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December 14, 2010

Ms. Marlene H. Dortch, Secretary
Federal Communications Commission
445 Twelfth Street, SW
Washington, DC 20554

Via Electronic Filing

Re: Notice of *Ex Parte* Presentation in MB Docket 10-56, Applications of Comcast Corporation, General Electric Company and NBC Universal, Inc. For Consent to Assign Licenses or Transfer Control of Licensees

Dear Ms. Dortch,

Pursuant to section 1.1206(b) of the Commission's rules, Free Press submits this notice regarding an *ex parte* communication in the above referenced docket.

On December 13, 2010, S. Derek Turner, Corie Wright, and Chris Riley of Free Press met with the following FCC staff members: Sharon Gillett, Deborah Broderson, Richard Hovey, Marcus Maher, Deena Shelter, and Carol Simpson.

In the meeting Free Press discussed the recent interconnection dispute between Comcast Corporation and Level 3 Communications. First, Free Press expressed concerns generally that last mile network providers can leverage their relationships with broadband subscribers to demand anticompetitive rates and terms from their business partners, leading to increased transmission disputes. If the parties fail to resolve these disputes, Americans could face service disruptions as traffic is re-routed through a few alternative peering points. In light of this danger, Free Press urged the Commission to initiate a proceeding to look into interconnection agreements and the potential impact on consumers.

Free Press also explained that the Comcast/Level 3 dispute highlights that interconnection represents yet another way in which Comcast can leverage its market power to adversely impact its rivals – particularly those providing online video services that compete with Comcast's cable and online video content and services. Moreover, Comcast's incentive to use this leverage would be intensified by its proposed acquisition of NBC-Universal's movies, cable, and broadcast network content.

Comcast has a terminating access monopoly to its customers, which represent over a fifth of broadband customers nationwide.[1] Comcast's market share is even higher in local areas where it has a cable franchise. In order to deliver content requested by end users that subscribe to Comcast's broadband services, online businesses must go through Comcast. By unilaterally and arbitrarily charging companies that transport Internet TV content, Comcast can, in effect, extort fees from Internet TV competitors that must reach Comcast's subscribers to sustain their business and compete in the marketplace.

For example, in the case of the Level 3 dispute, news that Comcast had decided to extract new rates from Level 3 came shortly after Level 3 entered into an agreement with Netflix to deliver its streaming online video service.[2] Netflix's supply of movie and television content competes directly with Comcast's cable and Fancast Xfinity TV offerings. The new types of charges demanded by Comcast will affect the rates paid by online content providers, such as Netflix (and, hence, the rates paid by Netflix subscribers). However, they will not affect Comcast's own cable or Internet TV offerings, thereby giving Comcast a competitive advantage.

Free Press reiterated its opposition to the merger, explaining that Comcast's proposed acquisition of NBCU, if approved, would increase Comcast's incentive to use interconnection as a way to raise rival costs. To afford a modicum of protection to consumers and competition, the FCC must prohibit the joint venture from exacting unfair rates, terms, or conditions in interconnection agreements that have the effect of favoring the joint venture's affiliated content or services. Additionally, the Commission should require the joint venture to make publicly available detailed information regarding any interconnection agreements entered into post-merger, including terms and rates. Moreover, in the event of future interconnection disputes involving the joint venture, the Commission should require Comcast to disclose its pre-merger interconnection agreements to provide a basis by which the Commission can evaluate the reasonableness and potential anti-competitive impact of post-merger interconnection agreements. To the extent that such pre-merger agreements are subject to non-disclosure clauses, they could be submitted to the FCC under confidential seal.

In the meeting Free Press also presented FCC staff with the following attached documents:

- Joint Letter submitted by Free Press, New America Foundation, and Media Access Project regarding the Comcast/Level 3 dispute.
- Nate Anderson, "Peering problems: digging into the Comcast/Level 3

[1] *See* Leichtman Research Group, **"**Over 800,000 Add Broadband in the Third Quarter of 2010," (2010), available at http://www.leichtmanresearch.com/press/111510release.pdf.

[2] Although Comcast asserts that Level 3 has the alternative of using Comcast's main transit link, this may not be a viable option: Some sources have provided data indicating that this link is heavily congested (perhaps even intentionally so) and is therefore unsuitable for additional high-volume use. *See* NANOG users mailing list, "Some truth about Comcast – WikiLeaks style," (Dec. 13, 2010), available at http://www.gossamer-threads.com/lists/nanog/users/133861 (containing analyses of daily and monthly graphs on capacity utilization, purportedly from Tata Communications (which provides Comcast with its primary transit services), and indicating the existence of massive congestion which under ordinary circumstances would have been remedied by upgrading the transit connection).

grudgematch," Ars Technica (Dec. 9, 2010).

- Adam Rothschild, "Peering Disputes: Comcast, Level 3, and You," Voxel Blog (Dec. 2, 2010).

In accordance with the Commission's rules, this *ex parte* notice is being filed electronically in the above referenced docket. If you have any questions regarding this filing, please do not hesitate to contact me.

Respectfully submitted,
_____/s/_____

Corie Wright
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December 8, 2010

The Honorable Christine A. Varney
Assistant Attorney General for the Antitrust Division

U.S. Department of Justice
950 Pennsylvania Avenue, NW
Washington, DC 20530

Chairman Julius Genachowski
Commissioner Michael J. Copps
Commissioner Robert M. McDowell
Commissioner Mignon Clyburn
Commissioner Meredith Attwell Baker

Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Dear Assistant Attorney General Varney, Chairman Genachowski, and Commissioners:

Last week, a dispute between Comcast Corporation and Level 3 Communications generated significant discussion and commentary among journalists, policymakers, advocates, and engineers interested in Internet and broadband policy issues. The dispute highlights the critical role that commercial arrangements to transmit IP data play in the smooth functioning of the Internet. It also raises serious concerns about whether owners of networks should be permitted to leverage their unique position in the marketplace to the disadvantage of their commercial partners. Further, it raises questions about whether last-mile network owners may leverage their position in these interlocking networks to harm their competitors in other markets, such as the markets for Internet content, applications, and services, particularly in regards to reaching last-mile customers. We call on you to investigate both the facts of this particular dispute as well as interconnection agreements more generally. Because the Internet literally could not function in the absence of effective interconnection, we urge you, as expert federal regulators, to maintain active oversight of these critical negotiations, agreements, and practices.

Background

The Internet is comprised of thousands of interconnected networks extending across the globe. In order for data to flow from one endpoint to another (e.g., from a server hosting Netflix content to a user requesting a Netflix movie), that data may traverse a number of networks. In broad terms, these networks fall into several categories: last-mile residential and business broadband networks, intermediate transit networks, and backbone networks. The operators of these various networks make agreements to carry each other's traffic so that data can be transmitted from one endpoint to the other.

These agreements typically fall into one of two categories: "peering" agreements and "transit" agreements. In a typical peering agreement, network operators agree simply to exchange traffic with one another. For example, one network operator might

deliver content in the form of applications or services to the other, in exchange for requests for those same applications or services generated on that peer's network. Historically, many peering arrangements were "settlement-free"; that is, the network operators did not charge each other for the traffic exchanged. Rather, each network operator recouped its costs from its own customers. These customers were typically either content creators or end-users.

By contrast, transit arrangements usually arise in situations exist in which one autonomous network operator agrees to carry the traffic that flows between two other networks. Thus, transit uses a third-party middleman to get from one network to another. As a result, transit arrangements typically are not "settlement-free"; a transit provider must recoup his costs from one of the other networks in the chain because he has no end-user customers in this scenario.

These types of agreements make up the fabric of a working and thriving Internet. However, left unchecked, this fabric can be torn by network providers that unfairly leverage their considerable market power to create disparities between networks, drive up the costs for rivals, and prevent consumers from accessing lawful Internet content and applications.

The Recent Dispute Between Comcast and Level 3 Illustrates Emerging Concerns Regarding Interconnection Practices and Highlights the Need for Federal Oversight of Interconnection

Comcast's dispute with Level 3 arises from an abrupt change in a peering arrangement. According to accounts of the dispute appearing in the press and elsewhere, Comcast recently sought to renegotiate its contract with Level 3, demanding a recurring fee for carrying Level 3 traffic to and from Comcast broadband customers. According to many accounts, Comcast had never before requested such a fee. The demand came on the heels of news that Level 3 had signed an agreement to become the primary backbone delivery provider for Netflix's streaming video service.[1] Comcast claims a change in the proportion of traffic between the two networks changed the peering relationship while Level 3 claims they had little option but to accept unprecedented "take it or leave it" terms under protest in order to avoid interruptions of service for Level 3's customers.[2]

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[1] Cecilia Kang, *Level 3 Communications Calls Comcast Fees for Netflix Feeds Unfair*, WASH. POST, Nov. 29, 2010, https://www.washingtonpost.com/wp-dyn/content/article/2010/11/29/AR2010112907024.html (last visited Nov. 29, 2010).

