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NORTH AMERICA
OPEN NETWORKING //
Integrate, Automate, Accelerate

March 26-29, 2018
Los Angeles, CA

Building Cloud Native, Web Scale, Deployable VNFs with Service Mesh Architecture

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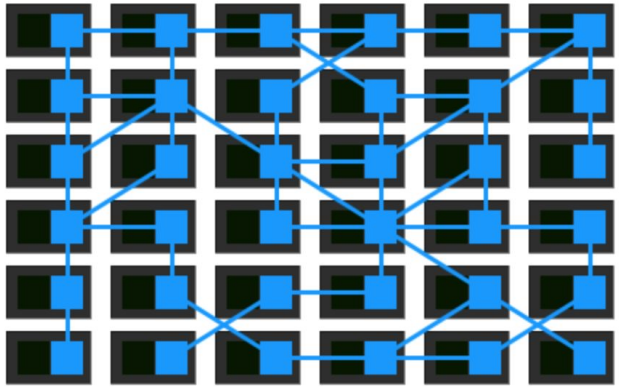
Motivation

1. Future Telecom Services, e.g. 5G's top use cases
    - 50 billion IoT devices by 2020
    - Exceptional user experience AR/VR
    - Ultra low latency services (extending cloud to the edge), autonomous vehicles
2. Zero Touch
    - ETSI ZSM
    - "DT: Brutal Automation is Only Way to Succeed" (Lightreading)
3. Application Innovation
    - Monetization with close user engagements
    - Data analytics driven automation and optimization

=> Call for Cloud Native, Web Scale, and Deployable VNFs

Cloud Native is more than containers or Kubernetes

- CNCF defines *cloud native* as
  - Containerized
  - Dynamically Managed by e.g. Kubernetes
  - *Micro-service oriented*
- *Micro-service oriented*
  - *The Service Mesh model (e.g. Istio, Conduit...)*



Control Plane

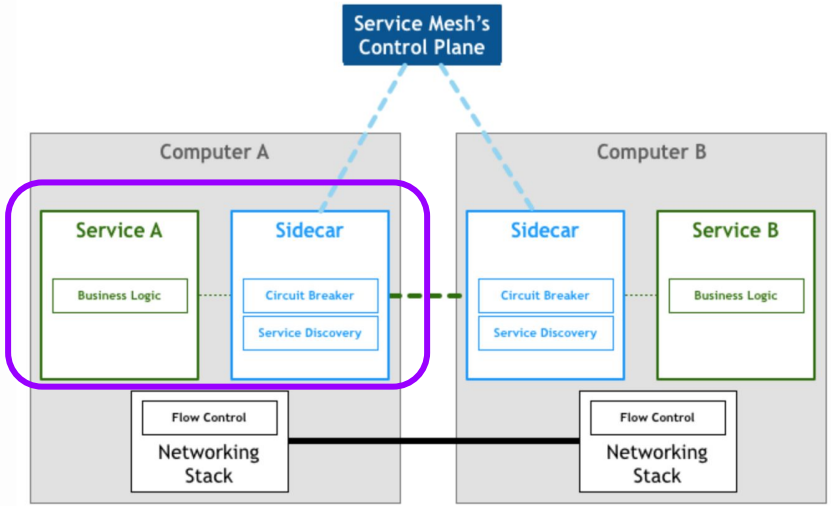


Diagram credit: http://philcalcado.com.

Design for Web Scale

- Scalability
  - Decouple infrastructure scaling from application development and scaling.
  - Enable traffic splitting, A/B testing, gradual rollout, Canary releases, mirroring etc. sophisticated automated operations.
- Reliability
  - Incorporate failure tolerance into the core framework
  - Adopt micro-services : reduce systemic risk, avoid failure cascading
  - Monitor everything : tracing, logging, event monitoring, ... *failure as events*
  - Implement common operation patterns such as traffic steering, circuit breaker, fault injection, failure isolation (bulkhead), ... for native fault tolerance. Again, *failure as events*.
  - Aim for 99.999% availability services

