10 April 2015

Aileen Chia (Ms.)
Deputy Director General (Telecoms and Post)
Infocomm Development Authority of Singapore
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Dear Ms. Chia,

Public Consultation on the Internet Protocol Transit and Peering Landscape in Singapore

In 2010, the European Commission ("EC") ruled that the Polish telecom regulator, Urzd Komunikacji Elektronicznej ("UKE") must refrain from implementing ex-ante regulations on the Polish incumbent Telekomunikacja Polska ("TP")'s IP Peering and IP Transit services. This was the first time a regulator considered regulating these complex issues. As a precedent case, Viviane Reding, EU Telecoms Commissioner (as she was then), declared that nothing short of a thorough, in-depth analysis, and supporting evidence would clarify if the competitive situation justifies ex-ante regulation.

The EC held that UKE failed to establish that both the IP Peering and IP Transit markets were uncompetitive. The EC saw IP Peering and IP Transit as substitutes and therefore construed as one single market in any competition analysis. Additionally, the EC noted that even if UKE were right in that they were separate markets, UKE failed to prove that TP had significant market power them.

An important implication of the EC decision is that IP Peering and IP Transit constitute a single market, the IP Traffic Exchange market. This decision however injects an unacceptable degree of uncertainty into how IP Peering and IP Transit markets are defined. And this has serious consequences on how these markets are regulated, if required, going forward.

I hope my academic discussion on the EC's decision can help iDA as it reviews a similar but equally complex market issue here in Singapore.

Yours sincerely,

Andrew Ngiam

INTRODUCTION

The mechanics of Internet Packets ("IP") routing is fundamentally complex and its associated cost structure is opaque. This non-transparent nature poses problems for market participants and regulators alike. As such, anti-competitive conduct, if any, in the IP Peering and IP Transit markets, is capable of repetition and yet evading review.

This paper reviews the European Commission's ("EC") decision to reject Polish's regulator, Urzd Komunikacji Elektronicznej ("UKE") attempts to impose ex-ante regulations on the Polish incumbent Telekomunikacja Polska ("TP")'s IP Peering and IP Transit services.

UKE's attempts to impose ex-ante regulations on TP's IP Peering and IP Transit services and the subsequent rejection by the EC unfortunately injects an unacceptable degree of uncertainty into how IP Peering and IP Transit markets are defined. This may have consequences on how one should approach the complex issue of IP Peering and IP Transit.

IP PEERING AND IP TRANSIT

As a starting point, one must explain the concepts of IP Peering and IP Transit. IP Peering involves a mutual exchange of IP Traffic by one Internet Service Provider ("ISPs") with another, at technically feasible network access points. Peering thus allow these ISPs unbridled access to each other's internet network as well as the networks of other ISPs who have entered into similar peering arrangements. Peering arrangements are either Fee-Based or Settlement-Free, the latter typically restricted to equivalently-sized ISPs.

Should Peering negotiations fail, a smaller ISP must procure IP Transit, as a wholesale service offering, from the Higher Tiered ISPs-those with extensive ownership of the international or domestic IP backbones, or both. A failure to do so causes that ISP to end up with isolated IP network, one that is unconnected to the other 45,000 clusters of interconnected computer networks or ASNs, consisting of ISPs, Internet Content Providers, that collectively make up the Internet.

REGULATING PEERING AND IP TRANSIT

As a general rule, mandating Peering is an overbroad application of a regulator's power and is avoided if possible. Such regulations constraints an ISP's freedom to decide how they optimize their networks; decide on fundamental questions on who they wish to enter into Settlement-Free Peering arrangements; and what is suitable compensation for the traffic imbalances. Peering regulations also risk opening a Pandora's Box. It may have unintended consequences on the unfinalised framework and rules regarding IP termination and settlement.

IP Transit, as a service offering, on the other, could face regulations and regulators have in their arsenal, Ex-ante and Ex-post regulatory tools. Ex-ante regulations are applied on dominant ISPs with significant market power. Ex-post regulations are also effective in deterring other forms of anti-competitive conduct in a competitive market. In Singapore,

abuse of its dominant position by an ISP are adequate grounds for regulatory intervention[1].

POLAND'S MAIDEN ATTEMPT AT REGULATING IP PEERING AND IP TRANSIT

The Polish telecom regulator, Urzd Komunikacji Elektronicznej ("UKE") made an unsuccessful attempt to regulate IP Transit and IP Peering. UKE sought to regulate incumbent Telekomunikacja Polska ("TP")'s IP Peering and IP Transit by way of ex-ante regulations[2]. UKE believed that TP's dominance allowed a persistently refusal to Peer with its competitors or offer them Transit services at competitive rates.

