

Network Working Group
Internet-Draft
Intended status: Informational
Expires: May 11, 2014

Y. Hong
ETRI
J. Youn
DONG-EUI Univ.
November 07, 2013

Sleep node control mechanism for Constrained networks
draft-hong-lwig-sleepmode-control-00

Abstract

This document describes the mechanism of sleep mode control. The router which manages a network can control IPv6 sleepy nodes and deliver the packets from/to exterior networks. The IPv6 router can keep the IPv6 sleepy node as sleep state and handle the packets from/to the IPv6 sleepy nodes. Also, this document describes the mechanism of sleep mode control using synchronization information.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <http://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on May 11, 2014.

Copyright Notice

Copyright (c) 2013 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to BCP 78 and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of

the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Table of Contents

1. Introduction	2
2. Conventions and Terminology	3
3. Related Work and Background	3
4. Sleep mode control mechanism	3
4.1. Sleep mode request/response	4
4.2. Sleep mode advertisement by Router	5
4.3. Sleep mode control by using synchronization information	7
5. Security Considerations	7
6. IANA Considerations	8
7. References	8
7.1. Normative References	8
7.2. Informative References	8
Authors' Addresses	9

1. Introduction

In order to minimize the use of the battery of devices which are not always connected to a power source, the devices become asleep (sleep mode) for a long time and wake up to communicate (active mode) for a short time. To keep the exact time of sleep mode/active mode of the devices, the network usually utilizes the synchronization information of a Base Station or an Access Point. Although the devices switchover between active mode and sleep mode, the protocol in PHY/MAC layer knows the transit time in advance through the synchronization information.

The goals for power management may be different by the conditions of device and environment. The general strategies for power management of various conditions are depicted as always-on, always-off, and low-power [I-D.arkko-lwig-cellular]. A constrained node, creating constrained node networks, may occasionally go into sleep mode according to strategies of using power for communication [I-D.ietf-lwig-terminology]. In [I-D.ietf-lwig-terminology], a device is divided into four classes according to energy limitation of a device. Here, the constrained nodes classed such as class E1 and E2 in classes of energy limitation may occasionally go into sleep mode. Thus, in constrained node networks, there can exist the end-to-end communications between a sleep mode node and a non-sleep mode node.

Recently, the power management issues arise in not only PHY/MAC layer but also above network layer. In network/transport/application layer, it is assumed that the network devices are always connected

and ready to communicate. But, as various smart object devices become connected to the Internet and power management to save battery of devices is required.

2. Conventions and Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

3. Related Work and Background

Power saving in wireless networks is mainly accomplished in PHY/MAC layer. The basic idea of power saving in PHY/MAC layer is to minimize the time of transmission/receipt. In IEEE 802.11 WLAN, the feature of power saving is Power Save Mode (PSM) that is available for nodes existing in an infrastructure based IEEE 802.11 WLAN. PSM is based on a synchronous sleep scheduling policy, in which wireless nodes are able to alternate between an active mode and a sleep mode [PowerMgmt].

Recently, the consideration of power saving is moved to network layer, too. In 6lowpan, the Neighbor Discovery operations must consider the low-power wireless personal area networks such as IEEE 802.15.4. Because the usage of multicast signaling raises severe energy consumption, the Neighbor Discovery optimization for 6lowpan has limited the usage of multicast signaling [I-D.ietf-6lowpan-nd].

In application layer, the CoAP has two functions such as proxy and cache. The proxy function in the CoAP can cache and service requests for sleepy servers. Thus, a client sends a CoAP request to a proxy on behalf of an origin server of sleep mode and then it respond directly to the client through the proxy. Otherwise if the proxy has an invalid representation of the resource in its cache, the proxy has to attempt to get the valid resource from an origin server of sleep mode. The attempt may or may not be successful according to the state of the origin server [I-D.ietf-core-coap].

4. Sleep mode control mechanism

Figure 1 shows the environment where the sleep mode control mechanism is used. In the constrained network, one or more sleepy nodes are connected to the router which manages the constrained network and the router is connected to external network.

