Benefits of negotiated interdomain traffic engineering

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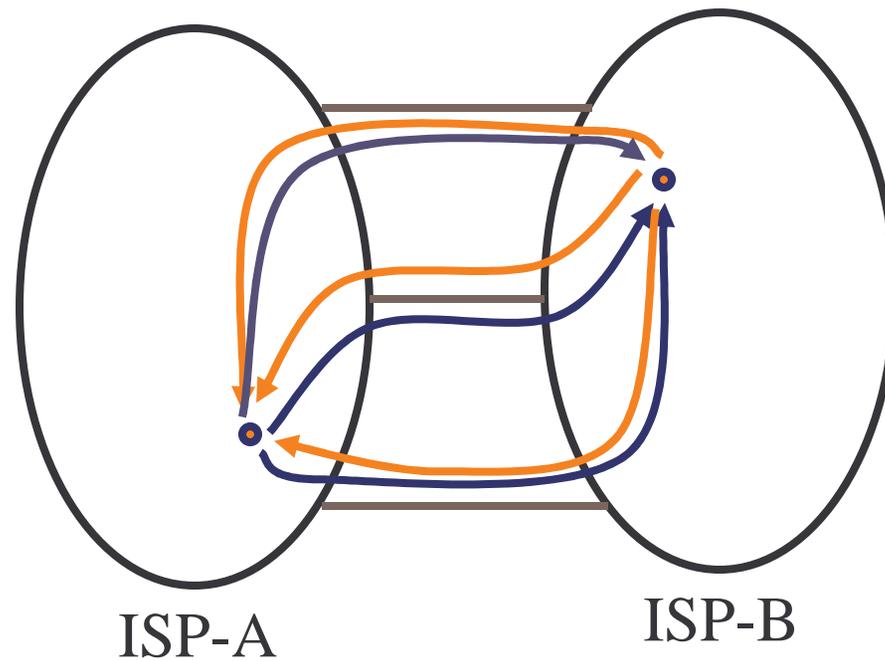
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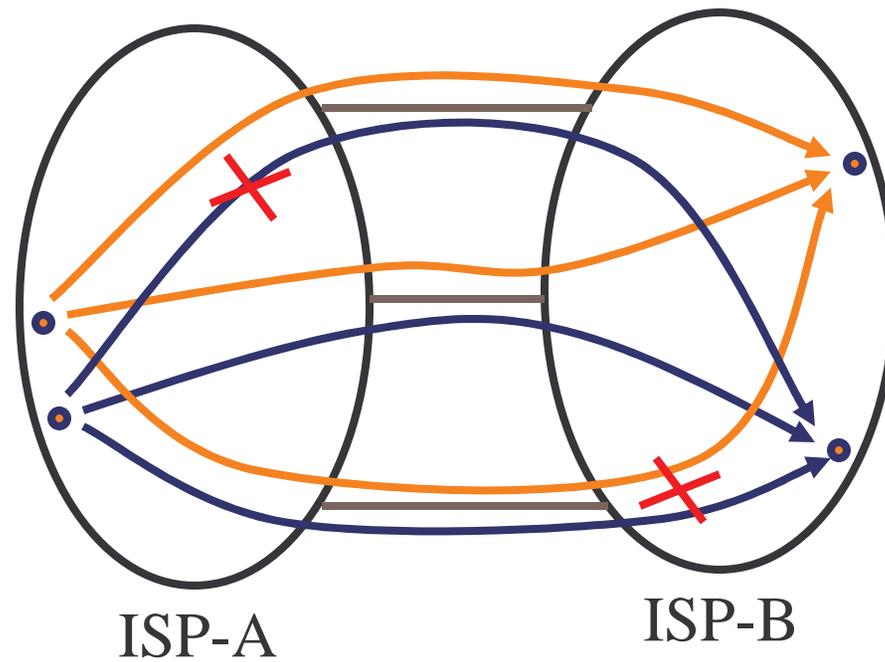
Problem

