OVERVIEW OF

SPIRE

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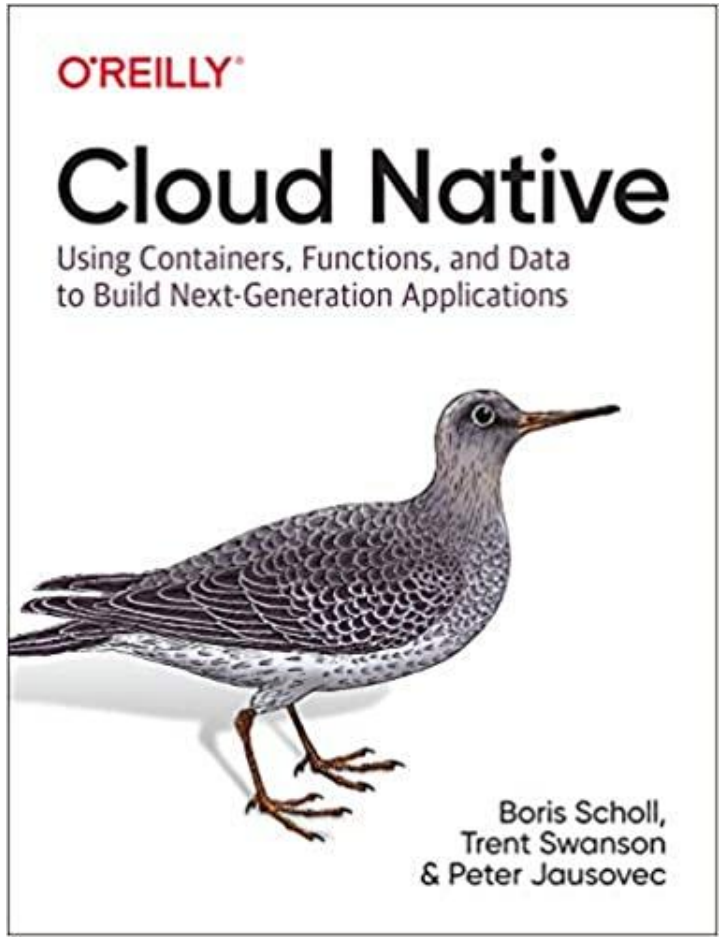

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Agenda

01 What is SPIRE?

02 How do SPIFFE / SPIRE work?

03 Using SPIRE with Istio

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What is SPIRE?

Production-ready implementation of **SPIFFE** APIs that perform node and workload **attestation** to securely **issue SVIDs** to workloads and **verify SVIDs** of other workloads based on some conditions.

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SPIFFE: Three Core Components

SPIFFE ID

A string to uniquely and specifically identify a workload.

```
spiffe://cluster.local/ns/default/sa/sleep
```

SPIFFE Verifiable Identity Document (SVID)

Used by a workload to prove its identity to a resource or caller

Workload API

Used by a workload to receive its identity, private key/cert, and trust bundle.

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SPIFFE ID in x.509 SVID

- Identity in Istio = based on service accounts, trust domain, and namespace
- SPIFFE ID is encoded in SAN field (Subject Alternative Name)
- x.509 certificate:

```
X509v3 Authority Key Identifier:
    keyid:45:13:7D:E0:94:F6:42:8F:F0:66:E3:45:DB:67:82:F8:D8:81:89:F3
X509v3 Subject Alternative Name: critical
    URI:spiffe://cluster.local/ns/default/sa/sleep
```


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SPIFFE vs SPIRE

A set of open-source standards for securely identifying software systems

An open-source, production-ready implementation of the SPIFFE APIs

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How SPIRE works?

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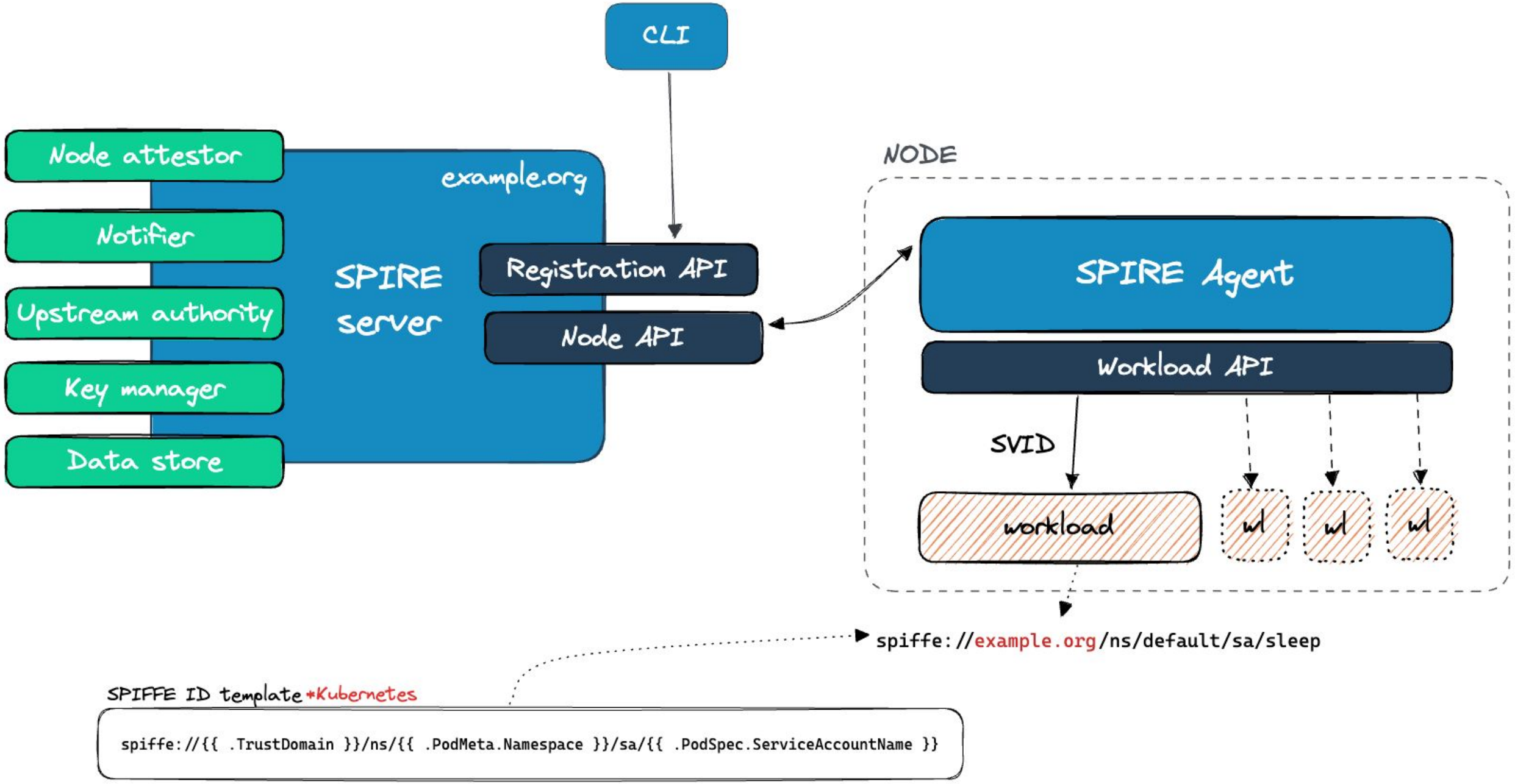
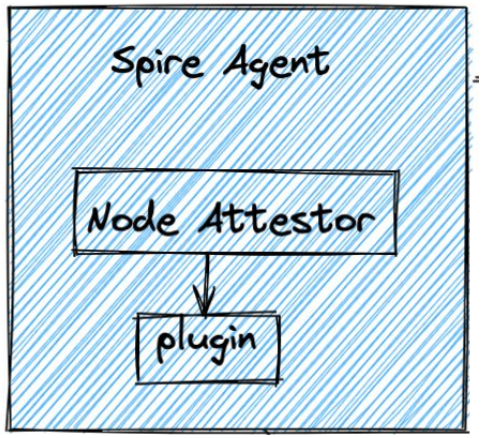
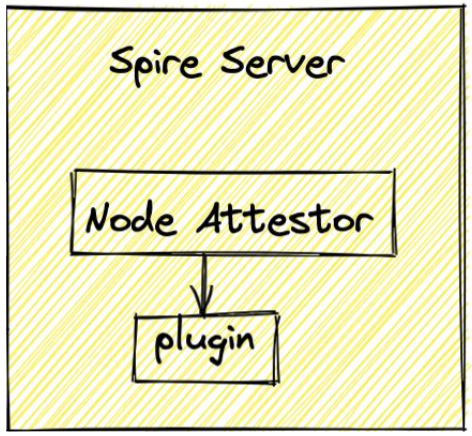
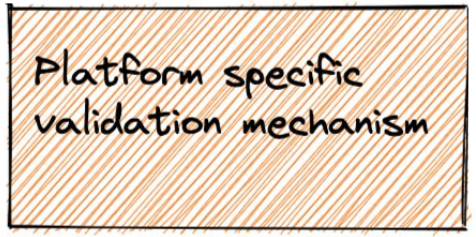


