Introduction

- **RFC7872**: “Observations on the Dropping of Packets with IPv6 Extension Headers in the Real World”.
- JAMES, a different methodology with more recent results.
- Hop-by-Hop Options not usable over the Internet?
- Hot topic in 6man WG:
  - [draft-ietf-6man-hbh-processing-00](https://datatracker.ietf.org/doc/draft-ietf-6man-hbh-processing-00/) (IPv6 Hop-by-Hop Options Processing Procedures)
  - [draft-ietf-6man-eh-limits-00](https://datatracker.ietf.org/doc/draft-ietf-6man-eh-limits-00/) (Limits on Sending and Processing IPv6 Extension Headers)
- What about other EHs and some IP protocols?
JAMES - Vantage points
JAMES - Methodology

- Traceroute-like technique
- Each pair (13 VMs) is tested in both direction
- Experiments (UDP and TCP):
  - Hop-by-Hop and Destination Options (sizes 8, 16, 32, 64, 128, 256, 512)
  - Routing Header (types 0-6)
  - Fragment Header (atomic, non-atomic)
  - Authentication Header
  - No Next Header (protocol 59)
  - Ethernet (protocol 143 RFC 8986)
- Probe traffic is marked as proposed in draft-vyncke-opsec-probe-attribution-01
- Drop responsibility is attributed per hop, then per AS (see next slide)
Drop Responsibility Attribution

- At hop level: probe as much as possible

- At AS level:
  - Uncertainty interval as small as possible (best case: size = 1)
  - Corner cases: shared link between ASs, (un)identified ASn before/after the hop
Early results

- Hop-by-Hop Options… **unreliable**
- Destination Options:
  - size = 8 or 16… **pass**
  - size >= 32… **unreliable** (size 32 → 93%, size 64 → 42%, size 128 → 5%)
- Routing Headers:
  - types 0 and 4… **unreliable** (only resp. 81% and 69% pass)
  - types 1, 2, 3, 5, 6… **pass**
- Fragment Headers:
  - atomic… **unreliable** (only 70% pass)
  - non-atomic… **pass**
- Authentication Headers… **pass**
- No Next Header / Ethernet… **pass**
- Drop attribution (WIP): more details in the draft
Next steps

- **Operator Survey:**
  [https://docs.google.com/forms/d/1wzPdS_McuwIhl0c963ZZHO4sd_Cd2Is0oNBuvGxM_Y/](https://docs.google.com/forms/d/1wzPdS_McuwIhl0c963ZZHO4sd_Cd2Is0oNBuvGxM_Y/)

- Extend the topology
  - Looking for IPv6 VM in Africa / China
  - Probing beyond the vantage points? (BGP prefixes? Alexa?)

- Improve the drop responsibility attribution algorithm:
  - per hop: reduce the uncertainty interval
  - per AS: use `bdrmapit`?
Thank you!