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

- poor performance
- instability, oscillations
- tedious, error-prone management

Example of poor performance

ISP-A   ISP-B

Example of oscillation

ISP-A ISP-B

Current methodology

u Whenever interdomain routing changes need to be made

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

An alternative

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

u 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
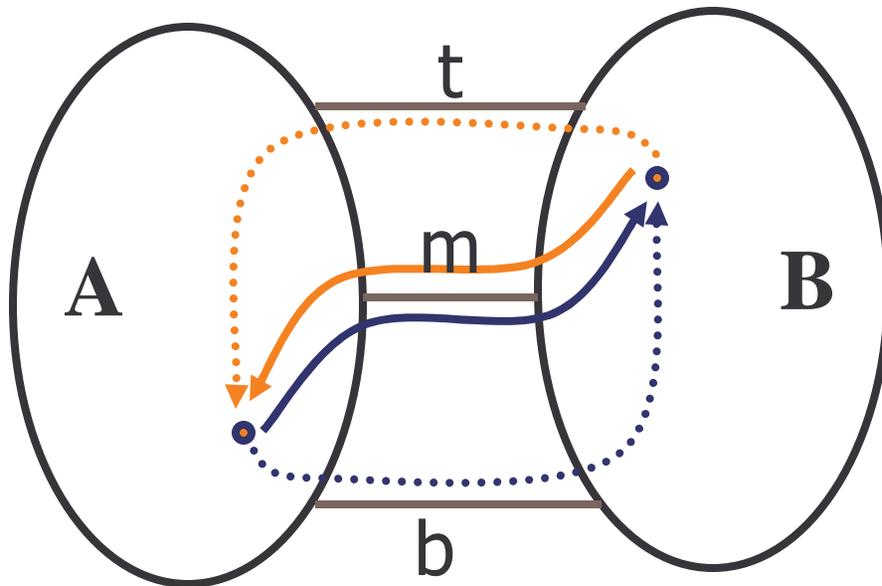
u A and B negotiate for 2 flows

	Aà B	Bà A
t	(-6, 6)	(0, 0)
m	(-1, 4)	(4, -1)
b	(0, 0)	(6, -6)

u Trade small sacrifices for bigger gains such that both ISPs win

Evaluation

u Compare three routing methodologies

1. default: early-exit, selfish

2. optimal: globally best across the two ISPs

3. negotiated

u Dataset: 65 measured PoP-level ISP topologies; synthetic traffic models

u Evaluate latency reduction and hotspot avoidance

Experiment 1: Latency reduction

u Higher latency

  $\Rightarrow$ poorer performance

  $\Rightarrow$ more resource usage $\Rightarrow$ costlier

u Measure latency of traffic when routed using the three routing mechanisms

  - default, optimal, negotiated

Results: Latency reduction
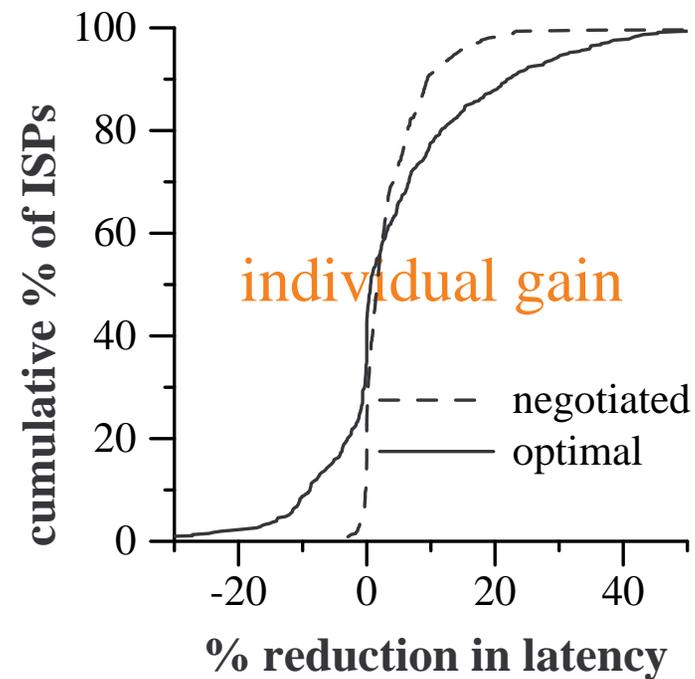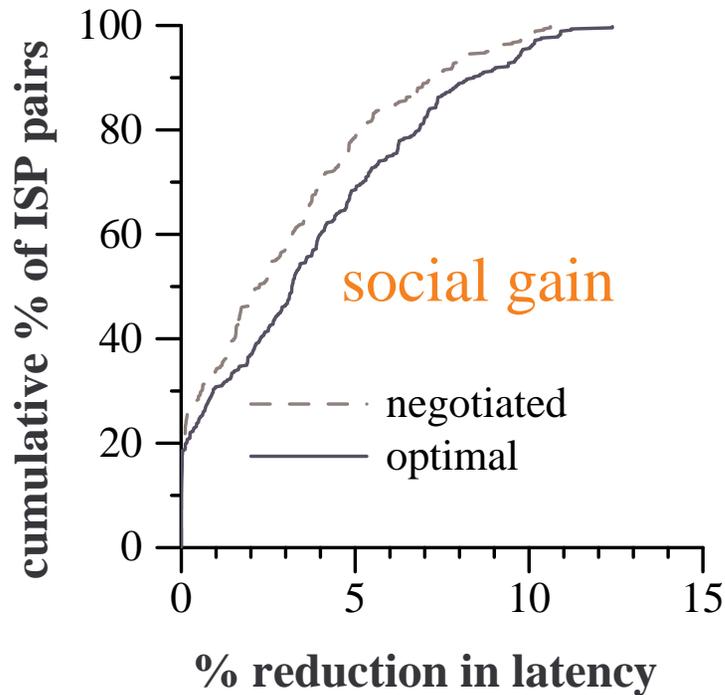
- u Small latency reduction
  - Q: is this valuable?

