OVN:
Open Virtual Network for Open vSwitch

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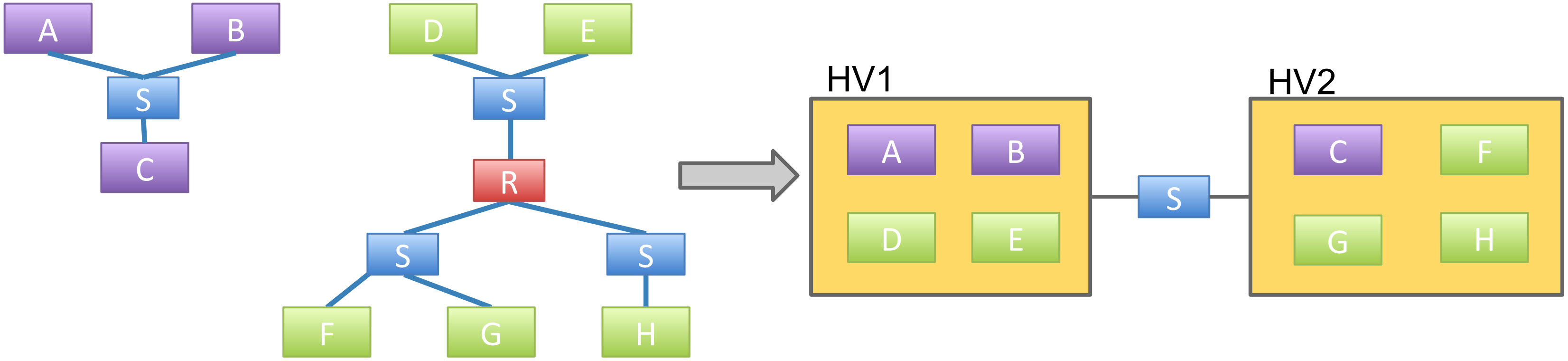
The Case for Network Virtualization

- Network provisioning needs to be self-service.
- Virtual network needs to be abstracted from physical.
- Virtual network needs same features as physical.



Legacy Physical Network

Cloud Physical Network

What is OVN?

- Open source L2/L3 network virtualization for Open vSwitch (OVS):
  - ✓ Logical switches
  - ✓ L2/L3/L4 ACLs (no connection tracking yet)
  - – Logical routers
  - – Security groups
  - ✓ Multiple tunnel overlays (Geneve, STT, and VXLAN)
  - – TOR-based and software-based logical-physical gateways
- Works on same platforms as OVS:
  - ✓ Linux (KVM and Xen)
  - ✓ Containers
  - ? DPDK
  - – Hyper-V
- Integration with:
  - ✓ OpenStack
  - – Other CMSes

The Particulars

- Developed by the same community as Open vSwitch
- Vendor-neutral
- Design and implementation all occur in public
- Developed under the Apache license

Goals

- Production quality
- Straightforward design
- Scale to 1000+ hypervisors (each with many VMs/containers)
- Improved performance and stability over existing OVS plugin

