



OpenStack and Resource Management-1 – Revision Notes

♦ OpenStack – Overview & Capabilities

- **Definition:** OpenStack is a **cloud operating system** that manages large pools of compute, storage, and networking in a datacenter, accessible via a **web dashboard**.
- **Service Models:**
 - **SaaS:** Access through browser/thin client.
 - **PaaS:** Platforms like **Cloud Foundry**, built on IaaS.
 - **IaaS:** Provisioning of compute, network, and storage.

♦ OpenStack Major Components

Service	Project	Function
Compute	Nova	Manages VMs lifecycle – spawn, schedule, decommission.
Networking	Neutron	Provides Network-as-a-Service . API to define networks.
Object Storage	Swift	RESTful API for unstructured data; replicates across servers.
Block Storage	Cinder	Persistent block storage for VMs; pluggable drivers.
Identity	Keystone	Authentication/authorization; catalog of service endpoints.
Image Service	Glance	Stores/retrieves VM disk images.
Telemetry	Ceilometer	Monitoring and metering for billing/statistics.
Dashboard	Horizon	Web-based UI for OpenStack services (e.g. launch VMs, manage IPs).

♦ OpenStack Provisioning Flow

1. User requests VM via Horizon.
2. **Keystone** authenticates.
3. **Nova API** → Scheduler via MQ.
4. **Scheduler** picks node, updates DB.
5. **Nova Compute** provisions VM:
 - Fetches DB info via Nova Conductor.
 - Calls **Neutron** for networking (IP, DNS, L2).
 - Calls **Cinder** to attach volumes.
 - Fetches image from **Glance**.
 - Image retrieved via **Swift**.
 - VM rendered by Hypervisor.

♦ Storage Types in OpenStack

Type	Persists Until	Managed By	Accessible As
Ephemeral	VM termination	Nova	Local file system
Block Storage	User deletion	Cinder	Block device (e.g., /dev)
Object Storage	User deletion	Swift	Anywhere (web/API)

♦ Google Cloud Platform (GCP)

- **Definition:** Google's cloud service to **build, test, deploy** applications on its infrastructure.
- **User-End Services:**
 - **App Engine:** Migrate apps for better performance.
 - **Cloud Endpoints:** Scale apps globally.
 - **Google APIs:** Integrate Google services.

♦ Resource Types in Cloud

- **Physical Resources:** Computers, disks, networks, instruments.
- **Logical Resources:** Application execution, monitoring, communication.

♦ Data Center Energy Use

- Servers use **~0.5% of global electricity**.
- Energy demand **doubles every 5-6 years**.
- Leads to high **CO₂ emissions** from fossil fuels.

♦ Green Computing Strategies

- **Goals:** Reduce energy with minimal performance impact.
- **Techniques:**
 - **Power-aware scheduling:** Consolidate VMs on fewer cores.
 - **Thermal-aware scheduling:** Avoid thermal hotspots.
 - **Efficient cooling and rack design.**

- **VM Image minimization.**

◇ **VM Scheduling on Multi-core Systems**

- Nonlinear relation between **processes & power**.
- Greedy algorithm: Schedule multiple VMs per node.
- Track available cores, match with VM needs.

◇ **Key Summaries for Quick Recall**

OpenStack Workflow:

- Horizon → Keystone → Nova (Scheduler + Compute) → Neutron → Cinder → Glance → Swift → Hypervisor

Storage:

- **Ephemeral** – temp (Nova),
- **Block** – persistent (Cinder),
- **Object** – distributed (Swift)

Cloud & Green Computing:

- Power-aware + thermal-aware scheduling.
- Optimize infrastructure & images for **energy efficiency**.