
KubeCon
CloudNativeCon
North America 2019

SERVICE MESH: THERE AND BACK AGAIN

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NOVEMBER 19, 2019

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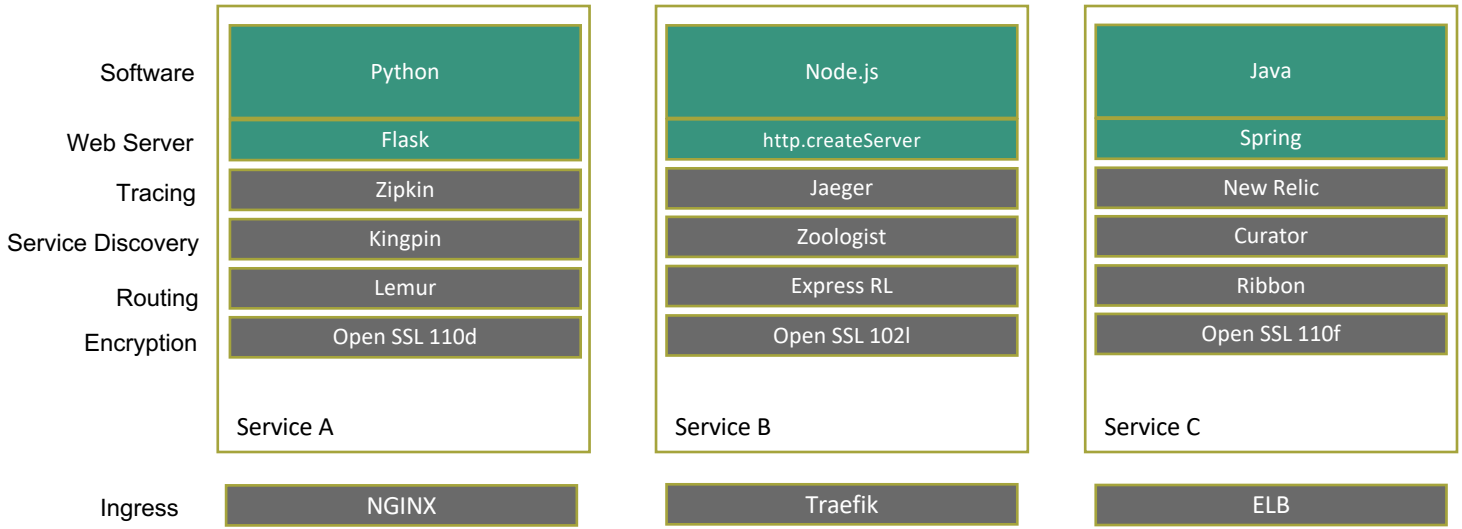
WHY SERVICE MESH?

"…A **SERVICE MESH** IS A DEDICATED INFRASTRUCTURE LAYER FOR FACILITATING SERVICE-TO-SERVICE COMMUNICATIONS BETWEEN MICROSERVICES"[1]

