Networking Basis

Types of Networks

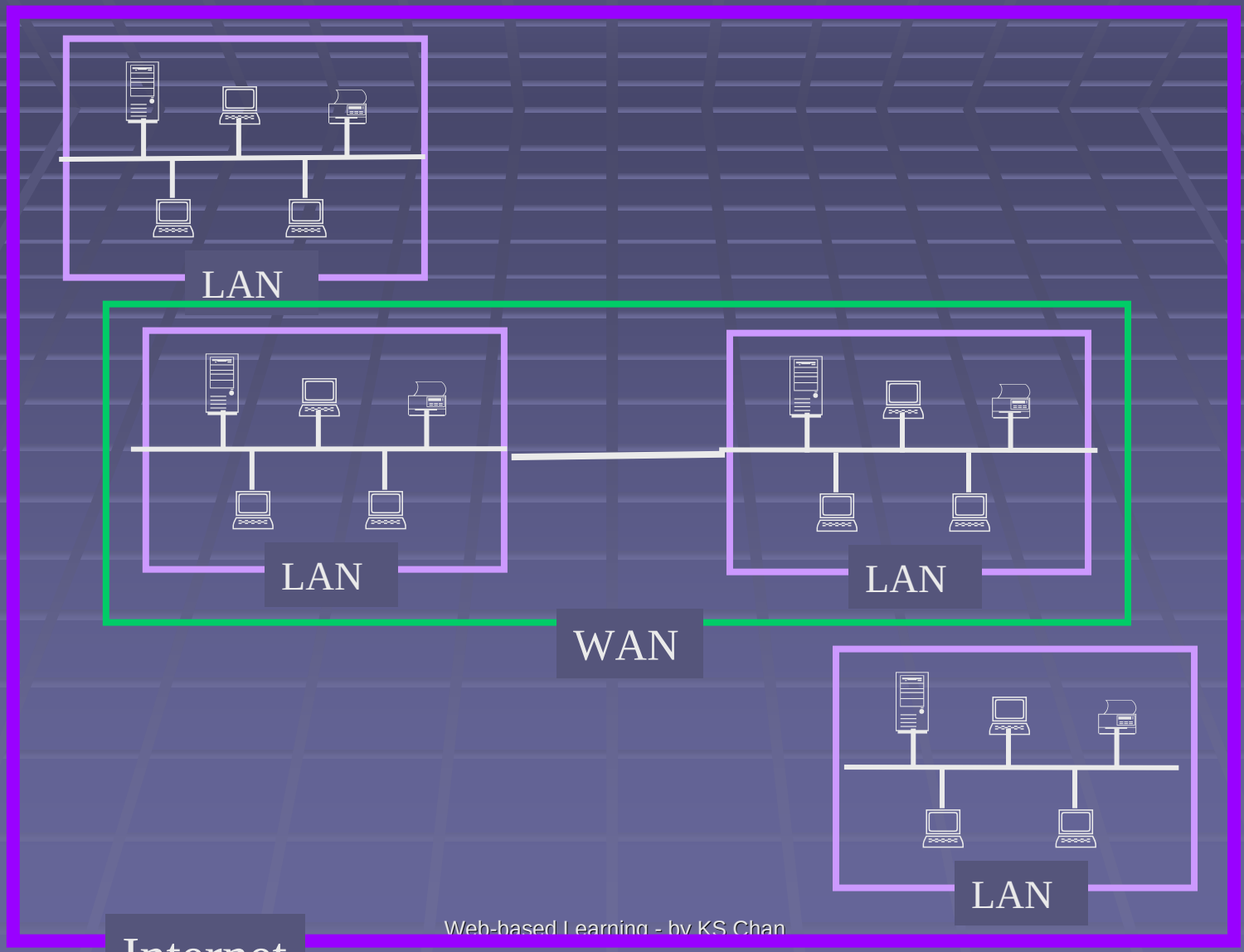
- There are two types of networks: LAN and WAN
- LAN
  - It stands for Local Area Network.
  - It is a network that linked computers together within a specified region, or within the same building. Eg. LAN of an office, LAN of a school, etc..

Types of Networks

WAN

- It stands Wide Area Network.
- It is a network that linked computers together over a longer distance or between two distant region.
- For example, a company builds a WAN which links the LAN in the head office in Hong Kong and the LAN in the sub office in Shanghai.

Types of Networks



Knowing Network Relationship Types

- The term *network relationship* refers to two different concepts about how one computer connects to another computer over the network.
- Two fundamental types of network relationships exists: Peer-to-Peer and Client/Server.
- These types of network relationships define the very structure of a network.

