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The cloud and telecoms networks in APAC

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COMMUNICATIONS CHAMBERS

Disclaimer

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Contents

1 Executive summary

A cloud service is an on-demand IT service (such as processing or storage) provided over the internet, with pay-as-you-go pricing. There are generally three categories of services provided by cloud providers – infrastructure-as-a-service (IaaS), platform-as-a-service (PaaS) or software-as-a-service (SaaS). Cloud services underpin a vast array of applications across these 3 categories, ranging from internet banking to Netflix. Third party application developers also make heavy use of IaaS to enable their products, to bring flexibility and to accelerate innovation.

Cloud services are becoming increasingly important to companies and governments in their digitalization journey. Global spend on public cloud services is expected to grow by 20% in 2022.[1] Uptake is already high in APAC, with corporates, small companies and government bodies all making use of the cloud. At end 2021, annualised cloud infrastructure revenues in APAC were $68bn, and growing at 40% per year.[2]

Cloud services bring major benefits to national economies

Increased cloud use:

- Improves the efficiency of private and public bodies.
- Strengthens competition, levelling the cost and technology playing field between national and multi-national players
- Provides adaptability to sudden growth or external shocks (such as the pandemic).
- Frees up capital to be used for more productive investment. (Cloud providers can offer cost savings to their customers because they operate at much greater scale. They also allow organisations to avoid upfront capex and respond to volatile demand)
- Reduces growth in demand for scarce IT skills. (Cloud providers also provide substantial free training)
- Accelerates innovation, by making it simpler for organisations to launch new services and to make use of advanced enabling technology such as artificial intelligence and quantum computing

[1] Gartner, *Gartner Forecasts Worldwide Public Cloud End-User Spending to Reach Nearly $500 Billion in 2022*, 19 April 2022. Gartner, *Gartner Says Four Trends Are Shaping the Future of Public Cloud*, 2 August 2021

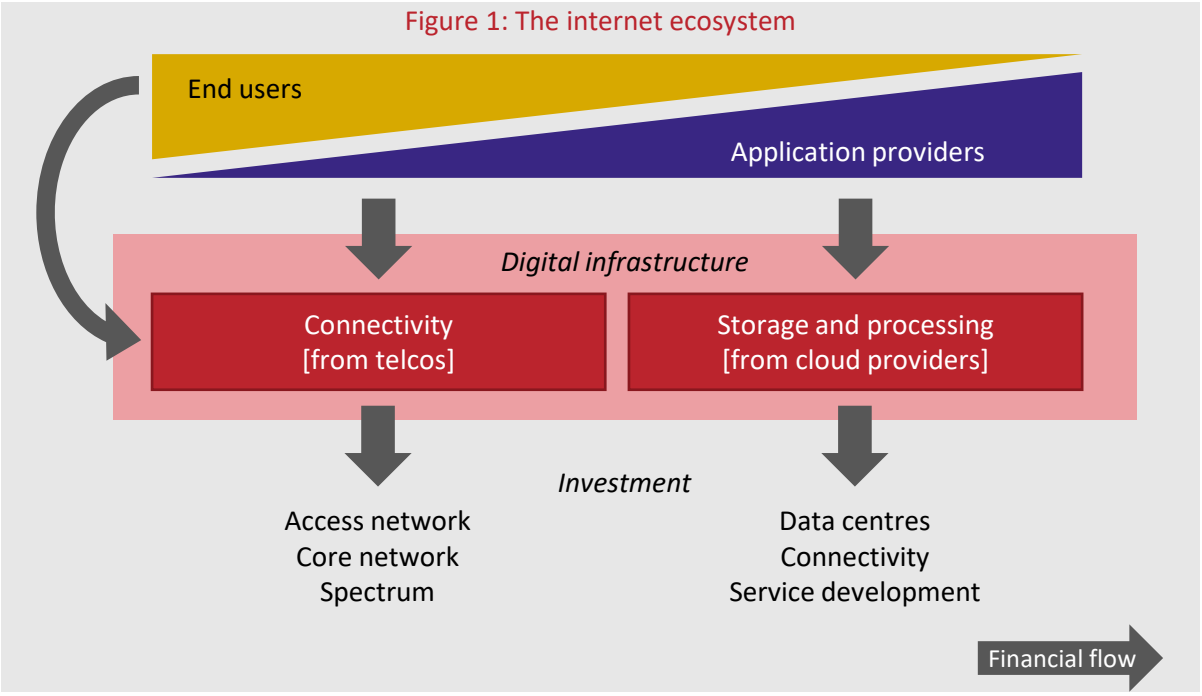
[2] ARN, *Asia Pacific businesses tap cloud at pace*, 3 March 2022

- Increases resilience, protecting against a range of threats from cybercrime to power outages.
- Supports digital inclusion, by simplifying services for 3consumers and reducing their cost. For example, moving processing and storage to the cloud means that cheaper and simpler mobile devices can still make use of advanced services
- Reduces energy use, since public cloud data centres are more energy efficient than typical corporate data centres.
- Brings investment to a country, as cloud providers build out data centres and networks.

