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# Red Hat Cloud Infrastructure - Networking Deep Dive

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# Lost decade of networking



Source: [www.flickr.com/commons](http://www.flickr.com/commons)

# VLAN constraints

- Number of VLANs: 4096 (theoretically)
- L2 VLAN = a single failure domain
- VM MAC addresses usually visible in the network core
  - Requires end-to-end provisioning

# Exciting times!

# SDN

# Exciting times!

# NFV

# Exciting times!

# Network Fabrics

# Exciting times!

# Network Virtualization

# Agenda

- Journey to an Open Hybrid Cloud
  - And the network challenges it brings

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- Red Hat Enterprise Virtualization (RHEV)
- Red Hat Enterprise Linux OpenStack Platform
  - OpenStack Networking: Neutron

# Agenda

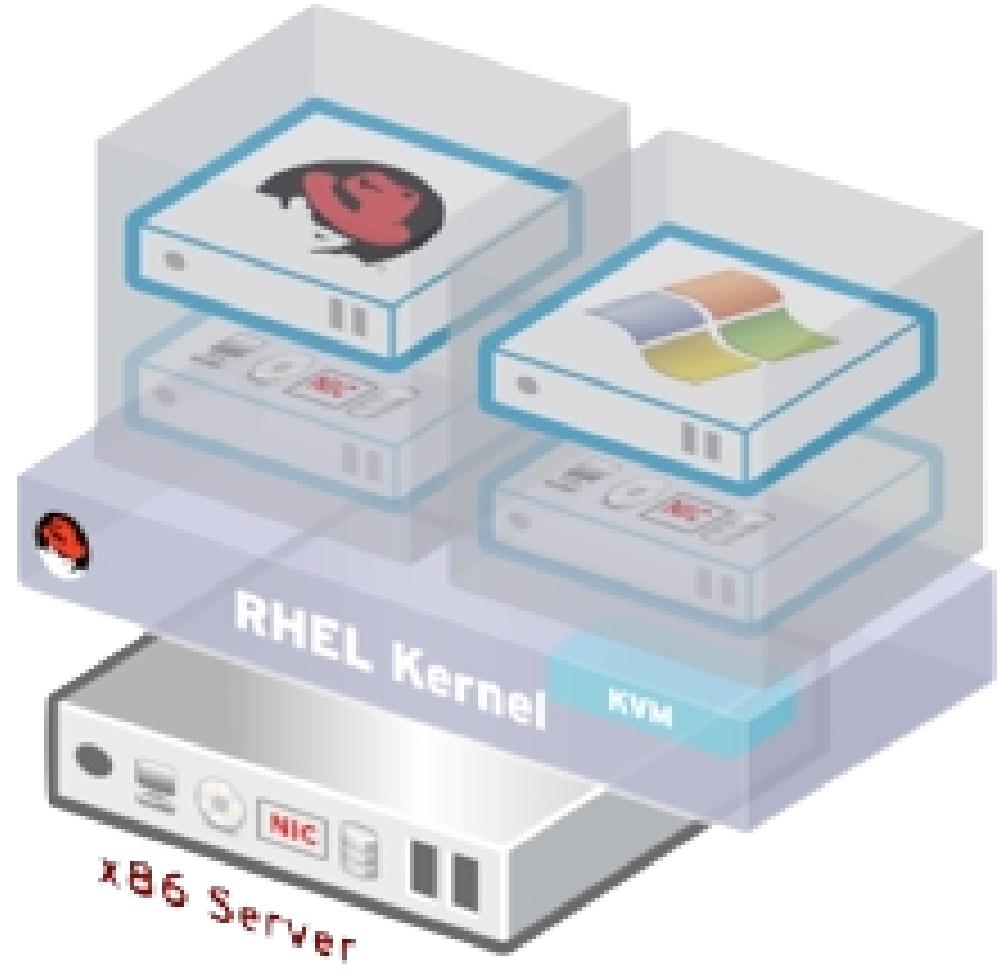
- Journey to an Open Hybrid Cloud
  - And the network challenges it brings
- Red Hat Enterprise Virtualization (RHEV)
- Red Hat Enterprise Linux OpenStack Platform
  - OpenStack Networking: Neutron
- Putting It All Together
  - RHEV and Neutron integration



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# JOURNEY TO AN OPEN HYBRID CLOUD

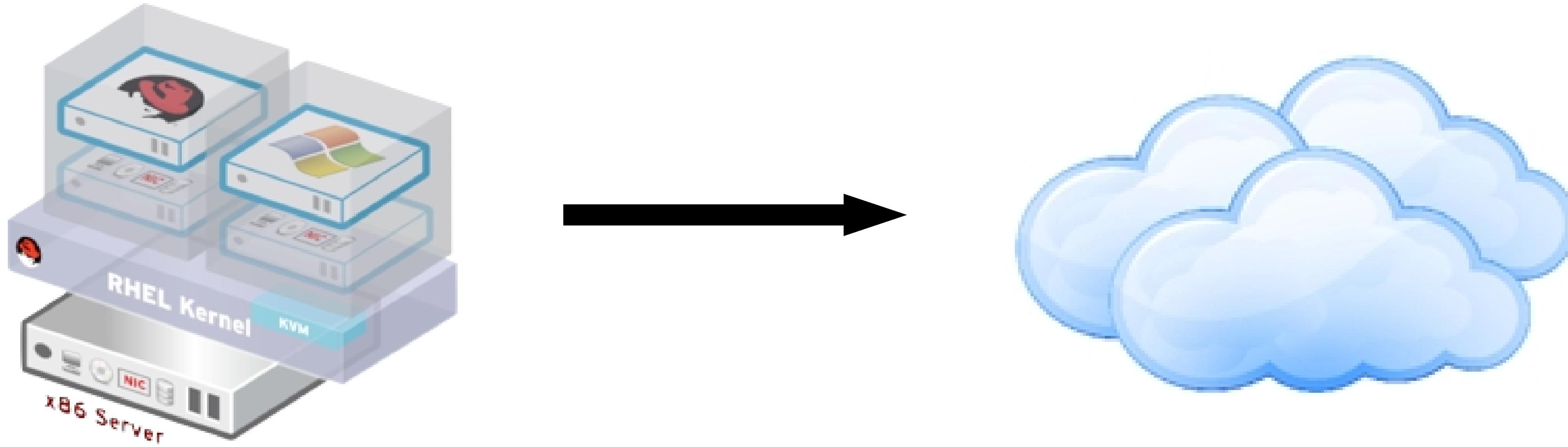
# Workload Evolution



- Stateful large VMs
- Lifecycle measured in years
- Applications NOT designed to tolerate failure
- Applications scale up

- Smaller stateless VMs
- Lifecycle measured in hours to months
- Applications expect failures
- Applications scale out with new VMs

# Enterprise Virtualization != Elastic Cloud



- Many applications on each server
- Maximum server utilization
- Minimum server count
- On-demand self service
- Broad network access
- Measured service

# Are your apps ready?

**VIRTUALIZATION BASED  
PRIVATE CLOUD**



**CLOUD-ENABLED  
PUBLIC AND PRIVATE**



**MULTIPLE HETEROGENEOUS RESOURCE POOLS  
TRADITIONAL AND CLOUD APPLICATION MODELS**

# Why does the network care?

- Complex and flexible application stacks
  - L2/L3 packet forwarding
  - Firewall
  - NAT
  - Load Balancing
  - VPN
- Our data is too large!

# Changes in traffic patterns

- Applications generate east-west traffic
  - Existing network designs focused on north-south



