This video explains **OpenStack**, a cloud operating system that helps build private or public cloud infrastructures (2:40).
The video highlights the advantages of cloud computing over on-premise systems (1:01), including:

- **Scalability:** Cloud allows paying only for what is utilized, making scaling up and down easier and faster (1:35).
- **Servers:** Cloud services provide direct access to virtual servers, saving space and money on physical server storage and maintenance (1:48).
- **Data Recovery:** Cloud systems have robust disaster recovery measures for faster data recovery compared to on-premise systems (2:12).

OpenStack is presented as an **Infrastructure as a Service (IaaS)** (3:19), pulling, provisioning, and managing storage, network resources, and computing (3:32). It is built on top of a virtualized environment (4:14) to create a cloud operating system that supports many users for tasks like web hosting, application hosting, and big data (4:18).

Key benefits of OpenStack mentioned in the video include:

- **Cost-effectiveness:** It is free under the Apache 2.0 agreement (4:41).
- **Industry Support:** Developed by NASA, it has strong support and investment from industry leaders like IBM, Red Hat, AMD, and Intel (4:48).
- **Ease of Management:** It offers an easy-to-manage panel for visibility, control, and access to power management tools (5:09).
- **Scalability, Compatibility, and Security:** These are also listed as advantages (5:03).

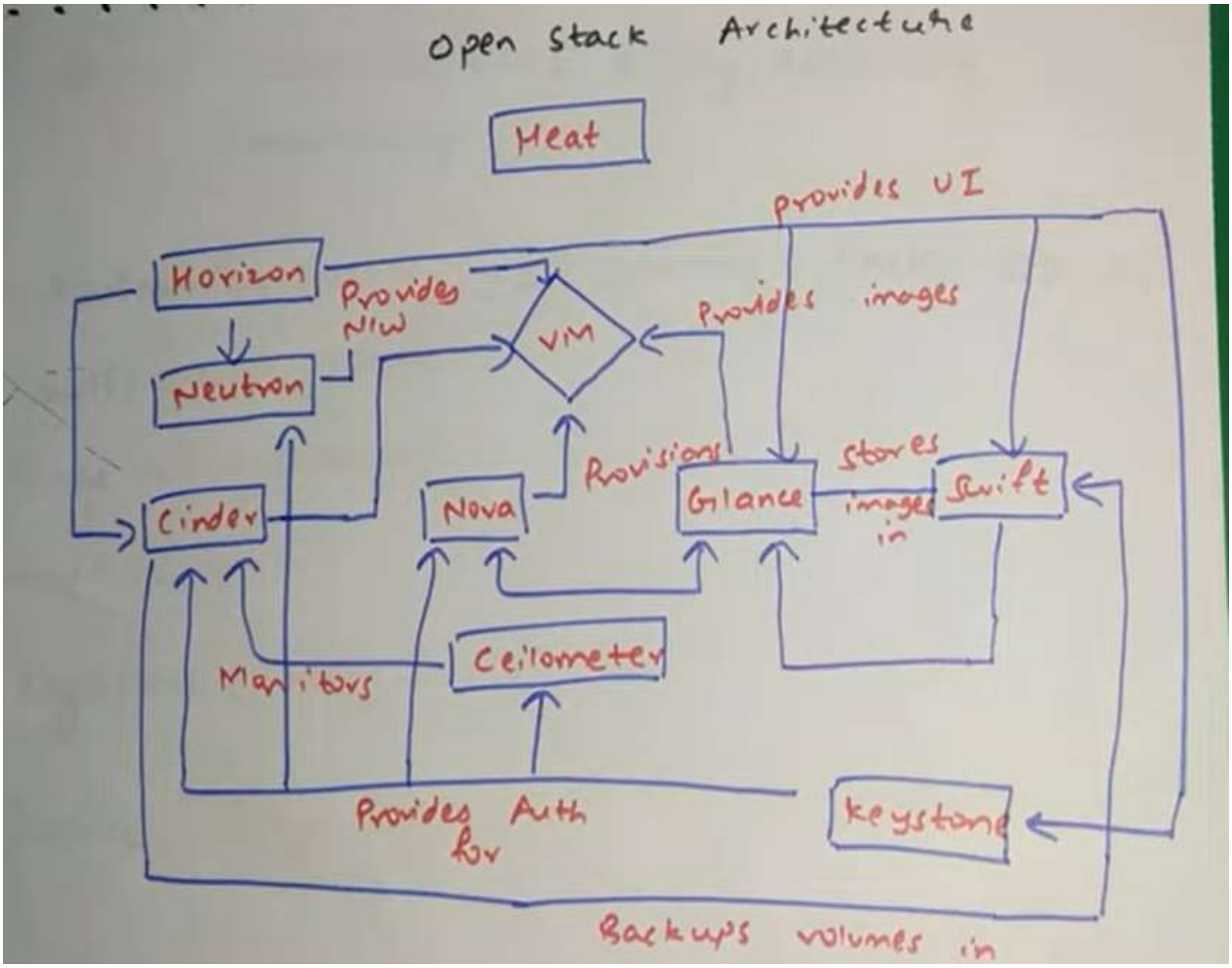
OpenStack is a collection of software modules, or **projects**, that work together to create and manage cloud infrastructures (0:07-0:13). It provides **Infrastructure as a Service (IaaS)** functionality by pooling, provisioning, and managing compute, storage, and network resources (0:15-0:21). OpenStack is an open-source alternative to cloud platforms like AWS and Azure (0:22-0:31).
Organizations use OpenStack to form a **cloud operating system** on top of a virtualized environment, broadening their pool of computing resources for various tasks such as web hosting, application hosting, or big data (0:40-1:03). Enterprises can select specific software components (projects) to build out the features of their cloud, typically starting with central components like compute, VM images, networking, storage, identity management, and resource management (1:05-1:24).
OpenStack offers several benefits (1:26-1:44):

