Linkerd
CNCF Project Update

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LINKERD

LINKERD

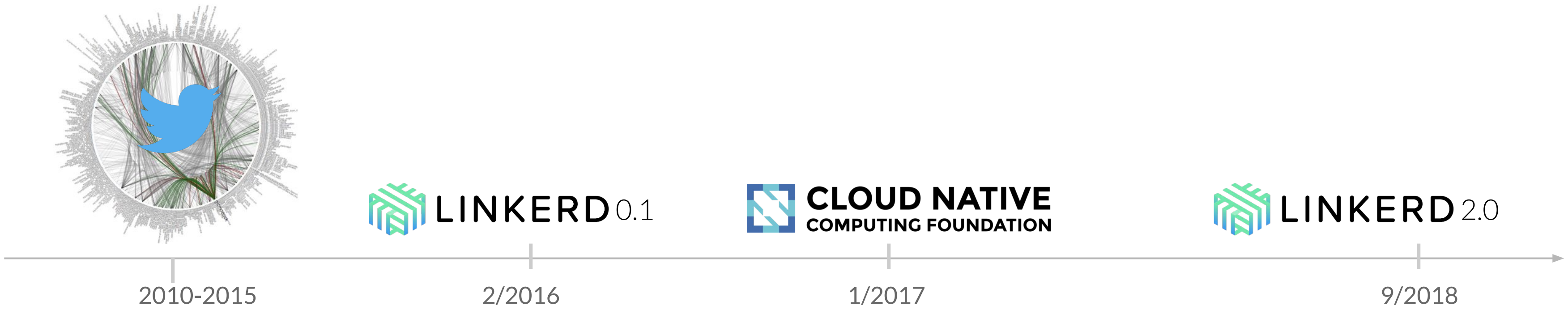
An open source **service mesh** for Kubernetes.

- 🔥 **42+** months in production
- 🔥 CNCF since **January 2017**
- 🔥 **3,500+** Slack channel members
- 🔥 **10,000+** GitHub stars
- 🔥 **100+** contributors
- 🔥 *Edge* releases **weekly**
- 🔥 *Stable* releases every **~2 months**

CLOUD NATIVE COMPUTING FOUNDATION

NORDSTROM CHASE
GoDaddy Walmart
STRAVA BIGCOMMERCE
Expedia OfferUp
ebay Cisco webex
COMCAST planet.

History of Linkerd



Two parallel branches of development:

- 🚀 **Linkerd 2.x:** ultralight, zero-config, Kubernetes-first (active)
- 🚀 **Linkerd 1.x:** JVM-based and multi-platform (maintenance)

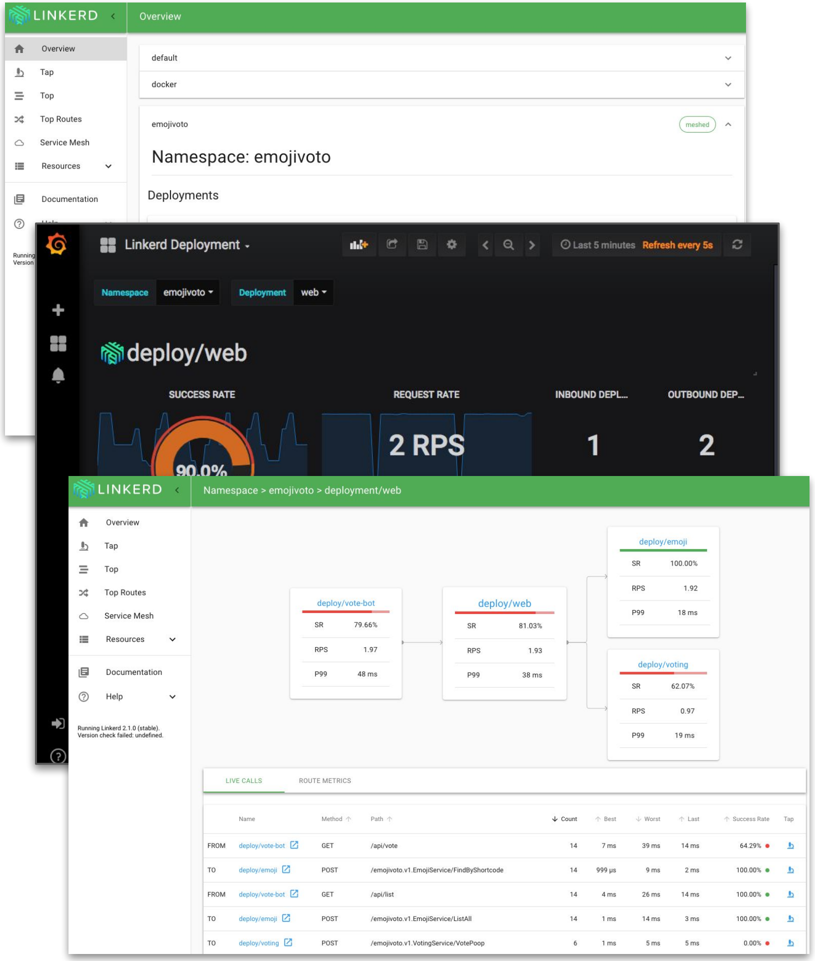
What does Linkerd do?

⚡ **Observability:** *Golden metrics:* success rates, latencies, throughput; Service topologies; Distributed and ad-hoc tracing.