Node Attestation







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Node Attestation

- Uses node attestors (AWS, GCP, Azure, HSM) → SPIFFE ID & SVID for the agent

```
Entry ID         : 62ebacd3-eaaa-4b21-b52e-79ba09da2adf
SPIFFE ID        : spiffe://example.org/k8s-workload-registrar/demo-cluster/node/k3s-peterj-istio-9e0a-ec4355-node-pool-e972-imoph
Parent ID        : spiffe://example.org/spire/server
Revision         : 0
TTL              : default
Selector         : k8s_psat:agent_node_uid:266b3555-9979-4ba2-8ed8-f902cb70b8e2
Selector         : k8s_psat:cluster:demo-cluster
```


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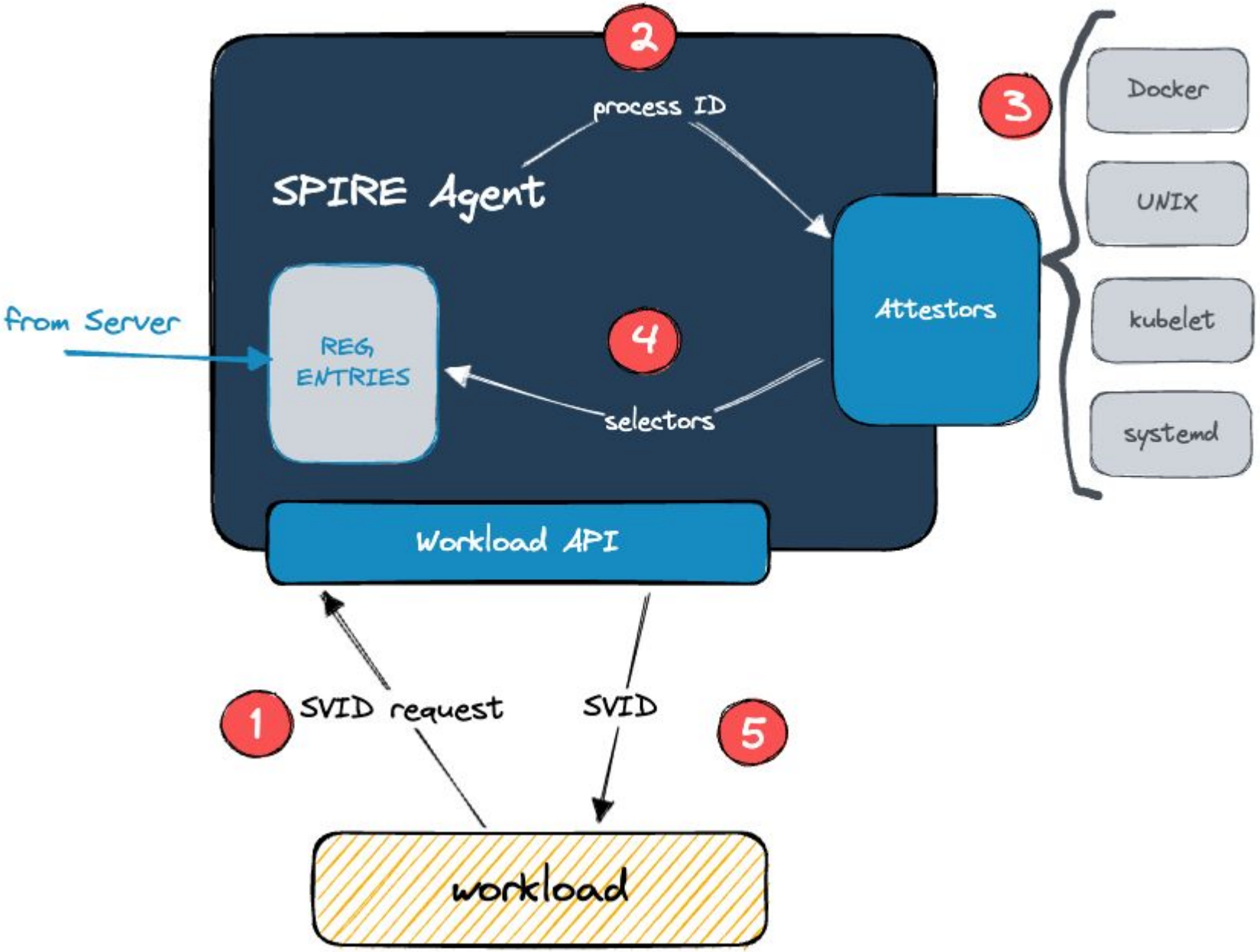

