HashiCorp Consul

Consul Onboarding Program

COBRA Team | HashiCorp Customer Success

October 2022

Agenda

1. Welcome
2. Consul Onboarding Program
3. Consul Overview
4. Key Concepts
5. Consul Architecture
6. Project Success Considerations

Code of Conduct

HashiCorp is dedicated to providing a harassment-free Consul Enterprise onboarding experience for everyone, regardless of gender, gender identity, sexual orientation, disability, physical appearance, body size, race, national origin, or religion. We value your attendance and do not wish anyone to feel uncomfortable or threatened at any time.

The bottom line is that we do not tolerate harassment of conference participants in any form. Harassment includes but is not limited to offensive verbal comments related to gender, gender identity, sexual orientation, disability, physical appearance, body size, race, national origin, religion; sexual or inappropriate images in public spaces; deliberate intimidation; stalking; trolling; sustained disruption of talks or other events; and unwelcome sexual attention. Participants asked to stop any harassing behavior are expected to comply immediately. If you are being harassed, notice that someone else is being harassed, or have any other concerns, please let the HashiCorp event representative know immediately or email customer.success@hashicorp.com.

HashiCorp Consul

Consul Enterprise Onboarding Program

HashiCorp Consul Enterprise Onboarding Journey

A 5-week guided community program following a prescriptive path to successfully onboarding and adopting Consul

- Week 1 - Kickoff - Introduction to Consul & Architectural Basics
- Week 2 - Webinar - Consul Foundations
- Week 3 - Webinar - Consul Deployment & Operations
- Week 4 - Office Hours
- Week 5 - Webinar - Advanced Concepts
- Exit Ramp and Operational Readiness Check

Onboarding Goal

Our objective is to make you successful with our products and see value within 90 days

Consul Installed

- Consul Enterprise installed in your environment
- Basic configuration completed
- Telemetry and monitoring in place
- Deployment and operational patterns established

Consul Operational

- 3+ foundational use cases in place
  - Service Catalog
  - Service Health Checking
  - Service Discovery
  - Consul DNS
  - Consul Key Value store
- A roadmap created for onboarding additional use cases (Service Mesh track or NIA track).

Completed within 90 days

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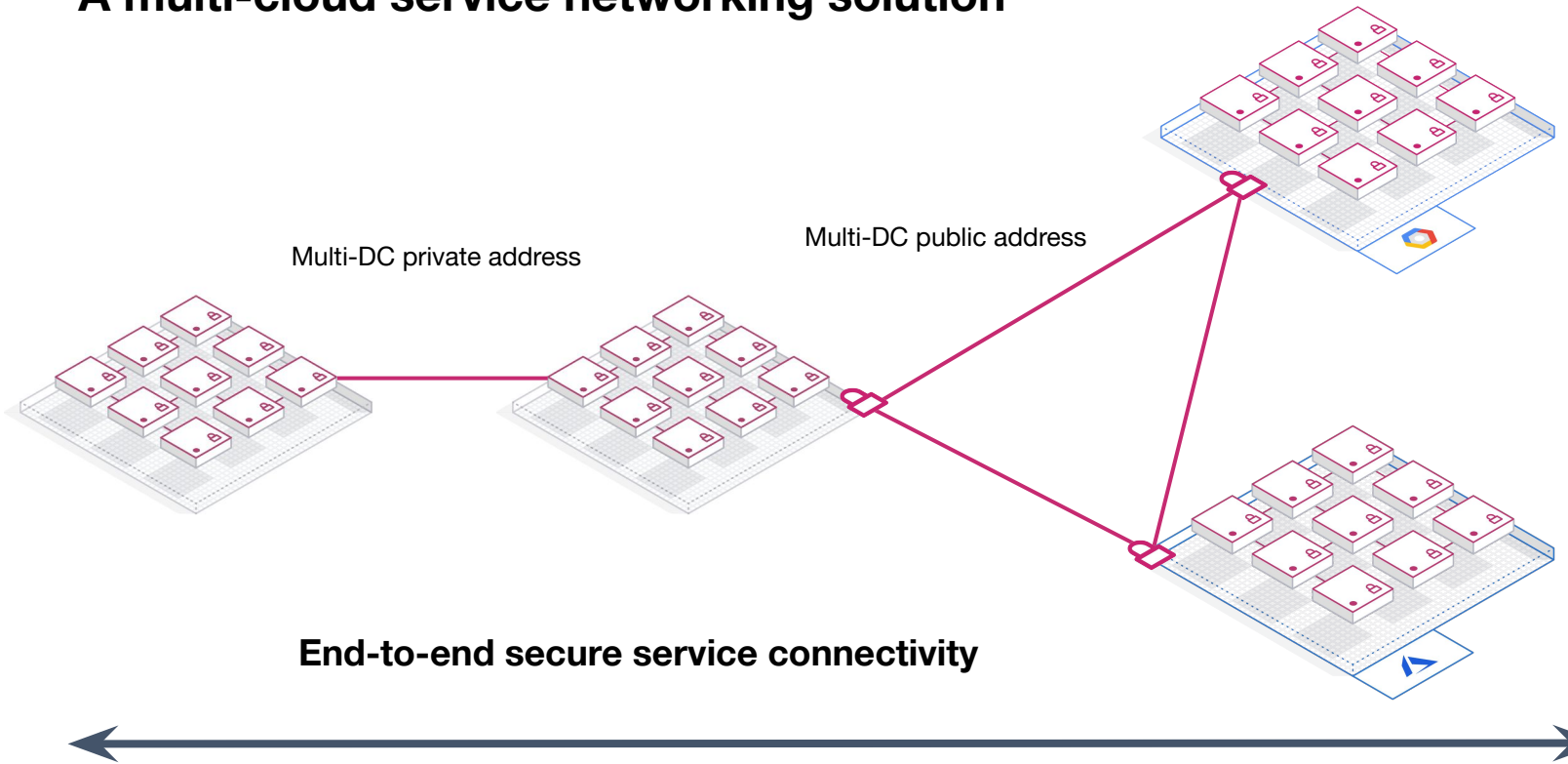
Consul Overview

What is Consul?

