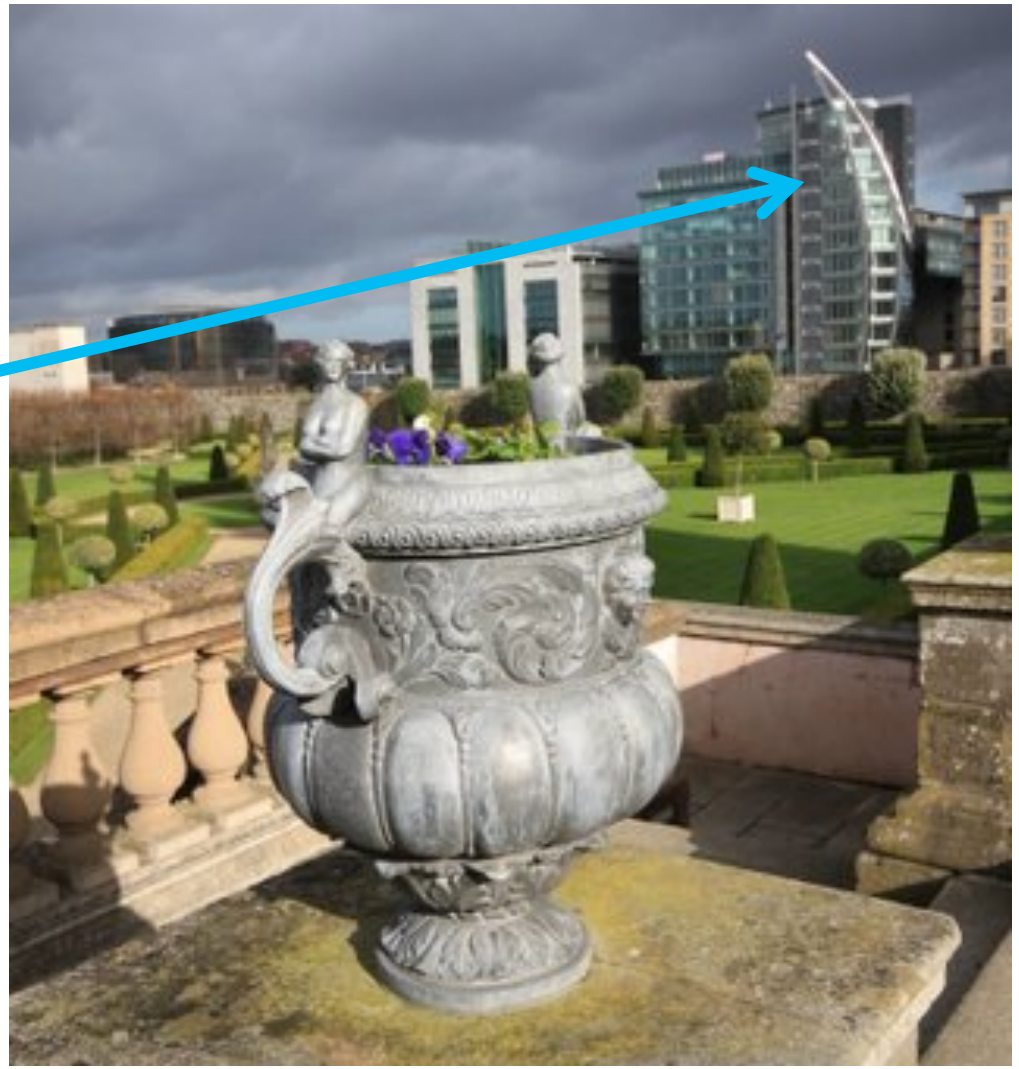
Real Time Bidding with Erlang

Aol PLATFORMS.

About Me

2012 Erlang at AOL

Erlang Here



Agenda

What is RTB ?

RTB Exchange Architecture

Bottlenecks

Tracing and Debugging

What is RTB ?

Online Advertising

Placement with Advertiser's Banner

Free Content on WWW

Paid for by Advertising

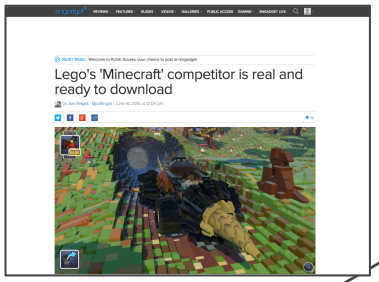
Upfront agreements between Publishers and Advertisers

What is Real Time Bidding

- The buying a selling of online advertisements in real time while a page is loading

Exoclick, www.exoclick.com (2014)

