chapter 4

Local Area Networks - Connectivity

CHAPTER OBJECTIVES

- Describe the purpose of a repeater and indicate where repeaters are used.
- Discuss different hub technologies and where hubs are used.
- Discuss bridge technology and identify where bridges are used.
- Discuss switch technologies.
- Compare the differences between routing and switching.

라우팅 스위치 = 라우터

- List the functions of a gateway, and identify the reasons that gateways are implemented.

CHAPTER OBJECTIVES (cont'd)

- Identify the three layers of network backbone
- Describe the Internet Protocol and provide examples of different IP address classes.
- Identify different methods of assigning IP addresses and the business impact of DHCP.
- List and describe other LAN communications protocols and their importance.
- Describe the network management protocol, SNMP.

LAN DEVICES

- These are the hardware components that provide the interfaces among servers, workstations, and media types in a LAN.
- LAN devices provide a variety of functions.
- Repeaters, hubs, bridges, switches, routers, and gateways are common LAN devices.

LAN DEVICES

- Repeater – extends the distance over which a signal can be transmitted.
  - It's an OSI layer 1 device.
  - A repeater receives a signal from a media segment, cleans the signal, amplifies it, and then sends the signal onto the next media segment.
  - Repeaters are commonly built into LAN devices such as hubs or switches.

물리계층에 속하는 장비

키우다

신호가 전송될 수 있는 기회를 늘려주는 장비. 리피터를 단독 장비로 사용하는 경우는 거의 없다.

LAN DEVICES

- Hubs – are LAN devices to which servers, workstations, printers, and other computing devices can be connected.
  - Hubs are OSI layer 1 devices. 신호만 관여한다. 데이터 분석 x
  - Hubs do not interpret data – that is, they're unaware of source and destination addresses.
  - All packets flowing through a hub are broadcast to all other devices that are connected to the hub. 받은 거를 뿌려주기 때문에 브로드 케스팅 역할을 한다.

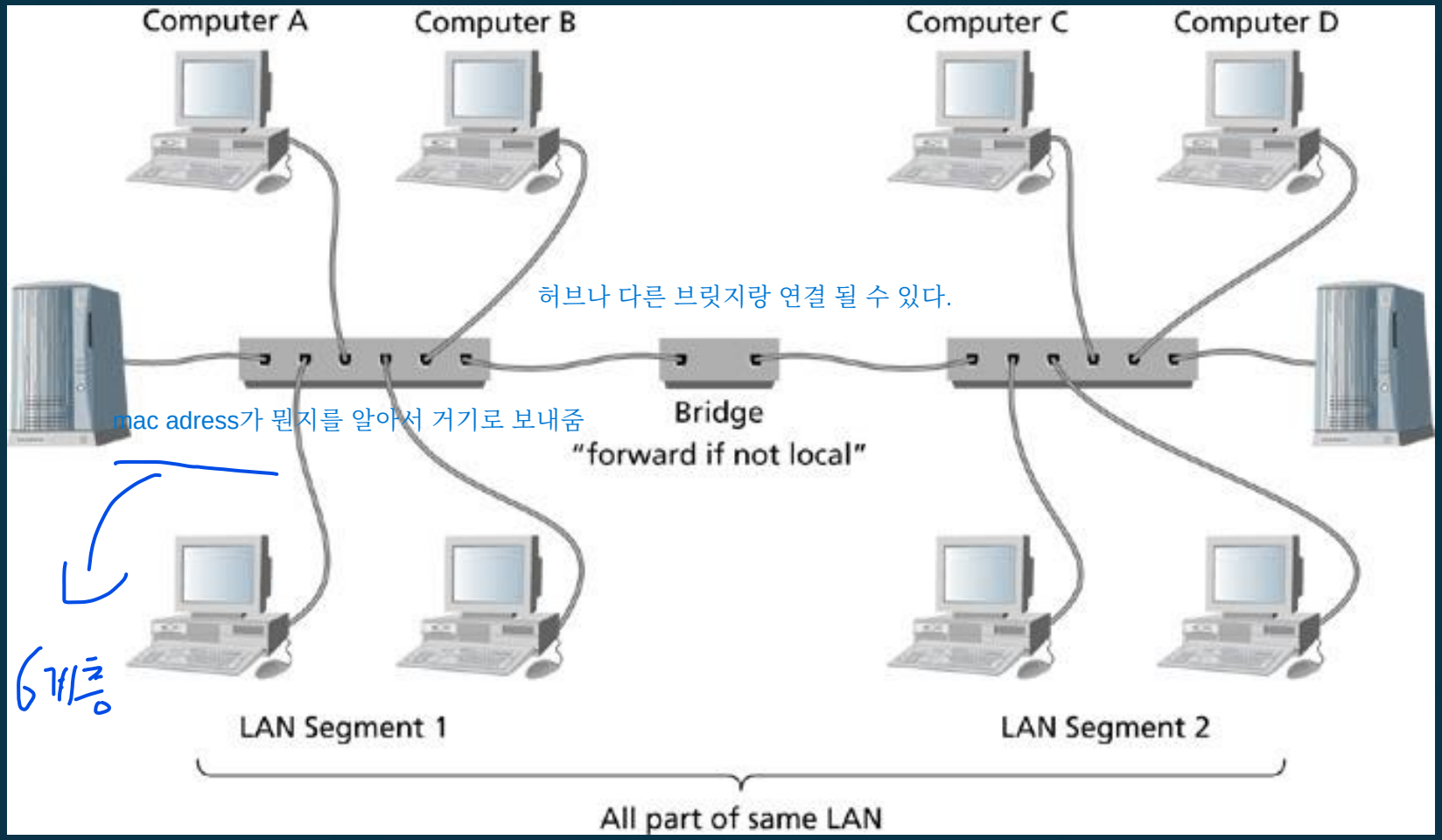
허브는 다양한 장치를 연결하는데 관여한다

Simple LAN Hubs

LAN DEVICES

- Bridges 랜을 구성할 때 몇개의 세그먼트로 나눌 수 있다.
  - Are LAN devices that connect two or more LAN segments while simultaneously filtering network data transmissions between the segments.
  - Bridges are sometimes referred to as “forward if not local” LAN devices.
  - A bridge can improve overall LAN performance.

