



# MIS, 11e

## Module 14: Emerging Trends, Technologies, and Applications

# Module Objectives

By the end of this module, you should be able to:

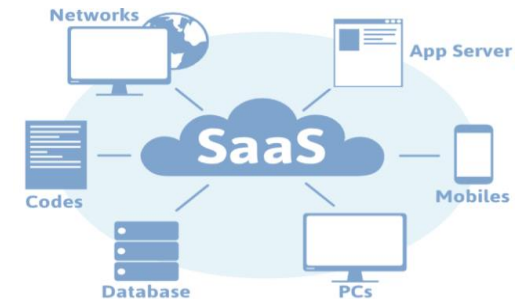
- 14.1 Summarize new trends in software and service distribution.
- 14.2 Describe virtual reality components and applications.
- 14.3 Explain non-fungible tokens (NFTs) and their business applications.
- 14.4 Discuss the metaverse, its foundation and its applications.
- 14.5 Describe the foundation, models, and applications of cloud computing.
- 14.6 Discuss uses of nanotechnology.
- 14.7 Describe blockchain technology and cryptocurrency.
- 14.8 Explain quantum computing and its applications.

# Pull and Push Technologies

- **Pull technology** is when a user states a need (makes a request) before getting information
- **Push technology** is when a web server delivers information to users who have signed up for the service without waiting for the user's request.
- Push technology improves business relations and customer service
- Examples of push technology includes the following:
  - Microsoft Azure Notification Hubs
  - Apple Push Notification
  - Facebook Push Notification

# Application Service Providers

- Internet service providers provide access to the Internet
- **Application service providers** provide access to a software or provides a service for a fee
- **Software as a Service (SaaS)** is an example of ASPs where software is delivered to users for a fee
- <https://www.digitalocean.com/blog/what-is-iaas#iaas-vs-paas-vs-saas-what-s-the-difference>



# Application Service Provider

## Advantages

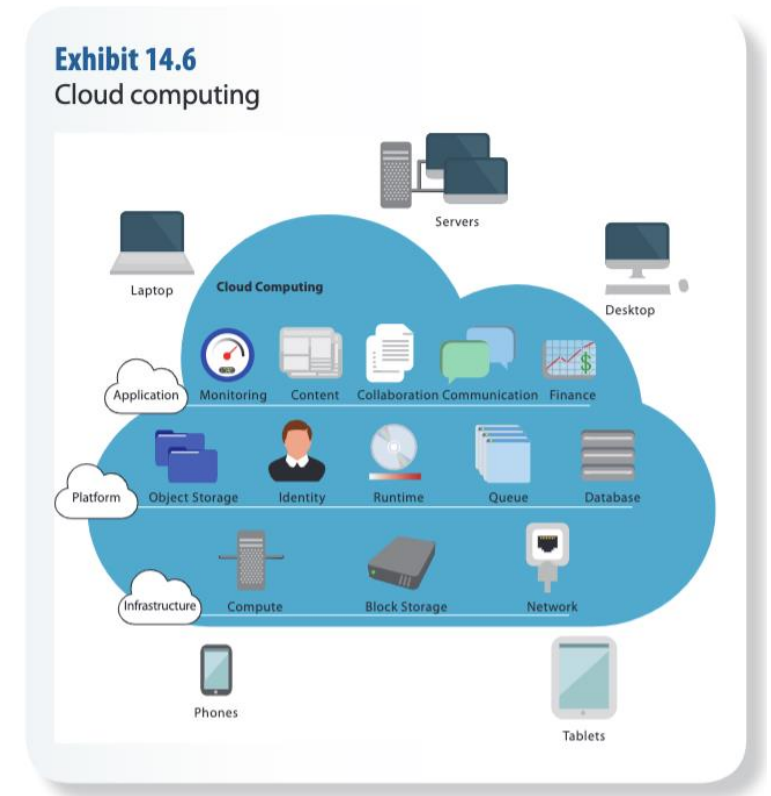
- Customer does not need to be worried about software updates
- Frees up personnel resources for other business-focused tasks
- Software development costs are spread out
- ASP contract guarantees a certain level of technical support
- Predictable monthly fees

