Elixir, Erlang, and Phoenix

Building Software Systems That Scale

Agenda

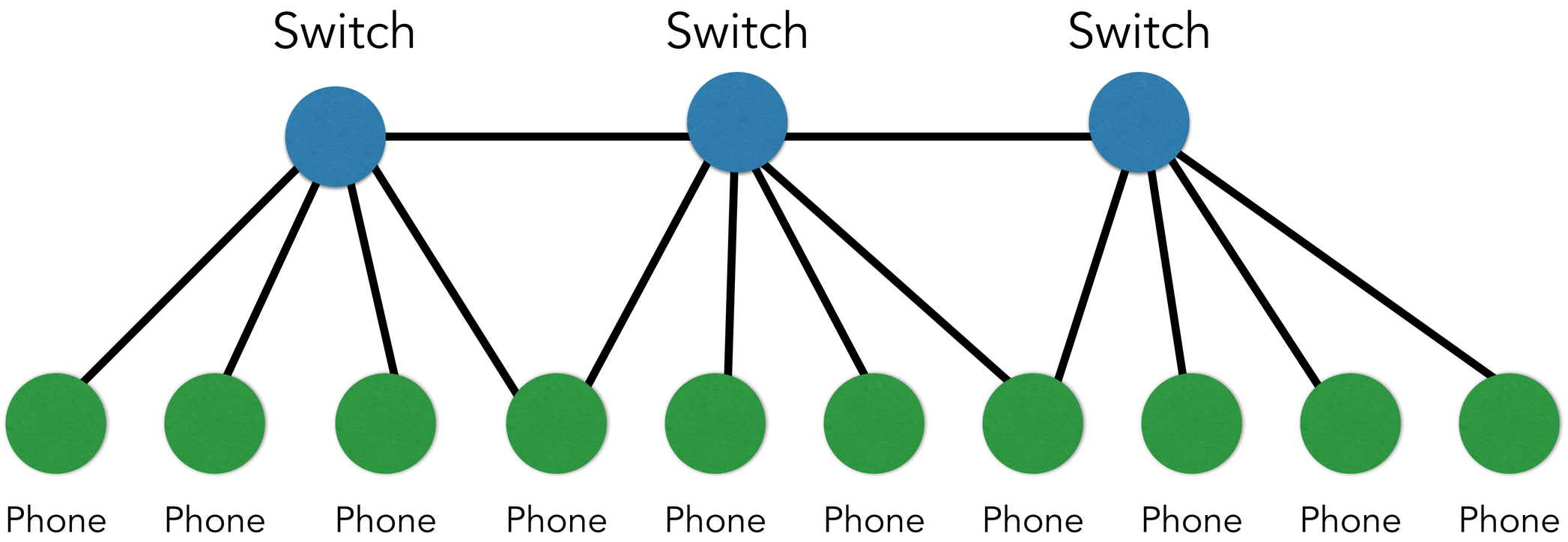
- Background
- Elixir Overview
- OTP
- Phoenix

Definitions

- Elixir - a programming language
- Phoenix - a web framework
- Erlang - a programming language and virtual machine on which Elixir runs

Erlang/OTP

- Erlang was developed by Ericsson and released in 1986
- Designed to build Distributed, Fault-Tolerant, and High Available applications
- Functional Language with immutable data and pattern matching
- Open sourced in 1998
- OTP is a framework of libraries and conventions that is synonymous with Erlang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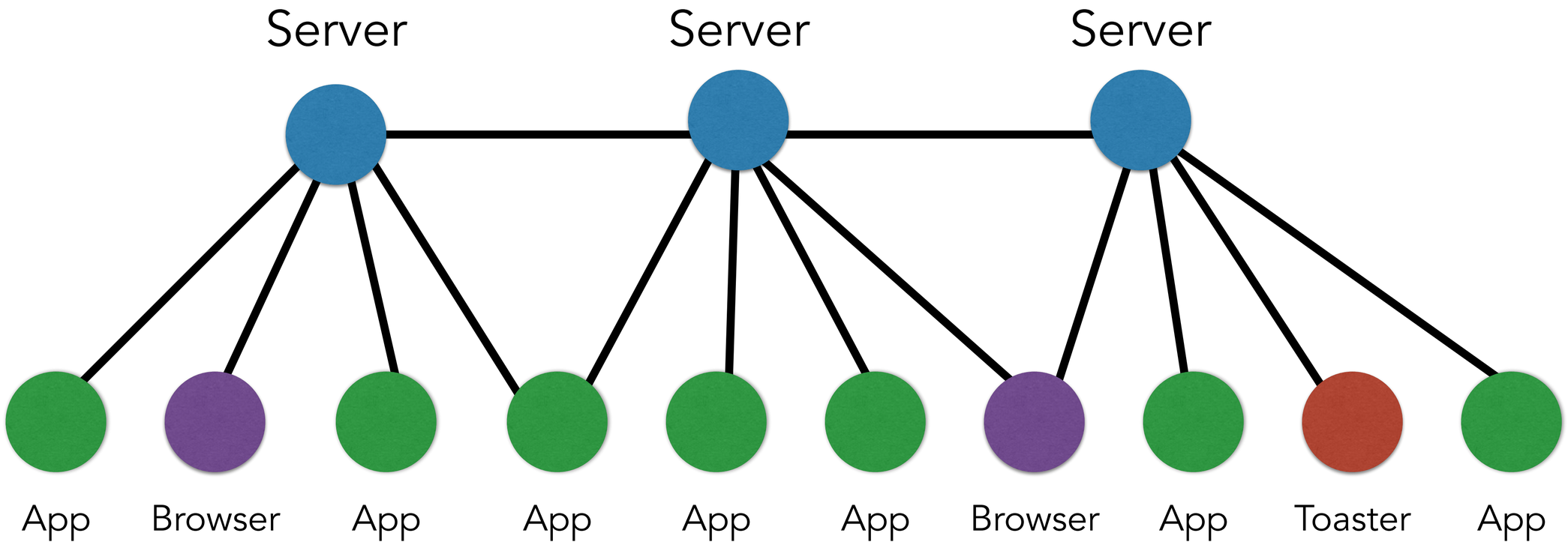
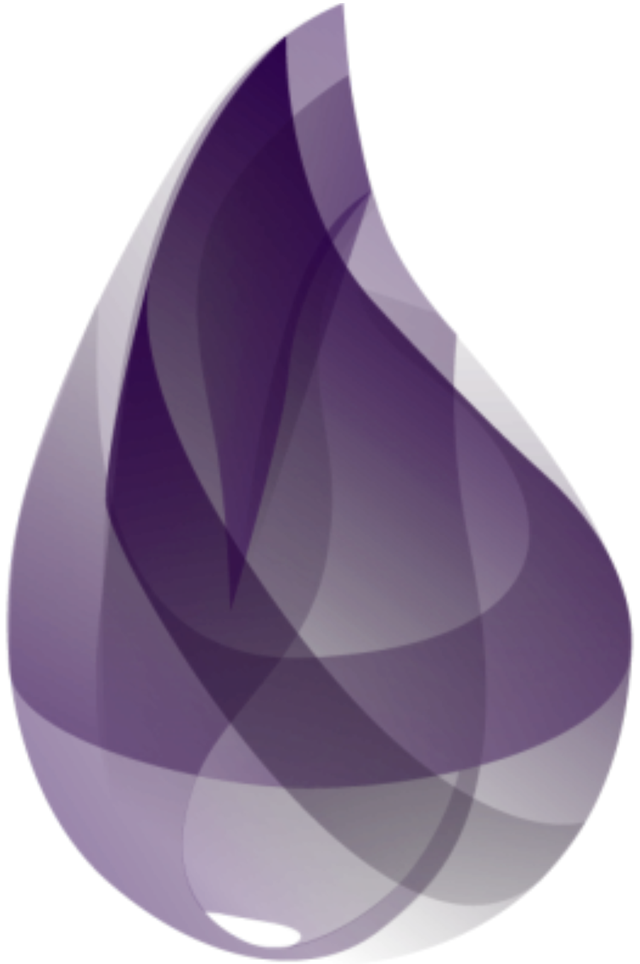