Cloud services and connectivity together make up the digital infrastructure that enables the digital economy

The value of the digital economy derives from rich interaction between end-users and applications primarily over the internet. This depends on digital infrastructure, in the form of network connectivity and storage & processing of information. Telcos mostly invest to provide the former, and cloud providers mostly invest to provide the latter.

Figure 1: The internet ecosystem



Telcos and cloud providers have a symbiotic relationship that supports the entire digital ecosystem

The entire digital infrastructure that powers the digital economy, relies on telcos and cloud providers who depend upon each other – without connectivity, cloud providers would not be able to sell their services; equally, without cloud services, there would not be the range of applications to persuade consumers to buy and upgrade broadband, and telcos would lose substantial revenue.

Cloud services also support telco revenue more directly. Corporate cloud customers need connectivity to reach the relevant data centre, and this will be procured from telcos and ISPs. Cloud providers also need to connect to their enterprise customers (often over private circuits).

Cloud providers also have their own extensive internal networks linking their datacentres. To support this, they invest substantially in international connectivity and buy capacity from telcos nationally to bring their customers' data closer to end users in order to improve latency[3] and reduce the amount of data sent over third-party networks.

Finally, there are numerous partnerships between telcos and cloud providers. These enable telcos to bundle cloud services into their proposition to corporate customers, and thereby generate revenue.

There are some challenges, which may negatively impact the telco-cloud provider relationship: telcos claim that cloud providers should pay traffic charges to support investment in network connectivity – but their case is weak

Telcos are arguing that cloud providers (alongside other content and application providers - CAPs) should pay traffic charges for the traffic they send over telco networks.[4] They claim traffic growth is overwhelming, triggering unsustainable cost.

In fact, traffic growth is slowing. For instance, in Japan and Hong Kong, growth in traffic per fixed line had fallen to below 10% pre-pandemic, and this year has returned to similar levels.[5] Meanwhile, the cost-per-bit for telecoms equipment has been falling at

[3] Roughly speaking, latency is the time it takes for a server to respond to a user's request
[4] See FN 45 for examples
[5] Ministry of Internal Affairs and Communications [Japan], 我が国のインターネ ットにおけるトラヒックの集計・試算, 4 February 2022; OFCA [Hong Kong], *Customer Access via Broadband Networks*; Ofca, *Statistics on Internet Service Subscriptions in Hong Kong*, [accessed 14 April 2022]. Communications Chambers analysis

approximately 25% annually for many years.[6] Further, traffic over the open internet from cloud providers is modest – we estimate under 5% of the total.[7] This all suggests that cloud-driven traffic will not trigger material costs for telcos.

Telcos also argue that is wrong that in a two-sided market such as broadband (serving consumers and CAPs) that only consumers should pay them. On the contrary, this is common in such markets, as the OECD has noted.[8] An associated claim is that cloud providers are 'free-riding' because they are not supporting investment in networks. But cloud providers are investing substantially in their area of digital infrastructure. In 2021 the largest five providers invested $53bn in data centres and other assets. [9]

Traffic charges are also unlikely to flow through to benefits for users

Telcos claim that if they received traffic charges, they would reinvest them. However, total cloud revenues are a fraction of telco revenues, suggesting that any plausible traffic charge imposed on cloud providers is unlikely to make much difference to telcos' overall income. By extension they will not support material additional investment by telcos. Moreover, Asian telcos are already paying substantial dividends. It seems likely that if they were to receive further funds from traffic charges, these too would be passed through to shareholders rather than (say) invested in networks.

Imposing traffic charges carries significant risk

The case *for* traffic charges is weak, but there are also strong arguments *against*. Such charges will flow through into increased costs for cloud services, which could have downstream effects on businesses using the cloud, discouraging a vital transition for Asian organisations and economies. Traffic charges are counter-productive to governments' digitalization goals because they raise the cost of participating in the digital economy and accessing digital services. Countries imposing traffic charges also risk weakening their own national cloud providers, and encouraging multinationals to locate their datacentres elsewhere.

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[6] Ciena, *How near-zero margin networking changes network economics*, 19 August 2020
[7] See page 21 for detailed discussion
[8] OECD, Policy Roundtables: Two-Sided Markets, 2009
[9] RBC Capital Markets, *RBC Datacenter Download*, 20 September 2021

USF levies, which may be considered as an alternative to traffic charges, also carry significant risk

USF levies have been suggested in certain markets (South Korea and Malaysia, for example) to address telco's claims about lack of funding for digital infrastructure investment. But there are significant risks in the imposition of USF levies on cloud providers. The logic for such levies on application providers is much weaker than for levies on telcos, and they are equally likely to discourage cloud investment. Traditional USFs, focused on network deployment, may also no longer be as appropriate, as the challenge shifts to network uptake rather than network build in many markets. Implementation and operation of USF funds also has a very mixed track-record.