Further, UKE believed that TP engaged in the following prohibited discriminatory practices:

i. Failure to enter into Settlement-Free Peering arrangements with competing ISPs;
ii. Failure to offer a stand-alone Paid-Peering service, which forces alternative ISPs to purchase at an excessive price service bundles (including both IP traffic exchange with TP network and access to resources that an alternative ISP does not want to use but has to pay for);
iii. Failure to publish its Peering policy;
iv. Failure to establish Settlement-Free Peering at Public Internet Exchange Points; and
v. Failure to price Paid-Peering based on the actual line usage.

In a surprising turn of events, the EC ruled that UKE's decision did not comply with the policy objectives of Electronic Communications Framework Directive (2002/21/CE)[3]. Specifically, the EC held that UKE failed to establish that the IP Peering and IP Transit market was uncompetitive. According to the EC, IP Peering and IP Transit services are product substitutes and the correct approach is to analyse them as a single market. And UKE had not done so. Further the EC held that even if there were two separate markets as alleged, UKE failed to provide market share information which may help determine if TP had significant market power.

[1] ***Code of Practice for Competition in the Provision of Telecommunications Services, 2012***, Abuse of Dominant Position and Unfair Methods of Competition: s. 8, 8.1,8.2, 8.3, 8.4

[2] *Office of Electronic Communications, Republic of Poland, "Why the Polish IP Traffic Exchange Markets Involving Peering and Transit should be regulated", February 15, 2010* . <http://www.en.uke.gov.pl/why-the-polish-ip-traffic-exchange-markets-involving-peering-and-transit-should-be-regulated-327>

[3] *European Commission, "Telecoms: European Commission extends extends consultation on draft measures for IP traffic exchange in Poland*", January 15, 2010 . <http://europa.eu/rapid/press-release_IP-10-1_en.htm>

SINGAPORE'S PRELIMINARY VIEW ON REGULATING IP PEERING AND IP TRANSIT

IDA examined a similar issue of intervening in Singapore IP Peering and IP Transit markets[4]. Specifically, iDA considered mandatory IP Peering arrangements for all ISPs, or obligate all ISPs to route local IP traffic within the country[5]. In examining these issues, iDA considered regulating the IP Transit market under iDA's powers to address market failures and prevent anti-competitive conduct by market participants under the Competition Code[6]; and iDA's broad powers to implement policies to further develop the telecommunications sector under the Info-communications Development Authority of Singapore Act[7]. IDA also took notice of its policy approach towards Net Neutrality[8] and its Consumer Protection Frameworks[9].

IDA arrived at its preliminary view that:

i. there is no strong justification to take further regulatory measures, such as mandating IP Peering arrangements[10], and
ii. IP Transit and Peering arrangements are best left to commercial decision-making to foster a conducive wholesale environment for a diverse and agile ISP retail market[11].

IDA relied principally on the following conclusions from an iDA-commissioned market study:

i. Singapore has a competitive wholesale IP Transit market[12];
ii. IP Traffic "tromboning" is minimal as operators prefer to route their traffic locally as a cost effective solution[13];
iii. IP Transit prices in Singapore are not significantly higher than benchmarked cities of Hong Kong and Taiwan[14];
iv. There are no competition concerns in the IP Transit market or adverse impact on the quality of Internet services[15].

AN ISSUE OF COMPETITION IN THE DOMESTIC IP TRANSIT MARKET

But a regulator can look at this issue from another perspective. A regulator may ask if a Domestic IP Transit market is competitive; and if there are impediments to a proper functioning of that market. Further, a regulator may also ask if providers for Domestic IP Transit services may exercise significant market power in both the Domestic IP Transit and Global IP Transit markets. At this juncture, it is important to take a closer look at

[4] *IDA*, " The Internet Protocol Transit and Peering Landscape in Singapore", *13 February 2015*
[5] ***Ibid*** at para. 7
[6] ***Supra*** Note 1
[7] The Info-communications Development of Authority of Singapore Act (Cap137A, 2013 Rev .Ed.Sing), s.6(1)a, 6(1)c, 6(1)m, 6(1)r,6(1)u.z
[8] *iDA,"Decision Issued by the Info-Communications Development Authority of Singapore*", June 16, 2011
[9] *IDA, "QOS Standards for Retail Broadband Internet Access Service*". Local Network Latency less than or equal to 50msec; International Network Latency less than or equal to 300msec.
[10] ***Ibid*** at para 23a
[11] ***Ibid*** at para 23b
[12] ***Supra*** Note 2 at para. 13a
[13] ***Ibid*** Note 2, at para. 13b
[14] ***Ibid*** at para. 13c
[15] ***Ibid*** at para. 14

Global IP Transit and its constituent sub-markets: International IP Transit and Domestic IP Transit.

