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New models and conflicts in the interconnection and delivery of Internet-mediated content

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ABSTRACT

This paper examines the dramatic changes in interconnection and compensation agreements between content providers and carriers resulting from increasing use of the Internet for bandwidth intensive carriage of video. It identifies two emerging models: (1) interconnection and compensation arrangements that increase the total payments to Internet Service Providers ("ISPs") from end users, upstream ISPs and content providers; and (2) strategies by content creators and distributors to achieve congestion-free delivery at the lowest cost.

While supportive of commercially negotiated agreements, the paper suggests that the two emerging models will trigger more disputes as interconnecting parties increasingly lack motivation to cooperate in finding ways to balance traffic flows and instead seek ever increasing compensation. The paper recommends that National Regulatory Authorities require ISPs to engage in transparent network management practices, backed up with reporting requirements that can help identify the causes of congestion and degraded service.

The paper also suggests ways for regulators to resolve disputes between ISPs and content providers that could harm consumers, particularly when retail ISPs, providing the first and last kilometer of service, seek to leverage access to end users by demanding surcharges from upstream carriers and content providers. By creating such a bottleneck, retail ISPs may reduce the value of Internet access subscriptions, or increase costs even when congestion remedies do not require more broadband network capacity. Reporting requirements can provide empirical data for necessary forensic investigations that can determine whether a massive increase in traffic volume has caused congestion, or a carrier has artificially created it by strategic allocation of existing bandwidth and switching capacity.

1. Introduction

Forecasts of media convergence have become a reality as the Internet increasingly provides a single medium for the delivery of information, communication and entertainment ("ICE").[1] As media technologies merge, previously stand alone channels of distribution begin to combine making it questionable whether existing business models and regulatory regimes

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[1] "[O]ne of the most consistent drivers of profound change in the area of cyberspace law has been the convergence of cloud-based products and services with the distribution and consumption of entertainment content. Specifically, the public's relentless desire for access to and consumption of 'any content, anywhere, at any time,' coupled with the widespread proliferation of Internet-connected consumer devices—from the mobile phone, to the tablet, to the Smart TV—has played a substantial role in the marked growth of novel cloud-based products and services" (Schnapp, 2013, p. 1).

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will persist.[2] Already trend setting consumers have begun to abandon pay television subscriptions as they "cut the cord"[3] and access content on their own terms. These early adopters of new technologies and do it yourself strategies consider anathema the traditional concept of "appointment television"[4] where viewers access content at a specific time, on a particular channel and via a single display technology. One can anticipate a future predominated by "cord-nevers" who primarily access content on an ad hoc basis, having never subscribed to a multi-channel package of programming.

Early adopters of new media expect to have near ubiquitous broadband access to content anytime, anywhere, via any device and in any presentation format. Many consumers have no patience with business models that ration content access through a series of display windows that match availability with willingness to pay. For example, movie access traditionally has run a time sequence starting with theatrical presentation and followed by pay per view, DVD sale, premium cable and satellite channel access, DVD rental, broadband download, etc. Many consumers now resort to unlawful strategies that achieve access to pirated premium content via multiple screens soon after initial release. Television sets, computer monitors, smartphone screens and tablets offer much of the content previously made available exclusively via the movie screen, or to only one of the many other mediated screen options.

New media options and convergence have the potential to disrupt the business plans of incumbents, but also challenge established legal, regulatory and policy assumptions. However if finding alternative ways to access desired content results in abandonment of existing subscription options by many consumers, content providers and distributors may slow down or end their experimentation with new distribution technologies.[5] Alternatively they will more aggressively pursue digital rights management ("DRM") techniques to prevent piracy and even fair use (Raymond, 2013; Weiser & Parchomovsky, 2011).[6] In any event, the proliferation of new media access options will require much more coordination between and among the ISPs and the providers and distributors of content at the very time incentives to cooperate have declined.

As the Internet has evolved and diversified, interconnection terms and conditions have changed between ISPs. These carriers experiment with alternatives to conventional models that classify interconnection as either peering,[7] or transiting.[8] The former typically involves interconnection between carriers whose traffic volumes generally match thereby eliminating the need for a transfer of funds. Historically smaller ISPs have paid transit fees to larger ones for the opportunity to secure upstream links throughout the Internet cloud.[9]

With the growing availability of bandwidth intensive content carried via the Internet, traffic volume disparities have increased between ISPs. A new category of ISP has targeted the downstream video content delivery market, all but guaranteeing that these Content Distribution Networks ("CDNs") will have more traffic for which they need to secure delivery to end users than what retail ISPs can or will hand off to them for upstream delivery. Such asymmetry in traffic flows traditionally has forced CDNs to become transit payers even if previously they qualified for zero cost peering (Dr. Peering International, n.d.; Kovacs, 2012; Weller & Woodcock, 2013).