Before Service Mesh



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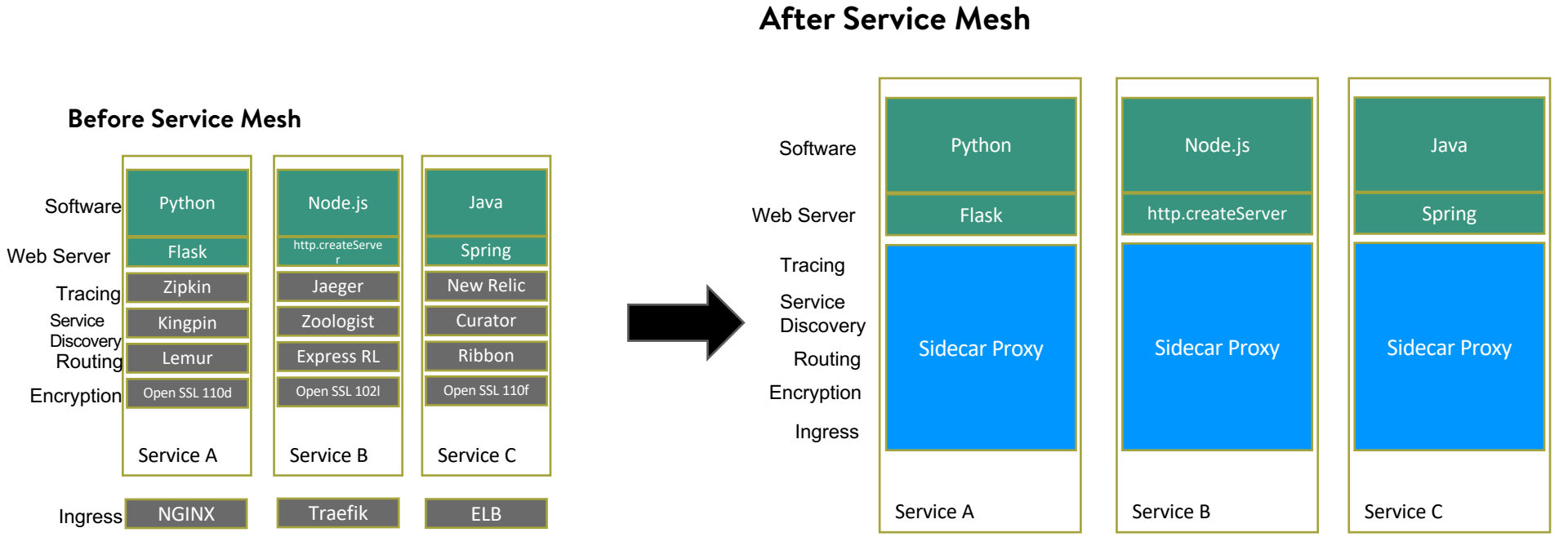
WHY SERVICE MESH?



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WHY SERVICE MESH?

- Increasing Application Resiliency
- Improving Developer Experience
- Metrics
- Performance
- Securing Communication

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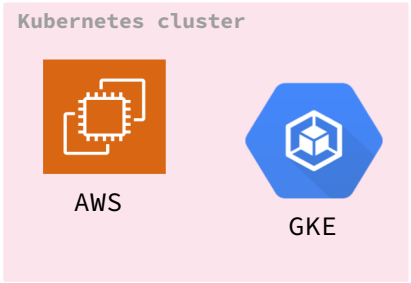
INVESTIGATIONS AND FINDINGS

- Where should we focus our priorities?
  - Which environments?

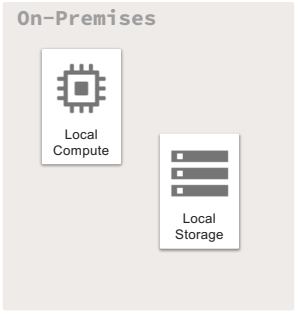


Kubernetes

6000 AWS Prod Pods
680 GKE Prod Pods

Functions
5500 unique Lambdas
3000 Daily Ave

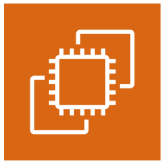
Serverless



On Premises

~7,000 Prod VMs

6,056 Prod EC2s



AWS EC2s

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INVESTIGATIONS AND FINDINGS

- Why re-invent the wheel?
- Build or buy? What do we value?

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INVESTIGATIONS AND FINDINGS

WHAT IS ON THE TABLE?

LINKERD PERFORMANCE TESTING

Load Testing – p90

Latency @ 500 Requests per Second	Latency @ 5,000 Requests per Second
3.70ms	4.23ms

Scalability Testing

Cluster	Number of Pods	Memory per Pod
Baseline	20	10 MB
Large Scale	3,500	10 MB

LINKERD FEATURE SET

- ✓ Lightweight proxy
- ✓ Service discovery
- ✓ Observability: service and route-level metrics include success rate, request volume, latency
- ✓ Diagnostic tools: service dependency maps, live traffic samples
- ✓ Traffic Splitting

CHALLENGE ACCEPTED

- Secure communication
  - On premises
  - AWS
  - GCP
  - Kubernetes
- Resources
  - # Engineers
  - Time
- Extra complexity

OUT OF THE FRYING PAN INTO THE FIRE

- Kubernetes?...Say what?!
- Installing Linkerd
- Challenges
- Open source community

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OUT OF THE FRYING PAN INTO THE FIRE

- **Kubernetes?...Say what?!**
- Installing Linkerd
- Challenges
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KUBERNETES?...SAY WHAT?!