WHAT IS GLOBAL IP TRANSIT?

Global IP Transit is a simply a telecommunications service that provides customers wholesale access to the Internet. As a basic service, this market is commoditized due to the great availability of service suppliers. This service is readily available from owners of International or Domestic Internet Backbones, or sold by resellers.

Global IP Transit is extremely price competitive and the network is built for reliability and resilience. Network latency is often the only product differentiator. As a result, IP Transit service is often characterized by its "quality of experience". As a requisite, IP Transit Services are dedicated and not oversubscribed. With minimal room to price differentiate, to achieve a competitive advantage over its business rivals, service providers offer a superior internet access service characterized by a very low network latency rate. Technically, this is possible only if IP traffic is routed over the least number of hops over any particular route. Global IP Transit comprises International Transit and Domestic IP Transit; and these services are offered either as a bundled service or available separately according to customer needs.

It is crucial to distinguish these markets as it is easy to conflate Global IP Transit with its constituent geographic sub-markets: International IP Transit[16] and Domestic IP Transit. In an uncompetitive Domestic IP Transit market, coupled with an absence of local Peering arrangements between International IP Transit Service providers and Domestic IP Backbone owners for the carriage of local IP Traffic, Global IP Transit services as we know today, is simply International IP Transit alone and that market is competitive.

INTERNATIONAL IP TRANSIT

As a wholesale service, International IP Transit is sold to ISPs who provide internet access services as a retail service offering but have not built their own International IP backbone. This service is typically provided over access services such as domestic leased lines or international IPLC circuits. Due to the global nature of IP Transit services, they are provisioned directly in-country where the International IP Transit service provider has a Point-of-Presence in the form of dedicated domestic leased circuit to a local IP switch or to its nearest Point-of-Presence offshore using a dedicated international private leased circuit. In Singapore, iDA has declared that the International IP Transit market is effectively competitive[17].

[16] *IDA, "Explanatory Memorandum to the Decision of the Info-Communications Development Authority of Singapore on the Request by Singapore Telecommunications Limited for Exemption from Dominant Licensee Obligations with Respect to the "International Capacity Services" Market"*, 12 April 2005, at 64, The iDA: The International IP Transit market consists of the provision of a service, for compensation, in which one operator terminates international Internet traffic on its network or transits the internet traffic for termination on a third operator's network. This service does not include the provision of domestic access facilities, such as LLCs.

[17] ***Ibid*** at para. 108

DOMESTIC IP TRANSIT

Domestic IP Transit, as opposed to International IP Transit, is simply a wholesale service provided by owners of the Domestic IP Backbone to ISPs specifically for accessing those components of the Internet- the series of network routers, servers and hosted content- resting on the Domestic IP Backbone[18]. Unlike International IP Transit, Domestic IP Transit is relatively congestion-free. This is particularly true for small city states like Singapore and Hong Kong. A domestic IP backbone has fewer Points-of-Presence, compared to an international IP Backbone, and as s uch fewer hops are traversed.

Domestic IP Transit is sold to ISPs who have already invested in international Internet capacity and require Domestic IP Transit as essential network elements for and end-to-end Global IP Transit service. Hence a competitive market for Domestic IP Transit is crucial as an upstream input element for Global IP Transit. With a full-fledged Global IP Transit network, Global ISPs are able to provide a fully optimized end-to-end IP transit service where domestic IP traffic is kept within the host country, dispensing with the need of routing them across offshore Points-of-Presences.

