

Data Link Layer: CSMA/CD

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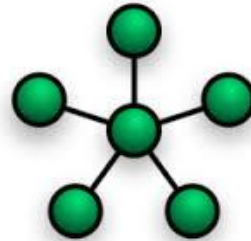
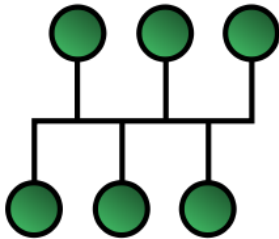
<http://commons.wikimedia.org> (Wikipedia, Wikimedia and workbooks); <http://www.sxc.hu> and <http://www.pixabay.com>

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)

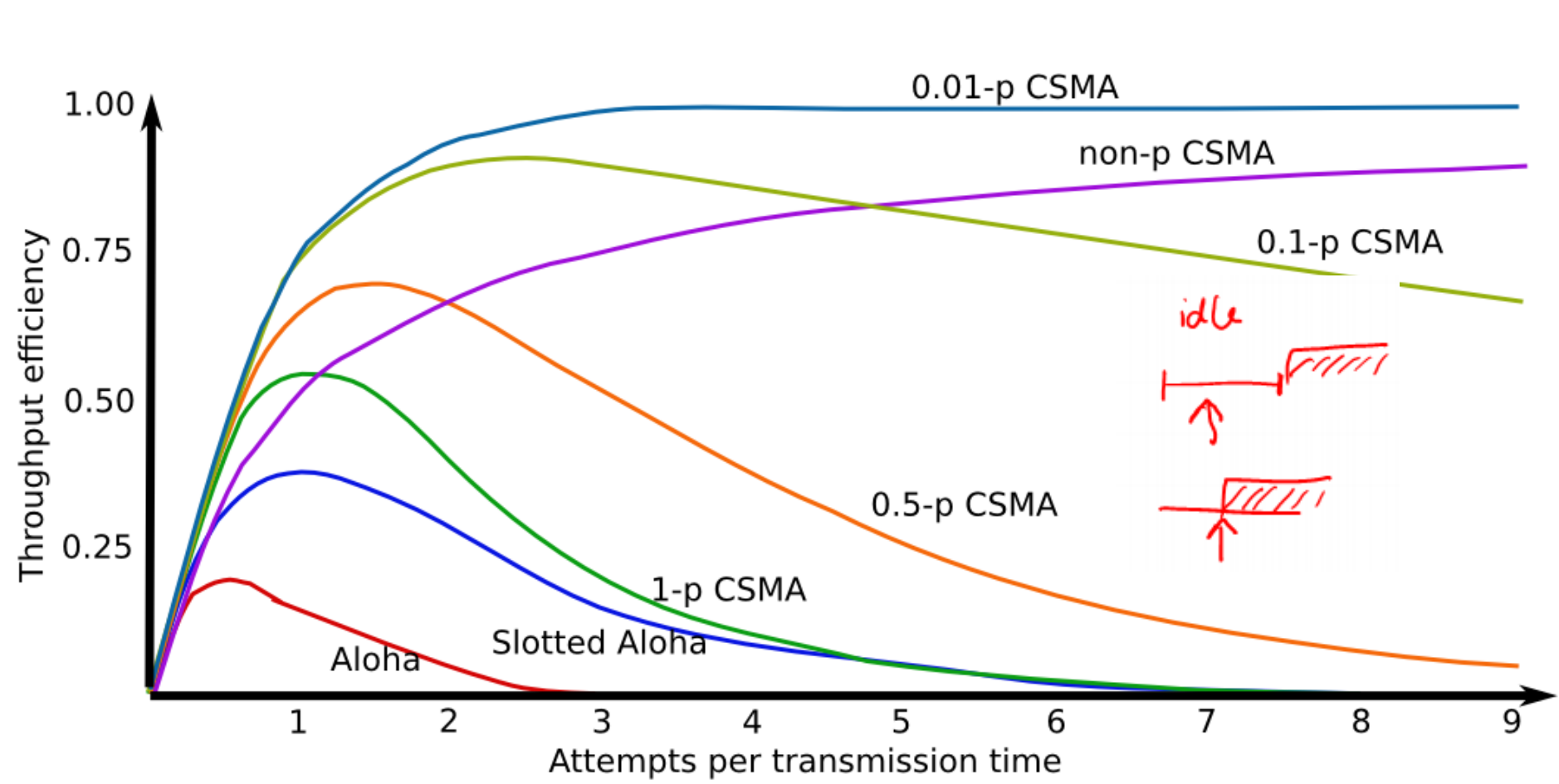
CSMA

- ‘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

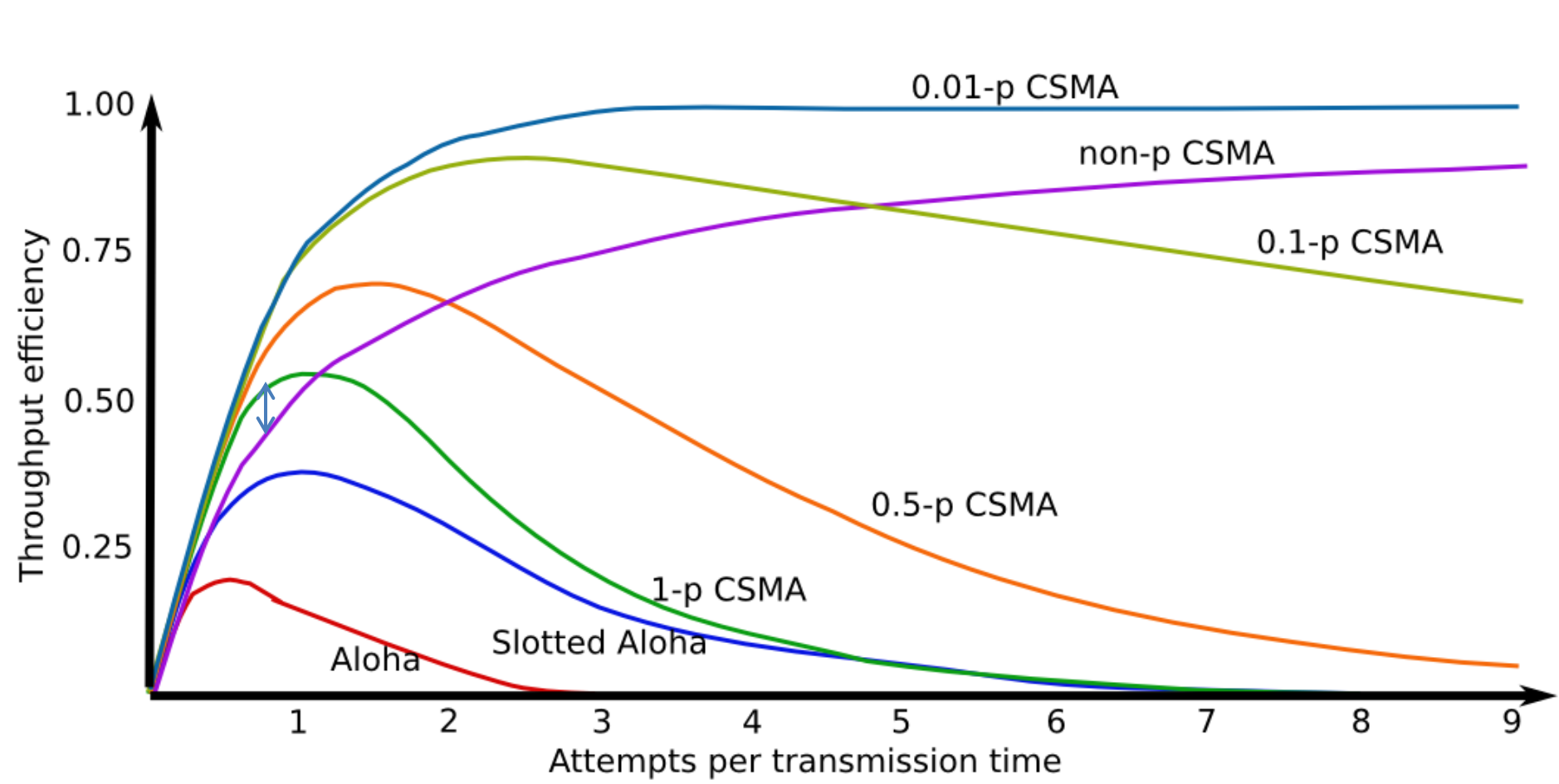
↳ p-persistent

- 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?



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



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

$p = ?$

