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# Introduction to Information Systems

ITISA1

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# *What will be covered in the rest of today's session?*

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What will be covered in the lecture-led session:

- Identify key management responsibilities
- Leavitt's Diamond model and Value Chain
- Benefits of creating a strategic plan
- Information Systems Careers



# Information Systems—A Means to Achieve Competitive Advantage

- Competitive advantage
  - Generates more sales
  - Achieves superior profit margins
- Gained through cost leadership, differentiation, focus
- Requires considerable effort to sustain
- Managers' key role
  - Identify and use information systems to gain a competitive advantage



# Managers' Role in Implementing Successful Information Systems



## Leavitt's Diamond model

Used to introduce new systems into the workplace

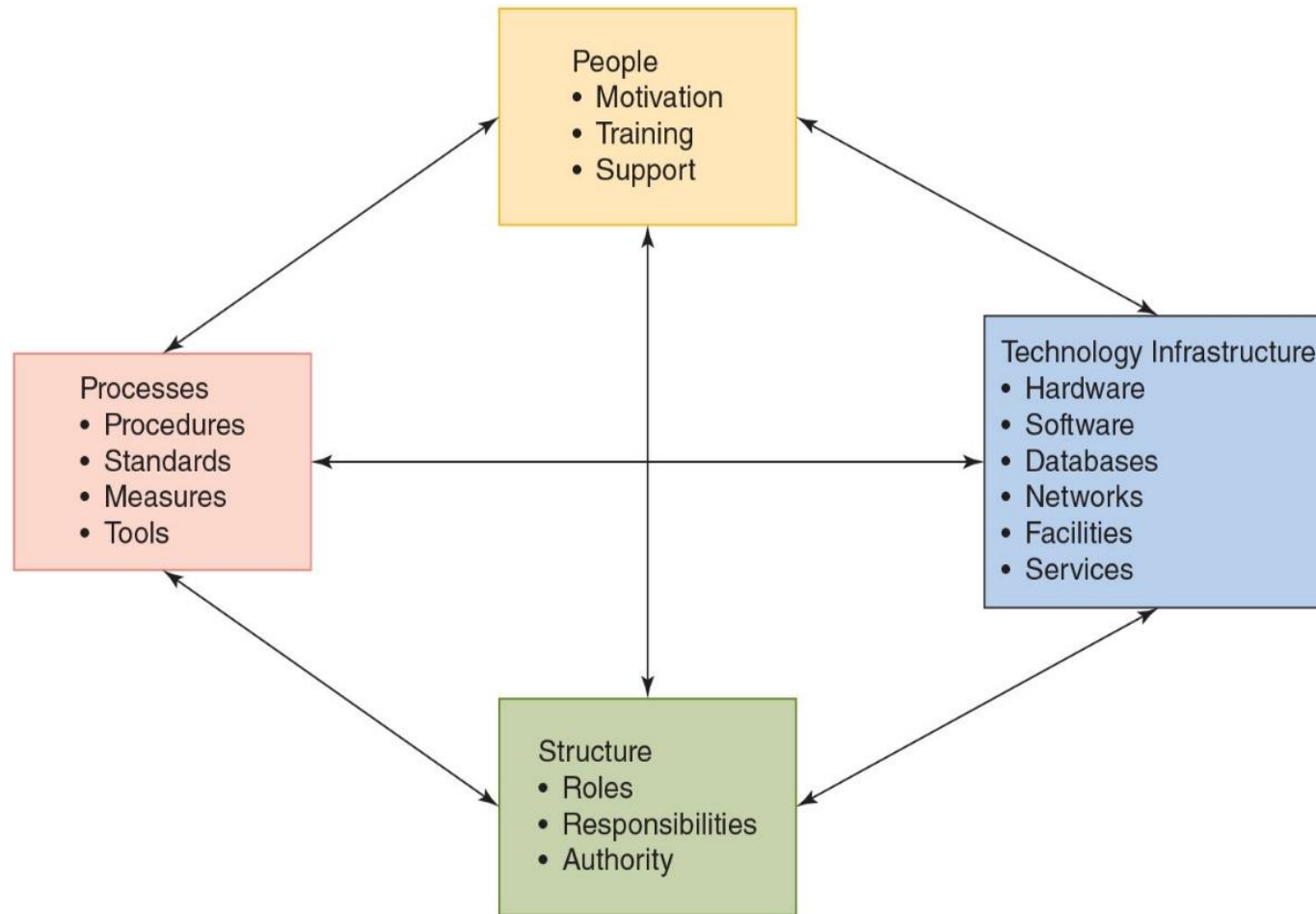
Intended to lower stress, encourage teamwork, and increase successful implementation

