S-WiFi: Scheduling for Uplink Transmissions with Point Coordination Function

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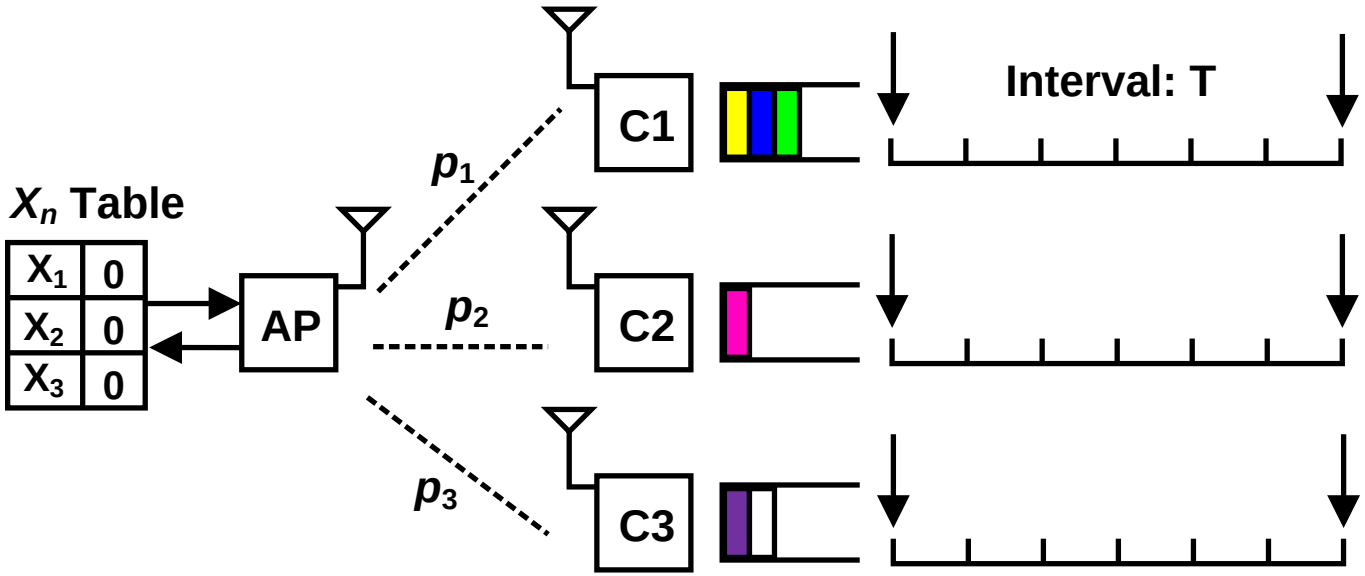
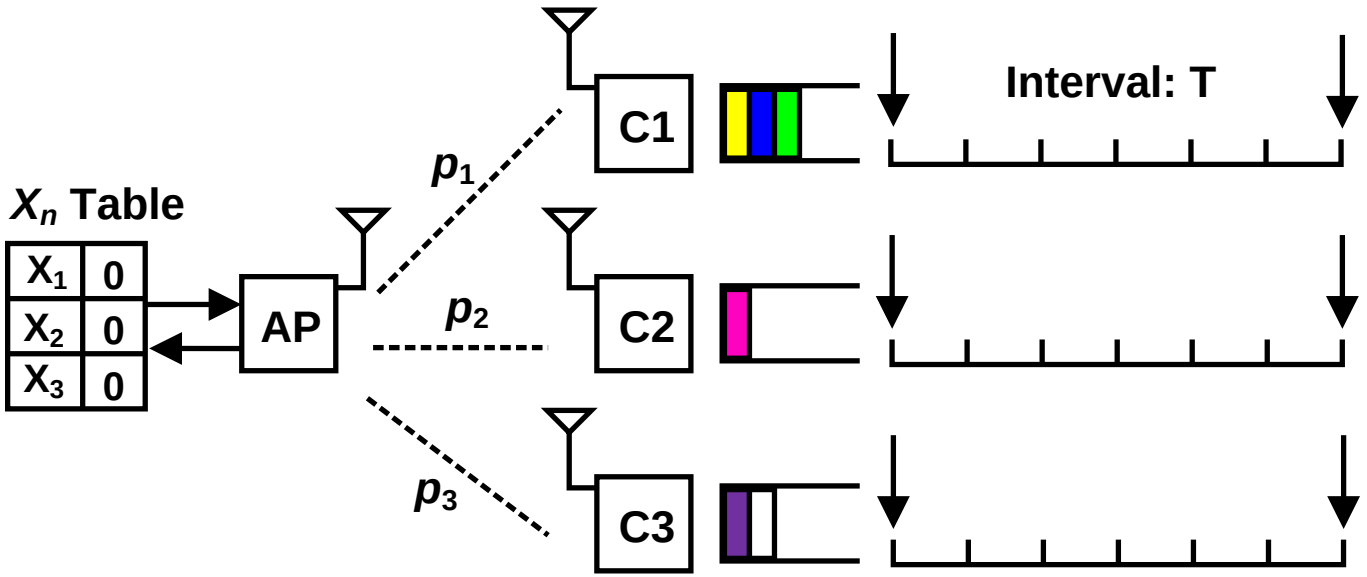
Uplink Transmissions

