



1. Figure below show system throughput of between pure Aloha and slotted Aloha. From this given throughput result, please explain why slotted Aloha gives 2 times higher (with draw a diagram of each scheme) (10 marks)

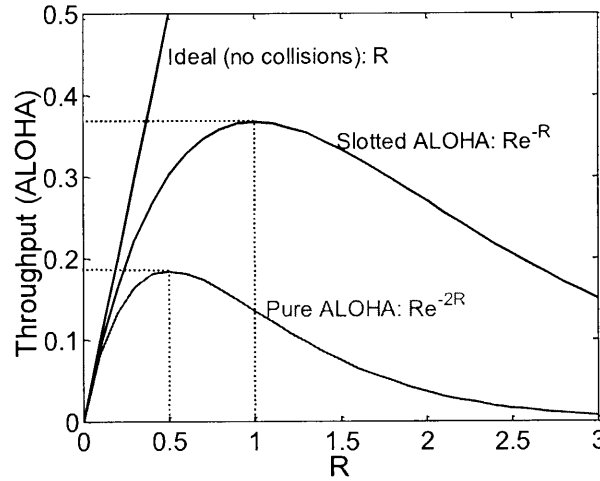


Figure 1 Throughput of pure Aloha and slotted Aloha

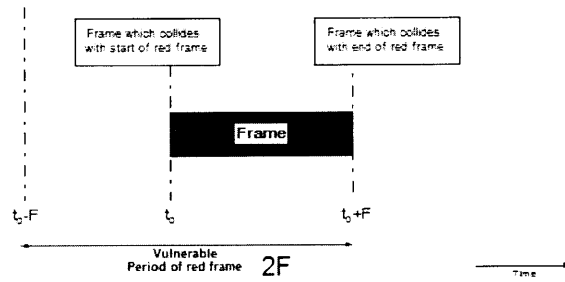


Figure 2 Pure Aloha Analysis

Answer

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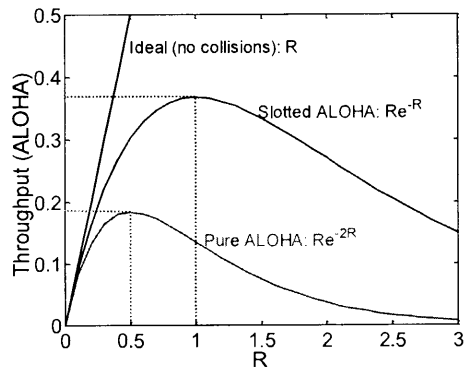
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2. Pure Aloha and Slotted Aloha performance (10 marks)

Suppose that a radio system uses a 9600 bps channels for sending call setup request messages to a base station. Suppose that packets are 120 bits long, that the timeout is 20 ms, and that the backoff is uniformly distributed between 1 and 7. What is the maximum throughput possible with ALOHA and with slotted ALOHA? Compare the average delay in ALOHA and slotted ALOHA when the load is 40 percent of the maximum possible throughput of the ALOHA system.



Answer

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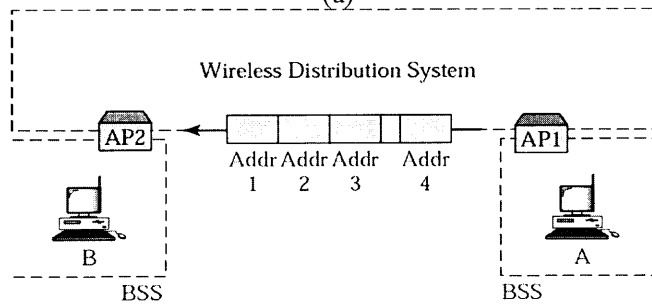
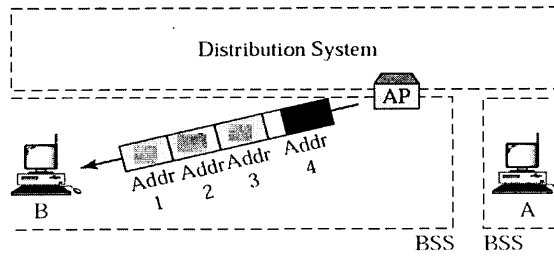
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3. Below table show the description of Subfields in FC field used in WLAN. Please fill in what addresses (1, 2, 3 and 4) used in scenarios (a) and (b). (10 marks)

