Internet Impact Brief

South Korea's Interconnection Rules

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Abstract

A series of enacted and proposed revisions to South Korea's Telecommunications Business Act (TBA) spell out new interconnection rules for Internet Service Providers (ISPs) and Value-Added Telecom Service Providers (VSPs), such as content providers, operating in the country. These rules include network usage fees and quality of service requirements for content providers to deliver content to Internet users in South Korea.

This report uses the Internet Impact Assessment Toolkit (IIAT) to assess how these rules may affect further Internet development in South Korea and, more broadly, the health of the global Internet. Our analysis finds that the existing rules create unnecessary costs and bottlenecks in South Korea's digital ecosystem. They also risk increasing market concentration and dominance by a few large service providers. The proposed provisions will only make this worse.

South Korea, with its Digital New Deal strategy, is entering a new phase in its digital evolution. For South Korea to continue gaining the benefits of the Internet to reach its goal of a hyperconnected society and economy, the country must remove these restrictive provisions. It must reinforce its place as a global pacesetter for Internet advancement by re-aligning its policies to support the principles of an open, globally connected, secure, and trustworthy Internet.

Methodology

The Internet owes its strength and success to a foundation of critical properties that, when combined, represent the Internet Way of Networking (IWN). This includes: an accessible Infrastructure with a common protocol, a layered architecture of interoperable building blocks, decentralized management and distributed routing, a common global identifier system, and a technology neutral, general-purpose network.

To assess whether the present proposal has an impact on the Internet, this report will examine its impact on the IWN foundation the Internet needs to exist, and what it needs to thrive as an open, globally-connected, secure and trustworthy resource.

Background

The Internet is composed of thousands of independently owned, managed and operated networks, forming a network of networks. These include commercial, academic, research, and government networks that are "glued together" through voluntary interconnection arrangements. These connections are driven by strong incentives to be part of the larger network and are the result of commercial negotiations. There are two primary forms of interconnection:

Transit: typically a bilateral agreement where a network provides full connectivity to the Internet for upstream and downstream transmission of traffic on behalf of another network. This includes an obligation to carry traffic to third parties.

Peering: an agreement where two or more networks agree to exchange traffic between themselves, including each other's customers (but not to use each other's transit connections).

The two forms of interconnection differ in (a) scope: peering provides access to the peer's customers, while transit allows a network to reach all of the Internet; and (b) the terms of the arrangement itself. For example, transit agreements are often governed by normal customer-supplier commercial contracts, while peering agreements are typically informal supplier-to-supplier agreements. Furthermore, the vast majority of peering arrangements are settlement-free—meaning no money changes hands—because it is seen as mutually beneficial for both parties to interconnect. As shown in an OECD report[1] and more recent surveys by the Packet Clearing House (PCH)[2], 99% of Internet peering agreements are informal, and usually settlement-free.

Not all peering relationships are symmetrical however. They may involve asymmetric obligations—either in the form of peering criteria (where a network agrees to provide access to its customers if certain conditions are met), and/or in the form of paid peering (where one network pays the other network for access to its customers).[3]

This means that interconnection in the Internet is commonly agreed through one of the following forms of business arrangements:

- A network pays another network to carry traffic to all parts of the Internet (transit).
- A network pays another network to exchange traffic between their customers (paid peering).

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[1] Weller, D. and B. Woodcock (2013), "Internet Traffic Exchange: Market Developments and Policy Challenges", OECD Digital Economy Papers, No. 207, OECD Publishing, Paris, https://doi.org/10.1787/5k918gpt130q-en

[2] See, for example, https://www.pch.net/resources/Papers/peering-survey/PCH-Peering-Survey-2016/PCH-Peering-Survey-2016.pdf

[3] Abecassis, D and Kende, M (2020), "IP interconnection on the internet: a white paper" https://www.analysysmason.com/consulting-redirect/reports/ip-interconnection-korea-white-paper/

- A network establishes a payment-free relationship with another network to exchange traffic between their customers (often called "settlement-free" peering).

The voluntary nature of Internet interconnections means that network operators typically make use of a combination of these arrangements to manage costs and performance according to their needs. This allows each network operator to efficiently operate their networks at commercial rates supported by a competitive market, and to optimize their network interconnections to meet their customers' demands.

What Are the South Korean "Sender Pays" Rules?

