

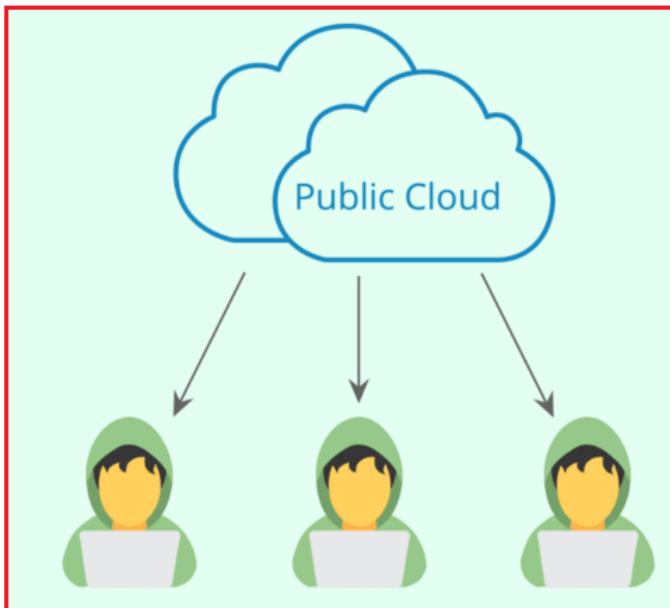
Types of Clouds in Cloud Computing (deployment models)?

In cloud computing, there are **three primary types** of cloud deployment models: public, private, and hybrid. Each type has unique characteristics, benefits, and use cases.

- **Public Cloud:** A public cloud is a cloud infrastructure that is **open to the general public**. It is owned, managed, and **operated by a third-party** cloud service provider (CSP) that delivers computing resources over the Internet.
- **Private Cloud:** A private cloud is a cloud infrastructure **dedicated to a single organization**. It can be **hosted on-premises** or by a third-party provider, but the services and infrastructure are **maintained on a private network**.
- **Hybrid Cloud:** A hybrid cloud **combines public and private clouds**, allowing data and applications to be shared between them. This model enables businesses to take advantage of the benefits of both environments.

What is the Public Cloud in Cloud Computing?

- A public cloud in cloud computing refers to an **environment hosted and managed by a third-party service provider** and made available to multiple organizations or users over the Internet.
- In a public cloud, computing resources such as virtual machines, storage, networking, and services are shared among multiple customers in a multi-tenant model.



- In public cloud we **don't have to buy expensive hardware** or worry about setting up and maintaining the cloud. This **cloud service provider** sets up and maintains the

public cloud. **Microsoft Azure and Amazon Web Services** are examples of a public cloud.

- We access public cloud resources and services **over the Internet**. So, to use a public cloud, we **need an internet connection** and manage the cloud services and resources through a web portal provided by the cloud service provider.
- We have pay a **monthly fee to the public cloud service provider** for our cloud services and resources. This monthly fee is like our utility bills, water, or electricity. It's a pay-as-we-go model, meaning we pay for what we use.

Benefits of Public Cloud in Cloud Computing:

- **Cost Efficiency:** Public cloud reduces the need to buy or maintain expensive hardware, and you pay only for what you use through a pay-as-you-go model.
- **No Maintenance Headaches:** The cloud provider handles all maintenance, updates, and hardware issues, so users just pay a small monthly fee for the services they use.
- **Highly Scalable:** Resources in a public cloud can be easily scaled up or down based on business needs, and this can even be automated.
- **Highly Reliable:** Public cloud stores data across many servers, so data is safe even if there is hardware failure, power outage, or other disasters.

Limitations of Public Cloud in Cloud Computing:

- **Low Visibility and Control:** In a public cloud, the infrastructure is owned by the provider, so we have limited control and visibility over it.
- **Compliance and Legal Risks:** Because we rely on the provider to secure data and follow regulations, our company may still be responsible if there is a breach or failure, making public cloud less suitable for security-sensitive applications.
- **Cost Concerns:** Although the pay-as-you-go model reduces upfront costs, the total price can sometimes be higher than expected depending on usage, traffic, and

Public Cloud Service Providers:

The following are some of the most prominent and well-known public cloud service providers:

- **Amazon Web Services (AWS)**
- **Microsoft Azure**
- **Google Cloud Platform (GCP)**
- **IBM Cloud**
- **Oracle Cloud**