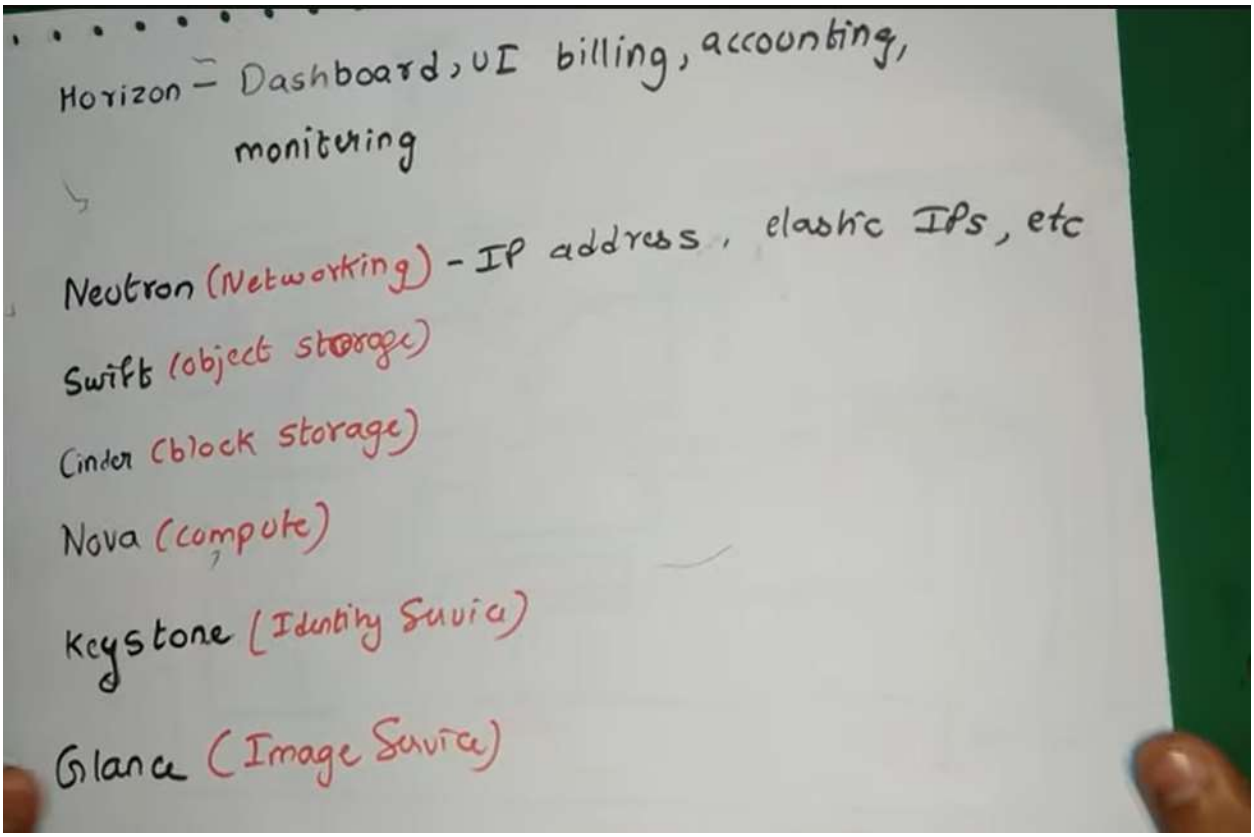
- **Affordability:** It's freely available under the Apache 2.0 license (1:30-1:32).
- **Reliability:** It has almost a decade of development and use (1:35-1:38).
- **Vendor neutrality:** Its open-source nature helps businesses avoid vendor lock-in (1:40-1:44).

However, there are also drawbacks to consider (1:46-2:06):

- **Complexity:** It requires IT staff with significant knowledge of the platform (1:48-1:53).
- **Support:** It relies on the open-source community as it's not owned by a single vendor (1:55-2:00).
- **Consistency:** The component suite is constantly changing with additions and depreciations (2:01-2:06).

Adopting OpenStack is a process that requires time, financial investment, and support from upper management (2:07-2:15).

