**☁️ Cloud Infrastructure Concepts**

**🛡️ Bastion Host**

* A **secure gateway** server used to access VMs in a private network.
* Typically deployed in a **public subnet**.
* Provides **SSH or RDP** access to private VMs without exposing them to the internet.
* **Azure Bastion** is a PaaS service that allows access through **browser over HTTPS (port 443)**.

**🌐 VNet (Virtual Network)**

* Azure's version of a **private network** in the cloud.
* Allows communication between **Azure resources**, on-premises systems, and internet (with control).
* Supports subnets, firewalls, and routing.

**🔁 Subnet**

* A logical **subdivision** of a VNet.
* Helps group resources by function, security, or role.
* Can be **public** (internet-facing) or **private** (internal use only).
* Network Security Groups (NSGs) can be applied at the subnet or VM level.

**🌍 Regions**

* A **geographical area** where Azure (or other cloud providers) has data centers.
* Example: East US, West Europe, Central India
* Each region has **at least one** data center, often more.

**🗃️ Availability Zones**

* **Physically separate locations** within a region (data centers).
* Provide **high availability and fault tolerance**.
* Each zone is independent: own power, cooling, networking.
* Use AZs to protect against **data center failure** within a region.

**🔗 VNet Peering (VPair / Virtual Network Peering)**

* Connects **two VNets** privately and securely (like internal LAN).
* Allows **resource sharing** across VNets (even across regions — Global VNet Peering).
* Very **low latency**, **high throughput**, and **no public IPs** required.

**☁️ Cloud Deployment Models**

**🌐 Public Cloud**

* Services offered over the **internet by third-party providers** (e.g., Azure, AWS).
* Resources are **shared among multiple customers (multi-tenant)**.
* Example: hosting a website on Azure App Service.

**🏢 Private Cloud**

* Infrastructure **dedicated to a single organization**.
* Can be hosted on-premises or by a provider.
* Offers **greater control**, compliance, and security.
* Example: VMware or Azure Stack Hub for on-premises cloud.

**🔀 Hybrid Cloud**

* **Combination of public and private cloud**.
* Allows data and apps to **move between** environments.
* Common use cases: cloud bursting, backup, disaster recovery, regulatory needs.