I got 10 trillion problems, but logging ain't one

John Graham-Cumming

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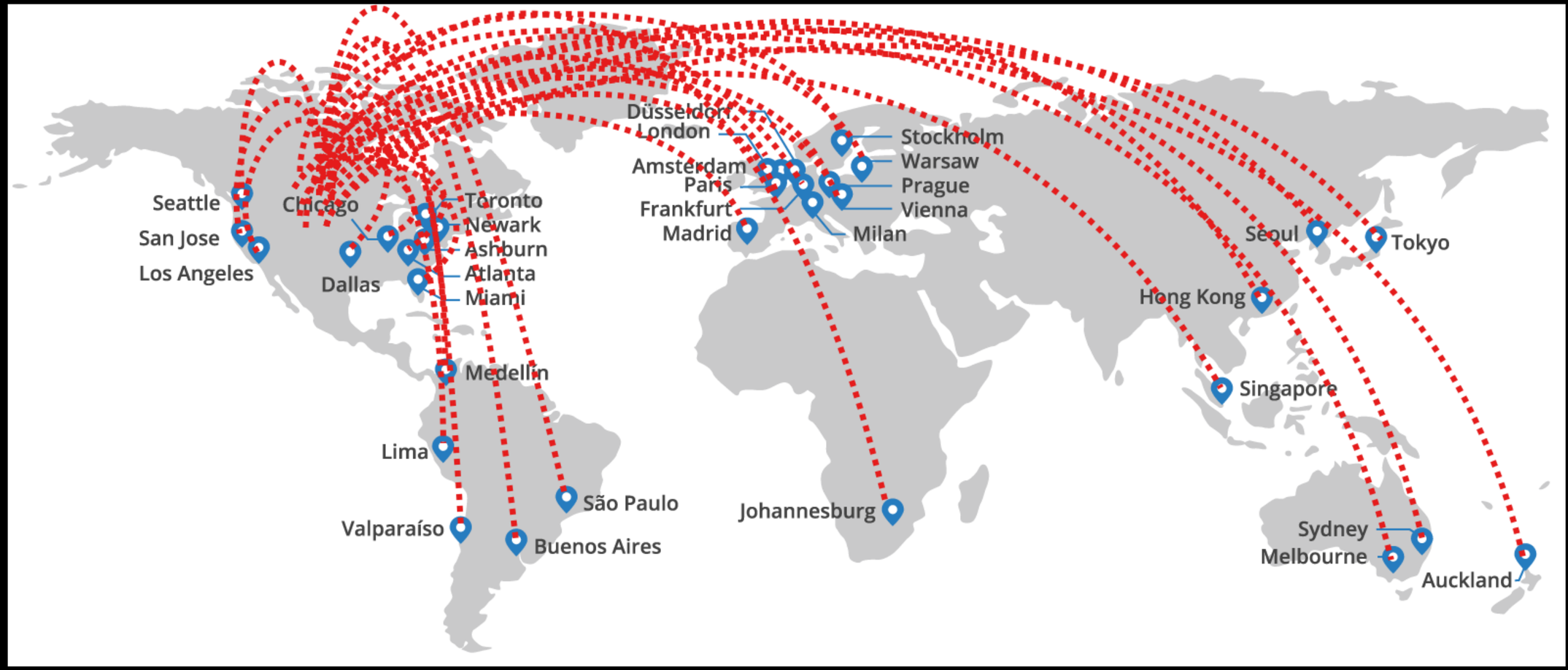
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BRACE YOURSELVES
THE LOG LINES ARE COMING
memegenerator.net

