BÀI TẬP

1. **What happens If the size of a transmitted frame is less than the minimum, or greater than the maximum?**
   - If a transmitted frame is less than the minimum size (64 bytes for Ethernet), it may be padded, risk collision detection issues, or be dropped as a runt. If it exceeds the maximum size (1518 bytes for standard Ethernet), it may be fragmented or dropped as a giant, leading to potential data loss and retransmission.
2. **What are the six Ethernet Frame Fields?**
   - **Preamble**: 7 bytes for synchronization.
   - **Start Frame Delimiter (SFD)**: 1 byte indicating the start of the frame.
   - **Destination MAC Address**: 6 bytes for the recipient's address.
   - **Source MAC Address**: 6 bytes for the sender's address.
   - **EtherType/Length**: 2 bytes indicating the protocol type or the payload length.
   - **Payload (Data)**: 46-1500 bytes of actual data, potentially with padding.
   - Additionally, there's the **Frame Check Sequence (FCS)**: 4 bytes for error checking.
3. **What is the Destination MAC Address Field?**
   - The Destination MAC Address field in an Ethernet frame is 48 bits (6 bytes) long and specifies the MAC address of the intended recipient. It ensures the frame is delivered to the correct device within the local network**.**
4. **What is the Source MAC Address Field?**
   - The Source MAC Address Field in an Ethernet frame is a 6-byte (48 bits) field that contains the Media Access Control (MAC) address of the device that is sending the frame. This address uniquely identifies the sender on the local network, allowing the receiving device to know the origin of the frame.
5. **What happens if s small packet is encapsulated.**
   - If a small packet is encapsulated, padding is added to meet the minimum Ethernet frame size of 64 bytes. This ensures proper network operation and collision detection. The padded frame is transmitted, and the padding is ignored or removed at the destination.
6. **What is the Frame Check Sequence (FCS) used for?**
   - The Frame Check Sequence (FCS) is used for error detection in Ethernet frames. It is a 4-byte (32 bits) field that contains a cyclic redundancy check (CRC) value. This CRC is calculated by the sending device based on the contents of the frame. When the frame is received, the receiving device performs the same CRC calculation and compares the result with the value in the FCS field. If the values match, the frame is considered error-free; if they do not match, the frame is considered to be corrupted and is typically discarded.
7. **Which part of an Ethernet Frame uses a pad to increase the frame field to at least 64 bytes?**
   - The Data (Payload) field of an Ethernet frame uses a pad to increase the frame size to at least 64 bytes if the payload is too small.
8. **Which part of an Ethernet frame detects errors in the frame?**
   - The part of an Ethernet frame that detects errors is the **Frame Check Sequence (FCS)**. This 4-byte (32 bits) field contains a cyclic redundancy check (CRC) value used to verify the integrity of the frame's data**.**
9. **Which part of an Ethernet Frame describes the higher-layer protocol that is encapsulated?**
   - The Type/Length field of an Ethernet frame describes the higher-layer protocol that is encapsulated. If it is used as a Type field (EtherType), it specifies the protocol type, such as IPv4, IPv6, or ARP.
10. **Which part of an Ethernet Frame notifies the receiver to get ready for a new frame?**

- The Preamble and the Start Frame Delimiter (SFD) together notify the receiver to get ready for a new frame. The preamble is a 7-byte field that provides synchronization, and the SFD is a 1-byte field that indicates the beginning of the actual frame.

