TP Session 4

Ensimag 2018-2019

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1 Aloha Protocol

The Aloha protocol is the first channel multiple access protocol. It has been set up for a radio communication network on the Hawaiian Islands. The purpose was to share the same frequency bandwidth for all communications.
When using Aloha, the network is first stable. But after a while, the number of pending packets start to grow indefinitely. The system was then manually reset. Rejecting at first the problem on a material dysfunction, it took more than 10 years to discover the real problem.

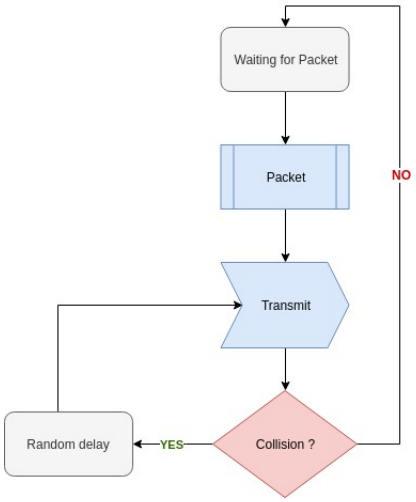


Figure 1: Pure Aloha

1.1 Pure Aloha

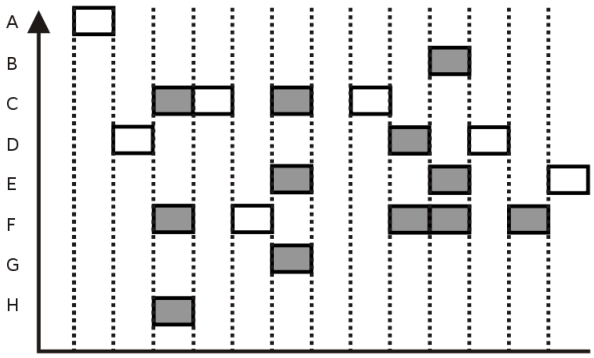
In this protocol, all stations are allowed to transmit a packet at any time. If two stations are transmitting at the same time, there is a collision and the packet must be retransmitted. In order to avoid a new collision, a station that experienced a collision waits a random time before retransmitting its packet.

- If two or more stations try to transmit at the same time, the packets are lost and the stations will have to try again in the future

- Any station that has a packet to retransmit decides to send its packet after a random delay rand(d) until the packet is successfully transmitted

1.2 Slotted Aloha

In pure Aloha, a transmission may start at any time. In slotted Aloha, the time axis is divided to slots of duration S. All terminals are assumed to know the times at which a new slot begins. Packets may only be transmitted at the beginning of a new slot.



Slotted ALOHA protocol (shaded slots indicate collision)

Source: https://www.wikipedia.org/

1.3 Exercice

Two routers are sending packets through a 64 kbps link following a Poisson process of intensity λ_1 and λ_2, such that $\lambda_1 = \lambda_2 = \lambda$. The length of the packets is an exponential random variable with mean 400 bytes. The channel access is based on Aloha.

1. Implement the pure Aloha protocol in the discrete event simulation API.
2. Plot the number of pending packets for different values of $\rho = \lambda/\mu$ and d. What do you observe? For what values of λ and d is the system stable? Explain the arguments that justifiy your choices.
3. Implement the slotted aloha protocol in the discrete event simulation API. Explain your choice of the slot duration S?
4. Plot the packet throughput as a function of ρ for pure and slotted Aloha. Explain the differences and conclude.