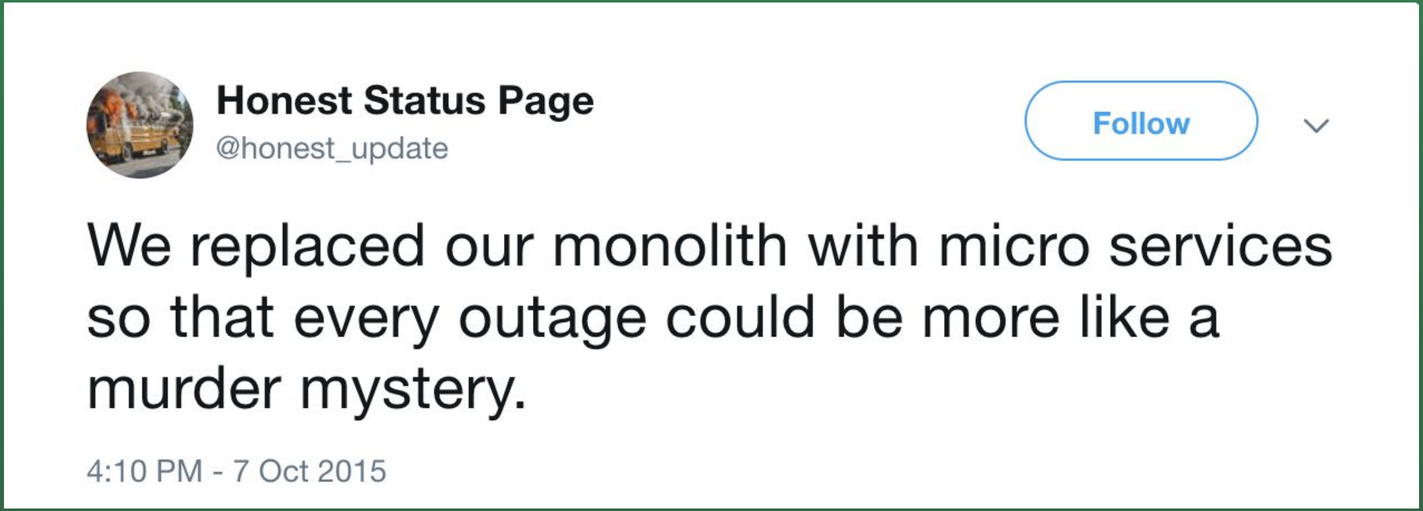
Best Practices for Debugging and Monitoring on Kubernetes

Thomas Rampelberg



Honest Status Page
@honest_update

We replaced our monolith with micro services so that every outage could be more like a murder mystery.

4:10 PM - 7 Oct 2015

👋 Hello GoSF!

Thomas Rampelberg

Software Engineer @ Buoyant

@grampelberg

grampelberg

What problem needs to be solved?

🚨 Alerting

- Downtime
- Exceptions
- Service Level Agreements

🕵️‍♀️ Forensics

- Memory leaks
- Performance issues
- Environment specific failures

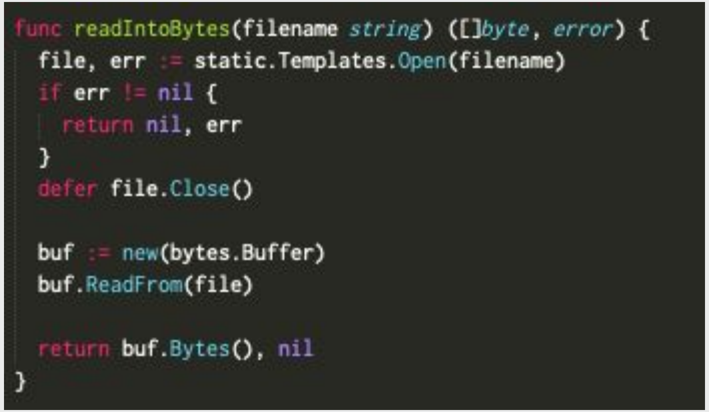
Monitoring for Alerting

🚧 Downtime

- External monitoring
- livenessProbe/readinessProbe
- kube-state-metrics

Pingdom:	https://www.pingdom.com/
Configuring livenessProbe:	https://kubernetes.io/docs/tasks/configure-pod-container/configure-liveness-readiness-probes/
Kube-state-metrics:	https://github.com/helm/charts/tree/master/stable/kube-state-metrics

Exceptions

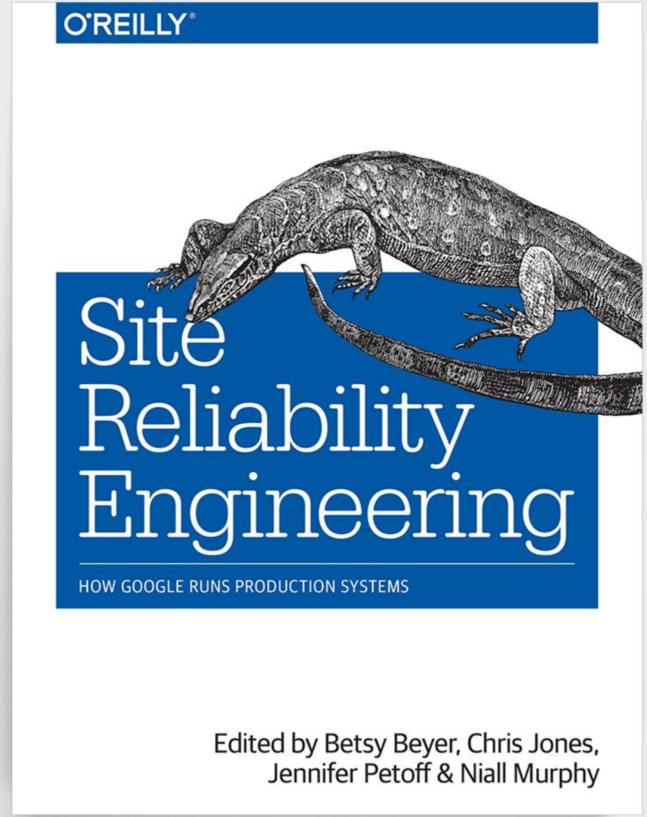


```
func readIntoBytes(filename string) ([]byte, error) {
  file, err := static.Templates.Open(filename)
  if err != nil {
    return nil, err
  }
  defer file.Close()

  buf := new(bytes.Buffer)
  buf.ReadFrom(file)

  return buf.Bytes(), nil
}
```