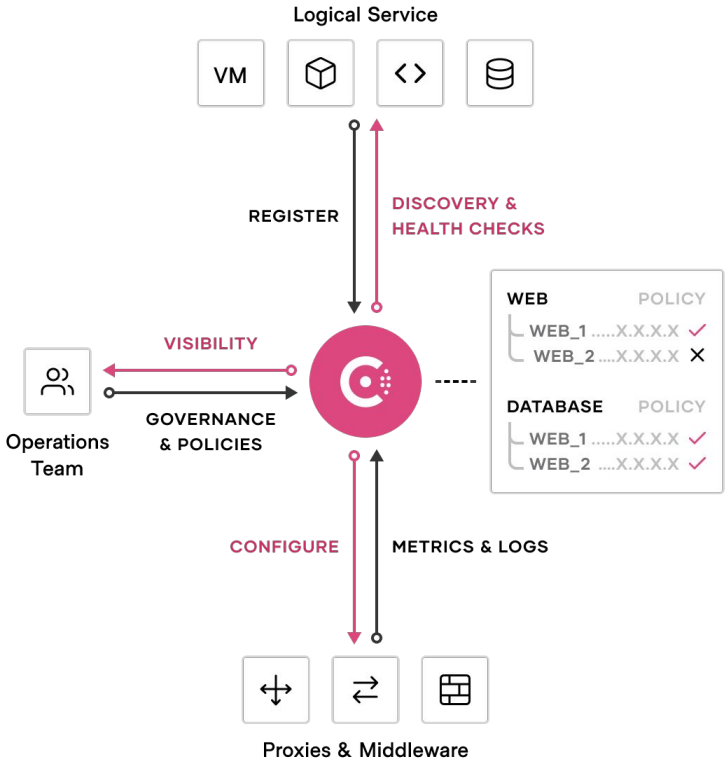
A multi-cloud service networking solution



Service Networking

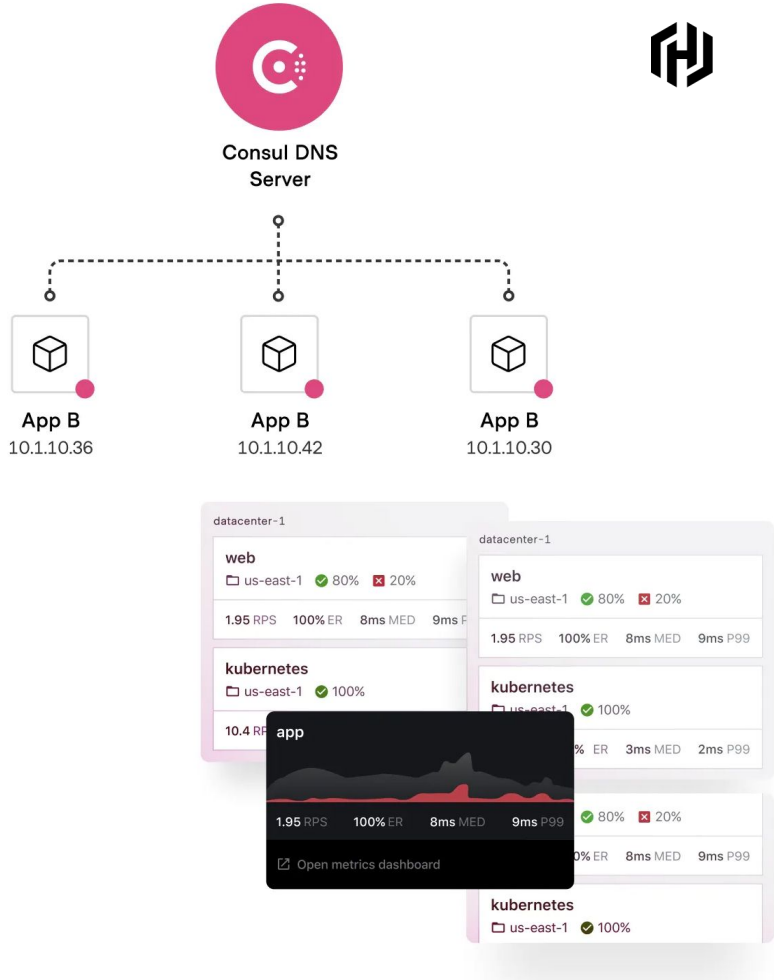
Discover and securely connect any service on any cloud or runtime

- **Discover**
  - Service discovery and health checks
- **Connect**
  - Service Identity
  - Service mesh to connect and secure services
  - Governance
  - Observability + Resiliency
  - Layer 7 traffic shaping
- **Automate**
  - Network Infrastructure Automation
- **Access**
  - Control access into and out of the service mesh with the API Gateway



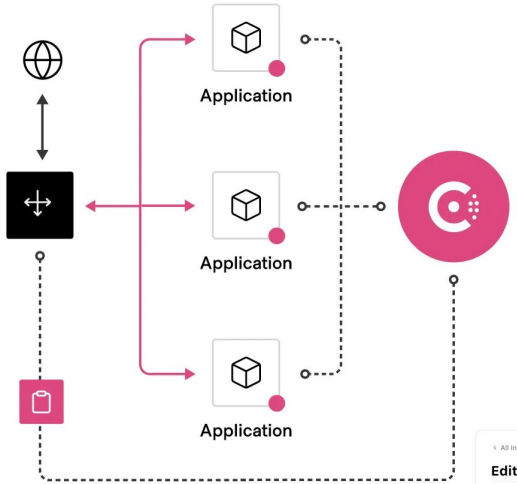
Service Discovery

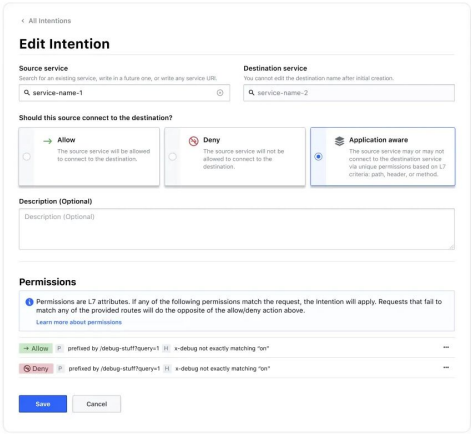
- Centralized catalog to register, track, discover, and monitor services
- Single source of truth for all services
- DNS and API access for service registration
- Health checks for systems and applications



Load Balance and Manage Traffic

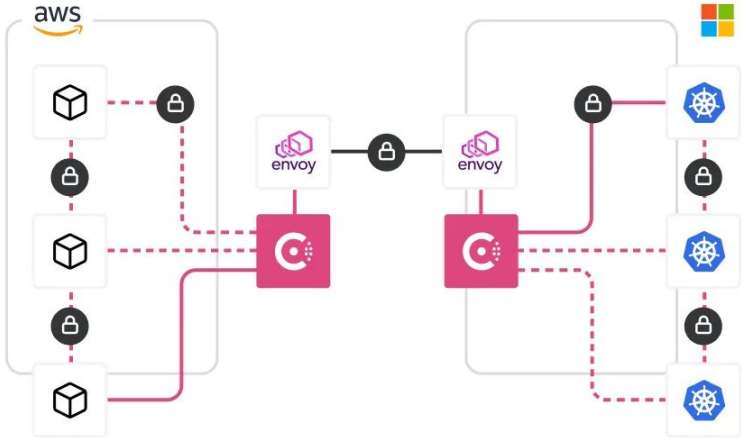
- Works as an L4/L7 load balancer
- Integrates with NGINX, HAProxy, and F5 for automatic service updates
- Single control plane for east/west and north/south traffic
- Deployment patterns include:
  - A/B test
  - Blue/green
  - Soft multi-tenancy (prod/qa/staging sharing compute resources)