To DS	From DS	Address 1	Address 2	Address 3	Address 4
0	0	Destination station	Source station	BSS ID	N/A
0	1	Destination station	Sending AP	Source station	N/A
1	0	Receiving AP	Source station	Destination station	N/A
1	1	Receiving AP	Sending AP	Destination station	Source station



Answer

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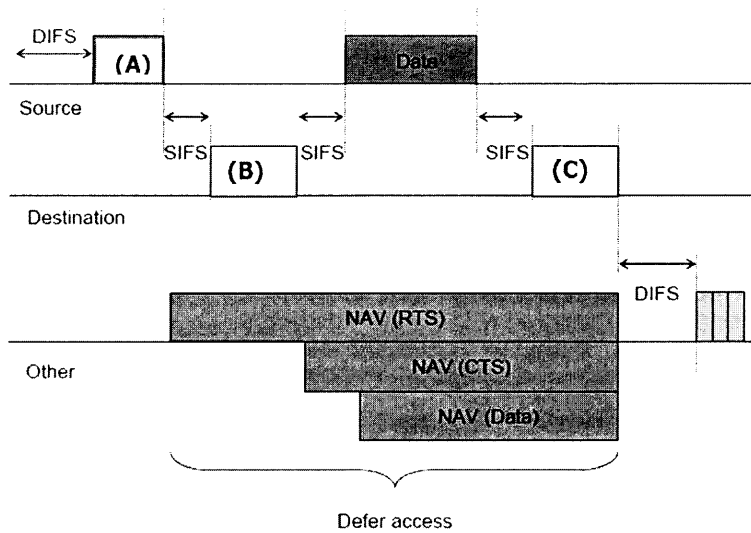
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4. In wireless LAN communication (IEEE 802.11), please indicate what the signal (A), (B), and (C) are (10 marks)



Answer

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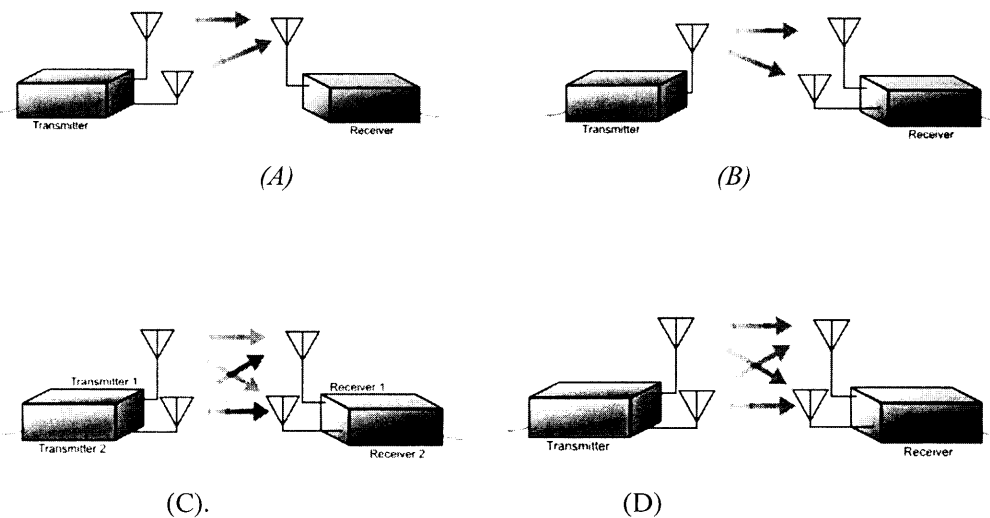
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5. Please explain how these antennas are used in WLAN (10 marks)



