Access Power Peering

A historical perspective on

The Evolution of the Internet Peering Ecosystem

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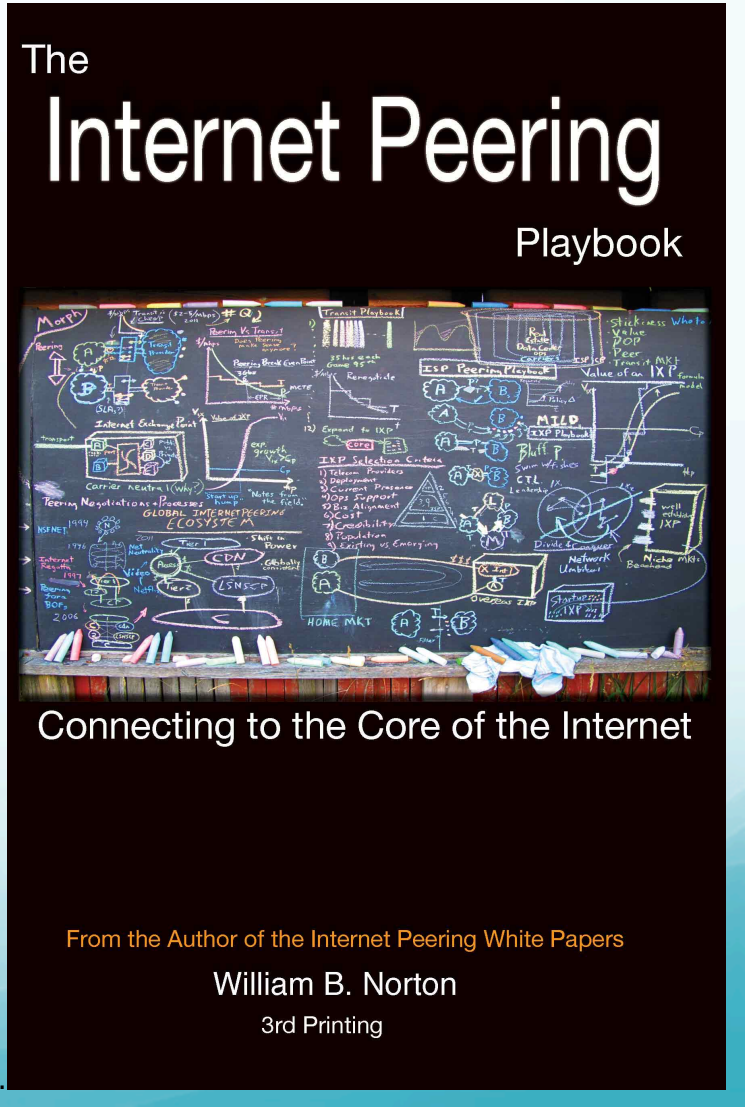
DR PEERING INTERNATIONAL

William B. Norton

- 1987 NSFNET / 1995-1998 NANOG Chair
- Equinix, 1998-2008, Co-Founder & Chief Technical Liaison
- 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

- 10 years of Process = 1000's of conversations
  - Assimilate mindset of the Peering Community
    - Collect data. Walkthroughs.
    - Share at Conferences
    - *Refine Primary* Research & feed back
- Results
  - White Papers
  - Web Pages
  - Book-excerpts used in this preso



Unexpected audiences...

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*.

The Evolving Internet Peering Ecosystem

All about Context

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

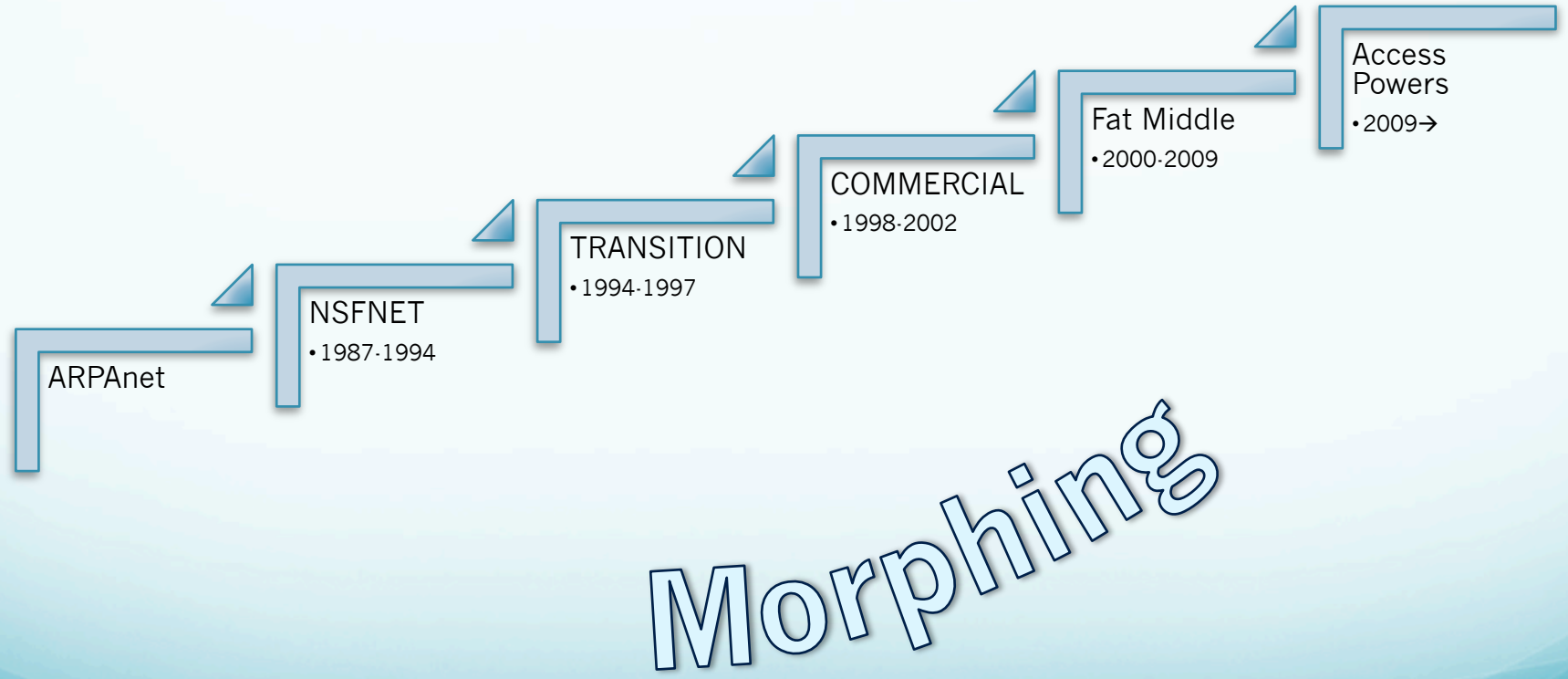
Who is responsible for riot?

