Identity Bootstrapping in Multi-tenant Multi-cluster Kubernetes

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Liberate your Infrastructure, Applications, and Data

Who are we?

SaaS provider enabling customers to ***build***, ***deploy***, ***secure***, and ***operate*** distributed applications and data across **multiple cloud providers** and **edge locations**.

Multi-Cluster, Multi-Tenant, Multi-...

- Why?
  - Applications Distributed across Geo-locations, Cloud providers and Edge locations
    - tl; dr; - Not if, but when
    - High Availability, DR, Latency/Performance, Compliance, Multi-cloud, Distributed Cloud, Cost, Dev/Prod, Edge etc.
- Challenges
  - Networking/Routing
  - Service Discovery
  - Visibility/Monitoring
  - CI/CD
  - Isolation (tenancy)
  - Security/Trust

Why Kubernetes?

- Community support
- Rich core functions
- Soft-tenancy available
- Pluggable and Extensible
- ...

History - Inspiration

AuthZ → AuthN → Identity

First Principles

- Definition (from Dictionary*)

  identity (aI den tih ti)

  > The unique and entire set of characteristics that make up what a person or thing is known or considered to be.

- Definition (from Crypto Geeks)

  identity (aI den tih ti)

  > The unique and entire set of **unforgeable and cryptographically verifiable** characteristics **cryptographically certified via an undelegated and secure protocol** by a **trusted authority** that make up what a person or thing is known or considered to be.

*source: www.wordsmyth.net

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Why do we need Cryptographic Identity?

- Identity Owner
  - Secure Communication
  - Prove eligibility
  - Vindication
- Peers
  - Secure Communication
  - Audit/Accounting
  - Non-repudiation

What makes a solid identity?

1. Granular
2. Securely Minted/Delivered
3. Rich, Usable, Extensible

1. Granular

Kubernetes Documentation:

"*Pods* are the smallest deployable units of computing that can be created and managed in Kubernetes."

