` = `S`,`M` or `H`

Request based: `-r NUM`

Add `-c NUM` for the number of concurrent users

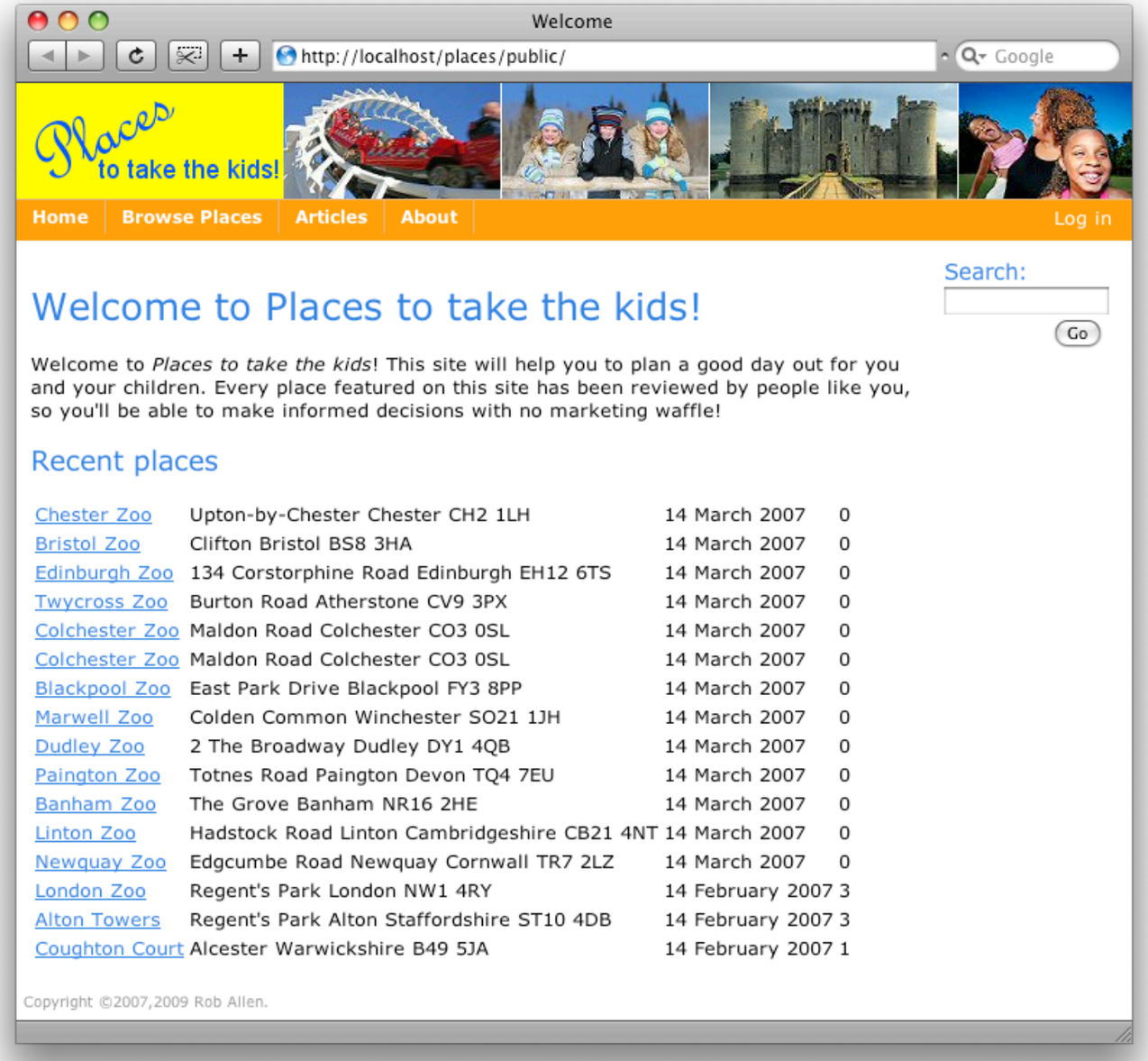
Siege output for info.php

```
$siege -t 30s http://localhost/info.php
** SIEGE 2.68
** Preparing 5 concurrent users for battle.
The server is now under siege...
Lifting the server siege...      done.
Transactions:                    26241 hits
Availability:                   100.00 %
Elapsed time:                    29.45 secs
Data transferred:              1491.16 MB
Response time:                    0.01 secs
Transaction rate:               891.04 trans/sec
Throughput:                      50.63 MB/sec
Concurrency:                      4.99
Successful transactions:         26241
Failed transactions:                 0
Longest transaction:              0.04
Shortest transaction:             0.00
```

