Building a cloud with Erlang and SmartOS

How hard could it possibly be?

Spoiler

Spoiler

Quite hard!

Who am I

- Writing Project FiFo
- Twitter: @heinz_gies
- Github: https://github.com/Licenser & https://github.com/project-fifo
- IRC: Licenser

Disclaimer

- This is time travel! Situations might have changed by today.
- This is about my experience not the total truth - yes there is a chance I was double wrong!
- I don't want to shame any technology, it is just about my experience on applying them to a specific problem.
- No dogs were harmed in the making!

Intro

- What is FiFo? - Open Source Cloud orchestration
    - For SmartOS: ZFS, DTrace, Crossbow, Zones, …
    - In Erlang: Distributed, fault tolerant, fun to write, …

The fail of Clojure Script

What was done

- CLJS app in GZ
- HTTP API

Reason

- existing client for the API
- node.js was on the GZ (looked like additional deps).
- Wanted to try Clojure Script.
- No idea of what Project FiFo would become.

The problem

- lots of dependencies (version conflicts, missing libraries).
- at that time very hard to debug (no source maps etc., lack of visibility/horrible stack traces).
- Everything in the Global Zone. (big footprint)
- Only one system

What I learned

- Try to plan what you do before you do it.
- Rewriting is no shame!
- What seems easy in the beginning is not always the right thing.

The fail of a single host

What changed

- Added wiggle, API endpoint over multiple cljs application
- running in a zone
- Allow more then 1 hypervisor!

Reason

- Needed good abstract over the existing code.

- A web interface for the clojurescript code.

- Wanted to work with Erlang.

The problem

- HTTP between wiggle and cljs-app.
- Single point of failure.
- Did not simplify the code on the hypervisor, it just forwarded.
- Still not enough separation.
- Authentication handled downstream in cljs.
  - Synchronization is a pain.

What I learned

- HTTP is not the silver bullet.
- Split out applications.
- Modularize (not only in code, but in applications).
- Handle things like authentication as high up as possible.
- Remove work from leaves that should be handled in a different layer.

The fail of distribution

What changed

- Split out authentication -> snarl
- Split out most logic -> sniffle
- Reduced GZ footprint -> scrap cljs replace by minimal erlang app

Reason

- Erlang apps are wonderfully self-contained (releases)
- Distributing systems protects against SPOF
- Separating concerns
  - management on system
  - authentication
  - API
  - Management of hypervisors

