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DNS: Old solution for modern problems

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Traffic SRE
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What is it that “Traffic SRE” does

- Responsible for:
  - Global PoPs
  - Proxies
  - “Fixing” it
- Basically boils down to:
  - Get traffic from the user to the correct frontend in the correct DC as fast as possible
- What do we use?

Why service discovery?

Traffic is easy!

- Obviously hosts are where they are, how hard could it be?
- Load balancing is easy!
- Routing is easy!

Why service discovery?

What does our environment really look like?

- Multi-tenant
  - LinkedIn
  - Slideshare
  - Lynda
  - Etc.
- Legacy
- Lots of microservices: new ones all the time
- Dynamically changing scale

Why service discovery?

Isn’t this problem already solved?

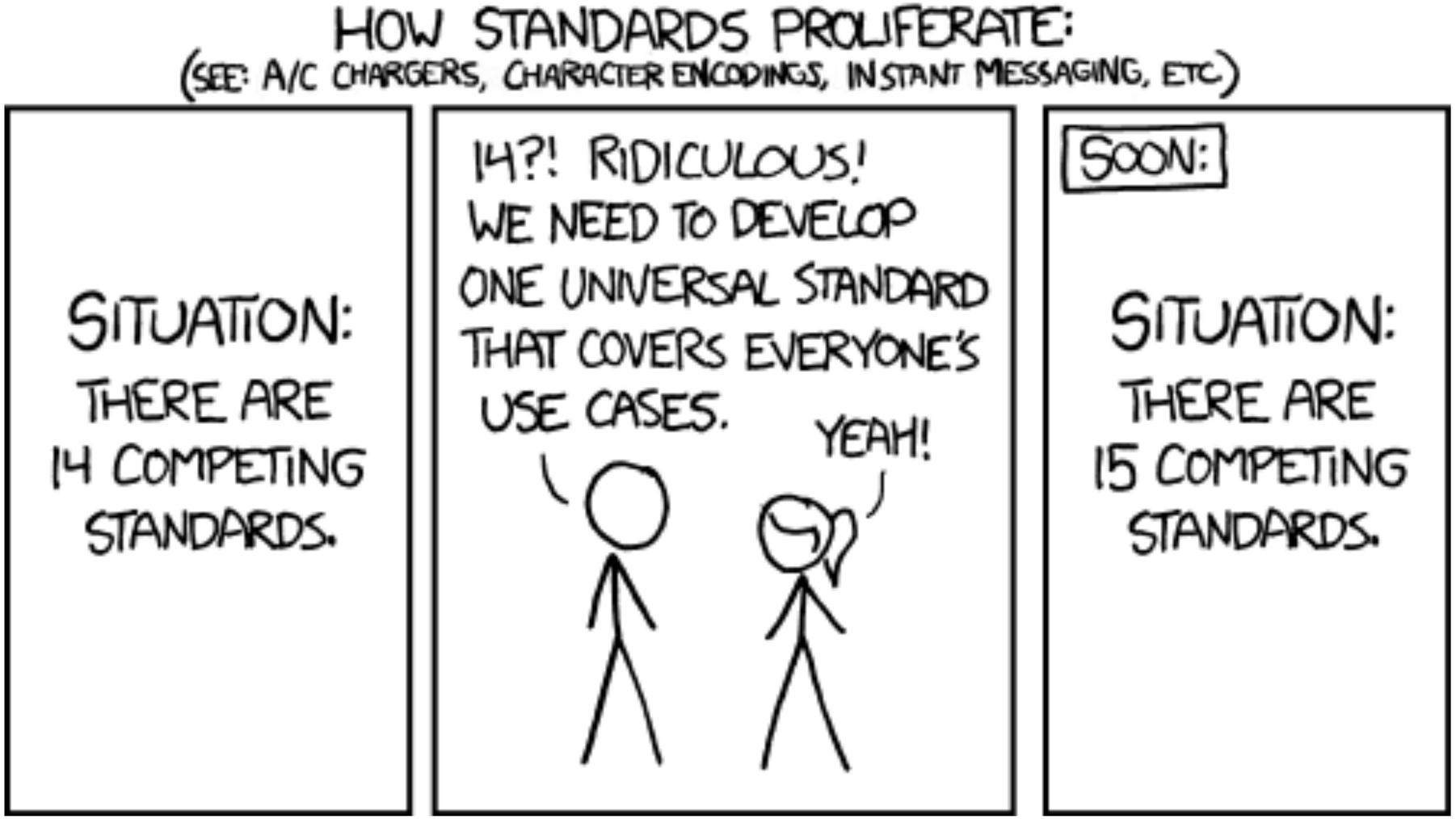
- Common solutions:
  - Frameworks: rest.li / thrift / etc.
    - Cons: Request/Response + DynamicDiscovery (solves more than we want…)
  - custom (usually zk-based) solution
    - Cons: doesn't scale to all platforms, all services, etc.