⚡ **Reliability:** Load balancing, retries, timeouts, circuit breaking*

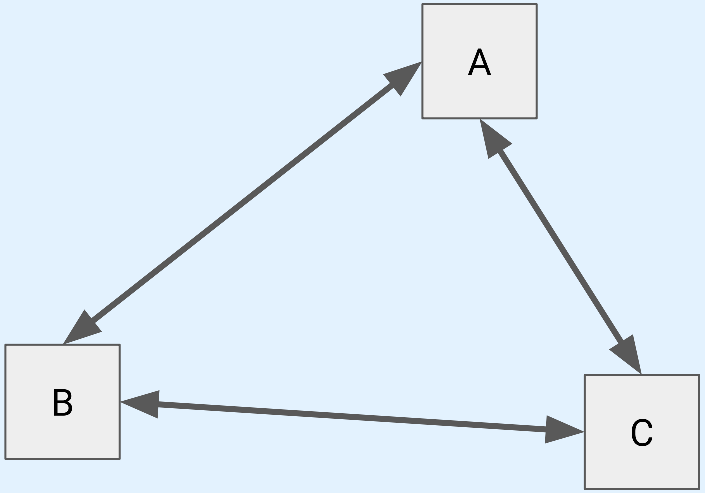
⚡ **Security:** Transparent mTLS, cert management and rotation, policy*

Focused on **operational simplicity**

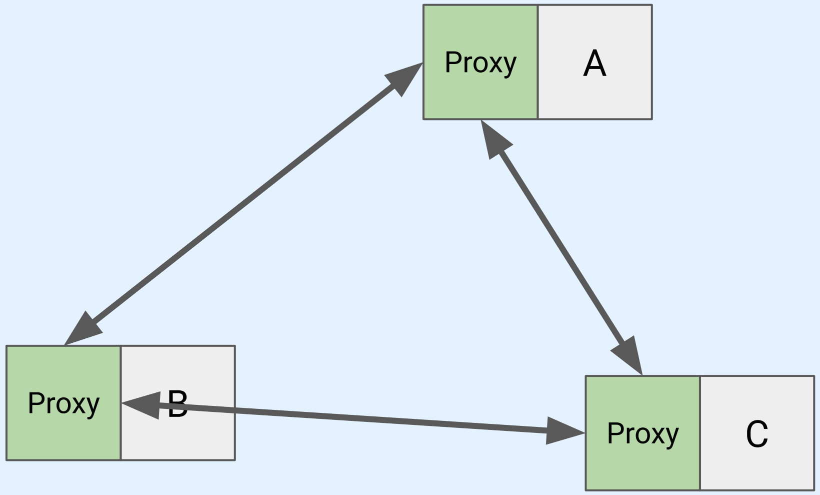


	Name	Method	Path	Count	Best	Worst	Last	Success Rate	Tap
FROM	deploy/vote-bot	GET	/api/vote	14	7 ms	39 ms	14 ms	64.29% 🟥	
TO	deploy/emoji	POST	/emojivoto.v1.EmojiService/FindByShortcode	14	999 μs	9 ms	2 ms	100.00% 🟩	
FROM	deploy/vote-bot	GET	/api/list	14	4 ms	26 ms	14 ms	100.00% 🟩	
TO	deploy/emoji	POST	/emojivoto.v1.EmojiService/ListAll	14	1 ms	14 ms	3 ms	100.00% 🟩	
TO	deploy/voting	POST	/emojivoto.v1.VotingService/VotePoop	6	1 ms	5 ms	5 ms	0.00% 🟥	

