中山大学软件学院软件工程专业 **2008** 级 (2010-2)

《SE-301 计算机网络》期末试题参考答案(B)

1） (10points) Compute the CRC for a given message (M) and a generator polynomial (P). M is 0111101 and P is 1011.

答：0111101000 除以 1011，商 0110110，余数010，故CRC为010.

2） (10points) CSMA/CA

a) What is CSMA/CA?

b) Why WIFI(802.11) uses CSMA/CA?

c) How CSMA/CA works?

答：

a) Carrier Sense Multiple Access / Collision avoidance：sense before transmitting，avoid collisions. (2points)

b) difficult to receive (sense collisions) when transmitting due to weak received signals (fading); can't sense all collisions in any case: hidden terminal, fading (3 points)

c) **Sender**:

1 if sense channel idle for DIFS then transmit entire frame (no CD)

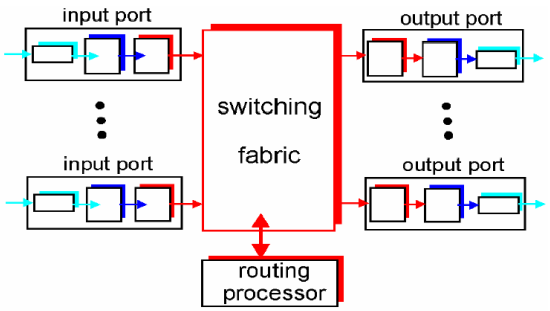
2 if sense channel busy then start random backoff time, timer counts down while channel idle, transmit when timer expires, if no ACK, increase random backoff interval, repeat 2

3 to transmit data, sender will broadcast RTS to Access Point (AP), and wait for CTS (broadcast from AP). Upon receiving CTS, sender can transmit the entire frame.

Receiver: if frame received OK, broadcast ACK after SIFS (ACK needed due to hidden terminal problem)

Avoiding collisions: Avoid data frame collisions completely using small reservation packets. Allow sender to "reserve" channel rather than random access of data frames: avoid collisions of long data frames. Sender first transmits *small* request-to-send (RTS) packets to BS using CSMA. BS broadcasts clear-to-send CTS in response to RTS. CTS heard by all nodes: sender transmits data frame; other stations defer transmissions. (5 points)

3） (10points) Where (input ports and/or output ports) can packet queuing occur in a router? Briefly explain the conditions that lead to such queuing.



答：

1) 输入端口的队列，等待路由处理器计算路由

2）输入端口的队列，等待输出端口空闲的缓存

3）输入端口队列，因总输入的速率比交换速率高

4）输出端口的队列，等待网络空闲以便发送

4） (10 points) Explain how a link-state routing algorithm (such as OSPF) works. If proper forwarding table is generated, please give answers to the following questions.

A router has the following (CIDR) entries in its routing table:

Address/mask	Next hop
135.46.56.0/22	Interface 0
135.46.60.0/22	Interface 1
192.53.40.0/23	Router 1
default	Router 2

For each of the following IP addresses, what does the router do if a packet with that address arrives?

(a) 135.46.63.10

(b) 135.46.57.14

(c) 135.46.52.2

(d) 192.53.40.7

(e) 192.53.56.7

答：link-state routing algorithm 见书本。Need to explain how to distribute link-state information and how to compute the shortest path. (5 points) A) Interface 1, B) Interface 0, C) Router 2, D) Router 1, E) Router 2 (5 points)

5） (15points) Consider a 4-layer protocol implementation with application, TCP, IP, and Ethernet layers in that order (top to bottom). Each layer requires a header except the Ethernet layer, which requires a header and trailer. The application header is 16 bytes in length, TCP header 20 bytes, IP header 20 bytes, and let the Ethernet header be 14 bytes, and the trailer 4 bytes (ignore the preamble and gap). Answer the following questions:

a) Sketch a packet for this system carefully showing and labeling all fields.

b) Assume a maximum data field for an Ethernet frame of 1500 bytes. What is the overhead (in %) for a 4096-byte application message? Hint: the message must be segmented into multiple frames and be careful of how you consider the data field in the Ethernet frame.