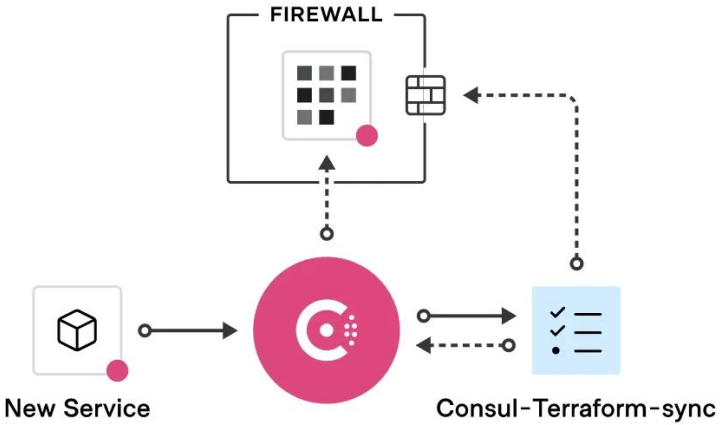
Zero Trust Networking

- Service mesh provides identity-based access and mTLS for all service to service communication
- Consul supports multiple Certificate Authorities (CAs)
- Service intentions secure service communications



Network Infrastructure Automation

- Automate networking tasks and configuration changes
- Triggers include:
  - Service scaling (up and down)
  - Service port changes
  - Health changes
  - Metadata changes



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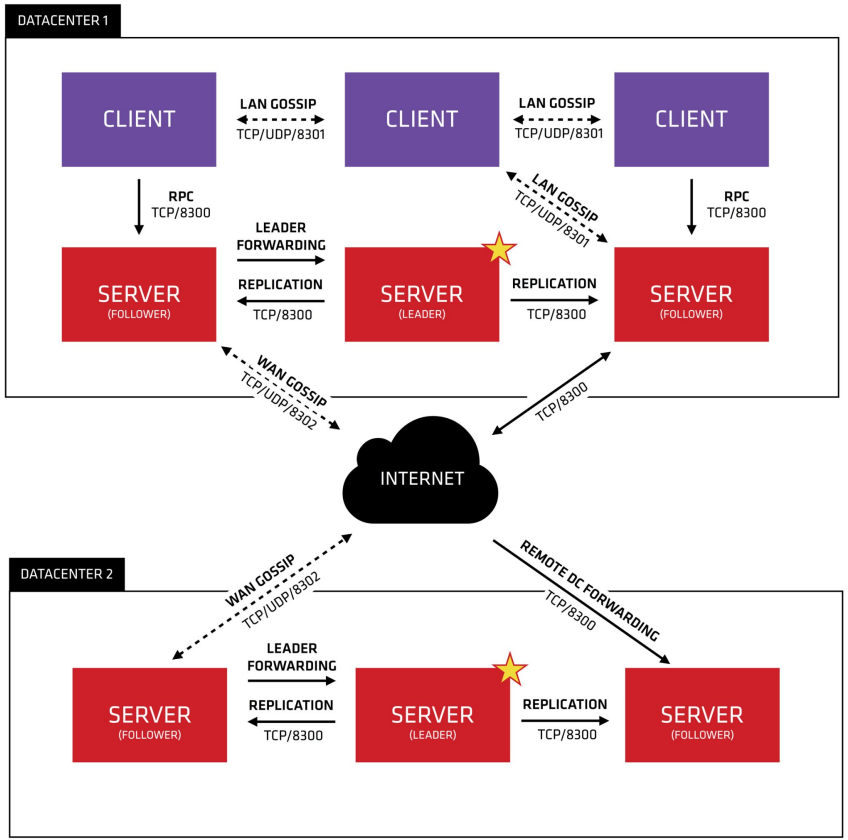
Consul Key Concepts

Consul Key Concepts

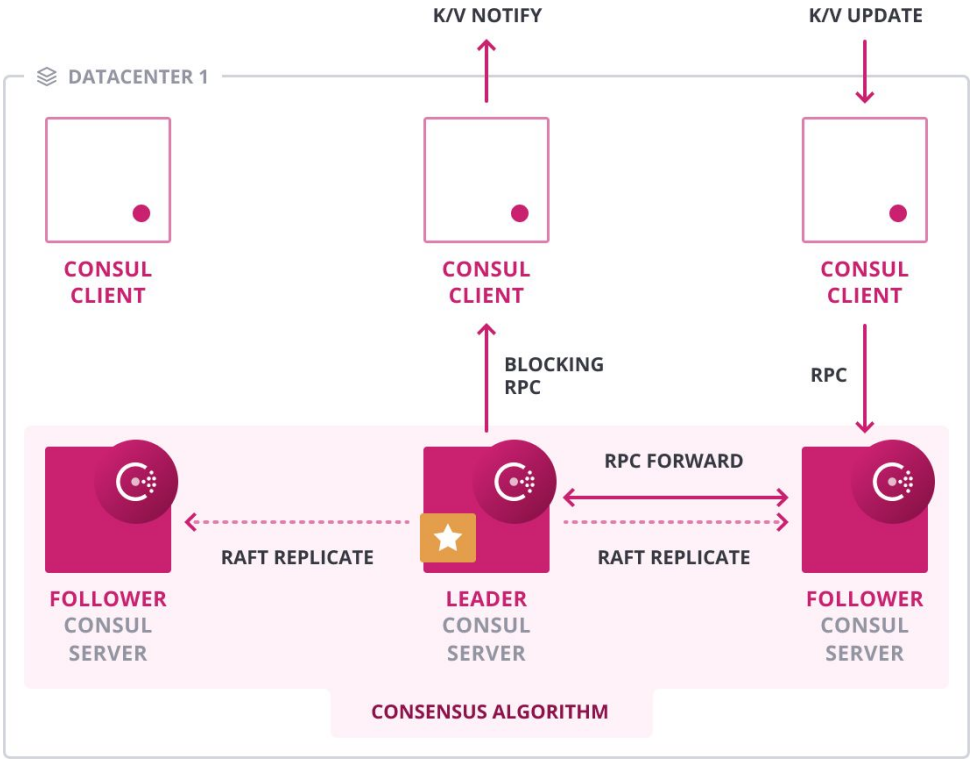
- Consul Servers & Clients
- Consul Clusters
- LAN Gossip Pool
- Consul Datacenters
- WAN Gossip