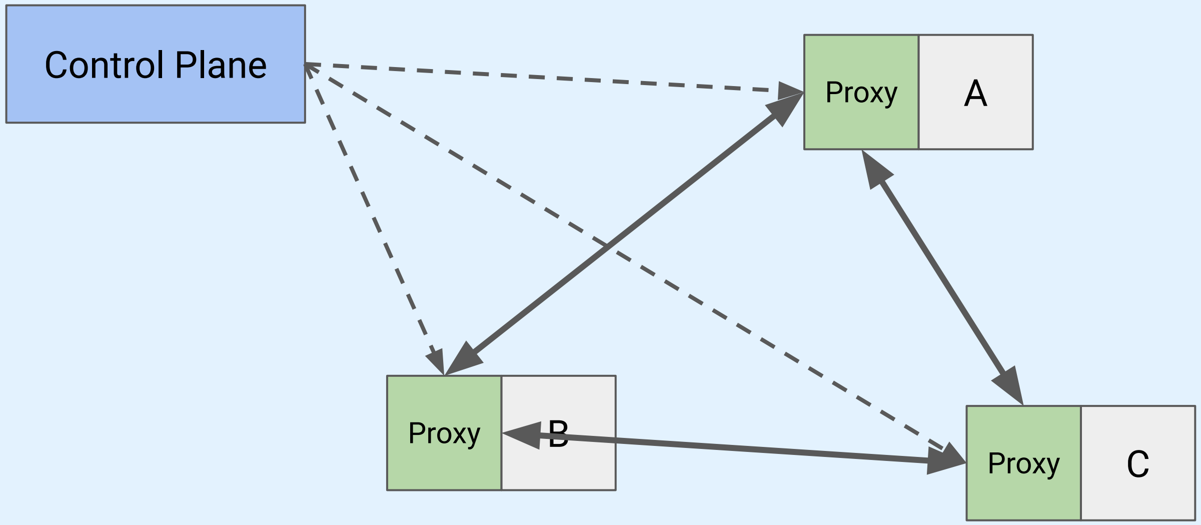
Microservices



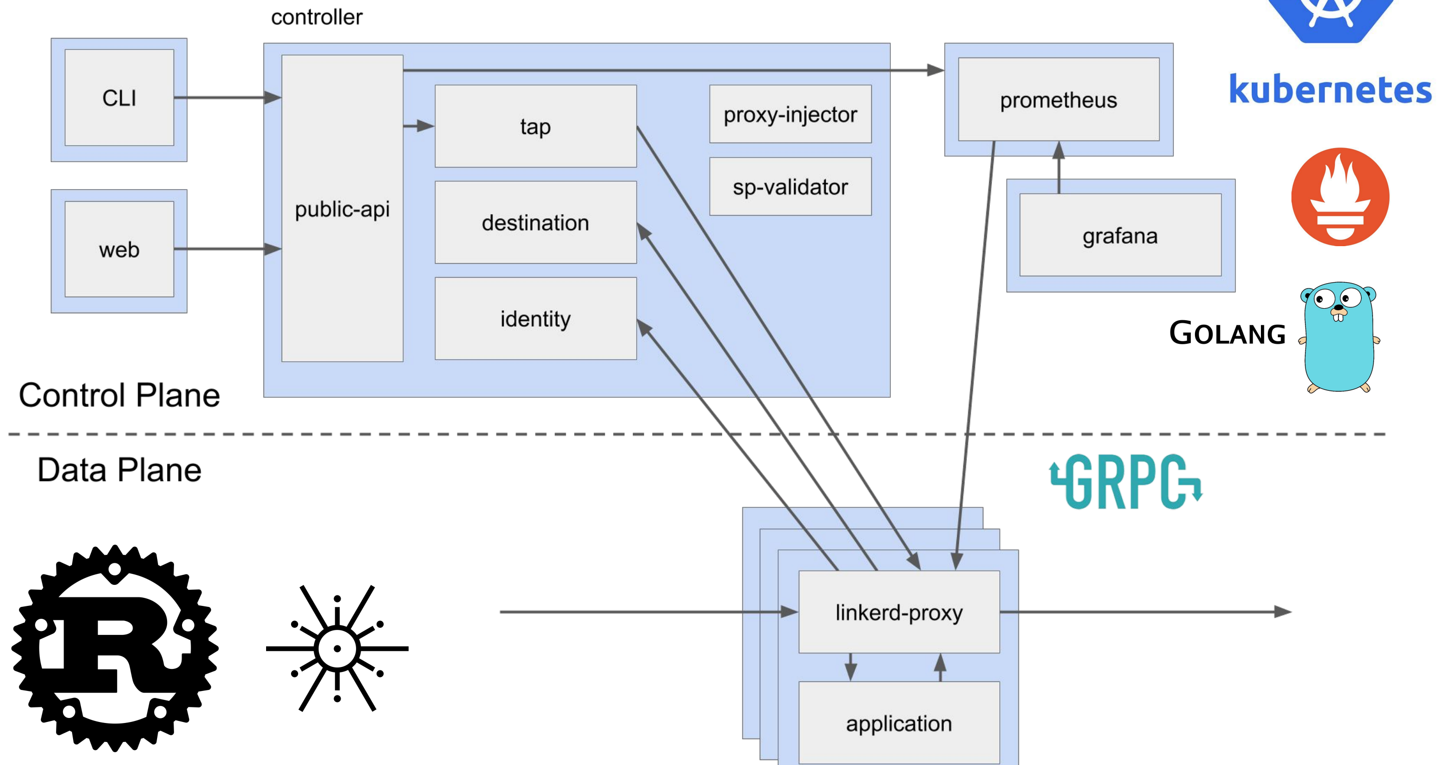
Service Mesh: Data Plane



Service Mesh: Control Plane



Linkerd 2.x architecture



How is Linkerd designed?

Zero-config, out-of-the-box functionality

Minimal latency and resource overhead

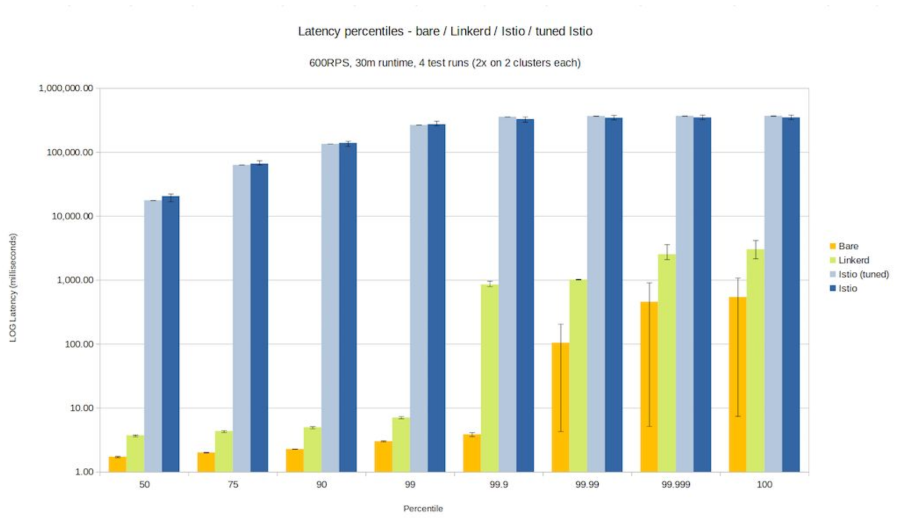
Kubernetes-native; integrates with the ecosystem

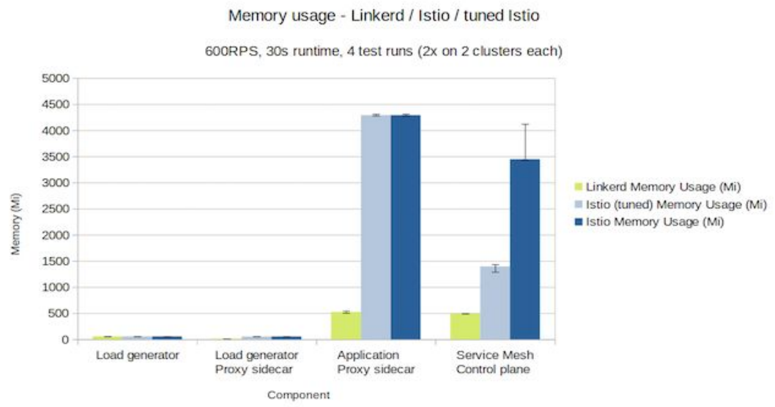
Control plane: Go. ~200mb RSS (excluding Prometheus). (Repo: linkerd/linkerd2).

