



SDN v praxi overlay sítí pro OpenStack

5.10.2015

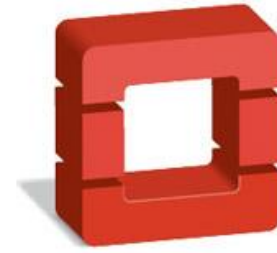
Daniel Prchal

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Agenda

- OpenStack
- OpenStack Architecture
- SDN – Software Defined Networking
- OpenStack Networking
- HP Helion OpenStack
- HP Helion CloudSystem

OpenStack – WTF ?



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Open source software for creating private and public clouds.

What is OpenStack?

OpenStack is a cloud operating system that controls large pools of compute, storage, and networking resources throughout a datacenter, all managed through a dashboard that gives administrators control while empowering their users to provision resources through a web interface.

Openstack distributions:

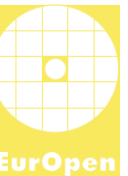
<http://www.openstack.org/marketplace/distros/>

Openstack drivers:

<http://www.openstack.org/marketplace/drivers/>

Openstack public clouds:

<http://www.openstack.org/marketplace/public-clouds/>

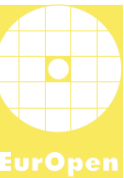


OpenStack – Public Clouds



Using a cloud

There are OpenStack powered public clouds all over the world. Explore the possibilities.



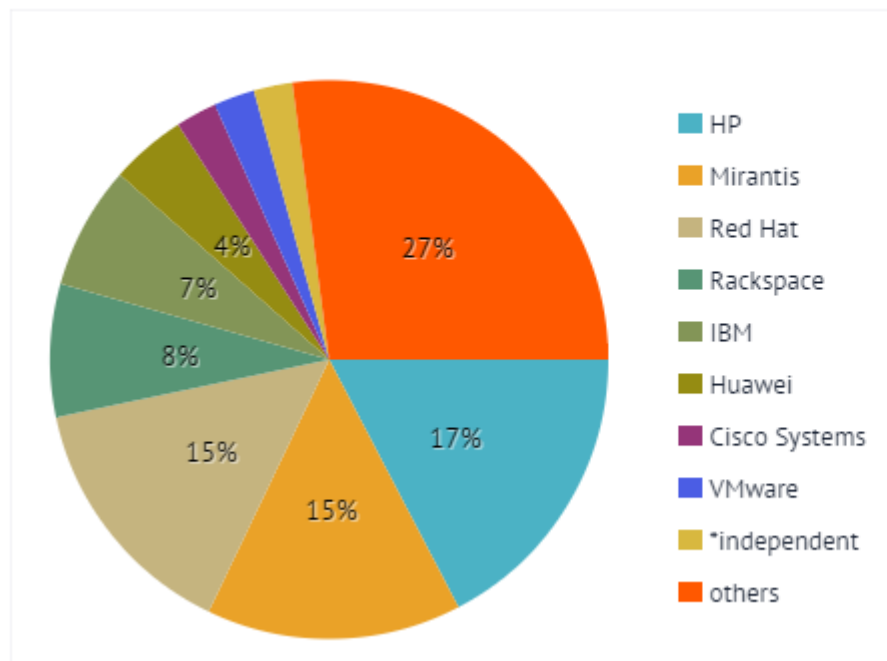
OpenStack – Contributors



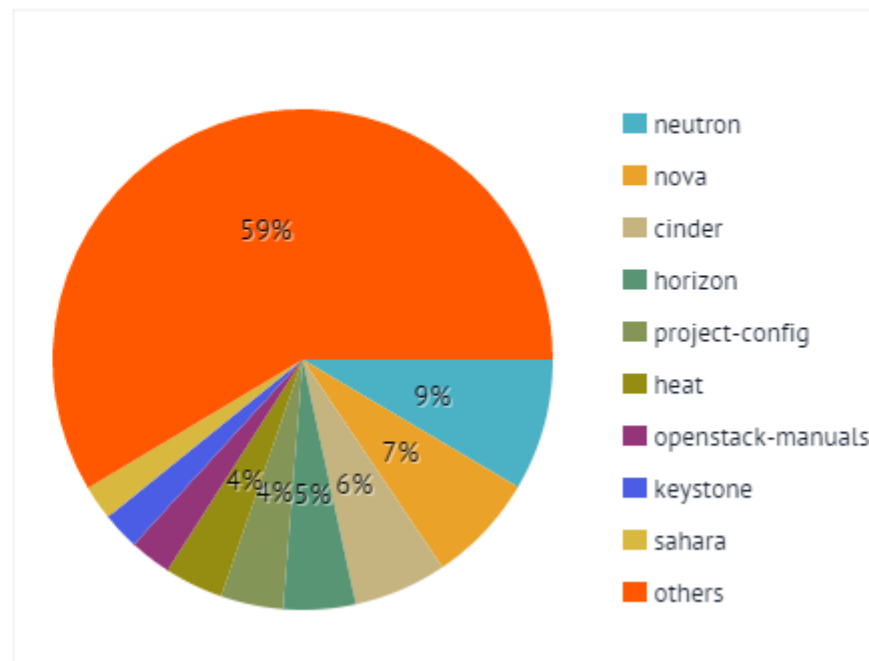
<http://stackalytics.com>

Release: Liberty | Project Type: OpenStack | Module: Any module | Company: Any company | Contributor: Any contributor | Metric: Reviews | Last updated on 01 Oct 2015 09:45:11 UTC

Contribution by companies



Contribution by modules



OpenStack – Contributors



<http://stackalytics.com>

Release: Liberty | Project Type: OpenStack | Module: Any module | Company: Any company | Contributor: Any contributor | Metric: Reviews | Last updated on 01 Oct 2015 09:45:11 UTC

#	Company	Reviews
1	HP	28693
2	Mirantis	24455
3	Red Hat	24137
4	Rackspace	12736
5	IBM	11806
6	Huawei	7263
7	Cisco Systems	3952
8	VMware	3916
	*independent	3714
9	Intel	3676

Showing 1 to 10 of 158 entries

#	Module	Reviews
1	neutron	14082
2	nova	11679
3	cinder	9982
4	horizon	7710
5	project-config	6682
6	heat	6294
7	openstack-manuals	4451
8	keystone	4004
9	sahara	3691
10	kolla	3594

Showing 1 to 10 of 404 entries



OpenStack – WTF ?