[2] *See Comcast Letter to Sharron Gillett Re: Preserving the Open Internet, GN Docket No. 09-191*, Nov. 30, 2010, http://fjallfoss.fcc.gov/ecfs/document/view?id=7020921811 (last visited Dec. 8, 2010)*; see also Level 3 Issues Statement Concerning Comcast's Actions*, Nov. 29, 2010, http://www.level3.com/index.cfm?pageID=491&PR=962 (last visited Dec. 3, 2010).

Although the facts of this dispute are not completely transparent to outside observers nor available from sources other than the disputants themselves, the situation clearly gives rise to three discrete and compelling concerns.

1. **The dispute raises concerns about whether and how last-mile providers might leverage their relationship with broadband consumers to act in an anticompetitive manner.** In any relationship between Comcast and Level 3, Comcast enjoys a unique position. In order to reach Comcast's millions of ISP customers, content providers like Level 3's customers must go through Comcast. In that sense, Comcast has a terminating access monopoly; no other provider can directly provide transmission to Comcast's subscribers. By contrast, if Level 3's customers have significant choice among backbone providers — data can flow among multiple backbone paths to get from the content creator to Comcast's network. Thus, whatever the character and operation of any agreements between the two entities, Comcast's position gives it substantial negotiating leverage with respect to Level 3. As Professor Susan Crawford suggests, "If [Level 3] wanted to reach Comcast's 25 million subscribers, it had to do the deal on Comcast's terms."[3]

   Moreover, if Level 3's characterizations are accurate, Comcast's behavior is particularly remarkable because it represents one of the first times that a residential Internet service provider apparently has succeeded in trying to charge transit fees to *terminate* traffic, rather than charging such fees to transmit traffic from one network to another. As a result, Comcast would be effectively double charging for the transmission of the same traffic – it gets one fee from Level 3 and an additional fee from its end-user customers.

   Yet, the problem is much broader than this particular dispute: the nature of the dispute suggests that every residential broadband network owner has the incentive to drive down its own costs in this way, and this incentive is not unique to Comcast. Furthermore, the means to act upon such an incentive are present because of the lack of competition in the market for residential broadband service. According to the National Broadband Plan 96% of American consumers have at most one or two choices among wireline providers,[4] meaning that there is really no hope that consumers can discipline Comcast's behavior.

2. **The dispute raises particular questions about whether last-mile providers can leverage their market power to harm their competitors in the market for Internet content. Policymakers should views these risks**

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[3] Susan Crawford, *Bad Timing: Comcast, Netflix, NN, Cable Modems, and NBCU*, Nov. 29, 2010, http://scrawford.net/blog/inside-job/1419/ (last visited Nov. 30, 2010).

[4] Federal Communications Commission, *Connecting America: The National Broadband Plan*, exhibit 4-A.

with heightened concern in the context of the proposed Comcast/NBC Universal merger. Because this dispute arose shortly after Level 3 signed a deal with Netflix to transmit Netflix content, regulators should examine Comcast's motives closely. Netflix competes directly with Comcast's cable programming offerings. In fact, over the past two quarters, cable has lost an increasing number of subscribers, and a number of those consumers have substituted Netflix streaming video service for the cable service they have eliminated.[5] It requires little imagination to view Comcast's behavior as an attempt to raise the distribution costs for Netflix and thus force that competitor to pass these new expenses onto consumers in the form of higher prices.

Both the Federal Communications Commission (FCC) and the Department of Justice should investigate Comcast's actions in connection with their respective reviews of Comcast's proposed merger with NBC Universal. That investigation should include obtaining the relevant agreements here, and then making those documents available to parties under the terms of the protective order in the Comcast/NBCU merger review proceedings. As you are already aware, the merger raises numerous anticompetitive concerns with respect to over-the-top Internet video. For example, the merger presents concerns regarding the ability of competitive video providers to access and offer Comcast/NBC content. It also raises the specter that Comcast may leverage its market power as the nation's largest provider of residential broadband access to restrict content owners' and distributors' access to its customers. This recent move by Comcast with respect to Level 3 substantially heightens these concerns: it suggests yet another method by which Comcast may able to use its position as a broadband provider to privilege its own content. The incentive to do so — while already significant — will only become more acute if the merger is consummated.

3. **Interconnection disputes represent an increasingly high-stakes game of chicken[6] and could lead to disruptive outages that cripple the functioning of our communications infrastructure.** As last-mile operators increasingly attempt to leverage their position to extract more money out of their business partners, we can expect these disputes to occur more frequently. If parties fail to resolve these disputes, Americans could face massive transmission failures as providers re-route traffic through a few alternative peering points. In the worst case, millions of consumers, businesses, and government users could lose access to the Internet. These types of outages will have much more severe consequences for the public

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[5] Ryan Lawler, *Big Cable Is Bleeding: 500K+ Subscribers Lost In Q3*, GigaOm, Nov. 4, 2010, http://gigaom.com/video/big-cable-is-bleeding-500k-subscribers-lost-last-quarter/ (last visited Nov. 30, 2010).

[6] W. B. Norton, *The Art of Peering -- The Peering Playbook v1.2*, *available at* http://www.gtnoise.net/papers/library/norton.pdf.

than the recent spat over retransmission consent between Fox and Cablevision, which resulted in a two-week blackout of Fox programming for millions of Cablevision subscribers and other Internet-based content disruptions as well.[7] Additionally, the historical record of intercarrier compensation demonstrates the continued problems that disagreements over interconnection can create. The Internet constitutes nationwide mission-critical infrastructure. We cannot afford to ignore the risks posed by interconnection disputes any longer.

In sum, unreasonable and discriminatory peering and transit agreements can allow network providers to increase costs for independent content and applications. Some network operators can extract rents, or refuse interconnection with backbone providers or content distribution networks that carry content or applications that compete with the refusing network's own offerings. Comcast may or may not have acted reasonably in its negotiations with Level 3, but the dispute highlights both (1) the incentives that last-mile providers have to act anticompetitively in making interconnection agreements and (2) the need for increased oversight and transparency with respect to these practices.

We urge the FCC and the Department of Justice to launch an investigation of the Comcast/Level 3 dispute.[8] The details of peering agreements are rarely transparent and are often protected by non-disclosure agreements.[9] Absent a government investigation, policymakers will never know the facts behind this dispute or others like it that may arise. We urge the Commission and Department of Justice to investigate not just this recent event but also how peering agreements are negotiated and whether companies are acting in an anticompetitive manner.[10]

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[7] Brian Stelter & Bill Carter, *Fox Returns to Cablevision*, N.Y. TIMES, Oct. 30, 2010, http://mediadecoder.blogs.nytimes.com/2010/10/30/fox-returns-to-cablevision/ (last visited Dec. 3, 2010).

[8] We are encouraged to hear that the FCC's Wireline Bureau has been in communication with Comcast. *See, e.g.*, Letter from Joseph Waz, Senior Vice President, External Affairs and Public Policy Counsel, Comcast Corp., to Sharon Gillett, Chief, Wireline Bureau, *Preserving the Open Internet*, GN Docket No. 09-191 (Nov. 30, 2010).

[9] William B. Norton, *Internet Service Providers and Peering*, *available at* www.nanog.org/papers/isp.peering.doc.

[10] The Open Technology Initiative has raised concerns about peering and transit arrangements several times in the past to the FCC. The Commission should investigate these arrangements not only because they present an opportunity for anticompetitive abuse, but also because they are critical to promoting broadband competition, rural deployment, and public safety goals. Most recently, the Open Technology Initiative raised these issues with the Commission in a pair of meetings on January 19, 2010, with the staff of the Omnibus Broadband Initiative and with the Commission's Wireline Competition Bureau. OTI raised these concerns again at a meeting with Edward Lazarus, Chief of Staff to Chairman Julius Genachowski, on July 26, 2010. *See* Letter from Sascha D. Meinrath, Director, Open Technology Initiative, New America Foundation, to Marlene Dortch, Secretary, FCC, *Framework for Broadband Internet Service*, GN Docket No. 10-127; *Preserving the Open Internet*, GN Docket No. 09-191; *Broadband Industry*

Without oversight, this peering framework could become a new means by which dominant market players utilize their position to squelch both competition and innovation. Both the FCC and Department of Justice must act proactively to ensure that peering is conducted in a transparent and equitable manner, and to prevent peering from becoming a means to discriminate against legal services, applications, and content.

Sincerely,

Benjamin Lennett
James Losey
Sascha Meinrath
Open Technology Initiative
New America Foundation

Tyrone Brown
Media Access Project

S. Derek Turner
Free Press

Practices, WC Docket No. 07-52 (Aug. 2, 2010); Letter from Matthew F. Wood, Associate Director, Media Access Project, to Marlene Dortch, Secretary, FCC, *Advanced Telecommunications Inquiry*, GN Docket No. 09-137; *A National Broadband Plan for Our Future*, GN Docket No. 09-51; *Broadband Data Improvement Act*, GN Docket No. 09-47; *Consumer Information and Disclosure*, CG Docket No. 09-158; *Truth-in-Billing and Billing Format*, CC Docket No. 98-170 (Jan. 20, 2010).

