Baker: Scaling OVN with Kubernetes API Server

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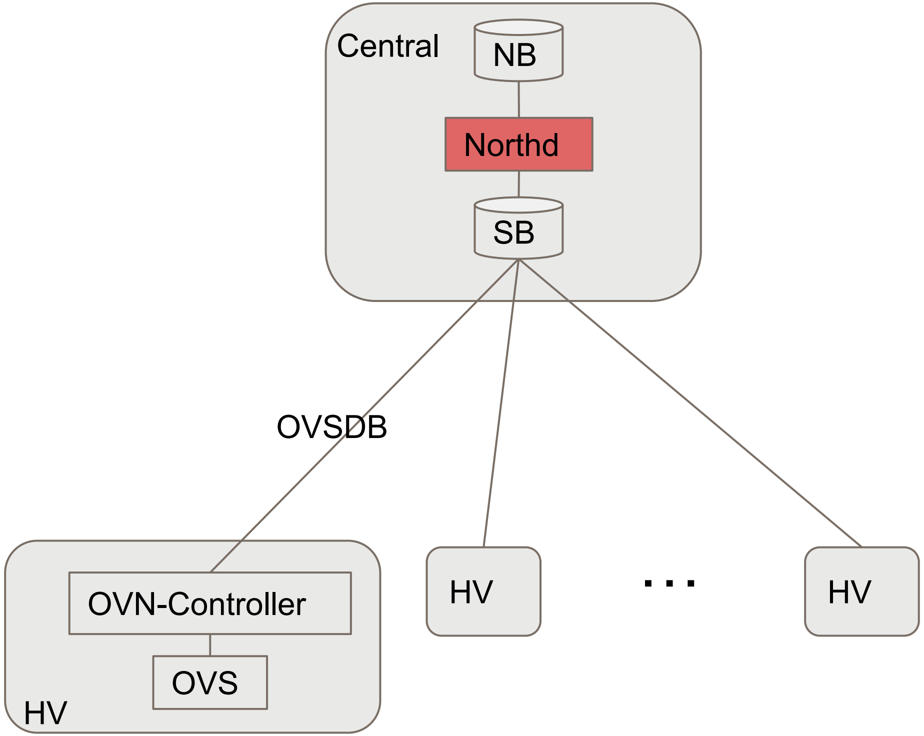
Why OVN?

OVS is GREAT.

OVN makes it GREATER!

OVN Challenges

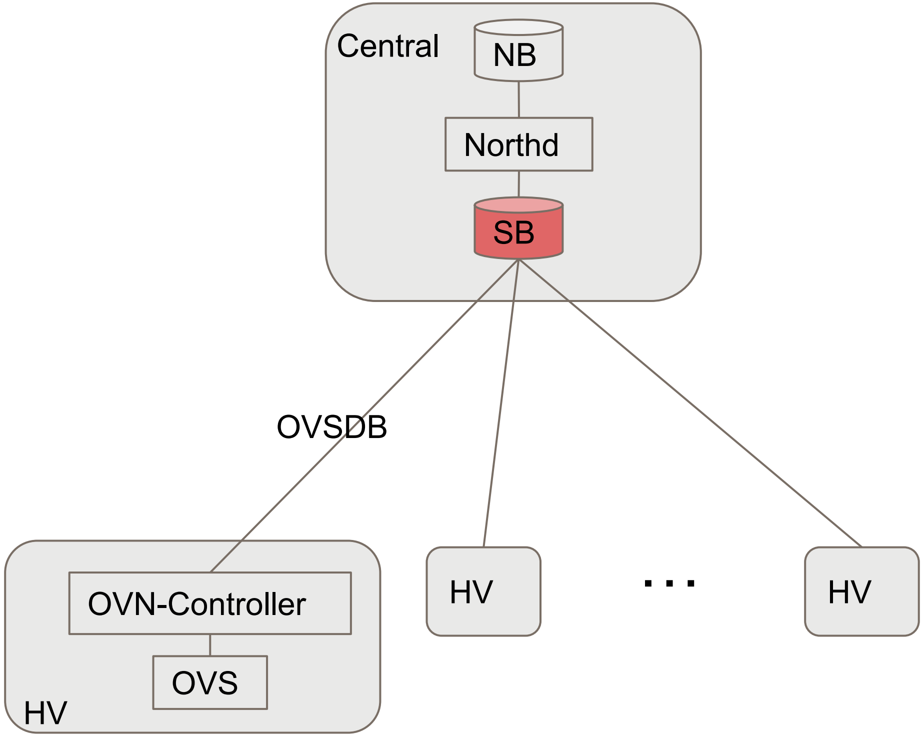
- OVN is distributed, but not fully …
    - Can we distributed Northd?



