On the analysis of Internet Paths with DisNETPerf, a Distributed Internet Paths Performance Analyzer

Sarah Wassermann, Pedro Casas, Benoit Donnet
Université de Liège, AIT Austria
sarah.wassermann@student.ulg.ac.be - http://wassermann.lu

Why DisNETPerf?
- Load-balancing: user-requests redirected to servers at hundreds of milliseconds
- Performance-monitoring of reverse paths (uncontrolled server→customer) challenging
- Reverse traceroute[2] relies on IP spoofing and IP Record Option: security concerns

Path asymmetry study
- Path asymmetry study between RIPE Atlas boxes in different regions of the world
- Asymmetric path: A→B different from B→A
- Metric: Route Similarity index (RSIM) - ratio between #shared links and #total links
- Path asymmetry indicated by RSIM(A→B, inverse(B→A))
- More asymmetric paths in larger zones
- Path asymmetry non negligible phenomenon

Overview
- DisNETPerf relies on RIPE Atlas (RA) distributed measurements
- Given: content server IPₐ, destination IPₜ, locate IPₐ - closest RA probe to IPₜ
- Combined topology- and delay-based distance: first locate candidate RA probes by AS and then elect IPₜ by propagation delay
- Periodically run traceroute measurements from IPₐ to IPₜ
- Data can be used to troubleshoot paths from the content server (mimicked by IPₜ) to the target customer

Probe selection: 2 approaches[3]

1. Smallest latency (SL) approach
   - Launch p⁺1st measurements from candidate RA probes to IPₜ
   - Probe with smallest minimum RTT elected as IPₜ

Landmark (LM) approach
   - Use some candidate RA probes as landmarks for distance reference
   - Launch p⁺1st measurements from landmarks to IPₜ and all other candidate RA probes
   - Elect as IPₜ probe with smallest normalized distance to IPₜ:
     \[ D_{ij} = \frac{1}{K} \sum_{k=1}^{K} |d_k - d_j | \]
     where K = #landmarks providing a RTT for both IPₜ and IPₜ,
     \( D_i = \min \text{RTT between } IPₜ \text{ and landmark } i \)

Evaluation
- IPₜ is a good probe w.r.t. IPₜ and IPₜ if the path from IPₜ to IPₜ is highly similar to the path from IPₜ to IPₜ
- Route Similarity index - RSIM(₁₁,₂₂,₃₃,₄₄) = \[ \frac{2 \times \text{Common Links}(₃₃,₄₄)}{\text{Total Links}(₃₃,₄₄)} \]

- Ground-truth: RA probes as IPₜ and IPₜ to compute real server→customer paths (300 tests)
- RSIM computed for different link definitions (AS, PoP, and IP level)
- AS-level measurements more relevant (troubleshooting faulty ASes)→high RSIM when RA probe located in same AS
- 2 approaches very accurate: select the best RA probe (highest RSIM) for more than 80% of tests

References