ADAPTIVE QUEUEING CONFIGURATION IN WLAN

INVENTORS:

LILI HERVIEU

GREGORY C. WHITE

Adaptative Queuing Configuration in WLAN

Problem statement:

WLAN have a limited number of QOS queues available in HW which is limiting efficient prioritization and scheduling.

Solution

An adaptative queueing configuration is proposed to adapt to the QoS queues with respect to the clients and their traffic

Queuing Usage in WLAN

VO = Voice
VI = Video
BE = Best effort
BK = Background

- 802.11 defines 2 possible queue systems for EDCA (figures 10-27 & 10-28). For APs, 1 queue system per client is implemented.
- The alternate queues (A_VO and A_VI) in fig 10-28 enable to prioritize traffic for latency sensitive applications or prioritized traffic such as a managed service. It typically handles traffic corresponding to SCS/MSCS/TSPEC.
- On the other hand, L4S that supports end to end low latency relying on a queuing implementation as described in figure "L4S"
- To support both MSC/SCS/TSPEC and L4S, implementing 3 queues per AC category would be best but this is not suitable due to HW constraints in WLAN

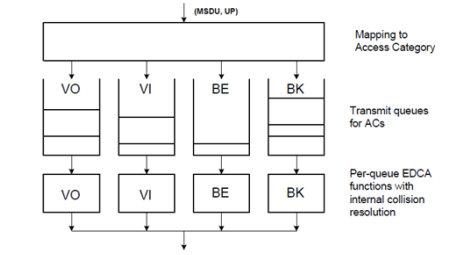


Figure 10-27—Reference implementation model when dot11AlternateEDCAActivated is false or not present

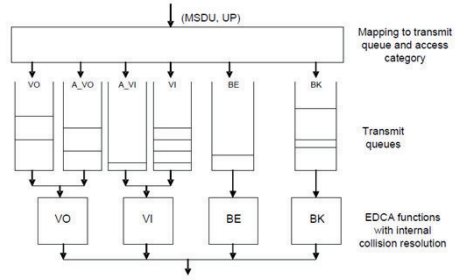
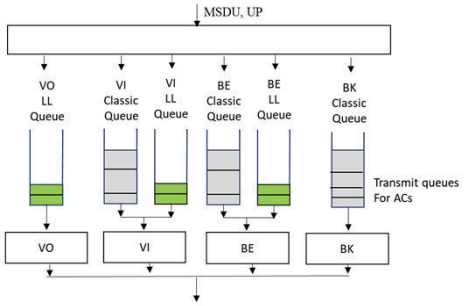
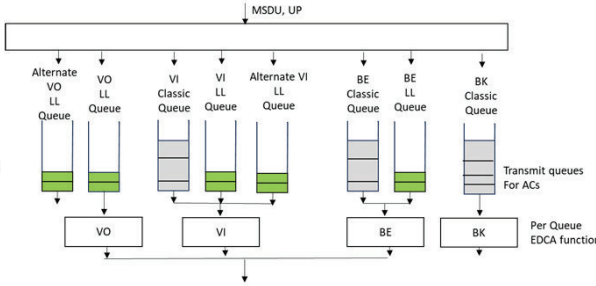


Figure 10-28—Reference implementation model when dot11AlternateEDCAActivated is true