- Common problems
  - fairly high barrier to entry (meaning FOSS and legacy won’t easily integrate)

- In a large-scale, multi-tenant environment relying on any single solution can cause some problems

Picking a solution

Why do we need ***another*** service discovery thing



https://xkcd.com/927/

Picking a solution

How do you pick a solution

1. Gather requirements
2. Find past/possible/passable solutions
3. Do it! (pick a solution)

Picking a solution: How do you pick a solution

1. Gather requirements

- What do we need?
  - reliable service discovery
  - Differentiate between hosts that “want” traffic and ones that don’t (OOR hosts)
- What do we want?
  - A single solution
  - Easily debuggable solution
  - Require no/little work

Picking a solution: How do you pick a solution

1. Find past/possible/passable solutions

- Multiple sources of truth (primarily internal topology, rest.li, range)

- Closest solution in existence was rest.li
- Idea for using DNS directly in ATS

Picking a solution: How do you pick a solution

1. Do it! (pick a solution)

- DNS: the original name -> IP solution
- We decided to go with dns-discovery and we are here to talk about it -- so it must have worked right? ;)
- And DNS is awesome, SRV records anyone?

DNS is Awesome

Example SRV response

```
$ dig srv _http._tcp.profile.linkedin.com
...
;; ANSWER SECTION:
_http._tcp.profile.linkedin.com.  3 IN SRV 0 0 8080 profile1.linkedin.com.
_http._tcp.profile.linkedin.com.  3 IN SRV 0 0 8080 profile2.linkedin.com.
_http._tcp.profile.linkedin.com.  3 IN SRV 0 0 8080 profile3.linkedin.com.
...

;; ADDITIONAL SECTION:
profile1.linkedin.com.  3600 IN    A   10.136.148.97
profile2.linkedin.com.  3600 IN    A   10.136.148.98
profile3.linkedin.com.  3600 IN    A   10.136.148.219
...
;; Query time: 13 msec
```

Architecture

How do we design infrastructure?

- Set your runtime priorities
- Create service contract
- While (!requirements_met)
  - Create design
  - Understand the design
    - How will it fail (hopefully NOT fail, but it is inevitable)?
    - How will it scale?
    - How will it be extended?
- Document it!

Architecture

Set your runtime priorities

- Terms:
  - Availability: will it respond to a query?
  - Consistency: will all of them respond with the same thing?
  - Accuracy: will the response be the same as the data source?
- For this particular product: availability -> consistency -> accuracy

