facebook

Functional Programming at Facebook

Chris Piro, Eugene Letuchy
Commercial Users of Functional Programming (CUFP)
Edinburgh, Scotland
4 September 2009

Agenda

1. Facebook and Chat
2. Chat architecture
3. Erlang strengths
4. Setbacks
5. What has worked

Facebook

The Facebook Environment

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- The web site
  - More than 250 million active users
  - More than 3.5 billion minutes are spent on Facebook each day

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  - More than 250 million active users
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- The engineering team
  - Fast iteration: code gets out to production within a week
  - Polyglot programming: interoperability with Thrift
  - Practical: high-leverage tools win

Using FP at Facebook

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- Erlang
  - Chat backend (channel servers)
  - Chat Jabber interface (ejabberd)
  - AIM presence: a JSONP validator

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- Haskell
  - lex-pass: PHP parse transforms
  - Lambdabot
  - textbook: command line Facebook API client
  - Thrift binding

Thrift

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- Servers define interfaces with an IDL
- Many supported languages

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C++	Objective C	Ruby
C#	OCaml	Squeakr
Erlang	Perl	
Haskell	PHP	HTML
Java	Python	XSD

Facebook Chat

Motivation

Sasha Rush wrote
at 10:47pm on May 31st, 2008

deleted upon pictureds request. still think we should keep the name.

Write on Sasha's Wall

Daniel Corson wrote
at 10:40pm on May 31st, 2008

did you use the ConeyTypeInference app to make that

Write on Daniel's Wall

Daniel Corson wrote
at 10:02pm on May 31st, 2008

the JuliaLambdas

Write on Daniel's Wall

Sasha Rush wrote
at 10:47pm on May 30th, 2008

Also we need a nerdy, groan inducing name. I'm thinking ZuckerLambda.

Write on Sasha's Wall

Sasha Rush wrote
at 10:45pm on May 30th, 2008

I was just going to send you that link. Let's do it. Although maybe we should try one of the old contests first. My practical haskell is still kind of slow.

Write on Sasha's Wall

Daniel Corson shared a link
at 9:38pm on May 30th, 2008

http://www.icfpcontest.org/

Motivation

Why does Facebook need Chat?

- Inbox, Wall, Comments are asynchronous, slow
- Real-time conversation
- Unique advantages:
  - List of friends for free
  - Integrated Facebook content
  - No install required

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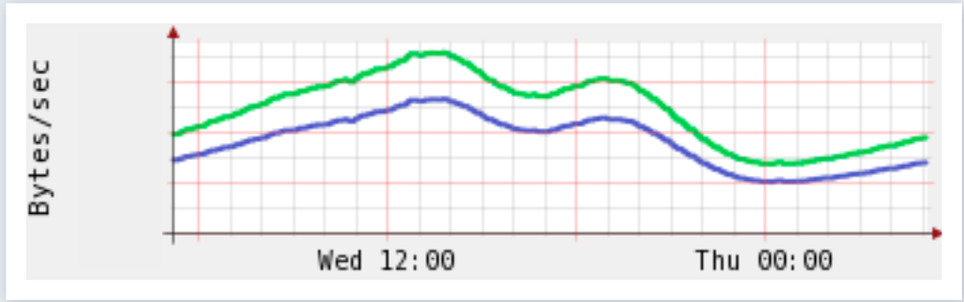
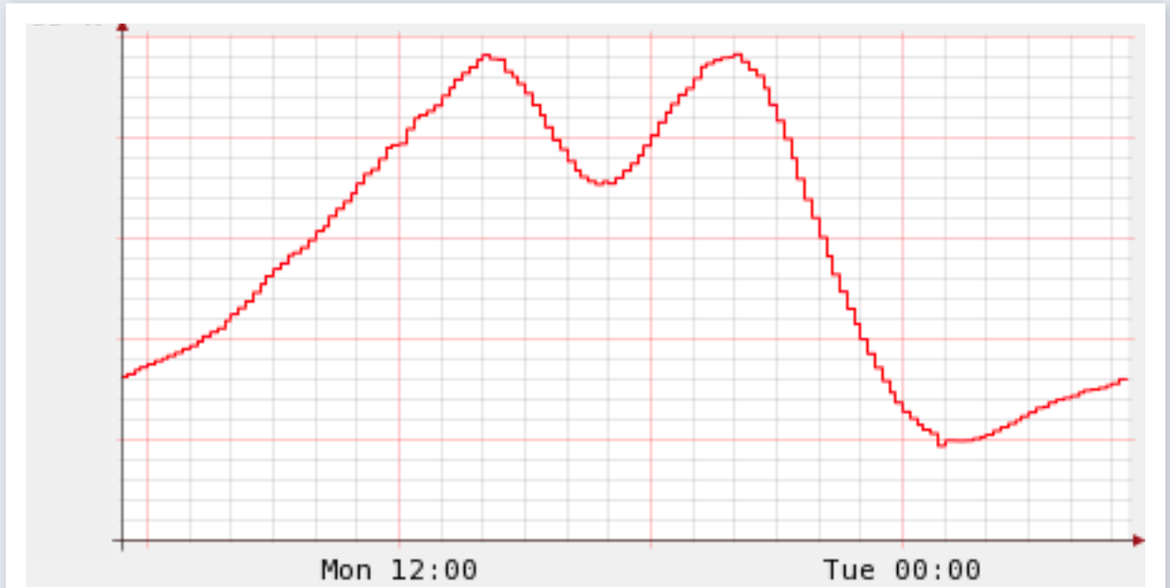
- Apr 23, 2008: 100% rollout (Facebook has 70M users at the time)