"Kubernetes is a **portable**, **extensible**, **open-source** platform for **managing containerized** workloads and services, that facilitates both **declarative** configuration and **automation.**"[2]

kubernetes

KUBERNETES?…SAY WHAT?!

"Kubernetes is a portable, extensible, open-source platform for **managing containerized workloads and services**, that facilitates both declarative configuration and automation."[2]

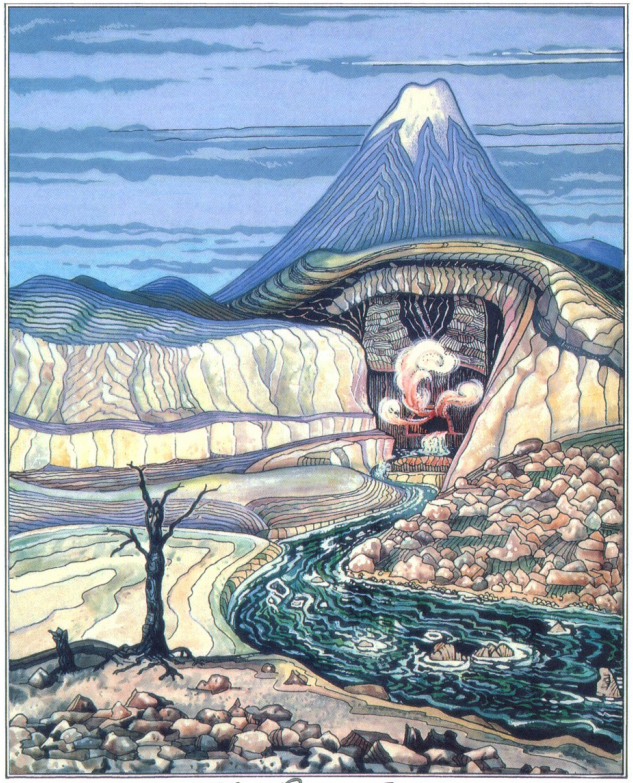
- Monoliths -> microservices
- Desire to increase developer productivity
  - CI/CD automation for deployments
  - Common platform for services
- Desire to reduce costs
  - Many services on an instance

KUBERNETES?...SAY WHAT?!

- New terminology
  - Pod, Deployment, ReplicaSet
  - K8s RBAC: ClusterRole, Role
  - Admission Controller, Webhook
- New set of tools to learn
  - kubectl
  - minikube
  - Go
- Development/Test clusters
  - AWS account permissions
  - Cost concerns
  - Custom tooling

SERVICE MESH ROLLOUT

- Kubernetes?...Say what?!
- **Installing Linkerd**
- Surprises and challenges during rollout
- Open source community



