lec 7 MC

① MAC Protocol ② Multiple access technique

Medium Access protocol
- sublayer (data-link layer) < wire / wireless → شبكة
- Communicate with Physical layer
- Enforce discipline in the access of shared channel when multiple nodes Contend to access that channel

- Must be fair → no node has to wait for long time

شبكة wireless → ① difficult to Collision detection ② hidden terminal ③ Infrastructure-less network (AD-hoc)

MAC Protocol → 802.11 → max utilization
short delay ← → waiting time أقل

MAC protocol
- ① Fixed assignment (static)
- ② Random Assignment (Dynamic)
- ③ Demand Based (taking turns)

Static → Channelization Method (Conflict free)
↳ Channel allocation assignment is done in predefined way and doesn't change
X → 1
Y → 2 ---

Dynamic Mac → Contention Based
↳ allocation as needed, changes with time

Conflict free

MAC Protocol

① Static Channelization
a) FDMA
b) TDMA
c) CDMA
d) OFDMA (orthogonal Frequency)

② Dynamic Contention
- scheduled
  a) Tree
  b) window
- Random
  a) Aloha
  b) CSMA (Carrier sensing)

③ Demand taking turns
a) polling
b) token passing

Static Channelization (Conflict - free)

① FDMA (Frequency)
Frequency Band is devided into sub band (Channels) and each user assigned channel (time Constant)

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② TDMA (time) (Frequency Constant)
one channel is used by many users, BS assign time slot for users in Round-Robin

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③ CDMA (Code) (All time freq) No Interference ← orthogonal
Spread Spectrum → each user is assigned to unique Code
Code is mixed with each bit before transition

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④ OFDMA (orthogonal Frequency)
one signal is Composed of number of closely-spaced modulated orthogonal frequencies

User → different time
→ different frequency

TDMA

access Channel in rounds

user → get Fixed length slot (pkt trans time)

a) Frequency Division Dupleding (FDD) up, down link Freq
b) time Division Duplexing (TDD) up down link time

differs

FDMA

Channel is divided into frequency band

user → assigned to each fixed Frequency band

in used transmission → Idle

OFDMA ⇒ IEE 802.11 algin

multiple use access Channel at same time

uses Single user modulation methods

802.16d → Fixed

wi MAX → 802.16(e) Mobile Services

2 Dynamic Multiple Access technique

no prior Co-ordition

node Send pkt → Send at Full Channel Rate

2+ nodes → Collision

Random Access → detect Collision

→ recover for Collision (delay transmission)

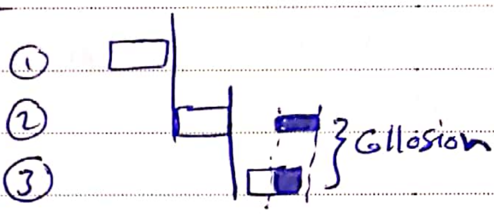
ex Aloha, Slotted Aloha

CSMA < CA → wireless
CD → wire

/ /

[1] Aloha (Pure - un slotted)

- Simple _ no synchronization
- when first frame arrive ⟶ transmit Imediatly
- Sender ⟶ Sense channel free

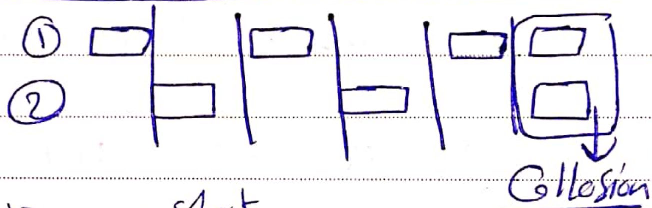


Collision probability increase as → num of Station inc → Rush hour

$P \times (1-p)^{2(N-1)}$ (1/2e) (18%)

Full overlap / partailly overlapp
كل ال pkt / بعض ال pkt

[2] Slotted Aloha (1/e) (37%)



Assumptions

① All frames are equal in size → slot
② time divided into equal size (time to transmit 1 frame)
③ node only transit at begining of time slot
④ nodes are Synchronized
⑤ if 2 Nodes transmit in slot !
↳ All nodes sense / detect Collision

Operation

when node obtain fresh frame ⇒ transmit in next slot
→ no Collision ⟶ Send new frame in next slot
→ Collision ⟶ Re transmit frame in each subsequent slot with probability (p) untill (Sucess)

Pros
① single active node
② high decentralized → nodes in slots to be sync

Cons → Idle slots → clock synchroniz.
① Collision ② waisting slots
② nodes detect Collision in less than time to transmit pkt

ALADIB

CSMA (Carrier sense) / /

listen before transmit

If Channel senses Idle → transmit entire frame
If " " busy → defer transmission
improve throughput Aloha, Slotted Aloha

Wireless → Request → clear
CSMA/CA RTS CTS
if (A) ready for transmission to (B) it Broadcast (RTS)
(B) recieve (RTS) and reply with (CTS) to (A)
since (C) is in transmission Range of (B)
↳ C can recieve cts
Now (C) knows that (B) in other transmission

Collosion Can Still occur → propagation delay when 2 nodes may not hear each other's transmission
↓
Collosion detection
Collesion Avoidance

Random Access protocol ⇒ allow MS to retransmit a Collided message only after (random) dely
Non - Presistaule CSMA

scheduled protocol ⇒ Shecdelling schemes to Control re-transmission
Presistant CSMA

CSMA/CD → wired

Collision detected in small time

Colliding transmission (aborted), reducing channel waste

⇒ easily in wired lans

↳ measure signal strength, Compare transmitted

⇒ difficult in wireless lan

recieved signal strength (overwhelmed) by local transmission strength

3 Demand Based
taking turns

Channel Partioting MAC protocol

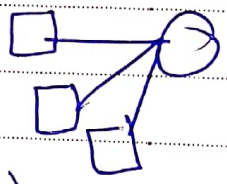
Share Channel efficiency fairly at high load

in efficient in (low load) (1/N) bw allocated even 1 node is active

Polling

↓ Master node invite slaves to transmit in order

↳ use dumb slave devices



① Pooling overhead over Master ② latency ③ Single point failure (master)

Token passing

↓ Control token passed from node to other sequentially

token msg

① token overhead ② latency ③ single point of failure