Chat today





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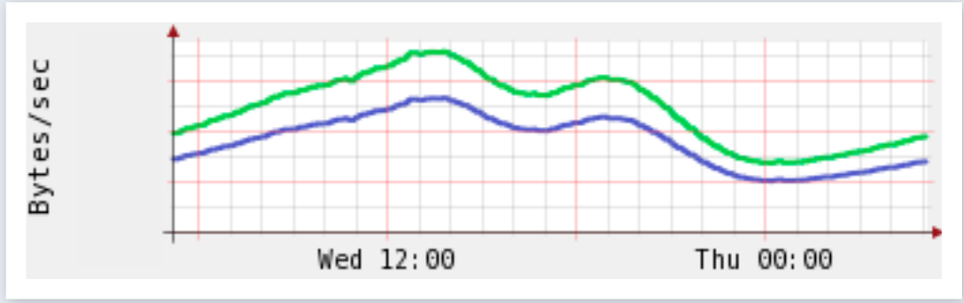
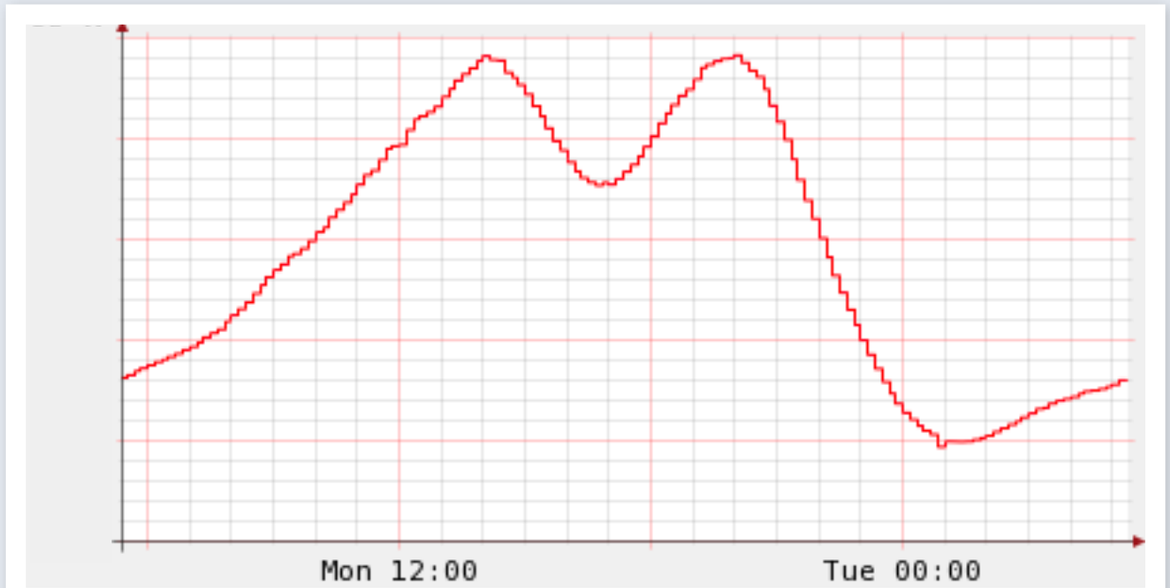
- 10+ million active channels at peak
- 1+ GB traffic at peak
- 100+ channel machines