Conclusion

The internet ecosystem, which is reliant on the underlying digital infrastructure that is maintained by the telco-cloud provider relationship is working well, creating enormous value for consumers and economies. Unnecessary policy interventions bring the risk of disrupting the telco-cloud provider relationship and unsettling this success.

Before taking any action that might negatively impact the existing rich and symbiotic relationship between cloud providers and telcos, and by extension, the digital economy, it is best to consider clearly defining the problem that needs to be addressed before considering appropriate remedies.

Analysis of the arguments made by telcos suggests that there is not in fact a problem that requires policy intervention. Moreover, the proposed solutions being considered (traffic charges and USF levies) are likely to be more costly than beneficial to a country's digital economy.

2 Introduction

In this paper we discuss the relationship between cloud providers and telcos and how it supports the underlying digital infrastructure of a country's digital economy and some of the issues that threaten this relationship.

We begin by describing cloud services and their benefits. They are increasingly fundamental to the operations and services of companies in many countries and industries. We consider how the use of the cloud by these companies supports national economies.

We then turn to the interaction of cloud services with telecommunications. We begin by looking at how cloud traffic is delivered, over the cloud providers' own networks and those of telcos. We next consider the financial effects of cloud services on telcos, which are multistranded and go far beyond the simple cost of carriage of traffic. The relationship between cloud providers and telcos is in fact strongly mutually beneficial.

Finally, we turn to recent arguments that threaten the symbiotic relationship between cloud providers and telcos – the argument for imposition of traffic charges or USF levies for cloud providers. We consider their impact on this relationship, and on the wider societal benefits of cloud services.

3 What is a cloud service?

In this section we briefly describe cloud services – their variety, how they are provided, the benefits they bring and who uses them.

3.1 The basic concept of a cloud service

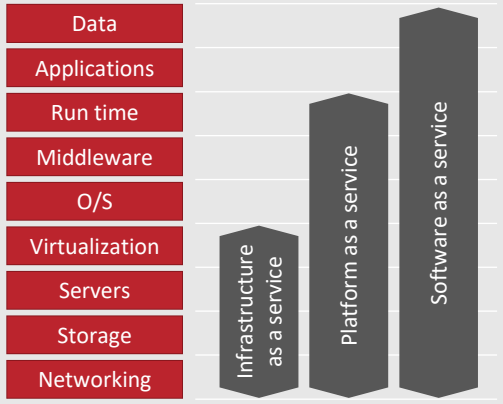
A cloud service is an on-demand IT service (such as processing or storage) provided over the internet, with pay-as-you-go pricing. It may replace similar functionality that the customer previously provided using their own on-site equipment.

3.2 Varieties of cloud service

There is a great variety of cloud services. At a high level they are generally categorized into infrastructure-as-a-service (IaaS), platform-as-a-service (PaaS) and software-as-a-service (SaaS). These categories move an increasing amount of the user's 'IT stack' into a cloud. The IT stack is the set of capabilities that enable an IT system to deliver value to the user.

At the bottom of the stack is physical cloud infrastructure and hardware, such as data centres, servers and associated storage. In the middle is the software that enables the hardware to run applications – operating systems, for example. At the top of the stack are the applications themselves and the associated data.

Figure 2 The IT stack and cloud services[10]



IaaS shifts the hardware to the cloud, but leaves the customer to manage enabling software and applications. PaaS also moves operating systems, middleware and run time capabilities to the cloud, leaving only data and applications for the user to manage. SaaS migrates the entire IT stack to the cloud (Figure 2).

Cloud services may also private, public or hybrid. A private cloud solution is operated on-premise by an organisation for its own needs. Public cloud services are provided by third parties (such as AWS or Alibaba) for organisations. Hybrid solutions blend these two options.

[10] Adapted from Information Technology and Innovation Foundation, *Secrets From Cloud Computing's First Stage: An Action Agenda for Government and Industry*, June 2021

3.3 How cloud services are provided

To provide cloud services requires premises, hardware, software and connectivity. (A PaaS or SaaS provider may not operate all these themselves, but may instead procure them from an IaaS provider). Each requires both capital investment and significant expertise. We discuss them in turn.

Premises

Cloud services are provided from data centres – physical locations dotted around the world to be close to users. (Being close to users increases reliability and responsiveness of services).

These are large and complex facilities. They require

- External security (fencing, guards and so on)
- Internal security and access control
- Reliable power and back-up power (usually batteries and on-site generation)
- Cooling to handle the heat generated by servers
- Constant testing and maintenance

By way of example, Amazon Web Services operates 26m square feet (2.4m m^2) of property, of which the great majority is data centres.[11]

Hardware

At the heart of data centres are racks of servers. At one time these would have been 'off the shelf' models from a third party. Today, larger cloud providers build their own hardware – not just servers, but also the chips embedded in them. For example, some are deploying their own chip designs customised for specialist tasks such as image processing and machine learning.[12]

Software

Cloud services make use of wide array of sophisticated and proprietary software. At a basic level, this ensures that requests for data and services are handled by the data centre and server that is most suited, taking into account proximity, existing loads and so on. It also enables replication of data across multiple data centres.

