Who am I?

- Name: Berner Setterwall
- Co-founding CTO at Campanja
- Likes climbing, paragliding and bicycling.
- Favorite programming language prior to Erlang: Perl

Switching to Erlang

For fun and profit!

Campanja?

- Search Engine Marketing Optimization system
- Solving the problems for big advertisers
- Minimal customer facing dashboard
- Mainly using Erlang
- 20 FTE, moving into new office, expanding

A short Campanja history

- How SEM software companies start.
- Focus on short time to market
- Wanted cheap hosting

Campanja 2007 - 2010

- SEM productivity tool
- Tailored for media agencies needs
- Client software build using .NET
- Backend+API based on LAMP+Perl
- 2 - 3 FTE

Problem: Data

- Large datasets
- Queries hard to pre-compute
- Most queries useless to cache
- MySQL can be hard to scale

Problem: Concurrency

- Advertising is naturally parallel
- Need async I/O due to “slow” queries

Switching to Erlang

Google introduces “preferred pricing”

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Sign Avito.ru

Need to scale again

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Node.js

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Node.js: Hopes

- Easy to get started
- Easy to run untrusted code
- Internet says it is fast =)
- Hoping for short time to market
- Easy to be charmed trendy stuff

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Node.js: Despair

- Performance not what I hoped for
- Callback Hell
- Poor error handling

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Node.js: Example

```
var http = require('http');
var sys  = require('sys');

function DEBUG(str) {
    if (1) console.log(str);
}

var serv = http.createServer(function (request, response) {
    response.writeHead(200, {'Content-Type': 'text/json'});
    var post_data = "";
    DEBUG("waiting for data ..");
    request.on('data',function (chunk) {
        DEBUG("got data ..");
        post_data += chunk;
    });
    request.on('end', function() {
        output = {'hello': 'world'};
        response.end(JSON.stringify(output));
    });
});

serv.on('error',function (err) {console.log('error event: '+err)});
serv.on('clientError',function (err) {console.log('clientError event: '+err)});

Port = 1234;
serv.listen(Port)

:!node example.js
waiting for data ..
got data ..
clientError event: Error: Parse Error
```

```
$ curl -v -XPOST 'http://127.0.0.1:1234' -d 'asd ' '-HContent-Length: 12345'
* About to connect() to 127.0.0.1 port 8125 (#0)
*   Trying 127.0.0.1... connected
* Connected to 127.0.0.1 (127.0.0.1) port 8125 (#0)
> POST / HTTP/1.1
> User-Agent: curl/7.18.2
> Host: 127.0.0.1:8125
> Accept: */*
> Content-Length: 12345
> Content-Type: application/x-www-form-urlencoded
>

^C
```

Can Scala replace Node.js?

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Scala: Hopes

- JVM error handling better than V8 + node.js hack?
- Better support for multiple cores?
- JVM better performance?
- More mature?
- Lots of libraries to use
- Not Java :)

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Scala: Prototypes

- Performance seems better than Node.js
- Some java examples hard to translate to scala
- Need lots of classes and stuff to get things going

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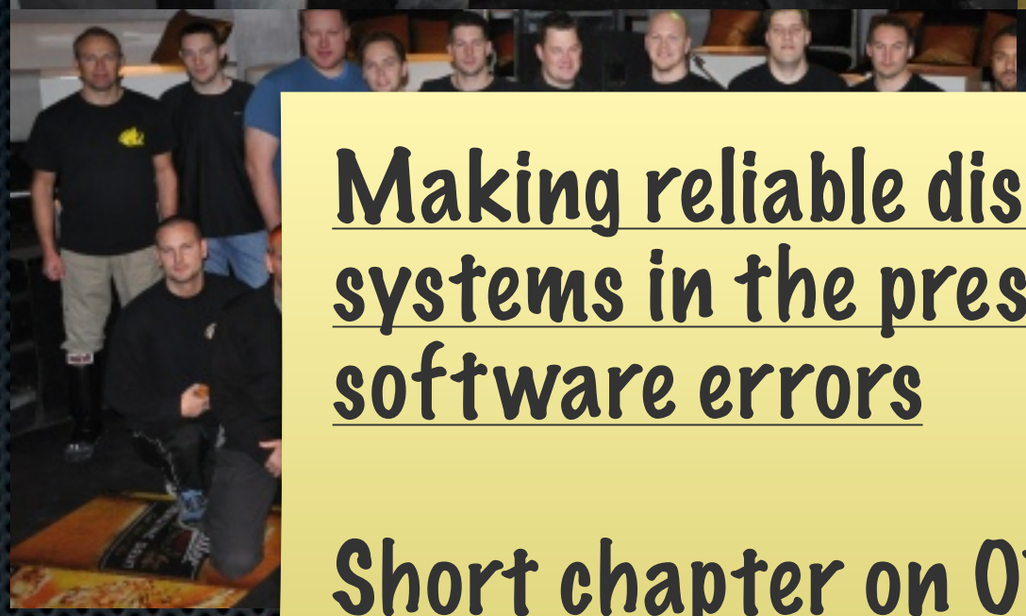