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Answer

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6. 802.11ac achieves its raw speed increase by pushing on three different factors. Please describe what they are. (5 marks)

**Answer**

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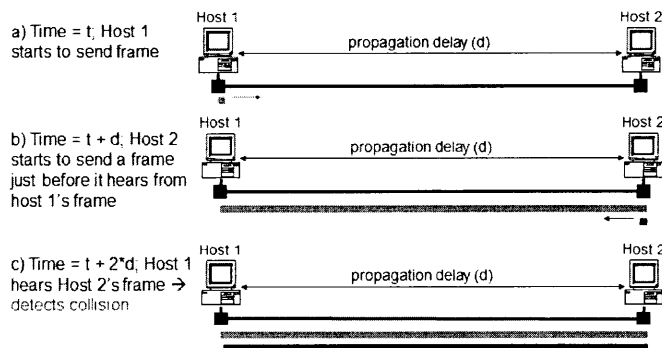
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7. Below figure shows collision detection of Ethernet using CSMA/CD.



รูปที่ 1 Collision detection in Ethernet

ชื่อ.....รหัส.....

If propagation delay in copper wire is 250,000 km/hr, and Ethernet smallest packet size is 512 bytes. Ethernet transmission rate is up to 1 Gbps. Please calculate the maximum cable length that CSMA/CD is still working properly. (5 marks)

**Answer**

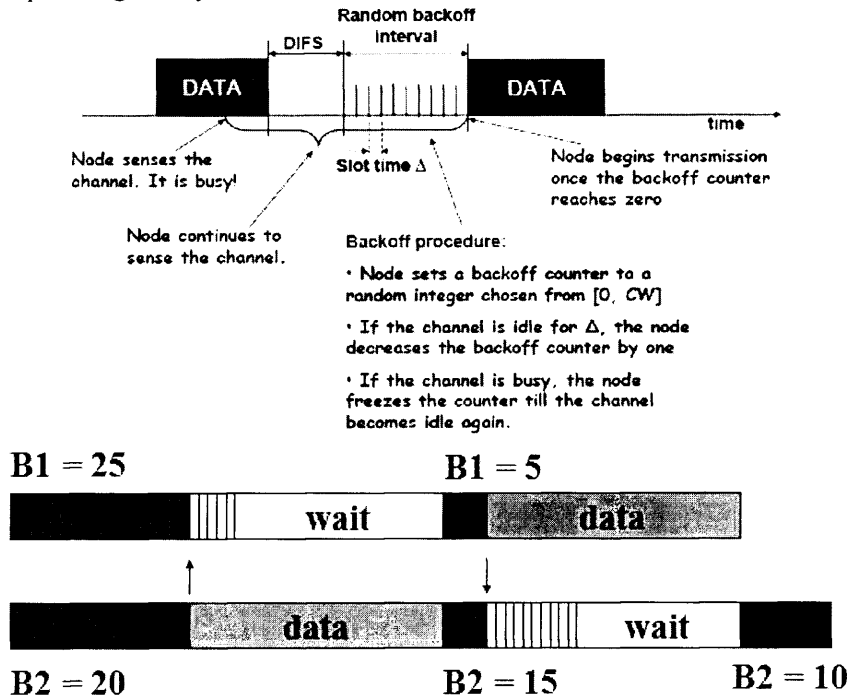
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8. Please give some 802.11ad Key Features (at least 4 of them) (5 marks)

**Answer**

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9. Two Ethernet stations are using CSMA/CA to communicate to each other. Station 1 and Station 2 have backoff interval B1 and B2 respectively, as given in the figure below. Please describe its working sequence, given by the table below. (10 marks)



Step	Station 1	Station 2
1		
2	B1=5, and wait for idle	Send data
3		
4		

Answer




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10. The table below is compared between 1G and 10G Ethernet. Please fill in all missing items in the table. (5 marks)