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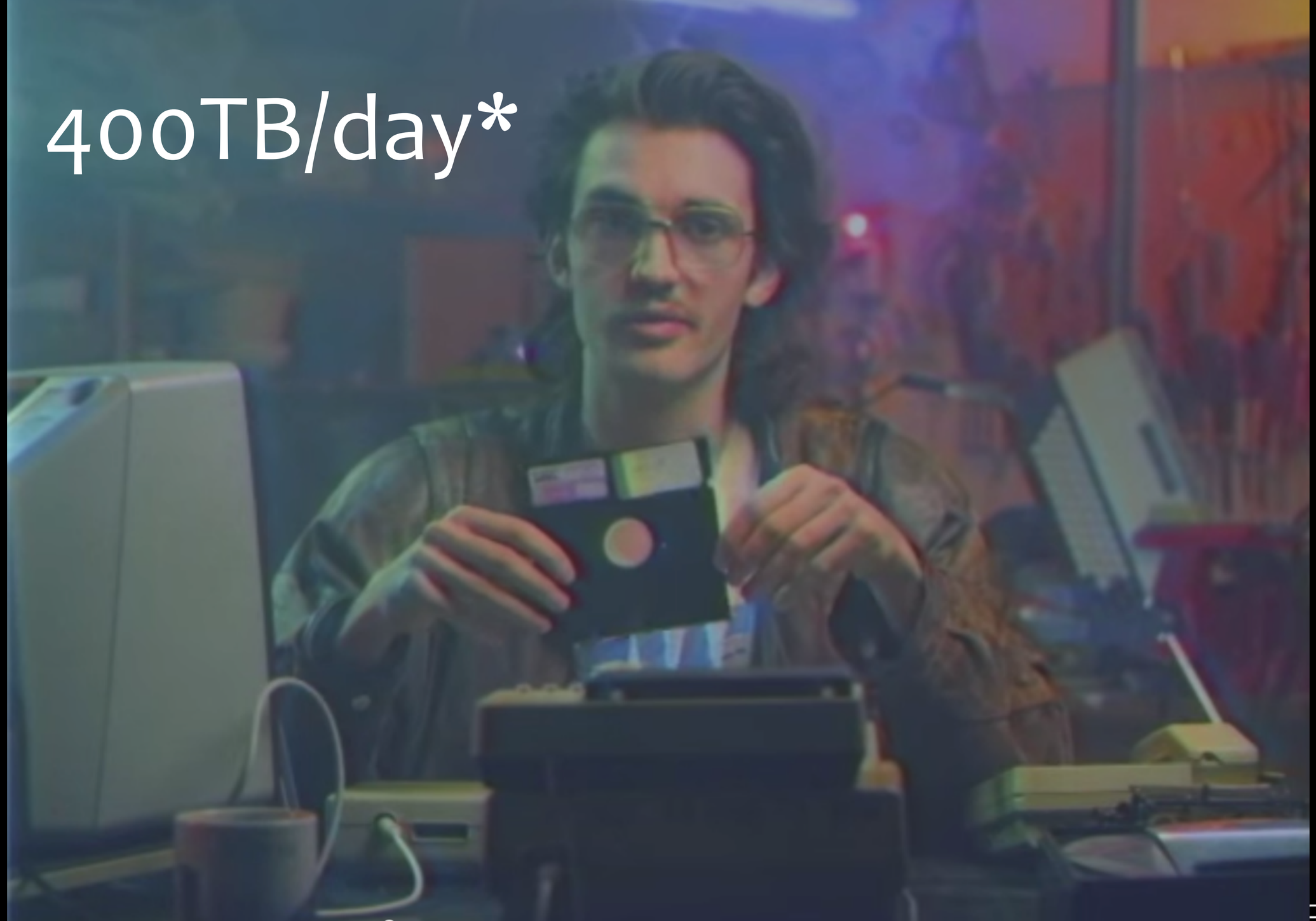
10 trillion HTTP requests
per month

4Mhz log lines

A log processing* company
that also runs a CDN and
web security service

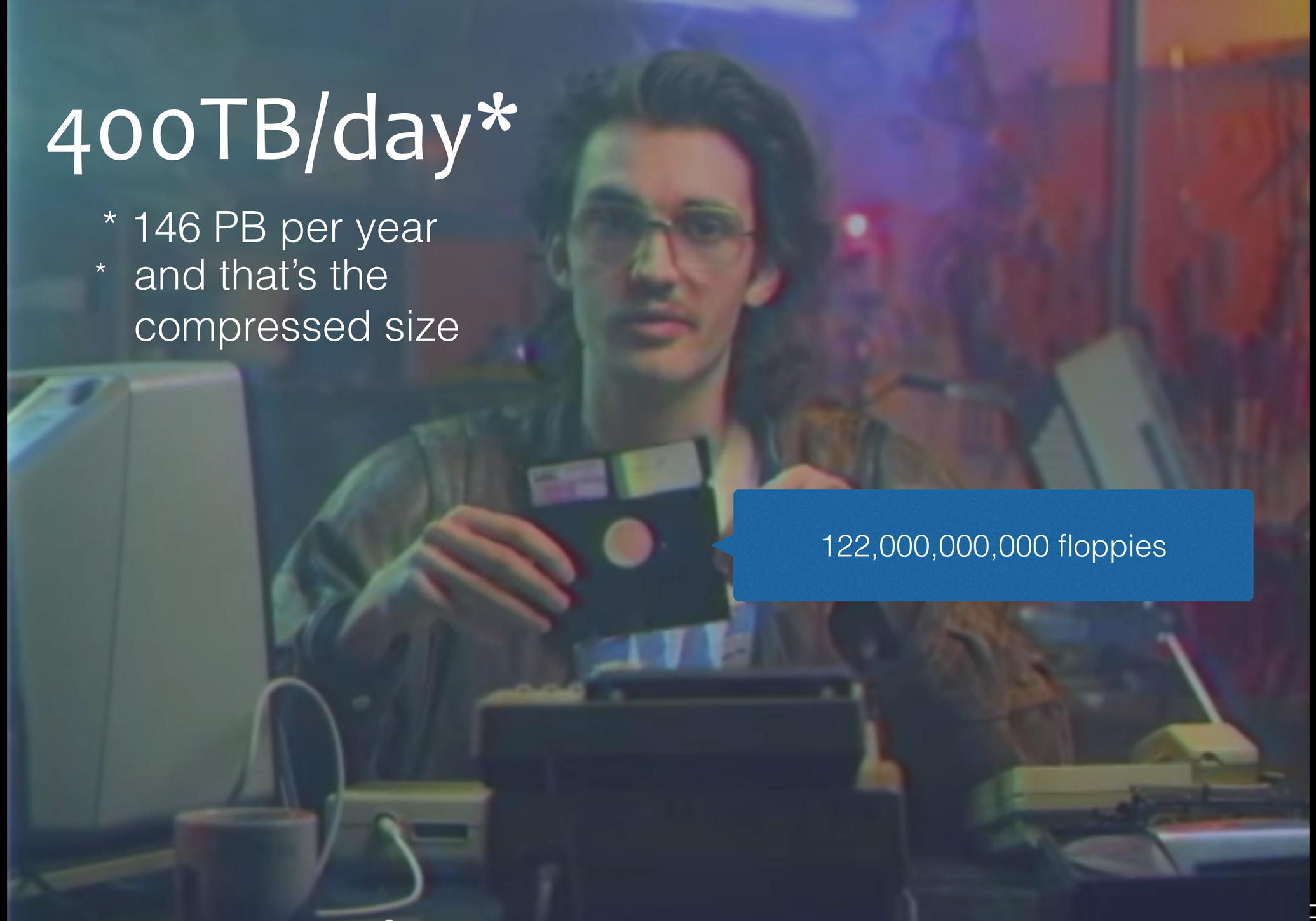
A log processing* company
that also runs a CDN and
web security service