Software also enables virtualisation – giving users a virtual machine to operate their applications on, even though in reality one server may be serving the needs of multiple users.

[11] Amazon, *10-K*, 26 January 2022
[12] T_HQ, *Cloud giants are customizing their own chips – here's why*, 14 June 2021

Above this, there is the code that supports SaaS, dependent on the specific application – such as accounting logic for bookkeeping SaaS. Many smaller SaaS providers will make use of IaaS or PaaS from larger players – in this way these larger players enable significant and widespread innovation in applications by a host of specialists.

Investment in software is enabling evermore specialised cloud services. At the end of 2017, AWS offered around 90 services. By the end of 2021 this had risen to 225.[13]

Network

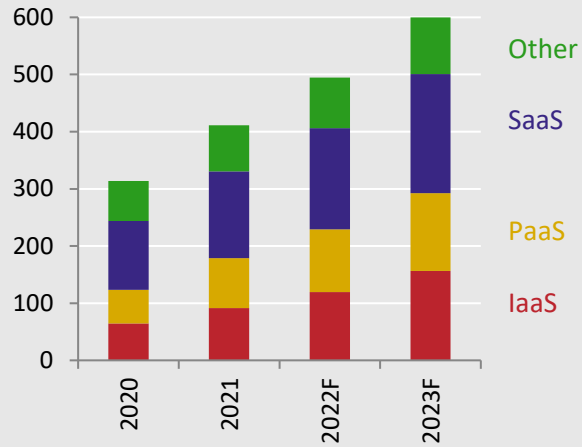
Cloud services include significant networking. Most obviously, relevant data must be delivered to the consumer, via (in part) that user's internet connection. In addition, corporates buying cloud services will often have a direct connection to their cloud provider. But cloud providers also operate substantial internal networks, linking together their data centres. Such networks enable replication of data (for redundancy), enable load balancing (directing requests to the server best able to handle them), support global availability of customer applications and so on.

All this connectivity will generally be provided by telcos, whether paid for by the cloud provider itself, by corporate cloud customers or by consumers. (We discuss cloud and the network in more detail in section 5).

3.4 Why organisations use cloud services

Cloud services are seeing rapid uptake globally (Figure 3). This is because they provide clear benefits to the consumers and organisations that use them.

Figure 3: Global spend on public cloud, $bn[14]



They provide access to economies of scale. The data centres and networks operated by cloud providers are far larger than those that could be justified by any one corporate customer, and so have much lower unit costs.

Cloud services provide redundancy. Because they operate multiple servers and multiple data centres, cloud providers can offer a highly

[13] DXC, *Leveraging the hyperscalers: Constructing cloud-native business capabilities*, December 2021

[14] Gartner, *Gartner Forecasts Worldwide Public Cloud End-User Spending to Reach Nearly $500 Billion in 2022*, 19 April 2022. Gartner, *Gartner Says Four Trends Are Shaping the Future of Public Cloud*, 2 August 2021

reliable service, where the failure of any one piece of hardware or network connection is very unlikely to interrupt service to end-users.

They provide scalable costs. An organisation operating its own servers must invest up front, perhaps against uncertain future demand. Using a cloud service allows an organisation to pay only for what they use, when they use it.

They provide flexibility. Capacity can be easily procured to add service in a new region, or to meet a surge in demand.

They provide best-in-class operations. Cloud providers are in a position to recruit highly skilled teams, and to implement their expertise widely. By outsourcing some of their technology operations to such teams, organisations can focus on their own strategic priorities.

They provide enhanced security. This is a particularly important aspect of cloud providers' best-in-class operations.

They are more sustainable, with greater energy efficiency that in-house operations.

3.5 Cloud customers in Asia Pacific

Cloud services are widely used in Asia Pacific. At end 2021, annualised cloud infrastructure revenues in APAC were $68bn, and growing at 40% per year.[15] This growth is well above the global average, and as a result APAC is growing its share of worldwide cloud usage.

Asian governments, corporates and smaller businesses all make substantial use of cloud services to support their critical applications. While some of these applications will be internal to the organisation, many are consumer-facing. Indeed, most of the apps used on a smartphone will depend on cloud services, for example.

Figure 4 shows a sample of corporate and government customers for each of the five main cloud providers, across four representative countries in the region:

[15] ARN, *Asia Pacific businesses tap cloud at pace*, 3 March 2022

Figure 4 Cloud service customers – sample markets and providers[16]

3.6 Conclusion

Cloud operators, through investment and technology, offer an array of services that bring value to both commercial and government users in Asia. Uptake is widespread, and continuing to grow fast.

