# 浙江大学《计算机网络》课程课后作业四

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1. A group of N stations share a 56-kbps pure ALOHA channel. Each station outputs a 1000-bit frame on average once every 100 sec, even if the previous one has not yet been sent (e.g., the stations can buffer outgoing frames). What is the maximum value of N?

Answer:

在最好情况下，Pure ALOHA 的信道利用率为 18.4%，因此可用的信道容量为 0.184*56kbps，每个站平均每秒传输 10bps，即最多包含的 Station 数量 N=0.184*56/(1000/100)=1030

2. Consider the delay of pure ALOHA versus slotted ALOHA at low load. Which one is less? Explain your answer.

Answer:

Pure ALOHA 在低负载时由于没有冲突可以立即启动传输，而 Slotted ALOHA 需要等待下一个 Slot，这里存在一定的延时。故 Pure ALOHA 延时更少。

3. Sixteen stations, numbered 1 through 16, are contending for the use of a shared channel by using the adaptive tree walk protocol. If all the stations whose addresses are prime numbers suddenly become ready at once, how many bit slots are needed to resolve the contention?

Answer:

此时有(2,3,5,7,11,13)需要发送数据：

Slot1：2，3，5，7，11，13

Slot2：2，3，5，7

Slot3：2，3

Slot4：2

Slot5：3

Slot6：5，7

Slot7：5

Slot8：7

Slot9：11，13

Slot10：11

Slot11：13

共 11 个 Slots

4. Six stations, A through F, communicate using the MACA protocol. Is it possible for two transmissions to take place simultaneously? Explain your answer.

Answer:

可以。因为 MACA 是一种能够避免冲突地多路访问协议，假设 6 个 Station 以 ABCDEF 的顺序一次排列，则 B->A 发送信息时即使 C 能够侦听到 RTS，但 C 也会保持沉默，此后 CTS 被返回给 B，开始传输，同理 E->F 也一样。

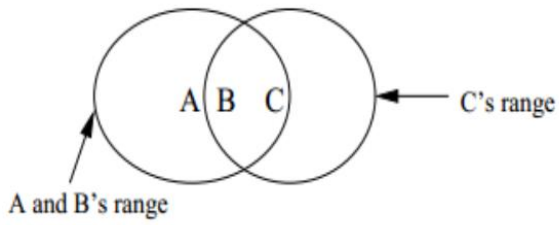
5. Consider building a CSMA/CD network running at 1Gbps over a 1km cable with no

repeaters. The signal speed in the cable is 200,000 km/sec. What is the minimum frame size?
Answer:
帧在信道传输的最远时间时间 t=1/200000s=0.000005s=5us
确保不会产生冲突的充分必要条件是监听时间为 2T=0.00001=0.01ms=10us=10000ns
以 1Gbps 的速率每秒可以发送 1 位需要 1ns，因此最小帧长需要 10000bits=1250Bytes

6. Please show the differences between
(a) The Ethernet CSMA/CD protocol and the 802.11 CSMA/CA protocol
(b) The MACA protocol and the 802.11 CSMA/CA protocol
Answer:
(a) CSMA/CD 当站点在传输时，需要侦听介质，如果检测到冲突则会立即终止传输，在等待一段随机时间后重发。而 CSMA/CA 则是在发送前帧听介质是否正在使用中，如果在使用中，则会一直等待到空闲为止。
(b)CSMA/CA 无法处理隐藏终端和暴露终端问题，而 MACA 通过基于 RTS 和 CTS 设计的协议来解决了这一问题。

7. An unscrupulous host, A, connected to an 802.3 (Ethernet) network biases their implementation of the binary exponential backoff algorithm so they always choose from {0,1} after a collision, in any situation. Another host, B, is trying to send a frame at the same time as A. Assuming A and B collide exactly three times before one of their transmissions succeeds, what are the odds that B sends its frame before A(as opposed to A sending before B)?
Answer:
在第 i 次冲突后，A 总是选择等待{0,1}个时间槽，而 B 等待$\{0,2^i-1\}$个时间槽，因此在 3 次冲突后，A 有 2 种选择，B 有 8 种选择，由乘法原理，共 16 种情况，其中存在两种冲突情况(0,0)和(1,1)，因此所有不冲突的情况为 14 种。
如果 B 先行，则(x,y)应满足 y<x，当 x=0 时，y 总是不可能满足，当 x=1 时当且仅当 y=0 时满足，因此只有(1,0)满足条件。
故概率为 1/14

8. Consider the following wireless network, where the circles are showing transmission ranges, and the presence of a host (letter) in a particular circle indicates it can hear that transmitter. If hosts A and C are both trying to send to host B will they encounter the hidden or exposed station problems? Does the MACA protocol help in this situation?




Answer:
将会遇到隐藏终端问题(hidden station problem)，因为当 A 和 C 同时给 B 传输时，C 不知道 A 已经发送帧了，所以会继续发送，因此在 B 处产生冲突/
MACA 能够解决这种问题，因为当 A 要给 B 传输数据时，先会给 B 发送 RTS，此时 C 虽然

侦听到了 RTS 但它必须保持沉默，此后 B 给 A 返回 CTS，开始数据传输。直到 A 完成传输后 C 再开始。

9. Consider the extended LAN connected using bridges B1 and B2in Fig. 4-41(b). Suppose the hash tables in the two bridges are empty. List all ports on which a packet will be forwarded for the following sequence of data transmissions:
(a) A sends a packet to C.
(b) E sends a packet to F.
(c) F sends a packet to E.
(d) G sends a packet to E.
(e) D sends a packet to A.
(f) B sends a packet to F.
Answer:
a) B1:2,3,4 B2:1,2,3
b) B1:1,2,3 B2:1,2,3
c) B1:null B2:null
d) B1:null B2:2
e) B1:1 B2:4
f) B1:1,3,4 B2:2