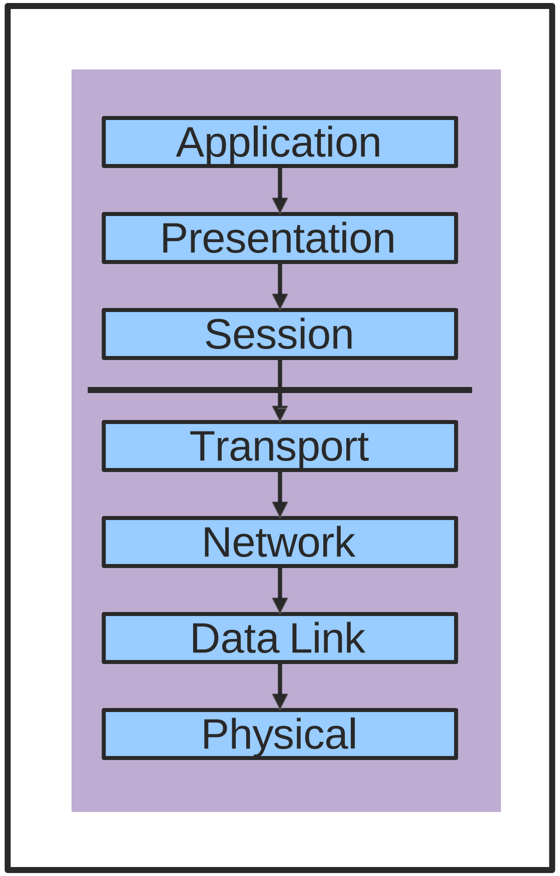
In Class Practice 1

Introduction

What are seven layers in the OSI model?



- OSI: Open Systems Interconnection
- Application: Application specific protocols
- Presentation: Format of exchanged data, data translator (convert ***coded file to ASCII-coded file)
- Session: Name space for connection mgmt (request/response. Eg. RPC)
- Transport: Process-to-process channel (connection-oriented, flow control, reliability, e.g. TCP)
- Network: Host-to-host packet delivery (Packet forwarding, routing)
- Data Link: Framing of data bits (including error correction, e.g MAC: CSMA/CD)
- Physical: Transmission of raw bits

Introduction

Store-and-forward transmission is used in which type of switching?

a. Circuit switching

b. <u>Packet switching</u>

c. other

RDT

Q: Suppose you are designing a transport protocol and use a version of selective repeat to implement reliable data transfer. What are the constraints you have in selecting the number of bits for the sequence numbers?

RDT

Q: Suppose you are designing a transport protocol and use a version of selective repeat to implement reliable data transfer. What are the constraints you have in selecting the number of bits for the sequence numbers?

A: Sequence number range should be at least twice as big as the window size used by SR. Sequence numbers should not wrap around within a maximum segment lifetime. The receiver should no have two segments with the same sequence number.

$$SWS < (MaxSeqNum + 1)/ 2$$

RDT

Q: Consider a Go-Back-N protocol with a sender window size of 3 and a sequence number range of 1,024. Suppose that at time t, the next in-order packet that the receiver is expecting has a sequence number of k. Assume that the medium does not reorder messages. Answer the following questions:

(a) What are the possible sets of sequence numbers inside the sender's window at time t? Justify your answer.

A: Receiver has received packet k-1. That is, it should have Acknowledged packets up to k-1. Case 1: All ACKs received at the sender → sender window = [K, K+1, K+2]. Case 2: All ACKs lost: Sender window = [K-3, K-2, K-1]