[16] Cloud provider websites. Note that organisations (including those in the Figure) may use more than one cloud provider

4 How cloud services support national economies

We discussed above some of the benefits cloud services bring to the organisations that use them. These translate into a range of benefits for national economies.

4.1 Improved efficiency of local organisations

Most directly, cloud services reduce costs and enhance performance of the organisations that use them. This in turn flows through to benefits for consumers and citizens.

4.2 Enhanced competition and economic growth

Cloud services bring additional, indirect benefits by enhancing competition. By offering low cost infrastructure and technologically advanced services to all players in the market, they 'level the playing field'. For example, most organisations would be quite unable to develop their own artificial intelligence capabilities in-house, but cloud providers now offer them 'on tap'.

This helps national companies compete with multinationals and new entrants compete with bigger players. As the ADB has put it:

> "The potential for start-ups to generate opportunities for economic growth can be expanded greatly with the use of cloud-computing technologies"[17]

Such are the advantages of the cloud to digital start-ups that they are increasingly 'born in the cloud', building their entire technology stack on cloud services, with little or no infrastructure of their own.

4.3 Accelerated uptake of key technologies

Technologies such as IoT,[18] artificial intelligence and machine learning are all seen as key contributors to economic development and competitiveness in the 21st century. Many countries have implemented policies to encourage their uptake. Using AI as an example, Korea has a 'Data & AI-Driven Economy Promotion Plan', Vietnam has a 'National Strategy on R&D and Application Of AI' and Thailand has a 'National AI Strategy and Action Plan'.[19] Government

[17] ADB, *Cloud computing as a key enabler for tech start-ups across Asia and the Pacific*, July 2021
[18] Internet of Things
[19] For details and many more examples, see the OECD AI Policy Observatory

interest is unsurprising, since such general purpose technologies can have meaningful impact on national economies.

However, this impact is only possible if the technologies are adopted. Cloud provision can greatly accelerate adoption, by reducing the need for upfront investment and specialist skills (skills that may not just be in short supply in a particular organisation, but across a country as a whole).

4.4 Earlier availability of new services

One of the reasons organisations use cloud services is that they enable them to bring their new services to consumers or citizens more quickly. This is a benefit to the organisation, but also of course to the end-users.

For example, the Moderna COVID-19 vaccine was developed in 42 days rather than a more typical 20 months. Moderna was able to do this in part because it is a customer of AWS cloud services, which it used to accelerate the design of research experiments; automate its laboratory and manufacturing processes; and to support compliance.

4.5 Adaptability

From time to time societies face external shocks. These may create surges in demand for IT capacity. Cloud services, by offering flexible capacity, allow organisations to adapt to such shocks.

For example, in response to COVID-19 the UK's HMRC (tax office) needed urgently put in place schemes to support job retention, the self-employed and a new sick-pay scheme. This took HMRC "from being an organisation that collects revenue to one that distributes it in a matter of weeks."[20]

It also created huge demand for processing capacity. For this HMRC turned to AWS. One of those working on the project described this as "opening the garage and finding a Ferrari sitting there". [21]

4.6 Capital available for higher productivity investment

As we have seen, cloud services reduce the investment required for IT operations, by converting an up-front cost to a 'pay as you go'

[20] Institute for Government, *Digital government during the coronavirus crisis*, 2020
[21] Ibid

operating cost. This frees up capital for higher productivity uses, focused on national or corporate competitive advantages. For example, an airline would be able to spend more on modernising its fleet, rather on data centres to serve the back office.

4.7 Mitigating IT skills shortages

As the global economy undergoes a digital transformation, IT skills are in huge demand, in APAC as elsewhere. Amongst IT decision makers in the region, 73% report that they are facing skills gaps.[22] AlphaBeta found that across seven APAC countries, 86m more people will need digital skills training over the next year.[23]

Use of cloud services allows organizations to outsource some of their skills requirements to the provider. This both eases their own recruitment challenges, but also reduces overall growth in demand for these scarce skills (compared to in-house provision), meaning that they are less likely to be a constraint on the wider economy of the country in question.

Cloud providers are also investing to increase the supply of skills. Programmes such as Alibaba's DigiTalents Forward, Google's Cloud Skills Boost and AWS Skill Builder provide free online courses for cloud practitioners. AWS has committed to provide free skills training to 29m people by 2025.[24]

4.8 Resilience and data security

An important aspect of cloud services to organisations that use them is their resilience. Cloud providers invest significantly to defend against cyber-attacks and to protect against power outages and other incidents that might lead to loss of service.

