

Unit II: Hardware and Software

Chapter 8: Cloud Storage and Computing

8.1: Goal:

In this chapter, you will discover how cloud computing has transformed the way individuals and organizations store data, run applications, and collaborate with others. You will learn how cloud services provide flexibility, accessibility, and scalability while considering the benefits and challenges of storing information online.

8.2: Objectives:

- Define cloud computing and cloud storage.
- Explain how cloud services differ from local computing.
- Identify the advantages and disadvantages of cloud computing.
- Describe common cloud service models, including Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS).
- Compare public, private, and hybrid clouds.
- Recognize common cloud storage services and collaboration tools.
- Explain how cloud computing supports artificial intelligence and modern applications.
- Apply best practices for securely using cloud services.

8.3: Think About It

Imagine you're working on a class presentation in the campus library. Before you're finished, it's time for your next class. Later that evening, you open your laptop at home, and your presentation is already there, complete with every change you made earlier that day.

You didn't email the file to yourself or copy it to a flash drive.

How did your work follow you from one computer to another?

8.4: Opening Scenario

Mia begins a group research project with three classmates. Instead of emailing different versions of the report back and forth, the group creates a shared online document. One student edits the introduction from a laptop, another adds images from a tablet, and a third reviews the document from a smartphone while riding the bus. Everyone sees the latest version immediately.

When Mia accidentally deletes a paragraph, she simply restores an earlier version of the document with a few clicks.



Although the students are using different devices in different locations, they are all working on the same file because it is stored in the cloud.

Understanding cloud computing helps Mia collaborate more effectively, protect her work, and access her files from almost anywhere.

8.5: Why This Chapter Matters

Cloud computing has transformed how people work, learn, communicate, and store information. Many of the applications you use every day, including email, online file storage, video streaming, artificial intelligence, and online collaboration tools, depend on cloud services.

Employers expect workers to understand how to access shared files, collaborate online, protect sensitive information, and use cloud-based software safely and effectively. Whether you're writing a report, backing up photos, or attending an online meeting, chances are you're already using the cloud.

8.6: Behind the Scenes: What Happens When You Save a File to the Cloud?

Saving a file to cloud storage may seem as simple as clicking **Save**, but several processes happen almost instantly behind the scenes.

1. You click **Save** in an application.
2. The software temporarily stores the changes in your computer's memory.
3. The file is encrypted to protect it while traveling across the Internet.

4. Your computer sends the encrypted data to the cloud service through your Internet connection.
5. Remote servers receive and verify the uploaded file.
6. The cloud service stores multiple copies of the file in secure data centers to improve reliability.
7. If you use another authorized device, the updated file is synchronized automatically.
8. Other users with permission can immediately view or edit the newest version.

This entire process usually takes only a few seconds and allows millions of people to collaborate and access their files from almost anywhere in the world.

8.7: Cloud Storage

Cloud storage is a service that allows users to save files on remote computers, called **servers**, that are accessed through the Internet. Instead of storing a document, photograph, or other file only on a computer or phone, users can store it online and access it from multiple devices. Popular cloud storage services include Google Drive, Microsoft OneDrive, Apple iCloud, and Dropbox.



Cloud storage makes it easier to **back up files, synchronize files across devices, share information, and collaborate with others**. For example, a student might begin a document on a college computer and continue working on it later from a laptop at home. Changes can be synchronized automatically so that the most recent version is available on each device.

Cloud storage also requires responsible use. Users should protect their accounts with **strong passwords and multi-factor authentication**, understand sharing permissions, and avoid assuming that every file stored in the cloud is automatically backed up forever. Internet access may also be required to reach files that have not been downloaded for offline use. For important files, keeping an additional backup provides extra protection against accidental deletion, account problems, or data loss.

8.8: Cloud Computing

Cloud computing is the use of computing resources and services over the Internet instead of relying entirely on software, storage, and processing located on a user's own computer. These resources are provided by remote servers in **data centers** and can include applications, processing power, databases, storage, and other services. When people use online email, stream media, edit documents in a browser, or participate in a video meeting, they are often using cloud computing.

Cloud computing allows users and organizations to access services from different locations and devices without purchasing and maintaining all of the necessary hardware themselves. Resources can also be increased or decreased as needs change. Businesses and schools use cloud computing for collaboration, data storage, online applications, backups, and many other activities. However, cloud services depend heavily on **Internet access** and raise important considerations involving **security, privacy, reliability, cost, and control of data**.

8.9: Cloud Service Models

Cloud service models describe different ways that computing resources can be provided over the Internet. The three major models are **Software as a Service (SaaS)**, **Platform as a Service (PaaS)**, and **Infrastructure as a Service (IaaS)**. They differ mainly in how much of the technology is managed by the cloud provider and how much is managed by the customer.

Software as a Service (SaaS) provides complete applications that users access through the Internet, often through a web browser. Examples include online email, document editing, and video-conferencing applications.

Platform as a Service (PaaS) provides developers with tools and an online environment for creating, testing, and deploying applications without having to manage the underlying servers.

Infrastructure as a Service (IaaS) provides computing resources such as virtual servers, storage, and networking. With IaaS, customers have greater control over the computing environment but are also responsible for managing more of it.

A simple way to remember the difference is: **SaaS** lets you use software, **PaaS** lets you build software, and **IaaS** lets you rent computing infrastructure.

8.10: Types of Clouds

Cloud computing environments can be organized in different ways depending on **who owns the resources, who can access them, and how they are used**. The most common types are **public clouds, private clouds, and hybrid clouds**.