RDT

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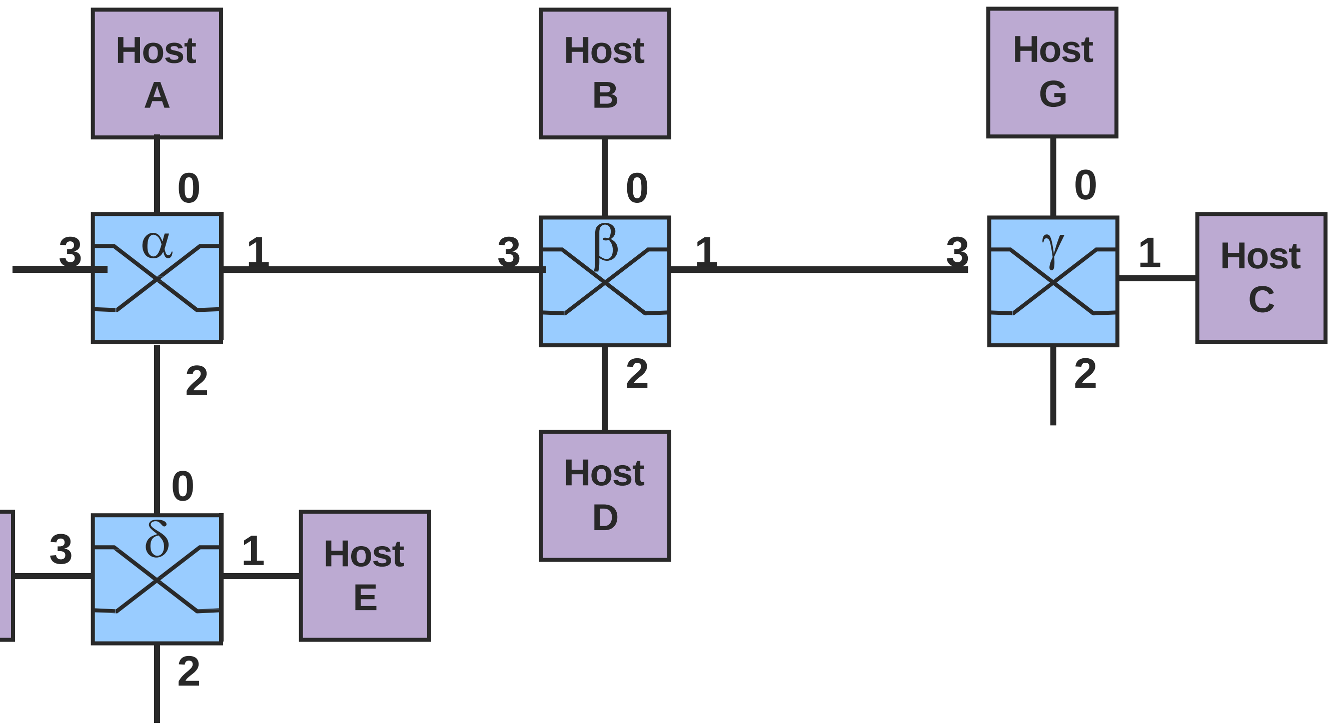
(b) What are all possible values of the ACK field in all possible messages currently propagating back to the sender at time t? Justify your answer.

A: For the worst case (case 2 in (a)), K-3 has to be acknowledged. K-4 needn't to be acknowledged because sender already sent K-1. Therefore, ACK range [k-3, k-1]

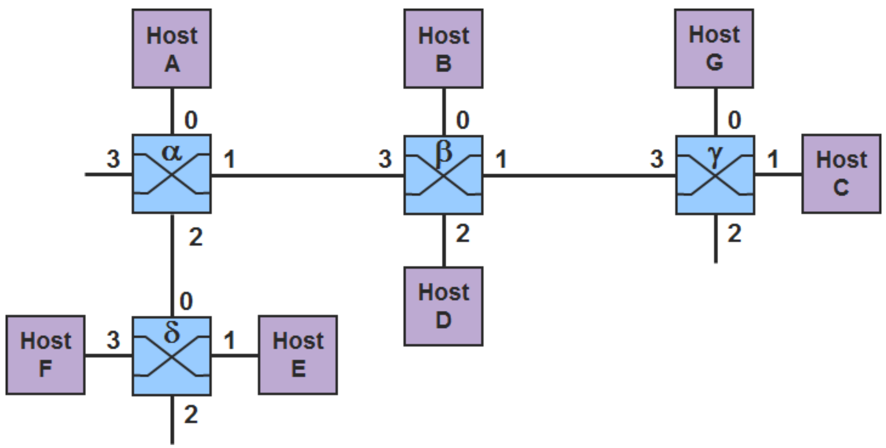
Forwarding with Datagrams

What are the routing tables of the switches?



