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Conceptualized Framework for Regulation of OTT Video Services: A New Battlefield of Interconnection and Peering^{*}

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Abstract

Under the two broad concepts of net neutrality and IP interconnection, it is not easy to distinguish the paid prioritization and paid peering. The prioritized service may be prohibited under a strict net neutrality rule while the paid peering may be a normal arrangement of commercial interconnection. For better service quality, the paid peering replaces the “best efforts” with “better than best efforts” which fits customers’ desire. In fact, prioritized delivery options for content providers may satisfy specialized requirements in much the same ways as CDNs offer higher QoS and delivery guarantees. In many cases, large content providers build their own CDNs that may also act themselves as normal ISPs by offering terms and conditions that seem equivalent to peering arrangements.

The paper also discusses the case of Taiwan authority amending rules to “regulate” the IP interconnection in order to balance the market power of existing monopolistic operator. Though the measures of reform stop in the consideration whether the rulemaking is adequate or not, the government should carefully review every step it takes to deal with problems of the entire fixed-network market. In conclusion, the paper argues that governments should defer to commercially driven interconnection arrangements and should still be ready to resolve the disputes that become harmful to consumers.

Keywords: IP Interconnection, Paid Peering, Prioritized Services, Content Delivery Network, Net Neutrality, Open Internet

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1. Introduction

In the book of *Digital Crossroad*, the authors laid out an interesting analysis of a relationship between the “paid peering” of Internet protocol (IP) interconnection and the “prioritized connectivity” under the concept of network neutrality (Nuechterlein & Weiser, 2013). For the nature of IP interconnection, the paid peering is under the commercial negotiation and unregulated. In the discussion of network neutrality, the paid prioritization is not allowed under the strict statement made by the US President Obama (FCC, 2010; White House, 2014; Wyatt, 2014).

This paper explores two concepts that are easily confused by many researchers. These two concepts can be divided into different levels: the net neutrality problems are better addressed at the retail level (where infrastructure operators are generally dominant) while the interconnection issues are to assess to what extent disruptions at the wholesale level. The IP interconnection market has developed to such an extent without the need for regulatory intervention that any such measures should be carefully considered before being imposed (Leal, 2014). The paper attempts to explore the research question whether an ISP encounters a problem of “net neutrality” can be resolved by moving to the discussion of “interconnection negotiation,” such as the dispute between Comcast and Level 3 in 2010. This paper also addresses a case from Taiwan. Though the interconnection is unregulated in most countries, Taiwan’s authority plans to introduce the regulatory intervention to adjust the imbalanced market situation of IP interconnection. In conclusion, the paper argues that governments should defer to commercially driven interconnection arrangements but still be ready to resolve the disputes that are harmful to consumers.

2. The characteristics of OTT video content delivery

Today there is no clear definition for “over the top” (OTT) service. According to a report of OECD, the OTT refers to “video, voice and other services provided over the Internet rather than solely over the provider’s own managed network” (OECD, 2013). A simple one points out “services carried over the networks, delivering value to customers, but without any carrier service provider being involved in planning, selling, provisioning, or servicing them – and of course without any traditional telco booking revenue directly from them” (Wedge & Lancaster, 2007). In this description of OTT services, two aspects are noteworthy. First, OTT providers offer a service to customers, for which they may or may not be required to pay. These services may compete directly with the services offered by the network operator providing

connectivity to the customer. Second, the OTT services are provided without any direct involvement with the network operator. Content or services that require the purchase of network elements from the network operator (*e.g.*, unbundling and resale of telecom access), or are bundled with the network operators' own services (*e.g.*, Verizon and Xfinity) are not technically OTT services. Instead, OTT services are those provided by unaffiliated third parties, which utilize the network operators' facilities to access the end customer. Thus, OTT services reduce the network operator's connectivity services to a commodity (Jayakar & Park, 2014).

OTT services may include chat applications, streaming video services, voice calling and video chatting services and new services such as videogame streaming (*e.g.* Twitch). These services have been proliferating rapidly in most major countries in the world. For example, Netflix exceeded 50 million subscribers in the US as of July 2014 (Steel, 2014), and the large shares of peak time downstream traffic on fixed broadband networks were attributable to Netflix (34.2%) as of March 2014 (Spangler, 2014). In a view of European Union, an OTT services are characterized by virtue of its separation from the underlying carrier network, it cannot be an electronic communications service based on current definitions; however, OTT communications services are likely to be information society services. For example, the software for peer-to-peer calling is the provision of a service, a distance and on individual request (Brown, 2014).