NOT Namespace
NOT Service Account
NOT Service
IT IS Pod

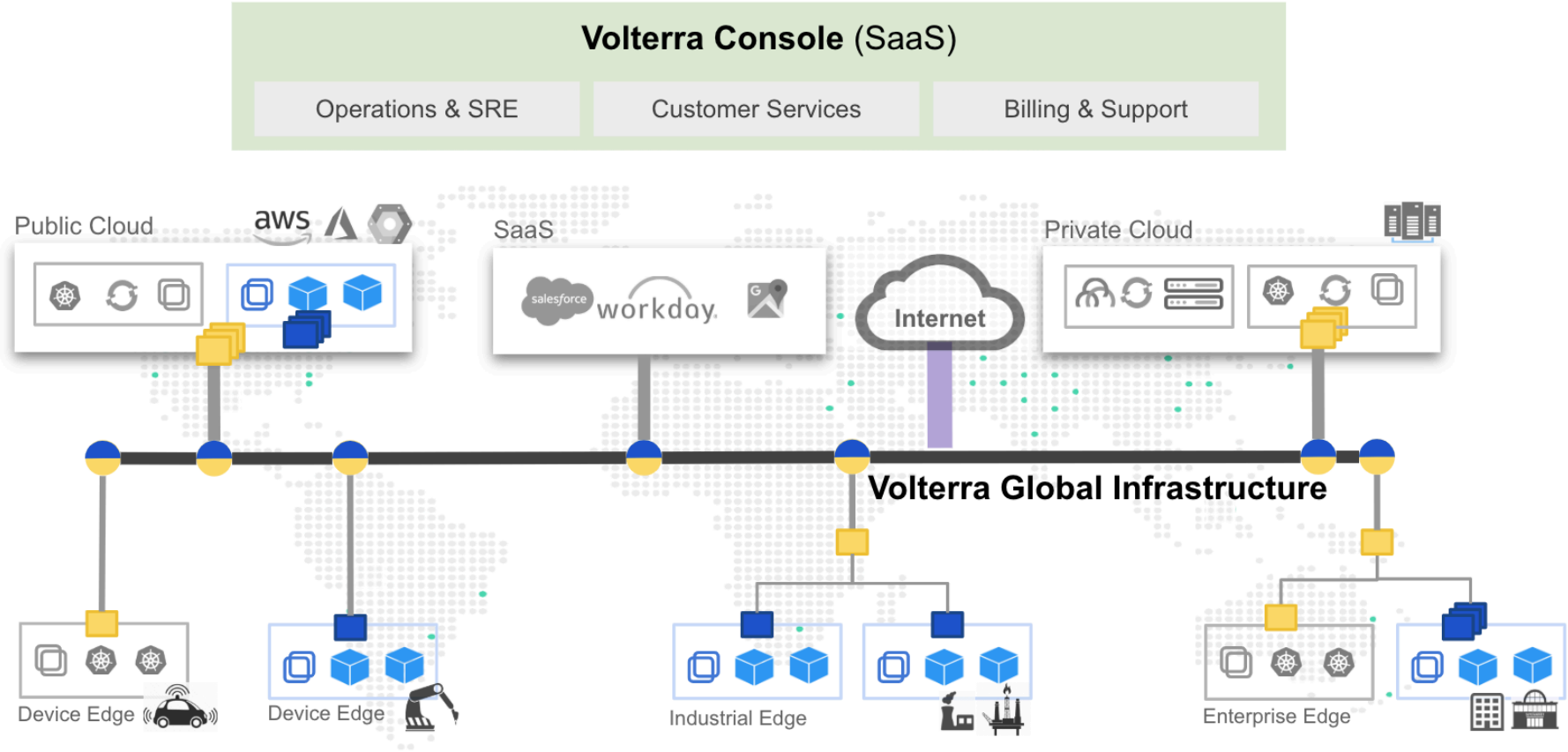
Identity Boundary = Trust Boundary

2. Secure Minting and Delivery
   - What is the “blast radius” of a compromised authority?
   - Can the compromise go unnoticed?
   - Who generated or has access to the identity secrets?
