OpenStack 101 and services integration for supporting Data Processing toolkits

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Available in:
https://github.com/ccamacho/openstack-presentations/tree/master/2017-01-25-meetup-openstack101-bigdata

Cloud computing

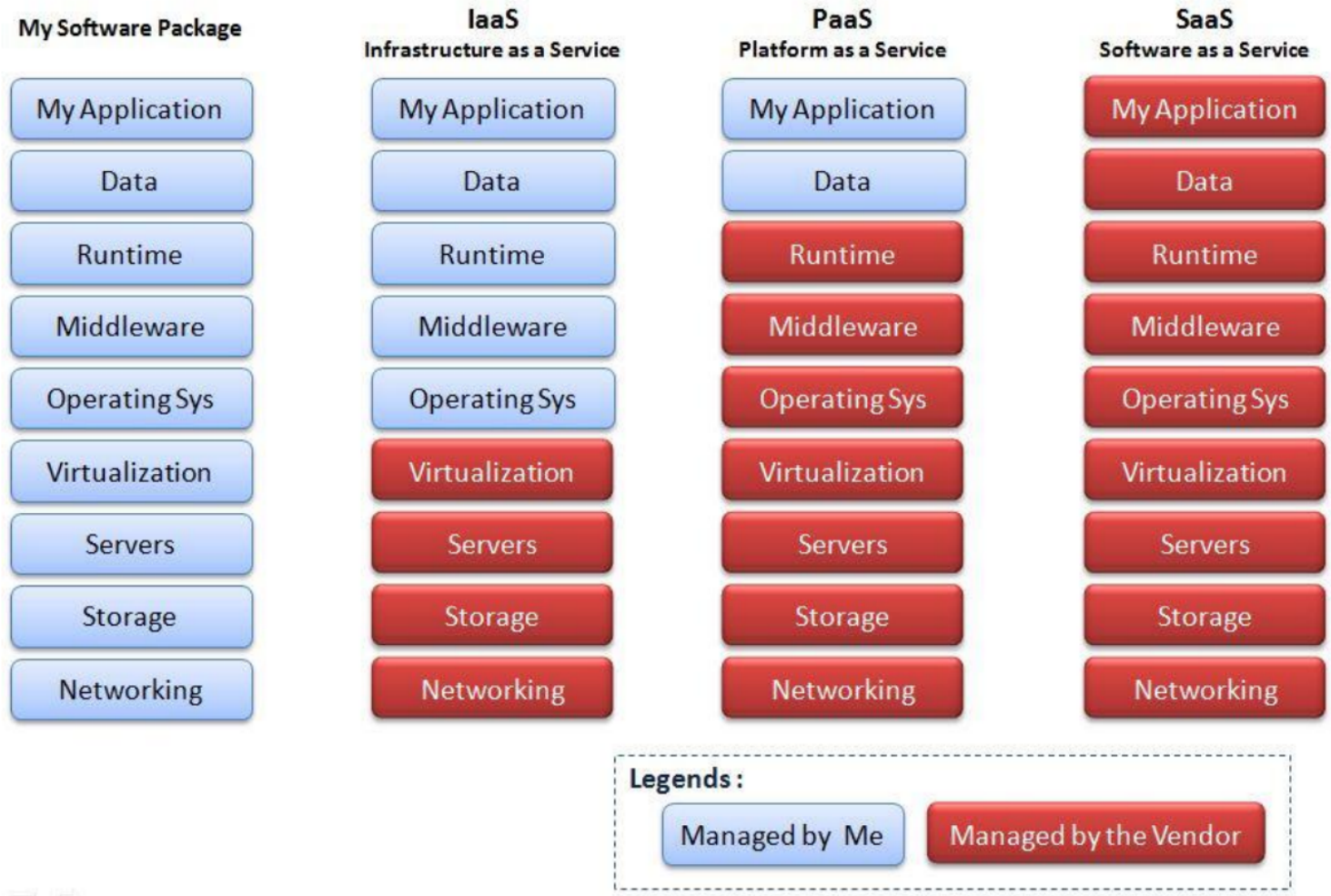
Cloud computing has been defined by the U.S. National Institute of Standards and Technology (NIST) as "...a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."

