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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