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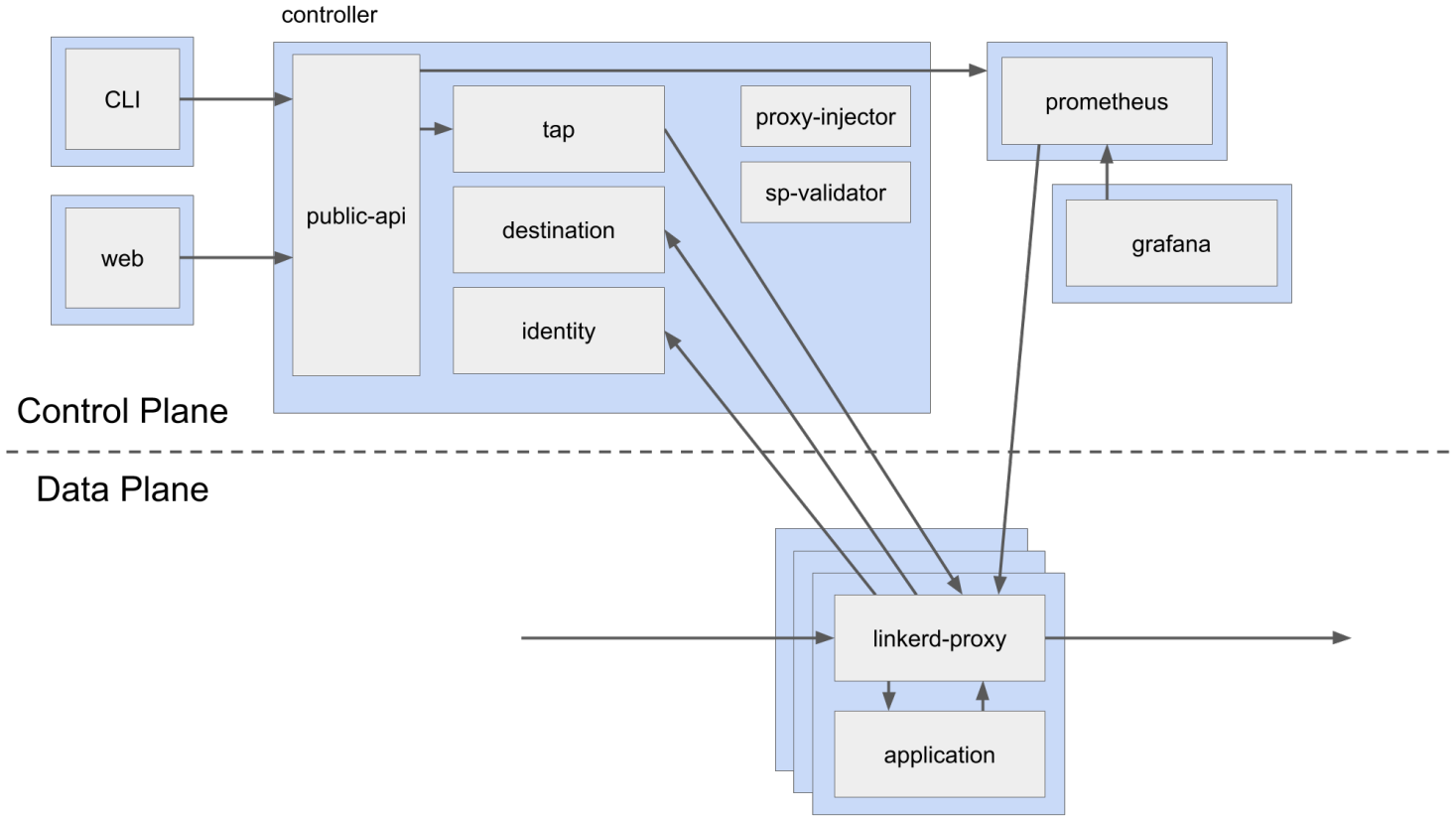
LINKERD