Cloud computing characteristics

Cloud computing has several essential characteristics:

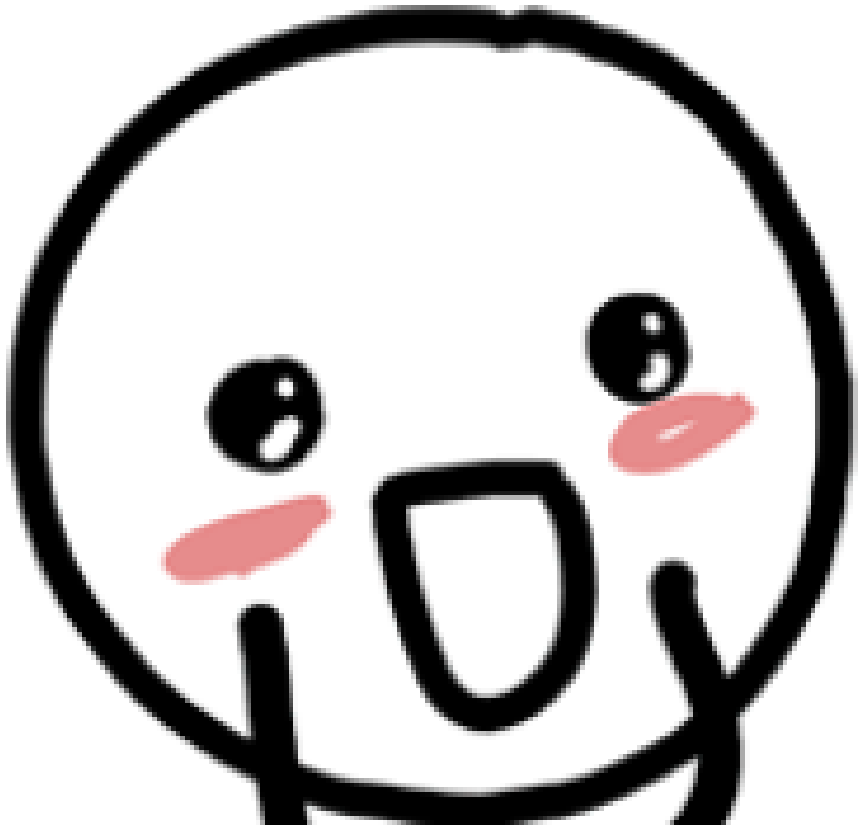
- Self-service: Allows cloud consumers to provision instances with computing resources.
- Global network access: Access the applications on the instance from the Internet.
- Multitenancy: Allows multiple cloud consumers to share the underlying hardware.
- Elasticity: Scales out (or scales in) instances to satisfy demand.
- Telemetry: Resources can be monitored and metered by the service provider as well as the cloud consumer.

Infra service levels



What is OpenStack

OpenStack is a set of software tools for building and managing cloud computing platforms for public and private clouds.



Nova

- Compute project
- Provision & manage virtual machines
- Multi-hypervisor support, included KVM & Xen

Neutron

- Networking project
- Manage virtual networks (L2 & L3)
- Multi-backend support: Linux Bridge, OVS, etc

Glance

- Image project
- Catalog & manage library of server images
- Backends: Swift, Amazon, Ceph, GlusterFS, etc

Swift

- Object storage project
- Redundant and scalable
- Long-term storage system for large amounts of data
- HTTP API (RESTFull)
- Similar to Amazon S3

Cinder

- Block storage project
- Manage volumes, plugable to virtual machines
- Backends: Ceph, NFS, iSCSI, etc
- Similar to Amazon Elastic storage

Keystone

- Identity service
- Provide unified authentication for OpenStack projects
- Also manage services endpoints catalog
- Concepts of User, Tenant, Role
- Backends: MySQL, LDAP