Server
Server
Server
App
Browser
App
App
App
App
Browser
App
Toaster
App

Notable Erlang Use-Cases

- WhatsApp had a single node with two million concurrent connections serving messages
- 40% of mobile data traffic in Europe runs on Erlang
- AXD301 telecom switch achieved 99.9999999% (nine nines) reliability

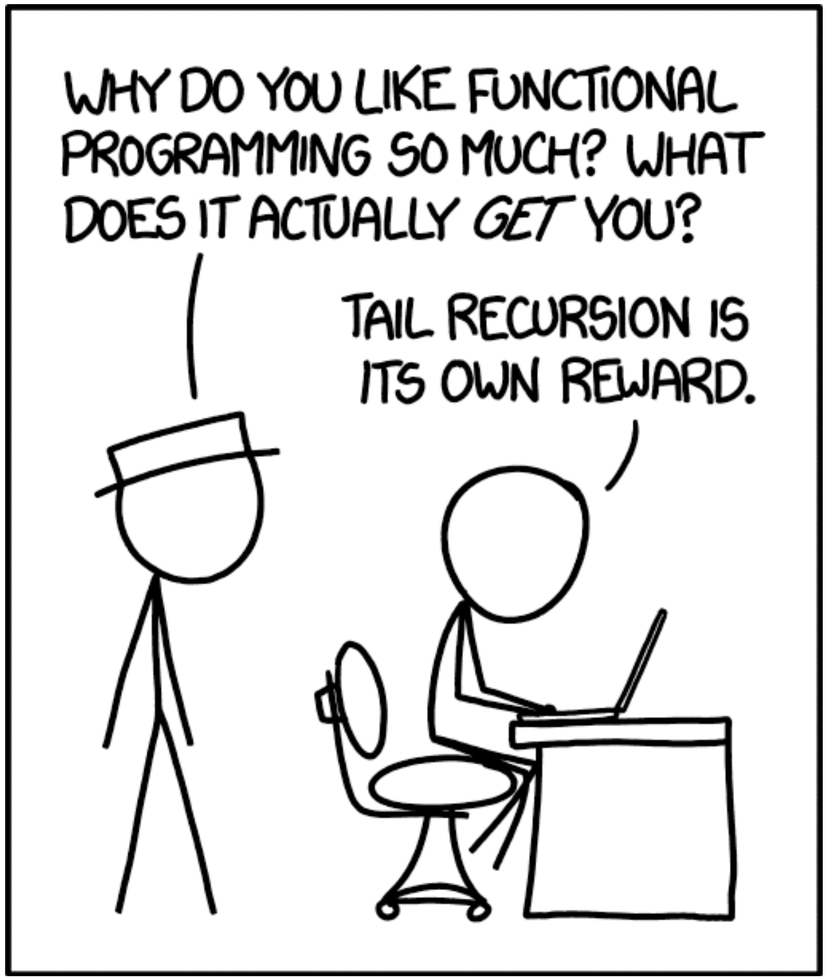
Elixir

- Released in 2011 (1.0 in 2014)
- Created by José Valim, a former rails core contributor
- “I loved everything I saw in Erlang, but hated what I didn’t see”



Functional Programming

- First Class Functions
- Immutable Data Structures
- Pure Functions (whenever possible)
- Make state explicit
- Recursion



Immutable Data Structures

- Data Structures can’t be mutated (duh)
- Can rebind to variables however
- Uses structural sharing to improve efficiency

Pattern Matching

- “=“ is the match operator
- mostly commonly used to destructure method arguments
- Essentially replaces control flow

Recursion

- Function that calls itself

  that calls itself that calls itself that

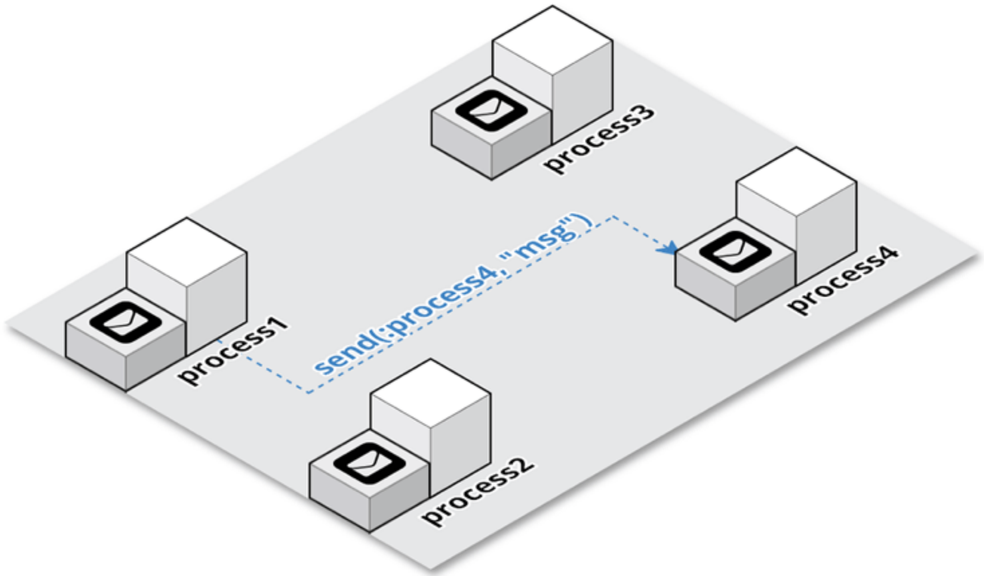
  calls itself that calls itself that calls itself that calls itself that calls itself

- Elixir and Erlang support tail call optimization

- Use recursion instead of for/while loops

Processes

- Foundation of programming model
- Lightweight and Isolated
- Communicate via message passing
- Preemptively Scheduled