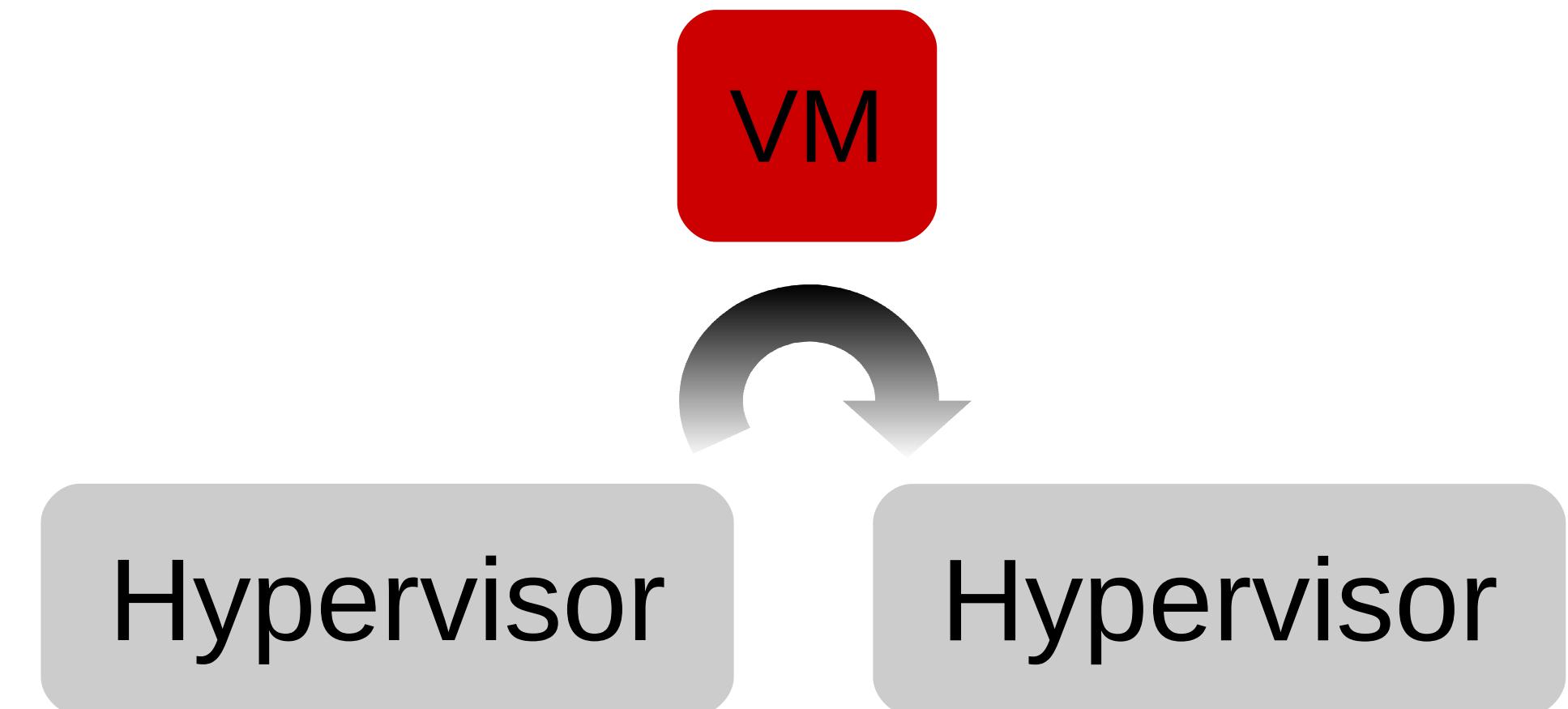
# Multi tenancy

- Shared resources, multiple customers



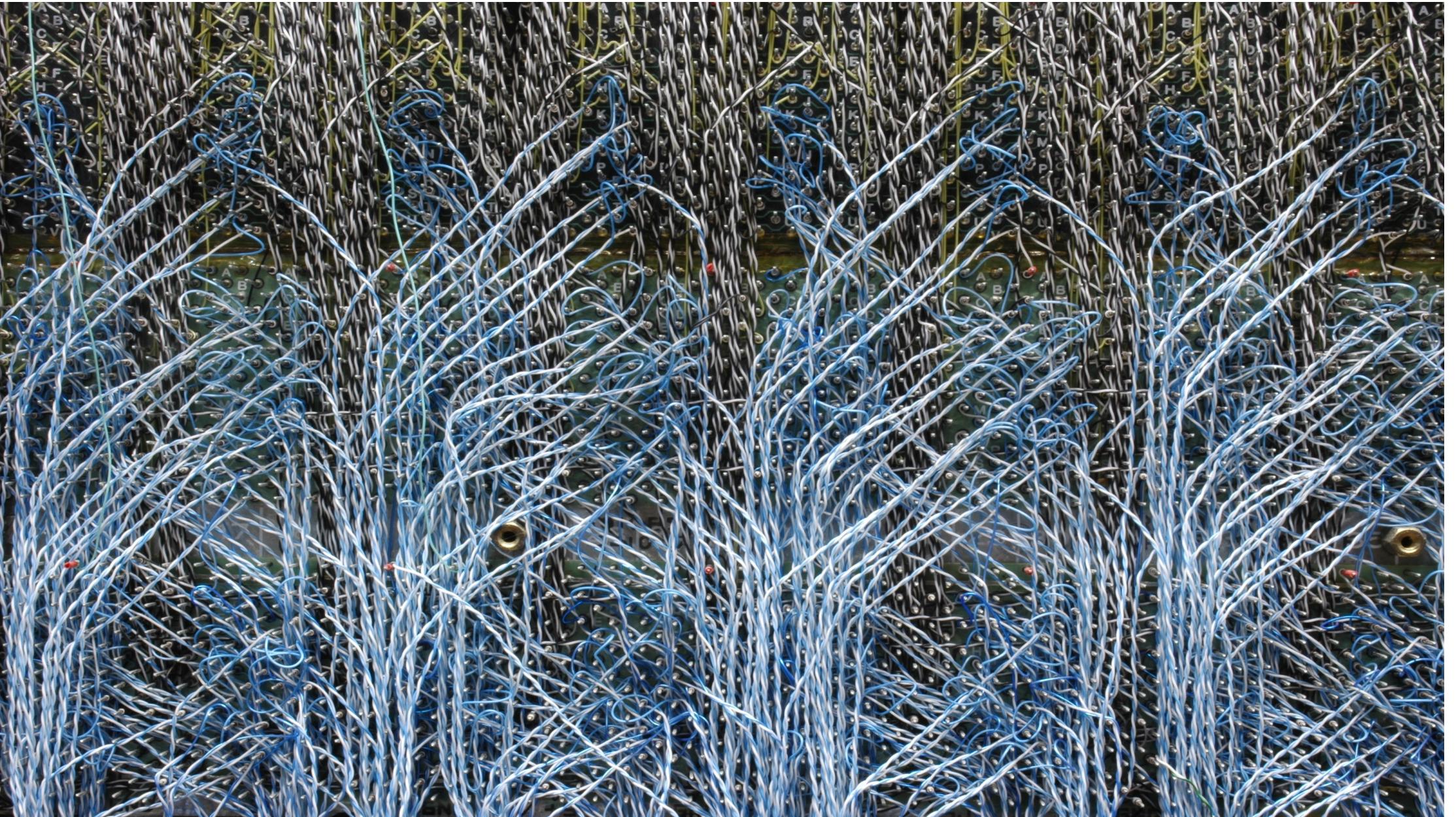
# VM mobility

- Dynamic workloads, flexible VM placement
- BYOD

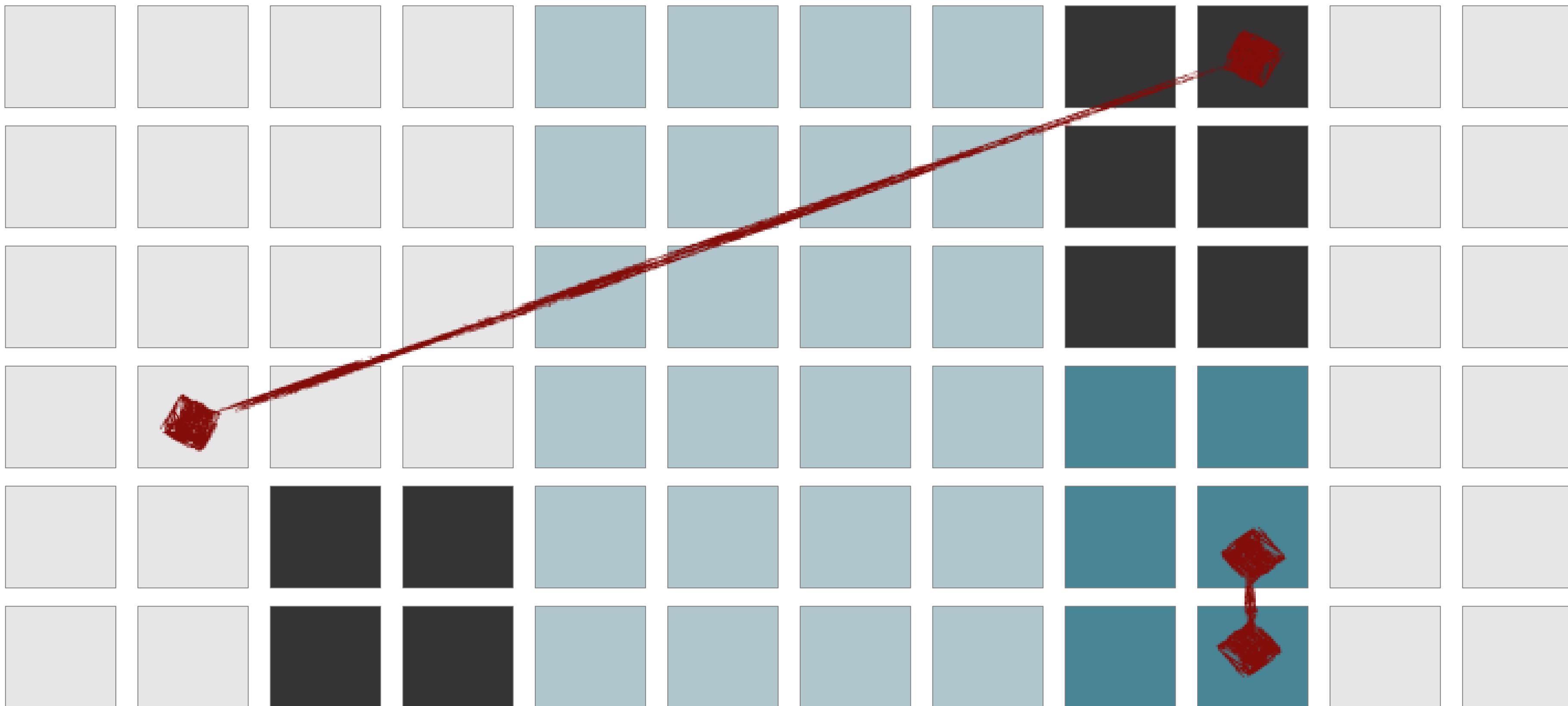


# Scale

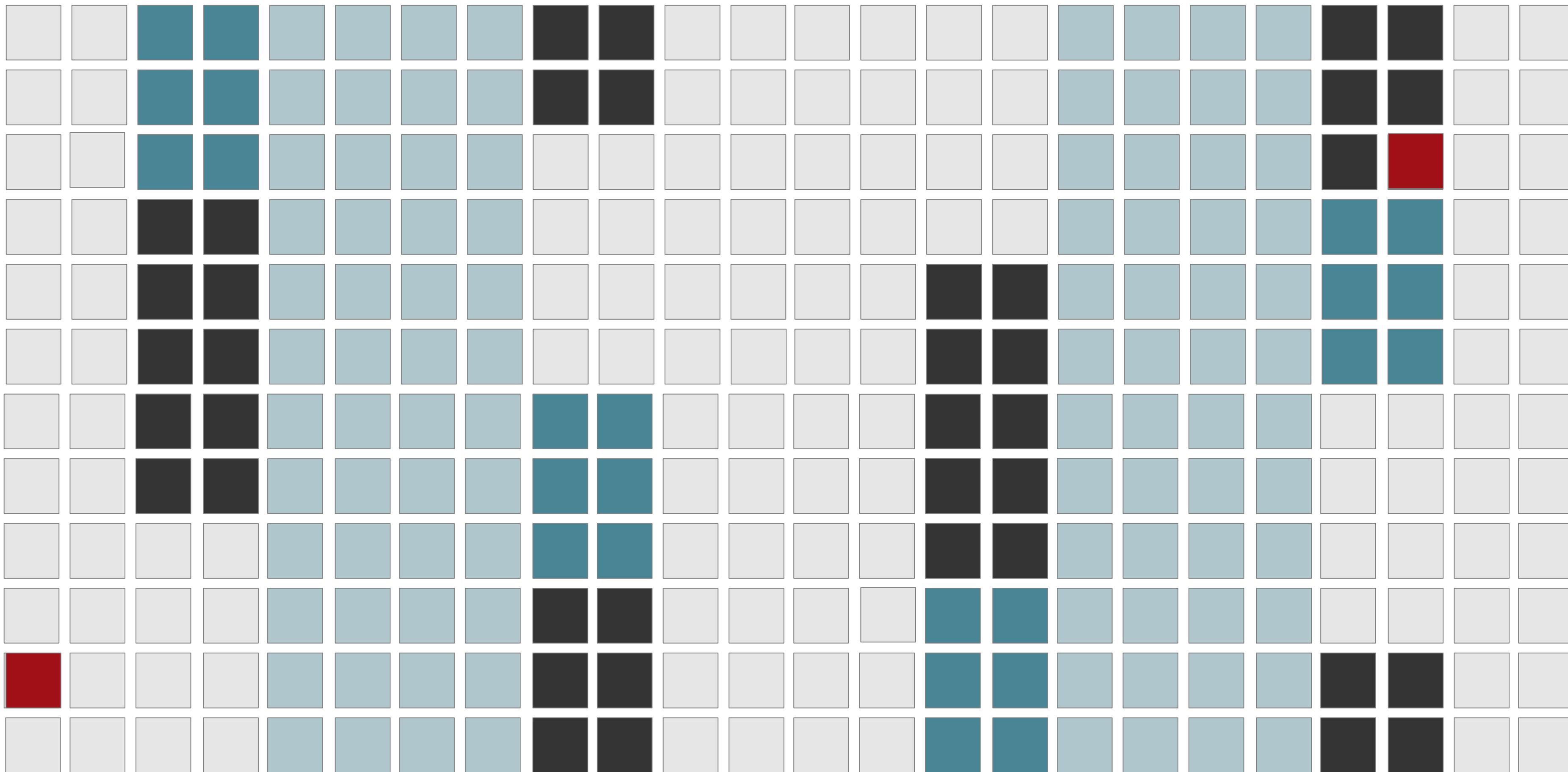
- 100,000s of networks
  - Hard to build using the old tricks