Ceilometer

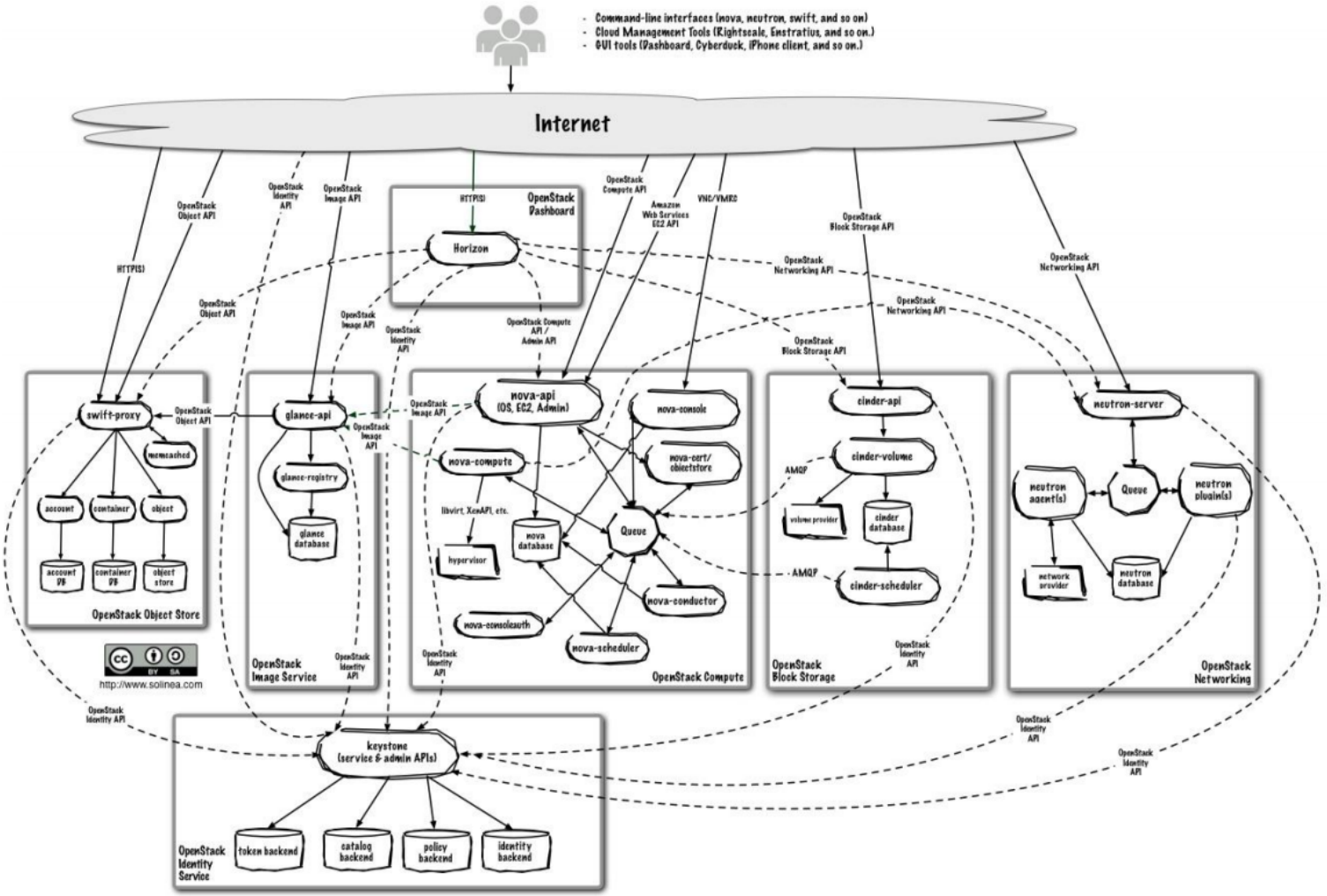
- Telemetry project
- Provide collection of metering data (CPU usage, network costs, etc) used by virtual machines
- Custom data by plugins

Heat

- Orchestration project
- Provide a template-based for describing an application
- Integrated with OpenStack projects
- Auto-scaling and High-Availability for VMs
- Compatible with AWS CloudFormation