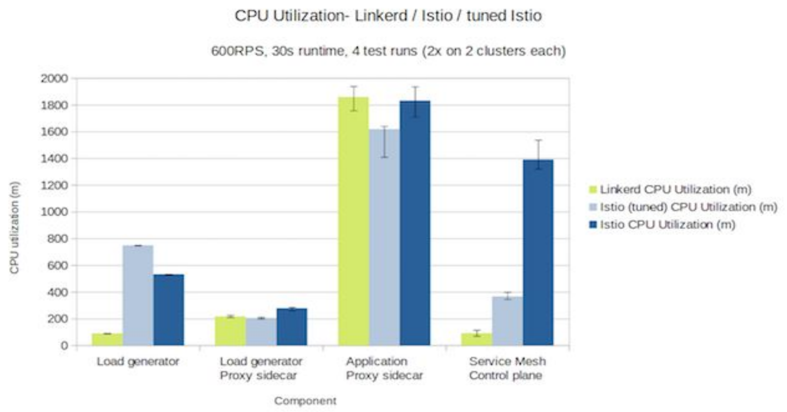
Data plane: Rust. <20mb RSS, ~1ms p99. (Repo: linkerd/linkerd2-proxy)

Background reading: Linkerd v2: How Lessons from Production Adoption Resulted in a Rewrite of the Service Mesh (InfoQ)

How fast/small is it?







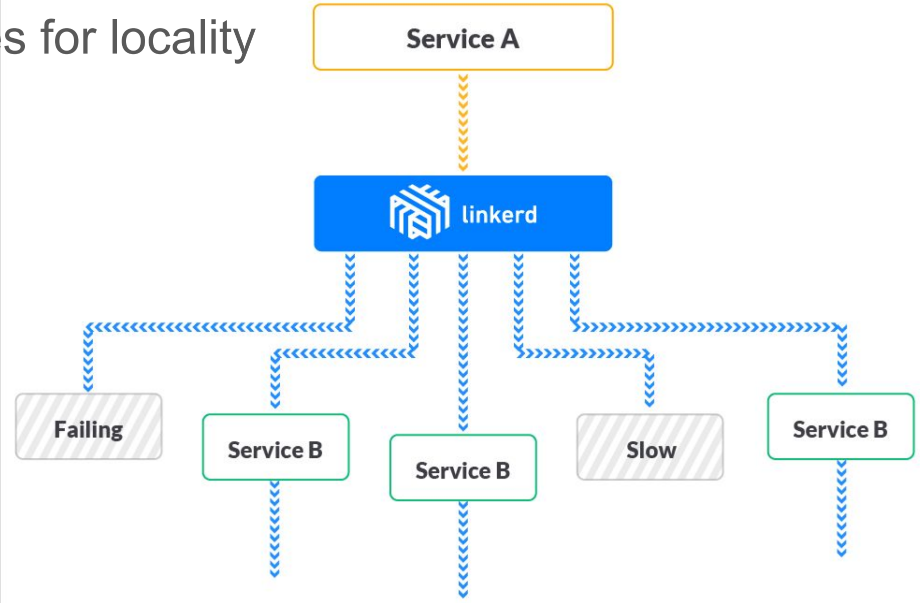
Tl;dr: really fast. Not as fast as "no service mesh", but *significantly* smaller and faster than Istio.

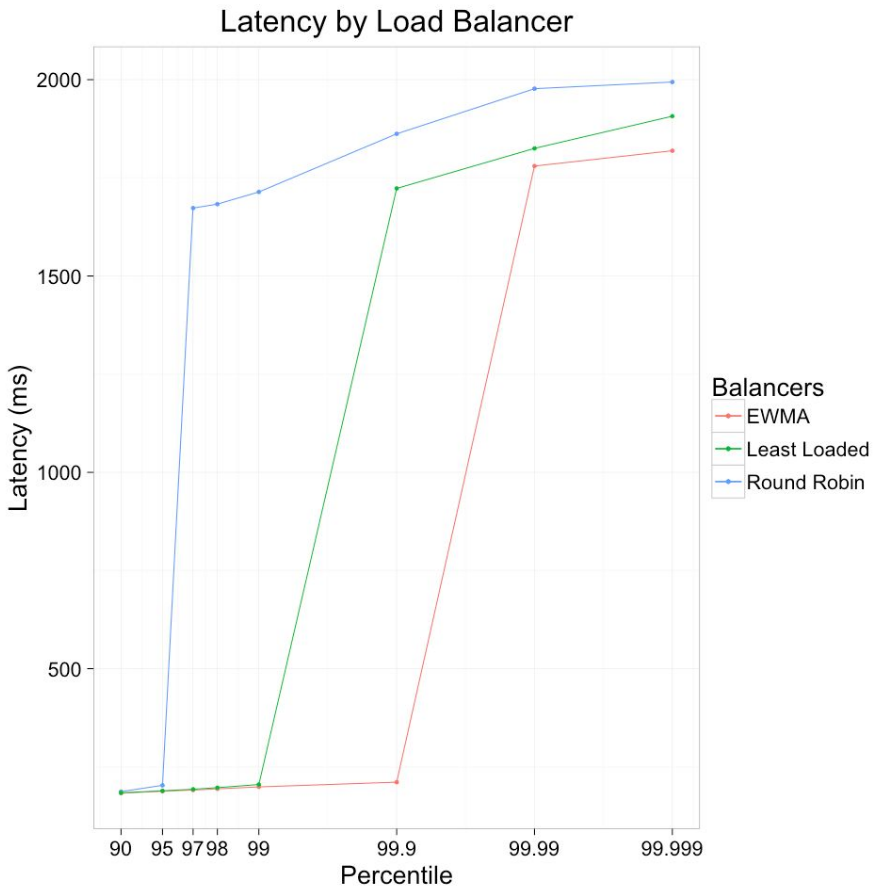
Source:
https://kinvolk.io/blog/2019/05/performance-benchmark-analysis-of-istio-and-linkerd/