A **public cloud** provides computing resources over the Internet to many customers. The cloud provider owns and maintains the servers and other equipment, while customers use the services they need. A **private cloud** is dedicated to a single organization and may provide greater control over security, privacy, and data management. A **hybrid cloud** combines public and private cloud resources, allowing an organization to keep some information or applications in a private environment while using public cloud services for others. Organizations select a cloud approach based on factors such as **cost, security, privacy, performance, and the amount of control they require**.

8.11: Benefits of Cloud Computing

Cloud computing provides several advantages for individuals, schools, organizations, and businesses. One of the most important is **accessibility**. Because cloud services are available through the Internet, users can often access applications and files from different computers, tablets, and smartphones. Cloud services also make **collaboration** easier because several people can work with shared documents and information without being in the same location.

Another major benefit is **flexibility and scalability**. Organizations can increase or decrease computing resources as their needs change instead of purchasing additional hardware for every increase in demand. Cloud computing can also reduce the cost and effort involved in maintaining servers, installing software, performing updates, and managing backups. Other benefits include **automatic synchronization, easier software updates, data backup and recovery options, and access to powerful computing resources** that might otherwise be too expensive for an individual or small organization.

8.12: Challenges of Cloud Computing

Although cloud computing offers many benefits, it also presents several challenges. One important concern is **dependence on Internet access**. If an Internet connection is slow or unavailable, users may not be able to access cloud applications or files. Cloud providers can also experience service outages, temporarily preventing customers from reaching their data or applications.

Security and privacy are also important concerns because information may be stored on servers operated by another organization. Users and businesses need to understand how

their data is protected, where it is stored, and who may have access to it. Other challenges include **ongoing subscription costs, limited control over cloud infrastructure, data-transfer difficulties, and vendor lock-in**, which can make moving from one cloud provider to another complicated or expensive. For these reasons, organizations must balance the convenience and flexibility of cloud computing with considerations such as **cost, reliability, security, privacy, and control**.

8.13: Cloud Security

Cloud security refers to the technologies and practices used to protect data, applications, and computing resources stored or operated in the cloud. Cloud providers use security measures such as **encryption, firewalls, access controls, monitoring, and backups** to protect their systems. However, security is a **shared responsibility**: the cloud provider protects the underlying infrastructure, while users and organizations are responsible for protecting their accounts, passwords, permissions, and the information they place in the cloud.

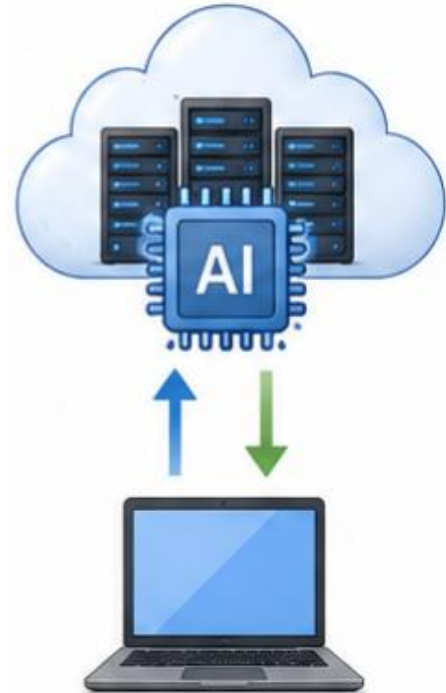


Users can improve cloud security by using **strong, unique passwords**, enabling **multi-factor authentication (MFA)**, keeping devices and software updated, and carefully controlling who can access shared files. It is also important to review sharing settings before making documents or folders available to others. Cloud services can provide strong security, but mistakes such as weak passwords, accidentally public files, phishing attacks, or excessive permissions can still expose information.

8.14: AI and the Cloud

Artificial intelligence (AI) and cloud computing often work together. AI systems can require large amounts of computing power and storage to analyze data, train models, and generate results. Cloud computing provides access to these resources over the Internet, allowing organizations to use powerful AI technologies without purchasing and maintaining all the necessary hardware themselves.

The cloud also makes AI features available through everyday applications. For example, cloud-based AI can provide **chatbots and AI assistants, language translation, speech recognition, image analysis, recommendations, and generative AI tools**. A user may interact with an AI feature on a laptop or smartphone while much of the processing takes place in a remote data center. As AI and cloud services become more closely connected, users should also consider **privacy, security, accuracy, cost, and the responsible use of data**, especially when uploading personal or confidential information to an AI service.



8.15: Future of Cloud Computing

Cloud computing will continue to evolve as organizations and individuals depend on online services for storage, applications, communication, and computing power. Future cloud systems are likely to become **faster, more automated, and more closely integrated with artificial intelligence**. AI can help cloud providers manage resources, detect security threats, analyze large amounts of data, and provide intelligent services to users.

Another important development is **edge computing**, which processes some data closer to where it is created rather than sending everything to a distant data center. This can reduce delays for technologies such as smart devices, autonomous systems, healthcare equipment, and connected vehicles. Organizations are also increasingly using **hybrid and multi-cloud approaches**, combining different cloud environments to meet their needs. As cloud computing expands, **security, privacy, energy use, reliability, and responsible AI** will remain important considerations.

8.16: Chapter Summary

Cloud computing allows users to access software, storage, and computing resources over the Internet instead of relying solely on their own devices. Cloud services make collaboration easier, simplify software updates, improve accessibility, and provide scalable computing resources for applications such as artificial intelligence. Understanding both the benefits and the risks of cloud computing helps users work more effectively while protecting their data.