Network Path Problems in DNSSEC's Deployment

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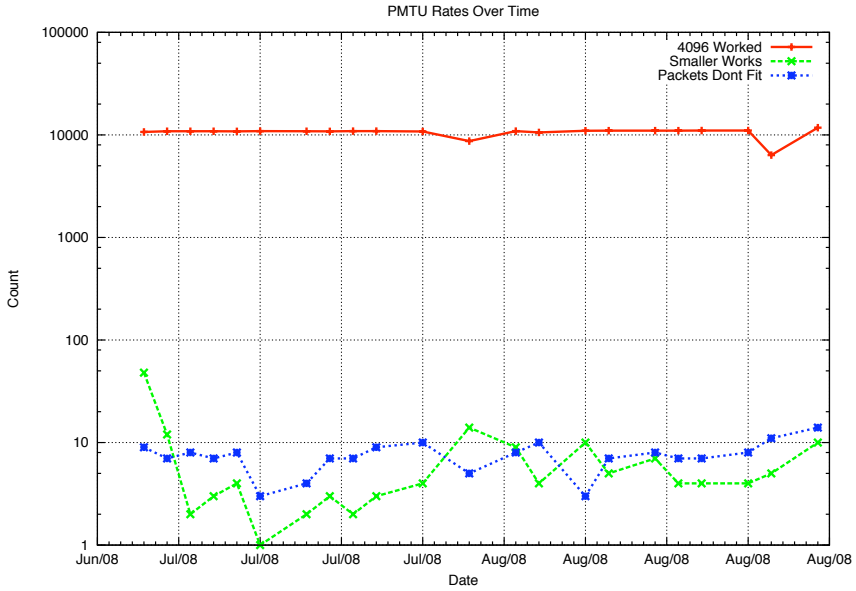
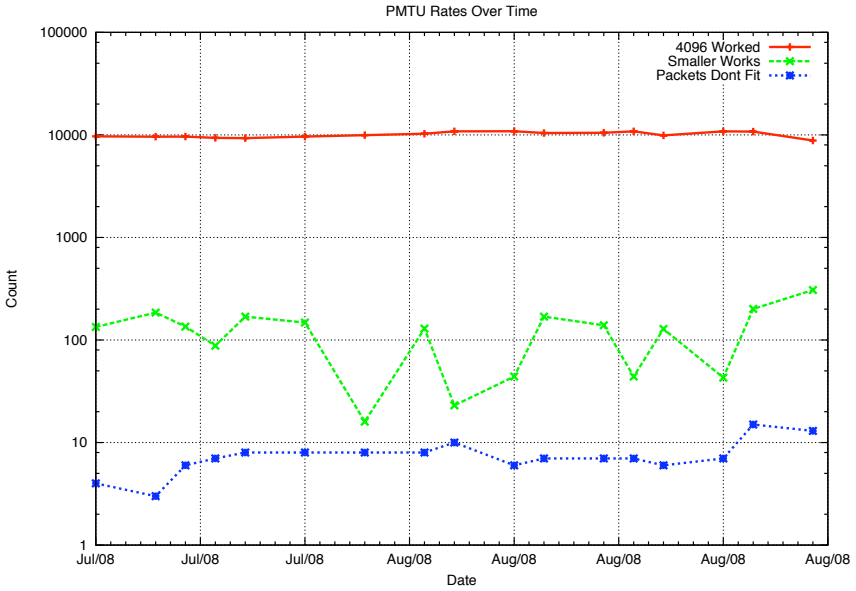
The Network Path and PMTU

- A network path is a sequence of links
  - Each link can only support packets of a certain size (MTU)
- The smallest MTU for a network path is its bottleneck (PMTU)
- Further limited by “middle boxes” (firewalls, NAT, etc.)
  - We overload the term PMTU to apply in these cases too
- Network paths that ***do*** support large packets may fail to deliver large DNS messages