Consul Servers & Clients

Consul Servers

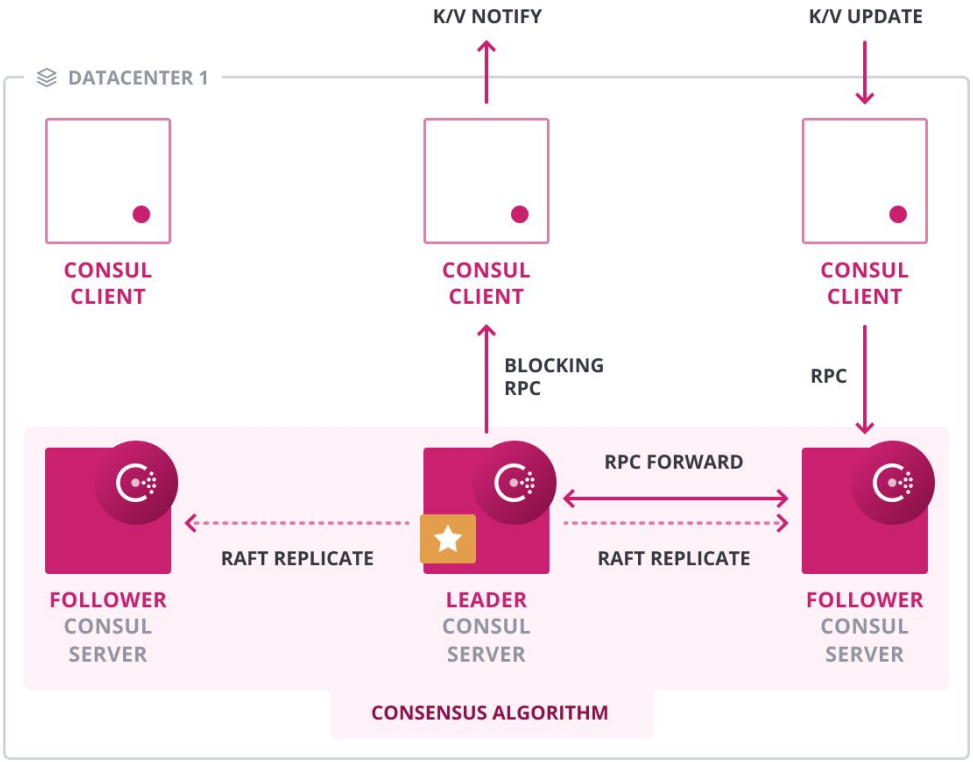
- Hold Key/Value store, Sessions, ACLs, Prepared Queries, Intentions
- Enforce ACLs for reading and writing access
- Use Raft protocol to provide consistency
- Enhanced read scalability provides for scaling of reads without impacting write latency
- Collate health check data from clients



Consul Servers & Clients

Consul Clients

- Register services & checks
- Hold service registration and health check data
- Determine pass/fail of checks and sync to Consul servers
- Authoritative source of truth for configured checks it is managing

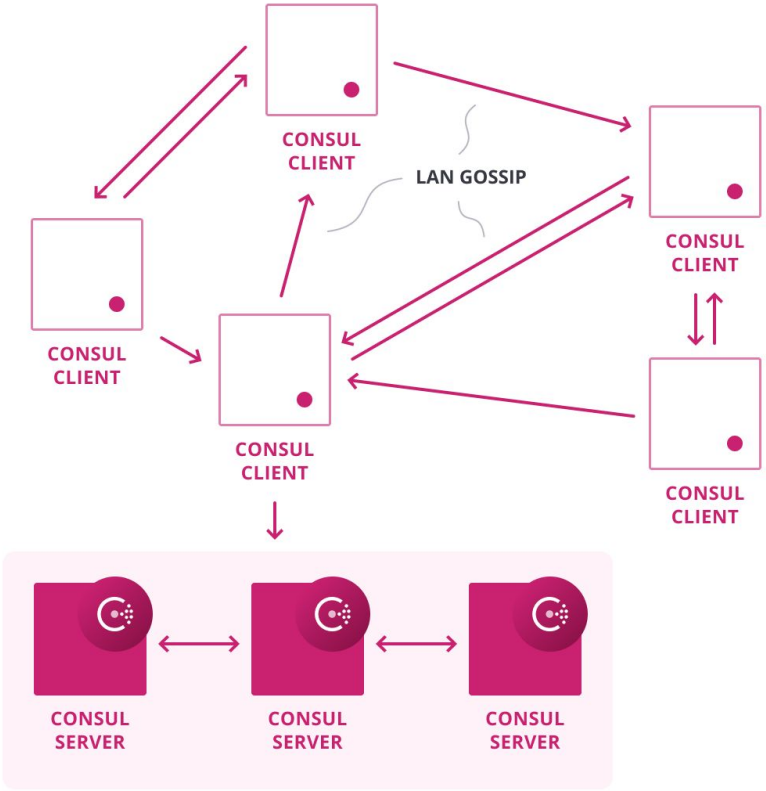


Consul LAN Gossip

Each datacenter has a **LAN gossip pool** containing all members, both clients and servers

Responsible for:

- Membership information allows clients to automatically discover servers
- Distributed failure detection avoids concentrating the load on a few servers
- Reliable and fast event broadcasts



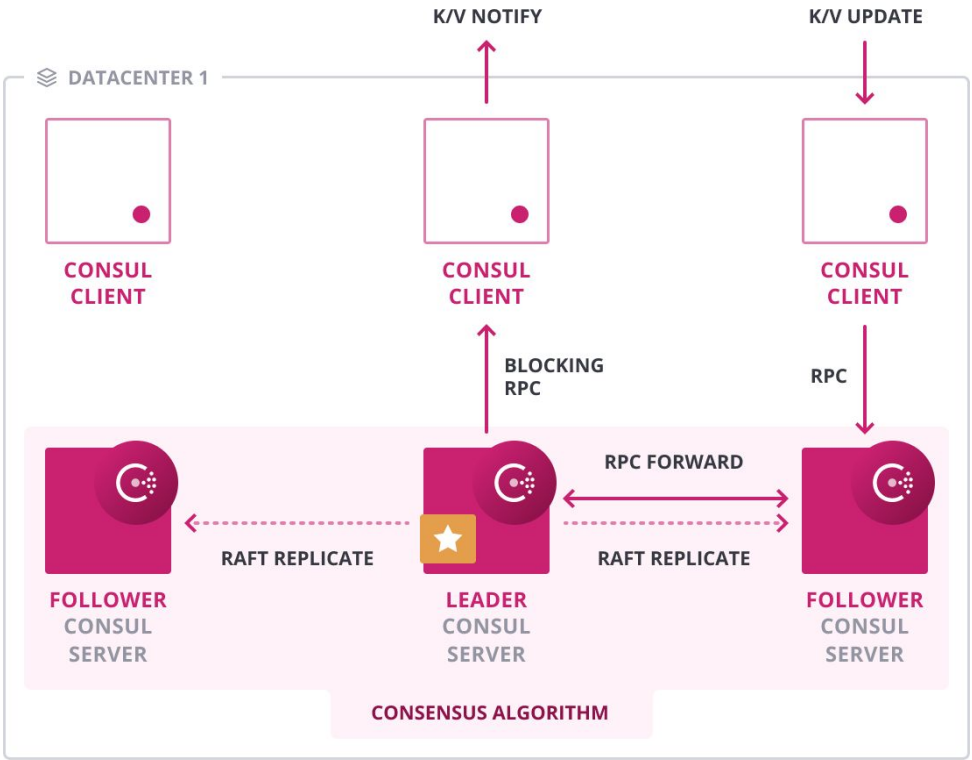
Consul Datacenters & Clusters

Consul Datacenter

- Smallest unit of Consul infrastructure that can before basic Consul operations
- Contains at least one Consul server, typically 3+ server nodes and client agents