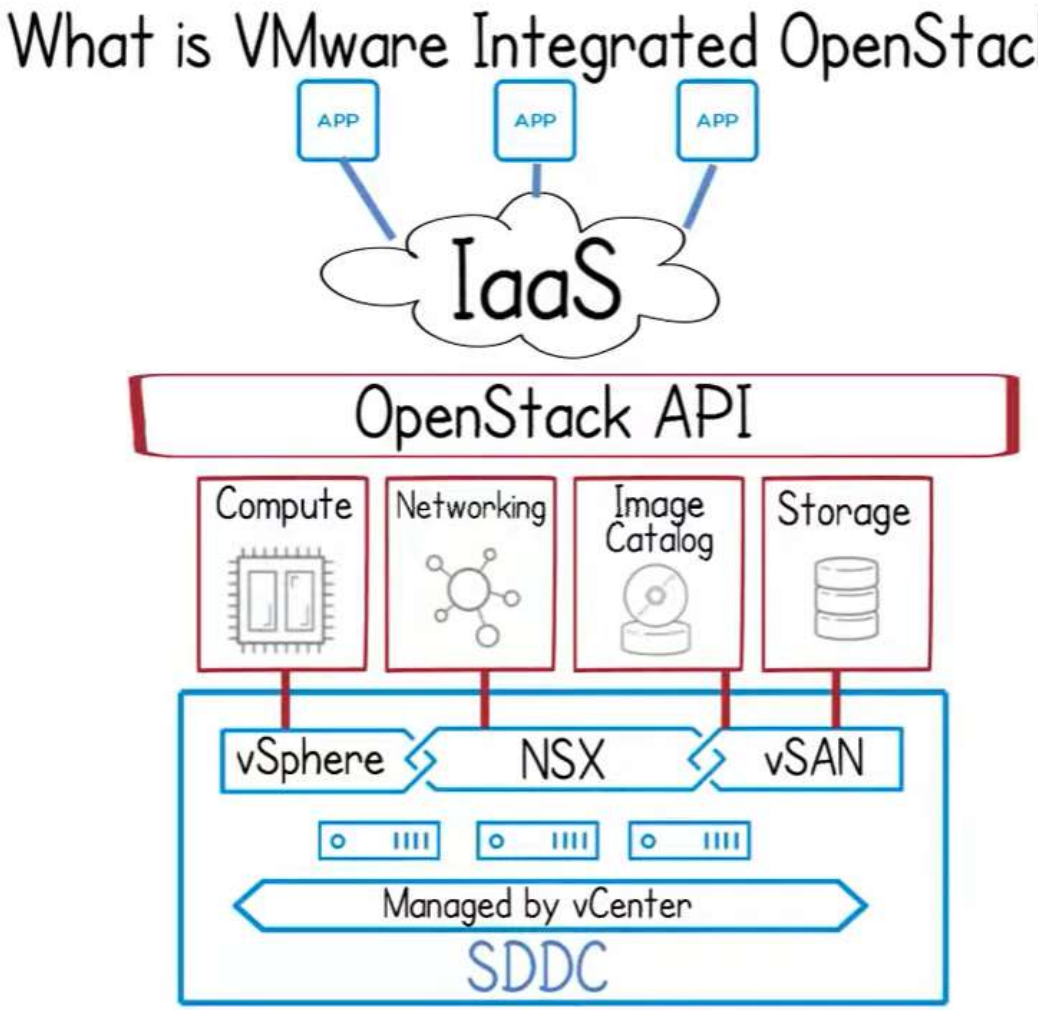

Open Stack Architecture
Heat
provides UI
Horizon
Provides N/w
VIM
Provides images
Neutron
Provisions
stores images in
Cinder
Nova
Glance
Swift
Ceilometer
Monitors
Provides Auth for
keystone
Backups volumes in



The video explains that **OpenStack is an open-source framework for delivering cloud-based IaaS** (Infrastructure as a Service) (0:06). It provides applications with API access to cloud services and is best suited for cloud-native applications (0:15). As a cloud operating system, OpenStack controls large pools of compute, networking, image storage, and other resources within a data center (0:29).

However, OpenStack itself does not provide the virtual infrastructure or most cloud management functionalities like monitoring, troubleshooting, policies, and governance (0:46). This is where **VMware Integrated OpenStack** comes in (0:55). It utilizes VMware's software-defined data center (SDDC) technology to provide the infrastructure, with familiar tools like vSphere, NSX, vSAN, and vCenter interoperating seamlessly with OpenStack (0:57-1:11). This integration simplifies installation and offers optimized management through vRealize operations, log insight, and automation (1:21-1:28).

Ultimately, VMware Integrated OpenStack allows IT administrators to easily deploy and manage a production-grade OpenStack cloud on a stable and feature-rich VMware platform (1:33-1:40).



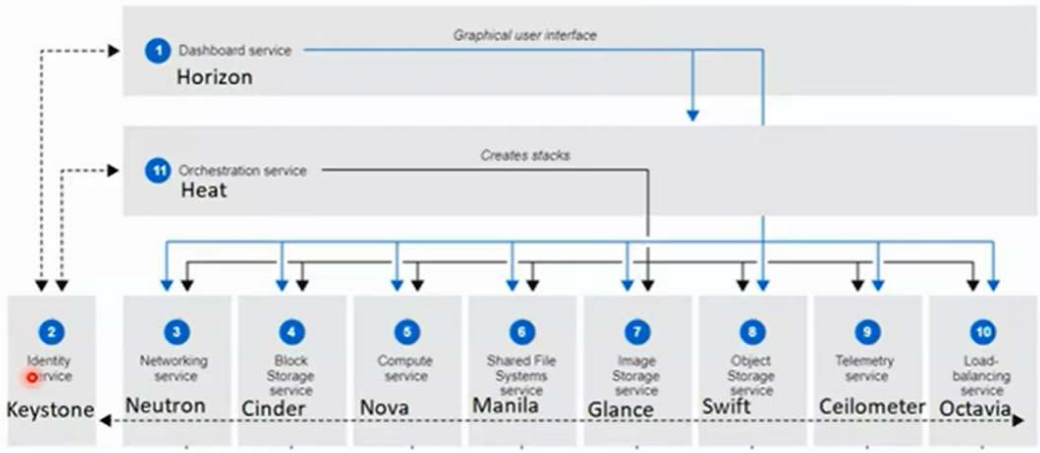
This video provides a simplified explanation of **OpenStack components** by relating them to the components needed to build a physical or virtual machine (0:28).

Here are the core OpenStack components and their functions:

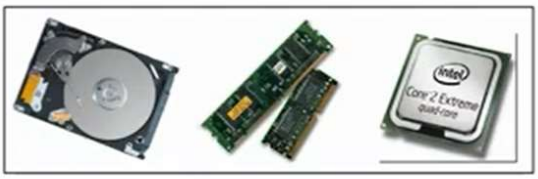
- **Nova** (0:46): Represents the compute resources like CPU, RAM, and disk, similar to the hardware of a machine.
- **Glance** (0:51): Corresponds to the operating system or VM image.
- **Neutron** (0:57): Handles the network connectivity for the virtual machine.
- **Cinder** (1:03): Provides external hard disk storage for additional space.
- **Keystone** (1:11): Manages users and accounting within OpenStack.
- **Horizon Dashboard** (1:17): Serves as the control panel to manage all these resources.
  When launching a virtual machine on the OpenStack dashboard, you primarily need to provide the VM name, the source (VM image), the flavor (CPU, RAM, and disk configuration), and the network to which the VM will be attached (1:38-1:54).

OpenStack components

As per official documentation



OpenStack components



Nova
(Compu
resource

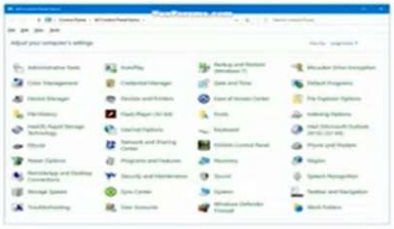
VM (Virtual Machine)

Glance
(Image)