- 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

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

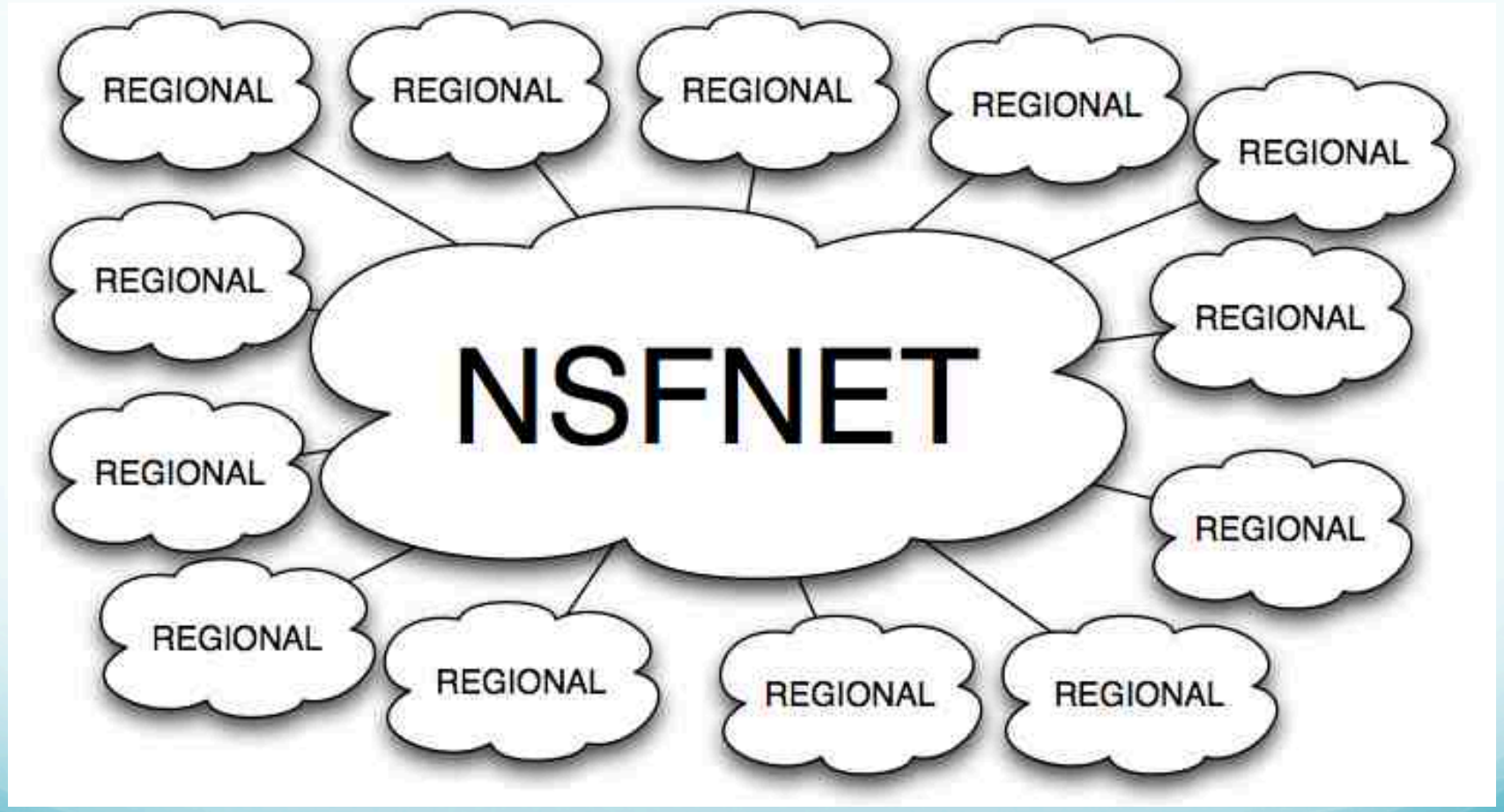


1st Peering: ARPANET 80's

- 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://drpeering.net/AskDrPeering/blog/articles/Ask_DrPeering/Entries/2010/10/22_Origins_of_Internet_Peering.html

