Improving an AS Traceroute Tool

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Problem

- High-level: useful to know who operates a router (identified by an IP address) when diagnosing problems, particularly with traceroute
- IP to AS mappings derived from BGP tables identify the origin AS, not necessarily who operates the router.

Prior work

- Scalable and Accurate Identification of AS-Level Forwarding Paths
  - INFOCOM 2004
  - Z. Morley Mao, David Johnson, Jennifer Rexford, Jia Wang, Mao David, Johnson Jennifer, Rexford Jia, Randy Katz
  - Code not released by AT&T

Related work

- Toward Topology Dualism: Improving the Accuracy of AS Annotations for Routers
  - PAM 2010
  - Brad Huffaker, Amogh Dhamdhere, Marina Fomenkov, k. claffy.

Current Status

- Implemented algorithm as described in INFOCOM2004 paper in C
- Recent focus has been on improving the initial IP2AS mapping derived from BGP: particularly filling “gaps” and using PCH IXP mappings
  - Algorithm improves paths with low error count; E <= 2.

Example

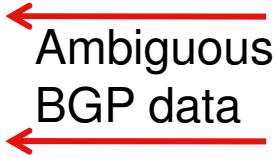
```
pq m:6 n:15 182.23.143.1 E:7 bad
 7660 4635 15412 18101 9583 131169
  203.181.248.60 7660 -> 7660
  202.40.161.188 703 10026 -> 4635
    85.95.25.217 15412 -> 15412
    85.95.25.238 15412 -> 15412
   62.216.147.98 15412 -> 18101
    124.7.237.85 9583 -> 9583
    119.227.4.85 ? -> 9583
    119.227.4.42 ? -> 9583
   119.227.4.137 ? -> 9583
 221.134.133.201 ? -> 9583
  221.135.145.37 9583 -> 9583
 221.134.200.125 ? -> 9583
     124.7.42.71 ? -> 9583
  124.30.188.110 9583 -> 9583
  124.30.188.114 9583 -> 9583
```

- When an IP address is not mapped to any ASN, this counts as an error
- Operators who do not announce prefixes used to number interfaces can cause the algorithm to ignore those paths

Example, +RIR delegation data

```
pq m:6 n:15 182.23.143.1 E:3 bad
 7660 4635 15412 18101 9583 131169
  203.181.248.60 7660 -> 7660
  202.40.161.188 703 10026 -> 4635
    85.95.25.217 15412 -> 15412
    85.95.25.238 15412 -> 15412
   62.216.147.98 15412 -> 18101
    124.7.237.85 9583 -> 9583
    119.227.4.85 9583 -> 9583
    119.227.4.42 9583 -> 9583
   119.227.4.137 9583 -> 9583
  221.134.133.201 ? -> 9583
   221.135.145.37 9583 -> 9583
  221.134.200.125 ? -> 9583
     124.7.42.71 9583 -> 9583
  124.30.188.110 9583 -> 9583
  124.30.188.114 9583 -> 9583
```

4635 is an IXP. Inferred alias in 15412 is a better mapping.



Ambiguous RIR and BGP data

Additional AS traceroute work

- Use router alias sets to assist algorithm in determining which AS operates a router
  - Adjust IP2AS mappings for interface IP addresses originated by some other AS
  - Particularly useful in cases where the first hop into an AS is observed using provider's IP address
- Identification of IXP route servers in AS path