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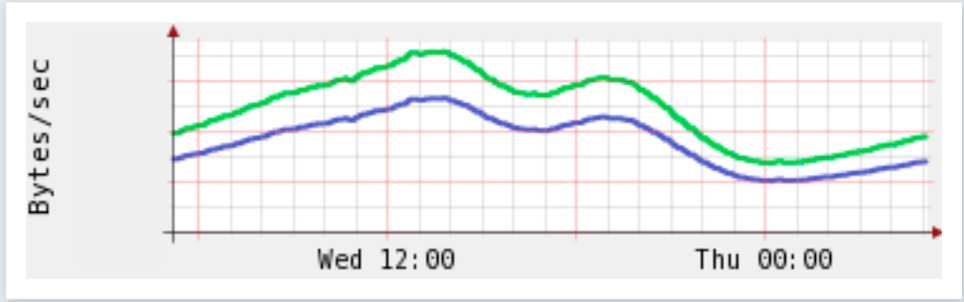

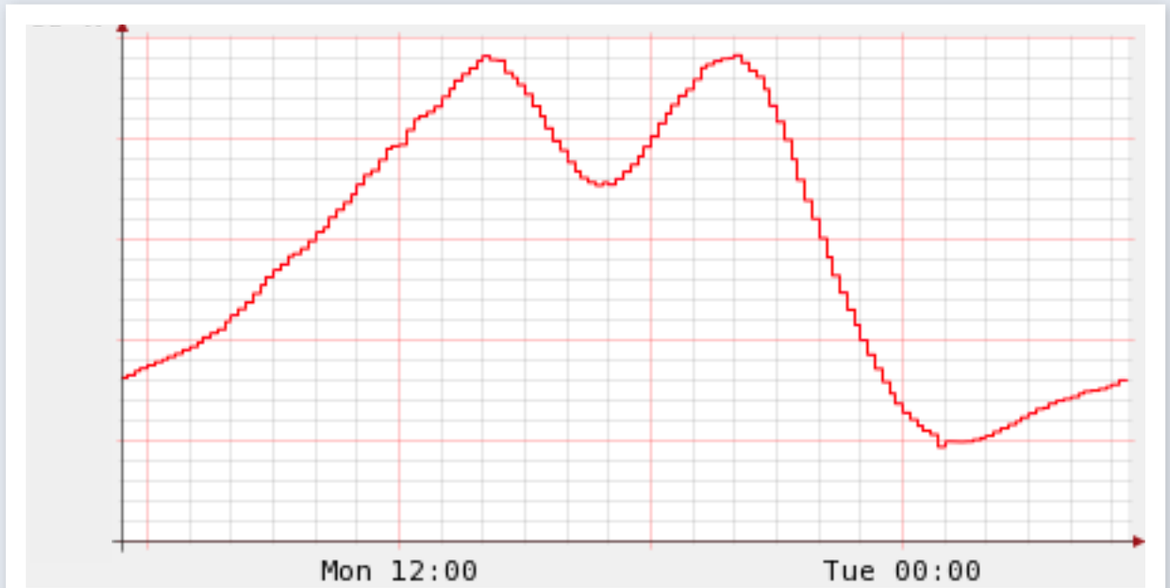