*not storage


400TB/day*


400TB/day*
* 146 PB per year


400TB/day*
* 146 PB per year
* and that's the compressed size


400TB/day*
* 146 PB per year
* and that's the compressed size
122,000,000,000 floppies
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Privacy

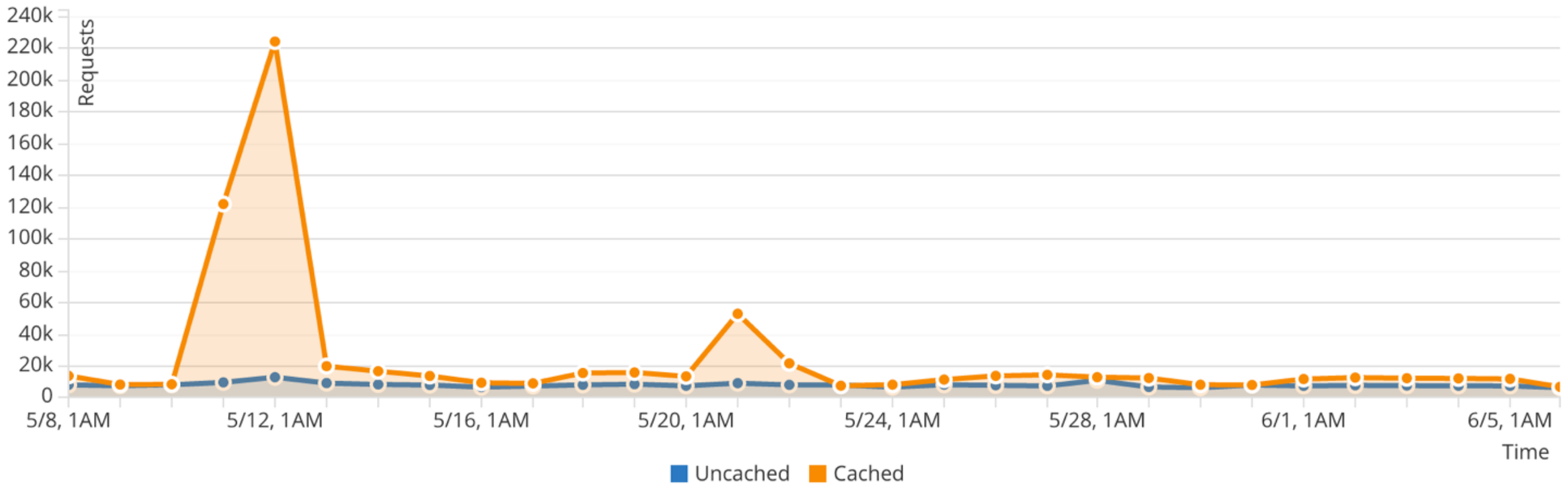
Three Things

- Provide charts for our customers
- Give customers data about attacks
- Automatically spot attacks in real-time

Requests Through CloudFlare

Requests • Bandwidth • Unique Visitors • Threats

Total Requests	Cached Requests	Uncached Requests
Last Month	Last Month	Last Month
950,299	719,254	231,045



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100030	Challenge	1[redacted]6	US	jgc.org	3 minutes ago	Details

100030

Date: 06/08/2015

Time: 09:14:20 +02:00

Data Center: SJC

Action: challenge

IP Address: 1[redacted]6 Filter On This | Block | Challenge | Whitelist

Details

Location: US Block | Challenge | Whitelist

User Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10_10_0) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/43.0.2357.81 Safari/537.36

Host: jgc.org

URI: /?try_to_be_bad=%3Cscript%3Ealert(%22pwned!%22);%3C/script%3E

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Things we ❤️

- NGINX + LuaJIT
- Cap’n Proto
- Apache Kafka
- Redis
- Go
- Postgres and CitusDB
- Streaming Algorithms

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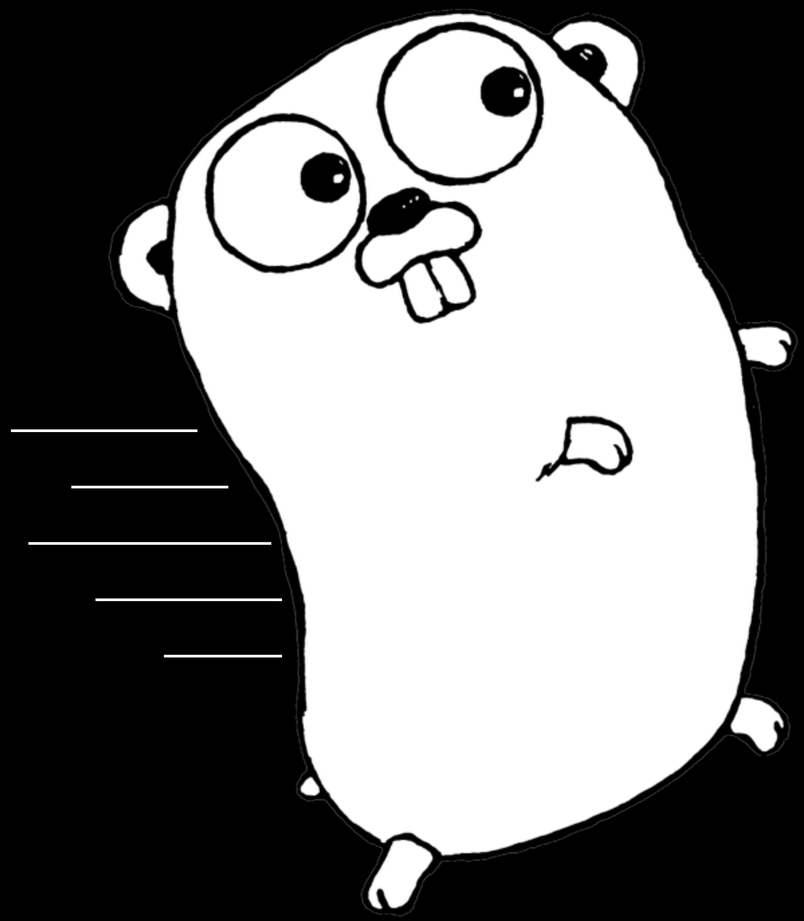

