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A subjective scheduler for subjective dedicated networks

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Abstract. Multiple access technique is one of important techniques within medium access layer in TCP/IP protocol stack. Each network technology implements the selected access method. Priority can be implemented in those methods to differentiate services. Some internet networks are dedicated for specific purpose. Education browsing or tutorial video accesses are preferred in a library hotspot, while entertainment and sport contents could be subjects of limitation. Current solution may use IP address filter or access list. This paper proposes subjective properties of users or applications are used for priority determination in multiple access techniques. The NS-2 simulator is employed to evaluate the method. A video surveillance network using WiMAX is chosen as the object. Subjective priority is implemented on WiMAX scheduler based on traffic properties. Three different traffic sources from monitoring video: palace, park, and market are evaluated. The proposed subjective scheduler prioritizes palace monitoring video that results better quality, xx dB than the later monitoring spots.

1. Introduction
WiMAX (IEEE 802.16) is other version of WiFi (802.11) that serving wider coverage area as well as high bit rate [1]. If WiFi employs request to send and clear to send (RTS/CTS), WiMAX uses frame allocation [2]. If WiFi allocates channel based on first come first served (random access), then WiMAX uses scheduler. The basic schedulers such as round robin (RR), weighted round robin (WRR), deficit round robin (DRR), first in first out (FIFO) can be implemented in WiMAX [3]. Cross layer scheduler based on physical (PHY) and medium access (MAC) cross layers such as the earliest deadline first (EDF) [3] and application cross layer such as frame-based [4] and non-sorting schedulers[5] are potentially improving the WiMAX performances.

This paper proposes the subjective feature of the application layer to be the basis of prioritization in WiMAX scheduler. The proposed method is an application and MAC cross layer technique as in frame-based scheduler. If frame-based scheduler enables WiMAX to prioritize I-frames of any multimedia packets, the proposed scheduler differentiates priority of packets based on its subjective feature. For instance, if a network is dedicated for football fans, then scheduler should prioritize any football-related packets. If a network is dedicated for education, scheduler prioritizes education materials. This requires application data to flag the traffic types. Although current application does not support it, future application may use it, for instance, prioritized traffics use a specific range of port numbers.
2. Research method

In order to evaluate the proposed scheduler, the NS-2 simulator was employed. The simulation scenario uses a point to multipoint system with 4 subscriber stations (SSs). The network configuration is shown in Figure 1. The transmitter power is set to provide a 1000 m coverage. The modulation scheme is 64 QAM. The Hatta propagation model is applied. The downlink to uplink ratio is set to 0.3, which means 30% of the network resources are allocated to downlink.

![Network configuration](image)

Figure 1. Network configuration

The evaluated traffics are uplink video streaming flowing from SS to a server connected to base station. Video streams are monitoring videos: palace, park and market. The priority is set to be the palace video. Each video source assigns flag to its packet header; 1 for palace, 2 and 3 for park and market. The evaluated performance metric is image quality, peak to noise ratio (PSNR). The objective features are frame type and GoP; and the subjective feature is flag 1.

3. Simulation results

By comparing the proposed scheduler to frame-based and non-sorting scheduler, the average PSNR values for prioritized and non-prioritized video are shown in Figure 2.

![Subjective feature performance](image)

Figure 2. Subjective feature performance
The non-prioritized videos: park and market produce higher image quality for frame-based and non-sorting schedulers. As both schedulers do not care what video flows in network. In opposite, the proposed scheduler is able to determine the prioritized video. As result, palace image has the clearest and highest quality than other images within the proposed and the compared schedulers. Palace image is 33.5 dB, 1.23 dB higher the best image produced by other scheduler. It shows that the proposed scheduler successfully achieves its goal.

4. Conclusion
The NS-2 evaluation of the proposed scheduler, which added video type property to frame type and GoP, is able to increase image quality of the prioritized video. The scheduler achieves the highest PSNR, 33.5 dB, compared to frame-based and non-sorting schedulers. Implementation of subjective scheduler to other type of networks could be of future work.

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