DOMESTIC IP TRANSIT IS CRUCIAL AS IP TRAFFIC BECOMES INCREASING LOCALISED

While International IP Transit in many countries is competitive, we are less than certain about the Domestic IP Transit market. This market may have evaded review until now. With the advent of cloud computing and the mirroring of servers within multiple hubs, Domestic IP Transit quickly grew into a separate and distinct market as customers prefer a direct routing of traffic within a country or region. It is important to appreciate this trend towards a localisation of IP traffic- the rapid growth of Content Delivery Networks results in bypassing of long haul links. Cisco estimates that Content Delivery Networks alone will carry over half of the world's IP traffic by 2018[19]. ISPs are also aware of the ramifications. Metro IP Traffic will surpass Long-haul IP Traffic in 2015 and will account for 62% of total IP traffic by 2018.[20]

For the Global ISPs, they are now under significant pressure to reduce network latency for customers who demand a higher "quality of experience". Specifically, A-End Customers expect network speeds to reflect a more direct route to their locally-situated servers. An absence of effective competition in the Domestic IP Transit market may cause harm or exhibit a reasonable probability of harming the Global ISPs. They are competitively disadvantaged if they do not own the domestic IP backbone; or have not entered into Peering Arrangements with owners of the domestic IP backbone. Without them, they must route domestic IP traffic indirectly via an offshore Point-of-Presence.

[18] <http://www.wholesale.vodafone.co.nz/pdf/vf-W-INT.pdf; http://indosat.com/en/business/product/fixed-connectivity/ip-transit>
[19] Cisco, "*Cisco Visual Networking Index: Forecasts and Methodology, 2013-2018"*, June 10, 2014 at 9
[20] ***Ibid***, at 9

DOMESTIC IP PEERING[21] AND DOMESTIC IP TRANSIT: SEPARATE OR SINGLE MARKET?

We have established above that the Domestic IP Transit is a separate and distinct market from International IP Transit. As it allows for the exchange of domestic IP only, it is best compared against its closest product substitute: Domestic IP Peering.

The proposition that IP Peering and IP Transit are substitutes is crucial to the EC's decision to reject UKE's contention. Contrary to UKE's position, the EC believed that Peering and IP Transit are interchangeable as network interconnections, the only difference in that Peering affords a direct interconnection while IP Transit, an indirect interconnection. According to the EC, IP Peering and IP Transit Services are market substitutes and should be treated as a single market for IP Traffic Exchange. Unfortunately UKE defined IP Peering and the IP transit as follows:

i. IP Peering market - a wholesale market where IP traffic exchange could only be made with the network of TP
ii. IP Transit market - a wholesale market for IP Traffic exchange.

Had UKE focused instead on the narrower Domestic IP Transit market, as opposed to the broader and effectively competitive International IP Transit market, the outcome could have been different for UKE today.

DOMESTIC IP PEERING AND DOMESTIC IP TRANSIT ARE NOT SUBSTITUTES IN MARKETS CHARACTERISED BY MARKET FAILURES

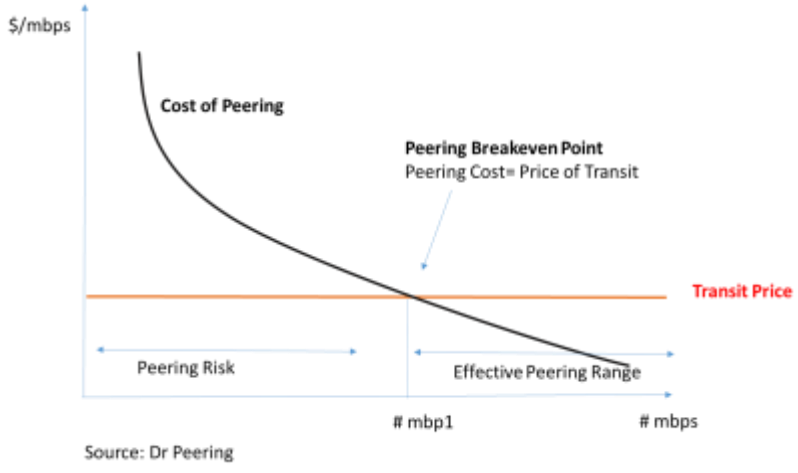
Having defined the comparison markets, the next step is to discover if the Domestic IP Transit and Domestic IP Peering are substitutes. Regulators typically apply the "SSNIP" test: if a small but significant non-transitory price increase in Domestic IP Transit service would lead consumers to switch to a substitute, in this case, Domestic IP Peering.

Domestic IP Transit in reality is a service offered by a Transit ISP to a Requesting ISP to effect peering on its behalf. Here the Requesting ISP's network has not achieved critical mass to allow for Peer-to-Peer negotiations on Settlement-Free Peering. Instead the Requesting Licensee is offered transit services which could appear in the form of Domestic IP Transit or Fee-based Peering. At a competitive market place, Domestic IP Peering is a straight forward substitute for Domestic IP Transit. .