1000BASE-T	10GBASE-T
5-level coded PAM signaling (2 information bits/symbol)	(A)
8-state 4D Trellis code across pairs	8-state 4D Trellis code across pairs
Full duplex echo-cancelled transmission	(B)
125 Mbaud, ~80 MHz used bandwidth	(C)
No FEXT Cancellation	(D)

Answer

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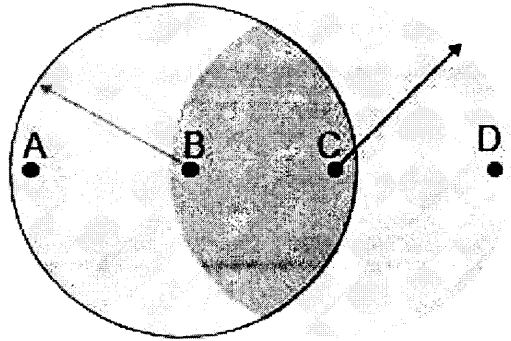
11. Please describe what are: a) MSDU aggregation and b) MPDU aggregation. What are the differences between MSDU and MPDP aggregations? (5 marks)

Answer

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12. In wireless Ethernet, it uses CSMA/CA. Please use the below scenario to explain:
- a) What are the problems of this scenario? (5 marks)
  - b) How does CSMA/CA work and eliminate these problem? (Please draw a signal flow diagram) (5 marks)



Answer

a) .....

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b)

other node in sender's range

sender

receiver

other node in receiver's range



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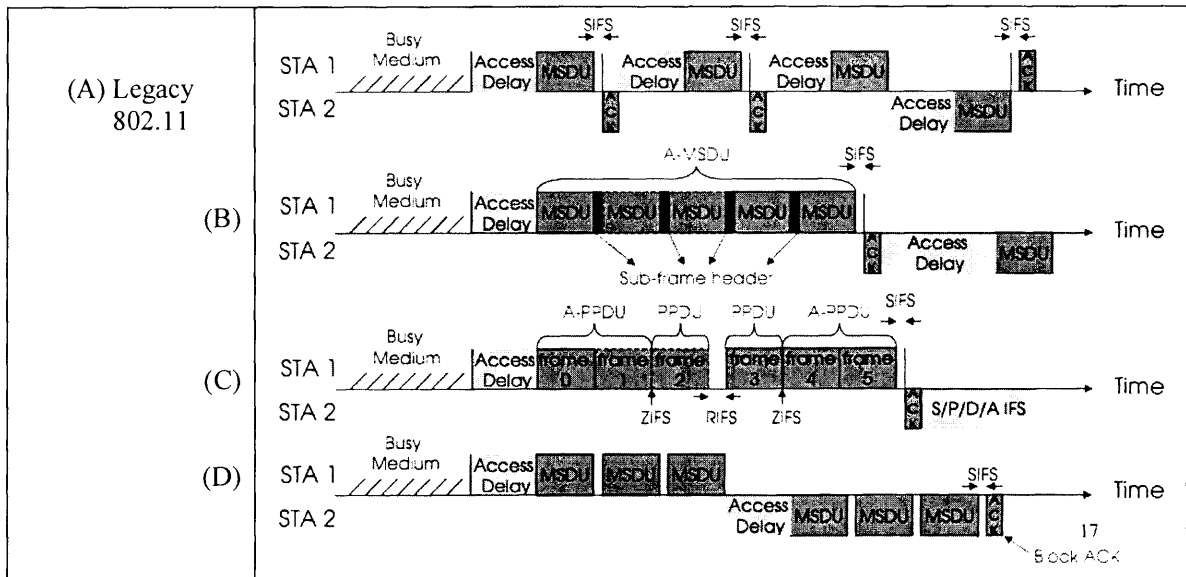
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13. In WLAN, (A) is legacy 802.11 (a/b/g) where it show how its mechanis works. After WLAN a/b/g, 802.11n has some improvements. According to the given picture below, please explain what are (B), (C), and (D) deployed in 802.11n. (10 marks)