Siege output for info.html

```
$siege -t 30s http://localhost/info.html
** SIEGE 2.68
** Preparing 5 concurrent users for battle.
The server is now under siege...
Lifting the server siege...      done.
Transactions:                   233746 hits
Availability:                   100.00 %
Elapsed time:                    29.45 secs
Data transferred:             10228.57 MB
Response time:                    0.00 secs
Transaction rate:              7937.05 trans/sec
Throughput:                     347.32 MB/sec
Concurrency:                      4.91
Successful transactions:        233746
Failed transactions:                 0
Longest transaction:              1.08
Shortest transaction:             0.00
```

A “real” page



- Zend Framework website
- Some CSS and images!
- Zend_Application
- View uses Zend_Layout
- Zend_Db_Table

Siege output

for a real-world page

```
$siege -t 30s http://localhost/places/public/
** SIEGE 2.68
** Preparing 5 concurrent users for battle.
The server is now under siege...
Lifting the server siege...      done.
Transactions:                    375 hits
Availability:                 100.00 %
Elapsed time:                  30.13 secs
Data transferred:               1.88 MB
Response time:                  0.40 secs
Transaction rate:              12.45 trans/sec
Throughput:                     0.06 MB/sec
Concurrency:                    4.94
Successful transactions:         375
Failed transactions:               0
Longest transaction:            1.60
Shortest transaction:           0.15
```

Profiling

Xdebug profiler

http://www.xdebug.org

Ouput file format compatible with:

- KCachegrind (Linux)
- WinCacheGrind (Windows)
- MacCallGrind (OS X)
- WebGrind (PHP)

Xdebug profiler

php.ini:

```
xdebug.profiler_enable = 0
xdebug.profiler_enable_trigger = 1
xdebug.profiler_output_dir = "/Users/rob/xdebug"
```

Enable per request:

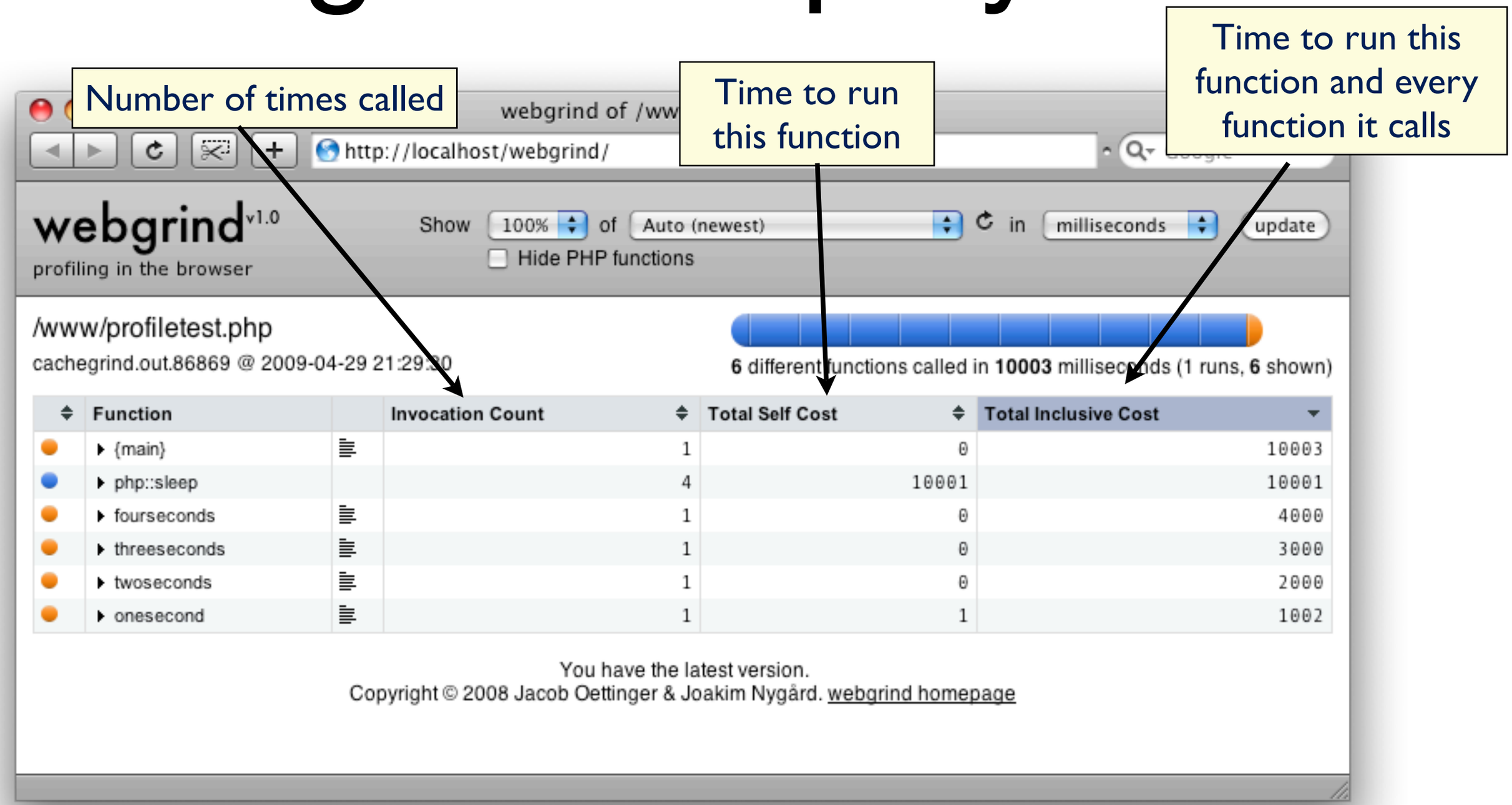
http://localhost/places/public/?XDEBUG_PROFILE=1

Simple example

```
<?php
function onesecond() {sleep(1);}
function twoseconds() {sleep(2);}
function threeseconds() {sleep(3);}
function fourseconds() {sleep(4);}
onesecond();
twoseconds();
threeseconds();
fourseconds();
```

http://localhost/profiletest.php?XDEBUG_PROFILE=1

Webgrind display



Look for:

- Functions with unexpectedly large call counts
- Functions with large self-times
- Unexpected calls to functions

Real-world example

webgrind of /www/places/public/index.php

http://localhost/webgrind/

Google

/www/places/public/index.php

cachegrind.out.3870 @ 2009-05-02 21:29:14

846 different functions called in **476** milliseconds (runs, **846** shown)

Function	Invocation Count	Total Self Cost	Total Inclusive Cost
{main}	1	1085	476463
Zend_Application->run	1	56	395293
Zend_Application_Bootstrap_Bootstrap->run	1	142	395233
Zend_Controller_Front->dispatch	1	3146	394831
Zend_Controller_Dispatcher_Standard->dispatch	1	301	358470
Zend_Controller_Action->dispatch	1	262	347706
IndexController->indexAction	1	171	297461
Places->fetchLatest	1	742	293909
Places->numReviews	16	1517	277210
Place->numberOfReviews	16	1043	182694
Place->reviews	16	876	181301
Zend_Db_Table_Row_Abstract->findDependentRowset	16	5937	180299