=> Service Mesh helps to achieve these goals *systematically*

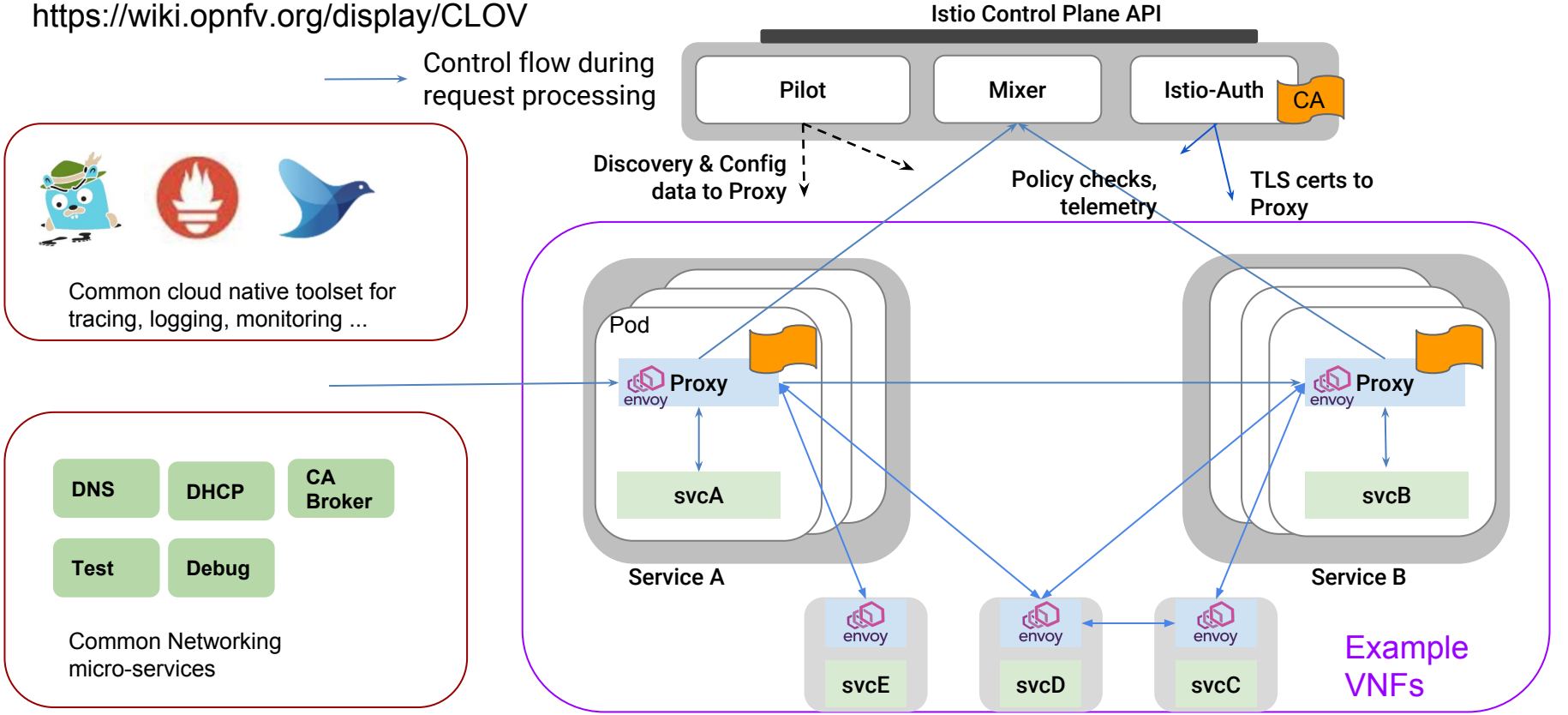
Design for Deployability

- Micro-services with Service Mesh
  - Are easier to be independently developed *right,* deployed/operated *right*
  - Reduce risk, simplify failure modes, enable automation
  - Provide unified toolsets and control
  - Provide uniform security
- Continuous deployment / DevOps
  - Design software for operation, remove the developer/operator gap
  - Operate the service for customers, remove the infrastructure operator/service operator/user gap
  - Service Mesh provides systematic policy control

=> Service Mesh helps operators to automate deployment and operation of large scale services

Project Clover : building VNFs with Service Mesh backed micro-services

https://wiki.opnfv.org/display/CLOV



Project Clover: NF centric challenges

- Infrastructure:
  - Baremetal, OPNFV Pharos/LaaS, Public Clouds, Network Edge, Edge devices
- Containers and Kubernetes: container4nfv
- Container networking, networking data path
- Cloud native storage and stateful VNFs
- Continuous delivery/deployment on top of CI
- Integration with overall management and operation

=> **A cross-project approach in meeting these challenges!**

Project Container4NFV : extensions to Kubernetes and container runtime

The goal is to provide container environment where cloud native VNF can run.

