

VIET NAM NATIONAL UNIVERSITY HO CHI MINH CITY  
HO CHI MINH CITY UNIVERSITY OF TECHNOLOGY  
FACULTY OF COMPUTER SCIENCE AND ENGINEERING



CC02 - CO3094 - Computer Network LAB

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LAB 1b

# Network Devices

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## 1 Objectives:

- Get to know basic network devices
- Understand functions of network devices
- Able to connect different network devices together to form a simple network

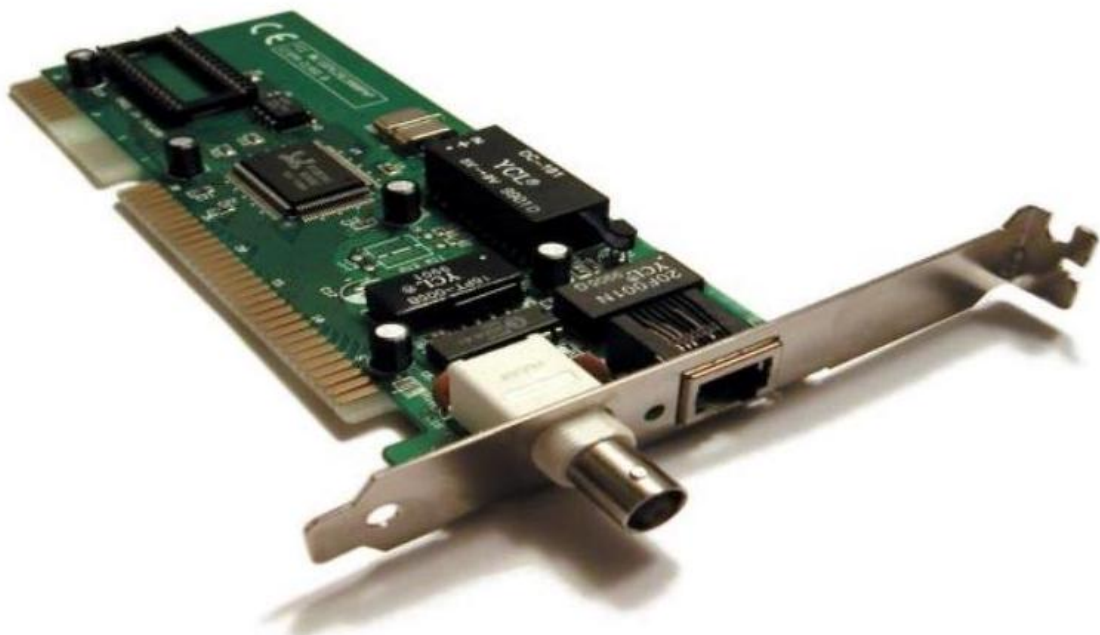
## 2 Content

### 2.1 Get to know network devices:

- ✓ Network Interface Card (NIC)
- ✓ Cables
- ✓ Hub
- ✓ Switches
- ✓ Routers
- ✓ Access Points
- ✓ Modems

### 2.2 Understanding functions of network devices

#### 2.2.1 Network Interface Card (NIC)



- NIC functions: Give a computer a continuous, always-on link to a network. It is needed to connect to a specific data transmission standard, like Ethernet or Wi-Fi, at the physical level.
- Code of NIC processors: Usually, this entails software embedded within the network interface card (NIC) or similar hardware, which oversees how the NIC functions, handles sending and receiving data, and interacts with the computer's operating system and network protocols.
- Check the NIC of a computer, what is its MAC address? **C0:25:A5:4B:BA:BE**

Name	[00000002] Realtek PCIe GbE Family Controller
Adapter Type	Ethernet 802.3
Product Type	Realtek PCIe GbE Family Controller
Installed	Yes
PNP Device ID	PCI\VEN_10EC&DEV_8168&SUBSYS_0A7F1028&REV_15\01000000684CE00...
Last Reset	3/26/2024 5:51 PM
Index	2
Service Name	rt640x64
IP Address	192.168.1.11, fe80::c0cd:2fdb:c503:45c7
IP Subnet	255.255.255.0, 64
Default IP Gateway	192.168.1.1
DHCP Enabled	Yes
DHCP Server	192.168.1.1
DHCP Lease Expires	4/3/2024 10:01 PM
DHCP Lease Obtained	4/3/2024 9:01 PM
MAC Address	C0:25:A5:4B:BA:BE
I/O Port	0x00003000-0x000030FF
Memory Address	0x8E004000-0x8E004FFF
Memory Address	0x8E000000-0x8E003FFF
IRQ Channel	IRQ 4294967273
Driver	C:\WINDOWS\SYSTEM32\DRIVERS\RT640X64.SYS (10.57.330.2022, 1.13 MB ...

