FRANCESCO CESARINI

presents

ERLANG/OTP

Francesco Cesarini
Erlang Solutions

@FrancescoC
francesco@erlang-solutions.com
www.erlang-solutions.com

Erlang SOLUTIONS


Erlang
SOLUTIONS

What Is Scalability?

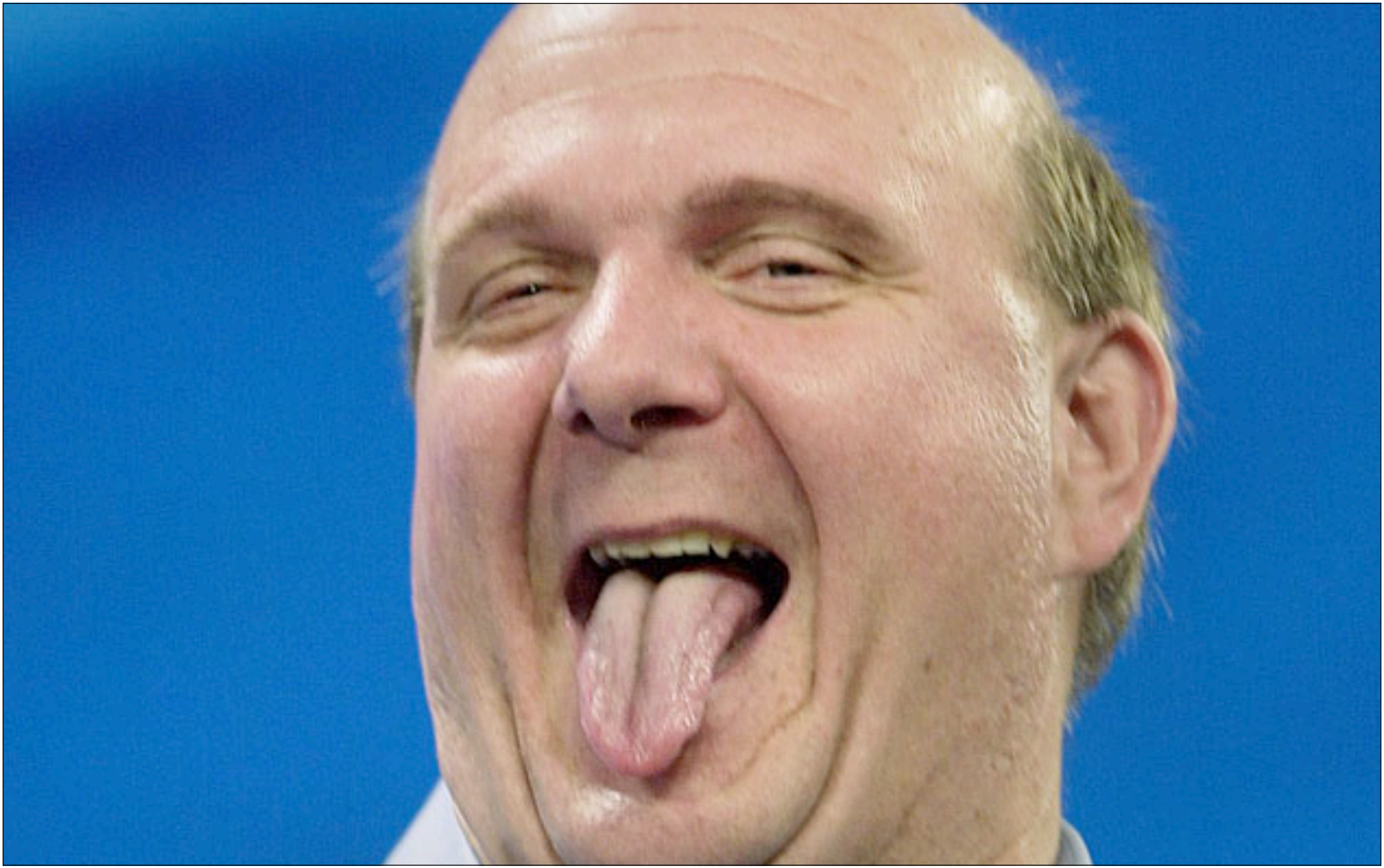
What Is (massive) Concurrency?


NOKIA

What Is High Availability?

What Is Fault Tolerance?

What Is Distribution Transparency?



Do you need a distributed system? Do you need a scalable system? Do you need a reliable system? Do you need a fault-tolerant system? Do you need a massively concurrent system? Do you need a distributed system? Do you need a scalable

YES, PLEASE!!!

system? Do you need a reliable system? Do you need a fault-tolerant system? Do distributed system? Do you need a scalable system? Do you need a reliable system? Do you need a fault-tolerant system? Do you need a massively

TO THE RESCUE

WHAT IS ERLANG

- Open source
- Concurrency-oriented
- Lightweight processes
- Asynchronous message passing
- Share-nothing model
- Process linking / monitoring
- Supervision trees and recovery strategies
- Transparent distribution model
- Soft-real time
- Let-it-fail philosophy
- Hot-code upgrades

WELL, IN FACT YOU NEED MORE.

ERLANG IS JUST
A PROGRAMMING LANGUAGE.

YOU NEED ARCHITECTURE PATTERNS.

YOU NEED MIDDLEWARE.

YOU NEED LIBRARIES.

YOU NEED TOOLS.

You need OTP.

What is Middleware?

Design Patterns

Fault Tolerance

Distribution

Upgrades

Packaging

MIDDLEWARE

What are Libraries?

Storage

O&M

Interfaces

Communication

LIBRARIES

What Tools?