In 2016, the Ministry of Science, ICT and Future Planning (predecessor of the Ministry of Science and ICT) began enforcing the revised Interconnection Standards for Telecommunication Facilities[4], requiring ISPs to charge for the traffic they receive from each other.

ISPs operating in South Korea used to be free to negotiate their own interconnection agreements commercially as they saw fit. This allowed for settlement-free peering among ISPs. The rules have been interpreted to imply a paid mutual settlement, also known as a Sending Party Network Pays (SPNP) model, where ISP A must pay ISP B to send traffic to ISP B's customers, and vice versa.

The SPNP rules deviate from the established peering practice where networks share the costs of interconnection, but do not pay for the traffic exchanged. Under the SPNP fees may be calculated based on the volume of traffic sent to an ISP's customers when they request for content. Some ISPs chose to shift the burden of the rule to content providers, such as video streaming platforms, which are the sources of content they provide to customers. As a result, companies that provide content and ISPs that carry it pay more to ISPs that mostly only receive content for their customers.

The "sender pays" policy was reinforced in 2020, when the country's National Assembly amended the TBA to require VSPs, specifically content providers that meet certain thresholds[5], to take measures to make sure that their services remain stable in the country. These include securing enough server capacity, ensuring uninterrupted Internet connection, and notifying ISPs before they change their traffic route.

A number of bills introduced since 2021 seek to mandate local and foreign content providers to enter into contracts with ISPs in South Korea to be able to use their networks. A contract would need to specify the ISPs' usage fees, the period of use, and their available capacity, among other terms. One

[4] Translated from 전기통신설비의 상호접속기준, the standard's official title

[5] The provision applies to online service companies that account for 1 percent or more of the country's average daily data traffic in the last three months of the previous year and that have more than 1 million daily users.

bill[6], in particular, instructs ISPs to calculate network usage fees based on (a) capacity and usage period, (b) the content provider's size based on its subscriber base or market share, (c) a discounted wholesale rate, or (d) the agreed method of calculation in the existing contract.

Another bill[7] prohibits content providers from using ISP's network without paying "fair consideration" for use of the network, whereby the non-complying content provider's service can be shut down by the authorities. This bill implicitly allows ISPs to refuse to carry traffic from content providers who fail to pay the "network usage fees".

In their legislative purposes, the bills aim to require foreign content providers to pay for "network usage" the same way that local content providers pay for transit, effectively formalizing the extension of the "sender pays" rule to content providers. Important in this context is also that the proposals are not clear as to whether or not they only apply to content providers that have a direct connection with local ISPs, or if they are applicable to any content provider offering their service on the Internet.

These successive bills demonstrate a trend of increasingly prescriptive mandatory rules that in effect: 1) mandate the practice of paid peering; 2) impose quality of service requirements on content providers, possibly including the ones simply accessed by Korean users while not directly connecting with Korean ISPs; and 3) impose an obligation on content providers to contract with and pay the local ISPs to carry their traffic to those ISPs' customers, again possibly including the ones not directly connecting with Korean ISPs.

How Do "Sender Pays" and Other Interconnection Rules Affect the Internet and Internet Development in South Korea?

To understand how the existing and proposed provisions would affect the Internet we assess how they impact the Critical Properties of the Internet Way of Networking, as described by the Internet Society.

An Accessible Infrastructure with a Common Protocol that is open and has low barriers to entry

South Korea's rise as a global frontrunner in ICT development is underpinned, in large part, by the Internet's highly accessible infrastructure. Once a network in South Korea has achieved the basic task of connecting to the Internet, they are part of the entire global Internet. To do this, they only need to find a network already connected to the Internet, and to negotiate to interconnect with that network. This has allowed the

[6] https://likms.assembly.go.kr/bill/billDetail.do?billId=PRC_P2W1Q1Y2M0H2L1I5M1H7L4P3Y6V2D1
[7] https://likms.assembly.go.kr/bill/billDetail.do?billId=PRC_T2N1P0U7R1H4H1Q0U0G3N1M7Y8R9I1

Internet to be continually extended by the many kinds of organizations that connect to it, and for the network to reach ~~a~~ global scale.