## Disadvantages

- Users must accept applications as provided by the ASPs
- May not meet organization's needs
- Integration with current systems could be challenging

# Cloud Computing

- Uses one platform to incorporate many technologies
  - SaaS model
  - Web 2.0
  - Grid computing
  - Utility computing
- Components are classified as IaaS, PaaS, and SaaS
- [https://www.youtube.com/watch?v=M988\\_fsOSWo](https://www.youtube.com/watch?v=M988_fsOSWo)



# Cloud Computing

**Software as a Service (SaaS)** is an example of ASPs where software is delivered to users for a fee

## **Infrastructure as a Service (IaaS)**

- Type of cloud computing hardware, servers and network components are delivered as a service
- Service provider owns the equipment and is responsible for maintaining it

## **Platform as a service (PaaS)**

- Provides a computing platform and solution as a service.
- Used to build applications and services over the Internet
- Hosted in the cloud and accessed by Web browsers
- Automates the configuration, deployment, and management of applications in the cloud
- Read: <https://www.digitalocean.com/blog/what-is-iaas#iaas-vs-paas-vs-saas-what-s-the-difference>



# Cloud Computing Categories and Top Players

**Table 14.1** Cloud Computing Categories and Top Players

Category	Top Players
Foundations (tools and software that make it possible to build cloud infrastructure)	VMware, Microsoft, Red Hat
Infrastructure	Amazon, IBM
Network services (the communication components that combine with cloud foundation and infrastructure to form cloud architecture)	Level 3 Computing Services, Amazon, Cisco, Citrix
Platforms	Amazon, IBM
Applications	Google, Salesforce, Oracle, Dropbox
Security	EMC/RSA, Symantec, IBM
Management	IBM, Amazon



# Cloud Computing Alternatives

## Public Cloud

- Users connect with an off-site infrastructure over the Internet
- Shared by a large number of users
- Offers the most cost savings
- Has security and privacy risks

## Private Cloud

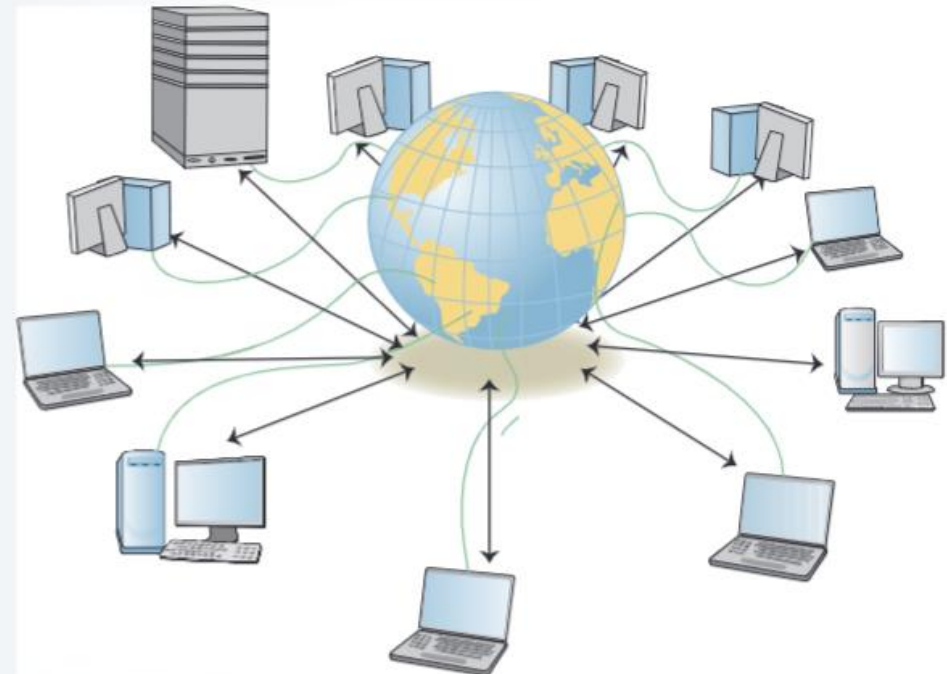
- Services and infrastructure are run on private network
- Provides better security and privacy than the public cloud
- Has less cost savings than the public cloud