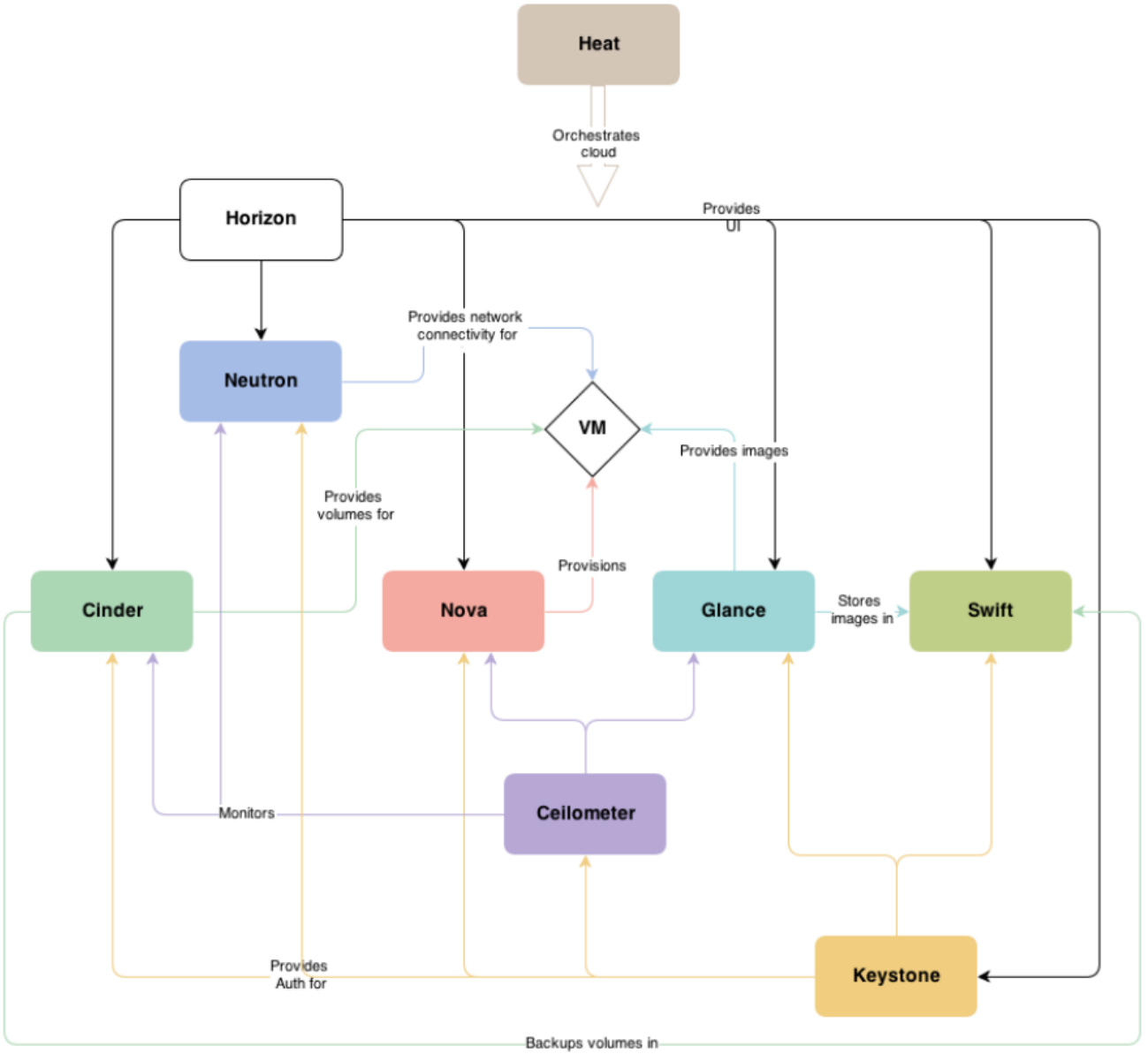
How does it look like?

True story


Command-line interfaces (nova, neutron, swift, and so on)
Cloud Management Tools (Rightscale, Enstratius, and so on.)
GUI tools (Dashboard, Cyberduck, iPhone client, and so on.)
Internet
OpenStack Dashboard
Horizon
swift-proxy
memcached
account
container
object
OpenStack Object Store
glance-api
glance-registry
glance database
OpenStack Image Service
nova-api (OS, EC2, Admin)
nova-compute
nova database
Queue
hypervisor
nova-consoleauth
nova-scheduler
nova-conductor
nova-console
nova-cert/ objectstore
OpenStack Compute
cinder-api
cinder-volume
cinder database
cinder-scheduler
OpenStack Block Storage
neutron-server
neutron agent(s)
Queue
neutron plugin(s)
network provider
neutron database
OpenStack Networking
keystone (service & admin APIs)
token backend
catalog backend
policy backend
identity backend
OpenStack Identity Service
http://www.solinea.com

Really???