https://blog.cloudflare.com/tag/go/

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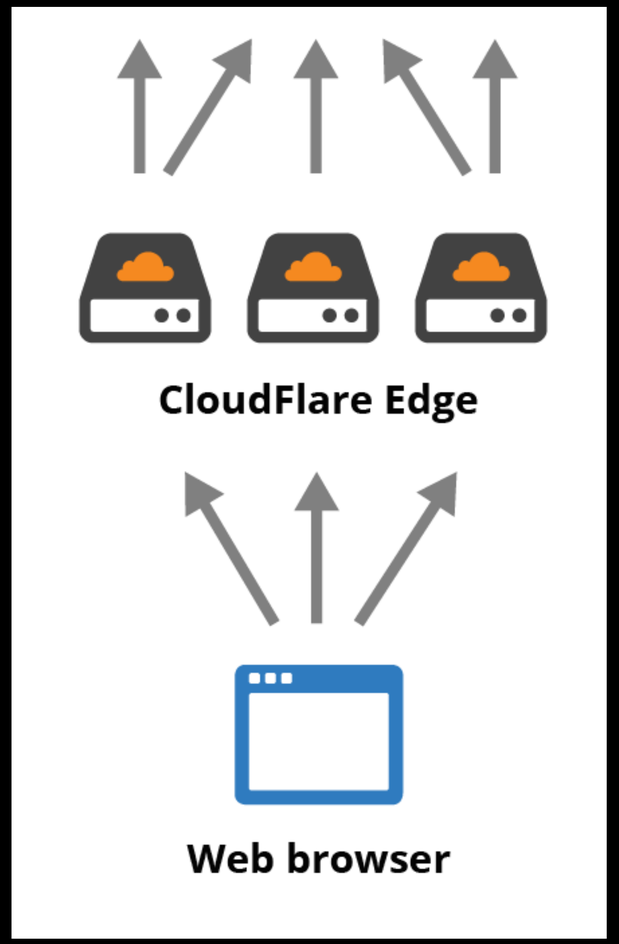
NGINX + LuaJIT

- Every request executes Lua code… lots
- LuaJIT is very fast
- Mixture of human-written Lua and generated code

- http://wiki.nginx.org/HttpLuaModule



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Lua for WAF

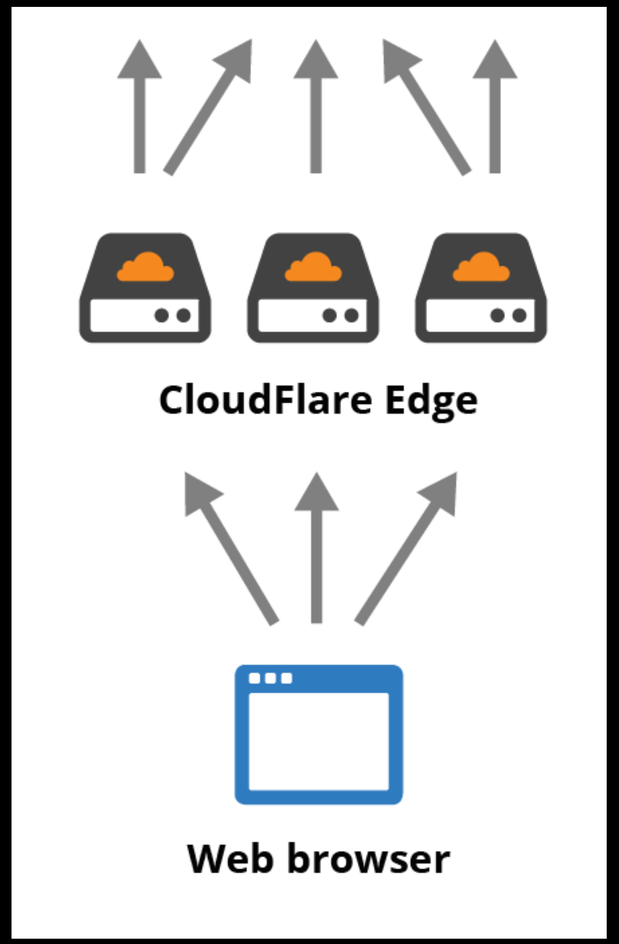
```
location / {
    set $backend_waf        "WAF_CORE";
    default_type            'text/plain';

    access_by_lua '
        local waf = require "waf"
        waf.execute("")
    ';

    log_by_lua_file "lua/metrics/waf_metrics_main.lua";

    content_by_lua 'ngx.say("")';
    error_page 500 =200 @error;
}
```