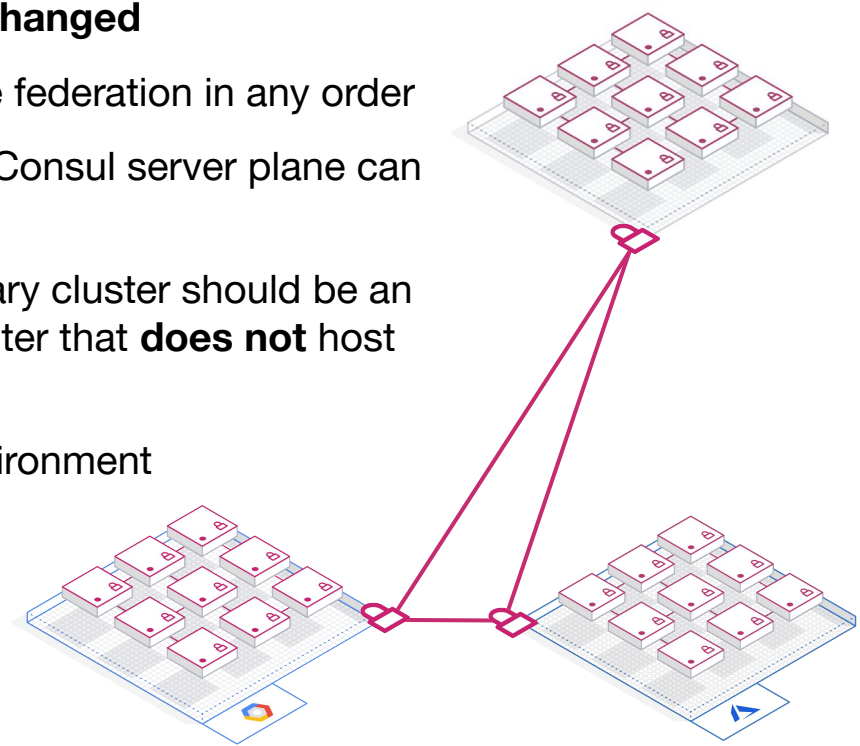
Consul Cluster

- A collection of agents that are aware of each other, often used interchangeably with datacenter
- In some contexts is only a collection of client agents

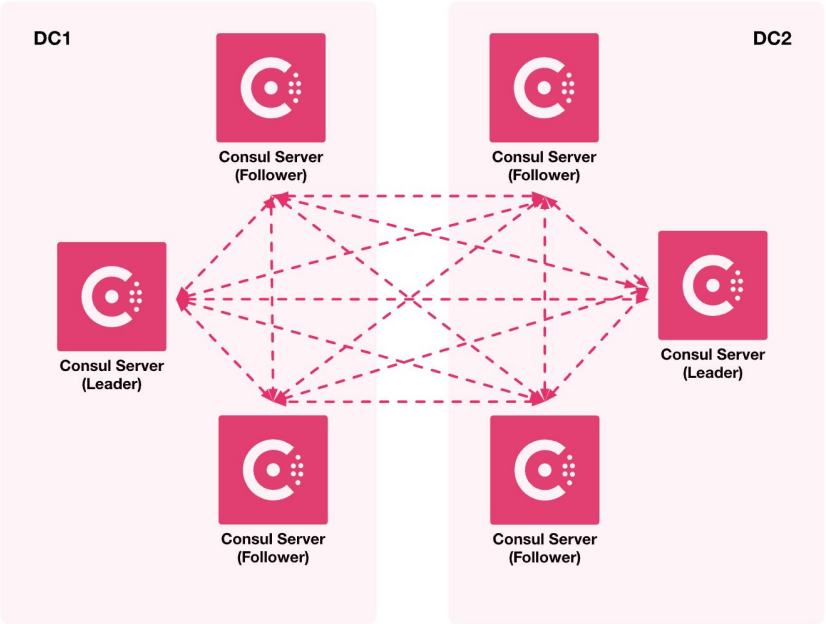


Consul Datacenter Creation

- The **first Consul datacenter** created in a federated deployment will be the primary Datacenter and **cannot be changed**
- Additional data centers can be added to the federation in any order
- When running Consul in Kubernetes only 1 Consul server plane can be deployed per Kubernetes Cluster
- In medium and large deployments the primary cluster should be an operational and administrative-only datacenter that **does not** host services
- Upgrade pattern for a federated Consul environment



WAN Gossip



- Designed for loose coupling between Consul datacenters and optimized for typical Internet latency
- Enables Consul servers to exchange information like addresses and health status
- Gracefully handles loss of connectivity in the event of failure in connectivity, etc
- Typically uses UDP/TCP 8302

Architecture

Consul Installation

What do we need to decide?

1

Cluster Platform

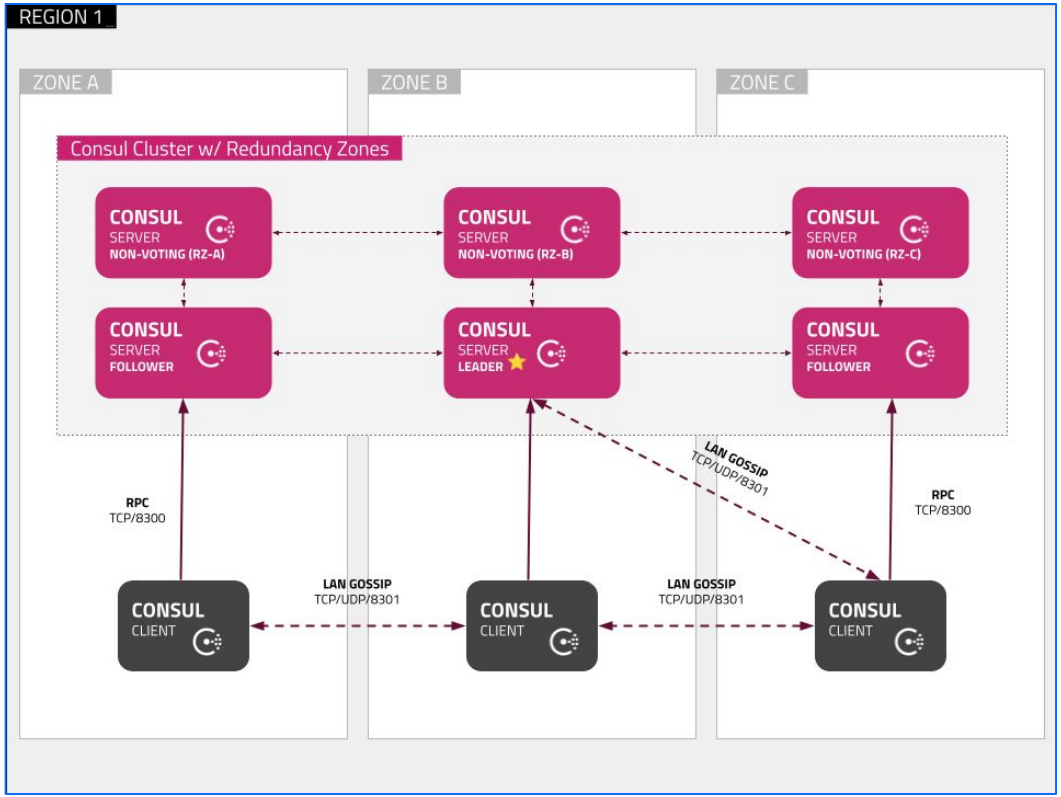
- Virtual Machines
- Bare Metal
- Containers
- Kubernetes