The migration of CDNs from peers to transit payers represents one of many adjustments in interconnection compensation arrangements triggered by vastly increasing total volume of traffic traversing ISP broadband networks and changes in traffic flows between ISPs. Heretofore commercially driven negotiations have managed the transition without resulting in many service disruptions. However it appears increasingly likely that interconnection negotiations will become more contentious and protracted, particularly when retail ISPs demand new or more compensation from sources of bandwidth intensive video content: (1) directly connecting upstream carriers, such as CDNs, or (2) farther upstream to the primary sources of content such as Netflix and YouTube.

[2] "The [Internet] cloud's appeal is its flexibility. Using the government as a source of norms in the early stage of the technology's development will not only moot this flexibility, but will also have the effect of locking the technology in at its current state. A government-centric regulatory model in cloud computing is inadvisable, as government is not sufficiently responsive to keep pace with the rapid manner in which technology evolves. Consumers will be the ones to shoulder the burdens of the cost of regulations made in ignorance of the technology's full potential" (Celestine, 2013, p. 158). "With the convergence of these various technologies—for instance, Voice Over Internet Protocol competing with circuit-switched telephony or Internet Protocol Television competing with broadcast and cable—[medium specific]… silo approach to regulation makes less sense today" (Ohlhausena, 2013, unpaginated).

[3] Incumbent multichannel video program distributors ("MVPD") "benefit from the current concentrated market larding them with high profits while they fail to compete or innovate. They have long feared some users would 'cut the cord' on pay-television by canceling their MVPD subscription, deciding, instead to choose a potentially competitive 'virtual MVPD' providing video content through the Internet" (Ammori, 2010, p. 378).

[4] "A secular trend toward narrowcasting has intensified on the web, as more individuals forsake appointment television for the 'long tail' of online content" (Pasquale, 2010, p. 10).

[5] "Many programmers—including both broadcast programmers and non-broadcast programmers—have increasingly begun to circle the wagons with incumbent MVPDs, concluding that they too are better off with a cut of the MVPDs' supra-competitive profits than with the potential wild-west competition enabled by the Internet" (Ammori, 2010, p. 378).

[6] Fair use refers to the lawful, but unapproved use of copyrighted content. In the balance between rewarding innovation and promoting access to content, fair use provides opportunities for limited and conditional access to content without securing and paying for a license when such use serves the public interest and causes little or no financial harm to the creator.

[7] Peering refers to a barter arrangement for traffic exchange where two Internet Service Providers agree to accept traffic from the other on without the transfer of funds. The carriers agree to a settlement-free arrangement, because traffic volumes generally match.

[8] Transiting refers to an exchange of traffic that triggers a financial settlement and transfer of funds. This arrangement typically results when a small carrier needs the services of a larger carrier to reach all Internet carriers and end users.

[9] The Internet cloud refers to the vast array of interconnected networks that make up the Internet and provide users with seamless connectivity to these networks and the content available via these networks. "The increasing functionality of the Internet is decreasing the role of the personal computer. This shift is being led by the growth of "cloud computing"—the ability to run applications and store data on a service provider's computers over the Internet, rather than on a person's desktop computer" (Robison, 2010, p. 1199).

Content providers have publicly protested having to make such payments (Netflix, 2014a), but privately they have made accommodations by agreeing to pay more to retail ISPs, such as Comcast, directly through paid peering arrangements (Netflix Media Center, 2014), or indirectly through the payments made to CDNs that in turn have acquiesced to surcharge demands from retail ISPs (Fitzgerald, 2013).

Retail ISPs have accrued such higher payments, because upstream ventures cannot risk congestion which would immediately result in inferior quality of service. Retail ISPs, keen on extracting higher payments from upstream carriers and content sources, can offer greater assurance for adequate quality of service, even when the cost for abating actual congestion does not require any significant investment in more bandwidth and switching capacity.

Simply put ISPs, providing the last kilometer delivery of bandwidth intensive content, can create artificial congestion by strategic allocation of downstream capacity. For example, in late 2013 and early 2014 Netflix reported a significant and measureable decline in the average downstream bit transmission speeds provided by several major retail ISPs (Fitzgerald & Ramachandran, 2014; Netflix, 2014b). In light of increased customer complaints about frozen images and poor quality of service, Netflix may have felt compelled to secure "better than best efforts" treatment of its traffic, not necessarily by securing a commitment by retail ISPs to prioritize its traffic, but instead by increasing the amount of total capacity available for routing Netflix traffic.