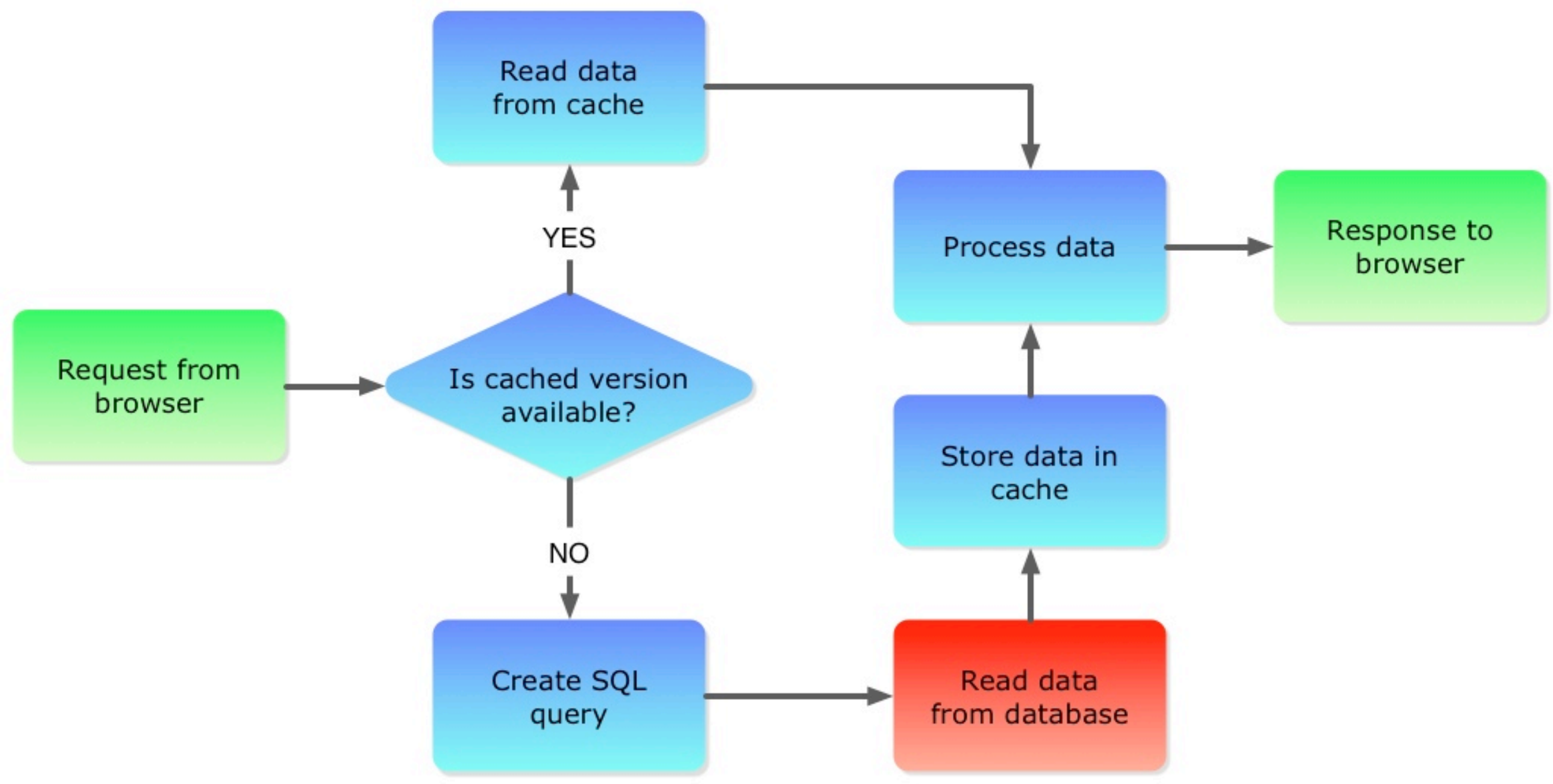
Principles of caching

1. Don’t execute code unless you need to
2. Get data from the fastest place you can
3. Don’t get the same data twice

Save the output of PHP code

AKA Don’t execute code unless you need to

Code caching



The current code

```
public function fetchLatest($count = 50)
{
    $rows = $this->fetchAll(null,'date_created DESC', $count);
    $rows = $rowset->toArray();
    foreach($rows as &$row) {
      $row['numberOfReviews'] = $this->numReviews($row['id']);
    }
    return $rows;
}
```

Adding a cache

Many choices: Zend_Cache, PEAR::Cache_Lite, ezcCacheManger and others

1. Set up the cache
2. Wrap cache loading around database query
3. That's it!

Zend_Cache set-up

```
function _initCache($cacheDir)
{
  $frontendOptions = array(
      'lifetime' => '7200',
      'automatic_serialization'=>true);
  $backendOptions = array(
      'cache_dir' => $cacheDir);
  $cache = Zend_Cache::factory('Core', 'File',
      $frontendOptions, $backendOptions);
  return $cache;
}
```