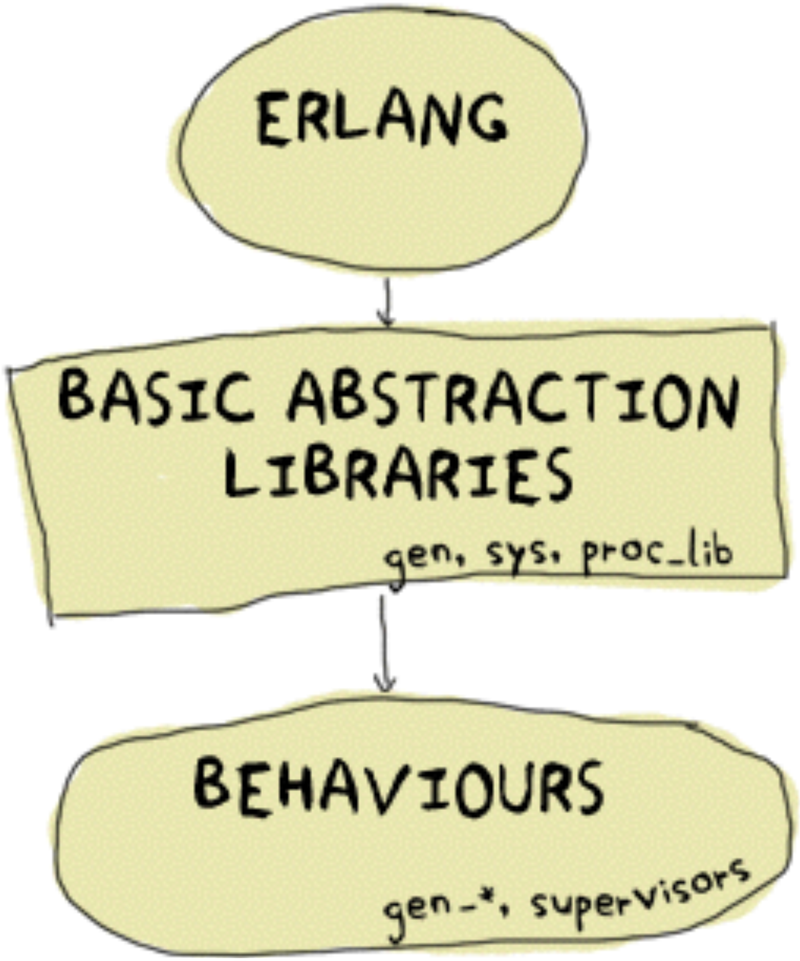
Elixir Review

- Immutable Data Structures
- Pattern Matching
- Recursion
- Processes
- + a lot more

OTP

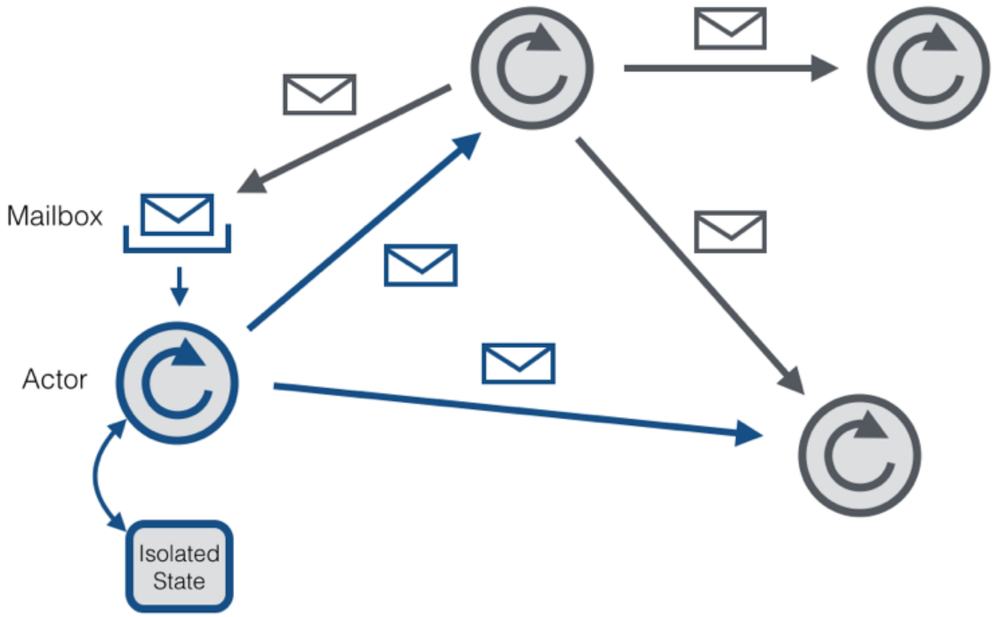
OTP

- Open Telecom Platform
- Erlang Compiler + ETS + Mnesia + Dialyzer + Behaviors + a lot more



State

- Processes + Recursion + Message Passing



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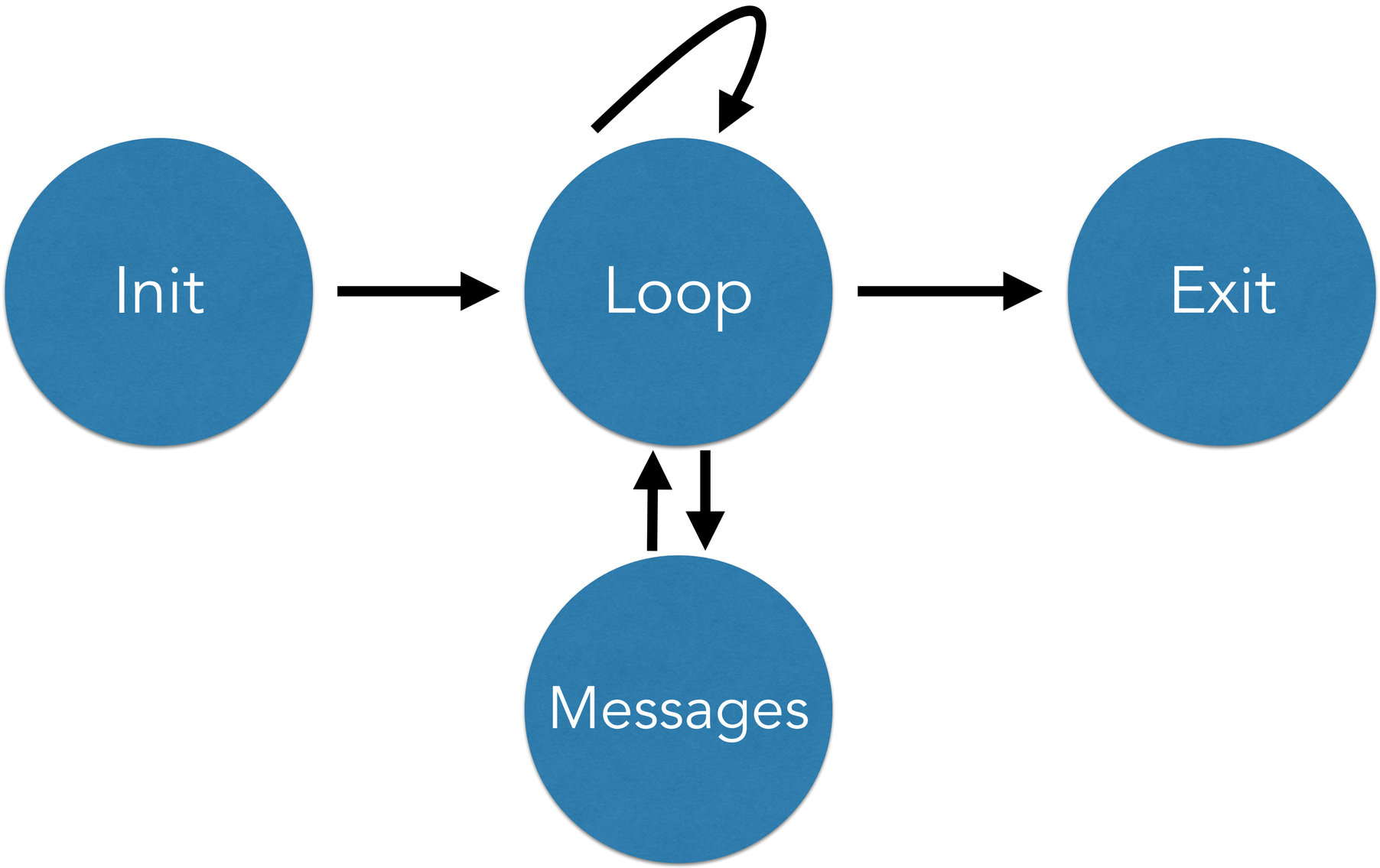