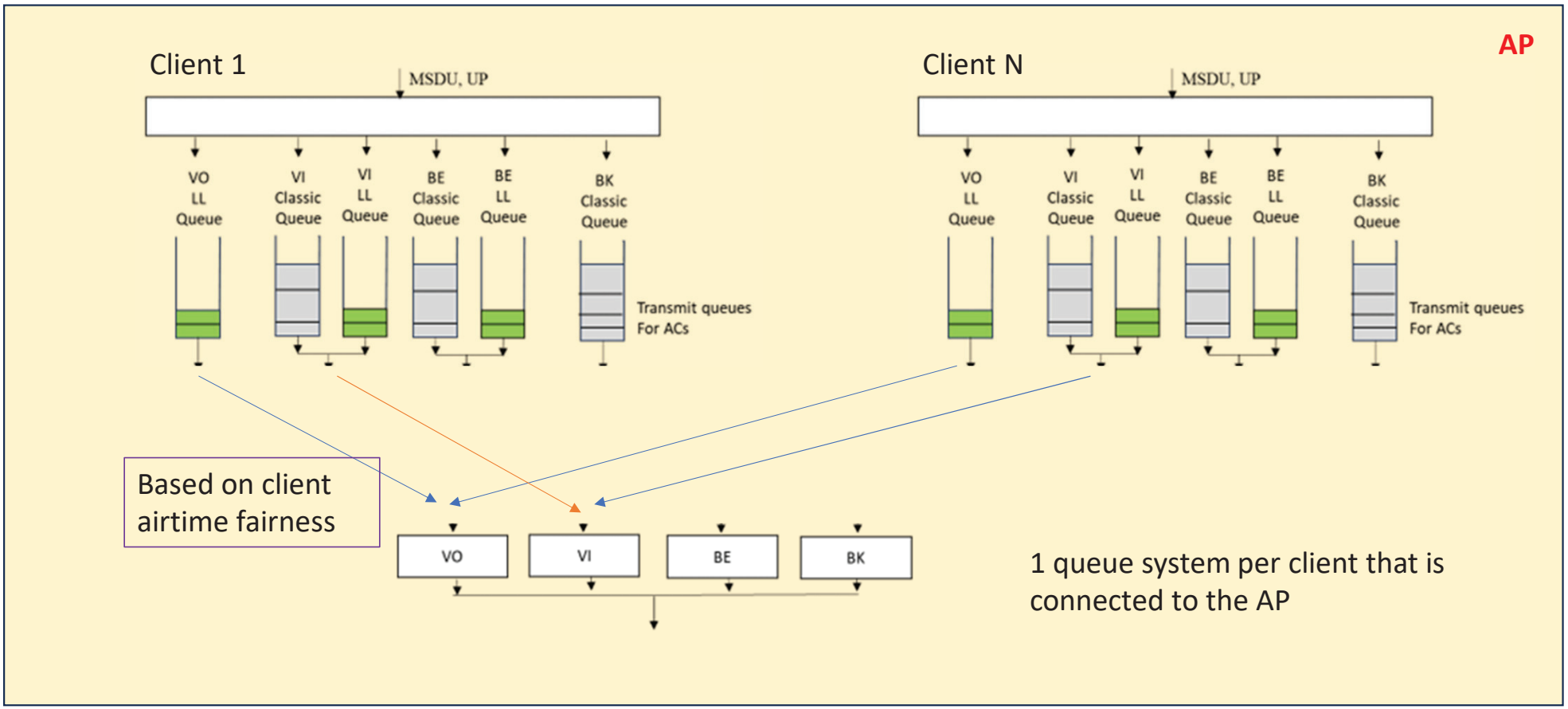
Default EDCA queue config

Alternate EDCA queue config

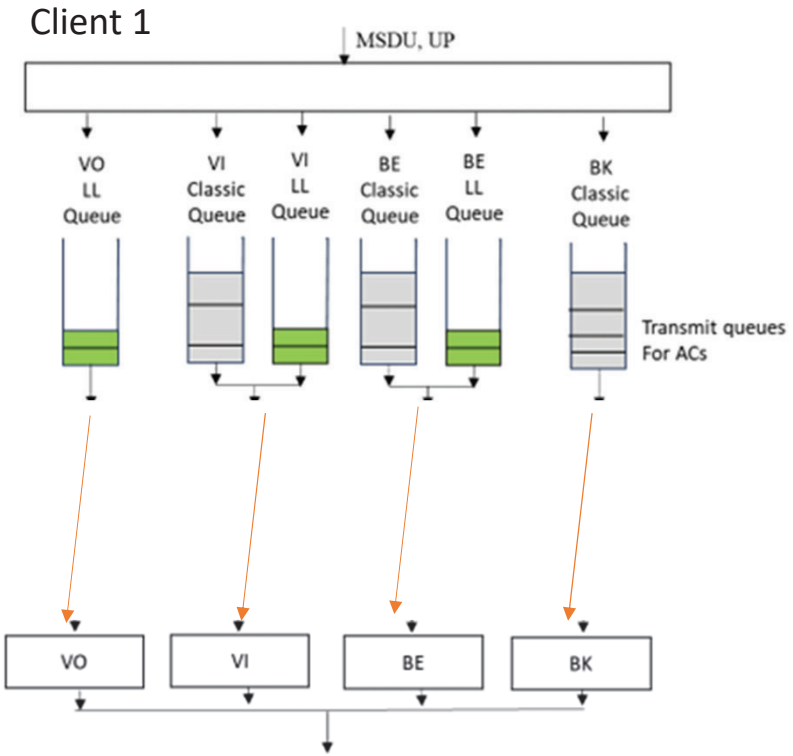
L4S queue config

L4S Alternate queue config

Queuing Usage in WLAN in APs



Queuing Usage in WLAN in Clients



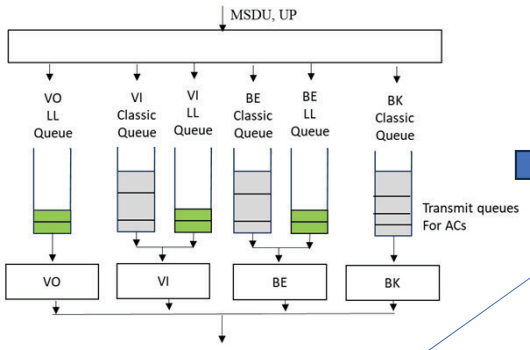
Proposed solution

- The proposed solution still relies on a maximum of QOS 6 queues per user (or 8 queues if supported by HW). However, the queues are configurable per user to adapt to the user traffic.

  - Case 1 : the client doesn't support MSC/SCS/TSPEC and the AP doesn't enforce DSCP to UP mapping. Only 3 queues are implemented LL BE (for L4S traffic), classic BE (non L4S BE traffic), BK.

  - Case 2: The AP can or is willing to classify traffic (UP/SCS/MSCS/TSPEC). By default (at time of connection), L4S queue system is implemented.