Forwarding with Datagrams

Answer:



α's Table

A	0
B	1
C	1
D	1
E	2
F	2
G	1

β's Table

A	3
B	0
C	1
D	2
E	3
F	3
G	1

γ's Table

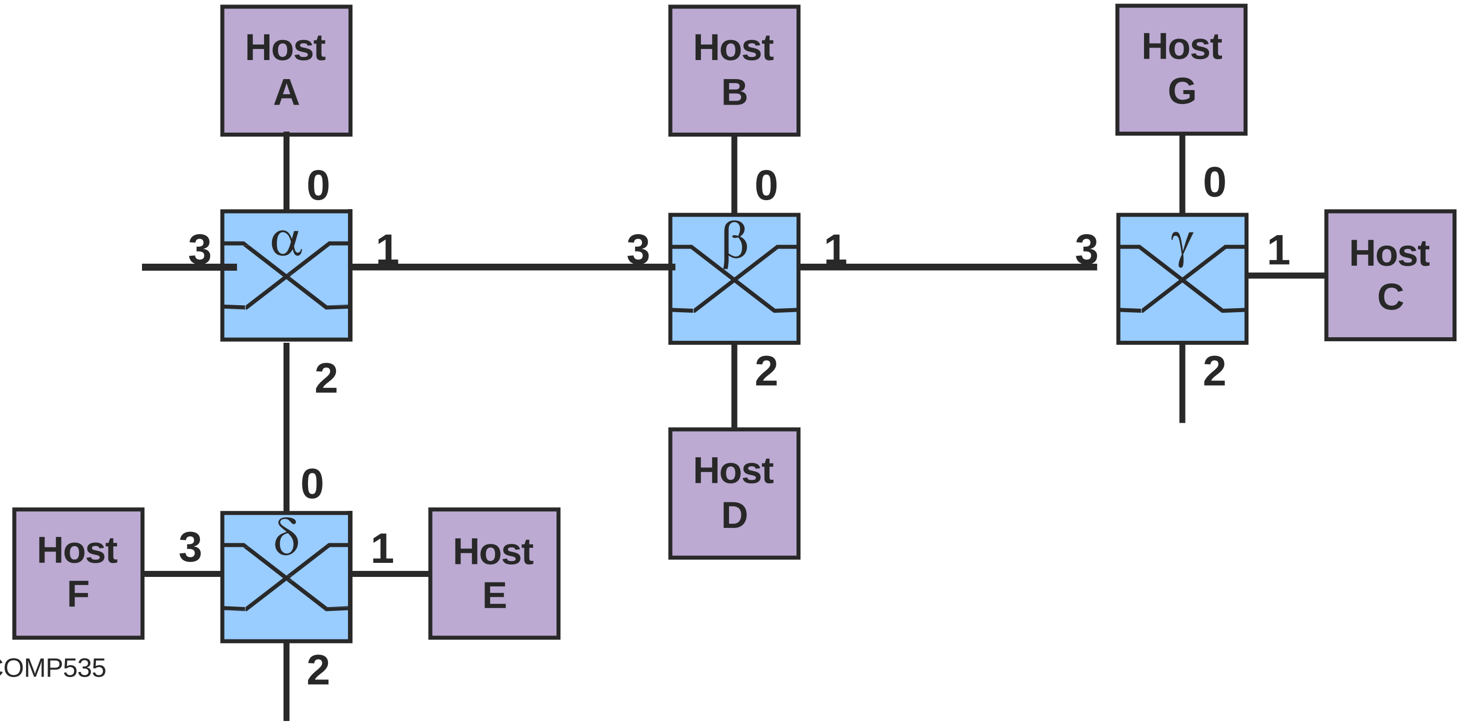
A	3
B	3
C	1
D	3
E	3
F	3
G	0

δ's Table

A	0
B	0
C	0
D	0
E	1
F	3
G	0

Forwarding with VC

We would like to build VCs in the following order: A – D, F – C, and G – D. Suppose we always use the smallest available number for VCI. What are the tables at the switches?