Cable to connect NIC to a network:

- Type: Realtek PCIe GbE Family Controller.
- Standard: Ethernet 802.3.

### 2.2.2 Hubs



- Roles of a hub in a network: A hub connects multiple computers and devices together. It serves as the central component for joining sections of a local area network (LAN) and is sometimes referred to as a repeater or concentrator. All devices connected to a hub share the same network and receive all data transmitted through it.

Main characteristics:

- Enable Half-Duplex communication, permitting transmission in only one direction at a time.
- Operate at the Physical Layer (Layer 1) of the OSI model, primarily handling the transmission of raw data bits across a physical medium.

- Utilize broadcasting and shared bandwidth.
- Maintain a single broadcast domain and collision domain.

Weaknesses of hub:

- Lack of dedicated bandwidth allocation, which can result in bandwidth constraints and network congestion.
- Predominantly operating in Half-Duplex mode, restricting the effectiveness of data transmission.
- Absence of congestion control mechanisms.
- Inability to determine the optimal network path.

Hub ports: Have 4/12 ports.

### 2.2.3 Switches



- Roles of switches in a network: Switches play vital roles in networks by directing network packets between various networking devices like switches, routers, computers, and servers. Commonly used in local area networks (LANs), switches examine the physical device address, known as the Media Access Control (MAC) address, to route each incoming message frame.

Main characteristics of switches:

- Operating at the Data Link layer (Layer 2) of the OSI model, switches enable communication between devices based on MAC addresses.
- Facilitating the creation and management of virtual LANs (VLANs).
- Capable of forwarding data packets in unicast (one-to-one), multicast (one-to-many), and broadcast (one-to-all) communication.
- Supporting both Half-Duplex and Full-Duplex transmission modes.

Differences between hubs and switches:

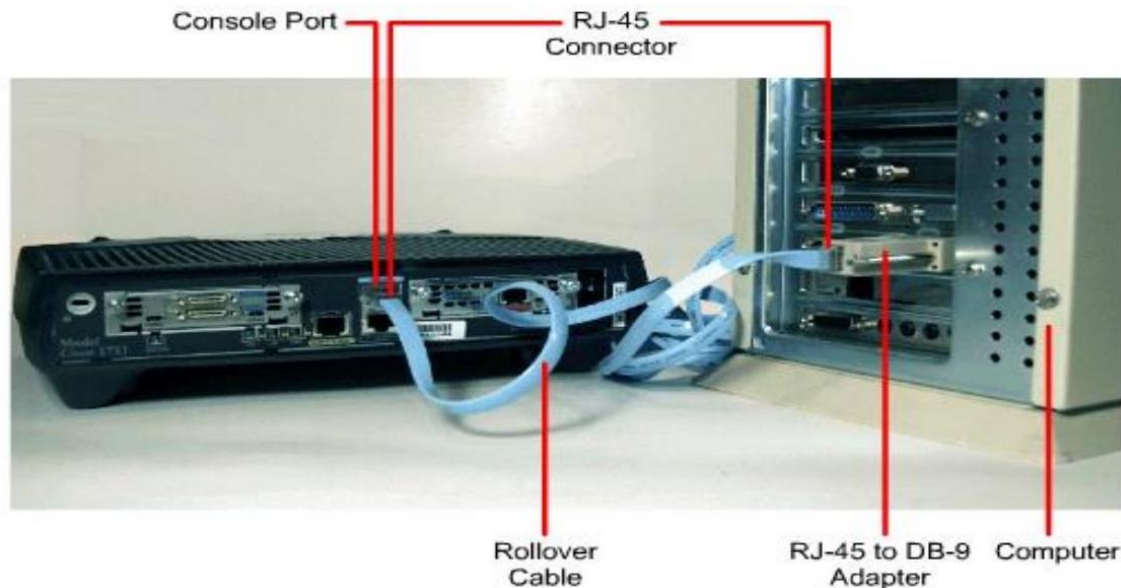
Hub	Switch
Operated on Physical Layer	Operated on Data Link Layer
Broadcast type transmission only	Unicast, multicast, broadcast
Half-Duplex	Half/Full-Duplex
Cheap	Expensive

Weaknesses of switches:

- Reduction in the number of Broadcast domains may restrict the range of certain network management and troubleshooting tasks reliant on broadcast traffic.
- Dealing with Multicast packets can be challenging due to the need for extensive configuration and proper design.

Switch ports: 24 to 48 ports. 3 types: Access port, trunk port, hybrid port.

## 2.2.4 Routers



- Routers connect multiple packet-switched networks or subnetworks and serve two primary purposes: managing congestion between these networks by forwarding data packets to their intended IP addresses and enabling multiple devices to utilize the same Internet connection.