LAN Bridge Connecting Two LAN Segments



LAN DEVICES

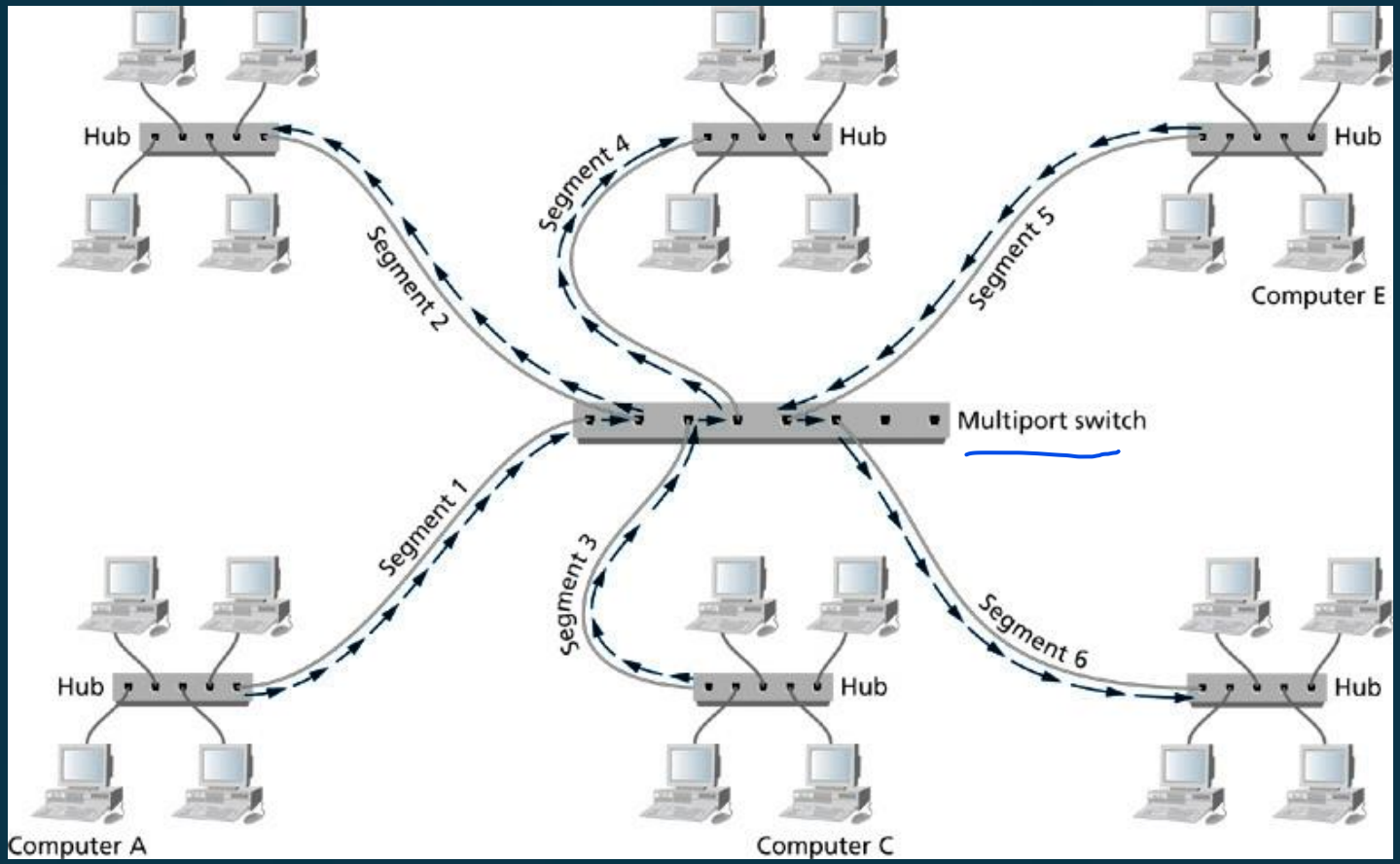
- Bridges (cont'd)
  - Have a built-in algorithm that learns the MAC (Media Access Control) address of each network card in each computing device on each LAN segment that is connected to the bridge.
  - MAC addresses are stored in a MAC address table.
  - The MAC address table is used in filtering data transmissions between LAN segments.

LAN DEVICES

- Switches 허브랑 다르게 1대1 통신을 한다 mac adress를 식별해서 통신
  - Are very similar to bridges. 스위치는 다양한 종류의 디바이스와 연결이 가능하다.
  - Switch ports can be directly connected to individual PCs, servers, hubs, bridges, other switches, and to routers whereas:
    - Bridges were typically connected to hubs or other bridges.
  - Switches use special hardware components that can read multiple ports simultaneously and establish multiple and simultaneous forwarding paths whereas:
    - Bridges generally had a single central processor that limited frame processing and forwarding to one frame at a time.

브릿지보다 성능이 훨씬 좋다 브릿지는 성능이 들어오는 순서대로 , 직렬적으로 처리하지만 스위치는 병렬적으로 처리 가능하다. 퍼포먼스가 훨씬 빠르다.

Data Propagation on a Multiport Switch



LAN DEVICES

보낸 데이터를 일단 다 받고 바로 보내는 게 아니라 저장했다가 보내준다 . 이 데이터가 오류 없이 왔는지 검증하기 위해서.

