Full Stack Web Application Performance Tuning

codecentric GmbH

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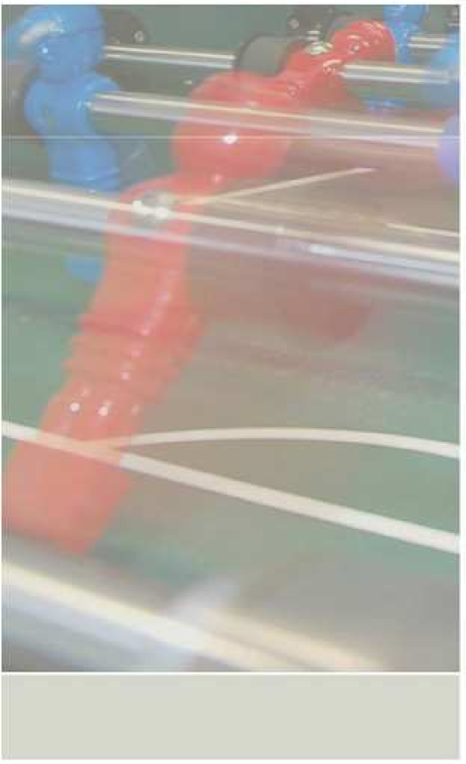
About the presenter



Fabian Lange, 27

married, no children but 2 cats

- **Fabian & symfony**

  Fabian.Lange@symfony-project.com

  Using symfony since late 2006

  Core team member since early 2008

  Release manager for symfony 1.2

- **Fabian & work**

  Working as Java & Web architecture and performance consultant at codecentric

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  Previously worked for Nokia / Nokia Siemens Networks and Hewlett Packard

- **Fabian & blogging**

  Company blog at blog.codecentric.de

  Private blog at blog.hma-info.de

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About codecentric

- **Performance**

  Specialized in Java Performance optimization, codecentric has 100% success rate in finding and solving performance issues at a huge number of customers. We strive to continue this rate using state of the art tools and processes.

- **Architecture**

  Consulting software architects or managers, assisting with the design and creation of modern software architecture, weather it shall be a SOA architecture or classical design, our experts will get you there.

- **Open Technology**

  Cost efficient Open Source Tools and Solutions complete our portfolio. We believe that using Open Technologies improve software products quality and are more cost efficient than reinventing the wheel.

- www.codecentric.de

  See our full portfolio, meet the team and get our contact details.

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Scope of this presentation

- **Make web applications feel faster**
  - Ideally a stopwatch can prove out effort
  - Performance is perceived differently
  - Tweak at the end of development cycle
- **Not an expert guide on specific issues**
  - But see the whole picture
  - No micro-tweaking
- **Targeted at small to medium deployments**
  - Larger ones have dedicated people or high end hardware
  - Application developer tweaks single server
  - Keep scaling options open – share nothing

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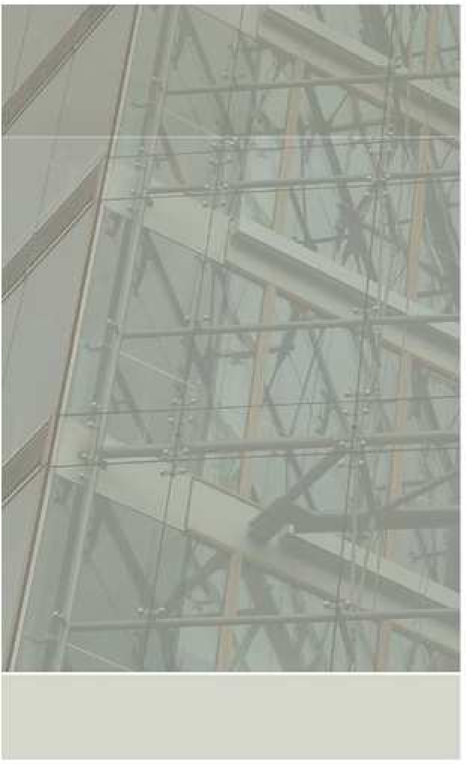
What is the Whole Picture?