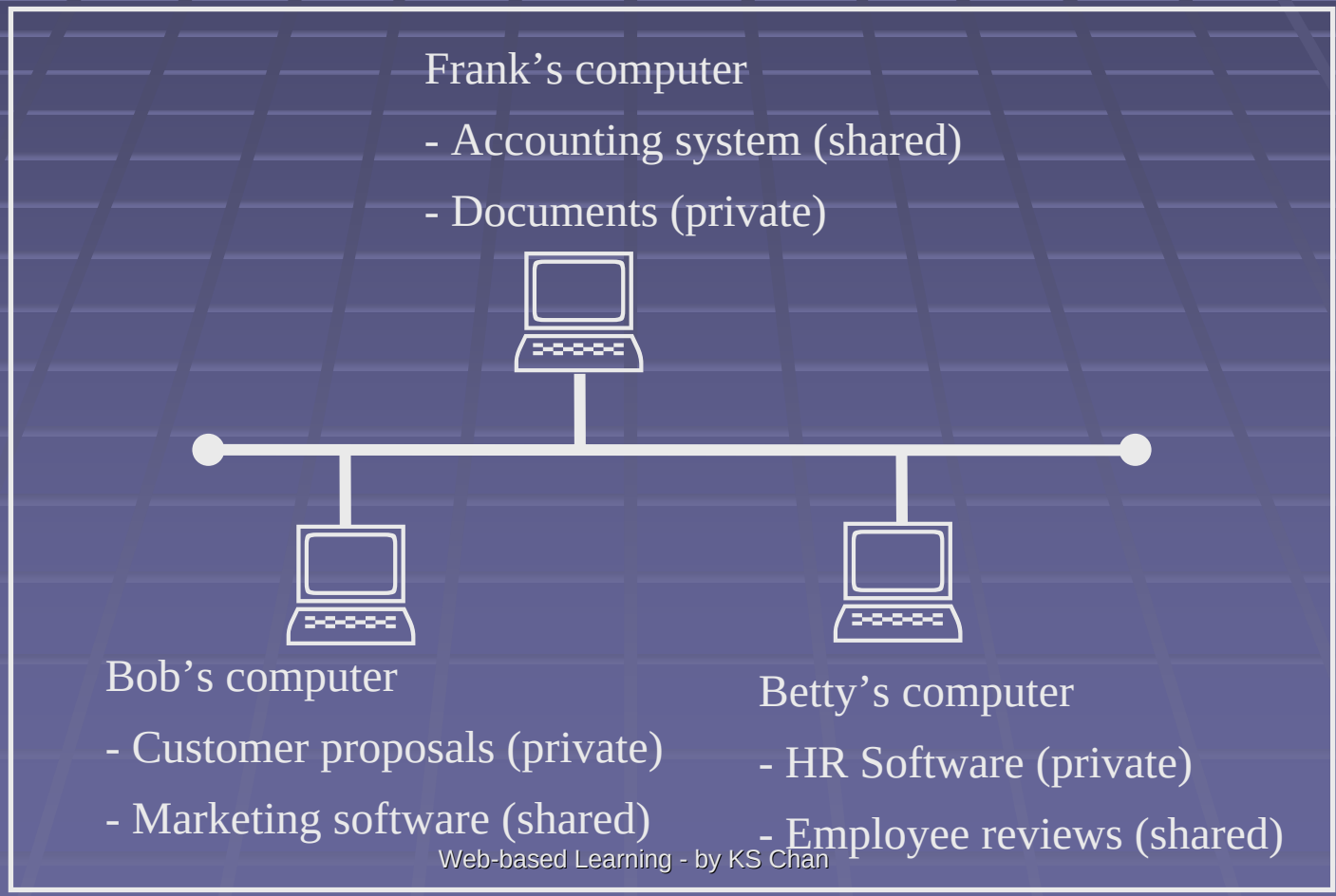
Knowing Network Relationship Types

Peer-to-Peer Network Relationships

- It defines one in which computers on the network communicate with each other as equals.
- Each computer is responsible for making its own resources available to other computers on the network.
- Each computer is also responsible for setting up and maintaining its own security for those resources.

Knowing Network Relationship Types

- Peer-to-Peer Network Relationships



Knowing Network Relationship Types

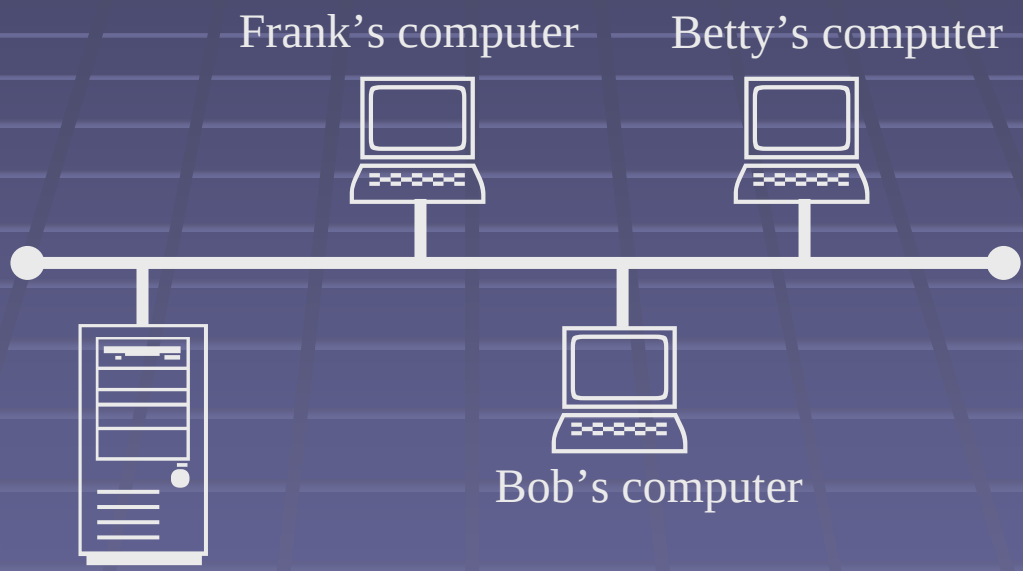
Client/Server Network Relationships

- It defines one in which a distinction exists between the computers that make a available network resources(*server*) and the computers that use the resources(*client*).

- A pure client/server network is one in which all network resources are centrally managed and hosted.

Knowing Network Relationship Types

- Client/Server Network Relationships



Server
- Accounting software(all)
- Documents (Frank only)
- HR software (Betty only)
- Employee reviews (Betty only)
- Customer proposals (Bob only)
- Marketing software (all)

Knowing Network Relationship Types

- Comparing peer-to-peer and client/server networks
  - Pros for Peer-to-Peer Network
    - Uses less expensive computer hardware
    - Easy to administer
    - No Network Operating System (NOS) needed
  - Cons for Peer-to-Peer Network
    - May hurt user's performance
    - Not very secure
    - Hard to back up

Knowing Network Relationship Types

- Comparing peer-to-peer and client/server networks
  - Pros for Client/Server Network
    - Very secure
    - Better Performance
    - Centralized backup
  - Cons for Client/Server Network
    - Require professional administration
    - More hardware intensive

Basic Network Features and Capabilities

- File Sharing

  It requires a shared directory or disk drive that many users can access over the network.

- Printer Sharing

  It can be done by either using *printer queue* on a server or letting each workstation access the printer directly.

Basic Network Features and Capabilities

Application Services

Just as sharing files on the network, application programs can also be shared on the network.

Electronic Mail

It is not only helpful for communications within an organization, but also fast becoming a preferred vehicle to communicate with people outside an organization.

Internet and Intranet

Internet

- Internet is a connection of worldwide LANs.
- An Internet connection for a network consists of a telecommunications network connected to an Internet Service Provider (ISP).
- Many different types of services are available over the Internet, including e-mail, the web, and Usenet newsgroup.

Internet and Intranet

Intranet

- Intranet is an internally focused network that mimics the Internet itself.
- An Intranet can host a web server, the documents in it are for internal use only.
- Intranets are usually not accessible from outside the LAN.