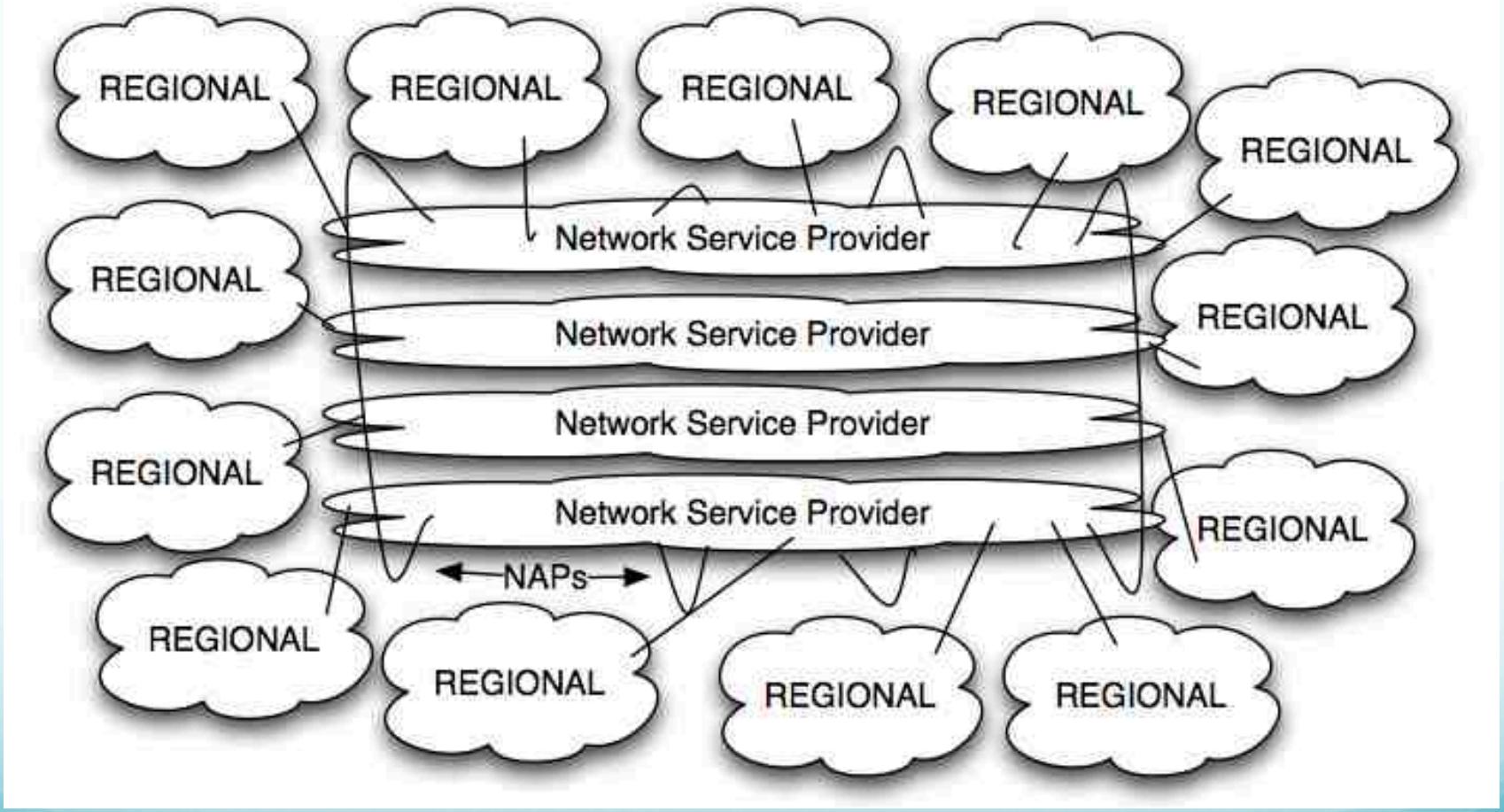
NSFNET – ‘87-’94



Core

Open Regional Techs NSF Growth→Time to privatize

NSFNET Transition – ’94-’96



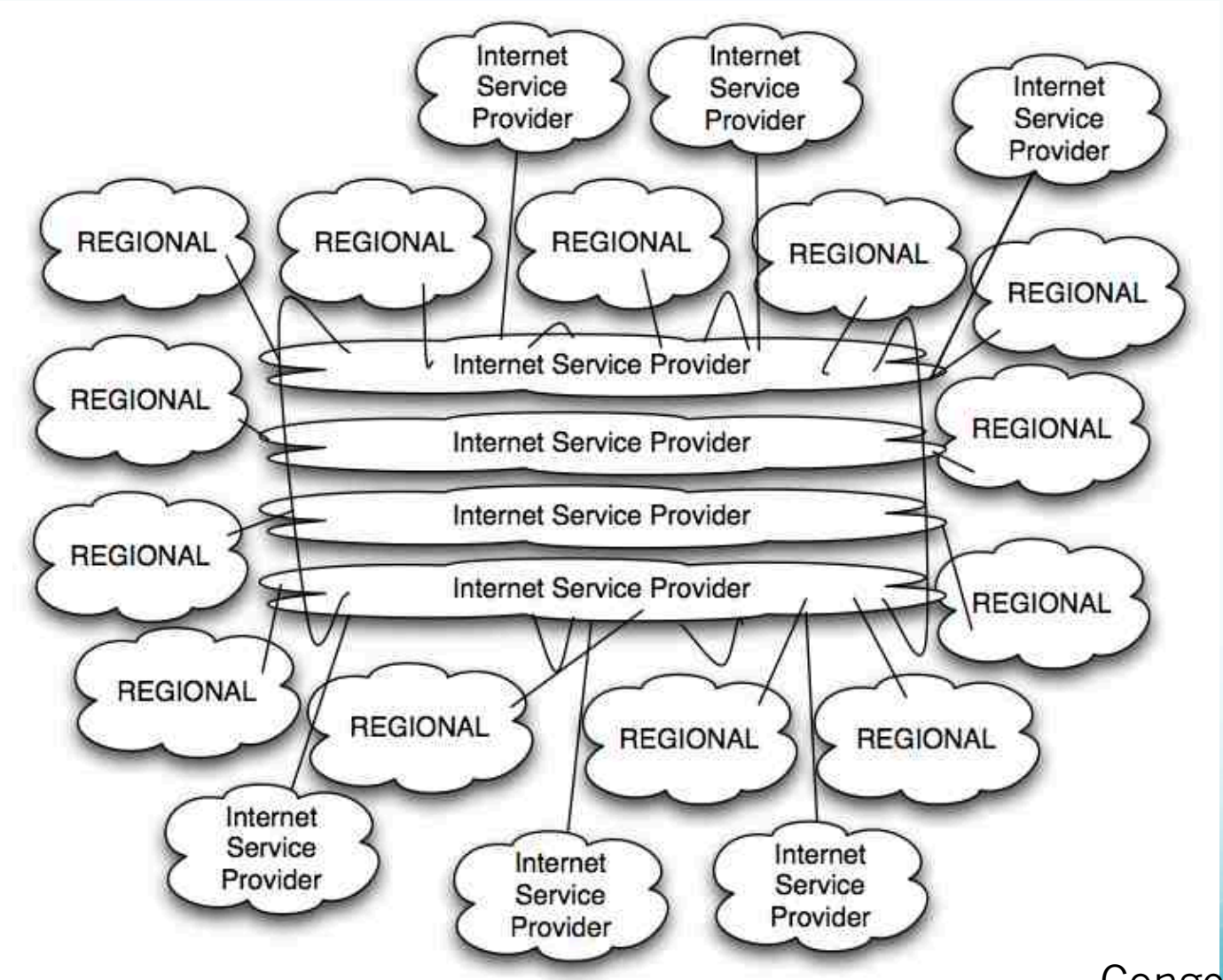
Strong NANOG Chair model

Chair & commercial interests

Interconnect a private matter

PacBell NAP AADS NAP MAE-East* Sprint NAP

Commercial Internet – ’96-’98