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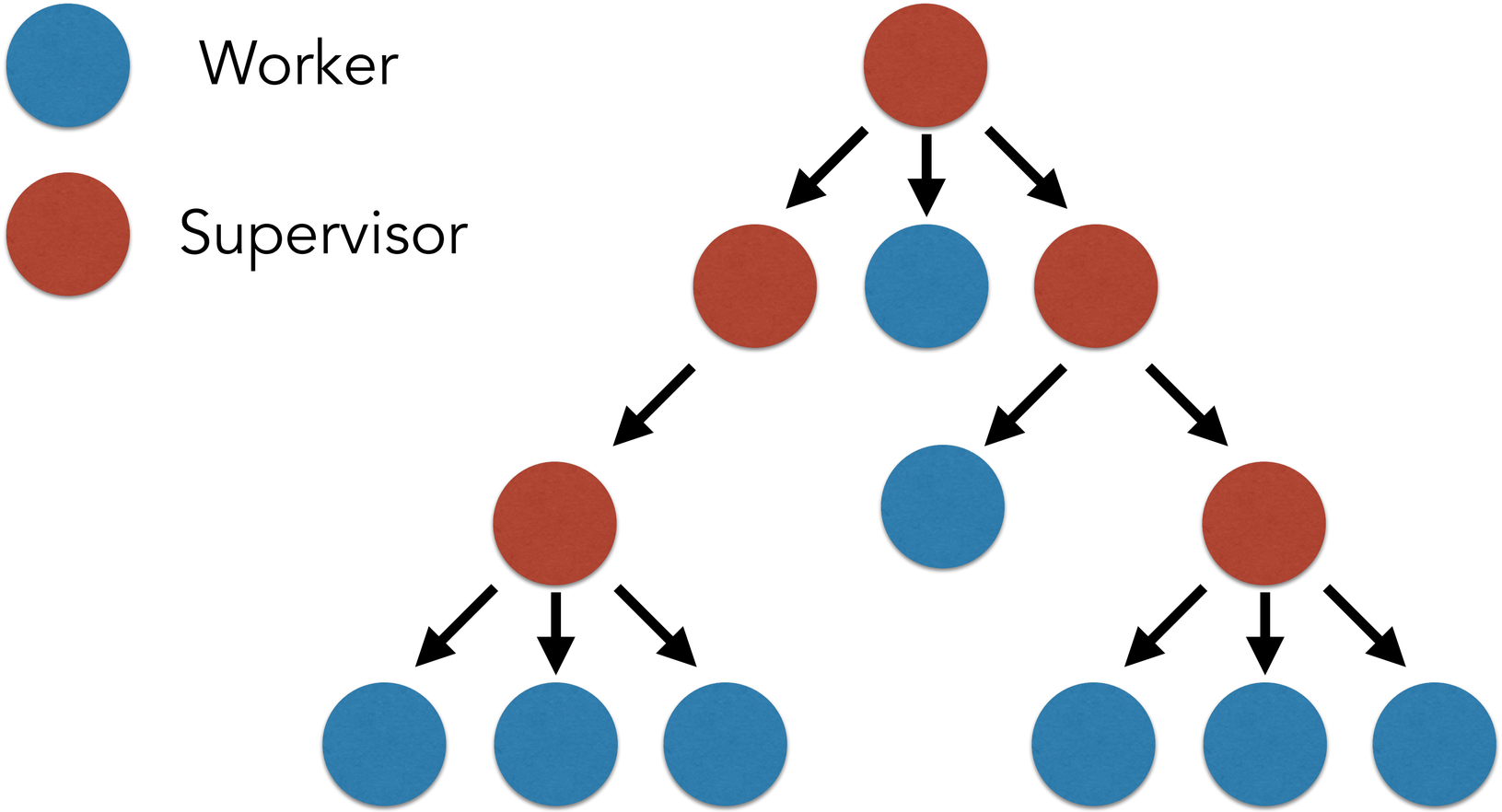

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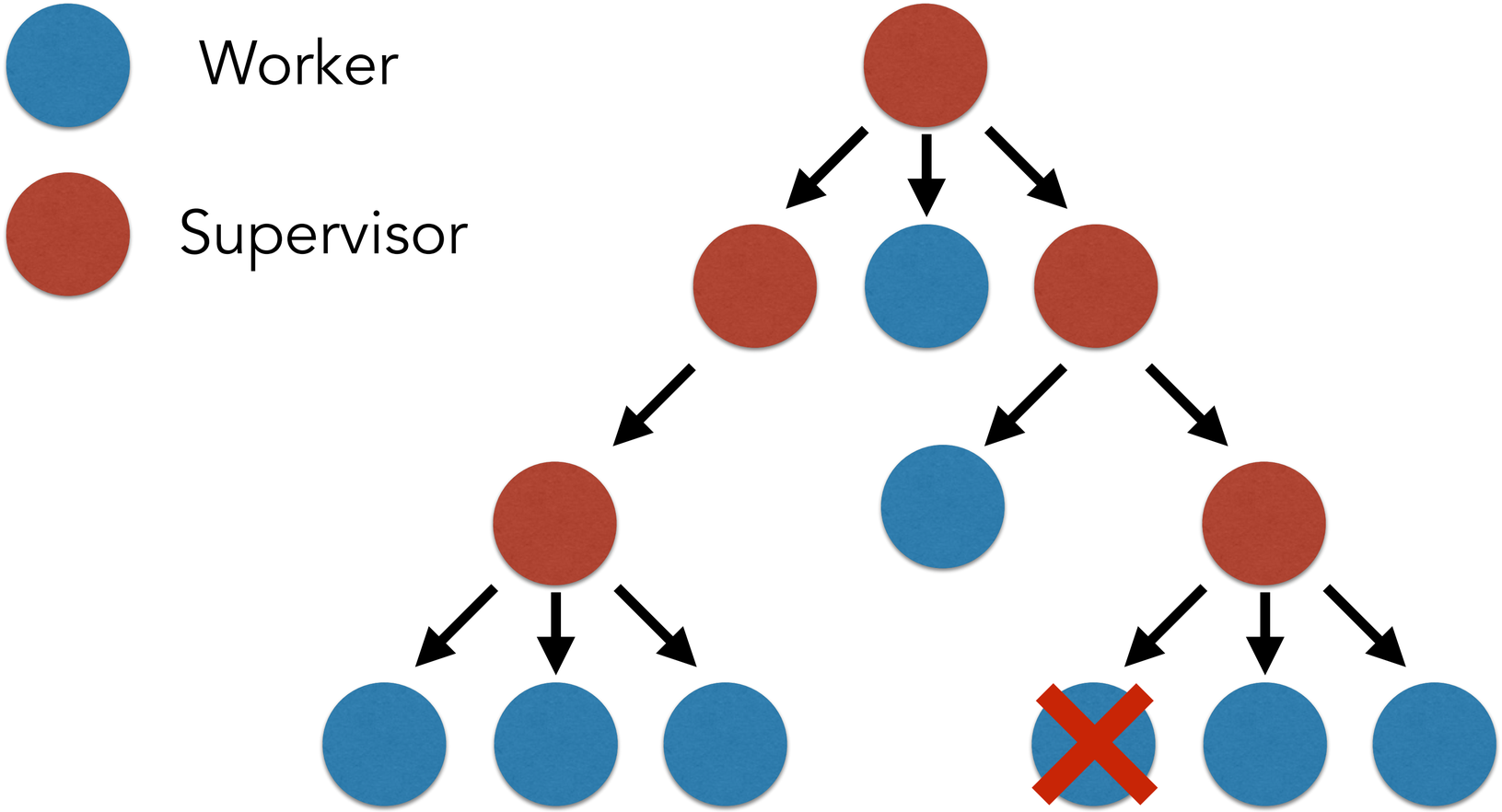