- u Individual ISPs can lose with the optimal
- u Negotiation is win-win

Experiment 2: Hotspot avoidance

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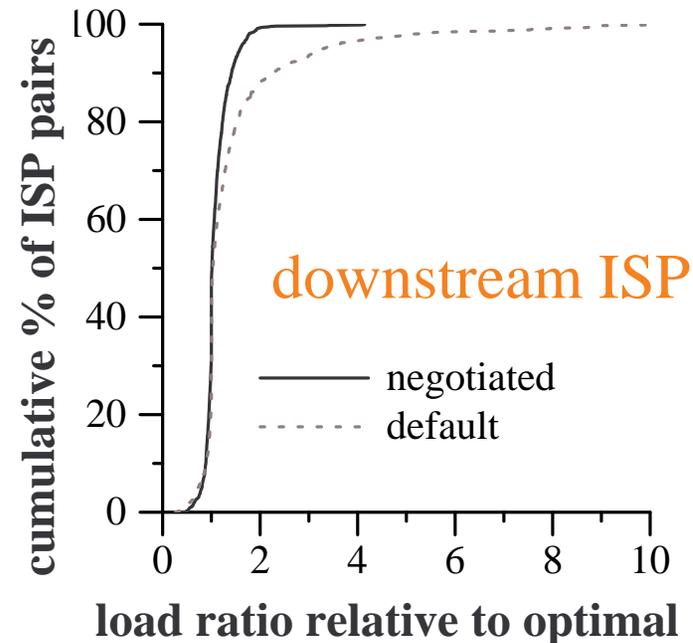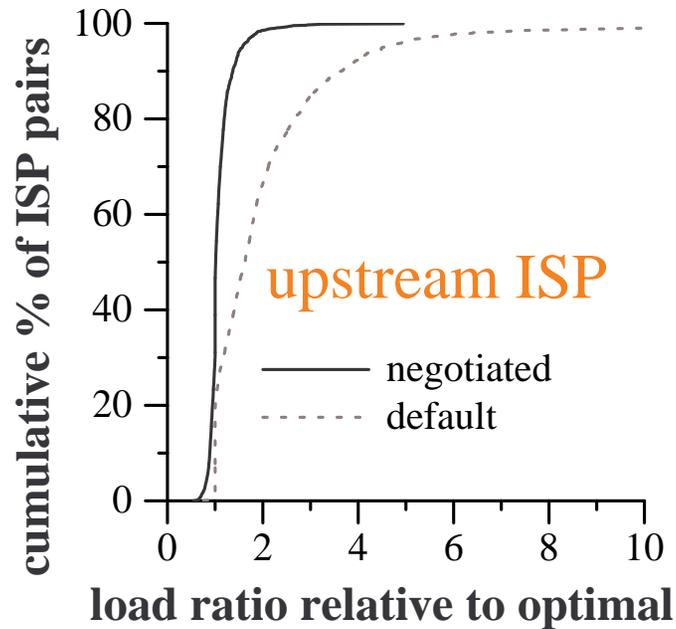
- u Default routing tends to overload certain links
- u Negotiation reduces the possibility of hotspots
  - fewer problems for the operators to resolve

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