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Workload Attestation

- Uses workload attestors (Docker, Unix, K8s) to determine the properties of the workload (e.g uid, gid, service account in K8s, …)
- Discovered properties are returned as selectors to the agent
- Agent determines the identity by comparing the selectors to registration entries

```
Entry ID         : 5d260de3-d8b3-4911-8ddc-4edfd6e5ec46
SPIFFE ID        : spiffe://hoot.solo.io/ns/default/sa/sleep
Parent ID        : spiffe://hoot.solo.io/k8s-workload-registrar/spire-demo/node/k3s-spire-demo-b371-c25841-node-pool-589b-hhgm5
Revision         : 1
TTL              : default
Selector         : k8s:node-name:k3s-spire-demo-b371-c25841-node-pool-589b-hhgm5
Selector         : k8s:ns:default
Selector         : k8s:pod-uid:4356c73f-b279-4ed7-8ae6-80f34abd0ddc
DNS name         : sleep-7679b5cf67-qprlj
DNS name         : sleep.default.svc
```


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SPIRE with Istio

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Breaking Down a Workload in Istio

Most of our workloads will be deployed as k8s pods

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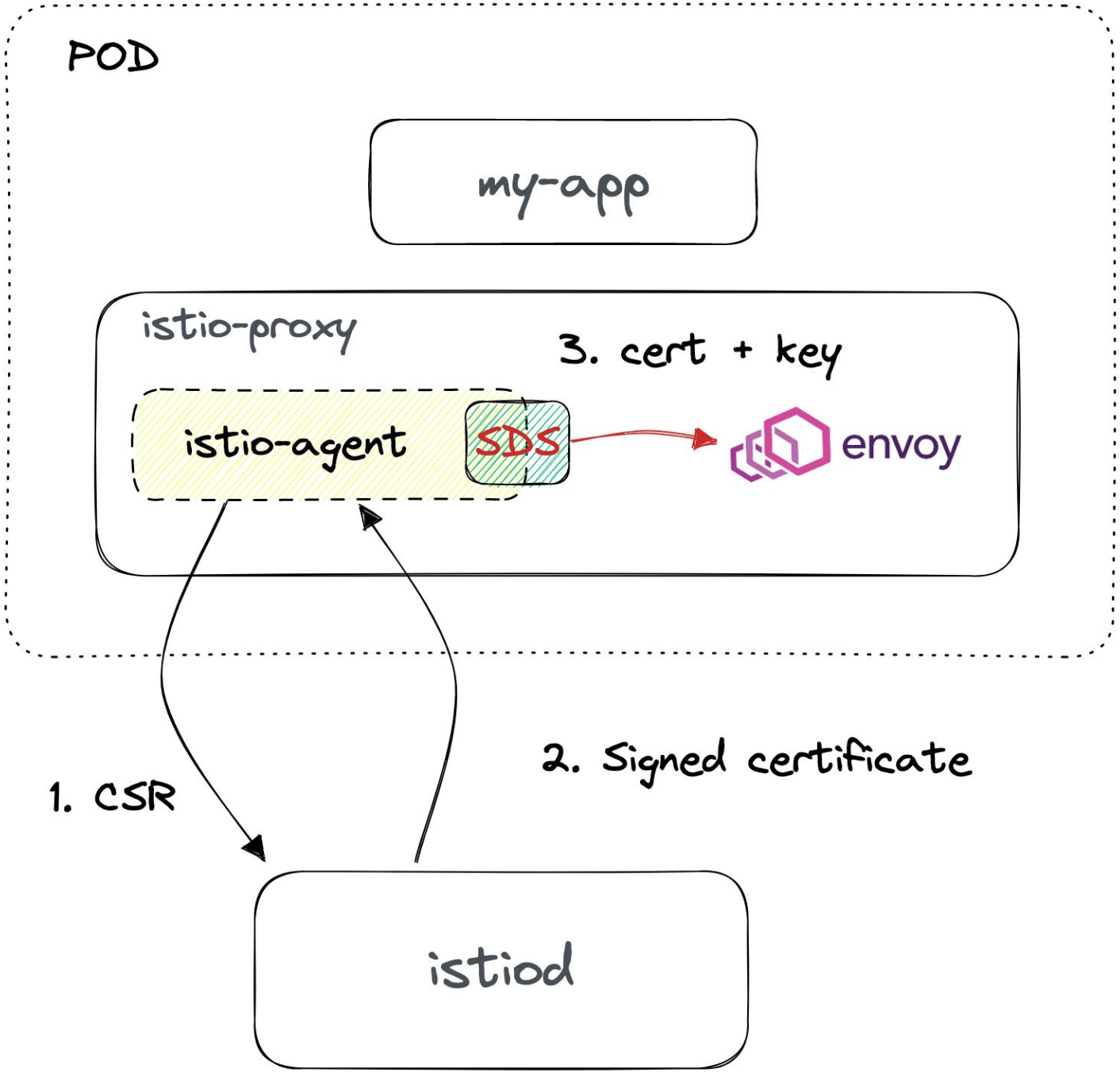