- **Client Software**
  - Browser
- **Web Framework**
  - symfony
- **Server Software**
  - PHP
  - Web Server
  - Database
- **Server Hardware**
  - Processor
  - Memory
  - Storage

Client Software – Browsers

- **Rendering priority**
  - Javascripts at bottom
    - Can be done by explicitly outputting them in the template
      `<?php echo include_javascripts();?>`
    - To make this possible avoid inline Javascript or use Event.observe
    - Watch out with using JS before it is loaded
      - For example mouseover events
      - Prototype Event.observe as well!
  - CSS at top
    - Layout can be already calculated when building the DOM tree.
  - Image dimensions
    - Same as with CSS. Browser knows the image size before it loads the image
    - Not only for performance, but flickering UI looks bad as well.

Client Software – Browsers

- Obtaining HTML is often the smallest part of the browser latency

- Limited connections (2-6) additionally slow down loading
  - Use a separate host for assets
    - You can even use another server for your media files
    - Even better try consider using a CDN -> less load
    - Cookies are not sent to other domains, which reduces request size

- Get rid of unneeded additional requests
  - Many pages use a lot of images
    - CSS Sprites

```
#nav li a {background-image:url('/img/image_nav.gif')}
#nav li a.item1 {background-position:0px 0px}
#nav li a.item2 {background-position:0px -32px}
```

    - Inline Image Data (RFC2397)

```
<img src="data:image/gif;base64, ASCIIDATA" />
```

Client Software – Browsers

- **Get rid of unneeded additional requests (2)**

  Combine JS & CSS

  - Automation tools available
  - Sensible modularization allows separate update cycles and selective inclusion
    - Protoculous: 1 file, but pages that just want Prototype have to parse Scriptaculous
    - http://code.google.com/apis/ajaxlibs/

  Minify JS and CSS

  - Easy and compatible using YUI Compressor
  - Dean Edwards Packer minifies better but produces runtime overhead

  Use expires for assets

  - Note: You need to change file name for users to see the change

```
ExpiresActive On
ExpiresDefault "access plus 10 years“
```

  Use redirects wisely

  - Redirects make sense to prevent double postings
  - Redirects are responses to the browser with a instruction to load a new page

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- **Performance Tweaks**
  - ETags
    - used to save bandwidth, but does not help with latency
    - calculates a hash code of the returned content and only returns content if doesn't match browsers Etag
    - doesn't work well with external compression
  - Core Compilation
    - symfony creates a single PHP files with all its core classes
    - Comments are removed from this file
    - Own classes can be added via app/config/core_compile.yml

```
- %SF_ROOT_DIR%/apps/frontend/lib/myUser.class.php
- %SF_ROOT_DIR%/lib/AutoLinker.class.php
```

    - Should be done only with classes

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- Propel
  - Use Propel 1.3 instead of 1.2 as it is faster and less memory consuming
    - Mainly benefits from object instance pooling
  - Monitor “slow queries” log
    - Use `EXPLAIN $slow_query`
    - Add index where no index used

```
SELECT section.ID, section.TITLE, section.TREE_LEFT,
section.TREE_RIGHT, section.TREE_PARENT, section.TREE_SCOPE FROM
`section` WHERE section.TITLE='_news' LIMIT 1;
```

select_type	table	type	possible_keys	key	key_len	ref	rows	Extra
SIMPLE	section	ALL	*NULL*	*NULL*	*NULL*	*NULL*	2121	Using where

select_type	table	type	possible_keys	key	key_len	ref	rows	Extra
SIMPLE	section	const	title	title	768	const	1	

    - Use `Peer:doSelectJoinXXX` when many related objects are loaded
  - Reduce unneeded hydration
    - `setUserID($comment->getUserId())` instead of `setUser($comment->getUser())`
  - Reduce unneeded queries
    - DB access is the most expensive part, it is always good idea to use few queries.
    - In extreme cases consider tweaking the database model by moving columns and merging tables, as a perfectly normalized database model is slow due to many joins.