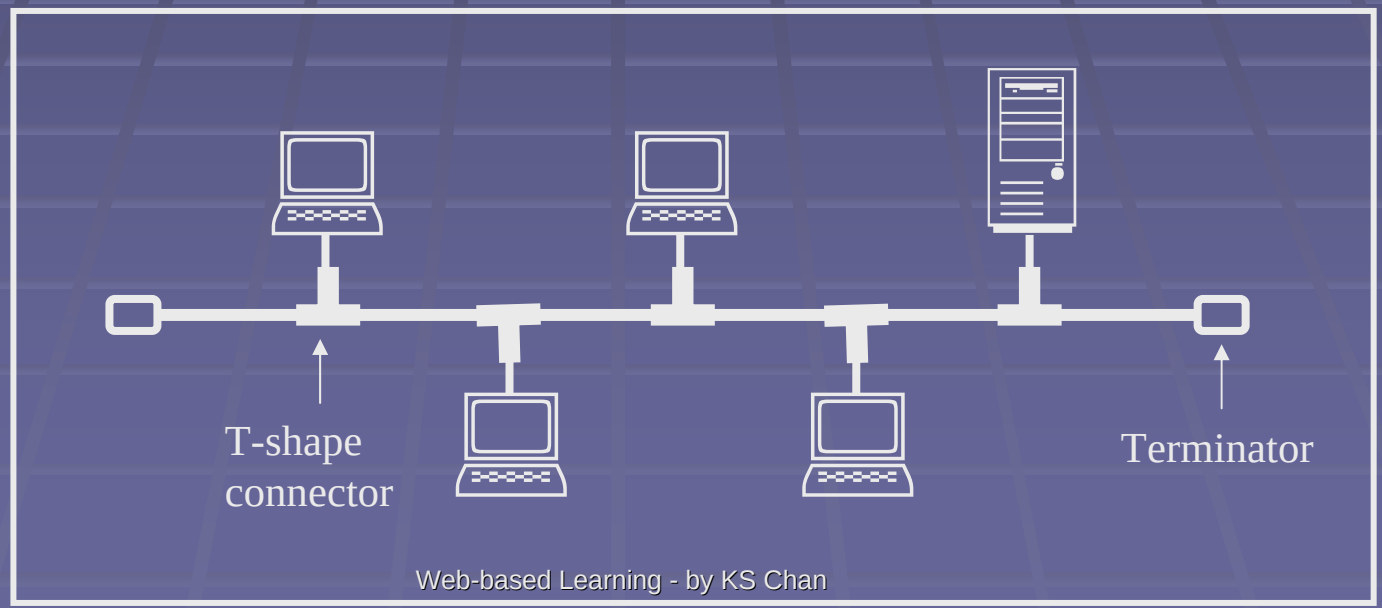
Network Topologies

- The term topology refers to the shape of a network.
- There are several different topologies in which networks are wired, and the selection of a topology is important.
- The three main network topologies are *Bus Topology*, *Star Topology* and *Ring Topology*.

Network Topologies

Bus Topology

- A bus topology, more completely called a *Common Bus Multipoint Topology*, is a network where a single cable is used from one end of the network to the other.



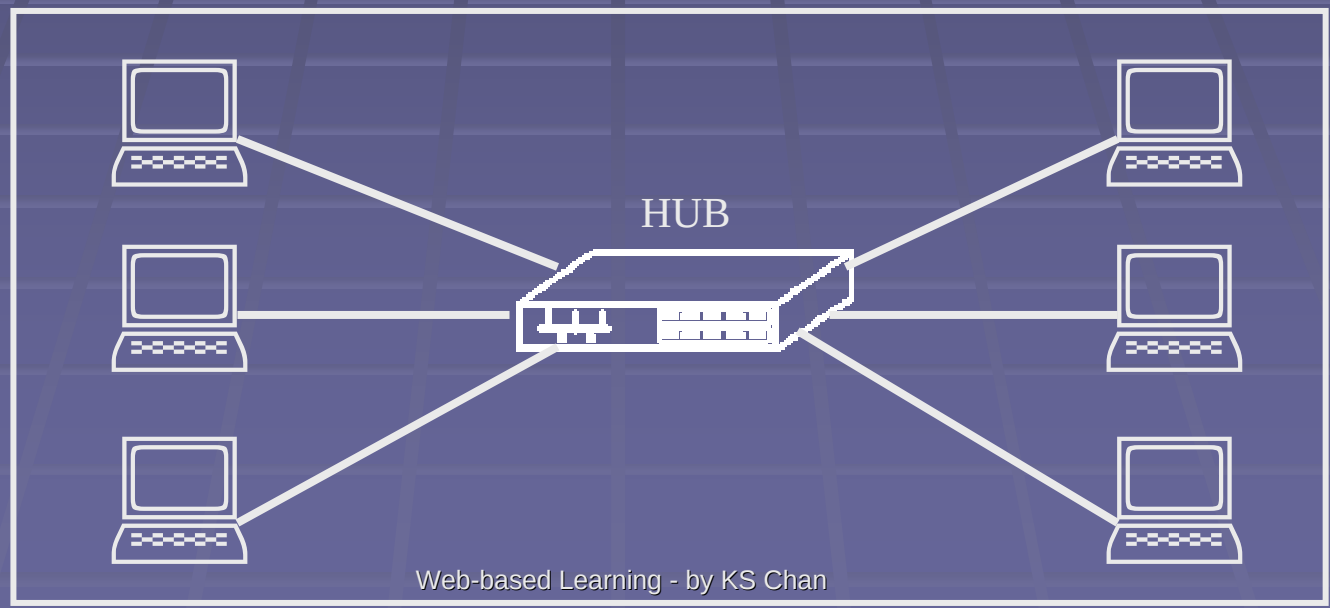
Network Topologies

- A bus topology networks use coaxial cable for connection. Each end of each segment of the network has a special cable terminator.
- Bus networks use *BNC* connectors to tie all the individual pieces of cable together. And, *BNC T-connectors* are used to connect each individual computers.
- The most common bus network in existence today is one called 10Base-2 Ethernet, or Thin Ethernet.

Network Topologies

Star Topology

- A star topology is one in which a central unit, called a *hub* or *concentrator*, hosts a set of network cables that radiate out to each node on the network.



