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C. Byrne
T-Mobile USA
D. Drown
A. Vizdal
Deutsche Telekom AG
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Extending an IPv6 /64 Prefix from a 3GPP Mobile Interface to a LAN link
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Abstract

This document describes two methods for extending an IPv6 /64 prefix from a User Equipment 3GPP radio interface to a LAN link.

Status of this Memo

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Table of Contents

1. Introduction

3GPP mobile cellular networks such as GSM, UMTS, and LTE have architectural support for IPv6 [RFC6459], but only 3GPP Release-10 and onwards of the 3GPP specification supports DHCPv6 Prefix Delegation [RFC3633] for delegating IPv6 prefixes to a single LAN link. To facilitate the use of IPv6 in a LAN prior to the deployment of DHCPv6 Prefix Delegation in 3GPP networks and in User Equipment (UE), this document describes how the 3GPP UE radio interface assigned global /64 prefix may be extended from the 3GPP radio interface to a LAN link. This is achieved by receiving the Router Advertisement (RA) [RFC4861] announced globally unique /64 IPv6 prefix from the 3GPP radio interface and then advertising the same IPv6 prefix to the LAN link with RA. For all of the cases in the scope of this document, the UE may be any device that functions as an IPv6 router between the 3GPP network and a LAN.

This document describes two methods for achieving IPv6 prefix extension from a 3GPP radio interface to a LAN link including:

1) The 3GPP UE only has a global scope address on the LAN link
2) The 3GPP UE maintains the same consistent 128 bit global scope IPv6 anycast address [RFC4291] on the 3GPP radio interface and the LAN link. The LAN link is configured as a /64 and the 3GPP radio interface is configured as a /128.

Section 3 describes the characteristics of each of the two approaches.

2. The Challenge of Providing IPv6 Addresses to a LAN link via a 3GPP UE

As described in [RFC6459], 3GPP networks assign a /64 global scope prefix to each UE using RA. DHCPv6 Prefix Delegation is an optional part of 3GPP Release-10 and is not covered by any earlier releases. Neighbor Discovery Proxy (ND Proxy) [RFC4389] functionality has been suggested as an option for extending the assigned /64 from the 3GPP radio interface to the LAN link, but ND Proxy is an experimental protocol and has some limitations with loop-avoidance.

DHCPv6 is the best way to delegate a prefix to a LAN link. The methods described in this document should only be applied when deploying DHCPv6 Prefix Delegation is not achievable in the 3GPP network and the UE. The methods described in this document are at various stages of implementation and deployment planning. The goal of this memo is to document the available methods which may be used prior to DHCPv6 deployment.

3. Methods for Extending the 3GPP Interface /64 IPv6 Prefix to a LAN link

3.1 General Behavior for All Scenarios

As [RFC6459] describes, the 3GPP network assigned /64 is completely dedicated to the UE and the gateway does not consume any of the /64 addresses. The gateway routes the entire /64 to the UE and does not perform ND or Network Unreachability Detection (NUD) [RFC4861]. Communication between the UE and the gateway is only done using link-local addresses and the link is point-to-point. This allows for the UE to reliably manipulate the /64 from the 3GPP radio interface without negatively impacting the point-to-point 3GPP radio link interface. The LAN link RA configuration must be tightly coupled with the 3GPP link state. If the 3GPP link goes down or changes the IPv6 prefix, that state should be reflected in the LAN link IPv6 configuration. Just as in a standard IPv6 router, the packet TTL will be decremented when passing packets between IPv6 links across the UE. The UE is employing the weak host model. The RA function on the UE is exclusively run on the LAN link.

The LAN link originated RA message carries a copy of the following 3GPP radio link received RA message option fields:

- MTU (if not provided by the 3GPP network, the UE will provide its 3GPP link MTU size)
- Prefix Information

3.2 Scenario 1: Global Address Only Assigned to LAN link

For this case, the UE receives the RA from the 3GPP network but does not use a global address on the 3GPP interface. The 3GPP RA /64 prefix information is used to configure NDP on the LAN and assigns itself an address on the LAN link. The LAN link uses RA to announce the prefix to the LAN. The UE LAN link interface defends its LAN IPv6 address with DAD. The UE shall not run Stateless Address Autoconfiguration [RFC4862] to assign a global address on the 3GPP radio interface while routing is enabled.

This method allows the UE to originate and terminate IPv6 communications as a host while acting as an IPv6 router. The movement of the IPv6 prefix from the 3GPP radio interface to the LAN link may result in long-lived data connections being terminated during the transition from a host-only mode to router-and-host mode. Connections which are likely to be effected are ones that have been specifically bound to the 3GPP radio interface. This method is appropriate if the UE or software on the UE cannot support multiple interfaces with the same anycast IPv6 address and the UE requires

global connectivity while acting as a router.

Below is the general procedure for this scenario:

1. The user activates router functionality for a LAN on the UE.

2. The UE checks to make sure the 3GPP interface is active and has an IPv6 address. If the interface does not have an IPv6 address, an attempt will be made to acquire one, or else the procedure will terminate.