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- **Caching**
  - Caching is very easy!
    - Create a cache.yml in the config directory of a module
    - List the actions/components/partials you want to cache

      ```
      action:
        enabled: on
      ```

    - Two important options:
      - `with_layout`
      - `contextual`
  - There are more cacheable partials than expected
  - Caching nearly always improves response times
  - Don't build complex cleaning
    - Introduces risk of not cleaning everything
    - Clean every hour
    - Clean more than needed
      - New wildcard cleaning in symfony 1.1

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- symfony is modular

  It is easy to bypass parts

```
#ajax_frontController.php

require_once(dirname(__FILE__).'/../config/ProjectConfiguration.class.php');
$config = ProjectConfiguration::getApplicationConfiguration(
                    'frontend', 'prod', false);
$context = sfContext::createInstance($config);

$action = $context->getController()->getAction(‘ajax',‘myMethod');
$action->initialize($context);
$action->executeMyMethod();

$context->getResponse()->sendHttpHeaders();
$context->getResponse()->sendContent();
```

  It is easy to exchange parts

```
#app/config/factories.yml
all:
  storage:
    class:   myMemorySessionStorage
```

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- **Session Storage**

  PHP stores user sessions by default in files

  symfony does the same by using sfSessionStorage

  Files on the filesystem can be slow, can be a security risk and are hard to scale

  symfony ships alternative Session Storage classes

```
#app/config/factories.yml
  storage:
    class: sfPDOSessionStorage
    param:
      database:     pdo       # Database connection to use
      db_table:     sessions  # name of table storing the sessions
      db_id_col:    id        # Name of column storing the session id
      db_data_col:  data      # Name of column storing the session data
      db_time_col:  timestamp # Name of column storing the session time
```

Note: reusing a propel connection for MySQL does not work

Server Software

- Server Software often differs, especially in versions
- PHP
  - PHP itself gains performance boosts with every release -> later is better
    - http://sebastian-bergmann.de/archives/745-Benchmark-of-PHP-Branches-3.0-through-5.3-CVS.html
- Web Server
  - Both Apache HTTPD and LightHTTPD work fine
    - http://www.markround.com/archives/30-LigHTTPd-and-Apache-Symfony-benchmarks.html
  - Using PHP via FastCGI brings huge performance boost!
    - But brings also troubles, e.g. for APC user cache
- Database
  - A standard setup usually ships a MySQL
    - InnoDB should be preferred because of its tuning options and reliability
    - MyISAM is claimed to be “faster” but in fact that is rarely the case.
  - Of course other DBs are good as well ☺

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Server Software – PHP

- As PHP becomes faster with each version, there should be no real reason to stay with old versions
- PHP itself allows not much performance tweaking
- A PHP opcode compiler should be mandatory, and actually will be included in PHP 6 by default
  - APC

    ```
    extension=apc.so
    apc.stat=0
    ```

    - Disables APC checking for PHP file modifications
    - Requires a server restart to detect updated files
  - xCache

    ```
    extension = xcache.so
    ```

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Server Software – Apache 2.2

- **Multi Processing Module**
  - Prefork
    - Will launch Apache processes that launch multiple PHP instances
  - Worker
    - Will launch Apache processes that launch one PHP instance with multiple threads
  - Worker works fine with most symfony applications, but some modules might not work
- **Logging**
  - Frequently accessed resources will cause excessive logging.
  - To selectively turn off logging use this:

```
#apache2.conf
   CustomLog /var/log/apache2/access.log combined env=!dontlog
#Site/v-host config
   SetEnvIf Request_URI "^/chat" dontlog
```

  - Or perhaps turn off logging at all ☺

Server Software – Apache 2.2

- Compression
  - There are 3 methods of compression possible:
    - Let Apache compress
    - Let PHP compress
    - Let symfony compress
  - Apache compression is most proven and easy to configure
    - `AddOutputFilterByType DEFLATE text/html text/plain text/xml text/css application/x-javascript`
    - works also on non PHP & non symfony content
  - Make sure to only compress with one option