- One AP and N clients
- 1 slot = 10ms; 1 interval = T slots
- Packets generated in the beginning of each interval
- Packet generation follows Unif$\{Rmin, Rmax\}$
- Real-time traffic



Baseline Policy - A Toy Example

- $N = 3$ and $T = 6$
- $p_1 = p_2 = p_3 = 0.5$
- Real-time traffic
- $X_n(k) =$ queue length at the start of the k-th interval



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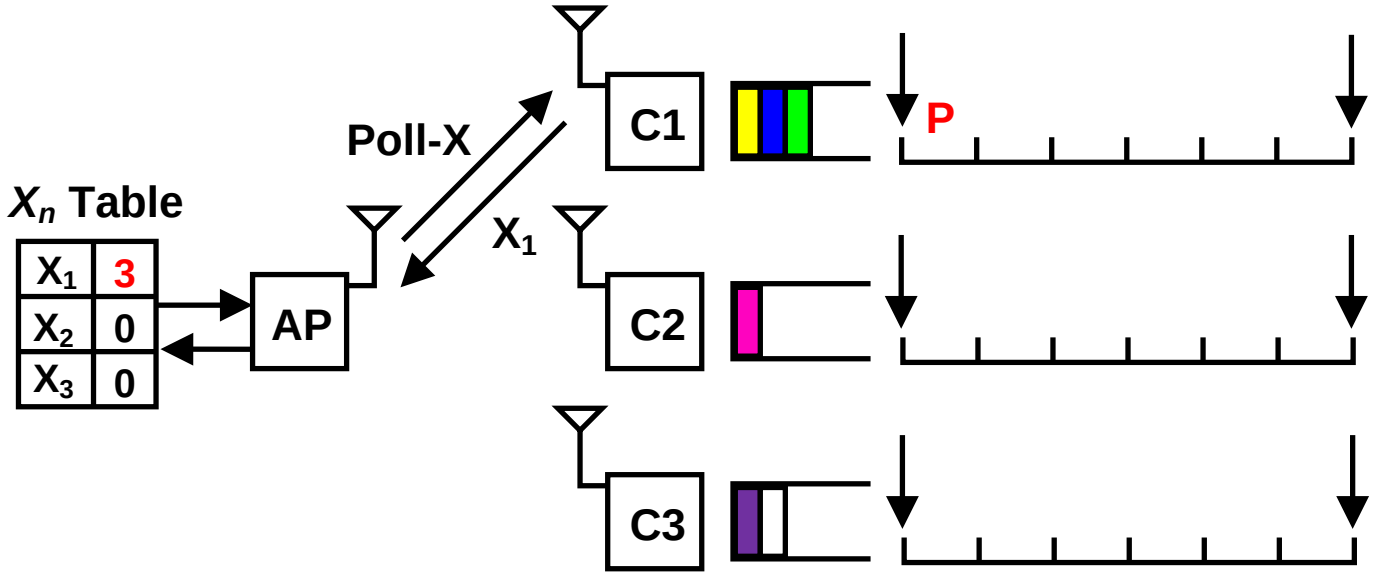
- Phase 1: AP polls X_n in a round-robin manner



