Scaling Erlang Web Applications

100 to 100K users at one web server

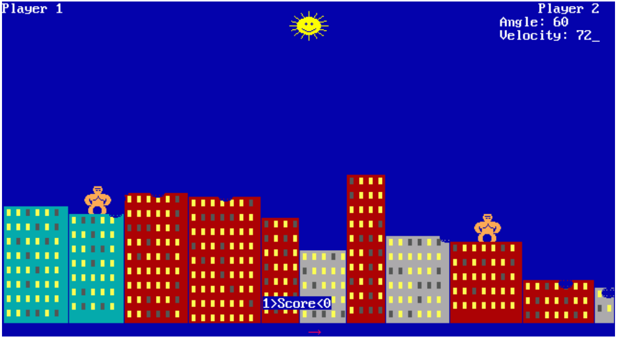
Fernando Benavides (*@elbrujohalcon*)

Inaka Labs

March 22, 2012

Hello World!

- I'm a developer since I was 10
- I'm an Erlang developer since 2008



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- I've built several dynamic web servers
  - Many of them with real-time updates
  - Most of them with high scale requirements
- I'll show you how I make them scale

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We will work on the scalability of a *web* project that has an *HTTP API* and a component that keeps clients *connected* to the server for *long periods* of time.

Examples:

- Social sites
- Chat sites
- Sports sites

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We will try to improve the way we use

- OTP behaviours
- TCP and HTTP connections
- Underlaying system configurations

*We will **not** deal with*

- Multiple machines/nodes
- Database choices and/or implementations

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Match Stream
General Idea

A soccer match is played at some stadium

Match Stream
General Idea

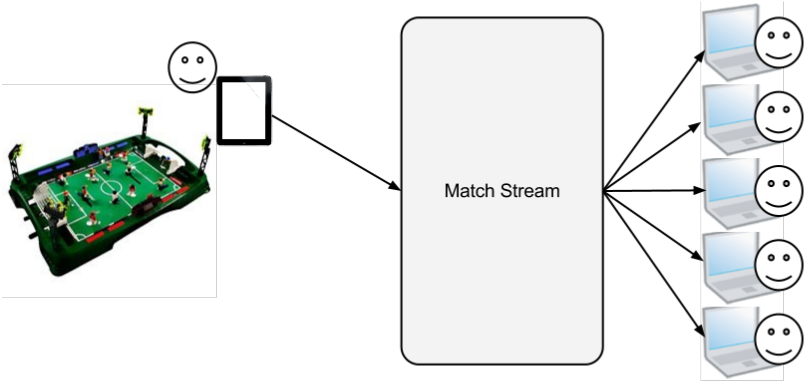
Soccer fans are connected to the internet in their offices

Match Stream
General Idea

A reporter is at the stadium with his device

Match Stream
General Idea

MatchStream ***connects*** *them in* ***real time***



Match Stream
Requirements

System Challenges

- Tons of concurrent users
- Two-hour-long bursts of connections followed by long periods of inactivity
- Real-time updates

Erlang seems to be **the right fit for this**

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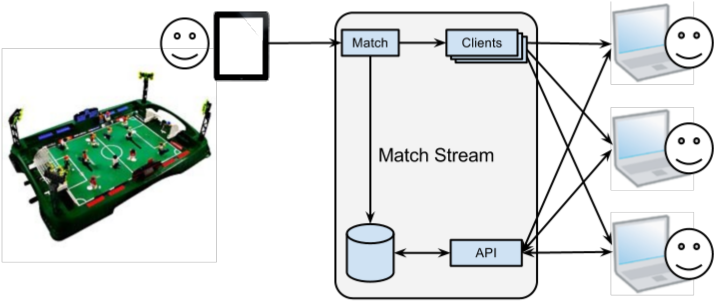
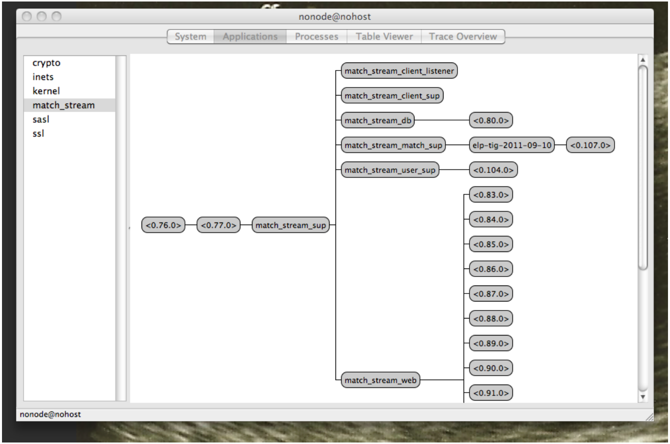
General Design