Sentry: https://docs.sentry.io/clients/go/

Golden Signals

- Latency
- Traffic
- Errors
- Saturation



O'REILLY®

Site Reliability Engineering

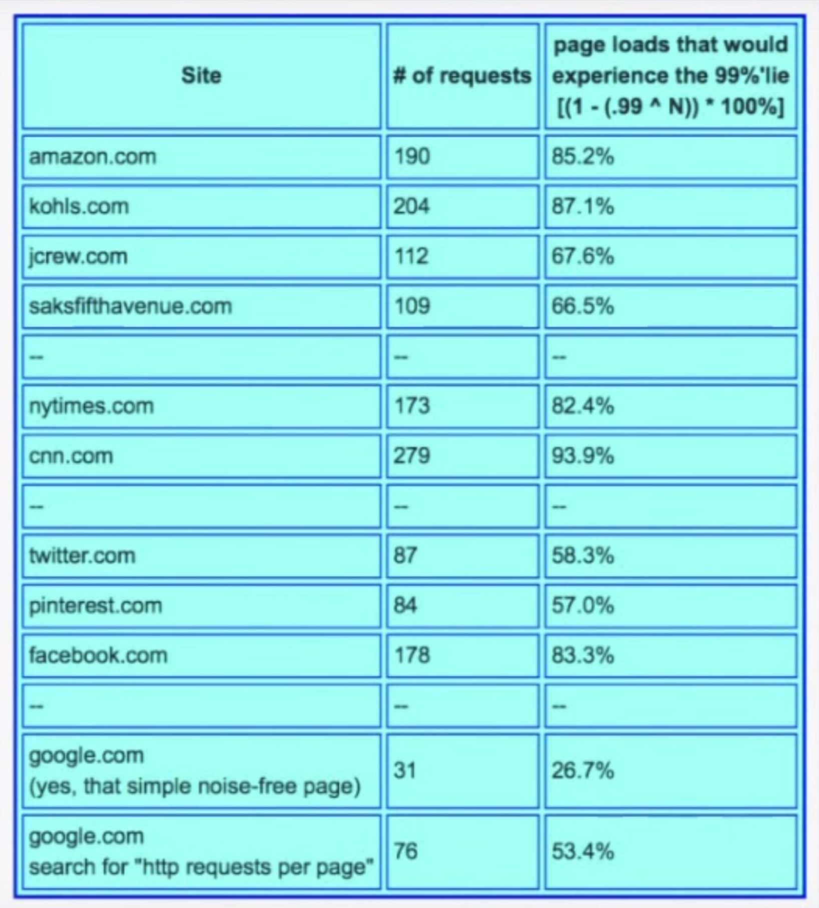
HOW GOOGLE RUNS PRODUCTION SYSTEMS

Edited by Betsy Beyer, Chris Jones,
Jennifer Petoff & Niall Murphy

http://bit.ly/golden-signals

🤗 Every request matters

- Tail latency is important
- Users see responses
- Latency is not normally distributed



Site	# of requests	page loads that would experience the 99%'lie [(1 - (.99 ^ N)) * 100%]
amazon.com	190	85.2%
kohls.com	204	87.1%
jcrew.com	112	67.6%
saksfifthavenue.com	109	66.5%
--	--	--
nytimes.com	173	82.4%
cnn.com	279	93.9%
--	--	--
twitter.com	87	58.3%
pinterest.com	84	57.0%
facebook.com	178	83.3%
--	--	--
google.com (yes, that simple noise-free page)	31	26.7%
google.com search for "http requests per page"	76	53.4%