     - Private key generated outside of the pod
     - Private key accessible by anyone other than the pod
   - Does the delivery method limit where it can be used?

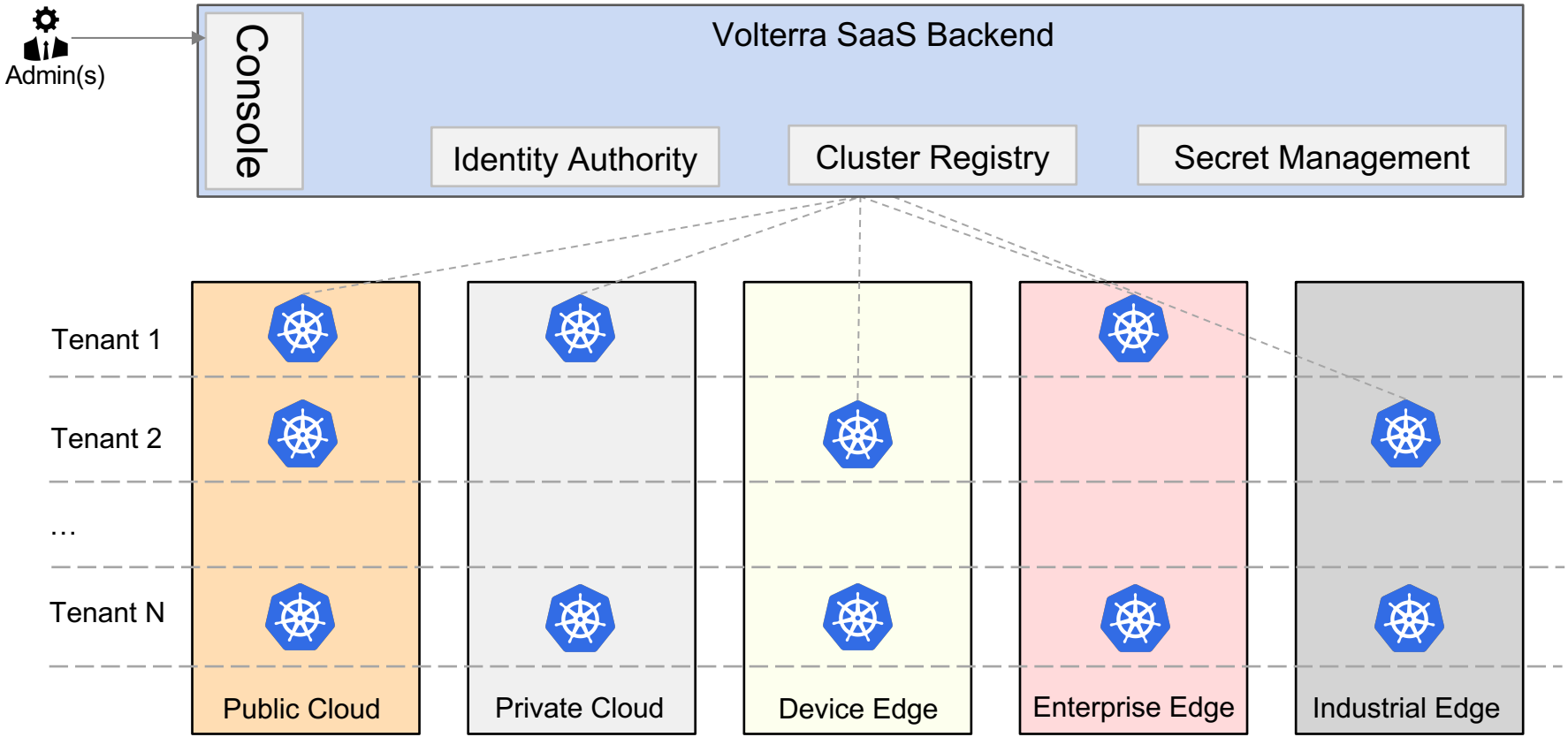
A solid identity solution should keep identity-related cryptographic material ***within*** the trust boundary (pod).

