Running OpenStack over a VXLAN Fabric

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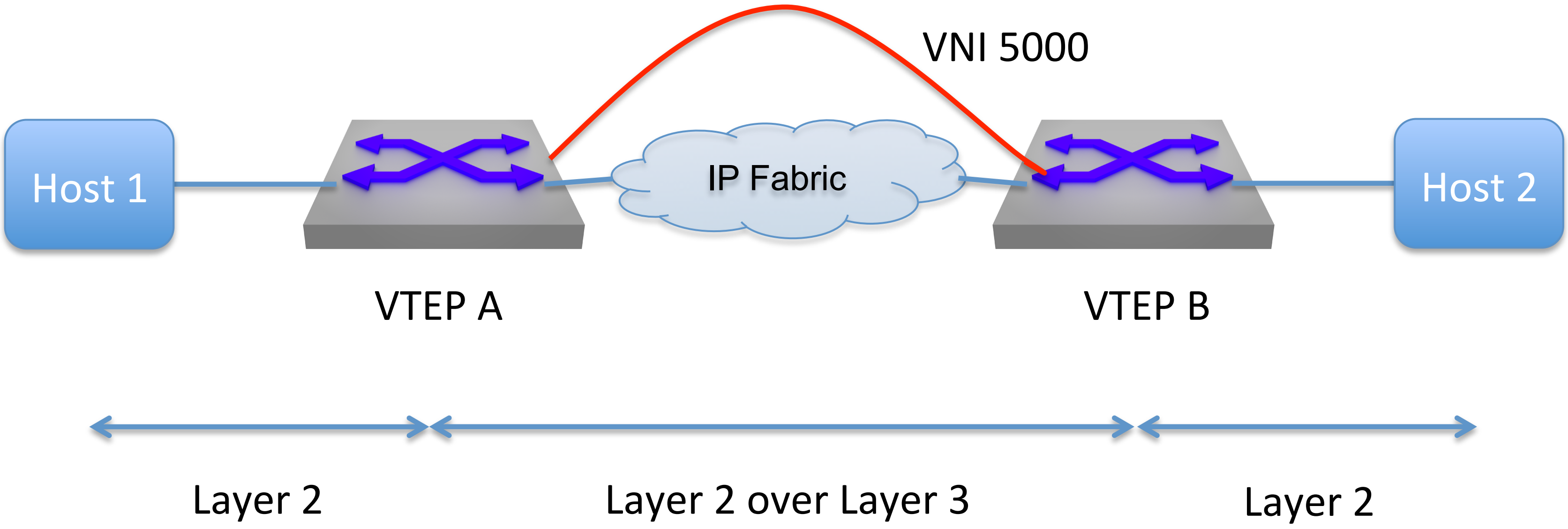
Overview

- VXLAN Refresher
- Why VXLAN?
- Network Design Requirements
- Key Decisions Points
- OpenStack over VXLAN designs
- Thoughts on future work

VXLAN Refresher

- Standardized overlay technology for encapsulating layer 2 traffic on top of an IP fabric



Learning and Flooding in VXLAN

- MAC Learning
  - Learn based on traffic received over the tunnel
  - And/or use a protocol to distribute MAC tables
- Handling BUM Traffic
  - BUM = Broadcast, Unknown Unicast, and Multicast traffic
  - Common options for BUM traffic distribution:
    - IP Multicast
    - Head-end replication / replication node

Why VXLAN?

- Addresses 4K VLAN limitation, enabling up to 16M tenant networks
- Solves mac address scaling issues at the core of the network
- Allows for better scalability and failover with an L3 ECMP fabric
- VXLAN support is only required at endpoints, allowing greater vendor flexibility in the network
- Networking ASIC support

Real World Requirements to Deploy OpenStack over VXLAN

- No IP Multicast!
  - IP multicast is an efficient, protocol based mechanism for BUM traffic distribution
  - But no one wants to run multicast in their network
- Hardware VXLAN gateways
  - Get North-South traffic into / out of your cloud
  - Bridge physical infrastructure (storage, non-virtualized servers, etc) into virtual networks
  - The performance and density of software VXLAN gateways is not sufficient

Some Key Design Decisions

- Software vs Hardware VTEPs
- Replication node vs fully distributed head-end replication
- External SDN Controller vs Standalone Neutron

Software vs Hardware VTEPs

- Flexibility of Software vs Performance of Hardware
  - Software VTEPs are limited only by RAM and CPU cycles, but there’s an overhead cost of 10-30% per compute node
  - Hardware VTEPs have great density and performance, but are limited to the size of hardware tables
- Network management in a VXLAN environment

