The Structure of Today's Public Internet

The

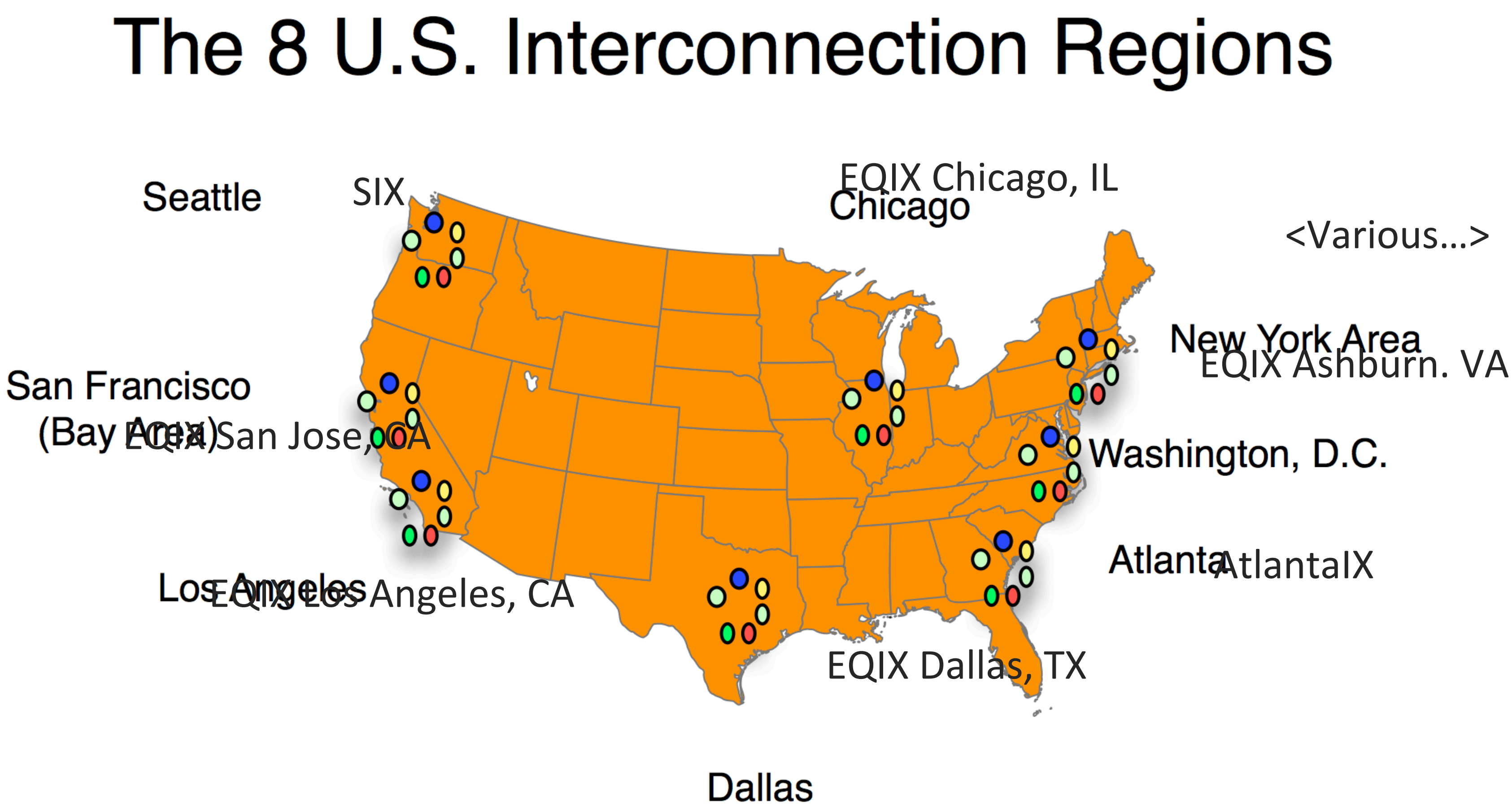
21^{st} Century Internet Peering Ecosystem

http://DrPeering.net

Tier 1 ISPs migrate back into IXPs

- 1999 WP: Interconnection Strategies for ISPs
- Working closely to understand their motivations
- Identify pain point: 18 mos past FOC date
- IXPs can do 24 hr turnaround
- Documented the math
- 5 ISPs in completely cover the cost of metro circuits
- And no 18 mo turnaround
- 8 independent RFPs released
- 2001: EQIX wins most

Where the Tier 1 ISPs peer



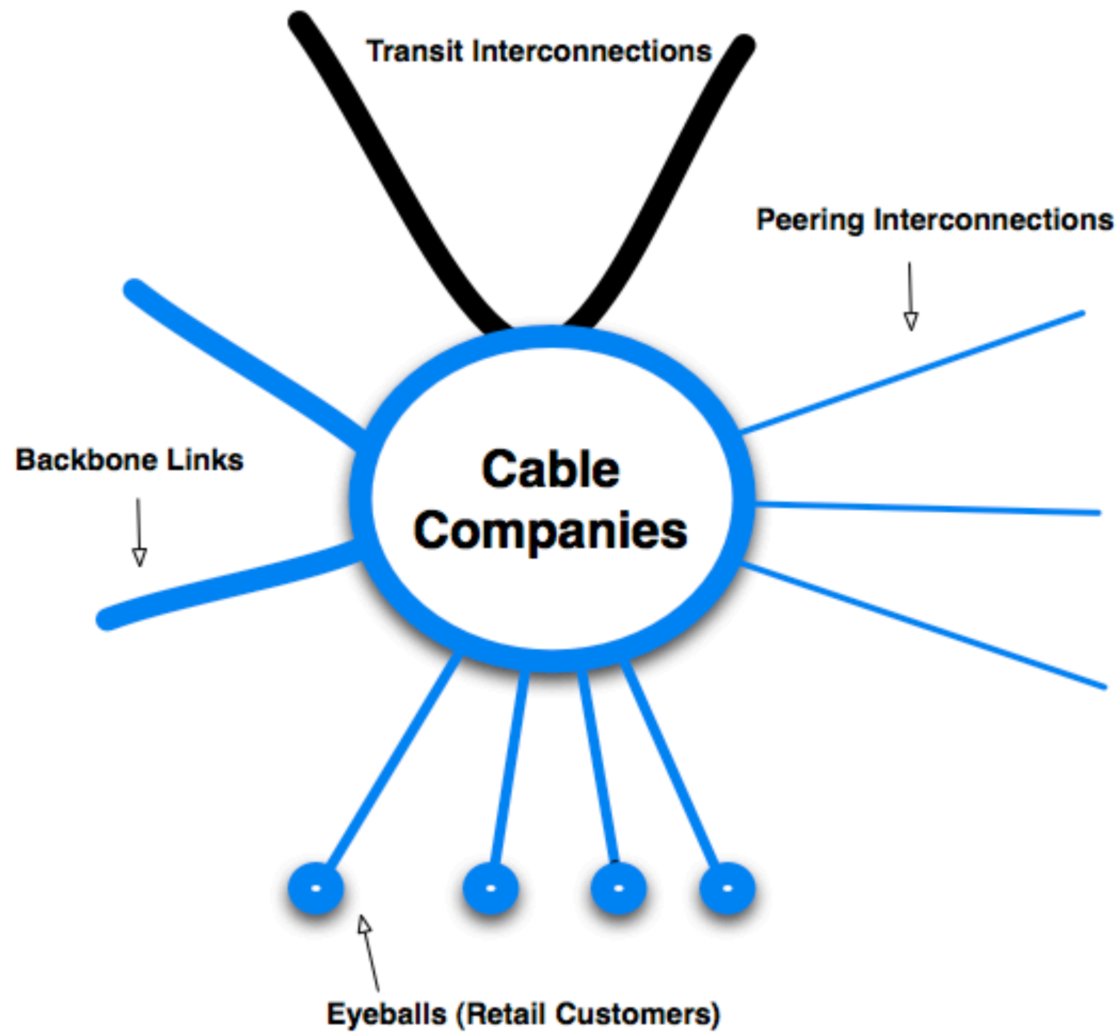
Spread the load, more paths to destination, better performance for customers.