Nondisclosure agreements[10] foreclose the opportunity to examine the terms and conditions by which Netflix improved the odds of incident-free delivery of its traffic. However in record time, Comcast managed to increase downstream delivery speeds after having received surcharge payments from Level 3 and a paid peering commitment directly from Netflix. Clearly Comcast did not have to make any additional infrastructure investment to accommodate Netflix traffic in the short term.

2. The impact of full motion video access

The consequences of retail ISP market dominance have become more significant as consumers increasingly rely on the Internet as a "one stop shop" for access to all forms of ICE. With the wider availability of broadband network access, consumers now can use the Internet as a medium for the delivery of full motion video like that previously available only from broadcast, cable and satellite television. Some consumers have "cut the cord" by abandoning legacy services and opting for access to video content exclusively via the Internet. An ever increasing inventory of choices has become available to alternative video display screens. The terms Internet Protocol Television[11] ("IPTV") (Yoo, I., 2009) and Over-the-Top Television[12] ("OTT") refer to the ability of content creators and new or existing content distributors to provide consumers with access to video content via broadband links, in lieu of, or in addition to traditional media.

IPTV options, which include such popular sites as Netflix, Hulu and YouTube, offer consumers greater flexibility in accessing content. Viewers no longer need to tolerate "appointment television" (Clancy, 2011) access to content at a time prescribed by content creators or distributors and available only on a single broadcast, satellite, or cable channel. Access is becoming a matter of using one of several software-configured interface options capable of delivering live and recorded content anytime, anywhere, to any device and via many different transmission and presentation formats. But as empowering as these technological options appear, they rely on a very small number of options for the last kilometer delivery to consumers. Cable modem service providers, DSL carriers and wireless operators provide the final delivery of content and the ever increasing volume of downstream traffic satisfying IPTV demand provides these carriers with increasing leverage in interconnection negotiations.

One cannot yet conclude that retail ISPs regularly abuse their control of a last kilometer bottleneck, but the growing number of interconnection disputes between ISPs as well as other ICE ventures should trigger concern. Because more traffic arrives at retail ISP switching facilities, these carriers enjoy opportunities to demand compensation even from other ISPs with which they previously had a zero cost peering arrangement. The possibility exists that retail ISPs will negotiate fairly and not act on the incentive and ability to meddle with downstream traffic flows to secure greater leverage in interconnection negotiations.

However one also can anticipate instances where a retail ISP does not refrain from exploiting the opportunity to demand more than a fair share. Already some retail ISPs have expressed the view that they should receive compensation from up to three sources: (1) end user monthly subscriptions for Internet access; (2) upstream ISPs and CDNs with which they directly interconnect and deliver more traffic than they generate for upstream carriage; and (3) some content creators and distributors with which they do not directly interconnect, but which generate the highest volume of downstream traffic, e.g., Netflix.[13]

[10] LINX (n.d.), VIX Vienna University Computer Center (n.d.), and Twtelecom, Public Peering Policy (n.d.) offer examples of publicly available peering terms and conditions.

[11] IPTV offers consumers with broadband connections options to download video files or view (streaming) video content on an immediate "real time" basis (Sky Angel U.S., LLC, 2010).

[12] "Over-the-top VoIP [and other] services require the end user to obtain broadband transmission from a third-party provider, and providers of over-the-top… [services] can vary in terms of the extent to which they rely on their own facilities" (FCC, 2010, p. 17905, no. 48).

[13] "[I]n negotiations that almost never become public, the world's biggest Internet providers and video services argue over how much one network should pay to connect to another. When these negotiations fail, users suffer. In other words, bad video performance is often caused not just by technology problems but also by *business decisions* made by the companies that control the Internet" (Brodkin, 2013).

Should retail ISPs overplay their control of access to end-users, the prospect increases for closer scrutiny by legislatures, NRAs and boards with authority to implement competition policy and sanction unfair trade practices. In nations where ISPs have qualified for little regulation, abuse of their retail bottleneck may trigger legislatures to reclassify Internet access so that some public utility, essential facility, or common carrier responsibilities apply.

2.1. Treatment of Content Delivery Networks

The most contentious recent interconnection disputes among ISPs have involved retail ISPs and Content Delivery Networks ("CDNs"), a new category identifying ventures that concentrate on providing downstream delivery of full motion video (Clark & Blumenthal, 2013). By emphasizing downstream services, CDNs all but guarantee traffic imbalances with interconnecting carriers, especially retail ISPs. In late 2010 Comcast, a major retail ISP in the United States, sought to impose a surcharge on traffic volumes generated by Level 3, a major ISP and CDN, in light of a significant increase in downstream traffic generated by Level 3 after it secured the opportunity to serve as a primary carrier for delivering Netflix movies and television programs to subscribers.