Replication Node vs Fully Distributed Head End Replication

- Replication nodes can be purpose-built
  - Flows can be spread across multiple replication nodes
  - But they to be managed and have an HA story
- Head-end replication at each VTEP requires no HA strategy
  - But burdens each VTEP with the cost of replication

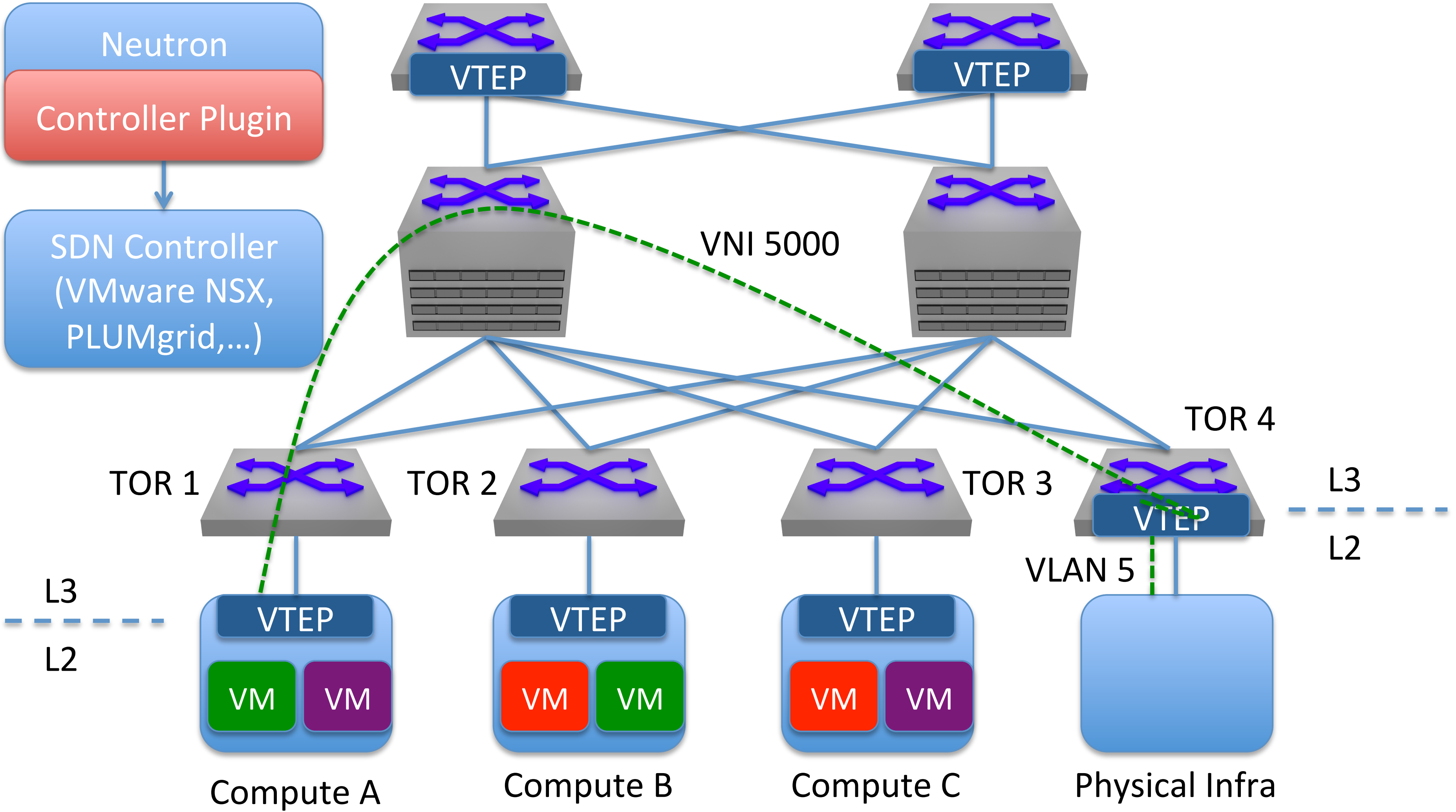
External SDN Controller vs Standalone Neutron

- Hard tradeoff to quantify
- Generally comes down to functionality vs cost

OpenStack over VXLAN

- Three designs that fit the real world production requirements:
  - External SDN controller with a mix of Software and Hardware VTEPs
  - Standalone Neutron with all Hardware VTEPs
  - Standalone Neutron with a mix of Software and Hardware VTEPs