Answer

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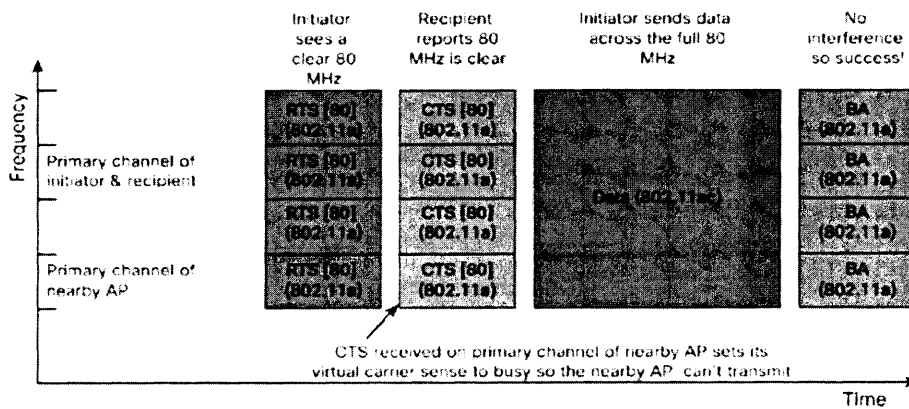
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14. In IEEE 802.11acm there is RTS/CTS enhanced with bandwidth signalling. Figure below show no interference case of RTS/CTS signalling. Please explain how it works using the diagram below. (5 marks)



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**Answer**

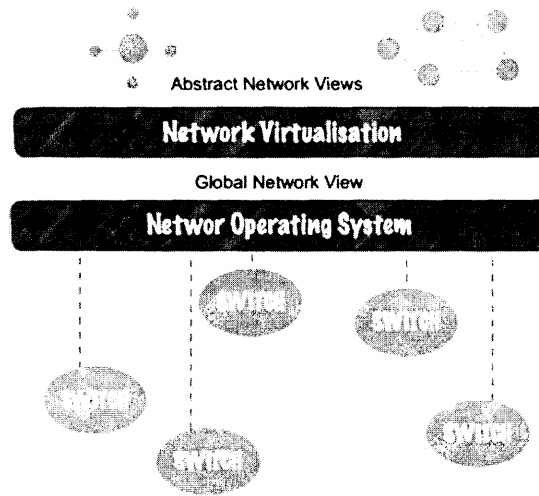
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15. In SDN (Software Defined Networking), its structure has 4 plans: Data, Management, Control, and Service. Please explain briefly how each plan works (10 marks)

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16. Below is the concept of Network Virtualisation and Network Operating System. Please explain and describe the idea of this figure, e.g. how it works, its functions. (5 marks)



**Answer**

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17. True or False answers (+2 marks for the correct answer, otherwise -1)

- 1. [ ] GbE uses 2 wire pairs in both directions simultaneously.
- 2. [ ] GbE can only operate in Full Duplex Mode.
- 3. [ ] 10 GbE is used for backplane for blade servers
- 4. [ ] 10 GbE can operate on half duplex and full duplex.
- 5. [ ] The 10 Gigabit Media Independent Interface (XGMII) transfers data 32 bits at a time, equivalent to four “lanes” of 8 bits plus 4 control bits (one per lane) and 1 clock bit.
- 6. [ ] GbE uses 64B/66B encoding.
- 7. [ ] 10GBASE-SR and 10GBASE-SW use short wavelength (850 nm) on multi-mode fiber.
- 8. [ ] 40 GbE and 100 GbE support full duplex mode only.
- 9. [ ] 100 GbE provides “Multilane Distribution (MLD)”, however, 40 GbE does not support MLD.
- 10. [ ] 40 GbE and 100 GbE support backplane feature.