Level 3 complained to the Federal Communications Commission ("FCC") and also launched a public relations campaign to frame the dispute in terms of Comcast imposing a "toll booth" on the Internet and singling out Level 3 and Netflix traffic for a surcharge to raise the cost of a major alternative to Comcast's pay per view movie services.[14] Comcast responded with an equally forceful campaign to explain that the dispute simply addressed a commercial peering matter.[15] Comcast claimed that Level 3's increased traffic triggered the right to demand more compensation in light of the higher volume of traffic Comcast delivered to its subscribers.

This dispute provides a high profile example of how ISPs now have a keen interest in the financial terms and conditions under which they interconnect with other carriers and sources of content. Comcast correctly stated that Level 3 and it had executed a peering agreement for reciprocal and zero cost treatment of traffic, provided the flows remain nearly symmetrical. Because Level 3 began to generate far more downstream traffic for Comcast to deliver than Comcast hands off to Level 3 for upstream transmission, the typical peering agreement would require Level 3 to compensate Comcast if the traffic flows cannot return to near parity. Unless the parties could find a way for Level 3 to receive more traffic from Comcast, Level 3 contractually bore a legal obligation to compensate Comcast.

On the other hand, Level 3 correctly stated that the peering agreement it negotiated with Comcast covered both downstream traffic from Level 3 to Comcast as well as upstream traffic from Comcast to Level 3. It remains unclear whether Comcast could have and should have taken affirmative steps to offset the traffic imbalance, perhaps by using Level 3's network facilities for more long haul traffic routing. Additionally Comcast risked inconveniencing its subscribers with the prospect of congestion, degraded quality of service and even dropped packets resulting in outages. Bear in mind that during the dispute Comcast continued to receive retail broadband subscription payments even though its dispute with Level 3 could have resulted in congestion that would have caused Netflix picture quality to deteriorate.

Comcast's cable modem service agreement with subscribers authorizes the company to manage its network in ways it sees fit, but arguably does not reserve the right to block, degrade or conditionally deliver traffic. Likewise broadband subscription agreements do not specify that service is contingent on the retail ISP receiving payments from content sources and upstream carriers. Most Comcast subscribers had no understanding about the potential for degraded Netflix service. When this outcome occurred, many Comcast customers may not have blamed the company, or understood that it could have resolved the problem, but did not do so to generate greater negotiating leverage with Level 3.

The incentive for Comcast to inconvenience its subscribers to discipline a peering partner parallels what happens when television broadcasters cannot reach closure with cable television operators on the terms and compensation for cable delivery of local broadcast stations. Such retransmission consent negotiations sometimes fail to reach closure before the cable company has to stop carriage. Consumer anger at denied access to "must see" television, such as live sporting events, ultimately forces cable operators to capitulate, but content providers, such as CBS and Fox, have identified and used new Internet access denial strategies to secure even greater negotiating leverage.

The companies used techniques to identify the Internet Protocol addresses used by broadband subscribers of the cable companies with which they had a retransmission dispute. By identifying these subscribers' identities, the companies succeeded in blocking cable broadband subscribers' access to video content available at the CBS and Hulu web sites. These content creators had a perverse incentive to deny access to eager viewers despite a reduction in audience ratings and the commensurate impact on advertising revenues. The companies understood that they had more to gain from higher cable television operator retransmission fees and willingly used Internet access blocking techniques to secure even more negotiating leverage.

The ability of CBS and Fox to block access to content far away from retail ISP facilities identifies a new location where carrier interconnection disputes can arise and frustrate consumers. Much of the debate about network neutrality (Candeub & Daniel McCartney, 2012; Grunwald, 2011; Leese, 2013; Lyons, 2012) has focused on the incentive and ability of retail ISPs

[14] "By taking this action, Comcast is effectively putting up a toll booth at the borders of its broadband Internet access network, enabling it to unilaterally decide how much to charge for content which competes with its own cable TV and Xfinity delivered content" (Level 3, 2010).

[15] "The bottom line is that this is a good, old-fashioned commercial peering dispute. It is not about online video, it is not a net neutrality issue, it is not about 'paid prioritization,' and it does not involve putting 'toll booths' on the Internet" (Comcast, 2010).

to operate in discriminatory ways that could favor corporate affiliates and other content providers and distributors willing to pay a surcharge for preferential delivery services. By blocking access to content far upstream at the source, or between the source and a content aggregator, such as Hulu, CBS and Fox have shown how to engage in selective blocking of another type of network interconnection in the Internet cloud. Such blockage occurs despite the displeasure of consumers who find themselves denied access to content based on who provides their broadband access to the Internet cloud.