OTT TV/video involves distributing video or television over the Internet directly to users connected to any electronic device. This is quite different from IPTV, which is a "managed" service under certain minimal level of bandwidth and requires even better access (Ganuza & Vieceus, 2013). With the wider availability of broadband access, consumers are gradually abandoning legacy TV services and opting for access to video content exclusively via the Internet. It is so-called "cord cutting" or "cord shaving."

3. The IP Interconnection and its complicated arrangements among ISPs

The Internet is referred to as the "network of networks." This phrase reflects the origin of the Internet as the interconnection between existing networks. The availability of easily generating new interconnections at a reasonable cost has been one of the key elements that allowed the continuous growth of the Internet in the past decades. A good interconnection not only has technical benefits, but it also allows innovation, attracts investments, and fosters the local ICT community.

Diverse and reliable interconnections can give these networks benefits, such as reducing costs by avoiding the use of expensive international links for purely local communications, improving users' experience by reducing the time needed to obtain content, and helping to attract new investments in the ICT sector. The participants in the Internet protocol Interconnection markets involve the following:

- **Internet service providers (ISPs):** These providers normally own last-mile networks that bring Internet access to end-users. They use a variety of technologies such as wireless, digital subscriber line (DSL), or cable-modem. ISP residential customers both consume and generate Internet content.
- **Content providers (CPs):** A CP may have presence only in a small number of data centers around the globe. However, many CPs have decided to increase traffic distribution by installing new nodes in different countries or using Content Delivery Networks (CDNs) in the past couple years. Many media companies (films, music, or videos), streaming services, e-learning, e-commerce, e-government, social networks, or software companies that use the Internet to distribute their products are examples.
- **Regional/global transit providers:** These networks are usually global providers of connectivity. They provide access to the global Internet for ISPs, allowing them to access distant networks.
- **Content delivery networks (CDNs):** CDNs act as local warehouses for content. CDNs have servers in many data centers distributed around the globe and their main customers are CPs. By hiring a CDN to distribute its content, CPs can cope with very high, short-term demand from end-users without needing to own infrastructure around the world.
- **Internet exchange points (IXPs):** IXPs are meeting points for all entities to facilitate interconnection. At the IXPs, every operator shares a common infrastructure, and, in most cases, inexpensive to access high speed connections at an IXP. The availability of IXPs is central to allowing more affordable local, regional, or international interconnection, particularly for smaller networks.
- **Infrastructure operators:** Interconnections need availability of infrastructure such as data centers and data transport (local, regional, or international).
- **Private entities:** These entities normally interconnect in order to improve their Internet access by adding multiple providers and reducing their access costs.

These participants have different strategies when searching for the best partners

to interconnect with. For example, when a CP or a CDN, interconnects with an ISP, a more direct and efficient path is established between the end-user and the content thus reducing network latency. In the case of OTT traffic, where a vast volume of content is terminated by end-users, direct interconnection of local ISPs ensures that the most cost efficient and optimal route is used.

The commercial terms of an interconnection relationship can be generally separated into two categories: transit and peering. For the transit relationship, some transit providers are international networks that have the ability to carry packets across the globe. As direct interconnections are not easily feasible, networks normally pay a transit provider for the service of accessing the networks to which they are not directly interconnected. The price that ISPs pay for transit has been steadily dropping in the past decades; however, cost varies from one region to another based on a variety of factors, including the effort of moving the traffic to the specific region. For the peering relationship, separate networks voluntarily interconnect to exchange traffic to and from their own customers. Peering may have no cost to both parties by way of settlement-free or bill-and-keep, or may have a cost that is lower than transit (which is called “paid peering”).

ISPs have used commercial negotiation to establish alternative and adjustments to the traditional dichotomy of peering or transit (Yoo, 2010). Such diversification in interconnection compensation largely results from the drastic growth of ventures requiring access and a number of subscribers, point of interconnection (POI), available transmission capacity, and video service traffic received from and handed off to particular ISPs. ISPs may also use the multihoming by increasing the number of carriers with which they interconnect to improve the transmission speed and provide the service more efficiently. Differing from transiting, ISPs that opt for paid peering may select several carriers, not limited to the largest ISPs, to handle a portion of the total access requirement (Frieden, 2014).

