           IPv6 Prefix Length Recommendation for Forwarding

Abstract

   IPv6 prefix length, as in IPv4, is a parameter conveyed and used in
   IPv6 routing and forwarding processes in accordance with the
   Classless Inter-domain Routing (CIDR) architecture. The length of an
   IPv6 prefix may be any number from zero to 128, although subnets
   using stateless address autoconfiguration (SLAAC) for address
   allocation conventionally use a /64 prefix. Hardware and software
   implementations of routing and forwarding should therefore impose no
   rules on prefix length, but implement longest-match-first on prefixes
   of any valid length.

Table of Contents

1. Introduction

   Discussions on the 64-bit boundary in IPv6 addressing ([RFC7421])
   revealed a need for a clear recommendation on which bits must be used
   by forwarding decision-making processes. However, such a
   recommendation was out of scope for that document.

   Although Section 2.5 of [RFC4291] states "IPv6 unicast addresses are
   aggregatable with prefixes of arbitrary bit-length, similar to IPv4
   addresses under Classless Inter-Domain Routing" (CIDR, [RFC4632]),
   there is still a misinterpretation that IPv6 prefixes can be either
   /127 ([RFC6164]) or any length up to /64. This misinterpretation is
   mainly induced by the 64-bit boundary in IPv6 addressing.

   As discussed in [RFC7421], "the notion of a /64 boundary in the
   address was introduced after the initial design of IPv6, following a
   period when it was expected to be at /80". This evolution of the
   IPv6 addressing architecture, resulting in [RFC4291], and followed
   with the addition of /127 prefixes for point-to-point links, clearly
   demonstrates the intent for future IPv6 developments to have the
   flexibility to change this part of the architecture when justified.

It is fundamental not to link routing and forwarding to the IPv6
prefix/address semantics [RFC4291]. This document includes a
recommendation in order to support that goal.

Forwarding decisions rely on the longest-match-first algorithm, which
stipulates that, given a choice between two prefixes in the
Forwarding Information Base (FIB) of different length that match the
destination address in each bit up to their respective lengths, the
longer prefix is used. This document's recommendation (Section 2) is
that IPv6 forwarding must follow the longest-match-first rule,
regardless of prefix length, unless some overriding policy is
configured.

This recommendation does not conflict with the 64-bit boundary for
some schemes that based on IPv6 stateless address autoconfiguration
(SLAAC) [RFC4862], such as [RFC2464]. Indeed, [RFC7421] clarifies
this is only a parameter in the SLAAC process, and other longer
prefix lengths are in operational use (e.g., either manually
configured or based upon DHCPv6 [RFC3315]).

A historical background of CIDR is documented in [RFC1380] and
Section 2 of [RFC4632].

1.1. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
"SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this
document are to be interpreted as described in RFC 2119 [RFC2119].

2. Recommendation

IPv6 implementations MUST conform to the rules specified in
Section 5.1 of [RFC4632].

Decision-making processes for forwarding MUST NOT restrict the length
of IPv6 prefixes by design. In particular, forwarding processes MUST
be designed to process prefixes of any length up to /128, by
increments of 1.

Policies can be enforced to restrict the length of IP prefixes
advertised within a given domain or in a given interconnection link.
These policies are deployment specific and/or driven by
administrative (interconnection) considerations.

3. Security Considerations

   This document does not introduce security issues in addition to what
   is discussed in [RFC4291].

   IPv6 security issues, including operational ones, are discussed in
   [RFC4942] and [OPSEC-v6].

4. References

4.1. Normative References

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4.2. Informative References

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