11. **Which data link sublayer controls the network interface through software drivers?**
    - The Media Access Control (MAC) sublayer of the data link layer controls the network interface through software drivers.
12. **Which data link sublayer works with the upper layers to add application information for delivery of data to higher level protocols?**
    - The Logical Link Control (LLC) sublayer of the data link layer works with the upper layers to add application information for the delivery of data to higher-level protocols. The LLC sublayer is responsible for identifying and encapsulating network layer protocols, and it provides flow control and error management.
13. **What is a function of the MAC sublayer? (State three.)**
    - The functions of the MAC sublayer include: Addressing devices with unique MAC addresses. Delimiting and recognizing frames. Controlling access to the network medium.
14. **AN Ethernet MAC address is a __ bit address expressed using __ hexadecimal digits.**
    - An Ethernet MAC address is a **48-bit** address expressed using 12 hexadecimal digits.
15. **What is a unicast MAC address?**
    - A unicast MAC address is a unique identifier assigned to a network interface controller (NIC) that is used for communication between two specific devices on a network. Unicast MAC addresses are used for point-to-point communication, meaning data sent to a unicast MAC address is intended for a single, specific device.
16. **Explain the broadcast MAC address.**
    - The broadcast MAC address is a special MAC address used to communicate with all devices on a local network simultaneously. This address is FF:FF:FF:FF:FF:FF in hexadecimal notation. When a frame is sent with this destination address, all devices on the local network segment will process the frame. This is typically used for network discovery protocols and certain types of network communication that require all devices to receive the same message
17. **Explain the multicast MAC address.**
    - A multicast MAC address is used in Ethernet networks for one-to-many or many-to-many communication. Devices interested in specific multicast traffic join multicast groups by configuring their network interfaces. When a packet is sent to a multicast MAC address, it's delivered only to devices in the corresponding multicast group, conserving bandwidth.
18. **Explain Ethernet Switch Learning.**
    - A multicast MAC address is used in Ethernet networks for one-to-many or many-to-many communication. Devices interested in specific multicast traffic join multicast groups by configuring their network interfaces. When a packet is sent to a multicast MAC address, it's delivered only to devices in the corresponding multicast group, conserving bandwidth**.**
19. **Explain Ethernet Switch Forwarding.**
    - Ethernet switch forwarding directs data frames to their destination ports based on the destination MAC addresses. Frames are either forwarded to the port associated with the destination MAC address or flooded to all ports if the destination MAC address is unknown or a broadcast/multicast address.
20. **When is a frame flooded to all ports (except the origin)?**
    - A frame is flooded to all ports (except the port it was received on) when the destination MAC address of the frame is unknown to the switch, or when the frame has a broadcast or multicast MAC address.

21. When will the switch add a new MAC address to the MAC table?

- A switch adds a new MAC address to its MAC table when it receives a frame from a device on a particular port. Upon receiving the frame, the switch learns the source MAC address and associates it with the port on which it arrived. This process allows the switch to build and update its MAC address table dynamically as devices communicate on the network.

22. When will the switch not add the MAC address to the MAC table?

- The switch will not add a MAC address to its table when it receives a frame with a source MAC address already in the table or when it receives a frame with an unknown destination MAC address.

23. When will a switch drop a frame?

- A switch will drop a frame if: The destination MAC address is not found in its MAC address table. Its buffer capacity is exceeded due to congestion. Security policies are violated. Frames contain errors or have malformed headers. Lower priority frames are dropped during congestion.

24. What are the two switches method for switching data between network ports?

- The two methods for switching data between network ports using switches are:
- **Store-and-Forward**: Receives entire frame before forwarding.
- **Cut-Through**: Forwards frame as soon as destination MAC address is read.

25. What is Store and Forward Switching?

- Store and forward switching is a method used by network switches where the entire Ethernet frame is received, stored in memory, verified for errors, and then forwarded to the destination based on its MAC address. This method ensures frame integrity but introduces some latency**.**

26. What is Cut Through Switching?

- Cut-Through Switching is a method used in network switches where the switch forwards incoming data packets as soon as it reads the destination MAC address portion of the frame header, without waiting for the entire frame to arrive. This approach reduces latency but provides less error checking compared to store-and-forward switching.

27. What are the two variants of cut-through switching?

- The two variants of cut-through switching are:
- **Fragment-Free**: Reads the first 64 bytes before forwarding.
- **Fast Forwarding**: Forwards frames as soon as the destination MAC address is read.

1. Em hãy đổi các số sau từ hệ thập phân sang hệ nhị phân.

a) 200 = 1 x 2^7(128) + 1 x 2^6(64) + 2^5(32) + 2^4(16) + 1 x 2^3(8) + 2^2(4) + 2^1(2) + 2^0 (1) = 11001000

b) 165 = 1 x 2^7(128) + 2^6(64) + 1 x 2^5(32) + 2^4(16) + 2^3(8) + 1 x 2^2(4) + 2^1(2) + 1 x 2^0 (1)=10100101

c) 176 = 1 x 2^7(128) + 2^6(64) + 1 x 2^5(32) + 1 x 2^4(16) + 2^3(8) + 2^2(4) + 2^1(2) + 2^0 (1)= 10110000

d) 241 = 1 x 2^7(128) + 1 x 2^6(64) + 1 x 2^5(32) + 1 x 2^4(16) + 2^3(8) + 2^2(4) + 2^1(2) + 1 x 2^0 (1)= 11110001

