Chapter 15
IPv6 Networking over Satellite for Mobile User Groups

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Abstract This paper deals with the support of IPv6 for mobile user groups using the scenario of passengers in an aircraft connected via a satellite link to ground Internet. Several solutions are discussed to support user laptops having IPv6. The peculiarity of the scenario lies in the fact that satellite modems usually offer single IPv4 addresses only. We address IPv6 over IPv4 tunnelling and Network Address and Port Translation (NAPT) with dual stack routers as possible solutions. The NAPT solution is optimized to save overhead over the satellite link, and required signalling to allow ground-to-air traffic is addressed. Finally, a performance estimation is given.

Introduction

Satellite networks play a vital role in serving passengers in aircrafts, ships or trains with Internet and mobile telephony [7]. The passengers in such mobile platforms represent a collective user group which is connected by satellite with ground networks. Today, Internet Protocol version 4 (IPv4) is practically the only version used in such environments. However, IP in version 6 is now available, and it can be expected that users will soon like to use the new IPv6. In this paper we address the support of IPv6 for moving platforms connected by satellite, e.g., in aeroplanes, trains and other vehicles.

In terrestrial networks for fixed IPv4/IPv6, migration is done in several ways, such as Tunnelling, NAPT-PT, or automatic tunnels such as 6over4 (RFC2529 [3]), which uses multicast in IPv4. The ISATAP protocol (RFC4214 [9]) works similar to 6over4, except for the multicast addresses. The protocol 6to4 (RFC3056 [2]) is designed for isolated IPv6 networks. Teredo (RFC4380 [6]) addresses isolated nodes behind NAT, whereas Tunnel Broker (RFC3053 [4]) controls tunnels configured by a new element.

We address the case when we have the transition between IPv6 and IPv4 in the satellite link connecting the aeroplanes to the Internet on-ground. Our goal is to connect the IPv6 users in aeroplanes minimizing the resources on the satellite.
Mobile User Groups Scenario

A scenario is considered with IPv6 users in aeroplanes. The IPv6 devices are connected to the Internet through satellites, which only support IPv4, as shown in Fig. 15.1.

The system under consideration is INMARSAT BGAN (Broadband Global Area Network) [1]. The terminal bit rate is up to approximately 432 kbps, though other transparent Ku-band satellite systems can provide up to 1 Mbps or higher. Typically, satellite systems serve IPv4 only by providing a routed IP interface.

In our scenario, we assume that each aircraft has a multitude of IPv6 users on board. An onboard router serves as gateway to the satellite transport; a corresponding router is placed on ground. The aircraft router must have, at least, one IPv4 interface with a public IPv4 address connected to the satellite. This address may change every time the router changes its point of attachment to the satellite. As there are not enough addresses to be assigned, nodes inside the network can not have public IPv4 addresses. However, the IPv6 nodes inside the aircraft have at least one public IPv6 address each; those IPv6 addresses may change with the router’s IPv4 public address.

A solution is wanted to send the IPv6 packets through the IPv4 satellite link. The main changes from IPv4 to IPv6 packets are summarized in the following list:

- The address space in IPv6 has been expanded from 32 bits to 128 bits and new auto configuration mechanisms have been added.
- The IPv6 header format has been simplified: fixed length and optional Extension Headers between the IP header and the upper layer header. Apart from that, five fields have been removed (Header Length, Identification Flags, Fragment Offset and Header Checksum).
- Authentication and privacy options have been added in IPv6.
- All flows can be labelled so the processing is faster in forwarding nodes.
- Mobility aspects have been improved: all nodes must have these capabilities, Foreign Agents are no longer necessary and Route Optimization is performed instead of Triangular Routing.

Possible Networking Solutions

In the following, 2 solutions are selected and explained in detail: Tunnelling and NAPT-PT. After that, other solutions are explained briefly.