Adserving Workflow



Web Server

SSP

AdServer

RTB

DSP 1

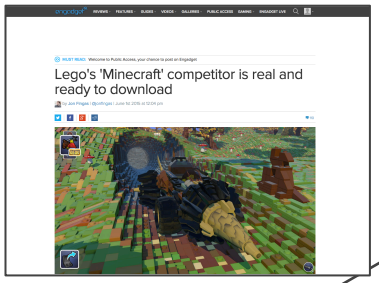
DSP 2

DSP 3

DSP N

Advertiser CDN

Adserving Workflow



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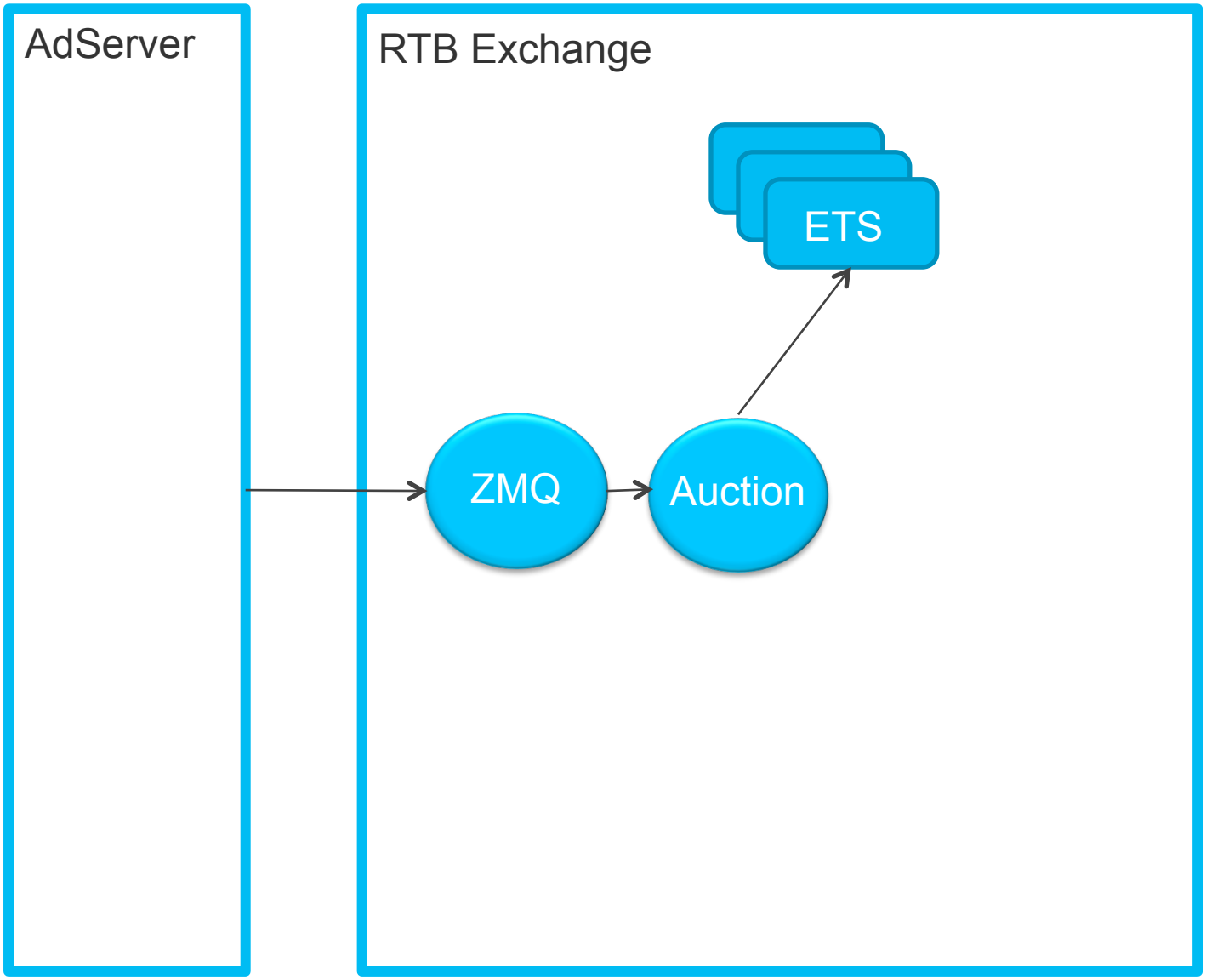
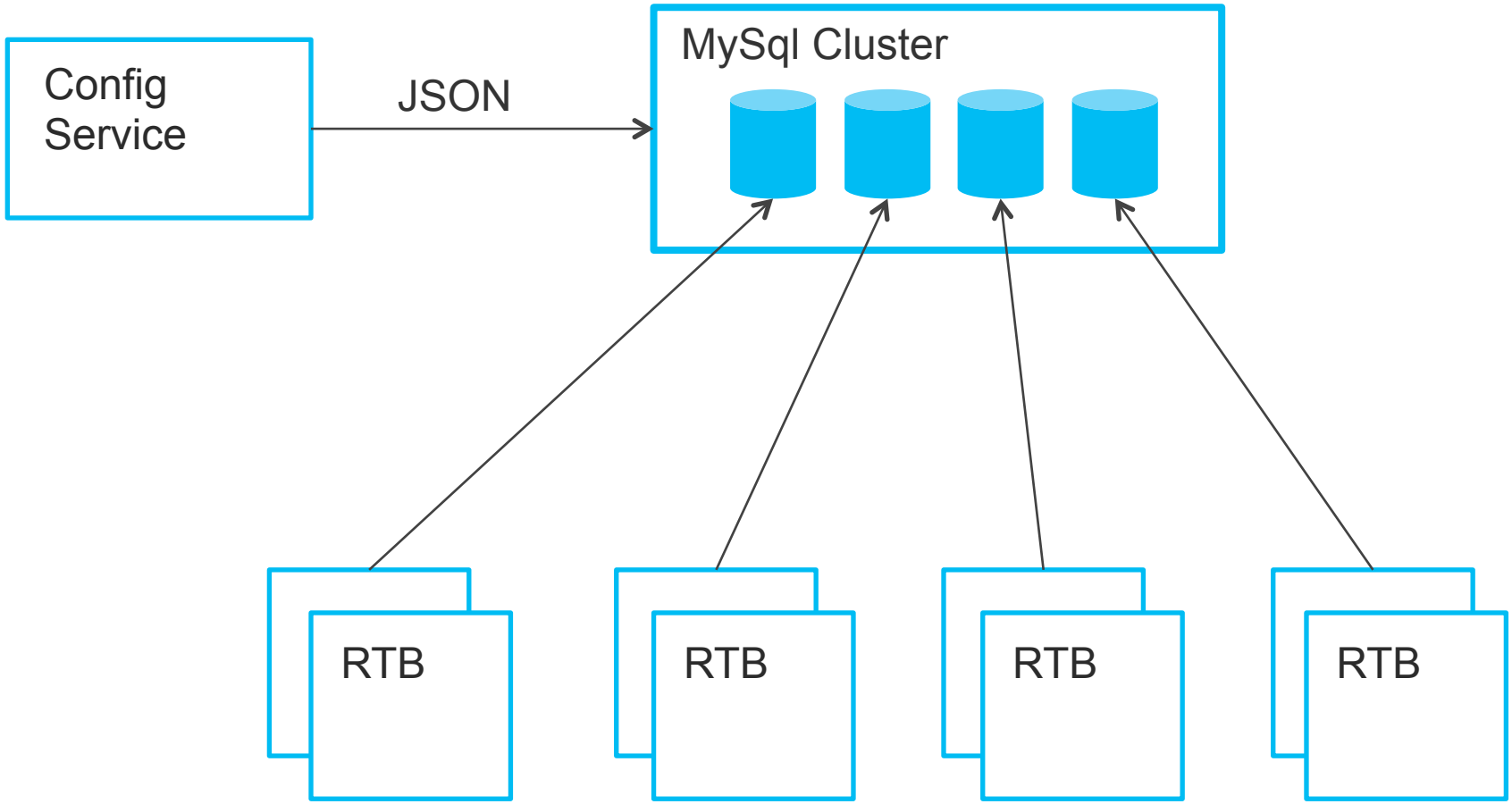
RTB Exchange Architecture