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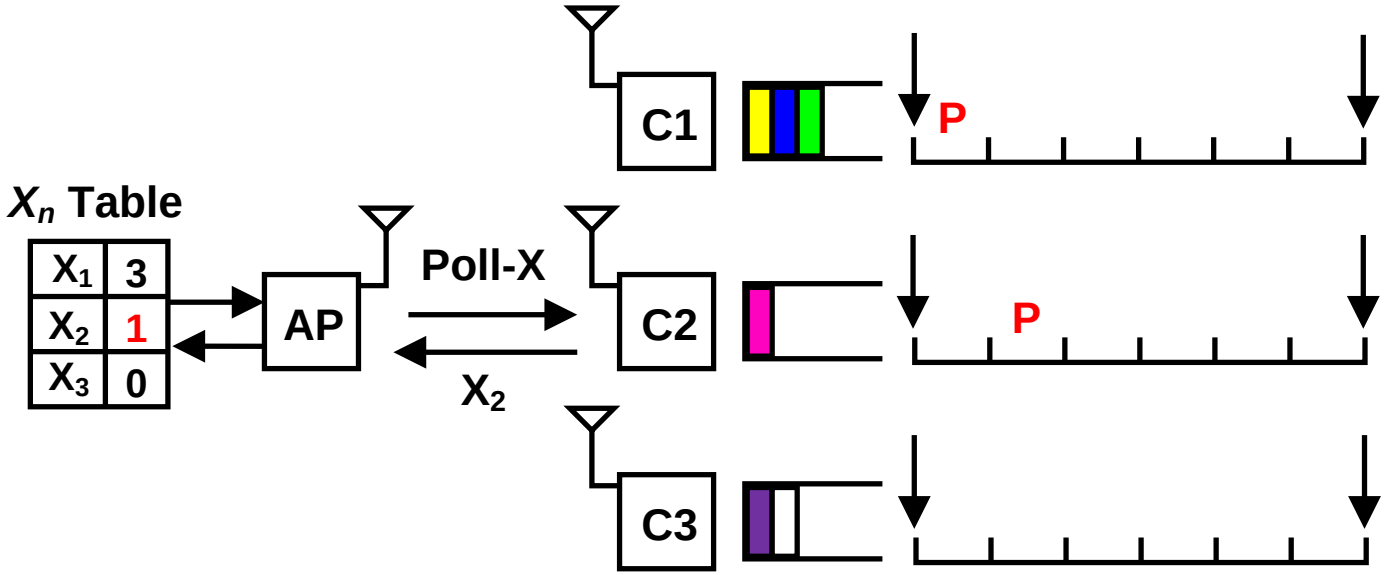

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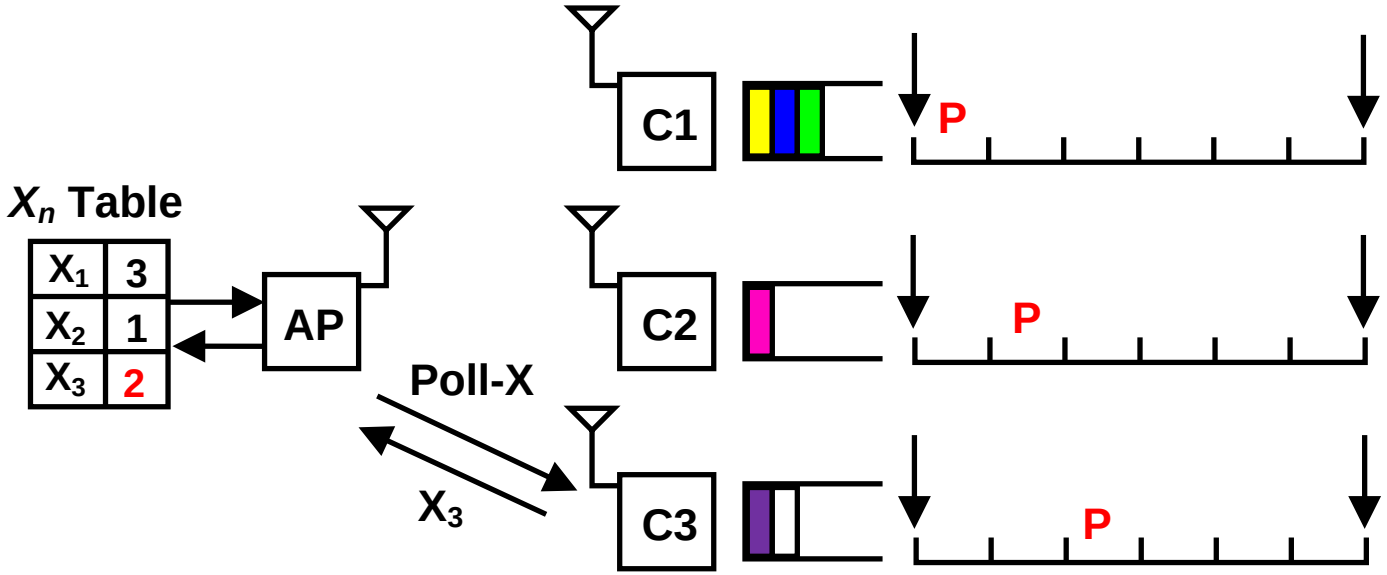

