

2. Each of two hosts A and B, connected to an Ethernet network has one frame pending of transmission, Fa and Fb, respectively. So far, host A has undergone a total of 12 collisions, 3 of which were as a result of attempting the transmission of F_a. Likewise, host B has undergone a total of 18 collisions, 3 of which were as a result of attempting the transmission of F_b.

    a. Calculate the probability that the two hosts collide again.

    b. Calculate the probability that a collision happens involving exactly two hosts from that Ethernet network. Explain your answer.

    Apply the Binomial Distribution formula

3. Mark the statements that are true from the following list:
    - a. An Ethernet switch stores a mapping of IP addresses to MAC addresses
    - b. An Ethernet switch stores a mapping of IP addresses to switch ports
    - c. The basic Lan Switching algorithm uses ARP for solving MACs to port numbers
    - *d. IP routers do implement ARP*
    - f. None of the above answers is correct

8. Can IP blocks 192.168.120.0/23 and 192.168.122.0/24 be joined into a single IP block that encompasses both? Discuss why and do the joining if possible even if some space will remain unassigned.

The sizes of the IP blocks are different and the two IP blocks don't overlap:

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Block A:
192.168.120.0/23 = [192.168.120.0 .. 192.168.121.255]

Block B:
192.168.122.0/24 = [192.168.122.0 .. 192.168.122.255]
```

We'll adjust the size of the smaller block ($2^{32-24} = 2^8 = 256$) to that of the larger ($2^{32-23} = 2^9 = 512$), consequently, block B is transformed into B' which size will be the size of the larger, A: 512; the CIDR prefix of B' will be: $\log_2 512 = 9$, $32 - 9 = 23$; the new CIDR prefix will be /23 and the resulting IP block B' = 192.168.122.0/23:

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Block B':
192.168.122.0/23 = [192.168.122.0 .. 192.168.123.255]
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Block B' is contiguous to A and both have the same size, 512, *potentially*, these two blocks can be joined into a single block. The resulting block would have a size 512 + 512 = 1024 which CIDR prefix would be = $\log_2$ 1024 = 10; CIDR = 32 – 10 = /22. Let's check that the resulting block is a correct IP block by checking its compliance with the arithmetical definition of IP block, in other words, the initial IP address is aligned on /22?

Is 192.168.120.0 aligned on /22? Otherwise:
192.168.120.0 mod 2^{32-22} = 0 ?
192.168.122.0 mod 1024 = 0 ?

$192.168.122.0_{DDN}$ = 11000000.10101000.01111000.00000000

Since the least significant 10 bits are all zero, the predicate is true and the resulting /22 IP block is correct.

10. Can IP blocks 192.168.181.0/24 and 192.168.182.0/24 be joined into a single IP block that encompasses both **without** adding additional space? Discuss why and do the joining if possible.

Blocks are contiguous and have the same size. The block resulting after joining them would have a CIDR of /24-1 = /23, however, the initial IP (192.168.181.0) is not aligned on the resulting block's size = $2^{32-23} = 2^9$ = 512:

192.168.181.0 mod 512 ≠ 0, therefore, the join of the blocks cannot be made without including additional space:

$192.168.181.0_{DDN}$ = 11000000.10101000.10110101.00000000

Observe that the last 9 bits are not all of them 0 ($\log_2$ 512 = 9), consequently, 192.168.181.0 mod 512 ≠ 0.

14. Technical University has purchased an IP block for its internal networks. The CIDR prefix is 20 and one of the IP addresses included in it is 193.146.101.46. The seven internal networks have the following sizes: Net A = 1000; Net B = 855; Net C = 500; Net D = 900; Net E = 50; Net F = 100; Net G = 20 . Obtain a partition into seven or more IP blocks that satisfies the given sizes; for each, obtain its IP parameters.