AdServer
RTB Exchange
ETS
ZMQ
Auction

Retrieving Campaign Data



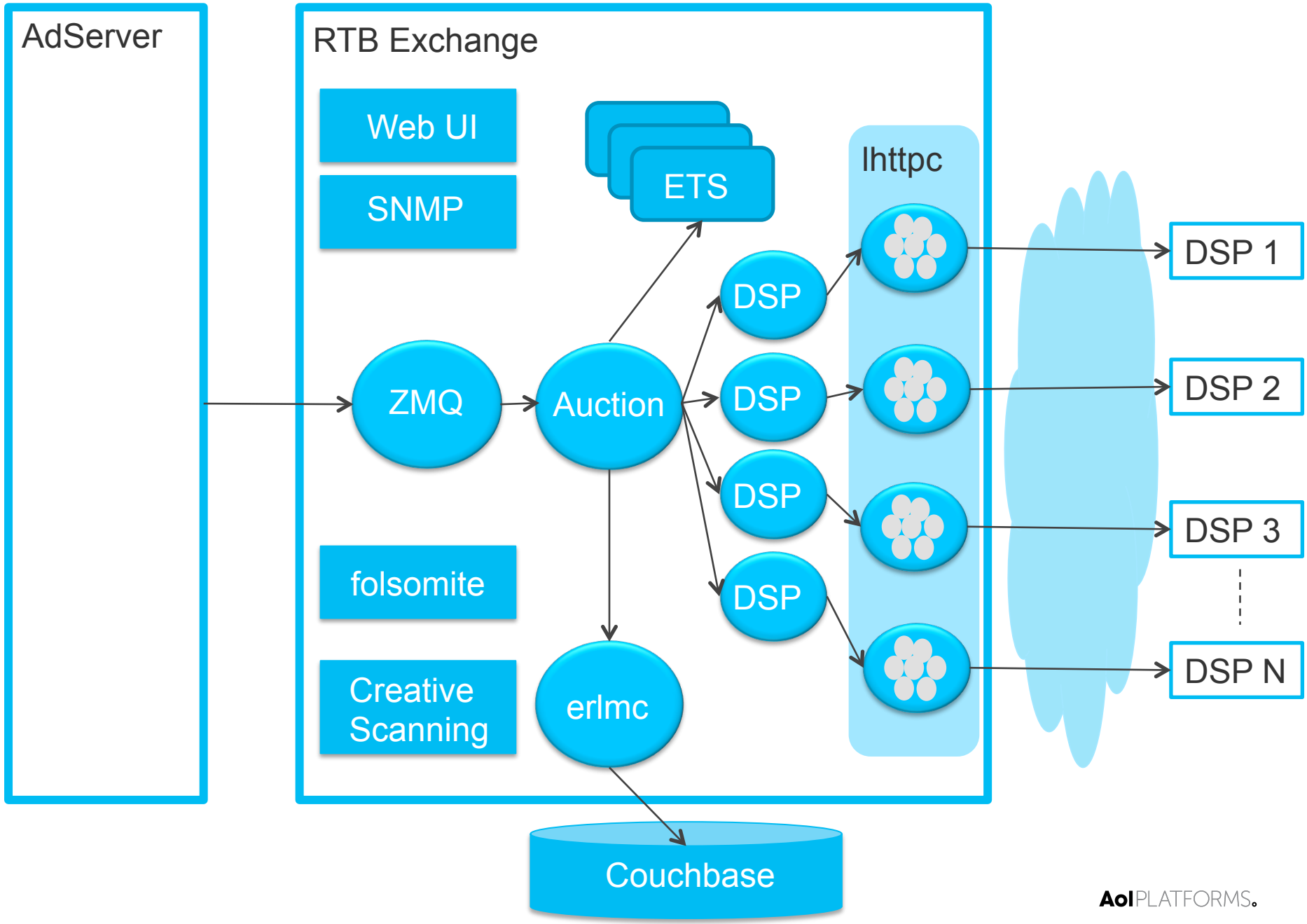
Hashing Node Name to MySql Server

```
1 hash_name(Node, MySqlHosts) ->

2     Sum = lists:sum(atom_to_list(Node)),

3     Index = Sum rem length(MySqlHosts),

4     lists:nth(Index, MySqlHosts).
```


AdServer
RTB Exchange
Web UI
SNMP
ETS
lhttpc
DSP
DSP
DSP
DSP
ZMQ
Auction
folsomite
Creative Scanning
erlmc
Couchbase
DSP 1
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DSP 3
DSP N

How Much does it Scale ?

