            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 IPvx, but IPvx 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 responser'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 repsonder/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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   Tero Kivinen for the comments.

## 9.  References

### 9.1.  Normative References

   [RFC2119]  Bradner, S., "Key words for use in RFCs to Indicate
              Requirement Levels", BCP 14, RFC 2119,
              DOI 10.17487/RFC2119, March 1997,
              <https://www.rfc-editor.org/info/rfc2119>.

   [RFC7296]  Kaufman, C., Hoffman, P., Nir, Y., Eronen, P., and T.
              Kivinen, "Internet Key Exchange Protocol Version 2
              (IKEv2)", STD 79, RFC 7296, DOI 10.17487/RFC7296, October
              2014, <https://www.rfc-editor.org/info/rfc7296>.

   [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. Haeffner,
              "An IPv6 Profile for 3GPP Mobile Devices", RFC 7849,
              DOI 10.17487/RFC7849, May 2016,
              <https://www.rfc-editor.org/info/rfc7849>.

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