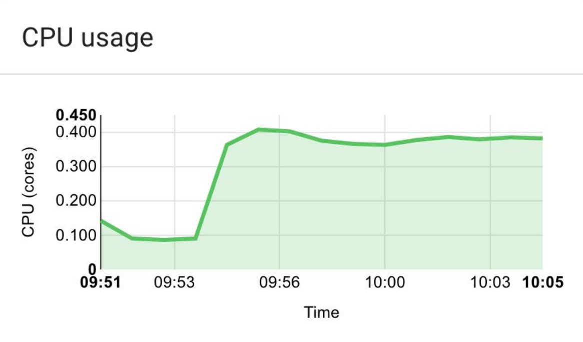
http://bit.ly/latency-wrong

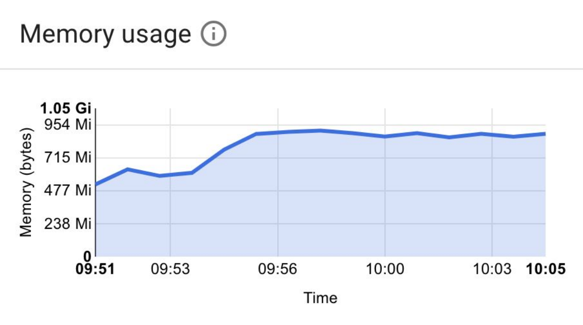
Monitoring for Forensics

📦Kubernetes

- CPU

- Memory



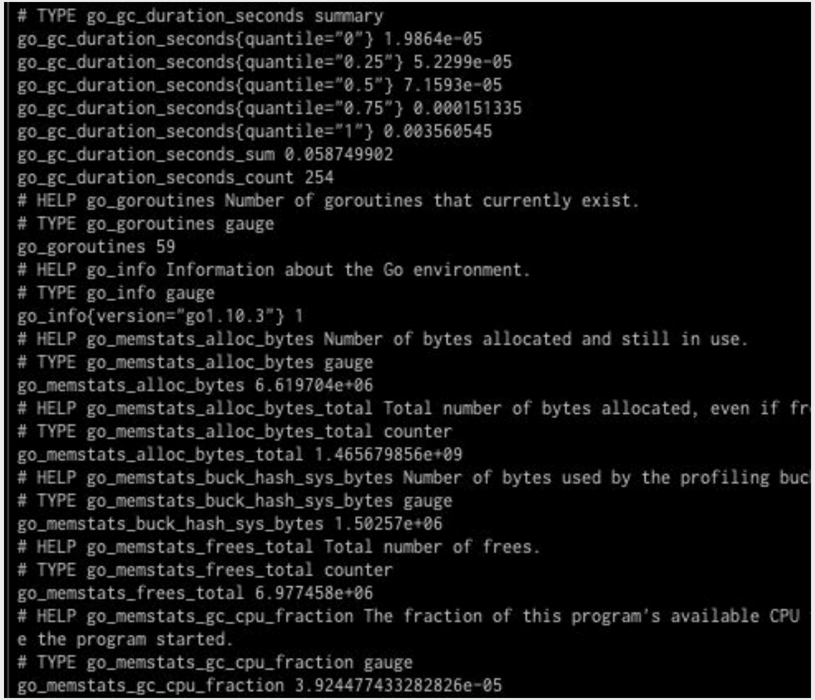


Prometheus

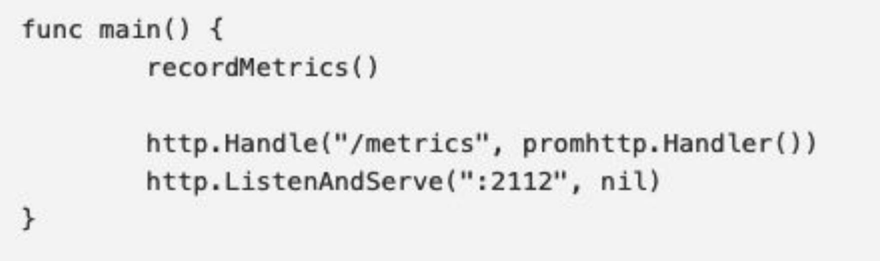
- Kubernetes Standard
- Time Series
- Alerts
- Extra Metrics

Install: https://github.com/helm/charts/tree/master/stable/prometheus
Tracked metrics: https://github.com/prometheus/node_exporter#enabled-by-default

Application Instrumentation



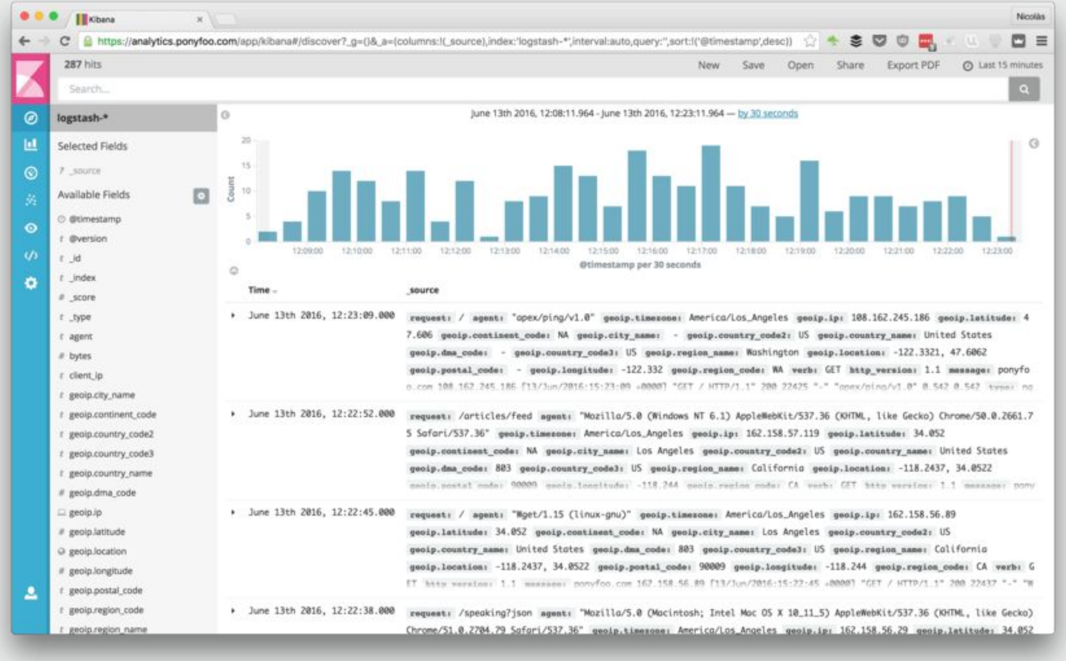
```
# TYPE go_gc_duration_seconds summary
go_gc_duration_seconds{quantile="0"} 1.9864e-05
go_gc_duration_seconds{quantile="0.25"} 5.2299e-05
go_gc_duration_seconds{quantile="0.5"} 7.1593e-05
go_gc_duration_seconds{quantile="0.75"} 0.000151335
go_gc_duration_seconds{quantile="1"} 0.003560545
go_gc_duration_seconds_sum 0.058749902
go_gc_duration_seconds_count 254
# HELP go_goroutines Number of goroutines that currently exist.
# TYPE go_goroutines gauge
go_goroutines 59
# HELP go_info Information about the Go environment.
# TYPE go_info gauge
go_info{version="go1.10.3"} 1
# HELP go_memstats_alloc_bytes Number of bytes allocated and still in use.
# TYPE go_memstats_alloc_bytes gauge
go_memstats_alloc_bytes 6.619704e+06
# HELP go_memstats_alloc_bytes_total Total number of bytes allocated, even if fr
# TYPE go_memstats_alloc_bytes_total counter
go_memstats_alloc_bytes_total 1.465679856e+09
# HELP go_memstats_buck_hash_sys_bytes Number of bytes used by the profiling buc
# TYPE go_memstats_buck_hash_sys_bytes gauge
go_memstats_buck_hash_sys_bytes 1.50257e+06
# HELP go_memstats_frees_total Total number of frees.
# TYPE go_memstats_frees_total counter
go_memstats_frees_total 6.977458e+06
# HELP go_memstats_gc_cpu_fraction The fraction of this program's available CPU
e the program started.
# TYPE go_memstats_gc_cpu_fraction gauge
go_memstats_gc_cpu_fraction 3.924477433282826e-05
```



```
func main() {
        recordMetrics()

        http.Handle("/metrics", promhttp.Handler())
        http.ListenAndServe(":2112", nil)
}
```

client_golang: https://prometheus.io/docs/guides/go-application/#adding-your-own-metrics