The nature of using CDN is similar to paid peering arrangement. The commercial relationship between CDN and retail ISP typically involves asymmetrical traffic volume. With large volume of traffic that must reach many end users, CDNs cannot qualify as zero payment peering unless the retail ISP uses an affiliate of the CDN for long haul or upstream delivery services. CDNs and other upstream carriers also dispute economic rationale that support double payments to retail ISPs based on the premise of a two-sided market theory: the ISP provides access service to end users at retail level, and provides downstream delivery service for upstream ISPs and their

content distributor clients (Rysman, 2009; Weisman & Kulick, 2010; Economides & Tåg, 2012). Thus, ISPs have occupied a better position to negotiate with upstream ventures.

In addition, some retail ISPs have proposed a deal with content providers direct payment models in exchange for specialized access to end users (Brodkin, 2013). This prioritized service has been criticized under current network neutrality regime in the US (FCC, 2014). In the EU, however, companies would be allowed to differentiate their offers (for example by speed) and compete on enhanced QoS, which is so-called “specialised services” that must not lead to quality degradation of the “normal”/best efforts Internet. In addition, content providers may agree deals with ISPs to assure a certain QoS to meet end-users’ demand for better service quality. Such offers will enable telcos to generate additional revenue from OTT operators, content providers as well as from consumers who are willing to pay for better or faster services.¹ However, the distinct possibility exists that prioritized/specialized service options can cross the line and constitute unreasonable discrimination. For example, some anticompetitive and unreasonable business practices, including intentionally dropping packets and service degradation, will force subscribers to migrate to more expensive specialized service.

What is the role of government to deal with the commercial peering (*e.g.*, paid peering) and the Internet connectivity (*e.g.*, prioritized connectivity) among ISPs and upstream content providers? The line between the private interest on peering arrangement and the public interest on restricting unreasonable discrimination is not so clear. Although the government should defer to commercially driven interconnection arrangements, but should still be ready to resolve disputes that become harmful to consumers.

4. ISP’s commercial practice in delivery of OTT video content

Typically OTTs do not make direct payments to ISPs for providing connectivity to users, but tend to buy upstream capacity and hosting services from ISPs and from CDNs which allow the storage of content closer to the users and thus a reduction in transit and peering costs (BEREC, 2012; Nuechterlein, 2009). In addition to these types of payments, paying for content delivery as such remains a controversial issue.

¹ European Commission, *Connected Continent legislative package*, Digital Agenda for Europe. Retrieved from <https://ec.europa.eu/digital-agenda/en/connected-continent-legislative-package>.

In the US, some scholars have indicated that a zero-price regulation (or net neutrality rule) which prohibits a broadband access provider from charging an application or content provider to send information to users are not well-founded because the existing protection of antitrust law against exclusion and the costs associate with the protection of content providers' revenues (Hemphill, 2008). However, others have focused on the danger that these types of charges can have for innovation, non-discrimination, service quality, and competition (especially for new entrants of access market) (Economides, 2010). According to this view, higher fees paid to ISPs do not necessarily lead to more investment on networks but could create incentives to reduce such investment, and it is more difficult to charge higher prices for priority lanes in the event of upgraded networks without congestion.

Incumbent telcos argue that web-based applications are replacing traditional telephony services in consumers' preference and that increasing competition from OTTs needs to be taken into account when considering the future of new telecommunications regulatory regime. Indeed, the market is pressing for solutions that preserve stakeholders' interests and escape from the regulatory gap. For example, ISPs will consider the role of peering arrangements and the increase in claims for remunerating the adjustments due to traffic imbalances linked with content delivery.