Making reliable distributed systems in the presence of software errors

Short chapter on OTP - maybe too tired =)

Krav

This is a good way to avoid focusing on work.

Product 1

changeset: 0:afc802228540
user: Berner Setterwall <berner.sett
date: Sun Feb 13 18:34:44 2011 +0
summary: * init commit - working cam

Making reliable distributed systems in the presence of software errors

Short chapter on OTP - maybe too tired =)

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Erlang: First impressions

- Hot Code loading enables fast iteration
- Modules are simple
- Used gen_event but wrote mostly pure erlang (i.e. w/o OTP)

Product 2

```
changeset:   0:394c9c2ad8b5
user:        Berner Setterwall <berner.setterwall@campanja.com>
date:        Wed Mar 02 13:16:03 2011 +0000
summary:     * init commit ..
```

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Erlang is number one

After two successful pilots, erlang is the new language of choice for (most) projects at Campanja

Product 3

```
changeset:   0:86bf0eaae903
user:        berset
date:        Thu Apr 07 06:49:07 2011 +0000
summary:     * dirty init commit (includes inets:start() patch).
```

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Some surprises during our first year

httpc

- Switched to lhttpc

emysql

- https://github.com/Eonblast/Emysql/issues/20

merle

- Switch to erlmc

ezk

handle_call(_, From0, _) ->
From = {blocking, From0},

```
From ! {error, client_broke, CommId, Path},
```

- https://github.com/infinipool/ezk/blob/master/src/ezk_connection.erl#L428

Data?

With the parallelism problem controlled, I started looking for a new approach to our data problems.

Riak

0.14.0

Riak Eval (scala client)

```
Status:     3856016/    49731000 in 11586.6s (s:  4292.1/s r:   332.8/s) Outstanding: 45874984 Missing: 92.25%
Status:     3856042/    49732000 in 11586.6s (s:  4292.2/s r:   332.8/s) Outstanding: 45875958 Missing: 92.25%
Status:     3856071/    49733000 in 11586.7s (s:  4292.2/s r:   332.8/s) Outstanding: 45876929 Missing: 92.25%
Exception in thread "pool-25-thread-1" java.lang.OutOfMemoryError: Java heap space
        at java.nio.HeapByteBuffer.<init>(HeapByteBuffer.java:57)
        at java.nio.ByteBuffer.allocate(ByteBuffer.java:329)
        at org.apache.mina.core.buffer.SimpleBufferAllocator.allocateNioBuffer(SimpleBufferAllocator.java:44)
        at org.apache.mina.core.buffer.SimpleBufferAllocator.allocate(SimpleBufferAllocator.java:36)
        at org.apache.mina.core.buffer.IoBuffer.allocate(IoBuffer.java:218)
        at org.apache.mina.core.buffer.IoBuffer.allocate(IoBuffer.java:203)
        at org.apache.mina.core.polling.AbstractPollingIoProcessor.read(AbstractPollingIoProcessor.java:609)
        at org.apache.mina.core.polling.AbstractPollingIoProcessor.process(AbstractPollingIoProcessor.java:598)
        at org.apache.mina.core.polling.AbstractPollingIoProcessor.process(AbstractPollingIoProcessor.java:587)
        at org.apache.mina.core.polling.AbstractPollingIoProcessor.access$400(AbstractPollingIoProcessor.java:61)
        at org.apache.mina.core.polling.AbstractPollingIoProcessor$Processor.run(AbstractPollingIoProcessor.java:969)
        at org.apache.mina.util.NamePreservingRunnable.run(NamePreservingRunnable.java:64)
        at java.util.concurrent.ThreadPoolExecutor.runWorker(ThreadPoolExecutor.java:1110)
        at java.util.concurrent.ThreadPoolExecutor$Worker.run(ThreadPoolExecutor.java:603)
        at java.lang.Thread.run(Thread.java:636)
Exception in thread "pool-7-thread-1" java.lang.OutOfMemoryError: Java heap space
Exception in thread "pool-1-thread-1" Exception in thread "pool-19-thread-1" java.lang.OutOfMemoryError: Java heap space
        at java.nio.HeapByteBuffer.<init>(HeapByteBuffer.java:57)
        at java.nio.ByteBuffer.allocate(ByteBuffer.java:329)
        at org.apache.mina.core.buffer.SimpleBufferAllocator.allocateNioBuffer(SimpleBufferAllocator.java:44)
        at org.apache.mina.core.buffer.SimpleBufferAllocator.allocate(SimpleBufferAllocator.java:36)
        at org.apache.mina.core.buffer.IoBuffer.allocate(IoBuffer.java:218)
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        at java.util.concurrent.ThreadPoolExecutor.runWorker(ThreadPoolExecutor.java:1110)
        at java.util.concurrent.ThreadPoolExecutor$Worker.run(ThreadPoolExecutor.java:603)
        at java.lang.Thread.run(Thread.java:636)
Exception in thread "pool-39-thread-1" java.lang.OutOfMemoryError: Java heap space
```