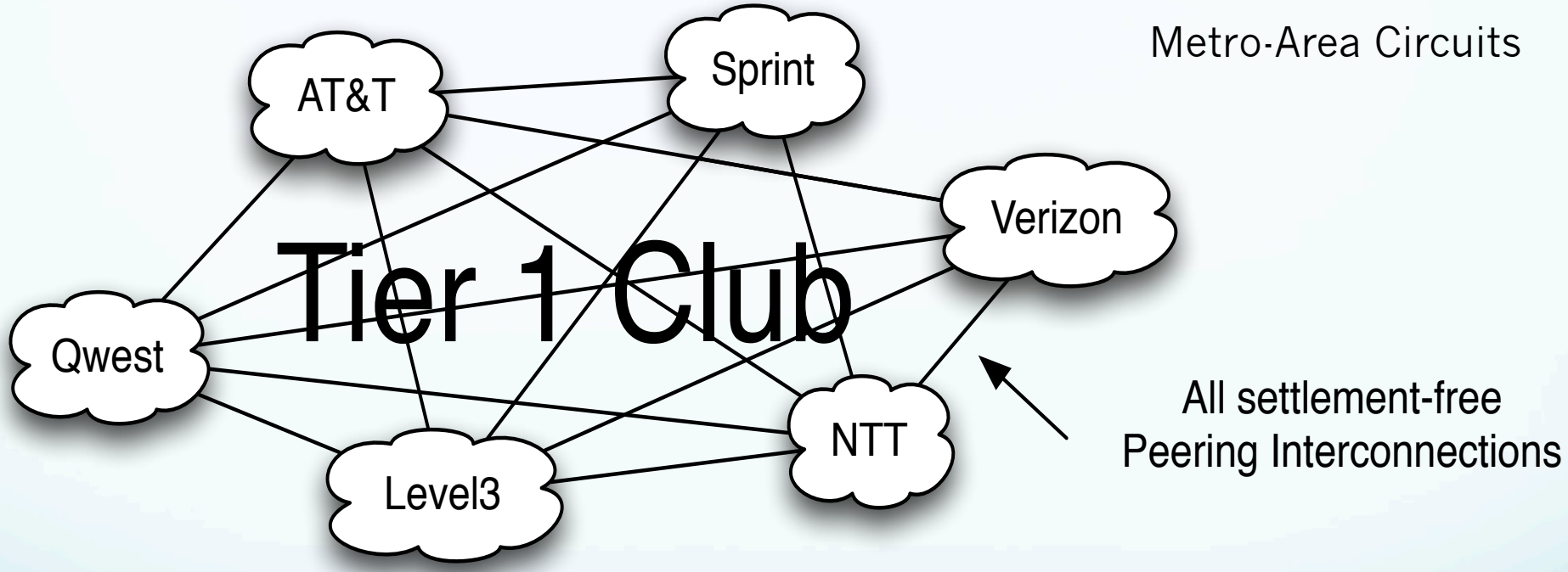


Resale & Growth

Little visibility/sharing

Congestion Points
→Private Peering

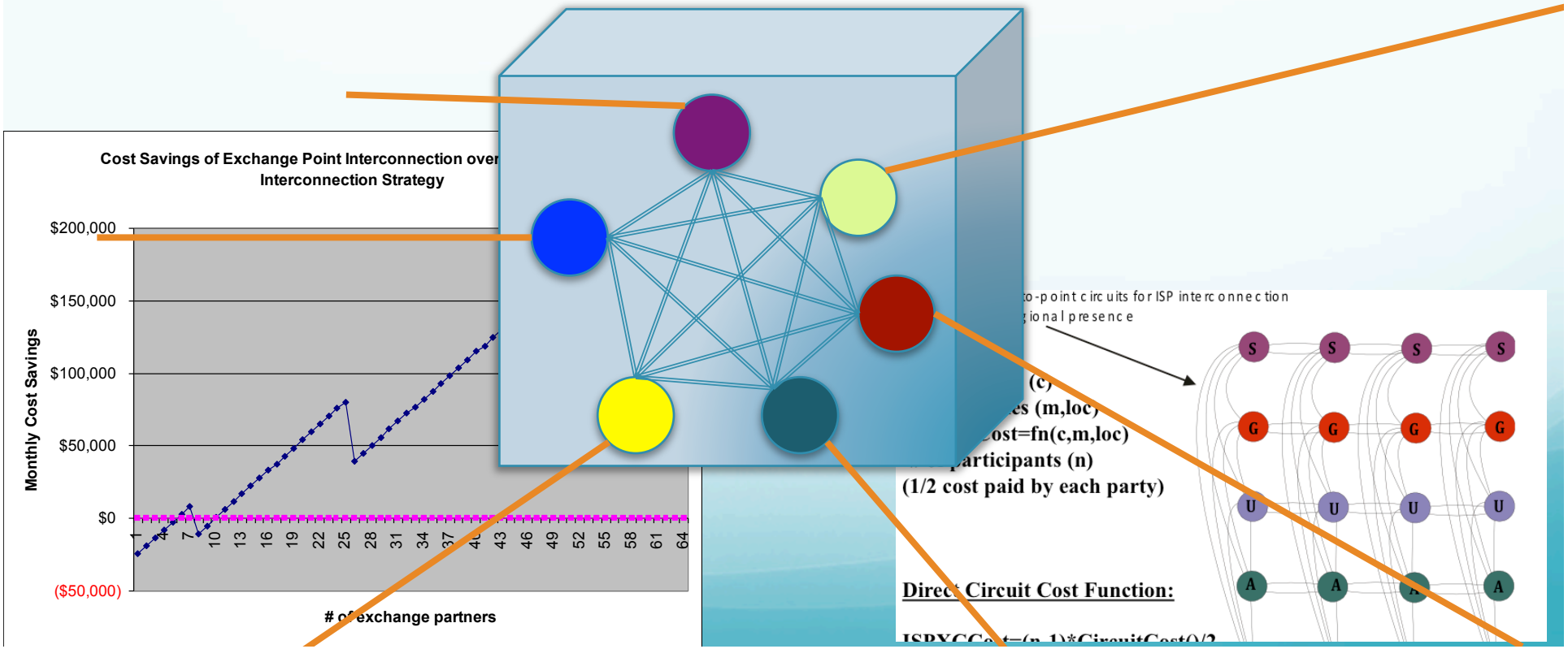
Tier 1 Club *Private* Peering Migration



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

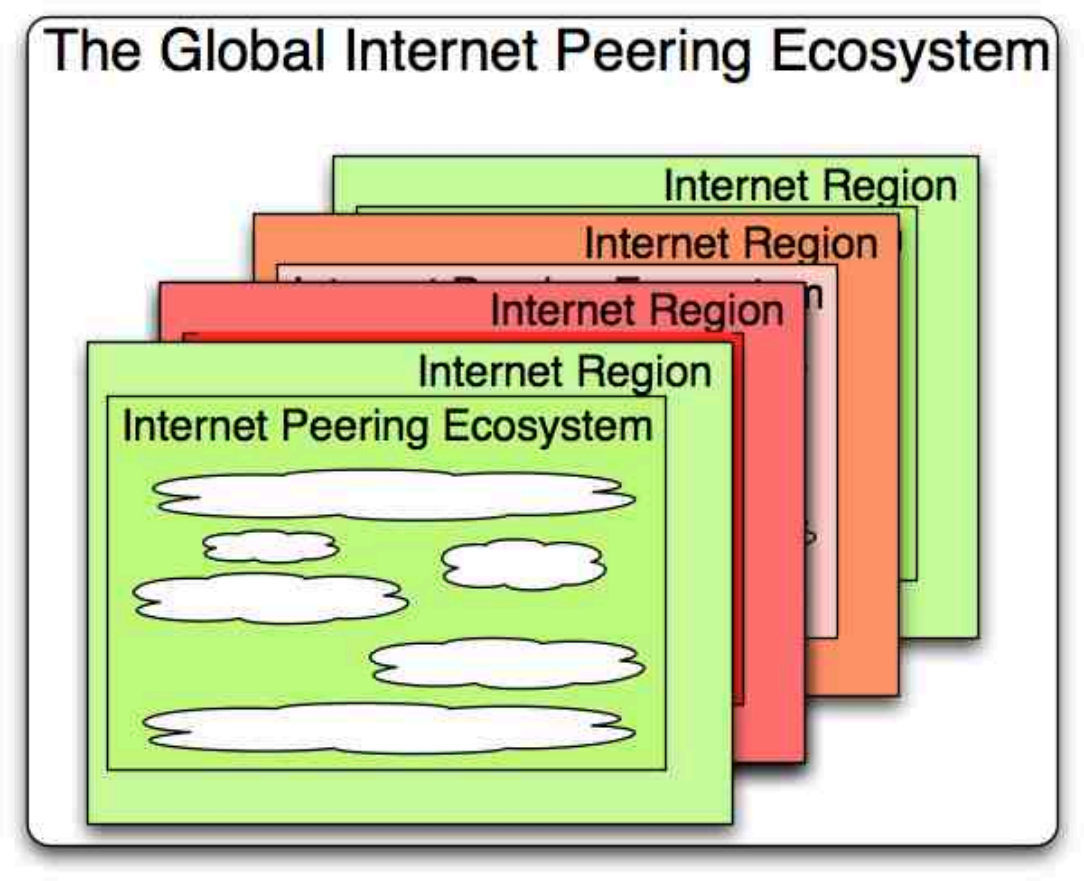
- Carrier Neutral Internet Exchange Points (PAIX/EQIX)