Generated Code

```
local waf_vars = waf.vars
local waf_streq = waf.streq
local waf_setvar = waf.setvar
local waf_msg = waf.msg
local waf_drop = waf.drop
local waf_disabled_ids = waf.disabled_ids
local waf_deny = waf.deny
local waf_activate = waf.activate
local t1_1 = {}
if not waf_disabled_ids['00001'] and waf_streq(waf, v2_5, '2_5', t1_1, '1_1', 'b783efc191a7c066c1d87068f63a84a39f9830bb', false) then
  waf_vars['RULE']['ID'] = '00001'
  waf_activate(waf, rulefile)
  waf_msg(waf, 'CloudFlare Test Rule (drop) activated')
  waf_setvar(waf, {{'TX:ANOMALY_SCORE', '+100'},{'TX:%{RULE:ID}', 'CloudFlare unique hash test rule (drop)'}})
  waf_drop(waf, rulefile)
end
if not waf_disabled_ids['00002'] and waf_streq(waf, v2_5, '2_5', t1_1, '1_1', '4709edce126971876b547523778fa7b942ec14b5', false) then
  waf_vars['RULE']['ID'] = '00002'
  waf_activate(waf, rulefile)
  waf_msg(waf, 'CloudFlare Test Rule (deny) activated')
  waf_setvar(waf, {{'TX:ANOMALY_SCORE', '+100'},{'TX:%{RULE:ID}', 'CloudFlare unique hash test rule (deny)'}})
  waf_deny(waf, rulefile)
end
```

NGINX + LuaJIT

- Go program receives log events from NGINX in Cap'n Proto format
- Batches events
- Compresses using LZ4
- Sends via TLS to Data



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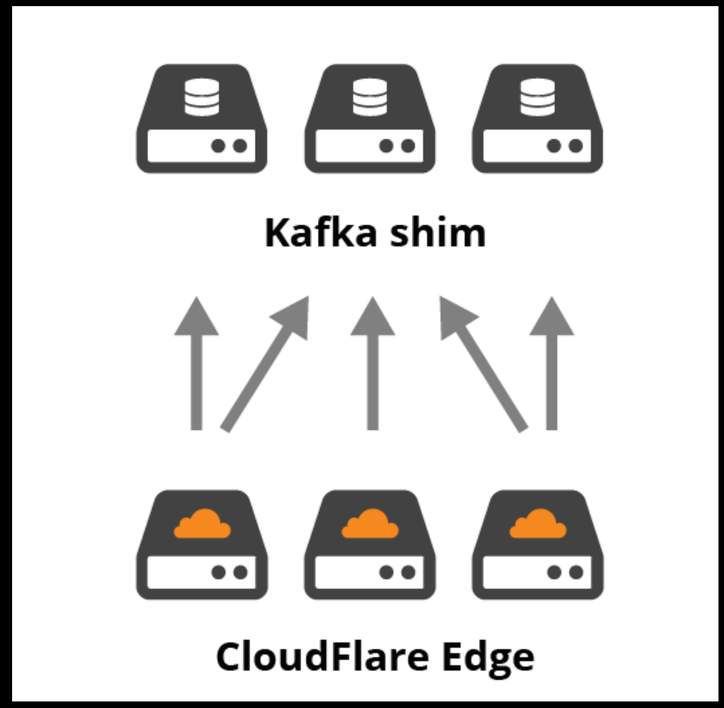
Cap'n Proto

- Insanely fast
  - Saw 20x speedup over cjson
- It's a wire format and an in memory representation
- Extend with no penalty
- https://capnproto.org/
- Our interface from Lua https://blog.cloudflare.com/introducing-lua-capnproto-better-serialization-in-lua/



