ISP-Friendly Peer Matching

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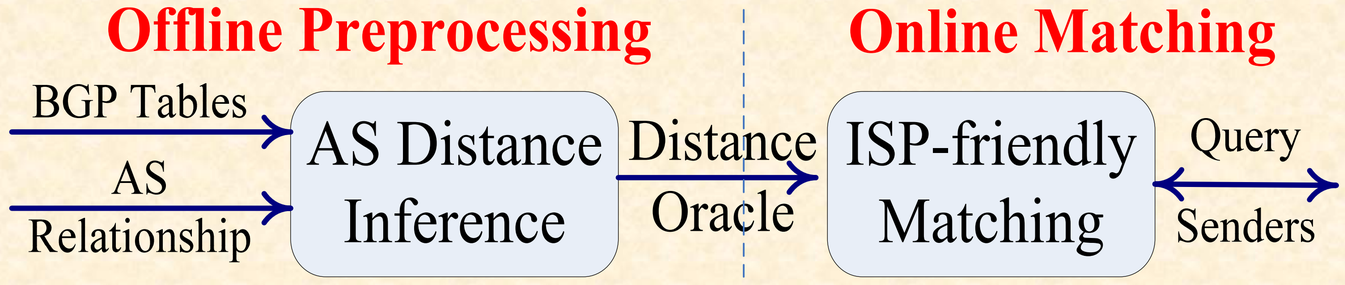
1. Motivation

- **P2P costs ISPs more money**
- **Challenge: find senders to**
  - **reduce loads on inter-ISP links**
  - **improve application performance**
- **Solution: ISP-friendly matching**
  - **find senders to minimize AS distance**
  - **within AS, get closer senders by IP prefix**

2. Big Picture



- **Infer AS distance offline → distance oracle**
  - **leverage public info**
  - **efficient inference algorithm**
- **Match senders online using oracle**
  - **faster distance lookup**
  - **smaller data structure in memory**
  - **exact/approximate distance**

3. Our Approach

- **Compute shortest valley-free AS paths**
  - **valley-free: customer AS does not transit data for its providers**
- **Current algorithms [e.g., Mao 05]**
  - ➔ $O(|V|^3)$ **time**
  - **runs in ~ 2 days (25,000+ ASes)**
  - **needs ~ 625 MB memory**
- **Our proposed algorithm**
  - **preprocess AS graph ➔ concise data structure: Core Matrix**
  - **exclude stub ASes; they don't transit traffic for any other ASes**
  - **runs in ~ 3 hours**
  - **needs ~ 10 MB memory (1.7 %)**

- ***V*: all ASes; *L*: stub ASes ← Most ASes are in *L* (87%)**

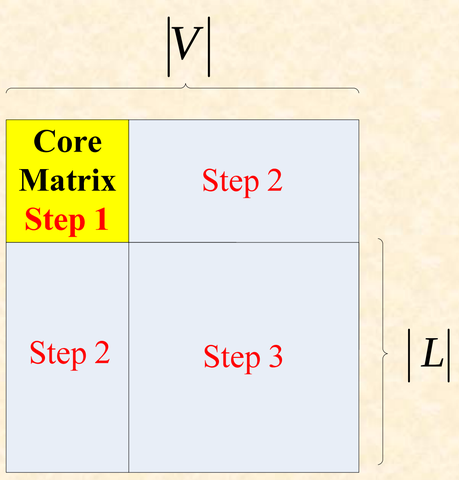
Construct_Distance_Oracle

For $s,t \in V \setminus L$**, compute shortest up-hill distance** — Step 1

For $s,t \in V \setminus L$**, compute valley-free distance** — Step 1

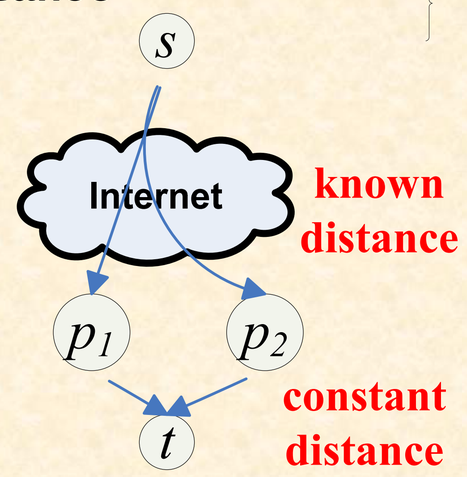
For $s \in V \setminus L$ **and** $t \in L$**, compute valley-free distance** — Step 2

For $s,t \in L$**, compute valley-free distance** — Step 3



Only Core matrix is stored

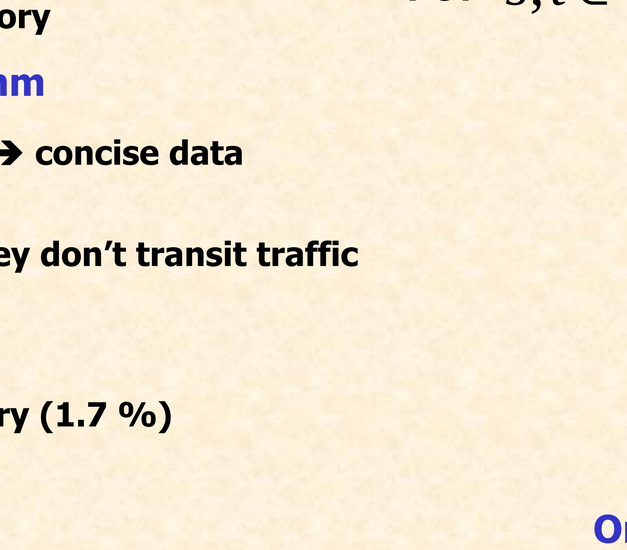
→ Small memory footprint



Determine distance for stub *t* is a couple of comparisons

4. Sample Results

- **For AS relationship info from CAIDA on 2008/06/23**
- **Client IPs:**
  - **147, 822 from BitTorrent trackers**
  - **160, 543 from CBC/Radio-Canada servers**



BitTorrent, 10 Senders

CBC, 2000 Potential Senders

Up to 15 times reduction on Inter-ISP traffic

5. Work-in-Progress

- **Improve accuracy of AS distance inference (~70 %)**
- **Even more compact data structure**
  - **recursively remove stub ASes**
- **Real implementations and measurements**
  - **BitTorrent, peer-assisted CDN**
- **http://nsl.cs.sfu.ca/wiki**