Riak Eval

```
$ curl 'http://localhost:8091/riak/bucket?keys=stream'
% Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100  159M    0  159M    0     0  93870      0 --:--:--  0:29:41 --:--:--     0

^C
```

```
root@db-bgc1:~# du -sh /var/lib/riak/bitcask/
90G   /var/lib/riak/bitcask/
root@db-bgc1:~#
```

top while reading:

```
top - 12:26:09 up 341 days, 21:23,  4 users,  load average: 6.49, 4.66, 3.44
Tasks: 133 total,   2 running, 131 sleeping,   0 stopped,   0 zombie
Cpu(s):  1.1%us, 18.0%sy,  0.0%ni, 31.0%id, 49.9%wa,  0.0%hi,  0.0%si,  0.0%st
Mem:  16473904k total, 16392440k used,    81464k free,      424k buffers
Swap:  3855592k total,  3457700k used,   397892k free,     4056k cached

  PID USER      PR  NI  VIRT  RES  SHR S %CPU %MEM    TIME+  COMMAND
 3421 riak      20   0 18.5g  14g 2260 S  108 94.9 966:03.30 beam.smp
  275 root      15  -5     0    0    0 R   70  0.0  14:19.60 kswapd0
 1354 root      15  -5     0    0    0 S   29  0.0  55:56.94 kjournald
```

```
=ERROR REPORT==== 1-Feb-2011::17:04:13 ===
** State machine <0.3623.0> terminating
** Last event in was timeout
** When State == initialize
**      Data  == {state,<0.3562.0>,undefined,default,undefined,undefined,
...
                    {dict,0,16,16,8,80,48,
                        {[],[],[],[],[],[],[],[],[],[],[],[],[],[],[],[]},
                          []}}}},
                undefined}
** Reason for termination =
** {{badmatch,none},
    [{riak_core_util,chash_key,1},
     {riak_kv_get_fsm,initialize,2},
     {gen_fsm,handle_msg,7},
     {proc_lib,init_p_do_apply,3}]}
```