- Proved financially better if at least 5 Tier 1's build in and do fiber cross connects



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.

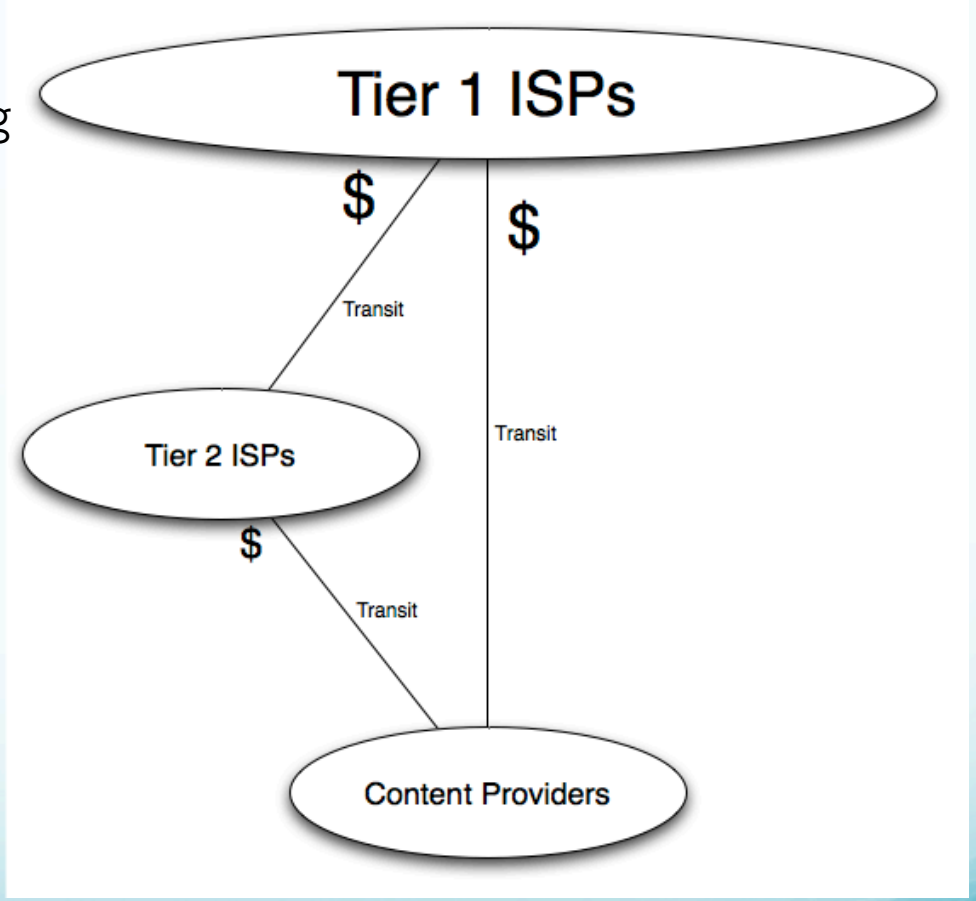
Revenue and traffic flows to T1s.

Tier 2 ISPs are everyone else.

Pay transit fees.

Interested in peering around transit providers.

