Data Link Layer: CSMA/CD

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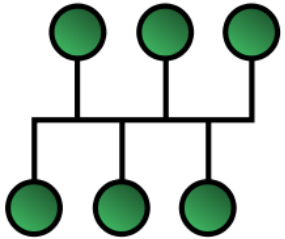
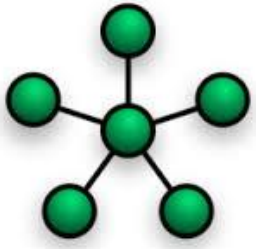
Recap

- Many types of MAC protocols
  - Looked at simple random access protocols: Pure Aloha, Slotted Aloha
  - Maximum efficiency is rather poor (37%)
- Another class of random access protocols: CSMA (Carrier Sense Multiple Access)

Outline

- CSMA class of protocols
  - Persistent and Non-persistent
- Ethernet MAC : CSMA/CD
  - Applicable for Bus or Star topology in shared mode





Problems with Aloha

- What causes collisions?
  - Pure Aloha: Transmissions without care or concern for channel state
  - Slotted Aloha: Multiple arrivals in previous slot → collision in current slot (greedy to access channel)

CSMA

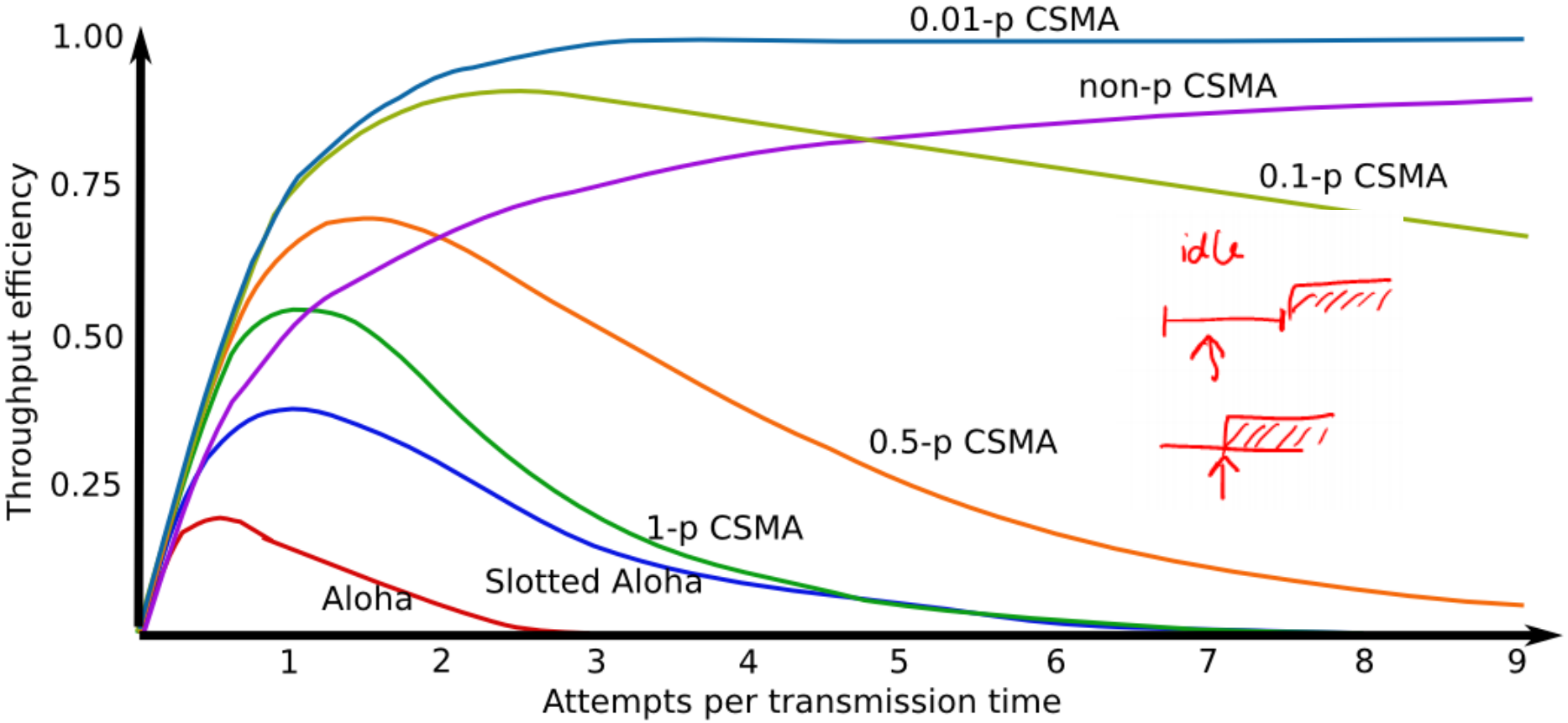
- 'Listen before Talk' – Carrier Sense
- If a node has a frame to send, listen to channel first
  - If busy, don't send frame --- don't disrupt ongoing transmission
  - If idle, send frame
- Two categories: persistent and non-persistent