- Store and Forward Switches
  - Are designed to perform error checking on each frame after the entire frame has been received into the switch.
  - If the frame is error free, the switch forwards the frame to the appropriate port.
  - Bad frames are not forwarded which makes this switch type highly reliable.
  - They are slower than other switch types because they hold onto each frame until it is completely received in to check for errors.

LAN DEVICES

- Cut Through Switches

오류체크를 안하는 스위치

  - Do not perform error checking on frames.
  - Are faster than store and forward switches.
  - Read only the address information for each frame as frames enter the switch.

검사를 하는 스위치보다 빠르다. 신뢰도는 스토어앤 포워드 스위치가 훨씬 높다.

사진 이미지 비디오 이런것들 다루면 컷트로우가 유리하다. 데이터가 조금 깨져봐야 점하나가 다르게 찍히는 거임

LAN DEVICES

- Higher Layer Switches

l2 장비라고 부른다.

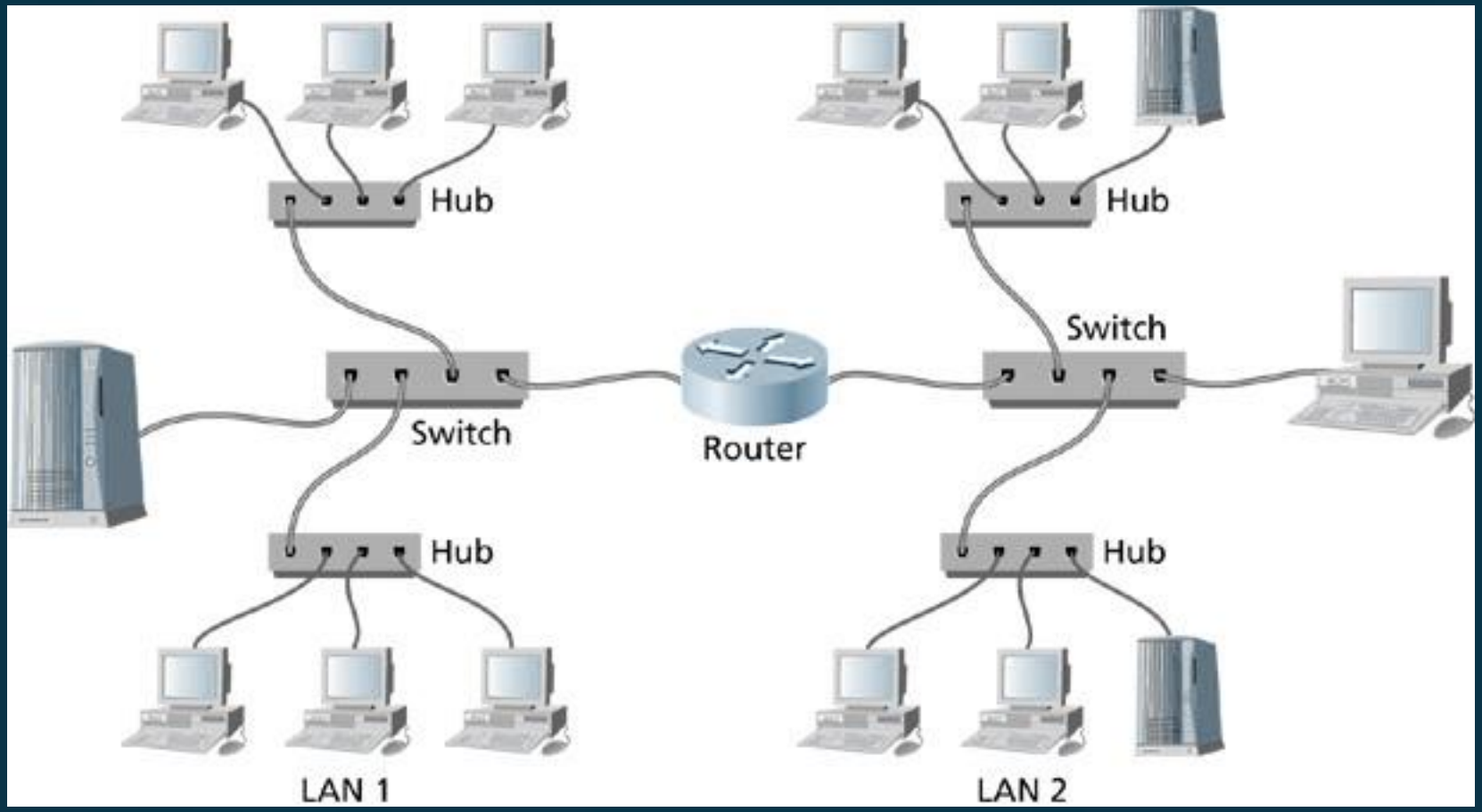
  - Traditional switches operate at OSI layer 2.
  - Newer switches can incorporate functionality for OSI layer 3 and OSI layer 4.
  - Layer 3 switches add routing capability.
  - Layer 4 switches add TCP port-level services.

LAN DEVICES

네트워크와 네트워크를 이어주는 장비가 라우터

- Routers 브로드캐스팅 메세지를 필터링을 해준다. 해주지 않는다면 광고 , 스팸이 미쳐날뛸거다.
  - Operate at OSI layer 3. 네트워크 계층 IP 주소를 다룬다 .
  - Allow packets to flow between networks.
  - Connect two or more networks, separate broadcast domains, and direct packets to their destinations based on IP addresses and across the best possible route.
  - Establish a path over which computers on one network can communicate with computers on another network.