What Does it Do?

Peak-EWMA HTTP/gRPC Balancing

- Efficiently distributes requests across k8s `Deployments`, etc
- Client-side: No centralized balancer state
- Latency-aware: Automatically optimizes for locality
- Backed by k8s `Services`
- Bypasses kube-proxy
- No application changes




Latency by Load Balancer
2000
1500
1000
500
Latency (ms)
90
95
97
98
99
99.9
99.99
99.999
Percentile
Balancers
EWMA
Least Loaded
Round Robin

Automatic, transparent mutual TLS

- All meshed HTTP traffic automatically secured
- Extends *workload identity* for zero-trust communication
    - Bootstrapped from k8s `ServiceAccounts`
- Automatic pod certificate rotation
- Can bootstrap from `cert-manager`
- Does not conflict with Ingress/Application TLS
- mTLS for arbitrary protocols coming soon
- No application changes

Transparent HTTP/2 Multiplexing

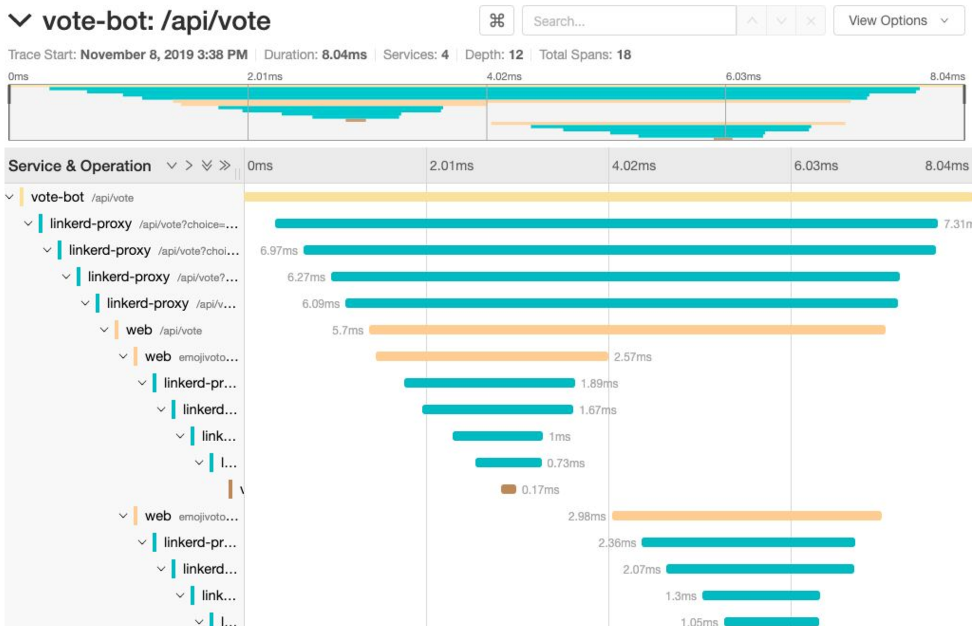
- All meshed HTTP traffic over HTTP/2 between pods
- Minimizes connection overhead (TCP, mTLS)
- No application changes

High-fidelity Prometheus Visibility

- **Uniform**: Every pod gets the same, app-independent traffic metrics
- HTTP- and gRPC-aware
- Rich k8s workload metadata
- Raw latency histograms: no avg on latencies
- Can be enhanced with **OpenAPI** (Swagger) & **gRPC** (Protobuf) specs
- No application changes

Distributed Tracing with OpenCensus

- Linkerd participate in your application’s OpenCensus tracing
- *Application changes required*