Forwarding with VC

Answer:

α

Port IN	VCI IN	Port OUT	VCI OUT
0	0	1	0
2	0	1	1

β

Port IN	VCI IN	Port OUT	VCI OUT
3	0	2	0
3	1	1	0
1	**1**	2	1

δ

Port IN	VCI IN	Port OUT	VCI OUT
3	0	0	0

γ

Port IN	VCI IN	Port OUT	VCI OUT
3	0	1	0
0	0	3	**1**

End-to-end Delay

Consider a path consisting of four nodes: A, B, C, and D in a packet switched network. The transmission speed of link (A,B) is s_1 bps, the transmission speed of link (B,C) is s_2 bps, and the transmission speed of link (C,D) is s_3 bps. The propagation delay of each of these three links is d seconds. The packet size is p bits. Node A sends two packets back-to-back at times t_1 and t_2, respectively, to node D. That is, $t_2 = t_1 + p/s_1 + d$. Assume that the processing delay and queueing delay of a packet are zero. If $s_3 > s_2 > s_1$, when does node D receive the last bit of the second packet?

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Answer: t1 + 4d + 2 p/s1+p/s2+p/s3.

CRC

- A CRC is constructed to generate a 4-bit checksum for an 11-bit message. The generator polynomial is $x^4 + x^3 + 1$. Encode the data bit sequence 10111010100. What is the code word to be sent by the sender?

- Can you construct error bit pattern which cannot be detected?

Answer

10111010100**1001**

```
11001 | 101110101000000
        11001
        -----
        011100
          11001
          -----
          0010110
              11001
              -----
              011111
                11001
                -----
                0011000
                    11001
                    -----
                    000010000
                         11001
                         -----
                         01001
```

Checksum

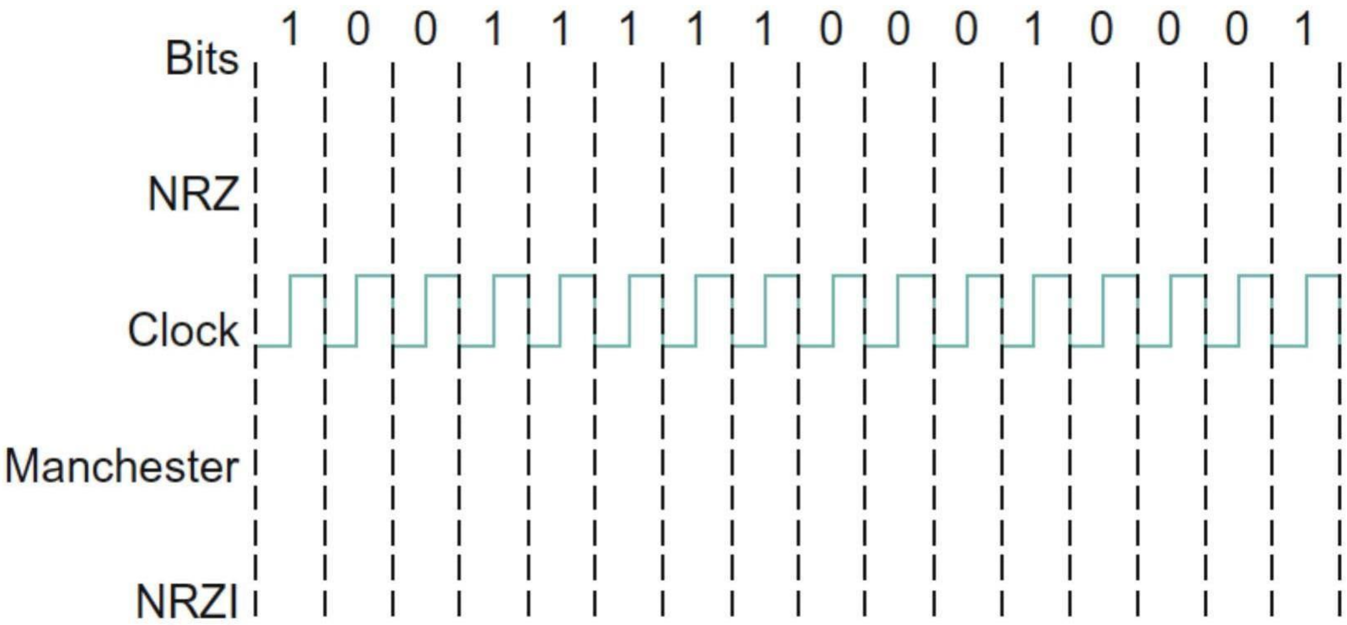
Suppose a header consists of four 16-bit words: (11111111, 11111111, 11111111, 00000000, 11110000, 11110000, 11000000, 11000000). Find the Internet checksum for this code.