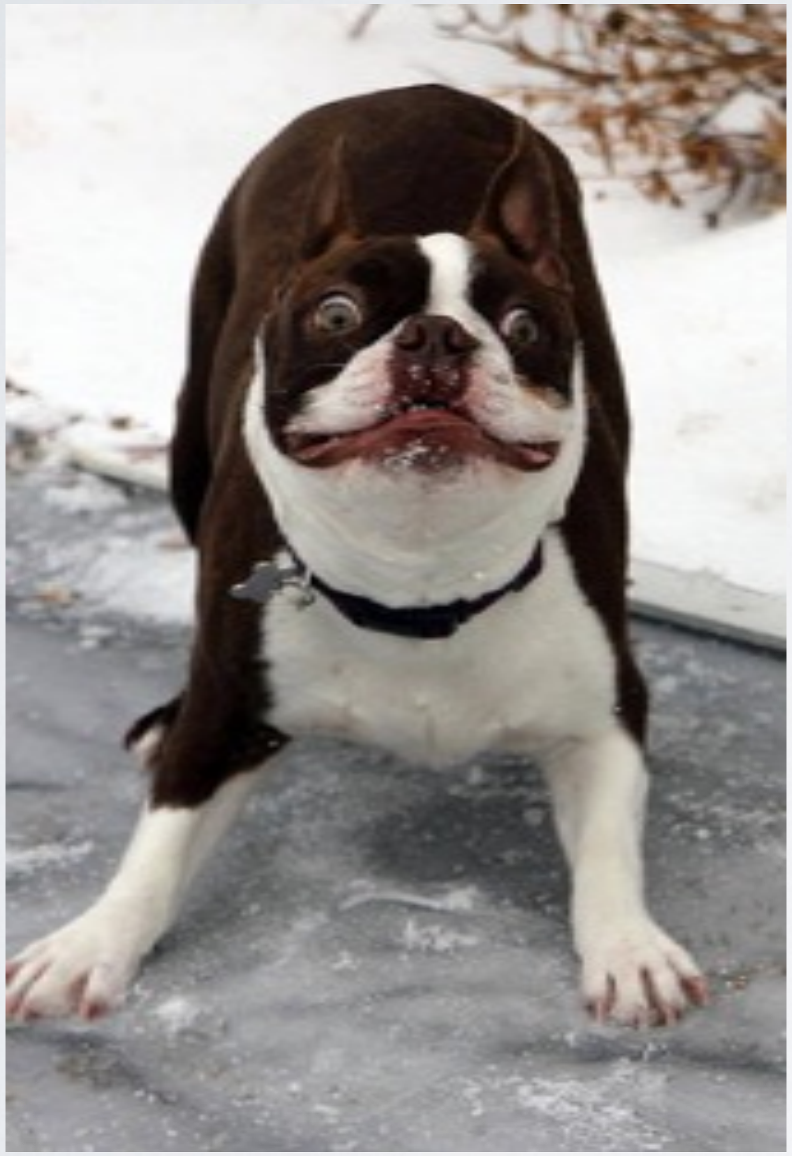
Problem

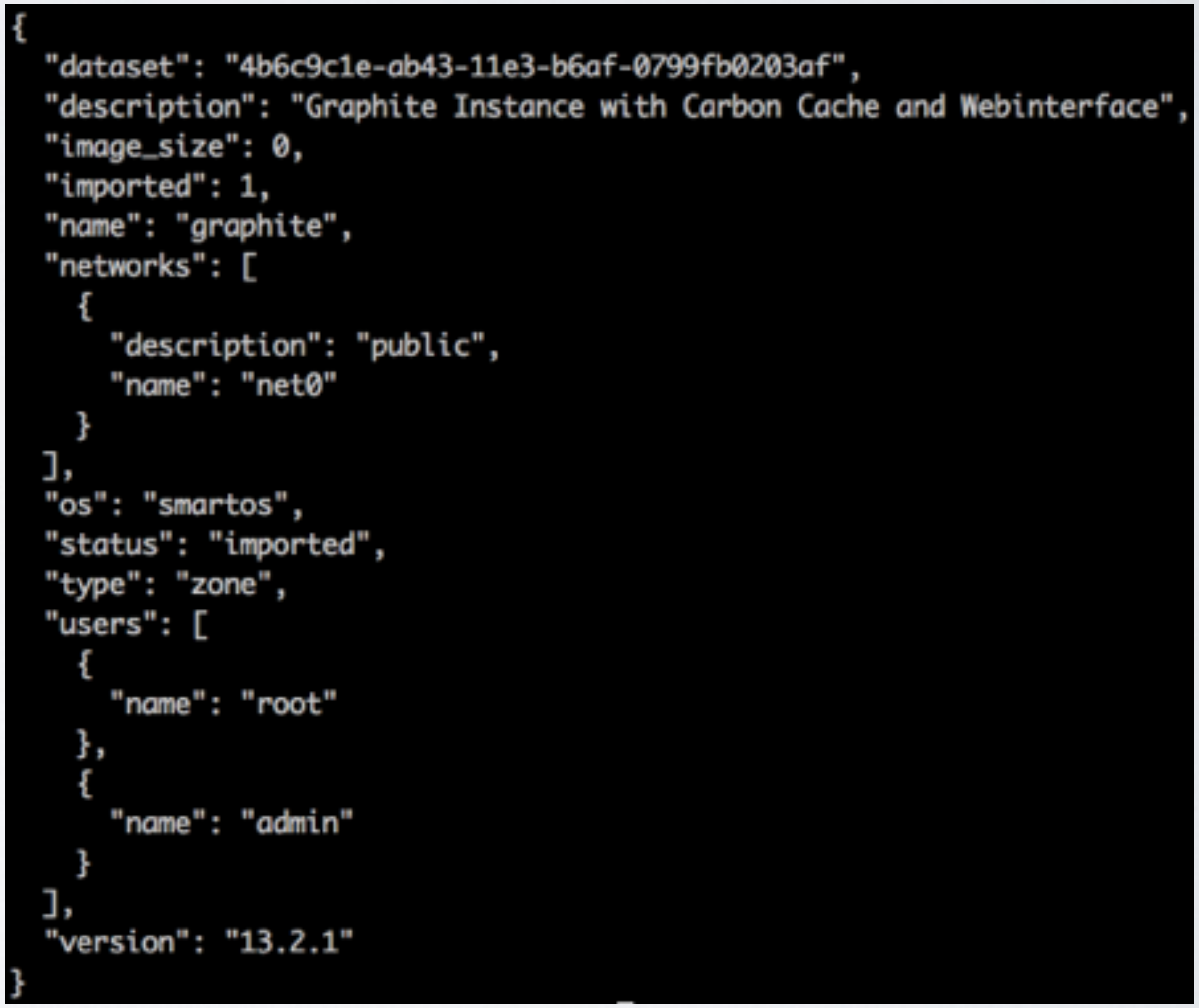
- Synchronization is really hard
- 1st try: gproc had problems with multiple nodes[1]
- 2nd try: wrapper around grpoc -> had a SPOF
- lots of configuration needed with connecting all the systems