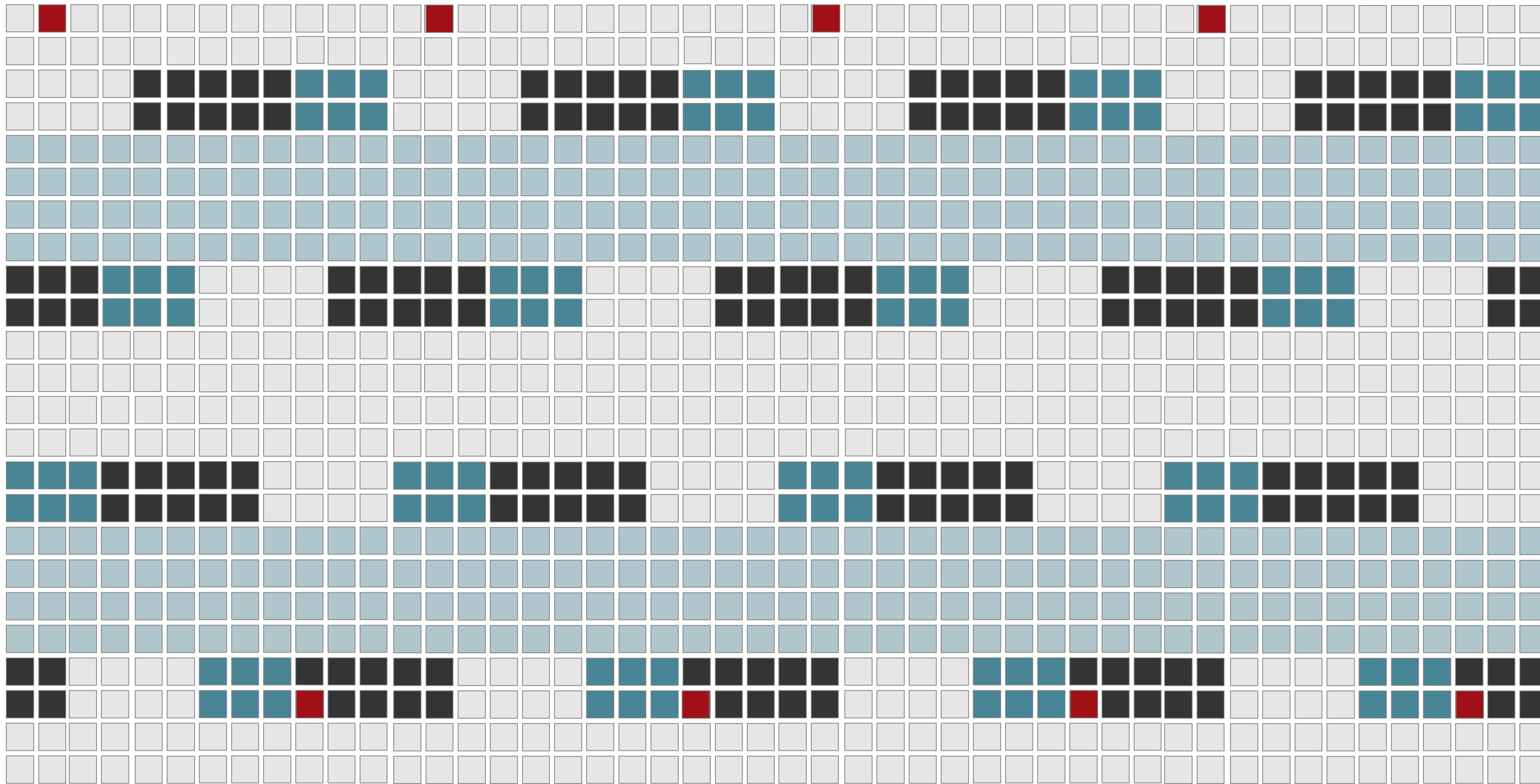
# Network elasticity



# Because your cloud will grow

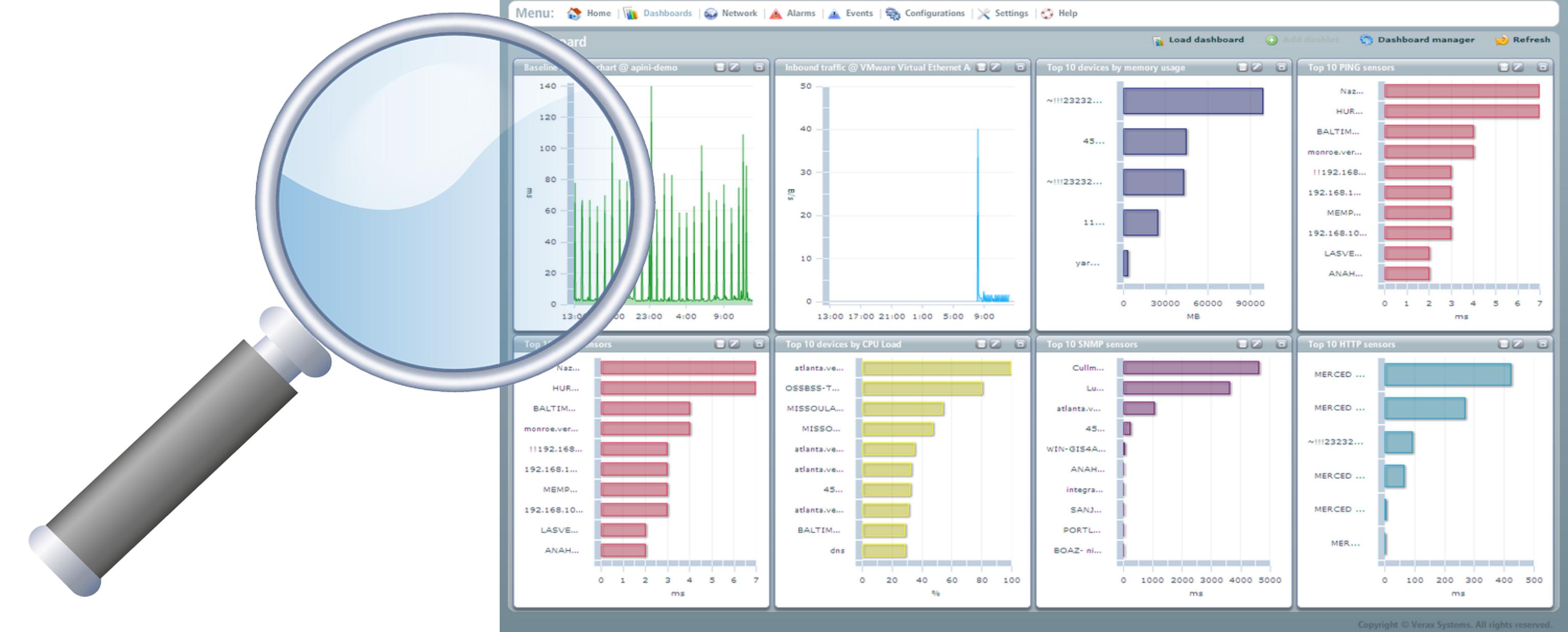


# And continue to grow..



# Visibility

- Someone needs to troubleshoot the network





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# RED HAT CLOUD INFRASTRUCTURE

# Red Hat Cloud Infrastructure

RED HAT®  
**CLOUD  
INFRASTRUCTURE**

RED HAT®  
**ENTERPRISE  
VIRTUALIZATION**

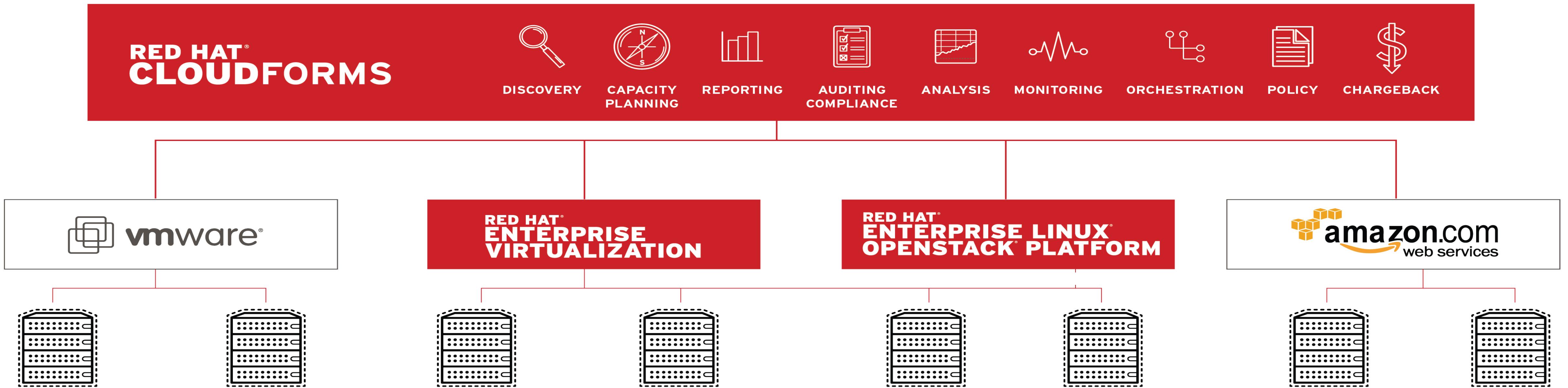
RED HAT®  
**CLOUDFORMS**

RED HAT®  
**ENTERPRISE LINUX®  
OPENSTACK® PLATFORM**

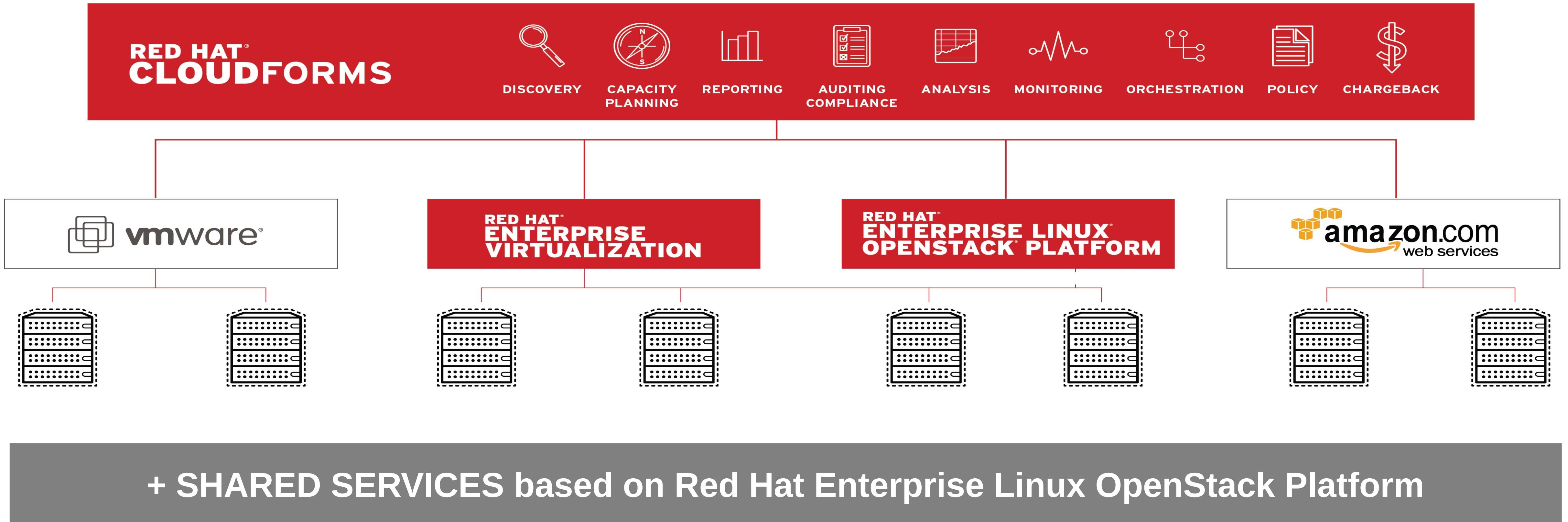
# Red Hat Cloud Infrastructure



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# RED HAT ENTERPRISE VIRTUALIZATION