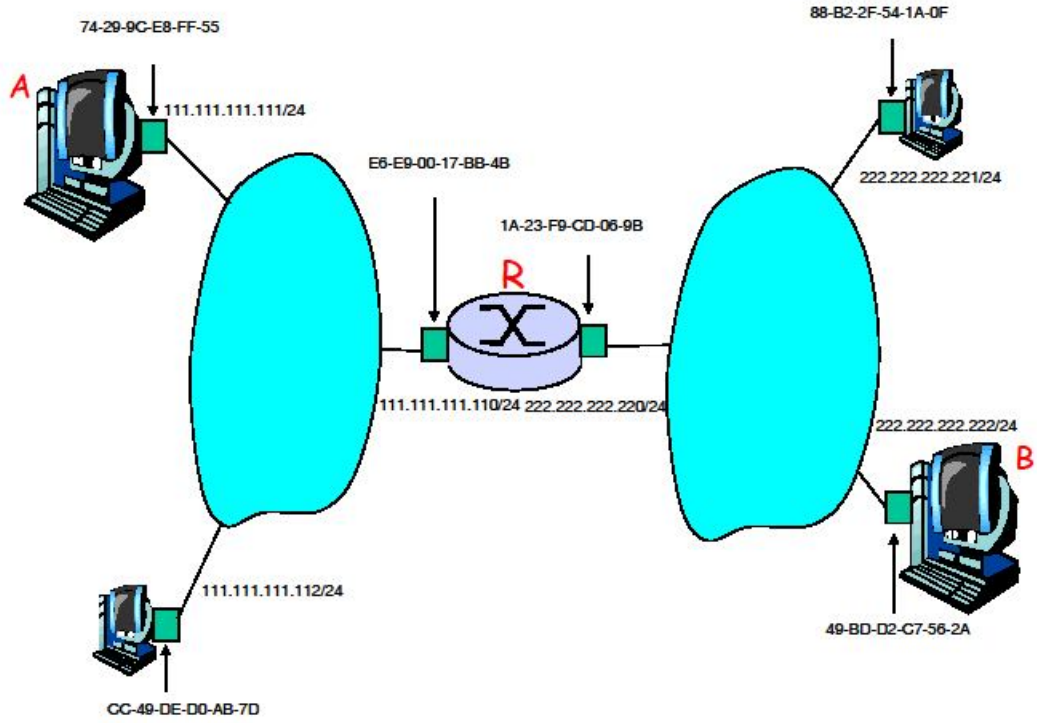
答：

a) Ethernet Header (14 Bytes) / IP Header (20 Bytes) / TCP header (20 Bytes) / Application Header (16 Bytes) / Data / Ethernet Trailer (4 Bytes) (5 points)

b) Solution 1：用一个包实现4096 数据的传送，在TCP层开始segment，则计算如下： 需要TCP层传送的数据合共为4096+16=4112，需要分3个segment传送，3个segment的消耗为3 x (20+20+14+4)= 174。合共传送的数据为4112+174=4286，实际有效数据4096，故overhead 为(4286-4096)/ 4286= 4.43% (10 points)

Solution 2: if using data link layer fragment (result is about 2.16%, deduct 2 points) because based on TCP specification, it should detect the MSS. So segment should be done in TCP (transport layer)

6） (15 points) Please refer to the following figure. Assume proper routing entries have been generated by related hosts or routers. If host A want to send 3 UDP packets to B, please describe on each host or router, from transport layer to data link layer, how the three packets are delivered to host B.



答：第 1 个 UDP：

(1) Host A Layer-4 Transport Layer add UDP header, then add Layer-3 Network Layer (IP IP header).

Based on routing forwarding table, host A know that the packet need to send via router R's 111.111.111.110 IP. R will be on the same LAN as host A.