Cybercrime (for example) is estimated to have cost $6trn globally in 2021,[25] or 6% of global GDP. Use of cloud services can mitigate this. As the UK government's National Cyber Security Centre has noted:

> "[U]sing a good cloud service can bring significant security benefits to your organisation. Cloud services have been designed with an array of security features in mind ... Good cloud services make advanced security accessible to **all**

[22] Skillsoft, *2021 Global Knowledge IT Skills and Salary Report*, 2021
[23] AlphaBeta, *Building digital skills for the changing workforce in Asia Pacific and Japan*, March 2022
[24] Amazon, *Amazon to help 29 million people around the world grow their tech skills with free cloud computing skills training by 2025*, 10 December 2020
[25] Cybercrime Magazine, *Cybercrime To Cost The World $10.5 Trillion Annually By 2025*, 13 November 2020

customers, not just those with large budgets."[26] [emphasis in original]

Such security benefits both the organisation using cloud services, and the consumers and citizens whose data is protected.

4.9 More efficient energy use

Cloud data centres are far more energy efficient, both because they use servers more intensely, and because their power and cooling systems are more efficient. Moving from a private data centre to the cloud can result in energy savings of 78%.[27]

The major cloud providers are also focused on securing green energy sources for their data centres. Alibaba Cloud expects to run entirely on renewable energy by 2030, for example.[28]

Thus a shift to the cloud helps limit demand for new generation capacity in a country, and reduces its carbon footprint.

4.10 Investment by cloud providers

Finally, cloud providers invest substantially to enable their services, and this investment has direct impact on local economies. RBC Capital Markets estimated the leading five providers had global cloud capex of $53bn in 2021.[29] In Indonesia (for example), AWS alone expects to invest US$5bn over the next 15 years.[30] In India, it is spending $2.8bn on a single cloud region over two years.[31] Microsoft is spending $1bn over five years on its Kuala Lumpur data centre region.[32] Such investments represent revenue for local construction firms, income for local employees and so on.

[26] NCSC, *Security benefits of a good cloud service,* 13 November 2020
[27] 451 Research (for AWS), The Carbon Reduction Opportunity of Moving to the Cloud for APAC, July 2021. See also IEA, *Data Centres and Data Transmission Networks*, November 2021; Uptime Institute, *Is PUE actually going up?*, 15 May 2019
[28] Alibaba Cloud, *How Alibaba Cloud Data Centers Will Reach 100% Clean Energy By 2030*, 28 March 2022
[29] RBC Capital Markets, *RBC Datacenter Download*, 20 September 2021
[30] Channel Asia, *AWS launches Indonesia cloud region, pledges $5B investment*, 14 December 2021
[31] TechCrunch, *Amazon to invest $2.8 billion to build its second data center region in India*, 6 November 2020
[32] MIDA, *MIDA welcomes Microsoft's plan in 'Bersama Malaysia' initiatives*, 20 Apr 2021

4.11 Conclusion

Thus cloud services support national economies (and societies) in a range of different ways, and help crystalize the potential of digitalisation. According to the Asian Development Bank:

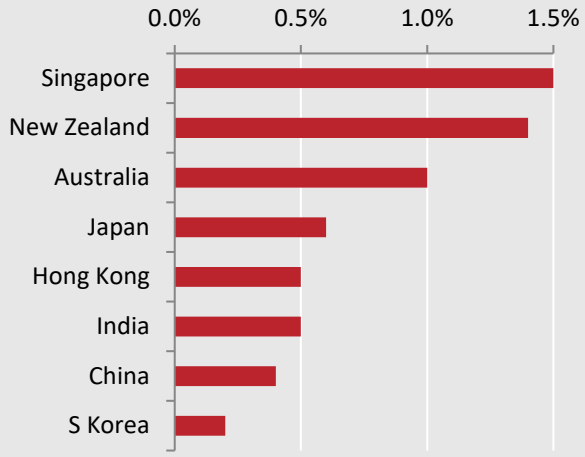
> "strong telecommunications networks … do not, on their own, provide a solid footing for the emergence and growth of a digital economy. The full economic potential of a digital economy can only be leveraged with sufficient access to data storage and cloud computing resources that process the data flows".[33]

The Thailand Board of Investment has taken a similar view:

> "Data center and cloud services are one the most essential driver[s] of the global digital economy" [34]

It is for such reasons that cloud services are likely to make meaningful contribution to Asian GDP growth, particularly in those countries that make greatest use of them (Figure 5). For India, NASSCOM & Oliver Wyman see even greater benefits, suggesting that cloud value-add could represent 8% of GDP by 2026.[36]

Figure 5: Cloud contribution to GDP (2020-24)[35]



The benefits are not limited to the commercial sector. According to the Asian Productivity Organization:

> "Cloud computing … helps public service organizations to make evidence-based decisions and improve productivity and citizen services. It offers the security for government databases in the cloud and helps hasten innovation in government using technologies in the cloud without the need to buy hardware."[37]