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Open Source

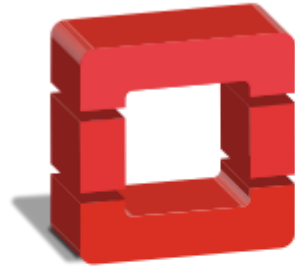
Cloud Operating System

Many Contributors

All major vendors are producing OpenStack drivers

Managed through a GUI, CLI or API

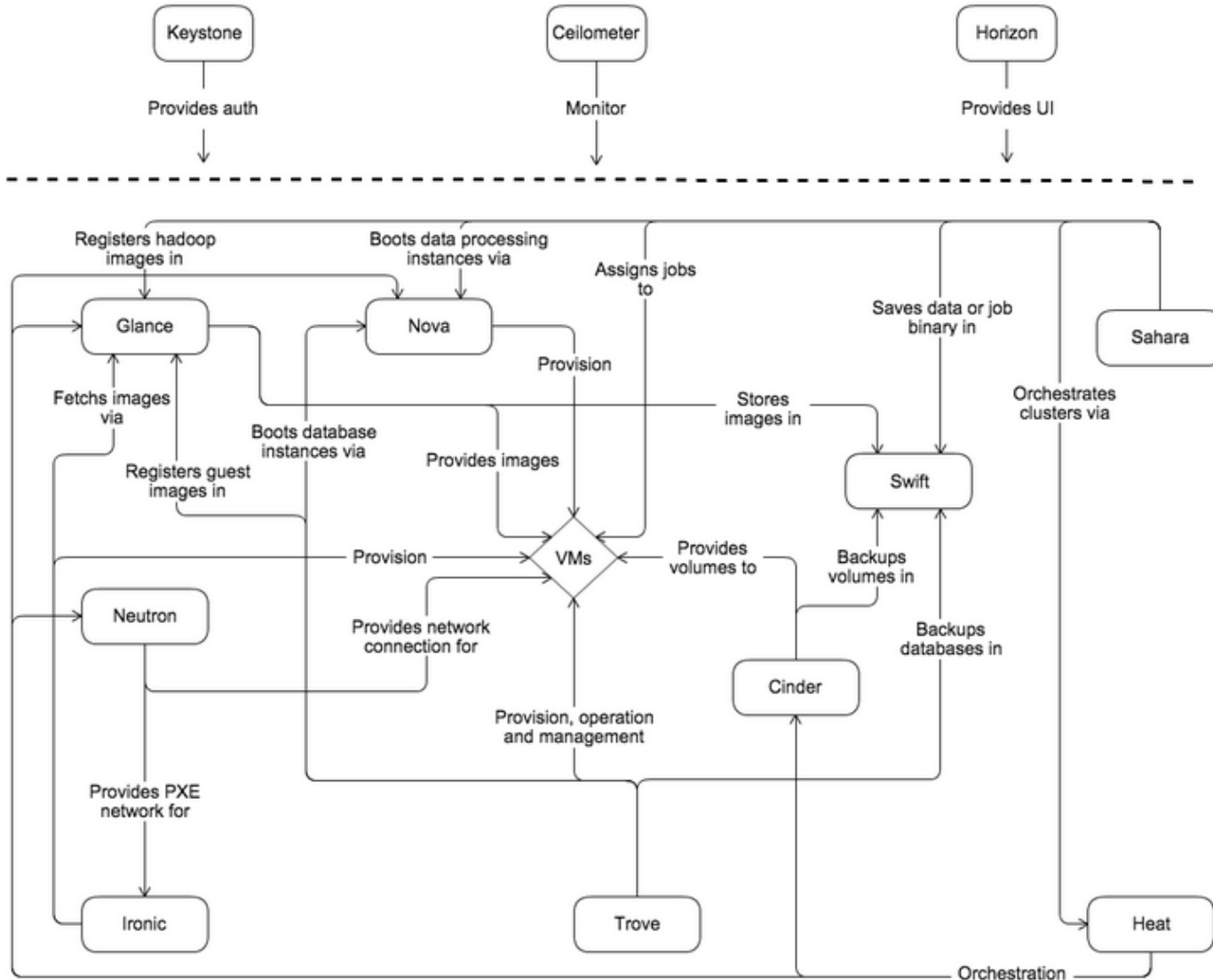
Simple Integration



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Architecture

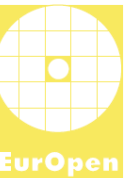
OpenStack – Conceptual Architecture



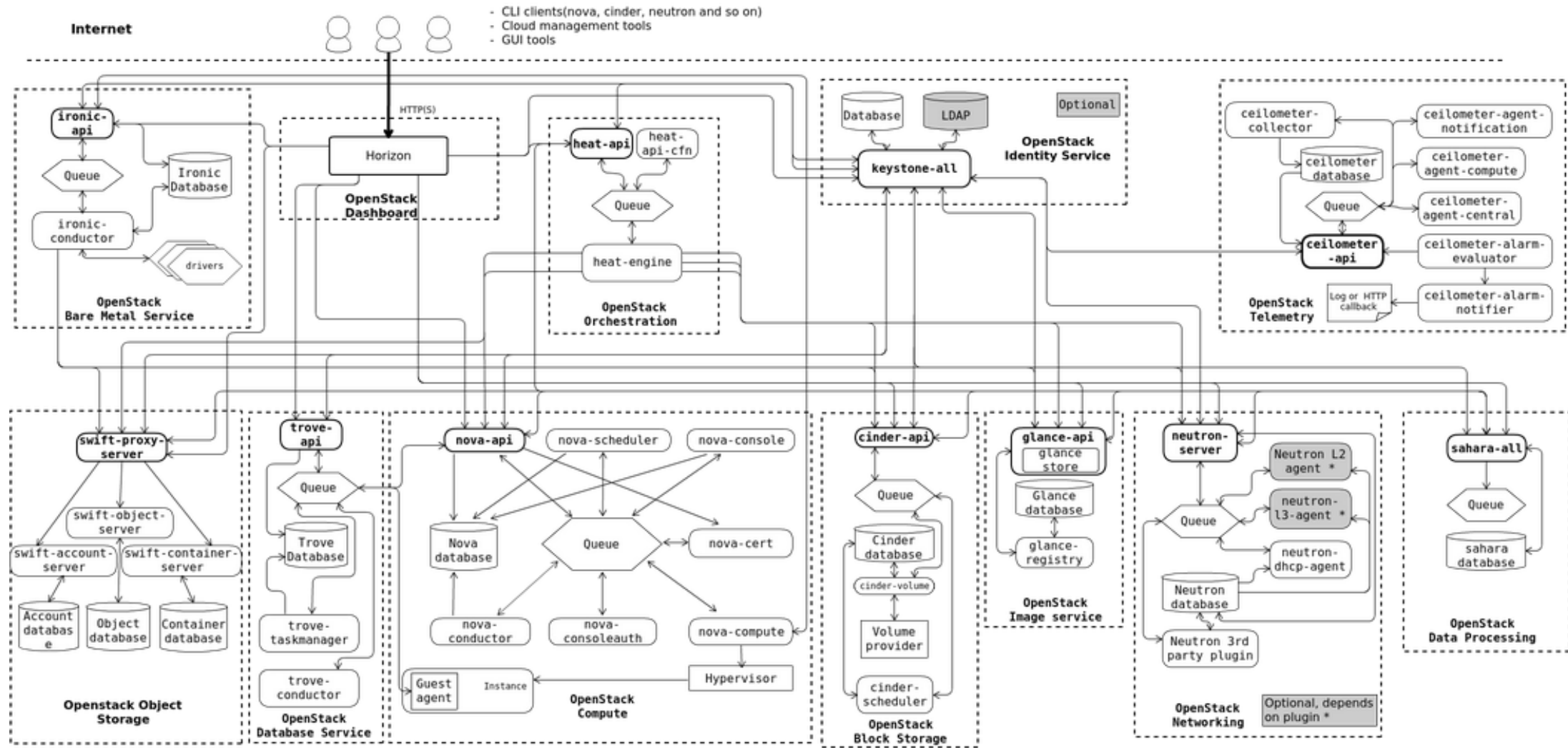
Keystone – Authorization
 Horizon – User Interface
 Ceilometer – Monitor

Glance – Image service
 Nova – Compute
 Swift – Object Storage
 Cinder – Block Storage
Neutron – Networking

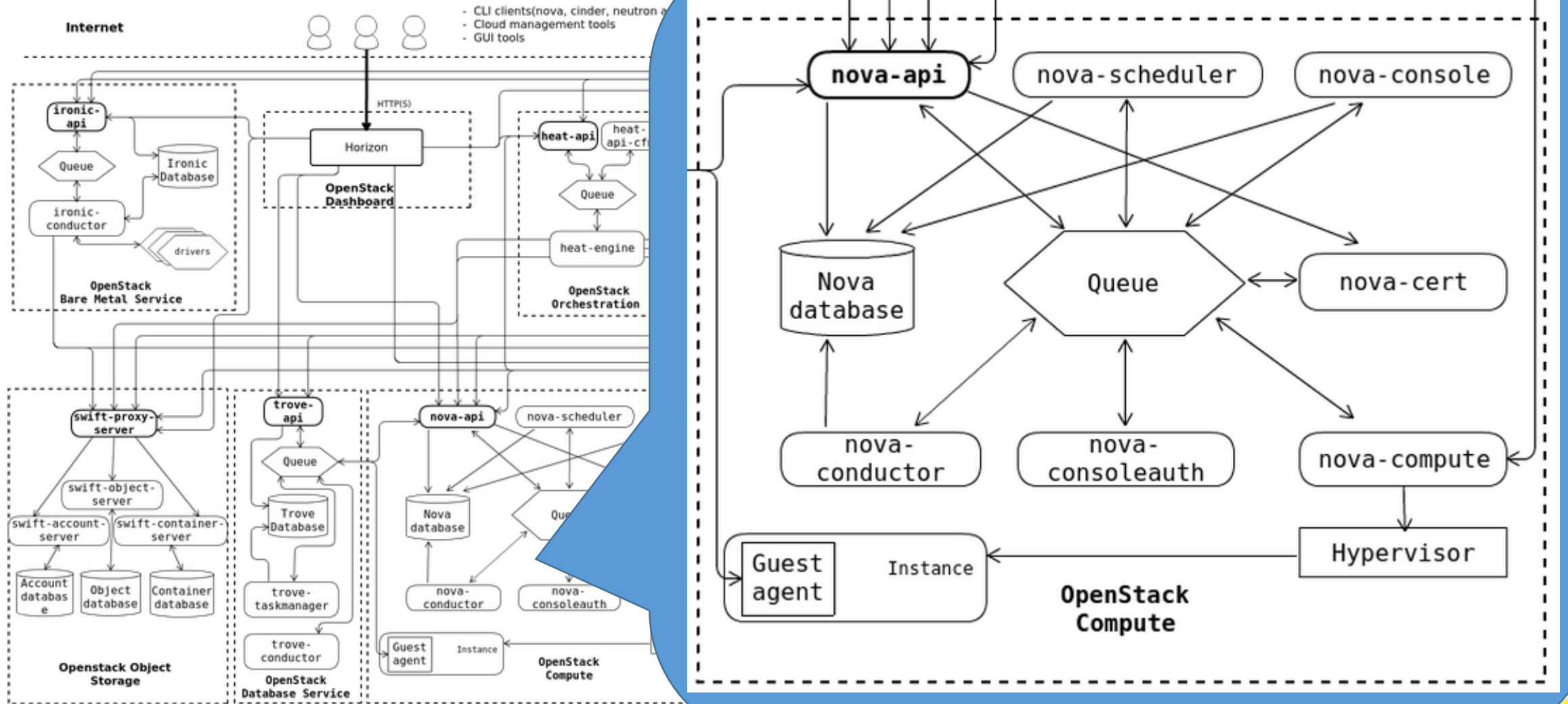
Ironic – Deployment
 Trove – Database
 Heat – Stack orchestration
 Sahara – Data-intensive application cluster



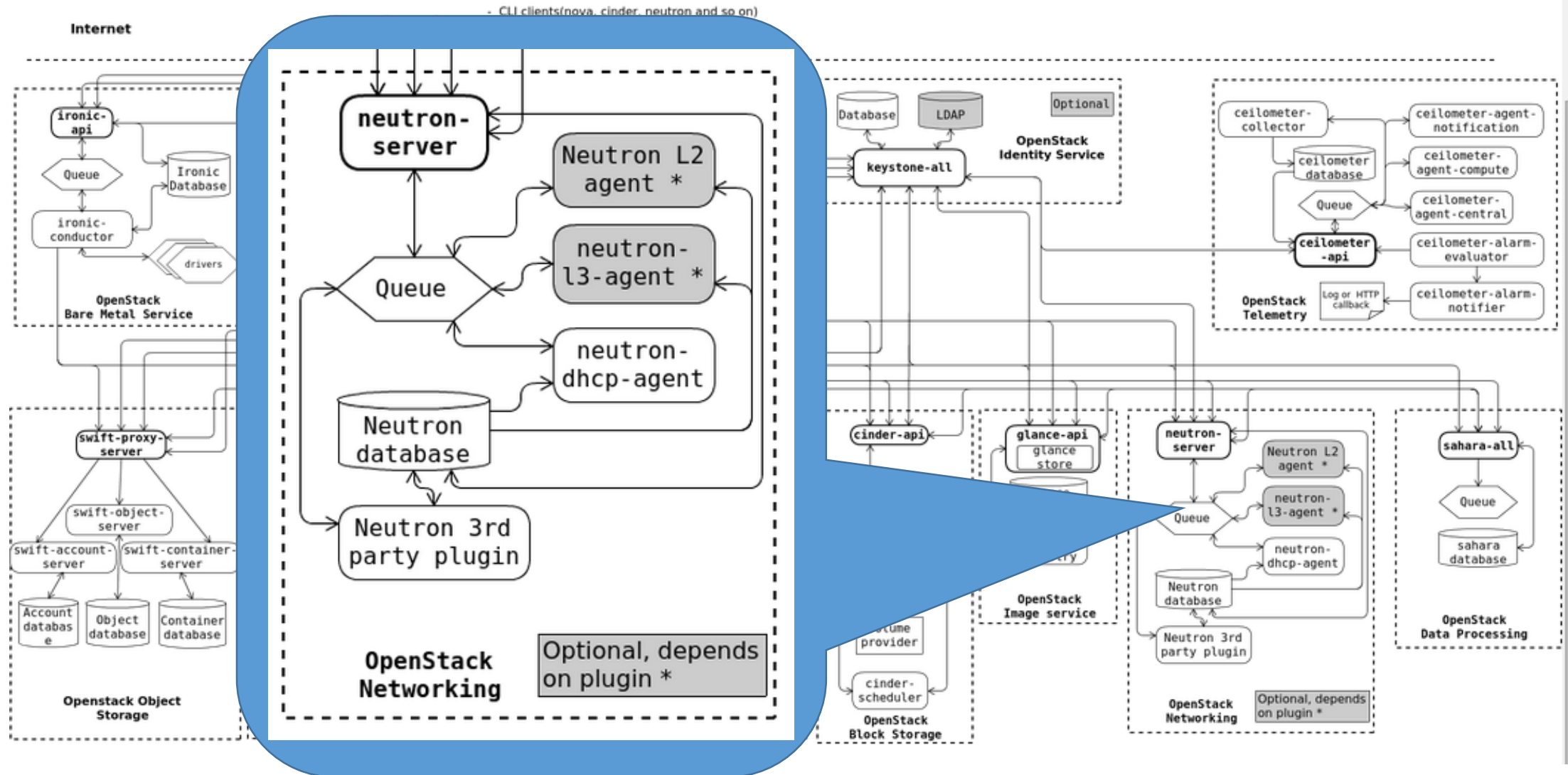
OpenStack – Logical Architecture



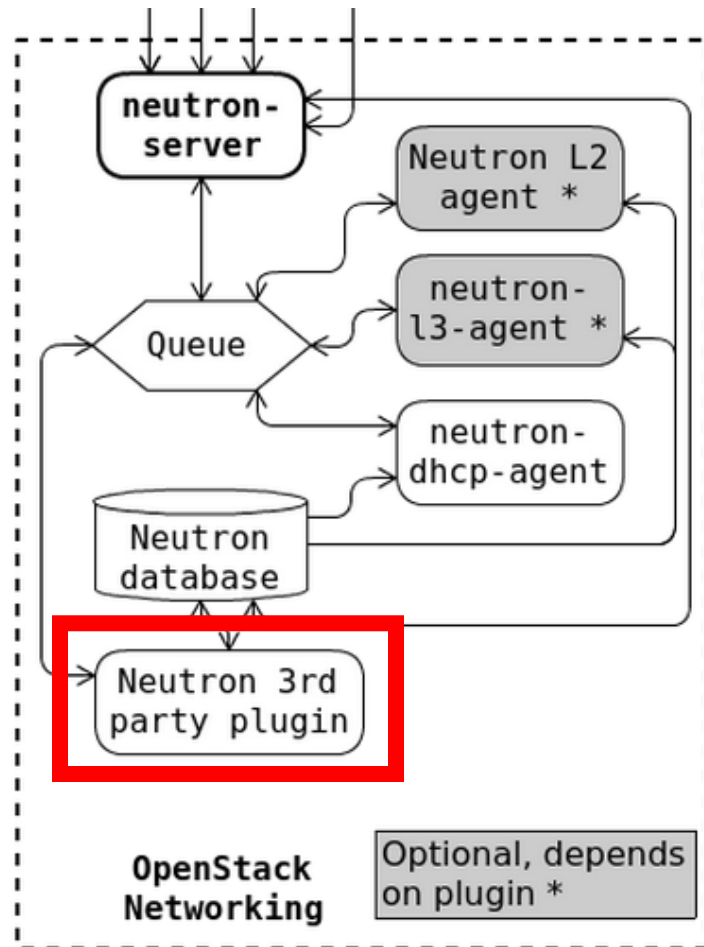
OpenStack – Logical Architecture



OpenStack – Logical Architecture



OpenStack – Neutron



The OpenStack Networking service provides an API that allows users to set up and define network connectivity and addressing in the cloud.

Plugins can extend networking functionality.