2.2. The paid peering option

In lieu of, or in addition to using CDNs, content sources can pay for the benefits of direct routing via peering. Such paid peering[16] enhances the likelihood of congestion-free traffic delivery by assigning dedicated transmission capacity for most, if not all, of the complete routing. This arrangement provides higher quality of service by reducing the number of networks and routers used to reach consumers. Rather than rely on traditional "best efforts" routing,[17] paid peering traffic can arrive via the most advantageous means, resulting in less latency, fewer circuitous routing arrangements and the use of fewer routers and other switching equipment.

Companies such as Netflix have opted to pay for peering rather than risk the consequences of degraded network delivery of "mission critical," bandwidth intensive video (Netflix Media Center, 2014). The decision by Netflix to secure paid peering access to the Comcast network triggered extensive commentary and analysis. (Benton Foundation, 2014). Some believe Comcast unfairly leveraged bottleneck control over last kilometer access to a large number of Netflix subscribers (Crawford, 2014; Wu, 2014). Others believe the parties reached a commercially driven adjustment in light of the torrent of Netflix traffic, increased by the company's decision to release all episodes of blockbuster programs instead of weekly installments (Rayburn, 2014).

3. Likely changes in cloud interconnection arrangements

ISPs already have used commercial negotiations to structure alternatives and adjustments to the traditional dichotomy of barter (peering) or payment (transiting) (Yoo, C., 2010). Such diversification in interconnection compensation largely results from the proliferation of ventures requiring access as well as growing differences in the number of subscribers, points of interconnection, available transmission capacity, portion of the total traffic carried constituting video and the volume of traffic received from and handed off to particular ISPs.

The structure and bargaining power of Internet carriers has become somewhat less hierarchical, particularly for ISPs that do not qualify for zero cost peering with major long haul ISPs. These ISPs may handle significant traffic, but the volume may be limited to retail services in specific localities, or concentrated in specific geographical regions. Many carriers that otherwise might have to pay for transiting services have agreed to interconnect with other similarly situated operators, often at mutually convenient locations where many carriers and even content providers locate equipment. Such interconnection supports the creation of a new or increased set of peering carriers and the use of Internet Exchange Points which serve as mutually convenient and centralized interconnection locations (Engebretson, 2013; Jensen, 2012). ISPs also have increased the number of carriers with which they interconnect. This process, commonly referred to as multihoming, can improve the speed of content delivery and achieve more reliable service.

ISPs, which do not qualify for peering now, can secure most of the benefits of direct interconnection with major carriers, by paying them. This paid peering process (Communications Daily, 2013) differs from transiting, because the paying ISP does not simply select, interconnect with and pay one major ISP for complete access to the Internet cloud. Instead an ISP might select several carriers, not limited to the largest ISPs, to handle a portion of the total access requirement. ISPs that opt for paid peering may operate a significant network of their own, but find it necessary to secure more transmission and switching capacity at locations where they do not operate. For example, it appears that the substantial increase in Netflix downstream traffic forced Level 3 into a paid peering relationship with retail ISPs, such as Comcast, because Level 3 lacks network capacity to reach endusers and existing zero payment peering arrangements require near parity of traffic flows.

CDNs by nature of their business plan have become paid peering customers. With large volumes of traffic that must reach very many end users, CDNs cannot qualify as zero cost peers unless the retail ISP uses an affiliate of the CDN for long haul, upstream delivery services. The CDN-retail ISP commercial relationship typically involves asymmetrical traffic volumes, because end users typically download more content than they upload and CDNs, operating upstream from the retail ISP, have growing volumes of traffic needing downstream delivery.

[16] "Paid peering involves all of the same aspects as conventional peering relationships. Peers announce to the rest of the Internet the addresses that their peering partners control, maintain a sufficient number of interconnection points across the country, and maintain the requisite total volume and traffic ratios. The key difference is that one peering partner pays the other partner for its services" (Yoo, C., 2010, pp. 95–96).

[17] "The Internet developed initially as an academic curiosity, based on a commitment to the 'end-to-end principle.' This principle requires that all Internet traffic, whether an email, a Voice over Internet Protocol (VoIP) 'call'" or a video stream, be treated equally and managed through 'best efforts' connections. In such a network, data packets pass from one router to another without the prioritization of any particular packets. In practice, this means that Internet traffic reaches its destination at varying times, depending on the traffic levels of the relevant Internet communications links" (Weiser, 2008, pp. 277–278).