Ví dụ:

$$a)\ 13 = 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 \Rightarrow\ 1101$$

2. Em hãy đổi các số sau từ hệ nhị phân sang hệ thập phân.

a) 11001101 = (1 × 2^7) + (1 × 2^6) + (0 × 2^5) + (0 × 2^4) + (1 × 2^3) + (1 × 2^2) + (0 × 2^1) + (1 × 2^0) = 205

b) 10011011 = (1 × 2^7) + (0 × 2^6) + (0 × 2^5) + (1 × 2^4) + (1 × 2^3) + (0 × 2^2) + (1 × 2^1) + (1 × 2^0) = 155
c) 10011100 = (1 × 2^7) + (0 × 2^6) + (0 × 2^5) + (1 × 2^4) + (1 × 2^3) + (1 × 2^2) + (0 × 2^1) + (0 × 2^0) = 156

Ví dụ

$$a)\ 1 \times 2^5 + 1 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 = 51$$

3. Chuyển đổi cơ số 16 sang cơ số 10

a) BFDE
= = (11 * 16^3) + (15 * 16^2) + (13 * 16^1) + (14 * 16^0)
= (11 * 4096) + (15 * 256) + (13 * 16) + (14 * 1)
= 45056 + 3840 + 208 + 14

b) 9ADE
= (9 * 16^3) + (10 * 16^2) + (13 * 16^1) + (14 * 16^0)
= (9 * 4096) + (10 * 256) + (13 * 16) + (14 * 1)
= 36864 + 2560 + 208 + 14

c) 8AAD
= (8 * 16^3) + (10 * 16^2) + (10 * 16^1) + (13 * 16^0)
= (8 * 4096) + (10 * 256) + (10 * 16) + (13 * 1)
= 32768 + 2560 + 160 + 13

d) 3ADE
= (3 * 16^3) + (10 * 16^2) + (13 * 16^1) + (14 * 16^0)
= (3 * 4096) + (10 * 256) + (13 * 16) + (14 * 1)
= 12288 + 2560 + 208 + 14

Ví dụ:

7DE là một số thập lục phân

- $7DE = (7 * 16^2) + (13 * 16^1) + (14 * 16^0)$
- 7DE = (7 * 256) + (13 * 16) + (14 * 1)
- 7DE = 1792 + 208 + 14

Các kiến thức cần nhớ

· Phân Lớp

+ 1-126 -> A (net_id = 1 byte, host_id = 3 byte; Subnet Mask = /8)

+ 128-191 -> B (net_id = 2 byte, host_id = 2 byte; Subnet Mask = /16)

+ 192-223 -> C (net_id = 3 byte, host_id = 1 byte; Subnet Mask = /24)

· Số địa chỉ IP hợp lệ với n bit host = $2^n - 2$

· Số mạng con chia được khi mượn n bit host = 2^n

Dạng 1: Tính các thông số cơ bản

4. 192.29.32.30/255.255.255.201

- Tính số mạng con và số host của mạng con?

- 192 -> phân lớp C (net_id = 3 byte, host_id = 1 byte; Subnet Mask = /24)
- Subnet Mask = 255.255.255.192 =11111111.11111111.11111111.11000000 = /26
- Số bit host id = 32 - 26 = 6
- Số bit làm subnet_id = 26-24 = 2 bit
- + số mạng con tương tự: 2^2 = 4
- +Số host trong mỗi mạng con: 2^6 - 1= 63

5. 172.16.250.196/255.255.231.31

- Tính số mạng con và số host của mạng con?

- 172 -> phân lớp B (net_id = 2 byte, host_id = 2 byte; Subnet Mask = /16)
- Subnet Mask = 255.255.231.128 =11111111.11111111.11100111.100000000=/23
- Số bit host_id: 32 - 23= 9
- Số bit làm subnet id 23 - 16 = 7 bit
- +Số mạng con tương tự: 2^7 = 128
- +Số host trong mỗi mạng con: 2^9 -2 = 510

Ví dụ:

Vd1:

172.29.32.30/255.255.240.0

- Hãy cho biết mạng chứa host đó có chia mạng con hay không? Nếu có thì cho biết có bao nhiêu mạng con tương tự như vậy ? Và có bao nhiêu host trong mỗi mạng con ?