8,000

The number of bid requests build and sent to DSPs every second per host at peak

1 Million

The number of placements

50 Billion

The number of bid requests build and sent
to DSPs every day

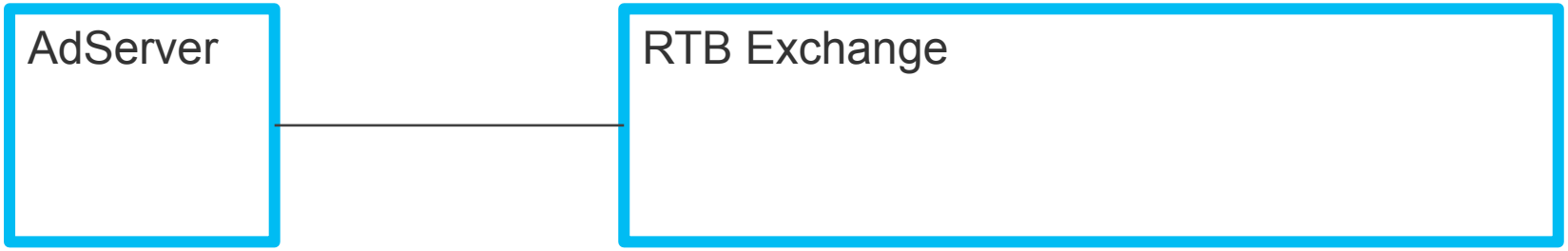
A Highly Concurrent System

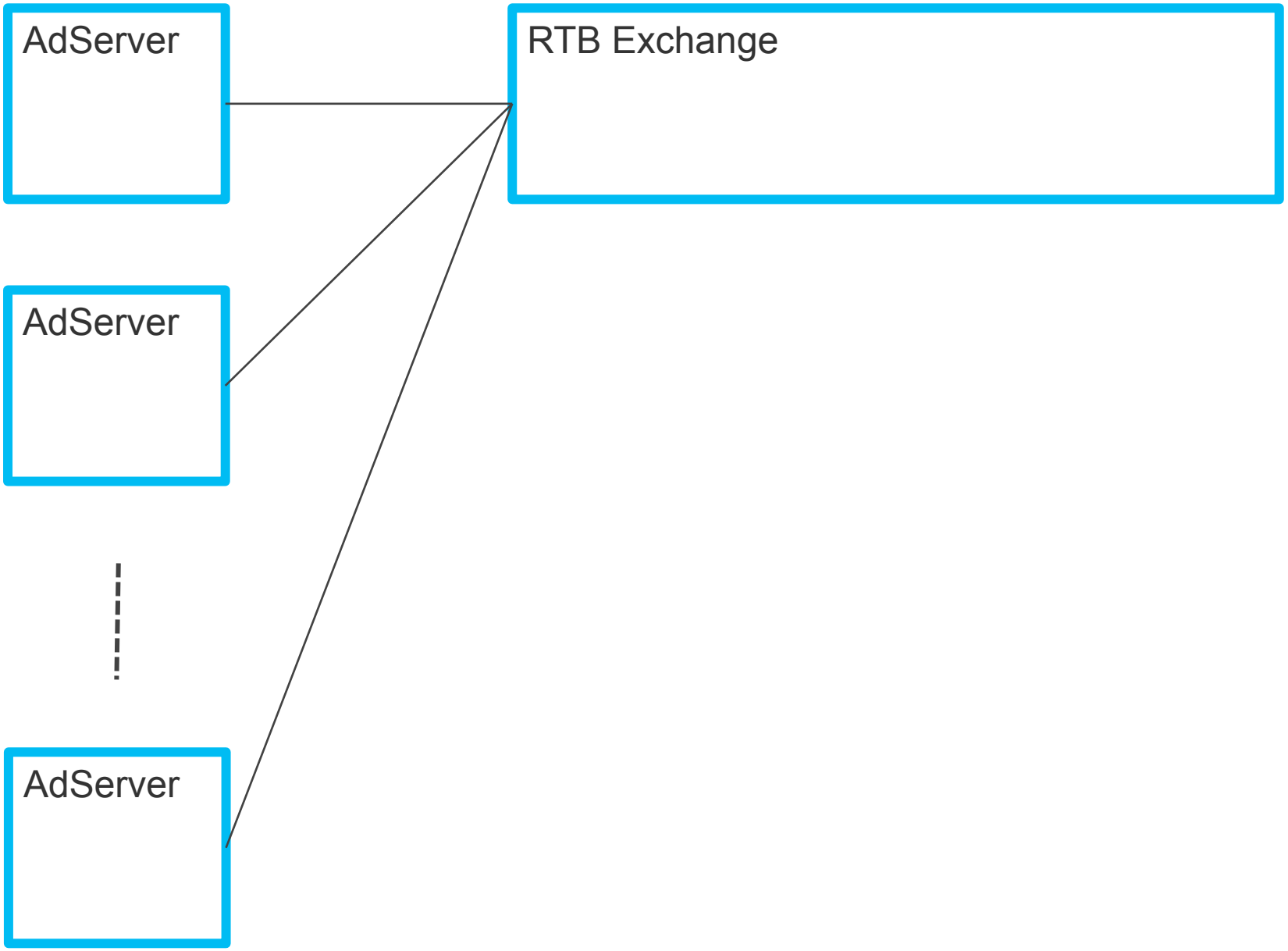
Independent Requests

Independent Auctions

Independent DSP Processes

ZMQ Interface


AdServer
RTB Exchange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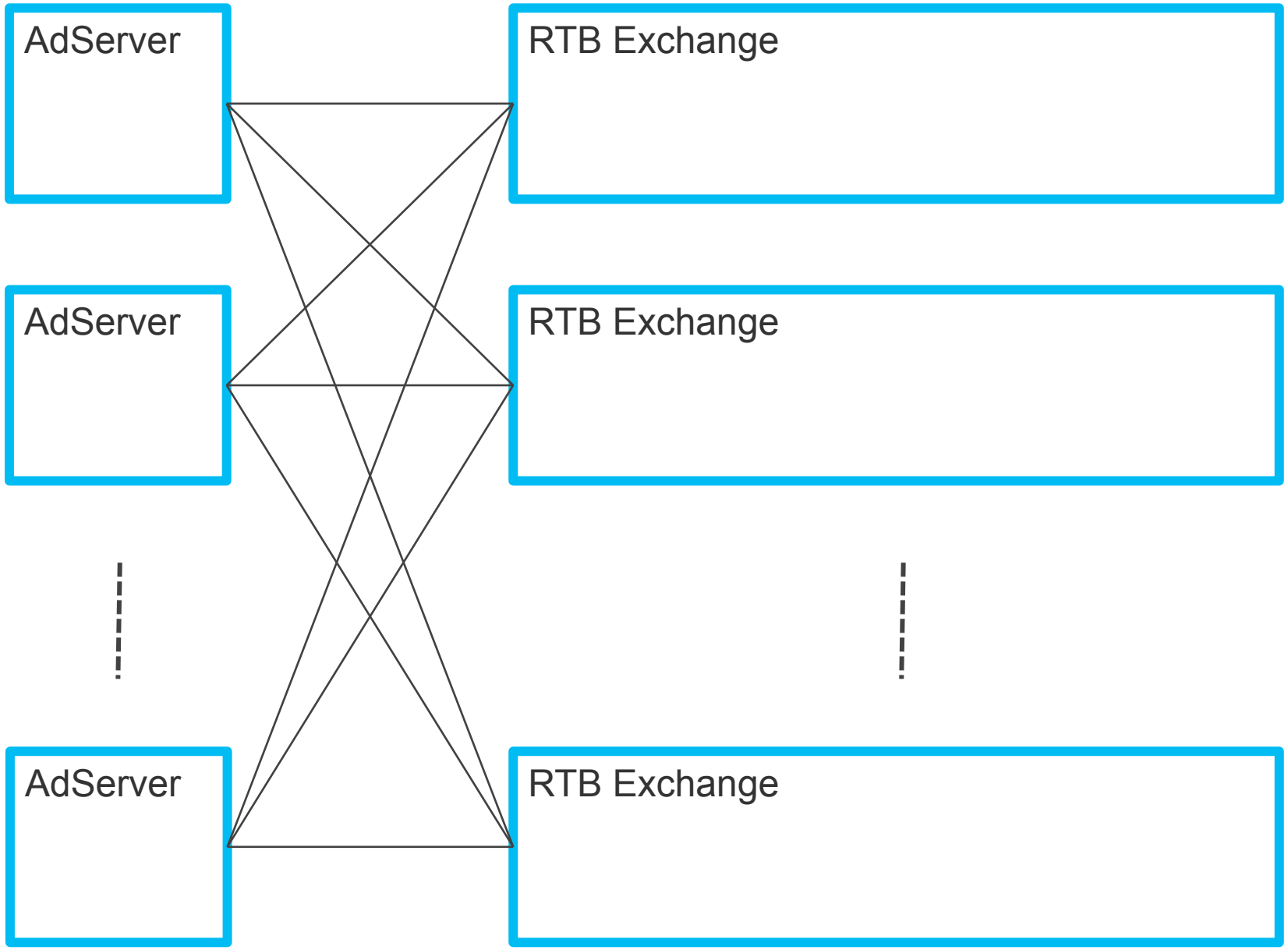
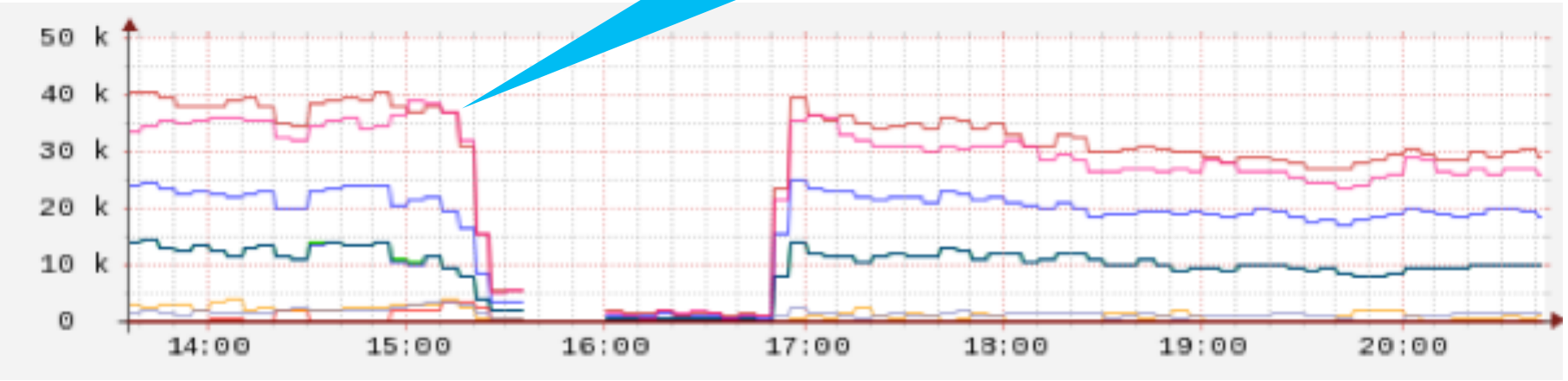
RTB Exchange
AdServer
AdServer