3. In this example, the UE finds the 3GPP interface has the IPv6 address 2001:db8:ac10:f002:1234:4567:0:9 assigned and active.

4. The UE moves the address 2001:db8:ac10:f002:1234:4567:0:9 as a /64 from the 3GPP interfaces to the LAN link interface, disables the IPv6 SLAAC feature on the 3GPP radio interface to avoid address autoconfiguration, and begins announcing the prefix 2001:db8:ac10:f002::/64 via RA to the LAN. For this example, the LAN has 2001:db8:ac10:f002:1234:4567:0:9/64 and the 3GPP radio only has a link-local address.

5. The UE directly processes all packets destined to itself at 2001:db8:ac10:f002:1234:4567:0:9.

6. The UE, acting as a router running NDP on the LAN, will route packets to and from the LAN. IPv6 packets passing between interfaces will have the TTL decremented.

7. On the LAN link interface, there is no chance of address conflict since the address is defended using DAD. The 3GPP radio interface only has a link-local address.

3.3 Scenario 2: A Single Global Address Assigned to 3GPP Radio and LAN link

In this method, the UE assigns itself one address from the 3GPP network RA announced /64. This one address is configured as anycast [RFC4291] on both the 3GPP radio link as a /128 and on the LAN link as a /64. This allows the UE to maintain long lived data connections since the 3GPP radio interface address does not change when the router function is activated. This method may cause complications for certain software that may not support multiple interfaces with the same anycast IPv6 address or are sensitive to prefix length changes. This method also creates complications for ensuring uniqueness for Privacy Extensions [RFC4941]. When Privacy Extensions are in use all temporary addresses will be copied from the 3GPP radio interface to the LAN link and the preferred and valid lifetimes will

be synchronized, such that the temporary anycast addresses on both interfaces expire simultaneously.

There might also be more complex scenarios in which the prefix length is not changed and privacy extensions are supported by having the subnet span multiple interfaces, as ND Proxy does [RFC4389]. Further elaboration is out of scope of the present document.

Below is the general procedure for this scenario:

1. The user activates router functionality for a LAN on the UE.

2. The UE checks to make sure the 3GPP interface is active and has an IPv6 address. If the interface does not have an IPv6 address, an attempt will be made to acquire one, or else the procedure will terminate.

3. In this example, the UE finds the 3GPP interface has the IPv6 address 2001:db8:ac10:f002:1234:4567:0:9 assigned and active.

4. The UE moves the address 2001:db8:ac10:f002:1234:4567:0:9 as an anycast /64 from the 3GPP interface to the LAN interface and begins announcing the prefix 2001:db8:ac10:f002::/64 via RA to the LAN. The 3GPP interface maintains the same IPv6 anycast address with a /128. For this example, the LAN has 2001:db8:ac10:f002:1234:4567:0:9/64 and the 3GPP radio interface has 2001:db8:ac10:f002:1234:4567:0:9/128.

5. The UE directly processes all packets destined to itself at 2001:db8:ac10:f002:1234:4567:0:9.

6. On the LAN interface, there is no chance of address conflict since the address is defended using DAD. The 3GPP radio interface only has a /128 and no other systems on the 3GPP radio point-to-point link may use the global /64.

4. Security Considerations

tbd

5. IANA Considerations

This document does not require any action from IANA.

6. Acknowledgments

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7. Informative References

[RFC1981] McCann, J., Deering, S., and J. Mogul, "Path MTU Discovery for IP version 6", RFC 1981, August 1996.

[RFC3633] Troan, O. and R. Droms, "IPv6 Prefix Options for Dynamic Host Configuration Protocol (DHCP) version 6", RFC 3633, December 2003.

[RFC4291] Hinden, R. and S. Deering, "IP Version 6 Addressing Architecture", RFC 4291, February 2006.

[RFC4389] Thaler, D., Talwar, M., and C. Patel, "Neighbor Discovery Proxies (ND Proxy)", RFC 4389, April 2006.

[RFC4861] Narten, T., Nordmark, E., Simpson, W., and H. Soliman, "Neighbor Discovery for IP version 6 (IPv6)", RFC 4861, September 2007.

[RFC4862] Thomson, S., Narten, T., and T. Jinmei, "IPv6 Stateless Address Autoconfiguration", RFC 4862, September 2007.

[RFC4941] Narten, T., Draves, R., and S. Krishnan, "Privacy Extensions for Stateless Address Autoconfiguration in IPv6", RFC 4941, September 2007.

Authors' Addresses

Cameron Byrne
T-Mobile USA
Bellevue, Washington, USA
EMail: Cameron.Byrne@T-Mobile.com

Dan Drown
Email: Dan@Drown.org

Ales Vizdal
Deutsche Telekom AG
Tomickova 2144/1
Prague, 149 00
Czech Republic
EMail: Ales.Vizdal@T-Mobile.cz