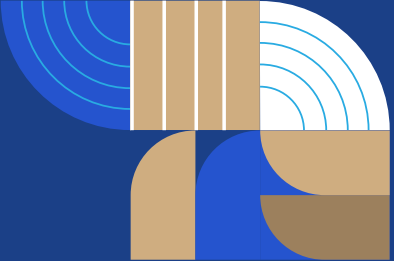
Model highlights four key components

People, technology infrastructure, processes, and structure



# Managers' Role in Implementing Successful Information Systems





# *Types of Information Systems*

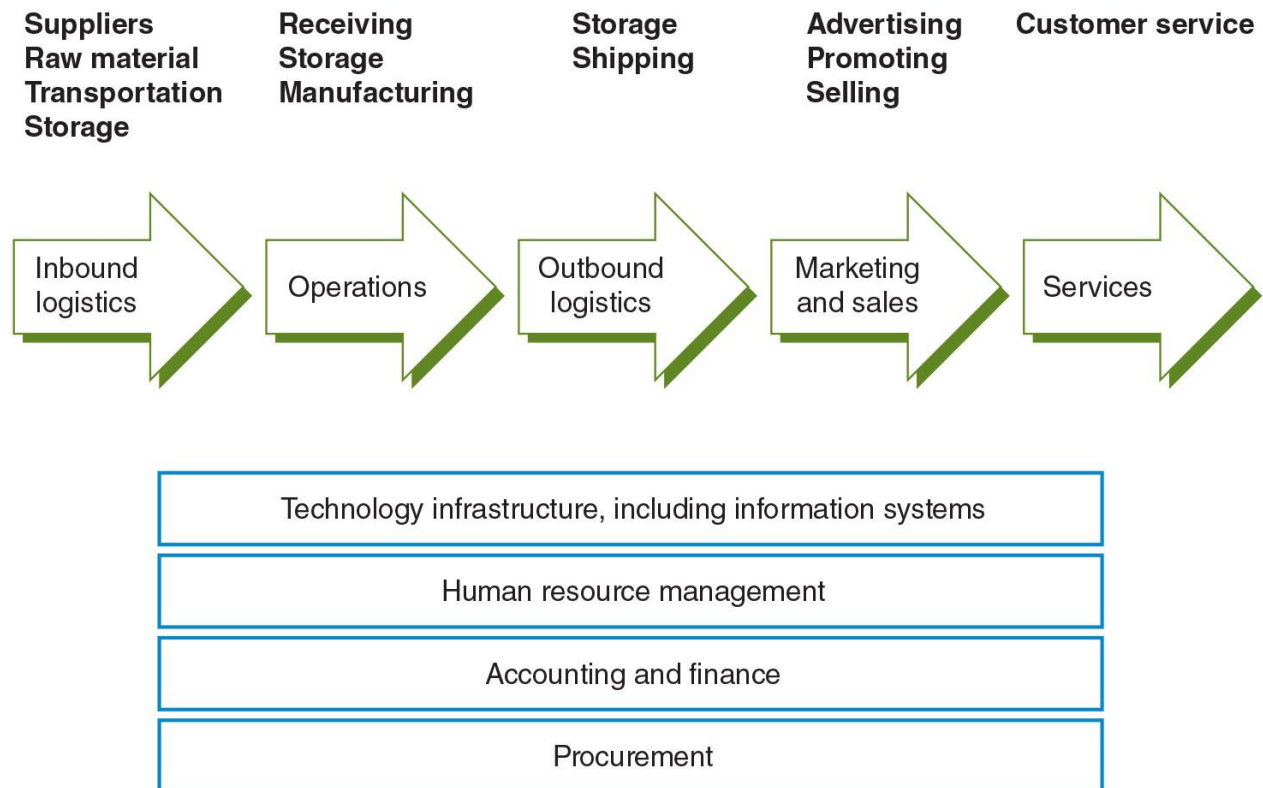


- Personal information system
  - Improves productivity of individual users in performing stand-alone tasks
- Workgroup information system
  - Enables people to work together effectively
- Enterprise information system
  - Facilitates organization-wide business needs
- Interorganizational IS
  - Enables the sharing of information across organizational boundaries





# Value Chain







# Strategic Planning



## Strategic planning

Managerial process designed to identify initiatives and projects to achieve organizational objectives

Must recognize that the organization and everything around it is in a state of flux

## Benefits

Provides a framework and clearly defined direction to guide decision making

Provides effective use of organization's resources





# Strategic Planning



## Benefits (continued)

- Allows organization to be proactive
- Improves communication

## Considerations

- Long-term impact of each strategy on revenue and profit
- Degree of risk involved
- Amount and types of resources required
- Potential competitive reaction

Must be consistent with organizational plan





# Information Systems Careers



## IS worker required skills

- Data analysis
- Mobile device application design/build skills
- Traditional programming and application development
- Technical support expertise
- Project management
- Networking and cloud computing
- System audit and security
- Web design and development
- Data center operations knowledge





# Typical Information System Roles



Chief information officer

- Employs IS department's equipment and personnel

- Achieves organization's goals

- Understands finance, accounting, return on investment

Software developer

- Creative mind behind computer programs

- Develops applications and operating systems

- Tests, debugs, and upgrades software

Information systems security analyst

Systems analyst

Programmer

Web developer

Business Analyst





# Certifications



## Certification

- A process for testing skills and knowledge
- Results in a statement by the certifying authority that confirms an individual is capable of performing particular tasks.