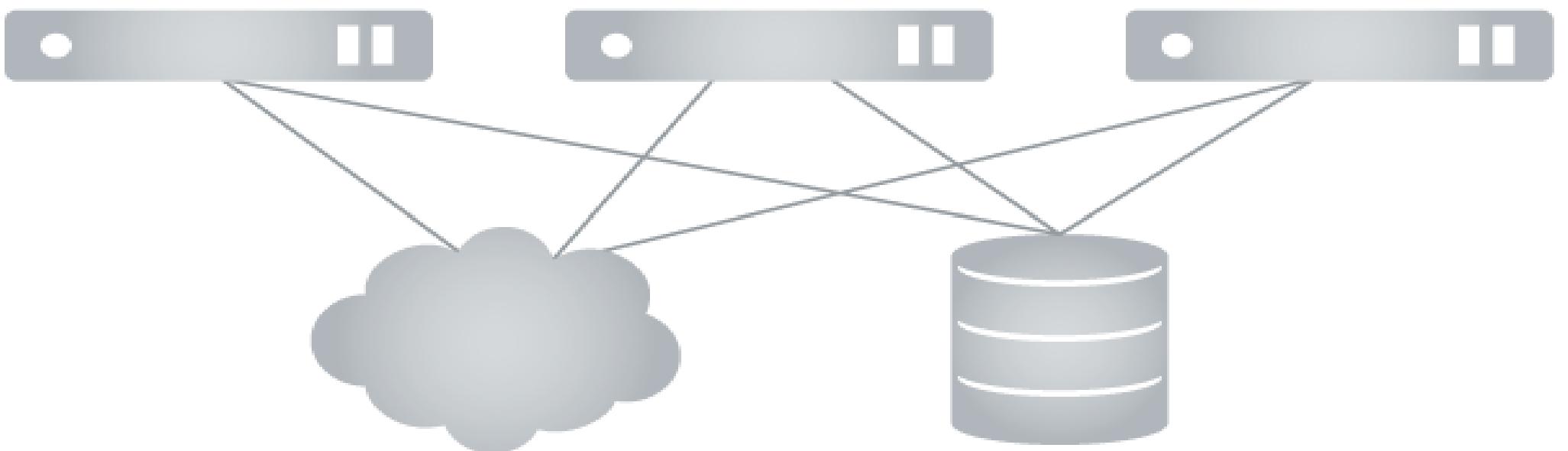


# Red Hat Enterprise Virtualization

- Supports latest virtualization technologies
  - Uses RHEL and RHEV-H hosts
- Leading performance
- Cost-effective



**RED HAT ENTERPRISE VIRTUALIZATION**



# Red Hat Enterprise Virtualization

The screenshot shows the Red Hat Enterprise Virtualization management interface. The top navigation bar includes the Red Hat logo, 'Red Hat Enterprise Virtualization', a search bar ('Search: Network:'), and links for 'Logged in user: admin | Configure | Guide | About | Sign Out' and 'Feedback'. The main menu tabs are Data Centers, Clusters, Hosts, Networks, Storage, Disks, Virtual Machines, Pools, Templates, and Users, with 'Events' being the current tab. On the left, a tree view under 'System' shows 'Data Centers' expanded, listing 'DC32' and 'dc33'. Under 'dc33', there are 'Storage', 'Networks', 'Templates', and 'Clusters'. A 'Bookmarks' section is also present. The central content area displays a table of networks:

Name	Data Center	Description	Role	VLAN tag	Label
rhevm	DC32	Management Network	vm	-	-
bre	dc33		vm	-	2
rhevm	dc33	Management Network	vm	-	-
blue	Default		vm	-	-
green	Default		vm	-	-
NET1	Default		vm	-	-
neutron_net1	Default		vm	-	-
N_w_subnet	Default		vm	-	-
red	Default		vm	-	-
rhevm	Default	Management Network	vm	-	-
rhevm	VLAN172	Management Network	vm	172	-
vlan171	VLAN172		vm	171	-

At the bottom, a message bar indicates 'Last Message: 2014-Apr-08, 13:04' and 'User admin logged in.' There are also links for 'Alerts (0)', 'Events', and 'Tasks (0)'.

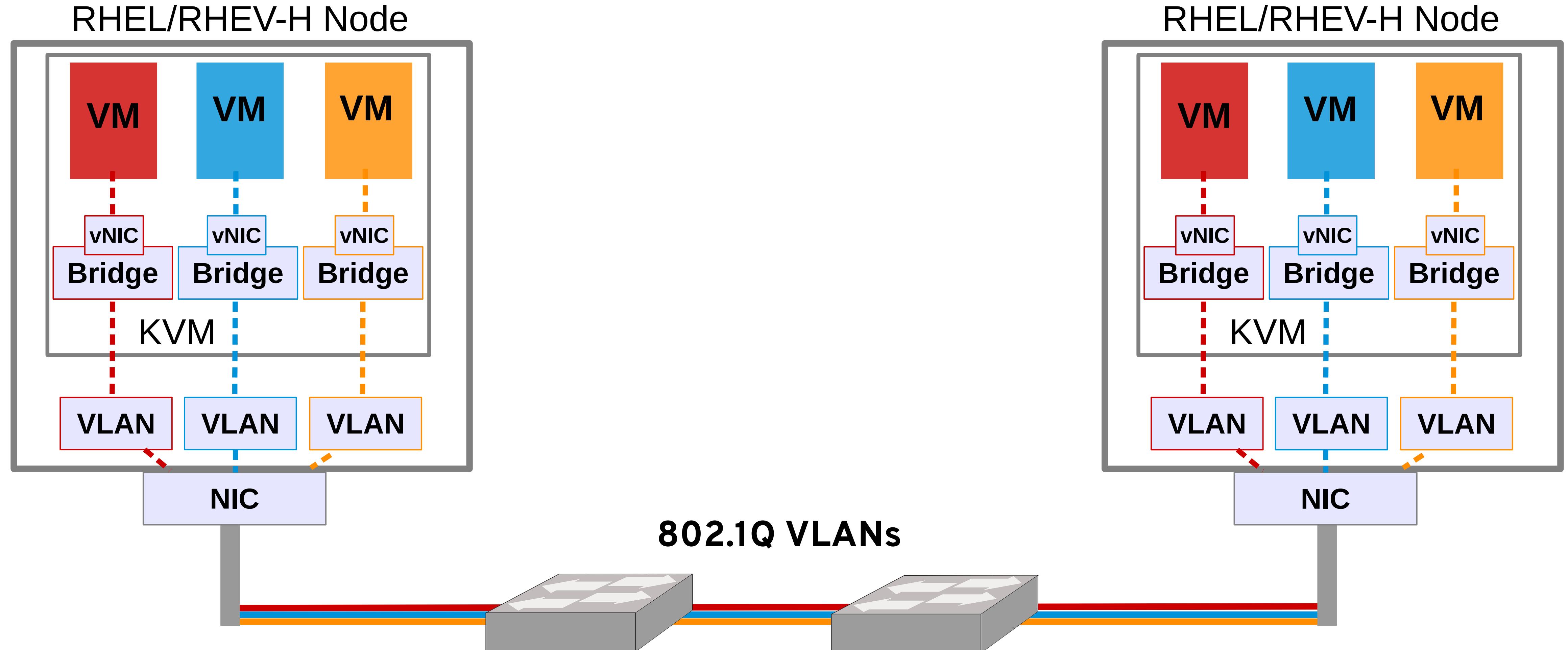
# RHEV networking – key features

- Provisioning and monitoring of hosts networking
  - Interfaces
  - Bonds/link aggregation
- Provisioning and monitoring of logical networks
  - VM connectivity
  - QoS
  - Port mirroring
  - Live Migration

# RHEV networking overview

- Networking implemented using Linux bridge
  - Logical networks map to VLANs in the physical environment
- Logical networks are assigned by functionality
  - Guest data
  - Storage
  - Management
  - Display
  - Migration

# RHEV networking overview



# RHEV 3.4 – Network Labels

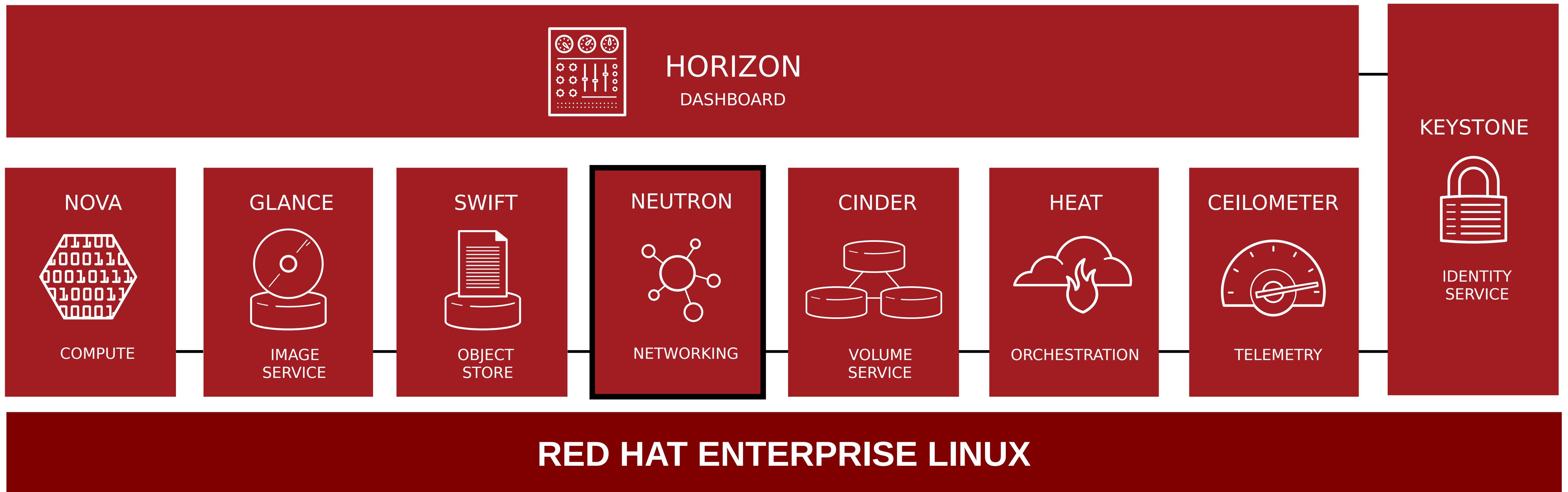
- Assign a label to a logical network
- Attach the label to NICs or Bonds
- Results in significant improvement of provisioning time across different hosts