[21] I have used the term "Domestic IP Peering" to distinguish it from a Peering arrangement (settlement-free or Paid-Settlement) for an exchange of domestic IP traffic at offshore Points-of-Presence.

The substitutability is depicted in the following diagram:

Equal Negotiating Power: Settlement-Free Peering Cost Curves



Source: Dr Peering

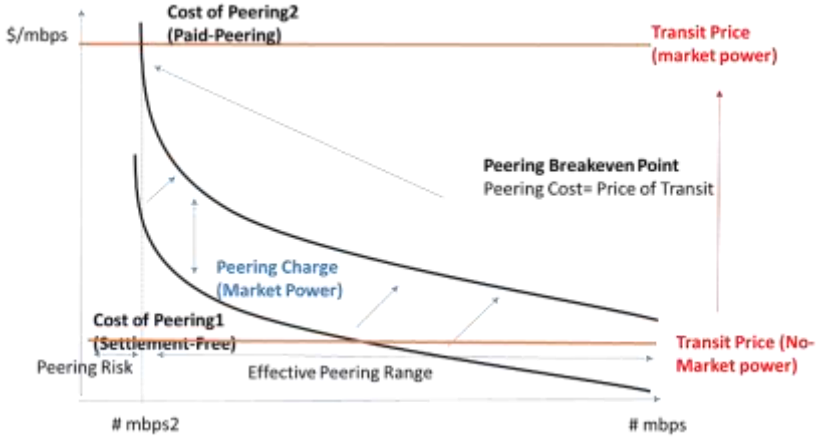
In a peering relationship between equally-sized ISPs, the relevant cost curves are depicted above and the Equilibrium Transit price is determined by his network size (# mbps1). The amount of mbps carried on ISP (A)'s network for peering with incumbent ISP determines the Transit Price for ISP (A). Should his network grow beyond #mbp1, his per unit cost of peering is lowered and market IP transit price falls as he switches to Peering. Market IP Transit price reaches equilibrium when there is no longer any incentive to switch from one substitute for another.

However, the situation is somewhat different when a small ISP attempts to negotiate with the incumbent ISP for Peering. Here, the incumbent ISP has market power in both the Domestic IP Peering and Domestic IP Transit markets- he can determine both Peering Charges and Domestic IP Transit prices independently from the market.

Here ISP (B) is constrained by his small network size (#mbps2). Unlike the ISP (A), his lack of bargaining power presents him with a different set of cost curves. His Cost of Peering Curve shifts upwards by the amount of the Peering Charge (determined by incumbent ISP). At the same time incumbent ISP can determine a Transit Price (Transit Price with Market Power) according to ISP (A)'s revised cost of Peering (Cost of Peering 2).

ISP (A)'s ability to substitute Peering for Transit is irrelevant so long as it fails to achieve critical size for a Settlement-Free Peering arrangement. Until and unless an ISP achieves a network critical mass, Domestic IP Peering is not a substitute for Domestic IP Transit. Where there are market failures in IP Peering and IP Transit, prices changes will not affect their substitutability.

Unequal Negotiating Power: Paid- Peering Cost Curves



CONCLUSION

The mechanics of Internet Packets ("IP") Routing is fundamentally complex and its associated real costing is opaque. As a result, any anti-competitive conduct in the IP Peering and IP Transit markets, is capable of repetition and yet evading review. This non-transparent nature makes it particularly difficult for market participants impacted by anti-competitive conduct to unravel its complexities. However, a regulator can carry this burden.

The decision of the EC to define the IP Peering and IP Transit markets as one single market for IP Traffic Exchange injects an unacceptable degree of uncertainty into the approach regulators should take when addressing market power. iDA could use this review to bring a finality to this concern, at least in the Singapore context.

At the same time, this review may allow iDA to resolve other substantial issues regarding the domestic IP Transit market- whether owners of domestic IP backbones are dominant and can exercise significant market power within that market and whether such powers have the ability to impact the Global IP Transit services, when domestic IP transit is used as a crucial domestic network component.

In the alternative, if ex-ante regulations are unsuitable, iDA could consider new and novel remedies using its powers given under the Info-Communications Development Authority of Singapore Act (Cap 137A)[22].

[22] ***Supra*** Note 6