A practical illustration of an interconnection dispute in the US took occurred between Comcast and Level 3 in 2010 where the major retail ISP sought to impose a surcharge on traffic volumes generated by Level 3, a major ISP and CDN. Due to significant increase in downstream traffic generated by Level 3 after it served as a primary carrier for delivering Netflix movies and TV programs to subscribers. Comcast argued that the proposed deal would result in a traffic imbalance in the range of about 5:1 and asked for payment.² Level 3 complained that Comcast imposed "toll booth" on the Internet and singled out the traffic of Level 3 and Netflix for a surcharge to raise the cost of a major alternative to Comcast's pay-per-view movie service.³ Eventually the FCC left the issue to commercial negotiation on executing a peering agreement for reciprocal and zero cost treatment of traffic if the flows remain nearly symmetrical (Frieden, 2012). Similarly a dispute between US transit operator Cognet and Orange-France on peering policy, the French Competition Authority⁴

² See Comcast and Level 3 letters to FCC, retrieved on October 30, 2014 from <http://corporate.comcast.com/comcast-voices/comcasts-letter-to-fcc-on-level-3>. The FCC eventually took the view that this should be left to the parties' commercial negotiations.

³ Level 3 Communications Issues Statement Concerning Comcast's Actions, *Level 3* (Nov. 29, 2010), <http://level3.mediaroom.com/index.php?s=23600&item=65045>.

⁴ Decision of September 2012, http://www.autoritedelaconcurrence.fr/user/standard.php?id_rub¼418&id_article¼1971.

concluded that requiring a surcharge is not in itself an anti-competitive practice under the consideration of highly asymmetric nature of traffic exchange.

In fact, the ISP, especially the cable, has incentive to inconvenience its subscribers in exchange of better terms and conditions for negotiating with the retransmission fees of “must carrying” television channels, such as live sport events. In the dispute between Cablevision and Fox, by identifying cable subscribers’ identities, Fox also have the incentive to block cable subscribers’ access to video content available at the CBS and Hulu websites (Kafka, 2010; Frieden, 2014). Many have focused on the debate about net neutrality (Leese, 2013; Candeub & McCartney, 2012; Nooren et al, 2012; Grunwald, 2011) with regard to the incentive and ability of retail ISPs to favor the corporate affiliates and other content providers and distributors on agreed payment for preferential delivery services.

In addition to CDNs, content sources can choose to pay for the benefits of directing routing via peering. Such “paid peering” enhances the possibility of congestion-free traffic delivery by dedicated transmission capacity for most of the complete routing. This arrangement offers higher QoS by reducing the number of networks and routers used to reach users. The paid peering traffic can obtain the advantages, such as less latency, fewer circuitous routing arrangements and the use of fewer routers and switching equipment, and replace the “best efforts” with “better than best efforts” which fits customers’ desire (Frieden, 2014).

Due to growing volume of traffic generated by end users to watch OTT video services, the retail ISPs will demand compensation under the peering arrangement. The OTT service providers, such as Netflix, understand that they need to ensure high quality video reception and try to reduce delivery costs. Netflix has proposed an “Open Connect Network” (Netflix, 2012) partnering with some retail ISPs. Under such program, Netflix has converted into an ISP with one downstream customer, itself, and with the ability to provide upstream service exceeding the speed of two Gigabits per second. In addition, Netflix also want to install equipment on the premises of retail ISPs that will store the most popular content and thus reducing the costs of routing other networks in downloading the content. The Open Connect Network measure is to promote new interconnection arrangement as a way to reduce burdens on retail ISP carriers, no matter by avoiding paid peering or reducing the reliance of CDN services. Some scholars believe that the performance enhancements will not trigger net neutrality concerns only if ISPs offer end users options on a voluntary basis without degrading promised service level.

Prioritized delivery options for content providers may satisfy specialized requirements in much the same ways as CDNs offer higher QoS and delivery guarantees (Frieden, 2014). However, the US Time Warner Cable complained that Netflix has made an attempt at “improperly tying access” to enhanced video content (*e.g.*, 3D and Super HD video formats) to the CDN initiative because the content is only available to subscribers whose ISPs are connected with Netflix CDN network.⁵ The different types of current CDNs indicate how content providers may also act as normal ISPs by offering terms and conditions that seem equivalent to peering arrangements. However, the disputes arising from such arrangements are more similar to the abovementioned retransmission disputes in must-carry scenarios.

