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Route Configuration by DHCPv6 Option for Hosts with Multiple Interfaces
draft-sun-mif-route-config-dhcp6-02

Abstract

Currently, more and more hosts have multiple interfaces such as GPRS, WiFi etc. One key issue is how to make the applications on the host access the network accordingly through the proper interfaces. The approach presented in this document is to extend DHCPv6 option to configure route tables of the hosts. In this way, the hosts can select a appropriate route.

Status of this Memo

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

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Table of Contents

1. Introduction

A host such as a laptop or a smart-phone may have multiple interfaces for connections, e.g., a wired Ethernet LAN, a 802.11 LAN, a 3G cellular network, one or multiple VPNs or tunnels. In view of more and more versatile applications, users may expect a host to utilize several interfaces simultaneously.

An application uses certain interface through select the corresponding source IP address. if the applicaiton does not specifiy it, the transport layer must ask the IP layer. According to [RFC1122] all the packets whose destination IP addresses are not specified in the route table will be sent to the default gateway for forwarding. Accordingly, the IP address corresponding to the default gateway will be chosen as the source IP address.

To avoid all packets passing through the same interface corresponding to the default gateway, the approach proposed in this document configures certain routes in route tables of the host. The configuration information is obtained through DHCP messages which extend the DHCPv6 option.

An optional extension to Router Advertisement messages is described in [RFC4191] for communicating default router preferences and more-specific routes from routers to hosts. To address multi-homed problems in a flexible way, [I-D.hui-mif-dhcpv4-routing-02] extends DHCPv4 through introducing TOS and specific routes into DHCP options. This document considers the situations for IPv6 cases. Similar approach was presented in [I-D.dec-dhcpv6-route-option-03] , however, TOS and metrics information have not been involved.

2. Solution of Multiple Interface Usage

The procedures for a host to configure the routing information and select the interface are depicted in Figure 1. The routing configuration procedures are shown as steps a1) to a3).

a1) An interface sends Information-requirement when the connection is established or when an existing connection receives reconfiguration message from the server.

a2) The server sends routing information through DHCPv6 option as to be defined in Section 3.2.

a3) The routing information received from the interface is used to update the routing table of the host.

The procedures that an application employs an interface for network access are depicted in Figure 1 as steps b1) to b4).

b1) An application calls sockets to build IP packets.

b2) The socket selects source address based on the routing table.

b3) The socket sends packets to the corresponding interface.

b4) The interface will forward the packets to the next hop (the corresponding gateway).

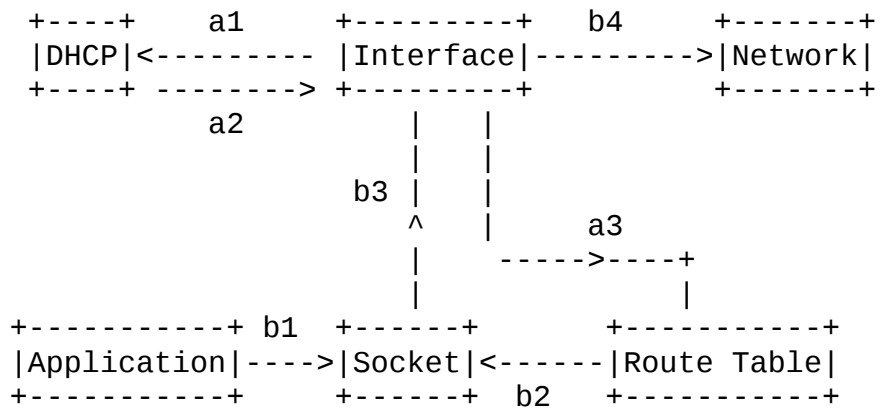

Figure 1: The procedures of updating a routing table and select an interface for an application

Notice that the approach proposed in this document is feasible under

the strong ES model as defined in [RFC1122].

3. DHCPv6 Option Extensions

3.1. Host and Server Behavior

The host must include "Option Request" option to let the server know the option the host interested. The request option code is set as the "Route Information" defined in Section 3.2.

The server constructs a Reply message to provide route information to the host. Also, a server may send a Reconfigure Message to a host. The host may initiate a request when receiving the Reconfigure message for the host.

3.2. Route Information Option

The DHCPv6 option is extended to contain multiple pieces of route information. Each piece of route information contains TOS, metric, destination IP address and the next hop IP address. The ROUTE_INFO option is depicted in Figure 2.