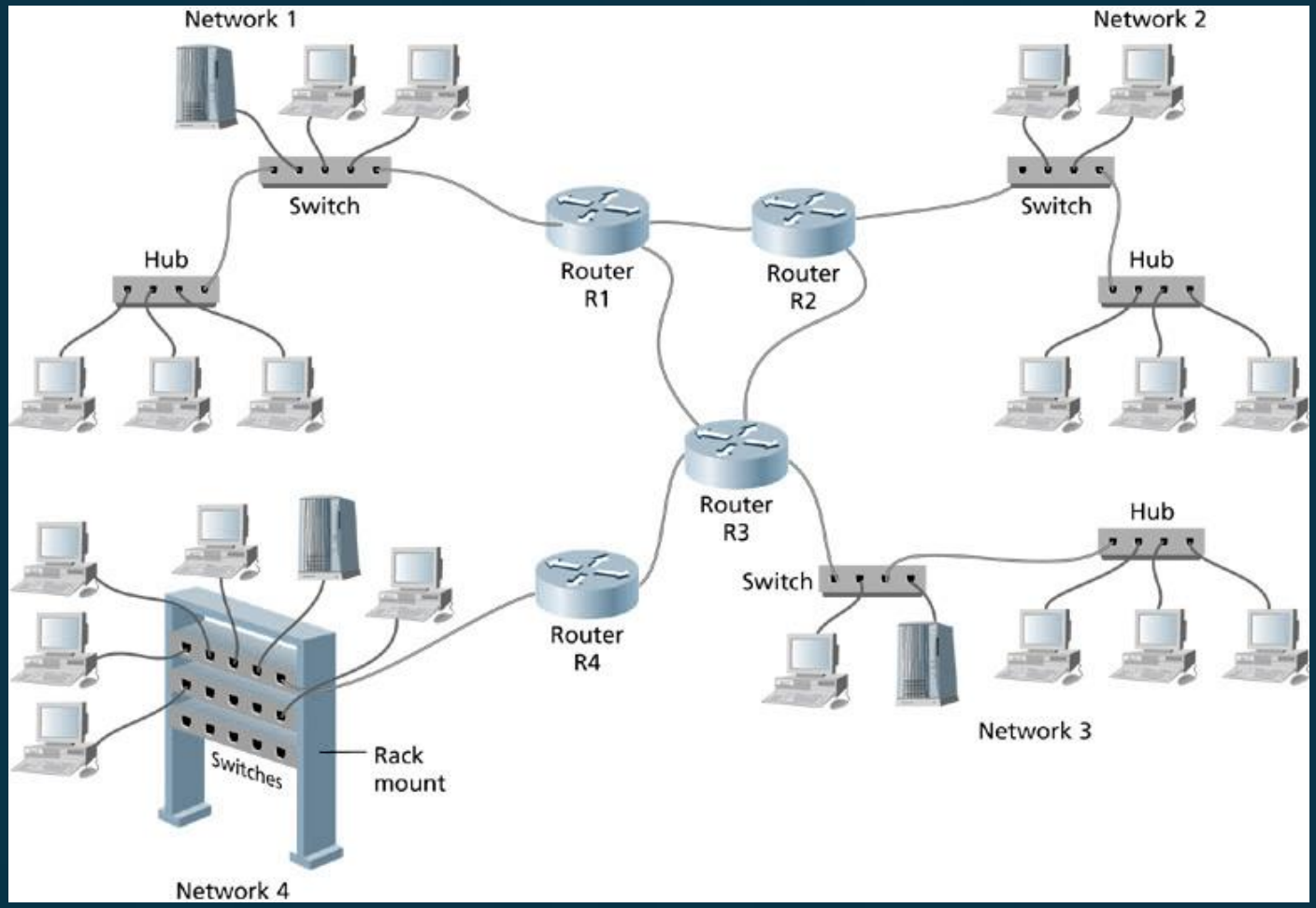
Two Networks Connected by a Router



LAN DEVICES

- Routers (cont'd)
  - Improve network security by filtering broadcasts.
  - Can be installed at the edge or border of a LAN to connect a LAN to distant networks.
  - Each router maintains a routing table that stores addresses of other networks and best paths and path costs to other networks.

Networks Interconnected by Routers



라우터는 하나이상의 라우터와 연결이 되어야 한다.

LAN DEVICES

- Creating Routing Paths
  - Static Routing – a network administrator defines the paths to other networks, creates an entry for each path, assigns metrics to those paths, and manually enters this information into the routing table.
  - Static routing is effective when routing metrics are not expected to change over time.