A simpler view



Installers

- TripleO/OSP
- Packstack
- Fuel

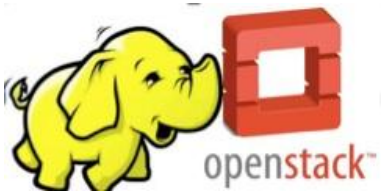
Big Data

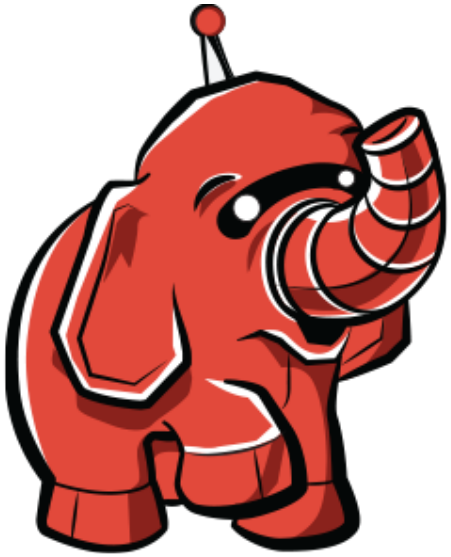
Big data is a term that describes the analysis and processing of large volumes of data.

Hadoop

Apache Hadoop is an open source software platform for distributed storage and distributed processing of very large data sets on computer clusters built from commodity hardware. Hadoop services provide for data storage, data processing, data access, data governance, security, and operations.

The intersection of Hadoop and OpenStack





Sahara

Mission

Saharas mission is to provide a scalable data processing stack and associated management interfaces. Sahara delivers on that mission by providing the ability to rapidly create and manage Apache Hadoop clusters and easily run workloads across them. All on OpenStack managed infrastructure, without having to deal with the details of cluster management.
With full cluster lifecycle management, provisioning, scaling and termination, Sahara allows the user to select different Hadoop versions, cluster topology and node hardware details.

Sahara key features and use cases

- Fast and agile Hadoop cluster deployment
- An extensible framework for management and provisioning components
- Run Hadoop workloads in few clicks without expertise in Hadoop operations
- Analytics as a Service utilization of unused compute capacity for ad-hoc or bursty analytic workloads
- Sahara supports different types of jobs: MapReduce, Hive, Pig and Oozie workflows. The data could be taken from various sources: Swift, HDFS, NoSQL and SQL databases. It also supports various provisioning plugins.
- The intersection of two of the largest open source movements
- OpenStack provides the foundation and hub of innovation for cleanly managing infrastructure resources. While Apache Hadoop serves as the core and innovation driver for storing and processing data.

Sahara Functionality

- Bringing up cluster
- Configure it along the way
- Scale cluster
- Terminate cluster
- Job execution (Elastic Data Processing)

Upload Sahara image

```
[fedora@devstack-sahara  ~]$ openstack image create --disk-format qcow2 --container-format bare --file sahara-newton-vanilla-2.7.1-centos7.qcow2 centos7-sahara

+------------------+------------------------------------------------------+
| Field            | Value                                                |
+------------------+------------------------------------------------------+
| checksum         | a7853681c18fe1f611d70e003f3c9639                     |
| container_format | bare                                                 |
| created_at       | 2017-01-24T14:52:47Z                                 |
| disk_format      | qcow2                                                |
| file             | /v2/images/dc751e7c-65d8-4f60-ae72-58abe0a780d4/file |
| id               | dc751e7c-65d8-4f60-ae72-58abe0a780d4                 |
| min_disk         | 0                                                    |
| min_ram          | 0                                                    |
| name             | centos7-sahara                                       |
| owner            | 5ff033fe302641eb9ec1317ee7e77c1c                     |
| protected        | False                                                |
| schema           | /v2/schemas/image                                    |
| size             | 1575288832                                           |
| status           | active                                               |
| tags             |                                                      |
| updated_at       | 2017-01-24T14:53:08Z                                 |
| virtual_size     | None                                                 |
| visibility       | shared                                               |
+------------------+------------------------------------------------------+
```