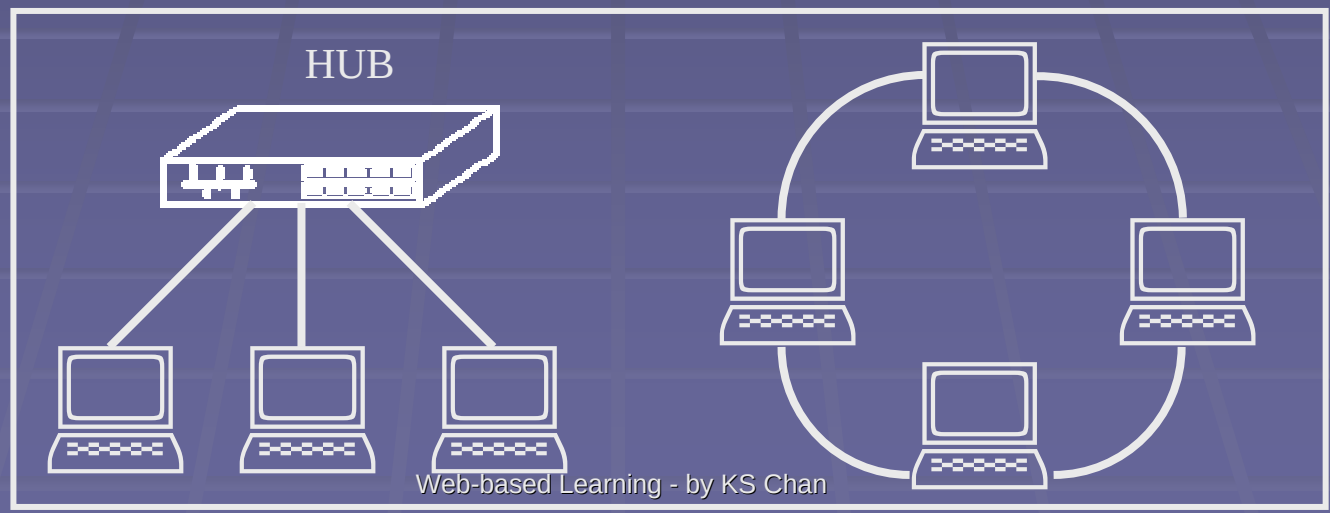
Network Topologies

- There are two common types of star networks, 10Base-T Ethernet and 100Base-T Ethernet.
- The 10Base-T Ethernet requires four actual wires (Cat-3 or Cat-5 cable) providing 10 Mbps of bandwidth.
- The 100Base-T Ethernet requires eight actual wires (Cat-5 cable) providing 100 Mbps of bandwidth.
- In star networks, RJ-45 connectors are used for all connection.

Network Topologies

Ring Topology

- A ring topology has its actual cables wired in a star shape.
- It is a logical arrangement, and the electrical signal travel round the ring to each node in turn.



Comparing Rings to Stars and Buses

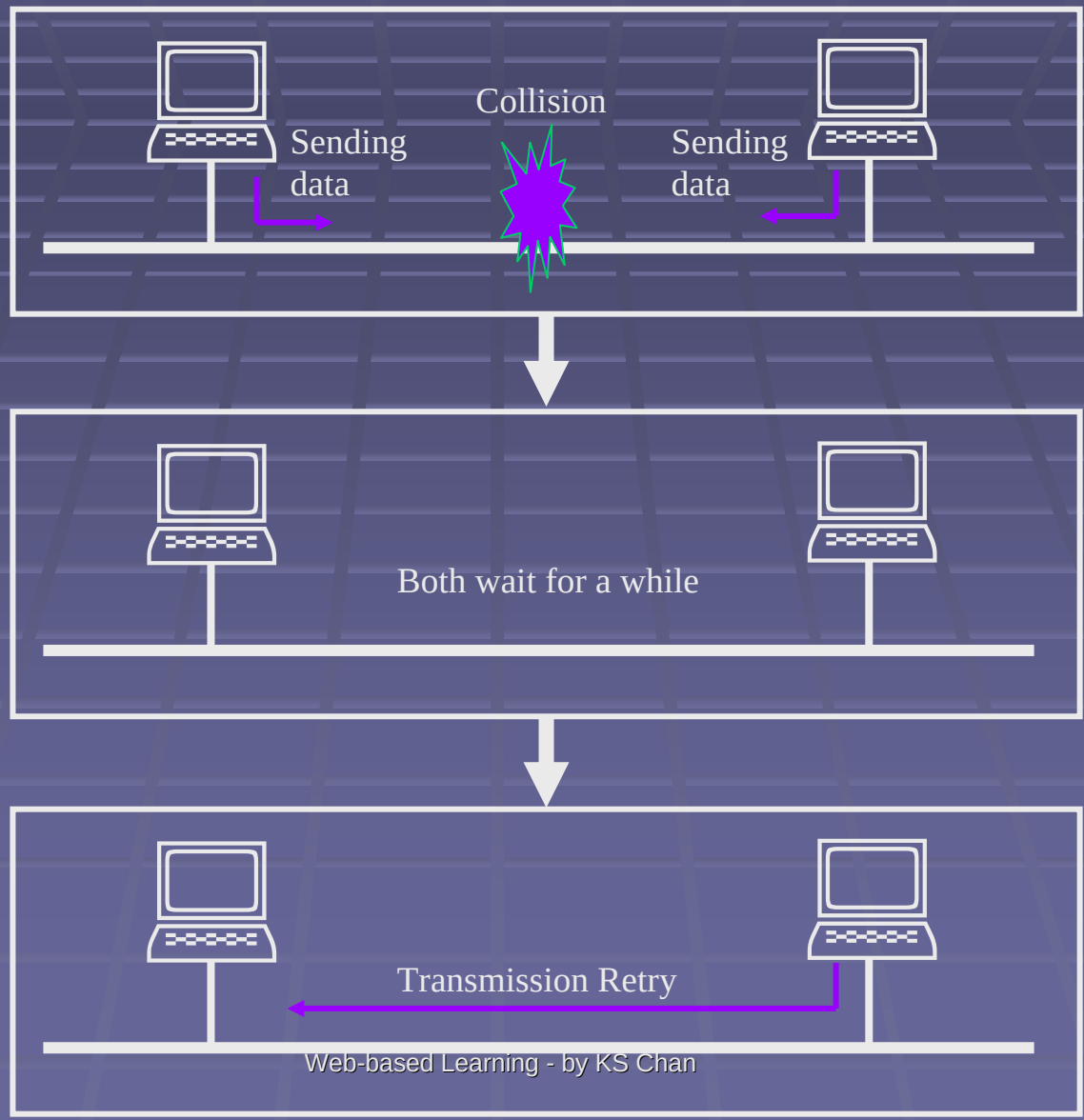
- The star and bus networks manage all the needed signals on the network using a technique called CSMA/CD.
- CSMA/CD stands for Carrier Sense Multiple Access/with Collision Detection.
- CSMA/CD allows each node on the segment to transmit data whenever it likes.

Comparing Rings to Stars and Buses

- If, by chance, two nodes try to transmit at the same time, they each detect this occurrence with their collision detection, and then both nodes wait a random amount of time to retry their transmission.

- In real world, CSMA/CD works well, and Ethernet is the predominant network standard in the world because it works so well and so flexible.