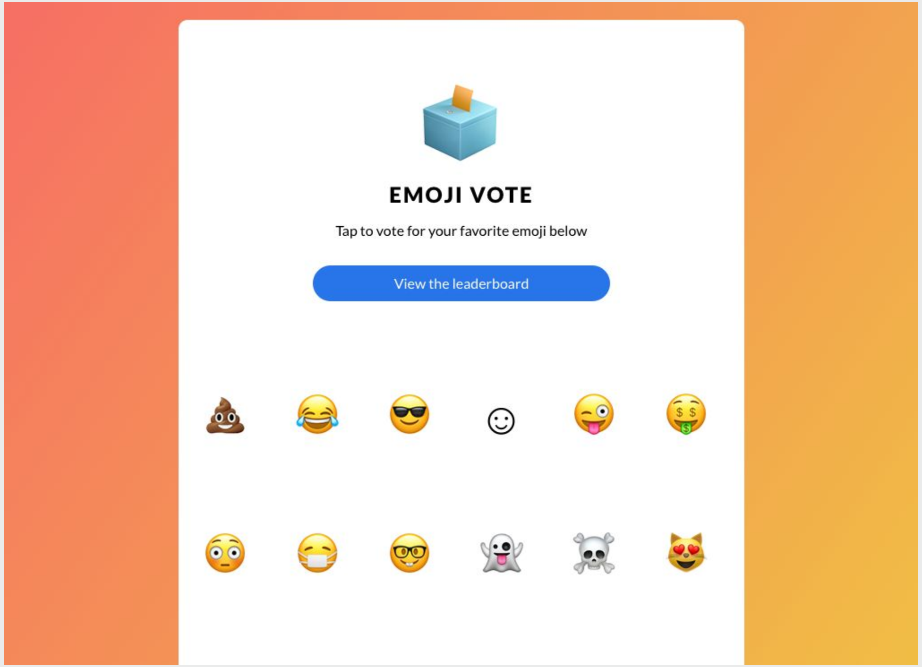
Log Aggregation



```
June 13th 2016, 12:23:09.000  request: / agent: "opex/ping/v1.0" geoip.timezone: America/Los_Angeles geoip.ip: 108.162.245.186 geoip.latitude: 4
                              7.606 geoip.continent_code: NA geoip.city_name: - geoip.country_code2: US geoip.country_name: United States
                              geoip.dma_code: - geoip.country_code3: US geoip.region_name: Washington geoip.location: -122.3321, 47.6062
                              geoip.postal_code: - geoip.longitude: -122.332 geoip.region_code: WA verb: GET http_version: 1.1 message: ponyfo
                              o.com 108.162.245.186 [13/Jun/2016:15:23:09 +0000] "GET / HTTP/1.1" 200 22425 "-" "opex/ping/v1.0" 0.542 0.542 type: ng

June 13th 2016, 12:22:52.000  request: /articles/feed agent: "Mozilla/5.0 (Windows NT 6.1) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/50.0.2661.7
                              5 Safari/537.36" geoip.timezone: America/Los_Angeles geoip.ip: 162.158.57.119 geoip.latitude: 34.052
                              geoip.continent_code: NA geoip.city_name: Los Angeles geoip.country_code2: US geoip.country_name: United States
                              geoip.dma_code: 803 geoip.country_code3: US geoip.region_name: California geoip.location: -118.2437, 34.0522
                              geoip.postal_code: 90009 geoip.longitude: -118.244 geoip.region_code: CA verb: GET http_version: 1.1 message: pony

June 13th 2016, 12:22:45.000  request: / agent: "Wget/1.15 (linux-gnu)" geoip.timezone: America/Los_Angeles geoip.ip: 162.158.56.89
                              geoip.latitude: 34.052 geoip.continent_code: NA geoip.city_name: Los Angeles geoip.country_code2: US
                              geoip.country_name: United States geoip.dma_code: 803 geoip.country_code3: US geoip.region_name: California
                              geoip.location: -118.2437, 34.0522 geoip.postal_code: 90009 geoip.longitude: -118.244 geoip.region_code: CA verb: G
                              ET http_version: 1.1 message: ponyfoo.com 162.158.56.89 [13/Jun/2016:15:22:45 +0000] "GET / HTTP/1.1" 200 22437 "-" "W

June 13th 2016, 12:22:38.000  request: /speaking?json agent: "Mozilla/5.0 (Macintosh; Intel Mac OS X 10_11_5) AppleWebKit/537.36 (KHTML, like Gecko)
                              Chrome/51.0.2704.79 Safari/537.36" geoip.timezone: America/Los_Angeles geoip.ip: 162.158.56.29 geoip.latitude: 34.052
```

Howto: https://kubernetes.io/docs/tasks/debug-application-cluster/logging-elasticsearch-kibana/