The CDN and its upstream sources of content may object to a payment obligation in addition to the sizeable Internet access subscriptions paid by retail ISPs' customers. Arguably a retail ISP subscription includes a representation that the carrier will provide Internet access service at a particular delivery speed. If subscribers make increased use of a resource the carrier would prefer they not actually use, then the remedy arguably lies in download caps and/or higher service fees, rather than demands for compensation from upstream carriers. The alternative view favoring retail ISPs narrows scrutiny to the commercial relationship between the upstream venture and applies the peering/transit dichotomy, or a recent alternative such as paid peering.

CDNs and other upstream carriers also will dispute economic rationales that support double payments to retail ISPs based simply on the premise that they operate in a two-sided market: (1) the retail, Internet access service provided to end users and (2) the wholesale, downstream delivery service provided upstream ISPs and their content producer/distributor clients (Rysman, 2009; Weisman & Kulick, 2010). Regardless whether ISPs can invoke economic rationales, bottleneck control of access to very many "eyeballs" puts them in a superior negotiating posture with upstream ventures. Recently some retail ISPs have proposed to content providers direct payment models in exchange for superior access to end users, or an agreement not to debit their traffic from end user monthly downloading caps (Brodkin, 2013).

3.1. Content provider/distributor strategies

Facing the growing likelihood that retail ISPs will demand compensation above that provided by Internet access subscriptions, content providers and distributors have pursued alternatives to using CDNs and paid peering. Ventures like Netflix understand that they need to ensure high quality video reception. They strive to reduce delivery costs, but also to reduce the distance between the origination point for content delivery and its consumption by subscribers. For example, Netflix has proposed that ISPs partner with it in an "Open Connect Network" (Netflix, 2012). In application this program appears to convert Netflix into an ISP with one downstream customer, itself, but also with the ability to provide upstream service exceeding 2 Gigabits per second. Netflix also proposes to install equipment on retail ISP premises that will store the most popular content thereby eliminating the need to use a cascade of many ISPs providing a portion of the route used to download the content (Netflix, n.d.).

Netflix promotes new interconnection arrangements as a way to reduce burdens on retail ISP carriers, including fewer subscriber service complaints and the need to increase bandwidth to handle the downstream torrent of full motion video content. However Netflix has attempted to avoid paid peering, despite the fact that direct interconnection with retail ISPs could reduce Netflix's total content delivery costs and certainly reduce its CDN payments. As the Open Connect Network grows, Netflix's need to rely on CDN services declines as the company installs or leases transmission capacity for direct interconnection with retail ISPs.

3.2. The short and long term

In the short term ISPs will continue to negotiate customized interconnection arrangements when traditional and conventional models do not suffice. Such flexibility can accommodate specialized requirements of content creators, distributors and consumers. However they also can impose anticompetitive and unfair trade practices that both consumers and regulators may not readily undercover.[18]

Examples of the former include accommodation of consumers' desire for "better than best efforts" traffic routing of "mission critical bits." Video gamers and viewers of high definition video programming want heightened quality of service and may willingly pay for guaranteed premium service. Such performance enhancements should not trigger network neutrality concerns or regulations provided ISPs offer end users options on a voluntary basis without intentionally degrading standard service.

Prioritized delivery options for content creators and distributors also may satisfy specialized requirements in much the same ways as CDNs offer higher quality of service and delivery guarantees. However the distinct possibility exists that premium or specialized service options can cross the line and constitute unreasonable discrimination. Examples of such anticompetitive and unreasonable trade practices include deliberately dropping packets and other forms of standard service degradation with an eye toward forcing migration to more expensive premium service "options." ISPs offering content access to their subscribers necessitate close scrutiny, because they have both the ability and incentive to favor their own, or affiliated content options and also to secure higher revenues by creating artificial congestion.

For example, an ISP could impose a severe cap on downloading volume, but offer not to meter traffic that routes content to a specific gaming platform, e.g., Xbox consoles. Comcast and other ISPs have begun offering such options, based on the questionable claim that such traffic routing traverses a specialized network and not the general Internet cloud. Such rationale works to exploit a loop hole created by the FCC that allows discriminatory exceptions to the general requirement of open and neutral access when an ISP engineers a specialized network unlike its conventional Internet routing (FCC, 2010).

[18] "MVPDs are often a customer's broadband provider as well, which means that customers who cut the cord are likely using the broadband Internet service provided by their MVPD to go 'over the top' of the MVPD's own video services. This conflict between MVPDs, content providers, and consumers is at the center of concerns that MVPDs might engage in anticompetitive practices against broadband video services in order to protect their core video business" (Vanwagner, 2011, p. 2919).

