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# 东 北 大 学 考 试 试 卷

## 2017 —2018 学年 第 一 学期

## 课程名称：Computer Networks（Test 1）

| 总分 | 一 | 二 | 三 | 四 | 五 | 六 | 七 | 八 |
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### I. Multiple Choices (20 points, 2 for each)

( C ) 1. Services provided by data link layer protocols do not include:
A. framing B. transparent transmission C. congestion control D. error control
( C ) 2. Ethernet switches forward packets according to:
A. destination IP address B. destination port number
C. destination MAC address D. destination host domain name
( B ) 3. According to the mechanism of CSMA/CD protocol, which of the following situation need to increase the shortest length of frames:
A. keep the network transmission rate, and shorten the maximum distance of collision domain.
B. keep the maximum distance of collision domain, and increase the network transmission rate.
C. extend the coverage of network using bridges.
D. increase the number of hosts.
( B ) 4. Ethernet switches are:
A. multi-port repeaters at Layer 1. B. multi-port bridges at Layer 2.
C. multi-port switches at Layer 2. D. multi-port routers at Layer 3.
( B ) 5. The service that Ethernet doesn’t provide is:
A. framing B. reliable delivery C. error detection D. medium access
( D ) 6. Which of the following is not a component of network protocols:
A. syntax B. semantics C. synchronization D. architecture
( A ) 7. The MAC protocol used by 802.11 WLAN is:
A. CSMA/CA B. CSMA/CD C. CSMA D. CDMA
( C ) 8. The transmission media below which is not affected by electromagnetic interference is:
A. STP B. coax C. fiber D. UTP
( B ) 9. When a host is moved from one network to another, which of the following is correct:
A. Both the IP address and MAC address should be changed.
B. The IP address may be changed, and the MAC address should not be changed.
C. The MAC address must be changed, and the IP address should not be changed.
D. Neither the IP address nor MAC address should be changed.
( C ) 10. Concerning 100BASE-T, which of the following is wrong:
A. The transmission rate is 100Mbit/s.
B. The signal is baseband signal.
C. The media takes Type 5 UTP, and the maximum distance is 185m.
D. Both sharing and switching networking approaches are supported.

### II. Fill in the Blanks (10 points, 1 for each blank)

1. The MTU of Ethernet is of length _1500_ bytes.
2. Computer networks take _packet （分组）_ switching approach, while the traditional telephone networks take _circuit（电路）_ switching approach.
3. The minimum length of frame transmitted by 802.3 Ethernet is _64_ bytes.
4. ARP tables keep the mapping from _IP_ addresses to _MAC_ addresses.
5. In computer networks, the two communication parties must obey some common rules or conventions, which are called _protocol_ .
6. From the point that two communication parties exchange information of view, there are three basic ways ,i.e _Simplex（单工）_ , _duplex（双工）_ and _half-duplex（半双工）_ .

### III. True or False (10 points, 1 for each)

( F ) 1. Ethernet switches can separate collision domains, so it can control broadcast storm.
( T ) 2. CSMA/CD protocol can only work in half-duplex mode.
( T ) 3. Ethernet provides connectionless, unreliable data transfer.
( F ) 4. Twisted-pairs is a kind of transmission media which has broadest bandwidth, least signal transmission attenuation and best anti-jamming capability.
( T ) 5. The basic concept of network architecture is layering, and the core is the communication between entities. In order to make the entities commnicatable, they must obey some common regulations, which are protocols.
( T ) 6. TCP/IP can be used for communication between different processes on the same host.
( F ) 7. Eight broadcast domains are created when you segment a network with an 8-port switch.
( T ) 8. The basic principle of ISO network protocol layering is that different nodes have different layers and the same layer of different nodes provides the same functions.
( F ) 9. As in Ethernet, access collisions may also happen in token ring networks.
( F ) 10. The most commonly used WAN topology is star topology.