Get your votes in

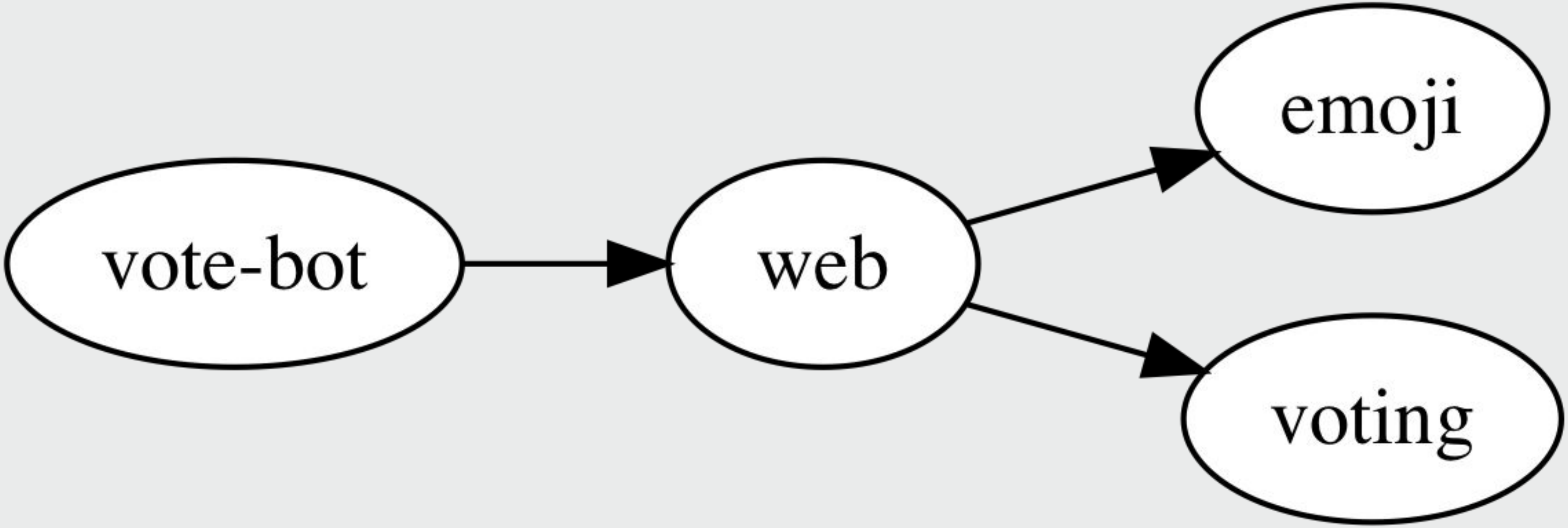


EMOJI VOTE

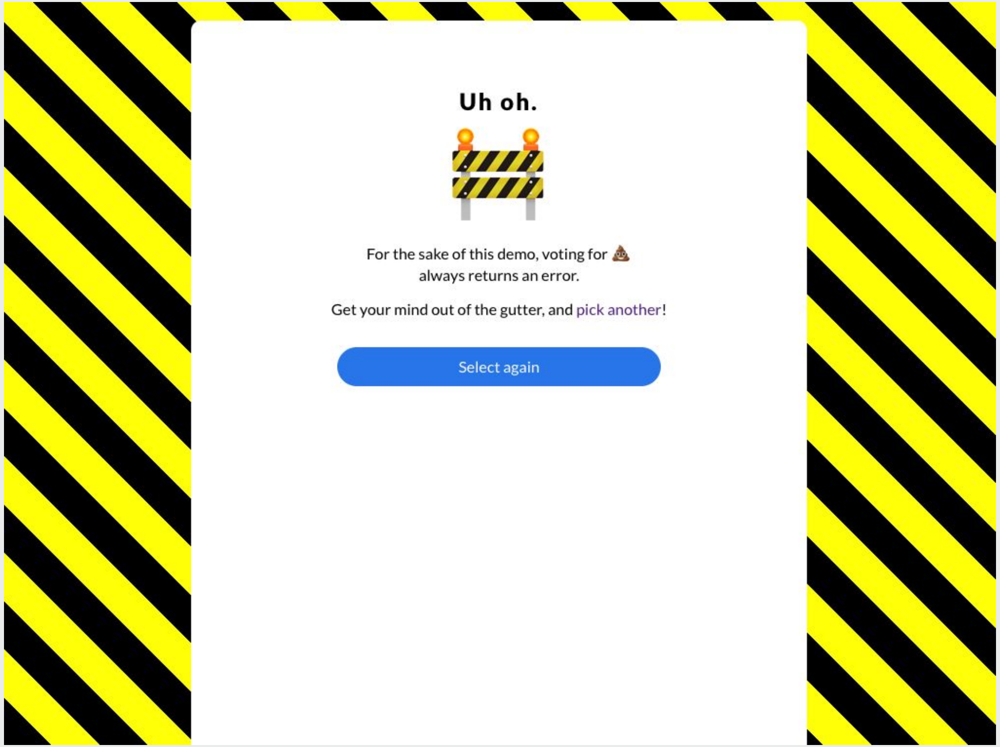
Tap to vote for your favorite emoji below

https://emoji.l5d.io

📐 The Architecture



🐛 The Problem



Uh oh.

🚧

For the sake of this demo, voting for 💩 always returns an error.

Get your mind out of the gutter, and pick another!

🙋‍♀️ Check the state

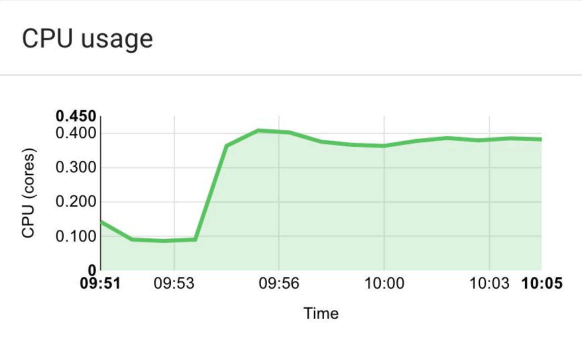
□ Service running?

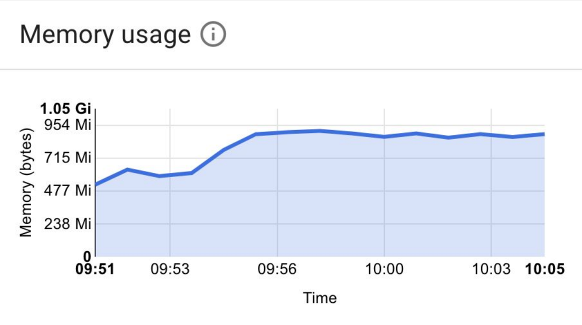
□ Health checks passing?

□ Logs look okay?

👌 No problem here!

- ✅ Service running!
- □ Health checks passing?
- □ Logs look okay?