OTP TOOLS

- Development
- Test Frameworks
- Release & Deployment
- Debugging & Monitoring

OPEN SOURCE

OTP IS

PART OF THE ERLANG DISTRIBUTION

OTP

Less Code

Less Bugs

More Solid Code

More Tested Code

More Free Time

Servers

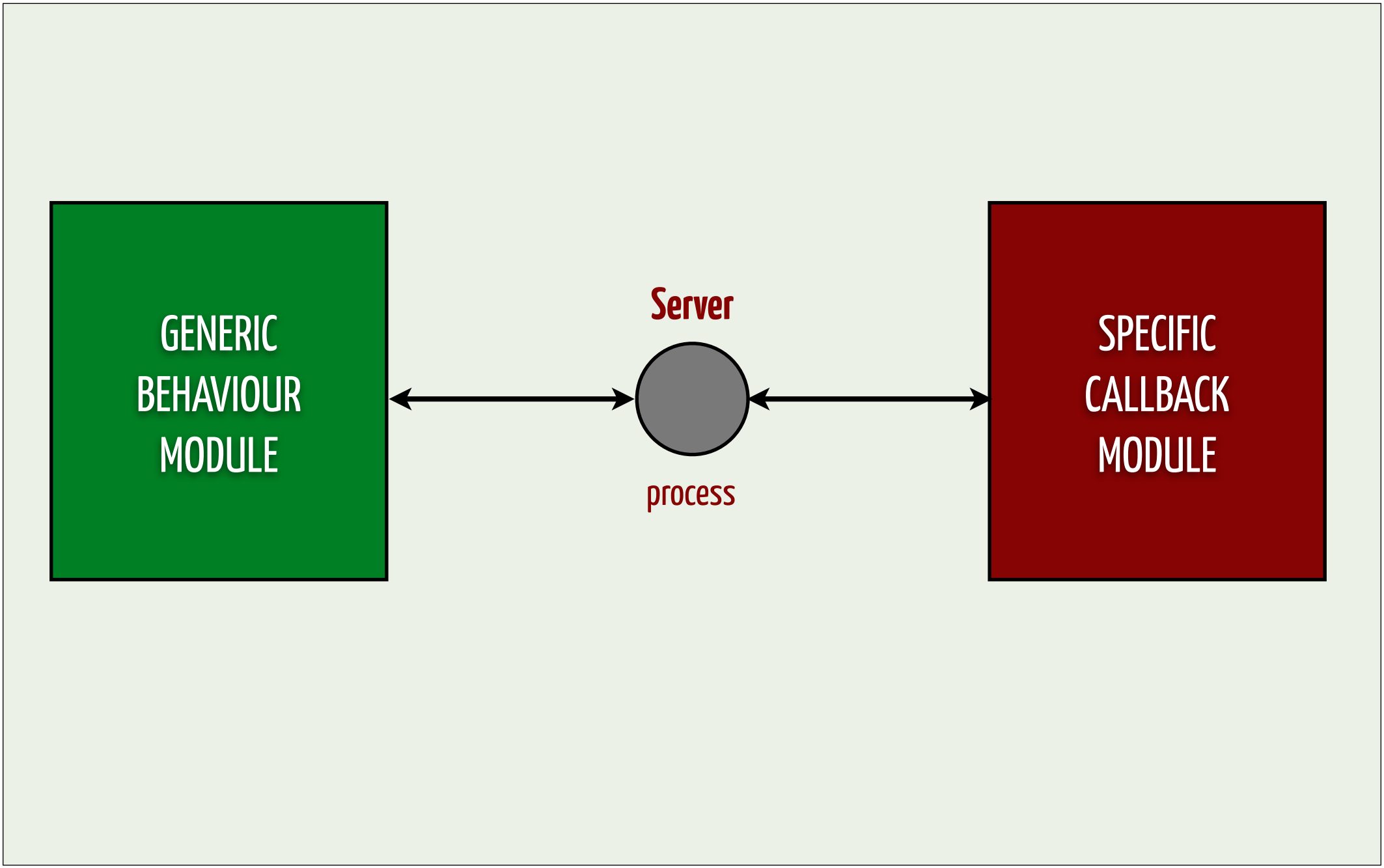
Finite State Machines

Event Handlers

Supervisors

Applications

Behaviours


GENERIC
BEHAVIOUR
MODULE
Server
process
SPECIFIC
CALLBACK
MODULE

OTP

Less Code
Less Bugs
More Solid Code
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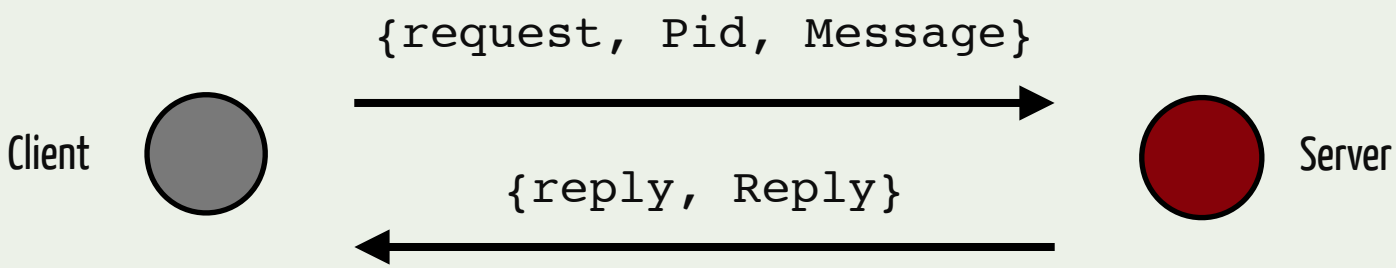
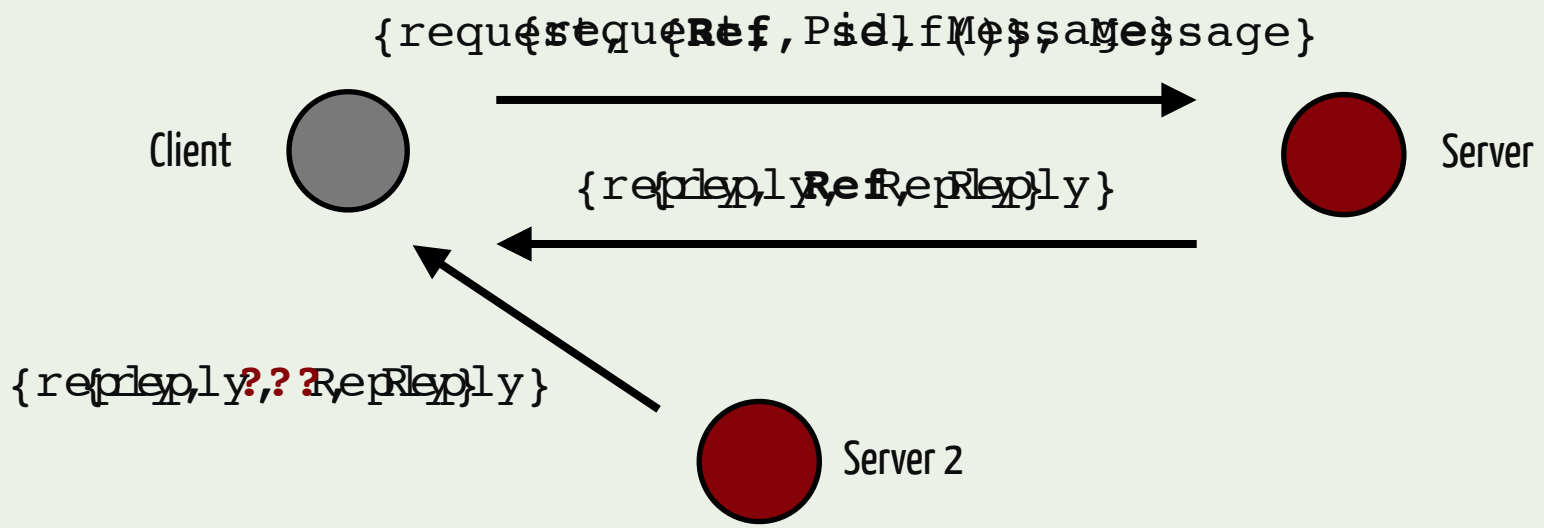
More Free Time