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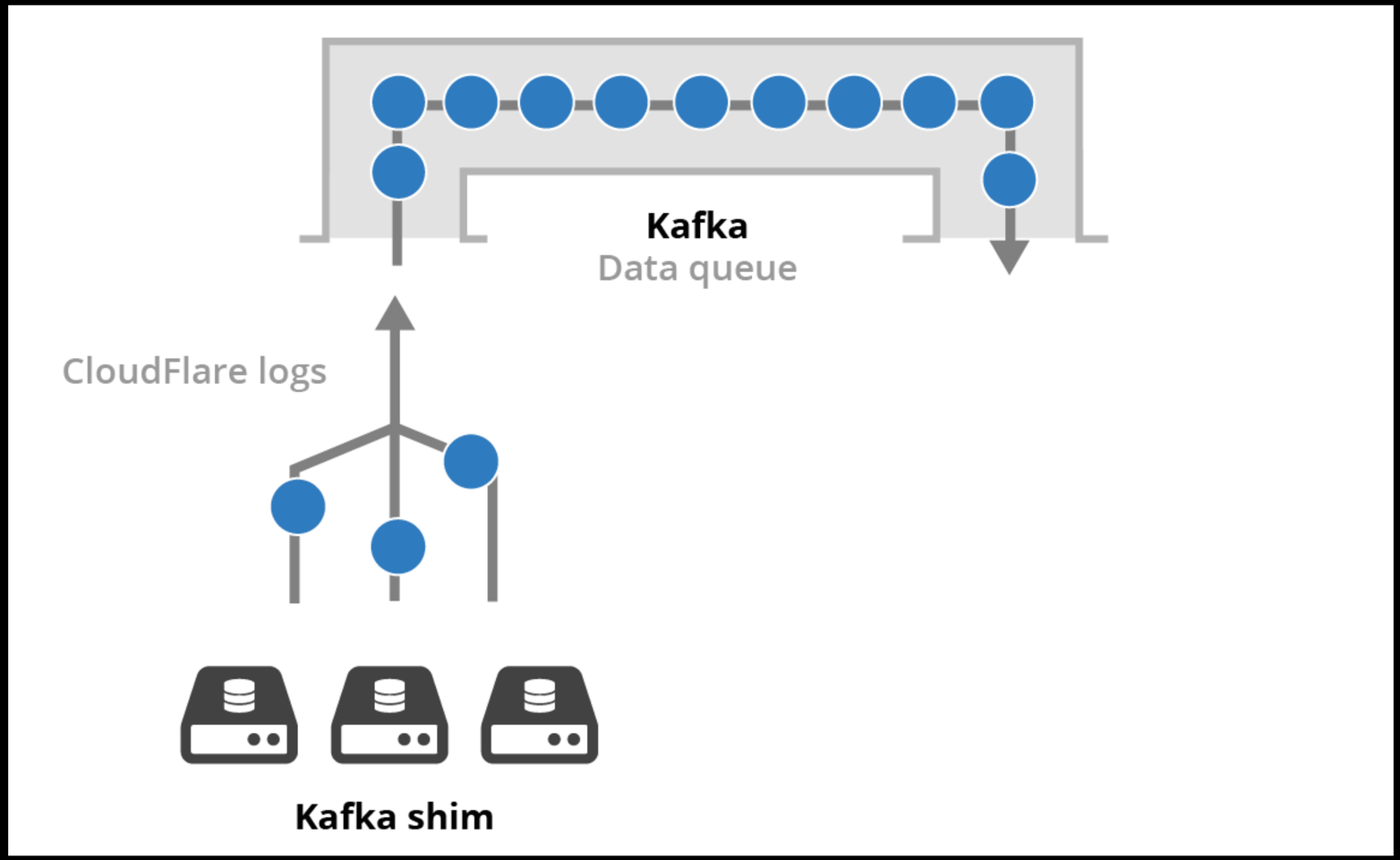
Apache Kafka

- Fast, scalable, resilient queue
- Queue on a cluster not a single machine
- Allows clusters of readers to process queue messages
- https://kafka.apache.org/



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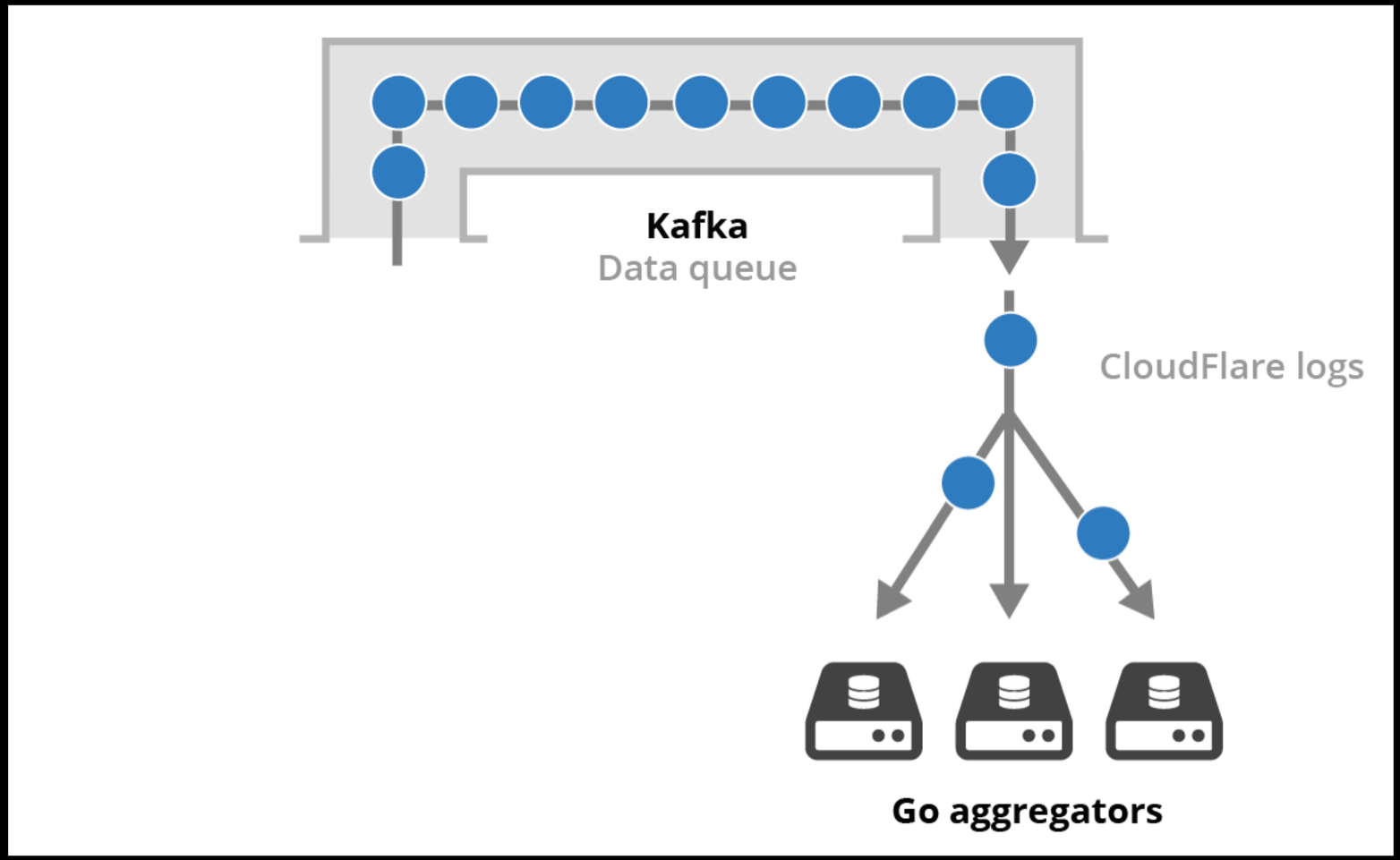
Apache Kafka