2

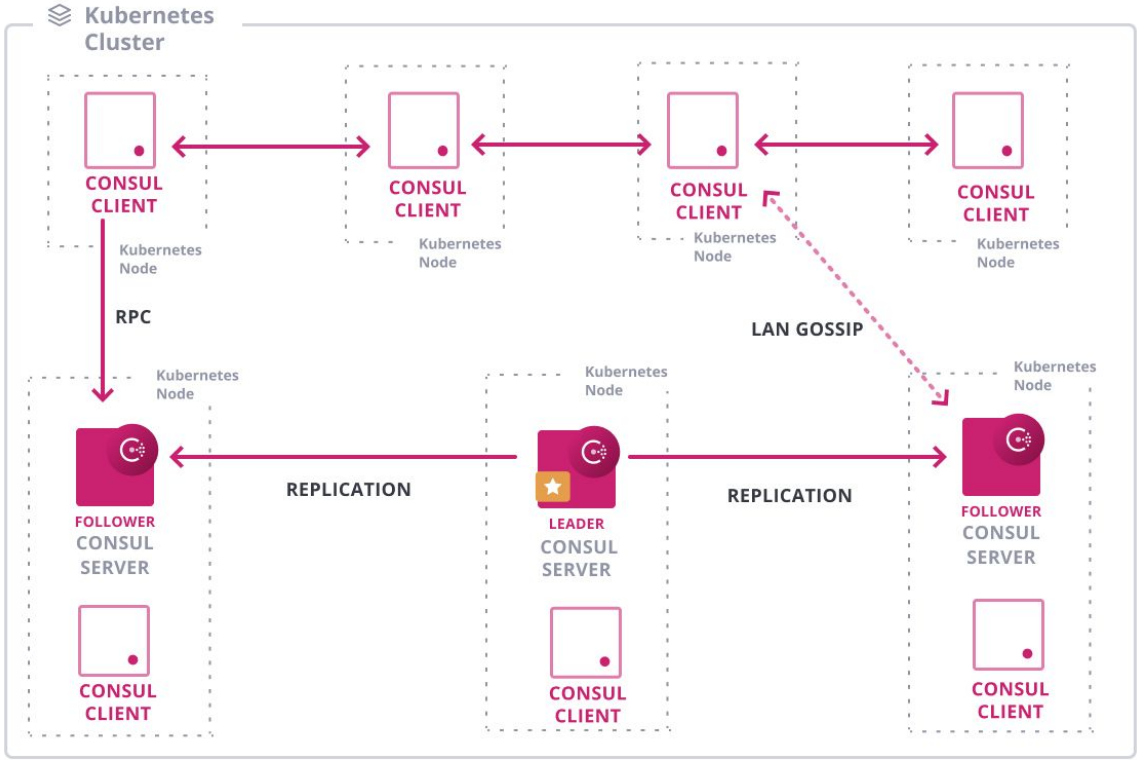
Deployment Pattern

- Static vs. Immutable
- Automation and upgrade pattern
- Sizing
- Agent locations