Zend_Cache in use

```
public function fetchLatest($count = 50)
{
  $cacheId = 'latestNews_'.$count;
  $rows = $this->_cache->load($cacheId);
  if ($rows === false) {
    $rows = $this->fetchAll(null,'date created DESC', $count);
    $rows = $rowset->toArray();
    foreach($rows as &$row) {
      $row['numberOfReviews'] = $this->numReviews($row['id']);
    }
   $this->_cache->save($rows, $cacheId, array('places'));
  }
  return $rows;
}
```

Unique id

Store to cache

Tag

Re-use existing code

Re-profile

webgrind of /www/places/public/index.php

http://localhost/webgrind/

Google

/www/places/public/index.php

cachegrind.out.3873 @ 2009-05-02 21:39:08

754 different functions called in **188** milliseconds (1 runs, **754** shown)

Function	Invocation Count	Total Self Cost	Total Inclusive Cost
{main}	1	1078	188120
php::call_user_func	69	1018	112632
Zend_Application->run	1	42	104076
Zend_Application_Bootstrap_Bootstrap->run	1	143	104033
Zend_Controller_Front->dispatch	1	3414	103633
Zend_Application_Bootstrap_BootstrapAbstract->bootstrap	5	124	100646
Zend_Application_Bootstrap_BootstrapAbstract->_bootstrap	5	419	100514
Zend_Application_Bootstrap_BootstrapAbstract->_executeResource	12	1365	98818
Zend_View_Abstract->render	5	510	77558
Zend_View_Abstract->__call	78	2965	76657
Zend_View->_run	5	1146	76538
Zend_Controller_Dispatcher_Standard->dispatch	1	353	66574

Siege output

for code cached real page

```
$siege -t 30s http://localhost/places/public/
** SIEGE 2.68
** Preparing 5 concurrent users for battle.
The server is now under siege...
Lifting the server siege...      done.
Transactions:                    875 hits
Availability:                 100.00 %
Elapsed time:                  29.80 secs
Data transferred:               4.51 MB
Response time:                  0.17 secs
Transaction rate:              29.36 trans/sec
Throughput:                     0.15 MB/sec
Concurrency:                    4.97
Successful transactions:         875
Failed transactions:               0
Longest transaction:            3.73
Shortest transaction:           0.06
```

Emptying Zend_Cache

```
   public function cleanCacheByTag($tag)
{
    return $this->_cache->clean(
        Zend_Cache::CLEANING_MODE_MATCHING_TAG,
        array($tag));
}
```

```
public function cleanAllCache()
{
    return $this->_cache->clean(Zend_Cache::CLEANING_MODE_ALL);
}
```

Page caching

Why stop at just the database?
Let’s cache the entire page!