Servers
Finite State Machines
Event Handlers
Supervisors
Applications



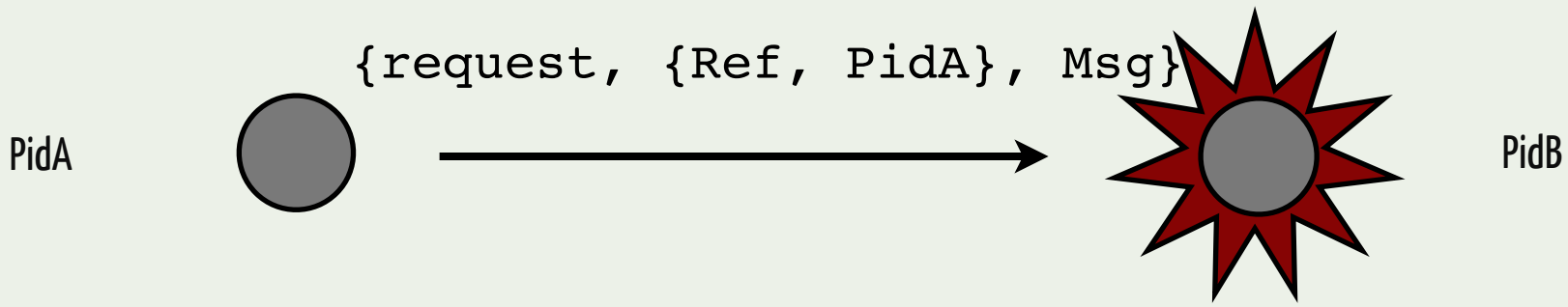

```
call(Name, Message) ->
    Name ! {request, self(), Message},
    receive
        {reply, Reply} -> Reply
    end.
```

```
reply(Pid, Reply) ->
    Pid ! {reply, Reply}.
```

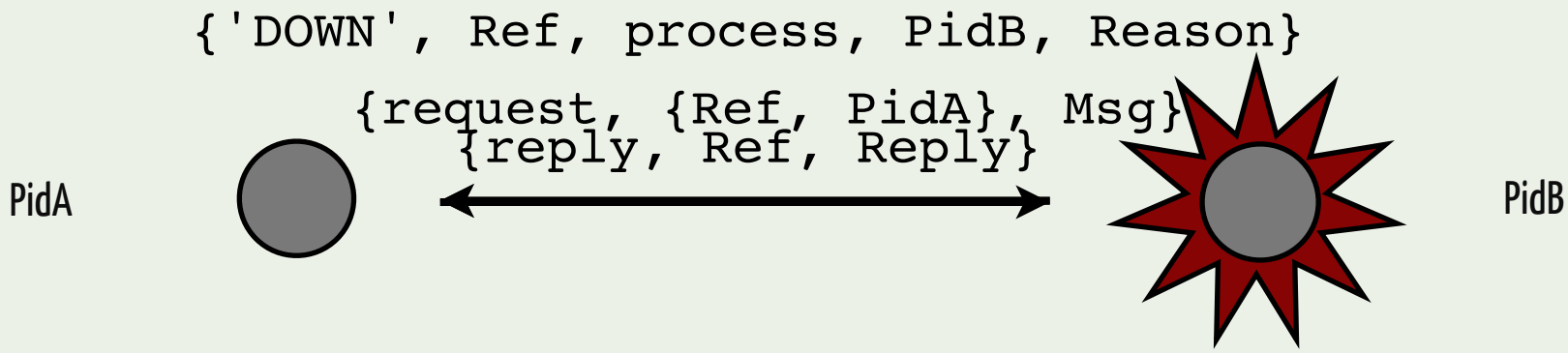



```
call(Name, Msg) ->
    Ref = make_ref(),
    Name ! {request, {Ref, self()}, Msg},
    receive {reply, Ref, Reply} -> Reply end.

reply({Ref, Pid}, Reply) ->
    Pid ! {reply, Ref, Reply}.
```




```
call(Name, Msg) ->
    Ref = erlang:monitor(process, Name),
    Name ! {request, {Ref, self()}, Msg},
    receive
      {reply, Ref, Reply} ->
        erlang:demonitor(Ref),
        Reply;
      {'DOWN', Ref, process, _Name, _Reason} ->
        {error, no_proc}
    end.
```




```
call(Name, Msg) ->
    Ref = erlang:monitor(process, Name),
    Name ! {request, {Ref, self()}, Msg},
    receive
      {reply, Ref, Reply} ->
        erlang:demonitor(Ref, [flush]),
        Reply;
      {'DOWN', Ref, process, _Name, _Reason} ->
        {error, no_proc}
    end.
```

BEHAVIOURS

TIMEOUTS

DEADLOCKS

TRACING

MONITORING

DISTRIBUTION

Let It Fail

```
convert(Day) ->
  case Day of
      monday    -> 1;
      tuesday   -> 2;
      wednesday -> 3;
      thursday  -> 4;
      friday    -> 5;
      saturday  -> 6;
      sunday    -> 7;
      Other ->
          {error, unknown_day}
  end.
```

