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What is 4 Frame Exchange?

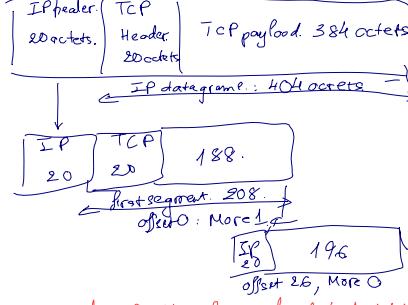
- used in 802.11 for reliable data transfer:
- Src sends Request to Send (RTS)
- Dest responds Clear to Send (CTS)

- Source transmits data after CTS
- Dest acknowledgement each time

it receives new frame
this technique replaces Collision Detection.

Structure of IP Fragmentation

- Org datagram split into multiple fragments, in multiples of 8 bits.
- Each fragment has IP header, & payload.
- Each IP header has:
 - Data ID: source & dest addr, the protocol layer that generates data.
 - Data length: length of user data field (1 unit = 8 bits)
 - Offset: part of fragment (1 unit = 4 bits, 208 in octets \rightarrow 26 in 64 bits)
 - IP flag: if false no more, 1 true has more



Why we need IP addr if we already had MAC add?

- carry info from one network to another

- distribute info based upon MAC addr

- IP is dynamic, MAC is fixed.

Which ensemble way IP use? At destination.

How does IHL measure IP header? 1 unit IHL=4 bytes

How does Total Length measure size of IPv4 data?

1 unit in Total Length = 1 byte in datagram.

What are IP service parameters?

Source & dest addr, protocol, type of service, identifiers, fragment indicator, TTL, data length, options & data, user data. IPR4 header size? 20 byte min. (5x4).

IP4 Header:

Byte	1	2	3	4
Version IHL TOS				Total Length
Identification	IP flag	Fragment offset		
TTL	Protocol	Header checksum		
Source				
Dest.				
IP option (var length, optional)				

IP4 Classes:

A:	0 7 bits	24 bits
B:	1 0 14 bits	16 bits
C:	1 1 0 21 bits	8 bits

111101 Multicast

111110 Broadcast

Calculate Network ID, host ID from IP & netmask.

- Network IP: AND IP & Netmask /192.168.17.57 AND 255.255.255.224

- Host ID: AND on the IP and inverted bit of Subnet mask.

How congestion is controlled in IP?

Via ECN bit, congestion indication.

What VLAN consist of? - Backbone virtual LAN

- Control Module, interface of WLAN, incl. bridge header.

- stations, user modules (bridged no. of stations on another virtual LAN).

10 requirements of WLAN?

- throughput: max capacity of medium use.

- number of nodes.

- connection to backbone LAN

- service area

- battery consumption

- trans. robustness & security.

- collocated network operation

- licence free operation

- hard off-roaming: use can move different cells.

- dynamic configuration.

What are mobility transition types of WLAN?

No transition, BSS trans, ESS trans

3 func areas of Medium Access Control?

Reliable data delivery (using 4 frame exchange), access control, security.

IEEE 802.11 WLAN Std.

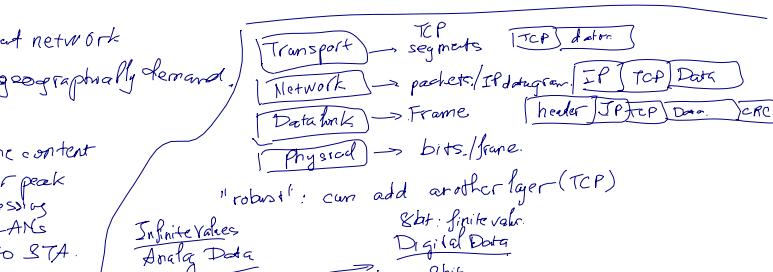
	Freq band.	bandwidth	Modulation	Max Data rate
802.11	2.4,5 GHz	20MHz	DSSS, FHSS	2Mbps
802.11b	2.4	20	DSSS	11Mbps
802.11a	5	20	OFDM	54Mbps
802.11g	2.4	20	DSSS, OFDM	54Mbps
802.11n	2.4,5	20,40	OFDM	600Mbps
802.11ac	5	20,40,80,160	OFDM	6.93Gbps
802.11ad	60	2.16GHz	SC, OFDM	6.7Gbps

IEEE 802.11 Services:

- Station Service: connect STA & similar to plug into etherenetrable.
 - Auth.
 - Deauth.
 - Enc.
 - MSDU delivery
 - DSSE
 - Dynamic Freq Selection (DFS)

- Distribution System Service (DSS): is all about getting data from 1 pair to the other, it exchanges the MAC frames. From 1 sta in 1 BSS to another STA in another BSS. It also works in same BSS.
 - Assoc: before can transmit data
 - Reassoc: move from one BSS to another
 - Disassoc: terminate
 - Distribution

Integration Service (IS) enable delivery of MAC frame between DS & non-DS in 802.11 network via portal, aka frame format translation, translates 802.11 frame into 802.3 frame.



Infinite Values
Analog Data
110V
Voltage step $\frac{10}{28} = 0.4$ volt.

8bit: finite value
Digital Data
2bit

What is HUB?

- active central element of star layout.
- station connects to HUB 2 lines
- acts as repeater.
- length of a line is limited 100m. (500m for fiber)

Key design aspect?

- Makes no mod to frame content
- contain enough buffer for peak
- contain routing & addressing
- connect more than 2 LANs
- bridge is transparent to STA.

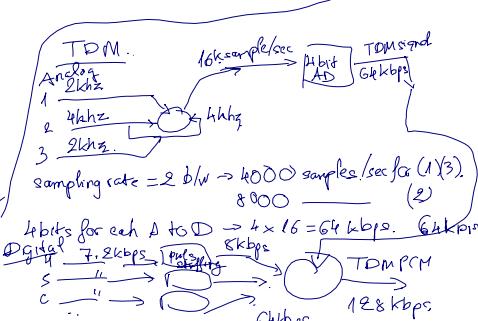
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sampling rate = 2 b/w \rightarrow 4000 samples/sec for (1)(3).

8000 _____ (2)

4 bits for each A to D \rightarrow 4 \times 16 = 64 kbps. 64 kbps

7.2 kbps _____ 8 kbps

5 " " 6 kbps

C " " 6 kbps

1 " " 6 kbps

TDM PCM 128 kbps