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Background: Active Measurement of Path Transparency

- Basic methodology:
  1. throw a bunch of packets at the Internet
  2. see what happens.
- Ideal: two-ended A/B testing
- Scalable: one-ended A/B testing
- Multiple sources: isolate on-path from near-target impairment
- PATHspider provides a framework for generalizing and scaling this approach.
PATHspider architecture

- Configurator: put system into configuration A or B (e.g. `sysctl`)
- Workers: generate test traffic
- Observer: passively observe test traffic
- Merger: combine information about active measurement with passive observations.
- Plugins allow for customizing traffic generation and observation for each kind of test (ECN, DSCP, TFO, etc.)
- Output fed into Path Transparency Observatory (see upcoming talk)
Current results, future plans

• Explicit Congestion Notification (ECN) to Alexa top 1M websites:

<table>
<thead>
<tr>
<th></th>
<th>IPv4</th>
<th>IPv6</th>
<th>all</th>
</tr>
</thead>
<tbody>
<tr>
<td>No ECN connectivity issues</td>
<td>99.5%</td>
<td>99.9%</td>
<td>99.5%</td>
</tr>
<tr>
<td>ECN successfully negotiated</td>
<td>70.0%</td>
<td>82.8%</td>
<td>70.5%</td>
</tr>
</tbody>
</table>

• Differentiated Services Codepoint (DSCP): 10.3% of Alexa top 100k have unexpected DSCP values on downstream.

• TCP Fast Open (TFO): 330 IPv4 and 32 IPv6 sites in Alexa top 1M supports TFO (mostly Google). CPE and anti-DDoS sites appear to impair TFO.

• Now in Debian testing (# apt install pathspider).
• Next releases include SCTP, UDP-Lite, MP-TCP testing; mPlane integration.