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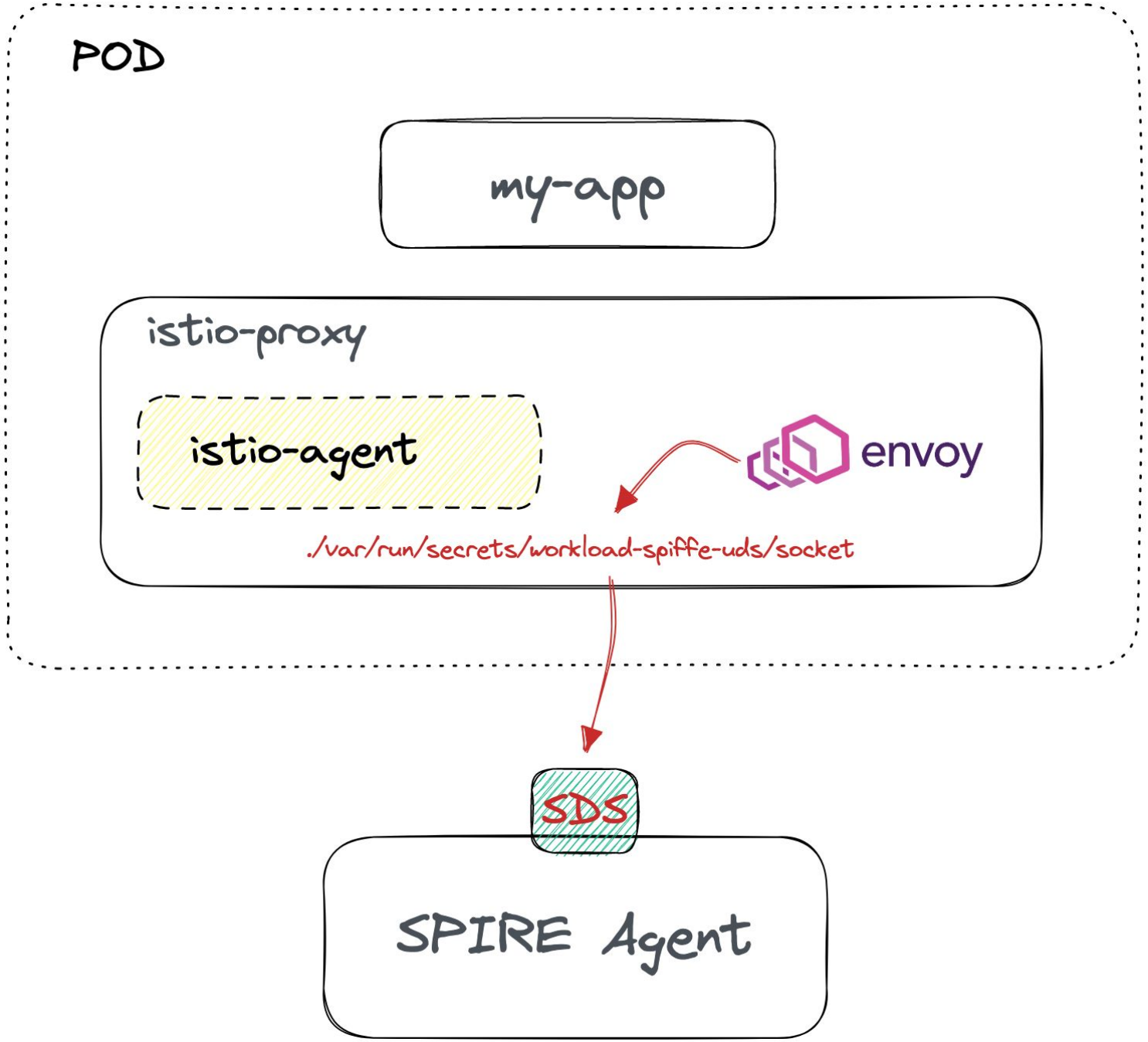

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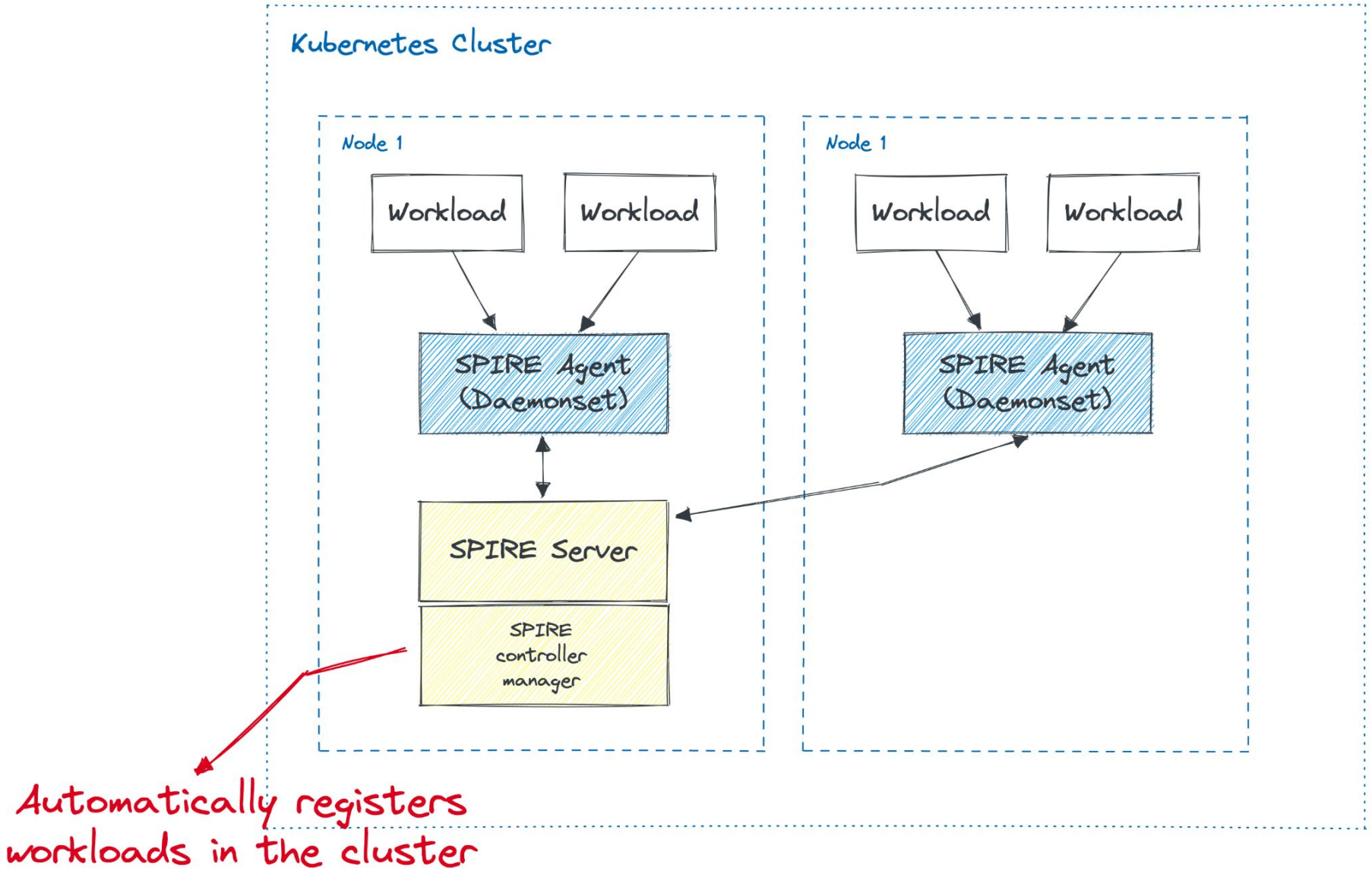
Kubernetes setup