The South Korean interconnection rules dramatically affect this property. Under these rules, networks, including VSP's whose traffic is mostly outbound, have to enter into a paid contract with other ISPs in the country to make their services available for the customers of these ISPs. Connecting to a single network is not enough, as the rule makes provision of IP transit inside the country unattractive for ISPs. The recently proposed amendments to the TBA aim at extending this rule to foreign content providers. As a result, it has a direct impact on this accessibility by raising barriers to entry, for both networks in South Korea and international networks that wish to connect with local networks.

Decentralized Management and a Single Distributed Routing System which is scalable and agile

One of the critical properties of the Internet is that each network voluntarily joins the Internet and makes independent decisions on who to interconnect with and how to route traffic to its neighbors, based on its own needs and local requirements. There is no central direction or coordination dictating how and where connections are made, but rather each operator makes its own decisions and collaborates freely with those it chooses, so the network grows organically, driven by local needs.

To effectively mandate a particular business arrangement between networks, as well as to VSPs, is in direct conflict with the autonomy of networks in the Internet model. By prescribing a set of requirements for participating parties it constrains the flexibility of networks to negotiate how they interconnect, and interferes with the Internet's voluntary nature by which independent networks are free to manage their connectivity arrangements according to local needs. For VSPs the combination of the SPNP rules and the 2020 amendments also risk creating "pay to play" scenarios whereby content providers are required to make costly interconnection arrangements to meet the requirements[8].

The result of existing rules, and the newly proposed provisions, is inefficient traffic flows, higher costs of data transmission, a more hierarchical and less resilient network topology, and lower quality of services for users in South Korea.

A Technology Neutral, General-Purpose Network that is simple and adaptable

As a networking model, the Internet is designed as a general-purpose network, meaning it is not optimized for voice, particular usage patterns, or special traffic characteristics. In this model, the network is agnostic with regards to the content of each data package, and is instead forwarding packets on a best-effort, which means that neither quality nor connectivity is guaranteed. New

[8] AccessNow (16 September 2020) "Open letter to South Korea's ICT Minister: ensure Net Neutrality" https://www.accessnow.org/open-letter-south-korea-net-neutrality/

innovations emerge because this approach allows innovators to design and pursue, without permission, their ideas knowing the network's benefits and drawbacks. It is why the Internet has gradually been able to facilitate new applications like voice communications, gaming or video streaming, without fundamental changes to the design of the underlying networks. The fact that many small and medium-sized companies (SMEs) can potentially serve customers all over the world is a testament to this critical property's importance to the success of the Internet.

The 2021 proposed amendments extend this problem by conditioning the quality, or even access to a service, on contracting with the local ISP. If such rules would apply to any content provider on the Internet–irrespective of a direct relationship with a local ISP or not–this constitutes a direct threat to the very idea of a global and general-purpose network. The result would be the abandonment of an agnostic networking approach based on best-effort to one in which service quality, and the ability to deploy a service globally, would be conditioned by regulation and contracting across the global network. Since the Internet is designed for connectivity across *all* of its participating networks this would also result in a form of Internet fragmentation where end-users can only access online services that have contracted with their ISP.

How Do the "Sender Pays" and Interconnection Rules Affect the Realization of the Full Potential of the Internet?

While the critical properties are essential for the Internet to exist, they are other elements the Internet needs to unlock its full potential. To identify whether the South Korean existing and proposed provisions impact what we need for an Internet that is open, globally connected, secure and trustworthy, we will assess them through the lens of the enablers of these goals.

Easy and Unrestricted Access

It is easy to become part of the Internet, for networks and users alike. Networks operators can easily add themselves to the Internet's infrastructure without unnecessary regulatory or commercial barriers. Responsive Internet infrastructure creates an Internet that is affordable for users and that has accessible services, empowering users to connect and use the Internet with minimal barriers.

The effect of the interconnection rules will be a misplacement of investment and long-term stagnation of infrastructure development that increases overall networking costs. In a competitive market, these costs are ultimately borne by the users in South Korea through increased costs of Internet access.

The voluntary interconnection model of the Internet, in which arrangements are the result of commercial negotiations, helps ensure efficient network operations in which network service can be optimized from a perspective of costs and performance. In most cases this is achieved through peering with other networks to minimize costly transit arrangements. For instance, Internet Exchange Points (IXPs), which facilitate the physical interconnection of different networks, have increasingly become

important hubs of such arrangements as they enable networks to exchange traffic with both local and international networks. The result is richness and agility of interconnections between networks, resulting in higher resilience and optimum traffic flows.