11111111 11111111
11111111 00000000
11110000 11110000
11000000 11000000

10110000 10110010
1's complement =
0100111101001101

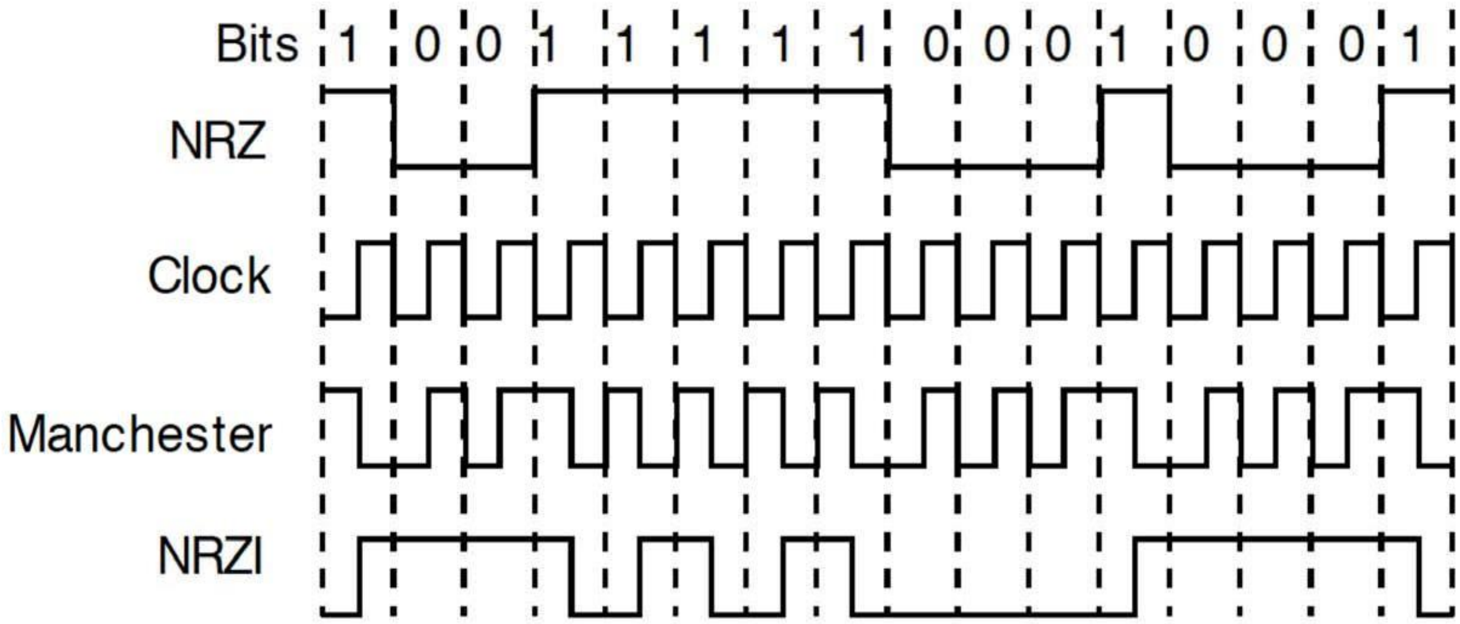
Encoding

Show the NRZ, Manchester, and NRZI encodings for the following bit pattern. For NRZ: High (1); Low (0). And the NRZI signal starts out low (0).



Encoding

Answer:



IP

1- IP currently uses 32-bit addresses. If we could redesign IP to use the 6-byte MAC address instead of the 32-bit address, What are the advantages and disadvantages of the proposed change?

A: Disadvantages:

- Lose hierarchical nature of IP.
- Inefficient routing (lose of aggregate routing).

Advantages:

Eliminate the need for address resolution (i.e., mapping between IP to physical address)

IP

2- IPv4 has fragment reassembly done at the endpoints, rather than at the routers. What are two strongest reasons NOT to make the IPv4 reassemble the packets?

A:

- loading the router: Reassembly overhead
- Multipath routing: Individual fragments can have different routes to the destination node.

IP

3- Suppose a computer is moved from one department to another. Does the MAC address need to change? Does the IP address need to change? State all the assumptions clearly.

A: MAC address is bound to the network interface (NIC adaptor). Therefore, it doesn't change. The IP address changes if the machine joined different subnet network.