Peering problems: digging into the Comcast/Level 3 grudgematch

Is Comcast really trying to wreck the open Internet with a set of new tollbooths? Is Level 3 really trying to browbeat its way to a good deal?

Ever since the Comcast/Level 3 interconnection dispute broke wide open into public view last week, the accusations from both sides have been flying. Sorting out those accusations has been difficult, in part because it was just so hard to know, on a technical level, what exactly has been going on.

Peering and transit issues can be notoriously complex but also murky, the details hidden behind nondisclosure agreements. As the 2009 Annual Report (PDF) from the ATLAS Internet Observatory put it, such deals are "difficult to quantify due to NDA/commercial privacy."

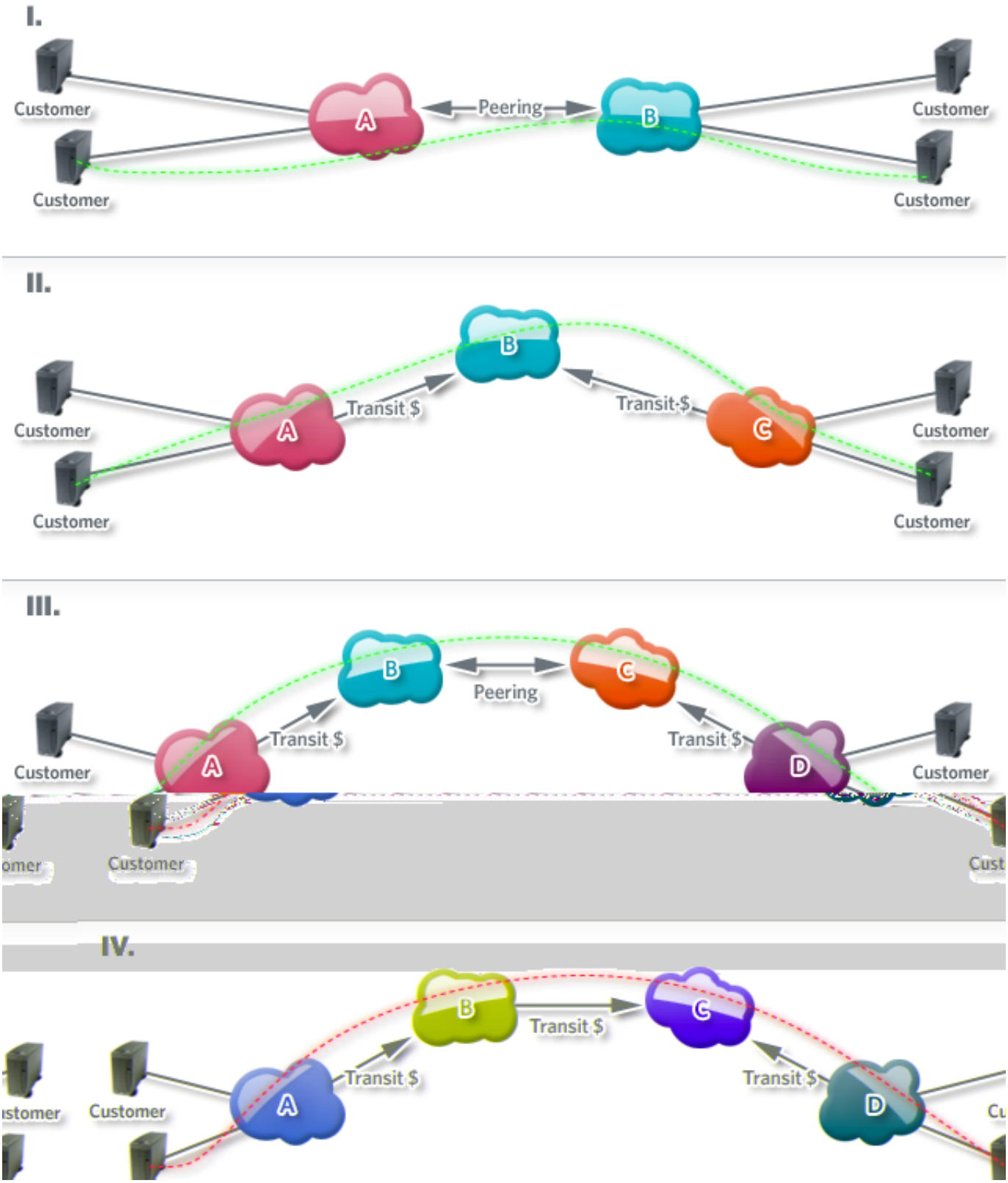
One upside of the dispute is that some of this secrecy has been lifted, and both sides have been unusually open with the press and with regulators about how they interact and what they believe to be at stake. If Level 3 is right, Comcast is trying to do nothing less than turn every Tier 1 network in the US into its customer, rather than the other way round. The result: a fundamental shift in network economics, and the beginning of an era in which the major ISPs start throwing their weight around, making it almost impossible for content companies to reach customers without paying each ISP an additional fee for direct network access. In this view, it's no coincidence that the big ISPs like Comcast, Verizon, and AT&T all operate content businesses of their own, including cable TV, video on demand, and IPTV.

If Comcast is right, Level 3 simply got in over its head and offered cut-rate pricing to Netflix in order to deliver the company's streaming video; now it needs to secure an unbelievable deal in order make the number work.

More fundamentally, the entire controversy is a reminder that there are no hard-and-fast rules about network interconnection; indeed, the increasingly complex nature of these interconnection deals means that it's not always clear, even to the participants, who should be paying whom. Traffic flows alone don't tell the story; it's all about perceived value. Now that "eyeball" networks like Comcast and "content" networks like Level 3 or Akamai have established deeply asymmetrical connections and traffic is

often out of balance, should the content networks pay? As a 2008 paper from MIT and Akamai noted, "The question of who should pay whom to recover the costs of supporting that interconnection is ambiguous in this asymmetric world."

There's no better public example of that ambiguity than the Level 3/Comcast mudfight.



It's complicated: a variety of ways that two networks can connect

Some background

Prior to this dispute, Comcast and Level 3 had a longstanding, two-part relationship: they exchanged both free and paid traffic. Because Level 3 operates an Internet backbone, Comcast paid the company for true Internet "transit"—getting access to all the other networks with which Comcast had no direct interconnection. If a Comcast customer entered bbc.co.uk into her browser, for instance, that request could pass over Level 3's network and would be routed to the BBC's computers; traffic from the BBC could return on the same path. To make this work, Level 3 and Comcast had direct port-to-port network connections at various locations in the US.

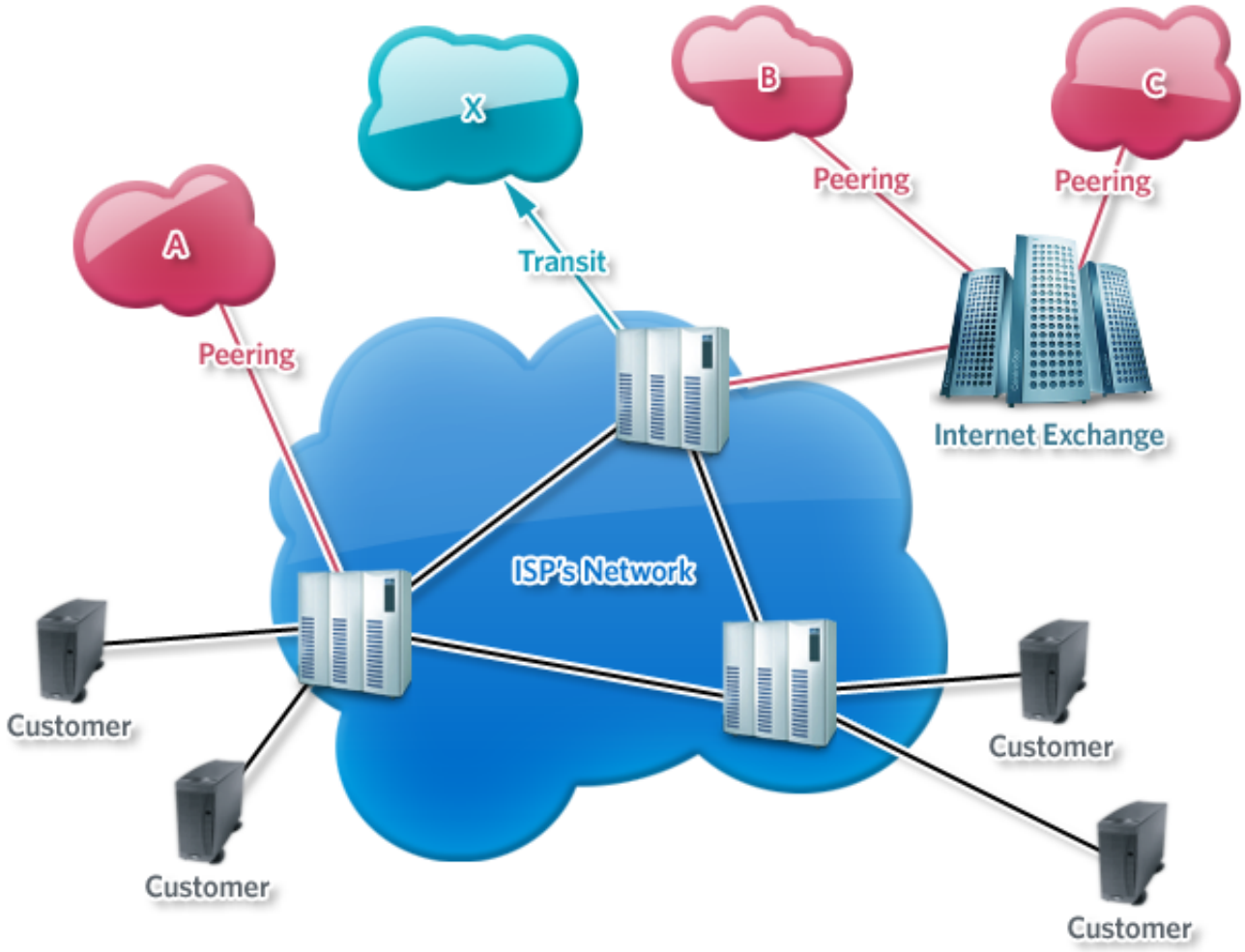
But not all of the traffic passing across these connections was paid transit. Level 3 also operates a content delivery network (CDN) to provide cached (and therefore faster) access to streaming video and other content. If a Comcast customer tried to watch one of these videos, that request would then go to Level 3's network and would terminate there. The video that was returned would be handed to Comcast, and would be sent on to the user who requested it without leaving the network.