- Frequently involves specific, vendor-provided or vendor-endorsed coursework

Examples: (Search for more examples)

Cloud Computing:

AWS Certified Cloud Practitioner, Azure Fundamentals (AZ-900), Google Cloud certifications.

Cybersecurity:

CompTIA Security+, Certified Ethical Hacker (CEH), Certified Information Systems Security Professional (CISSP).



# Activity



- What are some of the information systems you use everyday and how does the technology make your life easier?
- What are the characteristics of a successful information systems worker?
- Discuss the specific technical skills that are important for an IS worker to possess.
- What are some of the roles you will undertake as an Information systems graduate?
- Link to freelance jobs available: <https://www.freelancer.com/>



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What will be covered in the lecture-led session:

- Network Fundamentals
- The Internet and World Wide Web
- Cloud Computing services
- Internet of Things (IoT)



# Network Fundamentals

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## Computer network

- Communications media, devices, and software
- Connects two or more computer systems or devices

## Communications media

- Any material substance that carries an electronic signal to support communications between a sending and a receiving device





# Network Topology

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## Network topology

- Shape or structure of a network

## Star network

- Devices connect through a single central device called the hub node

## Bus network

- Devices connected to a common backbone
- Serves as a shared communications medium

## Mesh networks

- Multiple access points link a series of devices across a large area



# Network Types

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## Personal area network (PAN)

- Connects devices close to one person

## Local area network (LAN)

- Connects systems and devices within a small area

## Metropolitan area network (MAN)

- Connects users and their computers in a geographical area that spans a campus or city

## Wide area network (WAN)

- Connects large geographic regions



# Channel Bandwidth



## Channel bandwidth

- The capacity of a communications channel to carry traffic
- Usually measured in megabits bits per second
  - One million bits per second (Mbps)
- The higher the bandwidth, the more traffic that can be carried