Match Stream
Architecture



Match Stream
Client-handling Components

CLIENT_LISTENER
: `gen_server`. Listens on a TCP port to receive client connections

CLIENT_SUP
: `supervisor`. Supervises connection processes

USER_SUP
: `supervisor`. Supervises user processes

WEB
: `mochiweb_server`. Listens for HTTP API calls

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DB and Watcher Components

DB
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Lesson Learned

Using Erlang to build your system is ***not enough*** *to ensure* ***scalability***

Stage 1

Testing the system as it is

Goals

- Find how much the system can handle

Steps

- Create automated testers
- Start the system on a *clean* machine
- Test repeatedly adjusting the number of connections
- Have a human trying the system himself

STAGE 1
TESTING THE SYSTEM AS IT IS

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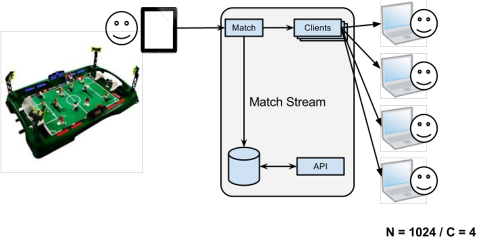
Stage 1
Results



- **1024** users
- **4** at a time
- **10s** ART

Stage 2
Improving the Environment

Goals

- Improve the system environment without altering the code

Settings to Tune Up

- Concurrent TCP connections
- Open files limit
- TCP backlog size
- TCP memory allocation
- Erlang VM startup parameters

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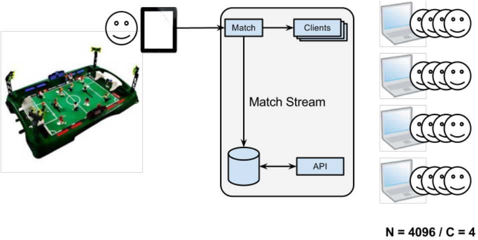

- **4096** users
- **4** at a time
- **9s** ART

Stage 3
Improving Match Stream

Goals

- Tune up the system for one node

Steps

- Find a problem
- Fix it using the list of *Tips and Tricks*
- If not there, add it
- Repeat from Stage 1

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Connection Tweaks

Backlog

- Allow more concurrent connections
- Don’t forget TCP tuning your HTTP server

Connections

- Don’t use just one of them
- Check inbound and outbound connections

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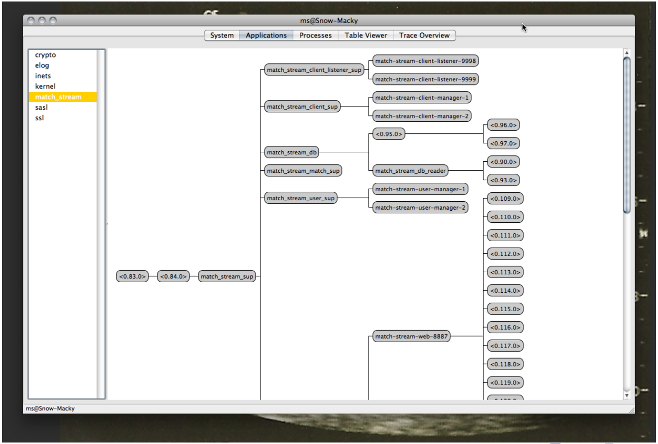
System Architecture



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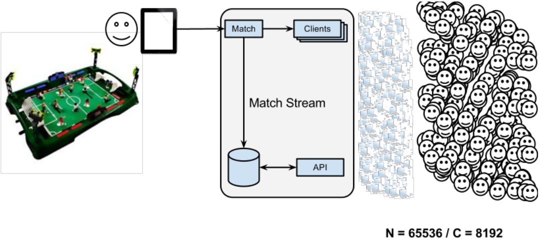