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IV. Terminology (10 points, 2 for each)

1. ARP　地址解析协议
   (Address Resolution Protocol)
2. CSMA/CD　带载波监听的多路访问/碰撞检测
   (Carrier Sense Multiple Access with Collision Detection)
3. ISP　Internet 服务提供商
   (Internet Service Provider)
4. PPP　点对点协议
   (Point-to-Point Protocol)
5. PDU　协议数据单元
   (Protocol Data Unit)

V. Comprehensive Questions (25 point)

1. Consider the TCP/IP protocol suite, provide the name of each layer and list the name of protocol data unit corresponding to each layer. (5 points)

application（应用层）, transport（传输层）, network（网络层）,
link（数据链路层）, physical（物理层）

message（报文）, segment（分段）, datagram（数据报）, frame（帧）
, packet/bit（分组/bit 流）

2. Consider two nodes A and B on the same Ethernet segment, and suppose the propagation delay between the two nodes is 225 bit times. Suppose at time t=0 both nodes A and B begin to transmit a frame. At what time (in bit times) do they detect the collision? Assuming both nodes transmit a 48-bit jam signal after detecting a collision, at what time (in bit times) do nodes A and B sense an idle channel? How many seconds is this for a 10 Mbps Ethernet? (8 points)

   Both nodes A and B detect the collision at time t=225. At time t = 225 + 48 = 273 both nodes stop transmitting their jam signals.

   The last bit of the jam signal from B arrives at A at time t = 273 + 225 = 498 bit times. Similarly, the last bit of the jam signal from B arrives at A at time t = 273 + 225 = 498 bit times.

   For a 10 Mbps Ethernet, this corresponds to (498 bits)/($10^6$ bits/sec) = 49.8 microseconds

3. Consider delays with multiple links. (12 points)

   a. Consider a packet of length L which begins at end system A, travels over one link to a packet switch, and travels from the packet switch over a second link to a destination end system. Let $d_i$, $s_i$ and $R_i$ denote the length, propagation speed, and transmission rate of link i, for i=1,2. The packet switch delays each packet by $d_{proc}$. Assuming no queuing delays, in terms of $d_i$, $s_i$, $R_i$, (i=1,2) and L, what is the total end-to-end delay for the packet? Suppose the packet is 1,000 bytes, the propagation speed on both links is $2.5*10^8$ m/s the transmission rates of both links is 1 Mbps, the packet switch processing delay is 1 msec, the length of the first link is 4,000 km, and the length of the last link is 1,000 km. For these values, what is the end-to-end delay?

   The first end system requires L/R1to transmit the packet onto the first link; the packet propagates over the first link in d1/s1 the packet switch adds a processing delay of d proc after receiving the entire packet, the packet switch requires L/R2 to transmit the packet onto the second link; the packet propagates over the second link in d2/s2 .
   Adding these five delays gives dend-end = L/R1+ L/R2 + d1/s1 + d2/s2 + dproc.

   To answer the second question, we simply plug the values into the equation to get 8 + 8 + 16 + 4 + 1 = 37 msec.

   b. Now suppose $R_1 = R_2 = R$ and $d_{proc} = 0$. Furthermore, suppose the packet switch does not store-and-forward packets but instead immediately transmits each bit it receives before waiting for the packet to arrive. What is the end-to-end delay?

   Because bits are immediately transmitted, the packet switch does not introduce any delay; in particular, it does not introduce a transmission delay. Thus, dend-end = L/R + d1/s1 + d2/s2 .

   For the values in Question 3, we get 8 + 16 + 4 = 28 msec.

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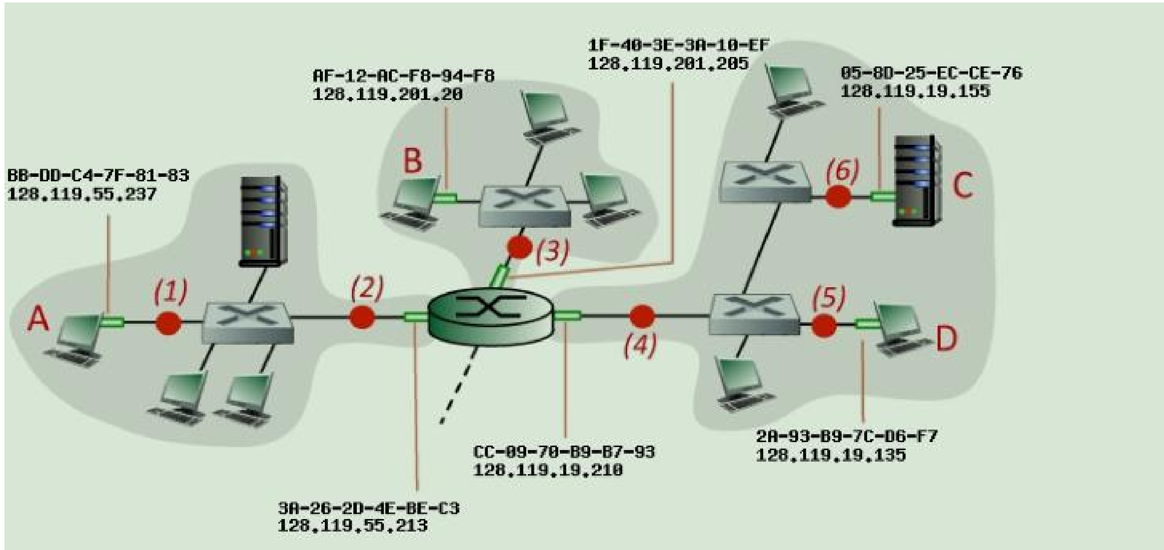
VI. Analysis and Design (25 points)