Register Sahara image

```
[fedora@devstack-sahara  ~]$ openstack dataprocessing image register centos7-sahara --username cloud-user
+-------------+--------------------------------------+
| Field       | Value                                |
+-------------+--------------------------------------+
| Description |                                      |
| Id          | dc751e7c-65d8-4f60-ae72-58abe0a780d4 |
| Name        | centos7-sahara                       |
| Status      | ACTIVE                               |
| Tags        |                                      |
| Username    | cloud-user                           |
+-------------+--------------------------------------+
```

Configure Hadoop plugin

```
[fedora@devstack-sahara  ~]$ openstack dataprocessing image tags add centos7-sahara --tags vanilla 2.7.1
+-------------+--------------------------------------+
| Field       | Value                                |
+-------------+--------------------------------------+
| Description |                                      |
| Id          | dc751e7c-65d8-4f60-ae72-58abe0a780d4 |
| Name        | centos7-sahara                       |
| Status      | ACTIVE                               |
| Tags        | 2.7.1, vanilla                       |
| Username    | cloud-user                           |
+-------------+--------------------------------------+
```

Available Hadoop plugins

```
[fedora@devstack-sahara ~]$ openstack dataprocessing plugin show vanilla --plugin-version 2.7.1
+-------------------------------+-----------------------------------------------------------------------------------------------------------------+
| Field                         | Value                                                                                                           |
+-------------------------------+-----------------------------------------------------------------------------------------------------------------+
| Description                   | The Apache Vanilla plugin provides the ability to launch upstream Vanilla Apache Hadoop cluster without any management consoles. It |
|                               | can also deploy the Oozie component.                                                                            |
| Name                          | vanilla                                                                                                         |
| Required image tags           | 2.7.1, vanilla                                                                                                  |
| Title                         | Vanilla Apache Hadoop                                                                                           |
|                               |                                                                                                                 |
| Plugin version 2.7.1: enabled | True                                                                                                            |
| Plugin version 2.7.1: stable  | True                                                                                                            |
| Plugin: enabled               | True                                                                                                            |
| Plugin: stable                | True                                                                                                            |
|                               |                                                                                                                 |
| Service:                      | Available processes:                                                                                            |
|                               |                                                                                                                 |
| HDFS                          | datanode, namenode, secondarynamenode                                                                           |
| Hadoop                        |                                                                                                                 |
| Hive                          | hiveserver                                                                                                      |
| JobFlow                       | oozie                                                                                                           |
| MapReduce                     | historyserver                                                                                                   |
| Spark                         | spark history server                                                                                            |
| YARN                          | nodemanager, resourcemanager                                                                                    |
+-------------------------------+-----------------------------------------------------------------------------------------------------------------+
```

Create node templates

```
[fedora@devstack-sahara ~]$ openstack dataprocessing node group template create --name vanilla-default-master --plugin vanilla --plugin-version 2.7.1 --processes namenod
e resourcemanager --flavor 2 --auto-security-group
+---------------------+--------------------------------------+
| Field               | Value                                |
+---------------------+--------------------------------------+
| Auto security group | True                                 |
| Availability zone   | None                                 |
| Flavor id           | 2                                    |
| Floating ip pool    | None                                 |
| Id                  | 48c6a09f-9228-4b40-a5e8-e6ab079d8505 |
| Is default          | False                                |
| Is protected        | False                                |
| Is proxy gateway    | False                                |
| Is public           | False                                |
| Name                | vanilla-default-master               |
| Node processes      | namenode, resourcemanager            |
| Plugin name         | vanilla                              |
| Plugin version      | 2.7.1                                |
| Security groups     | None                                 |
| Use autoconfig      | False                                |
| Volumes per node    | 0                                    |
+---------------------+--------------------------------------+
[fedora@devstack-sahara ~]$ openstack dataprocessing node group template create --name vanilla-default-worker --plugin vanilla --plugin-version 2.7.1 --processes datanod
e nodemanager --flavor 2 --auto-security-group
+---------------------+--------------------------------------+
| Field               | Value                                |
+---------------------+--------------------------------------+
| Auto security group | True                                 |
| Availability zone   | None                                 |
| Flavor id           | 2                                    |
| Floating ip pool    | None                                 |
| Id                  | 835b9b18-92d1-492f-a2e9-a41cd0c2a01e |
| Is default          | False                                |
| Is protected        | False                                |
| Is proxy gateway    | False                                |
| Is public           | False                                |
| Name                | vanilla-default-worker               |
| Node processes      | datanode, nodemanager                |
| Plugin name         | vanilla                              |
| Plugin version      | 2.7.1                                |
| Security groups     | None                                 |
| Use autoconfig      | False                                |
| Volumes per node    | 0                                    |
+---------------------+--------------------------------------+
```