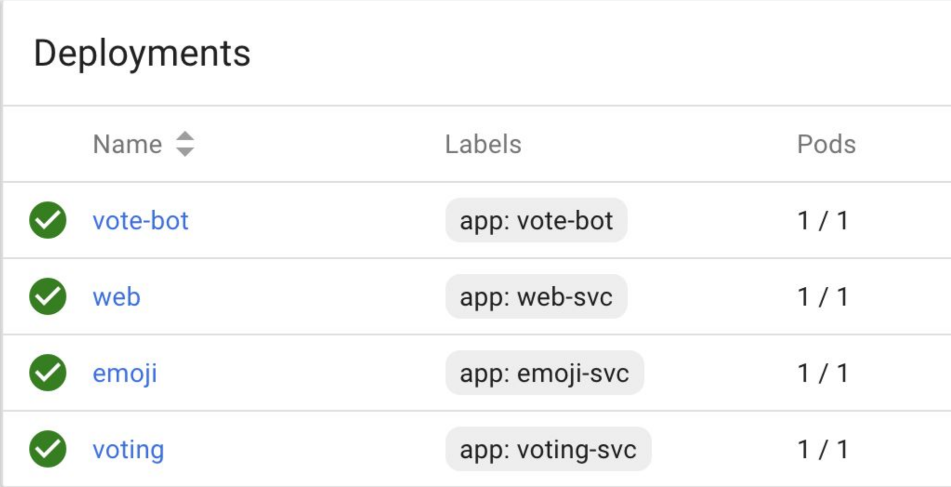


🔥 Everything is fine

☑ Service running!

☑ Health checks passing!

□ Logs look okay?

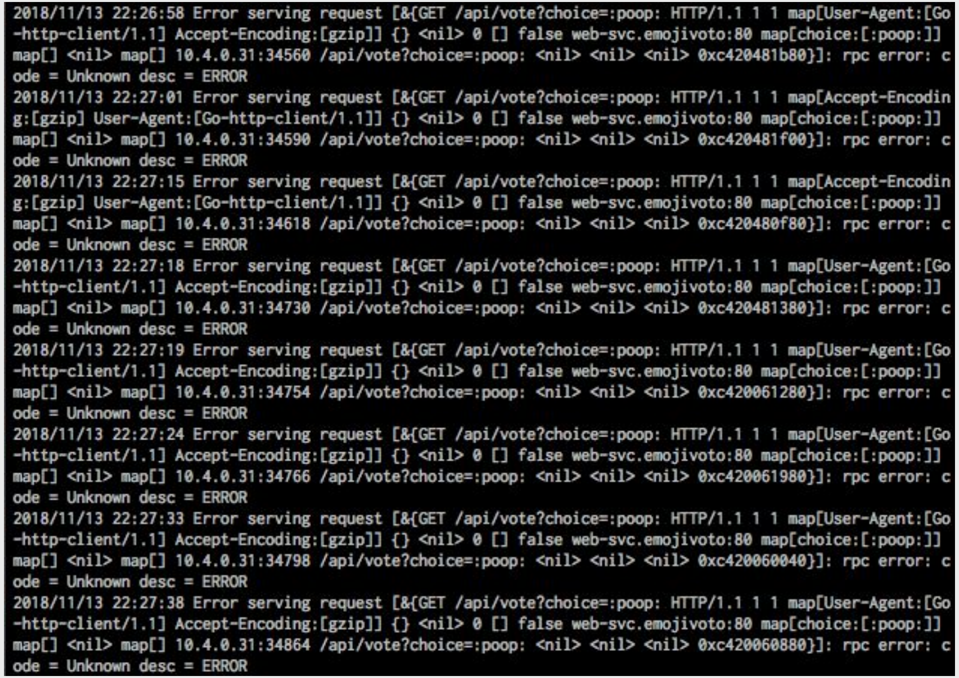


Deployments

	Name ⬍	Labels	Pods
✓	vote-bot	app: vote-bot	1 / 1
✓	web	app: web-svc	1 / 1
✓	emoji	app: emoji-svc	1 / 1
✓	voting	app: voting-svc	1 / 1

🤷‍♀️ Okay, *something* is fishy

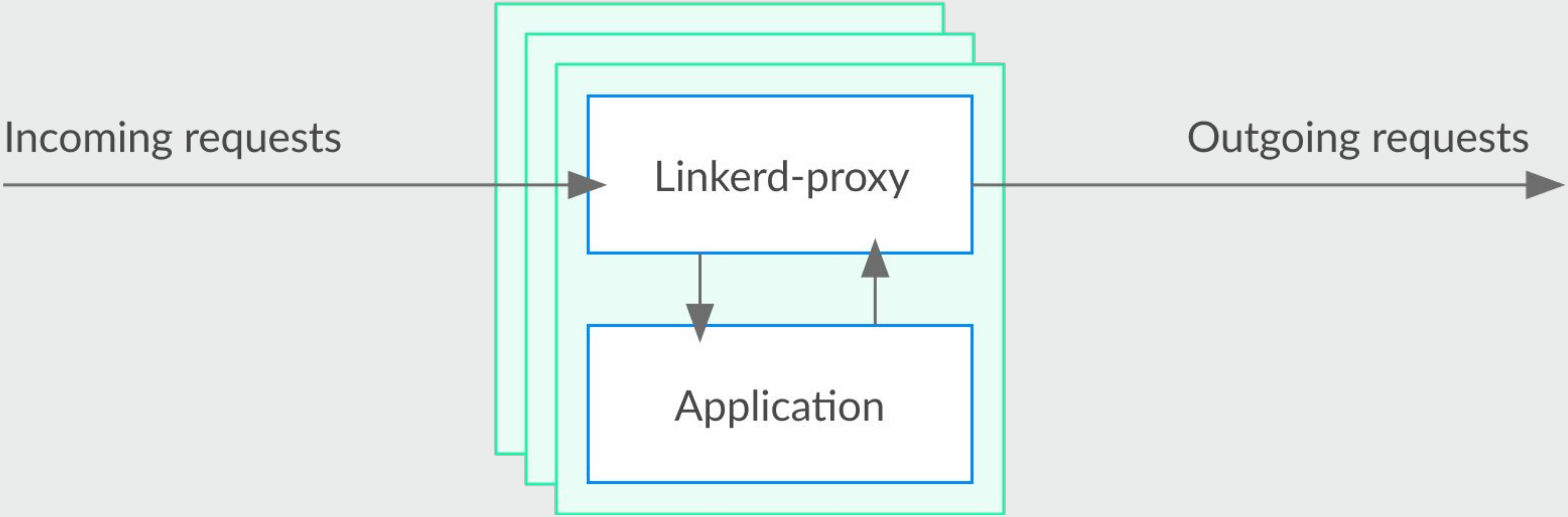
- ✅ Service running!
- ✅ Health checks passing!
- ⁉️ Logs look … something?