OVN Challenges

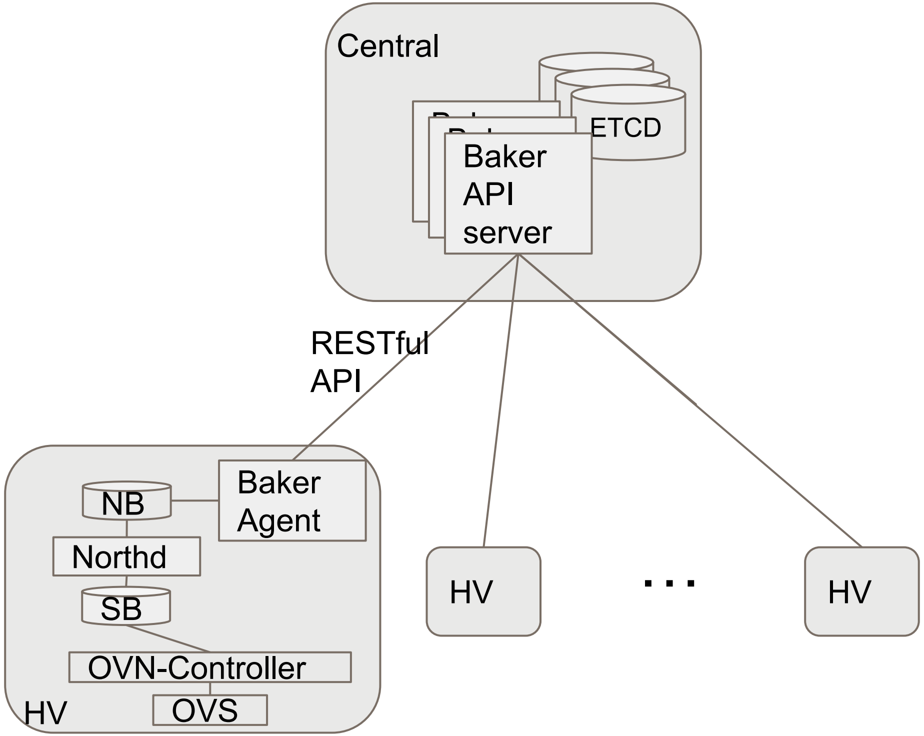
- OVSDB SB
  - No clustering (yet)

It is nothing but **distributed state management** ...



Scale-out with Baker

- Distributed northd
    - Computes lflows for **local** only
- Scale-out central cluster
    - K8S API server framework
    - Backed by ETCD
    - Clustering
- Distributed agents
    - Watch for **local** objects only
    - Translate objects to NB DB



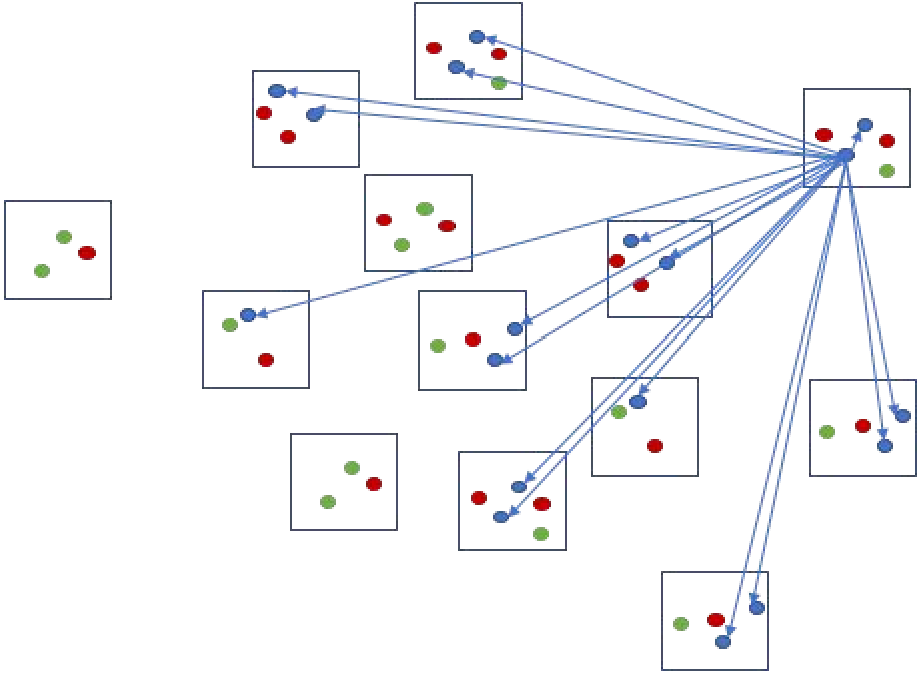
One more thing ...

- Northd and ovn-controller are all distributed
- They process data related to **local HV only**

But what does this mean?

In terms of overlay ...

- Logical-to-physical mapping states (port-binding) for connectivity
- Doesn't scale when everyone talks to everyone else in a ***large*** zone
  - Maybe not the case for public cloud, or small-to-medium enterprise cloud.
  - But it is typical use case for eBay's private cloud.



Are we solving the right problem?

