Benefits of negotiated interdomain traffic engineering

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Interdomain routing decisions are based on very little information about other networks:

- poor performance
- instability, oscillations
- tedious, error-prone management
Example of poor performance
Example of oscillation
Current methodology

Whenever interdomain routing changes need to be made

- tweak-n-pray
- call ahead
- determine a mutually agreeable set of routing changes
An alternative

- Automated negotiation
  - under real-world constraints
  - as good or better than manual negotiation
  - minimize manual firefighting

- We’ve looked at two-ISP negotiation so far
  - high-level methodology
  - evaluation of the potential benefit
Constraints on inter-ISP negotiation

- Controlled information disclosure
  - ISPs are competing entities

- Support for different optimization criteria
  - different ISPs have different objectives

- Flexible outcomes
  - different ISP pairs have different relationships
Simplified negotiation methodology

1. Assign a numeric preference (like MEDs) to each routing option for each flow
   - each ISP uses its own criteria
2. Exchange preference lists
3. Take turns to propose routing options
   - find good compromises
   - reassign preferences if needed
4. Stop when one of the ISP wants to
Example of negotiation

A and B negotiate for 2 flows

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- Trade small sacrifices for bigger gains such that both ISPs win
Evaluation

- Compare three routing methodologies
  1. default: early-exit, selfish
  2. optimal: globally best across the two ISPs
  3. negotiated
- Dataset: 65 measured PoP-level ISP topologies; synthetic traffic models
- Evaluate latency reduction and hotspot avoidance
Experiment 1: Latency reduction

- Higher latency
  - \( \Rightarrow \) poorer performance
  - \( \Rightarrow \) more resource usage \( \Rightarrow \) costlier

- Measure latency of traffic when routed using the three routing mechanisms
  - default, optimal, negotiated
Results: Latency reduction

- Small latency reduction
  - Q: is this valuable?
- Individual ISPs can lose with the optimal
  - Negotiation is win-win
Experiment 2: Hotspot avoidance

- Sudden changes (failures, DoS attacks) can cause short-term overload
  - fighting these is a major time sink

1. Assume that a peering link failed
2. Reroute flows traversing the failed link
3. Measure the potential for overload using max multiplicative increase in link load
Results: Hotspot avoidance

- Default routing tends to overload certain links
- Negotiation reduces the possibility of hotspots
  - fewer problems for the operators to resolve
Summary

- Interdomain routing decisions are based largely on local information
  - poor performance, instability
  - tedious, error-prone management
- Automated negotiation can help
- Feedback:
  - would you use it to talk to your neighbors?
  - www.cs.washington.edu/research/networking/negotiation