- Cluster of Go programs process log messages
- Generate detailed attack logs for customers
- Feed aggregates to Postgres



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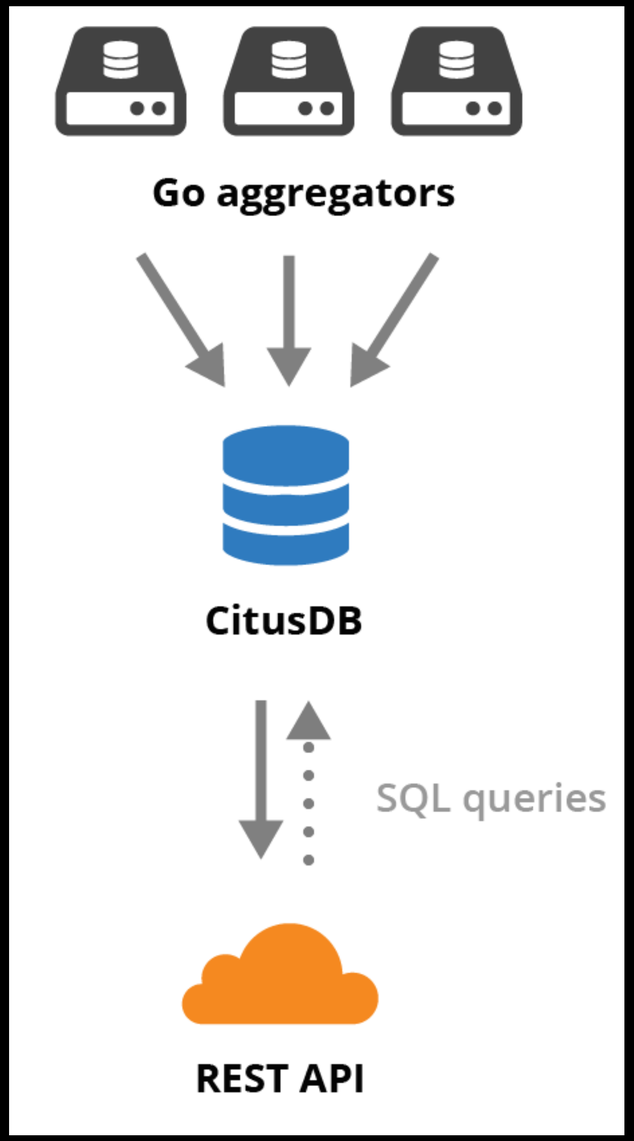
```
{
  "_index": "waf-2015.06.08",
  "_type": "waf",
  "_id": "1[redacted]9",
  "_score": null,
  "_source": {
    "type": "waf",
    "rayid": "1[redacted]9",
    "zone_id": [redacted],
    "timestamp": "2015-06-08T07:14:20.94Z",
    "client_ip": "1[redacted]6",
    "host": "jgc.org",
    "http_method": "GET",
    "protocol": "HTTP/1.1",
    "uri": "/?try_to_be_bad=%3Cscript%3Ealert(%22pwned!%22);%3C/script%3E",
    "country": "us",
    "action": "challenge allow",
    "rule_id": "100030",
    "colo": 4,
    "edge_dur": 3000064,
    "user_agent": "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_10_0) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/43.0.2357.81 Safari/53
7.36",
    "rule_group": "cloudflare_specials",
    "activated_rules": [
      "100030"
    ],
    "exit_code": 403
  },
  "sort": [
    1433747660940,
    1433747660940
  ]
}
```


Postgres and CitusDB

- Go processes produce 1 minute roll ups of customer analytics an insert into CitusDB
- Later 1 hour, 1 day etc. roll ups created
- CitusDB is a sharded, replicated Postgres implementation for very fast queries
- https://blog.cloudflare.com/scaling-out-postgresql-for-cloudflare-analytics-using-citusdb/
- https://www.citusdata.com/