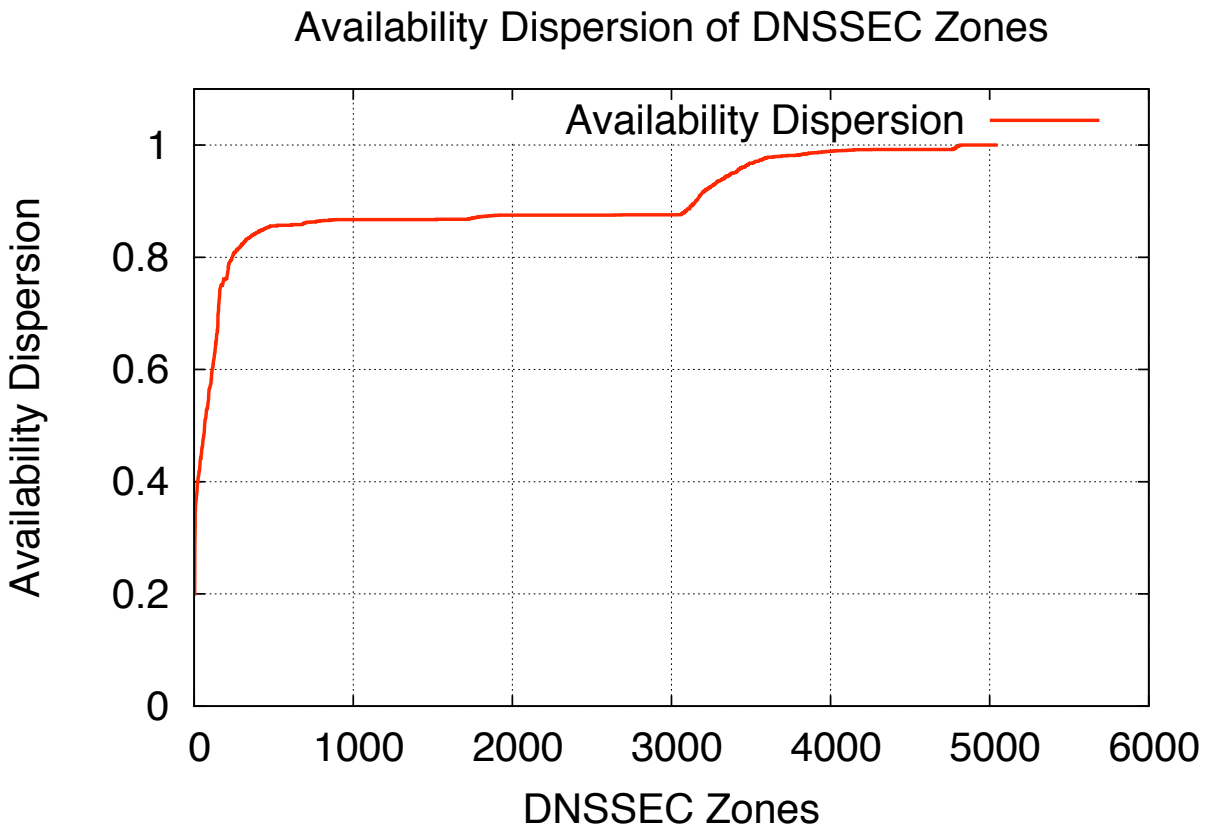
It Matters Where You Look From





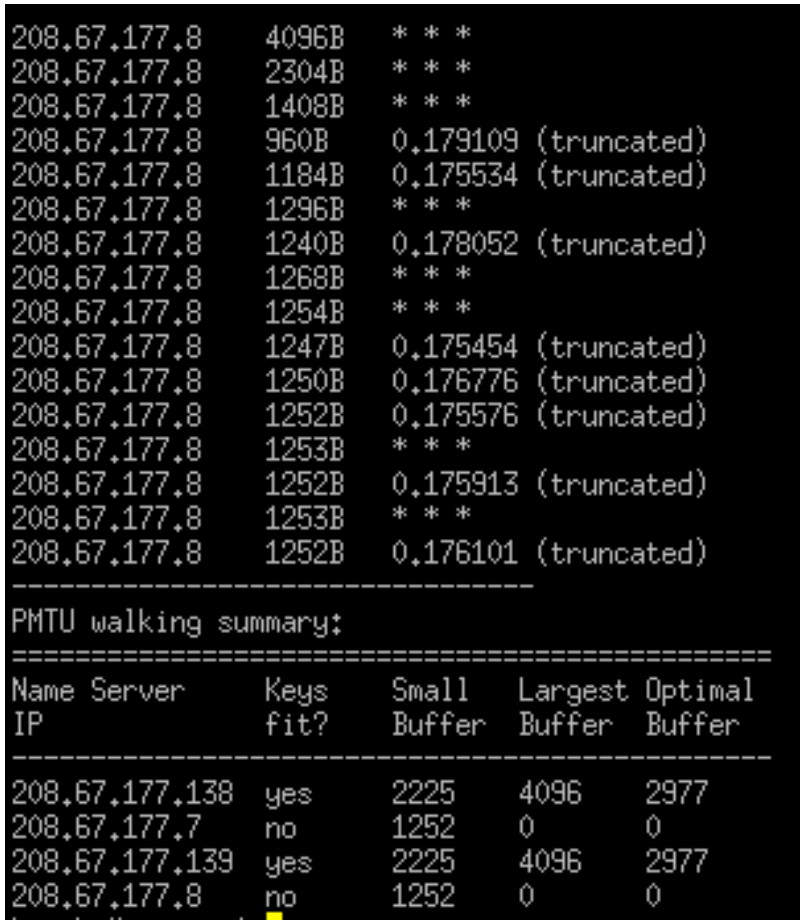
- NL NetLabs only has trouble with roughly 10 zones (graph on the left)
- At the same time, our SOHO router has PMTU problems with roughly 100 zones (on the right)