Use Cases for Public Cloud

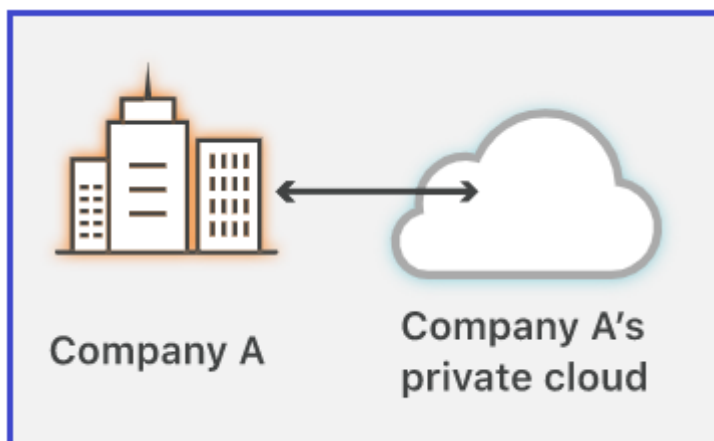
- **Web Hosting:** Hosting websites and web applications with flexible scalability.
- **Development and Testing:** Environments for software development and testing without hardware investments.
- **Big Data and Analytics:** Processing and analyzing large datasets using cloud-based tools and services.
- **Disaster Recovery:** Backup and recovery solutions with minimal upfront costs.

- **Content Delivery:** Distributing content globally with content delivery networks (CDNs).

So, Public Cloud offers a range of benefits, including cost savings, scalability, and accessibility, making it an attractive option for many businesses and organizations. However, carefully considering the challenges, such as security and cost management, is important.

What is a Private Cloud in Cloud Computing?

- A **private cloud** is a cloud computing environment that is hosted and used exclusively by a single organization, either on-premises or by a third-party provider.
- Computing resources such as virtual machines, storage, and networking are dedicated to that organization and are **not shared with others**.
- In a private cloud, the organization has full control over the infrastructure, security, and compliance policies.
- The organization or cloud provider sets up and maintains the private cloud, and users access resources through a secure network or web portal.
- Private cloud usually involves higher upfront costs than public cloud because the organization needs to manage or rent dedicated hardware.



Benefits of Private Cloud in Cloud Computing

- **Better Security and Control:** Resources are dedicated to a single organization, allowing stricter security, privacy, and compliance controls.
- **Customization:** Organizations can customize infrastructure, software, and policies according to their specific needs.
- **High Reliability:** Since the infrastructure is dedicated, performance is predictable, and resources are available when needed.
- **Scalable:** Resources can be scaled according to organizational needs, though scaling may require additional planning and hardware.

- **Regulatory Compliance:** Easier to comply with legal, industry, or internal regulations because the organization controls the environment.

Limitations of Private Cloud

- **Higher Costs:** Setting up and maintaining a private cloud can be expensive due to dedicated hardware and IT staff requirements.
- **Complex Management:** Organizations need skilled personnel to manage infrastructure, updates, security, and compliance.
- **Limited Flexibility Compared to Public Cloud:** Scaling resources quickly may be slower and more costly than in public cloud environments.

Private Cloud Service Providers

- VMware Cloud
- Microsoft Azure Stack
- IBM Cloud Private
- Oracle Private Cloud

Use Cases for Private Cloud/ When to use a Private Cloud

- **Sensitive Data Applications:** Hosting applications that require high security, such as banking or healthcare systems.
- **Internal Enterprise Applications:** Running company-specific software and workflows that need full control.
- **Compliance-Critical Workloads:** Applications that must meet strict regulatory or legal requirements.
- **High-Performance Computing:** Dedicated computing for analytics, simulations, or research that needs predictable performance.

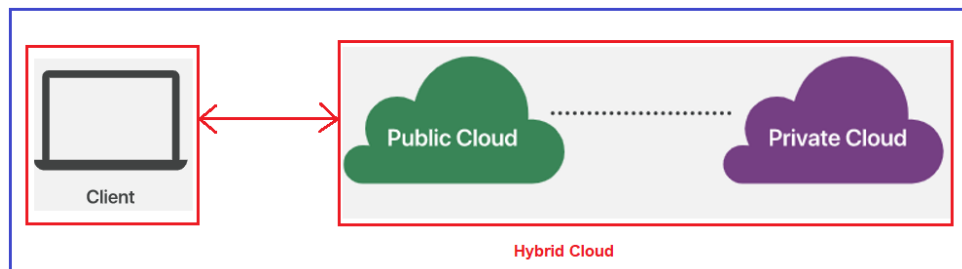
Types of Private Cloud Deployment Models

1. **On-Premises Private Cloud:** Infrastructure is hosted and **managed within the organization's own** data center, allowing complete control over infrastructure, data, and security. It requires significant upfront investment in hardware and IT resources.
2. **Hosted Private Cloud:** Infrastructure is Managed and **hosted by a third-party service provider but is dedicated to a single organization.** This model reduces the need for capital expenditure while maintaining control over the cloud environment.

