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Maximizing power saving with state transition overhead for multiple MSSs in Wimax

Key words: Power saving class, State transition overhead, IEEE 802.16e/m, Quality of service

Corresponding author: Bo Li
E-mail: bosign@gmail.com
ORCID: http://orcid.org/0000-0002-5790-4778

Motivation

- In Wimax, the MSSs can switch to sleep state to save energy. When the MSS switches sleep/active states, it costs an overhead power.
- The overhead power is not considered in existing algorithms. Thus, the energy savings of existing algorithms are overestimated.
- As a result, the energy savings of existing algorithms are not optimized.
- We propose a new algorithm which considers the overhead power. Consequently, the resulting energy saving is higher than existing algorithms.

Main idea

- Each time a MSS change to sleep state from active state, it will cost overhead energy once.
- Maximizing the energy saving is to minimize the number of times of state switching, i.e. to maximize sleep cycles of MSSs.
- In order to avoid confliction, the sleep cycle of each MSSs should be integer times of a base sleep cycle.
- The main idea is to set the sleep cycle of each MSS as an integer of a factor of the base sleep cycle .

Method

1. First, we set the minimum sleep cycle of all MSSs as the base sleep cycle.
2. Then, for each MSS we set its sleep cycles as an integer times of a factor of the base sleep cycle.
3. Finally, we find a valid start frame for the MSS.

Major results

- The proposed algorithm achieves more energy saving than existing algorihtms

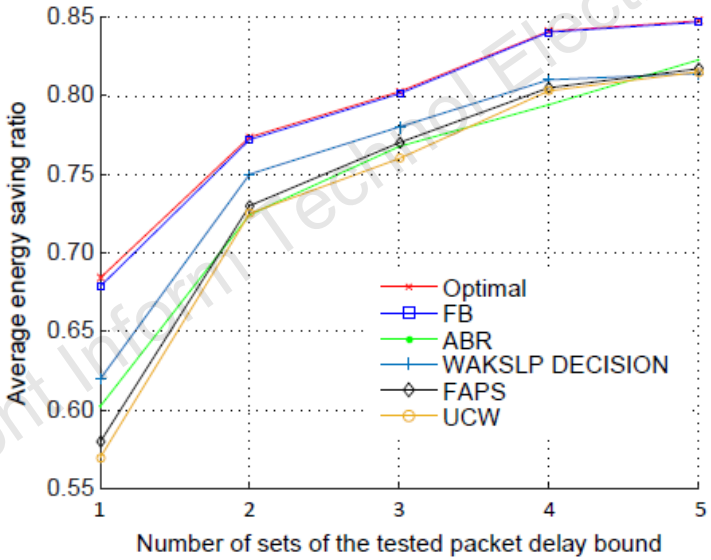

Fig. 5 Average energy saving ratio with different sets of packet delay bounds

FB: factor base; ABR: adaptive bandwidth; FAPS: frame aggregation based power-saving scheduling; UCW: user counting window; MSS: mobile subscriber stations

Major results (Cont'd)

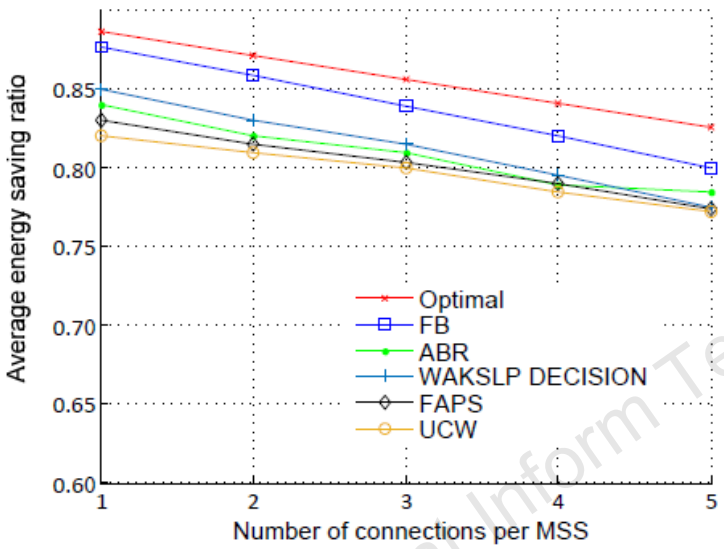

Fig. 6 Number of connections per MSS versus the average energy saving ratio

FB: factor base; ABR: adaptive bandwidth; FAPS: frame aggregation based power-saving scheduling; UCW: user counting window; MSS: mobile subscriber stations

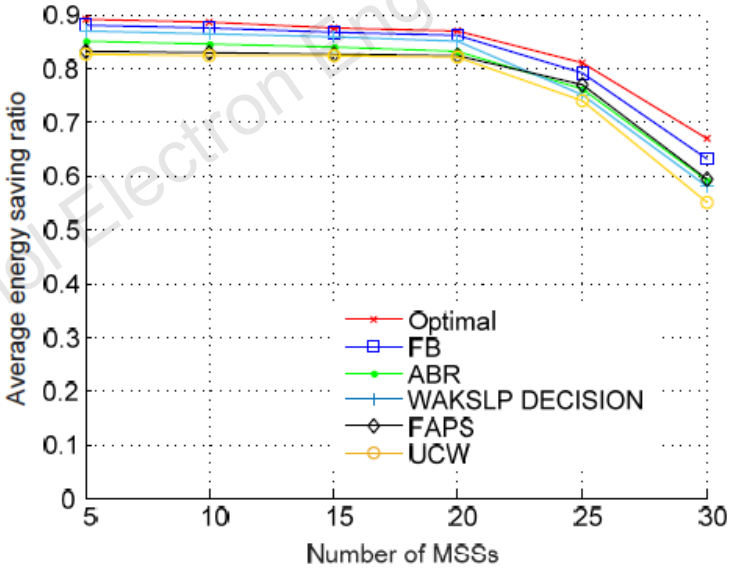

Fig. 7 Number of MSSs versus the average energy saving ratio

FB: factor base; ABR: adaptive bandwidth; FAPS: frame aggregation based power-saving scheduling; UCW: user counting window; MSS: mobile subscriber stations

Conclusions

- The core idea of the proposed algorithm is to set the sleep cycles of the MSSs to a multiple of a factor of the shortest sleep cycle.
- This permits the sleep cycles to be longer than those of the previous algorithms in the literature, and the resulting state transition overhead is lower.
- Simulation results showed that, on average, the energy saving ratio of the proposed algorithm is higher than that of the state-of-the-art algorithms.