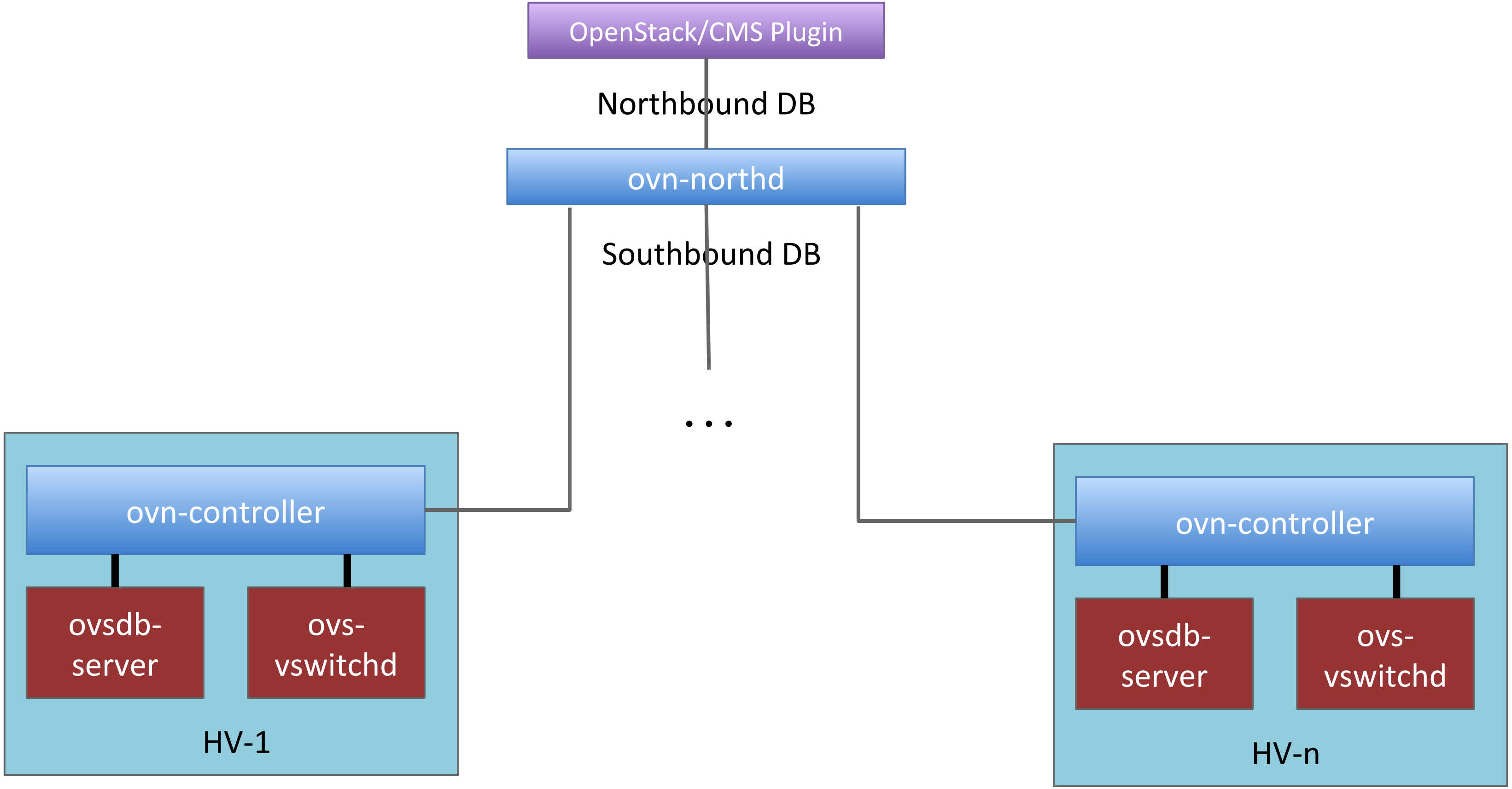
OpenStack Integration with OVN

- OVN has its own Neutron driver
  - Use instead of OVS ML2 driver and agent
- Goal: Reliability and good integration with OVS
  - Existing OVS plugin has poor reputation
- Goal: Avoid needing Neutron-specific agents on hypervisors
  - Currently, Neutron L3 and DHCP agents are used
  - OVN will supplant these over time.
- Long term goal: Supplant existing OVS driver.

Designed to Scale

- Configuration coordinated through databases
- Local controller converts logical flow state into physical flow state
- Desired state clearly separated from run-time state
- Grouping techniques reduce Cartesian Product issues

OVN Architecture



OpenStack/CMS Plugin

Northbound DB

ovn-northd

Southbound DB

. . .

ovn-controller

ovsdb-server

ovs-vswitchd

HV-1

ovn-controller

ovsdb-server

ovs-vswitchd

HV-n

The OVN Databases

- ovn-northbound
  - OpenStack/CMS integration point
  - High-level, desired state
    - Logical ports -> logical switches -> logical routers
- ovn-southbound
  - Run-time state
    - Location of logical ports
    - Location of physical endpoints
    - Logical pipeline generated based on configured and run-time state

The Daemons

- Central: ovn-northd
  - Converts from the high-level northbound DB to the run-time southbound DB
  - Generates logical flows based on high-level configuration
- Per-hypervisor: ovn-controller
  - Registers chassis and VIFs to southbound DB
  - Converts logical flows into physical flows (ie, VIF UUIDs to OpenFlow ports)
  - Pushes physical configuration to local OVS instance through OVSDB and OpenFlow