VM or Bare Metal Deployment

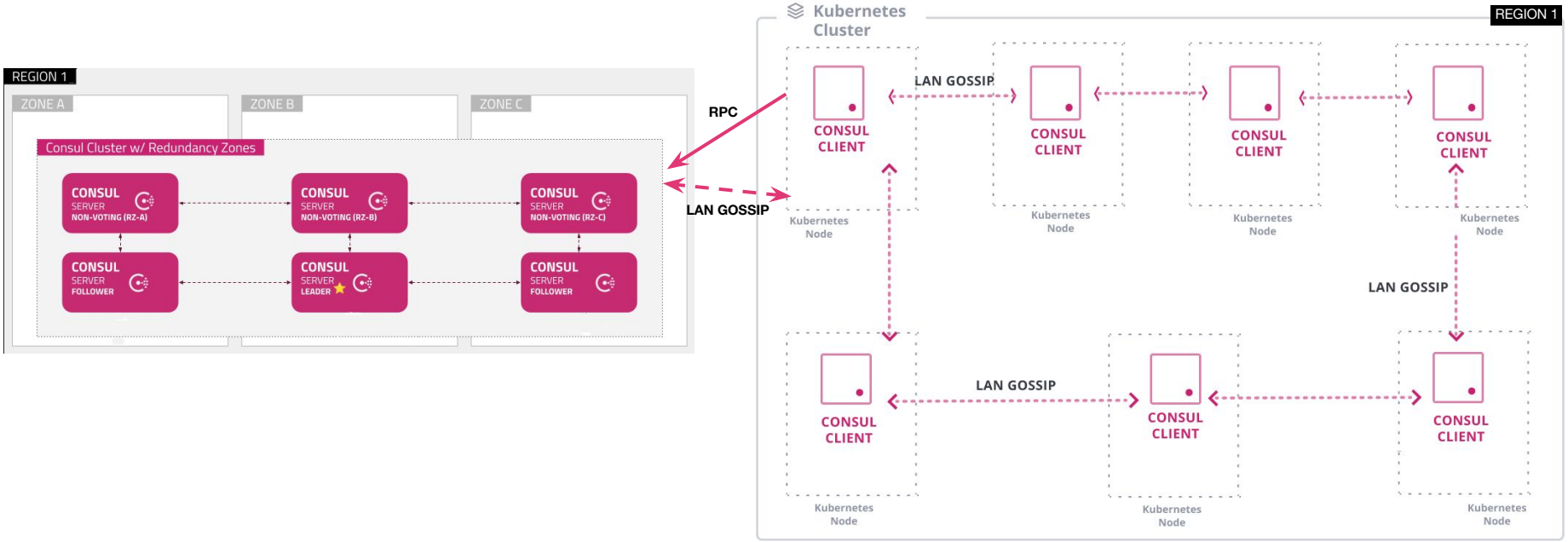


Kubernetes Deployment Patterns



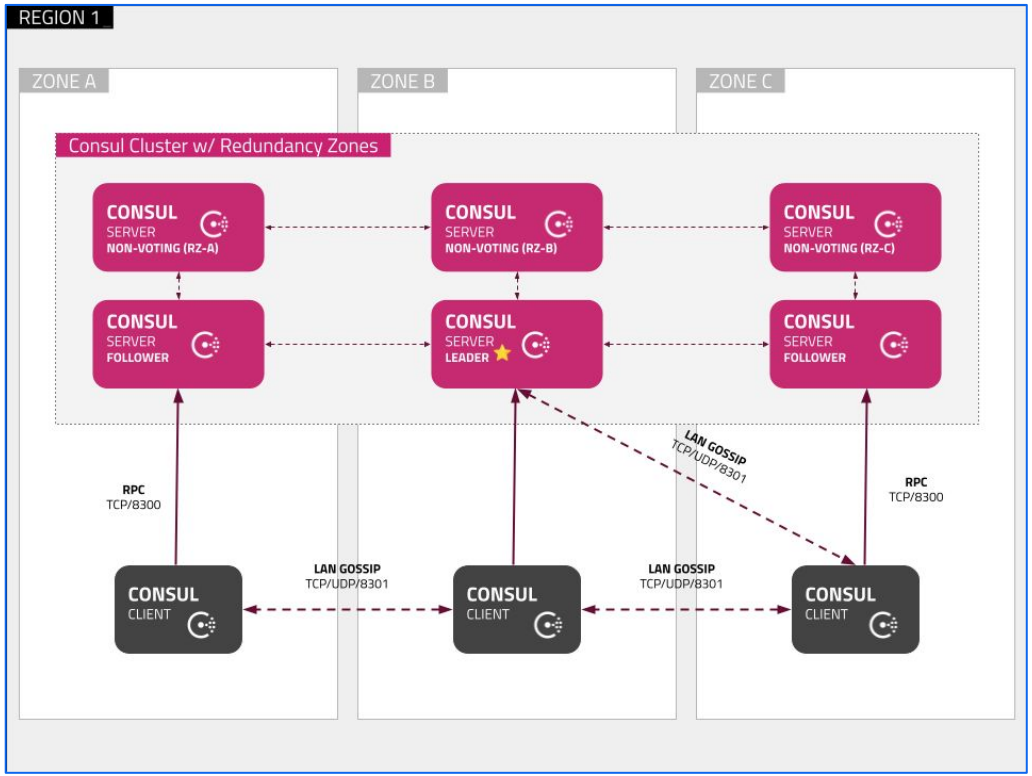
Consul Deployed inside Kubernetes

External Kubernetes Deployment



Consul Enterprise Reference Architecture

- Provides a highly resilient and scalable deployment for a single Consul cluster
- 6 node cluster with 3 non-voting nodes is capable of withstanding the loss of two nodes or an entire Availability Zone (AZ)
- Uses Consul Enterprise Autopilot and non-voting nodes for redundancy
- [Consul and Kubernetes Deployment Guide]



Sizing

Per instance sizing recommendations

	Small (Dev/Test/Staging/QA)	Large (Production)
CPU	2 - 4 Core	8 - 16 Core
Memory	8 - 16 GB RAM	32 - 64 GB RAM
Disk Capacity	100+ GB	200+ GB
Disk IO	3000+ IOPS	7500+ IOPS
Disk Throughput	75+ MB/s	250+ MB/s
AWS	m5.large, m5.xlarge	m5.2xlarge, m5.4xlarge
Azure	standard_d2s_v3, standard_d4s_v3	standard_d8s_v3, standard_d16s_v3
GCP	n2-standard-2, n2-standard-4	n2-standard-8, n2-standard-16

Network Connectivity

Name	Port / Protocol	Source	Destination	Description
RPC	8300 TCP	All agents (client & server)	Server agents	Used by servers to handle incoming requests from other agents
Serf LAN	8301 TCP & UDP	All agents (client & server)	All agents (client & server)	Used to handle gossip in the LAN. Required by all agents
Serf WAN	8302 TCP & UDP	Server agents	Server agents	Used by server agents to gossip over the WAN to other server Agents. Only used in multi-cluster environments.
HTTP/HTTPS	8500 & 8501 TCP	Localhost of client or server agent	Localhost of client or server agent	Used by clients to talk to the HTTP API. HTTPS is disabled by default.
DNS	8600 TCP & UDP	Localhost of client or server agent	Localhost of client or server agent	Used to resolve DNS queries.
gRPC (Optional)	8502 TCP	Envoy Proxy	Client agent or server agent that manages the proxies service registration	Used to expose the xDS API to Envoy proxies. Disabled by default.
Sidecar Proxy	2100 - 21255 TCP	All agents (client & server)	Client agent or server agent that manages the proxies service registration	Port range used for automatically assigned sidecar service registrations.
Mesh Gateway	8443* or 443* TCP	Varies	Services enabled for connectivity	*This port is configurable, the Helm chart uses 443 as a default for external services, 8443 is commonly used for traffic from Load Balancer to client nodes

Network Latency & Bandwidth

- LAN gossip occurs between all agents in a Consul datacenter. Client and Server agents participate in the gossip.
- LAN gossip is latency dependant, for a cluster to stay in sync, network latency between availability zones is required to be less than **eight milliseconds (8 ms)**.
- Network bandwidth consumed by Consul is entirely dependant upon environment specific usage patterns. In many cases, even a high request volume will not translate to a large amount of network bandwidth consumption. **All data** written to Consul will be **replicated across all server agents**. It's is important to consider bandwidth requirements to other external systems such as monitoring and logging collectors.
- Environment specific DNS Forwarding and DNS Caching considerations need to be included in architecture planning.

Key Consul Success Considerations

prepare for the upcoming weeks

Use Case Considerations

- What are the major problems/challenges/workflows that Consul is solving for?
  - What is the current solution in place?
  - What changes, improvements, is Consul solving?

- What are organizational goals for Consul?
  - Near term
  - Long term

- What is the rollout plan?
  - Where will the first deployment be?
  - How many data centers are planned?

Cluster Architecture Considerations

- Where will Consul be deployed?
- What integrations with external services or external tooling need to be implemented during the project (example Kubernetes clusters).
- Where are the target applications for the initial use case hosted? What are the networking and connectivity requirements for these target applications?
- What are the target Disaster Recovery RPO and RTO?
- What CA will be used to provide Consul certificates for mTLS?
- Are there any noteworthy regulatory constraints in the environment that need to be considered?

Your Success Metrics

- What are **your** short term goals for the rollout of Consul?
  - What are the must-haves?
  - What metrics are being used to gauge the success of this project?

- What are **your** longer term goals for the rollout of Consul?
  - Are there particular features that are planned to be adopted?
  - Are there particular business problems that Consul is going to solve?