4- Address 172.16.1.1 belongs to which IP Class?

A: Class B

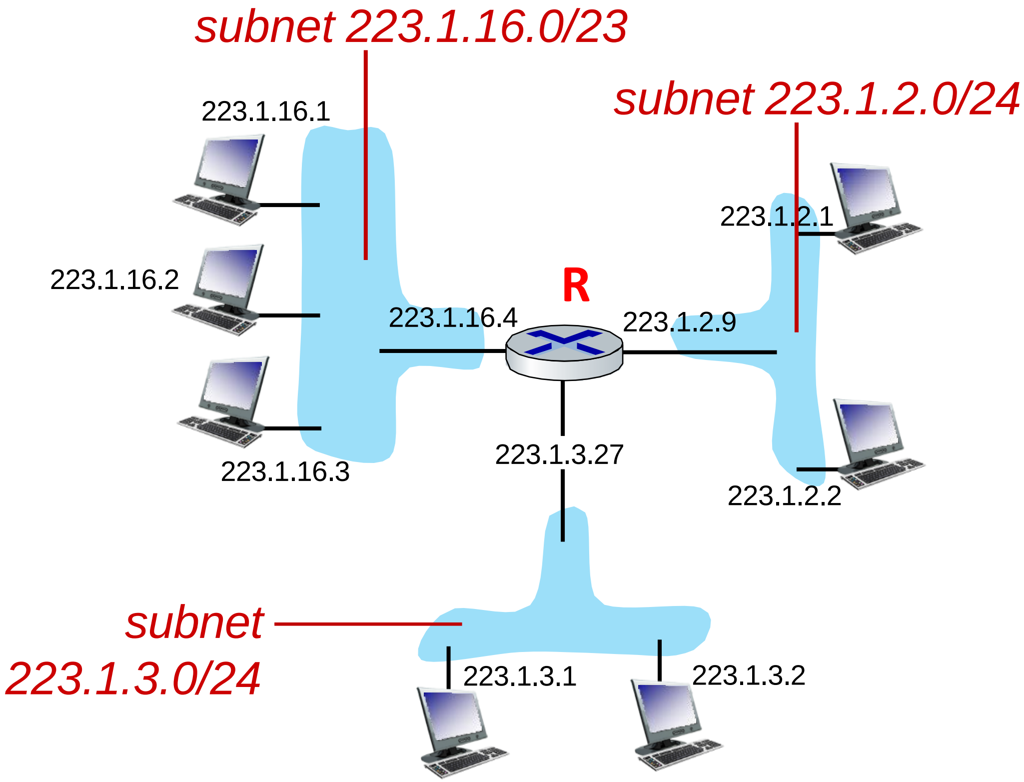
5- The network address of 172.16.0.0/19 provides how many subnets and hosts?

A: Class B has the first 16 bits is for network address, this leaves 3 bits out of /19 ones indicated in the above IP address to the subnet address. So, 2^3= 8 subnets.

Subnets

Write down the subnet mask of each host.

- 225.255.254.0 for hosts: 223.1.16.1, 223.1.16.2 and 223.1.16.3
- 255.255.255.0 for hosts: 223.1.2.1 and 223.1.2.2
- 255.255.255.0 for hosts: 223.1.3.1 and 223.1.3.2



Complete the following routing table of router "R"

IP	Subnet mask	Subnet number
223.1.16.4	255.255.254.0	223.1.16.0
223.1.3.27	255.255.255.0	223.1.3.0
223.1.2.9	255.255.255.0	223.1.2.0

Quick Questions

- 1. Explain why a CSMA/CD type protocol cannot be used in a wireless environment.
  - every radio is not necessarily in range of each other. Radios may collide each other because they cannot know the other is transmitting.

Quick Questions

- 2. Explain a drawback of virtual-circuit-based forwarding.

  - Round trip set up time
  - Not tolerant to node failures (must set up new route)
  - Global address path information still necessary for connection setup

Quick Questions

- 3. Why does Ethernet use binary exponential backoff during contention resolution?
  - To reduce the probability of future collisions after a collision has occurred.

Quick Questions

- 4. Why does Ethernet have a minimum packet size? How is it determined?
  - To ensure that all nodes can detect a collision. It is based on the maximum distance between two nodes.