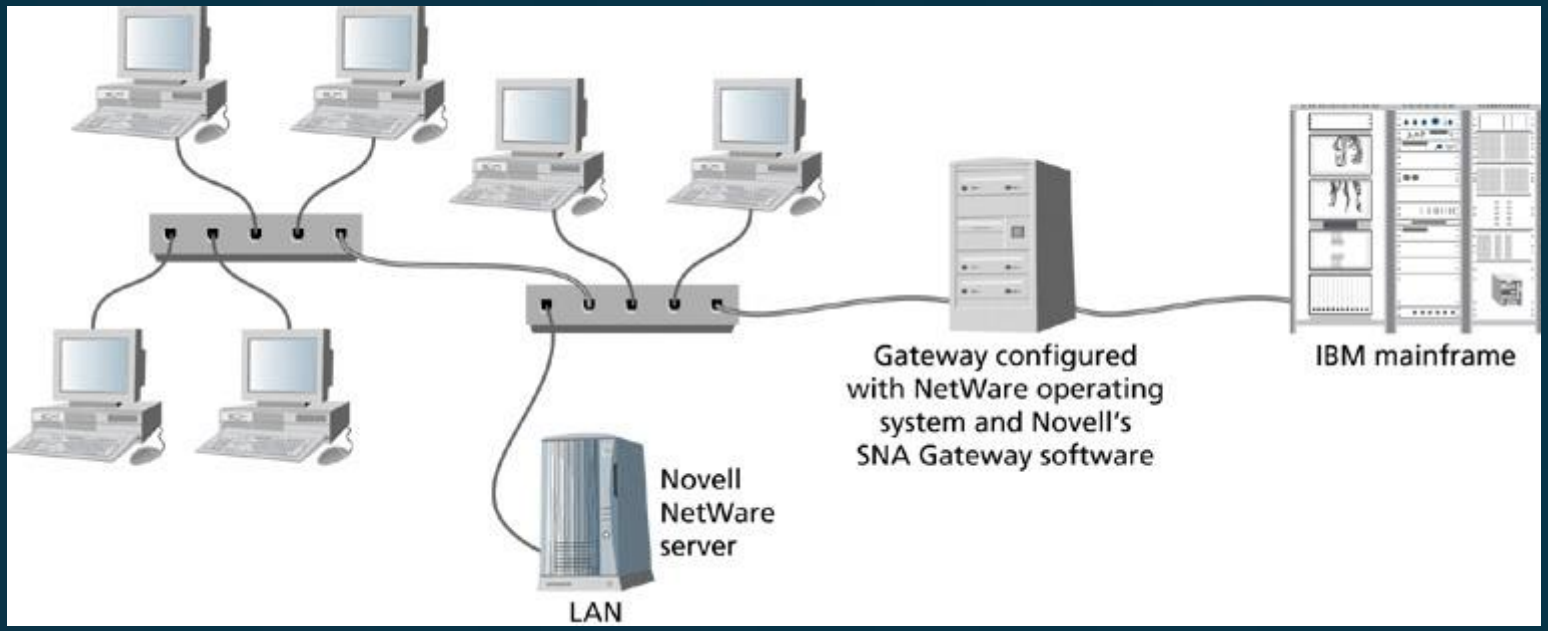
LAN DEVICES

- Creating Routing Paths (cont'd)
  - Dynamic routing – provides a mechanism for routers to automatically accommodate new routes and changing network conditions using sophisticated software known as a dynamic routing algorithm.
  - The routing algorithm is part of the router's operating system, and when a change is detected along any of the paths between the source and destination network, the routing algorithm recalculates optimal paths and updates the routing table.
  - The routing algorithm also exchanges updated information with other routers.

LAN DEVICES

- Gateways 서로가 다를 때 역할을 수행해준다.
  - A gateway is hardware or software or a combination of both that provides protocol translation or connectivity between disparate systems.
  - Operate above OSI layer 3.
  - Example use includes connecting a LAN to a mainframe computer, connecting a LAN e-mail system to external e-mail providers, and connecting a non IP network to the Internet.

Connecting Client Workstations to a Mainframe through Novell's SNA Gateway Software



LAN BACKBONES

- Network Backbones
  척추
  - Are the combination of hardware, media, protocols, and architecture that form the high-speed communications links between two networks.

    네트워크에서 가장 중요한 구간?? : 데이터 이동이 많은 구간.

    하드웨어 , 프로토콜 ,아키텍처 등 다양한 기술들이 조합되어 고속 통신을 가능하게 해주는 것들이다.

Simple Backbone

LAN BACKBONES – BACKBONE DESIGN

- Backbone Fault Tolerance and Load Balancing
  - Fault tolerance provides the ability to continue transmitting data across the backbone in the event that a backbone device or data path fails.
  - Load balancing provides the ability to transmit data that's going to the same destination across multiple paths simultaneously.
  - Requires the implementation of duplicate distribution layer switches, duplicate core layer switches, and redundant cabling to establish the extra data paths.

BACKBONE DATA TRANSMISSION ARCHITECTURES

- Any network backbone should incorporate a high-speed data transmission architecture.
- Examples include FDDI, ATM, Gigabit Ethernet, and 10 Gig Ethernet.

LAN PROTOCOLS

여러 나라가 모여서 합의한 약속들을 모아놓은 것을 통상적으로 프로토콜이라고 함

- Protocols are the rules that specify how services and devices exchange information.
- Protocols define the ways in which data can be packaged, how data can access a network medium, how data can be transported, how data is reassembled at the destination, and so on.