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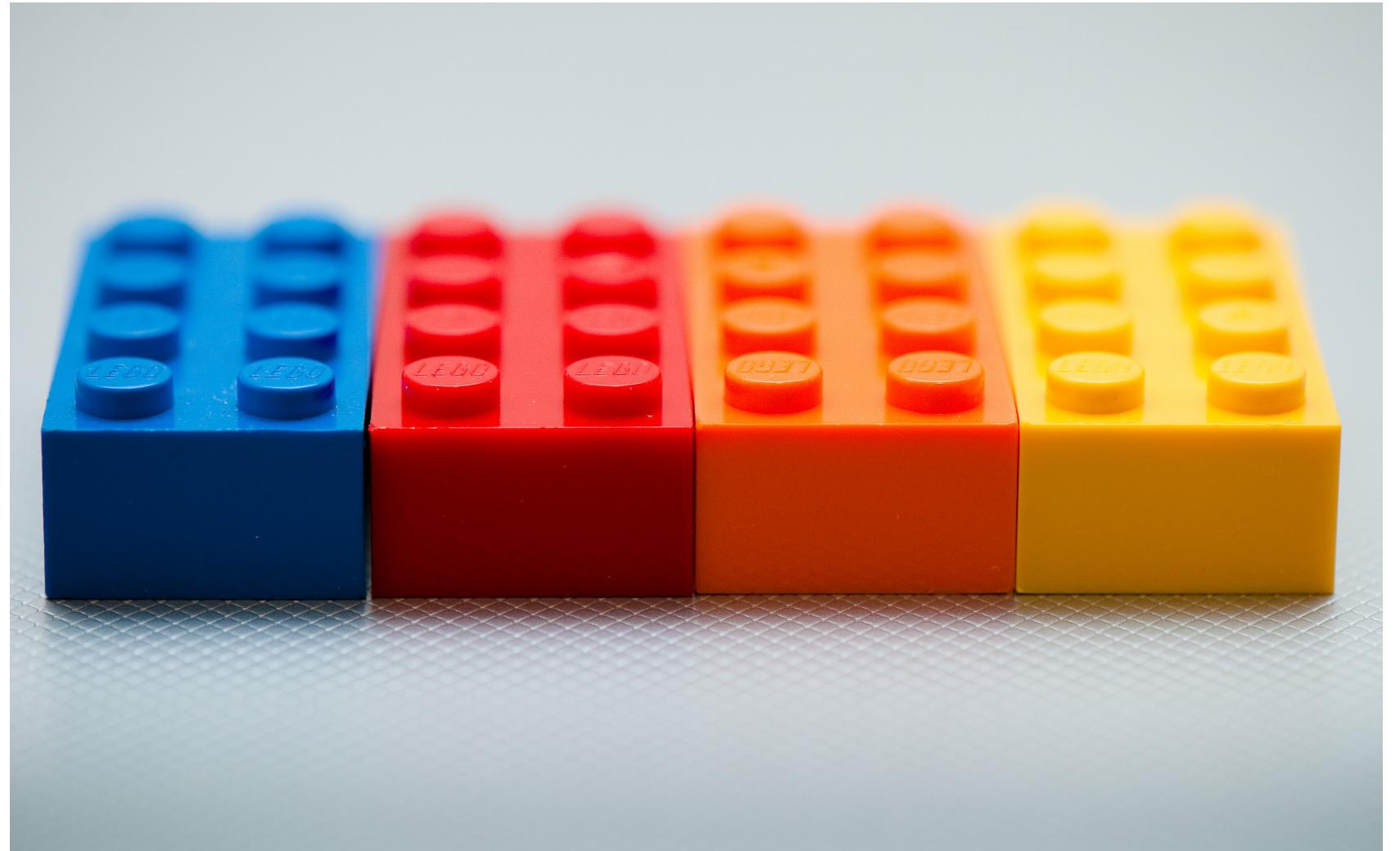
# RED HAT ENTERPRISE LINUX OPENSTACK PLATFORM

# Red Hat Enterprise Linux OpenStack Platform



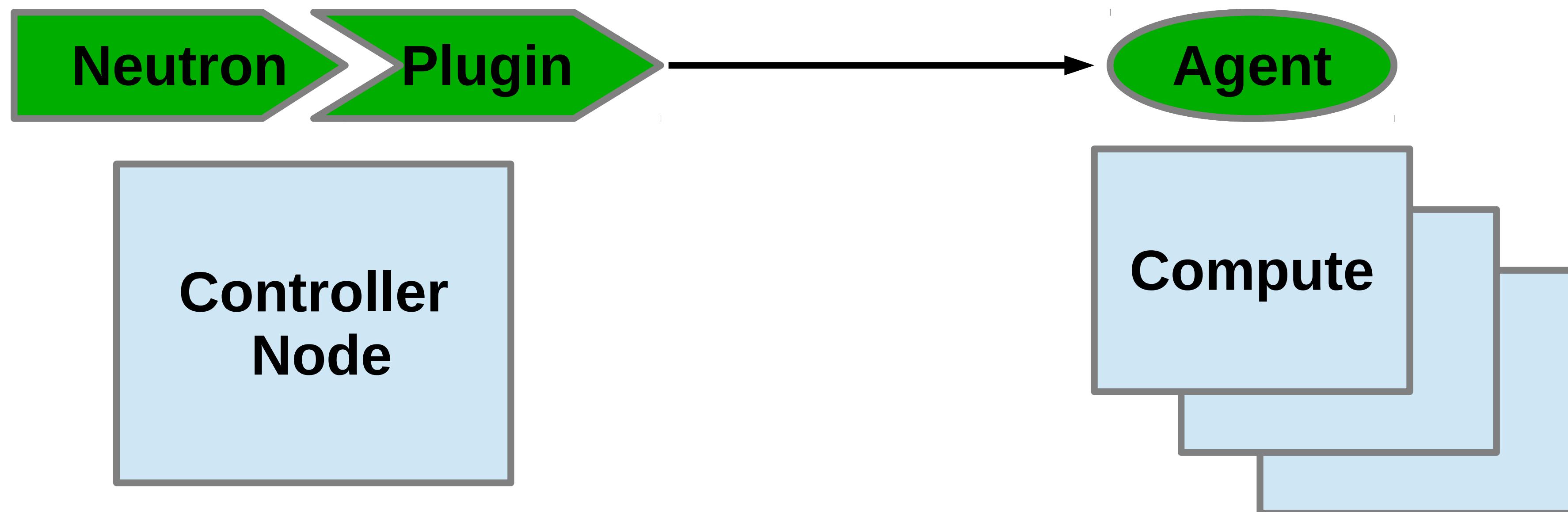
# OpenStack Neutron

- Fully supported and integrated OpenStack project
- Exposes an API for defining rich network configuration
  - Based on a pluggable architecture
  - Offers multi-tenancy with self-service



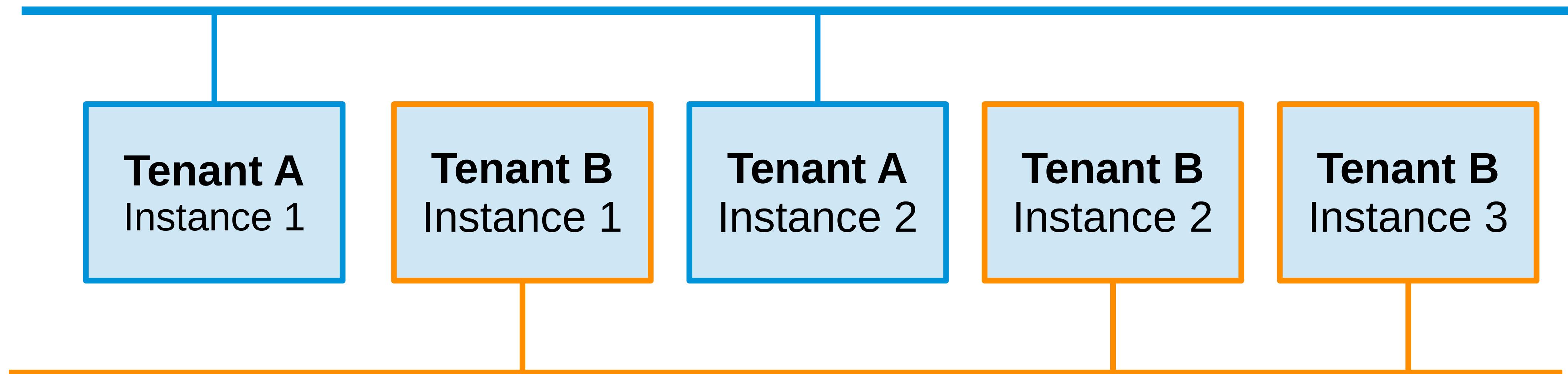
# Behind the scenes

- Neutron stores the logical abstraction
- Plugins “translate” the definition into actual configuration



# Neutron tenant networks

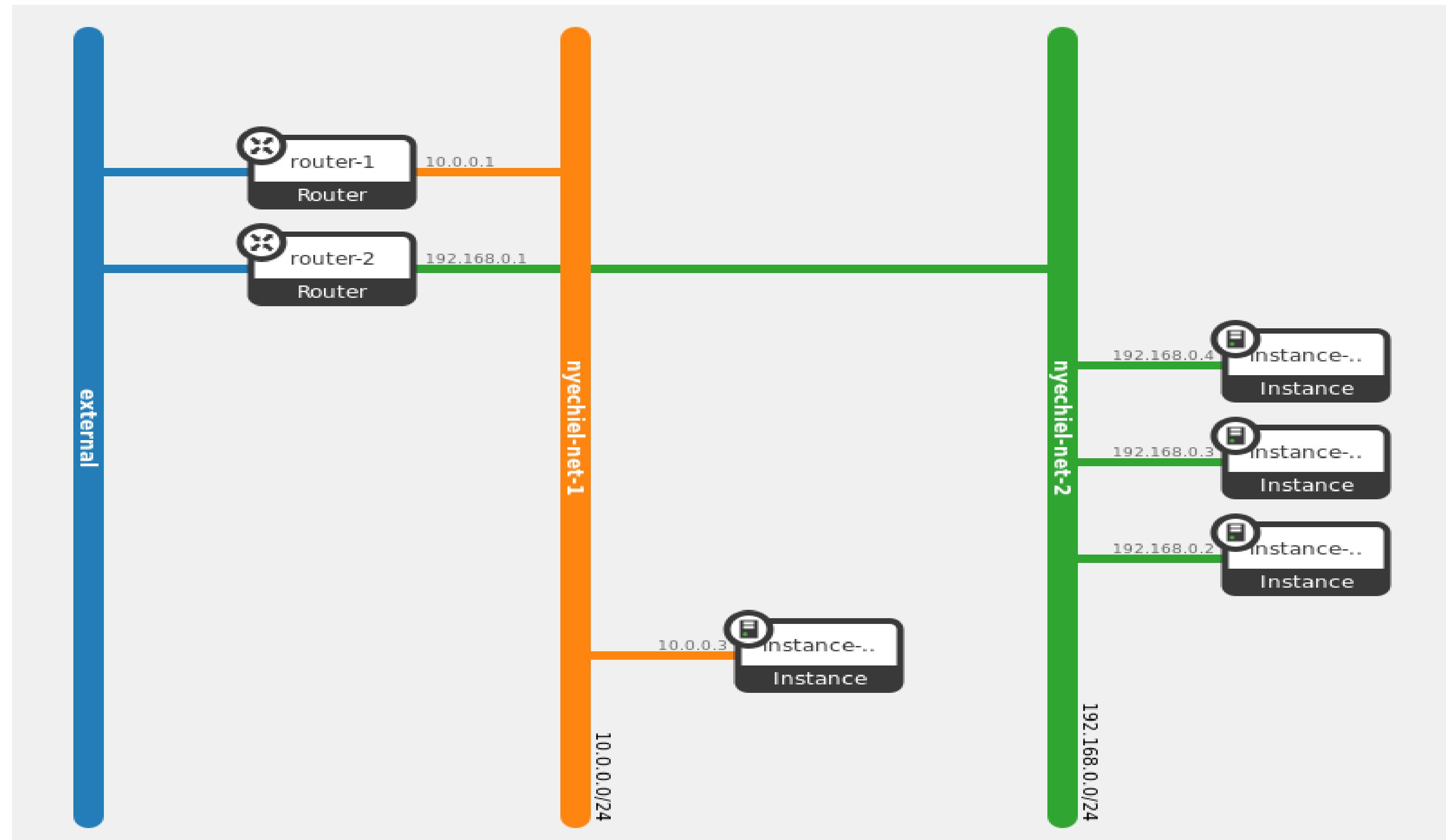
- User-owned and controlled virtual network
- Completely isolated from one another



