

Emergency Alerting System for Supporting Power-Efficient Set-Top Boxes

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Abstract— In recent days, previous studies have proposed power-efficient set-top boxes that can receive only magic packets for wake on LAN (WoL) technology in standby state where the set-top boxes do not receive broadcast services. However, current emergency alerting system cannot support the power-efficient set-top boxes in standby state because the set-top boxes cannot receive emergency alert messages from the emergency alerting system. In this paper, we propose emergency alerting system that activates the power-efficient set-top boxes in standby state by using WoL technology and thus enables the set-top boxes in standby state to receive emergency alert messages. The proposed emergency alerting system will contribute wide deployment of the power-efficient set-top boxes and huge reduction of national power consumptions.

Keywords— Emergency alerting, disaster, set-top box, Wake on LAN, Standby mode

I. INTRODUCTION

Many researchers study mechanisms for reducing power consumption of set-top boxes in standby state where a home appliance does not operate its main functions [1]-[3]. While other home appliances in standby state consumes lower than one watt, set-top boxes consumes higher than 10 watt [4]. Power-efficient set-top box proposed in [3] can reduce its standby power, which is the power that home appliances consume in standby state, by about two watt. The power-efficient set-top box in standby state receives only magic packets for WoL technology and allows low-power operations of the set-top box's central processing unit (CPU) and main memory. However, the power-efficient set-top box in standby state cannot receive emergency alert messages that include information to alert disasters (e.g., storm and earthquake). If the set-top boxes do not receive emergency alert messages, user of the set-top boxes may not cope with disaster. For this reason, the power-efficient set-top boxes are difficult to be widely deployed.

This paper proposes emergency alerting system that can support the power-efficient set-top boxes. The emergency alerting system can control activation of the set-top boxes in standby state by using WoL technology. If the emergency alerting system detects some disasters, the emergency alerting system activates set-top boxes by sending WoL magic packets to the set-top boxes. After the set-top boxes are activated by

receiving WoL packets, the set-top box can receive emergency alert messages. The proposed emergency alerting system can help wide deployment of the power-efficient set-top boxes.

The remainder of this paper is organized as follows. Section II explains related works for power-efficient set-top box. Section III describes the proposed emergency alerting system for supporting power-efficient set-top boxes. Section IV offers concluding remarks of this paper.

II. RELATED WORKS FOR POWER-EFFICIENT SET-TOP BOX

Active and passive standby modes were proposed as operation modes of set-top boxes in standby state [1], [2]. A set-top box in active standby mode operates power consumption by deactivating audio/video (A/V) output. The set-top box in active standby mode can be controlled by set-top box operators but cannot reduce standby power significantly. A set-top box in passive standby mode operates only front panel, CPU, and main memory, and thus reduces standby power significantly. However, set-top box operators cannot be control set-top boxes in passive standby mode because set-top boxes in passive standby mode deactivates a network interfaces (e.g., Ethernet interface).

Network-assisted passive standby mode (NAPSM) was proposed for reducing standby power consumption of set-top boxes and controlling set-top boxes in standby state [3]. Set-top boxes in NAPSM activate network interfaces as well as operations in passive standby mode. The set-top boxes in NAPSM can be activated by receiving WoL magic packets and thus controlled by set-top box operators. Study [5] explains a mechanism for controlling a set-top box in standby state by using WoL technology. The set-top box with NAPSM is expected to consume about two watt during standby state. The set-top box with NAPSM is the most representative power-efficient set-top box because it can reduce standby power and meet requirements for the set-top box operators. However, there is no mechanism for the set-top box in NAPSM to receive emergency alert messages. In section III, we propose the mechanism for the power-efficient set-top box in NAPSM to receive emergency alert message.

III. PROPOSAL OF EMERGENCY ALERTING SYSTEM FOR SUPPORTING POWER-EFFICIENT SET-TOP BOXES

This section explains the proposed emergency alerting system for supporting the power-efficient set-top boxes that is equipped with NAPSM. This section includes architecture and signalling for the proposed emergency alerting system.

A. Architecture for the Emergency Alerting System

Figure 1 shows the architecture of the emergency alerting system for supporting power-efficient set-top boxes. Disaster alerting information disseminator detects disasters, makes emergency alert messages that include information to alert disasters, and transmits the emergency alert messages to broadcasting service provider. Broadcasting service provider distributes the emergency alert messages to the power-efficient set-top boxes.