These two kinds of traffic ("on-net" and "off-net") were treated differently, even though they passed over the same interconnection points. Comcast paid Level 3 for off-net transit traffic, but Level 3 and Comcast exchanged on-net traffic without charging one another (called "settlement-free peering").

Who paid for the delivery of all this on-net traffic, then? The customers. In Level 3's case, this means that CDN customers like Netflix would pay Level 3, while Comcast's cable modem subscribers would pay Comcast. Very simple, very clean, and according to Level 3 now, this is the way the Internet *should be* connected.

But after winning the Netflix deal this autumn, Level 3 suddenly wanted to pass far more traffic over its links with Comcast. Comcast balked; Level 3 suddenly looked less like a transit vendor and more like a CDN. Comcast began talking about the imbalance in the two companies' traffic ratios and then demanded a fee from Level 3 for the traffic being dumped onto its network. (Indeed, Comcast's public peering

policy states, "Applicant must maintain a traffic scale between its network and Comcast that enables a general balance of inbound versus outbound traffic.")



ISPs connect to other networks in numerous ways

Comcast says that it didn't have the necessary 10 GigE ports available to meet's Level 3's demand, though it managed to dig up "customer" ports it could charge Level 3 to use. But Level 3 had never been a "customer" of Comcast before; the relationship had always been the other way round. Now, Comcast claimed that, due the traffic imbalance between the two, Level 3 had to become both a transit vendor and a paid peering customer.

Level 3 objected, arguing that it wasn't increasing Comcast's costs with the extra traffic. The company tells me that it actually offered to give the necessary hardware to Comcast (at around $50,000 per port) and that it offered to do "cold-potato" routing deep into Comcast's network, dropping off streaming traffic near the customers who requested it, for instance. This would save Comcast money, since the cable giant

wouldn't have to sling this streaming traffic across the country on its own network. Comcast said that wasn't good enough; it wanted cash.

Level 3 felt trapped. It could "just take it" or it could "take it and complain," the company's legal counsel John Ryan told me. It chose the latter.

"It's not about the money that we're now being forced to pay Comcast," he added. It's about the precedent.. and what it might have to pay in the future.

Routing around Comcast?

Like every ISP, Comcast has a monopoly on access to its subscribers, called a "terminating access monopoly." That is, there's no other way to reach those subscribers except to pass through the ISP's last-mile network—and to do so on the ISP's terms. Terminating access monopolies don't necessarily pose problems, but the *potential* for problems is there. This monopoly is at the heart of the Level 3/Comcast dispute that erupted into public last week, when Level 3 accused the cable giant of erecting new "tollbooths" on the Internet.

If Netflix wants to use a CDN, it has several excellent choices, including Level 3, LimeLight, and Akamai. If Comcast needs to buy transit, it can do so from several excellent providers (and in fact Comcast uses more than one transit link already, including both Level 3 and Tata). And despite too-limited competition, many US Internet users still have at least two options for buying access. But when Netflix and Level 3 need to reach Comcast customers, they have a single option—Comcast.

As Level 3 put it in a lengthy document released last week:

> There is vigorous and active competition among Internet backbone providers. It is very easy for one Internet backbone to send its traffic across any number of other Internet backbones. It's a little like driving across the US. There are many routes you can choose to get from one city to another.
>
> Unlike the Internet backbone, there is limited competition when it comes to Internet access at the home or business. The local access connections are generally dominated by two providers: the local phone company and the local cable company. Both sets of companies generally developed their dominant positions by virtue of exclusive government franchises that protected them from competition. While Comcast and others talk about

> theoretical competition from broadband cellular or broadband over power line, for almost all Americans, broadband to the home means service from either the cable or phone company. Anyone who believes that broadband wireless is a substitute for the broadband access services provided by cable and phone companies should try connecting their cell phone to their TV to try to watch an online movie or TV show...
>
> Unlike "peering" in the Internet backbone, where competition abounds and prices have been declining steadily, Internet carriers that have content requested by Comcast subscribers have no choice but to exchange traffic with Comcast. Comcast is using this dominant position to demand payment for traffic delivered at its customers' requests. You simply cannot "route around" Comcast to provide requested content to Comcast's subscribers.

This last bit, about "routing around" Comcast, is of course true, though Level 3 does make it sound like it must agree to Comcast's fees in order to get its CDN traffic onto Comcast's network. This isn't quite accurate, though it may be a functional requirement for a CDN. As Time Warner put it last week when it came to Comcast's defense, "regardless of whether two Network Operators reach an agreement, end users will still be able to receive any data or content they wish to reach as that traffic will find an alternate route over other available interconnecting networks." Comcast does maintain transit links that all non-interconnected networks can use to reach Comcast subscribers, and Level 3 could use these without striking a Comcast deal.

Still, most serious content owners bypass transit in favor or directly-connected CDNs. Why? Transit links don't always put content close to subscribers, for one thing, but they can also be heavily congested and offer a poor experience for the sustained throughput needed for (say) streaming video.

Some charge that Comcast keeps its transit ports jammed up on purpose, in order to force deep-pocketed content providers to interconnect directly on Comcast's terms. That's the contention of people like Voxel's Adam Rothschild, who wrote on his blog last week:

> As was the case with Level 3, Comcast purchases commodity IP transit service from Tata, as a means of reaching networks it doesn't maintain direct peering relationships with. Unlike Level 3 though, Comcast runs its ports to Tata at capacity, deliberately, as a means of degrading connectivity to

networks which won't peer with them or pay them money.

> Speaking off the record and respecting customer confidentiality, a Tata executive confirms, succinctly: "[our] San Jose and New York links with Comcast are running full."

Comcast insists that transit remains useful. As VP Joe Waz put it this week, "Every provider—including Level 3, right at this very moment—has the option of sending traffic to Comcast by using one of the many transit provider networks that are available. Indeed, some of Level 3's competitors do exactly that—they interconnect with us for some traffic, and they send traffic to us through other 'transit' providers as well. Because the Internet is an interconnected network of networks, there are literally hundreds of ways for traffic to get from any source to our network, through providers with whom we have all different kinds of relationships."

But the odd thing about this statement is that, if Level 3 decided just to send all its traffic over transit instead, it would cost Comcast money. Peering is much cheaper than transit, which is a key reason peering arose in the first place. As one of our own writers, who has extensive experience with Internet routing, put it to me, "Forcing traffic over transit that Level 3 is happy to deliver locally over peering means that Comcast is being disingenuous in some way. It costs them more money and it delivers worse service to their customers. You only do that to make a point. Normally, you have transit to reach destinations that you can't reach over peering."

And what point would that be? Why, that ISPs are players in the game. The 2008 paper mentioned above includes a helpful chart about what companies might be willing to peer with one another in the brave new world in which we find ourselves; as the chart below shows, Comcast will be less willing to do free peering with a CDN like Level 3, though Level 3 will of course want free peering with Comcast.