- **8192** users
- **256** at a time
- **16s** ART

Stage 3.2
gen_event

sup_handler

- Don't use it
- Monitor the processes instead

Long Delivery Queues

- Use *repeaters*

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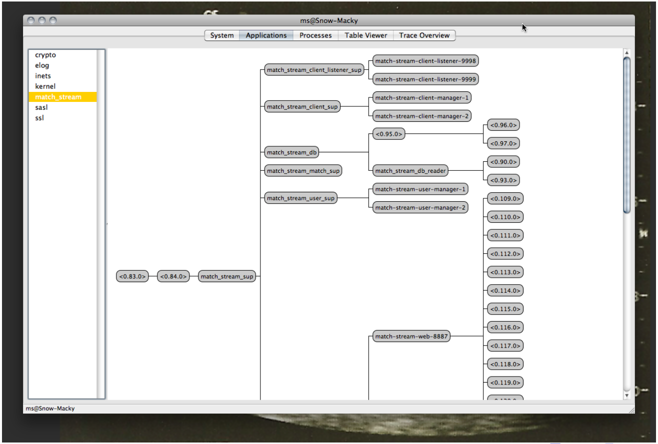

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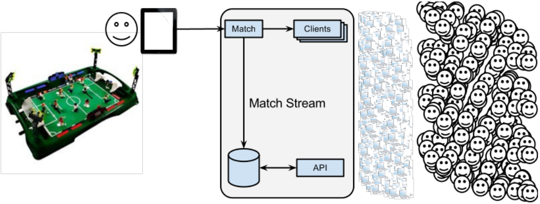

N = 65536 / C = 8192

- **8192** users
- **256** at a time
- **8s** ART

Stage 3.3

gen_server

Call Timeouts

Remember `gen_server:reply/2`

Memory Footprint

Remember `hibernate`

Long `init/1`

Use 0 timeout

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GEN_SERVER

Call Timeouts

Remember `gen_server:reply/2`

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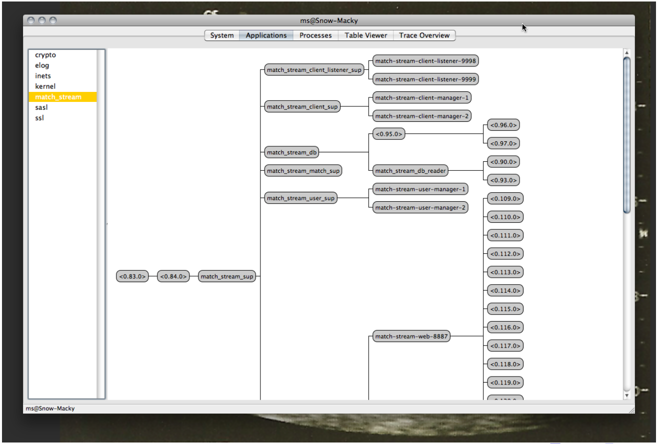

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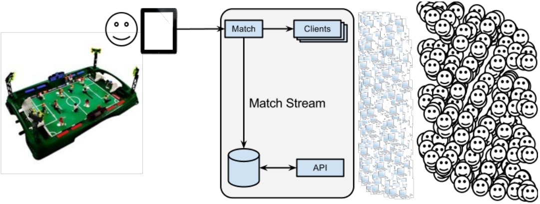


N = 65536 / C = 8192

- **32768** users
- **1024** at a time
- **1s** ART

Stage 3.4

Supervisors

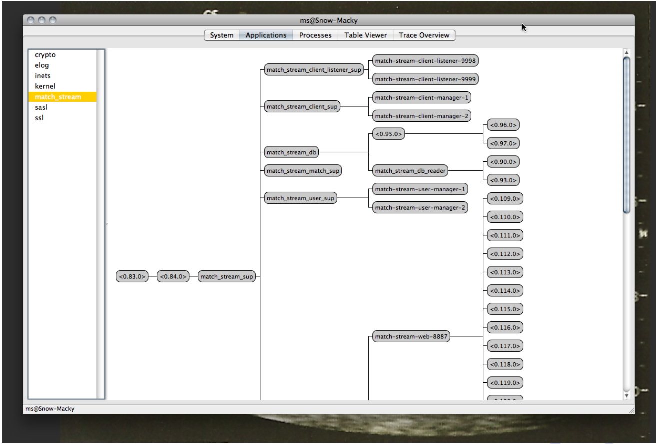
- Sometimes `simple_one_for_one` supervisors get overburdened because they have too many children
- Try a supervisor hierarchy with several managers below the main supervisor
- Turn `supervisor:start_child/2` calls into something like

```
supervisor:start_child(
  list_to_atom("module-name_" ++
                        integer_to_list(random:uniform(#ofSupervisors))).
```