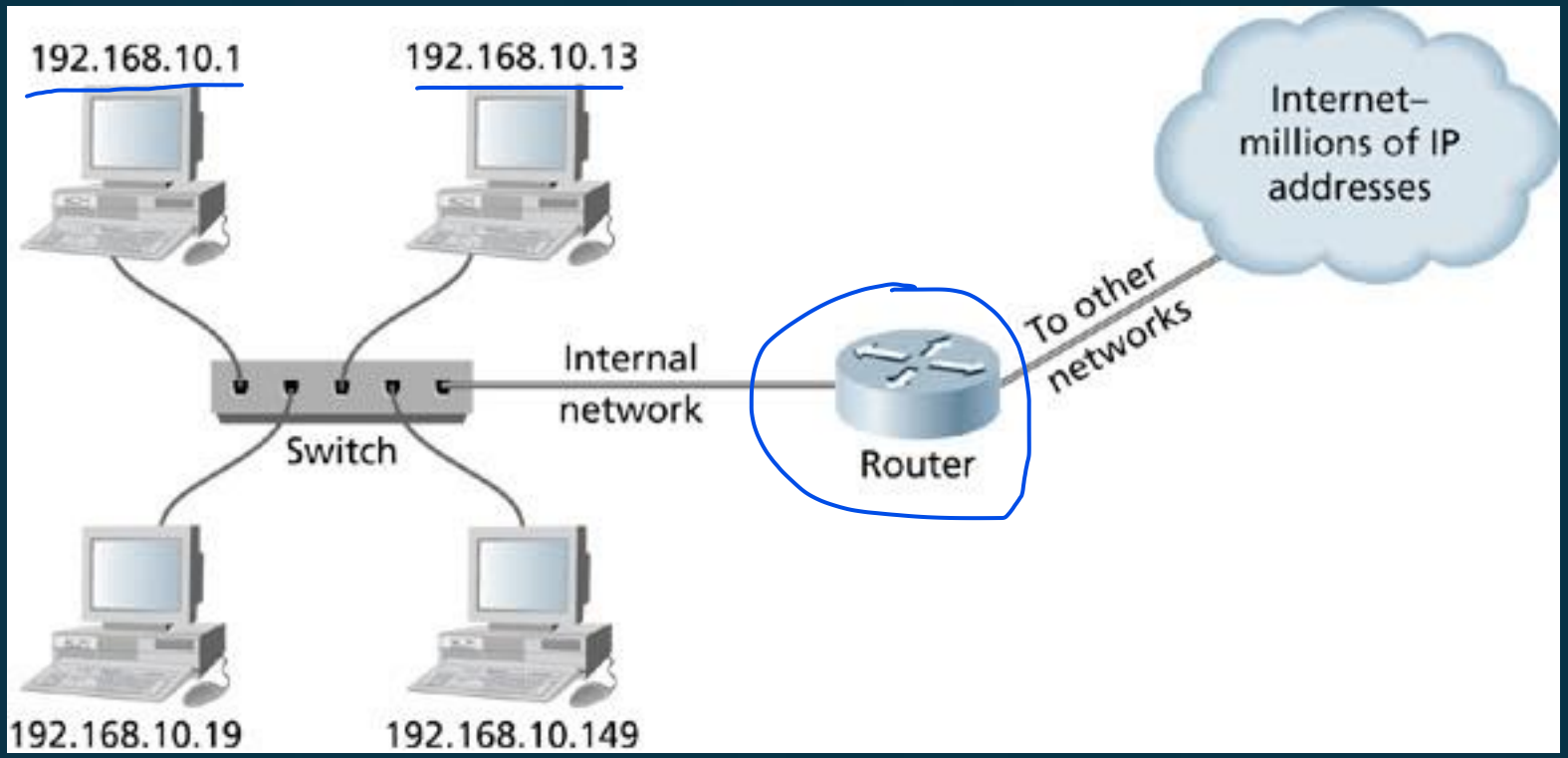
LAN PROTOCOLS

- Communications Protocols
  - Allow us to send and receive information from remote data sources.
  - Are the building blocks for information exchange.
  - The Internet Protocol is an example of a communications protocol.

LAN PROTOCOLS

- The Internet Protocol
  - Provides an addressing scheme for networks and nodes to uniquely identify individual networks and the devices connected to those networks.
  - Allows network devices to be located anywhere in the world so that source and destination devices can exchange information.

Internet Protocol and Data Communication



LAN PROTOCOLS

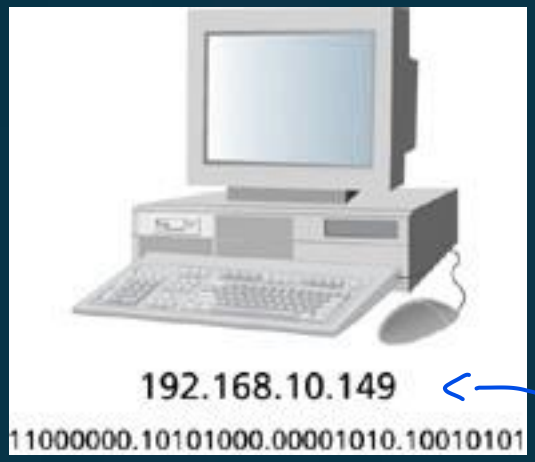
- IP Addressing
  - Most common implementation of IP addressing today is IPv4.
  - With IPv4, each IP address is comprised of a 32-bit binary address that is divided into four 8-bit octets.

32비트 주소 크기를 가짐

IPv4 주소가 부족한 상황에 처했음 32비트면 충분할줄 알고 설계를 했던 것.
사람 당 3~4개씩 씀 노트북 , 핸드폰 ,콘솔 게임.
그래서 IPv6 를 만듦 2진수 128비트이다.

iot 우리가 사용하는 모든 디바이스를 인터넷을 쓰게 하자.

IP Address for a Network Device Using IP's 32-bit Binary Addressing



10진수화

LAN PROTOCOLS

- IP Addressing (cont'd)
  - IP addresses can be represented in numeric dotted decimal form or in binary form.
  - Dotted decimal form can be converted to binary using powers of 2 to achieve the binary equivalent.

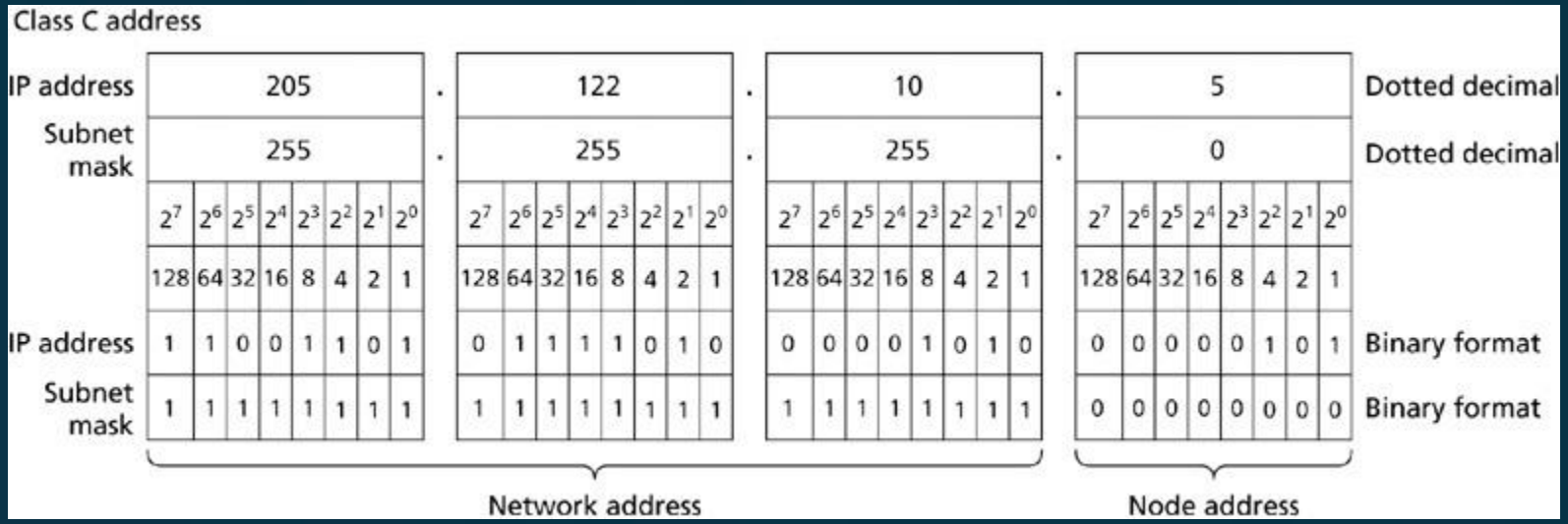
Binary to Dotted Decimal Conversion Grid