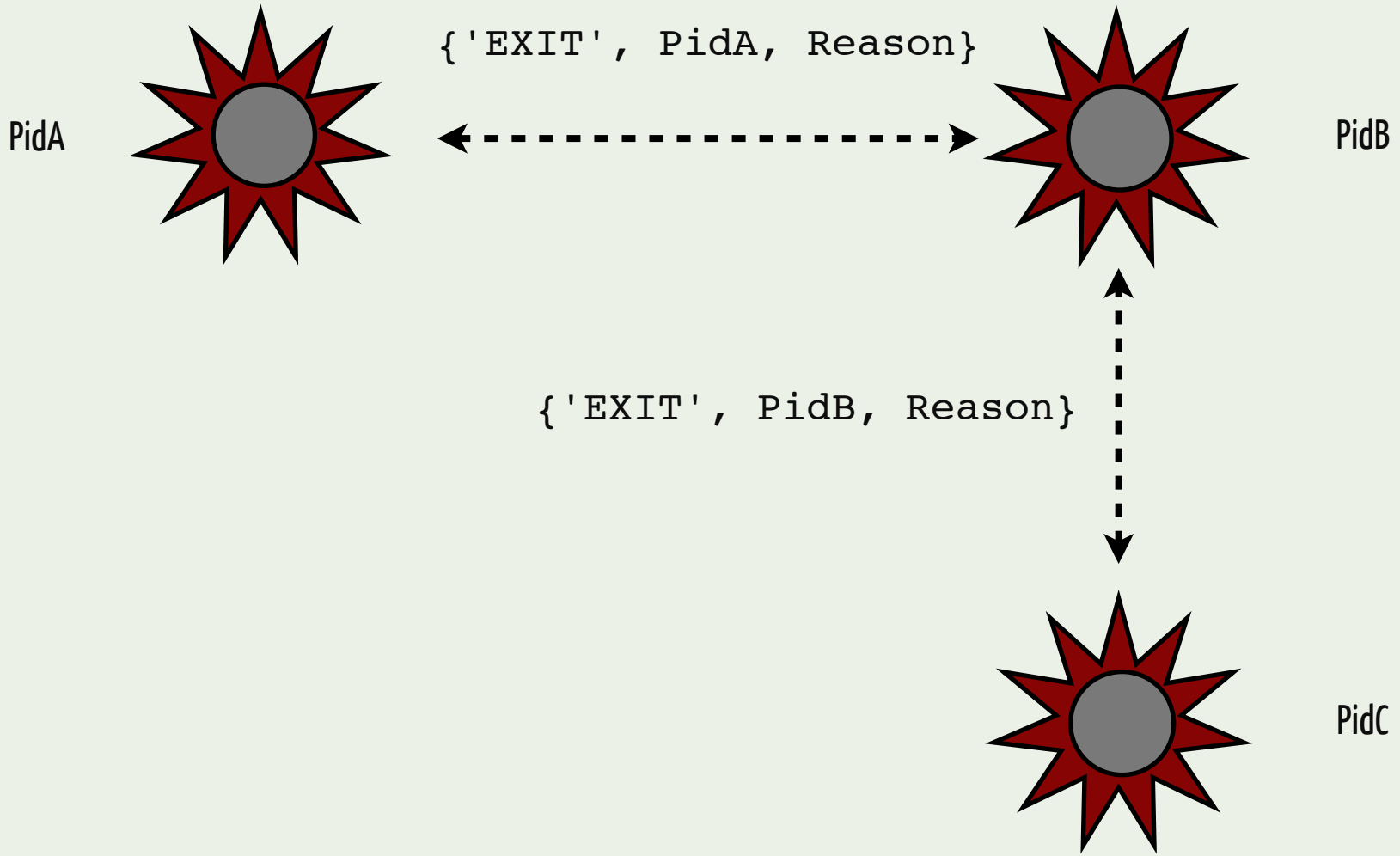
Let It Fail

```
convert(Day) ->
  case Day of
      monday    -> 1;
      tuesday   -> 2;
      wednesday -> 3;
      thursday  -> 4;
      friday    -> 5;
      saturday  -> 6;
      sunday    -> 7

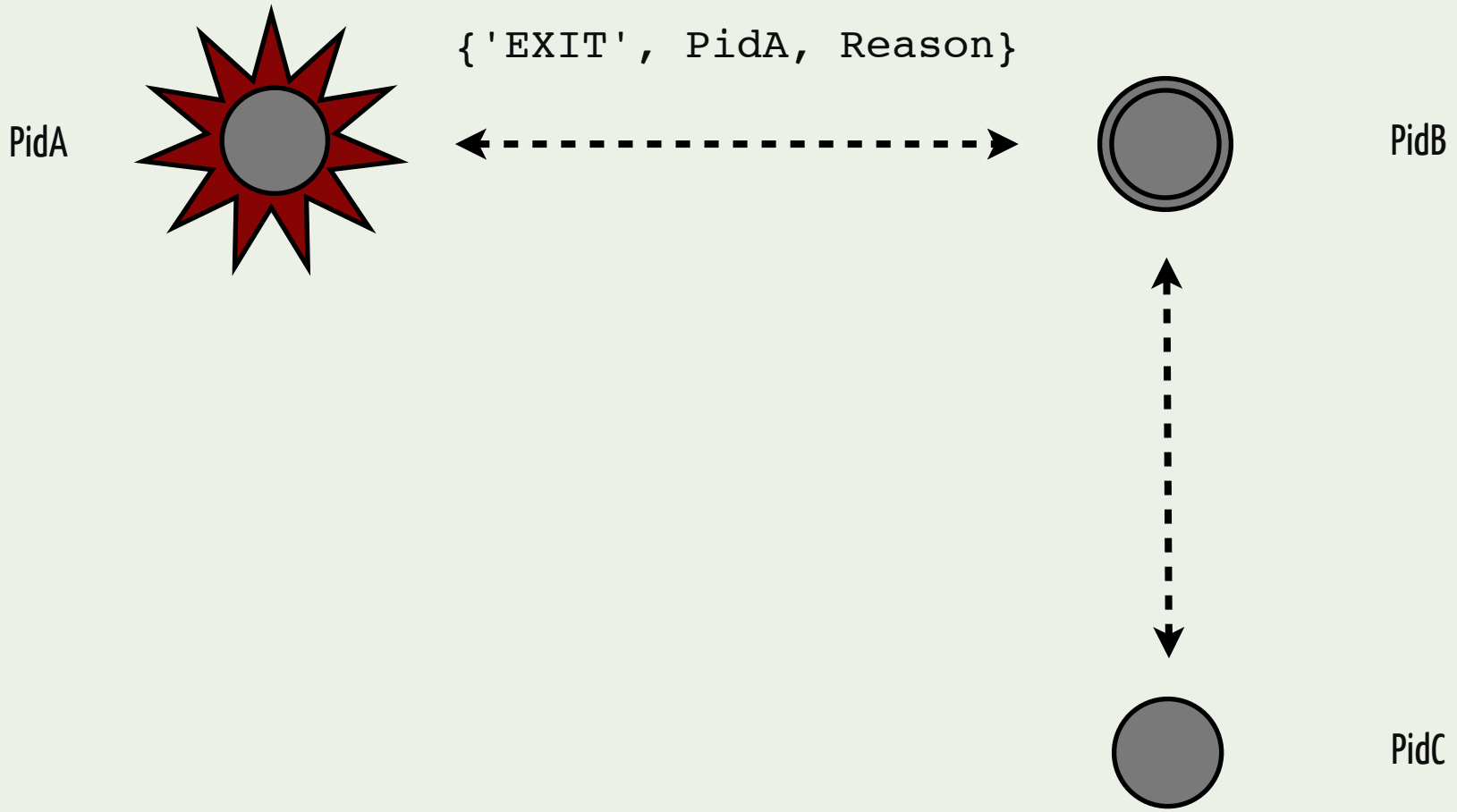

  end.
```

Isolate The Error!