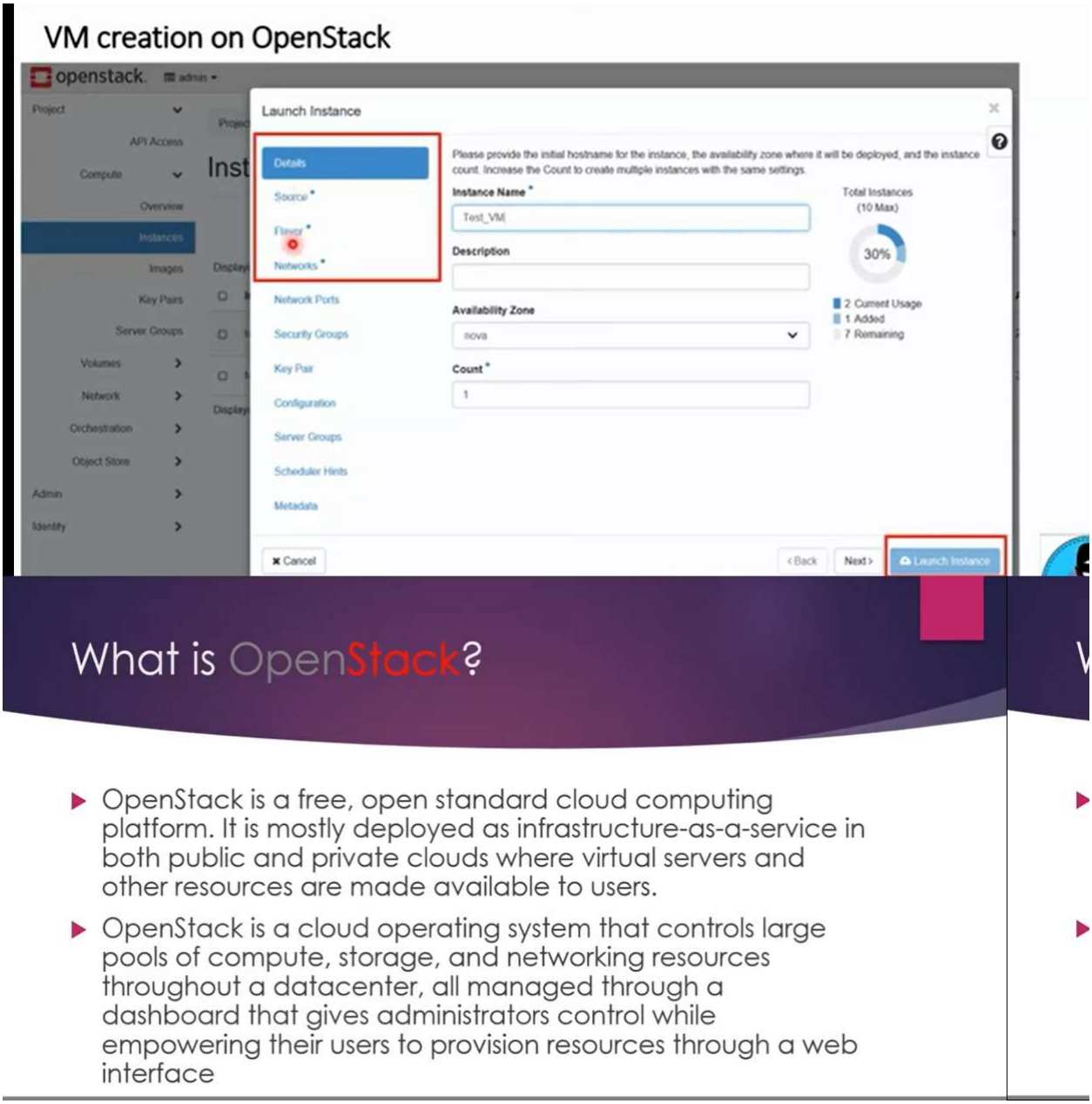
Neutron
(Network

Cinder
(External
HDD)

Keystone
(User
accounts)



Horizon
(Control
panel)



This video provides an introduction to **OpenStack**, an open-source cloud computing platform (0:05).

Here's a summary of the key points:

- **What is OpenStack?**
- It is a free, open-source cloud management software program (0:07-0:16).
- It is primarily deployed as Infrastructure as a Service (IaaS) (0:17-0:20).
- It is used in public and private clouds to manage virtual servers and other resources (0:27-0:34).
- OpenStack helps control large pools of computing, networking, and storage resources at a data center level (0:36-0:49, 0:55-1:09).
- **Origin and Technical Details**
- Originally developed by Rackspace Hosting and NASA (1:14-1:19).
- Its initial release was on October 21, 2010 (1:21-1:26).
- It is written in Python (1:26-1:29).
- Its official website is openstack.org (1:34-1:36).

- **Core Services (1:49-1:57)**
- **Nova:** Manages a large number of virtual machines (2:06-2:15).
- **Swift:** Provides object storage, similar to Amazon S3 (2:17-2:25).
- **Cinder:** Manages block storage and physical storage devices (2:27-2:39).
- **Neutron:** Provides networking services (2:41-2:44).
- **Horizon:** The dashboard or graphical user interface for OpenStack (2:47-2:57).
- **Keystone:** An identity service for authentication and authorization (2:59-3:08).
- **Glance:** Provides image services, allowing users to store and discover virtual machine images (3:28-3:42).
- **Ceilometer:** Offers metering services to track cloud resource usage on an individual basis (3:45-4:03).
- **Heat:** Allows developers to define cloud application requirements and necessary resources in a file (4:03-4:42).
- **Automation Capabilities**
- OpenStack can automate computing, storage, backup and recovery, networking, data analytics, security, identity and compliance management, monitoring, metering, application services, and development deployments (6:49-7:07).
- **Industries Using OpenStack**
- Major companies like Walmart, Snapdeal, AT&T, Harvard University, Comcast, and Verizon utilize OpenStack (7:25-7:42).
- It is widely used in Information Technology (IT), telecommunications, finance, government, manufacturing, and academic research (8:11-8:23).
- **Deployment Models**
- Most commonly used for **on-premise private clouds** (8:58-9:11).
- Also used in public and hybrid clouds (9:14-9:16).
- **Reasons for Choosing OpenStack**
- Increases operational efficiency (9:24-9:37).
- Offers excellent flexibility and innovation (9:37-9:42).