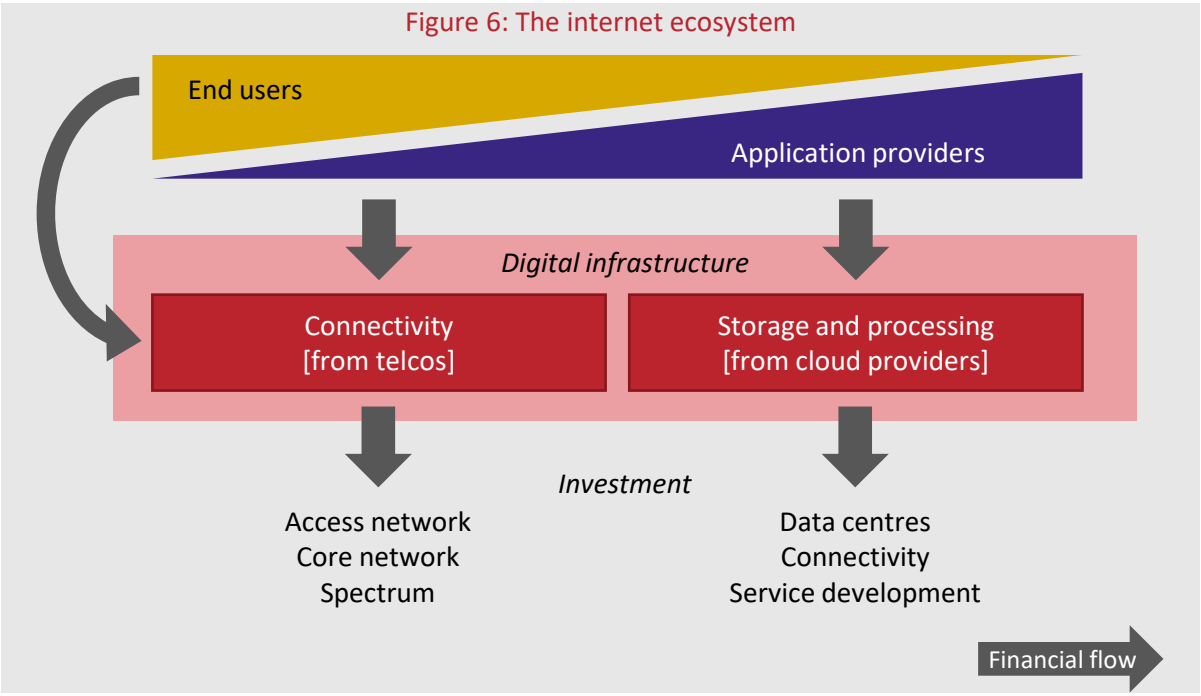
Given this range of benefits from the cloud, countries will benefit from supporting a transition to cloud services, either from national or international providers.

[33] ADB, *Cloud computing as a key enabler for tech start-ups across Asia and the Pacific*, July 2021
[34] Thailand Board of Investment, *Data Center and Cloud Service in Thailand*, June 2021
[35] Deloitte, *The cloud imperative - Asia Pacific's unmissable opportunity*, July 2021
[36] NASSCOM & Oliver Wyman, *Future of Cloud and its Economic Impact*, July 2022
[37] Asian Productivity Organization, *Digitialization of Public Services in Asia*, February 2021

5 Cloud services in the internet ecosystem

Today cloud services are a critical element of the internet ecosystem. While the interaction of end-users and applications (on the web or mobile) is the most visible aspect of the internet, this is absolutely dependent on digital infrastructure. There are two legs to this enabling infrastructure: connectivity provided by telcos, and storage and processing provided by cloud providers:

Figure 6: The internet ecosystem



To build this infrastructure, both telcos and cloud providers invest substantially in their relevant assets. For telcos this is networks (in part enabled by purchase of spectrum). For cloud providers, this is data centres around the world, and the connectivity to link them to each other and the wider internet. Cloud providers also need to invest to develop in constant improvement and expansion of their service portfolios.

While end users and application providers are practically dependent on digital infrastructure, telcos and cloud providers are financially dependent on those users and application providers respectively. By extension, telcos and cloud providers are dependent on each other. Without *both* legs of digital infrastructure, there are no end users and applications, and therefore no business for telcos or cloud providers.

6 Cloud services and the network

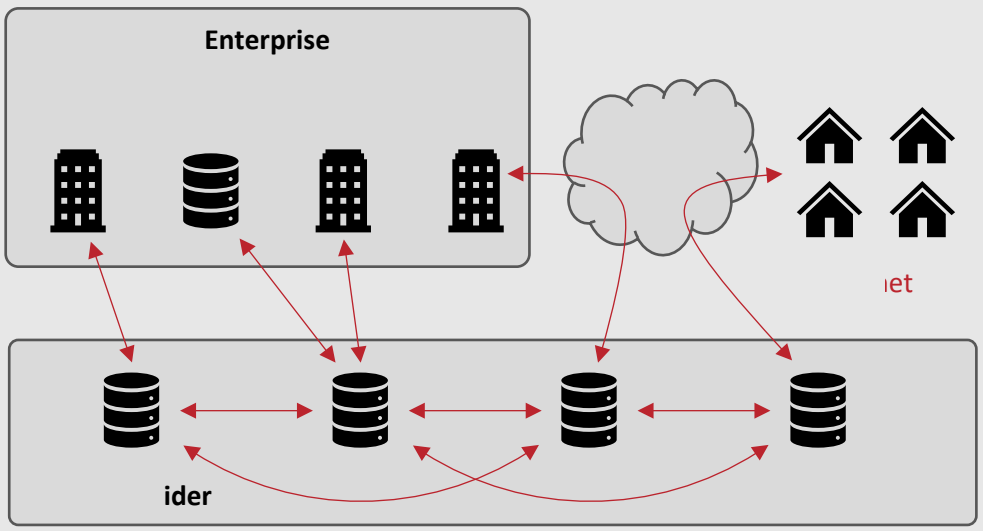
We now turn to a more detailed discussion of the interaction of the cloud and the network.