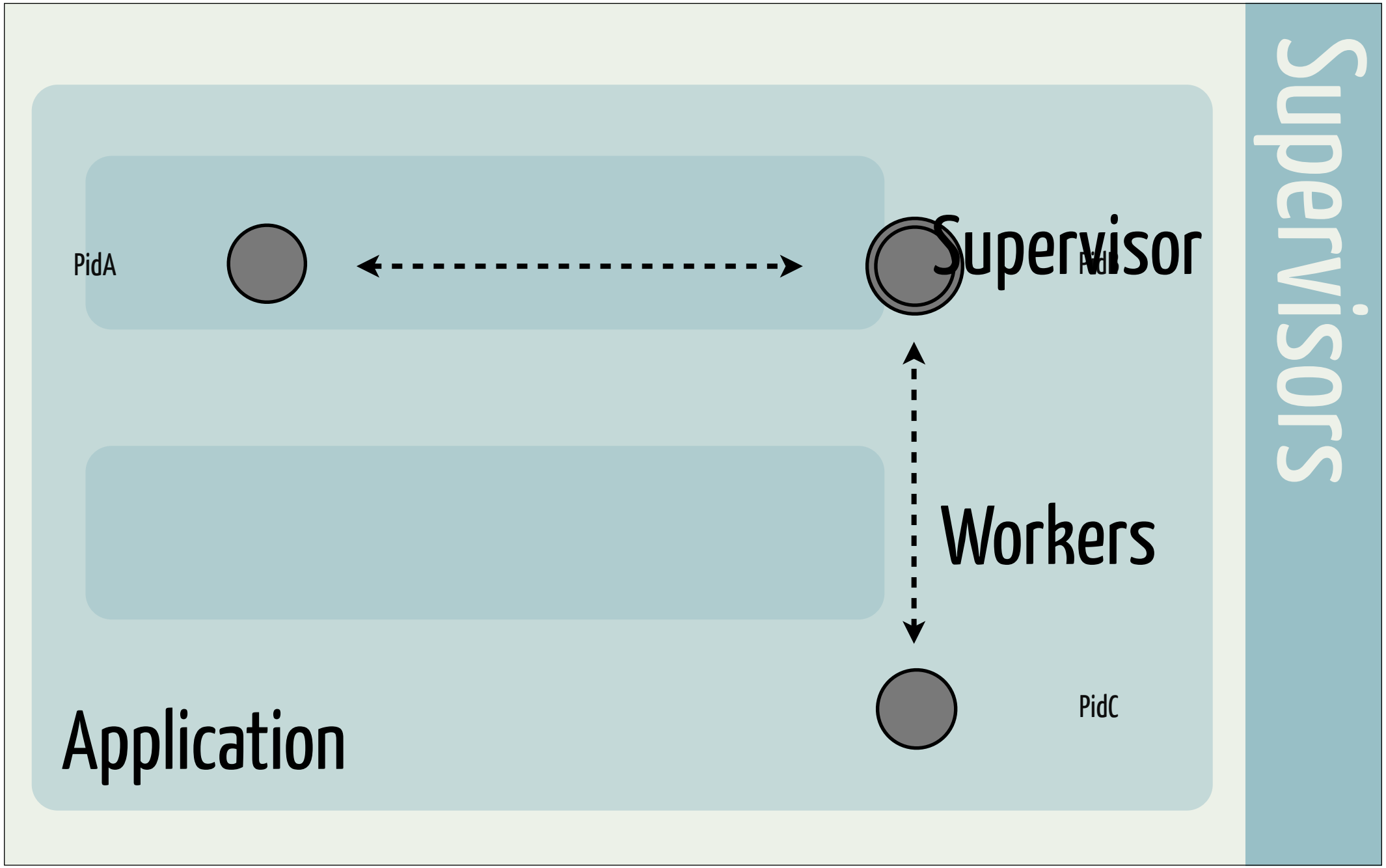
Propagating Exit Signals



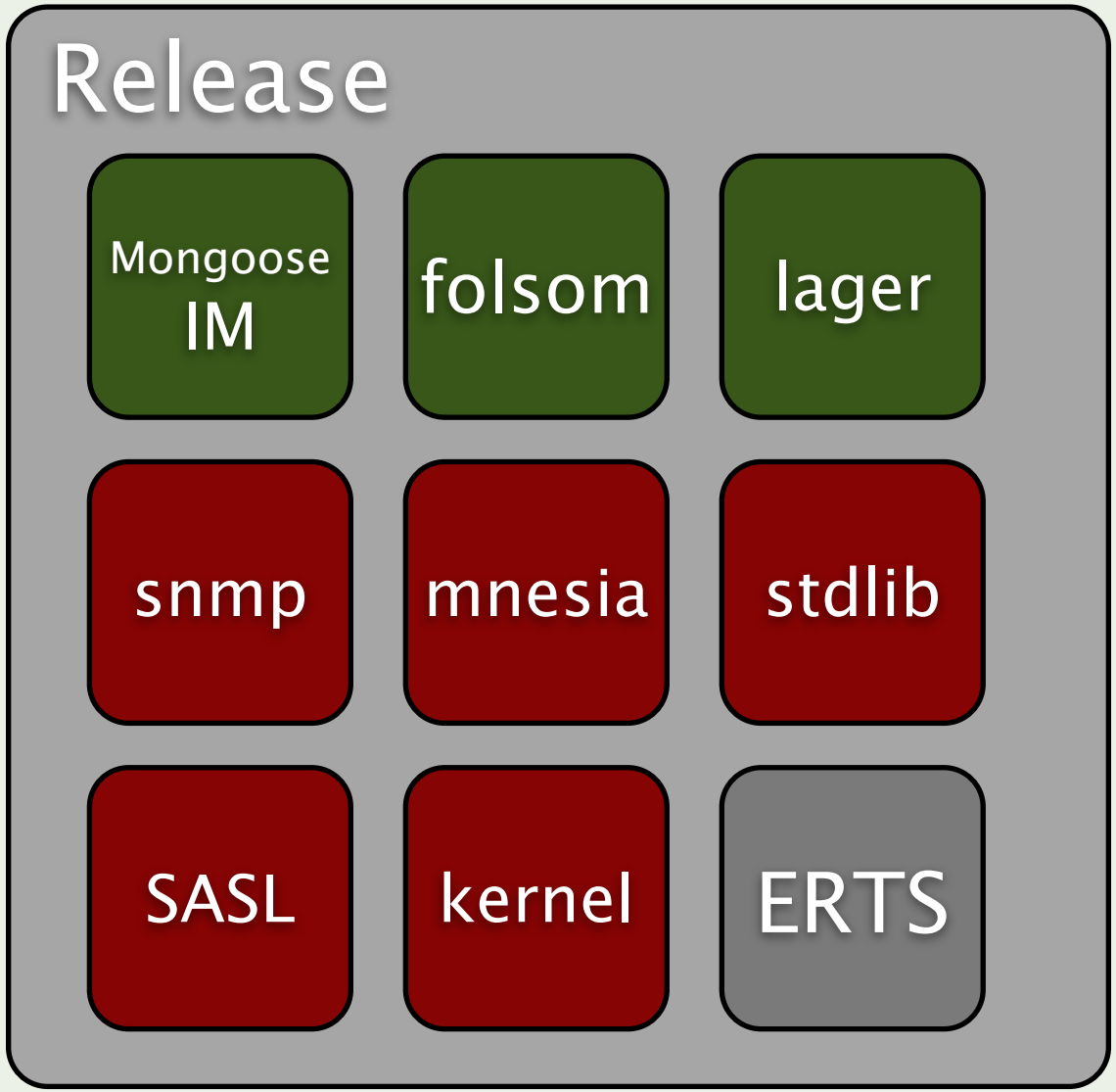
Trapping an Exit Signal



Trap Exit

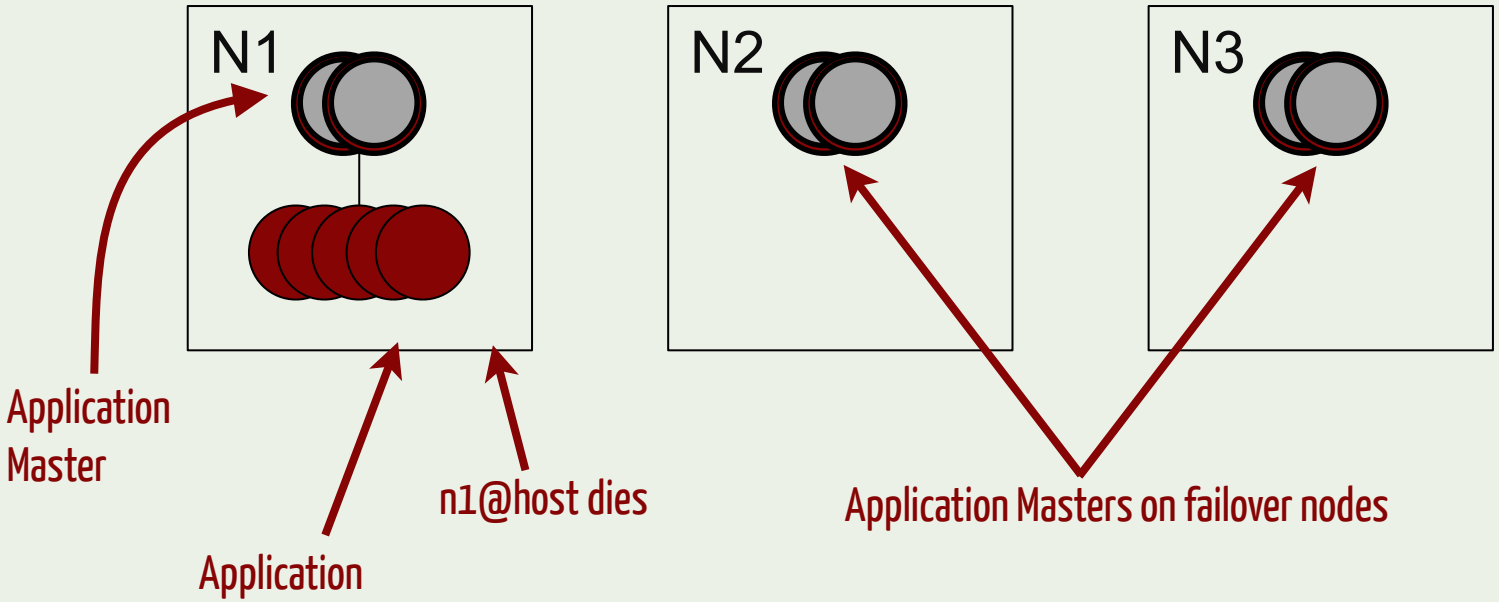

Supervisors
PidA
Supervisor
Workers
PidC
Application

Releases


Release
Mongoose IM
folsom
lager
snmp
mnesia
stdlib
SASL
kernel
ERTS

Automatic Takeover and Failover

```
{myApp, 2000, {n1@host, {n2@host, n3@host}]}
```



```
{myApp, 2000, {n1@host, {n2@host, n3@host}]}
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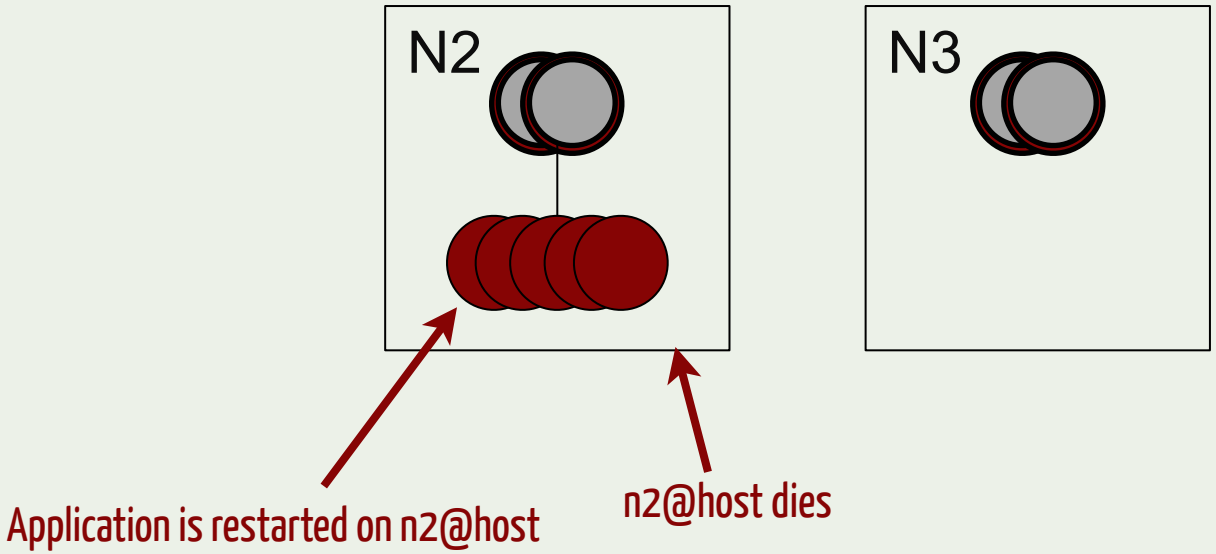

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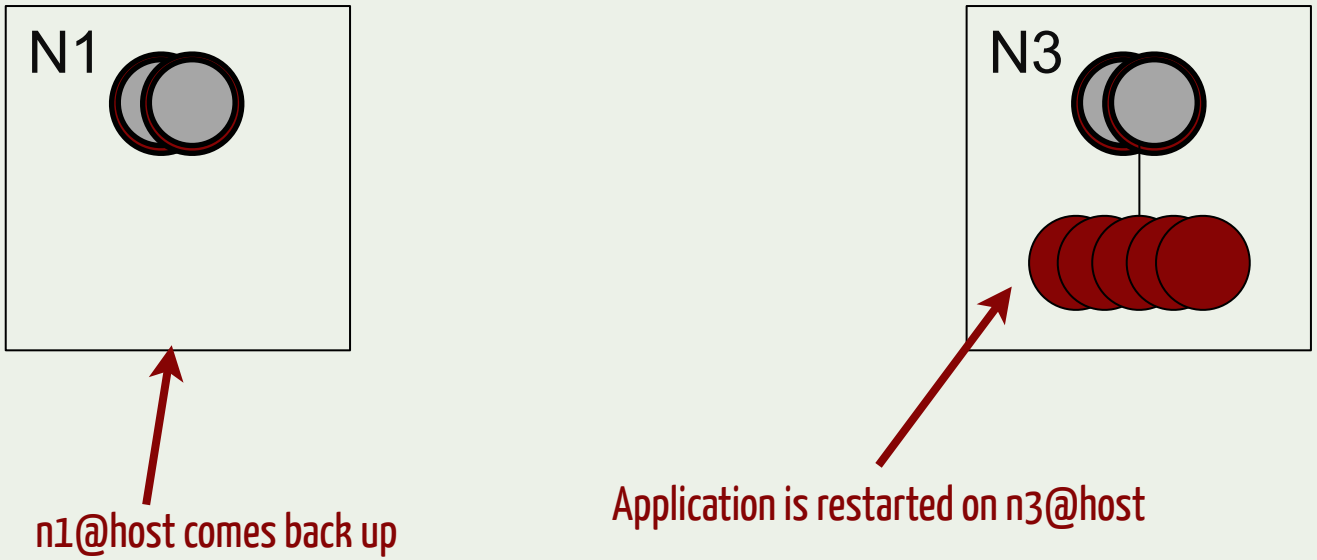

