Network Economics

Some thoughts and several questions

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Heavily biased by my own trajectory

\[ v_i \text{ wants to minimize:} \]
\[ C_i(S) = \sum_{v_j \in V_i} p_{ij} \cdot d_S(v_i, v_j) \]

from Network Formation Games to CAPEX, OPEX, 95-percentiles, etc
Thought 1: Network economics is an interesting area

Many research challenges and a potential for impact
Thought2: feels like there's a missing link in our understanding of net. economics

Scholarly research

✓ Can handle complexity (graph theory)
✓ Can handle dynamicity (game theory, economics)

✗ Misses the data
✗ Misses the operating practices

Real Ops

✓ Has the data
✓ Defines the operations

✗ But can it connect the dots?
Lot’s of ugly complexity hiding the truth from us
Thought3: Many of our discussions lack Quantification

- Rumors
- Speculations
- Gossip
- Guesses
- Beliefs
- Hopes
- Oversimplification

numbers vs. the rest
For example

What you should know about NET NEUTRALITY

MMVII
Volume of traffic grows annually by almost 36%

Global IP traffic growth is threatening networks capacity

Source: Cisco Visual Networking Index – Forecast, 2009-2014
Costs increase but revenues remain fixed because of flat rates

Revenues do not follow traffic patterns
The Net Neutrality position ➔ technology can absorb the growth

ML ➔ digital devices x2 faster in 18 months at same cost
40% CAGR of traffic ➔ x 1.96 efficiency improvement in 24 months – So we're OK!
Question 1: What is the efficiency improvement of networks?

**Moore's law & Networks**
- covers switching & routing
  - traffic growth is continuous whereas efficiency improvement come in jumps
- does not cover channel capacity
- does NOT cover OPEX
  - Energy
  - Real estate costs
  - Personnel costs (tech support, retraining administrators, technicians, etc)
  - OPEX > CAPEX and improvement is more like 30% in 5 to 10 years
  - Especially in the access
If technology cannot absorb the traffic growth

**Options**

1. Do not upgrade (or upgrade as fast as investors are willing to go)
   - An investment bottleneck on network capacity would be harmful to all

2. Agree on a way to share the costs
Our starting point

Richard T.B. Ma, Dah Ming Chiu, John C.S. Lui, Vishal Misra and Dan Rubenstein.
On Cooperative Settlement Between Content, Transit and Eyeball Internet Service Providers.

FLAT payments

USAGE based payments

advertisers

Google

Yahoo!

content providers

users

access ISP

transit ISP

Telefonica
Cost/Profit sharing under a *Premium Service* model

Our main additions to Ma et al.
1. Customer churn at the ISP and the Content Provider end
2. Advertiser churn at the Content Provider end

Quantify the power of different stakeholders
Questions: How well do we understand customer churn?

- Why do people purchase broadband connections?
  - How much do we value Search vs OSNs vs Email vs Online Gaming vs ...?

- How loyal are users to a given Video or VOIP provider?
  - Do we care about the video or the video site?

- Would users switch to an alternative Video or VOIP provider that gets them higher QoE by having purchased premium connectivity from ISP?

- Would users that are loyal to a video site stay with an ISP that does not offer premium connection to their favorite site?
Take-away message

- Research on network economics is squeezed between big interests

- Adding credible quantification is key to decision making
  - both at a policy
  - corporate strategy levels