Chat Architecture

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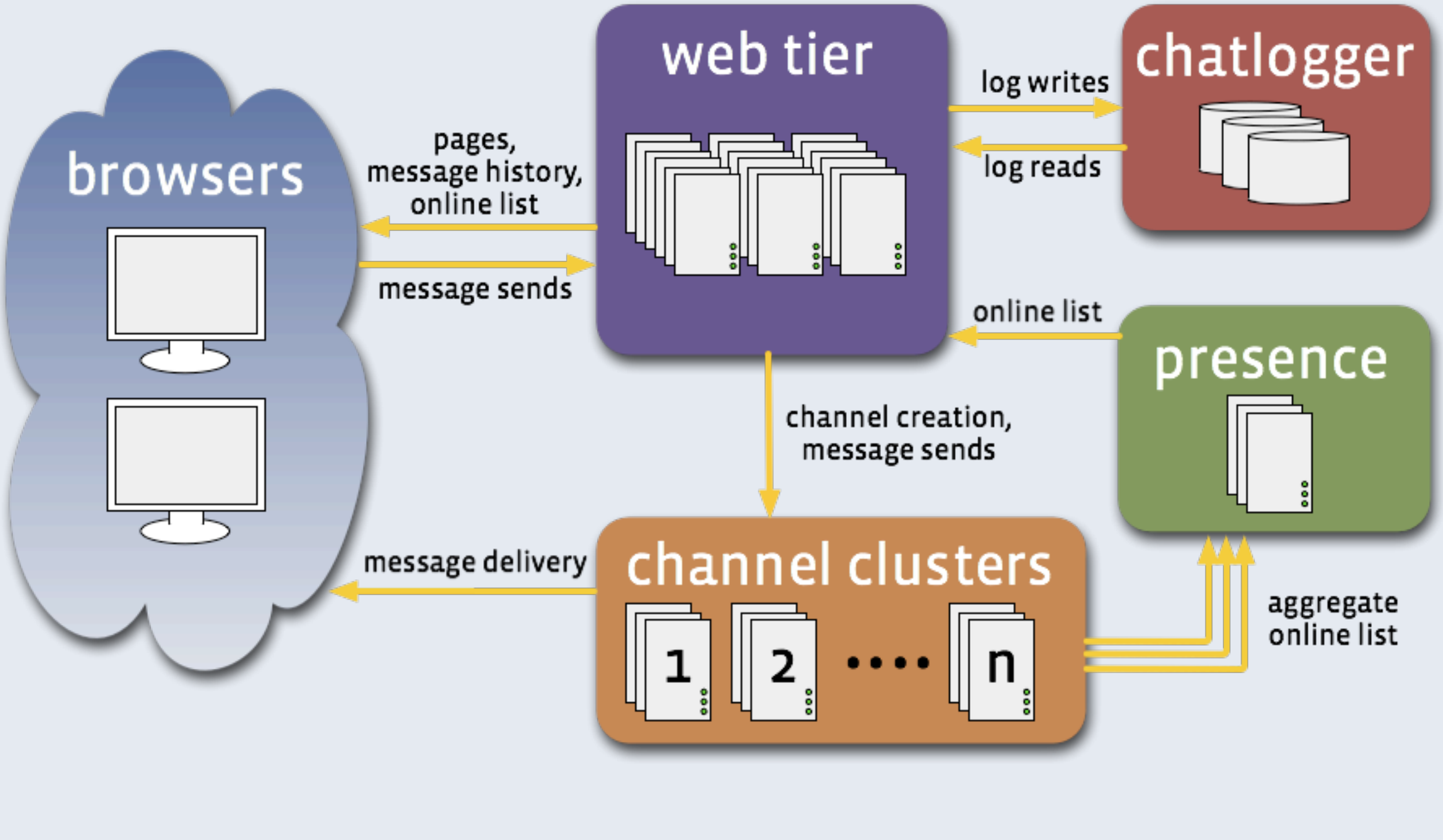