# Grid Computing

- **Grid computing** involves combining the processing powers of various computers
- Makes use of other computer resources to solve problems
- Check out:  
<https://aws.amazon.com/what-is/grid-computing/>

**Exhibit 14.5**

A grid computing configuration



# Edge Computing

- **Edge computing** pushes processing and data to the near edge of the network
  - Enables a timely collection, processing and analysis of data
  - Serves as a complement to cloud computing
  - Some advantages include the following:
    - Real-time data analysis at the edge
    - Lower operating costs
    - Reduced network traffic
    - Improved application performance
    - Increased network performance
    - Resilient from a single disruption
- <https://www.youtube.com/watch?v=MBUabimpai0>

# Cloud Computing Security

- Two types of security issues
  - The client (user)
  - the server (provider)
- Cloud computing could be more secure than traditional on-premise data centers
- Security risks include the following:
  - Privileged user access
  - Regulatory compliance
  - Data location
  - Data segregation
  - Recovery
  - Investigative support
  - Long-term viability

# Virtual Reality

- A **virtual world** is a simulated environment designed for users to interact with each other via avatars.
- An **avatar** is a 2D or 3D graphical representation of a person in a virtual world
- Most uses cases are focused on gaming, social networking, and entertainment
- **Virtual Reality (VR)** uses computer-generated, three dimensional images to create the illusion of interaction in a real-world environment.
- Uses stereo sound and tactile sensations to enhance the feeling of being immersed in a 3D world.

# Obstacles in Using VR Systems

- Lack of fiber-optic infrastructure to deliver high-speed data transmission
- Problems for VR users include the following:
  - Confusion between the VR environment and the real environment
  - Mobility and other problems with HMD
  - Difficulty representing sound
  - Need for additional computing power