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DEMO

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Using SPIRE to enable mTLS between a mesh and external VMs

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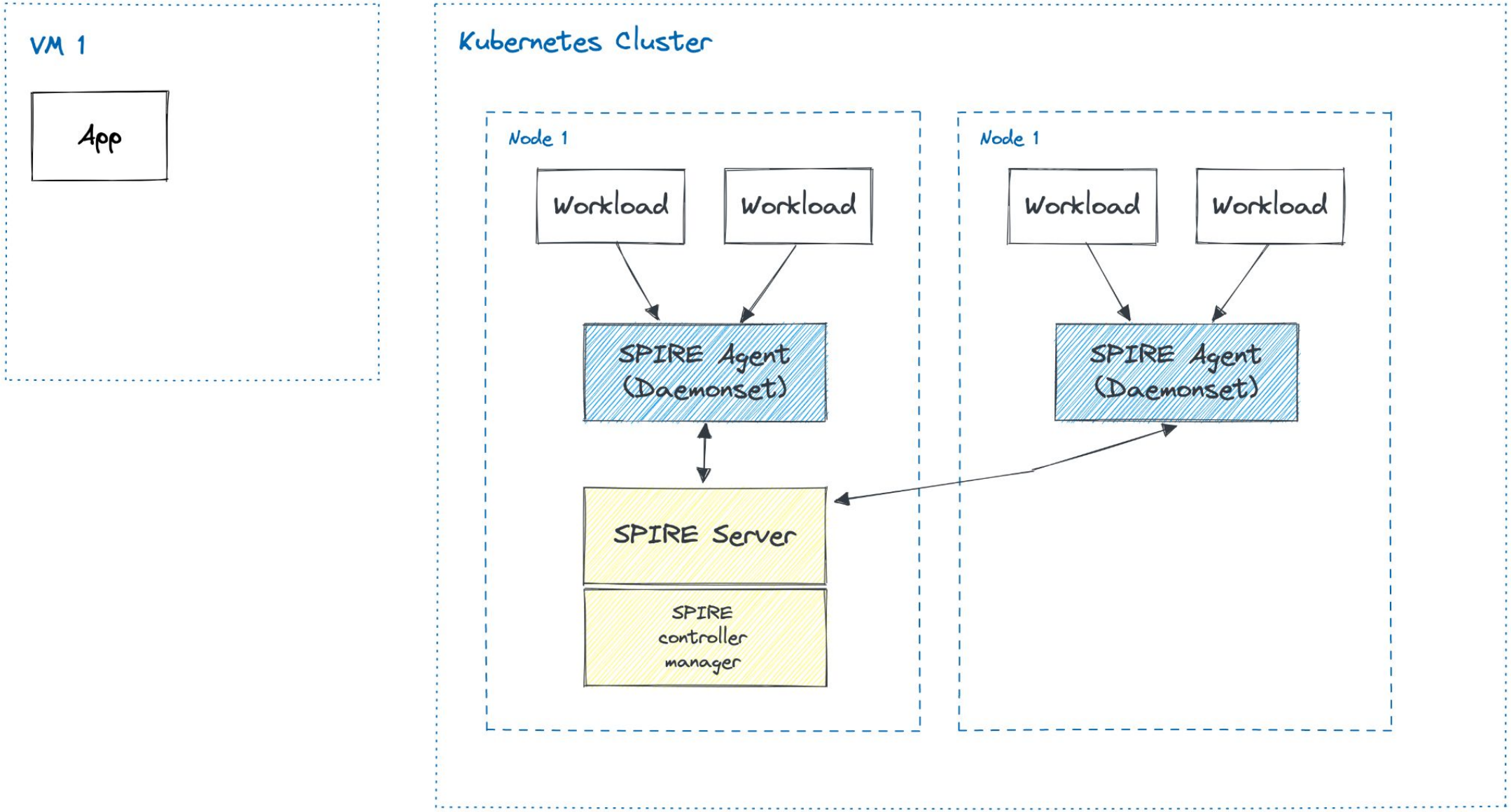
Adding a VM to our setup