Evolution of the U.S. Peering Ecosystem

- 1999/2000 Economic Collapse of the Telecom Sector
- Growth in used equipment market
- Upstream for cable cos goes bankrupt (@Home) 30 days notice to be ISPs!
- Peer-to-peer file sharing fills pipes
- Transit prices drop

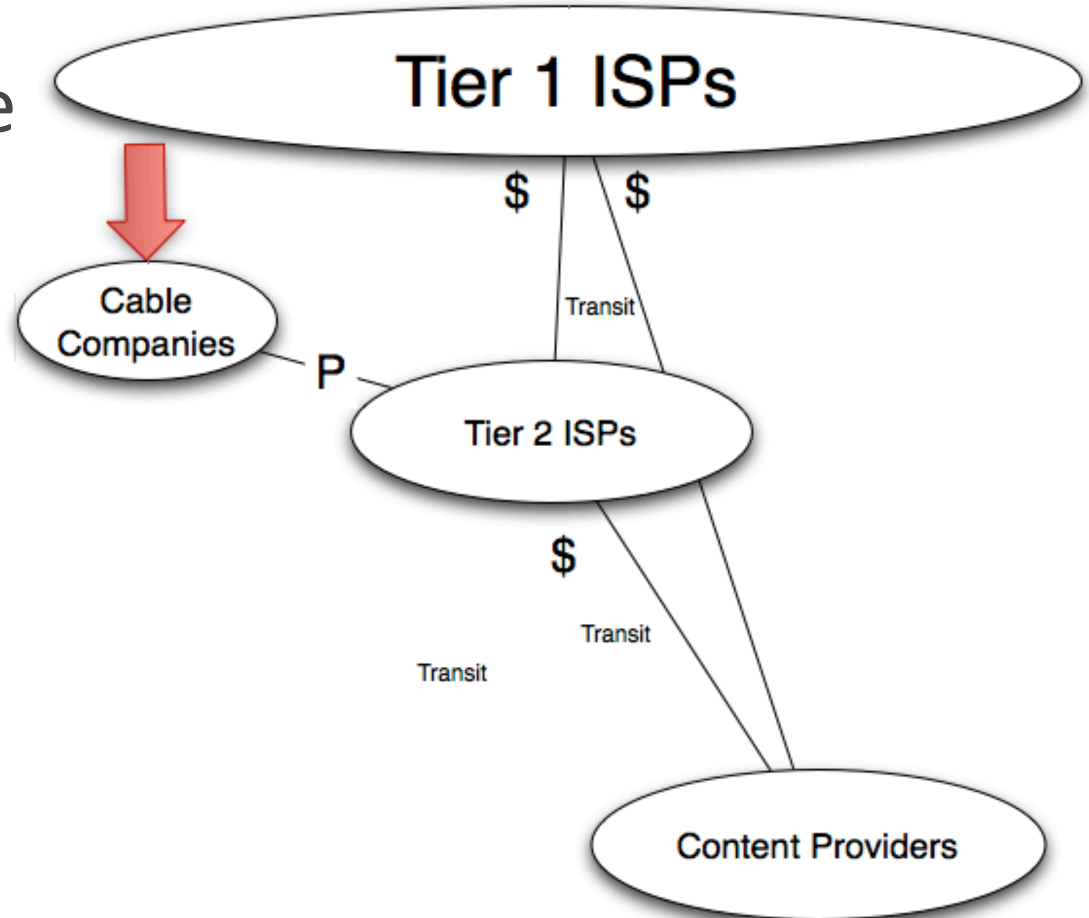
Evolution #1 – Cable companies peer

- 40% P2P (Kazaa)
- Capacity upgrades filled immediately
- Cable doesn't compete with cable
- Conference call



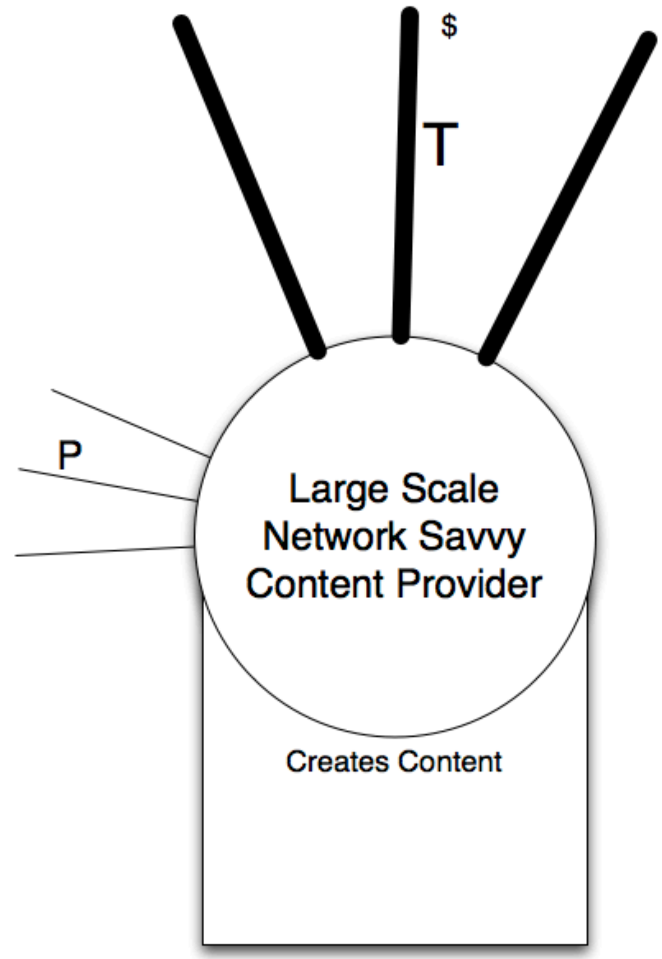
Cable Companies Peer

- Significant evolution because
  - Massive Volume of traffic peered
  - Kazaa Effect
    - 20%+ bump
    - “More local”
  - Grandma Story
  - Cable companies adopted open Peering Policy



Evolution #2 – Large Scale Network Savvy Content Providers Peer

- #1 Improve end user experience
- Reduce transit costs
- Move to new data center anyway
- Large volume traffic
- Open Peering Policies
- Leaders: Yahoo!, Google, Electronic Arts, Sony Online, Microsoft, etc.



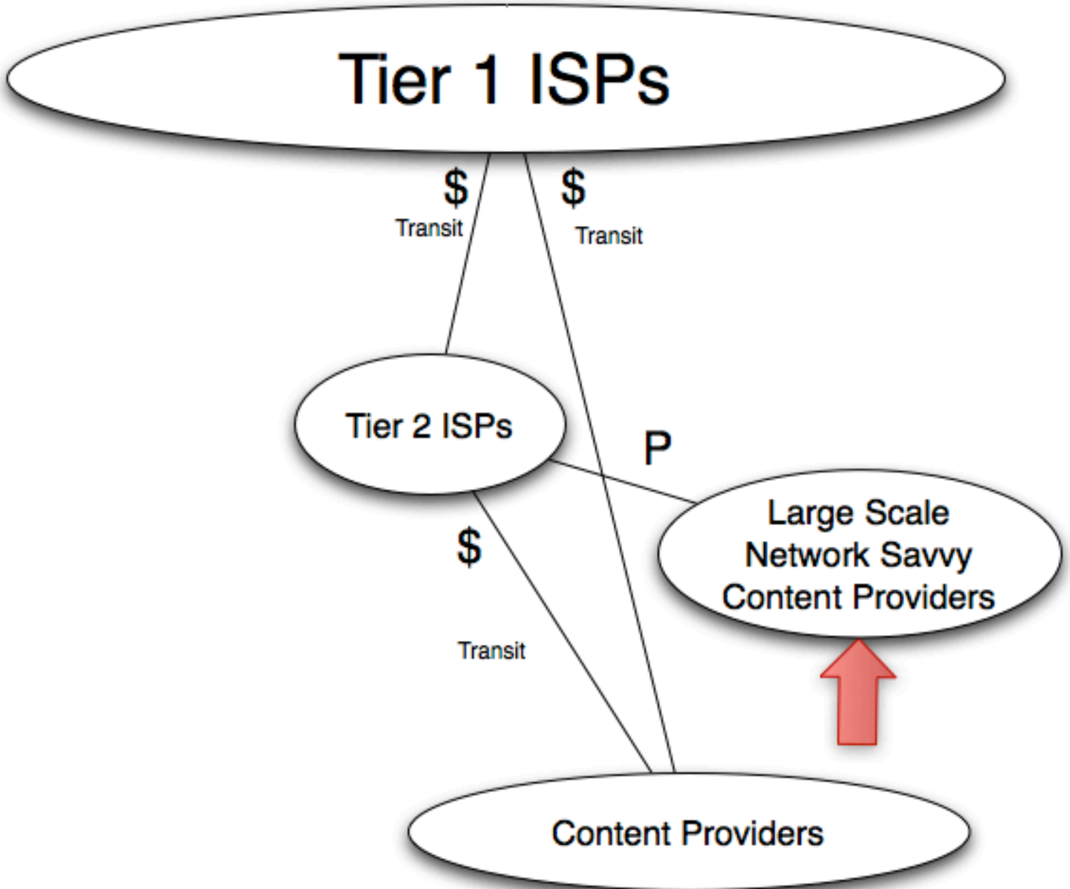
LSNSCP Peer

- Significant because:

1) End-User performance

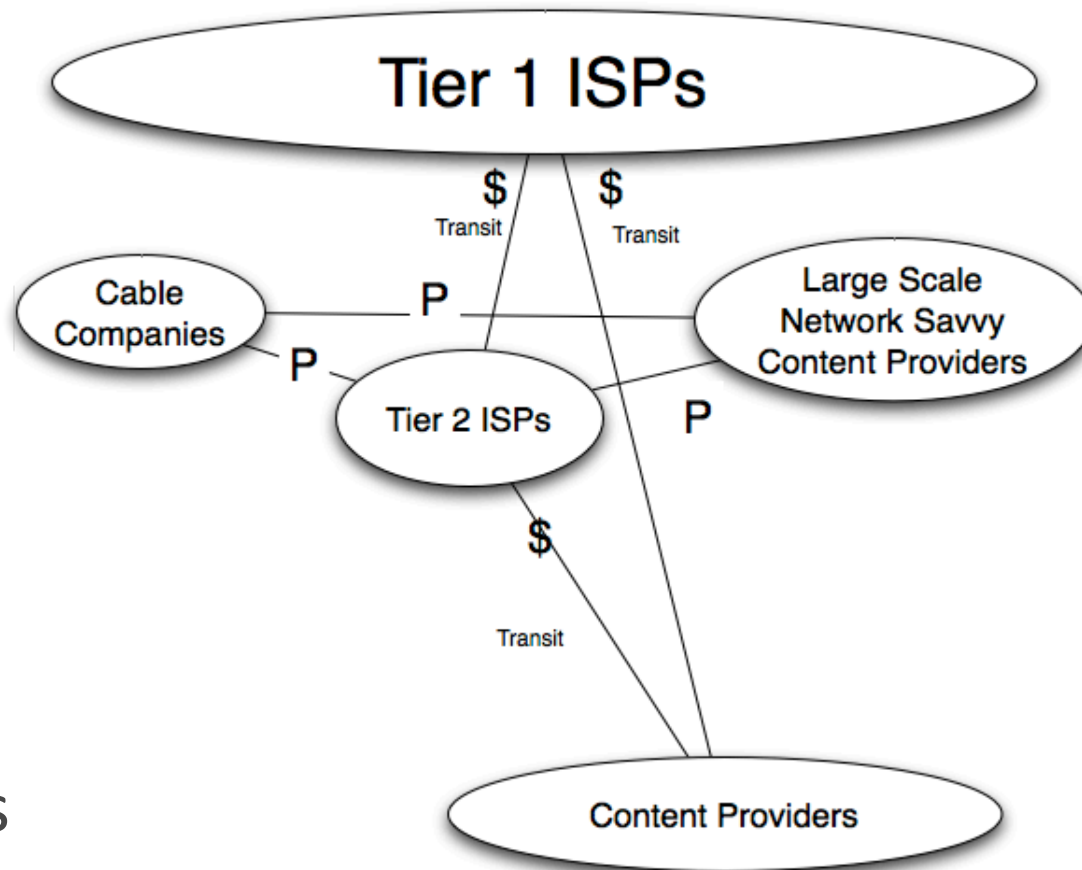
2) Transit cost reduction

3) Needed to move anyway (out of bankrupt data center)



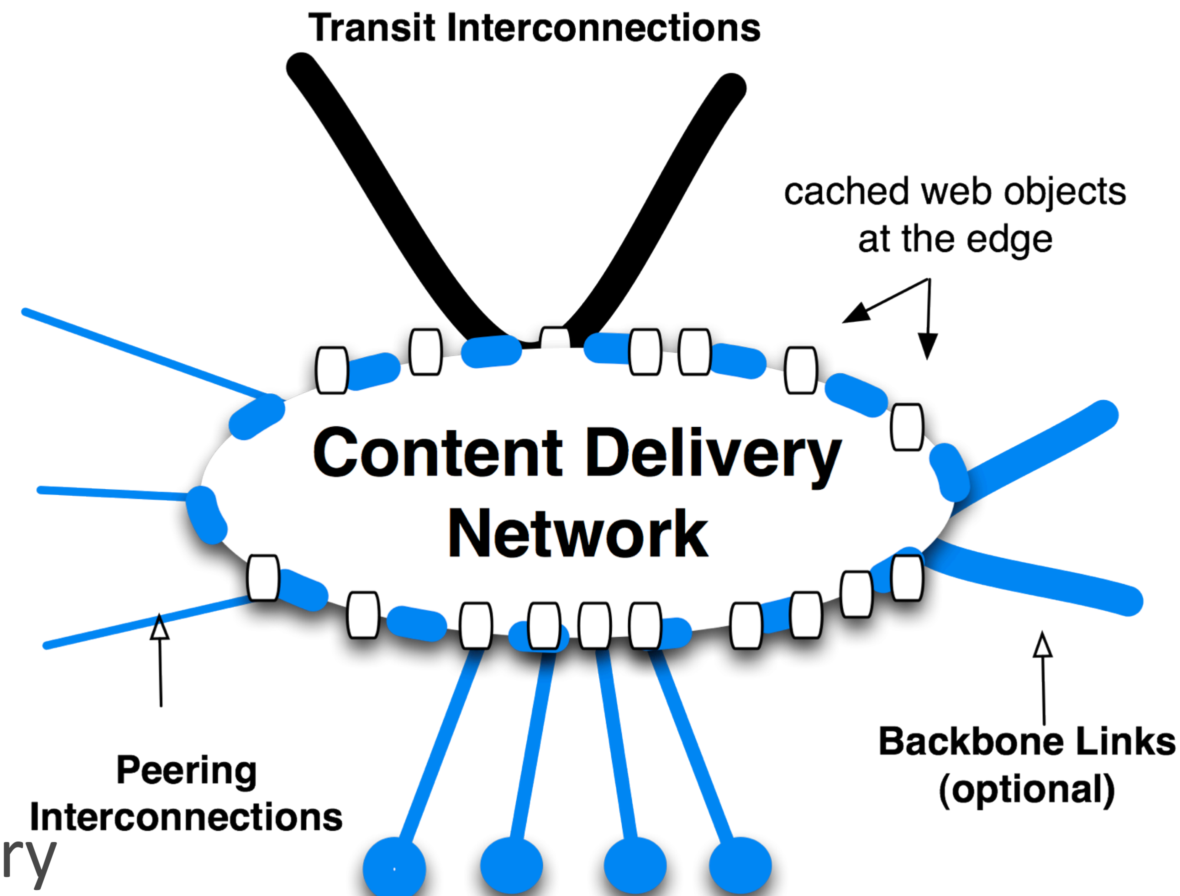
Evolution #3: Cable Companies and LSNSCP Peer

- Open Peering
- Massive traffic pulled from Tier 1 ISPs
- Fat Middle of the Internet Peering Ecosystem
- "Donut Peering"
- Leaders pave the wave
- "We expect customers to to that which is rational" – Level 3