Setup a page cache

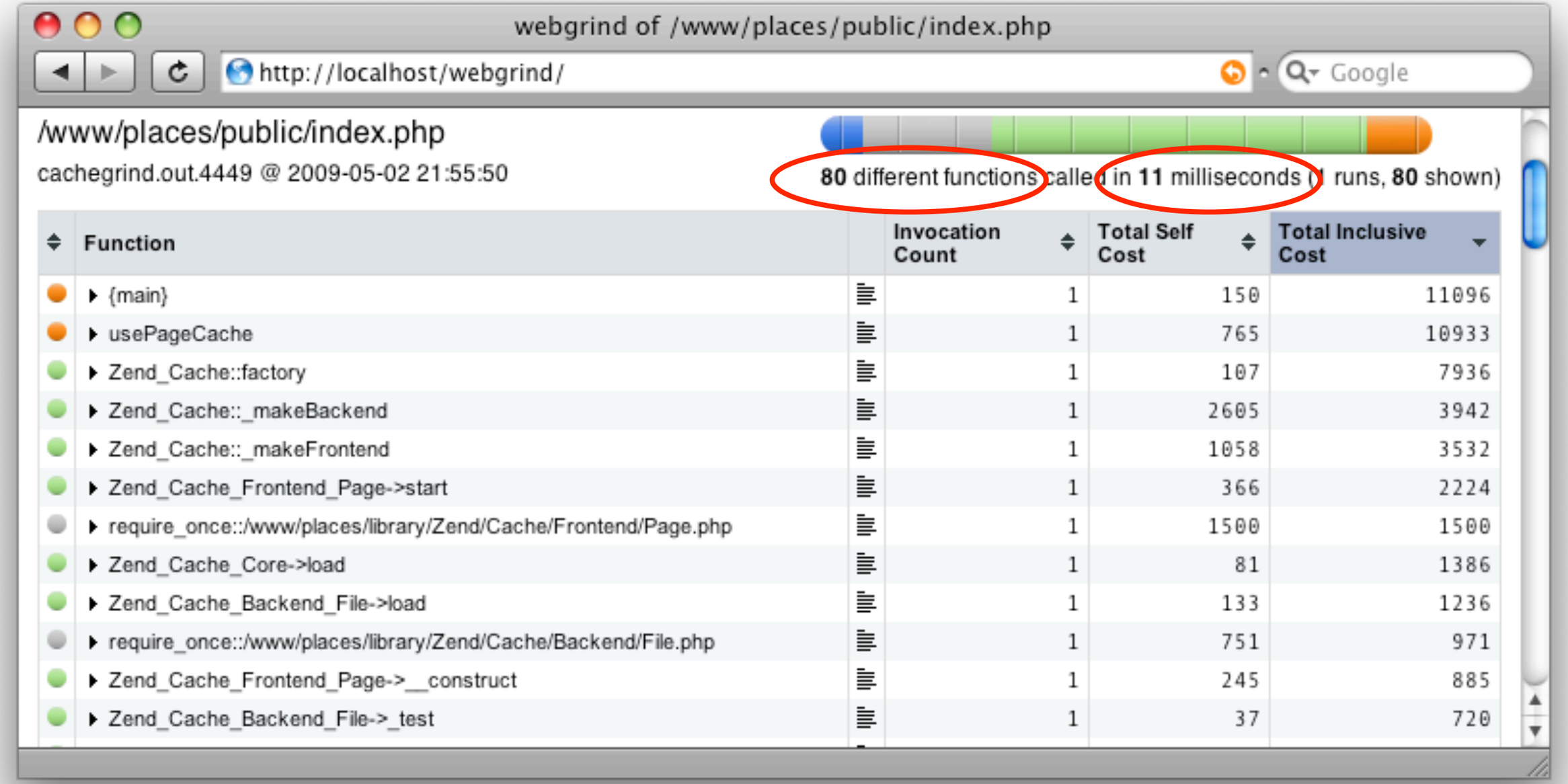
```
function usePageCache($cacheDir)
{
    $frontendOptions = array(
        'lifetime' => 3600,
        'default_options' => array('cache' => false),
        'regexps' => array(
            '^/$' => array('cache' => true),
            '^/places/' => array('cache' => true),
        ));
    $backendOptions = array('cache_dir' => $cacheDir);
    $cache = Zend_Cache::factory('Page', 'File',
        $frontendOptions, $backendOptions
    );
    $cache->start();
    return $cache;
}
```

Siege output

for a page cache

```
$siege -t 30s http://localhost/places/public/
** SIEGE 2.68
** Preparing 5 concurrent users for battle.
The server is now under siege...
Lifting the server siege...      done.
Transactions:                    10738 hits
Availability:                   100.00 %
Elapsed time:                    29.90 secs
Data transferred:                29.27 MB
Response time:                    0.01 secs
Transaction rate:               359.13 trans/sec
Throughput:                       0.98 MB/sec
Concurrency:                      4.94
Successful transactions:         10738
Failed transactions:                 0
Longest transaction:              1.46
Shortest transaction:             0.00
```

