IPv4 Residual Deployments
The Unified Solution (4rd-U)

draft-despres-softwire-4rd-u-06

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draft-despres-softwire-stateless-analysis-tool-01

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Contents

1. Scope (IPv6 Domains, CEs and BRs)

Common with MAP

1. ISP IPv6 routing domain - broadband, mobile, private …
2. Dual-stack CEs - hosts and/or routers – IPv6 prefixes
3. Stateless BRs between Domain and IPv4 toward Internet
4. Each CE derives from its IPv6 prefix a public IPv4 Prefix or Address or Address + PSID (Stateless Mapping rules)
5. At ISP choice, IPv4 tunnels are Mesh or Hub-and-spoke
6. Mapping rules and Domain parameters can be announced to CEs in DHCPv6

Different from MAP T+E

1. ISPs don't need to choose between E and T

2. Major feature: Unified packet format

- **IPv4 transparency** (DF, UDP-cksm=0, ICMPv4, ...?) – Like E but not T
  a) Except for packets that would need IPv4 options
  b) In case of shared IPv4 addresses, provided packets have ports at their usual position (TCP, UDP …)
- **IPv6-only compatibility** – like T but not E
  a) For port-based DPI (ports at their place in IPv6 payloads)
  b) For web caches (valid TCP checksums)

➔ **ISPs don't need to choose between Trans. and Encap.**

The key: Reversible header mapping IPv4 in IPv6 (no payload change)

1) *Fragment header is present even if there is only one fragment (Note: RFC6145 already has that when DF=0)*
2) *DF bit and TTL bits 1-7 are copied in free bits of the 32-bit IPv6 Packet-ID (16 bits in IPv4, 32 in IPv6)*
3) *TTL bit 0 is copied in Hop count bit 0 (domain routes < 127)*
4) *4rd IPv6 addresses are checksum neutral (CNP in bits 112-127)*

3. Features of U neither in T nor in E (but could be in them)

1. Subnet-ID assignments in customer sites are completely free
   - V octet rather than "u" octet in 4rd-U ipv6 addresses (also facilitates maintenance)
   - Uses the free combination of "u" & "g" bits in Interface IDs (backward compatible with all existing RFCs)
   - Open to other uses of this u-g combination
2. BRs can forward IPv4 fragments without reassembly

   ➔ Scalability and improved DOS-attack protection
3. Support of CEs behind 3rd-party router CPEs

   (For special cases only, but trivial to support)
4. Possible synergy with NAT64-based stateless solutions, e.g. 464XLAT: 4rd-U tunnels between CLAT and PLAT => improved IPv4 transparency (Null UDP checksum ...)

4. Feature of U&E not in T (but could be in it)

1. Avoidance of equal packet IDs from different shared-address CEs
   - Each CE uses packet IDs in its port set

5. Feature of T not in E and not in U - but not needed

1. MAP-T, because it uses RFC6145 translation, can support in some scenarios communication between IPv4-only applications and IPv6-only hosts
2. However, Bump-in-the-host of RFC 6535 already exist for this (also based on RFC6145)
3. Combining BIH and E or U in CE nodes is sufficient
4. A host node having a NAT44 can also be a router

Conclusion

1. 4rd-U is well understood to be easily implementable and deployable by those who studied the specification (from widely different origins)
2. It does what it has been designed for: ISP no longer need to choose between two incompatible operation modes (double translation or encapsulation)
3. Compared to Encapsulation, it looses nothing, and adds compatibility with IPv6-only DPI (plus various features not yet in MAP)
4. Compared to Double Translation, it looses nothing, and improves IPv4 transparency (plus various features not yet in MAP)
5. 4rd-u-06 is a self contained, complete, and ready to use, specification

➔ For **stateless IPv4 via IPv6 with mesh-topology support**, 4rd-U is proposed as ultimate synthesis of A+P and MAP efforts, and the best way for IETF to quickly publish a unique and deployable standard (forgetting NIH and FUD syndromes)