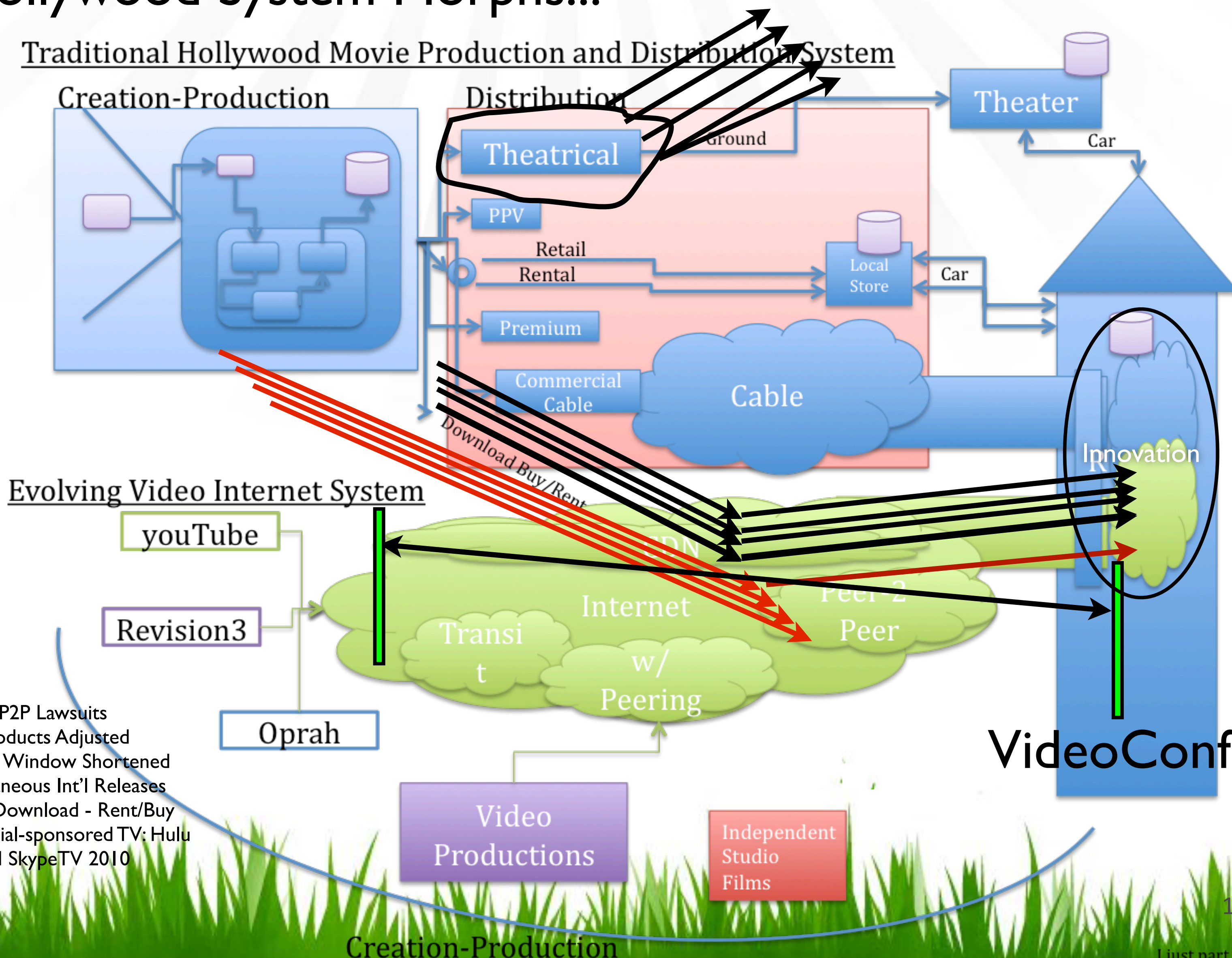
Evolution #4: CDNs Dominate Traffic Volume

- “Web Objects” uploaded to CDN
- Video Objects are massive
- Selling Transit but delivering from a place closer to the eyeballs
- Open Peering policy
- 10G deployment story



Evolution #5: Video

Hollywood System Morphs…



P2P Lawsuits
Products Adjusted
Release Window Shortened
Simultaneous Int'l Releases
Digital Download - Rent/Buy
Commercial-sponsored TV: Hulu
5M SkypeTV 2010

A fundamental shift in the power base of the Internet Peering Ecosystem

#6: Access Power Peering

Evolution #6: Access Power Peering

- 2010 – 40-50% of all Internet Traffic is Video
- Video unlike other content: quality matters
  - Artifacts & suspension of disbelief
  - Massive volume
- Cable Companies peering policy changes
  - Balanced ratios
  - Paid Peering offered
- Video is or soon will be the dominant application
- Massive customer demand
- Who has the power?
  - Eyeball networks?
  - Content distributors?
- We will demonstrate this with a recent story

2010-2012 CAPTIVE ACCESS POWER PEERING

The Hot Topic **Today** in the Internet Peering Community

Captive Access Power Peering Example

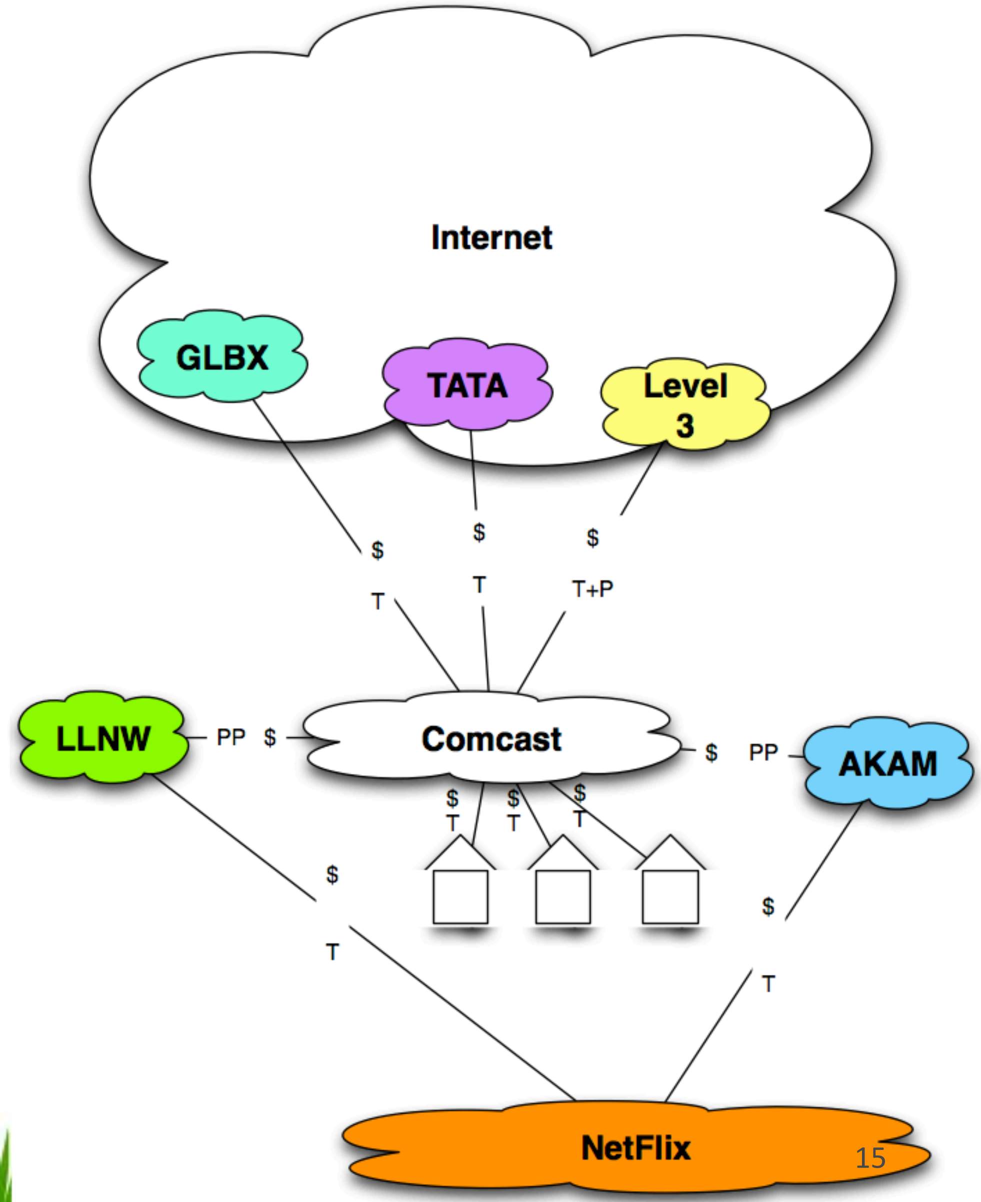
<u>Level3 broad business deal</u>
Fiber, transit, free peering (on-net), etc.