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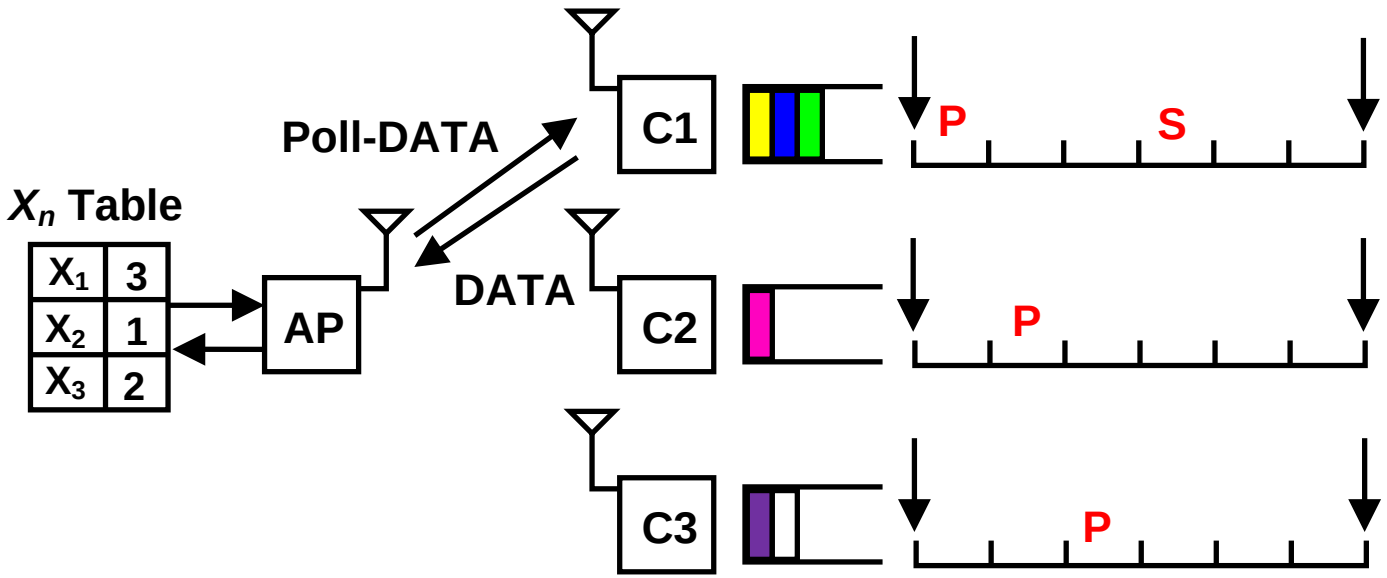
- Max-Weight: select the client that maximizes $p_n X_n$