1. Consider the figure below. The IP and MAC addresses are shown for nodes A, and D, as well as for the router's interfaces. (10 points)




Consider an IP datagram being sent from node D to node A. Give the source and destination Ethernet addresses, as well as the source and destination addresses of the IP datagram encapsulated within the Ethernet frame at points (5), (4), (2), and (1) in the figure above.

（5） 源 MAC 地址：2A-93-B9-7C-D6-F7 源 IP 地址：128.119.19.135
目的 MAC 地址：CC-09-70-B9-B7-93 目的 IP 地址：128.119.55.237

（4） 源 MAC 地址：2A-93-B9-7C-D6-F7 源 IP 地址：128.119.19.135
目的 MAC 地址：CC-09-70-B9-B7-93 目的 IP 地址：128.119.55.237

（2） 源 MAC 地址：3A-26-2D-4E-BE-C3 源 IP 地址：128.119.19.135
目的 MAC 地址：BB-DD-C4-7F-81-83 目的 IP 地址：128.119.55.237

（1） 源 MAC 地址：3A-26-2D-4E-BE-C3 源 IP 地址：128.119.19.135
目的 MAC 地址：BB-DD-C4-7F-81-83 目的 IP 地址：128.119.55.237

2. In the data link layer, we studied a number of multiple access protocols, including TDMA, CSMA, slotted Aloha, token passing, etc. (15 points)

a. Suppose you were charged with putting together a large LAN to support IP telephony(only) and that multiple users may want to carry on a phone call at the same time. Recall that IP telephony digitizes and packetizes voice at a constant bit rate when a user is making an IP phone call. How well suited are these four protocols for this scenario? Provide a brief (one sentence) explanation of each answer.

TDMA works well here since it provides a constant bit rate service of 1 slot per frame. CSMA will not work as work well here (unless the channel utilization is low) due to collisions and variable amount of time needed to access the channel (for example, channel access delays can be unbounded) and the need for voice packets to be played out synchronously and with low delay at the receiver. Slotted Aloha has the same answer as CSMA. Token passing works well here since each station gets a turn to transmit once per token round, yielding an essentially constant bit rate service.

b. Now suppose you were charged with putting together a LAN to support the occasional exchange of data between nodes (in this part of this question, there is no voice traffic). That is, any individual node does not have data to send very often. How well suited are these four protocols for this scenario? Provide a brief (one sentence) explanation of each answer.

TDMA would not work well here as if there is only one station with something to send, it can only send once per frame. Hence, the access delays are long (one half frame time on average), and the throughput over a long period of time is only 1/N of the channel capacity. CSMA would work well since at low utilization, a node will get to use the channel as soon as it need to. Slotted Aloha has the same answer as CSMA Token passing would work better than TDMA but slightly less well than CSMA and Slotted Aloha, since it must wait for the token to be passed to the other stations (who likely wouldn't use it) before sending again.

c. Now suppose the LAN must support both voice and data and you must choose one of these multiple access strategies in order to support both applications on the same network, with the understanding that voice calls are more important than data. Which would you choose and why? How would voice and data be sent in this scenario? That is, which access protocol would you use, or adapt/modify, and why?

Here are two possible answers. One approach would be to divide the channel into two "pieces" -one for data packets and one for voice. This can be accomplished by assigning some number of TDMA slots for voice calls (for example, one slot to each user). Also, add some additional slots and allow the stations with data to send to perform random access (for example, slotted aloha or CSMA) within those data slots only. A second approach would be to use token passing with priorities, and give priority to voice packets.