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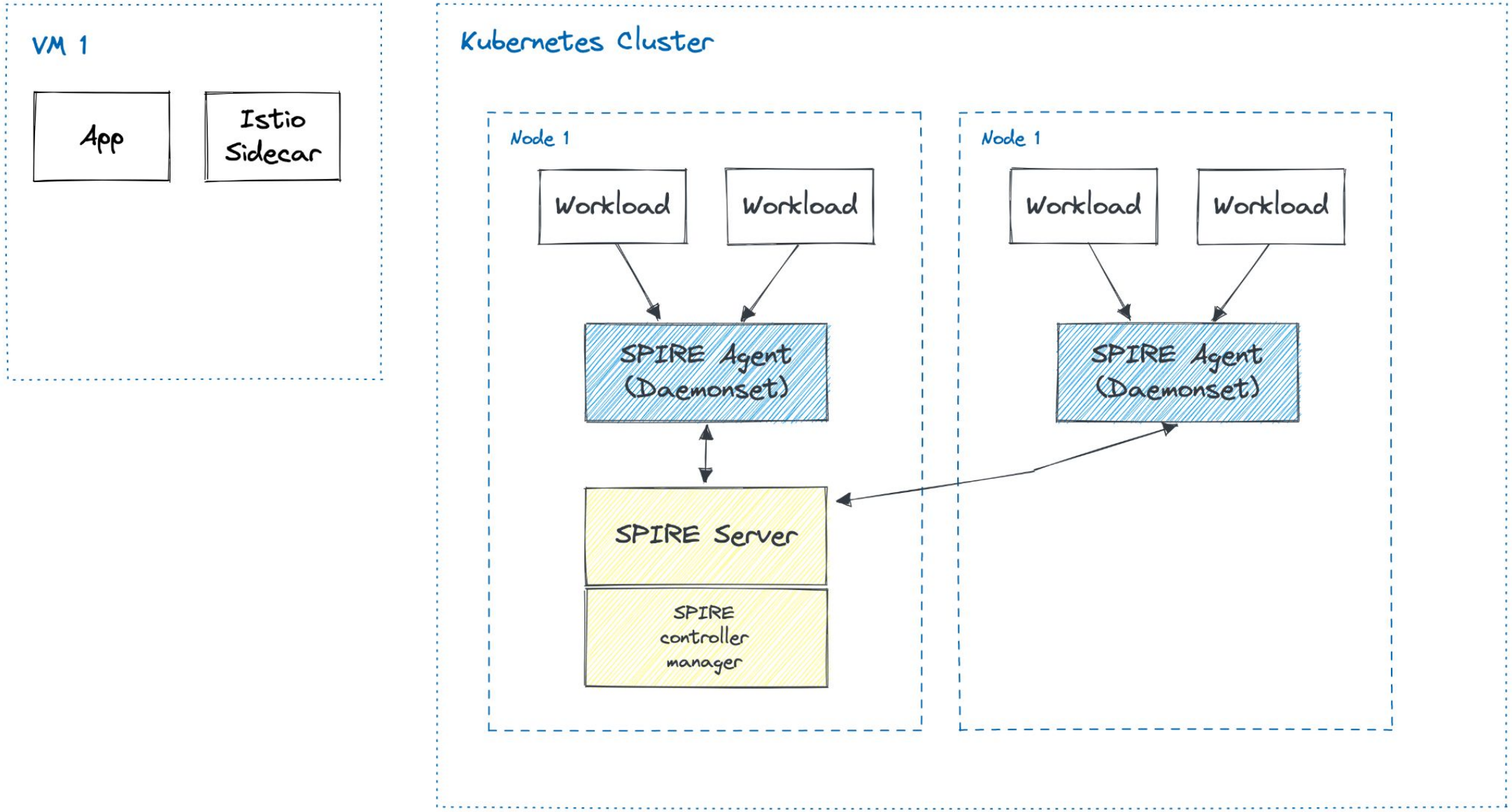
Adding a VM to our setup



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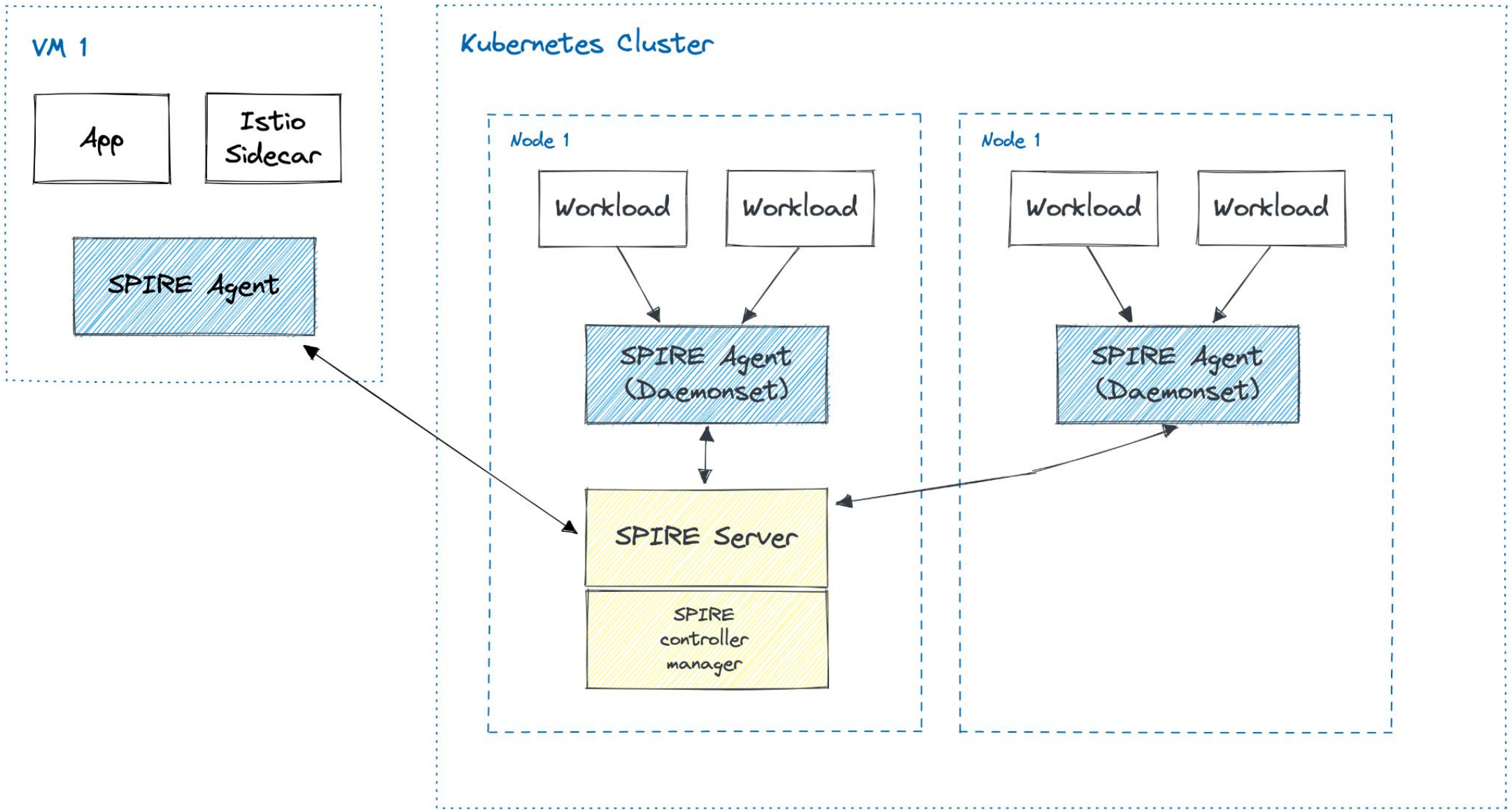
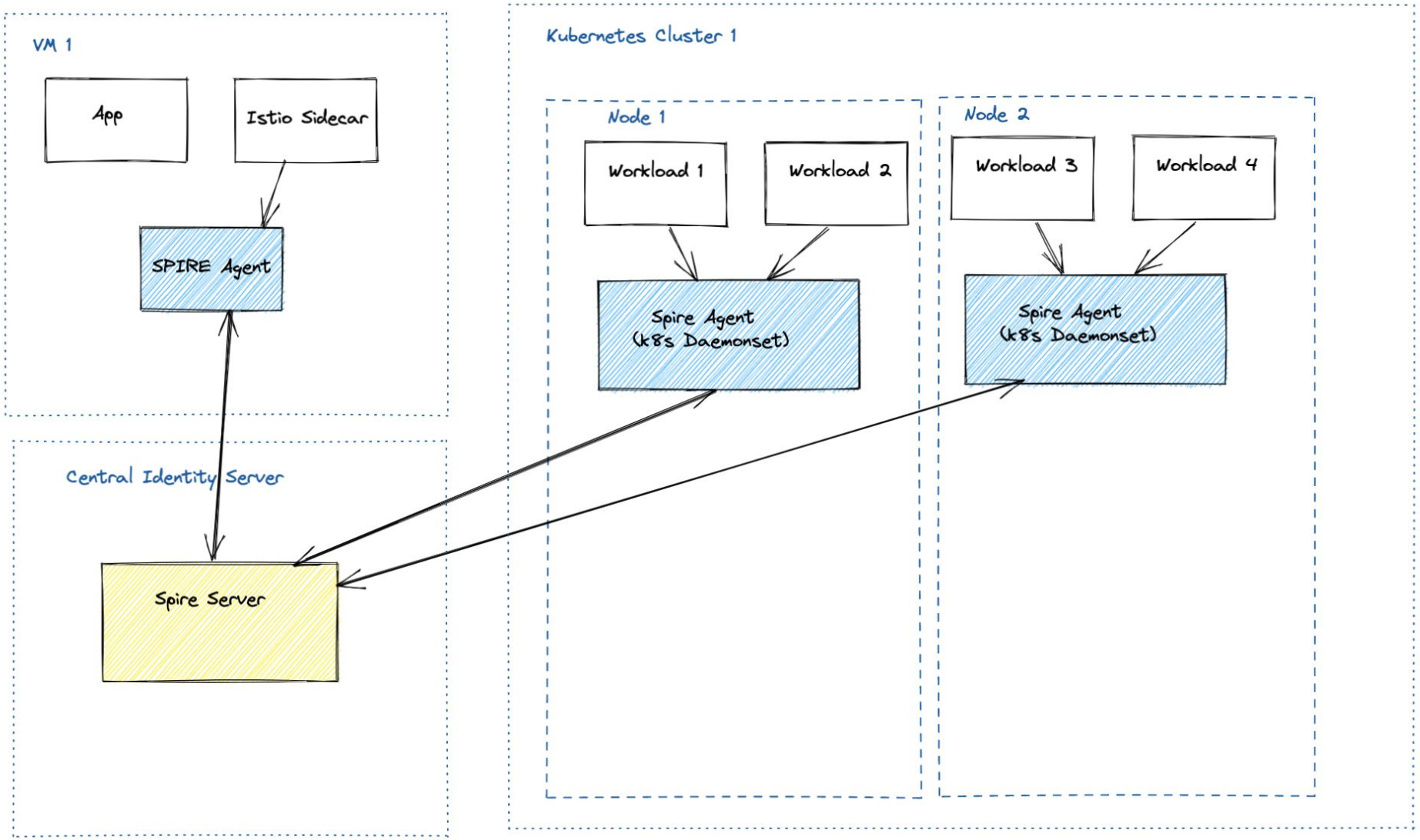
Adding a VM to our setup