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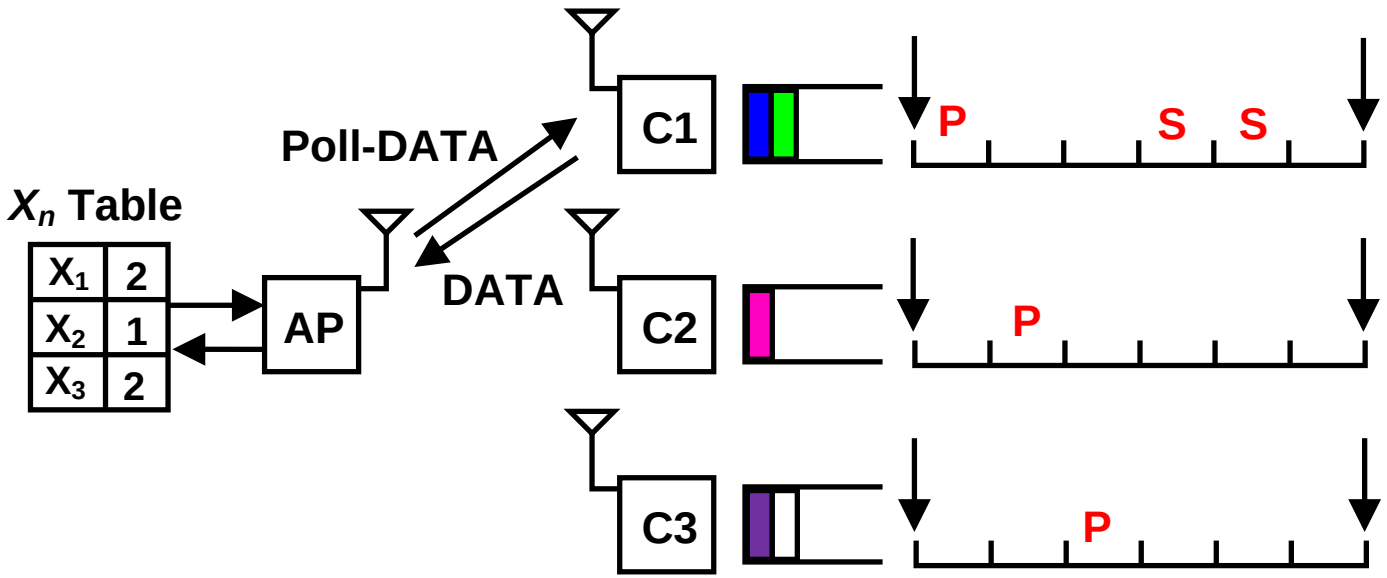

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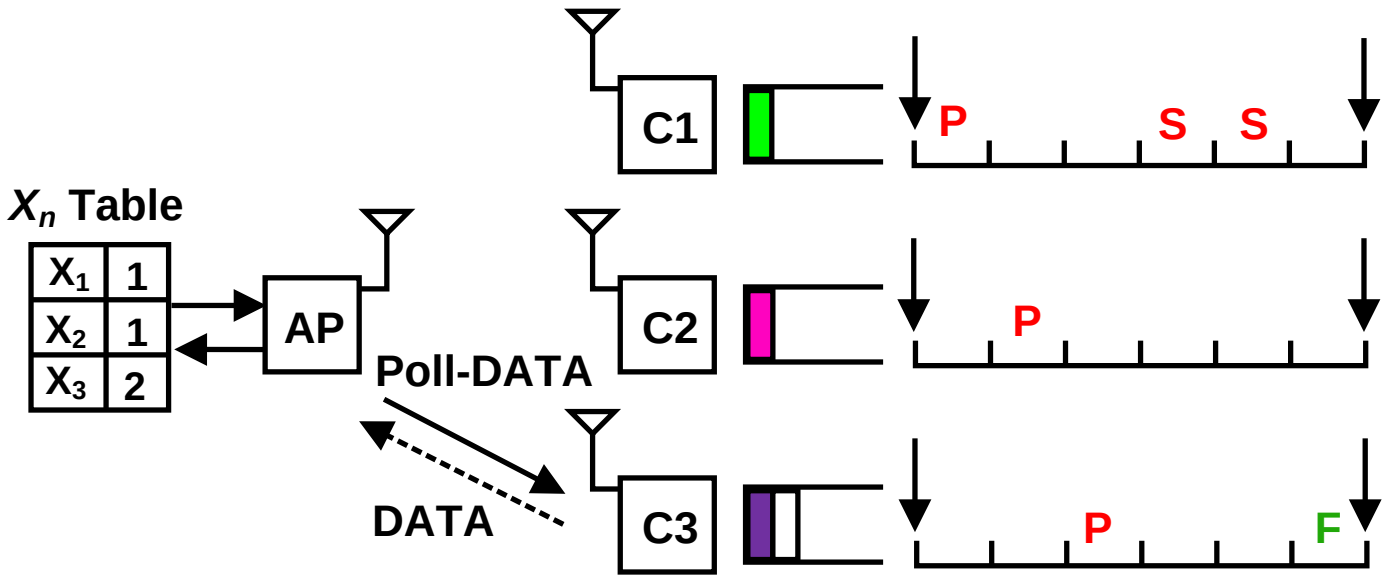