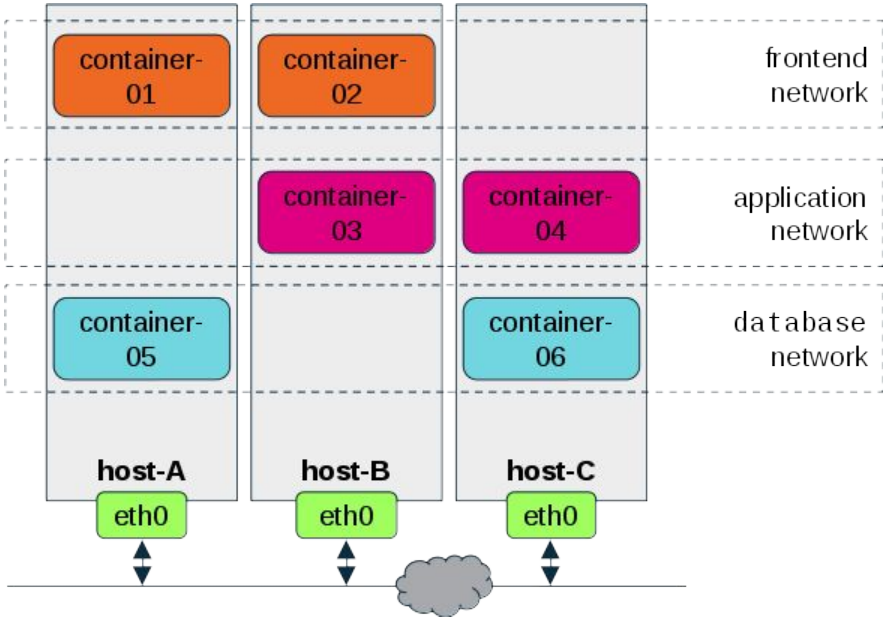
- Multus CNI Plugin
- OVS-DPDK
- Istio
- Stor4NFV (Will do)

OPEN CONTAINER INITIATIVE

- Kata Container
- Virtlet
- X86 Platform
- ARM Platform
- SGX（Security）

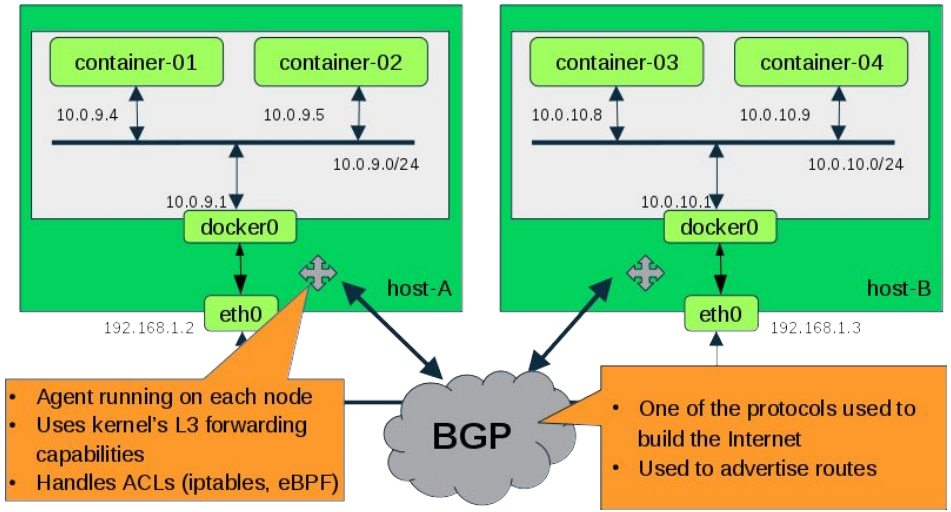
Container Networking and building VNF data path