# Neutron tenant networks

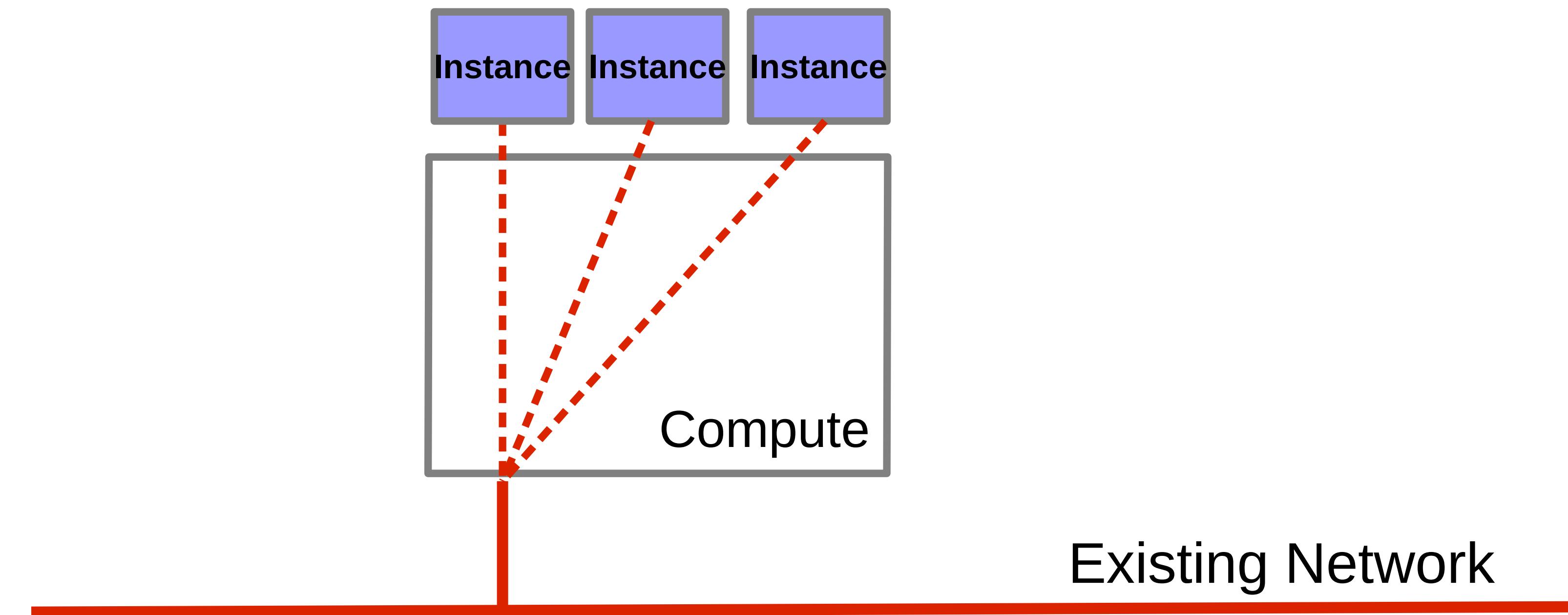
- Give users the ability to -
  - Define their network topology
  - Assign IP address, DHCP, DNS
  - Implement instance firewall rules (aka Security Groups)
  - Use VPNaas and Lbaas
- Segregation options: **VLAN, GRE, VXLAN**

# Neutron tenant networks



# Neutron provider networks

- What if you have an existing datacenter network?



# We've been OPEN all along



# What is Open vSwitch?

- Open-source alternative to Linux bridge
- Extensive flow table programming
- Designed for Overlay networking
  - GRE, VXLAN, LISP
- SDN-ready
  - OpenFlow 1.1/1.3
  - OVSDB



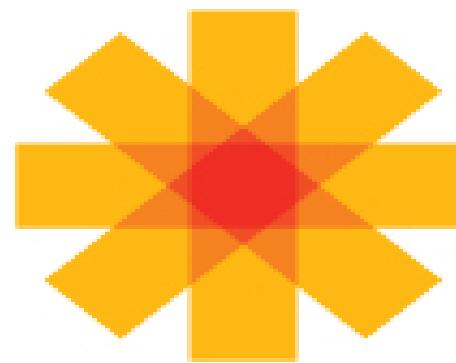
# What is Open vSwitch?

- The default plugin used in RHEL OpenStack
  - *openvswitch-12-agent* runs on each compute node

# What is OpenDaylight?

- Open platform to enable Software Defined Networking (SDN)
- Collaborative project under The Linux Foundation

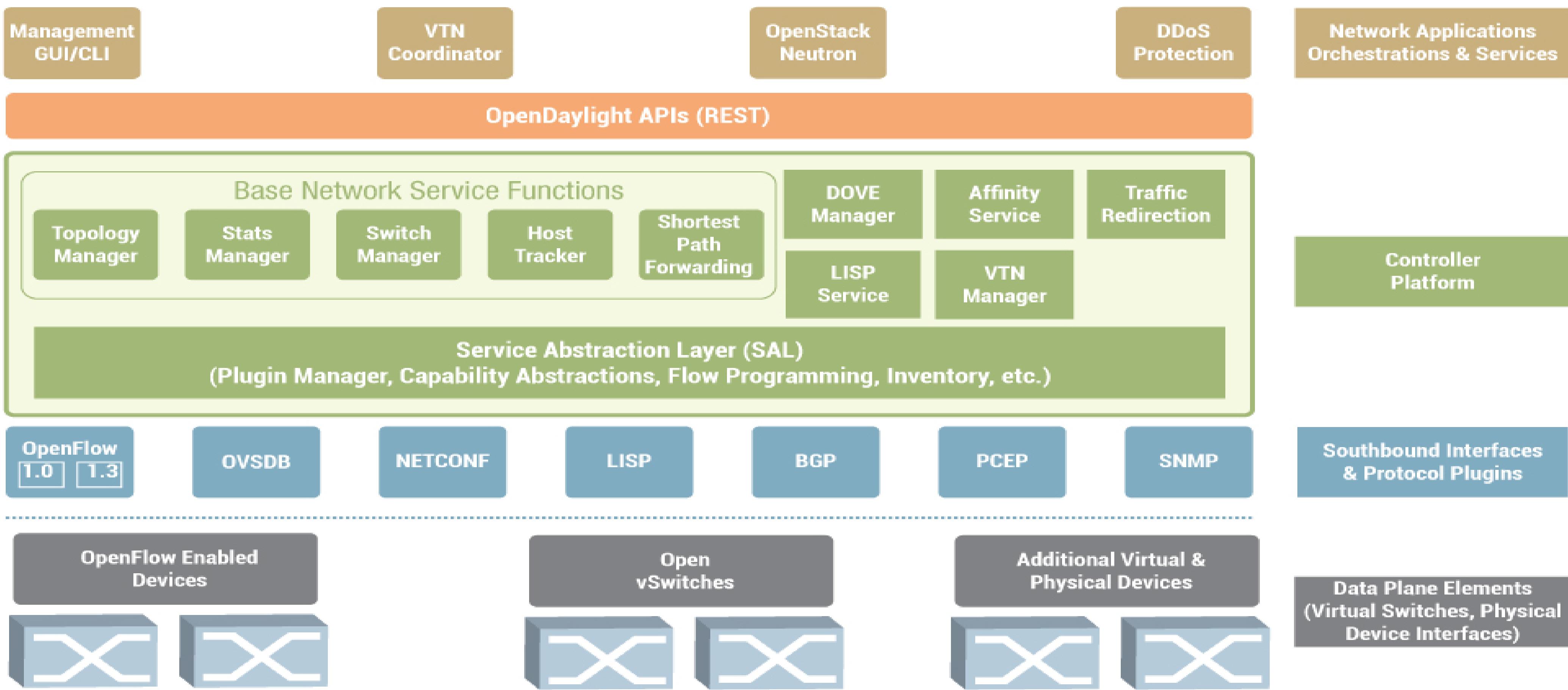




# OPEN DAYLIGHT

## First Code Release “Hydrogen”

**VTN:** Virtual Tenant Network  
**DOVE:** Distributed Overlay Virtual Ethernet  
**DDoS:** Distributed Denial Of Service  
**LISP:** Locator/Identifier Separation Protocol  
**OVSDB:** Open vSwitch DataBase protocol  
**BGP:** Border Gateway Protocol  
**PCEP:** Path Computation Element Communication Protocol  
**SNMP:** Simple Network Management Protocol



# What is OpenDaylight?

- Encourage you to visit *.opendaylight.org*
- OpenDaylight integration with Neutron is available on RDO
  - *[http://openstack.redhat.com/OpenDaylight\\_intergration](http://openstack.redhat.com/OpenDaylight_intergration)*



# Neutron Partner ecosystem

- Close engineering relationship with our partners
  - Cooperative development
  - Upstream collaboration
  - Joint testing
  - Validated Design/Ref Architecture
  - Mutual customer support
- Check out *marketplace.redhat.com/* for certified Neutron plugins



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# COMMON NEUTRON DEPLOYMENT ARCHITECTURE



# OpenStack Neutron main components

- **neutron-server**
  - Main process of the OpenStack Networking server

# OpenStack Neutron main components

- **neutron-dhcp-agent**
  - Provides DHCP services to all tenant networks

# OpenStack Neutron main components

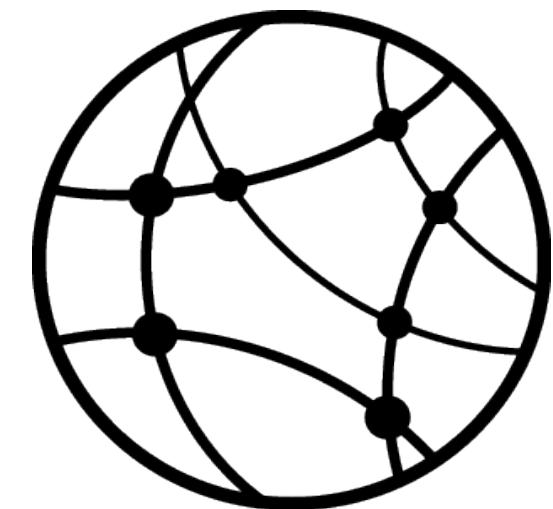
- **neutron-l3-agent**
  - Provides L3 forwarding and NAT to external networks