Create cluster template

```
[fedora@devstack-sahara  ~]$ openstack dataprocessing cluster template create  --name vanilla-default-cluster --node-groups vanilla-default-master:1 vanilla-default-worke
r:3
+----------------+-----------------------------------------------+
| Field          | Value                                         |
+----------------+-----------------------------------------------+
| Anti affinity  |                                               |
| Description    | None                                          |
| Domain name    | None                                          |
| Id             | b1273b68-7ac5-46ad-82af-e6c32b93811a          |
| Is default     | False                                         |
| Is protected   | False                                         |
| Is public      | False                                         |
| Name           | vanilla-default-cluster                       |
| Node groups    | vanilla-default-master:1, vanilla-default-worker:3 |
| Plugin name    | vanilla                                       |
| Plugin version | 2.7.1                                         |
| Use autoconfig | False                                         |
+----------------+-----------------------------------------------+
```

Create cluster

```
[fedora@devstack-sahara ~]$ openstack dataprocessing cluster create --name my-cluster-1 --cluster-template vanilla-default-cluster --user-keypair vagrant --neutron-netwo
rk private --image centos7-sahara
+---------------------------+-----------------------------------------------+
| Field                     | Value                                         |
+---------------------------+-----------------------------------------------+
| Anti affinity             |                                               |
| Cluster template id       | b1273b68-7ac5-46ad-82af-e6c32b93811a          |
| Description               | None                                          |
| Id                        | 298cea5f-c1e5-480a-ad21-1caef01d5a04          |
| Image                     | dc751e7c-65d8-4f60-ae72-58abe0a780d4          |
| Info                      | {}                                            |
| Is protected              | False                                         |
| Is public                 | False                                         |
| Is transient              | False                                         |
| Name                      | my-cluster-1                                  |
| Neutron management network | 62a86be4-0dea-45c0-913c-4bef8229a7e0          |
| Node groups               | vanilla-default-worker:3, vanilla-default-master:1 |
| Plugin name               | vanilla                                       |
| Plugin version            | 2.7.1                                         |
| Status                    | Validating                                    |
| Use autoconfig            | False                                         |
| User keypair id           | vagrant                                       |
+---------------------------+-----------------------------------------------+
```

Show cluster

```
[fedora@devstack-sahara ~]$ openstack dataprocessing cluster show my-cluster-1
+-----------------------------+-----------------------------------------------------+
| Field                       | Value                                               |
+-----------------------------+-----------------------------------------------------+
| Anti affinity               |                                                     |
| Cluster template id         | b1273b68-7ac5-46ad-82af-e6c32b93811a                |
| Description                 | None                                                |
| Id                          | 298cea5f-c1e5-480a-ad21-1caef01d5a04                |
| Image                       | dc751e7c-65d8-4f60-ae72-58abe0a780d4                |
| Info                        | {}                                                  |
| Is protected                | False                                               |
| Is public                   | False                                               |
| Is transient                | False                                               |
| Name                        | my-cluster-1                                        |
| Neutron management network  | 62a86be4-0dea-45c0-913c-4bef8229a7e0                |
| Node groups                 | vanilla-default-worker:0, vanilla-default-master:0  |
| Plugin name                 | vanilla                                             |
| Plugin version              | 2.7.1                                               |
| Status                      | Spawning                                            |
| Use autoconfig              | False                                               |
| User keypair id             | vagrant                                             |
+-----------------------------+-----------------------------------------------------+
```