Compute Engine

Google Compute Engine lets you create and run virtual machines on Google infrastructure.

Google Compute Engine Concepts

Features

- Large-scale IaaS workloads.
- High CPU, high memory, standard, and shared-core machine types.
- Persistent disks on standard (HDD), SSD, and local SSD.
- Resize disks and migrate instances with no downtime.
- Startup scripts and metadata.
- Robust networking:
  - Default and custom networks.
  - Firewall rules.
  - Regional HTTP(s) load balancing.
  - Network load balancing.
  - Subnetworks.
- Advanced APIs for auto-scaling and instance group management.
- Per-minute billing with sustained use discounts.
- Preemptible instances.
- High throughput to storage at no extra cost.
- Custom machine types allow you to only pay for what you need.
- Import VM uses Cloud Endure. Super easy.

Points of Interest

- Windows virtual machines require you to set a username and password.
- Configuration management options include:
  - Startup script for Compute instances.
  - Google Cloud Deployment Manager.
  - Open-source tools such as Pupper, Chef, Salt, and Ansible.

Shutdown Script

- Resetting an instance does not run the shutdown script.
- Restart, reboot, stop, shutdown, delete will allow approximately 90 seconds for the shutdown script to run.
- Preemptible machines will allow only 30 seconds for the shutdown script to run.

Changing Machine Type

- Set the boot disk to not be deleted when the virtual machine is deleted.
- Delete the virtual machine instance.
- Create a new instance with the new machine type settings.
- Select the boot disk from the existing disks.

Preemptible Machines

- Lower price for interruptible service (up to 80%),
- May be terminated at any time:
  - No charge if within 10 min.

  - 24 hours max run time.
  - 30 second termination notification.
- No live migrate.
- No auto restart.
- Can request a CPU quota be split between regular and preemption.

Disks

- HDD or SSD.
- Live disk resizing (bigger, not smaller).
- Supports attachment to multiple VMs in read only mode.
- Automatic Checksums.
- Automatic Encryption (can supply own keys).
- Persistent Disk:
  - Network storage appearing as a block device.
  - Attached to the VM through the network interface.
  - Durable storage.
  - Bound to zone.
  - Bootable.
  - Snapshots.
- Local SSD Disk:
  - Physically attached to VM.
  - Not available on shared core.
  - Faster than Persistent disk.
  - Ephemeral: data survives a restart but not a stop or terminate.
  - 3TB (375GB * 8).
- RAM Disk:
  - tmpfs
  - Faster than Local SSD, slower than memory.
  - Very volatile.
  - RAM required so larger machine type needed.

	Persistent HDD	Persistent SSD	Local SSD	RAM
Redundancy	Yes	Yes	No	No
Encryption	Yes	Yes	Yes	N/A
Snapshotting	Yes	Yes	No	No
Bootable	Yes	Yes	No	No
Use Case	Bulk File	Random IOPS	High IOPS Low Lat	Low Lat

No of Cores	Disk Limit
Shared Core	16
1 Core	32
2-4 Cores	64
8 or more	128

Moving a VM to a new zone

- Manual process:
  - Shapshot all persistent disks on the source VM.
  - Create new persistent disks in destination zone restored from snapshots.
  - Promote ephemeral external IP to static external IP.
  - Create new VM in the destination zone and attach new persistent disks.

  - Assign static IP to new VM, demote to ephemeral.
  - Update references to VM.
  - Delete the snapshots, original disks, and original VM.
- Automated process:
  - `gcloud compute instances move`
  - Update references to VM.

Performance Management

- Region choice affects machine type and CPU architecture options.
- 1 vCPU is equal to 1 hyperthreaded core.
- 2 vCPUs is equal to 1 physical core.
- Network throughput is 2Gbps per vCPU up to 16Gbps for 8 vCPUs.
- Disk throughput is tied to the network throughput.
- Disk IOPs is tied to the disk size.
- Local SSD is ephemeral and ties the instance to the hardware.

Availability Policy

- Preemptibility: On or Off.
- Automatic restart: On or Off.
- On host maintenance: Migrate or Terminate.
- GPUs will prevent migration on host maintenance.
- Local SSD disks will prevent migration on host maintenance.

Pricing

- Per minute billing with a 10 minute minimum.
- Sustained use discounts.
- Preemptible instances:
  - Live at most 24 hours.
  - Can be pre-empted with a 30 second notification via API.
  - Up to 80% discount.
- Custom machine types will have custom pricing.
- Recommendation engine notifies of under utilized instances.
- Committed use discounts (1 year or 3 years).
- Inferred instance discounts: Usage of VMs of the same machine type in the same zone are combined as if they were one machine.
- No charge for stopped instances apart from attached disks and IPs.
- Same charge for different CPU architectures. Choose your region wisely.

Autoscaling

- Automatically scale the number of instances in the managed instance group based on workload.
- Can reduce costs by shutting down instances when not required.
- Create one autoscaler per managed instance group.
- Support both zone-based managed instance groups or regional managed instance groups.
- It is fast responding typically within a 1 minute moving window.
- Policies include Max and Min number of replicas.
- Policy options:
  - Average CPU utilization.
  - HTTP load balancing serving capacity (backend service definition for Max CPU or Max req/sec/instance.)
  - Stackdriver standard and custom metrics.

  - Google Cloud Pub/Sub queuing workload.
- Supports up to 5 policies.
- Use Stackdriver custom metrics to autoscale more accurately to your application workload.

Autoscaler Configuration

1. Create instance template (startup scripts, shutdown scripts, software, logging).
2. Create managed instance group.
3. create autoscaler.
4. Optionally, define multiple policies.