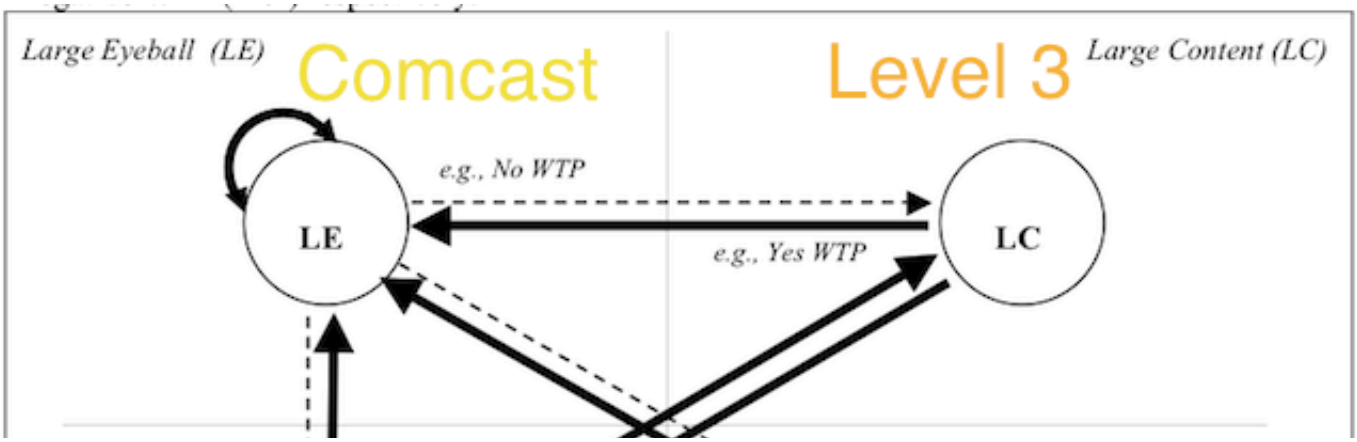


Figure 1: Willingness to Peer (WTP) Incentives

Source: "Complexity of Internet Interconnections" (named added)

The reason: "[Large eyeball networks] believe they have bargaining power over content providers, large and small, under the assumption that eyeball customers are less vulnerable to switching to another access provider than are [content networks]." Netflix can and will go elsewhere in a moment, but Bill Shoomkin of Schaumburg won't drop Comcast over these business disputes that don't concern him.

In other words, ISPs with eyeballs want to monetize those eyeballs. But why is Level 3 complaining about it?

A new world

In large part, the complaint comes because the practice of "paid peering" is relatively new, and Level 3 wants to prevent such fees from becoming the new norm. Some of my own sources in the industry indicate that Comcast has become well-known in the last few years for its aggressive approach to interconnection, and for trying to charge CDNs who want such a direct connection. Indeed, Comcast last week indicated that its Level 3 charges weren't an anomaly and that other CDNs had already paid up.

But Level 3 says that the charges are a dangerous outlier. The company's backbone is one of the world's largest, so it connects to plenty of other networks; still, Level 3 tells me that this is the first time it has been charged simply to access another network—that is, charged to deliver the content requested by that network's users. Other CDNs may well pay the fees, though John Ryan expressed near disbelief that any are paying just for *access* to Comcast's customers. Instead, they may be paying for transit, routing their traffic across the country to get it where it's needed, or paying ISPs to take on this data hauling themselves. But Level 3 has a huge fiber footprint in the US; it can localize its CDN traffic and dump it at regional Comcast connection points, so it

doesn't need transit services.

Level 3 is also willing to pay something for interconnection to compensate other networks for more ports or backhaul or other infrastructure. But what it will do only under public protest is pay ongoing fees simply for delivering on-net traffic—that is, for access—traffic ratios be damned. Ryan, clearly not feeling well disposed toward Comcast at the moment, suspects the company would still try to charge him even if he delivered traffic right to every user's local node.

You aren't my peer

Comcast insists the such upfront infrastructure payments aren't enough, and it has much to say about out-of-balance traffic ratios; that is, Level 3 is dumping far more traffic onto Comcast than Comcast sends to Level 3. As Comcast's Joe Waz put it this week:

> When Level 3 has been—in its own words—"one of the top two global Internet backbones in the world" and a provider of "high speed access to larger enterprises," it presumably transported a roughly equal balance of traffic in both directions (between different networks and to and from its own enterprise customers) consistent with industry peering practices. But since CDNs typically send far more traffic than they receive, Level 3 suddenly finds itself in a different business—one in which its new job will consist almost entirely of sending traffic to other networks. That's it in a nutshell—Level 3 wants to change its business, and therefore it wants to change the entire global framework of peering relationships to suit its needs. Now that Level 3 realizes it might for the first time be at the sending side of a traffic imbalance, it has decided that the rules of the game are all wrong. What a surprise.

Level 3, of course, says that it's Comcast who wants to change the rules of the game. While "peering" agreements are usually made only in cases where traffic ratios are roughly equal (less than 2:1, in most cases), Level 3 doesn't seem to think that it "peers" with Comcast at all, at least not in the old sense. What we have here is a failure to communicate, or even to agree on definitions.

Peering is a form of interconnection, traditionally used to describe Internet backbones that exchanged traffic without payment, but now used more broadly to talk about any

two networks that directly connect, whether or not fees are paid. In this case, Level 3 wants to dump most of its content onto Comcast at the request of Comcast's residential subscribers. It complains that Comcast wants to "apply a traditional backbone 'peering' concept to this dispute" in order to use the traffic ratios issue to basically mint money.

As for those ratios, Level 3 says they're a relic of an older world. In the new world, they will *necessarily* be out of balance at least when it comes to Comcast's residential customers; they are on asymmetrical pipes that privilege downloading, and it takes only a tiny bit of data to request a massive video stream. Comcast says that, with Level 3's addition of Netflix in the new year, the traffic ratios will be as high as 5:1. The question is whether this matters. Every CDN operation will have such imbalances thanks to the traffic being delivered, and they all want direct connections to Comcast. If Comcast charges for these connections as though they are backbone peering agreements, what happens as video quality on the 'Net climbs and ratios grow ever more lopsided? If in the future Level 3 sends 50x more traffic to Comcast than it does now, will it have to pay 50x what Comcast wants now?

The issue of ratios and cost is a tricky one. As we noted in our 2008 guide to peering and transit:

> It's a common misconception that the benefit an ISP derives from peering depends upon the direction of the flow of traffic. According to this way of thinking, if YouTube peers with an ISP, this benefits YouTube more than it does the ISP (since YouTube sends so much data but receives comparatively little). But in practice, the flow of traffic is not an issue for an interconnect. Whether it goes to or from the network, companies still need the same Cisco equipment.
>
> In practice, it is actually quite likely that the ISP side of an ISP-YouTube relationship would see the greatest savings both in absolute costs and as a percentage of total traffic costs. Most ISPs have less traffic (and buy less transit) than YouTube and its parent Google have. Their buying power therefore is less than that of YouTube/Google, so their price per Mbps/month for transit is likely to be higher. Given that the amount of traffic saved from transit is by definition equal for both YouTube and the ISP, it follows that the ISP is saving more money.

Given this situation, Level 3 essentially wants an end to paid peering—at least in

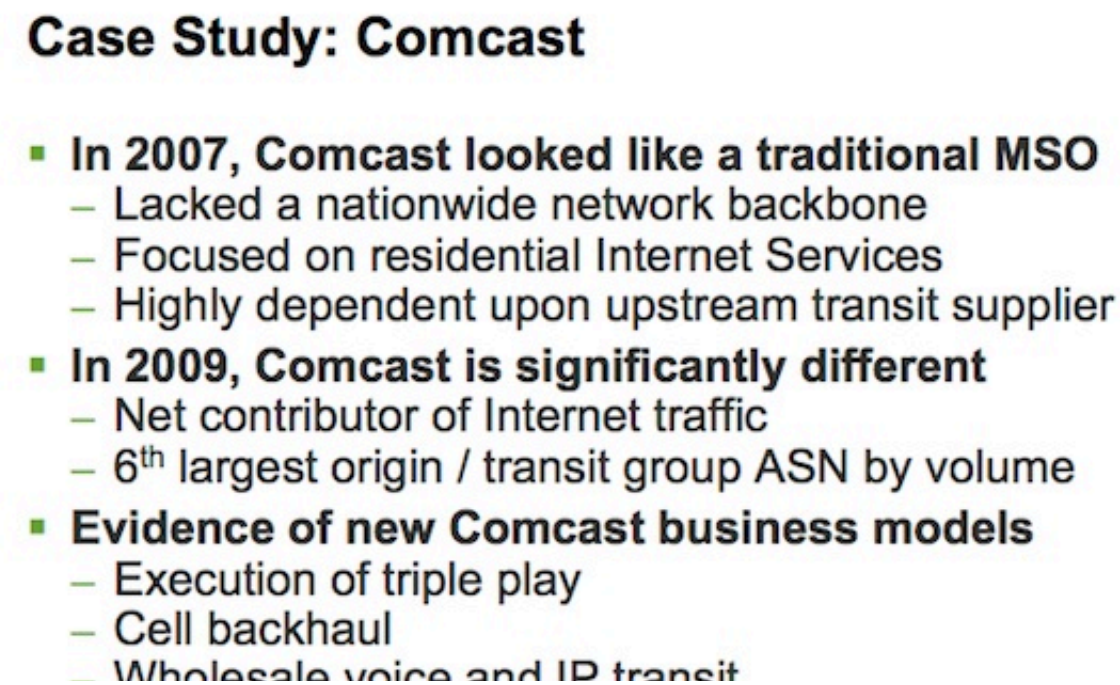
situations where the CDN can deliver content locally.