# Network Latency



## Network latency

- Measures how long it takes for a unit of data to get to its destination and back again
  - Measured in milliseconds (ms) or thousandths of a second

## Low-latency networks

- Small delays occur

## High-latency networks

- Experience long delays
- High latency creates bottlenecks





# Communication Media



Media Form	Description	Advantages	Disadvantages
Twisted-pair wire	Twisted pairs of copper wire, shielded or unshielded; used for telephone service	Widely available	Limitations on transmission speed and distance
Coaxial cable	Inner conductor wire surrounded by insulation	Cleaner and faster data transmission than twisted-pair wire	More expensive than twisted-pair wire
Fiber-optic cable	Many extremely thin strands of glass bound together in a sheathing; uses light beams to transmit signals	Diameter of cable is much smaller than coaxial cable; less distortion of signal; capable of high transmission rates	Expensive to purchase and install



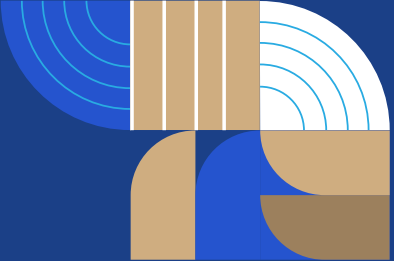


# Communication Media



Technology	Description	Advantages	Disadvantages
Radio frequency range	Operates in the 3 KHz–300 MHz range	Supports mobile users; costs are dropping	Signal is highly susceptible to interception
Microwave—terrestrial and satellite frequency range	High-frequency radio signal (300 MHz–300 GHz) sent through the atmosphere and space (often involves communications satellites)	Avoids cost and effort to lay cable or wires; capable of high-speed transmission	Must have unobstructed line of sight between sender and receiver; signal is highly susceptible to interception
Infrared frequency range	Signals in the 300 GHz–400 THz frequency range	Let's you move, remove, and install devices without expensive wiring	Must have unobstructed line of sight between sender and receiver; transmission is effective only for short distances





# Wireless transmission continue..



## Bluetooth

- Devices interconnected over distances of 10 to 30 feet at a rate of about 2 Mbps

## Wi-Fi

- Wireless network brand owned by the Wi-Fi Alliance
- Improves interoperability of wireless local area network products
  - Based on the IEEE 802.11 standard





# Wireless transmission continue..



## 4G wireless communications

- Delivers more advanced features over 3G
- Based on the Long-Term Evolution (LTE) standard

## 5G wireless communications

- Advantages over 4G networks
  - More bandwidth
  - Lower latency
  - Supports many more devices
  - Enables exciting new applications







# *The Internet and World Wide Web*



- The internet is a world-wide system of computer networks that are connected to each other. These networks connect with each other using cables, telephone lines and communication satellites.
- The world wide web (WWW) is a part of the internet where documents and other resources can be accessed. The WWW is often called “The Web”.





# *How the Internet works*



- Internet backbone
  - High-speed, long-distance communication link
- Transmission Control Protocol/Internet Protocol (TCP/IP)
  - Collection of communication protocols
  - Interconnects network devices on a packet switching network





# *How the Internet works..*



- IP address and MAC address
  - IP address
    - 64-bit number uniquely identifying a computer
    - Typically divided into four bytes
    - Translated to decimal
      - Example: 69.32.133.79
  - Network interface card (NIC)
    - Circuit board or card installed into a hardware device
    - Specific MAC address is “burned” into a NIC’s read only memory (ROM)





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# *How the Internet works..*



- Network hardware
  - Switch
    - Keeps a record of the MAC address of all the devices connected to it
    - Determines port a frame of data should be directed to
  - Router
    - Directs data packets to other networks until each packet reaches its destination
  - Routing
    - Use dynamic routing to move packets
    - Packets may arrive at the destination device out of order