    - If a "managed" prioritized traffic (SCS for example) is started by the client, say on VI alternate, the LL VI is reconfigured as an alternate VI queue. The L4S VI traffic (if any on going) is moved either to the LL BE or VI queues (not ideal but no other choice). When the flow stops, the queue system reverts to the L4S queue system. Same mechanism apply to VO. Queue reconfiguration is per AC based on the going traffic.
      - This could be also negotiated between the client and the AP when the client starts for example a zoom traffic and when the traffic ends.

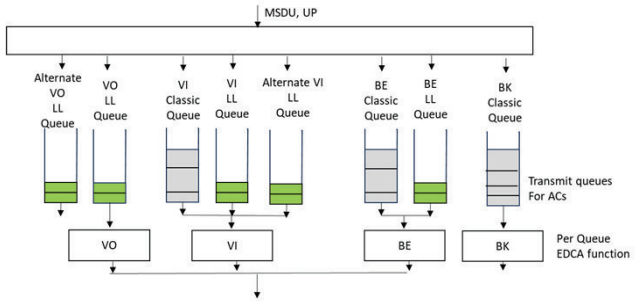
Client 1 connects to AP
Queue configuration on AP is L4S



Client starts an audio/video conf call and ask AP to switch queue config to Alternate EDCA

Client 1 start a latency sensitive app
(Zoom for example)
AP changes the queue configuration to

- Alternate if no additional queues available
- L4S & alternate queue config if additional queues available



OR

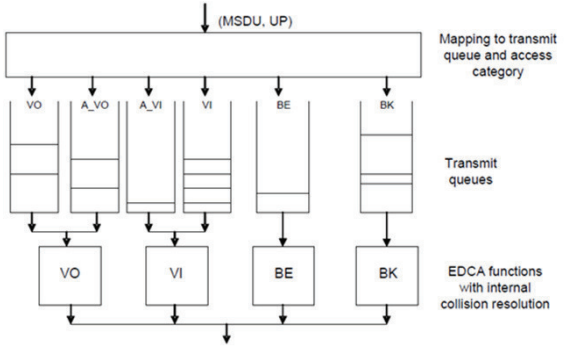
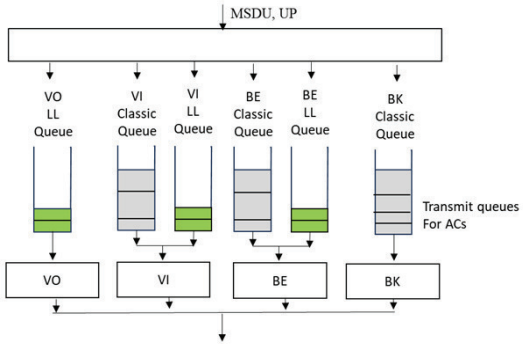