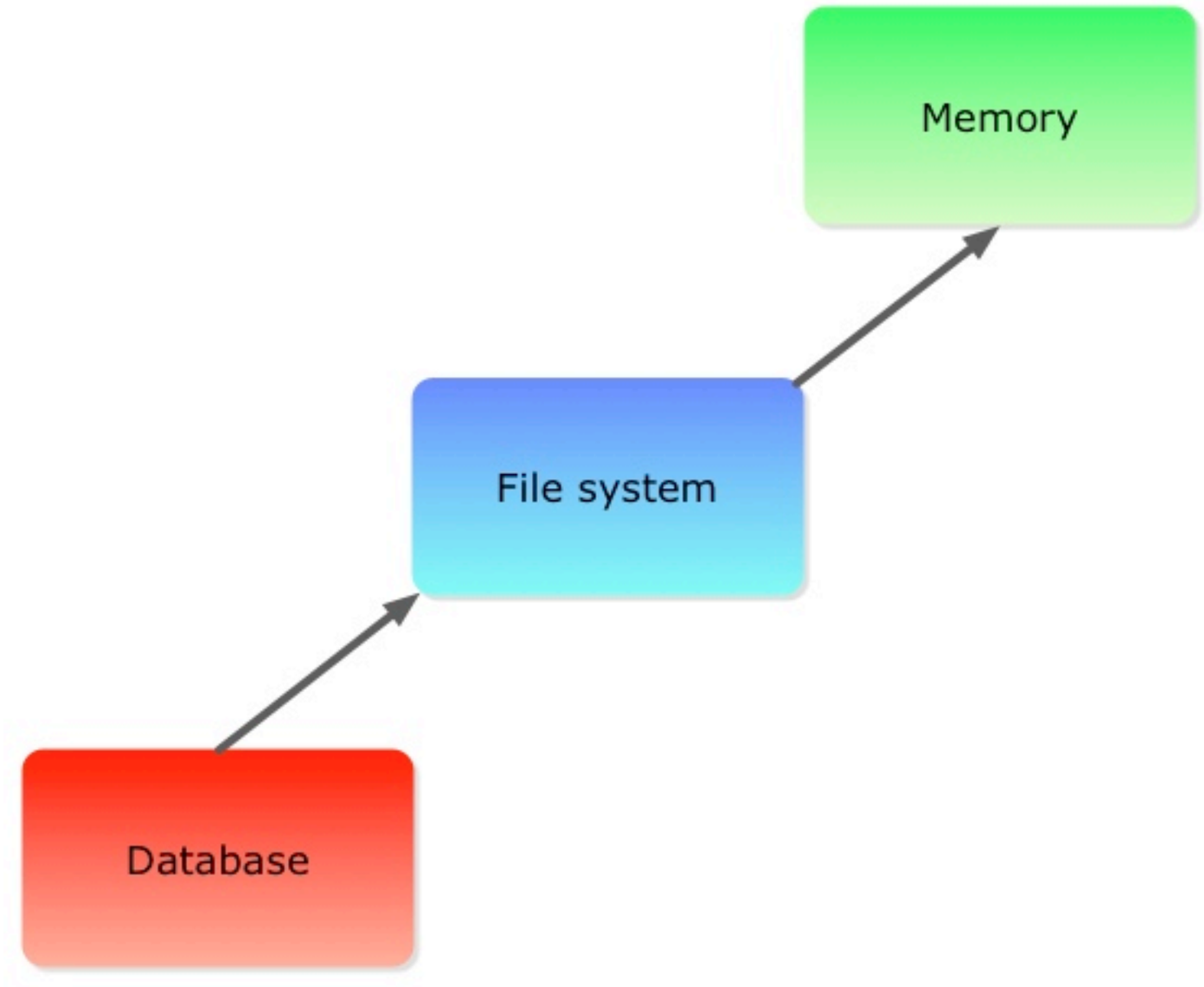
Profile for a page cache



Choose the right storage layer

AKA Get data from the fastest place you can

Where is your cache?



memcached

Cache to memory rather than disk.

memcached server:

```
./configure && make && make install
memcached -d -l 10.0.148.121 -m 512
```

PECL memcache extension:

```
pecl install memcache
```

php.ini:

```
extension=memcache.so
```

Zend_Cache set-up

```
function _initCache($cacheDir)
{
  $frontendOptions = array(
      'lifetime' => '7200',
      'automatic_serialization'=>true);
  $backendOptions = array(
      'servers' => array(array('host' => '10.16.148.121')));
  $cache = Zend_Cache::factory('Core', 'Memcached',
      $frontendOptions, $backendOptions);
  return $cache;
}
```