An Example

Logical_Switch

Name	Ports
LS1	LP1,LP2

Logical_Port

Name	MAC
LP1	AA
LP2	BB

Chassis (ovn-controller)

Name	Encap	IP
HV1	Geneve	10.0.0.10
HV2	Geneve	10.0.0.11

Bindings (ovn-controller)

Name	Chassis
LP1	HV1

Pipeline (ovn-northd)

Datapath	Match	Action
LS1	eth.dst = AA	LP1
LS1	eth.dst = BB	LP2
LS1	eth.dst = <broadcast>	LP1,LP2

LP2 Arrives on HV2

Logical_Switch

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LS1	LP1,LP2

Logical_Port

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LS1	eth.dst = <broadcast>	LP1,LP2

Security Groups

- **Security group:** a firewall policy that typically allows all outbound connections plus inbound return traffic.
- Legacy OVS plugin uses namespaces and iptables
  - Slow and badly integrated because of extra layers
- New OVS support for kernel-based connection state tracking
  - Much faster (see OpenStack Vancouver presentation)
  - Also being added to OVS DPDK switch
- OVN will use this new OVS feature to implement reflexive ACLs and construct security groups from them

Gateways

- Based on “vtep” OVSDB schema included with OVS
  - Hardware: Arista, Brocade, Cumulus, Dell, HP, Juniper, Lenovo
  - Software: Implement “vtep” schema in software, via DPDK
    - Will become a reference for building OVS DPDK applications
- Later: move beyond the capabilities of the “vtep” schema to support fail-over, scale-out, and more stateful services

Trying out OVN

Test #1 - ovs-sandbox

```
$ git clone http://github.com/openvswitch/ovs.git
$ cd ovs
$ ./boot.sh && ./configure && make
$ make sandbox SANDBOXFLAGS=”--ovn”
```

Test #1 - ovs-sandbox

```
$ ovn-nbctl lswitch-add sw0
$ ovn-nbctl lport-add sw0 sw0-port1
$ ovn-nbctl lport-add sw0 sw0-port2
$ ovn-nbctl lport-set-macs sw0-port1 00:00:00:00:00:01
$ ovn-nbctl lport-set-macs sw0-port2 00:00:00:00:00:02
$ ovs-vsctl add-port br-int lport1 -- \
  set Interface lport1 external_ids:iface-id=sw0-port1
$ ovs-vsctl add-port br-int lport2 -- \
  set Interface lport2 external_ids:iface-id=sw0-port2
```

Test #1 - ovs-sandbox

```
# Trace OpenFlow flows for a packet from port 1 to 2
$ ovs-appctl ofproto/trace br-int \
  in_port=1,dl_src=00:00:00:00:00:01,\
  dl_dst=00:00:00:00:00:02 -generate
```

Test #2 - Multi-node DevStack

```
$ git clone http://git.openstack.org/openstack-dev/devstack.git
$ git clone http://git.openstack.org/stackforge/networking-ovn.git
$ cd devstack
… Get local.conf from networking-ovn/devstack/
… local.conf.sample or computenode-local.conf.sample
$ ./stack.sh
```

Status

- From start of coding to first ping: 6 weeks
- Limited testing so far:
  - Small numbers of hypervisors and logical networks
  - Simulated scale testing up to 500 hypervisors
- Feature progress:
  - Gateways: In code review
  - Connection tracking: RFC patches
  - Security groups: RFC patches
  - L3: to-do

Features for 2016?

- Native IP management
  - Integrate DHCP server into ovn-controller
- NAT
- Load-balancing

Resources

- Architecture described in detail in ovn-architecture (5)
- Configuration is through a number of databases
  - OVN Northbound – Interface between CMS and OVN (ovn-nb (5))
  - OVN Southbound – Holds the configuration and state of the logical and physical components (ovn-sb (5))
- Available in the “master” branch of the main OVS repo:
  - https://github.com/openvswitch/ovs

How you can help

- Try it! Test it! Write Code!
- Report bugs and try it at scale
- Core OVN is being developed on ovs-dev mailing list:
  - http://openvswitch.org/pipermail/dev/
  - #openvswitch on Freenode
- Neutron plugin for OVN is being developed here:
  - http://git.openstack.org/stackforge/networking-ovn.git
  - openstack-dev mailing list
  - #openstack-neutron-ovn on Freenode

Thank you!

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