

# Reading Assignment: The NIST Definition of Cloud Computing

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## 1 Introduction

Cloud computing has fundamentally changed how digital infrastructure is designed, deployed, and consumed. In an effort to provide a standardized understanding of this rapidly evolving model, the National Institute of Standards and Technology (NIST) published Special Publication 800-145, titled *The NIST Definition of Cloud Computing*. This document outlines the essential characteristics, service models, and deployment models that collectively define cloud computing. The goal is to provide a common vocabulary and framework that can be used across academia, industry, and government.

## 2 Essential Characteristics of Cloud Computing

NIST identifies five essential characteristics that distinguish cloud computing from traditional IT infrastructure:

1. **On-Demand Self-Service:** Users can unilaterally provision computing resources—such as storage, server time, or network bandwidth—without needing human interaction with each service provider.
2. **Broad Network Access:** Services are available over the network and accessible through standard mechanisms, such as web browsers or APIs, supporting a variety of devices including smartphones, laptops, and tablets.
3. **Resource Pooling:** Cloud providers pool computing resources to serve multiple consumers using a multi-tenant model. Resources are dynamically assigned and reassigned based on demand, with the physical location of resources abstracted from the user.
4. **Rapid Elasticity:** Capabilities can be elastically scaled up or down—often automatically—depending on demand. To users, the available resources often appear to be unlimited.
5. **Measured Service:** Cloud systems automatically monitor and optimize resource use by employing metering capabilities. Usage can be tracked, controlled, and reported to ensure transparency between the provider and consumer.

### 3 Cloud Service Models

NIST defines three primary service models that categorize the kinds of services cloud providers offer:

- **Software as a Service (SaaS):** Users access the provider’s applications running on a cloud infrastructure. They manage neither the infrastructure nor the application’s core functionality, but may have limited configuration options. Examples include web-based email and online office suites.
- **Platform as a Service (PaaS):** This model allows consumers to deploy their own applications onto the provider’s infrastructure using tools and programming languages supported by the provider. While users control the applications, they do not manage the underlying infrastructure.
- **Infrastructure as a Service (IaaS):** Users are provided with fundamental computing resources—such as virtual machines, storage, and networking—on which they can install and run arbitrary software. This model offers the greatest control over computing resources while still abstracting the physical infrastructure.

### 4 Deployment Models

Cloud systems can be deployed in different ways depending on who uses them and how they are managed:

- **Private Cloud:** Designed for exclusive use by a single organization. It can be managed internally or by a third party, and may exist on-premises or off-site.
- **Community Cloud:** Shared among several organizations with common concerns, such as security, compliance, or mission goals. It may be managed by one or more of the participating organizations or a third party.
- **Public Cloud:** Open to the general public. These services are typically owned and operated by businesses, academic institutions, or government bodies.
- **Hybrid Cloud:** Combines two or more distinct cloud infrastructures (private, community, or public) that remain separate but are bound together by standardized or proprietary technologies. This model enables data and application portability across environments.

### 5 Conclusion

The NIST 800-145 definition provides a clear framework for understanding cloud computing. It outlines key characteristics, service models, and deployment strategies. This helps users and providers evaluate and discuss cloud systems with a shared understanding.