Lecture 2: Networking Devices

CSS 200 - Intro to Information Systems

Module 1

- What is an information system?
- Where do we use information systems?
- What is the difference between Data, Information and Knowledge?

What is an information system?

- An information system is a combination of technology, people, and processes that work together to collect, store, manage, and share data. It helps organizations make decisions, solve problems, and improve efficiency by providing accurate and timely information.

Where do we use information systems?

- Information systems are used in various sectors like business, education, and healthcare to support daily operations and long-term planning. They include hardware, software, databases, and networks, all designed to process and distribute information to users who need it.

What is the difference between Data, Information and Knowledge?

- Data refers to raw, unorganized facts or figures that by themselves have no meaning. For example, numbers, dates, or a list of names are considered data.
- Information is what you get when data is processed, organized, or structured in a way that adds context and meaning. For instance, data about sales figures organized in a report becomes information that can be used to understand business performance.
- Knowledge goes a step further and is the understanding or insight gained from analyzing information. It involves interpreting information and applying it to make decisions or solve problems, such as using sales information to predict future trends or improve strategies.

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What will we cover today?

- MLO 1: Explain the role of Enterprise Architecture in IT Governance
- MLO 2: Enhance Analytical Skills
- MLO 3: Identify IT infrastructure and networking components
- MLO 4: Identify the role of network devices.

What is a Network?

- A network is a group of computers and other devices connected to share data and resources.
- These networks allow communication between devices, whether they are in the same room or spread across the globe.
- These networks can range from simple home setups to large-scale enterprise environments."

What are Network Devices?

- Network devices, also known as networking hardware, are physical devices that allow hardware on a computer network to communicate and interact with one another. For example Repeater, Hub, Switch, Routers and Gateway, etc.

The Importance of Network Devices

- In these networks, network devices serve as connector.
- They make sure data is routed to the right place, managed efficiently, and sometimes even translated between different types of networks.
- The performance of a network heavily relies on how well these devices function.

Network Devices Overview

Types of Network Devices

What is a Hub?

- A hub is a simple networking device that connects multiple devices, such as computers, in a local network. It works by receiving data from one device and broadcasting it to all the devices connected to the hub
- Broadcast Communication: Sends data to all devices, even if only one needs it.
- No Intelligence: It can't figure out which device needs the data, so it broadcasts to everyone.
- Half-duplex: Devices can't send and receive data at the same time.

How does a Hub work?

Hub

Data sent by one node

Data is forwarded to all connected nodes
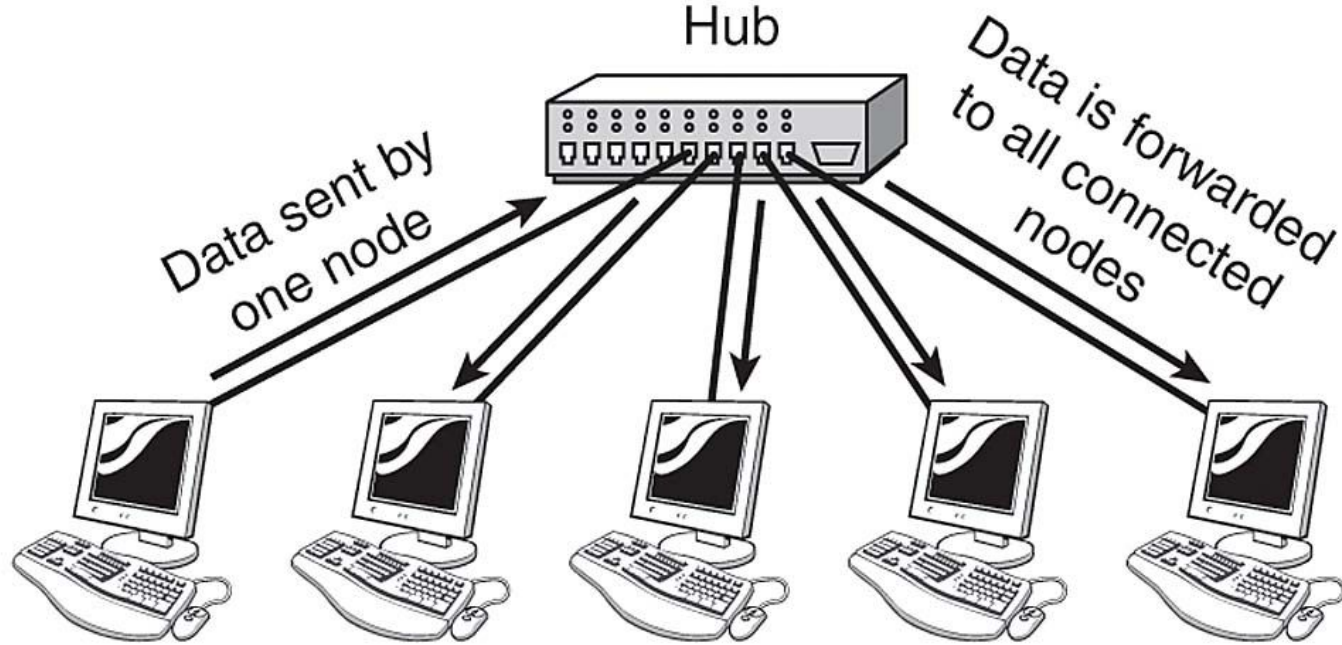
Example