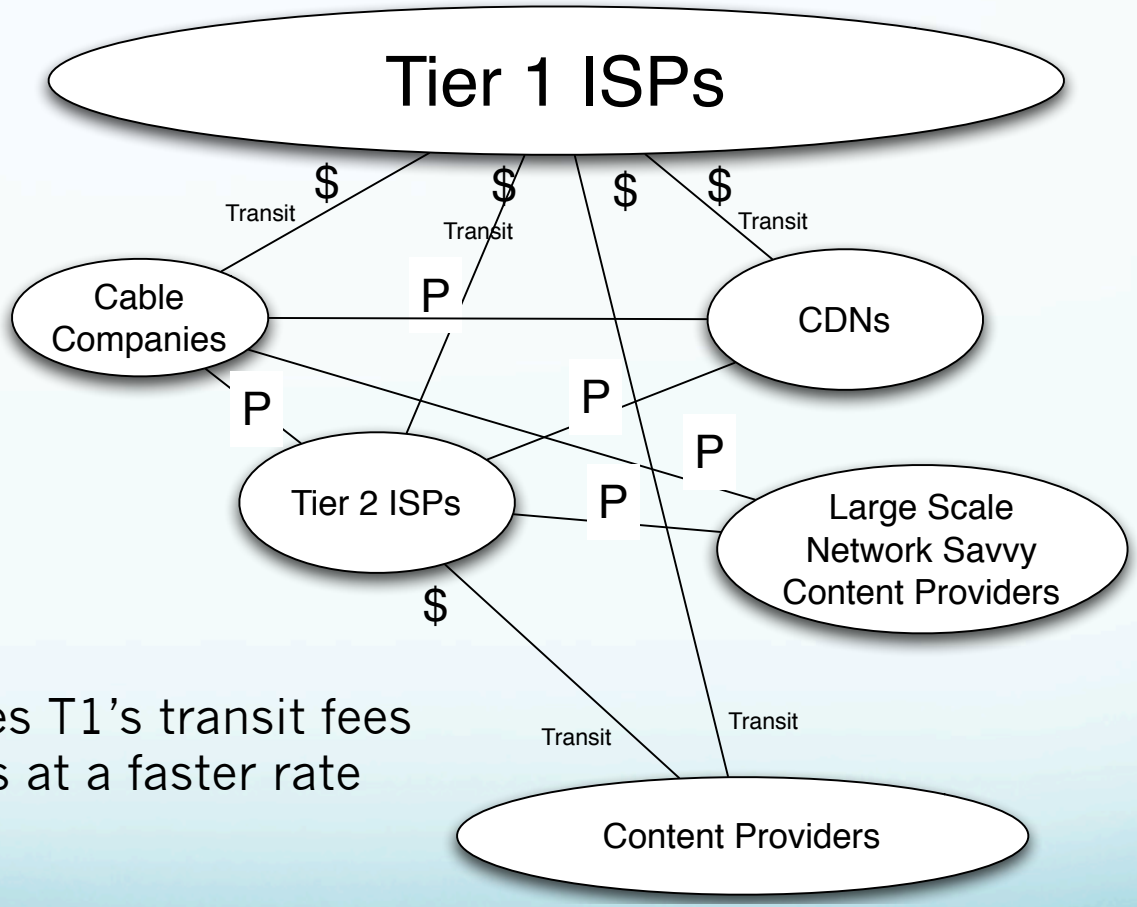
Attend Peering Fora



Fat Middle Peering '98-today

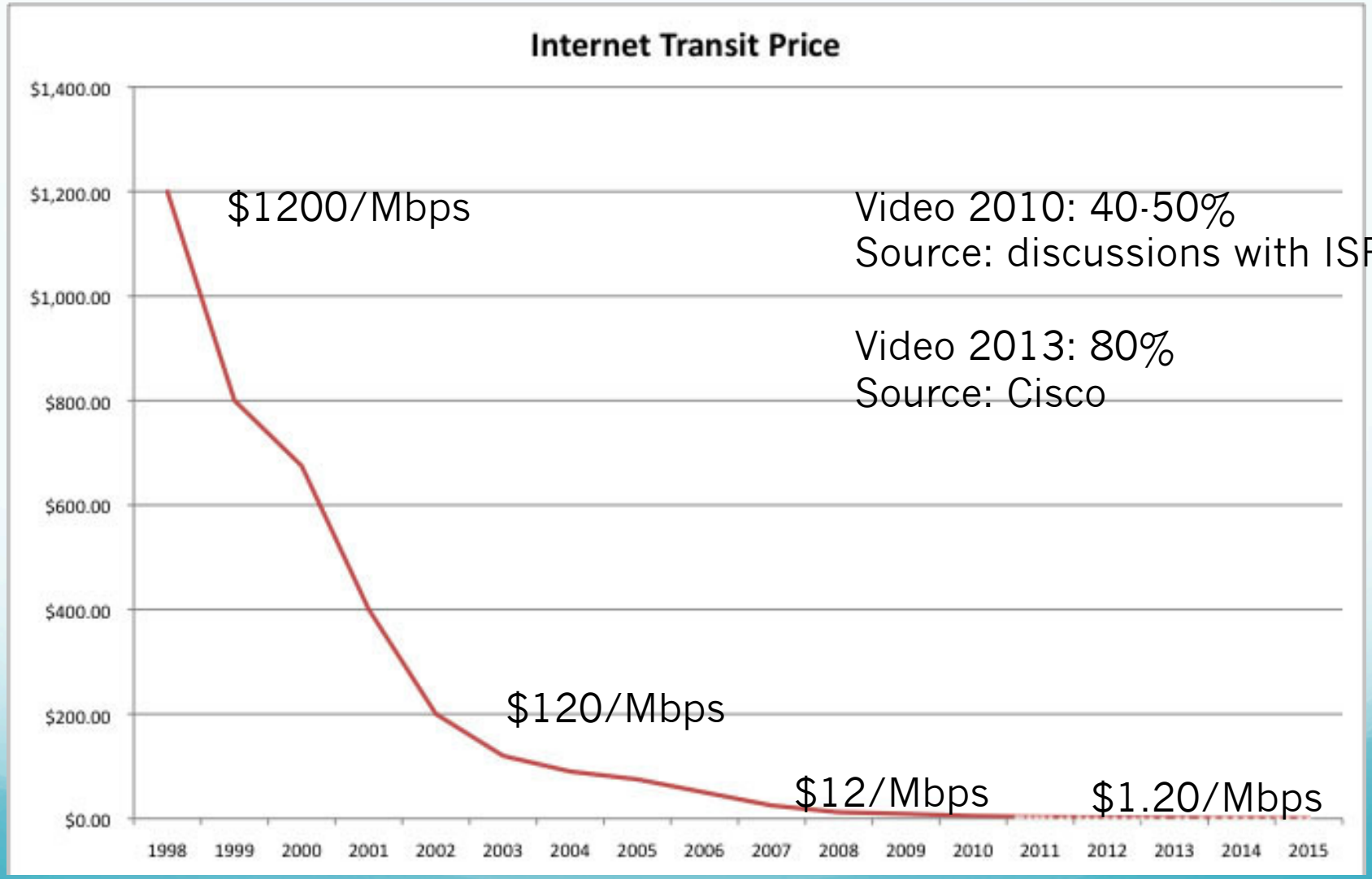
New Players
@home bankrupt
CDNs
LSNSCP

"Open" Peers
:
"Selective Peers"