The rules increase South Korea's heavy reliance on transit links to international networks by further disincentivizing local peering arrangements through an IXP. None of the country's three largest ISPs currently participate in the Korea Internet Neutral Exchange (KINX). This constant demand for transit, even for traffic destined within South Korea results in both higher costs and higher latency. For example transit cost in Seoul is around 10 times that of European network hubs in cities like Frankfurt or London that heavily rely on IXP-based interconnection rather than transit[9].

The new rules targeting VSPs also have a detrimental effect on new entrants for applications and services, perhaps especially when directly applied to content providers. As a new entrant grows, it necessarily pays increased traffic costs, making the business a victim of its own success. Combined with the quality of service requirements coming into force as the service grows, this would place additional burdens on new entrants that may still be in a growth phase towards profitability.

Unrestricted Use and Deployment of Internet Technologies

The Internet's technologies and standards are available for adoption without restriction. This enabler extends to end-points: the technologies used to connect to and use the Internet do not require permission from a third party, operating system (OS) vendor, a network provider, or any other third party. The Internet's infrastructure is available as a resource to anyone who wishes to use it. Existing technologies can be mixed in and used to create new products and services that extend the Internet's capabilities.

Modern provisioning of interactive content and streaming services uses several technologies and concepts that ensure scalable and efficient service delivery. This includes local content caches that can be placed as close to the end-user as possible. This dramatically improves latency and bandwidth consumption by keeping traffic as local as possible. At the same time, it minimizes overall costs by avoiding re-transmission of the same content for many users across expensive long-distance links.

It also includes local IXPs that help facilitate efficient traffic exchange within a country. IXPs and content caches both improve quality of service as traffic between the content provider and the ISP is exchanged closer to the end-user. They also reduce costs by exchanging traffic overseas across international links (transit) only when necessary.

The "sender pays" rule entrenches connectivity infrastructure and traffic exchange that is not optimized for scalable delivery of high-volume low-latency interactive content (e.g. gaming) and streaming (e.g. HD/4K video on demand), and at the same time impedes the use and deployment of modern techniques and technologies mentioned above. In other words, the rule imposes restrictions that

[9] Comparison based on data on 10GE and 100GE circuit types from Telegeography, Q4 2021.

undermine the Internet's inherent openness to new technologies and innovations, with consequences for both users and innovators. Crucially, it could derail South Korea's concerted push to develop its metaverse industry.

Collaborative Development, Management and Governance

The Internet's technologies and standards are developed, managed, and governed in an open and collaborative way. This open collaboration extends to the building and operation of the Internet and services built on top of the Internet. The development and maintenance process is based on transparency and consensus, and has as its goal the optimization of infrastructure and services to the benefit of the users of these technologies.

The voluntary interconnection model of the Internet means that it facilitates collaboration around a broad and diverse set of interconnection arrangements. The "sender pays" rule, and the proposed amendments to the TBA, constrain the range of available options for collaboration amongst both network operators and content providers. It restricts the ability for ISPs to engage in settlement-free peering while burdening them with administrative costs associated with compliance. The fact that these rules also deviate from global norms has led to regulatory uncertainty in the form of lawsuits and other costs that impact investments and service provision. For South Korean networks this makes collaboration with both national and international networks harder, with a negative effect on the Internet's openness for all parties.

Unrestricted Reachability

Internet users have access to all resources and technologies made available on the Internet and are able to make resources available themselves. Once a resource has been made available in some way by its owner, there is no blocking of legitimate use and access to that resource by third parties.

The Internet's key strength lies in the shared network produced through collaboration among independent network providers. This shared network of networks allows users and service providers, located in different networks and geographies, to communicate end-to-end and to access all parts of the shared network–without the need for contracts.

The proposed provisions in new legislation directly threatens this important feature by requiring certain VSPs to enter into a payment contract with local ISPs. Limiting the choices available for VSPs to deliver content by requiring a paid arrangement with ISPs, combined with the 2020 amendments to the TBA, which puts the onus of maintaining network quality of service on content providers, may cause VSPs to degrade or suspend the service they provide in South Korea. Alternatively, the payment rules could be used by local ISPs to strong-arm a VSP by degrading service or blocking its traffic.

It is also important to consider possible second-order effects of blocking or degrading the service of a VSP. For instance, a content provider that is also a software vendor may require security updates, or a

provider that also offers a networked service (e.g. authentication) that other online entities depend on could be blocked.