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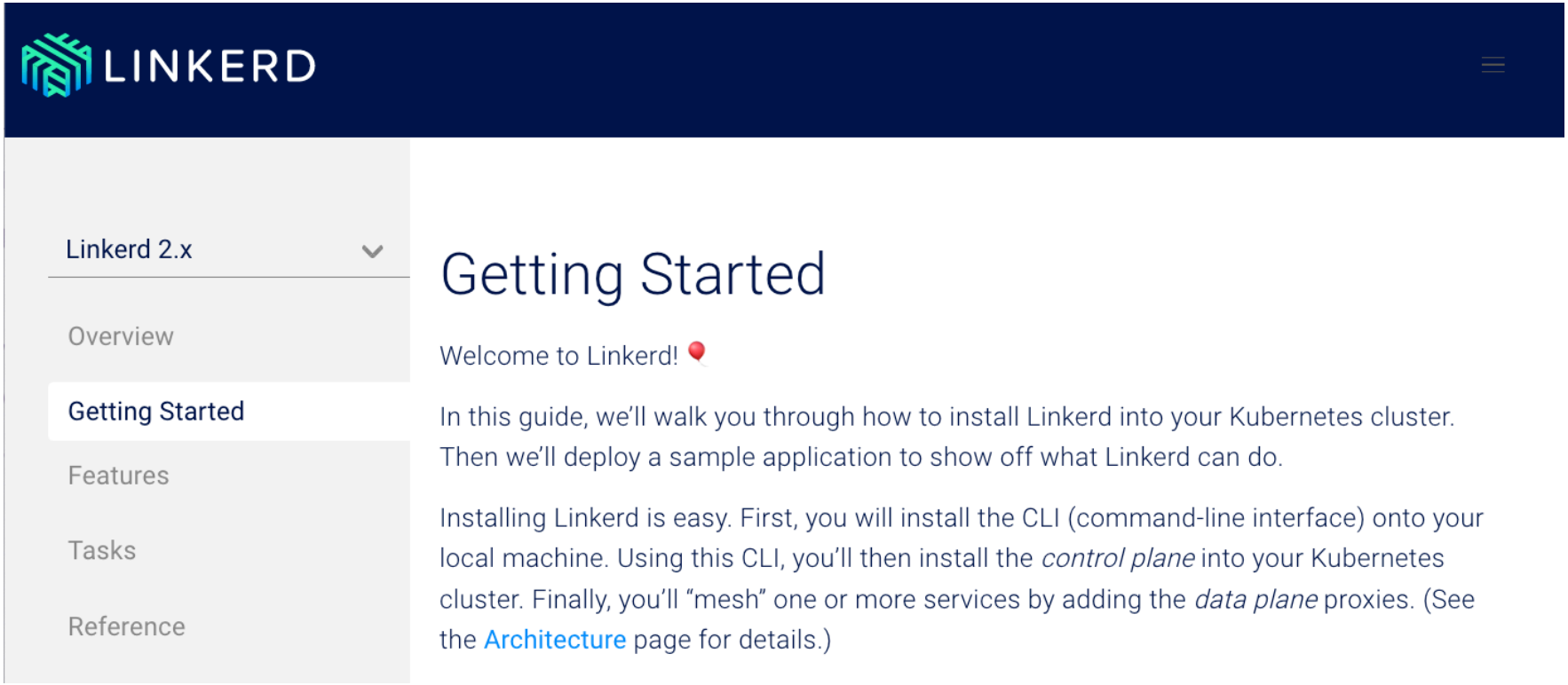
LINKERD INSTALL



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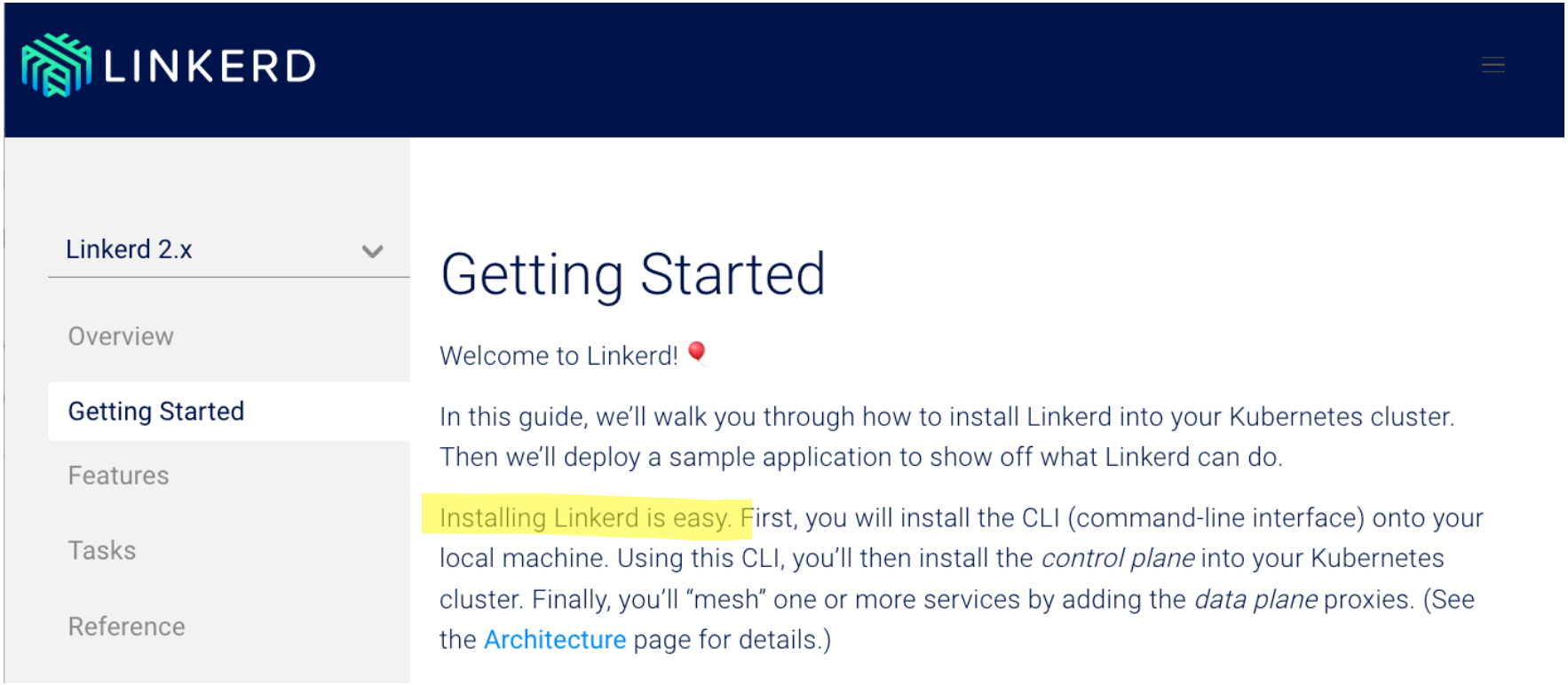
LINKERD INSTALL



