Towards a more systematic approach for interdomain traffic engineering

Steve UHLIG
suh@info.ucl.ac.be
http://www.info.ucl.ac.be/~suh/

Computer Science and Engineering Dept.
Université Catholique de Louvain, Belgium
State-of-the-art of interdomain TE

- “Route optimization” techniques (InterNap, RouteScience, Opnix, Proficient, Radware,...)
- Features in BGP routers for multiple-link load balancing (load-sharing and BGP multipath)
- ISP's interdomain TE is primitive:
  - change some route's attribute
  - check impact on traffic
  - accept or try again
Problem statement

- **Objective 1**: minimize changes to be performed to best route BGP choice
- **Objective 2**: optimize objective function defined on traffic sent to BGP neighbors (or next hop)
- **Objective 3**: deal with objectives 1 and 2 in near real-time (a few minutes)
Main issues

- Optimizing both traffic distribution and minimizing burden on BGP is NP-hard
- Tracking traffic over small timescales
- Uneven traffic distribution among neighbors found by BGP (tie-breaking)
BGP as a poor traffic-balancer

Traffic evolution per provider (stub1)

Traffic (unit = average of total traffic / 3)

Time (days)
# BGP decision process of stubs

<table>
<thead>
<tr>
<th>BGP decision process</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. highest local-pref</td>
</tr>
<tr>
<td>2. shortest AS path</td>
</tr>
<tr>
<td>3. lowest origin type</td>
</tr>
<tr>
<td>4. lowest MED</td>
</tr>
<tr>
<td>5. eBGP over iBGP</td>
</tr>
<tr>
<td>6. lowest IGP cost</td>
</tr>
<tr>
<td>7. lowest router-id</td>
</tr>
</tbody>
</table>

- prefer peers over providers
- Internet is shallow
- not set
- what's IGP?
- deterministic
Solution for stubs
Simulation results

Performance of tabu list method (stub2)

Average traffic imbalance

iBGP updates per 10 min time interval
Open issues

- Global impact of systematic interdomain TE by stubs:
  - interaction between outbound and inbound traffic?
  - impact on transit ASes traffic matrix?
  - perverse effects on BGP?

- Is systematic interdomain TE desirable at all?
Transit ASes

AS 1 → AS 3
AS 2 → AS 4
Provider 2

- best route for AS 5 before tweaking
- best route for AS 5 after tweaking
- expected best route by provider 2