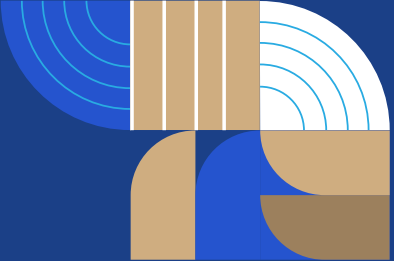


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# *How the World Wide Web works..*



- The Internet
  - Infrastructure on which the Web exists
  - Computers, network hardware, software, communications media, and TCP/IP protocols
- The World Wide Web (Web)
  - Server and client software, the hypertext transfer protocol (http), standards, and markup languages
  - All combine to deliver information and services over the Internet





# *Client Server Architecture*



- Hyperlinks
  - Highlighted text or graphics in a Web document
    - Opens a new Web page when clicked
- The Web
  - Hyperlink-based system using the client/server model
  - Internet resources organized into pages
  - Pages accessed and viewed using Web client software called a Web browser
    - Web client used to view Web pages







# *Client Server Architecture*



- Hypertext Markup Language (HTML)
  - Standard Web page description language
  - HTML tags (tags) indicate how to format text or graphic
- Extensible Markup Language (XML)
  - Markup language for Web documents
  - XML does not have a predefined tag set
- Cascading Style Sheet (CSS)
  - Markup language for defining the visual design of a Web page or group of pages



# Activity



- Draw three examples of physical network topologies and explain how each works.
- Discuss the role of network-management software including mobile device management software.
- Discuss how Web 2.0 differs from Web 1.0
- In what ways has the internet changed the ways that businesses operate.



# Cloud Computing and the Internet of Things





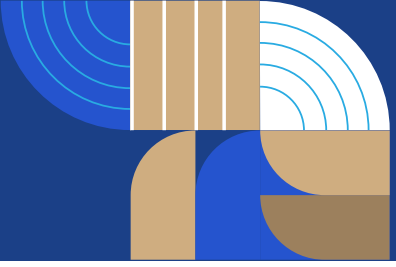
# Cloud Computing



Computing environment in which software and storage are provided as an Internet service and accessed with a Web browser.

Can be deployed in several different ways, including public cloud computing, private cloud computing, and hybrid cloud computing.





# Public Cloud Computing



A service provider owns and manages the infrastructure with cloud user organizations (tenants) accessing slices of shared hardware resources via the Internet

They can deliver increasing amounts of computing, network, and storage capacity on demand, without requiring any capital investment on the part of the cloud users





# Public Cloud Computing Benefits



## Benefits of public cloud computing

### Reduced costs

- Organizations avoid large, up-front investments in hardware

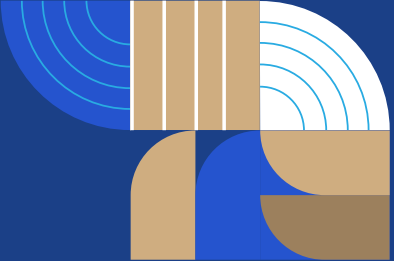
### Flexible computing capacity

- Should computing needs change, cloud computing service provider can deliver more or less capacity

### Increased redundancy in the event of disaster

- Providers operate multiple data centers distributed geographically





# Public Cloud Computing Services



## Cloud computing services

### Infrastructure as a service (IaaS)

- Organization outsources the equipment used to support its data processing operations

### Platform as a service (PaaS)

- Users are provided with a computing platform, typically including operating system, programming language execution environment, database services, and a Web server

### Software as a service (SaaS)

- Software delivery approach that provides users with access to software remotely as a Web-based service





# Public Cloud Computing Issues



Issues with public cloud computing

- Complex pricing arrangements
- Wide variations in performance over time
- Inadequate data security
- Vendor lock-in







# Private Cloud Computing



Private cloud computing environment

- Single tenant cloud

- Organizations often implement due to concerns that their data will not be secure in a public cloud

Divided into two types

- On-premises private cloud

- Service provider-managed private cloud (i.e., virtual private cloud)