- Imagine a classroom where one student (the device) is passing a note (data) to another student. Instead of giving it directly to the intended recipient, the note is passed to everyone in the room. Eventually, the intended recipient gets it, but everyone else has seen it too! This is how a hub works—it doesn't know which device should receive the data, so it sends it to all devices.

What is a Repeater?

- A repeater is a network device that extends the range of a network by receiving, amplifying, and retransmitting signals. It helps maintain signal strength over long distances, ensuring that data can travel without losing quality.
- Repeaters take a weak or corrupted signal, regenerate it, and send it back out at its original strength.
- Signal Amplification: Boosts weak signals to extend the distance data can travel.
- No Filtering: A repeater doesn't manage traffic; it simply regenerates and forwards all data it receives.
- Works at the Physical Layer: It operates on the lowest level of the OSI model (the physical layer), dealing only with electrical signals.

How does a Repeater work?
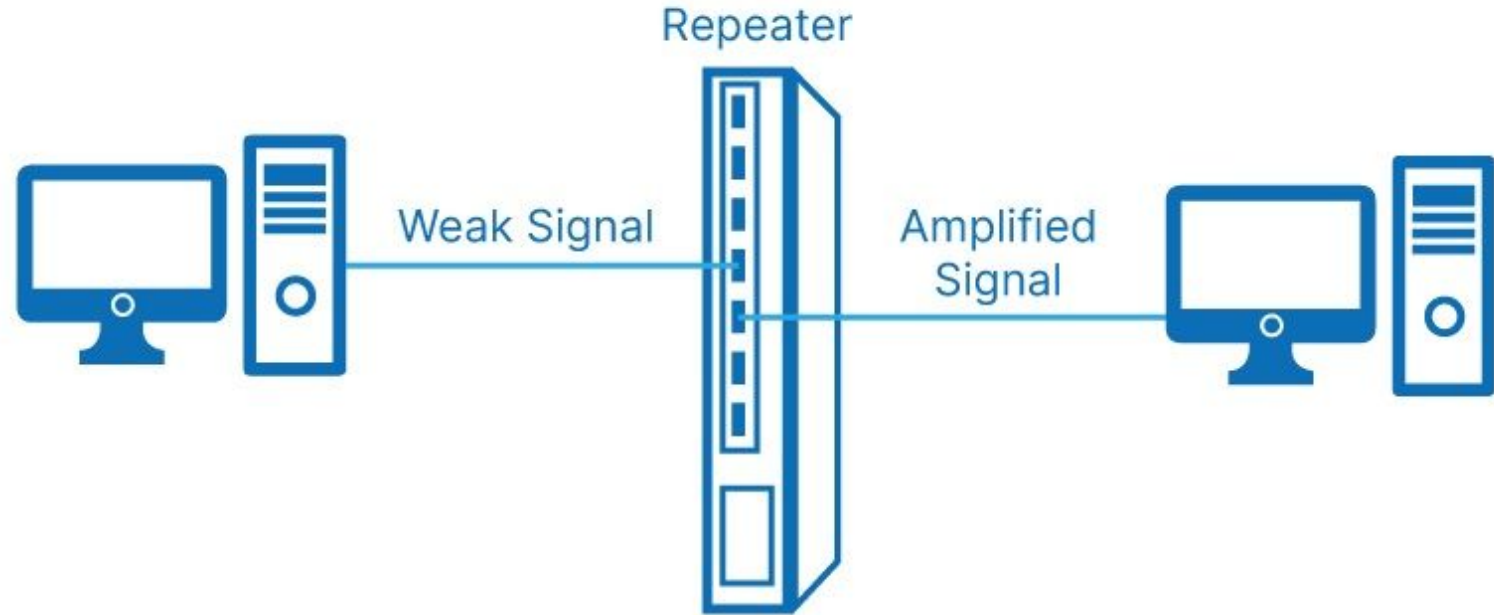
What is a Switch?

