The issue of poor QoE viewed as a problem of bad peering economics

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The QoE vicious cycle (thanks Ramesh 😊)

- Bad Economics
- Misaligned Incentives
- Persistent QoE Issues
- Users have Low QoE Expectations
If a QoE problem is real, it gets noticed and it will be fixed, right?

- Congestion: capacity upgrade
- Slow/old switching gear: hw upgrade
- Broken applications: new version
- Mis-configurations: manual fix or automated self-tuning
- etc
So, the only QoE problems that persist, are those that no-one is willing to pay to solve (even though they are well known)

• *In other words, persistent QoE problems are economic problems*
Both Internet connectivity markets have serious economic issues that create persistent QoE issues

- **Internet subscriber access**
  - Flat access fee leads to:
    - Either higher prices (cover heavy hitters)
    - Or limited access capacity - poor QoE

- **Autonomous System interconnections**
  - Peering, transit, paid peering, etc
  - Limiting, not providing right incentives
  - My focus on this talk
AS-level interconnections are both an economic and a routing/traffic flow issue.
How does a peering dispute affect Internet users?

- **Spring vs Cogent in 2008**
- **The single-homed customers of each of these ASes cannot communicate with the single-homed customers of the other**

Graph from Renesys – NANOG45 talk
Peering disputes can also cause persistent congestion customers of AT&T, CenturyLink, Comcast, Time Warner Cable, and Verizon in the Dallas area when connecting across transit ISP Cogent, Jan. 2013 to Aug. 2014.

https://medium.com/backchannel/jammed-e474fc4925e4#.ictdblmtj
Main point:

Transit and peering relations are very restrictive in terms of traffic flow and economics.
Transit relations are all or nothing

- X is forced to be transit customer of T1
- But X only needs routes to T1 & T2
  - X should be able to only pay for those routes
Transit relations do not consider the cost of each route

Why does X charge the same for all routes it sells to A?
- Price differentiation would provide the right incentives

A very hard to reach place..
Transit relations do not consider the performance of each route

- X should be able to provide A with a route to B that is more expensive (and costly) than the route through IXP/Y.
Settlement-free peering relations have all previous problems, plus more
Tier-1 clique disputes are due to limitations of SF-peering

- What happens if a Tier-2 AS wants to join the Tier-1 clique?
- What happens if a Tier-1 AS is viewed as “no longer eligible to be Tier-1”?
Settlement-free peering relations assume that both parties benefit equally from interconnection.

- X and Y have to either exchange traffic for free.
- Or they both have to pay T.
- There is nothing in between.