More Succinct



- We use a metric (defined in prior work) to quantify the "availability dispersion" of each zone
  - Captures how different each poller's view of each zone is
- Using a weighted average over time, we see that most zones have suffered dispersion

“dnsfunnel”
Take a Look Yourself



dnsfunnel questsys.com.

The Nature of the Problem

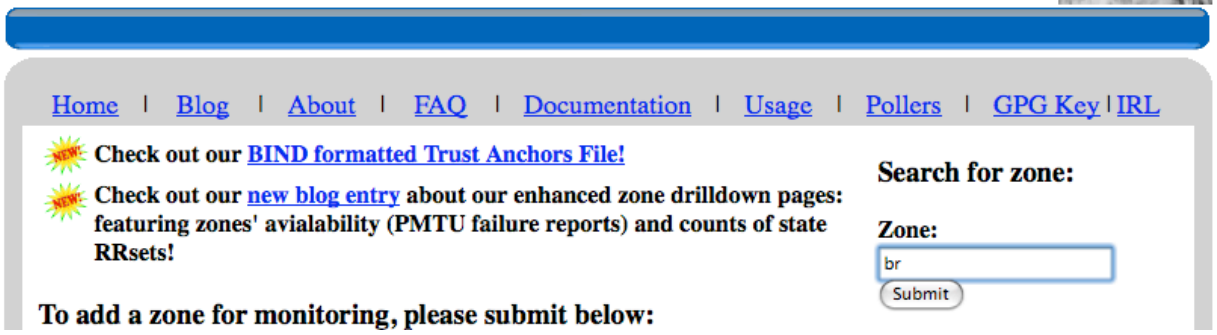
- There is no silver bullet
  - This is an end-middle-end problem
- Network paths have limitations at *various* points
  - Not always just the sender or receiver side
  - If problem is at the sender/receiver, test and upgrade
- Resolvers specify buffer sizes that exceed PMTUs
  - EDNS0 buffer size ≠ PMTU size
  - More intelligent discovery and use of buffer size
- Name servers treat buffer sizes as path-capacity
  - How should they know better?
  - Where possible, reduce set sizes

