



# A Comprehensive Review of Cloud Computing: Characteristics, Service & Deployment Models, and Core Technologies

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## Abstract

Cloud computing has emerged as a transformative paradigm in the information technology domain, offering on-demand access to a shared pool of computing resources (servers, storage, applications, services) via the Internet. This paper provides a broad overview of cloud computing by first introducing its definition and evolution; then summarizing its key characteristics; discussing its major applications; covering the principal service and deployment “versions” (models); reviewing enabling technologies; and finally offering concluding remarks on benefits, challenges and future directions.

**Keywords:** Characteristics, Applications, Service & Deployment Models, Technologies

## 1. Introduction

The term “cloud computing” refers to a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (for example: networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service-provider interaction. While the concept is built upon earlier computing paradigms (such as grid computing, utility computing, virtualization and distributed systems), the current form of cloud computing is distinguished by its scalability, service-orientation, and delivery over the Internet. As businesses and individuals increasingly demand flexible computing resources, global connectivity and large-scale data handling, cloud computing has become a core infrastructure enabler in modern IT ecosystems.

## 2. Characteristics

Cloud computing exhibits a set of essential characteristics that distinguish it from traditional on-premises computing. Some of the major ones include:

- **On-demand self-service:** A user can unilaterally provision computing capabilities, such as server time or storage, as needed automatically without requiring human interaction with the service provider.

- **Broad network access:** Capabilities are available over the network and accessed through standard mechanisms by a variety of client platforms (for example: mobile phones, tablets, laptops).
- **Resource pooling:** The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand.
- **Rapid elasticity (scalability):** Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand. To the consumer it appears as unlimited and can be purchased in any quantity at any time.
- **Measured service / Pay-as-you-go:** Cloud systems automatically control and optimize resource use by harnessing a metering capability appropriate to the type of service (storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled and reported, providing transparency for both provider and consumer.

These characteristics enable organizations and individuals to gain agility, cost- effectiveness, and flexibility in their computing practices.

### 3. Applications

Cloud computing supports a wide array of applications across business, industry, education and personal use. Key application areas include:

- **Data storage, backup & disaster recovery:** Cloud platforms allow organizations to store large volumes of data outside their local infrastructure and implement recovery strategies in the event of outages.
- **Software as a Service (SaaS) and productivity applications:** Applications such as email, collaboration tools, customer-relationship-management (CRM), enterprise resource planning (ERP) can be delivered over the cloud without local installation.
- **Development & testing:** Developers can spin up virtual machines or services in a matter of minutes on clouds, reducing time-to-market and capital expenditure for infrastructure.
- **Big data analytics and machine learning:** The cloud's scalable infrastructure enables processing and storage of massive data sets, and deployment of ML/AI models.

**Internet of Things (IoT), edge and mobile computing:** Cloud platforms ingest and process data from large numbers of IoT devices, enabling remote analytics and global scale services.

These illustrative use-cases demonstrate how cloud computing is leveraged to provide flexibility, accessibility, scalability and economic advantages in many domains.

## 4. Versions – Service & Deployment Models

### 4.1 Service Models

Cloud computing offers different levels (or “versions”) of service delivery, commonly categorized as:

- **Infrastructure as a Service (IaaS):** Provides fundamental computing resources (virtual machines, storage, networks) on which the consumer can deploy and run arbitrary software.
- **Platform as a Service (PaaS):** Offers a platform allowing customers to deploy applications onto the cloud infrastructure using programming languages, libraries, services and tools supported by the provider, without managing the underlying resources.
- **Software as a Service (SaaS):** Delivers software applications over the Internet; the provider manages the infrastructure, platforms and the software itself. These service models reflect ascending levels of abstraction from infrastructure toward complete applications.

### 4.2 Deployment Models

Cloud computing also distinguishes between deployment (or implementation) models, such as:

- **Public cloud:** The infrastructure is provisioned for open use by the public or a large industry group and is owned by an organization selling cloud services.
- **Private cloud:** The infrastructure is operated solely for a single organization (may be managed internally or by a third-party), and may exist on-premises or off-premises.
- **Hybrid cloud:** A composition of two or more distinct cloud infrastructures (public, private or community) that remain unique entities but are bound together by standardized or proprietary technology enabling data and application portability.
- **Community cloud:** The infrastructure is shared by several organizations and supports a specific community that has shared concerns (security, compliance, policy). Understanding these service and deployment models helps organizations choose a cloud approach aligned with their requirements.

## 5. Enabling Technologies

Various underlying technologies support and enable cloud computing. Some of the key technologies include:

**Virtualization:** Virtual machines and containers allow abstraction of physical hardware, enabling flexible resource allocation, isolation, multi-tenant operations and efficient utilization.

- **Distributed storage & computing:** Data is stored across geographically dispersed datacenters; processing can be parallelised and elastically scaled.
- **Network technologies & broadband access:** High-speed, reliable Internet connectivity and network protocols are essential to deliver cloud services to a global audience.
- **Service-oriented architecture (SOA), microservices & APIs:** Cloud platforms often provide services via APIs and implement microservices architecture to enable modular, scalable, loosely-coupled systems.
- **Automation, orchestration & management tools:** Automated provisioning, auto- scaling, monitoring and management tools underlie the “on-demand” nature of cloud computing.
- **Edge & fog computing integration:** As cloud evolves, technologies at the network edge (closer to

devices) help reduce latency and support IoT-driven workloads. ([arXiv](#)) These technologies collectively form the foundation that allows cloud computing to deliver its promise of scalable, flexible, on-demand services.

## 6. Conclusion

Cloud computing has transformed the way computing resources are consumed, moving from fixed, capital-intensive infrastructure to dynamic, service-based models. Its key characteristics (on-demand self-service, broad network access, resource pooling, rapid elasticity and measured service) contribute to agility, cost-savings and flexibility for organizations and individuals alike. The service models (IaaS, PaaS, SaaS) and deployment models (public, private, hybrid, community) provide a framework for understanding how cloud services are consumed and delivered. Underlying technologies such as virtualization, distributed computing, networking and orchestration enable cloud systems to scale and adapt to demand.

However, cloud computing is not without challenges. Issues such as data security and privacy, vendor lock-in, compliance, latency and performance (especially for time-sensitive applications) remain significant. Moreover, as emerging paradigms such as edge computing, serverless architectures, AI/ML integration and multi-cloud/hybrid-cloud strategies become more prevalent, new research and operational questions arise. In conclusion, organizations that adopt cloud computing thoughtfully—aligning business strategy, technological readiness and governance—are well-positioned to harness its benefits and drive innovation in the digital era.

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