External SDN Controller, Software and Hardware VTEPs



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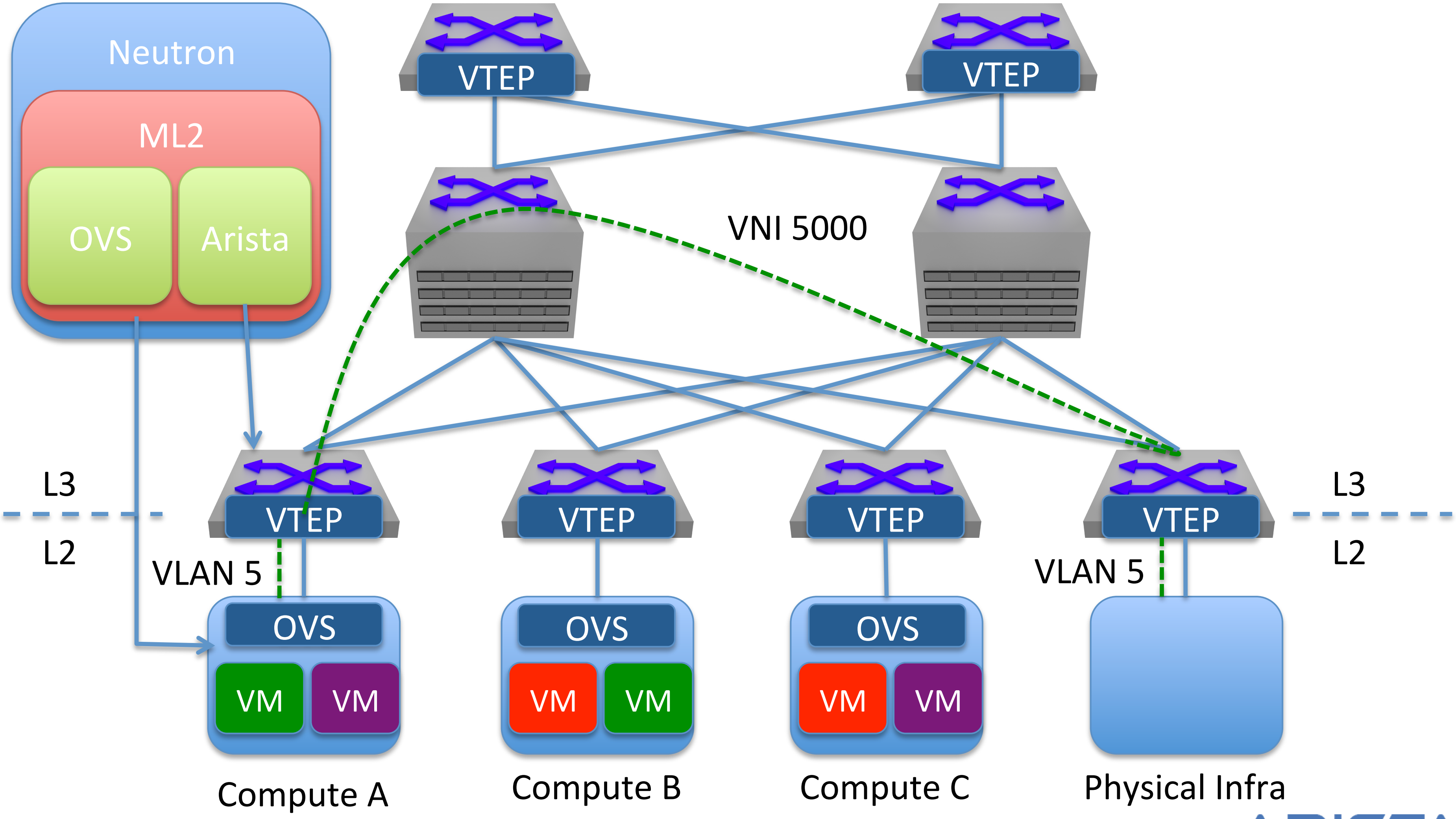
External SDN Controller, Software and Hardware VTEPs

- The SDN Controller (for example VMware NSX or PLUMgrid)
  - Manages virtual VTEPs and the VMs behind them
  - Integrates with the hardware VTEPs to configure gateway functionality for end-to-end provisioning driven by Neutron
  - Exchanges VXLAN MAC address table information between the physical and virtual VTEPs for a multicast-less VXLAN

ML2

- First, a quick plug for ML2
- ML2 is a new Neutron plugin in Havana which provides:
  - Separation between the state of tenant networks and how that state is then realized across the network
  - Flexibility in how the virtual and physical network are managed
  - Multi-vendor support via multiple "Mechanism Drivers" managing pieces of the network in parallel
- Talk on ML2 by Bob Kukura and Kyle Mestery on Friday at 11am