3. Rich, Usable, and Extensible
    - What all does the identity credentials contain?
    - How usable is it without changing current practices?
    - How easy is it to extend the identity credentials?

Identity Bootstrapping in Multi-Cluster – Volterra's take



Identity Bootstrapping in Multi-Cluster – Volterra's take – Simplified View



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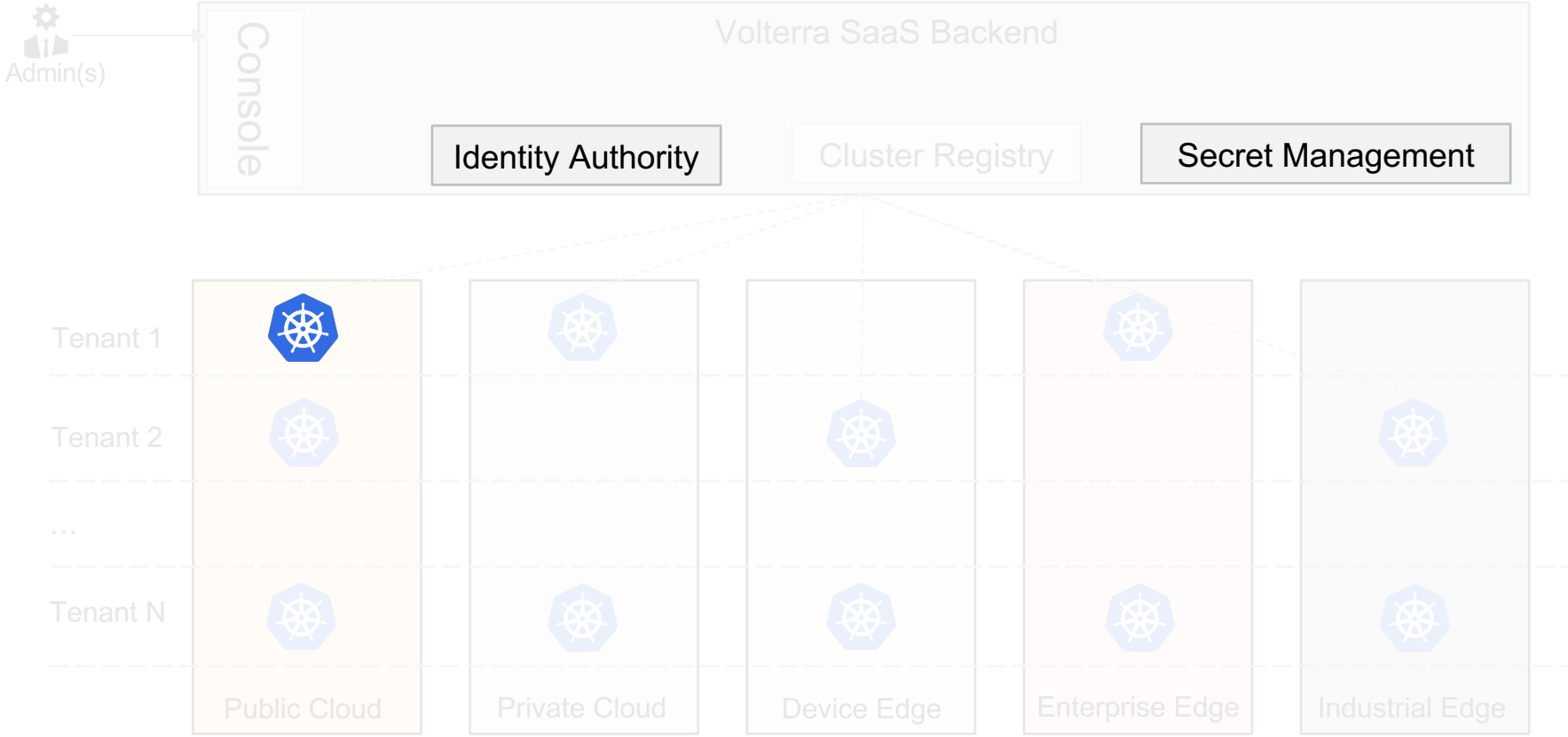
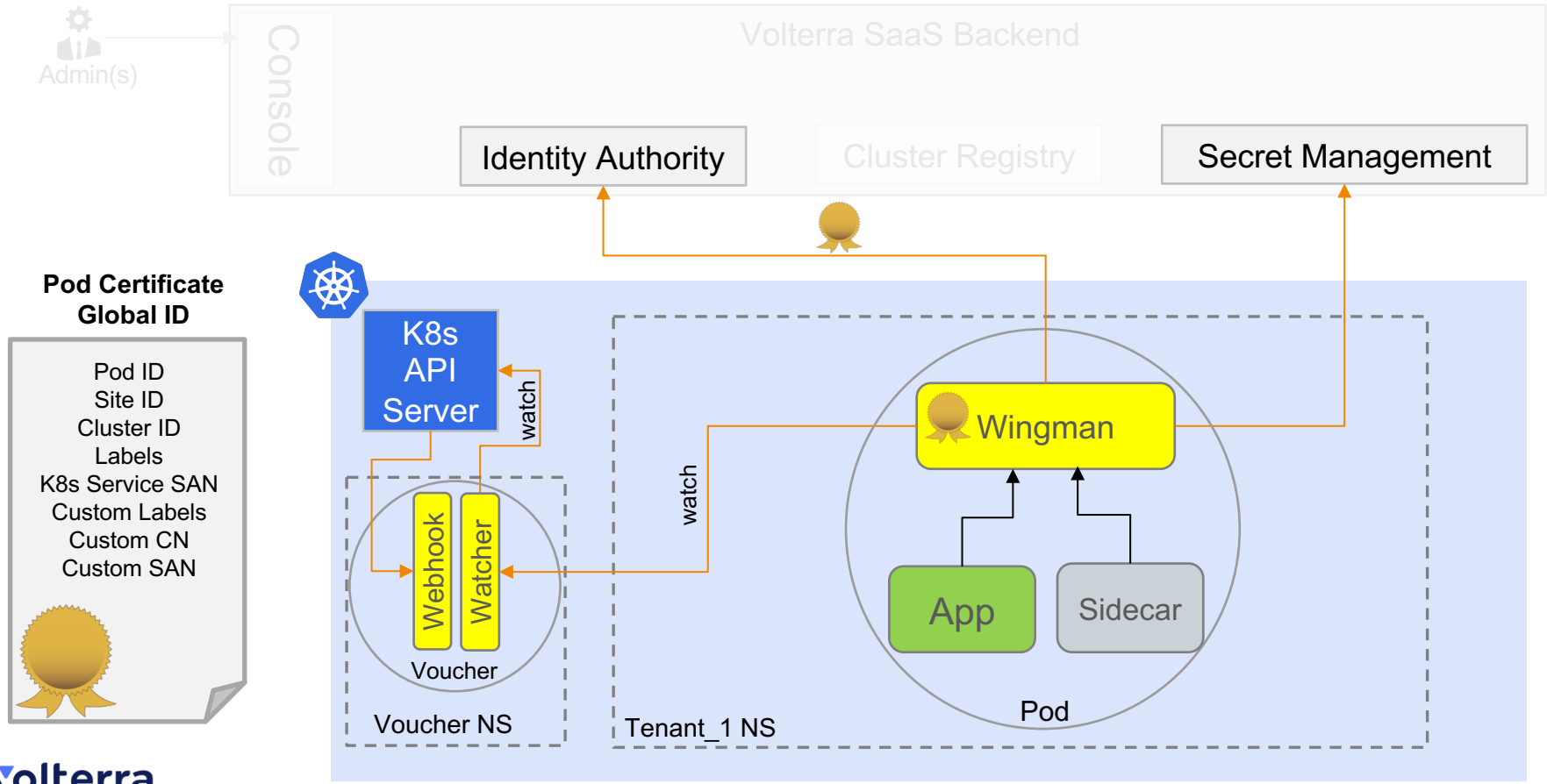
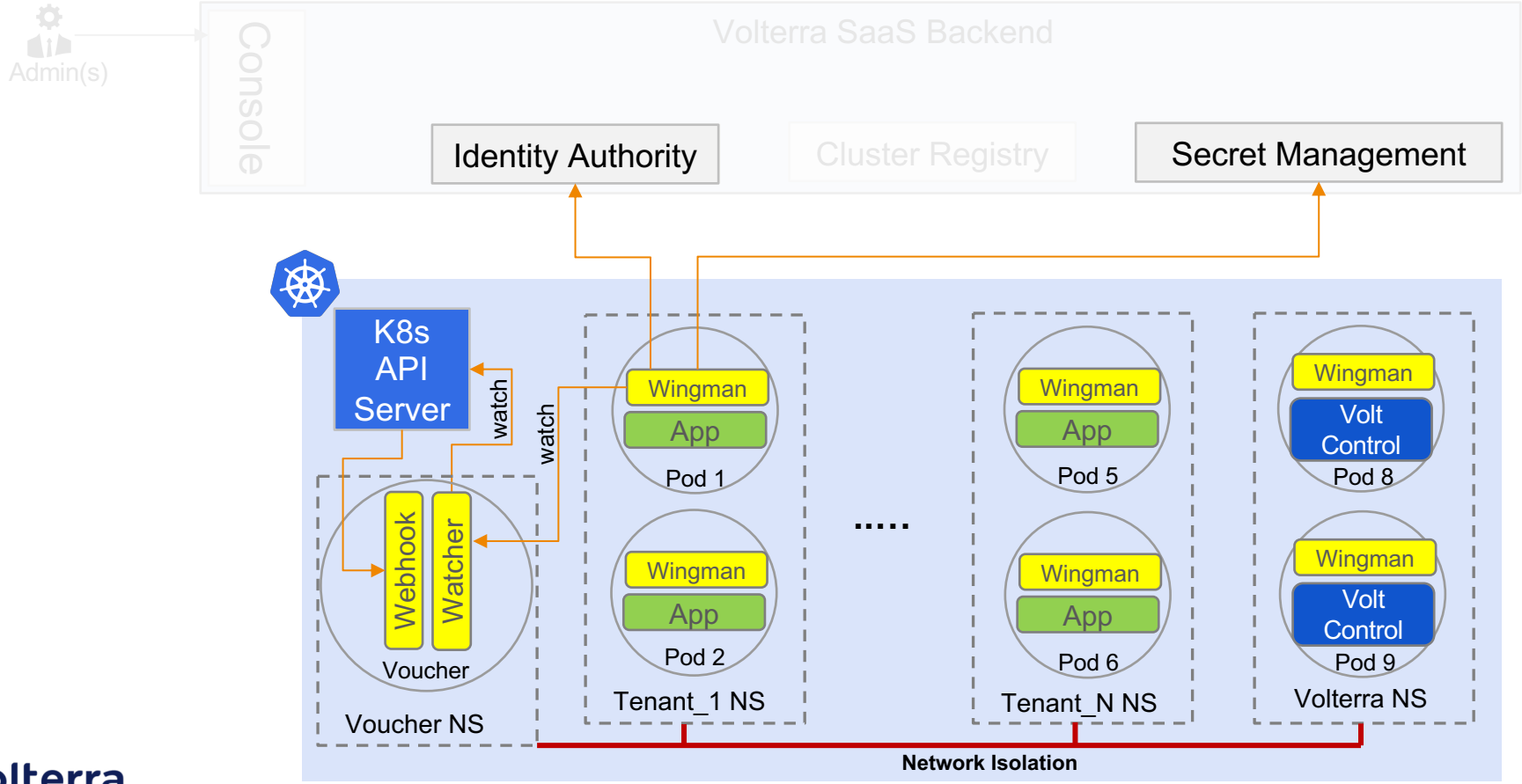
Identity Bootstrapping in Multi-Cluster – Volterra's take