BigCouch

0.4a

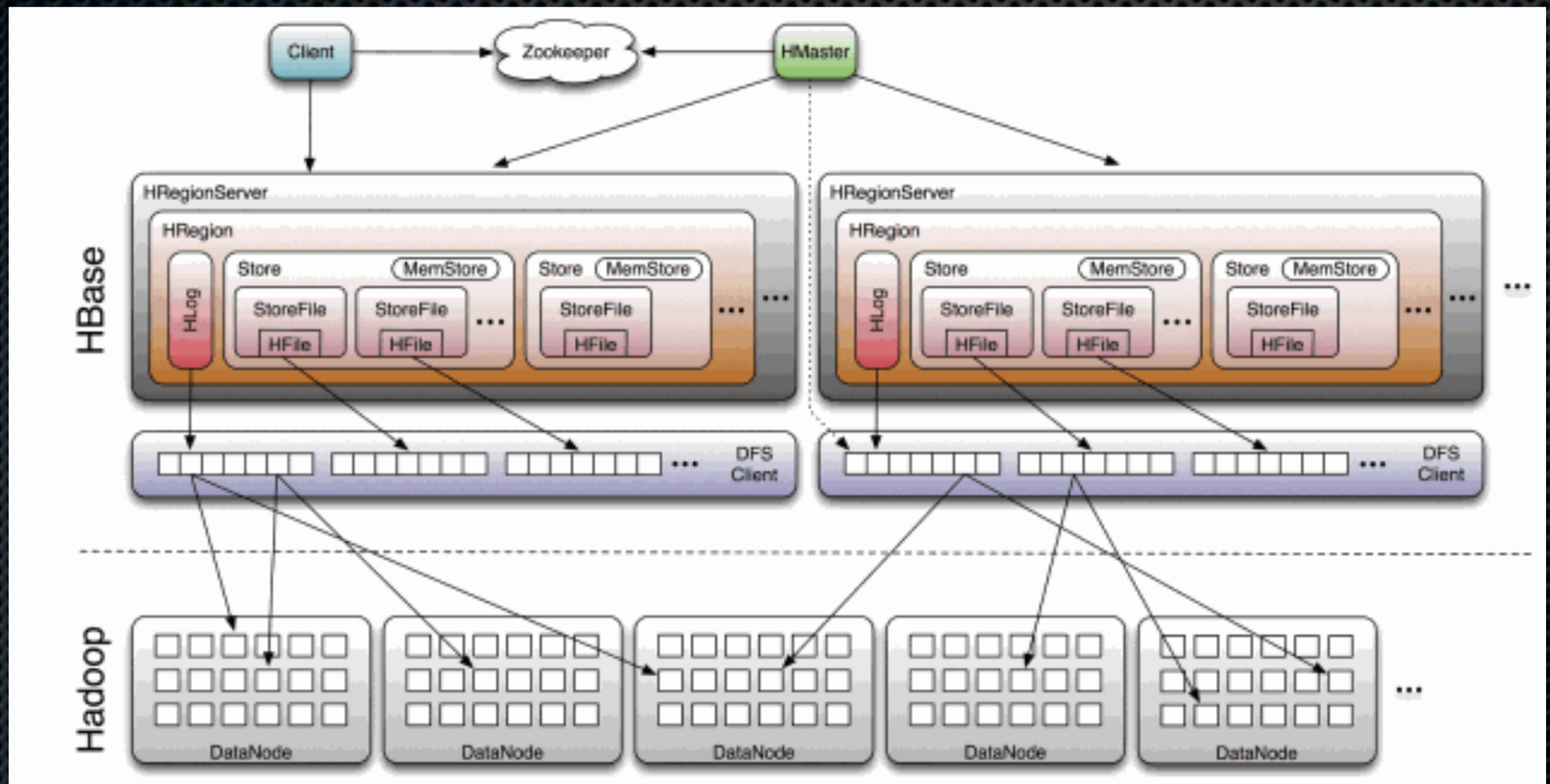
HBase

0.90

HBase in short

- First developed by Powerset to mimic Google's BigTable
- Today top-level Apache project.
- "random, realtime read/write access to your Big Data"
- "atop clusters of commodity hardware"
- "billions of rows X millions of columns"

HBase picture



HBase API

- Read
- Write
- Delete
- Atomic increments
- Scan table (in order)

HBase + Erlang?

Thrift

Need more speed

JInterface + HBase client (org.apache.hadoop.hbase.client)

JInterface + asynchbase (org.hbase.async.HBaseClient from stumbleupon)

Java fear

```
} else {  // We lost the second race.
          // Here we synchronize on two different references without any
          // apparent ordering guarantee, which can typically lead to
          // deadlocks.  In this case though we're fine, as any other thread
          // that still has a reference to `nsred_rpcs' is gonna go through
          // this very same code path and will lock `nsred_rpcs' first
          // before finding that it too lost 2 races, so it'll lock `added'
          // second.  So there's actually a very implicit ordering.
          if (can_retry_rpc) {
            synchronized (added) {  // Won't deadlock (explanation above).
              if (added.isEmpty()) {
                LOG.error("WTF?  Shouldn't happen!  Lost 2 races and found"
                          + " an empty list of NSRE'd RPCs (" + added
                          + ") for " + Bytes.pretty(region_name));
```

Pure-erlang HBase client?

asynchbase is about 12k lines of Java, how many lines erlang is that?

Summing up