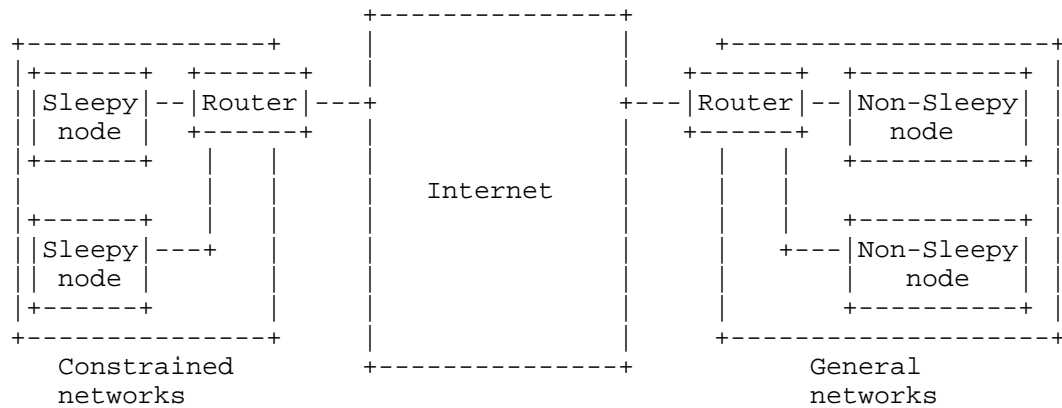
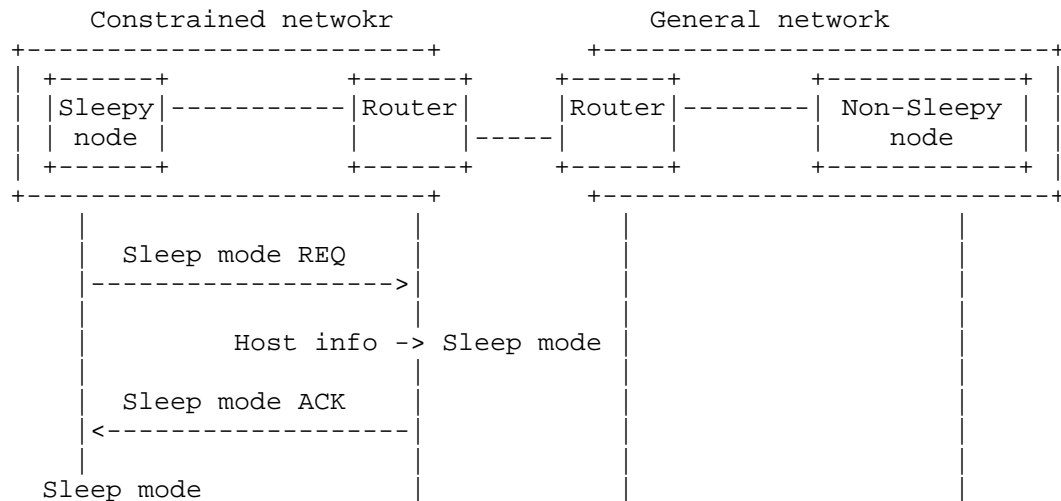


Figure 1: Environment where sleep mode control mechanism is used

4.1. Sleep mode request/response

If a sleepy host wants to enter to sleep mode, it sends a request message to the router. The router which receives the request message records the status of the sleepy node as sleep mode. And then, the router sends a response message to confirm the request. If the sleepy node receives the request message, it enters sleep mode. The router which manages the constrained network sends the status of the sleepy node to the corresponding nodes if the sleepy node is communicating. So, the corresponding nodes immediately know the status of the sleepy node. Figure 2 depicts this procedure.



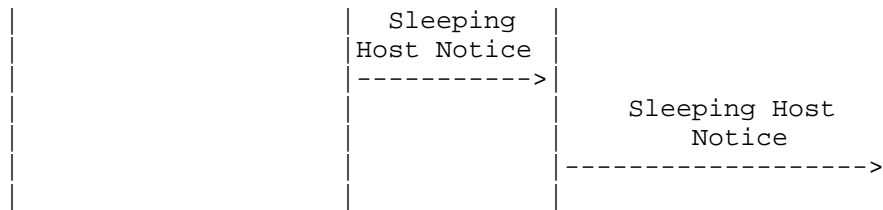


Figure 2: Procedure of sleep mode request/response

4.2. Sleep mode advertisement by Router

If some conditions are satisfied or events are triggered, a router in a constrained network sends a sleep mode advertisement message to sleepy nodes. The sleep mode advertisement message includes the start time and finish time of sleep mode. If sleepy nodes receive the advertisement message, they enter sleep mode. Some cases, the sleepy nodes may respond to the advertisement message. After the router changes the status of the sleepy node to sleep mode and delivers the status information of the sleepy nodes to corresponding nodes if there are corresponding nodes that are communicating to the sleepy nodes. So, the corresponding nodes immediately know the status of the sleepy nodes. Figure 3 depicts this procedure.