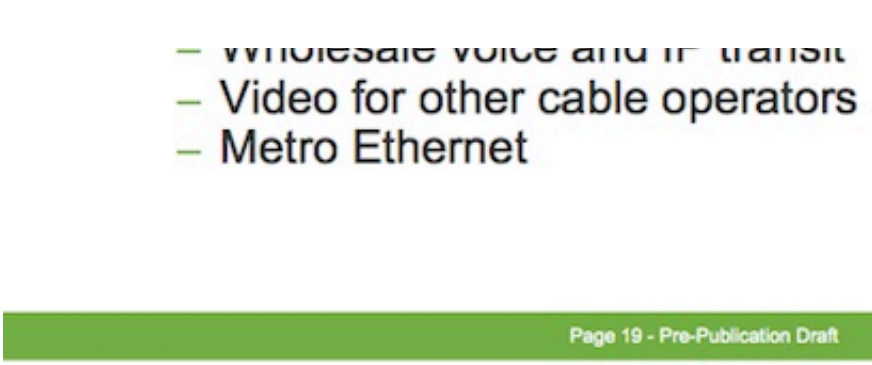
As Level 3 put it in (yet another) press release, "We said in 2005, and still say today, that simple traffic ratios are only one indicator of the additional capacity that IP backbone providers must install as customer traffic grows... The capacity that Level 3 and Comcast must add to their respective IP backbones is determined by the distance each company carries the traffic. When IP backbone companies have a dispute, it is fundamentally about this issue... Level 3 has and continues to offer to use its own IP backbone to carry content right to the edge of the Comcast local Internet access markets where the substantial majority of Comcast's customers reside."

Complications

In my misguided youth, I spent a year as a chemistry major. This year largely consisted of learning about concepts that, it was made clear, weren't strictly accurate; they were simplifications to help us grasp fundamental ideas, but the true mind-blowing reality would have to wait for upper-level courses.

In the same way, everything we've been saying above is something of a simplification. For instance, Comcast isn't just a provider a home broadband services. In the last three years, the company has moved beyond its cable roots to establish a major presence as an Internet backbone and to sell wholesale connectivity and transit service to other networks. Indeed, a recent presentation to the North American Network Operator' Group (NANOG) shows just how much Comcast has changed since 2007.





As for Level 3, it has also changed in the last few years, growing beyond the Internet backbone business to become a CDN player as well. Thus, it's a bit simplified to envision both companies using easy categories like "access network" and "backbone network," with the result that key questions have become murkier. Who is a "customer" of whom? When do two networks "peer," and do the old conditions for peering still hold? Which network needs the other network more?

As Comcast put it earlier this week:

> Level 3 desperately wants to define Comcast as mainly an 'access' network, but that's like saying a baseball team is mainly the catcher. Comcast operates a nationwide multi-service high speed network with residential, business, and wholesale customers, and its operations include a very robust backbone network. Neither Level 3 nor Comcast serve only end-user 'eyeballs.' We have a range of commercial customers who use Comcast's network for transit across the Internet, including video content providers, Content Delivery Networks, software companies, Web hosters, universities, town offices, local schools, smaller MSOs [cable companies], and others. Indeed, Comcast and Level 3 are comparable networks with comparable costs…
>
> Does some provider, somewhere down the line, have to interconnect with Comcast, to get traffic to a Comcast customer? Sure. But it is equally true that if you want to reach one of Level 3's enterprise customers, you have to work through your own or a third party's direct interconnection with Level 3. In other words: there's no difference.

Comcast takes the terminating access monopoly argument and turns it on its head, saying that Level 3 has customers over whom it exerts the same kind of control. In other words, this is just a business dispute.

Shine a light

Level 3 had made it something more, however.

"We're not maniacal or extremist about what's good business," says Level 3's Ryan, adding that his company hasn't "invoked the regulatory process frequently or lightly" in the past. But it's doing so now, throwing bombs in the networking community and trying to drag the FCC into the case. To date, Level 3 tells me it has spoken with the head of the FCC's Wireline Competition Bureau (as has Comcast). It has sought a discussion with FCC Chairman Julius Genachowski and the other commissioners. And it has gone to Congress, speaking with various members and their staffers.

Would more transparency around interconnection head off this sort of situation? Probably not—just look at this dispute, in which the parties have gone into truly unusual levels of detail about their operations and economic arrangements. At bottom, the two sides contend that the other is trying to change long-established norms for interconnection, or that those old norms no longer apply in a changed world.

Level 3 insists that CDNs who can bring their traffic to Comcast's virtual door shouldn't pay for mere network access. Comcast insists that they should, regardless of who requested that traffic or where it's going; if CDNs don't want to pay, they're welcome to use the "open Internet" by coming in through transit links.

Not coincidentally, each position would be financially good for the company making the argument.

Peering Disputes: Comcast, Level 3, and You

Coverage So Far

A number of folk have asked me why Level 3 and Comcast have been generating so much media attention over the past few days, and ultimately what this means for their hosting operations.

So, what's going on? Unfortunately, in a sea of rubbish, with authors ranging from Wall Street analysts to K Street lobbyists, it's difficult to find an accurate and objective accounting of what actually took place. For starters, I'd refer straight to the sources, which touch on why Level 3 and Comcast are unhappy with one another:

Level 3 Press Release: http://www.level3.com/index.cfm?pageID=491&PR=962

Level 3 Clarification: http://www.level3.com/index.cfm?pageID=491&PR=963

Comcast's rebuttals: http://blog.comcast.com/

Another good read is Dan Golding's GigaOM post (http://gigaom.com/2010/12/01/comcast-level-3-battle/). (While we disagree on several key points, it is nonetheless refreshing to read an analysis written by an author who's served his time in the trenches, and is a subject-matter expert on both the economics and technology in play.)

Game-Changers

In the absence of any real facts, one thing which *is* clear is that *both* Level 3 and Comcast grew their businesses in bold new directions, taking shortcuts and ignoring best-practices along the way.

In one corner, we have Comcast, freed from the shackles of AT&T as its sole provider, now aggressively attempting to establish itself as not merely an access provider, but a wholesale ISP which content hosters and smaller backbones might buy from. In doing so, Comcast took several key missteps, including treating "peering" as a profit center from practically day one. Where other access providers would be content with merely the "settlement free" exchange of traffic – an arrangement where both content originators and recipients exchange traffic at no cost, both avoiding having to pay a middleman to carry their bits – Comcast has made it clear it wants to collect money

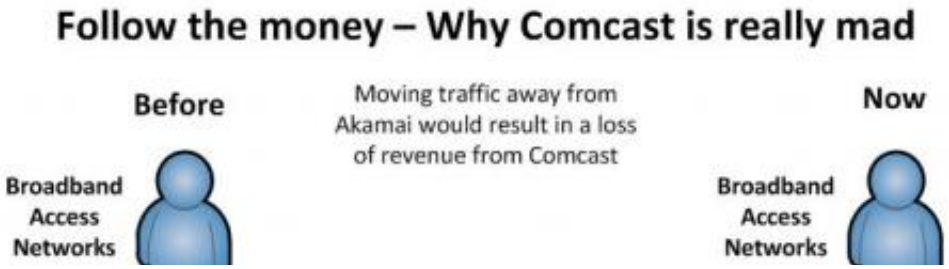
anywhere and everywhere possible. It would seem Comcast has again upped the ante, this time attempting the ultimate *chutzpah* of charging back its *vendors* for the "privilege" of servicing them. (Indeed, I'm a bit jealous I can't do this right now, though I'll certainly try with our next round of renewals.)