AT&T offers not to debit a wireless broadband subscriber's monthly download allotment when it can secure "sponsored data" payments from specific content sources (AT&T, n.d.; Reardon, 2014).

Another potential anticompetitive practice lies in a deliberate strategy of generating congestion for the traffic generated by a single venture. Retail ISPs can identify and target a particular carrier or source of content for deliberately degraded service. For example, if a retail ISP wanted to force an upstream carrier or content source to pay a surcharge on grounds that they have increased their carriage demands, the retail ISP could reduce or refuse to expand the inventory of available capacity available for the delivery of all or some types of traffic generated by the targeted company. A number of content creators and distributors have claimed that retail ISPs have generated artificial congestion, because the retail ISP has ample downstream capacity, but assigned insufficient channel and port capacity ensuring congestion for a subset of all downstream traffic. In a nutshell, upstream carriers and content creators/distributors have claimed that they encounter degraded service based on the saturation of the capacity made available to them even as other ventures, including corporate affiliates, partners and surcharge payers, encounter no such problem (Malik, 2013; Marek, 2013).

In both the short and long run, parties will dispute whether a retail ISP truly has incurred network congestion as a result of increased downstream volume, or as a result of clever network management practices designed to create congestion for some, but not all users. More broadly parties will dispute what constitutes reasonable and necessary network management. While a retail ISP surely owns its property and can manage it in any way it sees fit, the carrier can use the necessity of network management as justification for anticompetitive and unreasonable trade practices.

The history of telecommunications carrier interconnection contains many instances where parties deliberately refused to cooperate, and instead pursued strategies to handicap competitors through outright refusals to deal, inferior and more expensive arrangements, delays and time consuming litigation (United States v. Western Electric Co., 1987). Bear in mind that carriers could frustrate competition, despite having a legal requirement to deal and interconnect as common carriers, subject to unquestionable regulatory oversight. In the Internet ecosystem, most nations do not regulate ISPs, or apply a far less burdensome regulatory regime than that applied to telephone companies. If clever telecommunications service providers could avoid and evade regulatory mandates to interconnect fully and fairly, unregulated or lightly regulated ventures can do so as well. Marketplace driven self-discipline may not guarantee that every interconnection negotiation will reach closure on a timely basis with reasonable terms and conditions, particularly where one venture enjoys disproportionately greater negotiating leverage.

In both the short and long run, ISPs with market power may have incentives to gouge and discriminate excessively. Even through discriminatory tactics can be masked and not easily identified, over time consumers may understand the cause of service degradation and seek regulatory, legislative, or judicial remedies. If retail ISPs push too far to maximize revenues, they risk upsetting the balance needed when pricing in a two-sided market as well as loss of their unregulated status.

Despite a preference for unregulated, commercial negotiations, carriers that abuse market power risk punishment in the court of public opinion and in the marketplace. The possibility exists that in the longer term every leg in the Internet cloud will become sufficiently competitive, or at least one or more ISPs will emphasize neutrality and fair dealing as a market differentiating feature. Governments should defer to commercially driven interconnection arrangements, but stand ready to resolve disputes that become intractable and harmful to consumers.

4. Summary and conclusions

Expanding use of the Internet as a medium for IPTV and OTT video content delivery substantially increases the volume of traffic downloaded by retail broadband subscribers. To provide adequate delivery of ever expanding volumes of traffic, retail ISPs frequently have made substantial and costly infrastructure upgrades. These carriers have every right to recoup their investment and accrue profits both from their retail subscribers as well as from upstream ISPs and content providers that opt to interconnect directly, rather than use CDNs.

Retail ISPs have raised Internet subscription rates and also divided service into several tiers based on such factors as bit transmission speed and the permissible amount of content a subscriber can upload and download per month. Such increases appropriately defray the added costs incurred by retail ISPs when delivering an enhanced and more heavily used service.

These carriers have identified and tapped into a second source of increased revenue: upstream ISPs and content providers that create and distribute the bandwidth intensive content that has forced network upgrade investments. Not satisfied to rely solely on increased broadband subscriber revenues, resulting from the delivery of a more expensive to provide service, retail ISPs also demand additional payments from upstream sources.

Some of these second sources of additional revenue have objected vigorously. Upstream ISPs incur significant costs to carry traffic from content sources to interconnection points with retail ISPs. They also note that it is retail ISPs' customers who seeks upstream content culminating in the retail ISPs' final delivery. Additionally both upstream ISPs and content sources note that retail ISPs previously considered last kilometer delivery as a basic function they perform in exchange for subscription payments from end users. A surcharge demand for yet more compensation comes across as extortion based on retail ISPs' control of an essential last link, rather than the need to recover costs and generate a fair profit beyond that accrued from retail subscribers.