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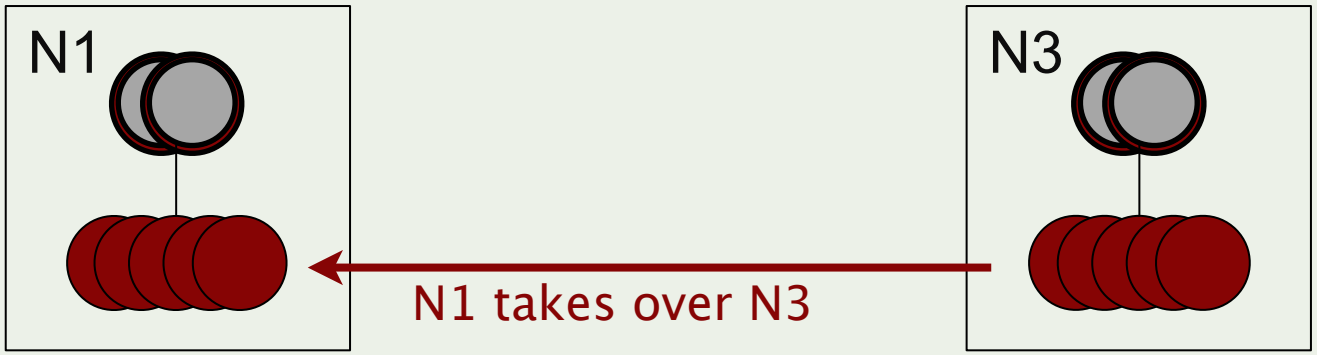
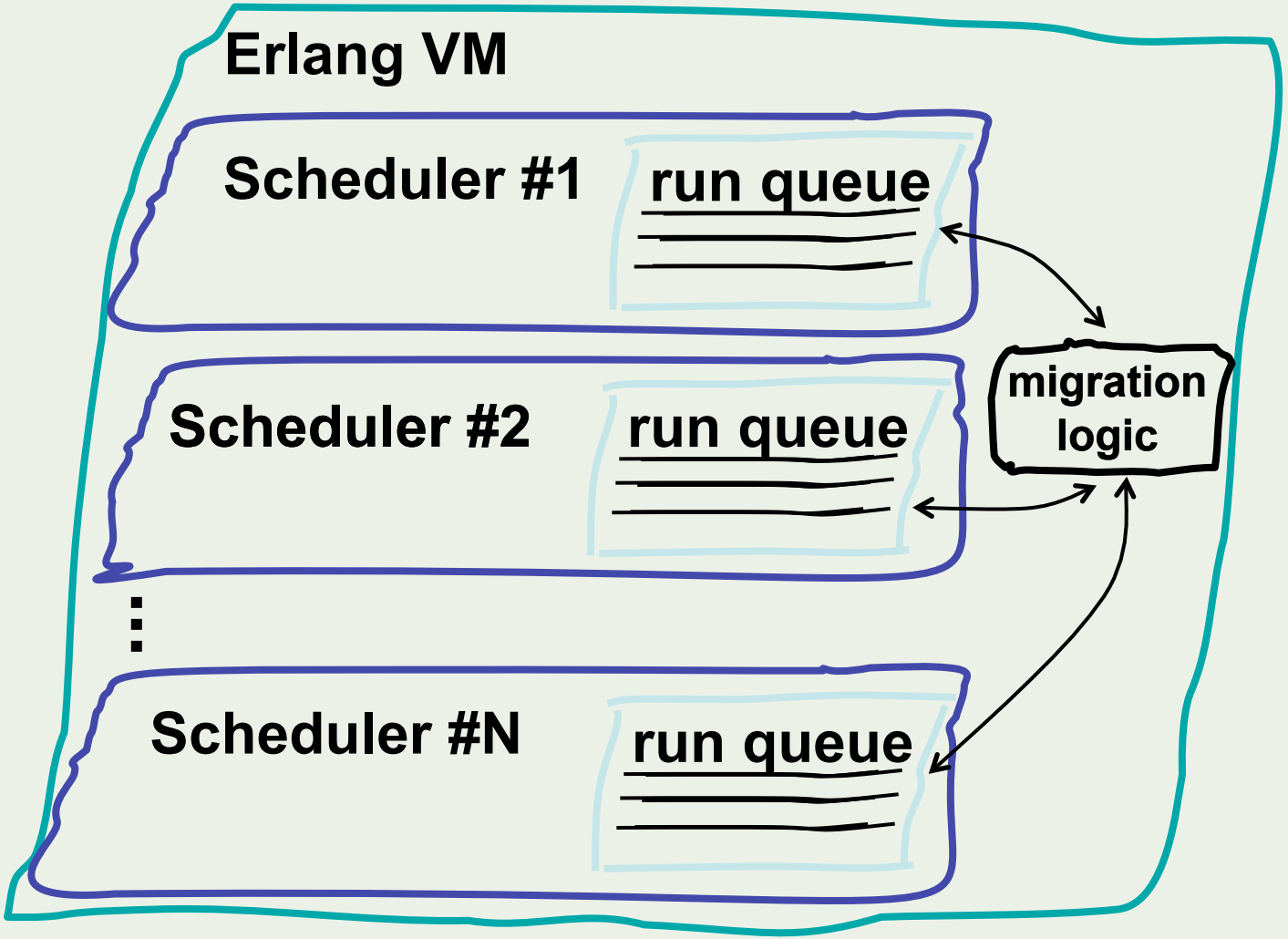


RELEASE STATEMENT OF AIMS

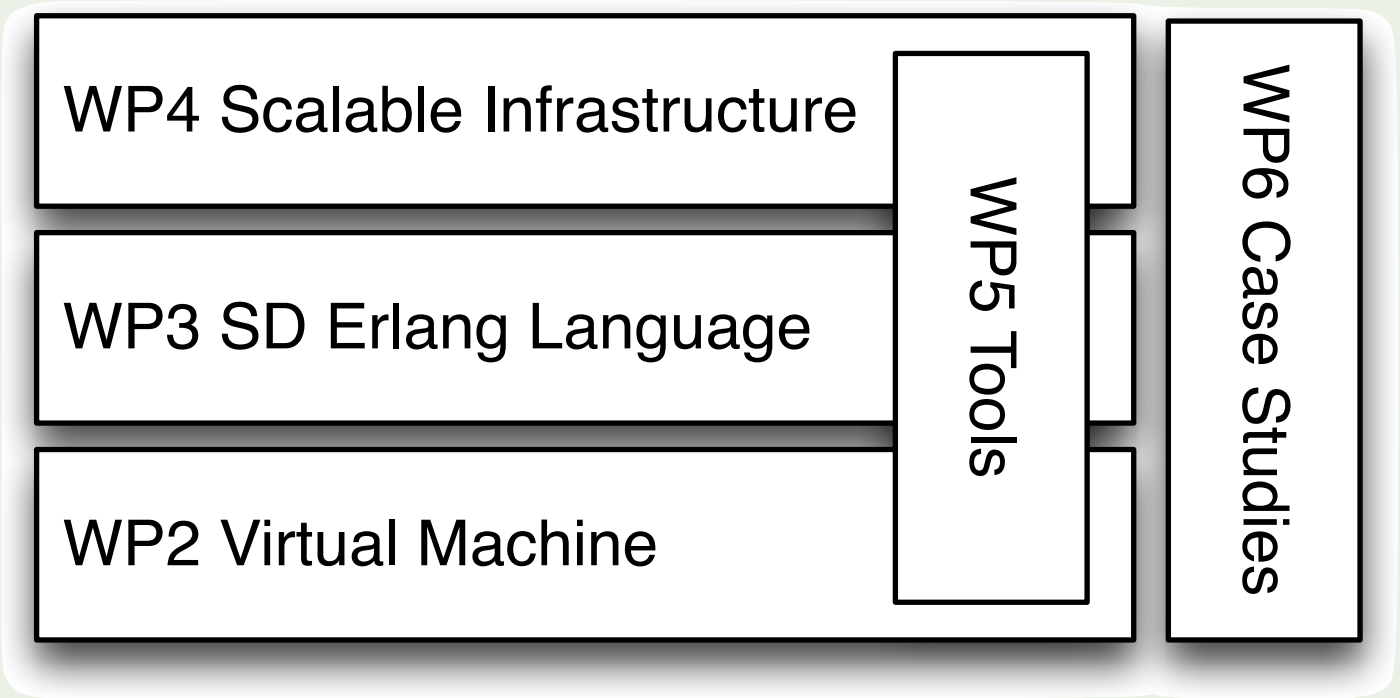
"To scale the radical concurrency-oriented programming paradigm to build reliable general-purpose software, such as server-based systems, on massively parallel machines (10^5 cores)."

The Runtime Queues



UPPSALA
UNIVERSITET

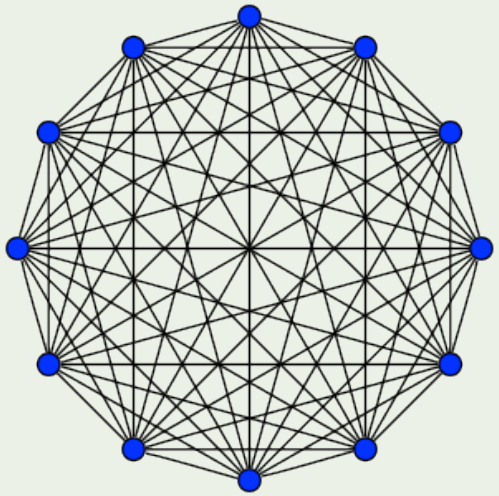
LIMITATIONS ARE PRESENT AT THREE LEVELS

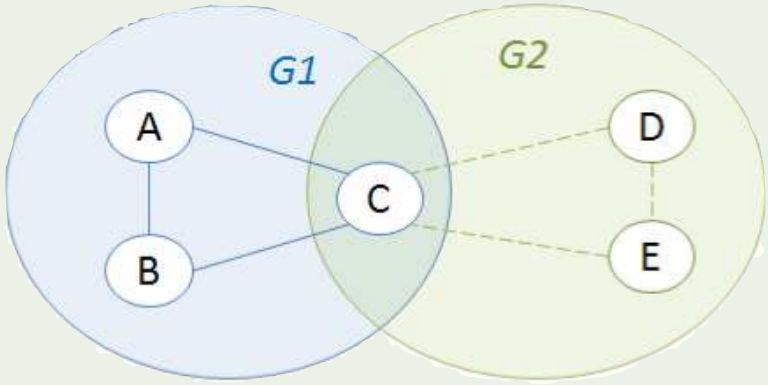


VM | LANGUAGE | INFRASTRUCTURE

- Push the responsibility for scalability from the programmer to the VM
- Analyze performance and scalability
- Identify bottlenecks and prioritize changes and extensions
- Tackle well-known scalability issues
  - Ets tables (shared global data structure)
  - Message passing, copying and frequently communicating processes

- Two major issues
  - Fully connected clusters
  - Explicit process placement
- Scalable Distributed (SD) Erlang
  - Nodes grouping
  - Non-transitive connections
  - Implicit process placement
  - Part of the standard Erlang/OTP package
- New concepts introduced
  - Locality, Affinity and Distance





VM | LANGUAGE | INFRASTRUCTURE

Wombat O&M

- Middleware layer
- Set of Erlang Applications
- Create and manage clusters of (heterogeneous) Erlang nodes
- API to monitor and control Erlang distributed systems
- Existing tracing/logging/debugging tools pluggable
- Broker layer between users and cloud providers
- Auto-scaling

... And Much More

Conclusions

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USE ERLANG

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USE ERLANG/OTP

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Questions?

@francescoC