Comparing Rings to Stars and Buses



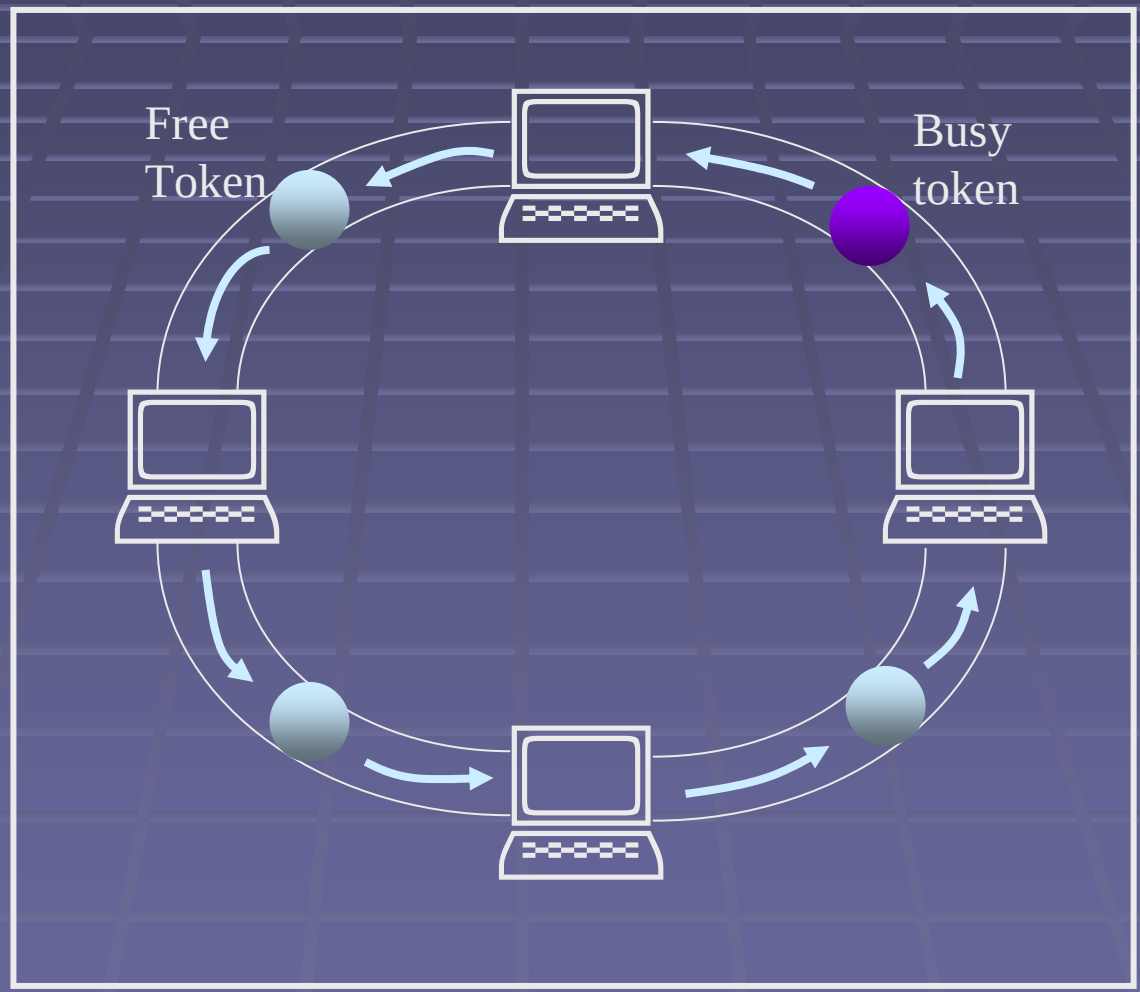
Comparing Rings to Stars and Buses

- Ring networks use the Token Ring technique for signal transmission.
- A data entity called a *token* circulates around the logical network ring. The token has two states: free and busy.
- When a node wants to transmit some data, it waits until the token coming into it is in a free state, and then the node marks the token busy.

Comparing Rings to Stars and Buses

- Next, after adding to the token packet the data to be sent and the destination address, the node sends the packet on to the next node.
- The next node, finding the token set to its busy state, examines the destination address and passes the token on unchanged toward the destination.
- Once the destination node receives the token, it gets its data, marks the token free, and sends it along to the next workstation.

Comparing Rings to Stars and Buses



10Base-What?

- The various Ethernet standards referred to as, for instance, 10Base-2, 10Base-T, 100Base-Tx...
- The first portion – the number – can be 10, 100, and this number indicates the data rate that the standard carries.
- The word *Base* means the network is *baseband, i.e. each line transmit a bit.*

10Base-What?

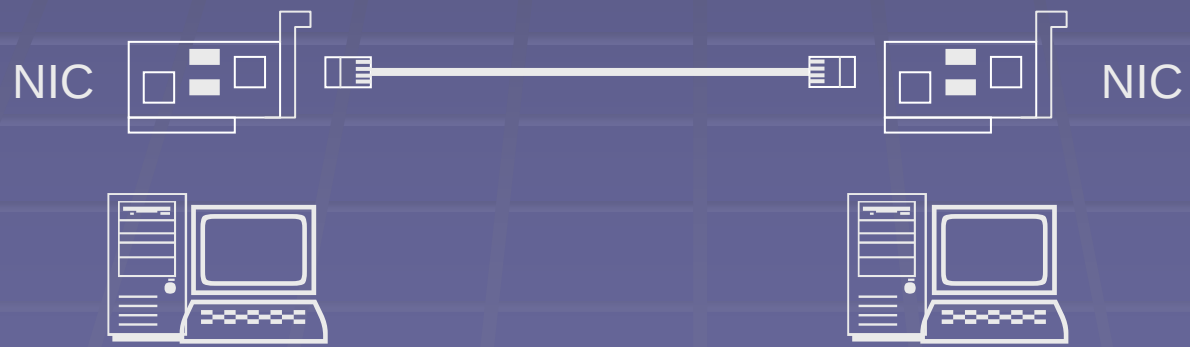
- The terminating number or letter indicates what sort of cable is used, with *T* denoting twisted-pair, *2* denoting thin coaxial, and *5* denoting thick coaxial.