Problem description

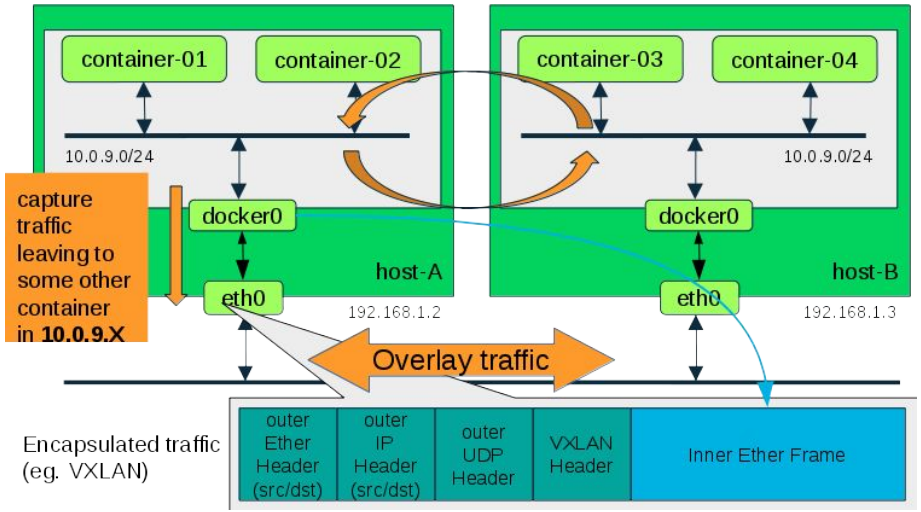


Container networking: solutions

Routing approach (Calico)



Overlay (Flannel, Docker)

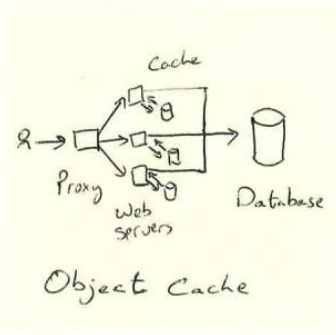


Cloud native storage and building Stateful VNFs

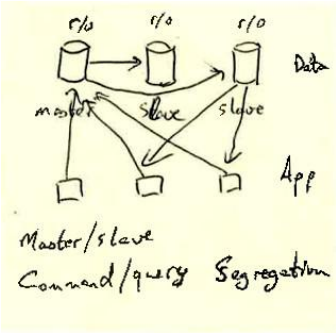
- Application state changes with microservices
  - Distributed application ➔ Consistency, Availability, Partition-tolerant conflicts
  - Resiliency moves to data layer from hardware layer
  - Back-up, caching strategies must evolve
- Application architecture can evolve
  - Just Enough Duct Tape approach
  - Understanding scaling issue is key

