IPv4 header: Recycle 16 bits?

draft-briscoe-intarea-ipv4-id-reuse-00

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problem: protocol extensibility

- new protocols need n bits in IP header (v4 and/or v6)
  - e.g. conex-abstract-mech, nat-reveal-option
- IPv4&6 extensibility mechanisms unusable in practice
  - any v4 option or v6 hop-by-hop ext hdr punt to slow-path

new extensibility design principle*

- put options where they will be ignored by existing kit
- kit with option code will know where to look

* ack: Rob Hancock
find a field ignored by existing kit

- this draft proposes a new way to extend IPv4
  - similar ideas could apply to IPv6
    - large majority of IPv4 packets are atomic
      - unfragmented and unfragmentable
      - ID field redundant in atomic packets [draft-ietf-intarea-ipv4-id-update]
    - this draft proposes a process to manage re-use of the ID field
re-use ID field in atomic IPv4 packets

- frees up 16 bits for use by Internet community
  - propose IANA registry for re-using ID field
  - IETF can reassign whole field, subfields or codepoints within subfields
  - within constraints of previous use of ID for reassembly
- call the ID field “ID-Reuse” when packet is atomic
  - set currently unused ID-Reuse bits to zero

example registration: a new 2-bit field called ExA
disambiguation

- how does an ExA implementation know whether this is:
  a) an atomic packet using codepoint 10 in protocol ExA?
  b) an atomic packet with arbitrary noise in the ID field?

- solution:
  - propose to redefine Reserved flag as ‘Recycled’ (RC) flag
  - if atomic AND RC=1, ID field redefined as ID-Reuse
  - consumes last available bit to free up 16b
incremental deployment tradeoff

- new problem
  - some pre-existing middleboxes (firewalls) discard RC = 1
- solution during initial deployment:
  - ExA implementation assumes packet using ExA protocol if
    \[
    \text{(non-ExA ID-Reuse} = 0 \ \text{AND} \ \text{RC} = 0 \ \text{AND} \ \text{atomic}) \\
    \text{OR} \\
    \text{RC} = 1 \ \text{AND} \ \text{atomic})
    \]
  - in this example, wrong with probability of \(1 : 2^{(16-2)} = 1 : 2^{14}\)
  - protocol must not risk being wrong unless it does no harm
constraints on re-using IPv4 ID

- only in atomic packets

- IPsec authentication header interaction
  - ID immutable at least between IPsec endpoints

- Tunnel encapsulation
  - cannot rely on DF propagating to outer
  - cannot rely on ID field being copied to outer
conclusions

• consume last available bit to free up 16 in IPv4
• with non-trivial constraints
• principled incremental deployment
  • and a hack with a tradeoff and an added constraint

<table>
<thead>
<tr>
<th>RC</th>
<th>middlebox traversal</th>
<th>new protocol recognition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>certain</td>
<td>uncertain</td>
</tr>
<tr>
<td>1</td>
<td>uncertain</td>
<td>certain</td>
</tr>
</tbody>
</table>

discussion

• too constrained for those who want more bits?
• is this the most useful use of the Reserved flag?
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