Architecture

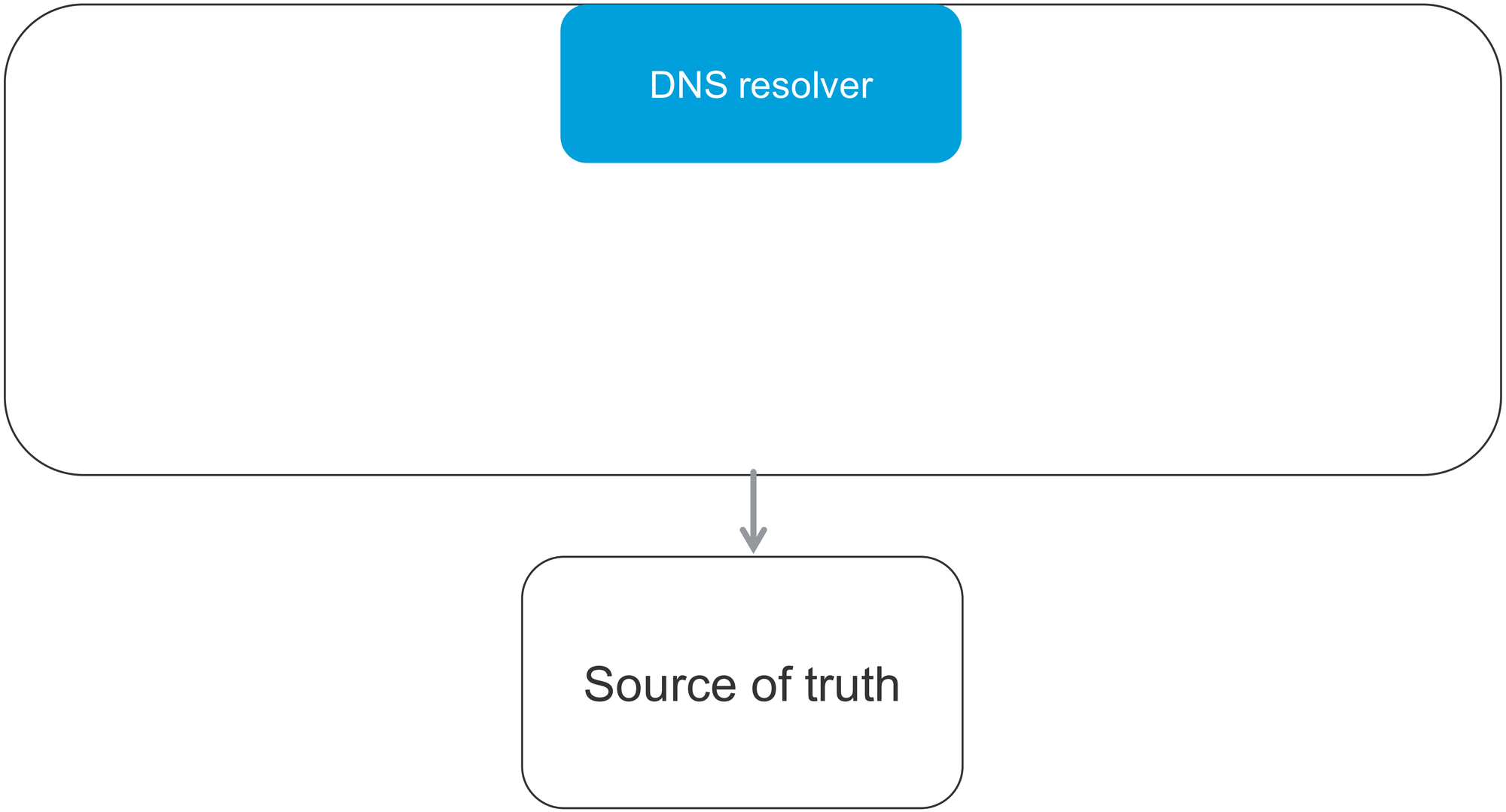
Service Contract

- Eventually consistent data across the cluster
- Best-Effort consistency to data source
- Best-Effort "real" status
- Best-Effort "host" resolution

- Client is responsible for
  - Following DNS RFC (for failover)
  - Load balancing