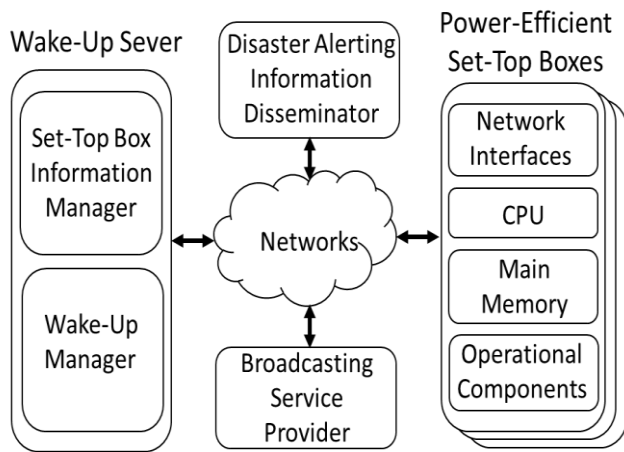


Figure 1. Architecture of the emergency alerting system for supporting power-efficient set-top boxes

Wake-up server can activate power-efficient set-top boxes in standby state by sending WoL magic packets to the set-top boxes. Wake-up server includes set-top box information manager and wake-up manager. Set-top box information manager records operating modes of power-efficient set-top boxes. Wake-up manager can have access to the set-top box information manager and sends WoL packets to the set-top boxes in NAPSM for activating them.

Power-efficient set-top boxes include network interfaces, CPU, main memory, and operational components. Operational components consist of remote control unit interface, front panel, A/V decoder, and A/V output. The set-top boxes in NAPSM activates network interfaces to communicate with broadcasting service provider and wake-up server, operates CPU and main memory in low power mode, and deactivate operational components. The set-top boxes periodically report their operating modes.

B. Procedure for Transmitting Emergency Alert Messages to Power-Efficient Set-Top Boxes in Standby State

Figure 2 explains procedure for transmitting emergency alert messages to power-efficient set-top boxes in standby state. During standby state, power-efficient set-top boxes operate in NAPSM (step 1). When disaster alerting

disseminator detects disasters, it makes emergency alert messages (step 2). Disaster alerting disseminator sends emergency alert messages to broadcasting service provider (step 3). Broadcasting service provider requests wake-up server to activate power-efficient set-top boxes (step 4). The wake-up server requests power-efficient set-top boxes to activate operational components by sending WoL magic packets to the set-top boxes (step 5), and then the set-top boxes activate their operational components and prepare to receive emergency alert messages (step 6). After broadcasting service provider waits for activation of power-efficient set-top boxes, the broadcasting service provider broadcast emergency alert messages that is received from disaster alerting disseminator (step 7)

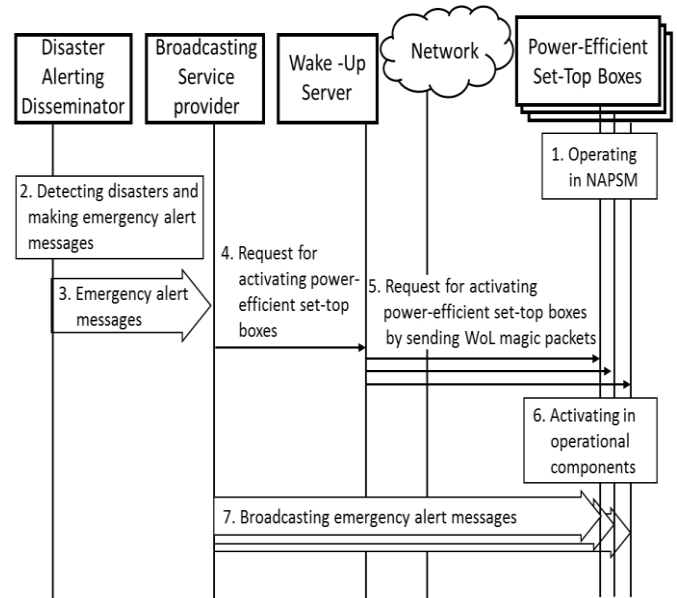


Figure 2. Procedure for transmitting emergency alert messages to power-efficient set-top boxes in standby state

IV. CONCLUSIONS

In this paper, we proposed emergency alerting system for supporting power-efficient set-top boxes. We presented that the emergency alerting system can activate the power-efficient set-top boxes in standby state by using WoL magic packets, and then transmit emergency alert messages to the set-top boxes. Future work will be conducted to be implemented the emergency alerting system proposed in this paper.

ACKNOWLEDGMENT

This work was supported by the Ministry of Public Safety and Security(MPSS) grant funded by the Korea government(NEMA-Human-2014-39, Development of Integrated Emergency Alert Systems)

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