# OpenStack Neutron main components

- **neutron-l2-agent**
  - Performs local virtual switch configuration on each compute node
  - Also responsible for Security Groups implementation
    - Caveat
      - OpenStack uses **iptables** rules on the TAP devices to implement security groups
      - Open vSwitch is not compatible with that
      - Currently requires an additional Linux bridge

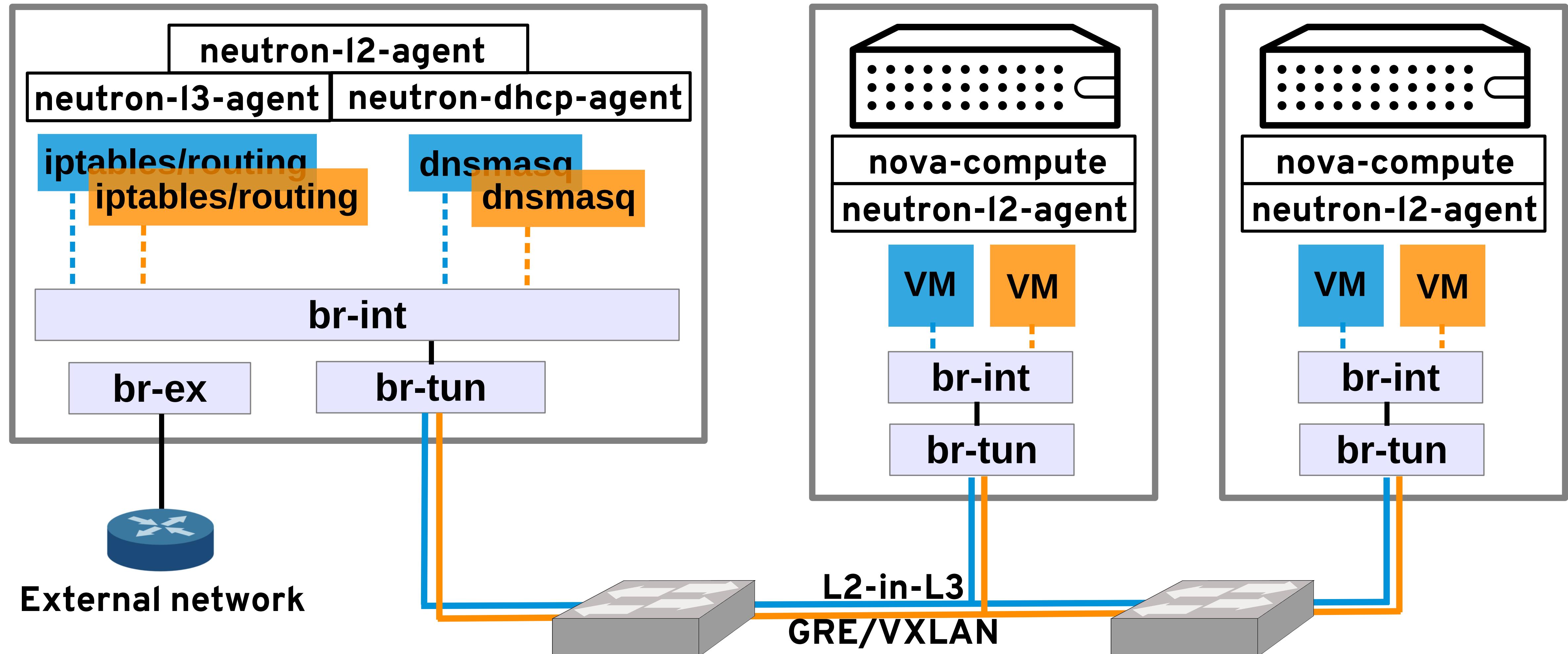
# OpenStack ‘Neutron Node’

- Provides per-network services
  - L3 routing
  - DHCP
- Provides connectivity with external networks
  - SNAT
  - Floating IPs
- Uses Linux network namespaces
  - Kernel version > 2.6.32-431.el6.x86\_64



<b>neutron-l2-agent</b>
<b>neutron-l3-agent</b>
<b>neutron-dhcp-agent</b>

# OpenStack Neutron Architecture





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# PUTTING IT ALL TOGETHER

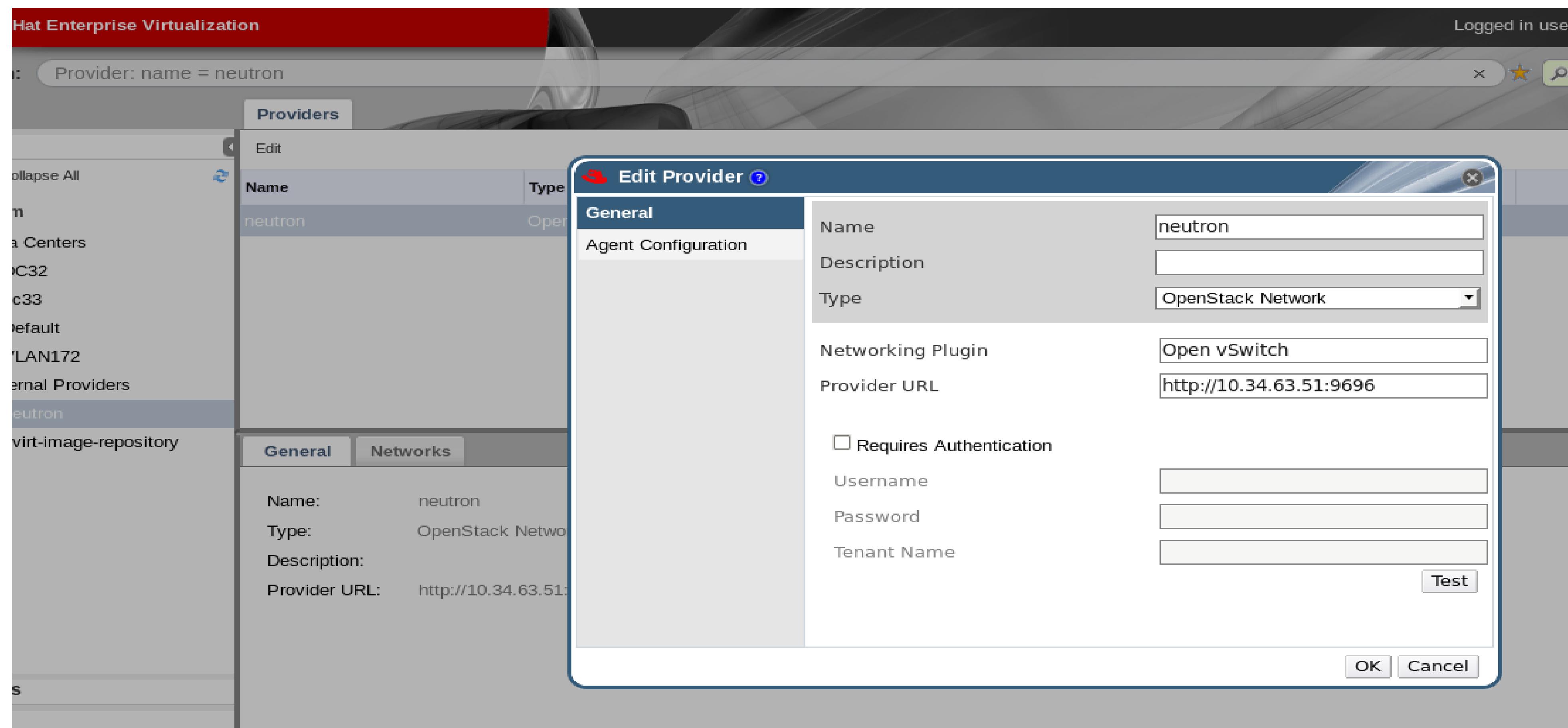
# RHEV and Neutron – better together

- Share Neutron with OpenStack and RHEV
- Extend RHEV via Neutron plugins
- Enhance RHEV to support:
  - DHCP and VM IP assignment
  - Security Groups/VM Firewall
  - L3-L7 services (road-map)
  - Overlay networks (road-map)

# RHEV - OpenStack Neutron Provider

- RHEV now supports two types of network
  - Internal network
    - Defined and provisioned by RHEV-M
  - External network
    - Provisioned by Neutron provider
    - Consumed by RHEV-M