What is a Hybrid Cloud in Cloud Computing?

- As the name implies, a hybrid cloud is a **combination of private and public clouds.**
- It is not a different cloud altogether. It's just that the **private and public clouds work together** to meet our organization's requirements. It offers the **best of both** worlds.

- For example, we can use the **private cloud for security-sensitive**, business-critical operations like financial reporting and the **public cloud for high-volume**, lower-security needs such as web-based email.



Benefits of Hybrid Cloud in Cloud Computing

- **Best of Both Worlds:** Hybrid cloud combines the advantages of both private and public clouds.
- **Flexibility and Scalability:** Businesses can use private cloud normally and expand to public cloud when demand increases.
- **Cost Efficiency:** Public cloud resources are used only when needed, such as during traffic spikes, and we scale back when demand decreases.
- **Data Control and Security:** Sensitive data can stay on private cloud or on-premises, ensuring security and regulatory compliance, while less critical tasks use public cloud.
- **Disaster Recovery:** Public cloud can be used for backups and disaster recovery, keeping data safe and minimizing downtime during problems.

Limitations of Hybrid Cloud in Cloud Computing

- **Complex Management:** Managing and integrating private, public, and on-premises clouds can be complicated and needs skilled staff.
- **Data Transfer Costs:** Moving data between private and public clouds can incur extra fees depending on the amount of data.
- **Security Risks:** Connecting public and private clouds can create security gaps if not managed properly.
- **Internet Dependence:** Hybrid cloud needs stable, fast internet to keep data and services synchronized between clouds.

When to use Hybrid Cloud in Cloud Computing:

- A hybrid cloud combines the benefits of private and public clouds.
- For example, an IT company serving two sets of clients can use the public cloud for clients who need easy scaling and less strict security.
- The same company can use the private cloud for clients who require high security and full control over their data.
- A hybrid cloud allows switching between public and private clouds depending on security and scalability needs.
- Organizations should use a hybrid cloud if they have strict security, compliance, or regulatory requirements and need control over data location.

- It is useful when they want to save costs by using public cloud for variable workloads while keeping fixed workloads on a private cloud.
- Hybrid clouds help implement disaster recovery and business continuity by using public cloud for backup and replication.
- They provide flexibility and agility to develop and deploy new applications quickly, using public cloud services for testing and development.

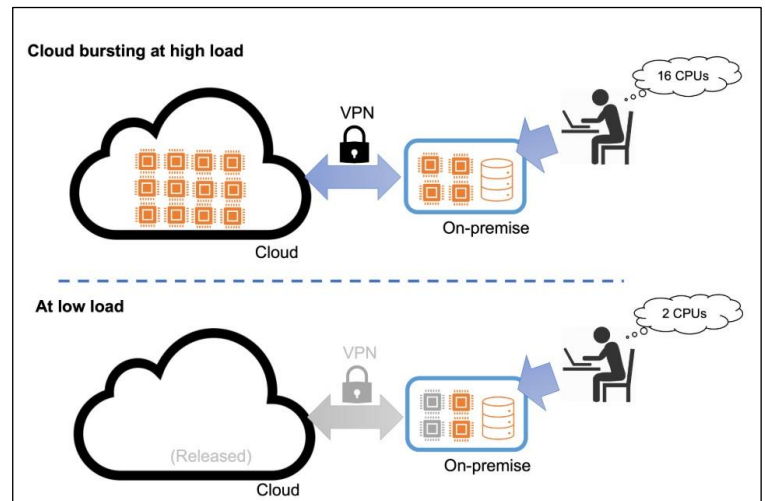
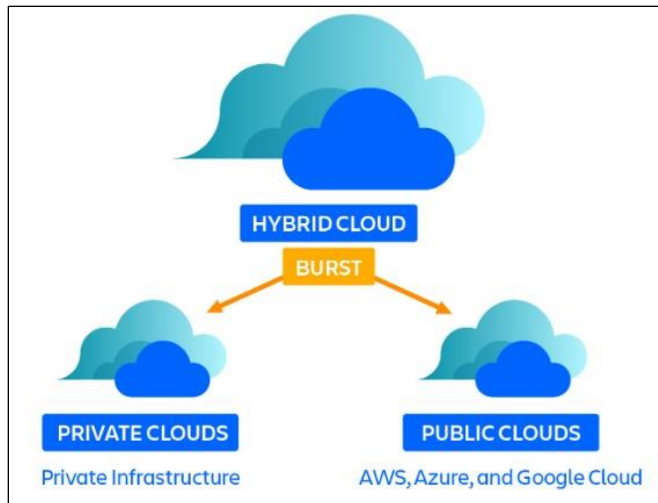
Hybrid Cloud Deployment Models

The Hybrid clouds can be deployed in several models:

- **Integration of Public and Private Clouds:** Connecting public cloud services (e.g., AWS, Azure, Google Cloud) with on-premises infrastructure or private cloud environments using hybrid networking solutions (e.g., VPN, Direct Connect).
- **Cloud Bursting:** Automatically scaling workloads from a private cloud to a public cloud during peak demand periods, ensuring performance and availability without over-provisioning on-premises resources.

