AODV for IEEE 802.15.4 Networks
draft-montenegro-lowpan-aodv-00

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Abstract

This document describes how to use the Ad Hoc On-Demand Vector Protocol (AODV) in IEEE 802.15.4 networks.
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1. Introduction

The IEEE 802.15.4 standard targets low power personal area networks. The "IPv6 over IEEE 802.15.4" document defines basic functionality required to carry IPv6 packets over IEEE 802.15.4 networks (including an adaptation layer, header compression, etc). Likewise, the functionality required for packet delivery in IEEE 802.15.4 meshes is defined, as mesh topologies are expected to be common in LoWPAN networks. However, neither the IEEE 802.15.4 standard nor the "IPv6 over IEEE 802.15.4" specification provide any information as to how such a mesh topology could be obtained and maintained.

This document specifies how to use the Ad Hoc On-Demand Vector Protocol (AODV) [RFC3561] to provide mesh routing in IEEE 802.15.4 networks. To distinguish this instantiation of the protocol from AODV over IPv4 and AODV over IPv6, the label "LoWPAN-AODV" is used in this document. Given the very stringent limitations of the target devices, this document offers guidance regarding simplifications that are recommended to the base AODV specification. Given the specificity of certain deployment scenarios, it is not expected that AODV will always be the best choice for a mesh routing protocol. Nevertheless, specifying how other mesh routing protocols may apply is out of scope of this document.

1.1 Requirements notation

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].

2. AODV Operation over IEEE 802.15.4

Except for the exceptions mentioned in this section, AODV operation over IEEE 802.15.4 networks is as defined in [I-D.perkins-manet-aodvbis].

The addresses used in AODV control messages are IEEE 802.15.4 IEEE 64-bit extended addresses [EUI64] (however, 16-bit short address support may be added later). Additionally, it should be noted that as used in this specification, AODV is not layered on top of IP, but underneath it. It is an underlay. As such, it creates a mesh network topology underneath and unbeknownst to IP. IP sees a PAN as a single link. This is similar to how other technologies regularly create complex structures underneath IP (e.g., ethernet spanning tree bridges, token ring source routing, ATM, etc). Of course, this does not preclude simultaneously using AODV above IP. One can envision a
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sub-IP mesh creating the illusion that all the devices on that PAN are on the same IPv6 link (sharing the same IPv6 prefix). At the same time, normal usage of AODV (above IP) could tie together several such "links" (potentially using different technologies for each) into a larger mesh.

AODV over IPv4 makes use of broadcast in its route discovery. It does so in order to propagate the Route Request control packets (RREQs). In this specification, such broadcast packets are obtained by setting the PAN id to the broadcast PAN (0xffff) and by setting the destination address to the broadcast short address (0xffff).

AODV control packets use the encapsulation defined in [I-D.montenegro-lowpan-ipv6-over-802.15.4]. All AODV control packets shall use the prot_type value TBD (suggested value of 4). This prot_type is used to send AODV messages in a manner similar to how normal AODV uses the properly assigned UDP port (654). In both cases, the different types of AODV control packets (i.e., RREQ, RREP, RERR and RREP-ACK) are handled via Types. This specification uses the same Types and message formats as defined for normal AODV [I-D.perkins-manet-aodvbis].

3. Suggested AODV Simplifications

Besides the main AODV specification [RFC3561], several efforts aim at further correctness [I-D.perkins-manet-aodvbis] or simplifications of the protocol, as in the AODVjr proposal [AODVjr] or the TinyAODV implementation [TinyAODV]. Similarly, DyMO allows for minimalist implementation leaving non-essential functionality as optional [I-D.ietf-manet-dymo]. In keeping with the spirit of the above, LoWPAN-AODV simplifies AODV as follows:

- The only AODV control messages required to be implemented are RREQ (Route Request) and RREP (Route Reply).
- Only the final destination responds to a RREQ by sending an RREP.
- Only hop count is used to determine best routes.
- Hello messages are not used. Instead, the IEEE 802.15.4 acknowledgement mechanism is used to determine if a neighbor is no longer responsive. This information is obtained when transmitting a packet with acknowledgements turned on.

4. Packet Delivery in a Mesh

Packet delivery is done by using the "Final Destination" field defined and procedures defined in [I-D.montenegro-lowpan-ipv6-over-
8. References

8.1 Normative References

[EUI64] "GUIDELINES FOR 64-BIT GLOBAL IDENTIFIER (EUI-64) REGISTRATION AUTHORITY", IEEE http://standards.ieee.org/regauth/oui/tutorials/EUI64.html.


[I-D.montenegro-lowpan-ipv6-over-802.15.4] Montenegro, G., "Transmission of IPv6 Packets over IEEE 802.15.4 Networks", draft-montenegro-lowpan-ipv6-over-802.15.4-02 (work in progress), February 2005.


8.2 Informative References


[TinyAODV]

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