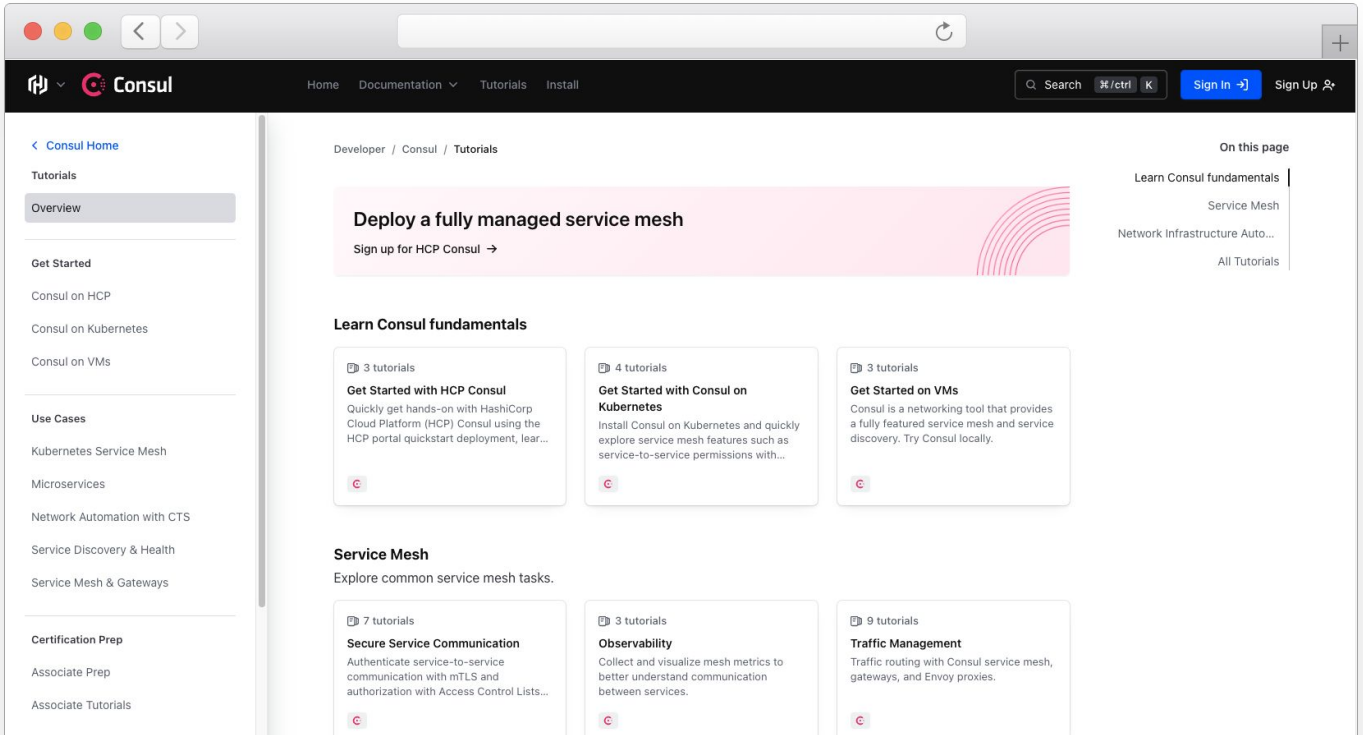
HashiCorp Consul

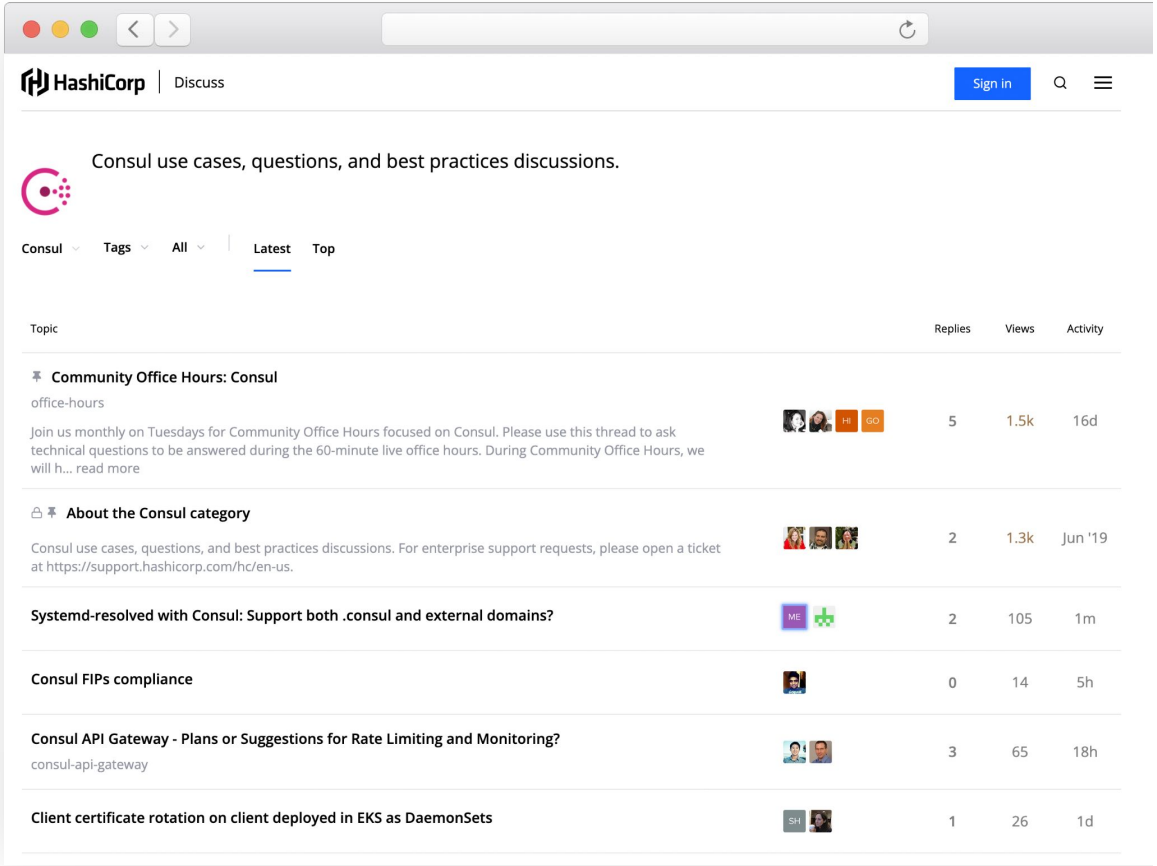
Resources

Tutorials

https://developer.hashicorp.com/consul/tutorials

Step-by-step guides to accelerate deployment of Consul





Discuss

Engage with the HashiCorp Cloud community including HashiCorp Architects and Engineers.

discuss.hashicorp.com

Need Additional Help?

Customer Success

Contact our Customer Success Management team with any questions. We will help coordinate the right resources for you to get your questions answered.

customer.success@hashicorp.com

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Technical Support

Something not working quite right? Engage with HashiCorp Technical Support by opening a new ticket for your issue at support.hashicorp.com.

HashiCorp Academy

Consul Enterprise Academy classes are virtual and delivered by a live instructor with in-depth Consul knowledge and implementation expertise.

Academy courses include a sandbox environment for hand-on experience in the 10 labs throughout the 3-day course.

Resources

- A Raft Consensus Primer - Secret Lives of Data
- Consul Reference Architecture
- Terraform starter code (VM installation)
  - AWS
  - Azure
  - GCP
- Consul and Kubernetes Reference Architecture
- Consul Helm Chart
- Terraform starter code for managed Kubernetes
  - AWS EKS
  - Azure AKS
  - Google GKE

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Next Steps

Up Next

Webinar: Consul Foundations

Authorized users for Support

Please email customer.success@hashicorp.com with your Support Contacts

Q & A

A Q&A will be held after this session

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Q&A

Thank You

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