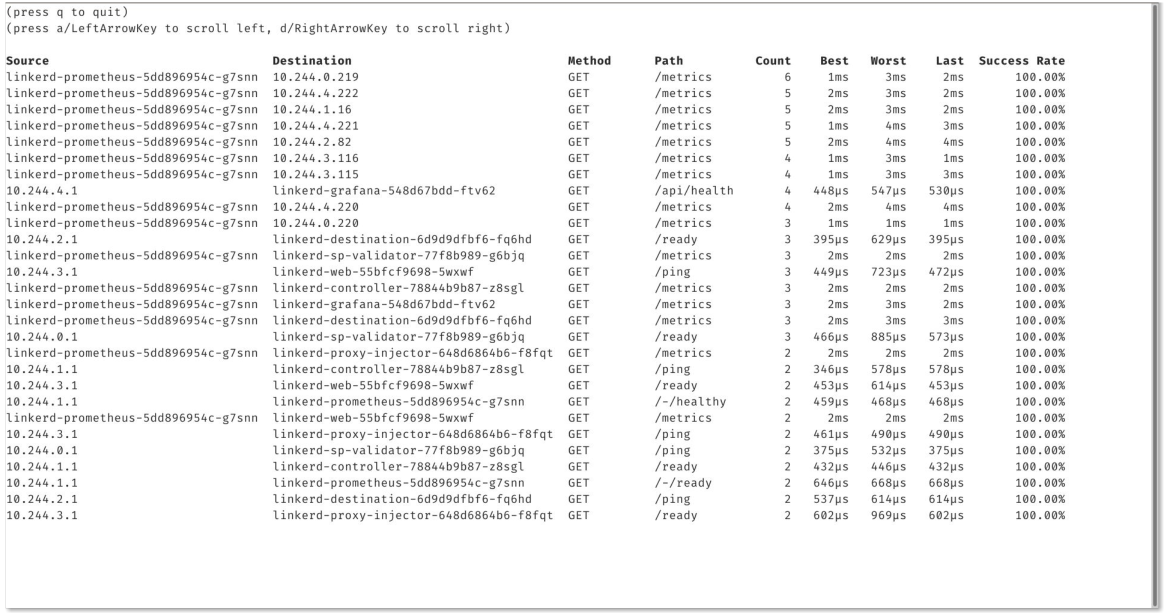


vote-bot: /api/vote

Trace Start: **November 8, 2019 3:38 PM** | Duration: **8.04ms** | Services: **4** | Depth: **12** | Total Spans: **18**

Ad-hoc tracing with Linkerd Tap

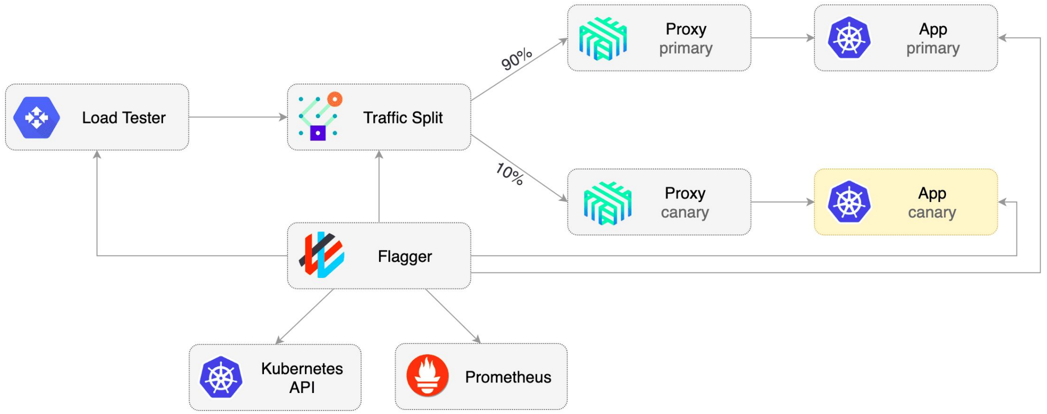
- Tap into the request stream at runtime
- Authorized via k8s RBAC
- No application changes



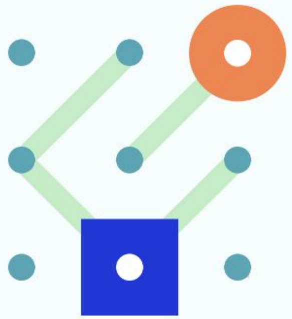
```
(press q to quit)
(press a/LeftArrowKey to scroll left, d/RightArrowKey to scroll right)

Source                               Destination                              Method      Path          Count    Best   Worst    Last  Success Rate
linkerd-prometheus-5dd896954c-g7snn  10.244.0.219                             GET         /metrics          6     1ms     3ms     2ms       100.00%
linkerd-prometheus-5dd896954c-g7snn  10.244.4.222                             GET         /metrics          5     2ms     3ms     2ms       100.00%
linkerd-prometheus-5dd896954c-g7snn  10.244.1.16                              GET         /metrics          5     2ms     3ms     2ms       100.00%
linkerd-prometheus-5dd896954c-g7snn  10.244.4.221                             GET         /metrics          5     1ms     4ms     3ms       100.00%
linkerd-prometheus-5dd896954c-g7snn  10.244.2.82                              GET         /metrics          5     2ms     4ms     4ms       100.00%
linkerd-prometheus-5dd896954c-g7snn  10.244.3.116                             GET         /metrics          4     1ms     3ms     1ms       100.00%
linkerd-prometheus-5dd896954c-g7snn  10.244.3.115                             GET         /metrics          4     1ms     3ms     3ms       100.00%
10.244.4.1                           linkerd-grafana-548d67bdd-ftv62          GET         /api/health       4   448µs   547µs   530µs       100.00%
linkerd-prometheus-5dd896954c-g7snn  10.244.4.220                             GET         /metrics          4     2ms     4ms     4ms       100.00%
linkerd-prometheus-5dd896954c-g7snn  10.244.0.220                             GET         /metrics          3     1ms     1ms     1ms       100.00%
10.244.2.1                           linkerd-destination-6d9d9dfbf6-fq6hd     GET         /ready            3   395µs   629µs   395µs       100.00%
linkerd-prometheus-5dd896954c-g7snn  linkerd-sp-validator-77f8b989-g6bjq      GET         /metrics          3     2ms     2ms     2ms       100.00%
10.244.3.1                           linkerd-web-55bfcf9698-5wxwf             GET         /ping             3   449µs   723µs   472µs       100.00%
linkerd-prometheus-5dd896954c-g7snn  linkerd-controller-78844b9b87-z8sgl      GET         /metrics          3     2ms     2ms     2ms       100.00%
linkerd-prometheus-5dd896954c-g7snn  linkerd-grafana-548d67bdd-ftv62          GET         /metrics          3     2ms     3ms     2ms       100.00%
linkerd-prometheus-5dd896954c-g7snn  linkerd-destination-6d9d9dfbf6-fq6hd     GET         /metrics          3     2ms     3ms     3ms       100.00%
10.244.0.1                           linkerd-sp-validator-77f8b989-g6bjq      GET         /ready            3   466µs   885µs   573µs       100.00%
linkerd-prometheus-5dd896954c-g7snn  linkerd-proxy-injector-648d6864b6-f8fqt  GET         /metrics          2     2ms     2ms     2ms       100.00%
10.244.1.1                           linkerd-controller-78844b9b87-z8sgl      GET         /ping             2   346µs   578µs   578µs       100.00%
10.244.3.1                           linkerd-web-55bfcf9698-5wxwf             GET         /ready            2   453µs   614µs   453µs       100.00%
10.244.1.1                           linkerd-prometheus-5dd896954c-g7snn      GET         /-/healthy        2   459µs   468µs   468µs       100.00%
linkerd-prometheus-5dd896954c-g7snn  linkerd-web-55bfcf9698-5wxwf             GET         /metrics          2     2ms     2ms     2ms       100.00%
10.244.3.1                           linkerd-proxy-injector-648d6864b6-f8fqt  GET         /ping             2   461µs   490µs   490µs       100.00%
10.244.0.1                           linkerd-sp-validator-77f8b989-g6bjq      GET         /ping             2   375µs   532µs   375µs       100.00%
10.244.1.1                           linkerd-controller-78844b9b87-z8sgl      GET         /ready            2   432µs   446µs   432µs       100.00%
10.244.1.1                           linkerd-prometheus-5dd896954c-g7snn      GET         /-/ready          2   646µs   668µs   668µs       100.00%
10.244.2.1                           linkerd-destination-6d9d9dfbf6-fq6hd     GET         /ping             2   537µs   614µs   614µs       100.00%
10.244.3.1                           linkerd-proxy-injector-648d6864b6-f8fqt  GET         /ready            2   602µs   969µs   602µs       100.00%
```