SPIRE is platform agnostic



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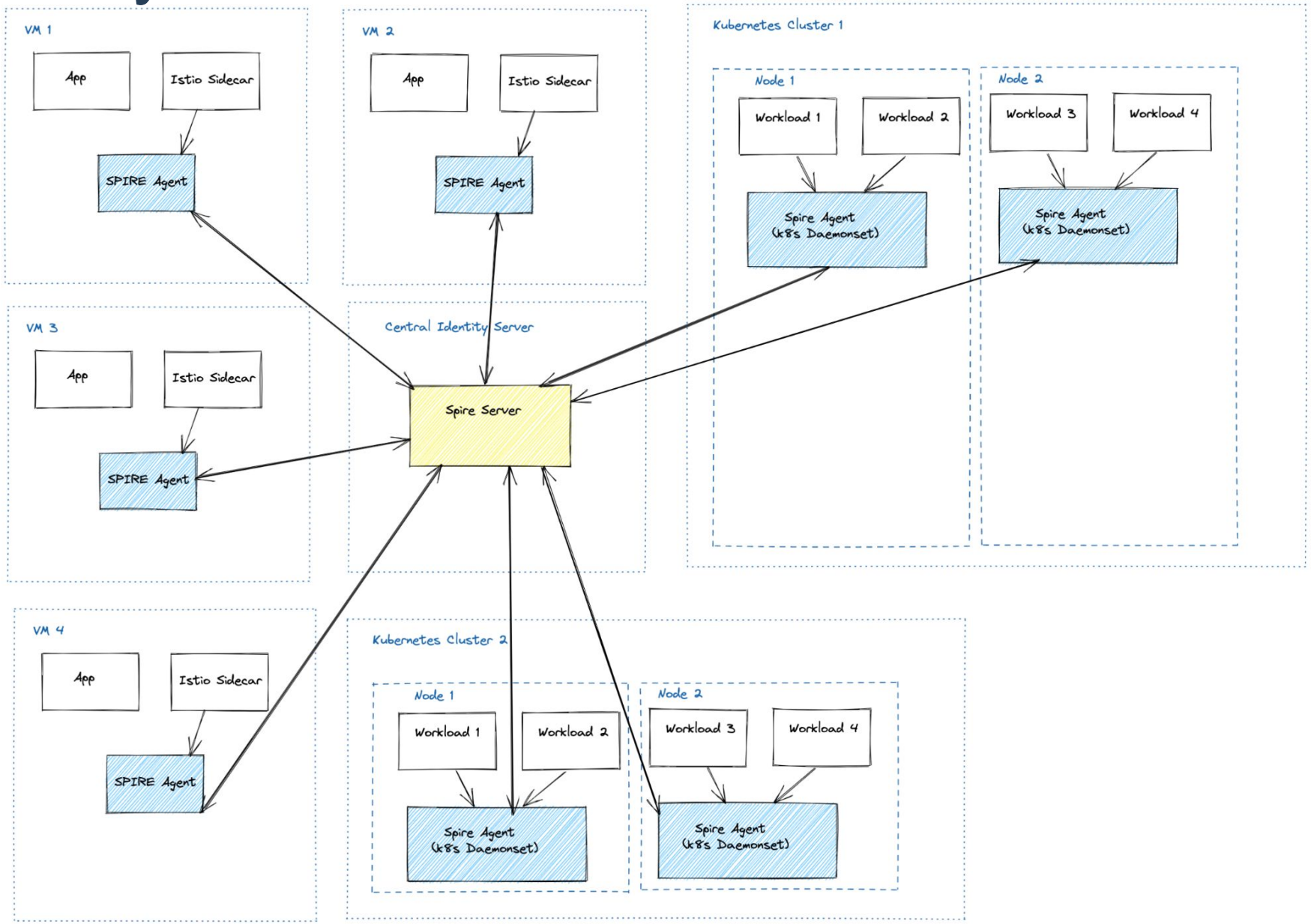
One identity server to rule them all