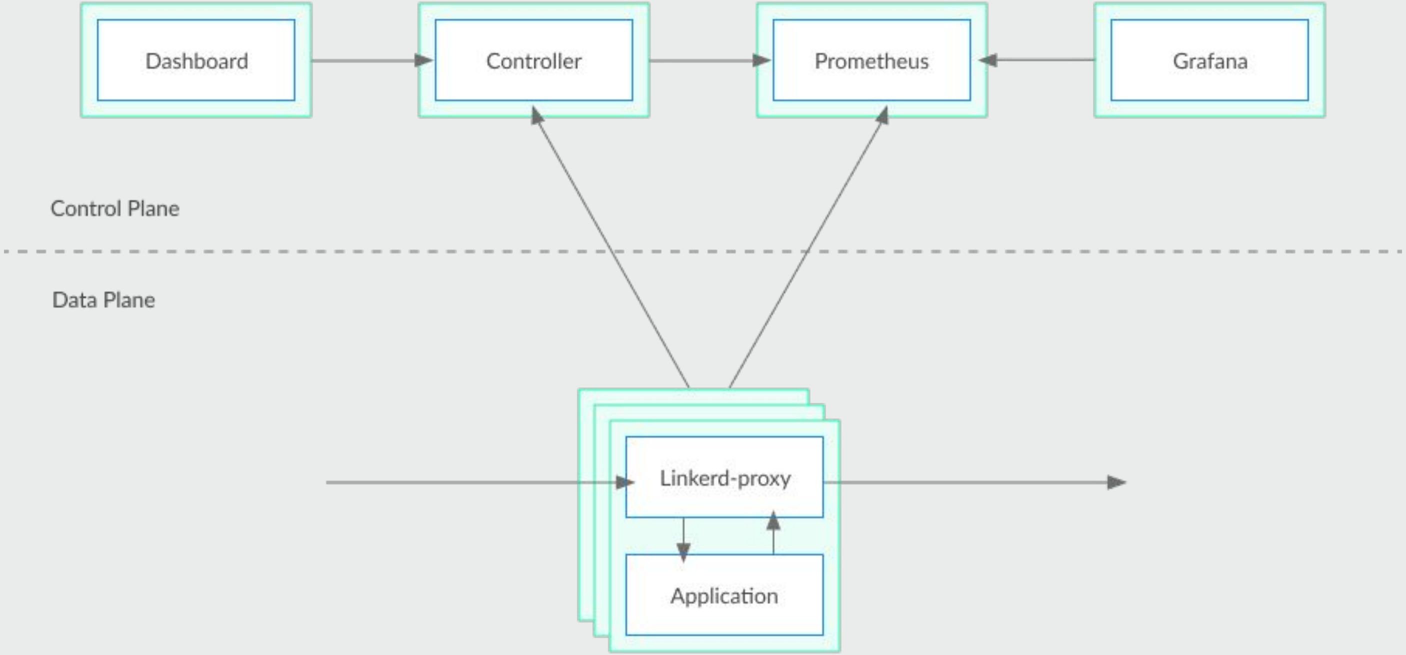
```
2018/11/13 22:26:58 Error serving request [&{GET /api/vote?choice=:poop: HTTP/1.1 1 1 map[User-Agent:[Go
-http-client/1.1] Accept-Encoding:[gzip]] {} <nil> 0 [] false web-svc.emojivoto:80 map[choice:[:poop:]]
map[] <nil> map[] 10.4.0.31:34560 /api/vote?choice=:poop: <nil> <nil> <nil> 0xc420481b80}]: rpc error: c
ode = Unknown desc = ERROR
2018/11/13 22:27:01 Error serving request [&{GET /api/vote?choice=:poop: HTTP/1.1 1 1 map[Accept-Encodin
g:[gzip] User-Agent:[Go-http-client/1.1]] {} <nil> 0 [] false web-svc.emojivoto:80 map[choice:[:poop:]]
map[] <nil> map[] 10.4.0.31:34590 /api/vote?choice=:poop: <nil> <nil> <nil> 0xc420481f00}]: rpc error: c
ode = Unknown desc = ERROR
2018/11/13 22:27:15 Error serving request [&{GET /api/vote?choice=:poop: HTTP/1.1 1 1 map[Accept-Encodin
g:[gzip] User-Agent:[Go-http-client/1.1]] {} <nil> 0 [] false web-svc.emojivoto:80 map[choice:[:poop:]]
map[] <nil> map[] 10.4.0.31:34618 /api/vote?choice=:poop: <nil> <nil> <nil> 0xc420480f80}]: rpc error: c
ode = Unknown desc = ERROR
2018/11/13 22:27:18 Error serving request [&{GET /api/vote?choice=:poop: HTTP/1.1 1 1 map[User-Agent:[Go
-http-client/1.1] Accept-Encoding:[gzip]] {} <nil> 0 [] false web-svc.emojivoto:80 map[choice:[:poop:]]
map[] <nil> map[] 10.4.0.31:34730 /api/vote?choice=:poop: <nil> <nil> <nil> 0xc420481380}]: rpc error: c
ode = Unknown desc = ERROR
2018/11/13 22:27:19 Error serving request [&{GET /api/vote?choice=:poop: HTTP/1.1 1 1 map[User-Agent:[Go
-http-client/1.1] Accept-Encoding:[gzip]] {} <nil> 0 [] false web-svc.emojivoto:80 map[choice:[:poop:]]
map[] <nil> map[] 10.4.0.31:34754 /api/vote?choice=:poop: <nil> <nil> <nil> 0xc420061280}]: rpc error: c
ode = Unknown desc = ERROR
2018/11/13 22:27:24 Error serving request [&{GET /api/vote?choice=:poop: HTTP/1.1 1 1 map[User-Agent:[Go
-http-client/1.1] Accept-Encoding:[gzip]] {} <nil> 0 [] false web-svc.emojivoto:80 map[choice:[:poop:]]
map[] <nil> map[] 10.4.0.31:34766 /api/vote?choice=:poop: <nil> <nil> <nil> 0xc420061980}]: rpc error: c
ode = Unknown desc = ERROR
2018/11/13 22:27:33 Error serving request [&{GET /api/vote?choice=:poop: HTTP/1.1 1 1 map[User-Agent:[Go
-http-client/1.1] Accept-Encoding:[gzip]] {} <nil> 0 [] false web-svc.emojivoto:80 map[choice:[:poop:]]
map[] <nil> map[] 10.4.0.31:34798 /api/vote?choice=:poop: <nil> <nil> <nil> 0xc420060040}]: rpc error: c
ode = Unknown desc = ERROR
2018/11/13 22:27:38 Error serving request [&{GET /api/vote?choice=:poop: HTTP/1.1 1 1 map[User-Agent:[Go
-http-client/1.1] Accept-Encoding:[gzip]] {} <nil> 0 [] false web-svc.emojivoto:80 map[choice:[:poop:]]
map[] <nil> map[] 10.4.0.31:34864 /api/vote?choice=:poop: <nil> <nil> <nil> 0xc420060880}]: rpc error: c
ode = Unknown desc = ERROR
```