Main characteristics of routers:

- Operating at the Network Layer (Layer 3) of the OSI model, routers make routing decisions based on IP addresses to direct data between different networks.
- Supporting filtering and encapsulation based on criteria such as source and destination IP addresses, ports, or protocols.
- Establishing various paths for data forwarding to optimize efficiency.
- Filtering out unwanted data to enhance network security and performance.
- Allows users to configure the port to their requirements in the network.
- Multi-port devices with high speed.

Differences between routers and switches:

Router	Switch
Work in Network Layer	Work in Data Link layer
Used by LAN and MAN	Used by LAN
Can work with wired and wireless networks	Can only work with wired networks
Data is sent in the form of packets	Data is sent in the form of frame
Less collision taking place in the router	No collision taking place in full duplex switch
Need at least two networks to connect	Need at least a single network to connect

Router ports: Console port, WIC port, HWIC port, Aux port, AUI port, Serial port, Ethernet port.

### 2.2.5 Access Points



- Roles of access points: Access points serve to increase the number of users able to join an existing network and extend its wireless coverage.

Main characteristics of access points:

- Network flexibility allows strategic placement to optimize coverage and adapt to changes in network requirements or user density. They often support advanced features like seamless roaming and network segmentation, enhancing flexibility and scalability.
- Expand network coverage by providing additional areas where users can wirelessly connect to the internet or other network resources.
- Enable more users to access the network, expanding connectivity in a wireless environment.

Access point's interfaces: Are exclusively provided for wireless clients to connect to an existing LAN, serving as central points for wireless connectivity, extending network coverage, and providing wireless access to a greater number of users. These interfaces include Ethernet Interface, Wireless Interface, and Management Interface.

Compare access points and other networking devices mentioned above:

#### Access Points vs. NIC (Network Interface Card)

- Access points offer wireless connectivity to multiple users, extending network coverage, while network interface cards (NICs) provide dedicated connections for individual computers.
- Access points have wireless interfaces to connect wireless clients, whereas NICs have Ethernet interfaces for wired networks.

#### Access Points vs. Hubs

- Access points expand wireless network coverage and provide connectivity for multiple wireless clients, while hubs simply repeat signals, connecting devices within a single network segment.
- **Characteristics:** Access points operate at the Data Link layer and support advanced features like seamless roaming and network segmentation, whereas hubs operate at the Physical Layer with limited functionality.



### Access Points vs. Switches

- Access points provide wireless connectivity and extend network coverage, whereas switches facilitate communication between wired devices in a LAN.
- Access points have wireless interfaces for wireless clients, while switches have Ethernet interfaces for wired devices.
- Switches support full-duplex communication and can create multiple collision domains, whereas access points focus on managing wireless connections and expanding coverage.

### Access Points vs. Routers

- Access points extend wireless network coverage and provide connectivity for wireless clients, while routers enable communication between different networks.
- Routers make routing decisions based on IP addresses for data forwarding between networks, whereas access points manage wireless connections within a single network.

## 2.2.6 Modem



Differentiate:

- Dial-up modem: Sends analog signals over telephone lines, typically used to connect to Internet Service Providers (ISPs) using analog signals.
- ADSL Modem: Uses telephone lines for bidirectional data transmission, offering faster speeds than traditional voice and modem connections.
- Cable Modem: Utilizes coaxial cables connected to the rear of the modem to establish internet connections.

For each type of modem describe its roles and characteristics:

#### • Dial-up Modem:

**Roles:** Sends analog signals over telephone lines, mainly for connecting to Internet Service Providers (ISPs) using analog signals.

**Characteristics:**

- Uses a standard telephone line for connection.
- Needs to dial a phone number to initiate a connection.
- Converts analog signals to digital for transmitting data over the telephone line.



- **ADSL Modem (Asymmetric Digital Subscriber Line):**

**Roles:** Utilizes telephone lines for bidirectional data transmission, offering faster speeds than traditional voice and modem connections.

**Characteristics:**

- Typically provides symmetrical upload and download speeds.
- Provides high-speed internet access via telephone lines.
- Requires a cable TV connection for internet access.

- **Cable Modem:**

**Roles:** Utilizes coaxial cables connected to the back edge of the modem to establish internet connections.

**Characteristics:**

- Provides high-speed internet access through cable television infrastructure.
- Offers higher bandwidth compared to dial-up and ADSL modems.
- Typically provides symmetric upload and download speeds.
- Requires a cable TV connection for internet access.

## 2.3 Connecting network devices:

Identify the type of network cable that can be used for the below network connections:

- a) Computer and hub: Straight through.
- b) Computer and switch: Straight through.
- c) Computer and router: Cross over.
- d) Computer hub and hub: Cross over.
- e) Hub and switch: Cross over.
- f) Hub and router: Straight through.
- g) Switch and switch: Cross over.
- h) Switch and router: Cross over.
- k) Router and router: Cross over.