IPv6, IPv4 and Coexistence Updates for IPPM's Active Metric Framework

(Title updated – formerly referred to as IPv6 update)

draft-ietf-ippm-2330-ipv6-02

A. Morton, J.Fabini, N.Elkins, M.Ackermann, V.Hegde

mailto:draft-ietf-ippm-2330-ipv6@ietf.org
Background

- The IPPM Framework (RFC2330) identifies two key prerequisites for valid measurements:

1. Valid measurement packets
   - “Standard-formed” packets
   - “…all metric definitions … include an implicit assumption that the packet is *standard formed*”...
   - Explicit criteria catalogue

2. Result may depend on measurement packet type
   - Distinct treatment of measurement packets along the path
   - Abstract term: packet of Type-P
   - Measurement is representative for any type (Type-P) vs. result is valid for ICMP-packets-64-byte-payload
Motivation and History

- Any {RFC|draft|metric} that references IPv6 is out of scope of the RFC2330 IPPM framework!
  - RFC2330, sec. 15 “…includes a valid IP header: the version field is 4 (later, we will expand this to include 6)”…

- **Trigger:** GEN-ART review of RFC 2679-bis

  - Input by Brian Carpenter: no IPv6 coverage
    - RFC 2679-bis only vs. IPPM update
    - Decision for IPPM update

- **IPv6-support for IPPM “outsourced” to dedicated draft**
  - Precondition for –bis RFCs to pass GEN-ART and IESG review
  - More documents pending in the queue (active-passive, PDM, …)
  - Avoid replication: one document can do the update for all.
Status @IETF99

- Adoption as IPPM WG item, July 2016
- Scope extended
  - Review comments Fred Baker and Marius Georgescu
  - Extension Headers covered in Type-P and Standard Formed packet sections
  - Load balancer as an example of Class C (equal treatment)
  - Examples where Type-P *changes from Src to Dst.
  - IP address family coexistence (NAT, v4 v6 transition)
- IETF99 meeting: proposed solutions for open topics
  - Handling of large packets in IPv6
  - Extent of coverage for 6LO and IPv6 Header Compression
  - Theoretical concept of "minimal standard-formed packet”.
  - IPv6 header treatment in intermediate nodes
Handling of large packets in IPv6

- Path MTU Discovery (PMTUD)
- Packetization Layer Path MTU Discovery (PLMTUD)
- Solution: Fragments are NOT standard formed
  - Adopt RFC2330 IPV4 fragment handling procedure for IPv6 fragments, too
  - Use of non-fragmented packets for measurements only.
  - Scope of IPPM framework metrics excludes fragmented IP(v4) packets.
  - Accepting IPv6 fragments means reviewing and updating ALL existing IPPM metric RFCs
If we do not include them explicitly, 6lo and ROHC IPv6 packets are out of scope of the IPPM (like IPv6 is right now).

6lo and IPv6 HC rely on state to be stored in gateway nodes (ingress, egress)

- 6lo and ROHC modify Type-P
- Distinct MTUs, physical-layer support, encryption,…
- IPv6 addresses mapped to 6LoWPAN addressing scheme
  - Source & destination IPv6 addresses not available

**Solution: 6LoWPAN is out of scope of this draft**
- Detailed arguments: sent to mailing list in reply to Spencer‘s question.
Definition of minimal standard-formed packet

"A particular type of standard-formed packet often useful to consider is the "minimal IP packet from A to B" - this is an IP packet with the following properties:

- It is standard-formed.
- Its data payload is 0 octets.
- It contains no options."

"Note that we do not define its protocol field…"

No known use of this concept in practice

- Practical use (router handling of "undefined" protocol?)
- IANA allocation: "no transport header"?