AdServer
AdServer
AdServer
RTB Exchange
RTB Exchange
RTB Exchange

The Symptom

Requests handled by
RTB Exchange
Drop off for 1.5 hours



The Problem

- 10,000s messages in ZMQ Mailbox
- Single Process
- Active Socket
- Mailbox full of messages being sent and received
- Selective receive when sending to adserver
- Other applications running on same host

How we Fixed It

escript for montoring

- RPC call to check message queue length
- erlang:halt/1 to shut down the node
- heart to Restart node

High Priority ZMQ Process

- process_flag(priority, high)
- Convert every request into a process ASAP

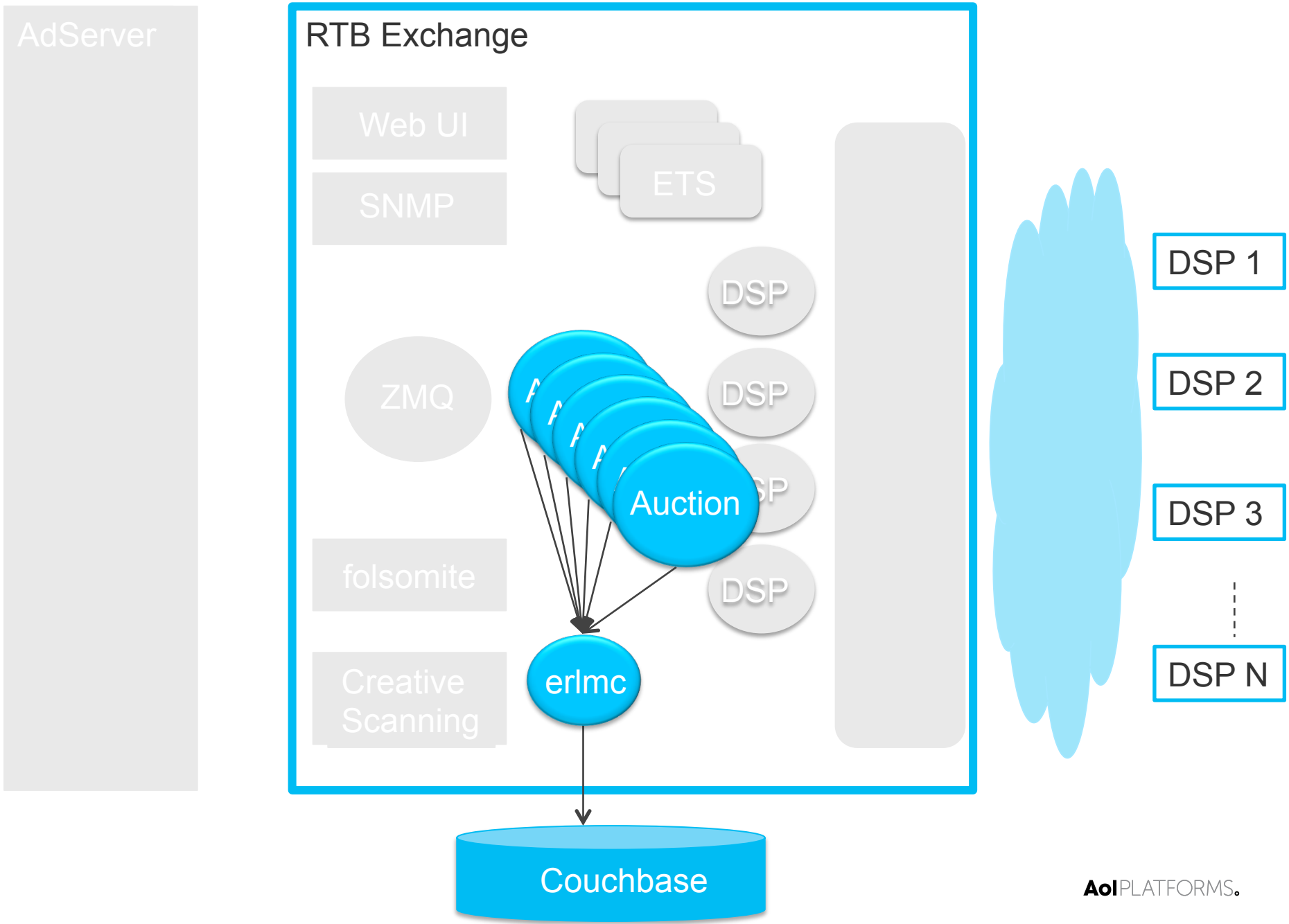
Passive Socket

- Polling for requests
- ZMQ High Water Mark

Multiple ZMQ Endpoints

- Gives us >1 ZMQ process
- Enabled by configuration

Pooling Resources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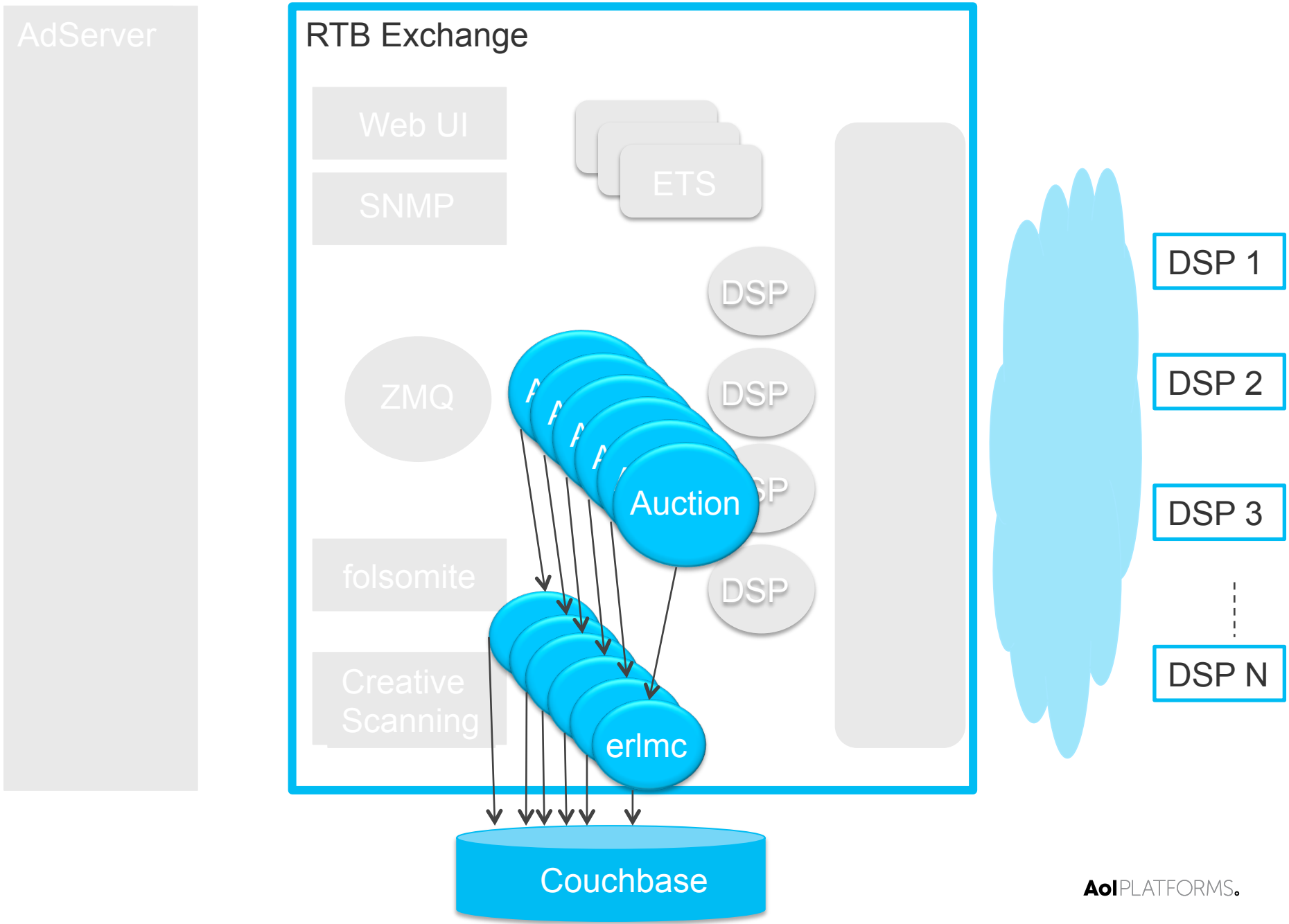
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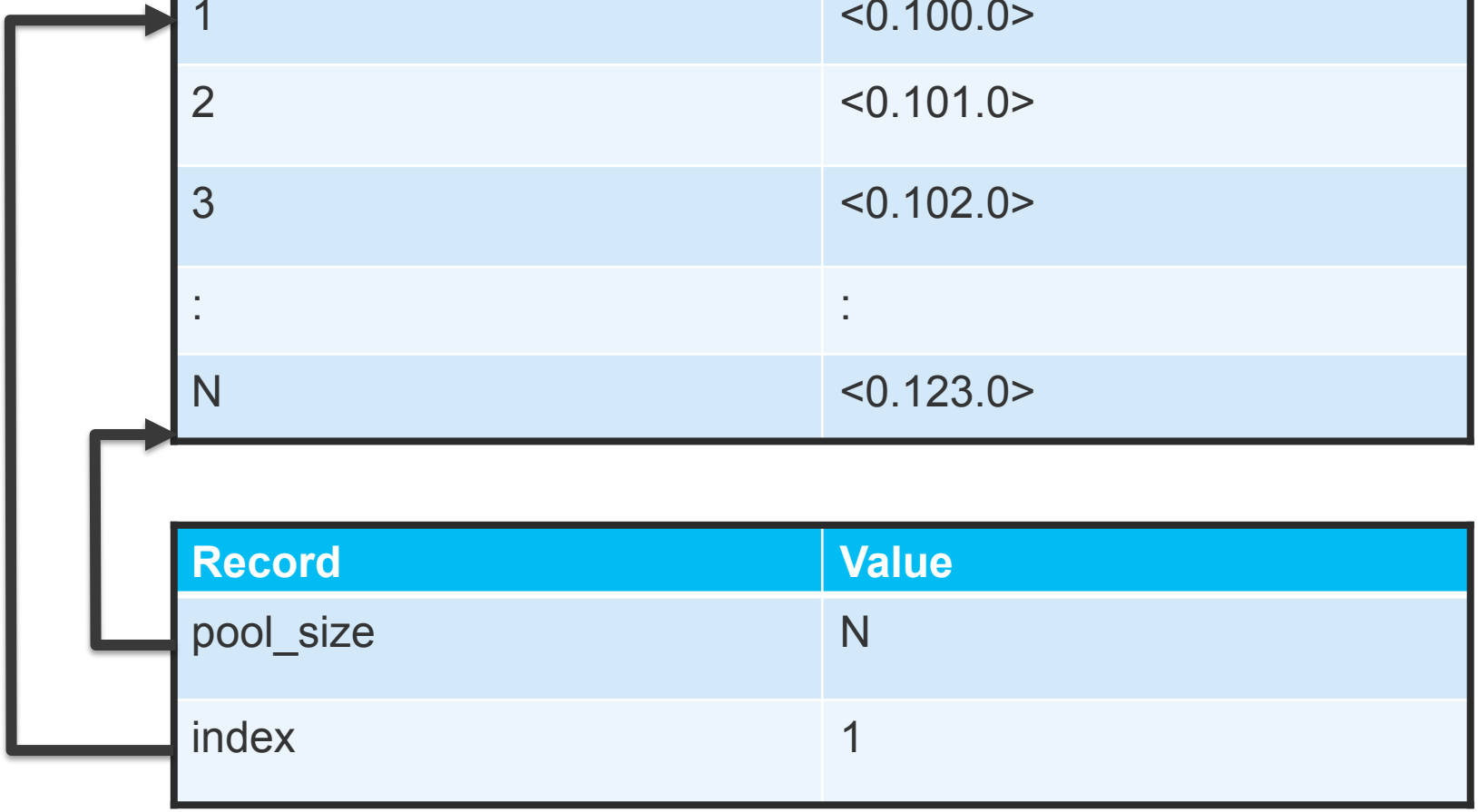
Storing Resources in ETS