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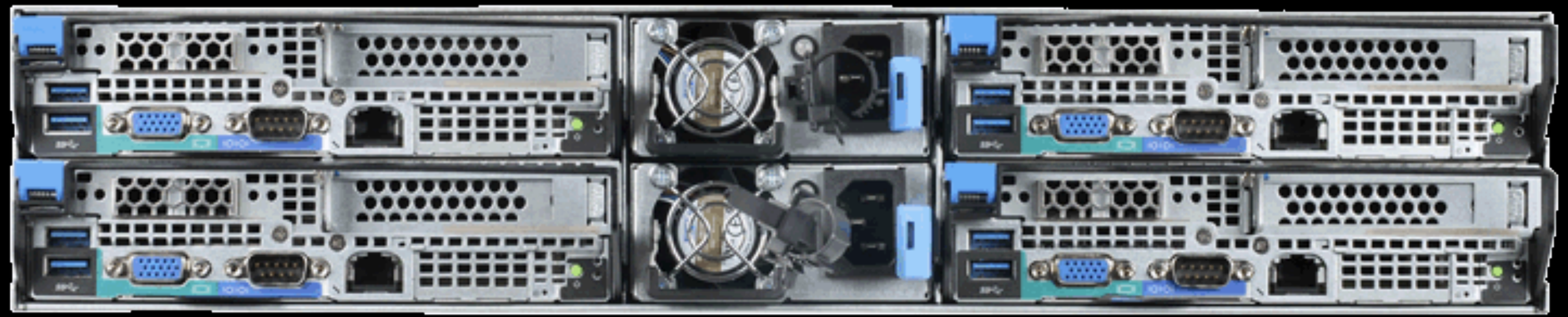

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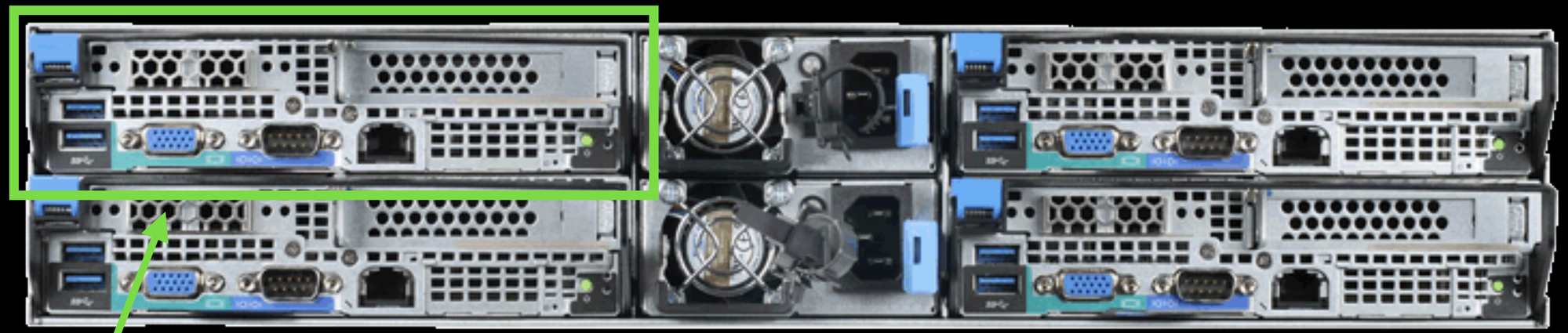

- 128GB RAM
  2x Intel® Xeon® Processor E5-2630 v3 (16 cores)
  10G Ethernet
  Disks vary
- Custom made for us by Quanta

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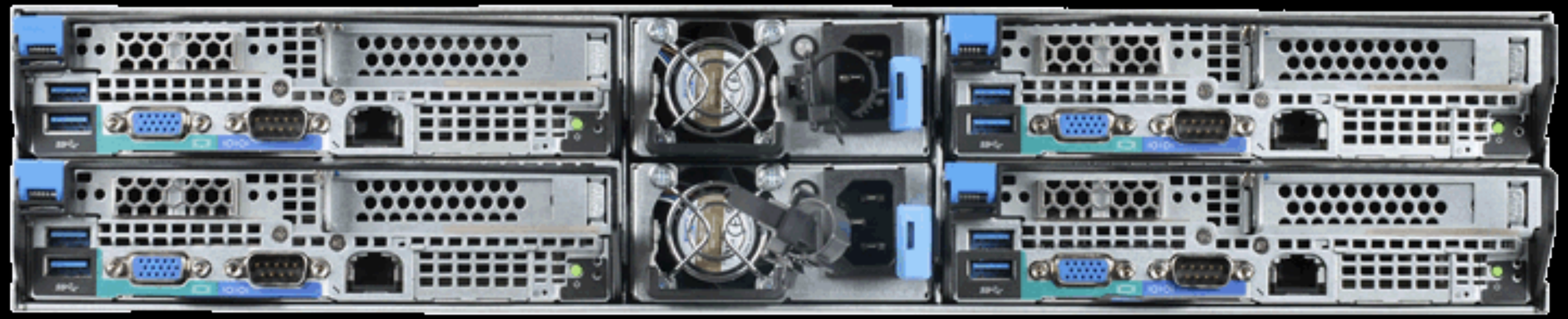

- 40 machines for Kafka
  400TB of compressed, replicated 500-byte log lines
  Ingest at ~15Gbps
  ~50TB of spinning rust per node
- 5 machines for CitusDB
  Analytics for 2 million customers
  ~12TB of SSD per node
- > 100 machines for consumers written in Go
  The analytics roll up processes
  Attack detection
  Botnet analysis

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Streaming Algorithms

- Space Saving Algorithm
  Efficient Computation of Frequent and Top-k Elements in Data Streams
  https://icmi.cs.ucsb.edu/research/tech_reports/reports/2005-23.pdf

  Hasn't worked well for 'long tail data'

- HyperLogLog
  Counting distinct elements
  https://github.com/aggregateknowledge/postgresql-hll

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CloudFlare Open Source.

JavaScript Go Nginx and Lua Postgres Other

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cf-tls · Sat Jun 06 2015 · 6 stargazers · 2 forks
collapsify · Mon Jun 01 2015 · 15 stargazers · 3 forks

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https://cloudflare.github.io/

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