OpenStack – Neutron plugins



- LBaaS

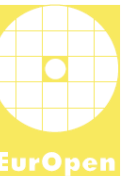
The Load-Balancer-as-a-Service (LBaaS) API provisions and configures load balancers. The reference implementation is based on the HAProxy software load balancer.

- FWaaS

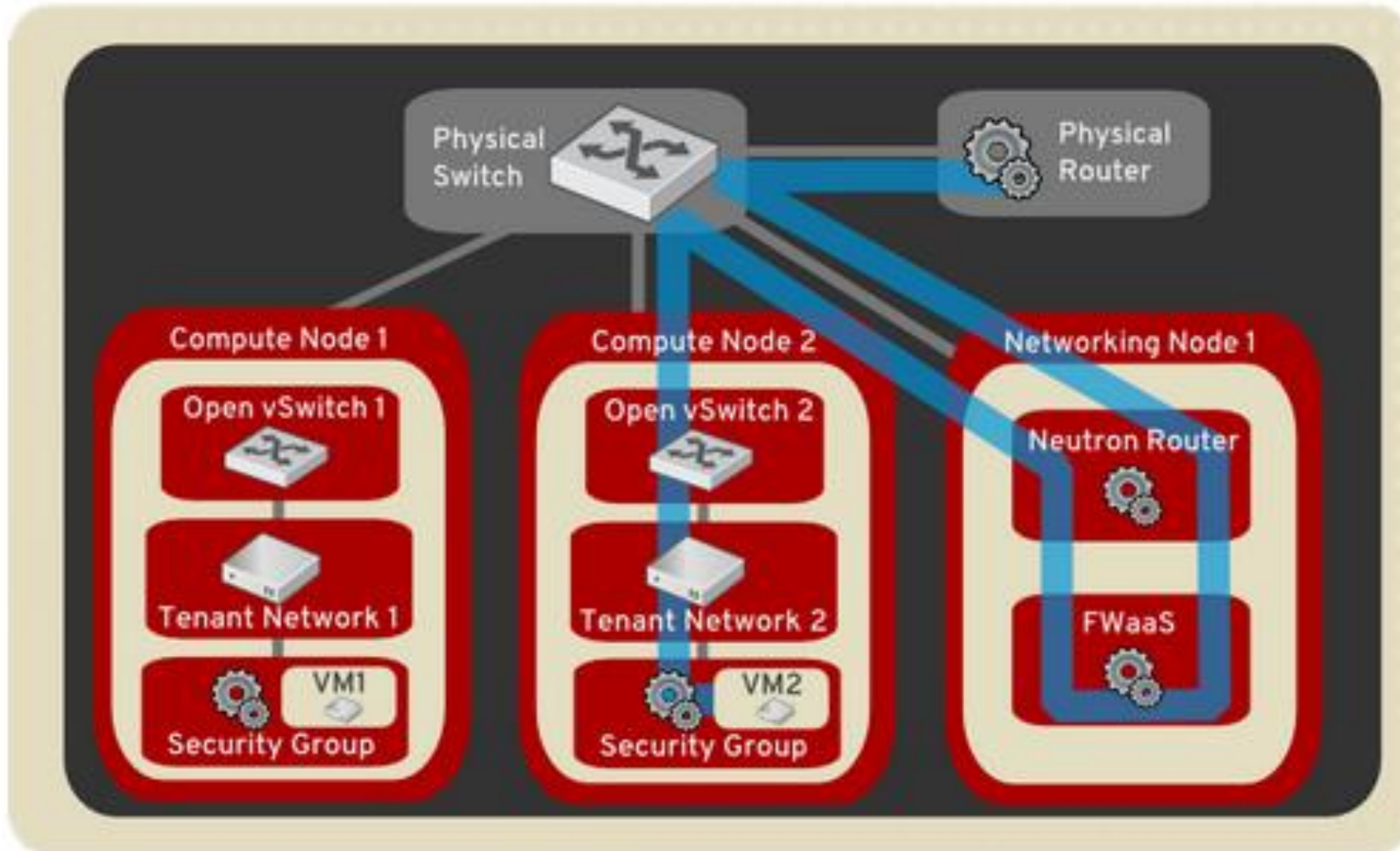
The Firewall-as-a-Service (FWaaS) API is an experimental API that enables early adopters and vendors to test their networking implementations.

- VPNaaS

The Virtual Private Network as a Service (VPNaaS) is a neutron extension that introduces the VPN feature set.



OpenStack – Neutron plugins





SDN – Software Defined Networking

SDN

Definition from the Open Network Foundation:

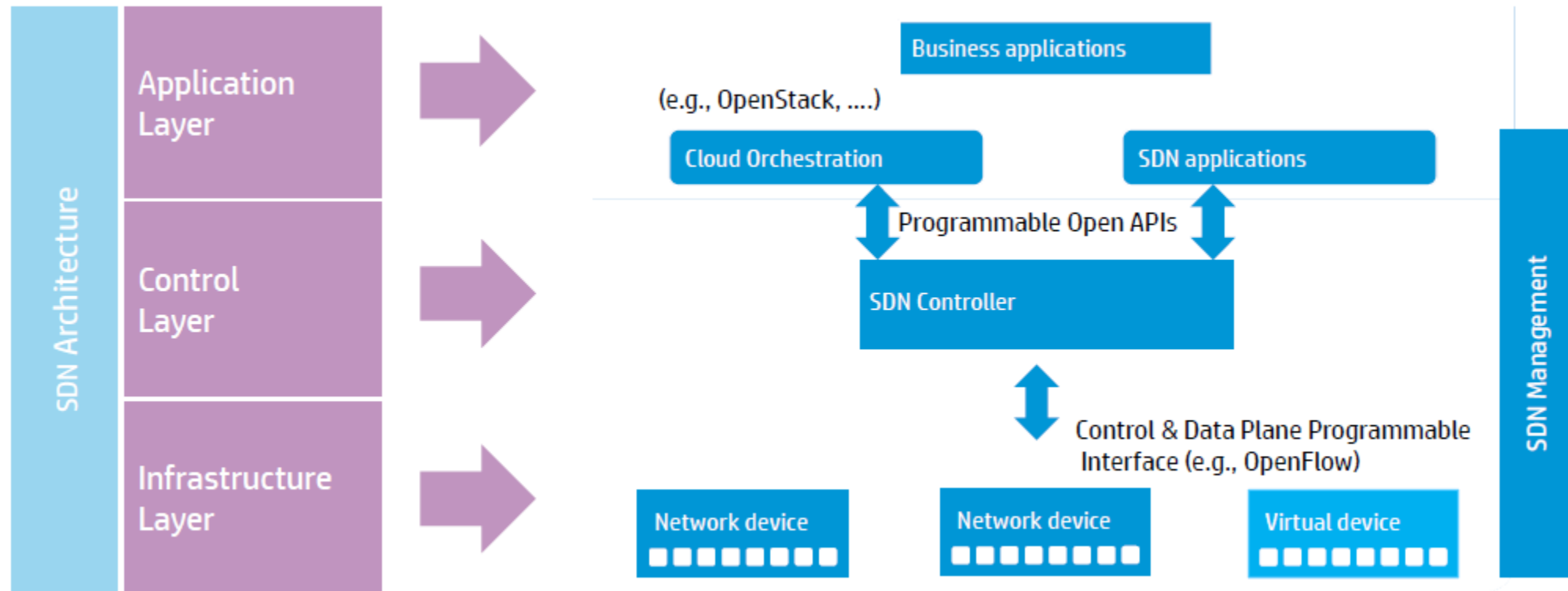
... In the SDN architecture, the **control** and **data planes** are **decoupled**, network **intelligence** and state are logically **centralized**, and the underlying network **infrastructure is abstracted from the applications**. As a result, enterprises and carriers gain unprecedented programmability, automation, and network control, enabling them to build highly scalable, flexible networks that readily adapt to changing business needs. ...

Source:

<https://www.opennetworking.org/images/stories/downloads/sdn-resources/white-papers/wp-sdn-newnorm.pdf>

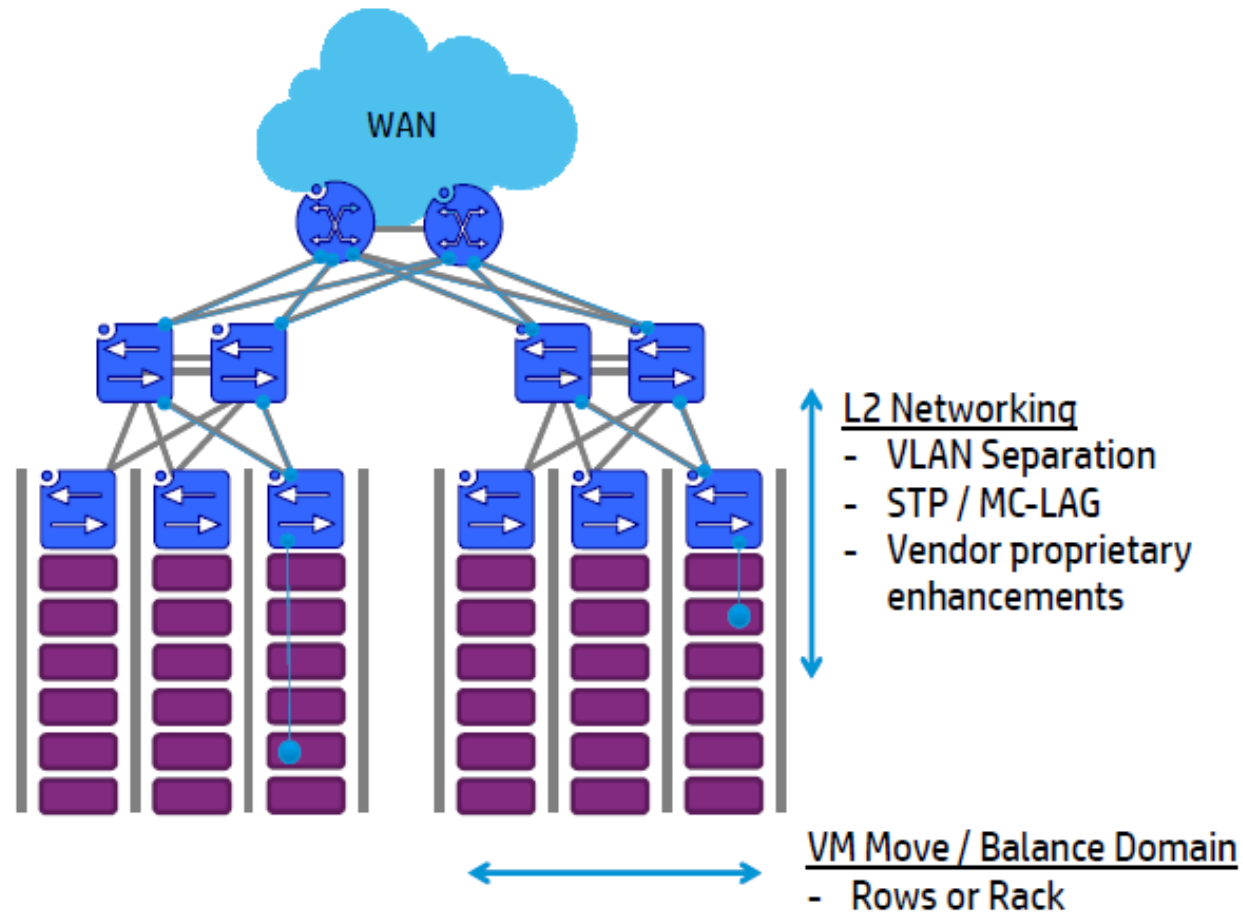
SDN - Architecture

Ability to Apply Business Logic to Network Behavior in Dynamic Fashion



SDN

Challenges with traditional 3 Tier datacenter design



Challenges:

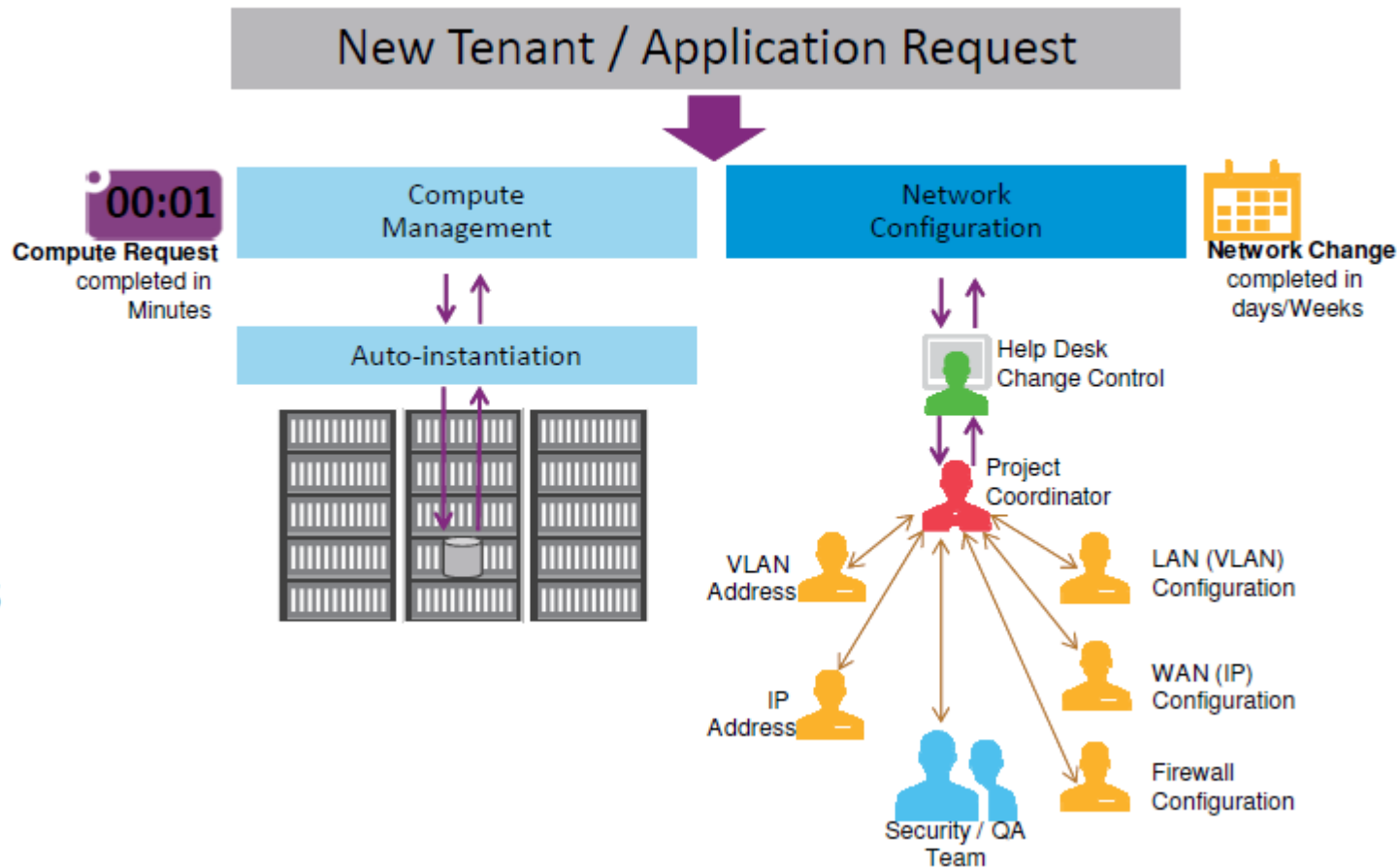
- MAC Address Explosion
- **VLAN ID Limitations**
- Subnet alignment with L2 domains

Results in:

- Asset isolation
- Scaling bounded by platform density
- Complex provisioning / mobility of endpoints
- Vendor lock-in
- Constrained growth / moves within a POD

SDN

Challenges with traditional 3 Tier datacenter design



Compute is Virtualized

- Available in Minutes !!!

Network is Partially Virtualized

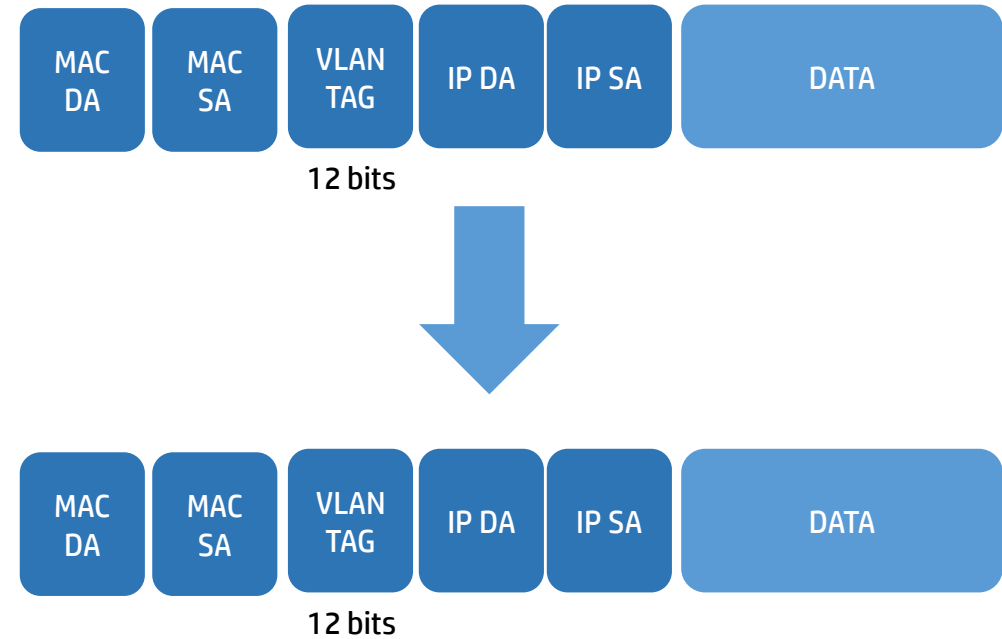
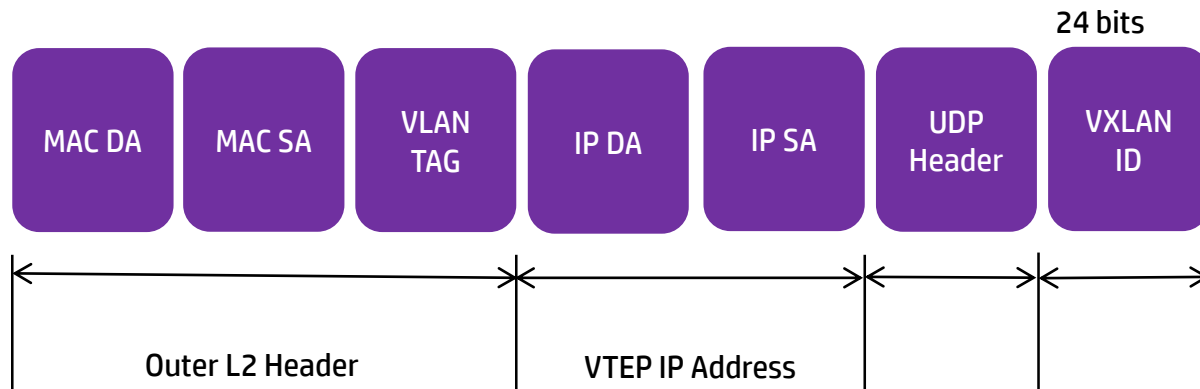
- Configuration takes Days/Weeks



VXLAN - Virtual eXtensible Local Area Network

VLAN

- Ideal for private cloud scale (up to 4k subnet)
- Uses L2 fabric underlay
- Universally supported technology



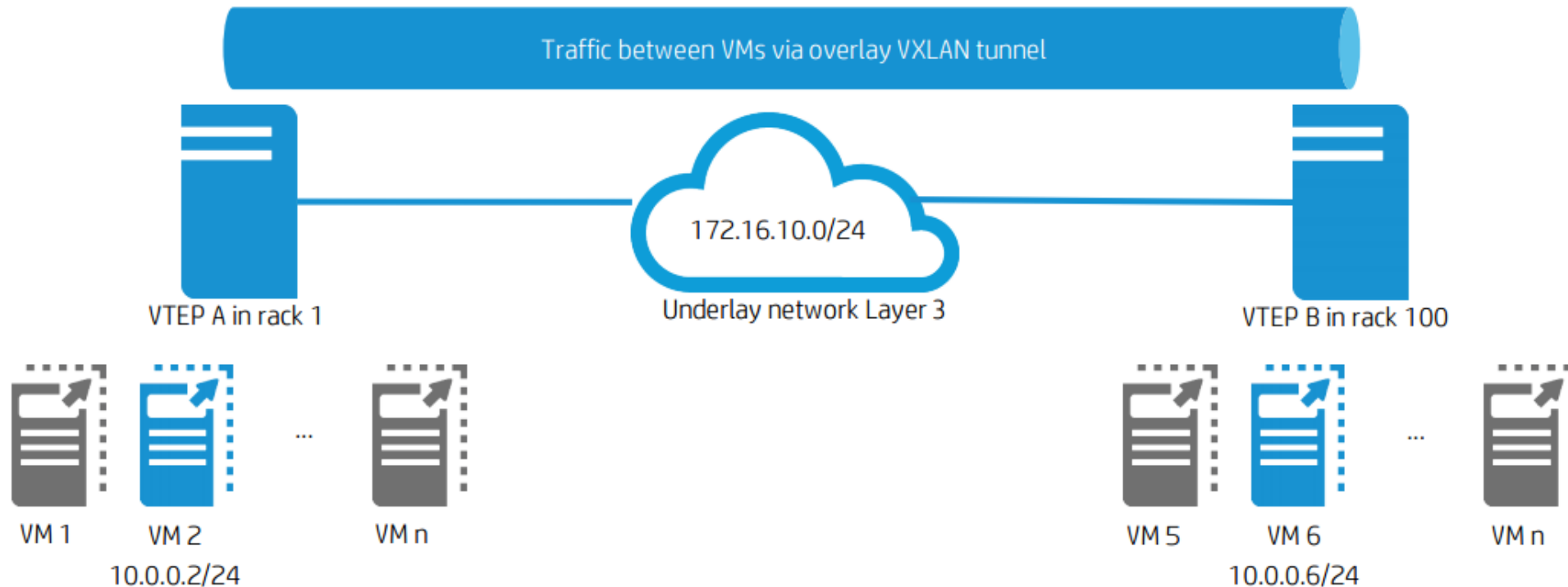
VXLAN

- Ideal for public cloud scale (up to 16M subnet)
- Uses L3 fabric underlay

VXLAN - Virtual eXtensible Local Area Network

VXLAN benefits

1. Enables VMs to be deployed on any physical hypervisor within the DC
2. Provides Layer 2 connectivity between VMs even though underlay network is L3



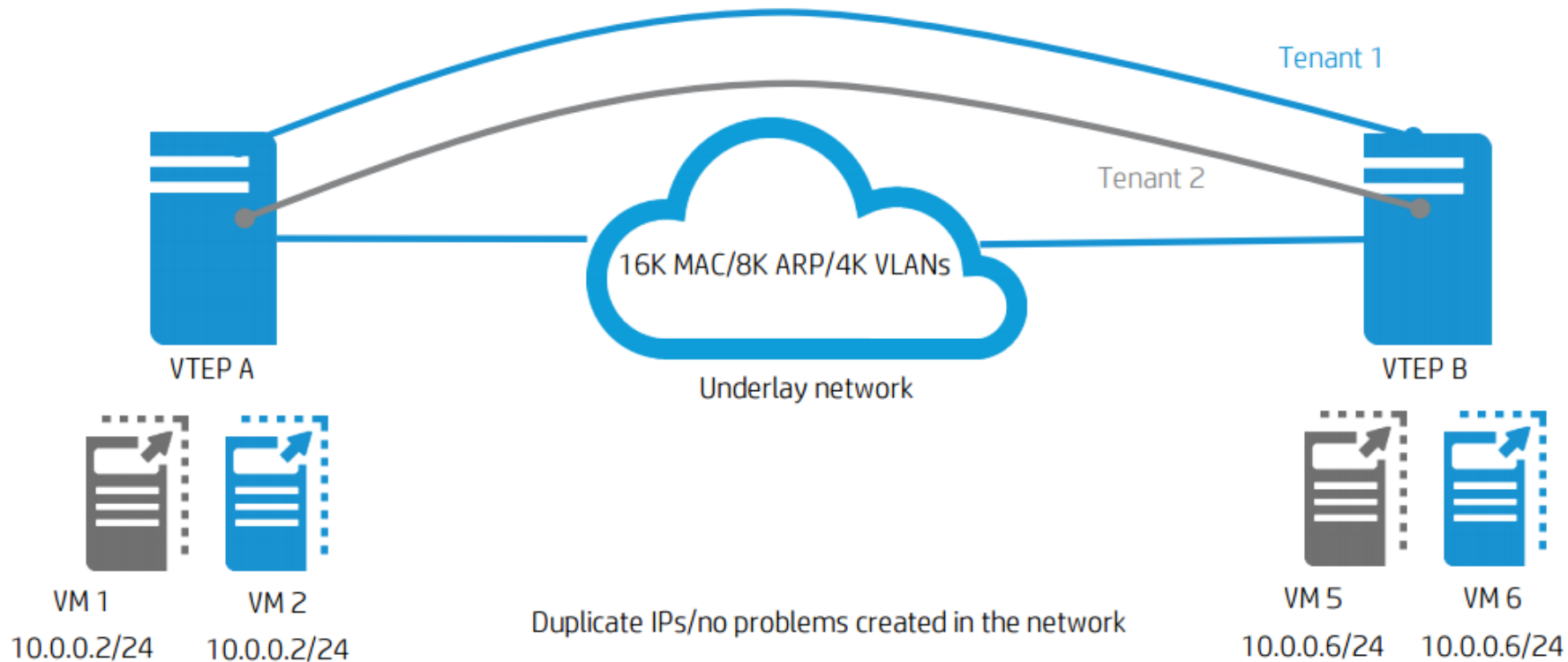
VXLAN - Virtual eXtensible Local Area Network