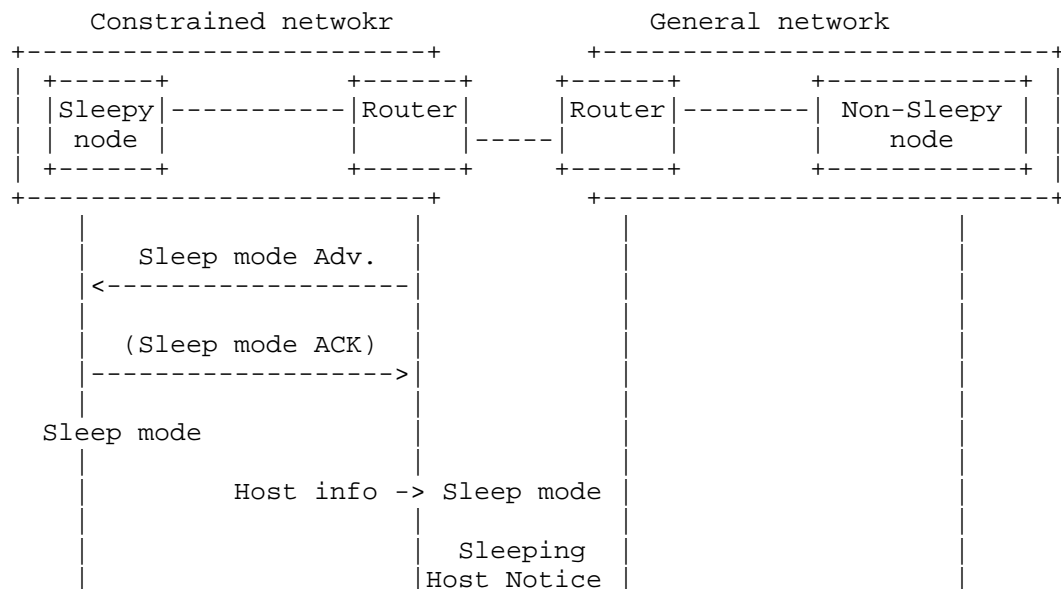




Figure 3: Procedure of sleep mode advertisement

If corresponding nodes sends packets to sleepy nodes, the router which manages a constrained network retrieves sleeping node list. If the target node is not included in the sleeping node list, the router handles the packets as normal process. If the target node is included in the sleeping node list, the router responds to the corresponding nodes and informs that the target node is in sleep mode. Figure 4 depicts this procedure.

