MINT: Market for Internet Transit

Presented by Kong Lam
Slides adapted from authors’
Networks terminate connections even when users are prepared to pay for the path!  

**October 2005**

**31 Jul 2005**: Level 3 Notifies Cogent of intent to disconnect.

**16 Aug 2005**: Cogent begins massive sales effort and mentions a 15 Sept. expected de-peering date.

**5 Oct 2005**: Level 3 disconnects Cogent. Mass hysteria ensues up to, and including policymakers in Washington, D.C.

**7 Oct 2005**: Level 3 reconnects Cogent

*During the “outage”, Level 3 and Cogent’s singly homed customers could not reach each other. (~ 4% of the Internet’s prefixes were isolated from each other)*
Internet Connectivity Inefficiencies

- Denied peering opportunities exist in every exchange
  - Disagreements over payment direction
  - Bilateral nature of contracts introduces information asymmetry

How could we improve this market?
MINT in a Nutshell

Replace bilateral contracts with **path auctions**

- **Sellers**
  - Sell **segments** from exchange to exchange
- **Buyers**
  - Buy multiple segments that form **paths**
From Pricing Connections to Pricing Segments

- Current market: pricing connections
  - No control to end-networks, coarse granularity
- MINT market: pricing segments
  - High granularity, possibility to value/construct entire paths
  - Pricing congestion, bw, delay, loss or combinations

Do you agree with such a market structure?
Market and connectivity efficiency
- End networks can directly express their valuation of network-to-network paths
- No incentive to de-peer as long as end-networks are valuing the paths

Incentive to end-networks: path control
Incentive to transit networks: increased revenue, direct policy expression through prices

Forms a flat network. Incentives?
Market Model

- **Modeling Internet as an Auction**
  - **Sellers** advertise prices (offers) for each segment
  - **Buyers** issue bids for “paths”

- **Auction properties:**
  - **Continuous**: ISPs are setting the prices to attract traffic
  - **Combinatorial**: Buyers issue the bids for set of goods
  - **First-price**: the lowest cost path is chosen
Mediator

- Mediator runs the auction, matches bids and offers
  - Bidding for price with bandwidth, delay, loss constraints

- What are the mediator’s incentives?
  - Charge for path requests
  - Allow multiple mediators to compete
Preliminary Market Evaluation

How fast statistical equilibrium is reached?

- Topology from Peering DB
  - ~170 exchanges, ~1000 ISPs
  - Capacity information
- Segment pricing
  - Randomized price bootstrap
  - Each ISP runs a heuristic to maximize the utilization
- Bid arrivals and demand curve
  - Uniformly random source destination exchanges, Poisson arrival
  - Three different demand distributions

\[ P(I_{ij}(t)) = \begin{cases} 
\alpha P(I_{ij}(t-1)), & \text{if } ij \text{ is utilized at } t-1 \\
\alpha^{-1} P(I_{ij}(t-1)), & \text{otherwise}
\end{cases} \]
Implementation

- Ongoing work
- Control Plane
  - Scalability of mediator
- Data Plane
  - Makes use of existing technologies
  - Tunneling, label switching
Summary

- BGP is insufficient for diverse and growing Internet
- MINT – alternative way of structuring inter-domain bandwidth trade
  - Rather trading connectivity, trade transit segments
- Multiple benefits
  - More control to the source
  - No notion of customer–provider or peer–peer
  - Policy expression through price