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LINKERD INSTALL

```
bbaggins@theshire-smial42:~$ linkerd install | kubectl apply -f -
```

LINKERD INSTALL

```
bbaggins@theshire-smial42:~$ linkerd install | kubectl apply -f -
  deployment.extensions/linkerd-identity created
```

LINKERD INSTALL

```
bbaggins@theshire-smial42:~$ linkerd install | kubectl apply -f -
  deployment.extensions/linkerd-identity created
  deployment.extensions/linkerd-controller created
  service/linkerd-proxy-injector created
```

LINKERD INSTALL

```
bbaggins@theshire-smial42:~$ linkerd install | kubectl apply -f -
  deployment.extensions/linkerd-identity created
  deployment.extensions/linkerd-controller created
  service/linkerd-proxy-injector created
  .
  .
  .
... 45 more resource creations later ...
bbaggins@theshire-smial42:~$
```

LINKERD INSTALL

```
bbaggins@theshire-smial42:~$ kubectl get pods -n linkerd
```

LINKERD INSTALL

```
bbaggins@theshire-smial42:~$ kubectl get pods -n linkerd

No resources found in linkerd namespace.
```

LINKERD INSTALL

```
bbaggins@theshire-smial42:~$ kubectl get deployments -n linkerd
NAME                     READY   UP-TO-DATE   AVAILABLE   AGE
linkerd-controller       0/1     0            0           96s
linkerd-grafana          0/1     0            0           94s
linkerd-identity         0/1     0            0           97s
linkerd-prometheus       0/1     0            0           95s
linkerd-proxy-injector   0/1     0            0           93s
linkerd-sp-validator     0/1     0            0           91s
linkerd-tap              0/1     0            0           90s
linkerd-web              0/1     0            0           96s
```

LINKERD INSTALL

```
bbaggins@theshire-smial42:~$ kubectl describe replicasets linkerd-controller-1 -n linkerd
Events:
  Type     Reason        Message
  ----     ------        -------
  Warning  FailedCreate  Error creating: pods "linkerd-controller-1-" is forbidden: unable to validate against any pod security policy: [spec.initContainers[0].securityContext.runAsNonRoot: Invalid value: false: must be true spec.initContainers[0].securityContext.capabilities.add: Invalid value: "NET_ADMIN": capability may not be added spec.initContainers[0].securityContext.capabilities.add: Invalid value: "NET_RAW": capability may not be added]
```