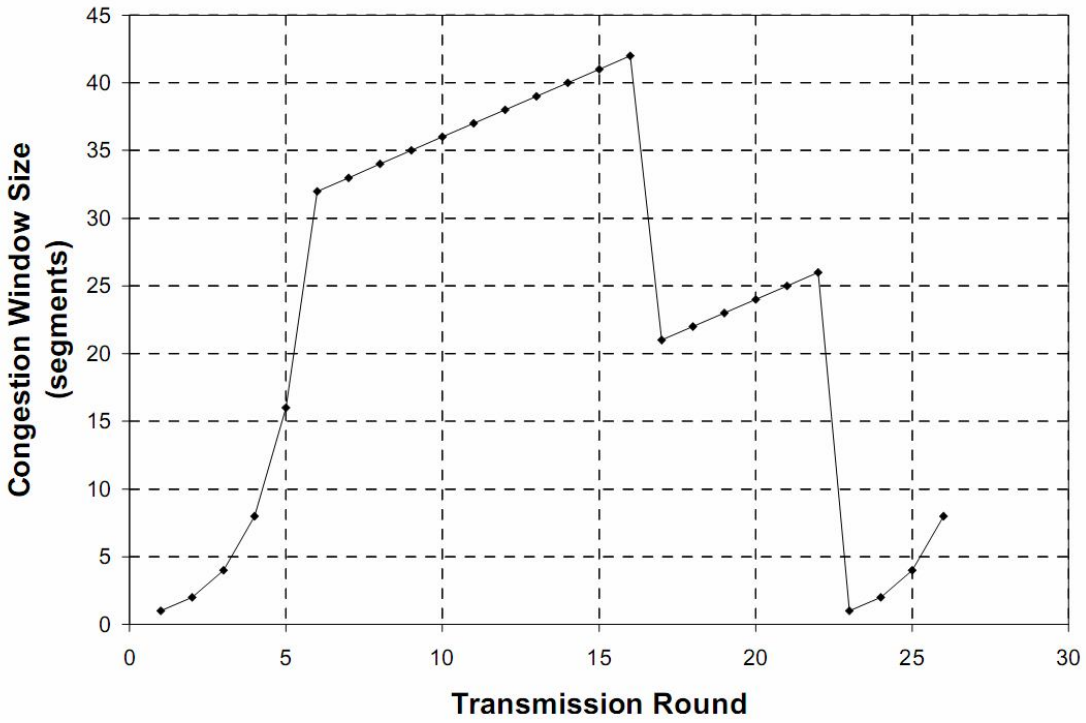
Using Layer-2 Link Layer，check whether there is ARP cache for router R's interface E6-E9-00-17-BB-4B to IP mapping. If so, using the cache. Else, use ARP query to get MAC to IP mapping. Then add layer-2 header and trailer. ARP will generate cache in the sending host.

(2)When packet get to routerR, Layer-2 header and trailer will be removed. Based on layer-3 header, it will look up routing forwarding table and conclude that the destination host is on the same LAN as the router interface IP 222.222.222.220/24 . Using similar ARP procedure as in (1), form layer2 frame and send the packet to host B.

(3) When packet reach host B，从 starting from layer 2, layer-2 frame header and trailer will be removed. Then IP packet header will be removed. Then UPD packet header will be removed and delivered to application.

(4) For second and third UDP packet, it is not necessary to do ARP since APR cache is generated. All other steps will be the same.

7） (15points) Consider the following plot of TCP window size as a function of time:



Assuming TCP Reno is the protocol experiencing the behavior shown above, answer the following questions.

(a) What is the value of **threshold** at the 18 transmission round**?**

答：21.

(b) Identify the intervals of time when TCP congestion avoidance is operating(AIMD)

答：6-16，17-22

(c) During what transmission round is the 70th segment sent?

答：7.

8） (15 points) I have machine connected to network and the Internet Explorer is open. If I enter the following address in the address field and press enter.

www.yahoo.com

Please explain from the direct connect router's (router that my machine directly connected to) perspective, what kind of operation (from application layer, if exist, down to data link layer), the router must do to get the webpage to display.

答：(1) Router w need not handle any application and transport layer information.

(2) Router might need to handler DNS (name to IP packet lookup) packet if DNS server is not on the same subnet.

(3) Router might also receive ARP query on it is IP to MAC mapping. This happens when first packet needs to be sent out via the router.

(4) To relay packet to the DNS server or the destination host, it need to look up the next hops for packets. To send packets to next hops, proper layer-2 mechanisms such as ARP to generate cache, generate layer-2 frames must be done.