Strategies for scaling out data stores

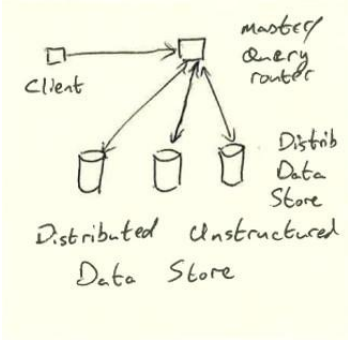
1. Caching



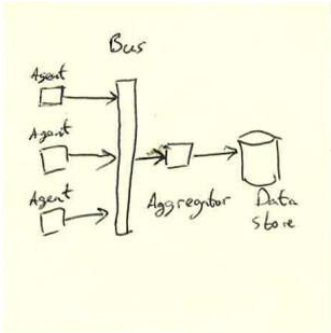
2. Read-only replicas



3. Alternative data stores

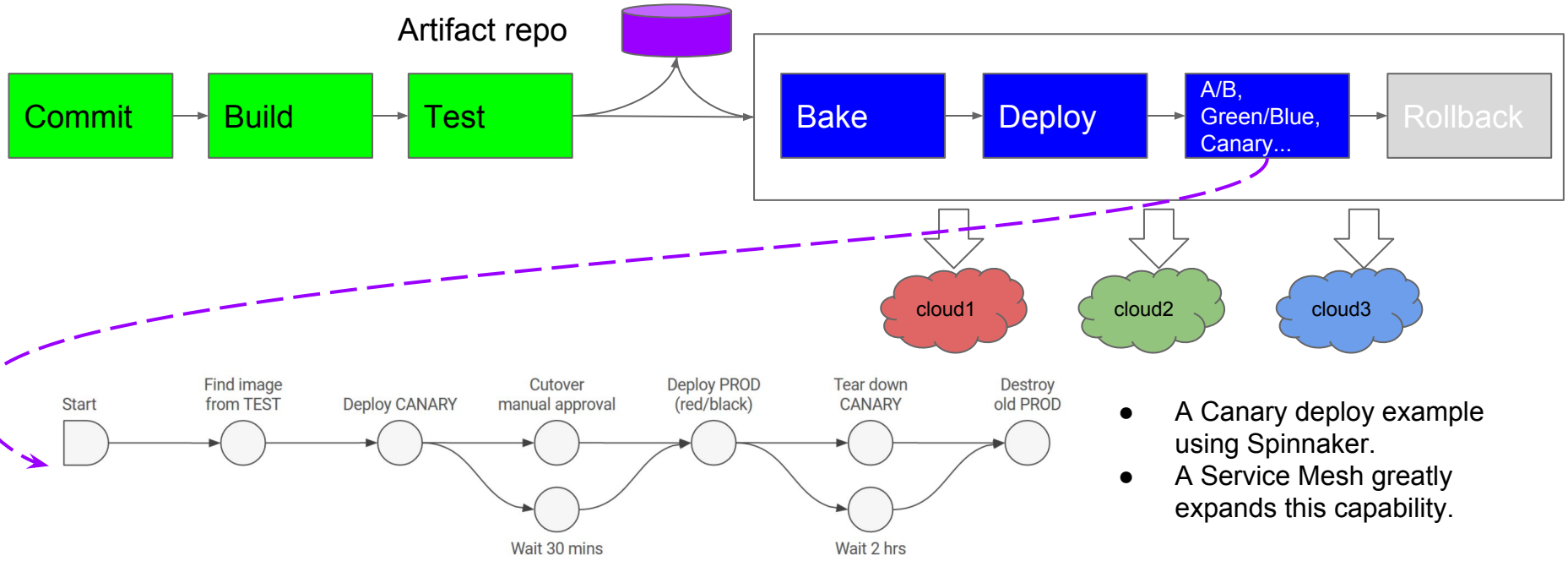


4. Pub/Sub - event driven



Cloud native CI/CD

- CD: Continuous delivery (and deployment)
  - Fast-paced user driven/data driven CI/CD is a core competency for Cloud Native DevOps.

