A simple coordination mechanism for interdomain routing

Ratul Mahajan*
David Wetherall
Tom Anderson

*now @ Microsoft Research
The nature of Internet routing today

Within a contractual framework, ISPs select paths that are best for themselves

Potential downsides
- higher BW provisioning
- requires manual tweaking to fix egregious problems
- inefficient end-to-end paths
An alternative approach: coordinated routing

ISPs have joint control
- path selection is based on the preferences of both ISPs

Potential benefits
- lower BW provisioning
- no egregious cases that need manual tweaking
- efficient end-to-end paths
  - basis for interdomain QoS
Exisiting mechanisms cannot implement coordinated routing

Route optimization boxes help (stub) ISPs pick better routes from those available

MEDs implement receiver’s preferences

Without MEDs

With MEDs
What makes for a good coordination mechanism?

MEDs have some nice properties
- ISPs can express their own metrics
- ISPs are not required to disclose sensitive info.
- lightweight
- requires only pairwise contracts

Provides joint control and benefits all ISPs
Our solution: Wiser

Operates in a lowest-cost routing framework
- downstream ISPs advertise their cost
- upstream ISPs select paths based on both their own and received costs
Problems with vanilla lowest-cost routing

ISP costs are incomparable

Can be easily gamed
Cost normalization

Normalize costs such that both ISPs have “equal say”
Bounds on cost usage

Downstreams log cost usage of the upstream ISPs
Compute the ratio of avg. cost of paths used and announced
Contractually stipulate a bound on the ratio
Wiser in action

Add incoming costs while applying a normalization factor.

$c_3 = c_1^l + \text{internal path cost}$
Example results

\[ \text{cumulative } \% \text{ of flows} \]

\[ \begin{array}{c}
\text{anarchy} \\
\text{Wiser}
\end{array} \]

\[ \begin{array}{c}
\text{overprovisioning } (\%) \\
\text{relative to stable load}
\end{array} \]

\[ \text{Wiser requires lower bandwidth provisioning} \]

\[ \text{Wiser produces shorter paths} \]

\[ \text{Significant benefit in the tail} \]

\[ \begin{array}{c}
\text{cumulative } \% \text{ of ISPs} \\
\text{Wiser}
\end{array} \]

\[ \begin{array}{c}
\text{path length inflation} \\
\text{relative to optimal}
\end{array} \]
Implementation

XORP prototype

Simple, backward-compatible extensions to BGP
- embed costs in non-transitive BGP communities
- border routers jointly compute normalization factors and log cost usage
- a slightly modified BGP decision process

Benefits even the first two ISPs that deploy it
Summary

*Wiser* is a simple mechanism to coordinate interdomain routing
- may lower provisioning, reduce manual tweaking, produce efficient paths, and help with interdomain QoS

Feedback: <ratul@cs.washington.edu>
Details/code:
http://www.cs.washington.edu/research/networking/negotiation/