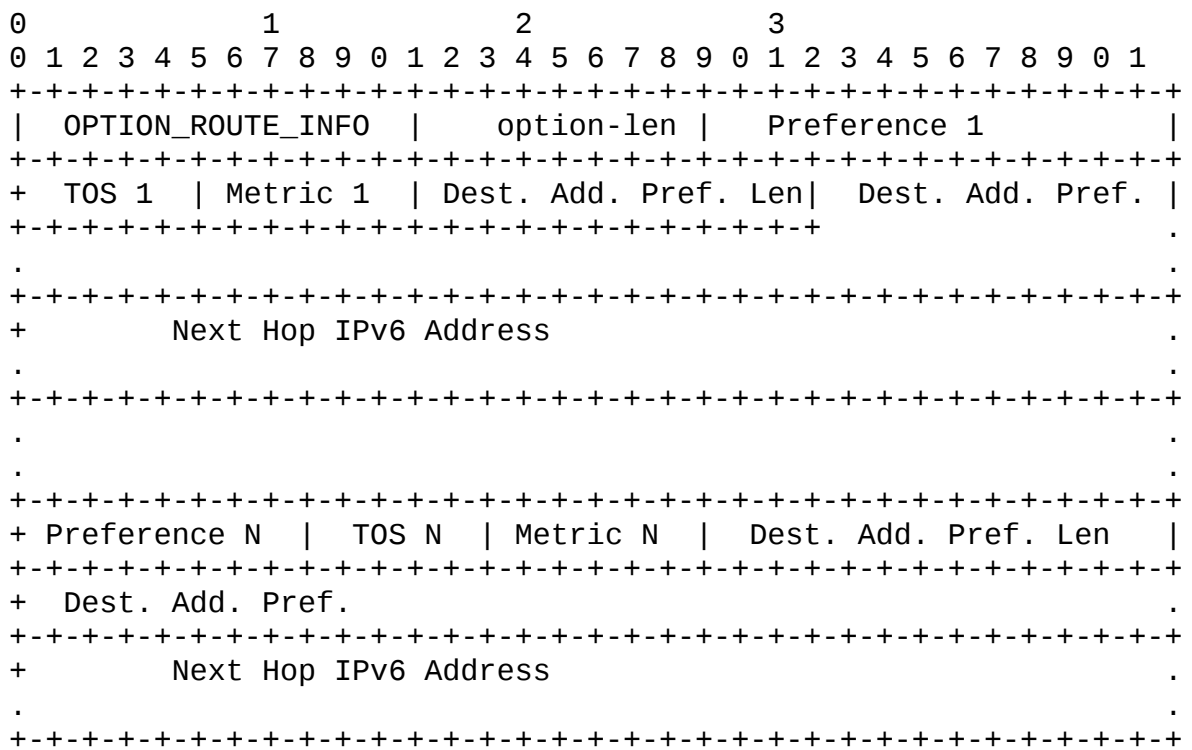

Figure 2: The Route Information Option

option-code:OPTION_ROUTE_INFO (should be defined by IANA).

option-len: length of the route rule field in octets.

Preference N: An integer to indicate the priority of applying the Nth route rule. The Preference identified the priority of a rule. if there are conflications, e.g., two rules have the same "Dest. Add. Pref." but different "Next Hop IPv6 Address", the rule with high preference SHOULD be applied by the host.

TOS N: The Nth TOS (Type-of-Service, 8 bits).

Metric N:The Nth route metric ranging from 1 to 9999.

Dest. Add. Prefix Len: Length of the IPv6 destination address prefix, an 8-bit unsigned integer ranging from 0 to 128.

Dest. Add. Prefix: The IPv6 destination address prefix

Next Hop IPv6 Address: A 128-bit IPv6 address that will be used as the next hop when forwarding packets.

In the above, the "Preference" of one route rule comes before the "metric." Namely, if there are conflict routes for one destination, the one with highest preference value should be used. For example, the network administrator may prefer one route in a connection for security or reliability considerations, even though the metric of the route is large.

3.3. Some Considerations of the DHCPv6 Option

3.3.1. Conflict of Route Rules

The host can use such information obatined from the DHCP message to build a "connection manager" on the host or to update the "Policy Table" defined in [RFC3484]. For the situations where a route option conflicts with one previous route rules, the latter one will override the previous rule.

3.3.2. Application Situations

There are two situations when DHCPv6 is applied, i.e., with or without stateless autoconfiguration. For the stateless case, since the address has been configured based on the link-local/site-local address, the DHCPv6 is used to obtain options.

3.3.3. Not Limited to DHCP Servers

The solution presented in this document is with the context of DHCP message. It should be pointed out that similar message may not be

conveyed by certain node in the network instead of a DHCP server. Such a node, for example in mobile network, may be the "ANDSF (Access Network Discovery and Selection function)" defined in TS 23.402.

4. IANA Considerations

The option code of OPTION_ROUTE_INFO will be defined by IANA.

5. Security Considerations

The security issues in this document are similar with those that have been met when using DHCPv6 options.

The interface selection is affected by the routing and address selection rules sent from servers. Therefore, incorrect information received by hosts will cause improper interface selection leading to bad user experiences. Attacks such as deny of services (DoS) or man-in-the-middle may redirect host's solicitation, change the information or flood the host with invalidate messages. Approaches to guarantee the communication securities between hosts and servers should be applied based on the network access types of the interfaces.

6. References

6.1. Normative References

[RFC1122] Braden, R., "Requirements for Internet Hosts - Communication Layers", STD 3, RFC 1122, October 1989.

[RFC2461] Narten, T., Nordmark, E., and W. Simpson, "Neighbor Discovery for IP Version 6 (IPv6)", RFC 2461, December 1998.

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[RFC3484] Draves, R., "Default Address Selection for Internet Protocol version 6 (IPv6)", RFC 3484, February 2003.

[RFC4191] Draves, R. and D. Thaler, "Default Router Preferences and More-Specific Routes", RFC 4191, November 2005.

6.2. Informative References

[I-D.blanchet-mif-problem-statement] Blanchet, M. and P. Seite, "Multiple Interfaces Problem Statement", May 2010, <draft-ietf-mif-problem-statement (work in progress)>.

[I-D.dec-dhcpv6-route-option-03] Dec, W. and R. Johnson, "DHCPv6 Route Option", March 2010, <draft-dec-dhcpv6-route-option-03(work in progress)>.

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