- Tìm địa chỉ mạng, địa chỉ broadcast.

Giải :

172 -> phân lớp B (net_id = 2 byte, S ubnet Mask = /16)

Subnet Mask = 255.255.240.0 = /20

Số bit host_id = 32 - 20 = 12

Số bit làm subnet_id : 20 – 16 = 4 bit

+ Số mạng con tương tự : $2^4 = 16$

+ Số host trong mỗi mạng con : $2^{12}-2 = 4094$

Dạng 2: Các bài toán chia subnet

6. 192.48.96.0/25

- Hãy phân hoạch thành 8 mạng con
- 192-> phân lớp C (net_id = 3 byte, host_id = 1 byte; Subnet Mask = /24)
- Để có 8 mạng con ta cần mượn n bit host sao cho
- 2^n >= 8
- -> n>=3
- Khi mượn 3bit
- + /28 -> còn lại 4 bit host
- + Bước nhảy: 2^4 = 16
- Vậy ta có các đường mạng
- Mạng 1:
- +Địa chỉ mạng: 192.48.96.0/28
- +Địa chỉ broadcast: 192.48.96.15/28
- Mạng 2:
- +Địa chỉ mạng: 192.48.96.16/28
- +Địa chỉ broadcast: 192.48.96.31/28
- Mạng 3:
- +Địa chỉ mạng: 192.48.96.32/28
- +Địa chỉ broadcast: 192.48.96.47/28
- Mạng 4:

- +Địa chỉ mạng: 192.48.96.48/28
- +Địa chỉ broadcast: 192.48.96.63/28
- Mạng 5:
- +Địa chỉ mạng: 192.48.96.64/28
- +Địa chỉ broadcast: 192.48.96.79/28
- Mạng 6:
- +Địa chỉ mạng: 192.48.96.80/28
- +Địa chỉ broadcast: 192.48.96.95/28
- Mạng 7:
- +Địa chỉ mạng: 192.48.96.96/28
- +Địa chỉ broadcast: 192.48.96.111/28
- Mạng 8:
- +Địa chỉ mạng: 192.48.96.112/28
- +Địa chỉ broadcast: 192.48.96.127/28

7. 172.16.156.0/16

- Hãy phân hoạch thành 4 mạng con
- 172 -> phân loại B (net_id = 2 byte, host_id = 2 byte; Subnet Mask = /16)
- Để có 4 mạng con ta cần mượn n bit host sao cho
- 2^n >= 4
- -> n>=2
- Khi mượn 2 bit
- +/18 -> còn lại 14 bit host
- + Bước nhảy: 2^14 = 16384
- Vậy ta có các đường mạng
- Mạng 1:
- +Địa chỉ mạng: 172.16.0.0/18
- +Địa chỉ broadcast: 172.16.63.255/18
- Mạng 2:
- +Địa chỉ mạng: 172.16.64.0/18
- +Địa chỉ broadcast: 172.16.127.255/18
- Mạng 3:
- +Địa chỉ mạng: 172.16.128.0/18
- +Địa chỉ broadcast: 172.16.191.255/18
- Mạng 4:
- +Địa chỉ mạng: 172.16.192.0/18
- +Địa chỉ broadcast: 172.16.255.255/18

Vd1: 192.48.96.0/24

Hãy phân hoạch thành 6 mạng con

Giải:

192-> phân lớp C (net_id = 3 byte, host_id = 1 byte; Subnet Mask = /24)

Để có 6 mạng con ta cần mượn n bit host sao cho

$2^n >= 6$ (Theo công thức tính số mạng con)

-> n>=3

Khi mượn 3b it

+ /27 -> còn lại 5 bit host

+ Bước nhảy : $2^5 = 32$

Vậy ta có các đường mạng

Mạng 1

+ IP đường mạng : 192.48.96.0/27

+ IP broadcast : 192.48.96.31/27

Mạng 2

+ IP đường mạng : 192.48.96.32/27

+ IP broadcast : 192.48.96.63/27

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