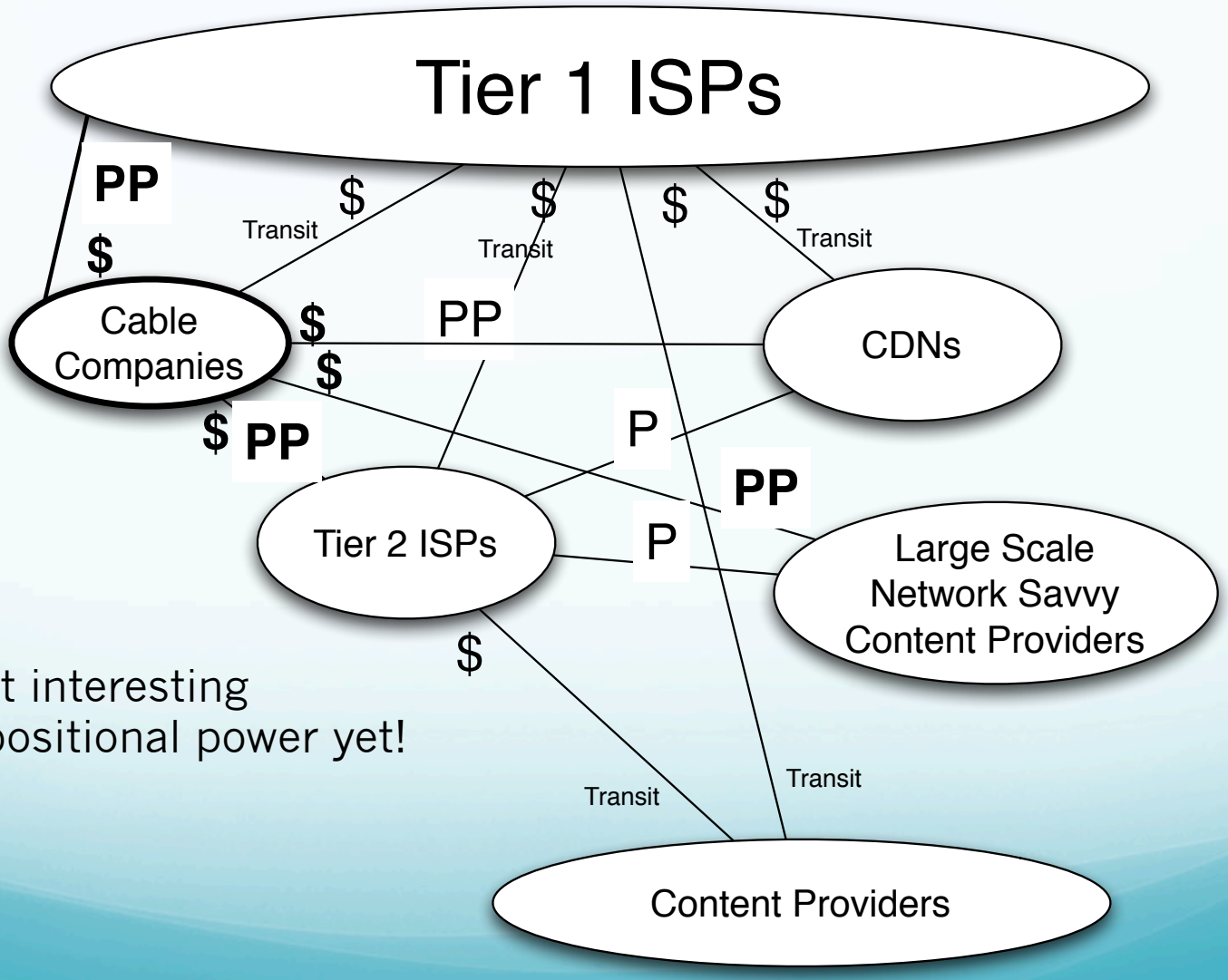


Peering decreases T1's transit fees
Growth increases at a faster rate

Transit Prices & Video



Captive Access Power Peering



The most interesting shift in positional power yet!

Fantastic

Fantastic

Captive Access Power Peering

Comcast-Level 3

Fantastic

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

Fantastic

Captive Access Power Peering Example

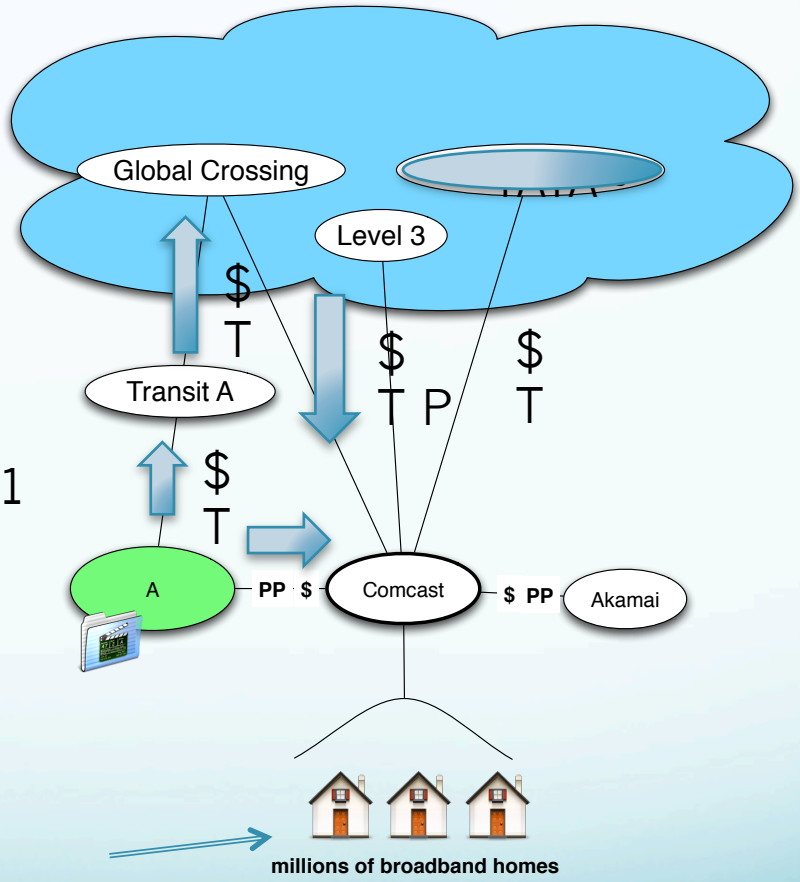
Level3 broad business deal
Fiber, transit, free peering (on-net), etc.