- Example

10Base-5	10Mbps, coaxial(RG58 cable)
100Base-T	100Mbps, twisted-pair(CAT-5)
100Base-TX	100Mbps, fiber-optic cable

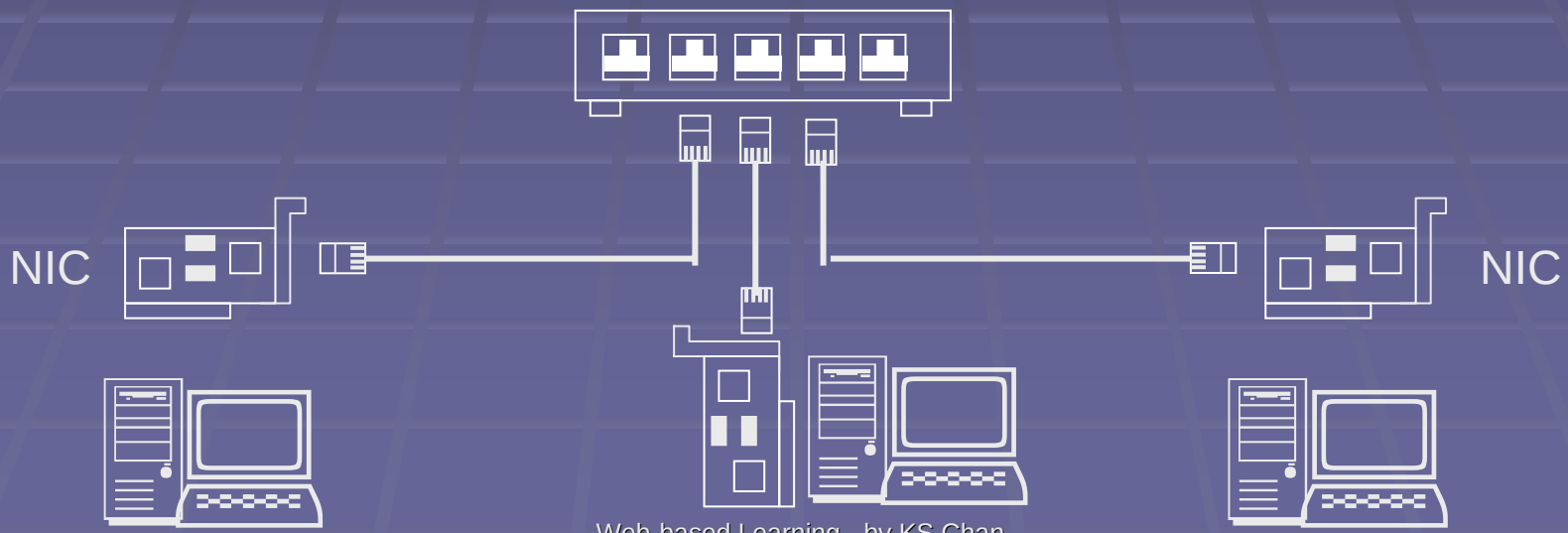
Constructing a LAN

- Case 1 – Direct connection between two computers
  - Network Interface Card x 2
  - Twisted-pair wire (Cross cable)



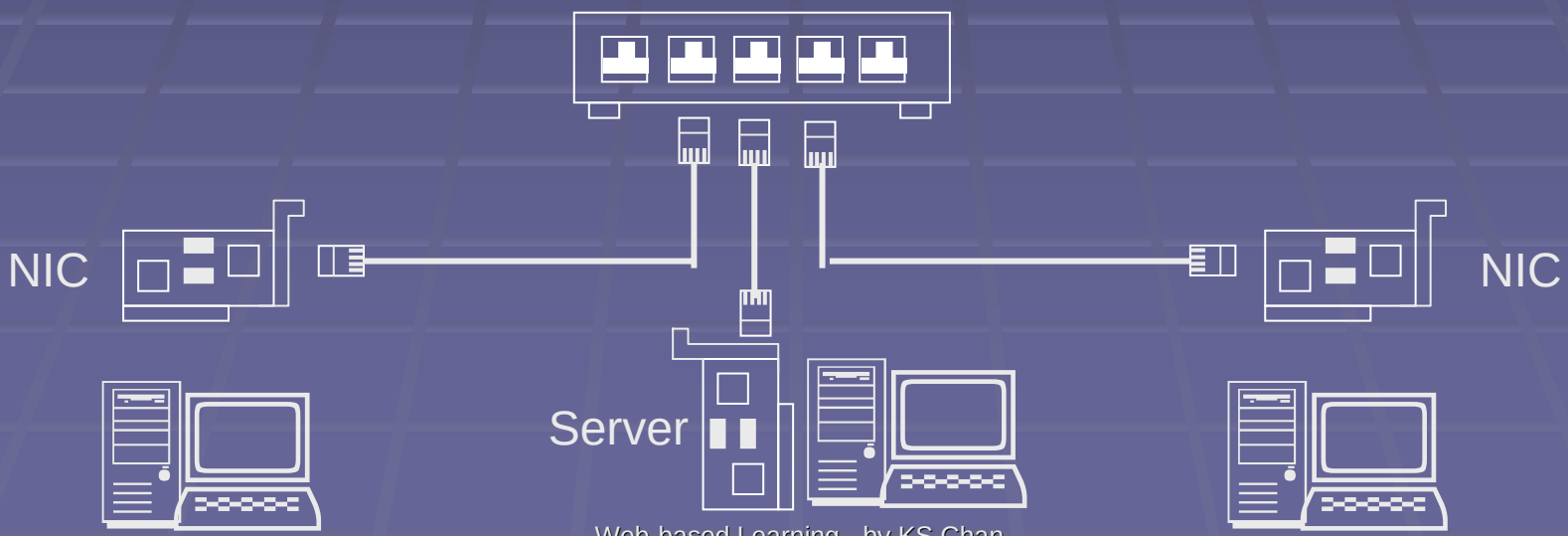
Constructing a LAN

- Case 2 – Peer-to-peer network with more than 2 computers
  - Network Interface Card (per each computer)
  - Twisted-pair wire (per each computer)
  - Hub / router



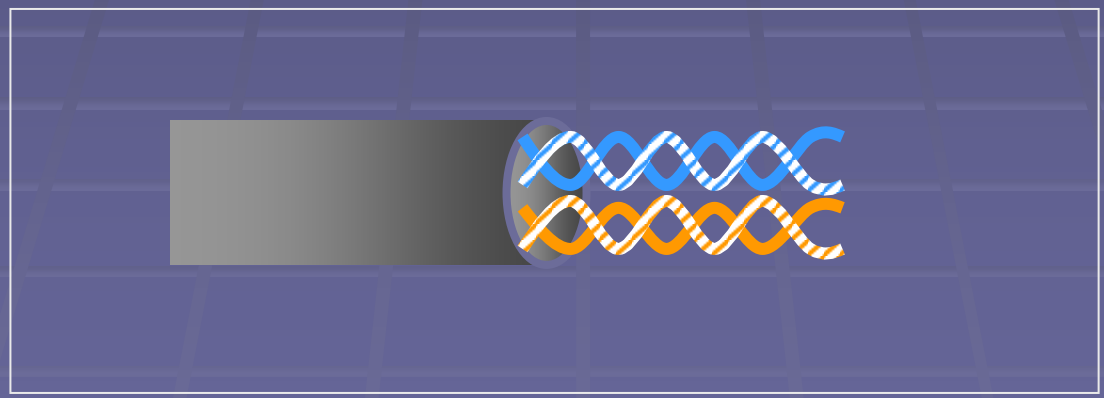
Constructing a LAN

- Case 3 – Client/Server network
  - Network Interface Card (per each computer)
  - Twisted-pair wire (per each computer)
  - Hub / router
  - Server