192								.	168								.	10								.	149								IP address
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0		2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	2^n power
128	64	32	16	8	4	2	1		128	64	32	16	8	4	2	1		128	64	32	16	8	4	2	1		128	64	32	16	8	4	2	1	Decimal equivalent
1	1	0	0	0	0	0	0		1	0	1	0	1	0	0	0		0	0	0	0	1	0	1	0		1	0	0	1	0	1	0	1	Binary representation of an IP address

LAN PROTOCOLS

- IP Addressing (cont'd)
  - IP Addressing also uses subnet masking to separate the network portion of the IP address from the node portion.
  - The subnet mask is also a 32-bit combination of binary digits.
  - If the subnet mask contains a binary 1 digit, then the corresponding binary digit in the IP address is part of the network address.
  - If the subnet mask contains a binary zero digit, then the corresponding binary digit in the IP address is part of the node address.

Separating an IP Address into its Network and Node Portions



LAN PROTOCOLS

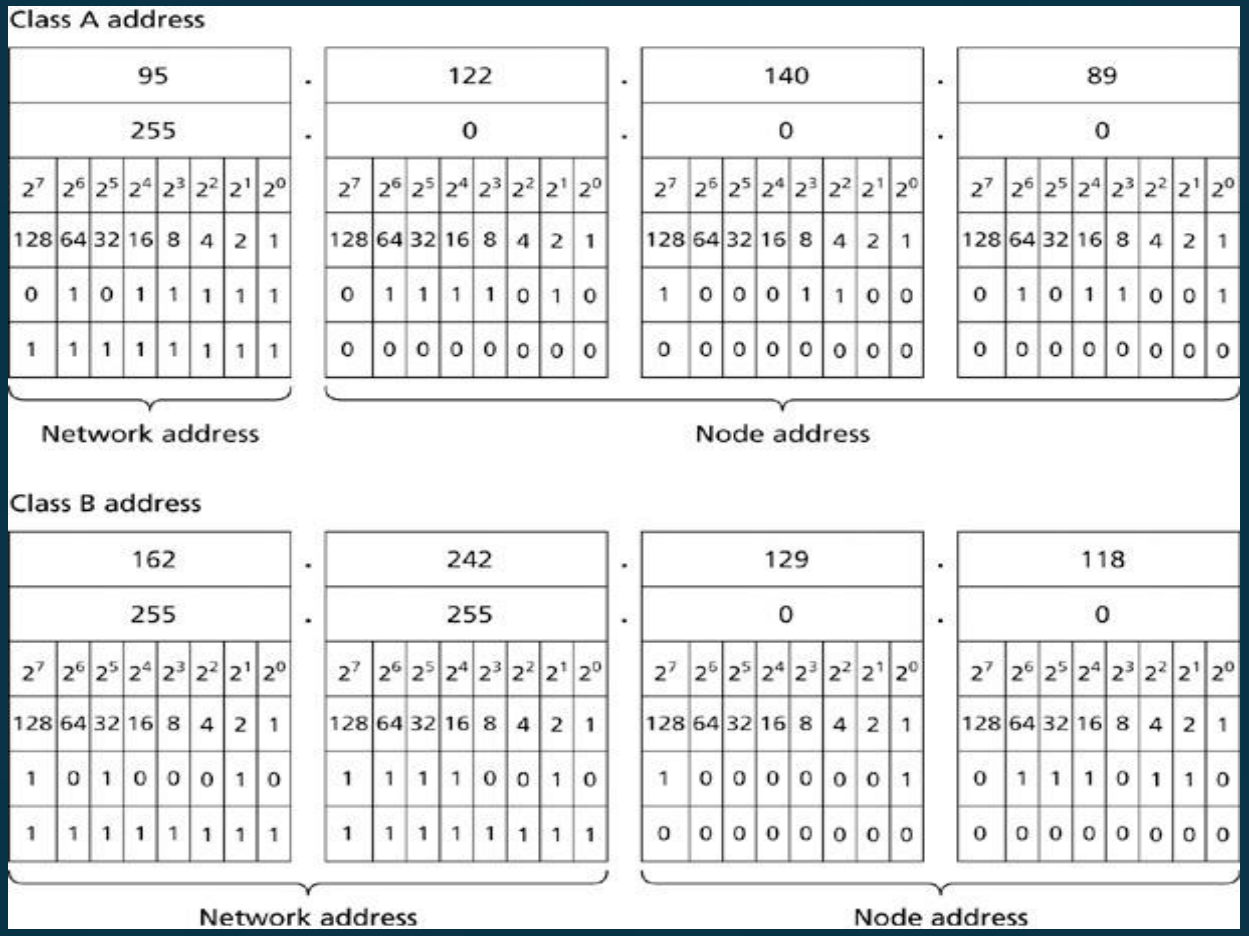
- The Internet Protocol has 5 different address classes:
  - Class A – the first binary digit in the first octet is always a binary zero. Addresses range from 1 to 126 in the first octet. Default subnet mask is 255.0.0.0.
  - Class B – the first two binary digits in the first octet begin with the binary digits, 10. Addresses range from 128 to 191 in the first octet. Default subnet mask is 255.255.0.0.
  - Class C – the first three binary digits in the first octet begin with the binary digits, 110. Addresses range from 192 to 223 in the first octet. Default subnet mask is 255.255.255.0.