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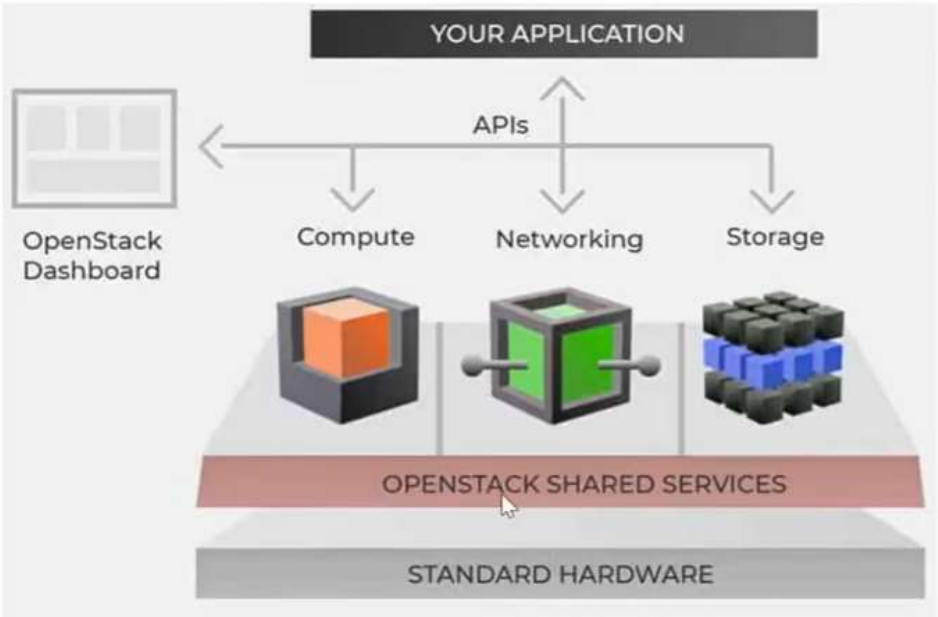
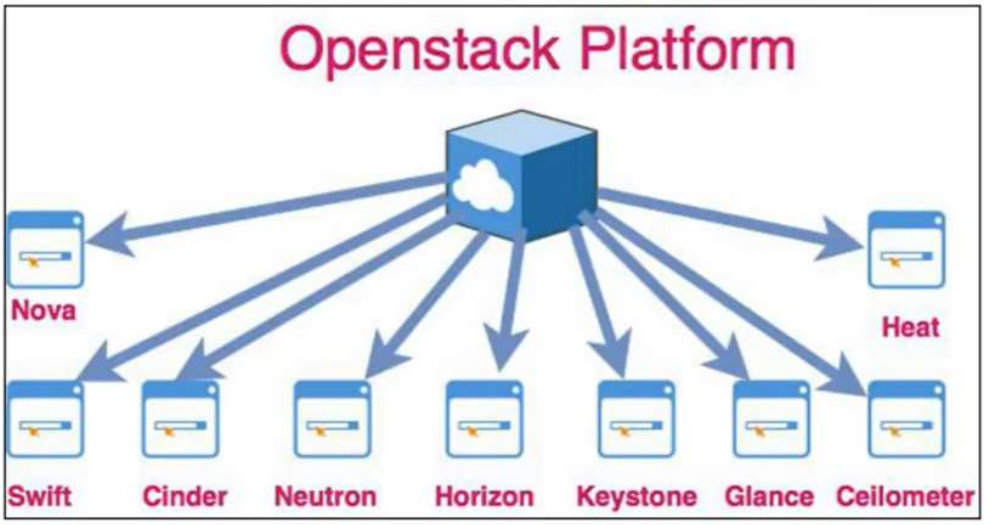

YOUR APPLICATION
APIs
OpenStack Dashboard
Compute
Networking
Storage
OPENSTACK SHARED SERVICES
STANDARD HARDWARE


Openstack Platform
Nova
Heat
Swift
Cinder
Neutron
Horizon
Keystone
Glance
Ceilometer

- **Nova** is a computing engine. It is used for deploying and managing large numbers of virtual machines.
- **Swift** is a storage system for objects and files.
- **Cinder** is a block storage component. It accesses specific locations on a disk drive.
- **Neutron** provides the networking capability.
- **Horizon** is the dashboard of Openstack. It is the only graphical interface (WEB UI).
- **Keystone** provides identity services. It is essentially a central list of all the users.
- **Glance** provides image services to OpenStack. In this case, "images" refers to images (or virtual copies) of hard disks.
- **Ceilometer** provides telemetry services, which allow the cloud to provide billing services to individual users of the cloud.
- **Heat** allows developers to store the requirements of a cloud application in a file that defines what resources are necessary for that application.

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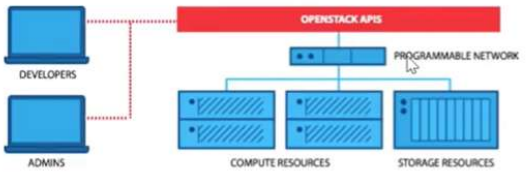
Installing Openstack

- As Openstack is an open source platform, there are many ways to install and deploy it through different software distributions. Each one of them adds their own value to the cloud operating system.

- To install them manually, the main distributors are −
- **Ubuntu** − https://www.ubuntu.com/cloud/openstack
- **Red Hat** − https://www.rdoproject.org/
- **Suse** − https://www.suse.com/products/suse-openstack-cloud/

What is OpenStack



Programmable infrastructure that lays a common set of APIs on top of compute, networking and storage

One platform for virtual machines, containers and bare metal

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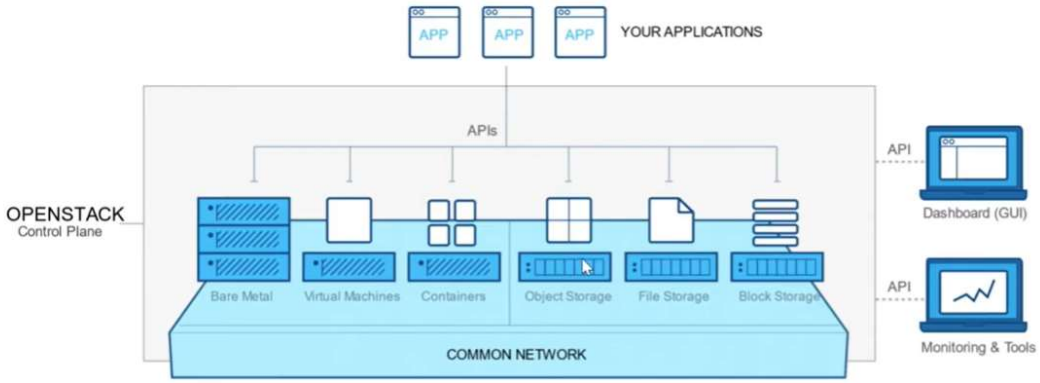
What is OpenStack?



