Cloud basics

Provision and manage cloud infrastructure as code (IaC).

What Are They?

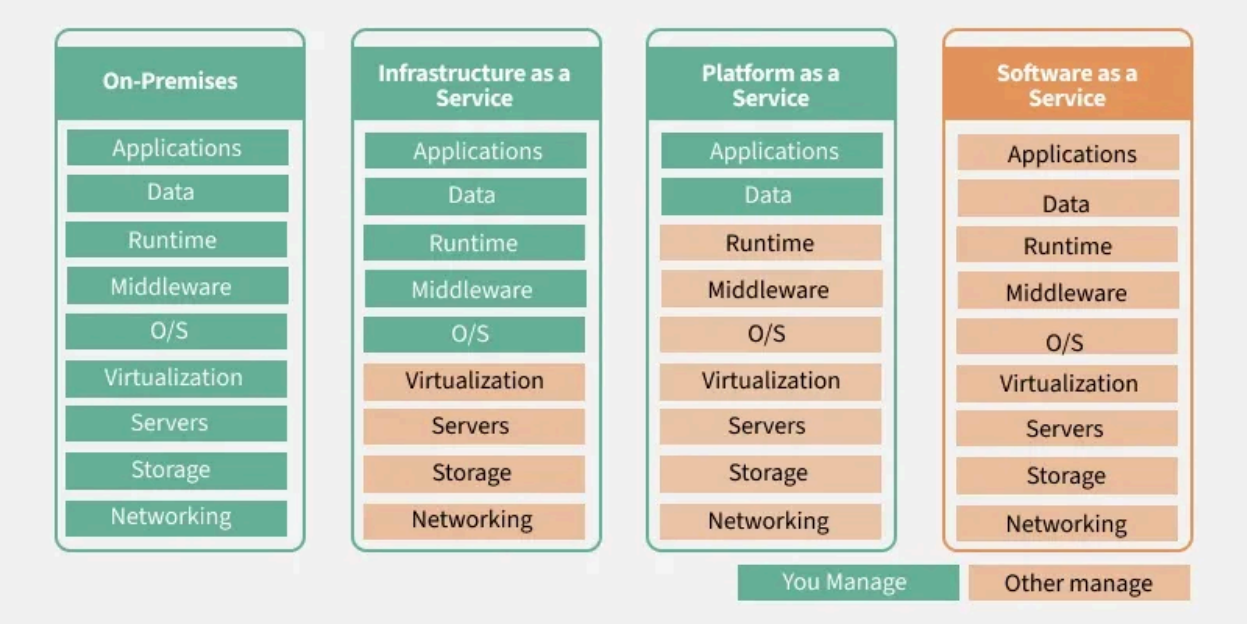
Tool	Description
ARM Templates	JSON-based templates native to Azure for defining infrastructure declaratively.
Azure Bicep	A newer, cleaner abstraction over ARM templates. It's a domain-specific language (DSL) for Azure.
Terraform	An open-source, cloud-agnostic IaC tool by HashiCorp that supports multiple cloud providers (not just Azure).

Key Differences

Feature/Aspect	**ARM Templates**	**Bicep**	**Terraform**
Syntax	JSON (verbose)	Bicep DSL (simpler)	HCL (HashiCorp Configuration Language)
Provider Support	Only Azure	Only Azure	Multi-cloud (Azure, AWS, GCP, etc.)

Ease of Use	❌ Verbose & hard to manage	✅ Cleaner & more readable	✅ User-friendly, powerful
Modularity	❌ Limited	✅ Good	✅ Excellent
State Management	Managed by Azure	Managed by Azure	✅ Local or remote state management
Tooling	Azure Portal, CLI, VS Code	Same as ARM, better with VS Code	Terraform CLI, VS Code, IDE plugins
Maturity	Oldest, battle-tested	Newer but rapidly growing	Very mature
Community Support	Microsoft Docs, smaller	Growing fast	Huge community, lots of modules

Cloud Service Models: IaaS, PaaS, SaaS



1. SaaS (Software as a Service)

- **Definition**: Delivers fully functional software applications over the internet.
- **User Responsibility**: Only application usage.

- **Provider Responsibility**: Manages everything else (infrastructure, platforms, updates).
- **Access**: Via web browsers or apps; typically subscription-based.
- **Ideal For**: End-users needing ready-to-use software without technical involvement.
- **Examples**: Salesforce, Microsoft 365, Zoom, Slack.

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2. PaaS (Platform as a Service)

- **Definition**: Offers a platform with tools to develop, run, and manage applications.
- **User Responsibility**: Application development and data management.
- **Provider Responsibility**: Handles infrastructure, operating systems, and runtime environments.
- **Ideal For**: Developers focusing on app development without managing underlying infrastructure.
- **Examples**: Google App Engine, AWS Elastic Beanstalk.

