Fragmentation and Extension Header Support in the IPv6 Internet

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Motivation

- Operators are known to filter IPv6 fragments
- Some data published by RIPE
  - Analyzes IPv6 fragment drops
  - Measured with ICMPv6 probes
- Remaining questions:
  - What about Extension Headers?
  - What about draft-ietf-6man-oversized-header-chain?
  - More data, anyone?
What we did

• Expanded the tcp6 tool of the IPv6 Toolkit (*)
  – “Full” application-layer TCP in the pipeline
  – Implemented “probe” mode -- easy to script

• For each Alexa Top 1M site
  – Identified those with AAAA records
  – Filtered out non-working AAAA records
  – Performed tests with specific packets
    • IPv6 fragments
    • Several combinations of IPv6 Extension Headers

* <http://www.si6networks.com/tools/ipv6toolkit>
Caveats

- Tests performed over a single network
- Tests performed from a single origin
- Tests performed for a single protocol (TCP)
- ACK-scan type of testing
- i.e., think of this preso as an invitation for testing
Results #1
Results #1: Overview

- Duplicate IPv6 addresses not removed
- Hence, “weighed” measurement
- Testing performed over 3603 “sites”
Fragmentation

• Failure rate: 47.68 %
Extension Header (8 bytes)

- Failure rate: 52.53 %
Extension Header (1 KBytes)

- Failure rate: 92.17 %
Oversized Header Chain

- Failure rate: 71.85 %
Results #2
Results #2: Overview

- Duplicate IPv6 addresses were removed
- Hence, non-“weighed” measurement
- Testing performed over 883 unique addresses
Fragmentation

- Failure rate: 41.57 %
Extension Header (8 bytes)

- Failure rate: 44.85 %
Extension Header (1 KBytes)

- Failure rate: 89.93 %
Oversized Header Chain

- Failure rate: 66.03 %
Some conclusions
Some conclusions

- IPv6 fragmentation more unreliable than expected?
- (As expected) it is not just fragmentation that is unreliable, but Extension Headers in general
Questions?
Thanks!

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