*3 Ways to reach Comcast
1) Transit (LLNW→GLBX→Comcast)
2) Paid Peering (LLNW->Comcast)
3) ~~Peering (LLNW->Comcast) w/vol & <2.5:1 ratio~~

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)



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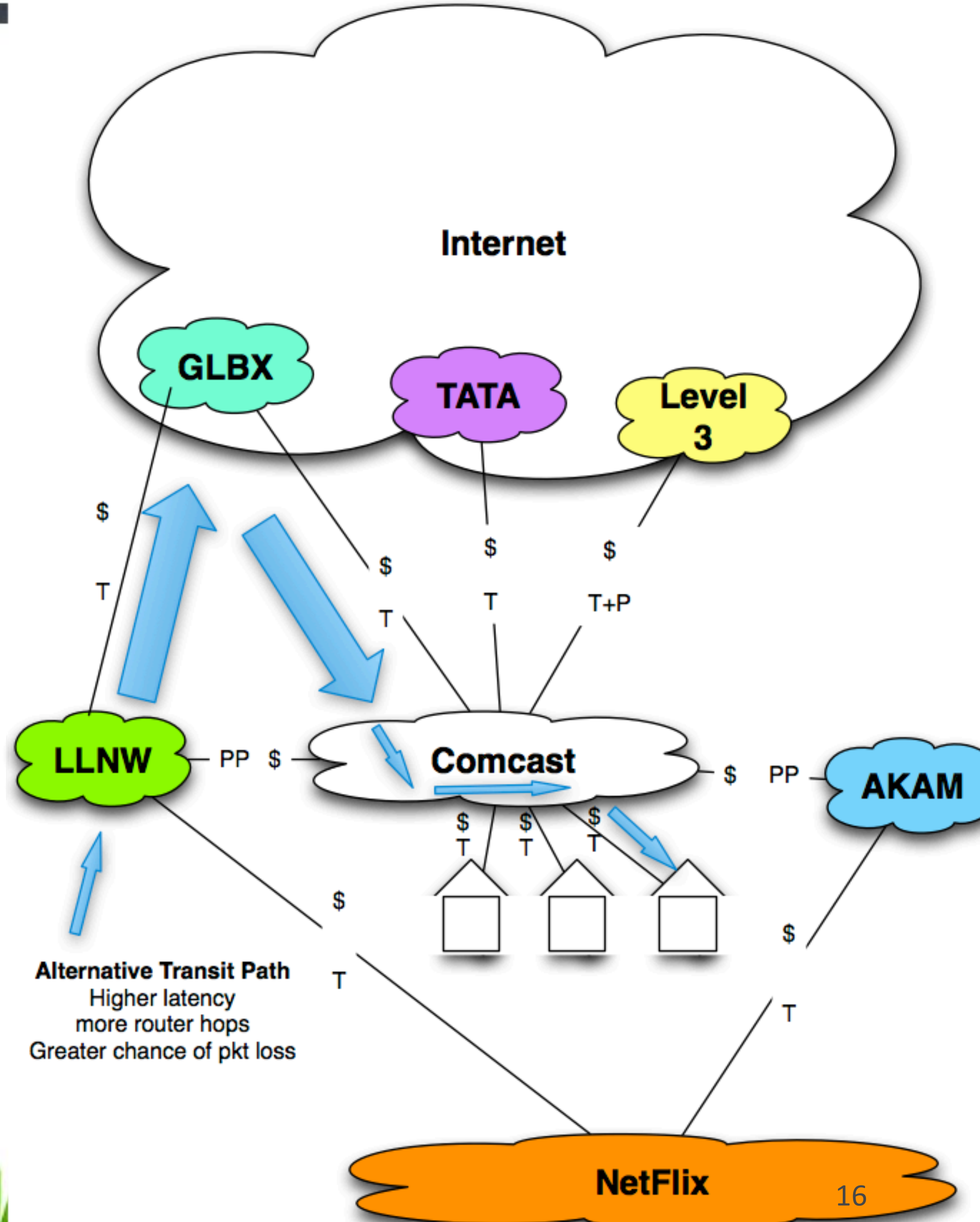

Captive Access Power Peering Example

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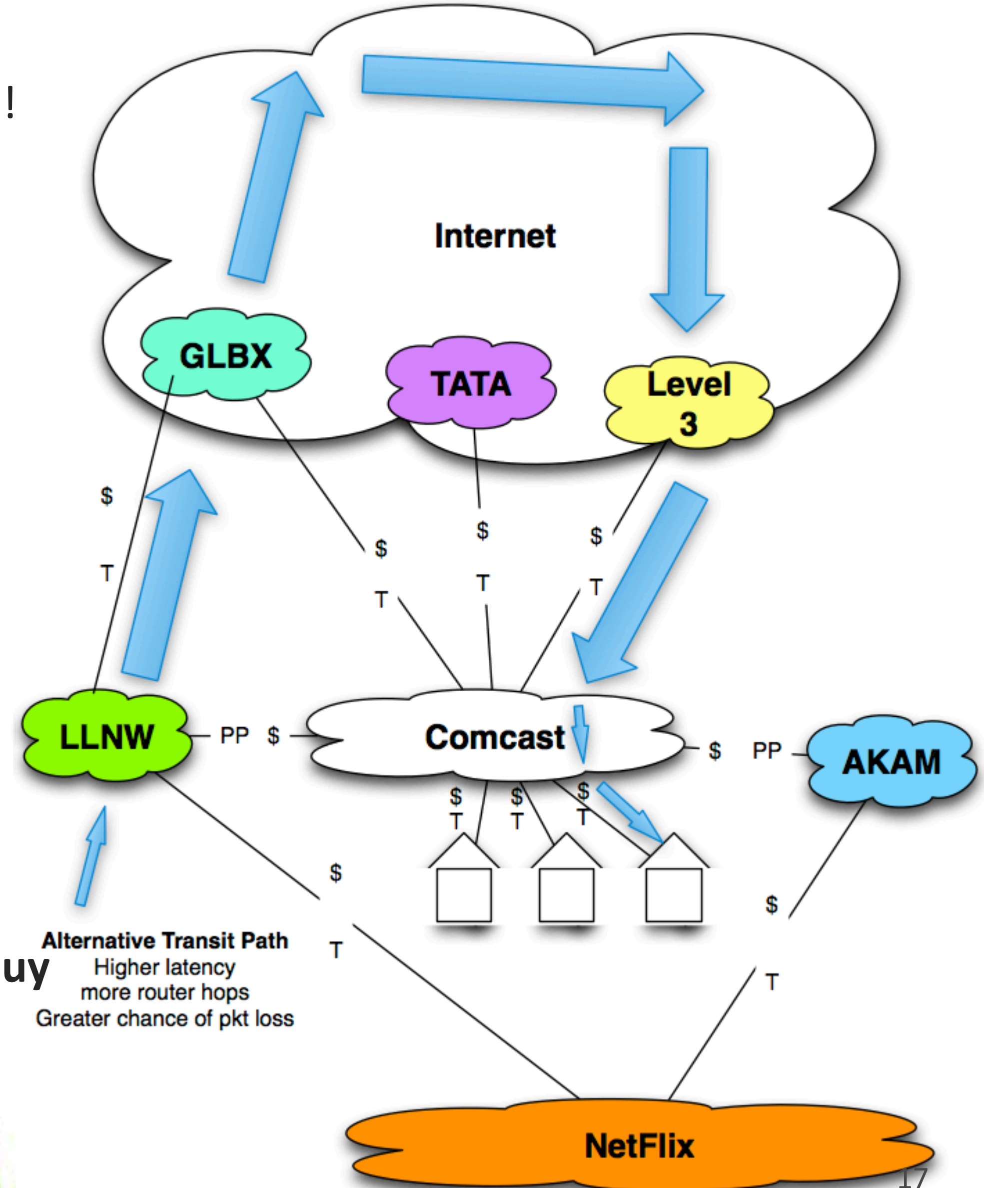