1-Persistent CSMA

subset of p-persistent

↳ p-persistent

- Employed by Ethernet
- If a node has a frame to send:
  - If channel busy, wait till it becomes idle, then transmit
  - If channel idle, transmit
  - If collision, wait a random amount of time and start over
- Better than Pure Aloha, but is it better than Slotted Aloha?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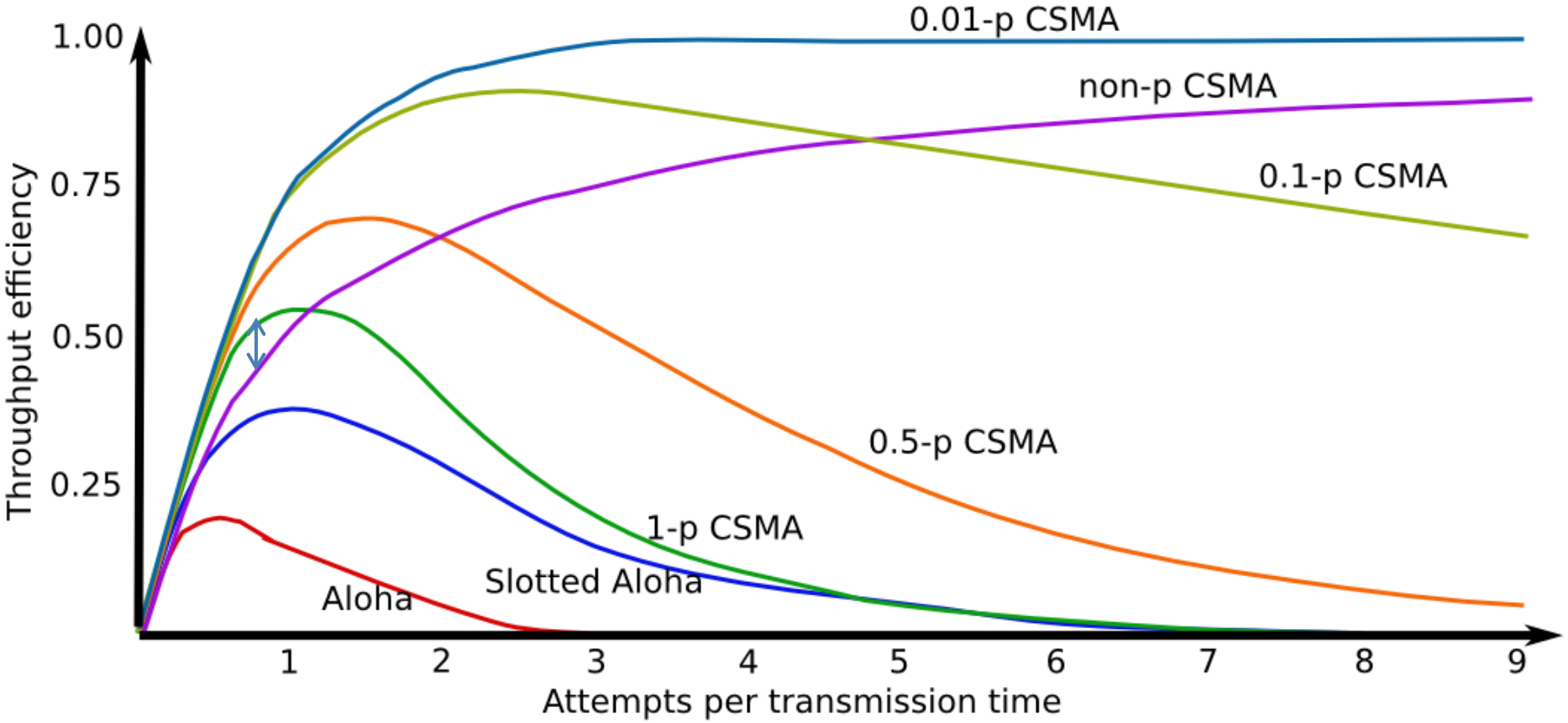
non-p CSMA
0.1-p CSMA
0.5-p CSMA
1-p CSMA
Slotted Aloha
Aloha
idle
1.00
0.75
0.50
0.25
Throughput efficiency
1
2
3
4
5
6
7
8
9
Attempts per transmission time