VXLAN benefits

3. Overcomes MAC/ARP table and VLAN scalability limitations of the physical underlay network

4. Enables multitenant networks with duplicate IPs

40K MAC/20K ARP/10K virtual networks required (no problems created in the network)

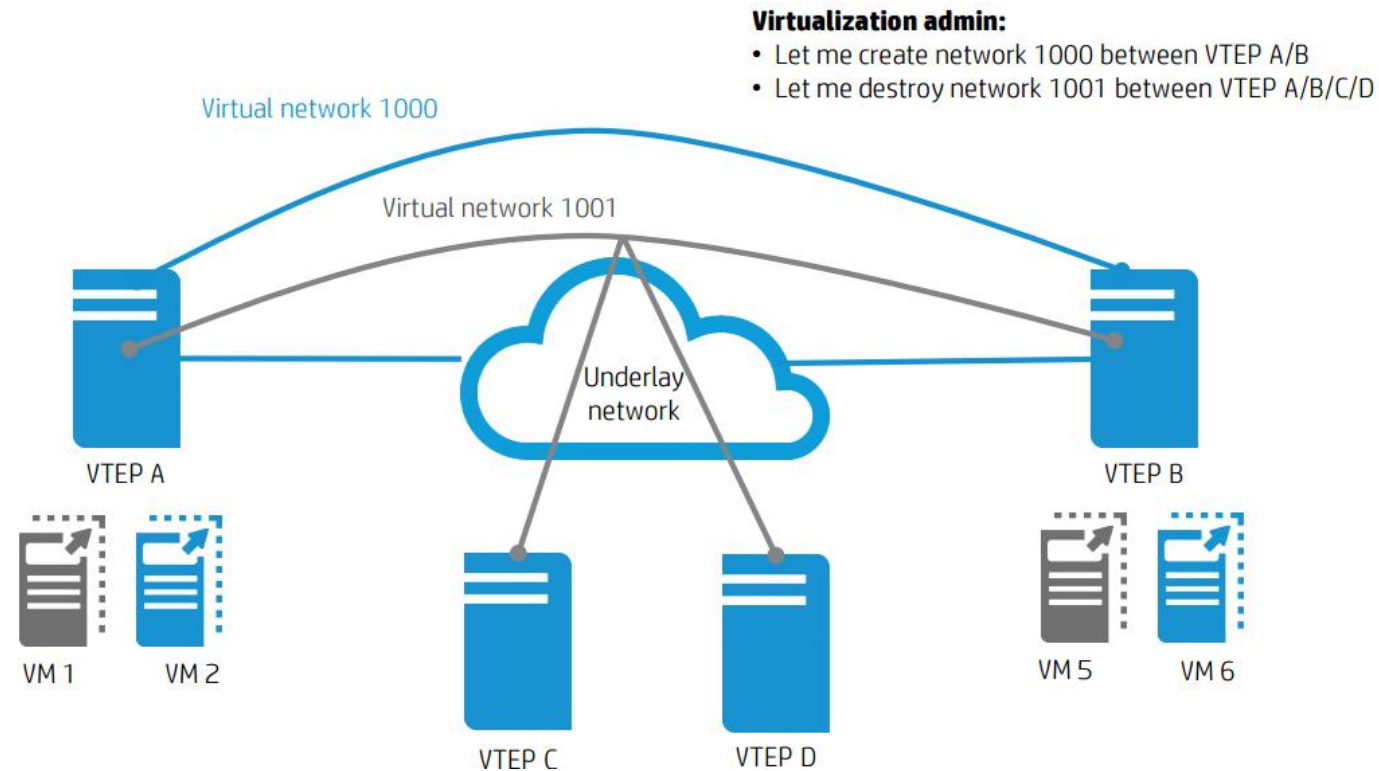


VXLAN - Virtual eXtensible Local Area Network

VXLAN benefits

5. Allows the virtualization admin to self-provision their required networks without waiting for the network admin

6. Increases the speed and agility of deploying virtual networks. Manual Command Line Interface (CLI) is not required and devices in the path do not need to be provisioned, providing for easier network automation using exposed application programming interface (APIs)

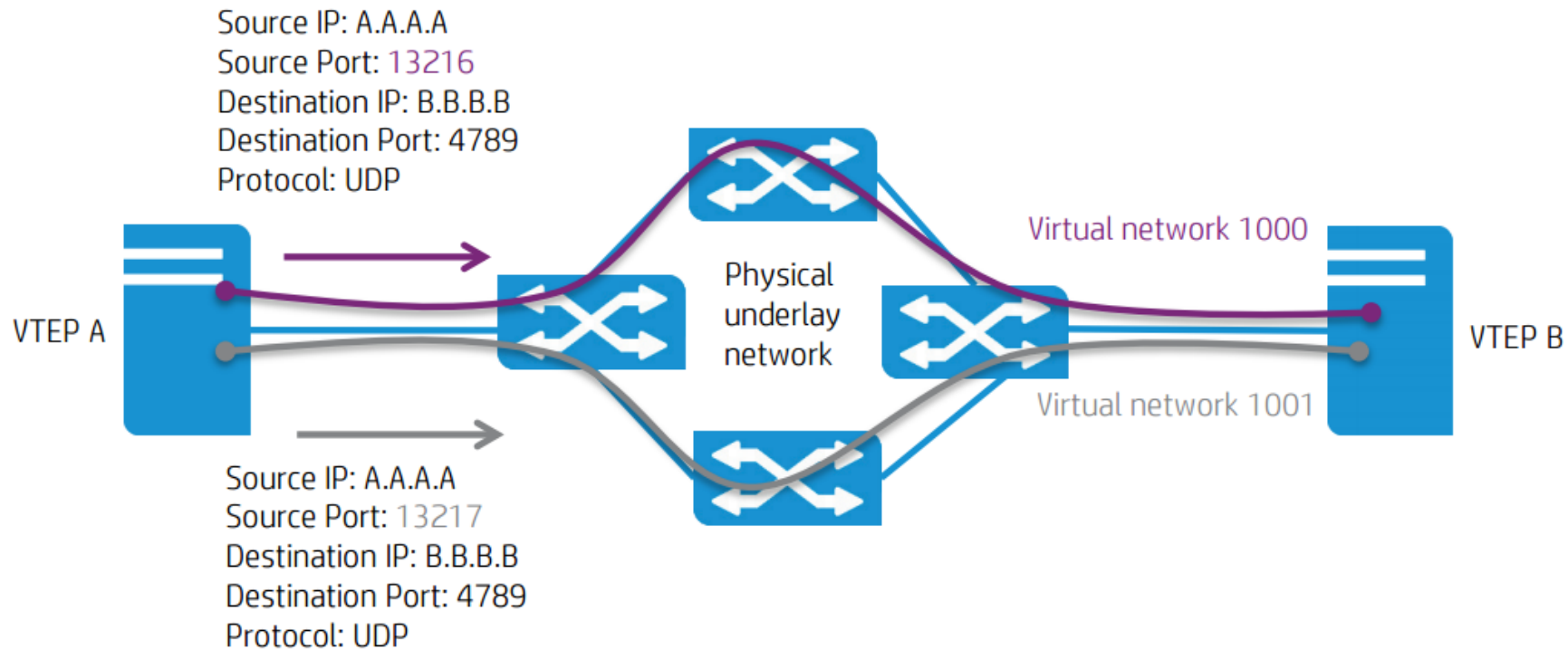


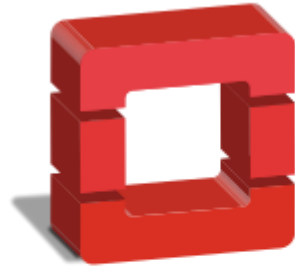
VXLAN - Virtual eXtensible Local Area Network

VXLAN benefits

7. Allows physical underlay network to load share tunneled traffic based on 5 tuple connection info

- Source IP address/port number
- Destination IP address/port number
- Protocol (UDP)





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OpenStack - Networking

OpenStack - Networking



- **Tenant networks**

- Created by user
- Provide connectivity between instances in a tenant
- A lot of different network types are used
 - **Local**
 - Isolated network from other instances and nodes. Instances connected to same local network can communicate with other instances on same compute node
 - Mostly only used for testing purposes
 - **Flat**
 - **VLAN**
 - **VXLAN and GRE**
 - Can be used with Open vSwitch to create overlay networks
 - Use peer to peer tunnels to create mesh network

- **Provider networks**

- Created by OpenStack administrator
- Mapped directly to physical network in datacenter
- Most useful network types:
 - Flat (untagged)
 - VLAN (802.1q tagged)
 - VXLAN (vxlan support on physical switches)

- **External Network**

- Created by OpenStack administrator
- Mapped directly to physical network in datacenter
- Used for External communication to internet
- Floating IP can be assigned from this network



OpenStack – Networking components



- **Subnets**

A block of IP addresses and associated configuration state. This is also known as the native IPAM (IP Address Management) provided by the networking service for both tenant and provider networks. Subnets are used to allocate IP addresses when new ports are created on a network.

- **Ports**

A port is a connection point for attaching a single device, such as the NIC of a virtual server, to a virtual network. Also describes the associated network configuration, such as the MAC and IP addresses to be used on that port.

- **Routers**

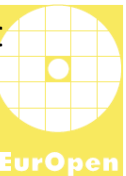
This is a logical component that forwards data packets between networks. It also provides L3 and NAT forwarding to provide external network access for VMs on tenant networks. Required by certain plug-ins only.