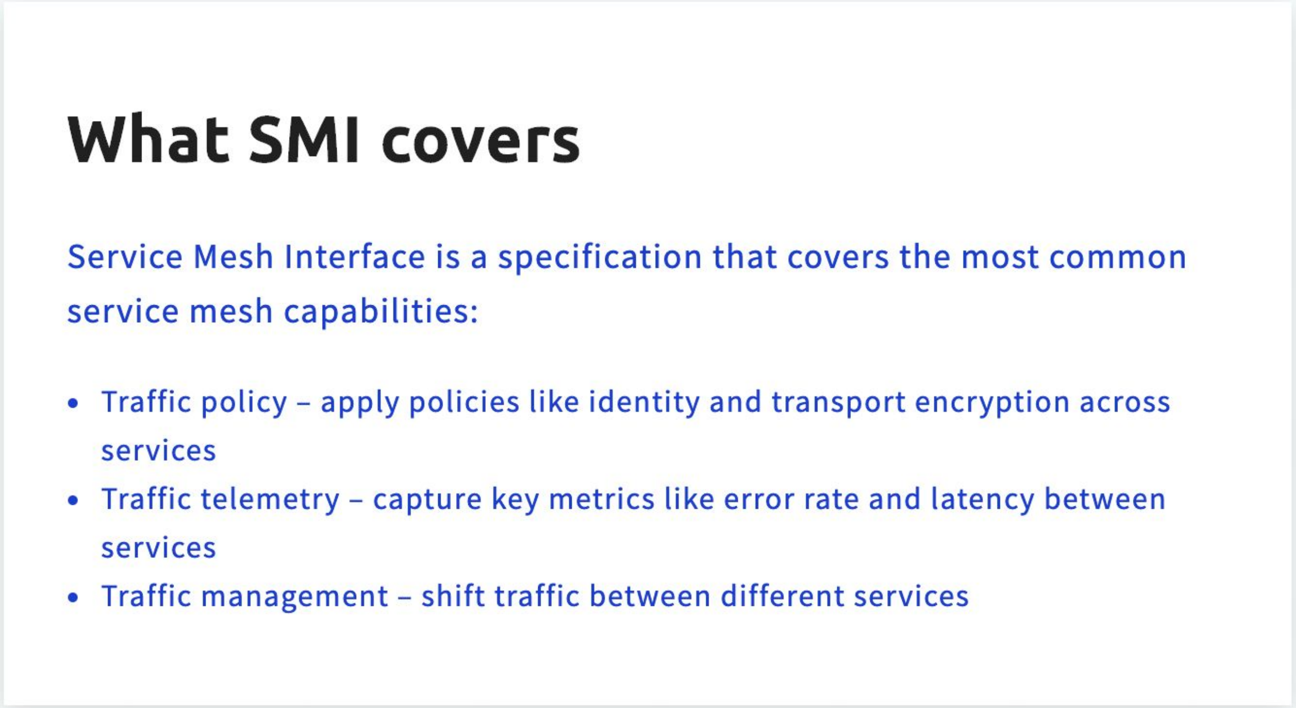
Traffic Splitting

- For canary and blue/green
- Splits requests between k8s `Services`
- Uses the Service Mesh Interface's `TrafficSplit` API
- Can be driven by Flagger



The Service Mesh Interface





What SMI covers

Service Mesh Interface is a specification that covers the most common service mesh capabilities:

- Traffic policy – apply policies like identity and transport encryption across services
- Traffic telemetry – capture key metrics like error rate and latency between services
- Traffic management – shift traffic between different services