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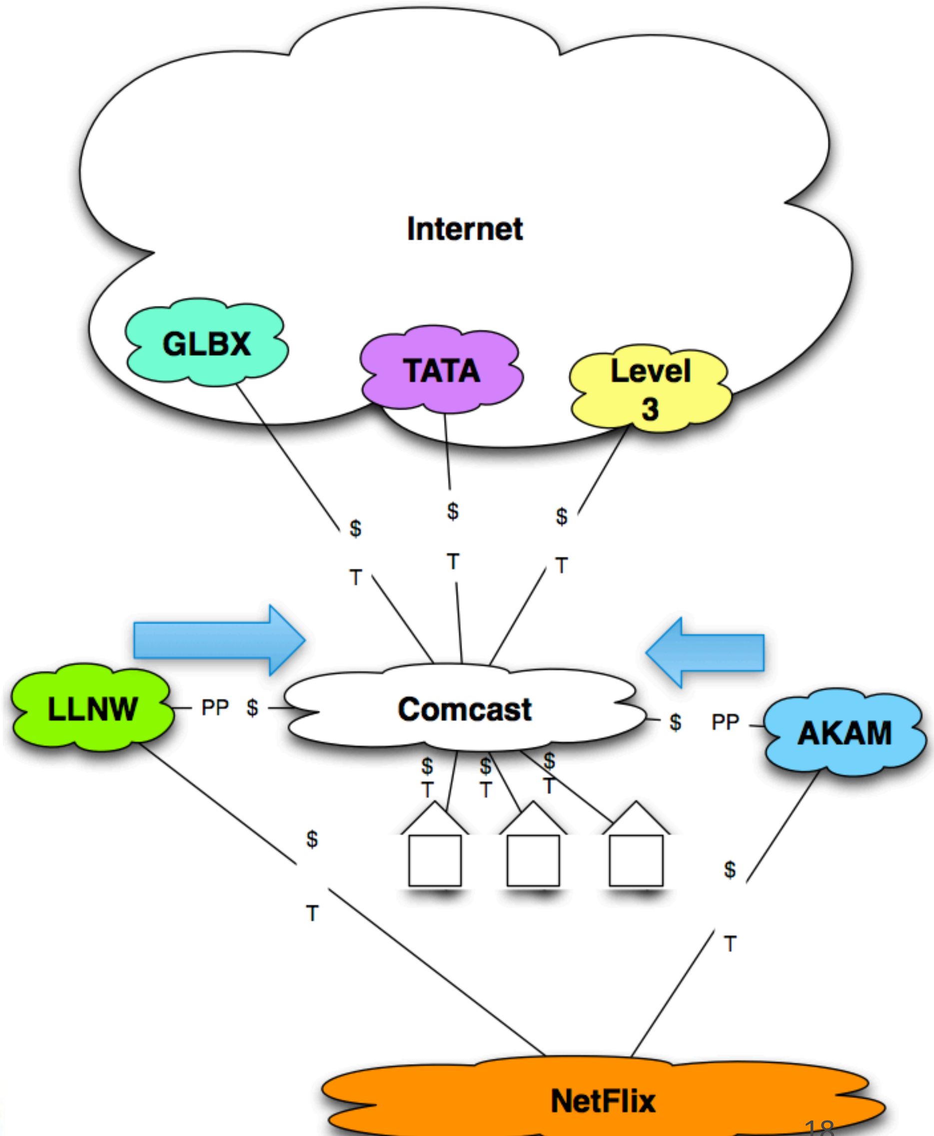


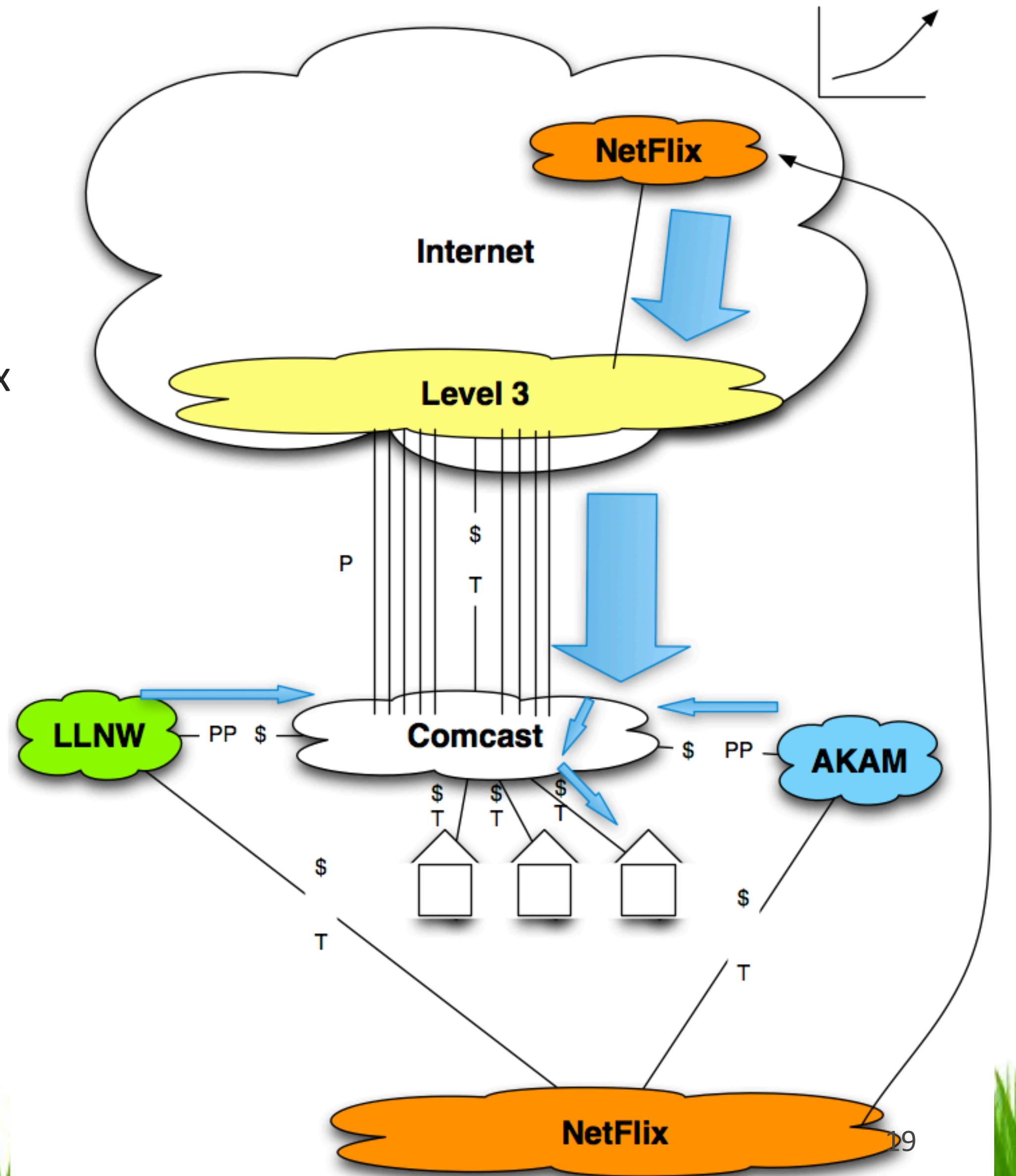
1) NetFlix Application 2010

NetFlix distributes Video via CDNs
Massive growth
O(100'sGbps)
Great Service

Level 3 bids cheaper and wins the NetFlix business

Who wins?

Who loses?