Non Persistent CSMA

- Used in 802.15.4 (Zigbee/Sensor technology)
- If a node has a frame to send:
  - If channel busy, do not sense anymore. Wait a random amount of time and try again
  - If channel idle, transmit
  - If collision, wait a random amount of time and start over
- Better channel utilization than 1-persistent but longer delays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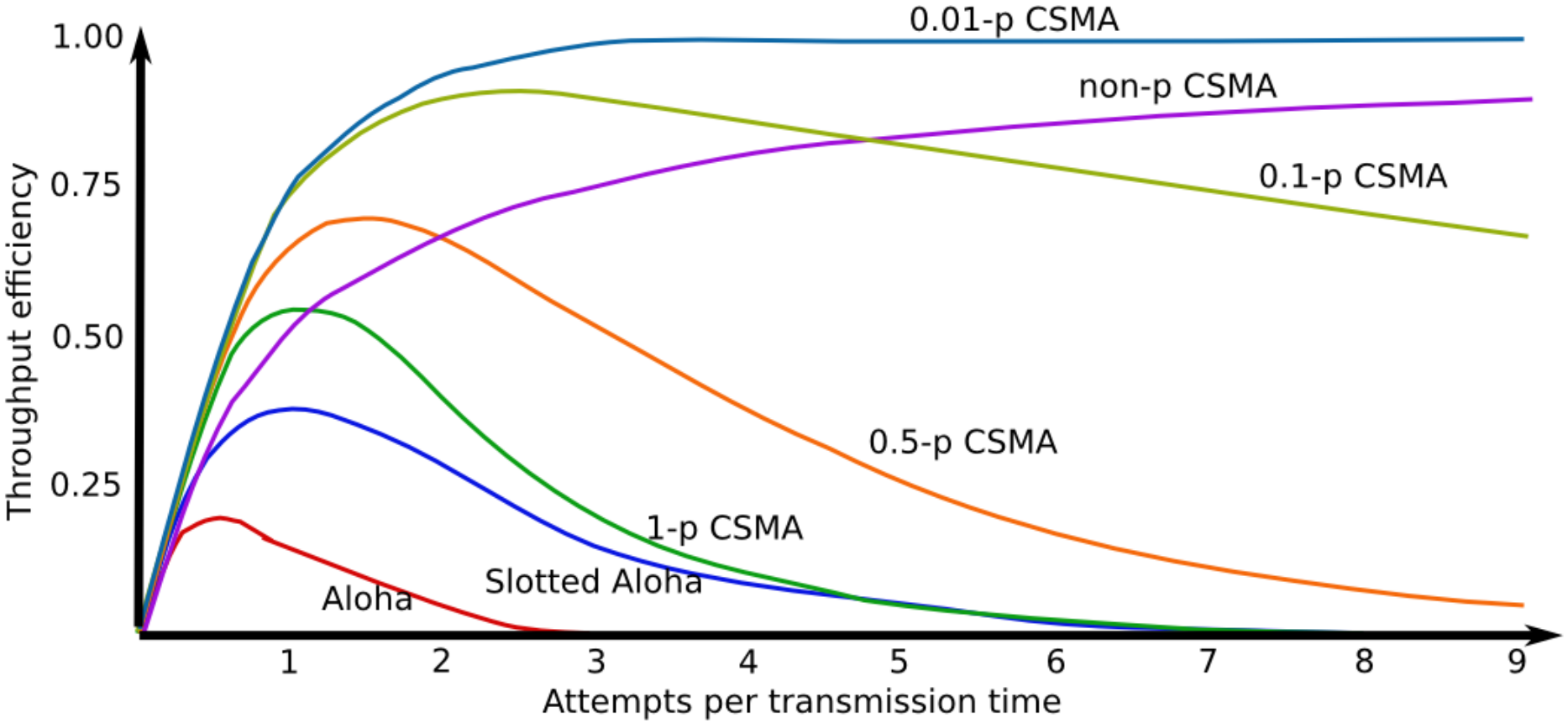
P-persistent

- Employed by 802.11 (WiFi)
- Assumes a slotted system
- If a sender has a frame to send:
  - If channel idle, transmit with probability p (defer to next slot with probability q=1-p). Repeat till frame sent or channel busy due to another transmission
  - If channel busy, wait till idle. Repeat above.
  - If collision, wait a random time and try again
- Good Tradeoff between non-persistent and 1-persistent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