- **Security Groups**

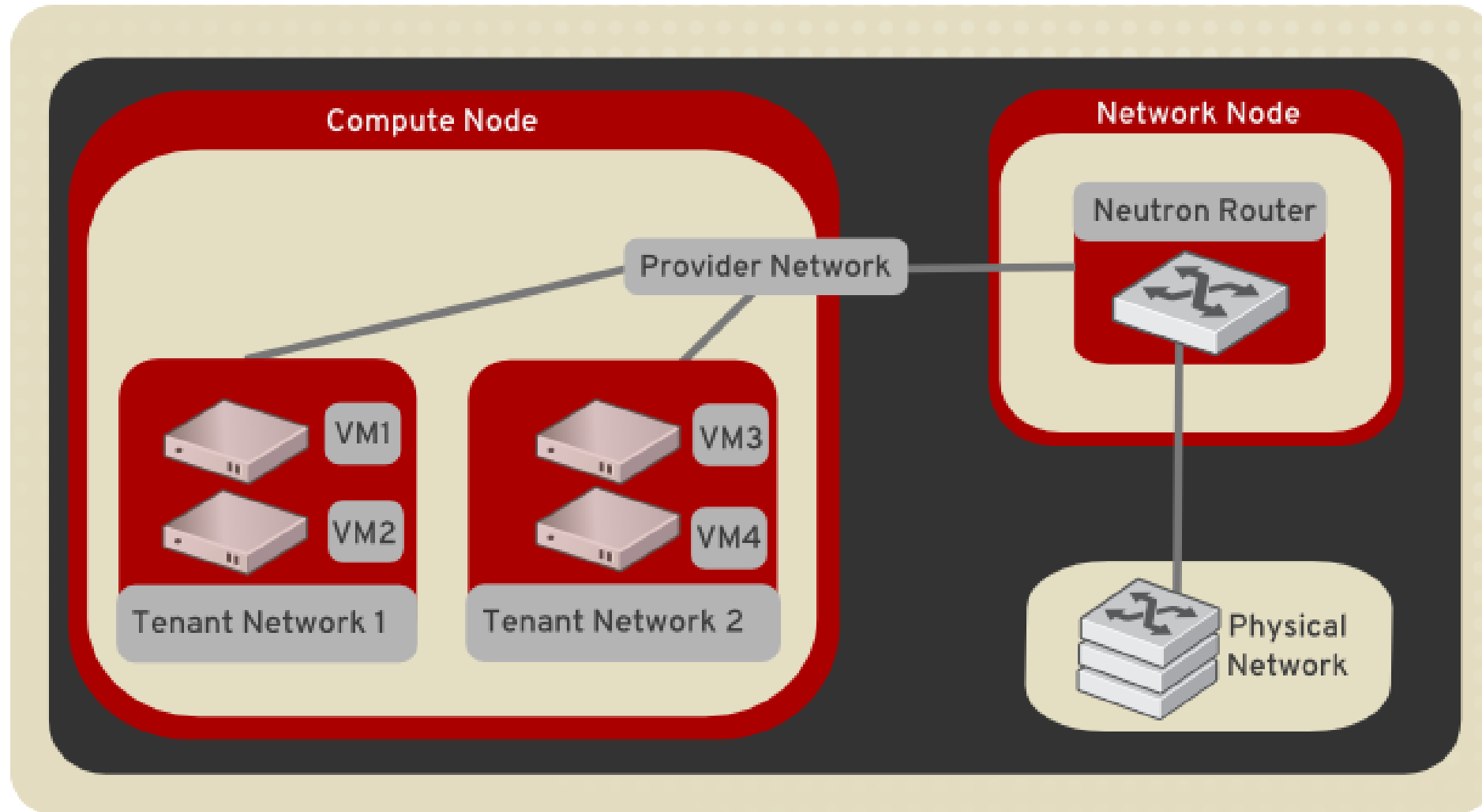
A security group acts as a virtual firewall for your compute instances to control inbound and outbound traffic. Security groups act at the port level, not the subnet level. Therefore, each port in a subnet could be assigned to a different set of security groups

- **Extensions**

The OpenStack networking service is extensible. Extensions serve two purposes: they allow the introduction of new features in the API without requiring a version change and they allow the introduction of vendor specific niche functionality.



OpenStack - Networking



OpenStack - Networking

HP Helion OpenStack®

Project


- Compute
- Network
- Network Topology**
- Networks
- Routers

Orchestration

Admin

Identity


Create Network


admin  Sign Out


Network * Subnet * Subnet Detail


Enable DHCP


Specify additional attributes for the subnet.


Allocation Pools 

DNS Name Servers 

Host Routes 

work  Create Router

« Back 



OpenStack – Networking



HP Helion OpenStack® demo admin Sign Out

Project

- Compute
- Network
- Network Topology**
- Networks
- Routers
- Orchestration
- Admin
- Identity

Network Topology

Small Normal

[Launch Instance](#) [+ Create Network](#) [+ Create Router](#)

net-ext 10.20.101.0/24

My New Network 01 172.28.1.0/24

provider-01 10.20.215.0/24



OpenStack – Networking

HP Helion OpenStack® demo admin Sign Out

Project **Routers**

- Compute
- Network
- Network Topology
- Networks
- Routers**
- Orchestration
- Admin
- Identity

Create Router

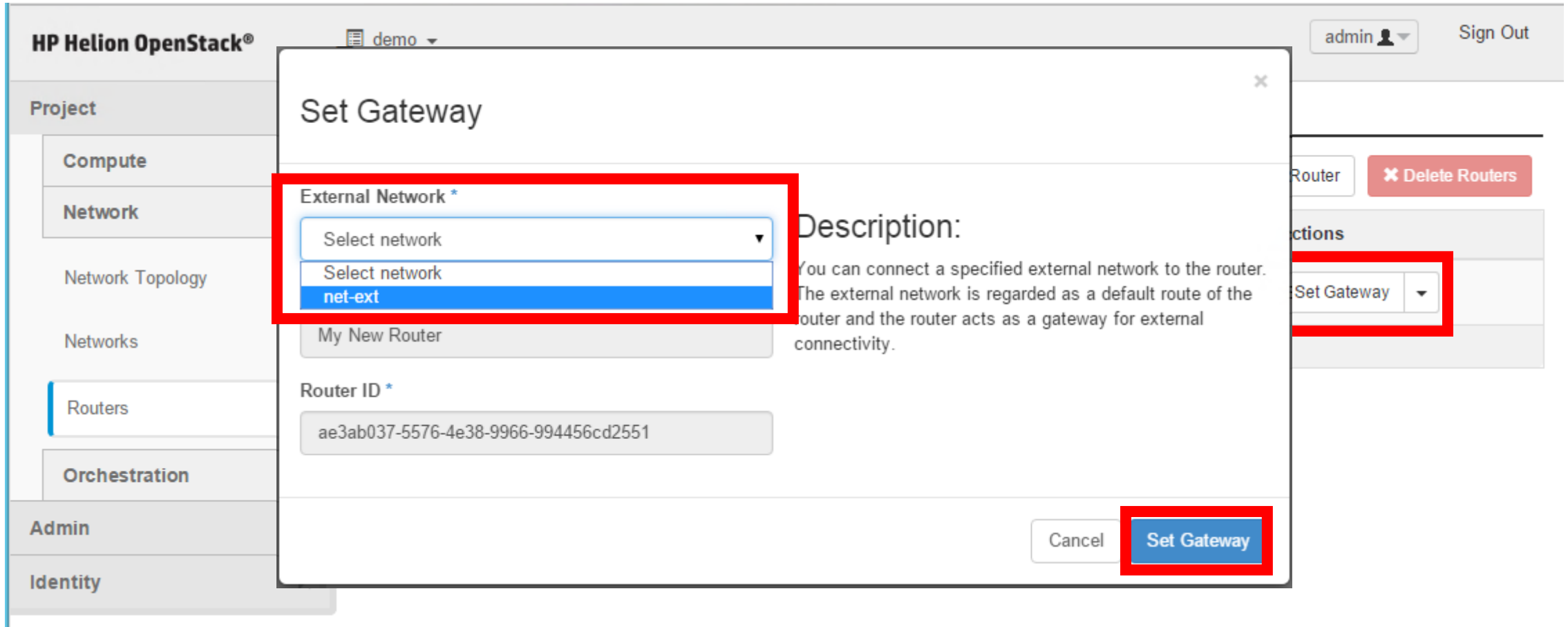
Router Name *

Cancel **Create Router**

+ Create Router

Actions

OpenStack – Networking

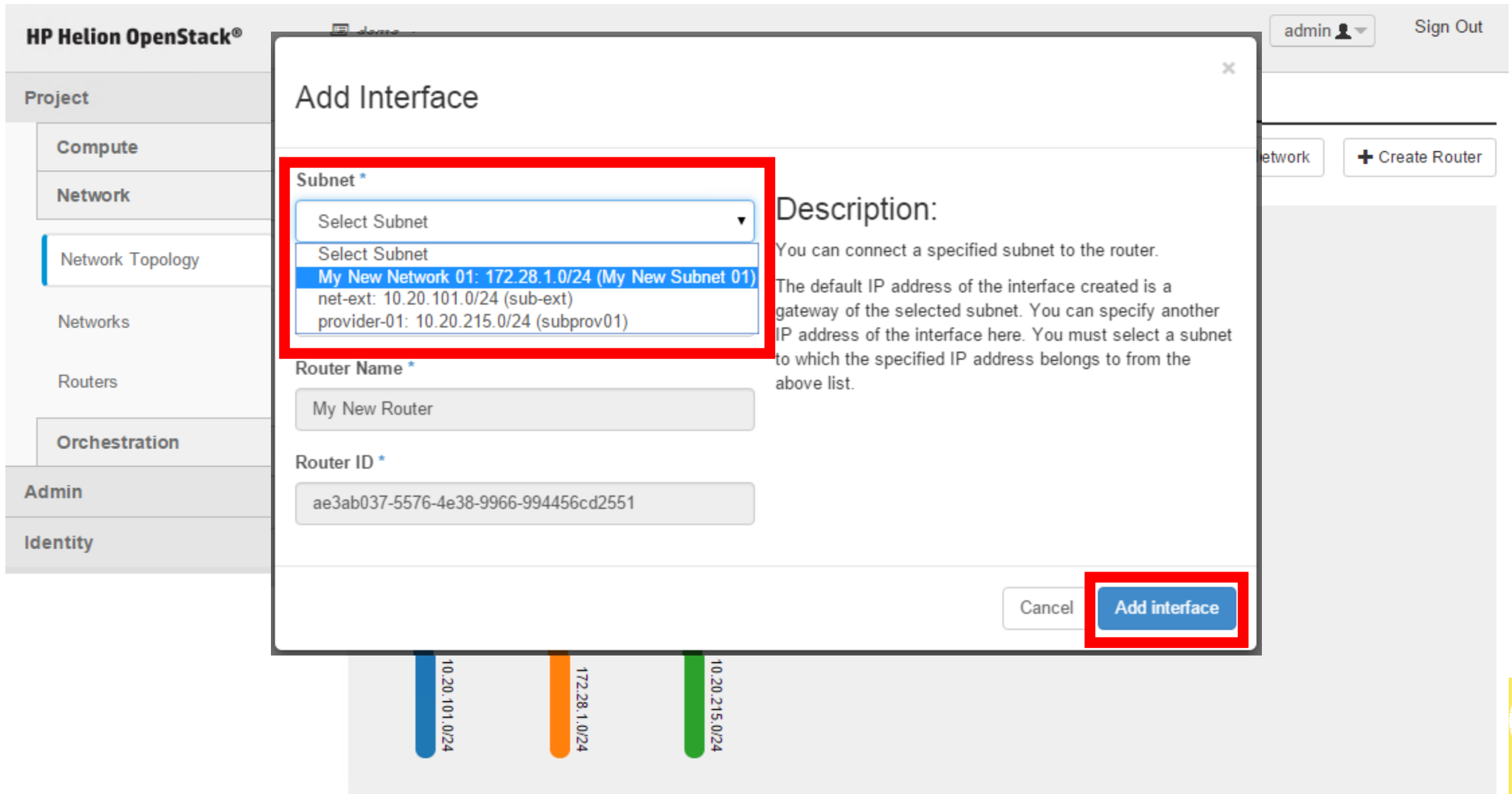


The screenshot shows the HP Helion OpenStack interface. A modal dialog titled "Set Gateway" is open. The dialog has a close button (X) in the top right corner. It contains the following fields and elements:

- External Network ***: A dropdown menu with "net-ext" selected. This field is highlighted with a red box.
- Router ID ***: A text input field containing the value "ae3ab037-5576-4e38-9966-994456cd2551".
- Description:** A text area containing the text: "You can connect a specified external network to the router. The external network is regarded as a default route of the router and the router acts as a gateway for external connectivity."
- Buttons:** "Cancel" and "Set Gateway" buttons are located at the bottom right. The "Set Gateway" button is highlighted with a red box.

In the background, the interface shows a sidebar with "Project" (Compute, Network, Network Topology, Networks, Routers, Orchestration) and "Admin" (Identity) sections. A "Router" section is visible with a "Delete Routers" button. A "Set Gateway" dropdown menu is also visible in the background, highlighted with a red box.

OpenStack – Networking



HP Helion OpenStack®

Project

- Compute
- Network
- Network Topology
- Networks
- Routers
- Orchestration

Admin

- Identity

admin Sign Out

Add Interface

Subnet *

- Select Subnet
- Select Subnet
- My New Network 01: 172.28.1.0/24 (My New Subnet 01)**
- net-ext: 10.20.101.0/24 (sub-ext)
- provider-01: 10.20.215.0/24 (subprov01)

Router Name *

My New Router

Router ID *

ae3ab037-5576-4e38-9966-994456cd2551

Description:

You can connect a specified subnet to the router.

