IPv4 Residual Deployments a Stateless Solution (4rd)

draft-ietf-softwire-4rd-03

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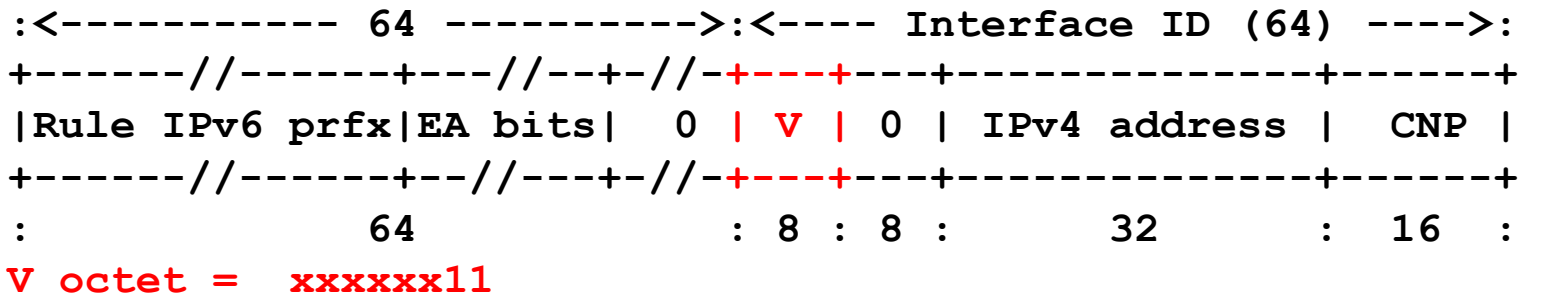
Main objectives

1. draft-ietf-softwire-stateless-4v6-motivation-03
   - Shared IPv4 addresses
   - Mesh topology support
   - No per-customer states in CEs and BRs
2. Advantages of both encapsulation and translation
   - E2E transparency to IPv4
   - IPv6-only middle-box compatibility (ACLs …)
3. No IPv6 renumbering needed in customer sites
4. *No conflict with any existing RFC*
5. *Overall simplicity*

Key Mechanism 1
Reversible Header Translation (RHT)

1. IP headers are translated v4-to-v6 and back v6-to-v4. **IP payloads are kept unchanged**, whatever their protocol.
2. **DF bit** is preserved (needed for PMTU discovery of RFC 4821) . Copied in Fragment Headers of fragmented and fragmentable packets, in available free space of packet-ID field.
3. **IP-layer security** on Addresses and ports is maintained (needed for ICMPv4 and UDP-0 which have no check at transport layer). An *address-and-protocol checksum* is placed in the IPv6 flow-label field (in conformity with constraints of RFC 6437 on FLs).

Key Mechanism 2
4rd IPv6 address format



1. **No renumbering** of any IPv6 site is needed for 4rd.
   - 4rd addresses contain an exclusive pattern, the V octet.
   - In the V octet, 11 is the existing escape pattern for unicast addresses that are neither local scope nor EUI-64 [RFC4291] .
   - 4rd can be its first use, with 0 as proposed xxxxxx value.
   - Once clear in Softwire, 6man has to be involved to request IANA to maintain a registry.
2. Tunnel packets are **valid IPv6 packets** for all protocols using the TCP checksum algorithm (TCP, UDP, UDP lite, DCCP, any other to come). For this, the Checksum-Neutrality Preserver CNP is minus the checksum of the first 80 address bits.

Conclusion

1. Specification has now been subject to thorough theoretical check
2. Ongoing implementation hasn't identified any ambiguity, or flaw, or implementation difficulty
3. Functional objectives are reached

=> 4rd is proposed as the standard for stateless on mesh topologies

Feature Analysis of proposed Stateless Mesh solutions MAP-T, MAP-E, 4rd

draft-despres-softwire-stateless-analysis-tool-02

MAP-T vs. 4rd

1. Limitations of MAP-T avoided in 4rd
   a) **Lack of transparency to DF=1 in fragmented packets (incompatibility with ICMP-less PMTUD of [RFC 4821], issue #8)**
   b) Need to renumber some IPv6 sites (issue #14)
   c) Currently Imprecise and inconsistent specification
2. Limitation of 4rd avoided in MAP-T
   - *IPv6-only DPI doesn't work on ICMPv4 (expected to be negligible)*

MAP-E vs. 4rd

1. Limitations of MAP-E avoided in 4rd
   a) **IPv6-only port-based ACLs and cannot apply to tunneled packets**
   b) Need to renumber some IPv6 sites (issue #14)
   c) *Anycast BR addresses subject to PMTU black holes & incorrect IPv6 reassembly (sec 10.1 of the draft)*
   d) *RFC3168 ECN not supported in RFC 2473 tunnels*
   e) *Currently Imprecise and inconsistent specification*
2. Limitation of 4rd avoided in MAP-E
   - *No support of IPv4 layer-3 options (expected to be negligible)*

Thank You