Despite the rancor and controversy, the vast majority of Internet interconnection disputes get resolved before consumers get upset. Regulators should refrain from acting before the parties involved have exhausted every commercial motivation to reach a settlement. As in the case of retransmission consent negotiations between broadcasters and cable television operators, the parties usually can reach a solution, albeit one that typically increases the cost of service to consumers.

Excessive or premature government intervention risks short-circuiting market driven solutions to inter-carrier disputes, replacing them with a government generated solution. In its capacity as judge or arbitrator, government may not create a solution that properly balances the growing need for ISP quality of service differentiation with the necessary safeguards to prevent easily executed, but not easily discovered, tactics that handicap competitors and harm consumers.

However, a very real possibility exists that Internet stakeholders will not always resolve their disputes before consumers get inconvenienced. Bear in mind that as the Internet becomes the primary medium for all forms of information, communications and entertainment, the stakes and potential for consumer distress increases within minutes of congestion and degraded service. Unlike broadcaster-cable television operator disputes over access to "must see" television, such as sporting events and live award presentations, access to "mission critical" Internet traffic has a quicker pain threshold.

Both parties will attempt to make their case to the public and to national regulatory authorities ("NRAs"). The latter should get involved in three ways: (1) imposing a transparency requirement on ISPs by requiring disclosure of ordinary peering and transiting offers as well as any specialized traffic handling arrangement, such as paid peering, and sponsored data carriage arrangements that do not debit end user downloading allotments; (2) requiring full disclosure of what an ISP offers subscribers in terms of bit transmission speed and content delivery as well as explaining what it will do to prevent congestion and what remedies it has available when degraded service arises ostensibly because of unavoidable congestion; and (3) providing a dispute resolution process triggered by the filing of a formal complaint.

Diversification in the type of ISPs and traffic delivered to consumers has reduced the incentive for ISPs to cooperate and to find ways to balance traffic flows. For example, rather than quickly seek additional compensation from upstream sources, Comcast could have attempted to offset downstream traffic with the considerable long haul traffic it handles, but could have handed off to other ISPs. Comcast might prefer to carry as much of its long haul traffic as possible knowing that doing so helps maintain the traffic imbalance that exists for its last kilometer delivery of video traffic. NRAs should not micromanage or second-guess traffic management decision making by ISPs, but in their analysis of congestion causes regulators need to examine traffic flows upstream from the retail ISP.

Regulators also should require ISPs to report instances where they have not met service commitments, such as advertised traffic delivery speeds. Such reporting can provide the basis for NRAs to conduct forensic analysis of what caused degradation in service. Such analysis should help identify instances where the ISP had no role in creating congestion and other situations where it might have generated artificial congestion, possibly as leverage in ongoing interconnection negotiations.

When and if ISPs and content providers cannot reach a timely resolution of an interconnection dispute, NRAs should lend their "good offices" to facilitate a resolution. The need to intervene should arise only when negotiations reach an impasse, or when the parties disagree on the cause of degraded service. If a market driven solution cannot be found and if litigation provides a delayed remedy far after harm to individual companies, the marketplace, and the level of consumer trust, then timely dispute resolution by NRAs makes sense.

In the spirit of transparency these agencies should fully inform the public about the causes of congestion, so that the responsible parties become known. Heretofore one cannot readily identify the cause for congestion and degraded service. For example, a Netflix subscriber may experience congestion because he or she subscribes to a low-speed broadband service tier. In other instances, degraded service may result because the retail ISP has refused to allocate sufficient ports and downstream transmission capacity for a particular type of traffic, or traffic from a particular source. In other instances, an upstream CDN might not have sufficient capacity, or may not have negotiated access to sufficient downstream capacity from the retail ISP.

The duty to investigate and resolve such practices should include ISPs particularly in light of the fact that broadband networks have become the preferred medium for a combination of audiovisual, textual and information services. The need for dispute resolution becomes more essential in light of the fact that competition may not exist at a sufficient level to eliminate ISP incentives to handicap competitors, or to offer superior connections only to content suppliers willing to part with the most money. Unless and until the ISP marketplace becomes so competitive as to guarantee self-regulation, the potential exists for individual ISPs to use the need to manage their networks as a ruse to handicap competition.

A fair-minded referee should acquire empirical evidence to identify the cause of congestion. Likewise a regulatory referee needs to understand the terms and conditions contained in the agreements used by ISPs and content providers to allocate responsibilities. Only with access to both types of information can NRAs provide effective dispute resolution.

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