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3. IaaS (Infrastructure as a Service)

- **Definition**: Provides virtualized computing resources over the internet.
- **User Responsibility**: Managing applications, data, runtime, middleware, and operating systems.
- **Provider Responsibility**: Manages virtualization, servers, storage, and networking.
- **Ideal For**: Network architects and IT administrators needing control over infrastructure.
- **Examples**: Amazon Web Services (AWS), Microsoft Azure.

What is NFR (Non-Functional Requirement)?

> Non-Functional Requirements (NFRs) define how a system should behave, not what the system should do.

If functional requirements are the **features** (“What it should do”),

then NFRs are the **qualities** (“How it should perform while doing it”).

Example:

Let’s say you're building a **food delivery app** like Swiggy or Zomato.

- **Functional requirement**:

  → “User can place an order.”

- **Non-functional requirement**:

  → “The app should load the menu in under 2 seconds.”

  → “It should handle 10,000 users simultaneously.”

  → “App should be available 99.99% of the time.”

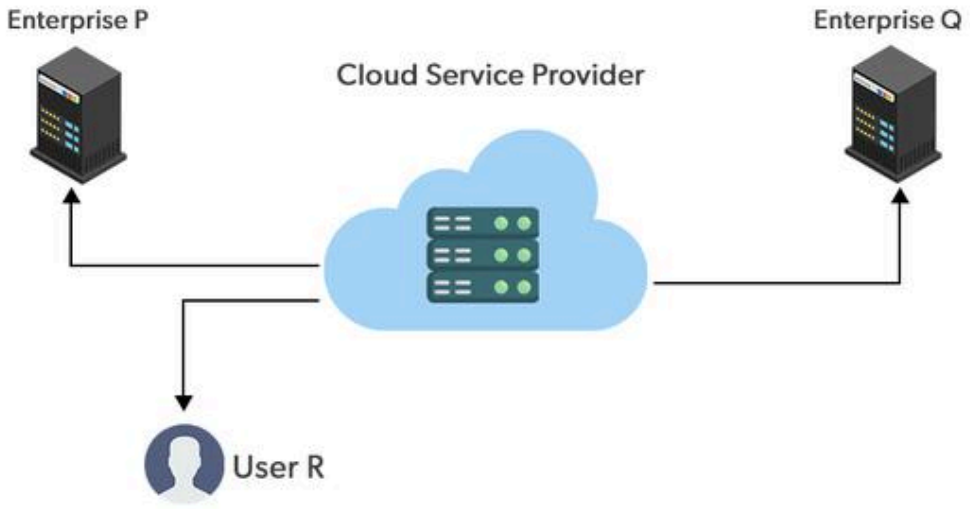
Common Types of NFRs

Category	Description	Example
Performance	Speed, responsiveness	"Page should load in 1s"
Scalability	Handle growth in users/data	"Support 1M users concurrently"
Availability	Uptime expectations	"99.99% uptime guaranteed"
Reliability	System should work consistently	"No crashes during usage"
Security	Data protection & access control	"Encrypt passwords at rest"
Maintainability	Easy to update/fix code	"Modular code structure"
Usability	User-friendly interface	"Users can learn app in 10 mins"
Portability	Runs on multiple platforms	"Supports Android & iOS"

Compliance	Follow legal/industry standards	"HIPAA/GDPR compliant"