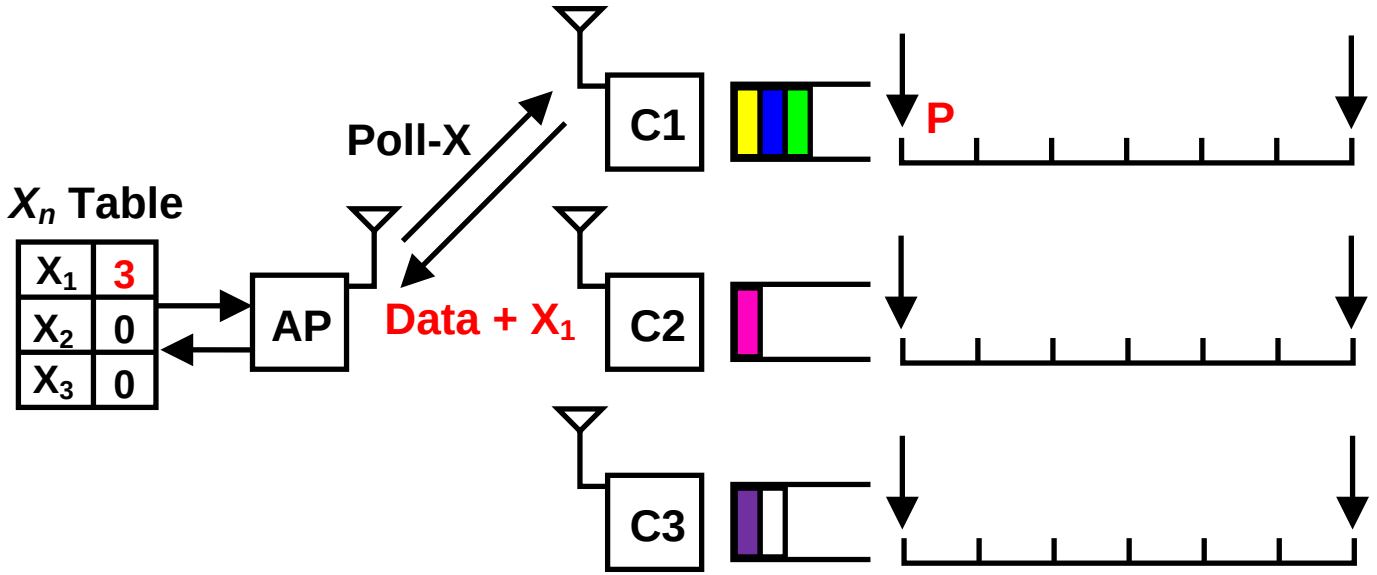
Drawbacks of the Baseline Policy

1. Overhead due to polling
2. Channel utilization for data packets is low
3. Not practical when N is large

- We propose three solutions to improve polling in phase 1

1. Piggybacked Queue Length

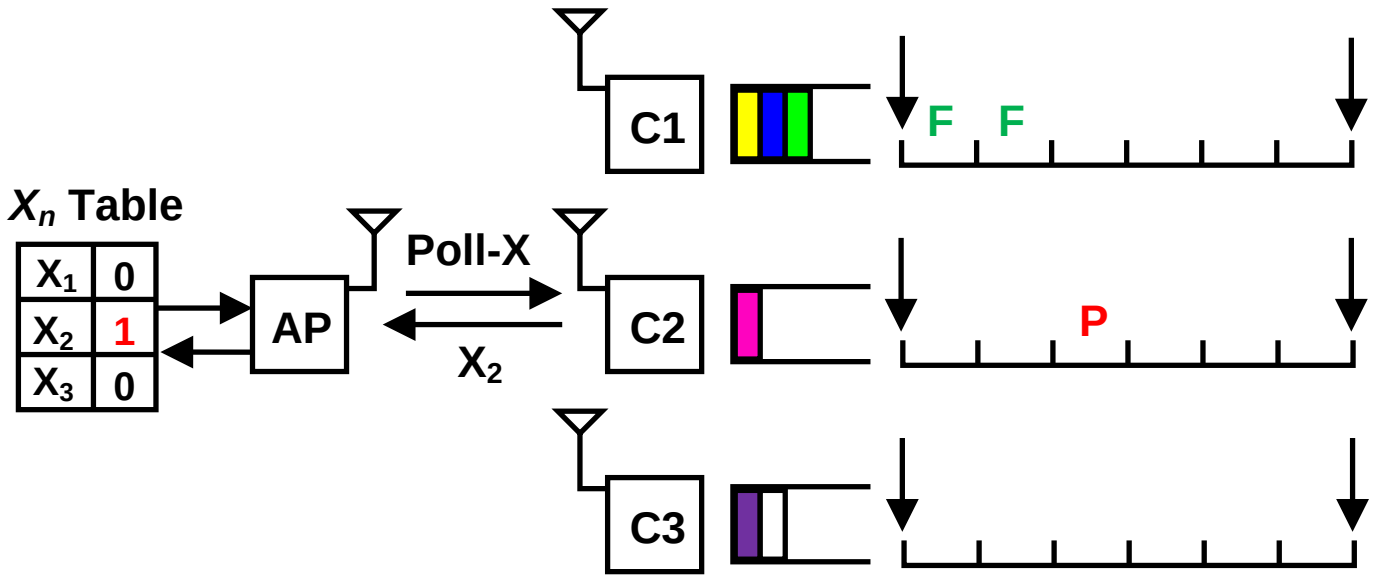
- Queue length can be appended in DATA packets