- A switch is a network device that connects multiple devices within a Local Area Network (LAN) and manages data traffic between them. Unlike a hub, a switch intelligently forwards data only to the device that needs it.
- Traffic Management: Switches reduce network congestion by directing data only where it's needed.
- Works at the Data Link Layer: Switches operate at the second layer of the OSI model, using MAC addresses to determine the best path for data.
- Full-Duplex Communication: Switches allow devices to send and receive data simultaneously, improving network efficiency.

# How does a Switch work?

Switch

Data sent by one node

Data is forwarded only to the destination node
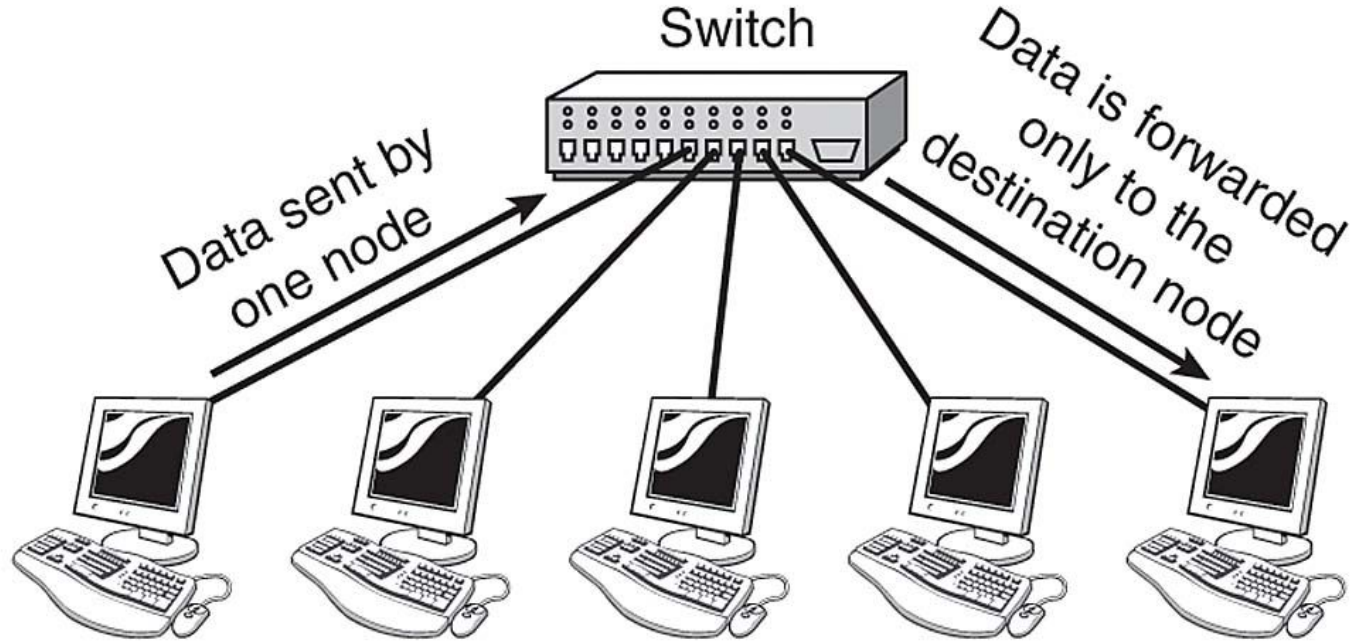
What is a Router?