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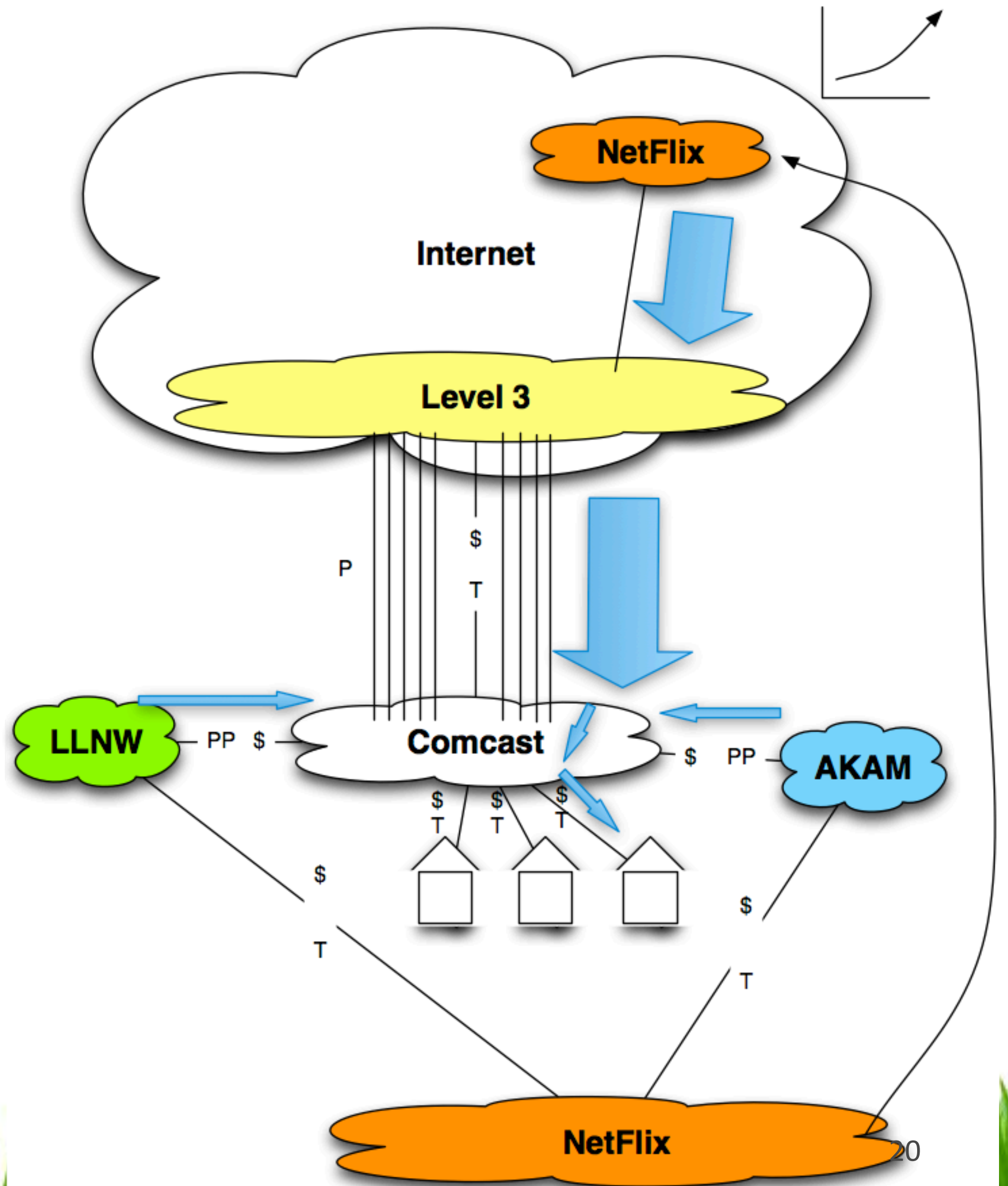
NetFlix – lower prices
Level 3 – new customer
Has eyeballs as customers also

Who loses?

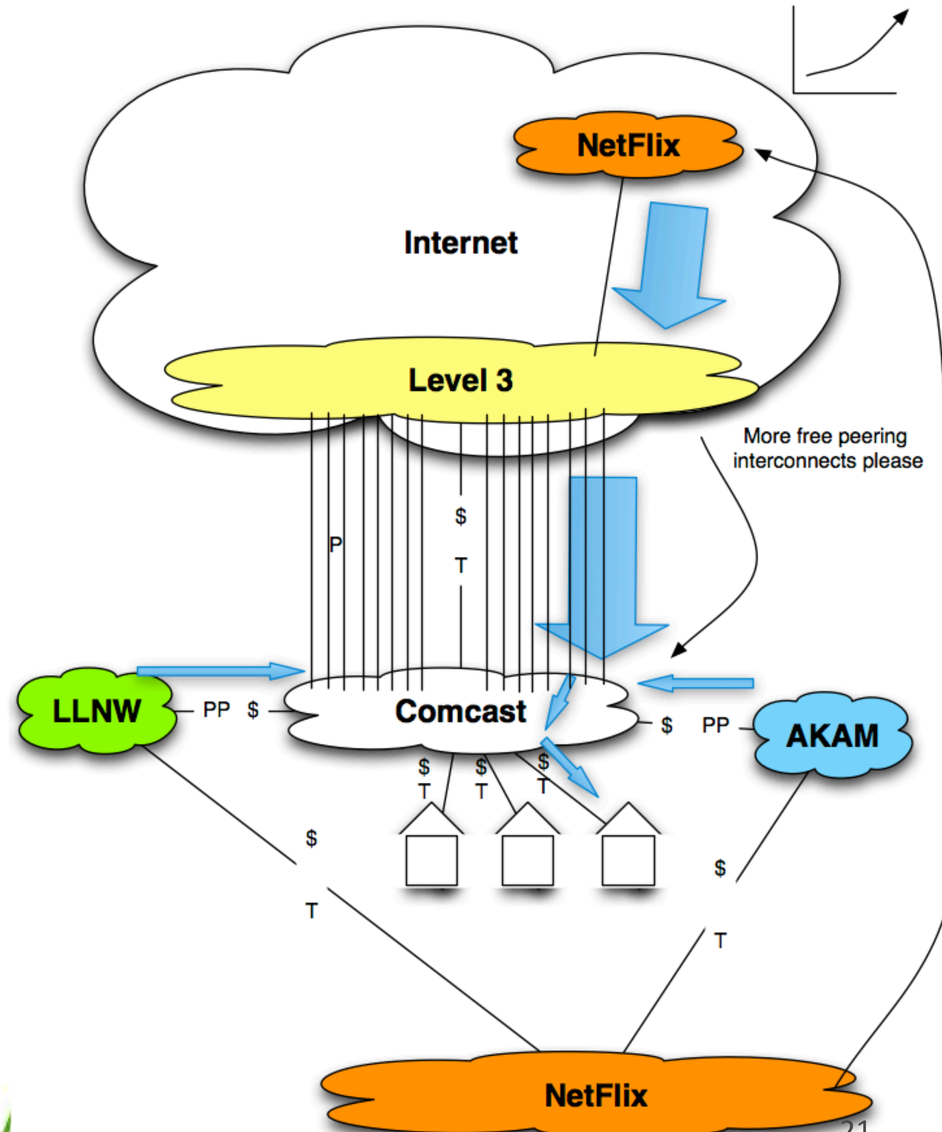
Akamai – revenue for leading & growing video customer
Comcast – revenue from Akamai