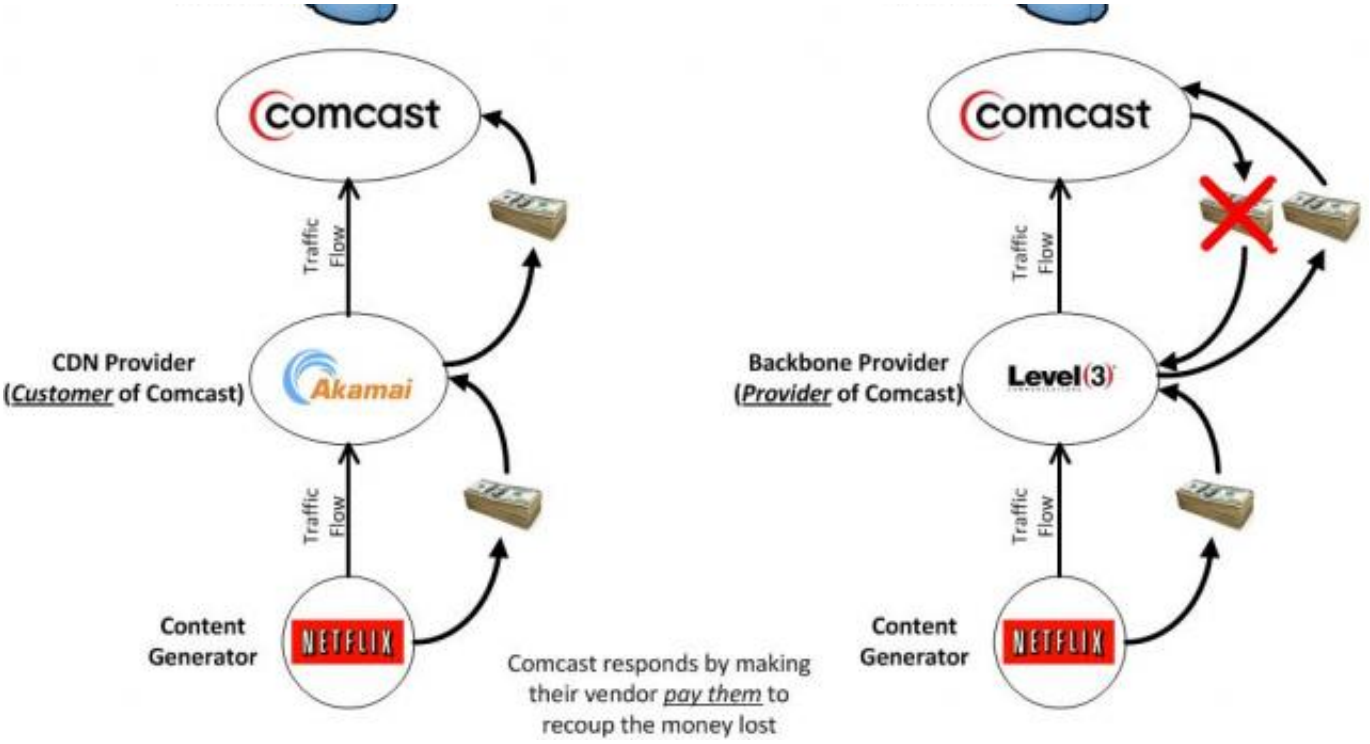
In the other corner, we have the financially-challenged Level 3, who's re-invented itself once again (as seems to happen once a year), shifting a lot of sales focus from wholesale IP transit and infrastructure to CDN. Though they arrived late to the game, they're coming on strong, targeting major content generators with cut-rate pricing. This is significant as Level 3 holds many large cable and DSL providers as its *customers*, and is effectively billing them for this new broadband-subscriber-bound traffic, as normal provider-customer relationships dictate. I can certainly sympathize with access providers trying to capacity plan around this influx of traffic. On a purely contractual basis, I'm sure what Level 3 is doing is on the up-and-up. No evidence points to traffic being "stolen"; likewise "peering contracts" were not "broken", as they didn't exist in the first place. Nonetheless, they certainly could have provided the operational community some additional forewarning, or perhaps built their CDN as a network autonomous to the Level 3 backbone, maintaining an open peering policy and seeking out access networks to exchange traffic with at no cost.

It's important to realize that, with the exception of Comcast, every major US cable operator maintains *settlement-free* peering relations with regional service providers, CDNs, and large websites. (This is not to say they'll peer with any network off the street, however peering policies exist to set a fair bar – for instance to make sure that the party they're dealing with is professionally staffed and can route to them intelligently – not to discriminate against certain business models outright.)

It's all about the "Benjamins"

What's ultimately under fire are simple economics, and how a jilted Comcast is trying to recover lost revenue. And who can blame them? A backbone provider sent me a diagram used to educate its costumers on the real issue:





Fairness

In their filings, Comcast states repeatedly that major CDNs, specifically Limelight and Akamai, are paying Comcast for access to its customers. What they fail to state is that both companies lead the industry with their fair peering policies and massive exchange presences:

Akamai peering: http://www.akamai.com/peering/

LLNW peering: http://login.llnw.net/noauth/peering.cgi

Why, then, are they ponying up cash? Given a choice, I have little doubt both organizations would have entered into a settlement-free relationship with Comcast, as precedent dictates. I'm sure they don't consider it right that they pay Comcast to deliver traffic – rather, they agreed to it under protest, as it's the only viable way to serve their content at scale. Captive eyeballs and extortion or not (more on this point later!), CDN is a competitive market: Akamai and Limelight are paid by their customers to deliver traffic; if these bits get discarded, customers will move their business elsewhere. If they had the luxury of time, these organizations might have gone to the regulators; unfortunately content has a habit of moving rapidly between providers and contracts.

As additional facts are revealed, I'd be very curious to see the term sheets and sales

orders companies like Akamai and Limelight signed with Comcast.

It's not about the ratios!

In an attempt to explain the issues, Comcast released a video of networking head honcho John Schanz discussing traffic ratios, disingenuously:

http://blog.comcast.com/2010/11/how-internet-peering-works.html

Traffic ratios date back to the days of "tier 1" telecom behemoths as major traffic sources, route miles, and hauling bits around the country to get between points "A" and "B". On a modern-day Internet , they are often cited as an excuse for denying peering where it might actually make business or technical sense. This is especially poignant in the frame of content-access negotiations – access providers are collocated at major carrier hotel locations; whether they absorb content from a free peer or paid-for transit connection, the routes and costs for hauling this traffic back to their broadband subscribers *remain the same*.

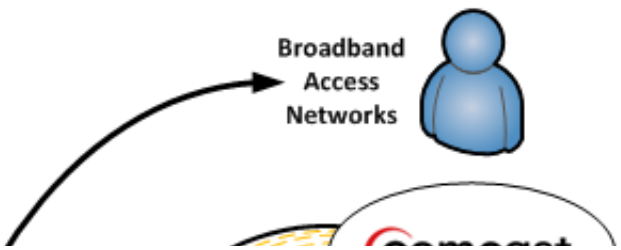
The Tata Problem

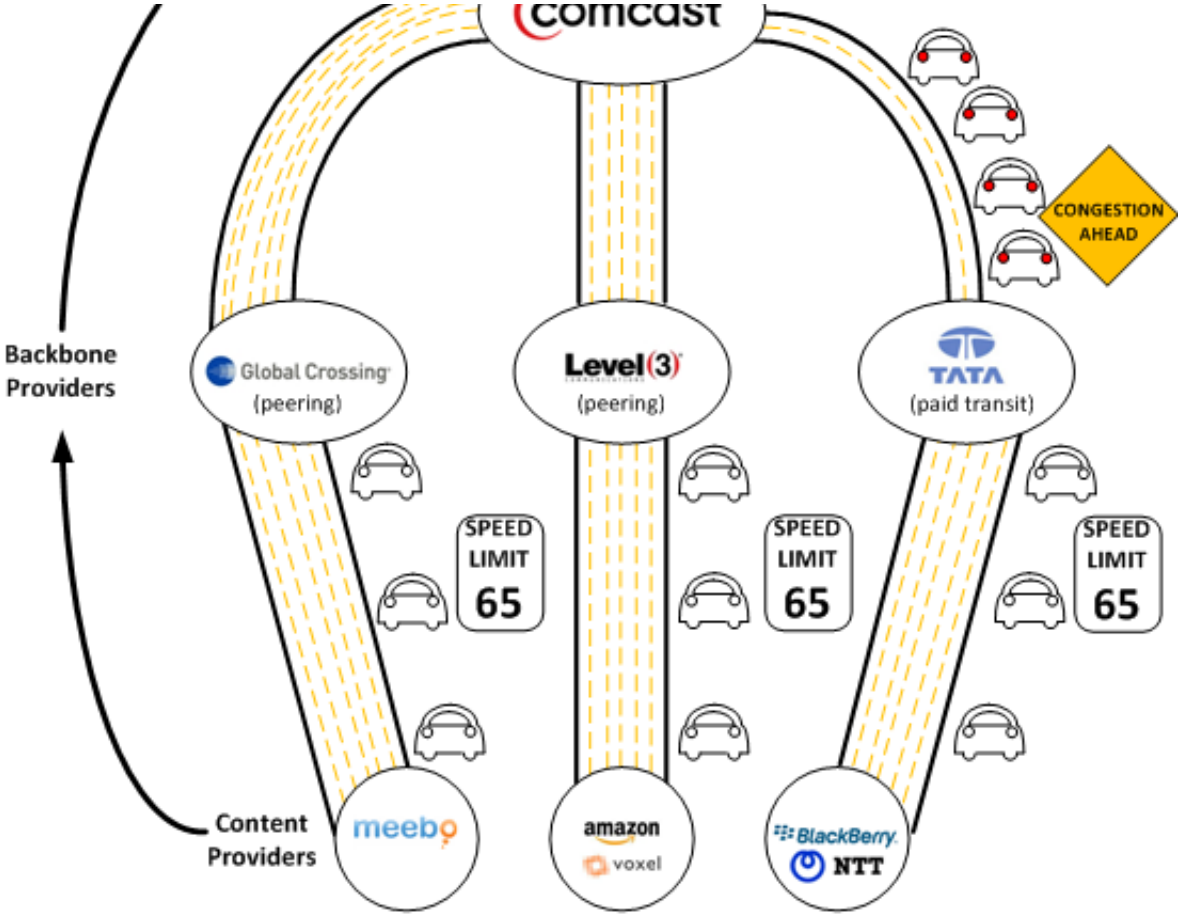
Amidst all the talk of foul play with Level 3, little attention has surrounded Comcast's relationship with Tata Communications, which I consider to be a far more egregious violation of their stated principles on Net Neutrality. As was the case with Level 3, Comcast purchases commodity IP transit service from Tata, as a means of reaching networks it doesn't maintain direct peering relationships with. Unlike Level 3 though, Comcast runs its ports to Tata at capacity, *deliberately*, as a means of degrading connectivity to networks which won't peer with them or pay them money.