# Hybrid Cloud Computing



Hybrid cloud computing environment

Composed of both private and public clouds integrated through a private network

Organizations typically use the public cloud to run applications with less sensitive security requirements and highly fluctuating capacity needs but run more critical applications on the private cloud





# The Internet of Things (IoT)



- A network of physical objects (i.e., things)
  - Embedded with sensors, processors, software, and network connectivity capability
    - Enables them to exchange data with the manufacturer of the device, device operators, and other connected devices
- Sensor: device that is capable of sensing something about its surroundings
  - Pressure, temperature, humidity, pH level, motion, vibration, or level of light



# The Internet of Things (IoT)



**1. Sensors gather data**



**2. Data passes over network**



**3. Data from across the IoT is gathered and stored-often in the cloud**



**4. Data is combined with other data from other systems**



**5. Data is analyzed to gain insights into operation of devices on IoT**



**6. Alerts sent to people, Enterprise systems, or IoT Devices based on these insights**



# The Internet of Things (IoT)



## Examples of IoT

- Home automation
- Wearable devices
- Smart cities
- Autonomous vehicles

## Enabling connectivity with 5G

- Latest generation of mobile communications
- High data transfer speed over high frequencies with minimal latency (delays in response time)
- Requires low energy
- Uses millimeter wave
- Enables many devices to transmit data quickly to the cloud





# The Internet of Things (IoT)



## Types of IoT applications

- Connect and monitor
- Control and react
- Predict and adapt
- Transform and explore

## Business benefits of IoT

- Reduce costs to achieve a competitive advantage
- Deepen the organization's understanding of consumer preferences and behaviors
- Improve customer service and experience
- Improve workplace safety

## Potential issues with IoT applications

- Many issues with the receipt and usability of sensor data
- Security is a very major issue





# Case Study



## Manufacturer Weighs Converting to Internet of Things

You are a member of the plant information systems group for a small manufacturer of all-natural ingredient cosmetics. Your firm promotes itself as adhering to the highest standards of compliance and quality. Manufacturing is rigorously monitored via sensors and computer controls throughout the entire process, and automated temperature controls ensure complete stability in the manufacturing environment. Sensor tracking is performed from the moment that raw materials enter your facility, throughout the manufacturing process, packaging, and on to distribution. The sensors and computer controls were installed when the plant was built in the 1990s and use proprietary communications protocols and are not Internet enabled. Data from these sensors is monitored by a group of three technicians in the computer control room. Twelve workers are required to staff the control room 24/7, including weekends and most holidays.

Your company has just purchased a plant previously owned by one of your competitors in a nearby state. Your group has been asked to look at the feasibility of upgrading the sensors used in both plants to Internet-enabled sensors connected to the Internet of Things. This would make it possible for technicians in one control room to monitor the operation of both plants. Plant staffing could be reduced by 12 workers saving \$1.2 million in labor expenses per year. It is estimated that the cost of replacing the existing sensors and converting to the Internet of Things is in the vicinity of \$1.5 million.

Source: Whenham, T. 2020. *15 Active Learning Activities to Energize your Next Class*. [Online] Available at: [15 active learning activities to energize your next college class \(nureva.com\)](https://nureva.com/15-active-learning-activities-to-energize-your-next-college-class/). [Accessed 16/07/2025].





# Case Study



## Review Questions

1. Why is it necessary to replace the existing sensors to implement an IoT network?
2. What additional benefits may arise from converting the plants to the Internet of Things?

## Critical Thinking Questions

1. What new risks are raised by placing the new system of sensors on the Internet of Things?
2. What actions could be taken to reduce these risks?