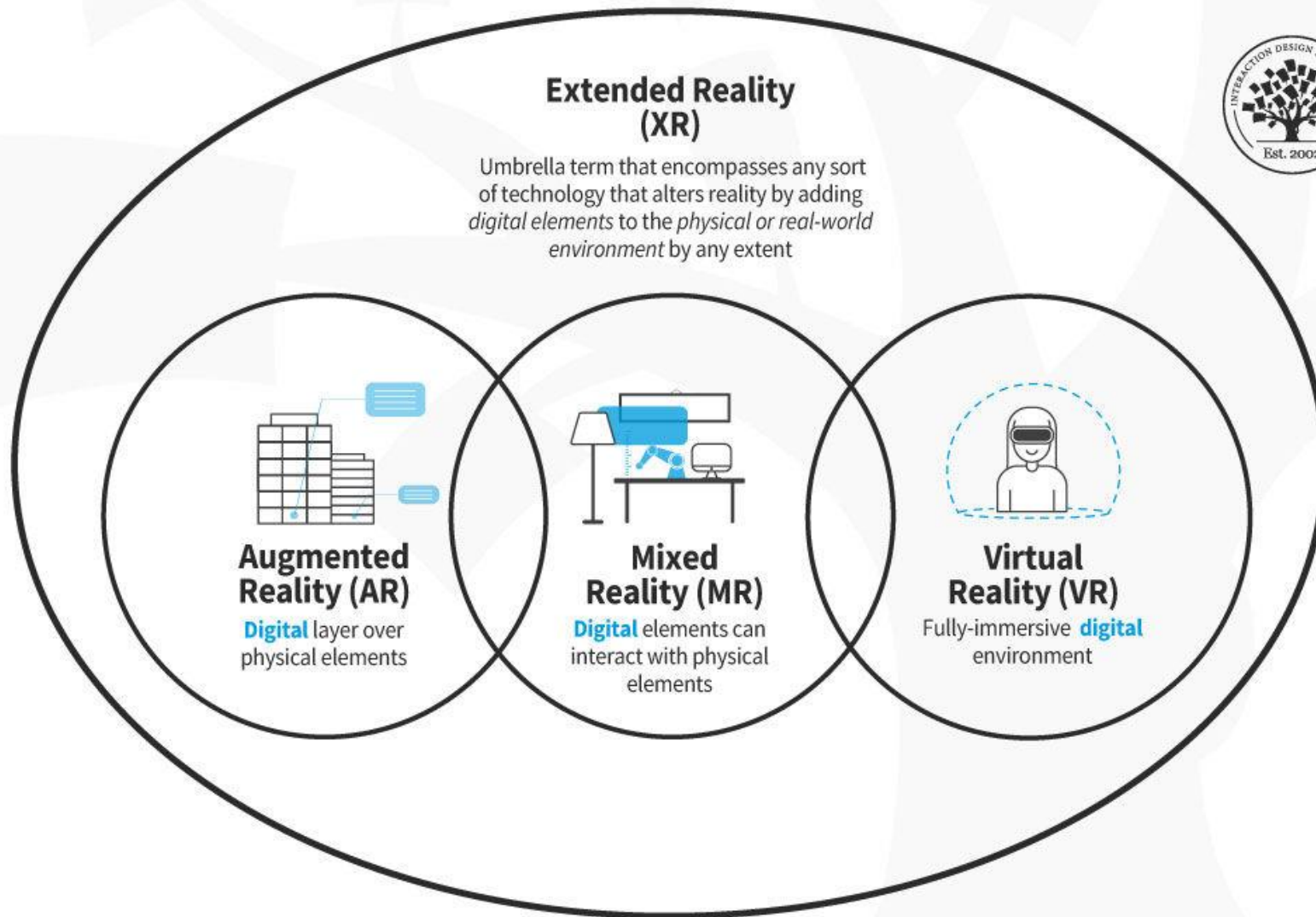
# Augmented Reality

- Branch of VR that generates a virtual scene that is overlaid on the real object
- Currently used as a marketing tool for fields like education, entertainment and medicine
- AR users stay connected to the real-world environment

## Mixed Reality

- Falls between AR and VR
- Merges real and virtual objects to produce new visualizations
- Overlays objects on real objects and anchors virtual objects to real world object so they can interact with one another
- User stays in the real-world environment





<https://www.interaction-design.org/literature/article/beyond-ar-vs-vr-what-is-the-difference-between-ar-vs-mr-vs-vr-vs-xr>

# Metaverse

- Described as the intersection of blockchain, Web 3.0, and VR
- VR, AR, MX provide the foundation of metaverse
- The **metaverse** is defined (for this course) as a 3D virtual world that provides a seamless digital environment
- Allows users to do almost everything they can do in the real world

Watch: <https://www.youtube.com/watch?v=rtLTZUaMSDQ>

# Blockchain Technology

- A **blockchain** is a decentralized and distributed network that is used to record transactions across connected devices as blocks of data that cannot be altered
- Transactions are grouped into blocks and linked together to create chains
- Uses encryption technology to make the network accessible only to authorized users
- Disadvantages include an uncertain regulatory environment and lack of widespread adoption of the technology
- Watch: [https://www.youtube.com/watch?v=SSo\\_EIwHSd4](https://www.youtube.com/watch?v=SSo_EIwHSd4)

# Cryptocurrency

- Digital money created from computer codes
- Monitored by peer-to-peer IP
- Individual owns the private and public key
- Popular keys include the following:
  - Bitcoin
  - Ethereum
  - Binance Coin
  - Tether
  - Solana
  - Cardano

# Cryptocurrency

## Advantages

- Cannot be counterfeited or reversed by the sender
- Immediate settlement
- Lower transaction fees
- No risk of credit theft
- Available to anyone with a smartphone and Internet access
- Global access without linkage to a particular monetary system

## Disadvantages

- Not widely accepted
- No way to reverse the payment
- Regulation uncertainty
- Financial vulnerabilities due to data loss
- High price volatility and manipulation
- Environmental impact of cryptocurrency mining
- Not exchangeable for fiat currency

# Non-Fungible Tokens

- **Non-fungible tokens (NFT)** is a one-of-a-kind crypto asset backed by a blockchain
  - *non-fungible* means that a token is not mutually interchangeable
- A blockchain is used to record transactions across connected devices as blocks of data that cannot be altered
- Digital representations of virtual and real-world assets

Watch:

- <https://www.youtube.com/watch?v=NNQLJcJEzv0>
- [https://www.youtube.com/watch?v=zpROwouRo\\_M](https://www.youtube.com/watch?v=zpROwouRo_M)
- [https://www.youtube.com/watch?v=X\\_AugmQpwho](https://www.youtube.com/watch?v=X_AugmQpwho)