Siege output

for memcached code cached page

```
$siege -t 30s http://localhost/places/public/
** SIEGE 2.68
** Preparing 5 concurrent users for battle.
The server is now under siege...
Lifting the server siege...      done.
Transactions:                    1824 hits
Availability:                  100.00 %
Elapsed time:                   30.29 secs
Data transferred:                4.97 MB
Response time:                   0.08 secs
Transaction rate:               60.22 trans/sec
Throughput:                      0.16 MB/sec
Concurrency:                     4.99
Successful transactions:         1824
Failed transactions:                0
Longest transaction:             2.88
Shortest transaction:            0.00
```

Don’t forget that PHP is interpreted…

AKA: Don’t execute code unless you need to

Op-code caching

Cache your php byte code using APC, Zend Optimizer+, XCache, eAccelerator, etc...

APC:

```
pecl install apc
```

php.ini:

```
extension=apc.so
```

Siege output

for real page (no other caching) & APC

```
$siege -t 30s http://localhost/places/public/
** SIEGE 2.68
** Preparing 5 concurrent users for battle.
The server is now under siege...
Lifting the server siege...      done.
Transactions:                    574 hits
Availability:                 100.00 %
Elapsed time:                  29.42 secs
Data transferred:               3.14 MB
Response time:                  0.25 secs
Transaction rate:              19.51 trans/sec
Throughput:                     0.11 MB/sec
Concurrency:                    4.96
Successful transactions:         574
Failed transactions:               0
Longest transaction:            1.05
Shortest transaction:           0.10
```

Siege output

for code cached page with APC

```
$siege -t 30s http://localhost/places/public/
** SIEGE 2.68
** Preparing 5 concurrent users for battle.
The server is now under siege...
Lifting the server siege...      done.
Transactions:                    8766 hits
Availability:                  100.00 %
Elapsed time:                   30.25 secs
Data transferred:               23.89 MB
Response time:                  0.02 secs
Transaction rate:             289.65 trans/sec
Throughput:                     0.79 MB/sec
Concurrency:                    4.98
Successful transactions:        8766
Failed transactions:               0
Longest transaction:            0.63
Shortest transaction:           0.00
```

Siege output

for a page cache with APC

```
$siege -t 30s http://localhost/places/public/
** SIEGE 2.68
** Preparing 5 concurrent users for battle.
The server is now under siege...
Lifting the server siege...      done.
Transactions:                    94834 hits
Availability:                   100.00 %
Elapsed time:                    29.35 secs
Data transferred:               258.53 MB
Response time:                    0.00 secs
Transaction rate:              3231.14 trans/sec
Throughput:                       8.81 MB/sec
Concurrency:                      4.84
Successful transactions:         94834
Failed transactions:                 0
Longest transaction:              0.56
Shortest transaction:             0.00
```

The browser’s cache

AKA Don’t get the same data twice

HTTP headers

- Expires
- Cache-Control

Expires

```
Expires: Sat, 13 June 2019 14:45:00 GMT
```

- Use for static components (CSS, JS, images)
- Encode version into filename
- Set via Apache's `ExpiresByType` directive

ExpiresByType

```
<IfModule mod_expires.c>
  ExpiresActive On

  ExpiresByType text/css "now plus 2 years"
  ExpiresByType text/javascript "now plus 2 years"
  ExpiresByType image/jpeg "now plus 2 years"
  ExpiresByType image/gif "now plus 2 years"
  ExpiresByType image/png "now plus 2 years"
  ExpiresByType application/x-shockwave-flash "now plus 2
years"
</IfModule>
```

Cache-Control

```
Cache-Control: max-age=3600, must-revalidate
```

- Set relative expiry time
- Configure expiry of proxy caches separately
- Ability to prevent caching completely

Validation headers

```
Last-Modified: Sun, 31 May 2009 10:21:09 GMT
ETag: 49705dbc03db283284362b3950bfd0
```

- Browser checks before serving cached copy
- ETag must be quoted
- Respond to: `HTTP_IF_MODIFIED_SINCE` & `HTTP_IF_NONE_MATCH` (in `$_SERVER`)
  Send back `header('HTTP/1.0 304 Not Modified');`

Rob's Recommendations

1. Run an op code cache
2. Cache slow code (usually db calls)
3. Cache CSS/JS/images in the browser

Thank you

Provide feedback on this talk: http://joind.in/579