What to do Tactically

- Download our toolkit that includes dnsfunnel:
  http://vantage-points.org/

Vantages

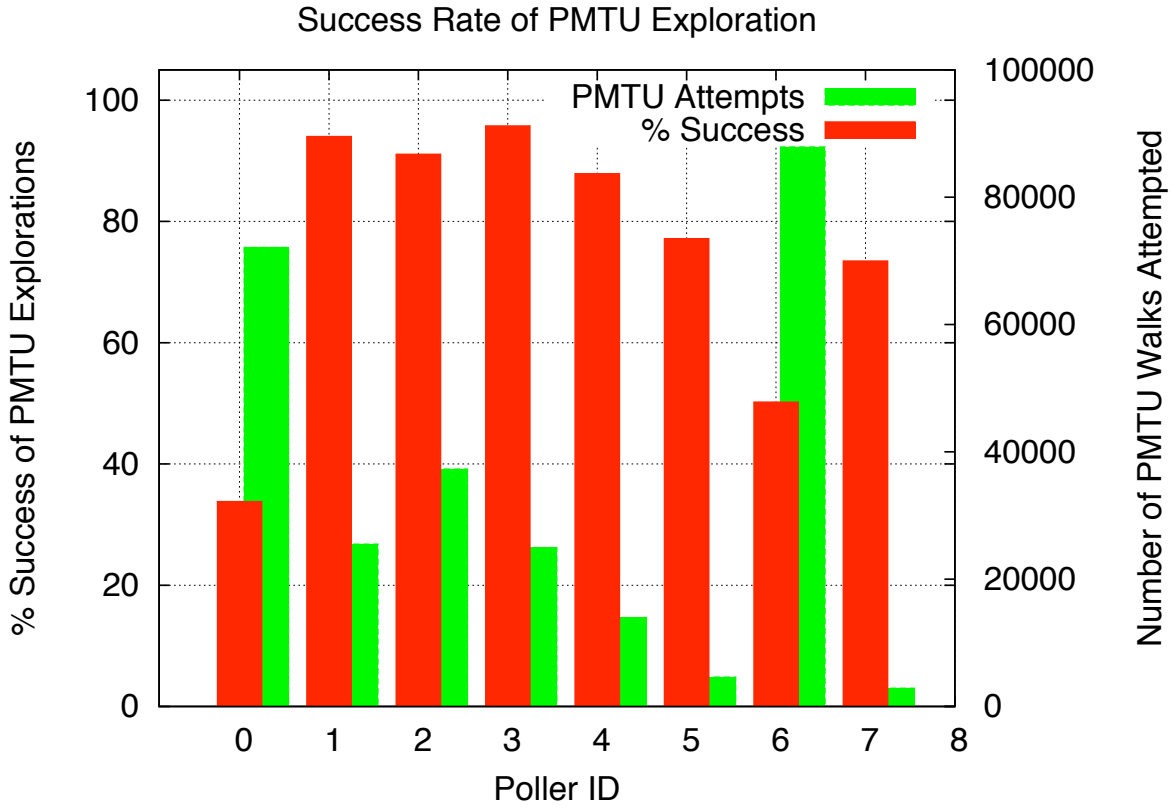
- Check your zones' availability at:
  http://secspider.cs.ucla.edu/



Thanks

Backup

As Seen From All of Our Pollers



- Green bars indicate the number of times a poller needed to do a PMTU walk
- Red bars indicate the percentage of times a PMTU was was able to find a buffer size the allowed DNSKEYs to be received

“dnsfunnel”
Take a Look Yourself

```
208.67.177.8    4096B   * * *
208.67.177.8    2304B   * * *
208.67.177.8    1408B   * * *
208.67.177.8    960B    0.179109 (truncated)
208.67.177.8    1184B   0.175534 (truncated)
208.67.177.8    1296B   * * *
208.67.177.8    1240B   0.178052 (truncated)
208.67.177.8    1268B   * * *
208.67.177.8    1254B   * * *
208.67.177.8    1247B   0.175454 (truncated)
208.67.177.8    1250B   0.176776 (truncated)
208.67.177.8    1252B   0.175576 (truncated)
208.67.177.8    1253B   * * *
208.67.177.8    1252B   0.175913 (truncated)
208.67.177.8    1253B   * * *
208.67.177.8    1252B   0.176101 (truncated)
--------------------------------

PMTU walking summary:

================================================
Name Server     Keys    Small   Largest Optimal
IP              fit?    Buffer  Buffer  Buffer
------------------------------------------------
208.67.177.138  yes     2225    4096    2977
208.67.177.7    no      1252    0       0
208.67.177.139  yes     2225    4096    2977
208.67.177.8    no      1252    0       0
```

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```
192.134.0.49    4096B   0.033097
--------------------------------

192.36.125.2    4096B   0.004157
192.36.125.2    2304B   0.002445
192.36.125.2    1408B   0.002923 (truncated)
192.36.125.2    1856B   0.002845
192.36.125.2    1632B   0.002304
192.36.125.2    1520B   0.002108
192.36.125.2    1464B   0.002897
192.36.125.2    1436B   0.003885
192.36.125.2    1422B   0.005049 (truncated)
192.36.125.2    1429B   0.001806 (truncated)
192.36.125.2    1432B   0.002284
192.36.125.2    1430B   0.002039
192.36.125.2    1429B   0.001743 (truncated)
192.36.125.2    4096B   0.002577
--------------------------------

PMTU walking summary:

================================================
Name Server     Keys    Small   Largest Optimal
IP              fit?    Buffer  Buffer  Buffer
------------------------------------------------
192.5.4.1       yes     1430    4096    1854
193.0.0.195     yes     1438    4096    1862
192.134.0.49    yes     1430    4096    2320
192.36.125.2    yes     1430    4096    2320
```

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