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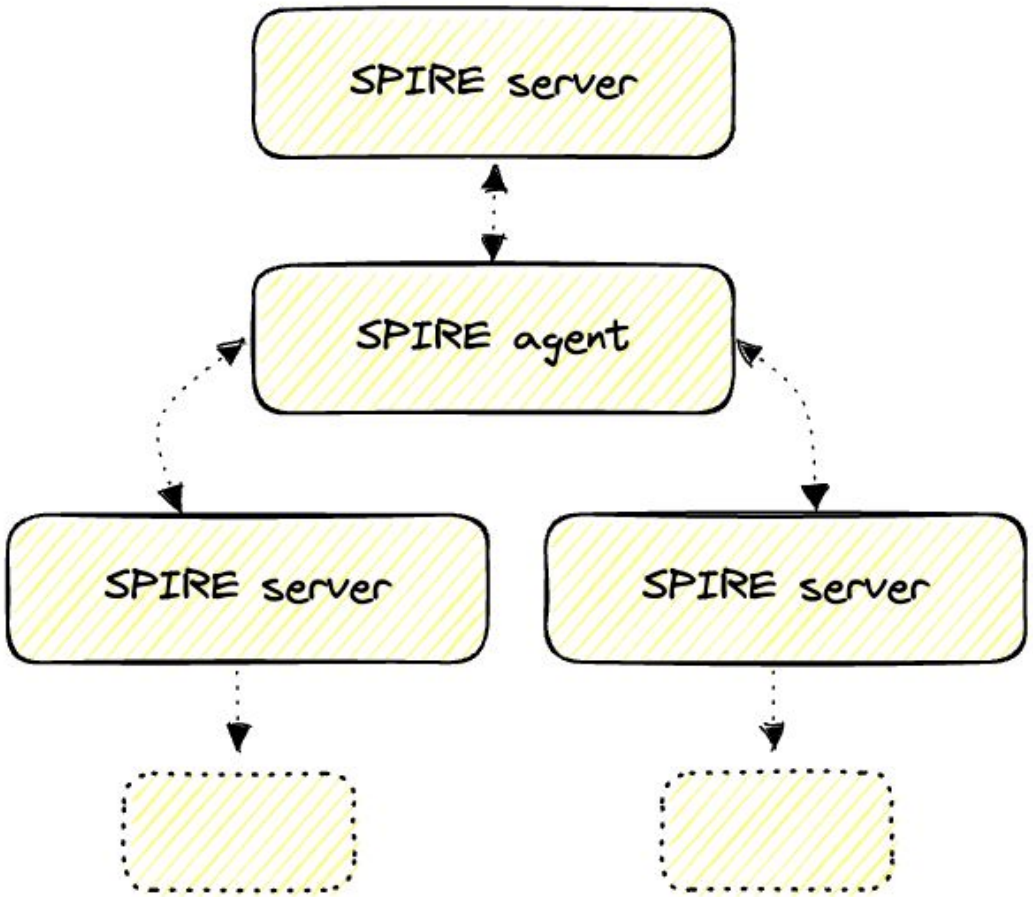
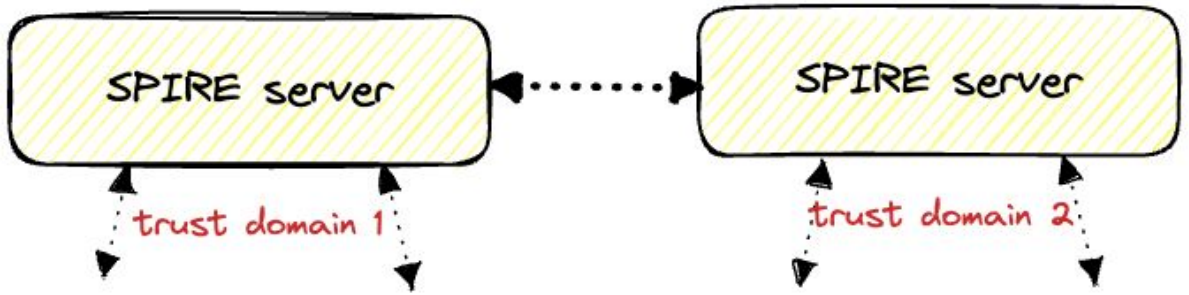
Nested SPIRE



Federated SPIRE



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Wrap up

- Creating, maintaining and rotating certs for workloads is a lot of work
- SPIRE enables you to deploy mTLS across your workloads by:
  - Attest workload identity at runtime
  - Delivers workload-specific short-lived certs
- How?
  1. Install SPIRE server and SPIRE agents on each VM/node
  2. Configure node and workload attestation
  3. Register workloads with the server
  4. Retrieve SVIDs from SPIRE agent API (use SDK or Envoy proxy for example)

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Thank You!

Useful resources / further reading

- SPIFFE spec - https://github.com/spiffe/spiffe/blob/main/standards/SPIFFE.md
- Official SPIFFE docs - https://spiffe.io/docs/latest/spiffe-about/overview/
- SPIRE architecture & components - https://spiffe.io/docs/latest/spire-about/spire-concepts
- Scaling SPIRE - https://spiffe.io/docs/latest/planning/scaling_spire
- Istio cert management - https://istio.io/latest/docs/concepts/security/#pki
- Istio SPIRE integration - https://istio.io/latest/docs/ops/integrations/spire

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