## Discuss

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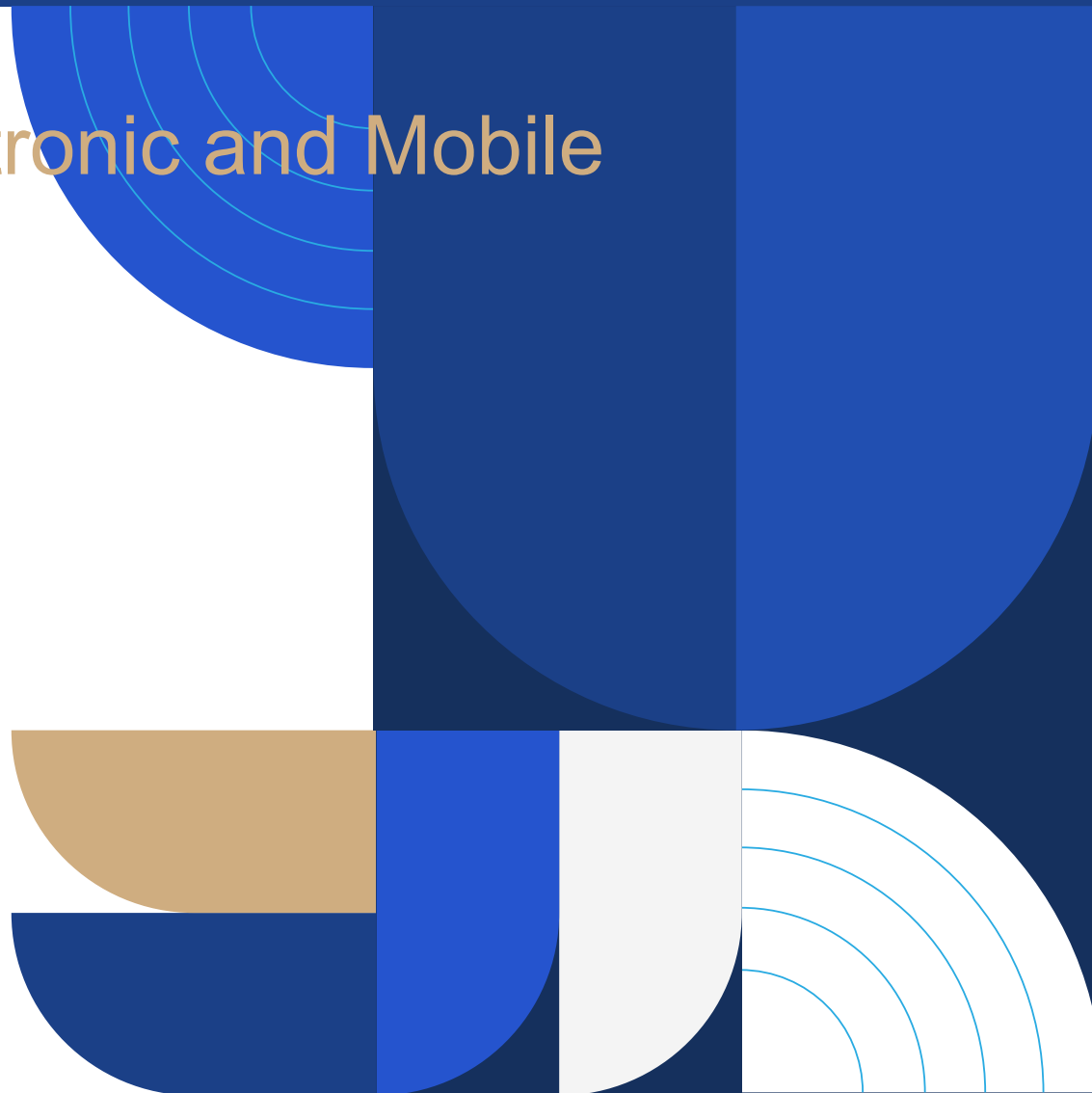
1. What are the different ways to deploy cloud services? (Discuss)
2. Discuss the different types of cloud computing.
3. How has cloud services changed/ improved the way people do things in today's world compared to the older ways?



# *What Happens Next?*



In the next session we look at Electronic and Mobile Commerce



# Bibliography



Stair, R. and Reynolds, G. 2020. Principles of Information Systems. 14th edition. Cengage Learning. Chapters 1, 7 and 8.