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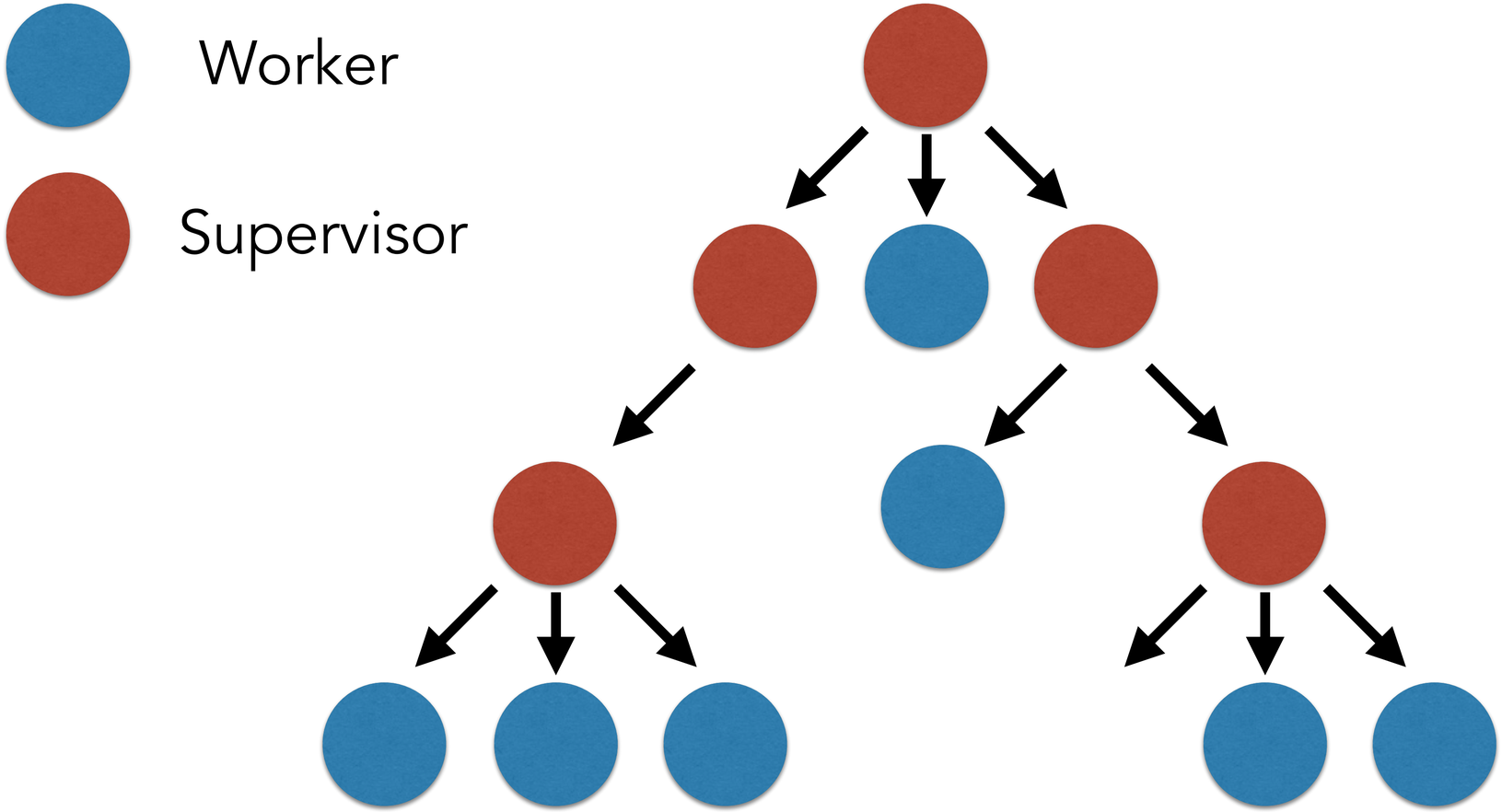

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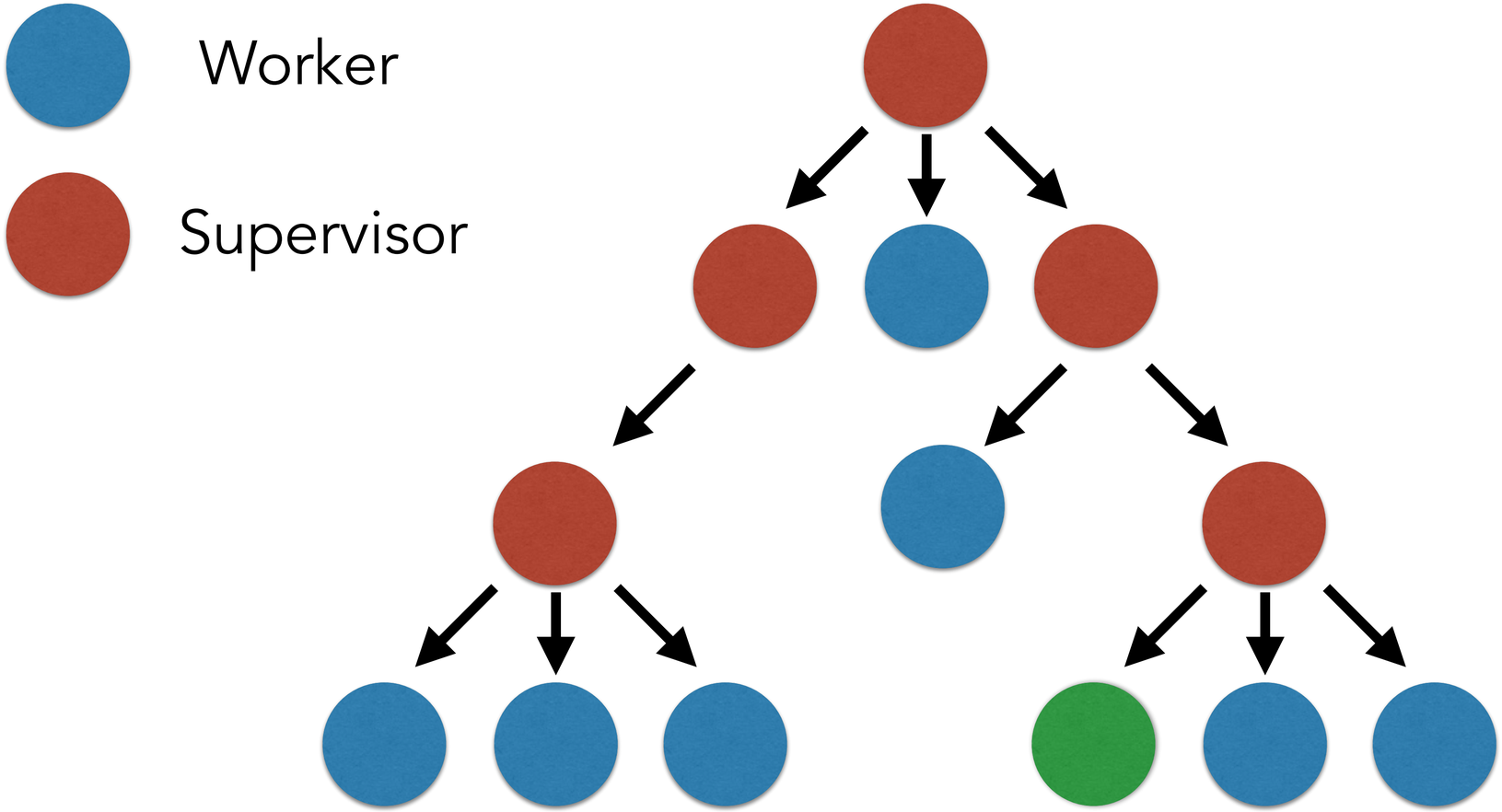

