Enhanced Energy Savings with Adaptive Watchful Sleep Mode for Next Generation Passive Optical Network

ABSTRACT

A single watchful sleep mode (WSM) combines the features of both cyclic sleep mode (CSM) and cyclic doze mode (CDM) in a single process by periodically turning ON and OFF the optical receiver (RX) of the optical network terminal (ONT) in a symmetric manner. This results in almost the same energy savings for the ONTs as achieved by the CSM process while significantly reducing the upstream delays. However, in this study we argue that the periodic ON and OFF periods of the ONT RX is not an energy efficient approach, as it reduces the ONT Asleep (AS) state time. Instead, this study proposes an adaptive watchful sleep mode (AWSM) in which the RX ON time of ONT is minimized during ONT Watch state by choosing it according to the length of the traffic queue of the type 1 (T1) traffic class. The performance of AWSM is compared with standard WSM and CSM schemes. The investigation reveals that by minimizing the RX ON time, the AWSM scheme achieves up to 71% average energy saving per ONT at low traffic loads. The comparative study results show that the ONT energy savings achieved by AWSM are 9% higher than the symmetric WSM with almost the same delay and delay variance performance.