NS-2 Implementation: Piggybacking

2. Retry Limit for Polling

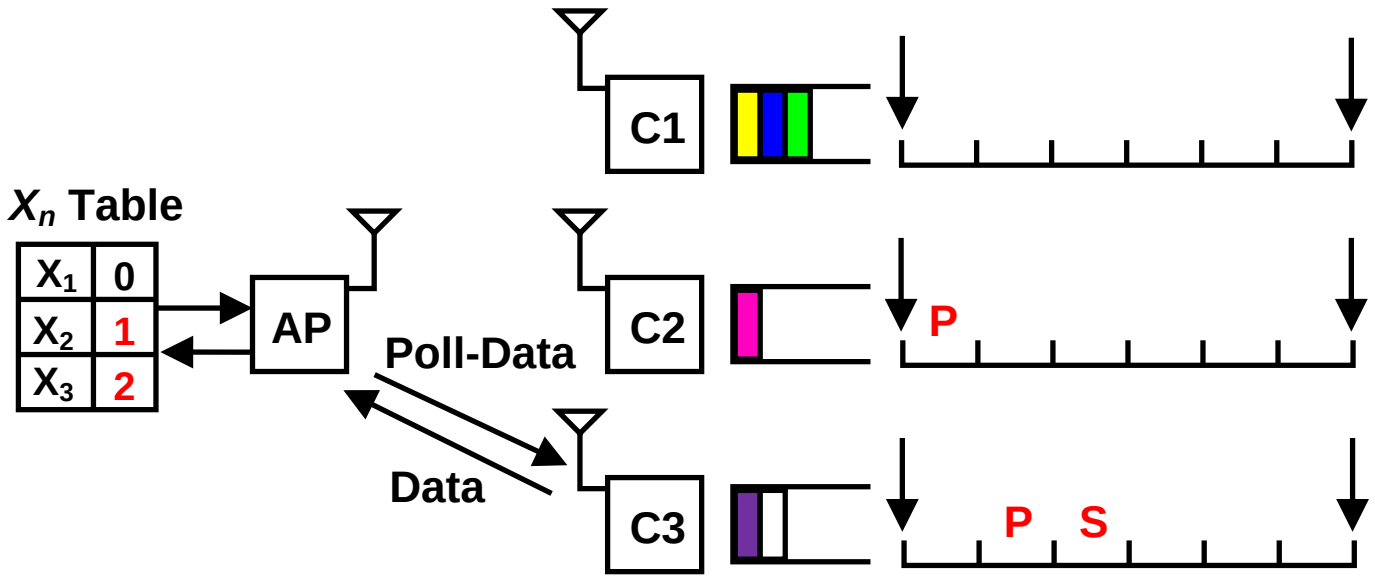
- Retry limit: avoid polling a client with poor channel indefinitely
- Example: $p_1 = 0.1$ and retry limit = 1



NS-2 Implementation: Retry Limit

3. Selective Polling

- Polling a subset of clients: avoid spending too much time on Phase 1 when the network size is large
- Example: Randomly select 2 out of 3 clients (say C2, C3)



NS-2 Implementation: Selection

Simulation Results