Access Power Peering

A historical perspective on
The Evolution of the Internet Peering Ecosystem

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- 1987 NSFNET / 1995-1998 NANOG Chair
- DrPeering, Executive Director – Keep info public
  - Ask.DrPeering.net – DECIX Newsletter
  - Consulting – GLG Expert Network, Peering Workshops
  - Work with mostly (private) clients – teams up-to-speed
  - Peering White Papers (public)

The Peering White Papers...
The Peering White Papers

- 10 years of Process = 1000’s of conversations
  - Assimilate mindset of the Peering Community
  - Collect data. Walkthroughs.
  - Share at Conferences
  - Refine Primary Research & feedback

- Results
  - White Papers
  - Web Pages
  - Book-excerpts used in this preso
**Financial Book review**

“This book is fantastic!” – Industry analyst

fantastic  |fanˈtastik|  adjective

1 imaginative or fanciful; remote from reality: novels are capable of mixing fantastic and realistic elements.

• of extraordinary size or degree: the prices were fantastic, far higher than elsewhere.

• (of a shape or design) bizarre or exotic; seeming more appropriate to a fairy tale than to reality or practical use: visions of a fantastic, mazelike building.

2 informal extraordinarily good or attractive: your support has been fantastic.
Why should we care about context?
My Airplane Story

- NWA Flight DTW-LAX Delay ➔ Cancel
- Rebook, go to gate 34 (short walk)
- On plane. Boarding disgruntles
- Flight attendant: “sit anywhere”
- Delayed... Palpable Anger

What happened?
What happened?

- Back at gate
- Flight was Cancelled
- “Room for 15-20 passengers”
- “Proceed in orderly fashion”
- “Will handle as many as we can”
- 154 frantic people hauled ass
- Line → special case override → Mob Scene
- Get the yellers out of the line
- Aggression, pushing, shoving, Detroit cops called in
Who is responsible for riot?

- Airline vs. Passengers
- Show of hands
  - ___ Airline 100% Passengers 0% responsible
  - ___ Airline 90% Passengers 10% responsible
  - ___ Airline 80% Passengers 20% responsible
  - ___ Airline 70% Passengers 30% responsible
  - ___ Airline 0% Passengers 100% responsible

Does Context drive Behavior?
The Peering Problematic

- Just as context drives behavior in the airline story, context drives behavior in the peering ecosystem
- Evolving *Internet Peering* context
  - Positional power
  - Predictable Behavior
- This is a talk about the future of peering
  - Trajectory from the past
- Discussion chapters in The Internet Peering Playbook
History of Internet Peering

Contexts

- **ARPAnet** • 1987-1994
- **NSFNET** • 1994-1997
- **Transition** • 1998-2002
- **Commercial** • 2000-2009
- **Fat Middle** • 2000-2009
- **Access Powers** • 2009→

Morphing
1st Peering: ARPANET 80’s

- USENET/BITNET/X.25 could not connect
- ARPAnet limited to gov’t & contractors
- CSNet-NSF project to connect all CS depts
- Spotlighted AUP problem
- Bureaucratic complexity
  - Settlement of financial, admin, contract etc.
- Peering is “interconnection without explicit accounting or settlement”

Source: Lyman Chapin [http://www.interisle.net/sub/ISP%20Interconnection.pdf](http://www.interisle.net/sub/ISP%20Interconnection.pdf) [http://drpeering.net/AskDrPeering/blog/articles/Ask_DrPeering/Entries/2010/10/22_Origins_of_Internet_Peering.html](http://drpeering.net/AskDrPeering/blog/articles/Ask_DrPeering/Entries/2010/10/22_Origins_of_Internet_Peering.html)
NSFNET – ‘87-'94

Core
Open Regional Techs
NSF
Growth⇒Time to privatize
NSFNET Transition – ’94-’96

Strong NANOG Chair model
Chair & commercial interests

Interconnect a private matter
PacBell NAP   AADS NAP   MAE-East*   Sprint NAP
Commercial Internet – ’96-’98

Resale & Growth

Little visibility/sharing

Congestion Points ➔ Private Peering
Tier 1 Club Private Peering Migration

Tier 1 ISPs abandon NAPs
Congestion at NAPs
NAPs run by competitors
Reduce complexity – fiber breaks less often than active electronics
Full Mesh in each of 8 interconnect regions across the U.S.
2000-2001

- Carrier Neutral Internet Exchange Points (PAIX/EQIX)
- Proved financially better if at least 5 Tier 1’s build in and do fiber cross connects
Commercial Internet

Internet Growth

Organic
With Structure:
Basic Internet Peering Ecosystem

**Tier 1 ISPs** have access to The entire Internet Region routing Table solely via their free peering Interconnects. They **do not pay transit fees** to reach any destination in their Internet Region.

Revenue and traffic flows to T1s.

**Tier 2 ISPs** are everyone else.

Pay transit fees.

Interested in peering around transit providers.

Attend Peering Fora
Fat Middle Peering ’98-today

New Players
@home bankrupt
CDNs
LSNSCP

“Open” Peers

“Selective Peers”

Peering decreases T1’s transit fees
Growth increases at a faster rate
Transit Prices & Video

1. **Video 2010**: 40-50%
   - Source: discussions with ISPs
2. **Video 2013**: 80%
   - Source: Cisco

- $1200/Mbps
- $120/Mbps
- $12/Mbps
- $1.20/Mbps
Captive Access Power Peering

The most interesting shift in positional power yet!
Captive Access Power Peering

Comcast-Level 3

Disclaimer: The facts here have not been verified. This is for discussion purposes only. The Comcast-Level 3 – NetFlix situation is used because it is a very public example that illustrates the power positions.
Captive Access Power Peering Example

Level3 broad business deal
Fiber, transit, free peering (on-net), etc.

3 Ways to reach Comcast
1) Transit (A→GLBX→Comcast)
2) Paid Peering (A→Comcast)
3) Peering (A→Comcast) w/ vol & <2.5:1

Video is highly asymmetric up to 30:1
Comcast peering ratio requirement <2.5:1

All paths require Comcast
Peering is direct, high performance
Transit is subject to loss/latency

OTT Video requires high performance
No alternative path to Comcast eyeballs but through Comcast (Captive customers)

If you are in the video distro biz you must buy paid peering from Comcast
1) NetFlix Application 2010

NetFlix distributes Video via CDNs
Massive growth O(100’sGbps)
Great Service
2) Level3 Bids Cheaper

Akamai loses T$
Comcast loses PP$

Level 3 freely peers the traffic
Level 3 requests more interconnects
Comcast says No – you pay like AKAM&LLNW
Level 3 Acquiesces

Access Power Peering

Comcast says (in essence) “We have others paying us.
It wouldn’t be fair not to charge you as well”
3) Result & Observation

Comcast leverages peering to get $$ from all sides

No alternative to reach Comcast customers

“Captive” Customers
Can’t peer around them
Can’t choose competitor
Exploiting Market power position: Captive Market

Where is this going?
Is this the right model?