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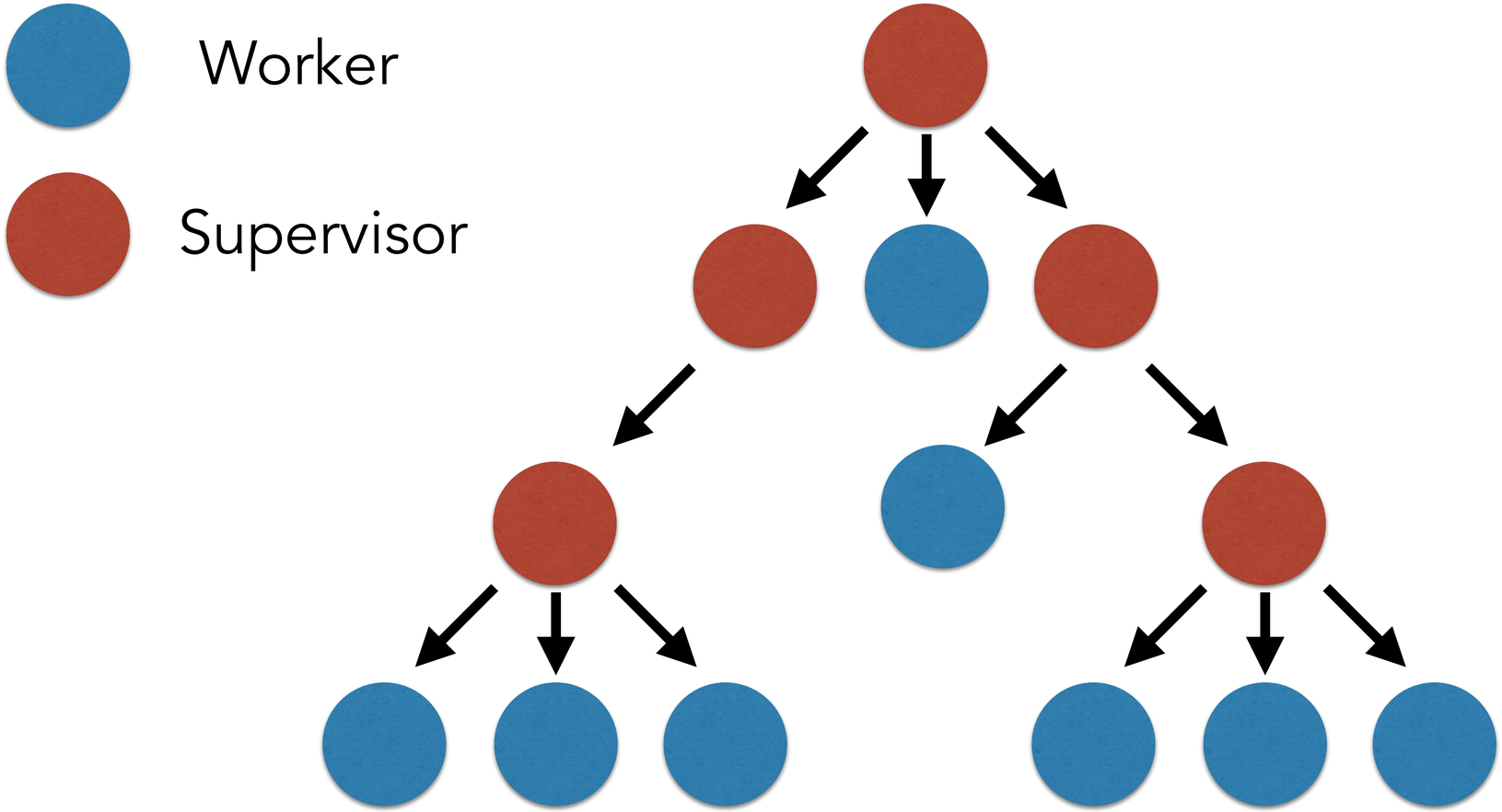

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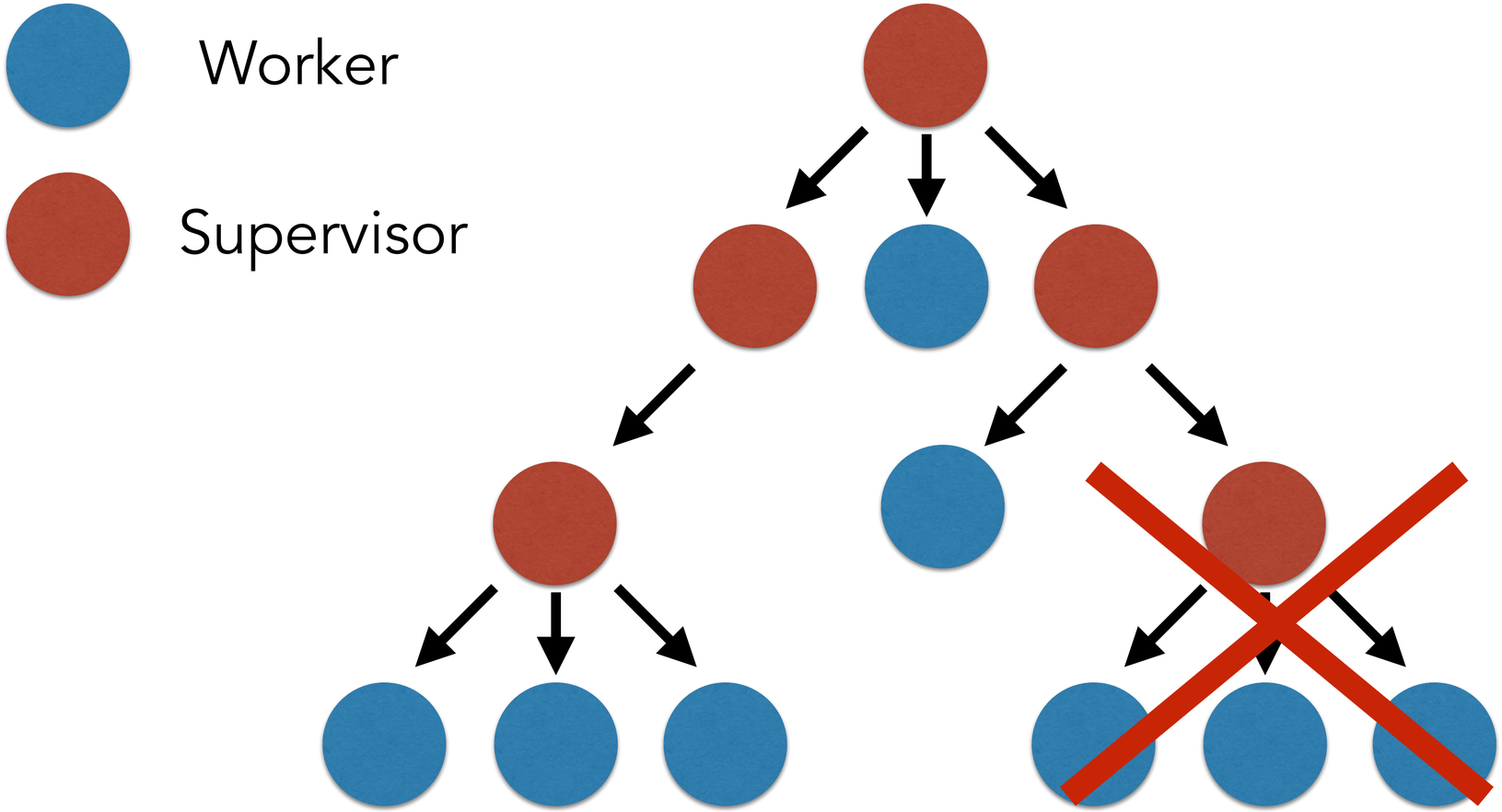