Speaking off the record and respecting customer confidentiality, a Tata executive confirms, succinctly:

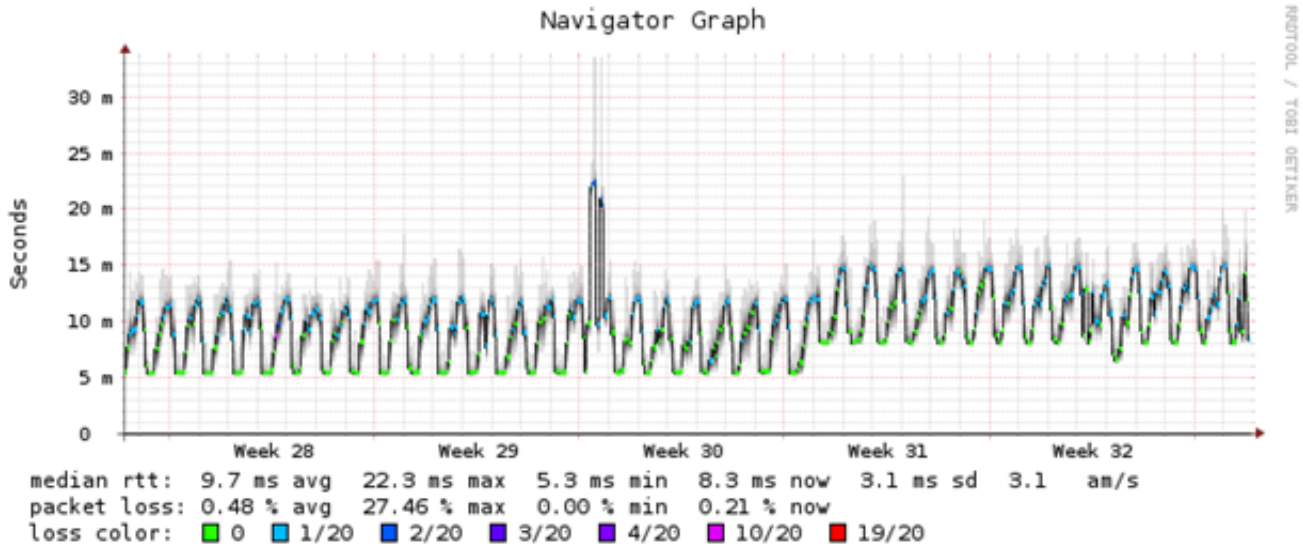
"[our] San Jose and New York links with Comcast are running full."

One might explain the situation with Tata to their customers using a diagram like this:

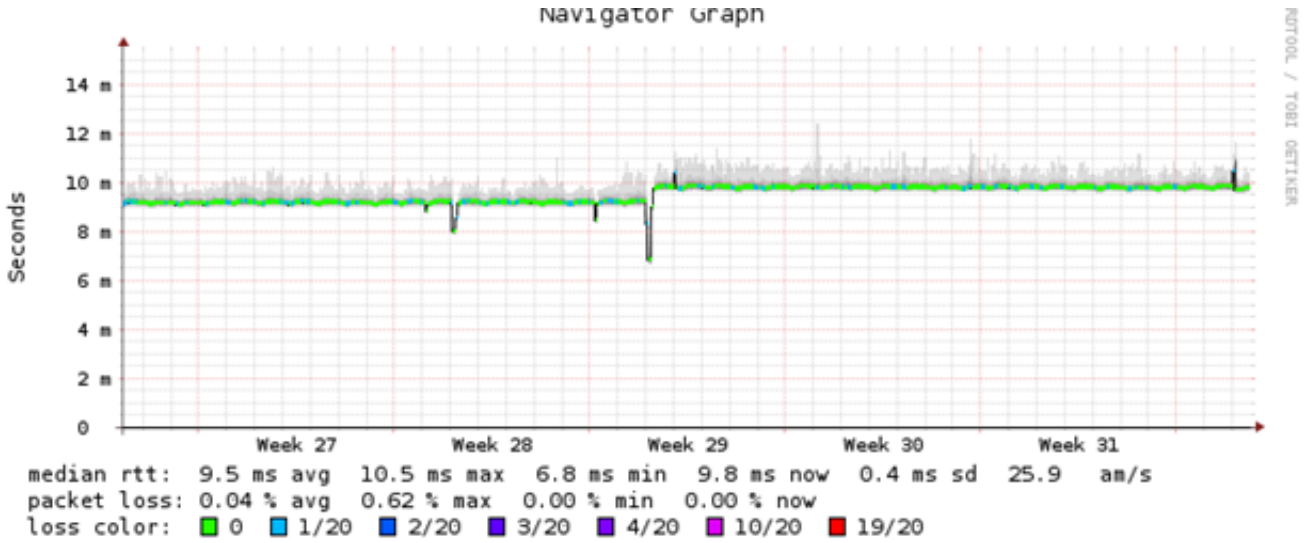




Indeed, testing reachability to Comcast eyeballs over Tata, we see loss statistics like this:



Given the high packet loss at certain times (likely corresponding to when these interfaces are saturated), serving even simple HTTP content is clearly not sustainable. In contrast, entering the Comcast network by way of Level 3, things look a lot better:



Perhaps Mr. Schanz could explain on the whiteboard why one need not worry, however a better course of action would be to simply purchase more capacity, through Tata and/or another provider. No stranger to Internet peering, Richard Steenbergen (CTO, nLayer) explains further:

"The true power of Comcast isn't in the size or scope of its network, it's in the captivity of its customer base.

If Level 3 turned off Comcast for refusing to pay their contractually obligated transit bills, the traffic would be forced through massively congested Tata transit ports, and a huge number of Level 3's customers would take their business elsewhere as a result. If Comcast intentionally congests its transit providers and provides terrible service to its end users, which it has been doing for several months now, most of those users have no real alternatives to switch to.

In other words, content is mobile, eyeballs are not. Comcast realizes that they can (ab)use their captive eyeballs to force content to pay them for access, without having to create a "100% down" partition like Cogent has done in the past. For a Netflix customer, 20% packet loss is effectively just as down as a hard partition.

[…] while it should be every network's right to choose who they do and don't peer with, or buy transit from, things start to get murky when one network is abusing their franchise agreements and near monopoly or duopoly status in many markets. If users had an actual choice, and could get comparable broadband access elsewhere, then Comcast would be free to congest their network however they see fit. But that isn't the case, and this is where government involvement and Net Neutrality start to have legitimate grievances with Comcast's actions."

Regulation and Disclosure

So, how should the FCC and other facets of the Federal Government intervene?

Perhaps at odds with my above criticisms, I believe in the power of the free market, and that networks should be left to negotiate (or not negotiate!) these issues without oversight. Telling network operators where they must or must not connect, and on what terms, is surely a recipe for disaster.

On the other hand, protecting the rights of broadband subscribers is of the utmost importance, given the scarcity of real competition on the last mile. If many Americans don't like the rates their cable providers charge, or the quality of service delivered, they're left to pound sand or downgrade to slow DSL. Just as the FCC is looking to codify "network management" practices on the last mile, I think it's fair to penalize monopoly/duopoly providers who fail to adequately manage their backbone and external capacity.

More immediately, I'm hoping for full disclosure of any commercial proposals and agreements between Level 3 and Comcast. Absent this data in its rawest form, it's impossible to form any intelligent opinions on the specific issues in play. For all we know, Comcast's commercial proposal might be fully reasonable, and limited to some basic cost-recovery of capex costs in router ports or Level3 transit install fees it must now incur on short notice. We just don't know!

Voxel Customer Impact

What does this all mean to your day-to-day hosting operations, as a customer of Voxel? Absolutely nothing, hopefully! The above commentary should serve only to shed light on a hot topic, not to present any grounds for immediate concern.

Voxel purchases a number of Ten Gigabit transit ports from Level 3, which provide a clear path for sending traffic to Comcast and other networks. When these circuits hit high "water marks" for utilization, we order more. Likewise, we carefully monitor for the quality of connectivity between our network and large broadband destinations; the above screenshots are only the tip of the iceberg for analytics. When we encounter a bad route, we engineer around it right away.

Holding our customers hostage, or deliberately saturating connections to prove a point, is at odds with how we do business, and is simply not in the cards.

(Disclaimer: Adam is Voxel's VP of Network Architecture; among his responsibilities are peering and transit strategy. No yellow journalists or Washington lobbyists were harmed in the making of this post.)