What is OpenStack?

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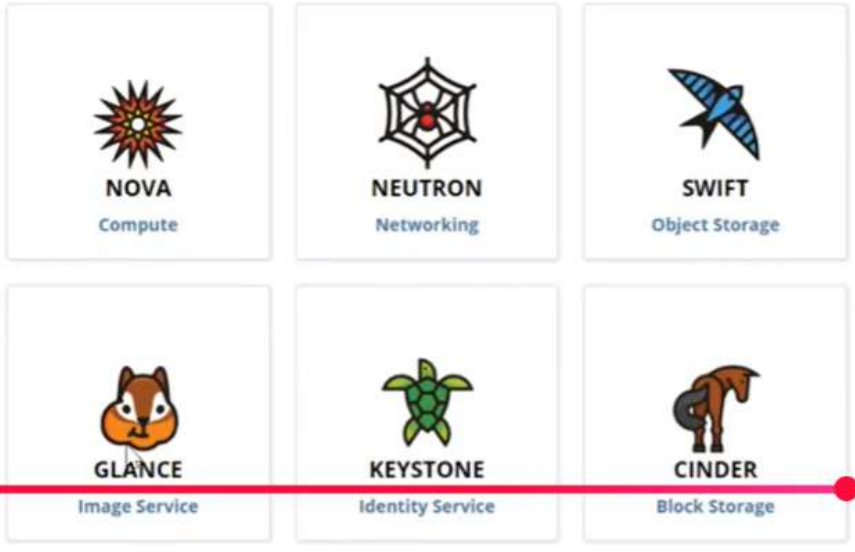
Popular Project Set



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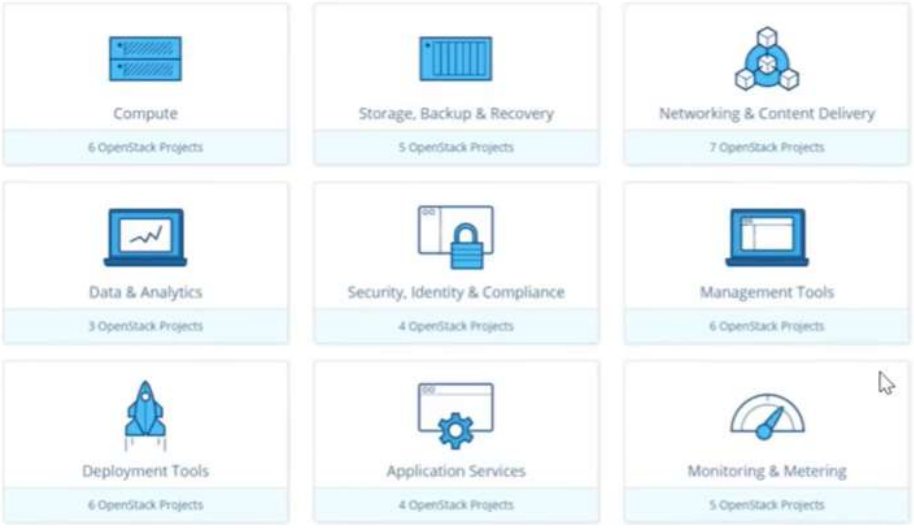
What can OpenStack Automate?



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Industries that uses OpenStack

Which industries choose OpenStack?