2) Level 3 requests more peering interconnects

Akamai loses T$
Comcast loses PP$

Level 3 freely peers the traffic
Level 3 requests more interconnects



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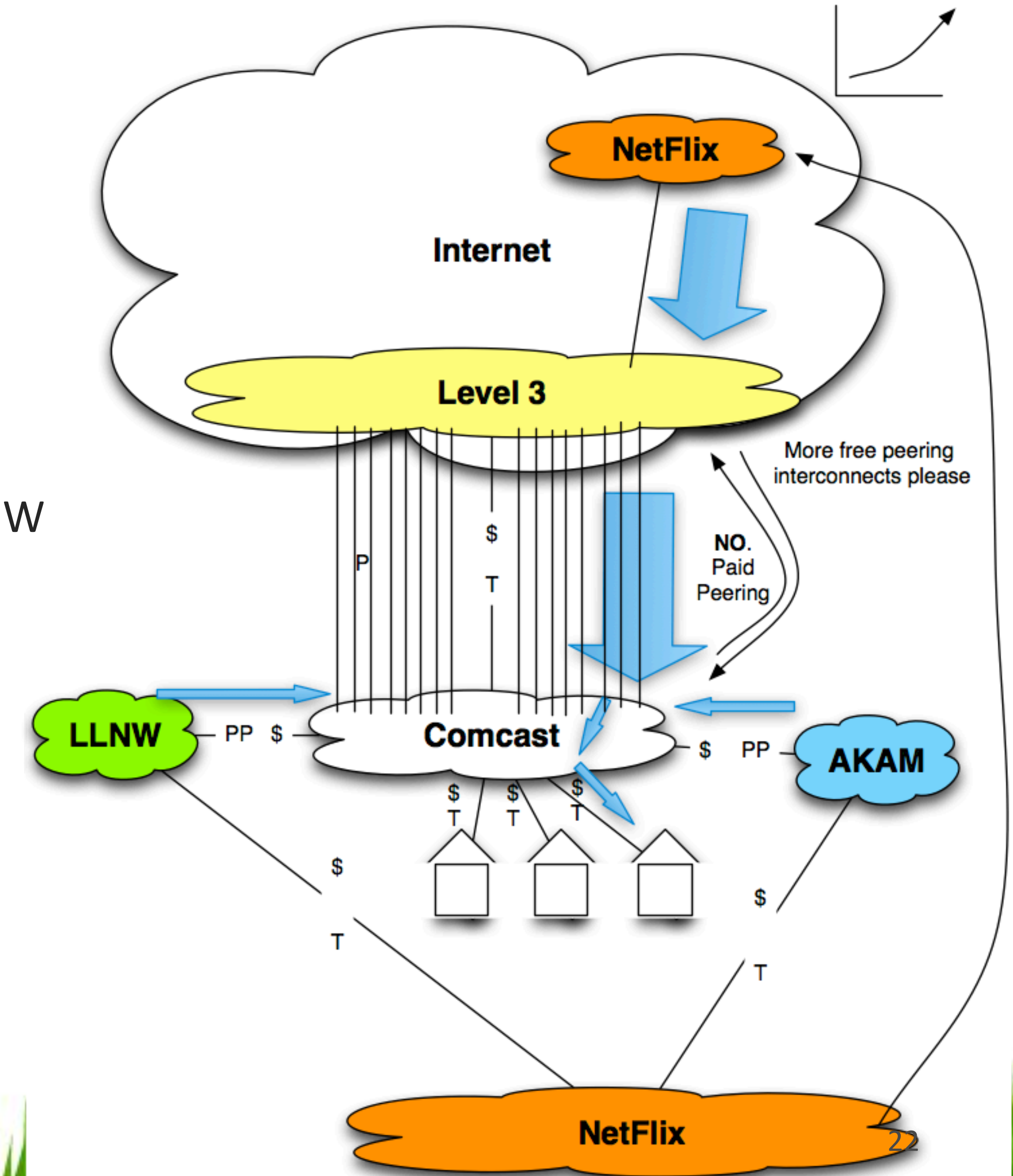

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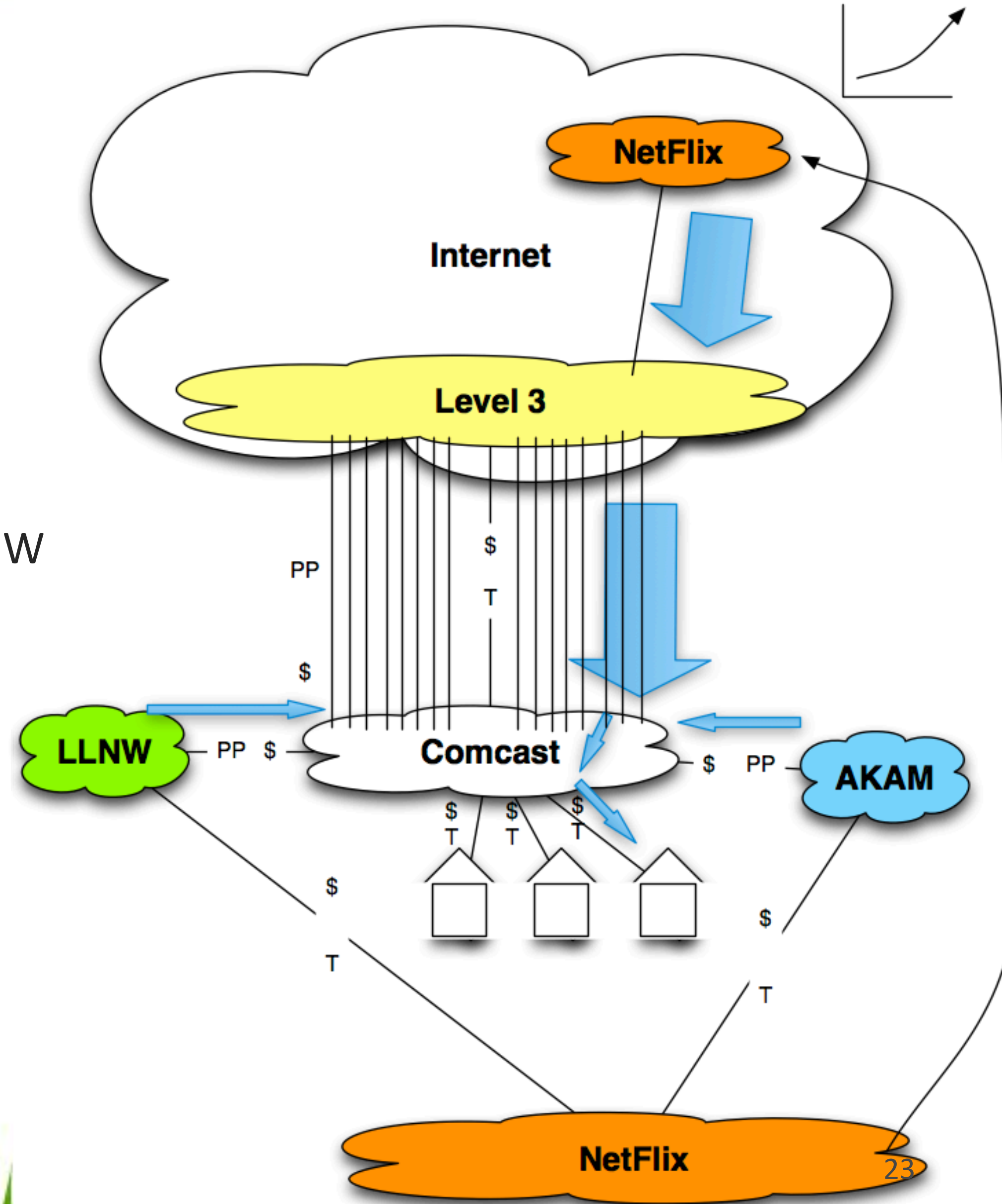
Level 3 Acquiesces
Level 3 pays paid peering fees to Comcast

=Captive Access Power Peering

Comcast's consistency hardens the
Captive Access Power play into a trend.



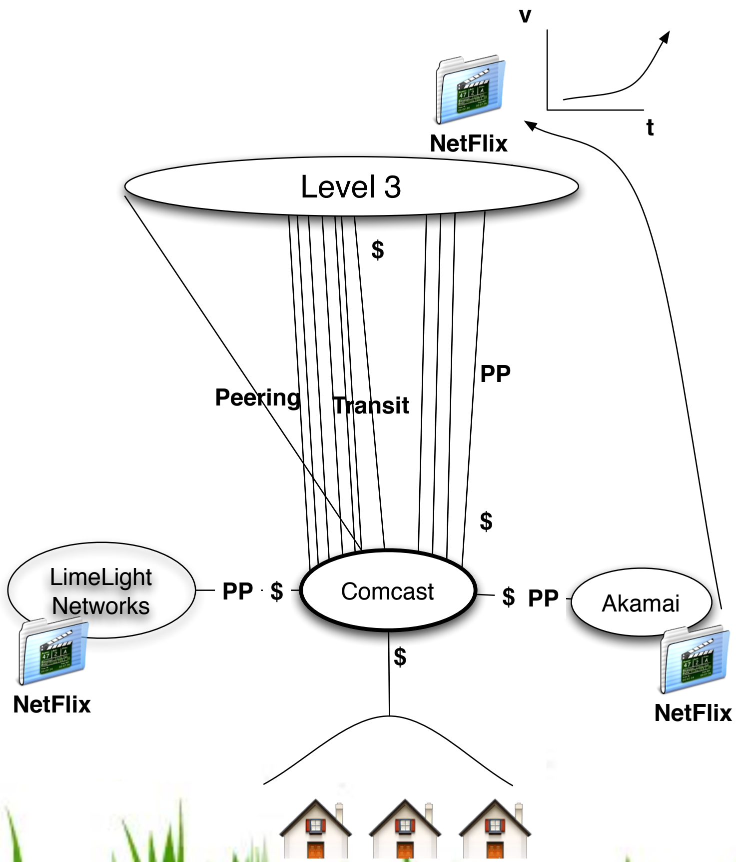
3) Result & Observation

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?



Last Break

Next Up:

The Internet Peering Playbook: The Art of Peering
Aka
The Tricks of the Trade