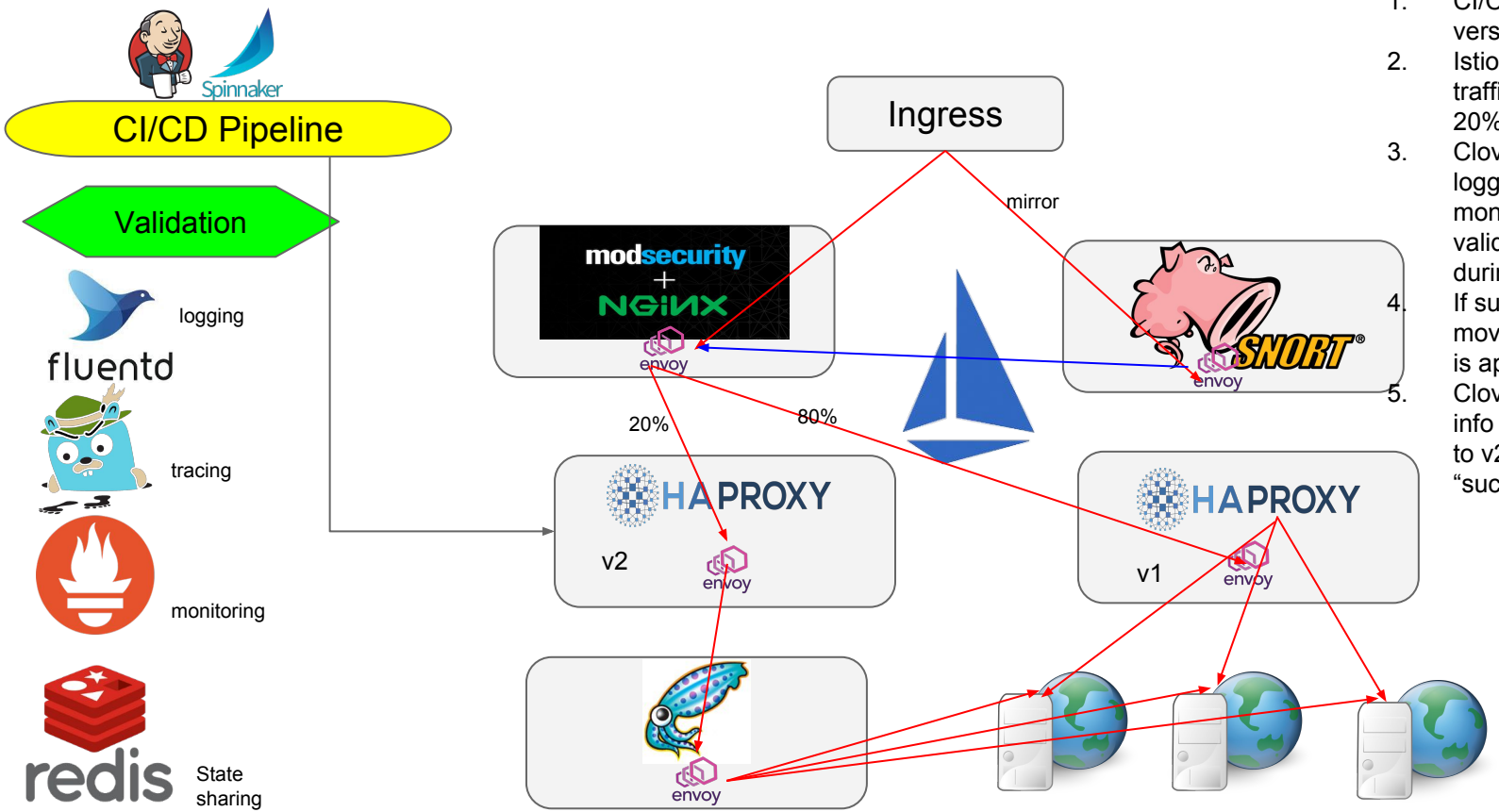


- A Canary deploy example using Spinnaker.
- A Service Mesh greatly expands this capability.

Integrating with VNF management and operations

- ONAP: Container based network service/function deployment
  - ONAP COE as subproject multicloud project
  - https://wiki.onap.org/pages/viewpage.action?pageId=16007890
- Goal/Scope
  - Allow ONAP orchestrator to handle k8s or other Container orchestration engine in addition to OpenStack(or VM based cloud management system)
  - Life cycle management for containerized VNF
- Challenges
  - Abstraction mis-match among VM (openstack) and container(k8s)
    - TOSCA
    - Container networking model is quite different from VM based system
    - K8s and service mesh have different abstractions

Putting all together : A/B Testing



1. CI/CD deploys L7 proxy version 2
2. Istio policy applies for 80% traffic to control (v1) and 20% to variant (v2)
3. Clover software gathers logging / tracing / monitoring and state info to validate “success” or “fail” during a time of traffic
4. If success, Istio policy of moving 100% traffic to v2 is applied
5. Clover software gathers info to validate 100% traffic to v2, and results met “success” criteria

Key takeaways

1. Embrace Cloud Native
2. Adopt Micro-services supported by a Service Mesh to replace Monolithic systems
3. Adopt CI/CD end-to-end for a User Driven rapid iterative lifecycle
4. Meet technical challenges together in the open source community

Get involved

- Clover Project
  - https://wiki.opnfv.org/display/CLOV
  - Fraser demo and Gambia release planning during OPNFV Unconference time
  - Time: Tuesday, March 27, 10:15 - 11:30 AM (Room: K-Town)
- Demo:
  - Huawei booth
- Talk: “Extending CI/CD to support Cloud Native VNFs and Operations: A proposal to the community for discussion”
  - 15:30 - 16:00, Monday, March 26. Room: K-Town.
- Other projects
  - Container4nfv: https://wiki.opnfv.org/display/OpenRetriever
  - Onap container support: https://wiki.onap.org/pages/viewpage.action?pageId=16007890