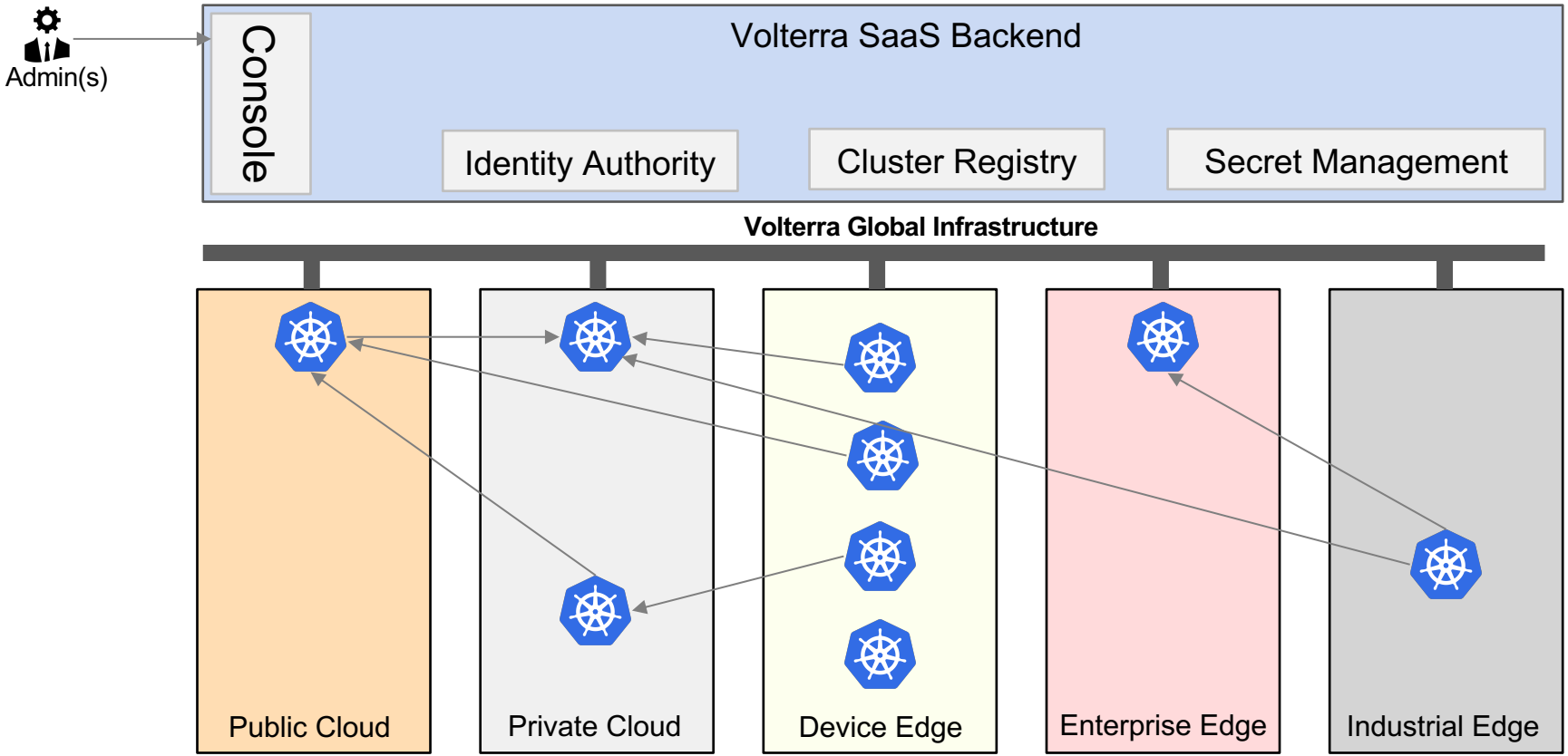
Identity Bootstrapping in Multi-Cluster – Volterra's take – Pod view



