**Virtual Machines and Networks in the cloud**

- (Virtual Private Cloud networking) A virtual private cloud (VPC) is a private cloud-computing model hosted within a public cloud like Google Cloud. It allows customers to run code, store data, and host websites with the scalability of public cloud computing and the data isolation of private cloud computing. VPC networks in Google Cloud are global and can have subnets in any region worldwide. Subnets can span zones within a region, allowing for a flexible network layout. Virtual machines within the same subnet can be in different zones, providing resilience to disruptions while maintaining a simple network setup.

- (Compute Engine) Google Cloud's IaaS solution, Compute Engine, allows users to create and run virtual machines on Google infrastructure. Virtual machines can be configured like physical servers, specifying CPU power, memory, storage, and the operating system. Instances can be launched through the Google Cloud console, CLI, or API and can run Linux, Windows Server, or other custom OS images.

Compute Engine offers a variety of pricing options, billing by the second with sustained-use discounts for long-running VMs. Committed-use discounts provide significant savings for stable workloads. Preemptible and Spot VMs offer even more cost savings for workloads that can tolerate interruptions. Storage between processing and persistent disks has high throughput by default without extra cost. Custom machine types allow users to pay only for the resources they need by choosing the desired CPU and memory configurations.

- (Scaling virtual machines) Compute Engine provides the option to choose between predefined and custom machine types for virtual machines. Autoscaling allows for dynamic adjustment of VM instances based on workload demands. Google's Virtual Private Cloud (VPC) supports various load balancing options for efficient traffic distribution. Users can scale out by adding more VM instances rather than scaling up a single VM. The maximum number of CPUs per VM is determined by the machine family and zone-based quotas. Specific machine type details can be found in the Compute Engine documentation.

- (Important VPC compatibilities) VPCs in Google Cloud offer built-in routing tables, eliminating the need for separate routers. The global distributed firewall simplifies access control for instances, both inbound and outbound. Firewall rules can be defined based on network tags assigned to Compute Engine instances, providing flexibility and convenience. VPC Peering allows VPCs in different projects to communicate, while Shared VPC enables the use of IAM for fine-grained control over interactions between projects and VPCs. These compatibility features enhance network connectivity and security within Google Cloud.

- (Cloud Load Balancing) Cloud Load Balancing is a managed service in Google Cloud that distributes user traffic across multiple instances of an application, reducing the risk of performance issues. It supports HTTP, HTTPS, TCP, SSL, and UDP traffic, and offers cross-region load balancing with automatic multi-region failover. Cloud Load Balancing reacts quickly to changes in traffic and backend health. Pre-warming is not required, even for anticipated spikes in demand. Google Cloud provides a suite of load-balancing options, including Global HTTP(S) load balancing, Global SSL Proxy load balancing, Global TCP Proxy load balancing, and Regional load balancing. For internal load balancing within a project, you can use the Regional internal load balancer, which works with Compute Engine VMs. These load-balancing options offer flexibility and scalability for various traffic scenarios in Google Cloud.

- (Cloud DNS and Cloud CDN) Google provides a public Domain Name Service (DNS) at 8.8.8.8, which translates internet hostnames to addresses For applications built on Google Cloud, Cloud DNS is a managed DNS service with low latency and high availability. Cloud CDN accelerates content delivery by caching data closer to users. Google collaborates with other CDNs through the CDN Interconnect partner program.

- (Connecting networks to Google VPC) To connect Google Virtual Private Clouds to other networks, customers have several options:

1. Virtual Private Network (VPN) over the internet using IPsec VPN protocol with dynamic routing using Cloud Router for automatic updates.
2. Direct Peering with Google, placing a router in a Google point of presence for direct traffic exchange.
3. Dedicated Interconnect, offering private connections to Google data centers with up to 99.99% SLA coverage.
4. Partner Interconnect through supported service providers for connectivity between on-premises and VPC networks, with SLA coverage based on configuration and provider.