Cable Types

- Unshielded Twisted-Pair wire
  - It is, by far, the most common wire used today.
  - It consists of two or more pairs of plastic-insulate conductors inside a cable sheath.



Cable Types

- UTP wires are classified into 5 categories:

Category	Maximum data rate
1, 2	4 Mbps
3	16 Mbps
4	20 Mbps
5	100 Mbps

- Among the 5 categories, CAT-5 UTP cable is most commonly used.

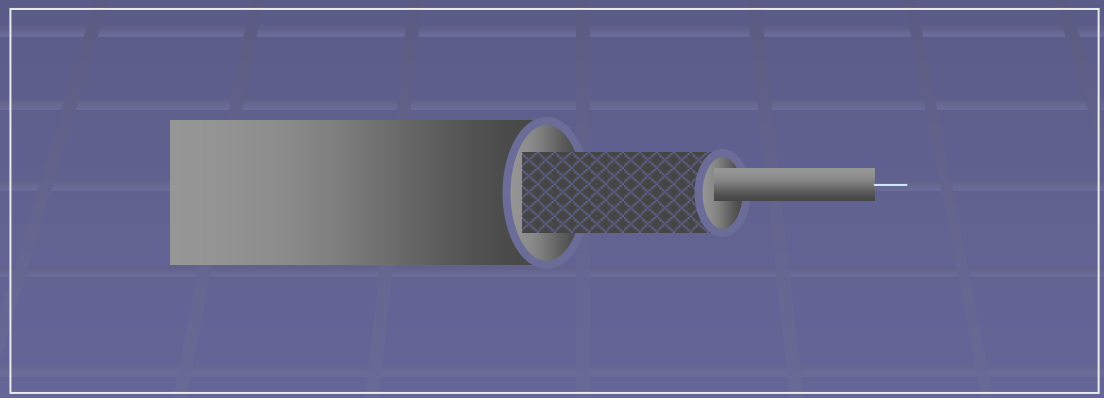
Cable Types

- Shielded Twisted-Pair wire
  - It is similar to UTP, but it has a braided metal shield surrounding the twisted-pairs to reduce further the chance of interference from electrical sources outside the cable.
  - UTP is used instead of STP almost all the cases because it’s less expensive, easier to installed and maintain.

Cable Types

Coaxial Cable

- It consists of a central copper conductor wrapped in a plastic insulation material, which in turn, surrounded by a braided wire shield and, finally, wrapped in a plastic cable sheath.



Cable Types

Fiber-optic Cable

- It uses a glass strand and carries the data signal signals as light instead of electricity.
- It can span extremely long distances, up to 10 km at 100 Mbps.
- It is often used to connect buildings in campus-like setting together.

Network Hardware Components

Network Interface Card

- It is also called LAN Card or Network Adaptor.
- Each NIC has a unique MAC address which is assigned by the manufacturer.
- There are several NIC interface:

  ISA interface, PCI interface, PCMCIA interface and USB interface

Network Hardware Components

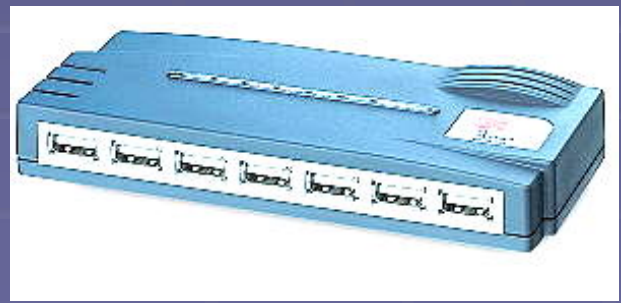
Servers

- It is any computer that performs network functions for other computers.
- There are several different types of servers: File and Print Server, Application Server, Email Server etc..
- Servers typically run some sort of Network Operating System(NOS), such as Windows NT Server, Netware or UNIX..

Network Hardware Components

Hubs

- It is sometimes called a concentrator, which is a device that connects a number of network cables coming from client computers to a network.
- There are two category of Hubs: Passive Hub and Active Hub.



Network Hardware Components

Hubs

- Passive Hub – it receive and transmit data without any implementation.
- Active Hub – it receive and transmit data after getting rid of noise.
- There are three types of Active Hubs:

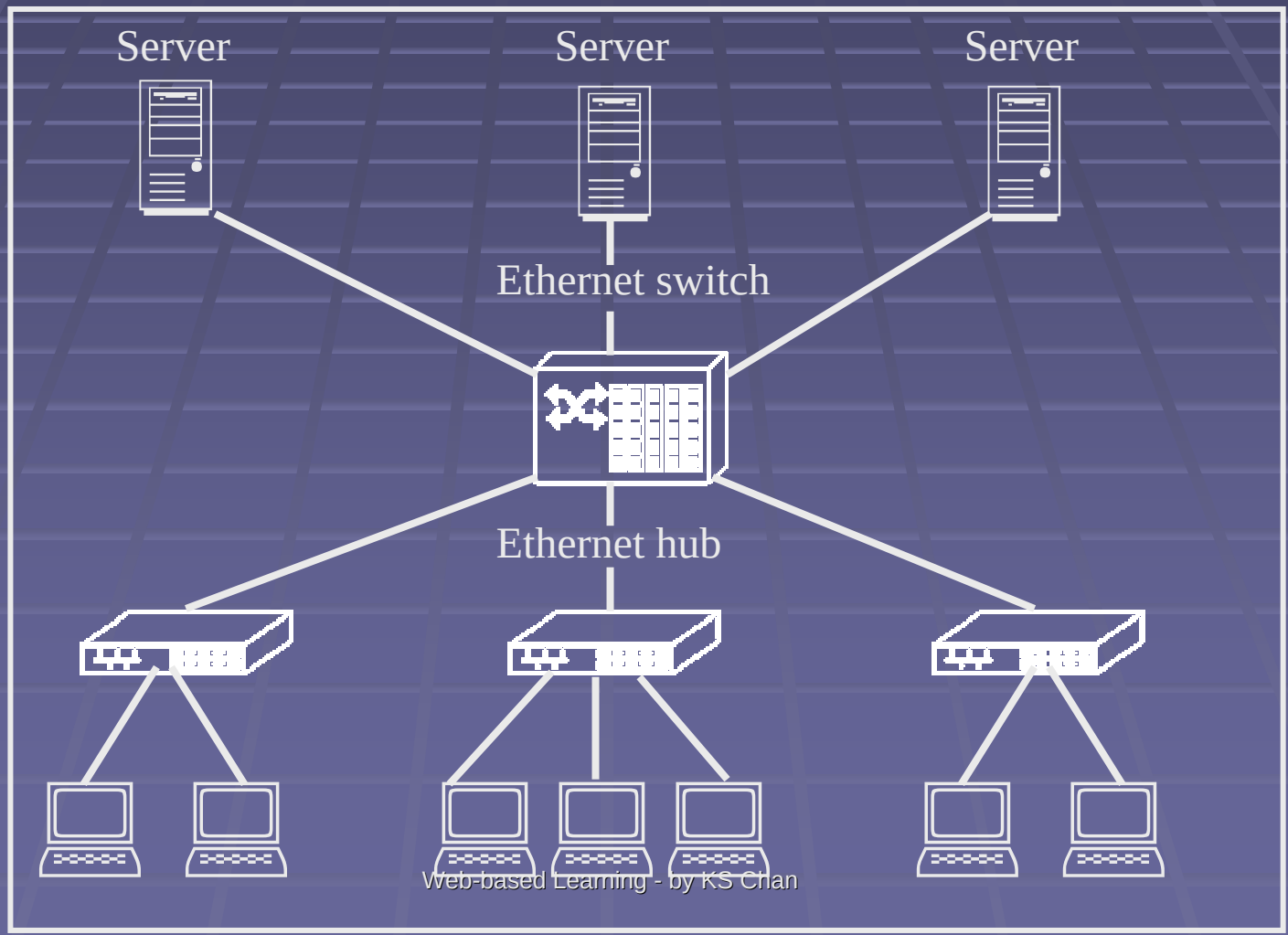
  Repeater Hub, Switching Hub and Dual Speed Hub

Network Hardware Components

- Switch
  - It looks like a hub, but a switch makes each network connection a private one, and then collects the data form each of the connections and forwards the data to a network backbone.
- Router
  - It routes data packets from one network to another.

Network Hardware Components

- Using switches and hubs in concert



The OSI Networking Model

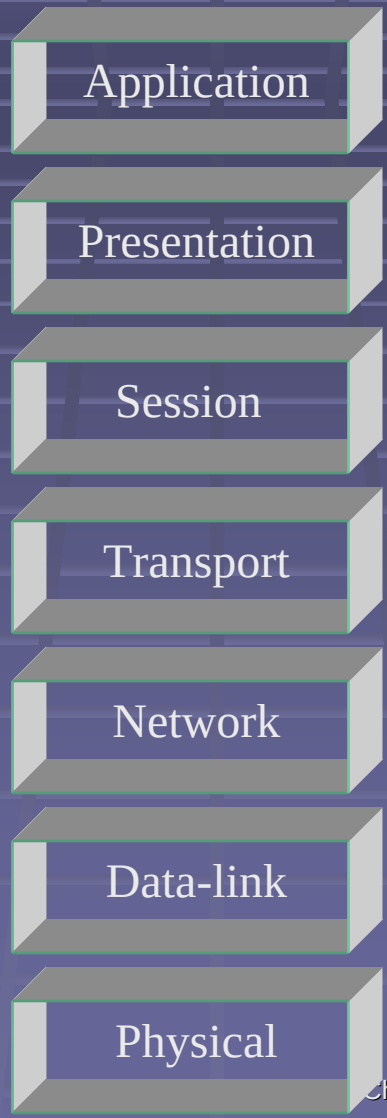
- OSI stands for Open Systems Interconnection.
- It is the model defines all the methods and protocols needed to connect one computer to any other over a network.
- Generally, all real-world networks conform to the OSI model.

The OSI Networking Model

- The OSI model separates the methods and protocols needed for a network connection into seven different layers. Thus, it is sometimes called “the seven-layer model”.

- For a complete network connection, data flow from the top layer on one computer, down through all lower layers, across the wire, and back up the seven layers on the other computer.

The OSI Networking Model



The OSI Networking Model

Physical Layer

- It is the first layer defines the properties of physical medium used to make a network connection, i.e. the network cable.
- It specifies how the stream of bits transmit between nodes. It also defines the cable used, the voltages carried, the timing of the electrical signals, the distance that can be run, and so on.
- A network interface card (NIC), for example, is part of the physical layer.

The OSI Networking Model

Data-Link Layer

- It is the second layer defines standards that assign meaning to the bits carried by the physical layer.
- It establishes a reliable protocol through the physical layer so the network layer(layer 3) can transmit its data.
- This layer includes error detection and correction to ensure a reliable data stream.

The OSI Networking Model

Network Layer

- It is the third layer defines how data packages get from one point to another on a network and what goes into each packet.
- It defines different packet protocols, such as IP(Internet Protocol) and IPX(Internet Protocol Exchange). These packet protocols include source and destination routing information.

The OSI Networking Model

Transport Layer

- It is the forth layer manages the flow of information from one network node to another. It ensures that the packets are decoded in the proper sequence and that all packets are received.
- Example of transport layer protocols include TCP(Transmission Control Protocol) and SPX(Sequenced Packet Exchange). Each is used in concert with IP and IPX, respectively.

The OSI Networking Model

Session Layer

- It is the fifth layer defines the connection from a user to a network server, or from a peer on a network to another peer.
- They include negotiation between the client and host, or peer and peer, on matters of flow control, transaction processing, transfer of user information, and authentication to the network.

The OSI Networking Model

Presentation Layer

- It is the sixth layer takes the data supplied by the lower-level layers and transforms it so it can be presented to the system.
- The functions take place at the presentation layer can include data compression and decompression, as well as data encryption and decryption.

The OSI Networking Model

Application Layer

- It is the seventh layer controls how the operating system and its applications interact with the network.
- An example of software at the application layer is the network you use , such as the Windows Client for Microsoft Networks, the Windows Client for Novell Networks, or Novell's Client32 software.
- It also controls how the operating system and applications interact with those clients.