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M. Boucadair
Orange
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IKEv2 Notification Status Types for IPv4/IPv6 Coexistence
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Abstract

This document specifies new IKEv2 notification status types to better manage IPv4 and IPv6 co-existence.

This document updates [RFC7296](#).

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[1.](#) Introduction

As described in [[RFC7849](#)], if the subscription data or network configuration allows only one IP address family (IPv4 or IPv6), the cellular host must not request a second PDP-Context to the same APN for the other IP address family. The Third Generation Partnership Project (3GPP) network informs the cellular host about allowed Packet Data Protocol (PDP) types by means of Session Management (SM) cause codes. In particular, the following cause codes can be returned:

- o cause #50 "PDP type IPv4 only allowed": This cause code is used by the network to indicate that only PDP type IPv4 is allowed for the requested Public Data Network (PDN) connectivity.
- o cause #51 "PDP type IPv6 only allowed": This cause code is used by the network to indicate that only PDP type IPv6 is allowed for the requested PDN connectivity.
- o cause #52 "single address bearers only allowed": This cause code is used by the network to indicate that the requested PDN connectivity is accepted with the restriction that only single IP version bearers are allowed.

If the requested IPv4v6 PDP-Context is not supported by the network but IPv4 and IPv6 PDP types are allowed, then the cellular host will be configured with an IPv4 address or an IPv6 prefix by the network. It must initiate another PDP-Context activation of the other address family in addition to the one already activated for a given Access Point Name (APN). The purpose of initiating a second PDP-Context is to achieve dual-stack connectivity by means of two PDP-Contexts.

When the UE attaches the network using a WLAN access by means of IKEv2 capabilities [[RFC7296](#)], there are no equivalent notification

codes to inform the User Equipment (UE) why an IP address family is not assigned or whether that UE should retry with another address family.

This document fills that void by introducing new IKEv2 notification status types for the sake of deterministic UE behaviors ([Section 4](#)).

These notification status types are not specific to 3GPP architectures, but can be used in other deployment contexts. Cellular networks are provided as an illustration example.

2. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [BCP 14](#) [[RFC2119](#)][[RFC8174](#)] when, and only when, they appear in all capitals, as shown here.

This document makes use of the terms defined in [[RFC7296](#)]. In particular, readers should be familiar with "initiator" and "responder" terms used in that document.

3. Why Not INTERNAL_ADDRESS_FAILURE?

The following address assignment failures may be encountered when an initiator requests assignment of IP addresses/prefixes:

- o An initiator asks for IPv_x, but IPv_x address assignment is not supported by the responder.
- o An initiator requests both IPv4 and IPv6 addresses, but only IPv4 address assignment is supported by the responder.
- o An initiator requests both IPv4 and IPv6 addresses, but only IPv6 prefix assignment is supported by the responder.
- o An initiator asks for both IPv4 and IPv6 addresses, but only one address family can be assigned by the responder for policy reasons.

[Section 3.15.4 of \[RFC7296\]](#) defines a generic notification error type that is related to a failure to handle an internal address failure. That error type does not explicitly allow an initiator to determine why a given address family is not assigned, nor whether it should try using another address family. INTERNAL_ADDRESS_FAILURE is a catch-all error type when an address-related issue is encountered by an IKEv2 responder.

INTERNAL_ADDRESS_FAILURE does not provide sufficient hints to the IKEv2 initiator to adjust its behavior.

4. IP6_ONLY_ALLOWED and IP4_ONLY_ALLOWED Status Types

IP6_ONLY_ALLOWED and IP4_ONLY_ALLOWED status types (see [Section 7](#)) are defined to inform the initiator about the responder's address family assignment support capabilities, and to report to the initiator the reason why an address assignment failed. These notifications are used by the initiator to adjust its behavior accordingly ([Section 5](#)).

No data is associated with these notifications.

5. An Update to [RFC7296](#)

If the initiator is dual-stack, it MUST include both address families in its request (absent explicit policy/configuration otherwise).

The responder MUST include IP6_ONLY_ALLOWED (or IP4_ONLY_ALLOWED) status type in a response to an address assignment request in the following cases:

1. The responder only supports IPv6 (or IPv4) address assignment, or
2. The responder supports both IPv4 and IPv6 address assignments, but it is configured to reply to requests asking for both address families with only an IPv6 prefix (or an IPv4 address).

The address family preference is defined by a policy that is local to the responder.

If the initiator receives IP6_ONLY_ALLOWED or IP4_ONLY_ALLOWED notification from the responder, the initiator MUST NOT send a request for an alternate address family not supported by the responder.

If a dual-stack initiator requests only an IPv6 prefix (or an IPv4 address) but receives IP4_ONLY_ALLOWED (or IP6_ONLY_ALLOWED) notification from the responder, the initiator MUST send a request for IPv4 address(es) (or IPv6 prefix(es)).

For other address-related error cases that have not been covered by the aforementioned notification status types, the responder/initiator MUST follow the procedure defined in [Section 3.15.4 of \[RFC7849\]](#).

6. Security Considerations

This document adheres to the security considerations defined in [\[RFC7296\]](#).

7. IANA Considerations

This document requests IANA to update the "IKEv2 Notify Message Types - Status Types" registry available at: <https://www.iana.org/assignments/ikev2-parameters/ikev2-parameters.xhtml> with the following status types:

Value	NOTIFY MESSAGES - STATUS TYPES	Reference
TBD	IP6_ONLY_ALLOWED	[This-Document]
TBD	IP4_ONLY_ALLOWED	[This-Document]

8. Acknowledgements

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9. References

9.1. Normative References

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- [RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in [RFC 2119](#) Key Words", [BCP 14](#), [RFC 8174](#), DOI 10.17487/RFC8174, May 2017, <<https://www.rfc-editor.org/info/rfc8174>>.

9.2. Informative References

- [RFC7849] Binet, D., Boucadair, M., Vizdal, A., Chen, G., Heatley, N., Chandler, R., Michaud, D., Lopez, D., and W. Haeflner, "An IPv6 Profile for 3GPP Mobile Devices", [RFC 7849](#), DOI 10.17487/RFC7849, May 2016, <<https://www.rfc-editor.org/info/rfc7849>>.

Author's Address

Mohamed Boucadair
Orange
Rennes 35000
France

Email: mohamed.boucadair@orange.com