5. Interconnection Dispute: A Taiwan’s Case

Retail ISPs may easily be disputed with consumers whether it has truly incurred network congestion as a result of increased downstream volume. More broadly parties will dispute what constitutes reasonable and necessary network management. When a retail ISP owns its network and can manage it in any suitable way, the necessity of network management can be justified for anticompetitive and unreasonable practices.

In the Internet ecosystem, most countries do not regulate ISPs or apply a light burdensome regulatory regime than that applies to telephone companies. Self-discipline in the *prima facie* competitive market may not guarantee that every interconnection negotiation will reach on a timely basis with reasonable terms and conditions, particularly where one venture enjoys disproportionately greater negotiating leverage. The ISP with market power may have incentives to discriminate excessively. If retail ISPs do so, they may risk upsetting the balance needed when pricing in a two-sided market as well as loss of their unregulated status.

In 2009 the Taiwan Mobile refused to pay the peering fees to the backbone operator—Chunghwa Telecom (Chunghwa), arguing that the unit price of peering was higher than other countries, and Chunghwa claimed to terminate the connectivity with Taiwan Mobile. All other ISPs are required to pay to peer with Chunghwa due to imbalance traffic flows, which means that no ISP can make a deal of free-settlement peering with Chunghwa. For such a unique marketplace of IP interconnection in Taiwan, the regulator of communication industry, the National Communications

⁵ <http://www.multichannel.com/cable-operators/twc-netflix-withholdingcontent-gain-unprecedented-access-isps/141261>.

Commission (NCC), declared that the fee for peering proposed by the dominant market player (only Chunghwa) was an item of “regulated” wholesale price subject to regular review. The price of peering was NT\$1,480 in 2009 for the first time, and the price is gradually reducing to NT\$411 in 2014. Even though the price is lowered under government supervision, other ISPs are not satisfied with the monopoly environment.

In 2012 the NCC has proposed a revised regulation about the peering management and considered to adopt an aggressive way to change the landscape of “one-way” peering. The NCC adjusted two conditions of peering for the purpose of creating more ISPs to meet the requirement of free-settlement in the IP peering market. If any ISP meets all of the six conditions, Chunghwa is required to deal with “free-settlement peering” arrangement. At the meantime, those ISP who qualifies the free-settlement peering with Chunghwa should have duty to offer the proportionate peering bandwidth for connecting to the public exchange center (TWIX) for free. In April of 2013 the NCC held a public hearing and discussed the following issues: whether the IP interconnection should be regulated under the law; whether to adopt asymmetric regulation on IP interconnection matters; whether to adjust the condition and eligibility of free-settlement peering, and whether the wholesale pricing of IP peering should be amended to the pricing regulation (Yeh, 2013).

However, the political measure for encouraging ISPs to meet the requirements of free-settlement peering with Chunghwa has come to a halt due to an atmosphere that no country has adopted a legislative bill to solve the peering dispute. In addition, the peering issue is merely one of the complicated problems in the monopolistic market of fixed-network telecommunications service. Now the NCC is gathering more public opinions and is clarifying the real issues in the IP interconnect market.

6. Conclusion

The paper examines two concepts of net neutrality and IP interconnection. The author found that the prioritized service and paid peering may be interpreted as similar commercial practices but the result differs. The US government is going to enforce a strict net neutrality rule prohibiting paid prioritized service while the paid peering is a normal commercial arrangement between two retail ISPs or between retail ISP and content providers/CDNs. For better service quality, the paid peering replaces the “best efforts” with “better than best efforts” which fits customers’ desire. In fact, prioritized delivery options for content providers may satisfy specialized requirements

in much the same ways as CDNs offer higher QoS and delivery guarantees. In many cases, large content providers build their own CDNs that may also act themselves as normal ISPs by offering terms and conditions that seem equivalent to peering arrangements. Thus, if a dispute occurs, there should be some room for the ISPs to adjust it into the basket of “net neutrality” or the basket of “interconnection negotiation,” depending on the nature of the dispute.

The paper also discusses the case of Taiwan authority amending rules to “regulate” the IP interconnection in order to balance the market power of existing monopolistic operator. Though the measures of reform stop in the consideration of the adequacy of rulemaking, the government should carefully review every step it takes to deal with problems of the entire fixed-network market. At last but not least, the paper argues that governments should defer to commercially driven interconnection arrangements and should still be ready to resolve the disputes that become harmful to consumers.

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