Index	erlmc process
1	<0.100.0>
2	<0.101.0>
3	<0.102.0>
:	:
N	<0.123.0>

Record	Value
pool_size	N
index	1



Round Robin Lookup in ETS

```
1 get_worker() ->
2   PoolSize = ets:lookup_element(?TABLE, pool_size, 2),
3   Index = ets:update_counter(?TABLE, index, {2,1,PoolSize,1}),
4   ets:lookup_element(?TABLE, Index, 2).
```

Random ETS Lookup

```
1 get_worker() ->
2   PoolSize = ets:lookup_element(?TABLE, pool_size, 2),
3   Index = erlang:phash2(self(), PoolSize) + 1,
4   ets:lookup_element(?TABLE, Index, 2).
```

phash2 vs update_counter

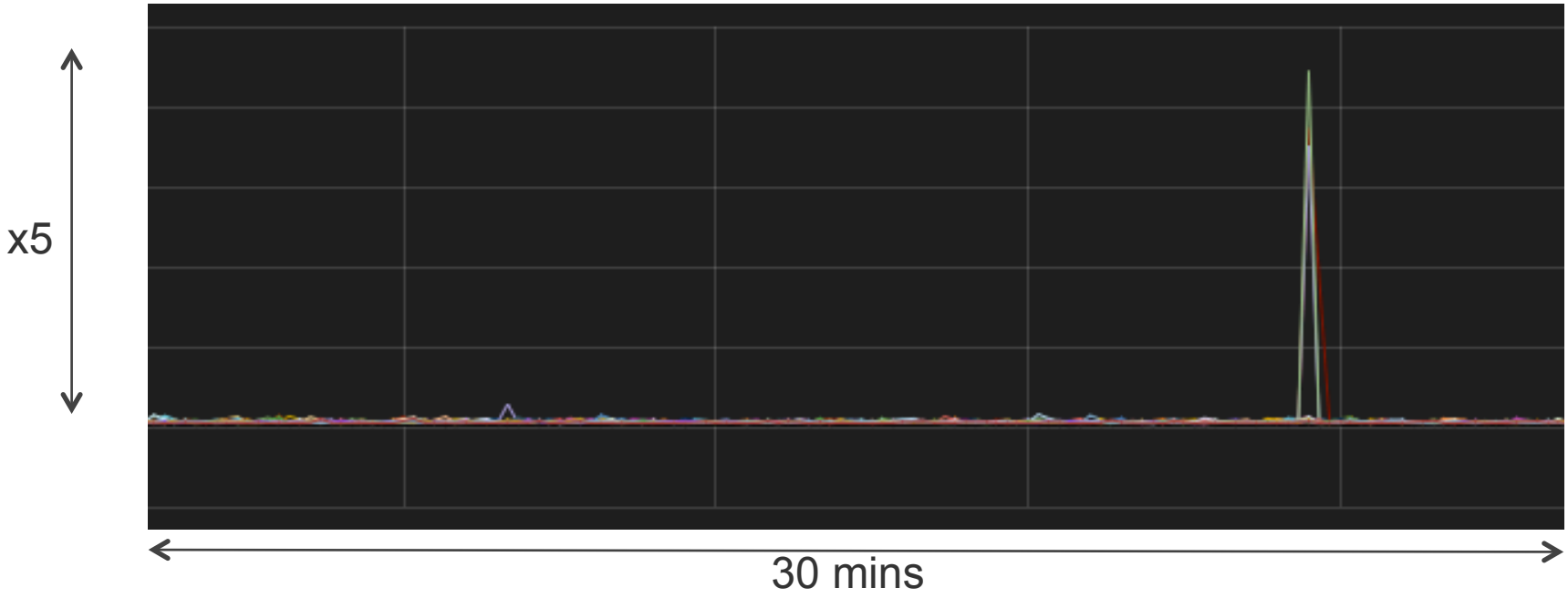
update_counter useful for round_robin

phash2 useful for random selection

phash2 faster than update_counter (x1.5 - x2)

phash2 does no writes to ETS hence no locking

Tracing and Debugging



Bid Collection Time

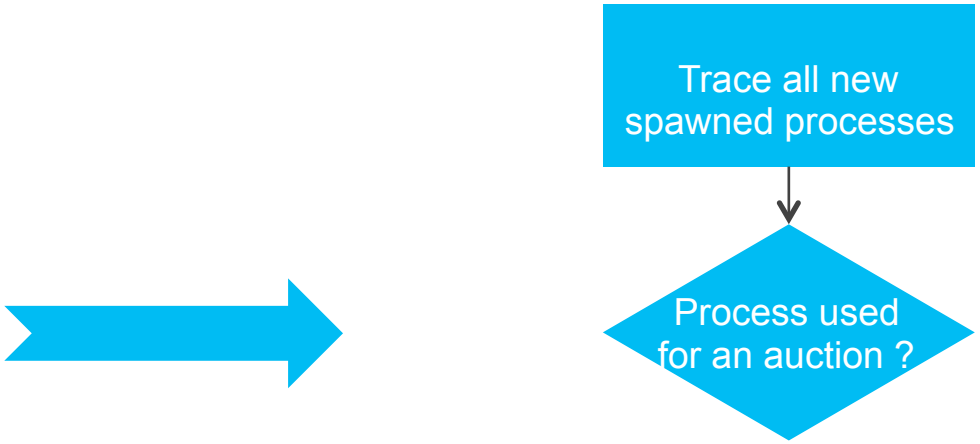
- Spike in Timer every 20-30 mins
- X5 magnitude
- System not under load