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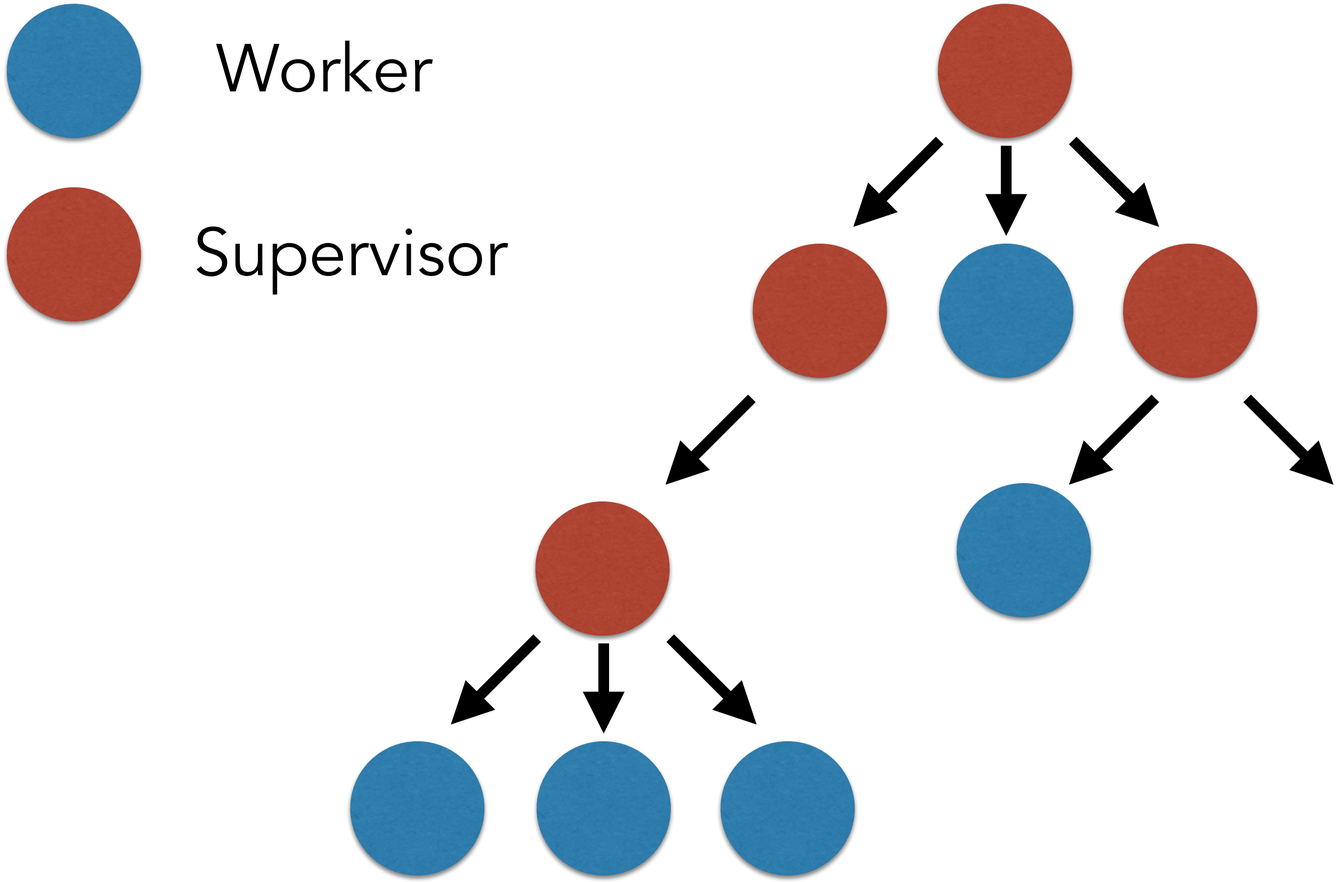

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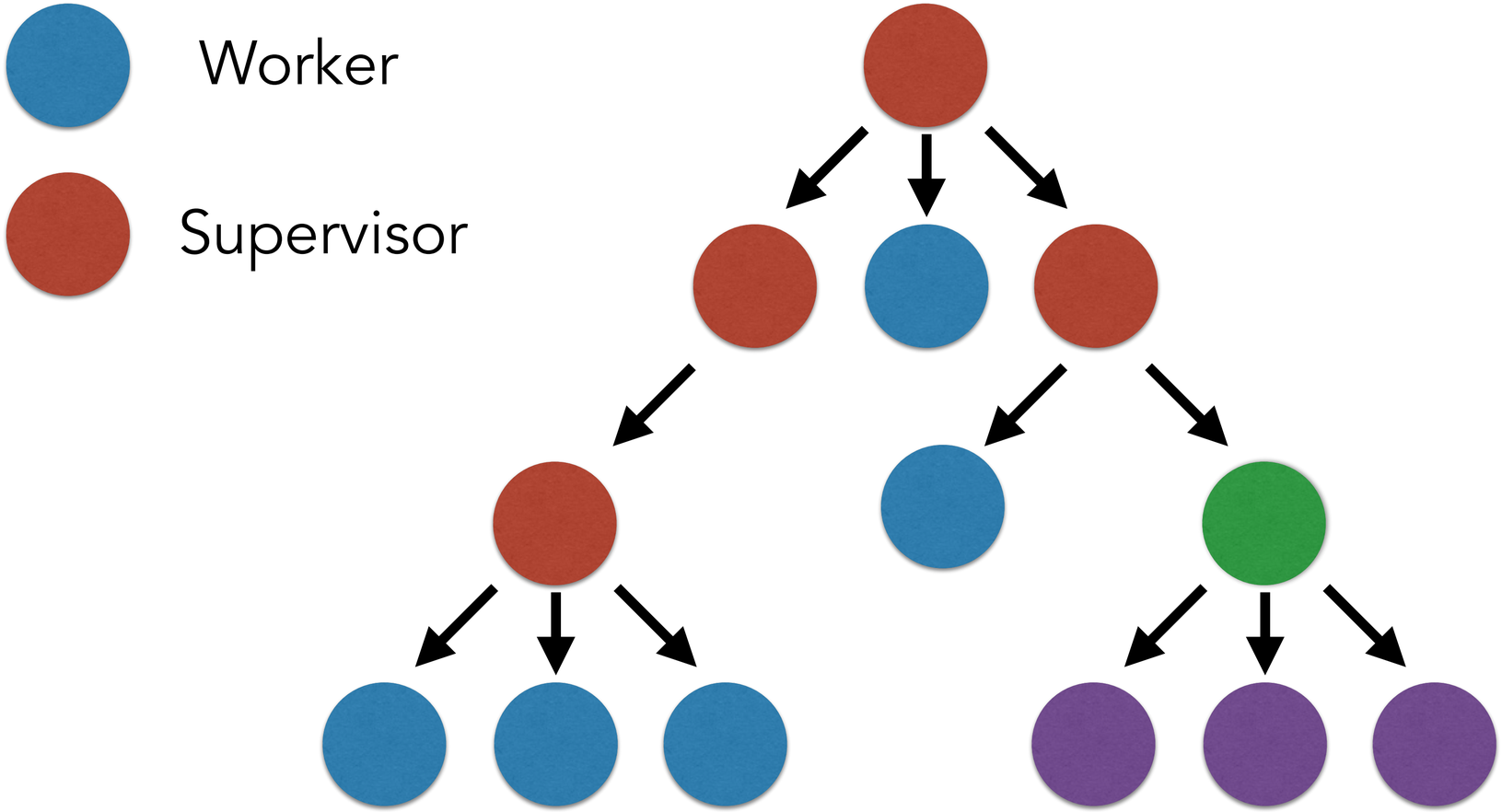