What is Cloud Bursting?

- Cloud bursting is used in a **hybrid cloud** environment where both private and public clouds are used together.
- Normally, an application runs in the **private cloud**, handling regular workloads and day-to-day operations.
- When there is a sudden increase in demand, the application temporarily uses extra resources from the **public cloud**.
- This temporary expansion of workload from the private cloud to the public cloud is called **cloud bursting**.
- The term “bursting” means the application extends beyond the private cloud limits when needed.
- Private cloud infrastructure has limited resources, so it may not handle a sudden spike in traffic efficiently.
- Examples of spikes in demand include online holiday shopping, tax filing periods, ticket booking, or launching a new product.
- Without cloud bursting, a private cloud may struggle, slow down, or even crash during high demand.
- Scaling a private cloud requires buying, installing, and configuring new hardware, which is **expensive and time-consuming**.
- After the demand decreases, extra hardware may remain unused, causing wasted resources and costs.
- Cloud bursting solves this problem by using **public cloud resources only when needed**.
- Organizations pay only for the additional resources used during the peak period and stop using them once the demand is over.
- Cloud bursting allows **cost efficiency, scalability, flexibility, and better performance** during peak workloads.
- Sensitive data and core operations stay secure in the private cloud, while extra capacity is handled by the public cloud.



Private vs. Public vs. Hybrid Cloud in Cloud Computing

Feature	Private Cloud	Public Cloud	Hybrid Cloud
Cloud Hardware	Organization owns and manages all infrastructure (servers, storage, networking). Example: Bank with its own data center.	Provided and maintained by a third-party provider (AWS, Azure, GCP). Example: Startup hosting website on AWS.	Private part managed by organization; public part provided by cloud provider. Example: Retail company uses private cloud for transactions, public cloud for analytics.
Tenancy	Single-tenancy, dedicated to one organization. Example: Healthcare provider storing patient records.	Multi-tenancy, shared among multiple users. Example: Small businesses sharing Azure resources.	Private part is single-tenant, public part is multi-tenant. Example: Healthcare provider uses private cloud for data, public cloud for research.
Performance	Consistent, high performance with dedicated resources. Example: Video game development testing.	Variable performance due to shared resources; can use auto-scaling. Example: E-commerce site handling traffic spikes.	Balances performance: private for high-performance tasks, public for scalable, less-critical tasks. Example: Media company editing on private cloud, distribution on public cloud.
Data Center Location	Inside organization's network. Example: University campus data center.	Anywhere globally via provider's data centers. Example: AWS or Azure data centers worldwide.	Private cloud on-premises; public cloud anywhere online. Example: Logistics company hosts sensitive tracking data privately, uses public cloud for global apps.
Scalability	Limited by physical infrastructure; scaling requires new hardware. Example: E-commerce peak season may exceed capacity.	Near-unlimited scalability. Example: Netflix handles huge traffic spikes.	Private cloud limited; public cloud provides additional capacity. Example: Educational institution uses AWS for online exams.

Cloud Maintenance	Organization manages updates, patches, and maintenance. Example: Enterprise IT team maintains private cloud.	Cloud provider manages setup, maintenance, and updates. Example: Small business relies on Google Cloud.	Private cloud maintained by organization, public cloud by provider. Example: Tech firm manages internal cloud, IBM Cloud for customers.
Costs	High upfront investment + ongoing maintenance and staff costs. Example: Enterprise spends millions on private data center.	No initial investment; pay monthly for services used. Example: Startup pays AWS only for resources used.	Private cloud costs + public cloud pay-as-you-go. Example: Organization invests in private cloud, uses public cloud for additional needs.
Accessibility	Only the organization can access resources. Example: Corporate intranet.	Publicly accessible over the Internet. Example: Dropbox, Office 365.	Private cloud for organization; public cloud accessible by anyone. Example: Organization stores internal data privately, uses Amazon S3 for public media.
Security	High security; infrastructure dedicated to one organization. Example: Bank storing financial data.	Security managed by provider; shared resources may pose risks. Example: E-commerce customer data stored in public cloud.	Security must be managed across both environments; sensitive data private, less sensitive data public. Example: Healthcare patient records private, R&D in public cloud.