# Fungible Tokens

- Representations of assets on a blockchain that are interchangeable
- Bitcoin is an example of fungible token



# NFT Drawbacks

- Excessive hype
- Exaggeration in pricing
- Uncertainty
- Environmental issues of blockchain technology

# Quantum Computing

- **Quantum computing** uses quantum mechanics to generate and manipulate qubits
- Solves problems considered impossible for traditional computers
- Will not replace traditional computers
- Watch: [https://www.youtube.com/watch?v=g\\_laVepNDT4](https://www.youtube.com/watch?v=g_laVepNDT4)

# Knowledge Check Activity 1-1

What is the major difference between VR and AR?

- a. VR has you completely immersed in a virtual world. AR is an overlay on a real object but you are not immersed in any other virtual world.
- b. AR has you completely immersed in a virtual world. VR is an overlay on a real object but you are not immersed in any other virtual world.
- c. AR requires extensive use of specialized equipment. VR does not require additional special equipment.
- d. AR takes place in a special room created to provide an immersive experience. VR does not require this to have an immersive experience

# Knowledge Check Activity 1-1: Answer

What is the major difference between VR and AR?

**Answer:** VR has you completely immersed in a virtual world. AR is an overlay on a real object but you are not immersed in any other virtual world.

VR uses visual, tactile, and auditory technologies to engross you into a virtual world. AR is an overlay (i.e a filter) on top of a real world object. It does not require special equipment and can be done on your smartphone.

# Polling Activity 1-1

It's time to take a poll! Get your devices ready and open your [Kahoot] app. You can join the poll using this link/PIN: [enter link or PIN]

Quantum computing encryption can help keep data secure. What is the vulnerability that quantum computing also creates?

- a. It would take less time for it to crack an encryption of another organization's secured data.
- b. It is not cost effective to use quantum computing for encryption.
- c. It is difficult to reset private and public keys should it be necessary.
- d. It requires too much resources to be an effective encryption tool.

# Polling Activity 1-1: Answer

Quantum computing encryption can help keep data secure. What is the vulnerability that quantum computing also creates?

**Answer:** It would take less time for it to crack an encryption of another organization's secured data.

Quantum computing can offer very strong encryption technology to protect digital assets. This powerful technology could also crack a sophisticated algorithm in a fraction of a time as a traditional computer.

# Discussion Activity 1-1

Have you ever used cloud technology? You most likely have whether you realized it or not. Many large organizations have migrated to the cloud due to the benefits they provide. You learned that Amazon (Amazon Web Services) is one of the largest cloud computing service providers. Go to [AWS's Customer Success Stories](#) and look through the customers list. Are there any names you are familiar with? Are there any products or services you use?

Discuss possible correct answers with your classmates.



# Discussion Activity 1-1: Answer

Have you ever used cloud technology? You most likely have whether you realized it or not. Many large organizations have migrated to the cloud due to the benefits they provide. You learned that Amazon (Amazon Web Services) is one of the largest cloud computing service providers. Go to [AWS's Customer Success Stories](#) and look through the customers list. Are there any names you are familiar with? Are there any products or services you use?

**Answer:** AWS is one the largest cloud providers. One of their biggest clients is a name most of us are familiar with - Netflix.

**Explanation:** Companies of all sizes use cloud computing for the benefits. Cloud computing is one of the fastest growing tech jobs as well.

# Self Assessment

What experiences (if any) do you have with AR, VR, or MR? What thoughts do you have about this technology?

If you have not experience any of these types of technologies - are you interested in experiencing them? If not, why?

Despite your experiences with AR, VR, MR how do you think these technologies will be used in the future?

# Summary

Now that the lesson has ended, you should be able to:

- Summarize new trends in software and service distribution.
- Describe VR components and applications.
- Explain NFTs and their business applications.
- Discuss the metaverse, its foundation and its applications.
- Describe the foundation, models and applications of cloud computing.
- Discuss uses of nanotechnology.
- Describe blockchain technology and cryptocurrency.
- Explain quantum computing and its applications.

# Summary