# Step 1: Link Neutron with RHEV



Neutron virtual appliance is under development

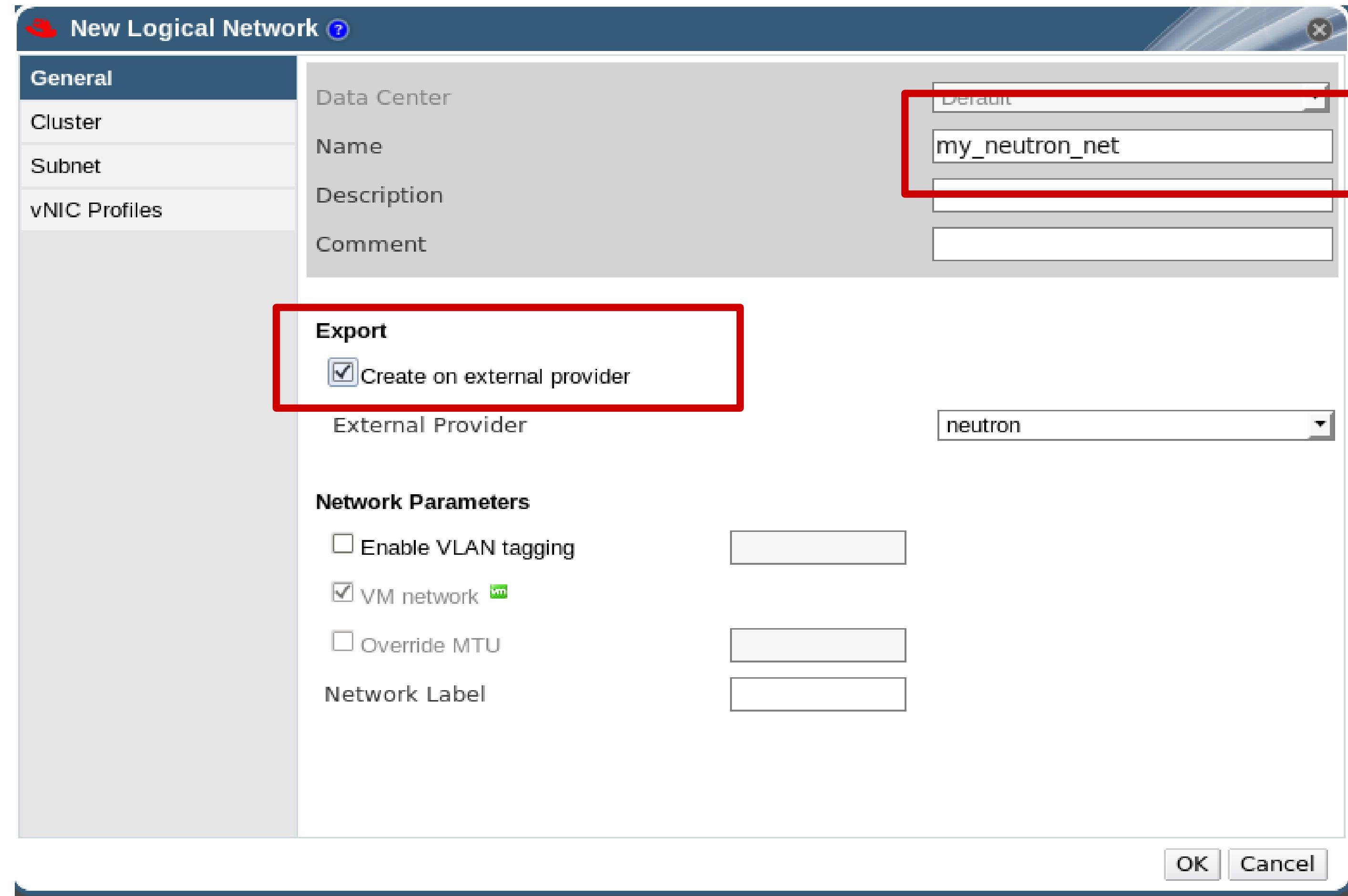
# Step 2: Add Compute Hosts

New Host ? X

General	External Network Provider	<span style="color: blue;">?</span> <input type="text" value="neutron"/>
Power Management	Type	<span style="color: blue;">?</span> <input type="text" value="OpenStack Network"/>
SPM	Networking Plugin	<input type="text" value="Open vSwitch"/>
Console		
<b>Network Provider</b>	Bridge Mappings	<span style="color: blue;">?</span> <input type="text" value="neutron:em2"/>
<b>QPID</b>		
	Host	<input type="text"/>
	Port	<input type="text"/>
	Username	<input type="text"/>
	Password	<input type="text"/>

RHEL node with plugin of choice

# Step 3.1: Add Neutron networks through RHEV



# Step 3.2: Add Neutron networks through RHEV

New Logical Network 

General	Name	my_neutron_net_subnet
Cluster	CIDR	192.168.10.0/28
<b>Subnet</b>	IP Version	IPv4
vNIC Profiles		

Add the network IP subnet

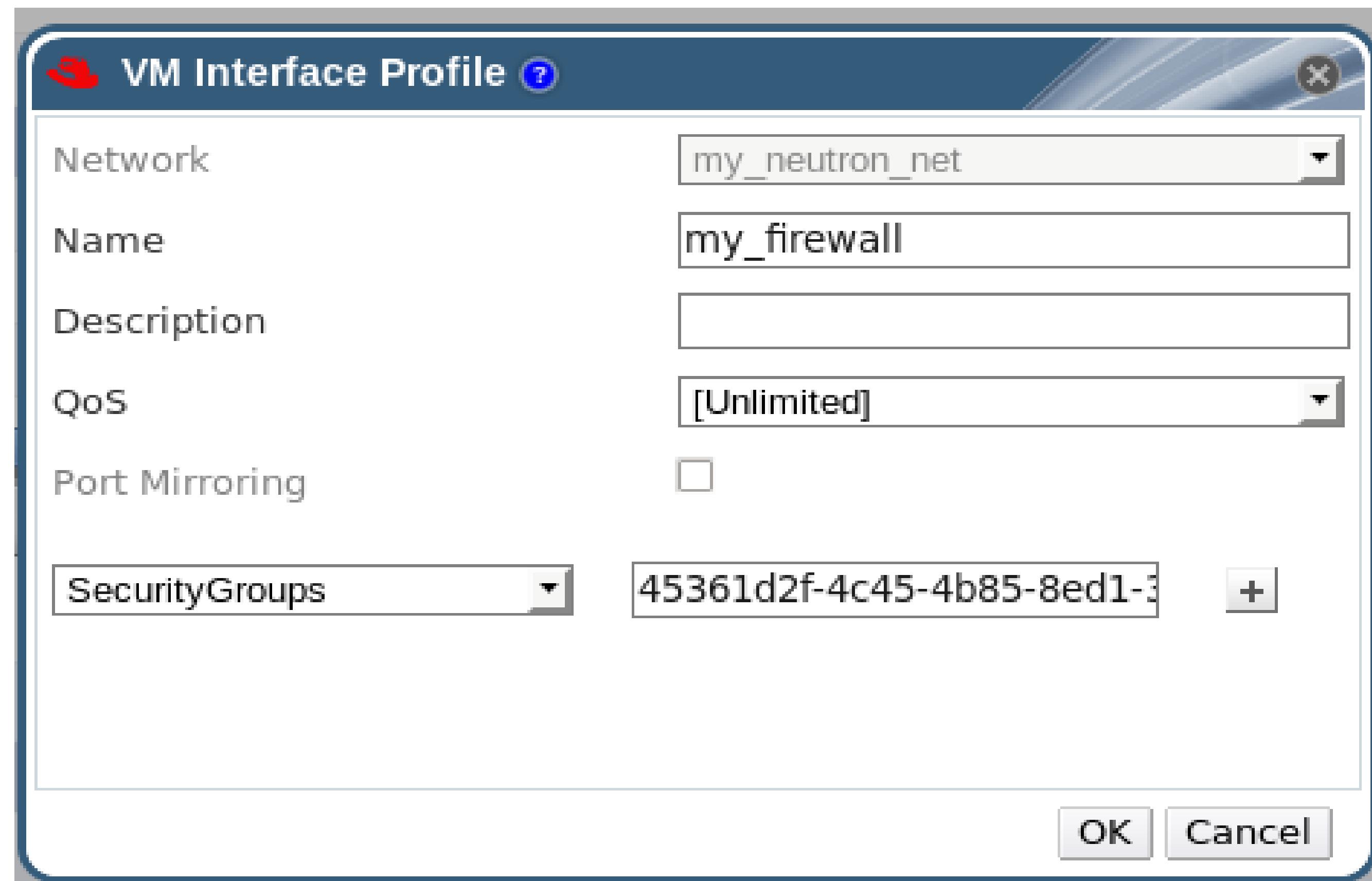
```
# neutron net-show my_neutron_net
```

Field	Value
admin_state_up	True
id	b15d6940-5752-427e-bda1-c6dadf6b2f53
name	my_neutron_net
provider:network_type	local
provider:physical_network	
provider:segmentation_id	
router:external	False
shared	False
status	ACTIVE
subnets	45a8f307-7cec-42e1-b890-1ac5a08c34da
tenant_id	oVirt

```
# neutron subnet-show 45a8f307-7cec-42e1-b890-1ac5a08c34da
```

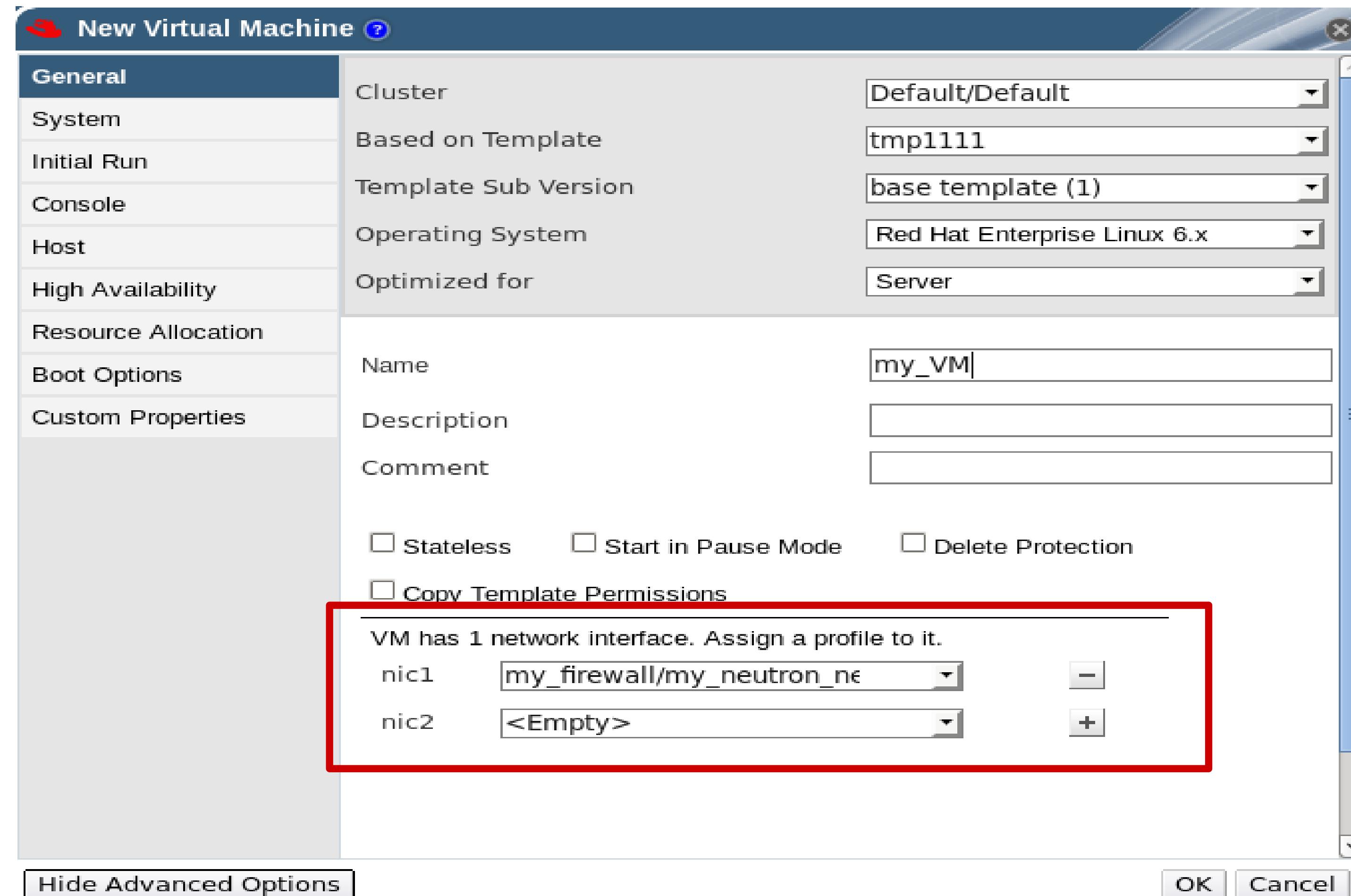
Field	Value
allocation_pools	{"start": "192.168.10.2", "end": "192.168.10.14"}
cidr	192.168.10.0/28
dns_nameservers	
enable_dhcp	True
gateway_ip	192.168.10.1
host_routes	
id	45a8f307-7cec-42e1-b890-1ac5a08c34da
ip_version	4
name	my_neutron_net_subnet
network_id	b15d6940-5752-427e-bda1-c6dadf6b2f53
tenant_id	oVirt

# Step 3.3: Add Neutron networks through RHEV



**Attach Security Group to vNIC Profile**

# Step 4: Attach networks to VMs





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**THANK YOU**  
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