Stage 3.4

Supervisors

System Architecture



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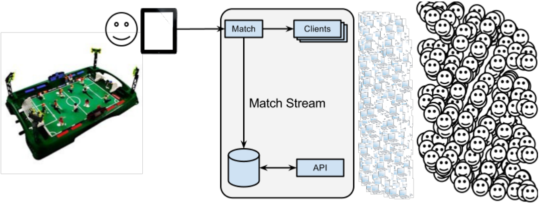

N = 65536 / C = 8192

- **65536** users
- **2048** at a time
- **1s** ART

Stage 3.5
Other Processes

Timers

- Don't use the `timer` module
- Use `erlang:send_after`

Logging

- Don't log too much
- Use a good logging system

Registration

- Sometimes it's better to register processes instead of keeping track of their pids manually
- You can always register processes both locally and globally

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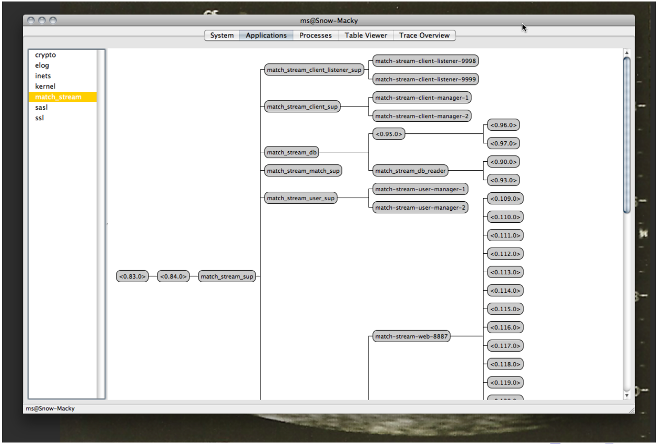

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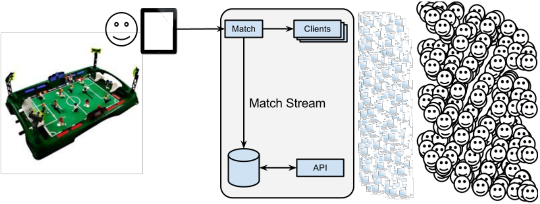

N = 65536 / C = 8192

- **65536** users
- **8192** at a time
- **10ms** ART

Stage 4
Adding Nodes

Goals

- Find the best system topology

Steps

- Prepare the system to run in more than one node
- Decide if nodes should be connected or independent
- Decide if nodes should be on the same machine or not

Stage 4
Adding Nodes

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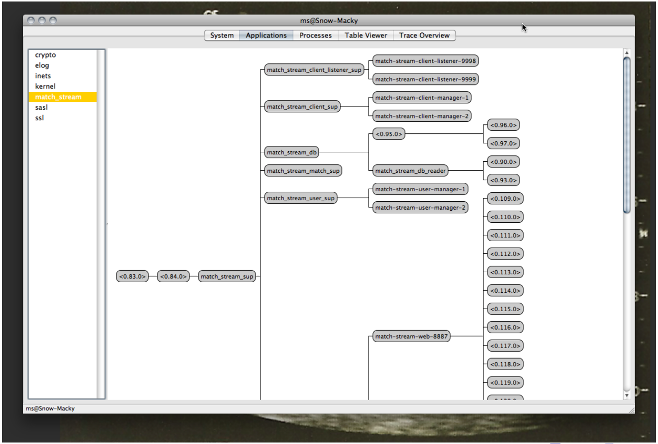

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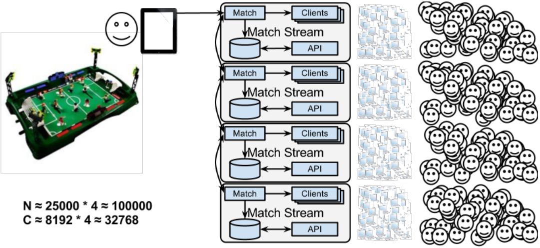

N ≈ 25000 * 4 ≈ 100000
C ≈ 8192 * 4 ≈ 32768

- **100K** users
- **32768** at a time
- **10ms** ART

Summary

- This is an iterative process
- It worked awesomely for us in both experimental and real-life systems
- It's no silver bullet
- The list of *Tips and Tricks* grows constantly over time

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Scaling Topics

that weren't covered on this presentation

- Managing many nodes
- Choosing databases
- System specific improvements
- Measuring tools

Questions

Thanks!