- Other Tweaks
  - `HostnameLookups off`
    - will prevent reverse lookup of hostename for IPs
  - `ExtendedStatus off`
    - will prevent apache collecting too much status information

Server Software – Apache 2.2

- **Keep alive**

  This HTTP 1.1 feature works roughly like this

    When a browser connects to load a page a connection is opened

    Instead of closing the connection after returning, lets say the HTML, with keep-alive the connection is kept open.

    When one of two criteria is reached the connection is closed. This can be either a number of requests, or a timeout.

  The upside of this feature is that some connection overhead is reduced

  The downside is that resources are wasted in idle periods

  Often the browser will load images directly after the HTML, unless the are cached

  Many guides recommend to turn this feature off, but for small to medium loaded servers this can improve the responsiveness

  A balanced config could look like

```
KeepAlive On
MaxKeepAliveRequests 1000
KeepAliveTimeout 3
```

  symfony 1.0 - Need to patch symfony response class

```
sfWebResponse::sendHttpHeaders()
HTTP/1.0 -> HTTP/1.1
```

Server Software – MySQL 5

- MySQL configuration done in config file

  `/etc/mysql/my.cnf`

  MySQL itself has multiple sample configurations, check them

- Generic MySQL settings

  `key_buffer = 32M`

  MyISAM but also for temp tables

  `thread_cache_size = 32`

  Creating threads is slow, try to get “threads created” low

  `table_cache = 1K`

  Opening tables is slow

  `sort_buffer_size = 16M`

  Used for sorting results, increase if “sort_merge_passes” increases

  `query_cache_limit = 1M`

  Caches how queries are executed, does not bring much but also does not cost much

  `query_cache_size = 32M`

  Caches results of queries, but too high settings involve high maintenance costs

Server Software – MySQL 5 & InnoDB

- Disable Logging

```
# log = …
```

- Specify Slow Logging for Optimisation

```
log_slow_queries  = /var/log/mysql/mysql-slow.log
long_query_time = 2
log-queries-not-using-indexes
```

- InnoDB settings

```
innodb_log_file_size = 250M
```

Data written goes into here first

```
innodb_buffer_pool_size = 1G
```

Main InnoDB data cache. Waste memory here!

```
innodb_additional_mem_pool_size = 20M
```

Utility buffer for InnoDB

```
innodb_thread_concurrency = 8
innodb_flush_log_at_trx_commit = 2
```

2 will flush to OS cache, 1 will write to disc every commit

Server Hardware

- **Processors**
  - More are better, but scales only until I/O wait
  - Even the most basic server offerings have a dual core by now
- **Memory**
  - Reduces I/O wait, as data can be in memory
  - An Apache process running symfony needs up to 64 MB
  - Also useful for database caching
    - Think of: DB Size x 2
- **Storage**
  - Web servers mostly spend time on loading database, html or asset data
  - Get fast discs. Noise doesn’t matter in server rooms
  - Use at least a two disc setup, if no raid
- **Main hardware issue is I/O wait!**

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Server Hardware – Two Disc Setup

- Even without expensive and perhaps even complicated raid configurations a second harddisc might significantly boost the server performance

- Separate discs by responsibility

- Example:

  One user does a heavy DB operation

  In meantime 10 other users want to browse the page, requesting 10 images each

  One disc can read/write for the DB operation continuously

  The other disc can handle the many small read bursts for images

- Simple config for InnoDB:

```
innodb_log_group_home_dir = /var/disc1/log/mysql/iblogs
innodb_data_home_dir = /var/disc2/mysql
innodb_data_file_path = ibdata:2000M:autoextend
```

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References

- Symfony

  http://www.symfony-project.org/book/1_1/18-Performance

  http://trac.symfony-project.org/wiki/Optimization

- Server:

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