The default IP address of the interface created is a gateway of the selected subnet. You can specify another IP address of the interface here. You must select a subnet to which the specified IP address belongs to from the above list.

Cancel Add interface

network + Create Router

10.20.101.0/24

172.28.1.0/24

10.20.215.0/24

OpenStack – Networking



HP Helion OpenStack® demo admin Sign Out

Project

- Compute
- Network
- Network Topology**
- Networks
- Routers
- Orchestration
- Admin
- Identity

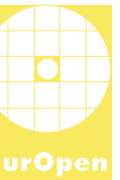
Network Topology

Small Normal Launch Instance Create Network Create Router

The diagram illustrates a network topology with a central router. The router is connected to three vertical network segments:

- net-ext** (blue): Connected to the router at IP 10.20.101.2.
- My New Network 01** (orange): Connected to the router at IP 172.28.1.1.
- provider-01** (green): A separate network segment.

Each network segment has a vertical label and a small IP address at the bottom (10.20.101.2, 172.28.1.1, and 10.20.101.17 respectively).



OpenStack – Networking

HP Helion OpenStack® demo admin Sign Out

Project Access & Security

Compute
Overview
Instances
Volumes
Images
Access & Security
Network
Orchestration
Admin

Create Security Group

Name *

Description *

Description:
Security groups are sets of IP filter rules that are applied to the network settings for the VM. After the security group is created, you can add rules to the security group.

Delete Security Groups

ns

age Rules

HP Helion OpenStack®

Project

- Compute
- Overview
- Instances
- Volumes
- Images
- Access & Security
- Network
- Orchestration

Add Rule

Rule *
Custom TCP Rule

Direction
Ingress

Open Port *
Port

Port ?
22

Remote * ?
CIDR

CIDR ?
0.0.0.0/0

Description:
Rules define which traffic is allowed to instances assigned to the security group. A security group rule consists of three main parts:
Rule: You can specify the desired rule template or use custom rules, the options are Custom TCP Rule, Custom UDP Rule, or Custom ICMP Rule.
Open Port/Port Range: For TCP and UDP rules you may choose to open either a single port or a range of ports. Selecting the "Port Range" option will provide you with space to provide both the starting and ending ports for the range. For ICMP rules you instead specify an ICMP type and code in the spaces provided.
Remote: You must specify the source of the traffic to be allowed via this rule. You may do so either in the form of an IP address block (CIDR) or via a source group (Security Group). Selecting a security group as the source will allow any other instance in that security group access to any other instance via this rule.

Cancel Add

admin Sign Out

Delete Security Groups

Page Rules

Page Rules

OpenStack – Networking



HP Helion OpenStack® demo admin Sign Out

Project **Compute**

- Overview
- Instances
- Volumes
- Images
- Access & Security**
- Network
- Orchestration

Manage Security Group Rules: MySecurityGroup

Security Group Rules

[+ Add Rule](#) [✕ Delete Rules](#)

<input type="checkbox"/>	Direction	Ether Type	IP Protocol	Port Range	Remote	Actions
<input type="checkbox"/>	Egress	IPv6	Any	-	::/0 (CIDR)	Delete Rule
<input type="checkbox"/>	Egress	IPv4	Any	-	0.0.0.0/0 (CIDR)	Delete Rule
<input type="checkbox"/>	Ingress	IPv4	ICMP	-	0.0.0.0/0 (CIDR)	Delete Rule
<input type="checkbox"/>	Ingress	IPv4	TCP	22	0.0.0.0/0 (CIDR)	Delete Rule

Displaying 4 items



Launch Instance

Details *

Access & Security *

Networking *

Post-Creation

Advanced Options

Selected networks

NIC:1 My New Network 01 (43622ad0-7db2-410a-9e18-0bb7c593b21)

Choose network from Available networks to Selected networks by push button or drag and drop, you may change NIC order by drag and drop as well.

Available networks

net-ext (325c7372-03d3-4b3d-8afe-c5ca8f5567ed)

provider-01 (38f4a720-b036-427f-b08b-0cb0d1c10a9f)

Cancel

Launch

Boot from image

Image Name

Ubuntu1504 (5.0 GB)

Number of Instances

0 of 40 Used

Number of VCPUs

0 of No Limit Used

Total RAM

0 of 51,200 MB Used

Cancel

Launch

Delete Images

launch

OpenStack – Networking



HP Helion OpenStack® demo admin [Sign Out](#)

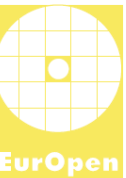
Project **Compute**

- Overview
- Instances**
- Volumes
- Images

Instances

Instance Name Filter Filter

<input type="checkbox"/>	Instance Name	Image Name	IP Address	Size	Key Pair	Status	Availability Zone	Task	Power State	Time since created	Actions
<input type="checkbox"/>	ub01	Ubuntu1504	172.28.1.10	custom.small	kp-admin	Build	nova	<div style="width: 20px; height: 10px; background: repeating-linear-gradient(45deg, transparent, transparent 2px, gray 2px, gray 4px);"></div> Spawning	No State	0 minutes	<input type="button" value="Associate Floating IP"/> <input type="button" value=""/>



OpenStack – Networking



HP Helion OpenStack® demo admin Sign Out

Project ▼

- Compute ▼
 - Overview
 - Instances**
 - Volumes
 - Images
 - Access & Security
- Network ▶
- Orchestration ▶
- Admin ▶
- Identity ▶

Instances

Instance Name ▼ Filter Launch Instance Soft Reboot Instances Terminate Instances

<input type="checkbox"/>	Instance Name	Image Name	IP Address	Size	Key Pair	Status	Availability Zone	Task	Power State	Time since created	Actions
<input type="checkbox"/>	ub01	Ubuntu1504	172.28.1.10	custom.small	kp-admin	Active	nova	None	Running	0 minutes	Create Snapshot ▼
<input type="checkbox"/>	ub01-1	Ubuntu1504	172.28.1.8 10.20.101.3	custom.small	kp-admin	Active	nova	None	Running	5 hours, 54 minutes	Create Snapshot ▼
<input type="checkbox"/>	ub01-2	Ubuntu1504	172.28.1.9 10.20.101.4	custom.small	kp-admin	Active	nova	None	Running	5 hours, 54 minutes	Create Snapshot ▼
<input type="checkbox"/>	ub02-1	Ubuntu1504	172.28.1.6	m1.small	kp-admin	Active	nova	None	Running	5 hours, 55 minutes	Create Snapshot ▼
<input type="checkbox"/>	ub02-2	Ubuntu1504	172.28.1.7	m1.small	kp-admin	Active	nova	None	Running	5 hours, 55 minutes	Create Snapshot ▼

Displaying 5 items



OpenStack – Networking

HP Helion OpenStack® demo admin Sign Out

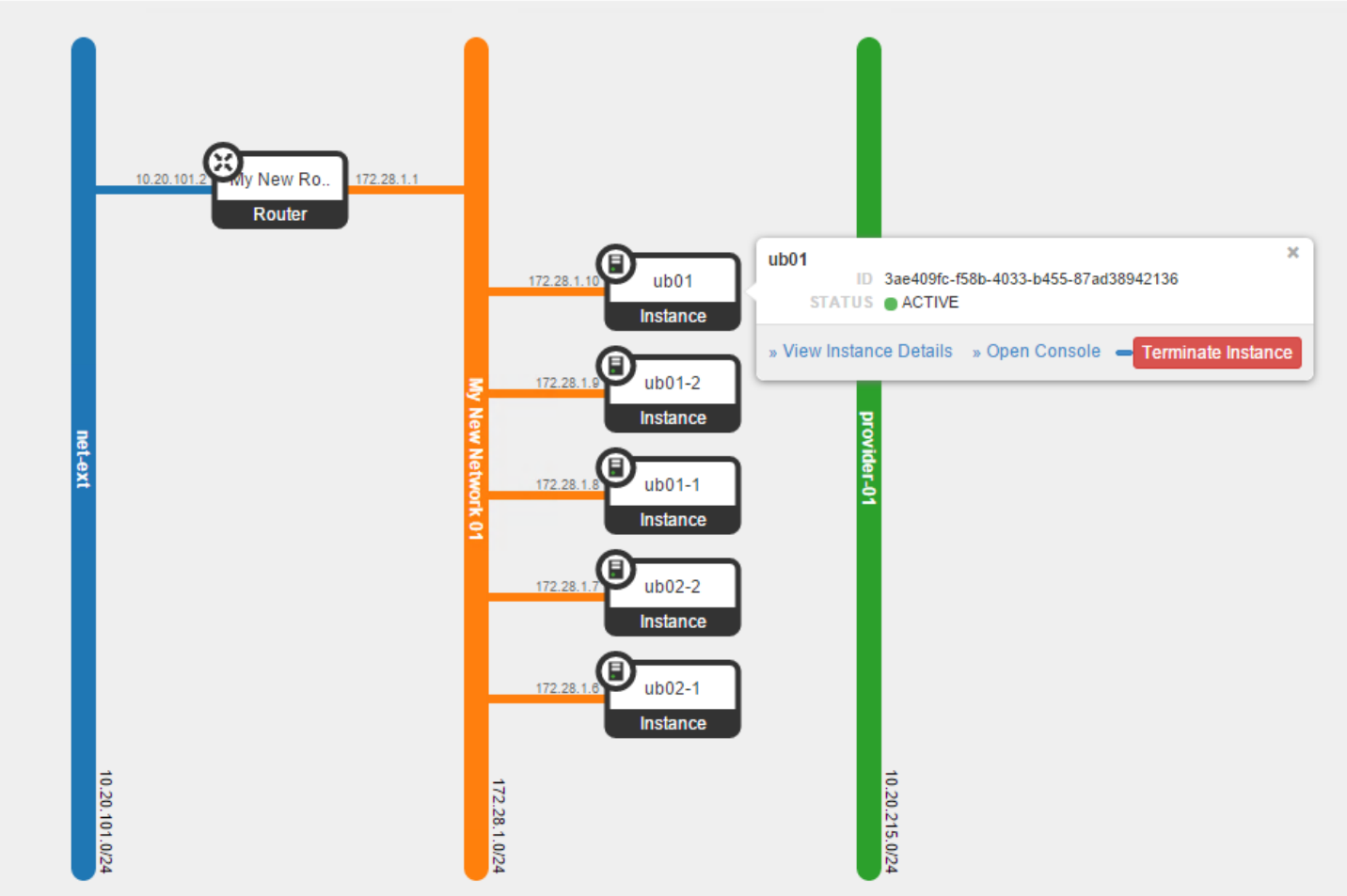
Project

- Compute
- Network
- Network Topology
- Networks
- Routers
- Orchestration
- Admin
- Identity

Network Topology

Small Normal

Launch Instance Create Network Create Router



net-ext 10.20.101.0/24

My New Router Router 10.20.101.2 172.28.1.1

My New Network 01 172.28.1.0/24

provider-01 10.20.215.0/24

ub01 Instance ID 3ae409fc-f58b-4033-b455-87ad38942136 STATUS ACTIVE

ub01-2 Instance 172.28.1.9

ub01-1 Instance 172.28.1.8

ub02-2 Instance 172.28.1.7

ub02-1 Instance 172.28.1.6

View Instance Details Open Console Terminate Instance

OpenStack – Neutron



Neutron CLI

```
root@ma1:~# neutron router-list
```

id	name	external_gateway_info	distributed	ha
ae3ab037-5576-4e38-9966-994456cd2551	My New Router	{"network_id": "325c7372-03d3-4b3d-8cdc-c5ccaf6567ed", "enable_snat": true, "external_fixed_ips": [{"subnet_id": "e5cdd900-6467-4966-b8e7-9e0b070a996b", "ip_address": "10.20.101.2"}]}	False	False

```
root@ma1:~# neutron net-list
```

id	name	subnets
325c7372-03d3-4b3d-8cdc-c5ccaf6567ed	net-ext	e5cdd900-6467-4966-b8e7-9e0b070a996b 10.20.101.0/24
38f4a720-b036-427f-b08b-0cb0d1c10a9f	provider-01	5f2a980c-9731-41bb-9019-262780d2a486 10.20.215.0/24
43622ad0-7db2-410a-9a18-0bab7c593b21	My New Network 01	cede6ecb-0118-4392-b73d-e2cf924fcbd5 172.28.1.0/24

```
root@ma1:~# neutron subnet-list
```

id	name	cidr	allocation_pools
5f2a980c-9731-41bb-9019-262780d2a486	subprov01	10.20.215.0/24	{"start": "10.20.215.100", "end": "10.20.215.200"}
cede6ecb-0118-4392-b73d-e2cf924fcbd5	My New Subnet 01	172.28.1.0/24	{"start": "172.28.1.2", "end": "172.28.1.254"}
e5cdd900-6467-4966-b8e7-9e0b070a996b	sub-ext	10.20.101.0/24	{"start": "10.20.101.2", "end": "10.20.101.254"}