- Connectivity v.s. Segmentation
- L2 Segmentation v.s. L3 segmentation
- Address sets (L3) based segmentation
    - ACL: default deny, whitelist access
    - IPAM:
        - Use ip efficiently
        - Summarized CIDRs to reduce address set size

Flat network

- Reuse OVN abstraction and pipeline
  - Port security
  - ARP proxy
  - ACL
  - LB
  - …
  - But NOT overlay
- Use localnet port to connect to physical network directly

- Data to be processed by each HV depends on size of AddressSet used by ACLs that apply to ports on the HV

Baker Object Model

- Similar as OVN NB Schema
  - Logical Port
    - Addresses
    - Port security
  - ACL
  - Address Set
  - Load balancer (TBD)
  - ...

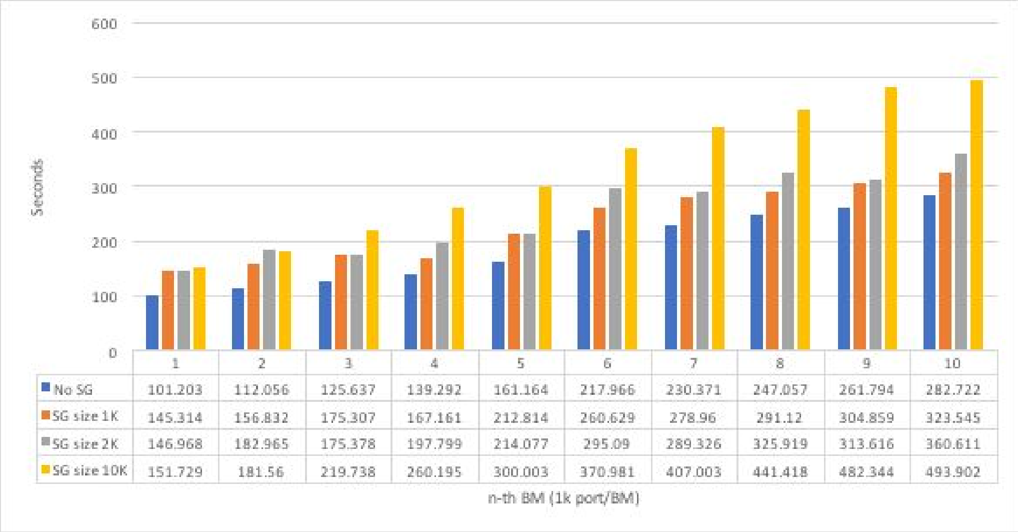
- Differences
  - No Logical Switch (local)
  - Port-SecGroup binding
  - ACL: SecGroup instead of individual ports in inport/outport

Neutron Plugin

- Support security group, with API extensions
  - Address set - support external IPs from legacy systems
  - Security group rule packet logging

Scalability - Control plane throughput

- Test
  - E2E: Neutron - Baker - OVS
  - Simulated 1k HVs on 10 BMs
    - OVS/OVN 2.7
  - 1 node Neutron + mysql
  - 1 node Baker API server + ETCD
    - K8s 1.6 pre-release, etcd 3.0
- Result for single client (parallel test TBD)
  - Result impacted by SG (address set) size
  - ~3 ports/sec for SG size 1K



	1	2	3	4	5	6	7	8	9	10
■ No SG	101.203	112.056	125.637	139.292	161.164	217.966	230.371	247.057	261.794	282.722
■ SG size 1K	145.314	156.832	175.307	167.161	212.814	260.629	278.96	291.12	304.859	323.545
■ SG size 2K	146.968	182.965	175.378	197.799	214.077	295.09	289.326	325.919	313.616	360.611
■ SG size 10K	151.729	181.56	219.738	260.195	300.003	370.981	407.003	441.418	482.344	493.902

Scalability - Latency

- Test
  - E2E from Neutron to OVS flow installation for the port created
    - Create port from neutron, bind port in ovs on HV
    - Wait:
      - *ovn-nbctl wait-until Logical_Switch_Port <port> up=true*
      - *ovn-nbctl --wait=hv sync*
  - Create ports on top of existing 10K ports, 1K HVs, SG size 1K
  - 10K * 3 (flows/ACL) = 30K flows / ovs port
- Result
  - Avg 2 sec

Improvement - ovn-controller

- Flow computation blocks flow installation
- Improvement: avoid repeated computation when in-flight messages to OVS pending
- Test result (SG size 10k, flow installation for 10 ports on HV):
  - 10k * 3 * 10 = 300k OVS flows
  - Before: 50 min
  - After: 16 sec

Other Lessons learned

- Postpone ACL expanding from Neutron to HV
  - Introduce port-group binding object in Baker
  - Use port-group instead of lport in “inport/outport” in ACL
  - Baker agent expand ACL on HV for local lports only
  - Benefit:
    - Reduced Neutron overhead
    - Reduced API calls from Neutron to Baker
    - Reduced data size in Baker

Other Lessons learned

- Baker RESTful API: use **Protobuf** instead of JSON-RPC
  - 10 - 20 % throughput increase for SG size 1k - 10k
  - Lower CPU cost on API-server

Q & A

Thanks!