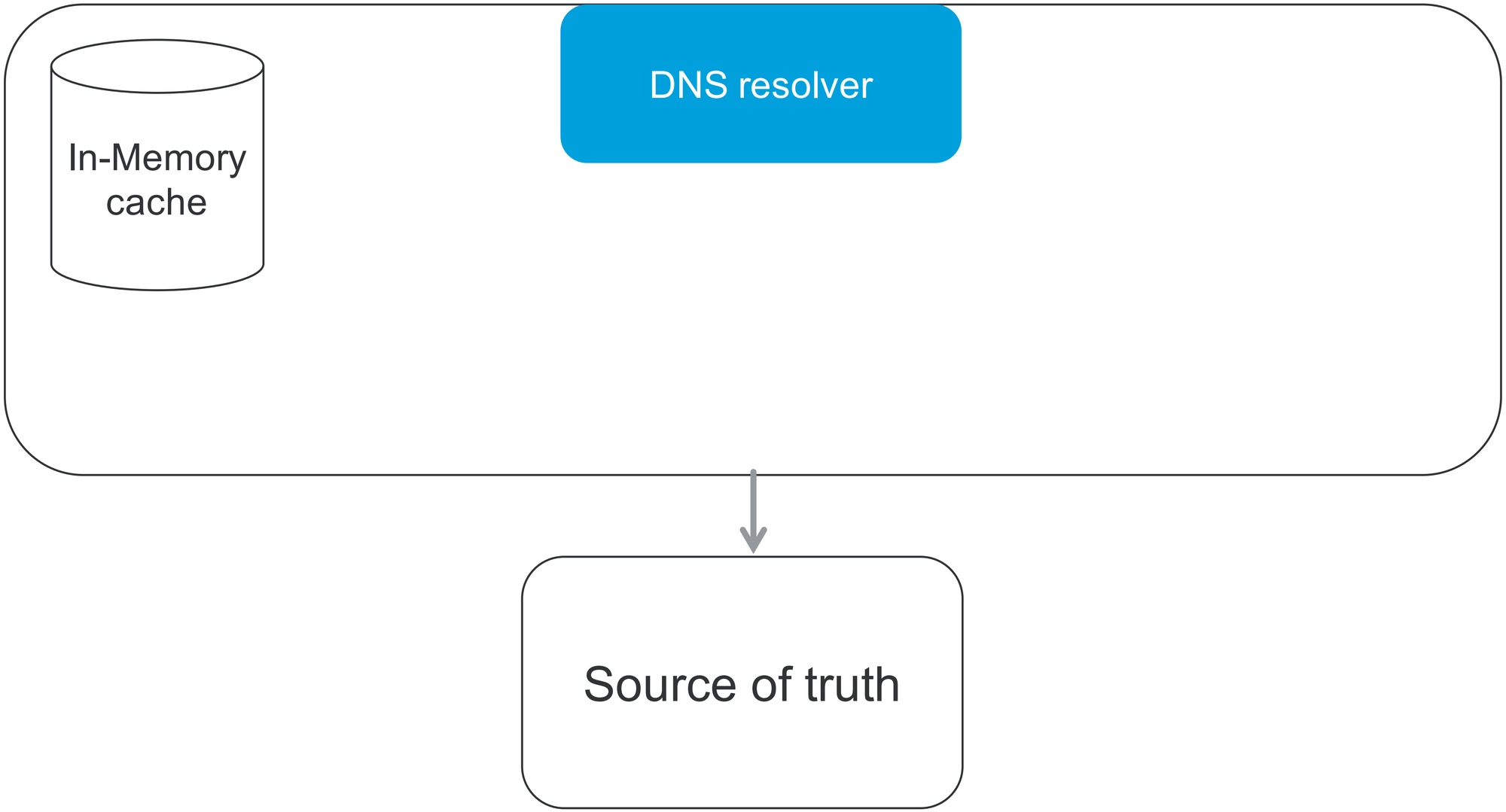
Architecture

V0.1



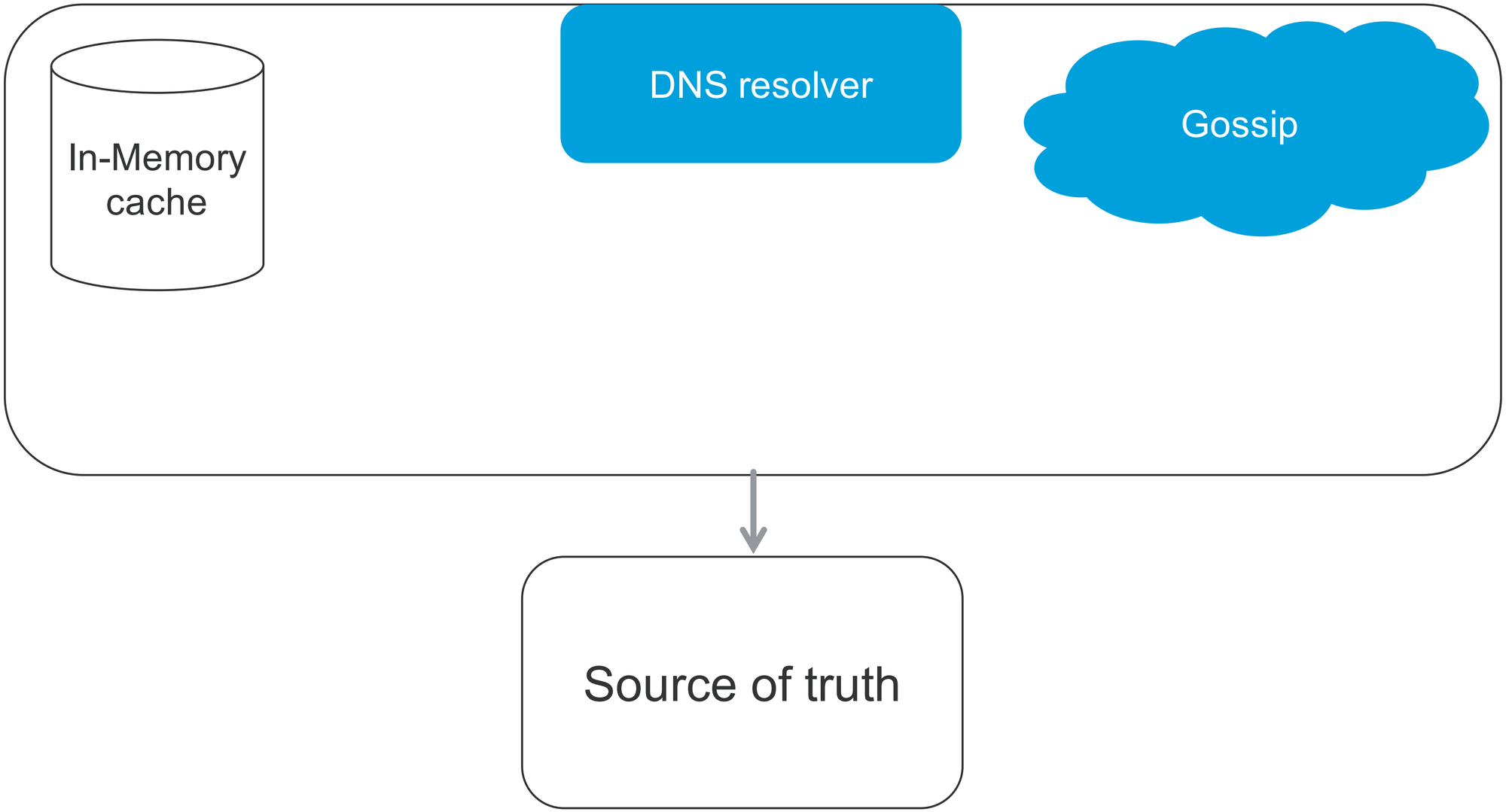
Architecture

V0.2



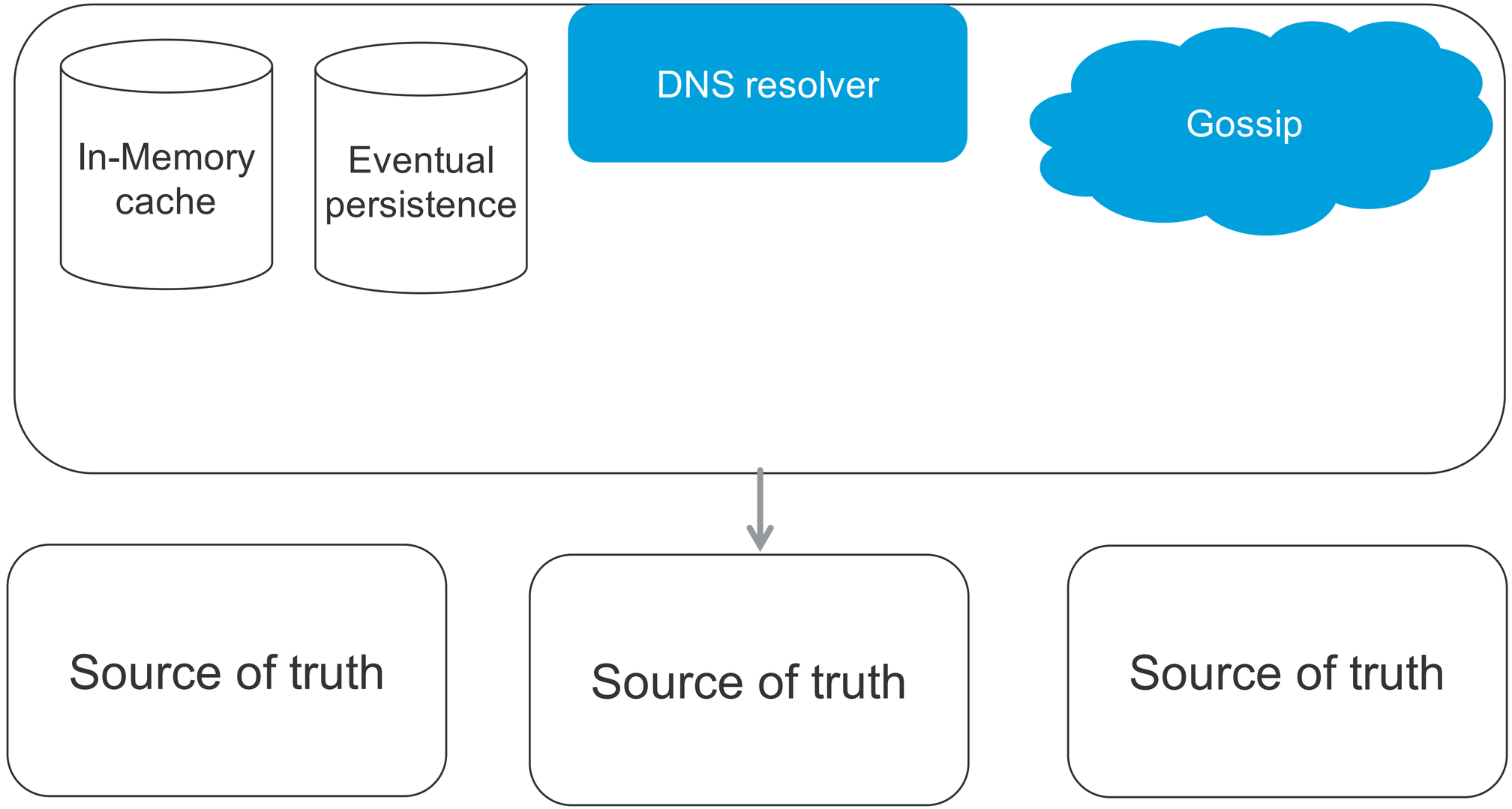
Architecture

V0.3



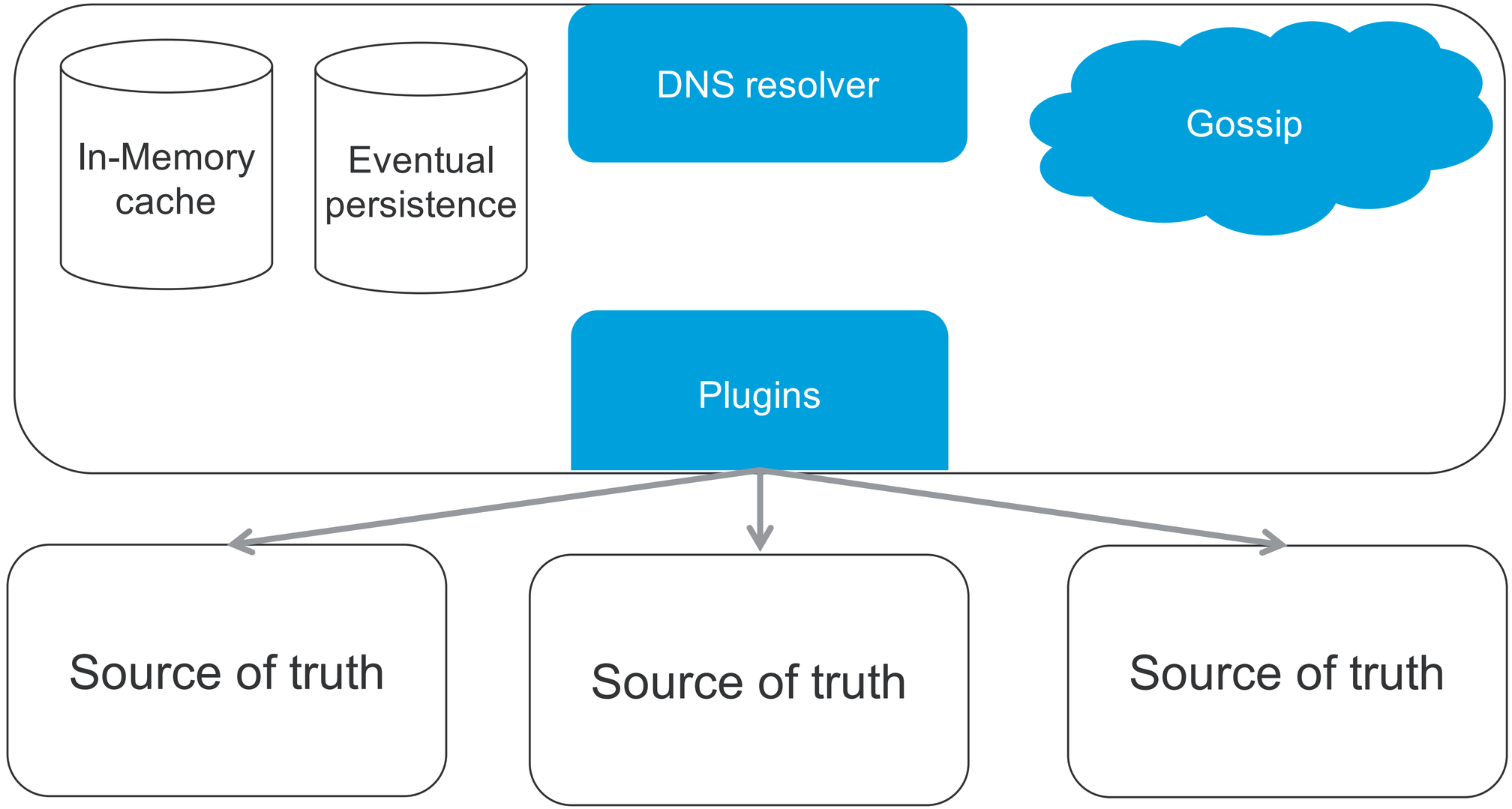
Architecture

V0.4



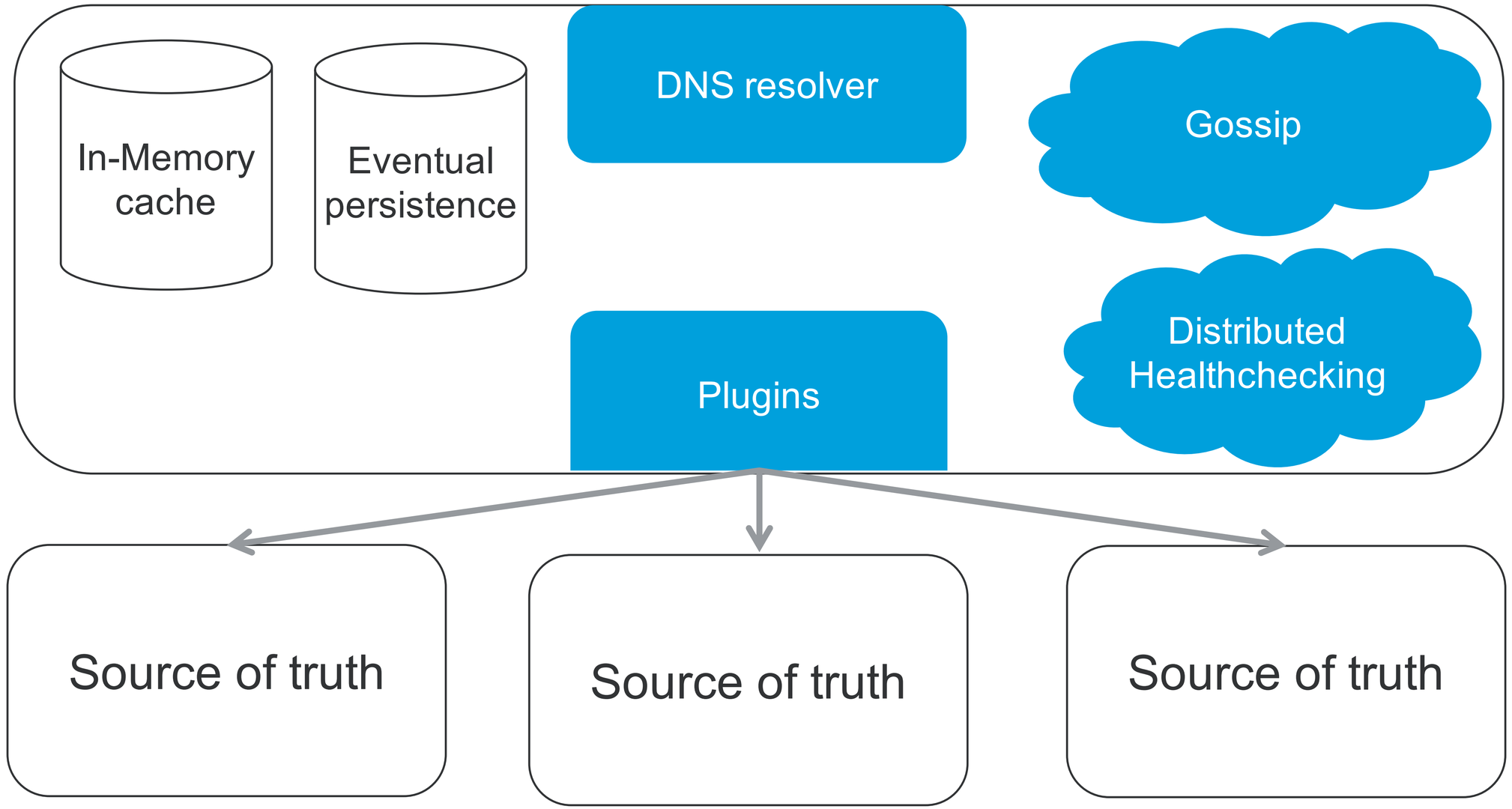
Architecture

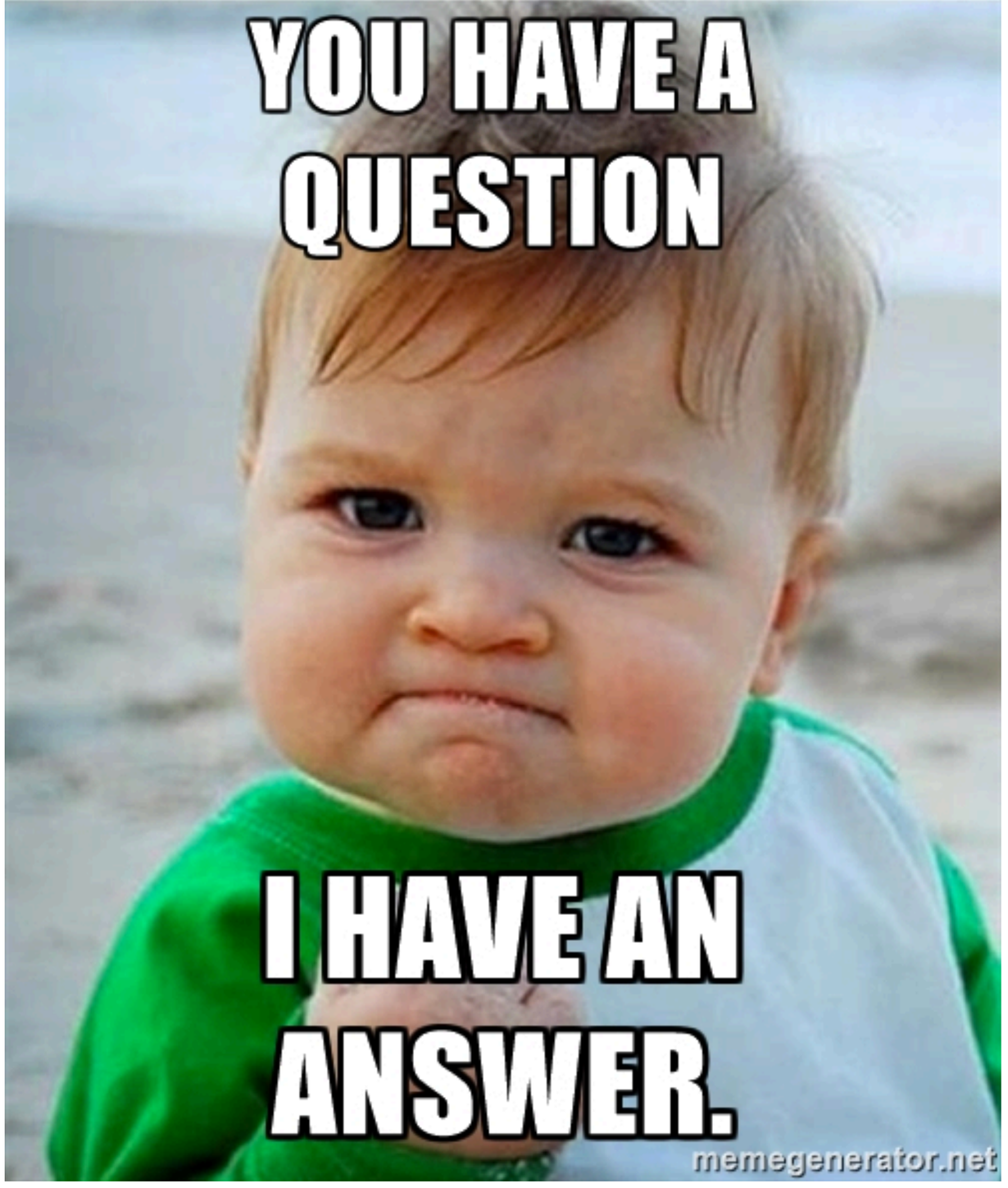
V0.5



Architecture

V0.6




YOU HAVE A QUESTION
I HAVE AN ANSWER.
memegenerator.net

Architecture

Heading off some common questions

- The source of truth should be able to handle all lookups!
  - Even if we assume that all sources of truth could (which is a fairly large "if") we don't necessarily want it to-- as there are potential tradeoffs made for accuracy over reliability (even though they may be small)
- But we can make everything use X instead of using this
  - This works in theory, but in practice something is always outside of "everything" (LBs, FWs, acquisitions, etc.)
- What about availability?
  - We use BGP to announce the same anycast IP address from multiple hosts

Implementation

Why is SRE building this anyways?

- This is a key piece of infrastructure, and at first we where the only users on the roadmap
- Infrastructure should be written by those who support it-- and have to handle the phone calls when it breaks
- Because we can, **E -** engineers ☺

Implementation

Prototype – in Python

- 1 week to get to staging
- Python ran into some serious scale problems in staging
  - Able to do 800 healthchecks/s per host– which isn't a lot!
  - Curse you GIL!!!