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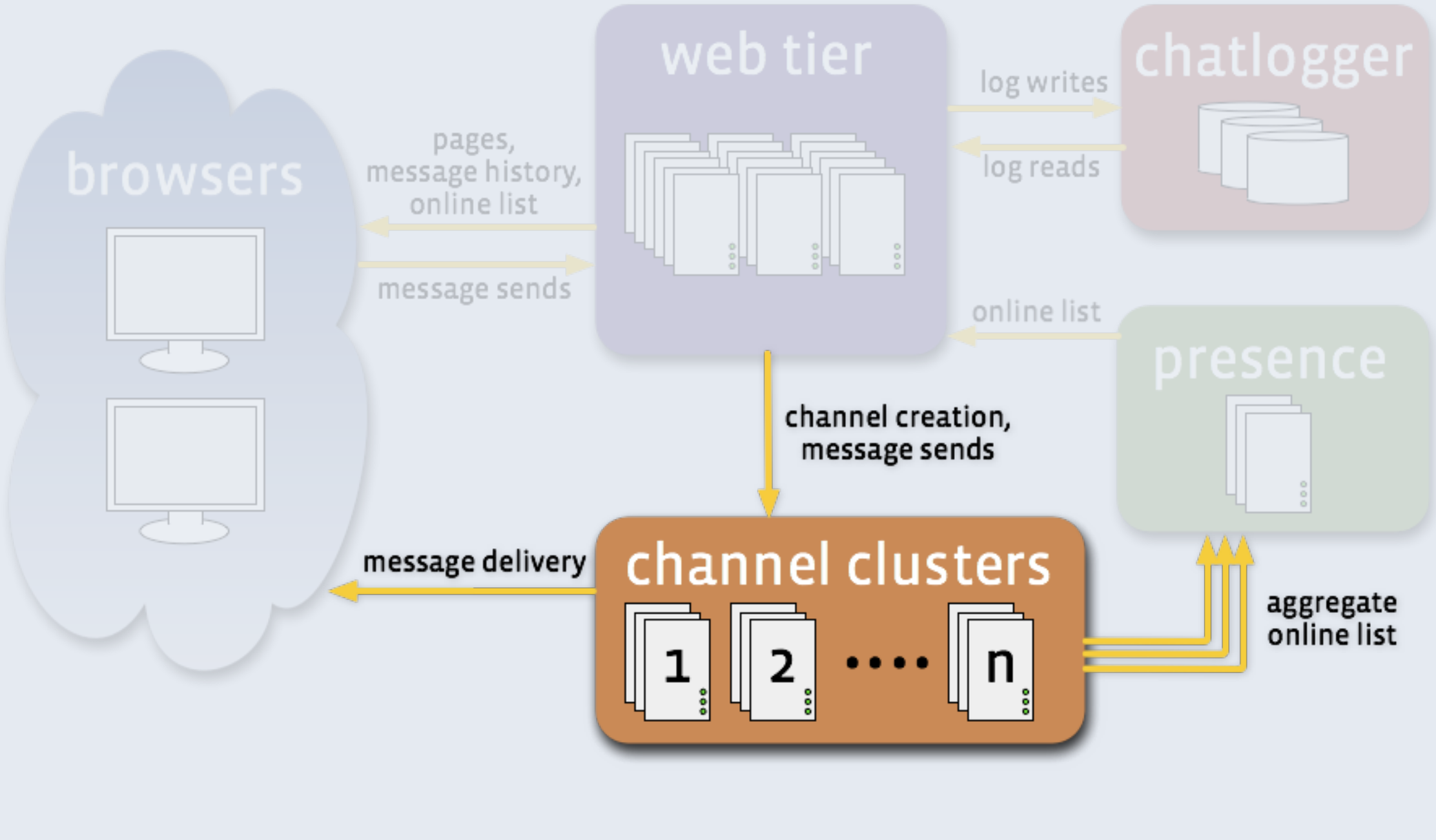