- A router is a networking device that connects multiple networks and directs data packets between them. It determines the best path for data to travel across different networks, making it essential for internet connectivity.
- A router receives data packets from one network, analyzes the destination addresses, and forwards them to the appropriate network.
- Inter-network Communication: Routers connect different networks, such as a local home network to the internet.
- Works at the Network Layer: Routers operate at the third layer of the OSI model, using IP addresses to route data.
- Packet Switching: They break down data into smaller packets for transmission and reassemble them at the destination.

How does a Router work?
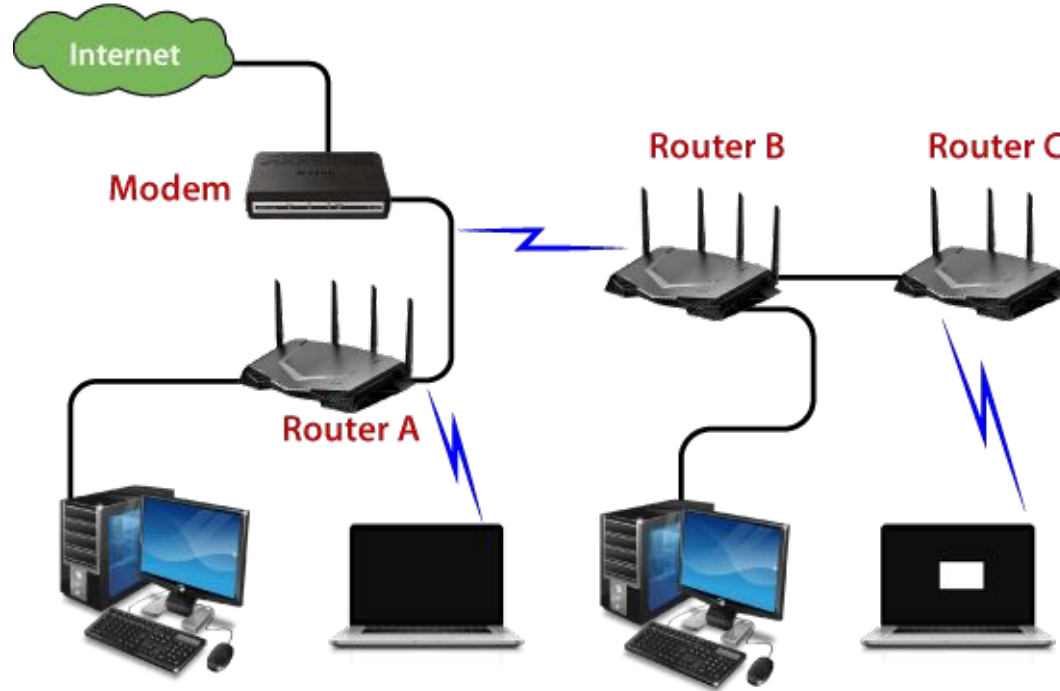
What is a Gateway?

- A gateway is a network device that acts as a "gate" between two different networks, allowing them to communicate and translate protocols. It enables data transfer between networks that use different communication protocols or architectures.
- A gateway translates the data format and protocols used in one network to those used in another.
- Protocol Conversion: Gateways can convert different communication protocols, making them essential for connecting diverse networks.
- Works at Multiple Layers: Gateways operate at various layers of the OSI model, depending on the protocols being converted.

Switches

Definition: A switch is a networking device that connects devices within a local area network (LAN) and uses MAC (Media Access Control) addresses to forward data to the correct destination.

- Traffic Management: Switches intelligently direct data packets to the appropriate device rather than broadcasting to all devices, reducing network congestion.
- Data Packet Switching: They operate at Layer 2 (Data Link Layer) of the OSI model, facilitating communication between devices on the same network.
- Segmentation: Switches can create separate collision domains for each connected device, improving performance and reducing the chances of data collisions.

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Routers

Definition: A router is a networking device that forwards data packets between different networks, such as between a LAN and the internet. Routers operate at Layer 3 (Network Layer) of the OSI model and use IP (Internet Protocol) addresses to make forwarding decisions.

- Inter-network Communication: Routers connect different networks and direct traffic between them based on IP addresses.
- Traffic Routing: They determine the best path for data to travel across networks, improving efficiency and performance.
- Network Address Translation (NAT): Routers often provide NAT functionality, allowing multiple devices on a local network to share a single public IP address.

Switch vs Router

- Switches connect devices within the same network to direct data efficiently, while routers connect different networks and route data between them.

Switch vs Router