Implementation

First cut – in Golang

- ~1 day

- Basically, rough around the edges but lightweight and extremely quick thanks to golang (and goroutines)!

Implementation

Bake time

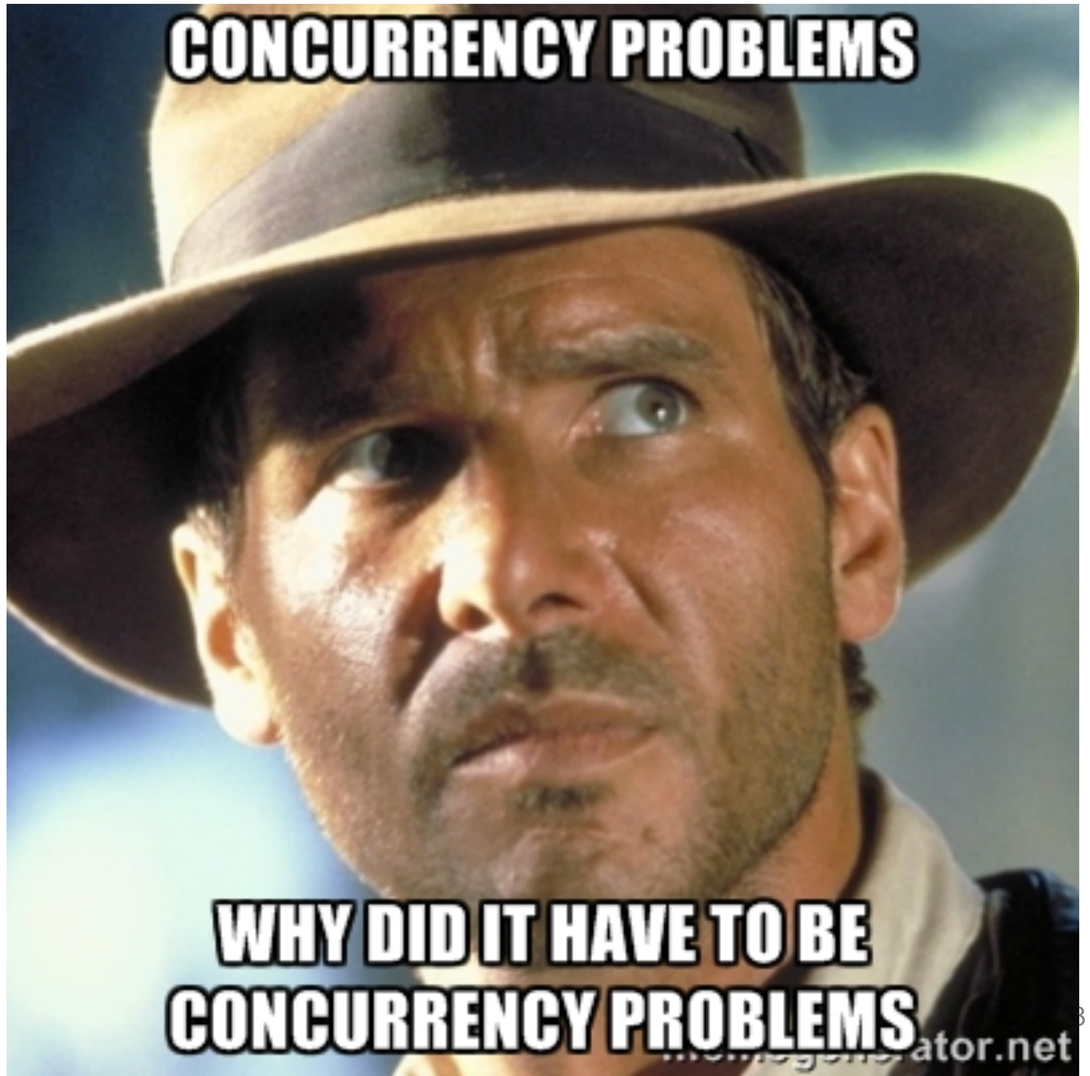
- Test function, failure, and scale
- DNS is EASY to test!
- Golang makes concurrency testing easy
  - go build –race

- We weren’t even the first users! (we were third!!)

Implementation

Problems while baking

- Concurrency
  - Deadlocks– channels are blocking!
- Concurrency
  - RWMutex -- can’t recursively acquire



Productionalizing

Monitoring/Alerting guidelines

- Metrics
  - Service health
    - Gororoutines
    - CPU/Memory usage
    - Gossip
    - Pacemaker delay
    - BGP
  - Plugin health
    - Number of lookups, loads, response latency, etc.
  - Customer focused metrics (how do we perceive your service)
- Alerts
  - All of the metrics you care about ☺
  - Tune thresholds as you go

Outcomes

- Significantly reduced complexity
  - ~2k unique DNS service names
- Dramatic decrease in convergence time (~3s instead of 1+ day)
- Ubiquitous service discovery
  - Even curl works with it!!
  - Other people are already using it!
- Leverage existing DNS infrastructure
  - We get ~800 QPS of the ~25k total QPS
- Self-supporting community


GREAT SUCCESS!
quickmeme.com