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

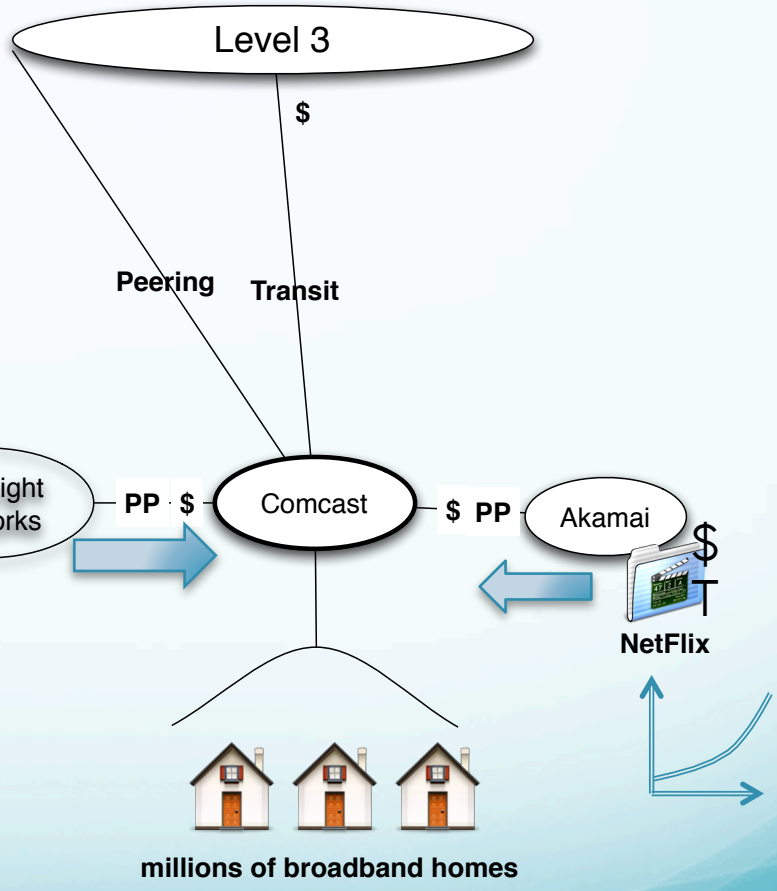
OTT Video requires high performance
No alternative path to Comcast eyeballs
but through Comcast (Captive customers)



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's Gbps)
Great Service

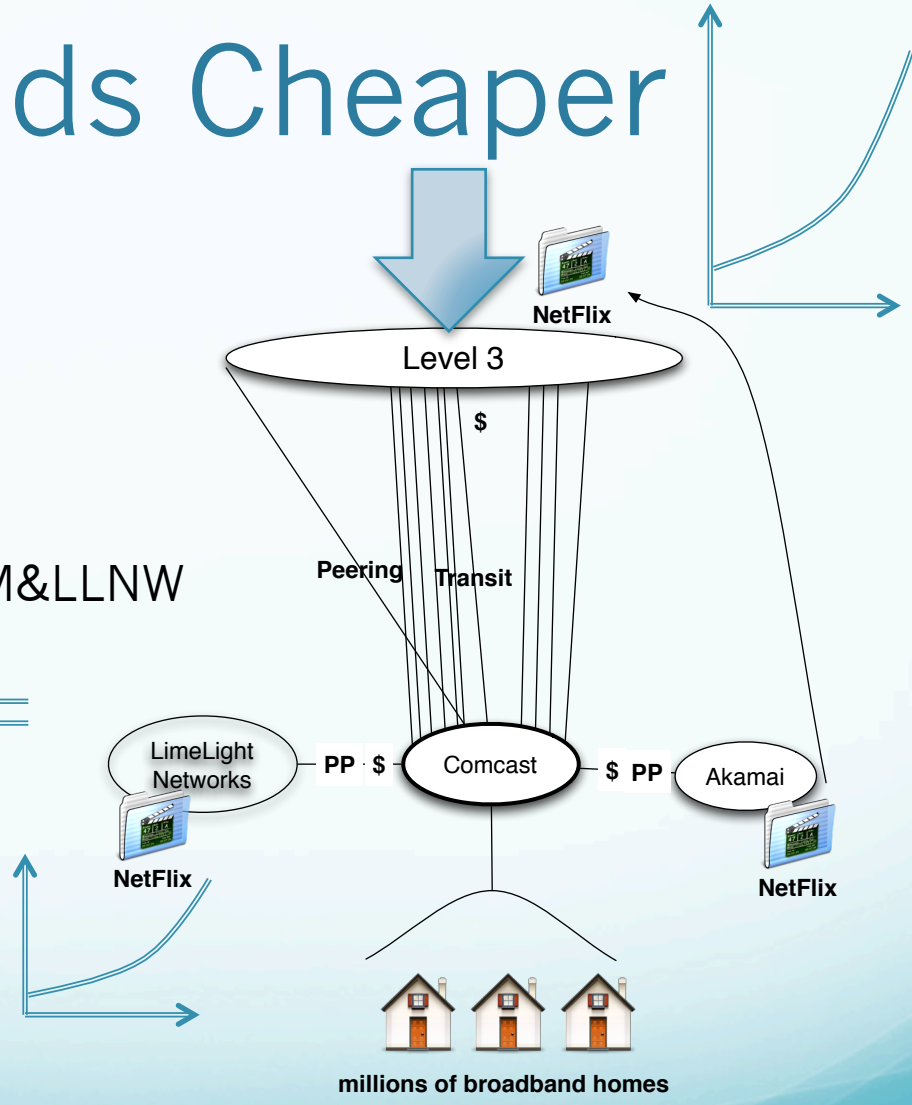


2) Level3 Bids Cheaper

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?