All scenarios are to the detriment of Internet users in the country, and could stunt the growth of South Korea's startup ecosystem which the country heavily invests in building.

Available Capacity

The capacity of the Internet is sufficient to meet user demand. No one expects the capacity of the Internet to be infinite, but there is enough connection capacity – ports, bandwidth, services – to meet the demands of the users.

As described above, the voluntary interconnection model of the Internet helps ensure efficient network operations in which network service can be optimized from a perspective of costs and performance. The 2016 amendment, as it has been implemented, forces specific interconnection arrangements in direct conflict with this approach and risks creating an inefficient infrastructure with sub-optimal traffic flows.

The country's heavy reliance on transit links rather than local peering is an example of this–instead of incentivizing foreign content providers to exchange traffic in the country, it is common that such traffic exchange with South Korean ISPs happens abroad. It also disincentivizes a more efficient deployment of infrastructure. For instance, by making it more attractive for content to be hosted abroad to avoid costly peering arrangements, South Korean users may experience increased latency. The result is an Internet experience that cannot be optimized for the demands of South Korean users. This issue would be made worse by the 2021 proposed revisions to the TBA, under which ISPs may resort to throttling or even blocking traffic from certain content providers.

Reliability, Resilience and Availability

The Internet is reliable when technology and processes are in place that permit the delivery of services as promised. If, for example, an Internet service's availability is unpredictable, then users will observe this as unreliable.

Some of the companies that provide content to Internet users in South Korea also provide important services, such as online banking, e-commerce, ride-hailing, navigation, and productivity tools—services that underpin a connected citizen's everyday activities, and are increasingly accessed through dedicated apps. A small subset of these firms also provide the operating systems on our devices. ISPs are largely unable to distinguish between the types of traffic originating from a particular source. Should the proposed provisions result in ISPs restricting access to content from VSPs who fail to comply, it could also risk blocking access to services that South Korean citizens rely on. Likewise, it risks blocking crucial system updates, including security updates, leaving South Korean users vulnerable to ever-evolving online security threats.

Accountability

Accountability on the Internet gives users the assurance that organizations and institutions they interact with are directly or indirectly acting in a transparent and fair way. In an accountable Internet, entities, services, and information can be identified and the organizations involved will be held responsible for their actions.

The 2020 amendments to the TBA impose certain requirements for the quality of service the content providers should meet, while at the same time limiting their options to interconnect with ISPs. In this case the accountability of the entities providing service to the users is undermined by not empowering them on the one hand (e.g. they cannot meet quality criteria by deploying local caches due to costly peering arrangements, etc.) and waving responsibility on the other (if poor service is perceived by the users as the fault of a content provider). At the same time, it may also hold content providers responsible for decisions that ISPs make in managing traffic congestion. The content providers may also be held responsible for conditions that are beyond content providers' control, such as poor network capacity.

Summary and Recommendations

The 2016 amendment that has effectively amounted to a "sender pays" rule has profound negative effect on the openness, global reach and trustworthiness of the Internet in South Korea. This trend has become stronger under the newly proposed amendments to the TBA that will extend the types of networks that have to follow mandated interconnection settlement schemes and unfairly placing responsibilities for service delivery on select entities without considering the whole supply chain.

In particular this leads to:

- Inefficient infrastructure and traffic flows, leading to high costs and low quality of content services.
- Misplaced investments supporting outdated models for content delivery, leading to long-term stagnation in the service development and evolution in South Korea.
- Higher barrier to entry, especially for newcomers and new applications/services, impeding innovation and service offerings.
- Shifting away from a general purpose network service by ISPs, affecting the network neutrality principle.

It is our interpretation that the 2020 amendments to the TBA, and the proposed bills in 2021, have been an effort to address the resulting inefficiencies and distortions in the deployment of new infrastructure, and to level the playing field for domestic and international service providers. However, as described in this impact brief, if that is the intent, they ironically worsen a problem that is grounded in a heavily regulated approach to interconnection, the 2016-enforced interconnection rule which has mandated

the sender pay rule among Korean ISPs. In this light we recommend that the most recently proposed revisions be rejected, and instead that the 2020 amendments to the TBA and the Interconnection Standards for Telecommunication Facilities are revised to align with global norms for Internet interconnection and service delivery based on voluntary collaboration.