Cloud Deployment Models

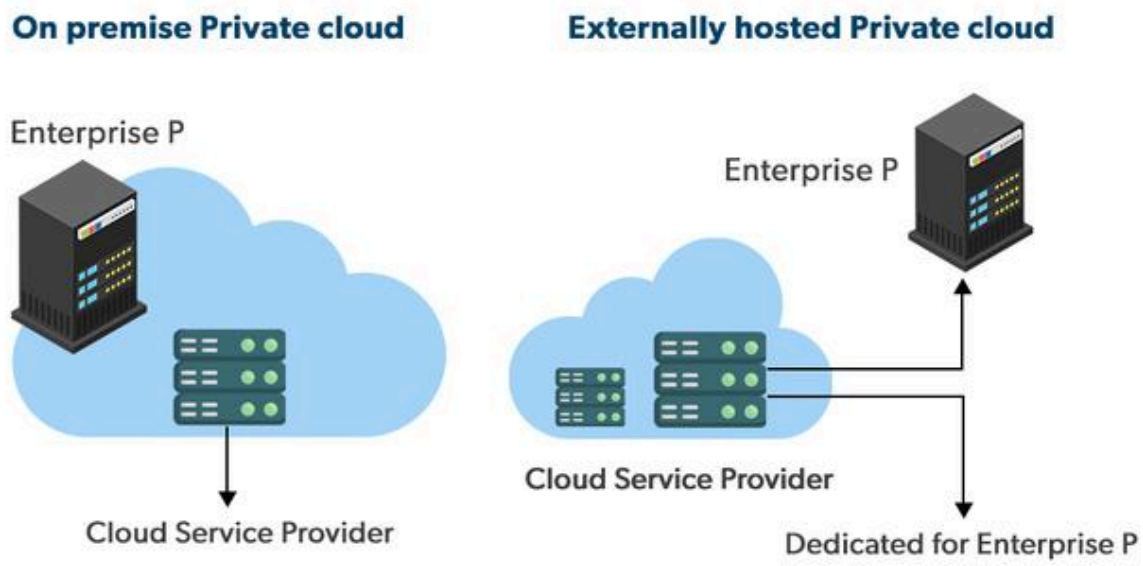
1. Public Cloud



- **Definition**: Cloud services offered over the public internet and available to anyone who wants to purchase them.
- **Ownership**: Owned and operated by third-party cloud service providers.
- **Examples**: Microsoft Azure, Amazon Web Services (AWS), Google Cloud Platform (GCP).
- **Advantages**:
  - Cost-effective due to shared resources.
  - Scalable and flexible to meet varying demands.
  - No need for physical hardware management.
- **Disadvantages**:
  - Less control over security and compliance.

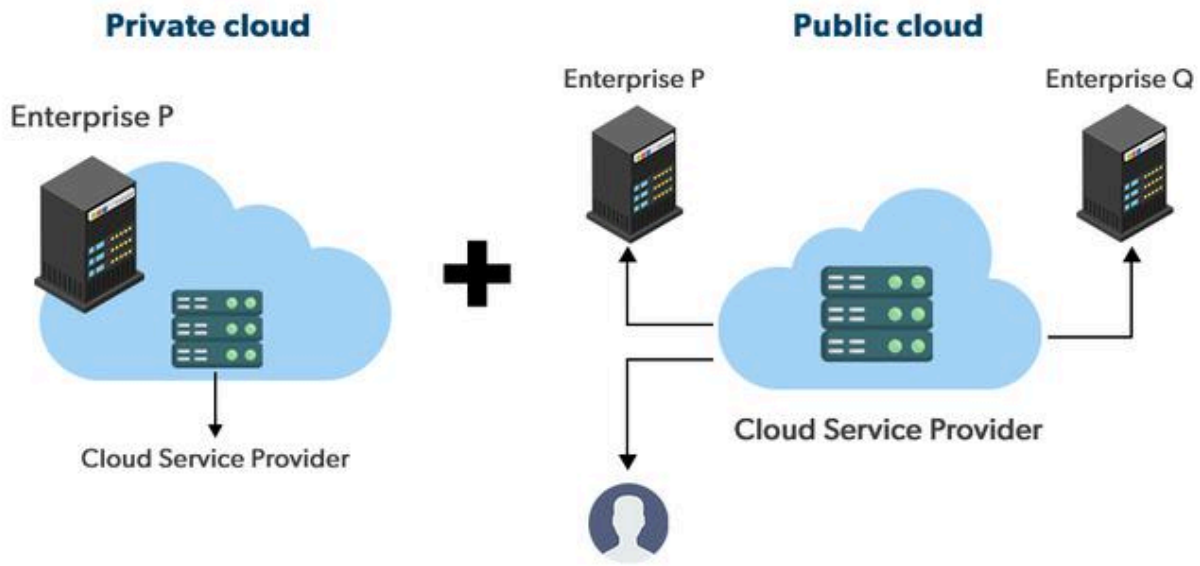
- Potential for performance variability.

2. Private Cloud



- **Definition**: Cloud infrastructure dedicated to a single organization, offering greater control and security.
- **Ownership**: Owned and managed internally or by a third-party exclusively for the organization.
- **Examples**: On-premises data centers, private cloud solutions like OpenStack.
- **Advantages**:
  - Enhanced security and privacy.
  - Greater control over resources and data.
  - Customization to meet specific business needs.
- **Disadvantages**:
  - Higher costs due to dedicated resources.
  - Requires in-house expertise for management.

3. Hybrid Cloud



- **Definition**: A combination of public and private clouds, allowing data and applications to be shared between them.
- **Ownership**: A mix of on-premises infrastructure and third-party cloud services.
- **Examples**: Using private cloud for sensitive data and public cloud for less-critical resources.
- **Advantages**:
  - Flexibility to move workloads between cloud solutions as needs change.
  - Optimized existing infrastructure, security, and compliance.
  - Cost-effective scalability.
- **Disadvantages**:
  - Complex to manage and integrate.
  - Potential security challenges in data movement

Quick Comparison

Feature	Public Cloud	Private Cloud	Hybrid Cloud
Ownership	Third-party providers	Single organization	Combination of both
Cost	Lower, pay-as-you-go	Higher, capital investment	Variable, depends on usage
Security	Standard security measures	Enhanced security controls	Balanced security approach
Scalability	High	Limited by internal resources	High, with strategic resource allocation
Management	Managed by provider	Managed internally	Shared management responsibilities