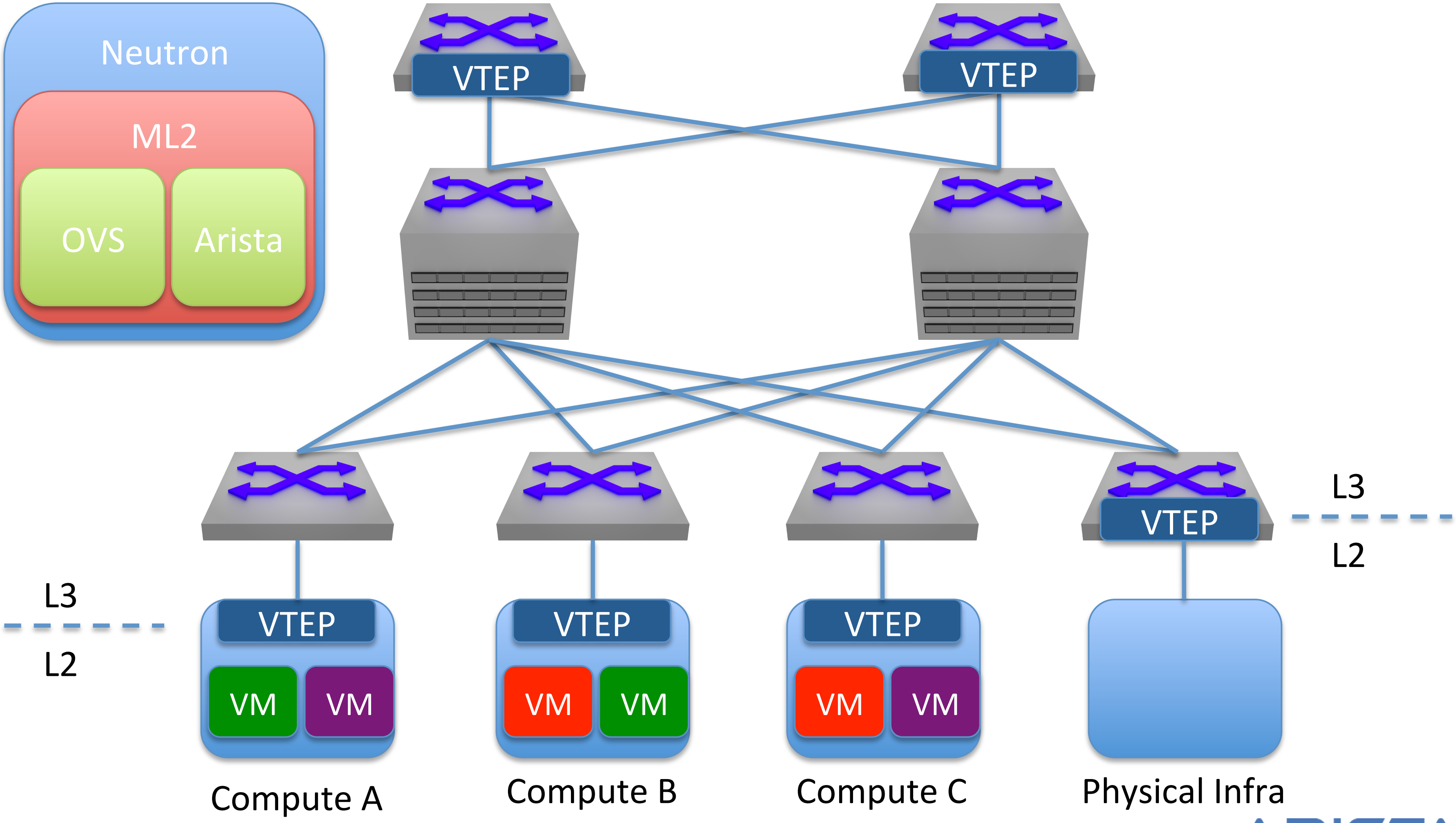
Standalone Neutron, All Hardware VTEPs



Standalone Neutron, All Hardware VTEPs

- Take advantage of hardware capabilities, reduce CPU utilization of each compute node
- Limited to 4K tenant networks (still limited by the VLAN space)
  - Though some work and ML2 multi-segment support, you could do rack-specific VLAN allocation and get beyond the 4K tenant network limit

Standalone Neutron, Software and Hardware VTEPs



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Thoughts on Future Work

- Standalone Neutron with Software and Hardware VTEPs is hard to achieve today
  - Requires hook to share VXLAN connectivity info between the virtual and physical infrastructure
  - L2 population mechanism driver in ML2 is a step in the right direction
- Need a general model of VXLAN gateway nodes in Neutron
  - Dynamically attach/detach physical infrastructure into tenant networks

Questions?