OpenStack – Neutron



Neutron CLI

```
root@ma1:~# neutron agent-list
```

id	agent_type	host	alive	admin_state_up	binary
0b42e813-e11f-43a5-b978-e5e354f9d388	HP VCN L2 Agent	ovsvapp-esxcptnode.example.org	:-)	True	hpcn-neutron-agent
182d27c6-1aca-4fe5-a7a7-92ac961def10	Metadata agent	cc1	:-)	True	neutron-metadata-agent
1f04c00b-c73f-4cba-a5c7-3b4704391855	DHCP agent	cmc	:-)	True	neutron-dhcp-agent
495feb13-d42b-4d96-bfe4-b4fcd7b7c632	DHCP agent	cc1	:-)	True	neutron-dhcp-agent
76029cdc-220c-4c28-800c-65faec106409	DHCP agent	cc2	:-)	True	neutron-dhcp-agent
7958e4c1-706f-4ded-b3a4-1d3658d98e63	L3 agent	cmc	:-)	True	neutron-l3-agent
7ec7caeb-bc53-45c0-bf46-19fb1e45ca30	Open vSwitch agent	cc1	:-)	True	neutron-openvswitch-agent
92e986b0-8171-4444-932b-c4661cac4095	Open vSwitch agent	cmc	:-)	True	neutron-openvswitch-agent
a48ce031-a4bc-40a2-98dc-31c173a2b166	Metadata agent	cmc	:-)	True	neutron-metadata-agent
b8c79f2e-d840-4b18-a8ec-2f1730f5a4a1	Metadata agent	cc2	:-)	True	neutron-metadata-agent
b9c36910-e9d1-4f9a-848a-cce14f13955f	L3 agent	cc1	:-)	True	neutron-l3-agent
d57707af-ff9d-4a70-93cd-678bbb571bc	Open vSwitch agent	cc2	:-)	True	neutron-openvswitch-agent
ee649627-902d-4559-b9db-97daa4b8847a	L3 agent	cc2	:-)	True	neutron-l3-agent





HP Helion OpenStack

HP Helion OpenStack 1.1

■	Open Source (OpenStack Juno)
■	HP Value-add (Open Source)
■	HP Value-add (HP Assets)

Operations Environment

UI	Operations (Horizon) Dashboard	Storage Dashboard (Store Virtual CMC/3PAR IMC)
	Sherpa	EON
	Sirius	
	Monitoring Dashboard (Icinga)	
	Logging Search Dashboard (Kibana)	

Operational Services	Deployment Service (TripleO)	Cinder Storage Configuration (Sirius)
	Deployment Artifacts <ul style="list-style-type: none"> Machine Images Boot Images Deployment Templates 	Nova ESX Configuration (EON)
	Bare Metal Provisioning Service (Ironic)	
	IPMI	PXE

Sub Systems	Block Storage (StoreVirtual VSA)	HTTPS Termination (Stunnel)	Infrastructure Monitoring Service (Icinga)	Centralized Logging (Log stash, Elastic Search)	Recovery Management (Backup/Restore Scripts)	Service Fail-over Management (HAProxy, Keepalived)	MySQL
							Rabbit MQ

Debian Host Linux

Physical Infrastructure – Servers, Networking, Storage

Execution Environment

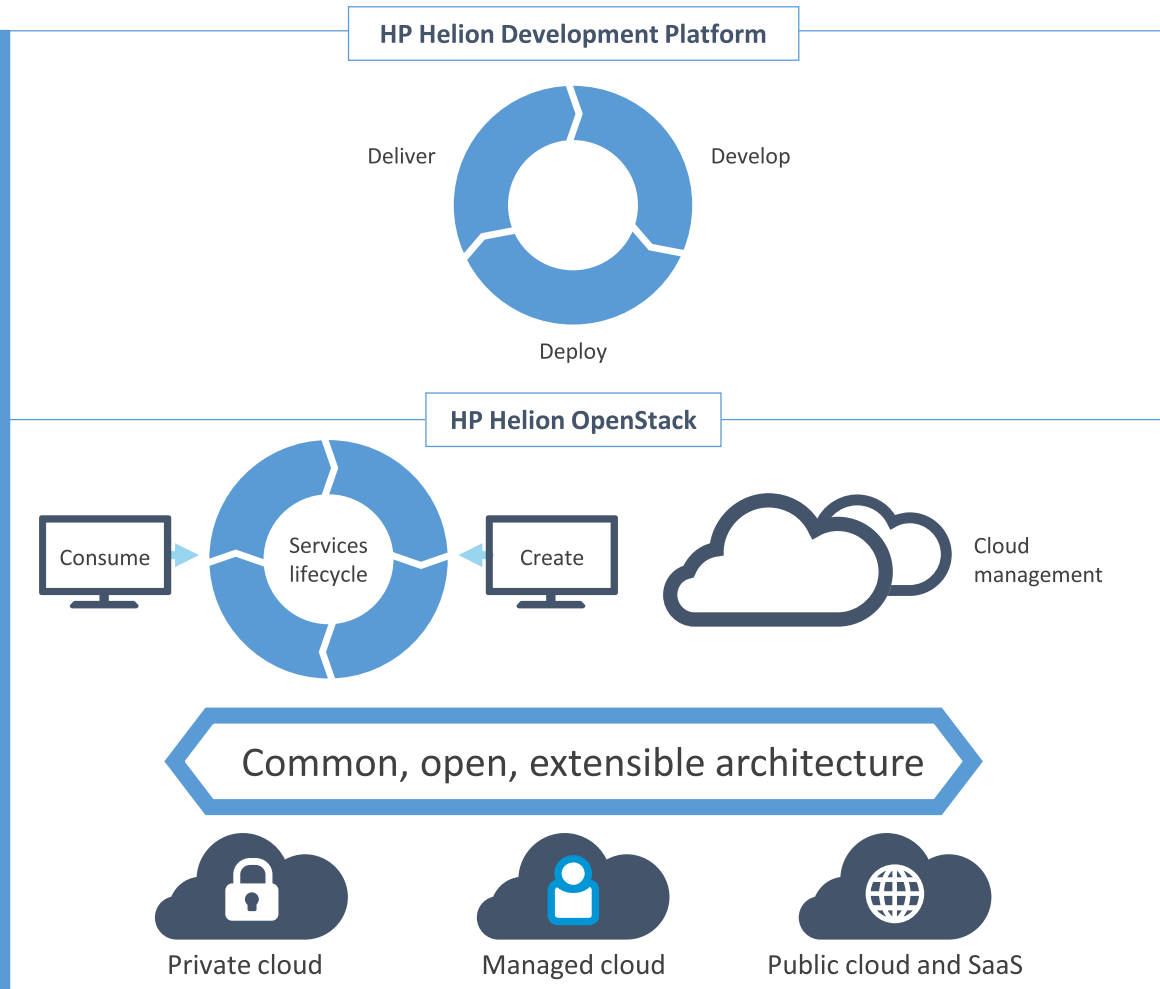
UI	OpenStack Dashboard (Horizon)	DNSaaS
	Sherpa	
Network Services		DNS Service (DNSaaS)

Infrastructure Services	Identity Service	Local	LDAP/AD	(Keystone)	
	Orchestration Service (Heat)				
	Object Storage Service (Swift)	Image Library Service (Glance)	Compute Service (Nova)	Network Service (Neutron)	VLAN VLAN DVR
				ML2	OVSvApp
	Object/Block/File Storage Service (Ceph)	Swift	KVM	Block Storage Service (Cinder)	iSCSI FC
		Ceph	ESX	LHN	3PAR
				VMDK	Ceph
Metering Service (Ceilometer)					

HP Helion Platform: Integrated IaaS and PaaS

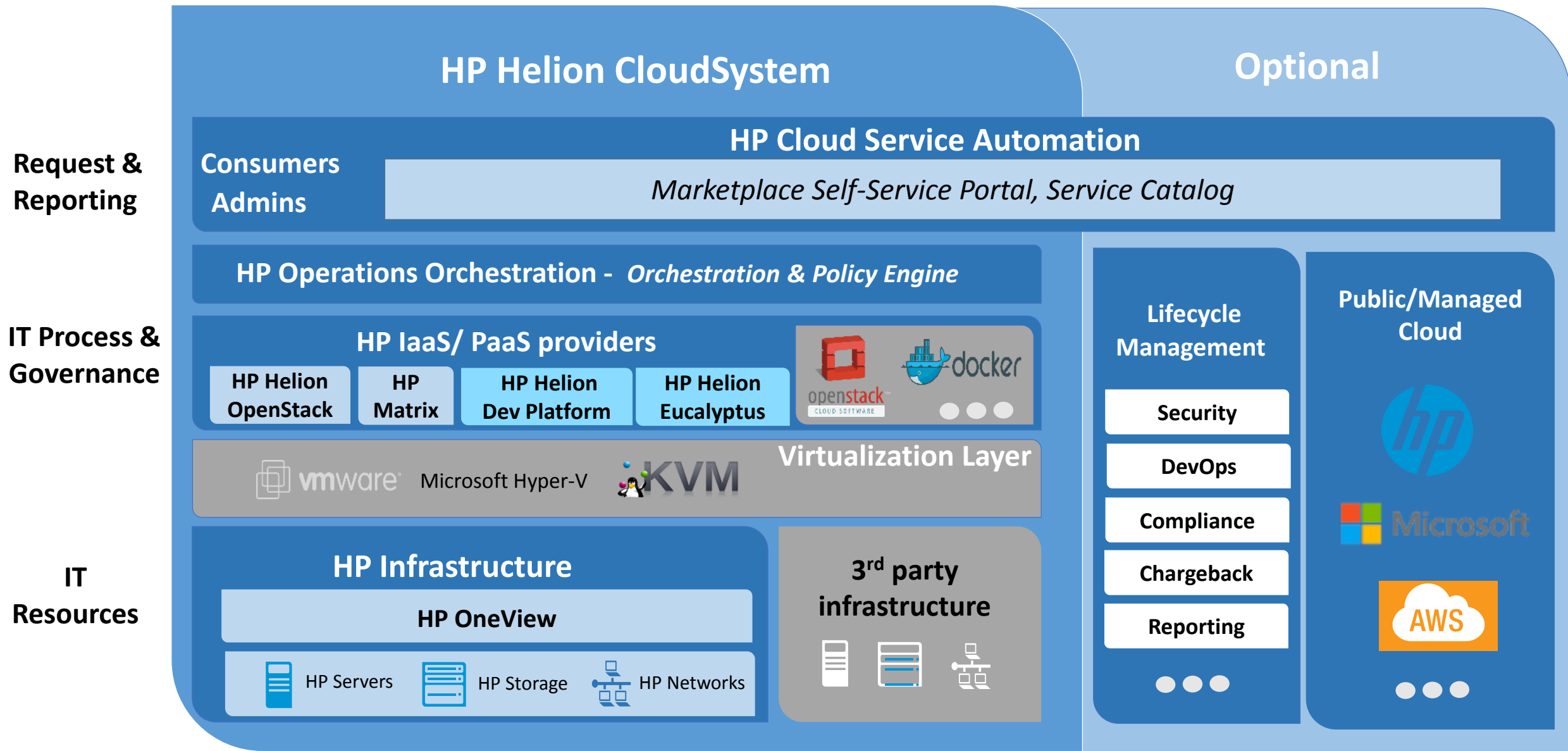
HP Helion OpenStack (IaaS) + HP Helion Development Platform (PaaS) = better together

- **Flexible cloud-native infrastructure**
- **Application portability**
- **Control costs and avoid vendor lock-in**
- **Easier administration**
- **Visibility into resources**





HP Helion CloudSystem



3rd party



Děkuji za pozornost 😊


Hewlett Packard
Enterprise

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