LINKERD INSTALL

```
bbaggins@theshire-smial42:~$ kubectl describe replicasets linkerd-controller-1 -n linkerd

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```
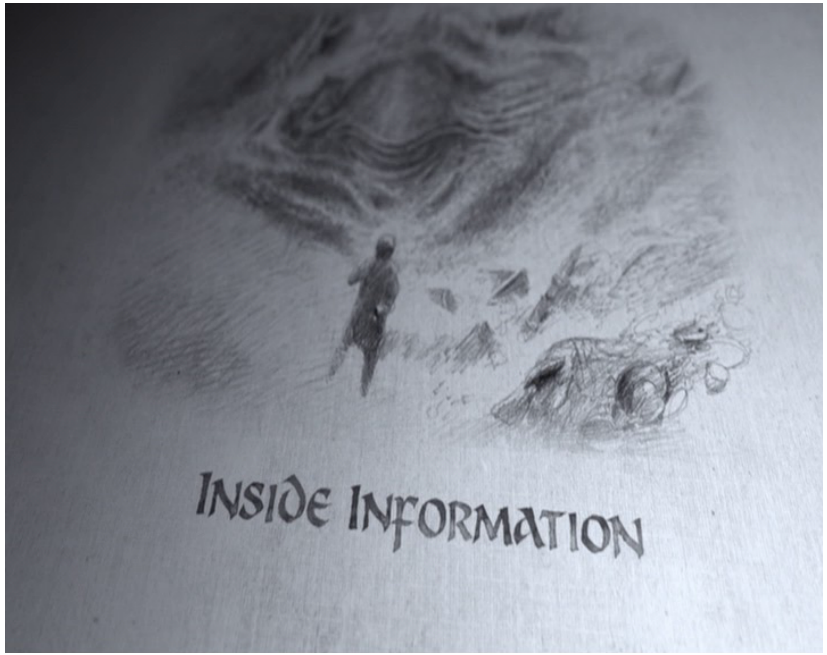

LINKERD INSTALL

INSIDE INFORMATION

- Kubernetes?...Say what?!
- Installing Linkerd
- **Challenges**
- Open source community



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CHALLENGES

CHALLENGES

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CHALLENGES

- We are not cluster administrators

```
Error from server (Forbidden): error when creating "linkerd.yaml":
clusterroles.rbac.authorization.k8s.io is forbidden: User “cody.vandermyn”
cannot create resource "clusterroles" in API group "rbac.authorization.k8s.io"
at the cluster scope
```

CHALLENGES

- We are not cluster administrators
- Pod Security Policies (PSP)
  - `mustRunAsNonRoot`
  - `NET_ADMIN`, `NET_RAW` Linux capabilities are prohibited
  - User and Group IDs must be greater than `10000`

THE RETURN JOURNEY

- Kubernetes?...Say what?!
- Installing Linkerd
- Challenges
- **Open source community**

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OPEN SOURCE COMMUNITY

- Container Networking Interface (CNI) Plugin
  - Provides an interface for a custom executable to perform network related activities whenever a Pod is created or deleted
  - Standard in/out is used as the mechanism to communicate from one plugin to another
  - Istio and Calico already had CNI plugins we could reference

OPEN SOURCE COMMUNITY

- Container Networking Interface (CNI) Plugin
- Deployment of the CNI plugin
  - Typical installation via a Daemonset didn't meet our needs

OPEN SOURCE COMMUNITY

- Container Networking Interface (CNI) Plugin
- Deployment of the CNI plugin
- AWS Certificate Manager Private Certificate Authority (ACM PCA)
  - Linkerd acts as its own CA and the proxies trust the certificates created
  - Fork of Linkerd to add this capability

LINKERD INSTALL