Solution: remove definition of minimal standard-formed packet for IPv4 and IPv6
IPv6 Extension Header Treatment

- IPv6 extension header treatment in intermediate nodes
  - Subject to discussions in v6ops
- Inspection/addition/removal of extension headers useful in the context of IPPM
  - Restricted to closed (enterprise) segments?
  - In-situ OAM (ioam)
- Challenges:
  - Extension header modifications change Type-P
  - Treatment in subsequent nodes (Segment routing?)
- **Solution:** allow, point out challenges/drawbacks
Current Status

• Version 2 of draft-ietf-ippm-2330-ipv6 published
  • Resolves all open items
  • Discussion on ippm mailinglist (thanks Spencer for the trigger): 6LoWPAN

• WGLC started 27.10.2017, ended this morning
  • WGLC end: 1:00 UTC, 13.11.2017.
  • Draft content considered to be stable
  • All open requests handled
  • No additional feedback during WGLC
Status and Next Steps

• WGLC concluded
• Document shepherd needed
• Need for additional 6LoWPAN feedback?
  • Does 6LoWPAN fit into IPPM charter (IP Performance Metrics)?
  • IPPM support for 6LoWPAN mandates revision of IPPM metric RFCs
    – Even if 6LoWPAN measurements could eventually be fit into the IPPM framework: RTD, OWD, Loss, ... explicitly reference src and dst IP
• Detailed arguments sent to the ippm mailing list as reply to Spencer‘s question
RFC 2330, Sec. 13:

- “A fundamental property of many Internet metrics is that the value of the metric depends on the type of IP packet(s) used to make the measurement…”
- “…Whenever a metric's value depends on the type of the packets involved in the metric, the metric's name will include either a specific type or a phrase such as "type-P".
- “…Generic notion of a "packet of Type-P“…”
  - Fully defined (port-http-tcp-connectivity-50byte-payload)
  - Partially defined (UDP packet)
  - Generic (Type-P)
- **Type-P becomes part of any metric definition**
  - Example: Define "IP-Type-P-connectivity" metric instead of "IP- connectivity" metric
RFC 2330 **Update**: Type-P

- Mention **special treatment of packets**
  - Diffserv, ECN, Router alert, extension headers, …

- Identify case when **Type-P changes along the path**
  - Type and length changes because of IPv4 <-> IPv6 translation, or IPv6 extension headers adding or removal
  - Modified values SHOULD be noted and reported with the results

- Discuss possible **impact of NAT** along path
  - Unpredictable impact on delay
  - Stateful NAT: state created on first packet: delay penalty

- RFC2330 Note: **class C equivalence** for path (MAP RG!)
  - …”it would be very useful to know if a given Internet component treats equally a class C of different types of packets. If so, then any one of those types of packets can be used for subsequent measurement of the component. This suggests we devise a metric or suite of metrics that attempt to determine C.”
RFC 2330, Sec. 14:

• “…all metric definitions … include an implicit assumption that the packet is *standard formed*”…

• “…a packet is standard formed if it meets all of the following criteria:…”

  • Length (IP header) = sizeof (IP header) + sizeof(payload)
  • Valid IP header: “version field is 4 (later, we will expand this to include 6)” (quote RFC2330!)
  • Header length >= 5, checksum is correct, no IP fragment.
  • Src and dest addr. correspond to the hosts in question.
  • TTL sufficiently large or 255
  • No IP options unless explicitly noted.
  • If transport header is present: valid checksum and fields.
  • Length B: 0 <= B <= 65535 …
**IPv4 and IPv6** allowed

**Basic requirements (aggregated IPv4 and IPv6):**
- Valid IP header
- Not an IP fragment.
- Source and Destination addresses intended.
- Transport header: valid checksum and valid fields

**Separate discussion of IPv4 and IPv6**
- IPv4 unchanged

**IPv6**
- Version field 6, total length including extension headers
- Extension headers: none or correct types and correct order, extension header parameters conforming with IANA
- Note controversies (RFCs 6564 and 7045): intermediate nodes inspect/add/delete/change IPv6 extension headers
Next Steps

• Urgent need to update IPPM for IPv6
  • RFCs and documents in queue depend on it!
  • Draft scope and structure is stable
  • Feedback and Input requested

Contact (all draft authors):
mailto:draft-ietf-ippm-2330-stdform-typep@ietf.org