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- User ID space partitioned statically (division of labor)
- Each partition served by a cluster of machines (availability)

Erlang strengths

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- Bonus: carries over to non-Erlang concurrent programming

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- Distributed Erlang works out-of-the-box (all nodes are trusted)

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- Bugs in the initial versions of Chat:
  - Process leaks in the Thrift bindings
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- Bugs in the initial versions of Chat:
  - Process leaks in the Thrift bindings
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  - Bad return state for presence aggregators
- (Horrible) bugs don't kill a mostly functional system:
  - C/C++ segfault takes down the OS process and your server state
  - Erlang badmatch takes down an Erlang process
    - … and notifies linked processes

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- WARNING: excessive error logging can OOM the Erlang node!

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- NOTE: we don’t use the OTP release/upgrade strategies

Monitoring and Error Recovery

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- Supervision hierarchies
  - Organize (and control) processes
  - Systematize restarts and error recovery
  - Extended supervisor with a “directory” type
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- heart: monitors and restarts the OS process

Hibernation

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- Drastically shrink memory usage with erlang:hibernate/3
  - Throws away the call stack, minimizes heap
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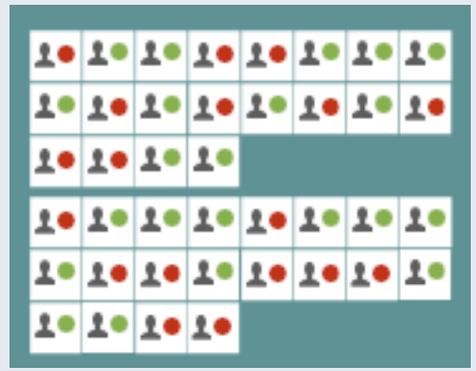
  - “Jumps” into a passed-in function for a received message
- Perfect for a long-running, idling HTTP request handler
- But … not compatible with gen_server:call (and gen_server:reply)
  - gen_server:call has its own receive() loop
  - hibernate() doesn’t support an explicit timeout
  - gen_hibernate: a few hours and a look at gen.erl

hipe_bifs



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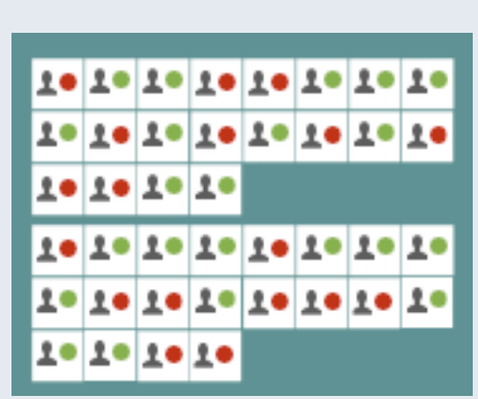

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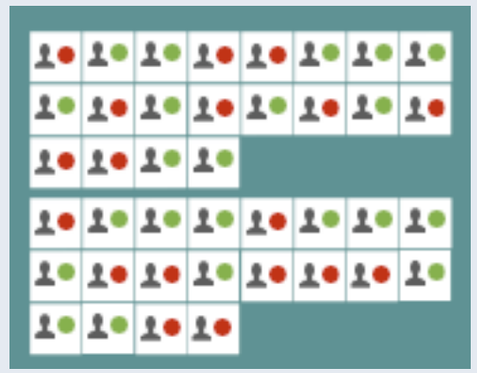
- hipe_bifs:bytearray_*(): manipulate references to mutable arrays (!)
  - Necessary for aggregating Chat users' presence
  - Same in-memory format as presence servers (C++)
  - Don't tell anyone!



Setbacks

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  - Few industry-focused English-language resources
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  - U.S. Erlang community limited in number and visibility
- Engineers are uncomfortable with FP
  - Universities have very conservative curricula
  - FP : academia, AI :: ‘normal programming’ : industry
  - “If you want to succeed, learn C++ and Java”, not “use the right tool for the job”
  - Not similar to rest of the codebase, not hiring specifically for FP

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- (Seemingly) contrary to “move fast” value

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