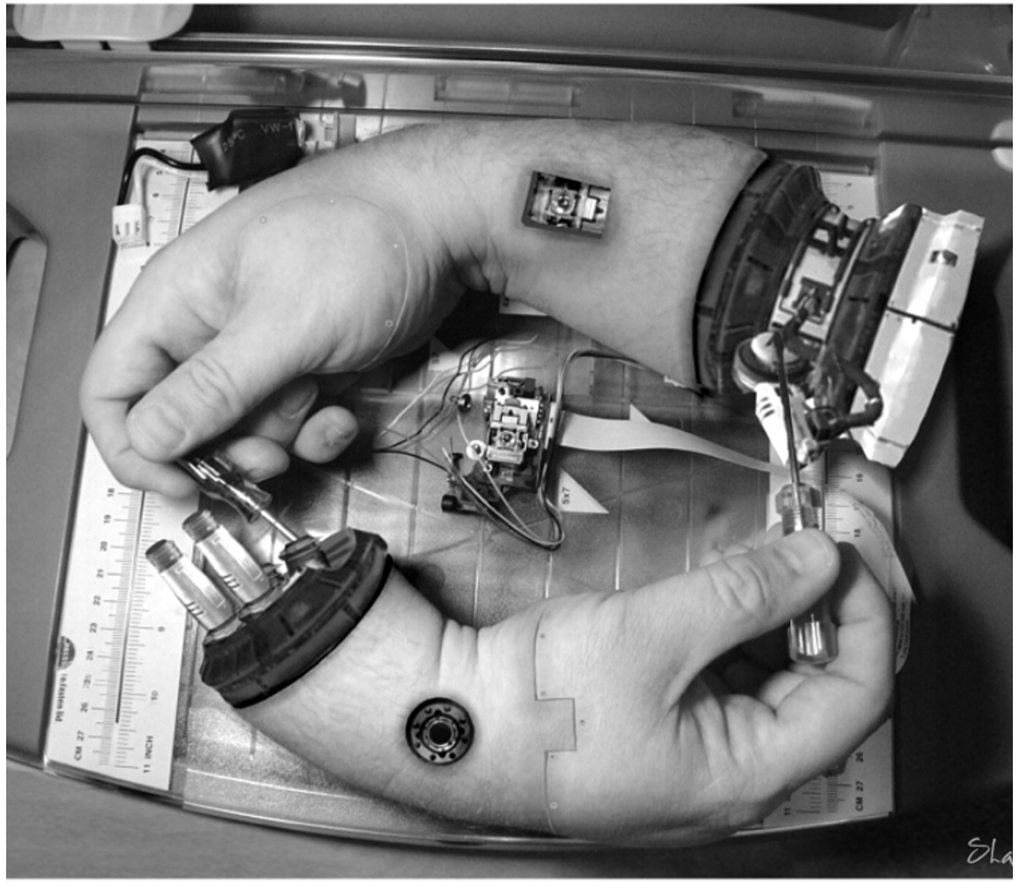
OTP Review

- Erlang Compiler & Interpreter
- Data Management with ETS and Mnesia
- Behaviors: Rock-solid implementation of common paradigms

More on Elixir

More on Elixir

- Syntax Niceties
- Metaprogramming
- Tooling



Syntax Niceties

- Pipe Operator
- Sigils
- Guard Clauses
- Comprehensions

Metaprogramming

- Macro system similar to Clojure
- Elixir is homoiconic
- Allows for easy creation of Domain Specific Languages (DSLs)

Tooling

- Robust build tool (Mix)
- Package manager (Hex)
- Release Manager (Distillery)
- Unit Testing (ExUnit)

Phoenix

Productive. Reliable. Fast.

Phoenix

- Web framework for Elixir
- Built for the Modern Web
- MVC
- Batteries Included

“Batteries”

Model

- Ecto
- Language Integrated Queries (similar to LINQ)
- Implemented using macros for a simple DSL
- Objectless ORM

View

- Templates and Views
- Views render templates, similar to presenters
- Templates are compiled for speed
- Views can also render JSON

Controller

- Implemented as Plugs
- Actions called by router
- Still just functions

Channels

- Realtime layer for Phoenix
- Routing similar to controllers
- Backed through typical distributed Erlang, Redis, or others
- High Performance

Presence

- Conflict-free Replicated Data Types (CRDTs)
- No single point of failure
- No single source of truth
- Just uses standard library
- Self Healing

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&= \sum_{i \in \mathbb{I}} m(i) \\
&= \{(i, \mathsf{max}(m(i), m'(i))) \mid i
\end{aligned}
$$

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OH
YEAH!

CAUTION
SLOW
DOWN
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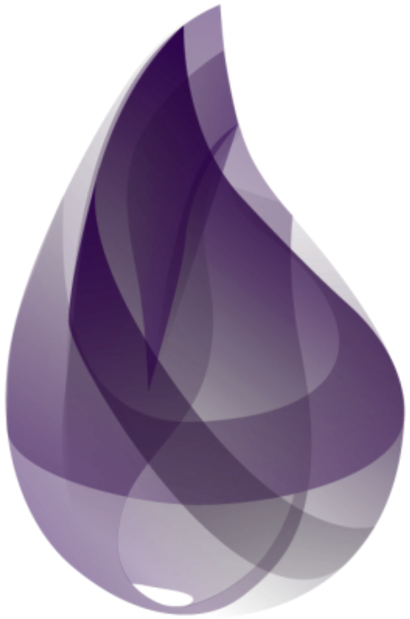
Delivering Value

Recap

- Erlang
- Elixir
- Phoenix



Questions?