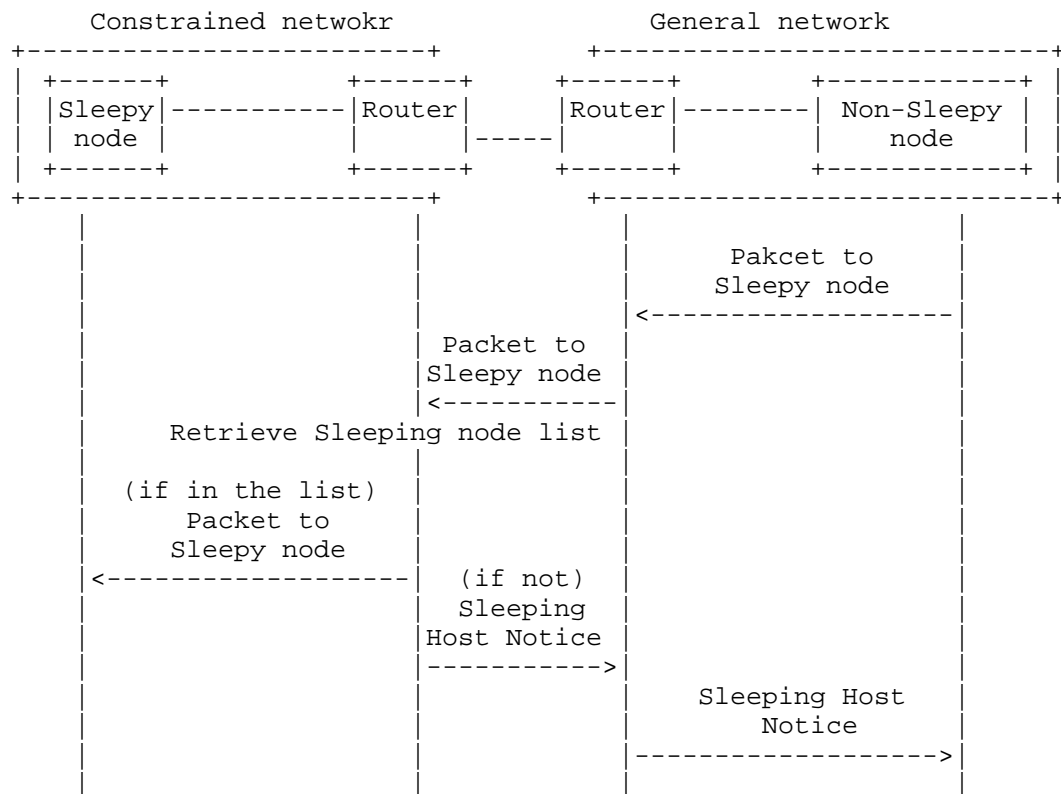


Figure 4: Procedure of the handling of packets from external network

4.3. Sleep mode control by using synchronization information

Generally, Base station or Access Point is used to synchronize the network entities. By using the synchronization information, the network keeps the exact time of sleep mode/active mode of the network entities. This synchronization information can be also used to provide sleep mode control. Figure 5 shows the case where synchronization information is used to provide sleep mode control. In Figure 5, the base station offers the synchronization information and this synchronization information is delivered to a router by using Layer 2 or Layer 3 message or cross-layer mechanism. After the router receives the synchronization information, it knows the sleep mode status of sleepy nodes. If there are corresponding nodes that are communicating to the sleepy nodes, the router delivers the status information of sleepy nodes to the corresponding nodes.

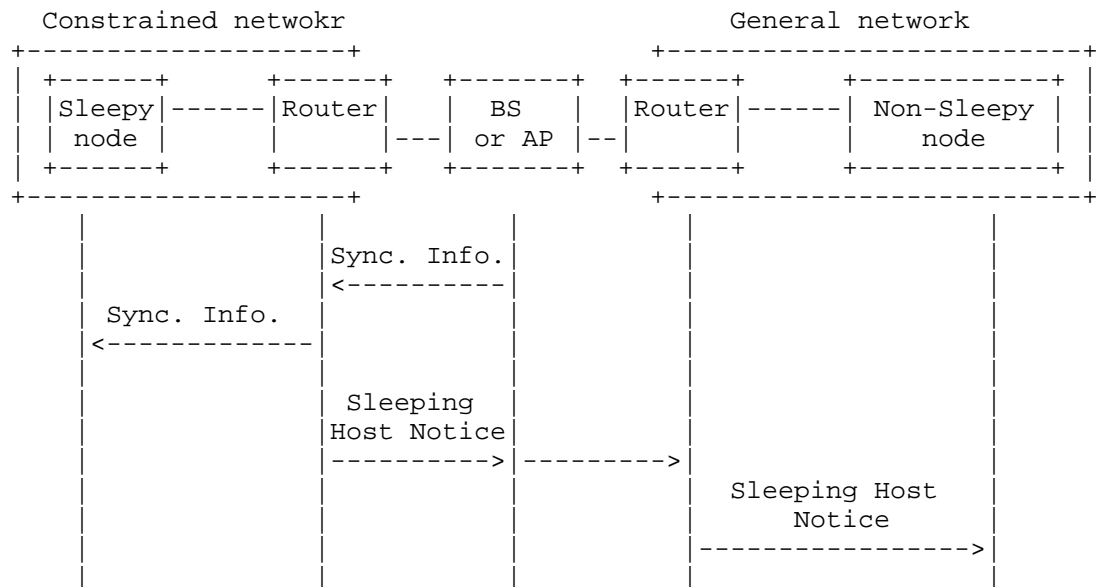


Figure 5: Procedure of sleep mode control by using synchronization information

5. Security Considerations

TBD.

6. IANA Considerations

TBD

7. References

7.1. Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.
- [RFC4861] Narten, T., Nordmark, E., Simpson, W., and H. Soliman, "Neighbor Discovery for IP version 6 (IPv6)", RFC 4861, September 2007.

7.2. Informative References

- [I-D.arkko-lwig-cellular]
Arkko, J., Eriksson, A., and A. Keranen, "Building Power-Efficient CoAP Devices for Cellular Networks", ID draft-arkko-lwig-cellular-00, February 2013.
- [I-D.ietf-6lowpan-nd]
Shelby, Z., Chakrabartiy, S., and E. Nordmark, "Neighbor Discovery Optimization for Low Power and Lossy Networks (6LoWPAN)", ID draft-ietf-6lowpan-nd-21, August 2012.
- [I-D.ietf-core-coap]
Shelby, Z., Hartke, K., and C. Bormann, "Constrained Application Protocol (CoAP)", ID draft-ietf-core-coap-18, June 2013.
- [I-D.ietf-lwig-terminology]
Bormann, C., Ersue, M., and A. Keranen, "Terminology for Constrained Node Networks", ID draft-ietf-lwig-terminology-05, July 2013.
- [PowerMgmt]
Klues, K., "Power Management in Wireless Networks", Report, for Advanced Topics in Networking: Wireless and Mobile Networking by R. Jain, Wash. Univ. in St. Louis, , 2006.

Authors' Addresses

Yong-Geun Hong
ETRI
218 Gajeong-ro Yuseung-Gu
Daejeon 305-700
Korea

Phone: +82 42 860 6557
Email: yghong@etri.re.kr

JooSang Youn
DONG-EUI Univ.
Busan
Korea

Phone: +82 51 890 1993
Email: joosang.youn@gmail.com