RETAIL/E-COMMERCE

BEST BUY Walmart ebay overstock snapdeal

FINANCIAL

TD Bank PayPal FICO AMERICAN EXPRESS

TELECOM

AT&T NTT Communications Deutsche Telekom 中国移动 China Mobile

ACADEMIC/RESEARCH

MIT Massachusetts Institute of Technology CERN HARVARD UNIVERSITY

ENERGY

STATE GRID CORPORATION OF CHINA

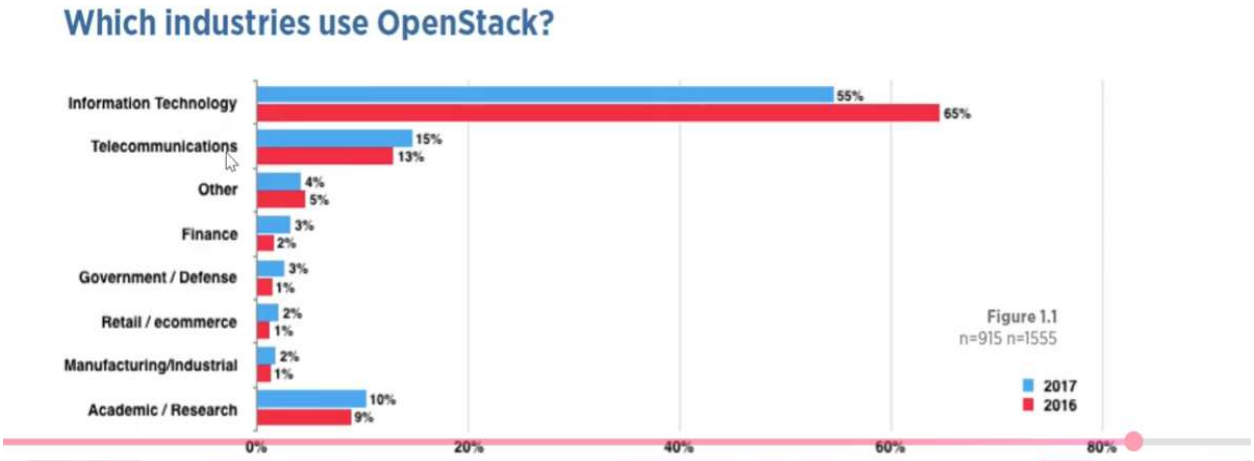
MANUFACTURING

ENTERTAINMENT

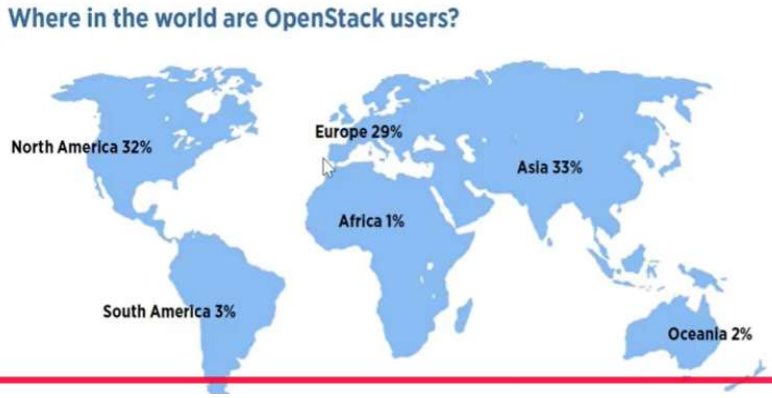
COMCAST betfair

See more at openstack.org/user-stories

Which Industries use OpenStack?



OpenStack Users worldwide



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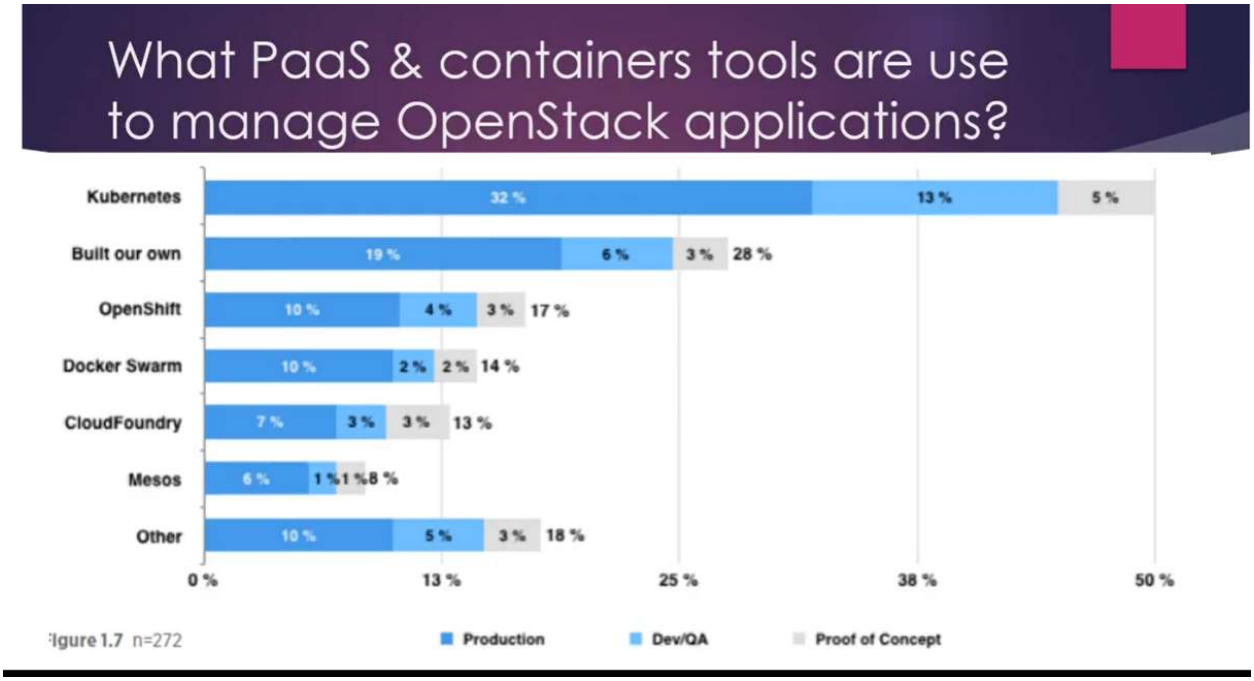

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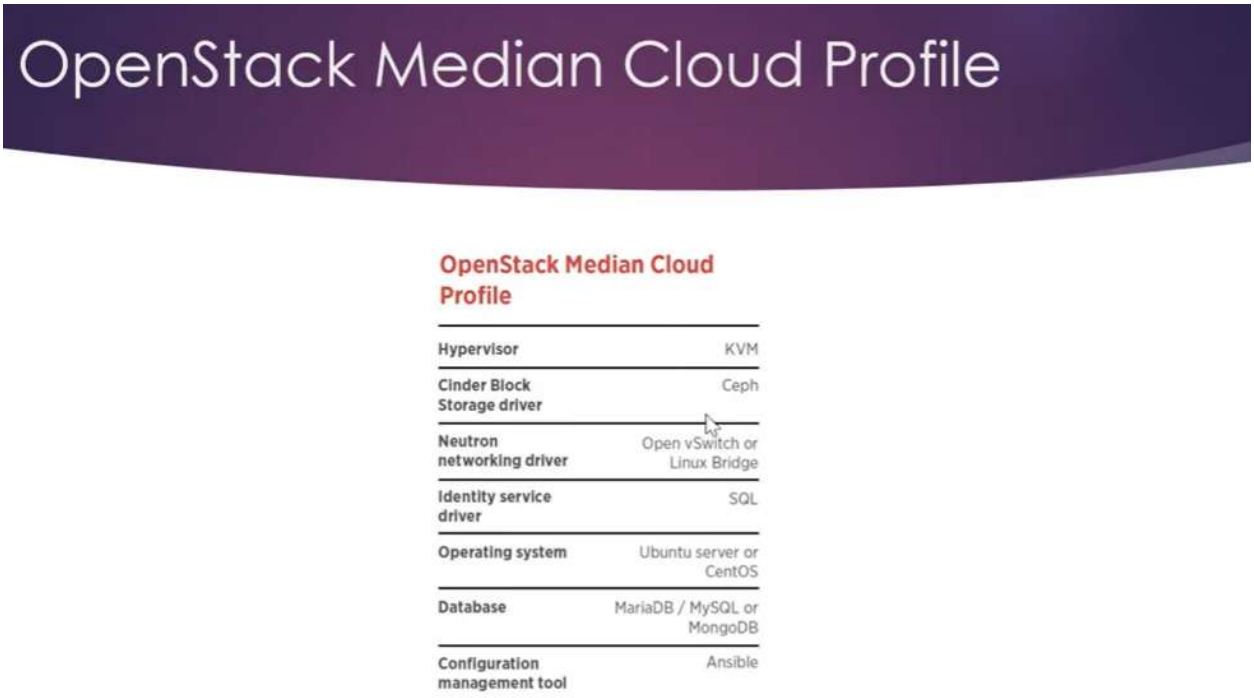

Here's a **complete, in-depth explanation of OpenStack** for **Parallel and Distributed Computing**, covering architecture, services, examples, and practical use cases.