이런거 외우지마 시험에 안나와

LAN PROTOCOLS

- Address classes (cont'd)
  - Class D – is used for IP multicasts. The first four binary digits of the first octet begin with 1110. Addresses range from 224 to 239 in the first octet.
  - Class E – is reserved and used in broadcast transmissions within a defined network. The first octet ranges from 240 to 255.

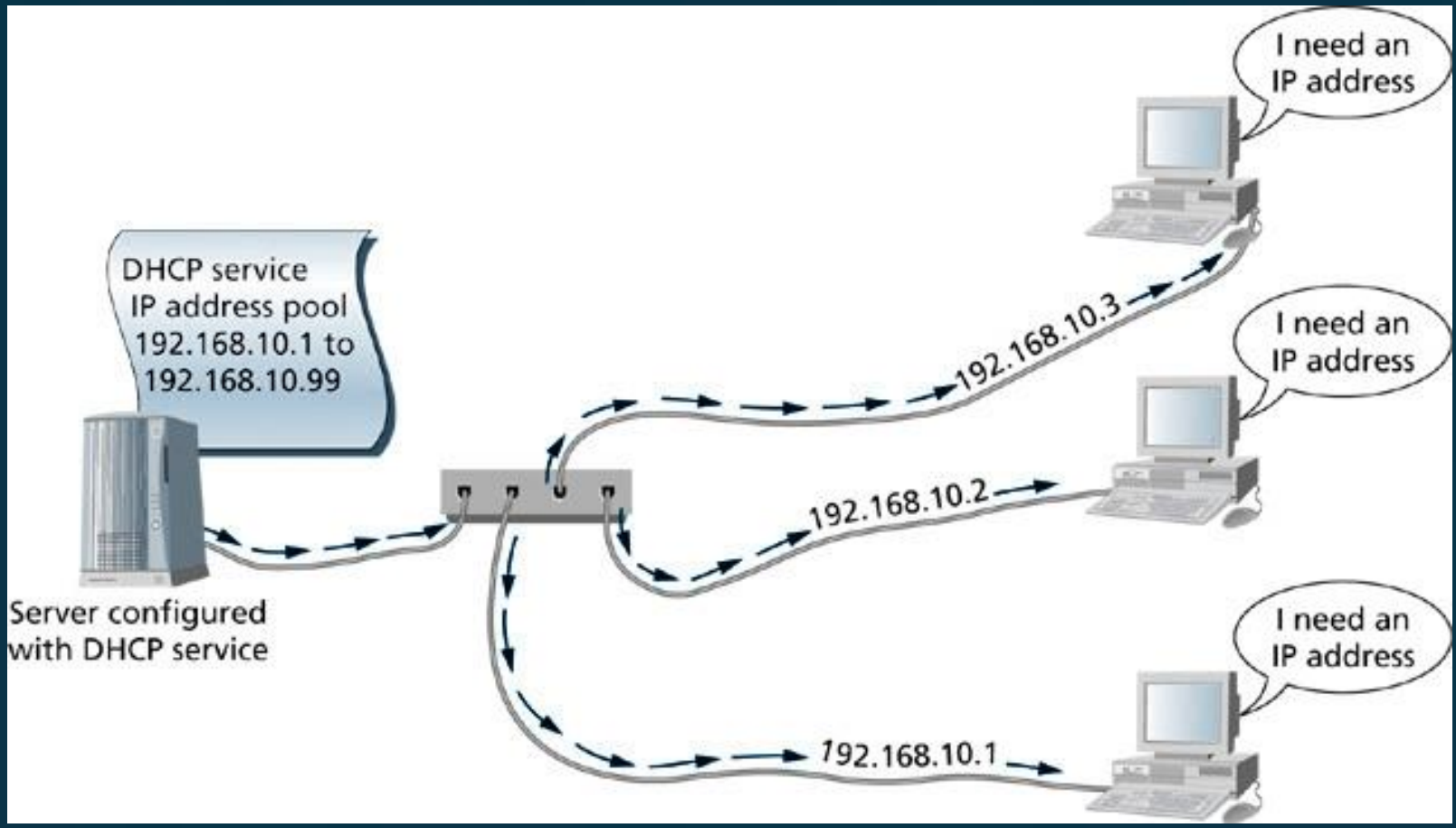
Network and Node Portions of IP Addresses



LAN PROTOCOLS

- Assigning IP Addresses
  - Manual IP Address Assignment – each LAN device is assigned a static IP address. Requires that each device be manually configured with an IP address.
  - Automatic IP Address Assignment – is achieved with DHCP. Configuration of a range of addresses takes place on a DHCP server, and manual assignment of IP addresses is reduced to devices that require such a manual assignment.

DHCP-Delivered IP Addresses



LAN PROTOCOLS

- Network Management
  - SNMP is a standardized application layer protocol that is used to communicate with, monitor, and control network devices such as hubs, switches, routers, and even NICs for the purpose of collecting network traffic and performance statistics.
  - SNMP works in conjunction with SNMP agent software, SNMP manager software, and MIBs (Management Information Base).