Identity Bootstrapping in Multi-Cluster – Volterra's take – Cluster view

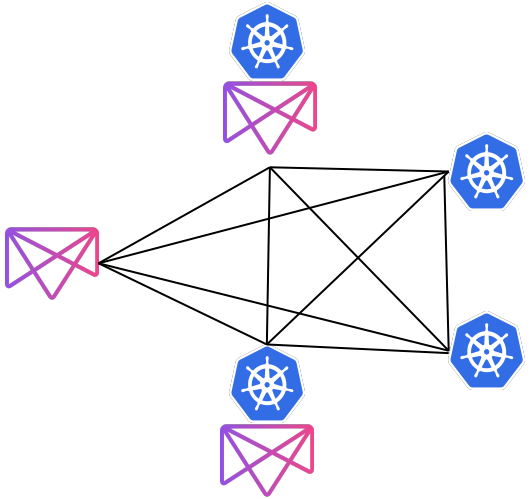


Identity Bootstrapping in Multi-Cluster – Volterra's take – Tenant View



Customer Perspective: Managing Access and Secrets across Multiple Clusters

- Multiple standalone clusters
  - Mesosphere DC/OS, Kubernetes, and Kubernetes on DC/OS
  - Multiple locations, multiple islands
- Cluster-level secrets management
  - Standard Kubernetes secrets
  - DC/OS Enterprise with embedded Vault
- Global secrets management through Vault
  - Single source of truth for secrets



Customer Perspective: Managing Access and Secrets across Multiple Clusters

- Possible solutions and their drawbacks
  - Homegrown integration
    - Development/maintenance costs
    - Limited by capabilities of cluster-level tools
  - Third-party container security software (Aqua, Twistlock)
    - Immature
    - Complexity/performance
    - Proprietary vendor software accessing secrets

Customer Perspective: Managing Access and Secrets across Multiple Clusters

- Feature requirements
  - Big picture: centralized management of secrets across multiple environments in multiple sites
  - Small picture: fine-grained control over secrets access and other access policies
  - Volterra provides centralized, cross-cluster management to cover the big picture and global identity management to cover the small picture

Quick Recap

- Solid Identity
  1. Granular
     - Pod, Not Namespace, Not Service Account, Not Service
  2. Securely Minted/Delivered
     - Private key always inside the pod, Limit blast radius
  3. Rich, Usable, Extensible
     - Readily usable format, Not tied to specific usage

Take Away

- Identity bootstrapping is the foundation of modern security
- Abstract away identity provisioning from K8s
- Multi-cluster deployments turn *cumbersome* into *unmanageable*
- Understand the risks of prescriptive solutions
- Secrets are called Secrets for a reason. Do not let others ever hand them to you.

Thank you!

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