Tracing the Spike

Trace all new spawned processes

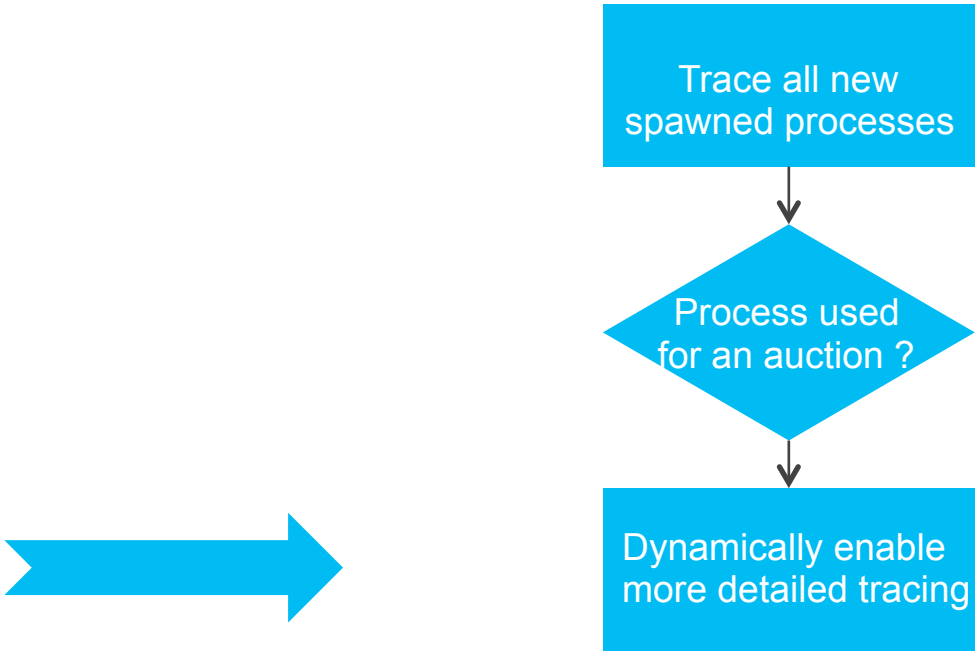
```
1     dbg:tracer(process,
                 {fun trace_handler/2,
                  {IO,           %% file to log to
                   dict:new(),   %% dict for recording info in
                   Threshold,    %% timer threshold
                   Count}}),

2     {ok, Tracer} = dbg:get_tracer(),

3     erlang:trace(new, true, [call, timestamp, {tracer, Tracer}]).
```

Tracing the Spike



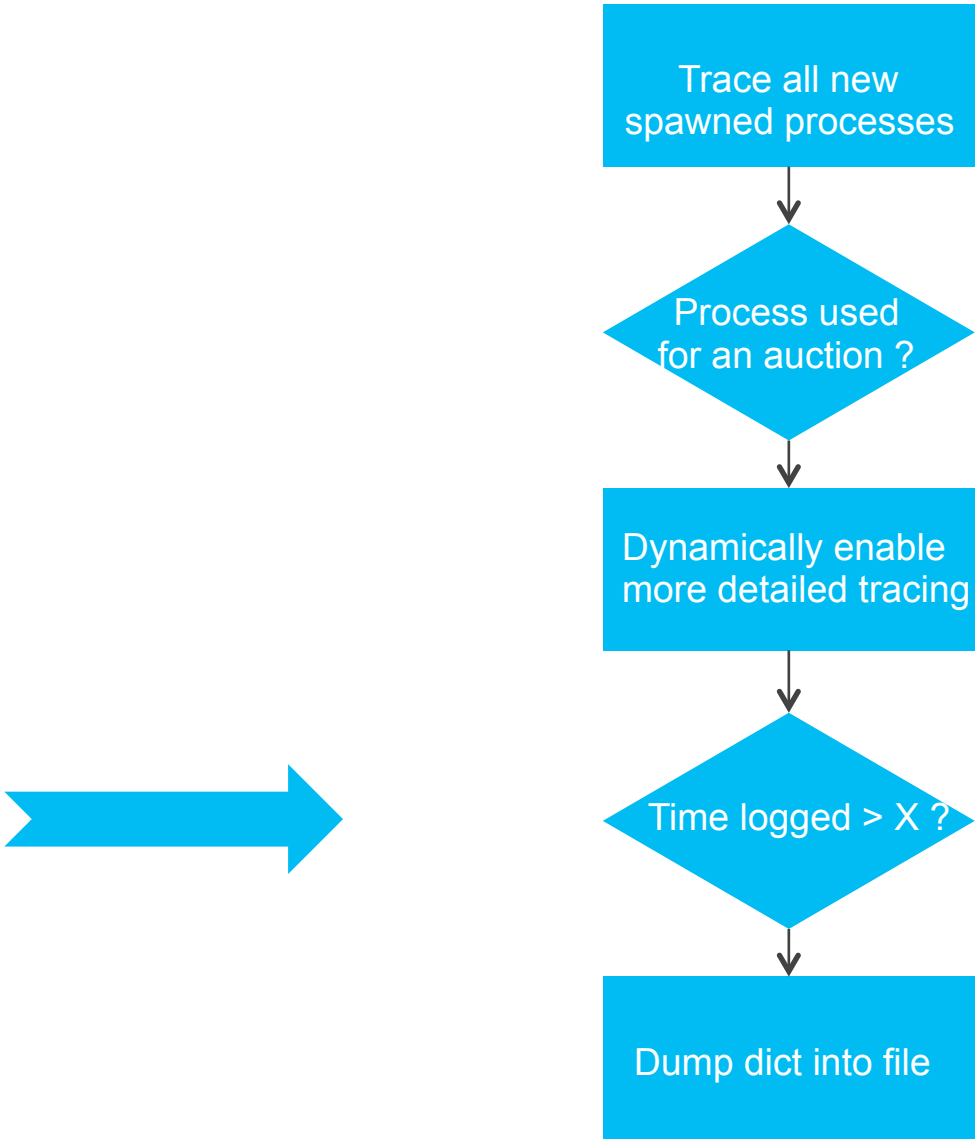
```
1    dbg:tp(bid_processor, process_request, x),
```

Tracing the Spike



```
1 trace_handler({trace_ts, Pid, call,
                 {bid_processor, process_request, _},
                 TS},
                 {IO, Dict, Threshold, Count}) ->

2     erlang:trace(Pid, true, [timestamp,  %% trace with timestamps
                               'receive',  %% messages received
                                call,      %% funcion calls
                                running,   %% when scheduled in/out
                                {tracer, self()}]),

3     Dict1 = dict:append(Pid, {TS, process_request}, Dict),

4     {IO, Dict1, Threshold, Count};
```

Tracing the Spike



Conclusions

Highly Concurrent System

Single Processes are bottlenecks

- High Priority
- Process Pools

Erlang VM a Great Platform for Debugging Production Systems

The Future

Scale for more Publishers and Demand Partners

Continue to Build a Great Erlang Team

Support Growth Erlang Community

- Internships
- University Presentations

Erlang Factory - Dublin Sept 2015