Universitat Pompeu Fabra Barcelona

TDS Practice: Slotted Aloha Specification Protocol & Model

Dolors Sala

First Quarter

2017-18

Aloha

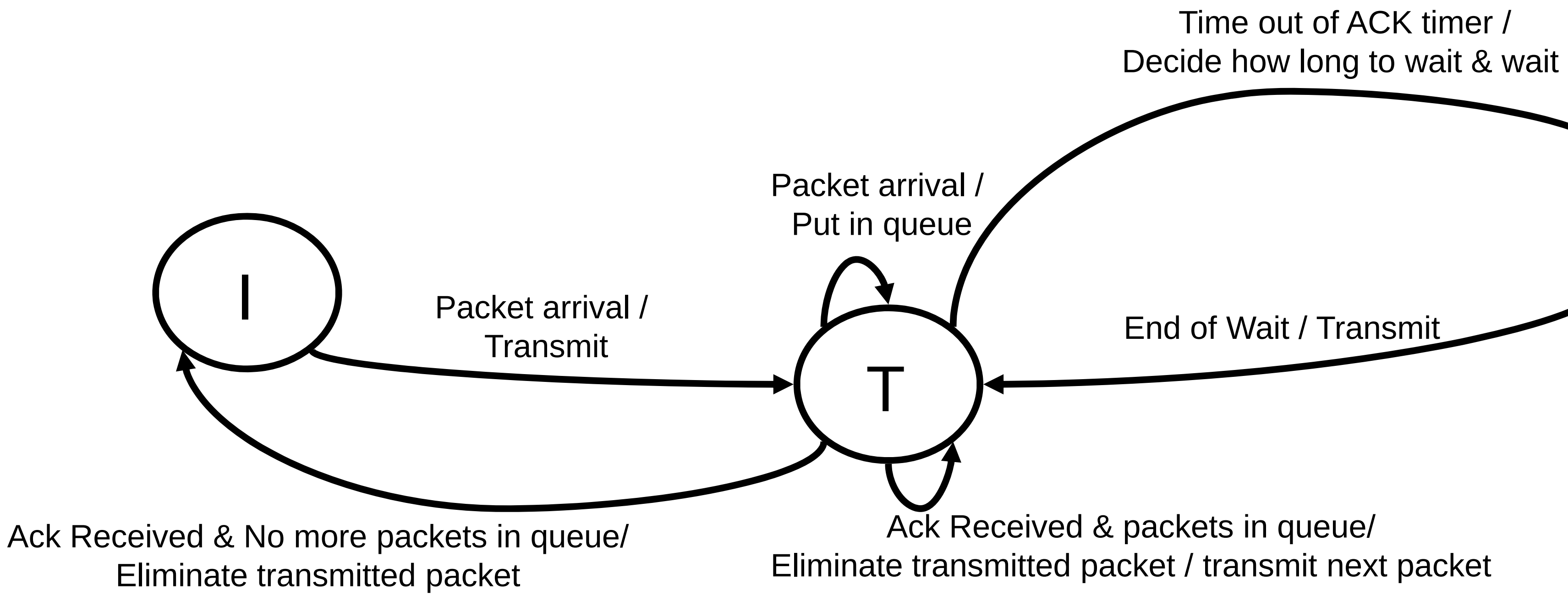
- Notation:
  - User: the station trying to communicate in the channel with another user/station
    - Wants to transmit packets
    - Wants to receive packets
  - Channel: transmission media that is broadcast and shared between all users to communicate
  - Sender: the user sending a packet to a destination user in the network
  - Destination: the user who has to receive the transmitted packet

Aloha : Protocol Definition

- Basic operation: Transmit a packet, the destination will send you an ack if received, if the ack reaches you the packet has been delivered correctly so it can be deleted and start again the process with the next packet in the queue
  - The sender waits for the ack for a time duration (set in a timer)
- Since the media is shared more than one user can transmit at the same time. In this case, the transmitted packets collide and the transmission cannot be received at the destination and sender will not receive the ack, and the ack timer expires which is the indication of a collision
- If collision happens users cannot transmit immediately all at the same time as the collision will repeat for ever
  - Each user has to wait (ideally) a different time before retransmitting
  - How long to wait is decided by the contention resolution algorithm (CRA)

Aloha : User State Diagram

- The user operation is implemented with a state diagram of 3 states:
  - Idle (I): initial state indicating that there is no packet with initiated transmission, so the user is doing nothing (Idle)
  - Transmit (T): A packet has been Transmitted and user is waiting for the ack
  - Resolution (R): A collision has occurred and is waiting for the Resolution time before the next Retransmission



Slotted Aloha : Protocol Definition

- Aloha protocol reaches a maximum efficiency of 18% due to collisions and partial collisions
  - A collision can be between the last bit of current packet transmitting and the first bit of a new packet being transmitted (both are lost)
- Performance is higher (double) if collisions can happen only at the start of the packet transmission
- Slotted aloha defines the slot unit and transmissions can only happen at this point
  - All arrivals during an slot must wait transmission at the beginning of the next slot
- Everything else remains the same as aloha protocol previously defined

saloha Program: Model (I)

- Assumptions made in the model are to simplify the implementation
  - They are good enough for our study (purpose)

- All packets are assumed same size

- The slot size is equal to the time to transmit a packet

- Time unit in simulation is the slot (time) → time driven simulation
  - Operations happen at slot times (finer time granularity is neglected)

saloha Program: Model (II)

- The channel is modeled with ONE slot
  - All operations happening in this slot are performed together and before the clock moves to next slot
  - Therefore no need to keep channel history when time passes to next slot
- All stations (0.. nstns-1) are sender users implementing the previous state diagram
- There is an extra station (stns[nstns]) that is the destination user of all packets sent by all stations
  - It generates the ack and delivers them to the corresponding sender station
- The contention resolution algorithm implemented is the determinist

saloha Program: Model (III)

- The acks are delivered directly to the destination (never collide)
  - It is not transmitted in the channel as in protocol rules
  - It is received immediately by the sender (same slot that the packet is transmitted)
    - A packet can have a transmission delay of zero, this is inaccurate, it has to be at least one
    - The delay can be corrected by just adding one, so no need to make the model more complex for an operation that can be reduced to add a constant to a metric result

Determinist (D) CRA

- This mechanism is not an algorithm per se
  - We use it as the simplest form of not colliding indefinitely in our basic initial implementation
  - It will be used in a CRA study together with typical algorithms
- Definition:
  - Each station has an identification number `n` which corresponds to the index /position of the station in the stations vector
  - The algorithm D is called once the collision is identified
  - It returns the number of slots to wait before trying to transmit again
  - The returned value is a constant value for each station equal to the station identification number `n`
    - `station 0 waits 0, station 1 waits 1, …`