Linkerd: Microservice Forensics

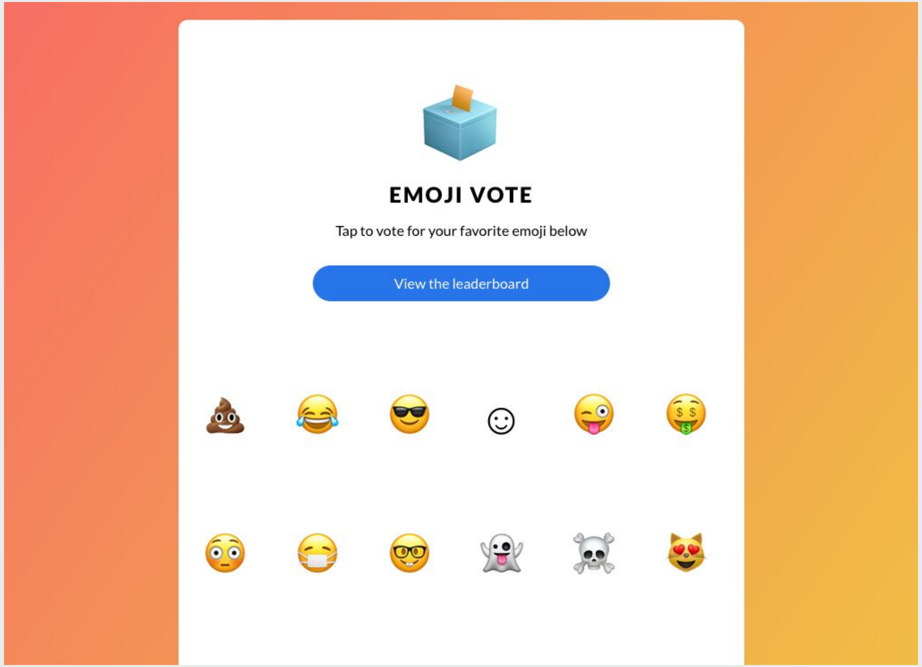
What is Linkerd?



🏢 Architecture



Get your votes in

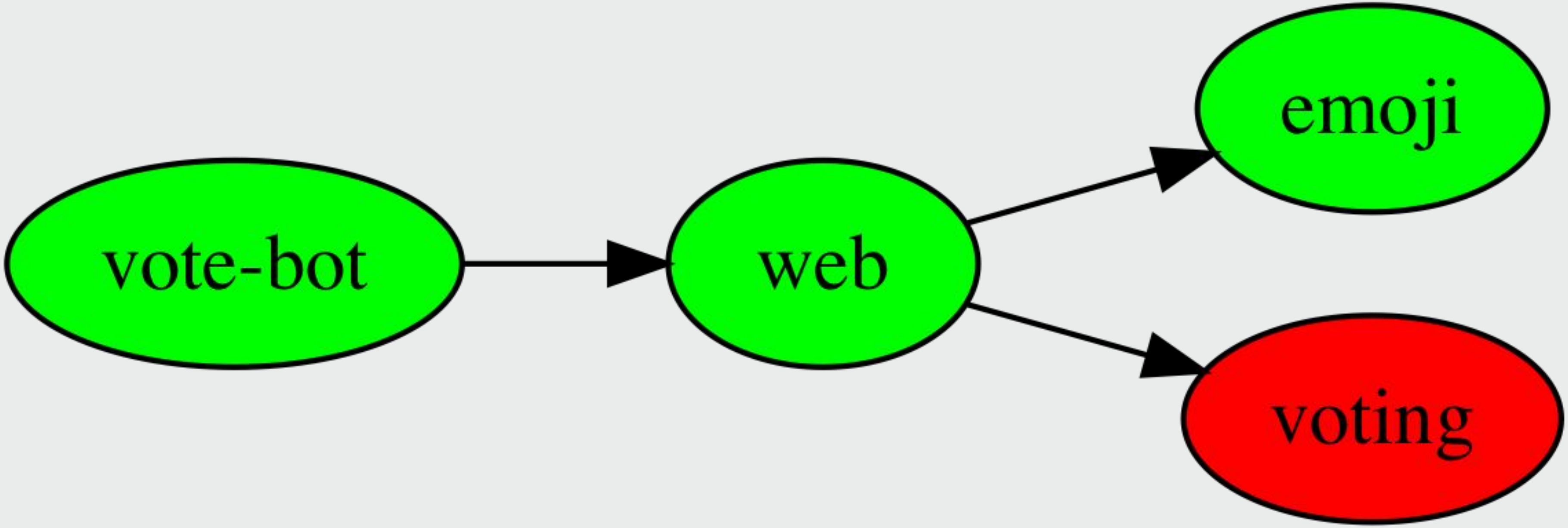


EMOJI VOTE

Tap to vote for your favorite emoji below

https://emoji.l5d.io

🕵 The Culprit



🔒 What is possible?

- Alerting
- Anomaly Detection
- Autoscaling
- Capacity Planning
- Chargeback
- Intelligent Deployments
- SLA Compliance

LINKERD

Slides	http://bit.ly/linkerd-gosf
Tutorial	http://bit.ly/linkerd-tutorial
Get Started!	https://bit.ly/linkerd-get-started