What I learned

- distributed systems are hard, who would have thought that!
- managing configuration is annoying, especially in a multi-node environment.
- in Erlang land there are great libraries for distribution.
- riak_core rocks!

The fail of storing JSON





```
{
  "dataset": "4b6c9c1e-ab43-11e3-b6af-0799fb0203af",
  "description": "Graphite Instance with Carbon Cache and Webinterface",
  "image_size": 0,
  "imported": 1,
  "name": "graphite",
  "networks": [
    {
      "description": "public",
      "name": "net0"
    }
  ],
  "os": "smartos",
  "status": "imported",
  "type": "zone",
  "users": [
    {
      "name": "root"
    },
    {
      "name": "admin"
    }
  ],
  "version": "13.2.1"
}
```

Reason

- It’s “easy”, no schema, good library support for serializing and deserializing
- The fronted/UI used it anyway
- everyone uses JSON, so it must be good right?

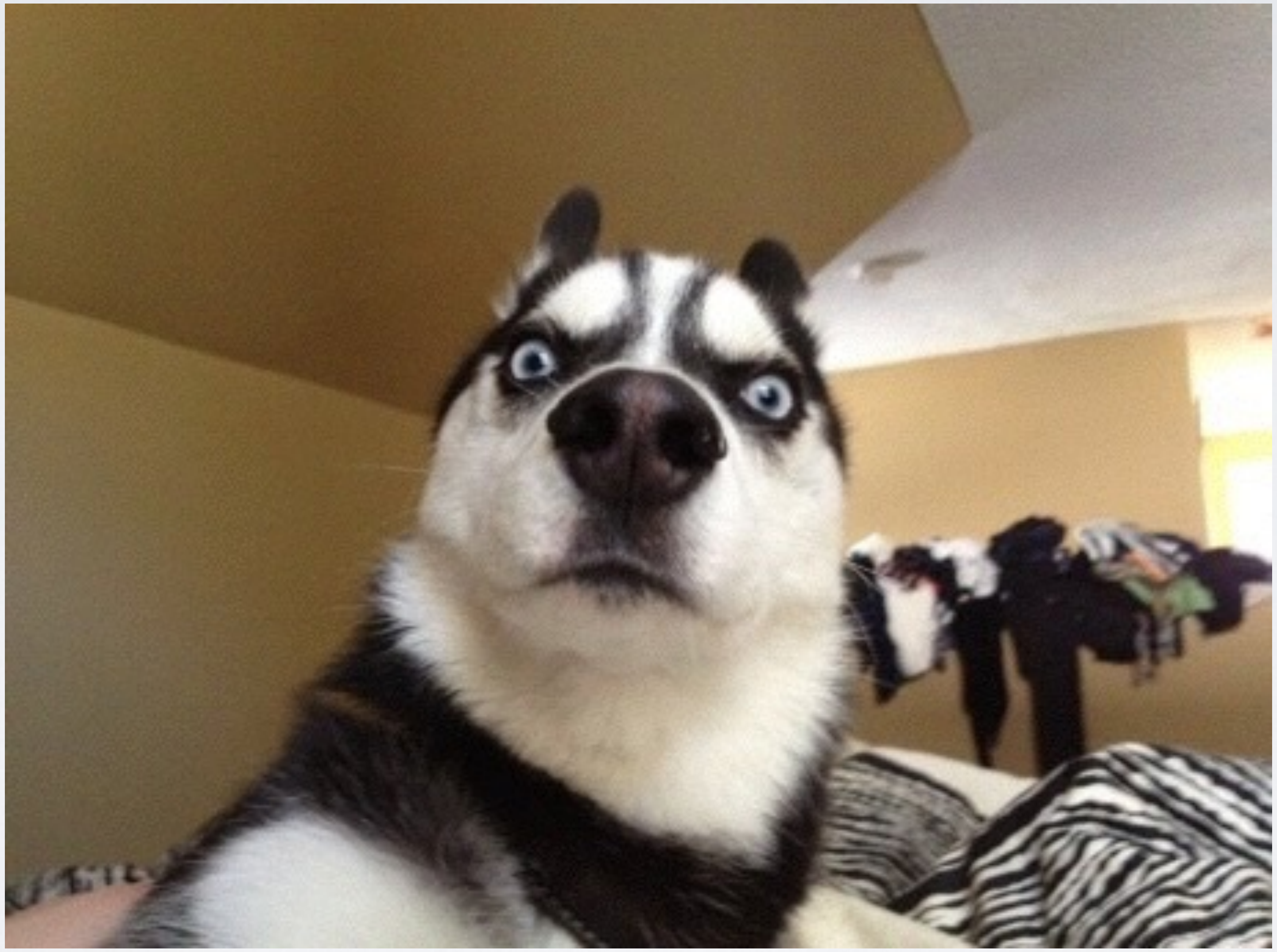
Problem

- Choice based on popularity not common sense
- No Pattern matching
- No good libraries to manipulating JSX-JSON
- Verbose and ‘big’
- hard to represent data in Erlang (esp. maps/objects)
- Hard to synchronize/merge (state box[2] is only a partial solution)

What I learned

- Model data around the backend not the front-end
- JSON is no silver bullet, it has the same problem XML had, it is used for the sake of being used
- CRDT's are a lovely thing[4]
- Records are not perfect but a very nice storage for structured information

The fail of CAP



Reason

- riak_core really rocks!
- Eventual consistency is a very tempting concept
- Availability is more important then consistency when managing a cloud

Problem

- Expect when it is not, like IP assignment, memory constraints on server :(
- Globally locking those things would break availability
- Not beating CAP anytime soon [3] :(

What I learned

- The more control you have over your data the further you can push the ‘eventual’ in eventual consistency
- Locks don’t have to be global need to just cover enough to ensure consistency
- The locks location matters:
  - Hypervisor memory on the hypervisor itself
  - IP’s ‘sharded’ over the ring

Links

- https://project-fifo.net
- https://docs.project-fifo.net
- [1] http://christophermeiklejohn.com/erlang/2013/06/05/erlang-gproc-failure-semantics.html
- [2] https://github.com/mochi/statebox
- [3] http://ferd.ca/beating-the-cap-theorem-checklist.html
- [4] http://aphyr.com/posts/285-call-me-maybe-riak