Figure 10-28—Reference implementation model when dot11AlternateEDCAActivated is true

Zoom call ends
AP changes queue to L4S queue

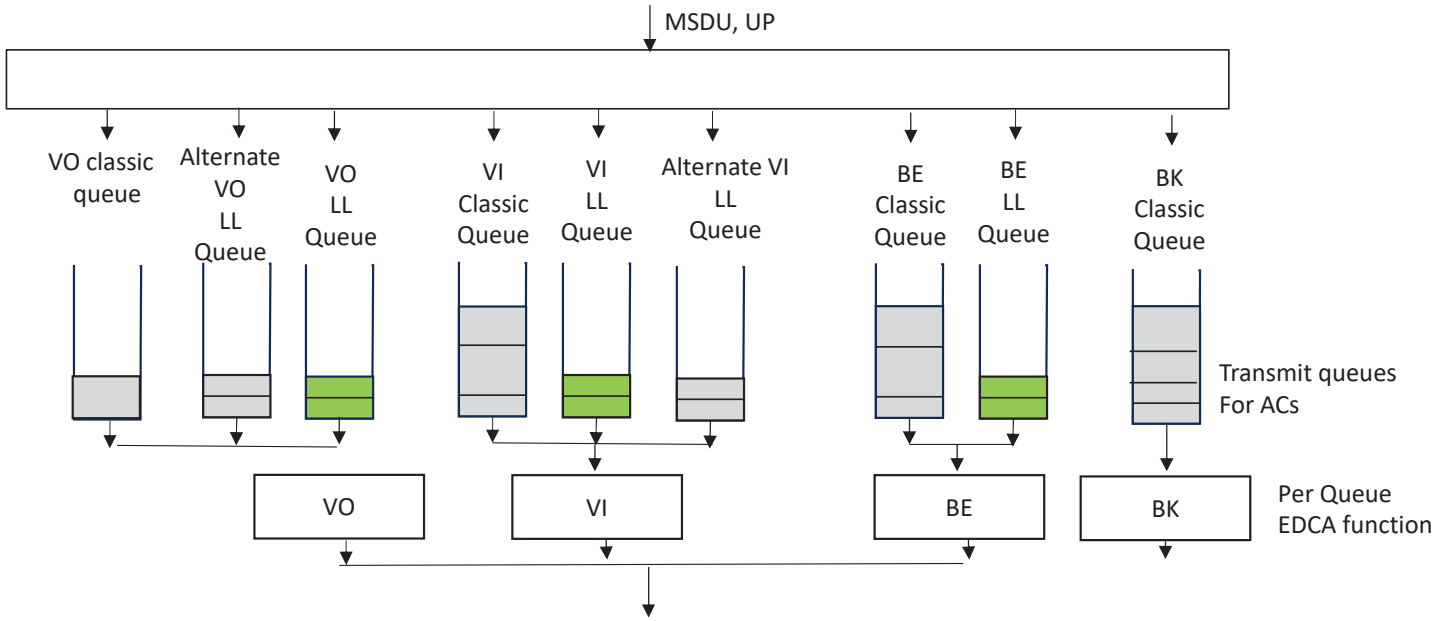


Client ends audio/video conf call and ask AP to return to L4S queue config

Simple example of adaptative queue reconfiguration

Refinement 1

- Other queue configuration option: 3 queues for VO and VI, 2 queues for BE and 1 queue for BK.



Refinement 2

- Residential APs will have many clients that do not require any QoS (i.e. most IoT devices).
- For these devices, only 1 data (BE) queue is needed – no L4S used (e.g., light bulb). The unused queues could be used for clients such as laptop, TV, smartphone.
- If N queues are available, they can be reconfigured according to the clients' capabilities.