OpenStack: Parallel & Distributed Computing

1. Definition of OpenStack

OpenStack is an **open-source cloud computing platform** that provides **infrastructure as a service (IaaS)**. It allows organizations to create **private and public clouds**, providing virtualized computing, storage, and networking resources over a distributed system.

Exam-ready one-line definition:

OpenStack is an open-source cloud platform that enables distributed and parallel computing by managing compute, storage, and networking resources in a scalable and virtualized environment.

---

2. Why OpenStack is Needed

Traditional computing challenges:

- Limited hardware
- Expensive scaling
- Resource underutilization
- Difficult multi-tenant management

OpenStack solves this by:

- Providing **on-demand virtual machines**
- Enabling **parallel execution of tasks**
- Offering **distributed resource management**
- Supporting **multi-tenant environments**

---

3. OpenStack Use in Parallel & Distributed Computing

- **Parallel Computing:** Run multiple virtual machines (VMs) or containers simultaneously across nodes for computational tasks.
- **Distributed Computing:** Deploy services across multiple nodes and data centers; manage workloads with fault tolerance and high availability.
- **High-Performance Computing (HPC):** Integrates with clusters and batch processing frameworks like SLURM or Kubernetes.

---

4. OpenStack Architecture

OpenStack has a **modular, layered architecture**.

4.1 Layers

Layer	Function
Compute	Virtual machines / bare-metal nodes (Nova)
Storage	Block storage (Cinder) & object storage (Swift)
Networking	Software-defined networking (Neutron)
Identity & Access	Authentication and authorization (Keystone)
Dashboard	Web-based UI (Horizon)
Image Service	VM image management (Glance)
Orchestration	Automation & deployment (Heat)
Telemetry / Monitoring	Collects metrics & logs (Ceilometer)

4.2 OpenStack Components & Services

Component	Role
Nova	Manages compute resources (VMs)
Neutron	Provides virtual networking and IP management
Swift	Distributed object storage for large data
Cinder	Block storage for VMs
Keystone	Identity management (users, roles, permissions)
Glance	Stores VM images and snapshots
Horizon	Web dashboard for managing OpenStack
Heat	Orchestration engine for automating deployments
Ceilometer	Monitoring, metering, and telemetry

---

5. How OpenStack Supports Parallel & Distributed Computing

Parallel Computing Example

- Run multiple VMs on different compute nodes for tasks like:
    - Scientific simulations

- Data analysis
- Batch processing

Steps:

1. User requests 10 VMs via Nova.
2. OpenStack schedules VMs on available compute nodes.
3. Tasks execute in parallel on these VMs.
4. Results are collected and merged.

Distributed Computing Example

- Deploying a distributed web service or database across multiple nodes:
  - Swift stores replicated data across nodes.
  - Nova deploys VMs on multiple servers.
  - Neutron connects nodes with private networks.
  - Load balancer distributes requests.

Result: A fault-tolerant, scalable distributed system.

---

6. Example Scenario: Distributed Data Processing

1. **Data Storage:** Store large datasets in Swift.
2. **Compute Nodes:** Launch multiple Nova instances to process the data.
3. **Networking:** Neutron ensures VMs can communicate securely.
4. **Orchestration:** Heat automates deployment of processing pipelines.
5. **Monitoring:** Ceilometer tracks performance metrics and usage.

---

7. Advantages of OpenStack

- **Open-source:** Free, community-supported
- **Scalable:** Easily add nodes to expand resources
- **Modular:** Components can be used independently
- **Flexible:** Supports private, public, or hybrid clouds
- **Distributed & Parallel:** Supports VMs and services across multiple nodes
- **Multi-tenant:** Supports multiple users/projects

---

8. Limitations of OpenStack

- Complex to install and maintain
- High learning curve
- Requires skilled administrators
- Performance may depend on hardware and network setup

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9. OpenStack vs AWS vs Globus vs Condor

Feature	OpenStack	AWS	Globus	Condor
Type	Private/Public Cloud	Public Cloud	Middleware	Job Scheduler
Parallel Computing	VMs, Containers	EC2, Lambda	Task distribution	Independent jobs
Distributed Computing	Across nodes	Across regions & zones	Across grids	Across idle nodes
Storage	Cinder, Swift	S3, EBS	GridFTP	Local/NFS
Cost	Free, hardware cost	Pay-as-you-go	Free / Academic	Free / Open-source
Security	Keystone, Firewall	IAM, Encryption	GSI	Authentication & Job Permissions

---

10. Real-World Use Cases

- Private cloud for universities
- Scientific research computing clusters
- Big Data processing
- Multi-node simulations
- Parallel batch job execution

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11. Exam-Oriented Summary

Keywords:

- IaaS
- Nova, Neutron, Swift, Cinder
- Parallel & Distributed computing
- Multi-tenant

- Orchestration

One-Paragraph Answer:

OpenStack is an open-source cloud platform that provides virtualized compute, storage, and networking resources for parallel and distributed computing. It allows users to deploy multiple VMs across nodes, manage data storage with Swift and Cinder, create virtual networks with Neutron, and automate deployments with Heat, enabling scalable, fault-tolerant, and multi-tenant cloud environments.

If you want, I can now make a **full diagram comparing OpenStack, AWS, Globus, and Condor architectures together**, which is extremely helpful for exams and quick revision.

Do you want me to do that?