```
bbaggins@theshire-smial42:~$ kubectl get pods -n linkerd
NAME                                      READY   STATUS    RESTARTS   AGE
linkerd-controller-5b95b6f449-2xw26       3/3     Running   2          12d
linkerd-controller-5b95b6f449-7mlh8       3/3     Running   2          12d
linkerd-controller-5b95b6f449-84kwg       3/3     Running   2          12d
linkerd-grafana-5d784ff96b-2z8nx          2/2     Running   0          12d
linkerd-identity-7546c77559-pvdw6         2/2     Running   1          13d
linkerd-identity-7546c77559-qxwt8         2/2     Running   1          12d
linkerd-identity-7546c77559-tdb99         2/2     Running   1          12d
linkerd-prometheus-8448f6d54f-4wdmm       2/2     Running   0          13d
linkerd-proxy-injector-78f5848766-clkjf   2/2     Running   1          13d
linkerd-proxy-injector-78f5848766-sdcch   2/2     Running   1          12d
linkerd-proxy-injector-78f5848766-t7z7j   2/2     Running   1          171m
linkerd-sp-validator-5874c6677-5brvf      2/2     Running   1          12d
linkerd-sp-validator-5874c6677-7qz8z      2/2     Running   1          12d
linkerd-sp-validator-5874c6677-wjpg6      2/2     Running   1          3h8m
linkerd-tap-576f7f8549-k8mfd              2/2     Running   1          12d
linkerd-tap-576f7f8549-pfctb              2/2     Running   1          12d
```

THE LAST STAGE

- Easy onboarding experience

```
metadata:
  annotations:
    linkerd.io/inject: enabled
  labels:
    nordstrom.com/uses-linkerd: true
    app: silmarillion
```

- Cluster impact
- Open Source Contributions
- Long journey ahead

THE END

Q&A

Contact Information

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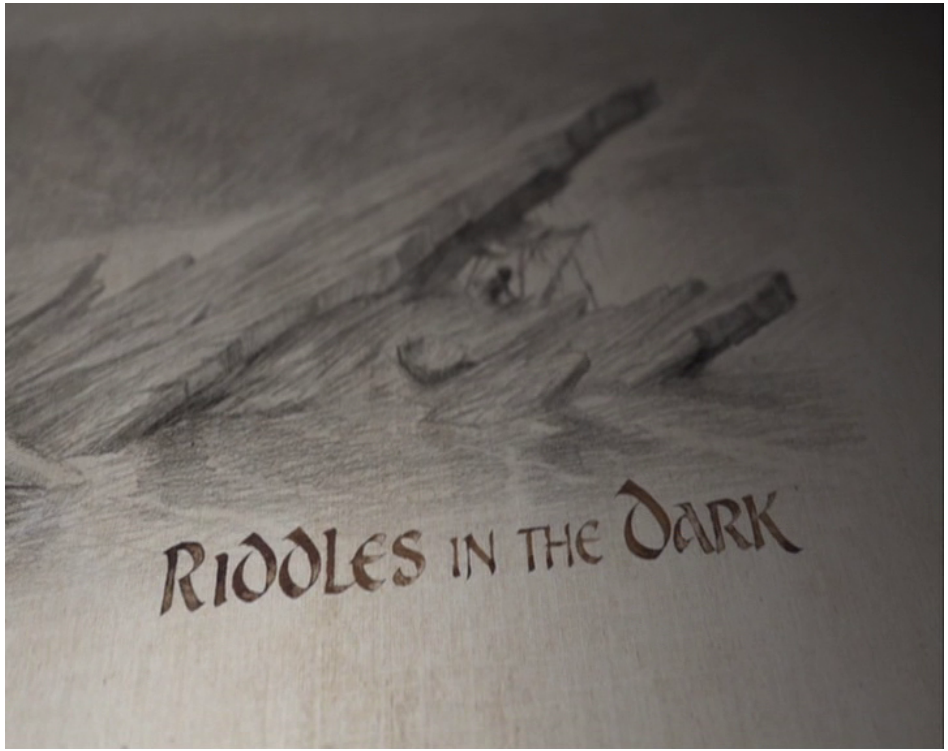
Hema: hemalekha.lee@nordstrom.com



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REFERENCES AND DISCLAIMERS

[1] https://en.wikipedia.org/wiki/Service_mesh

[2] https://kubernetes.io/docs/concepts/overview/what-is-kubernetes/

Images:

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EXTRA SLIDES

Extra Slides