Looking Forward

Roadmap

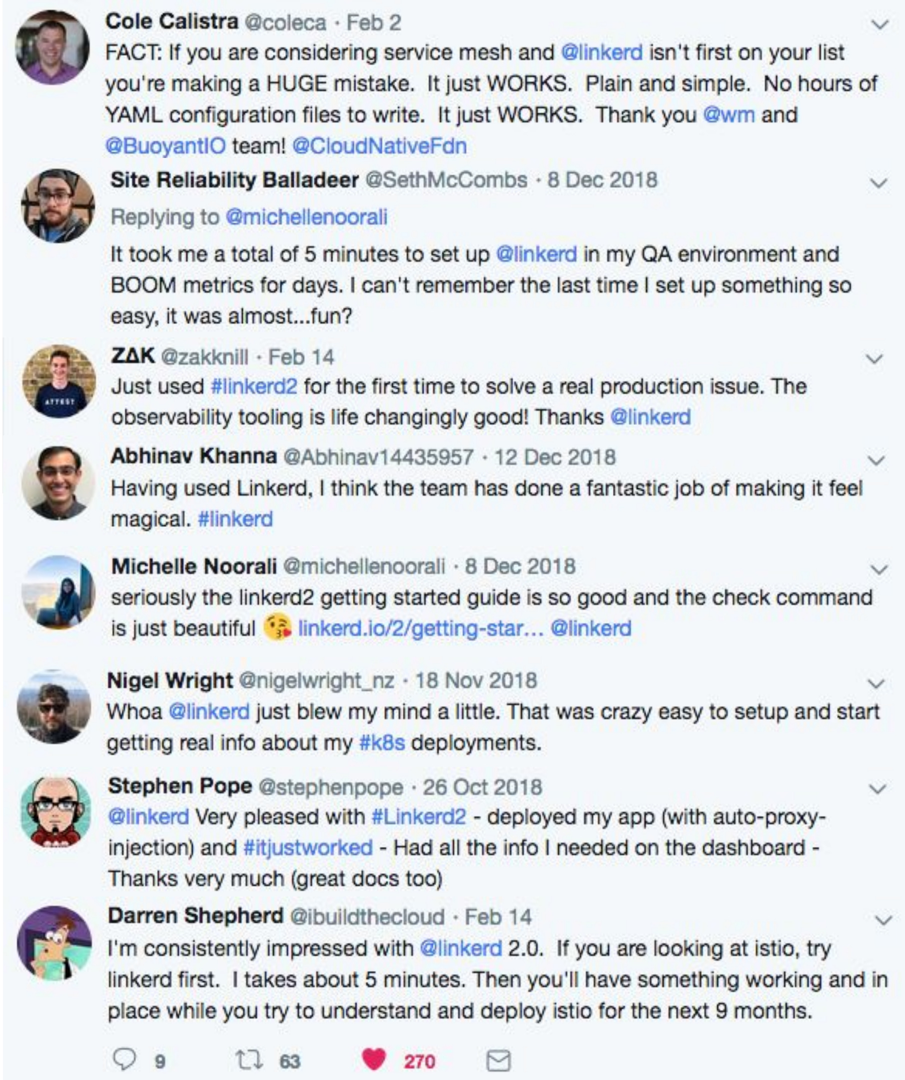
- 🗺️ Bring your own Prometheus
- 🗺️ Multi-cluster
  - Cross-cluster Service Mirroring
  - Come get involved!
- 🗺️ mTLS for everything
  - Mandatory TLS
  - SMI `TrafficPolicy`
- 🗺️ Exotic protocol support
  - Kafka, Redis, etc

Get involved!

- 💚 Development is all on GitHub
- 💚 New RFC process
- 💚 Thriving community in the Slack
- 💚 Formal announcements on the CNCF mailing lists
- 💚 Monthly community calls
- 💚 Formal 3rd-party security audits

Linkerd has a friendly, welcoming community! Join us!

Linkerd is 100% Apache v2 licensed, owned by a neutral foundation (CNCF), and is committed to



Cole Calistra @coleca · Feb 2
FACT: If you are considering service mesh and @linkerd isn't first on your list you're making a HUGE mistake. It just WORKS. Plain and simple. No hours of YAML configuration files to write. It just WORKS. Thank you @wm and @BuoyantIO team! @CloudNativeFdn

Site Reliability Balladeer @SethMcCombs · 8 Dec 2018
Replying to @michellenoorali
It took me a total of 5 minutes to set up @linkerd in my QA environment and BOOM metrics for days. I can't remember the last time I set up something so easy, it was almost...fun?

ZΔK @zakknill · Feb 14
Just used #linkerd2 for the first time to solve a real production issue. The observability tooling is life changingly good! Thanks @linkerd

Abhinav Khanna @Abhinav14435957 · 12 Dec 2018
Having used Linkerd, I think the team has done a fantastic job of making it feel magical. #linkerd

Michelle Noorali @michellenoorali · 8 Dec 2018
seriously the linkerd2 getting started guide is so good and the check command is just beautiful 😘 linkerd.io/2/getting-star... @linkerd

Nigel Wright @nigelwright_nz · 18 Nov 2018
Whoa @linkerd just blew my mind a little. That was crazy easy to setup and start getting real info about my #k8s deployments.

Stephen Pope @stephenpope · 26 Oct 2018
@linkerd Very pleased with #Linkerd2 - deployed my app (with auto-proxy-injection) and #itjustworked - Had all the info I needed on the dashboard - Thanks very much (great docs too)

Darren Shepherd @ibuildthecloud · Feb 14
I'm consistently impressed with @linkerd 2.0. If you are looking at istio, try linkerd first. I takes about 5 minutes. Then you'll have something working and in place while you try to understand and deploy istio for the next 9 months.

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