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16ng Problem Statement
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Abstract

This document describes the IPv6 over IEEE 802.16(e) networks (16ng) problem statement.

Table of Contents

1. Introduction 3
2. Requirements 3
3. Terminology 3
4. Problem Statement 4
5. Security Considerations 5
6. Acknowledgment 5
7. References 5
7.1. Normative References 5
7.2. Informative References 6
Authors' Addresses 7
Intellectual Property and Copyright Statements 8

1. Introduction

Broadband Wireless Access networks address the inadequacies of low bandwidth wireless communication for user requirements such as high quality data/voice service, fast mobility, wide coverage, etc. The IEEE 802.16 Working Group on Broadband Wireless Access Standards develops standards and recommended practices to support the development and deployment of broadband Wireless Metropolitan Area Networks. Additionally, IEEE 802.16e is an amendment that adds support for mobility over the base IEEE 802.16 specification.

Recently, the WiMAX Forum, and, in particular, its NWG (Network Working Group) is defining the IEEE 802.16(e) network architecture (e.g., IPv4, IPv6, Mobility, Interworking with different networks, AAA, etc). The NWG is thus taking on work at layers above those defined by the IEEE 802 standards (typically limited to the physical and link layers only). Similarly, WiBro (Wireless Broadband), a Korean effort which focuses on the 2.3 GHz spectrum band, is also based on the IEEE 802.16e specification.

IEEE 802.16(e) is different from existing wireless access technologies such as IEEE 802.11 or 3G. Accordingly, while 802.16 defines the encapsulation of an IP datagram in an IEEE 802.16 MAC payload, complete description of IP operation is not present. Thus, IP operation over IEEE 802.16(e) can benefit from IETF input and specification. This document will describe the problems identified in adopting IPv6 over IEEE 802.16(e) networks.

2. Requirements

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. Terminology

The following terms come from IEEE 802.16 [IEEE802.16] and IEEE 802.16e [IEEE802.16e] specifications.

Base station (BS): A generalized equipment sets providing connectivity, management, and control of the subscriber station (SS).

Subscriber station (SS): A generalized equipment set providing connectivity between subscriber equipment and a base station (BS)

MOB_HO-IND: Handover indication message from SS to BS.

REG-RSP: Registraion response message from BS to SS.

4. Problem Statement

The first problem identified in adopting IPv6 over IEEE 802.16(e) networks is that IEEE 802.16(e) is different from existing wireless access technologies such as IEEE 802.11 or 3G. For example: immediately subsequent to network entry, an 802.16 SS (Subscriber Station) has no capability whatsoever for data (as opposed to management) connectivity. The criteria by which the BS (Base Station) sets up the 802.16 MAC connections for data transport is not part of the 802.16 standard and depends on the type of data services being offered (ie. the set up of transport connections will be different for IPv4 and IPv6 services). Additionally - as 802.16 is a point-to-multipoint network - an 802.16 subscriber station is not capable of broadcasting (e.g., for neighbor discovery) or direct communication to the other nodes in the network. While the built-in LAN emulation feature of 802.16 ("802.3 Convergence Sublayer") rectifies this, it may involve additional packet overhead. This lacking of facility for native multicasting for IPv6 packet transfer results in inappropriateness to apply the standard Neighbor Discover Protocol specially regarding, address resolution, router discovery, duplicated address detection and stateless auto-configuration.

The second problem identified in adopting IPv6 over IEEE 802.16(e) networks is applying the Fast Handovers for Mobile IPv6 [RFC4068] owing to the difficulty in utilizing the layer 2 handover information. From RFC 4068, mobile node is recommended to send FBU (Fast Binding Update) message to the PAR (Previous Access Router) based on the accurate target BS information on the connected link to operate as predictive mode. In IEEE 802.16e [IEEE 802.16e], the mobile subscriber station decides the ultimate target base station and sends the MOB_HO-IND message to the serving BS to notify the decided target BS information which results in disabling any IPv6 packet transfer on that link. This means that the layer 3's fast handover processing needs to break into the layer 2 processing, between the target decision and the MOB_HO-IND message transfer, to operate as predictive mode. Normally, this kind of intervention is not preferred, because this requires certain interruption of the layer 2 processing, eventually resulting in the handover delay. For reactive mode, utilizing the "Link up" trigger to immediately initiate sending FNA (Fast Neighbor Advertisement) or performing DNA (Detecting Network Attachment) procedures is highly desirable to reduce delay and packet loss. In IEEE 802.16(e) networks, a SS receives a REG-RSP message from the serving BS when the registration is accepted. This registration authorizes a SS to forward IP traffic to the network. Thus, receiving the REG-RSP can be mapped as "Link

up" trigger in IEEE 802.16(e) networks. Accrodingly, special considerations will be required when implementing Fast Mobile IPv6 (RFC 4068), something which may be pursued in the MIPSHOP WG.

The third problem identified in adopting IPv6 over IEEE 802.16(e) networks is applying IP multicasting services. In IEEE 802.16 networks, two types of access to multicast and broadcast services (MBS) may be supported : single-BS access and multi-BS access. Single-BS access is implemented over multicast and broadcast transport connections within one BS, while multi-BS access is implemented by transmitting data from Service Flow(s) over multiple BS. However, the MBS seems to be broadcast services, not multicasting. MBS adheres to broadcast service, while traditional IP multicast schemes define multicast routing using shared trees or a source-specific tree to deliver packets efficiently. Therefore, two types of MBS services need to be mapped into source-specific multicast service, if necessary.

5. Security Considerations

None of considerations are required in this section.

6. Acknowledgment

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7. References

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