Connectivity is fundamental to cloud services. Corporate and government customers need to connect their locations (including any in-house data centres) to their cloud provider.

Their employees may also need to connect to the cloud from other locations, for home working or while on the move, for example. Many cloud services will include a consumer facing aspect. In both these cases, connectivity via the open internet is required.

Finally, cloud providers have substantial connectivity between their own data centres, to enable back-up of data at different locations, to bring data and applications closer to end users and so on.

Figure 7: Cloud connectivity requirements (illustrative)[38]



6.1 Enterprise/government connectivity

The connection between enterprise locations and cloud providers may take various forms. For smaller locations, the location's existing broadband connection may be sufficient. Data from or to the cloud can ride over this connection, likely via a VPN[39] for security.

[38] Redundant connections not shown

[39] VPN: Virtual private network, that provides security for traffic travelling over the open internet

However for larger locations – and particularly for an enterprise's own data centres (if they have them), greater and more reliable connectivity is likely to be required. This can take various forms, such as a leased (private) line between the enterprise location and the cloud provider, or a connection based on SD-WAN.[40]. Regardless of the form of connection, there will likely be diverse links to different cloud locations, to provide redundancy.

All of this connectivity between the enterprise and the cloud is ultimately likely to be procured from a telco. (In some cases it may be bought indirectly, via a reseller).

6.2 Cloud providers' internal connectivity

Cloud providers operate substantial internal networks to connect their various data centres, and to efficiently deliver traffic back to end-users. According to the ITU:

> "Cloud and content providers have emerged as some of the largest investors in backbone infrastructure, including submarine cables."[41]

Azure, for instance, has 165,000 miles of fibre network linking more than 185 locations globally.[42]

The scale of these networks is evident in the subsea capacity now held by the main cloud operators (Google, Amazon and Microsoft) They have ownership in 26 subsea cables. In some cases they own the cables outright, but many are co-owned with telcos.

This subsea capacity represents billions of dollars of investment by the cloud providers.

6.3 Connectivity over the wider internet

Finally, end users need connectivity to cloud services. This is the main case where cloud traffic travels over the open internet, be that fixed broadband or mobile.

However, the traffic requirements are often relatively modest. For example, consider the company using cloud services to monitor its pizza production line. This requires a constant video stream from the

[40] SD-WAN: Software defined wide area network. A virtual wide area network, providing connectivity between specified locations
[41] ITU, *Global Connectivity Report 2022*, 6 June 2022
[42] Microsoft, *Azure Global Network* [accessed 10 May 2022]

factory to the cloud provider, and occasional alerts back to the line manager. The video stream may require substantial traffic but this likely travels over a dedicated link. The email alerts may travel over the open internet but the associated traffic is trivial. (We discuss cloud traffic volumes further in Section 8.1.)

7 Benefits of cloud services to telcos

In this section we set out the benefits of cloud services to telcos and explore how the two are mutually dependent on each other.

7.1 Enablement of internet services drives broadband demand

Broadband – either fixed or mobile – has no value in of itself. Its entire value comes from the services it enables for consumers. People subscribe to be able to use social media, online shopping, government services, games and so on, not for the connectivity itself.

As we have noted, these applications depend heavily on cloud services. Without the cloud there would be far fewer applications, there would therefore be far fewer broadband customers and therefore far lower revenues for telcos. Thus, telcos are indirectly dependent on cloud providers for a large part of their revenues (just as cloud providers are dependent on telcos).

7.2 Corporate connectivity needs drive spend on point-to-point links from telcos

A corporate providing its own IT on premises may need no wider connectivity. However, if they shift to cloud-based services, they will require high capacity and reliable connectivity to their provider's servers. This drives demand for leased lines and other forms of point-to-point connectivity from telcos, increasing corporate spend with network providers.

According to Vodafone:

> "Large corporates continue to drive higher demand for robust, secure and efficient connectivity services as they transition from their own legacy hardware and services [to the cloud]".[43]

In Korea, Analysys Mason has noted:

> "growing business demand for high-bandwidth services to support cloud migration."[44]

[43] Vodafone, *Annual Report 2021*, 18 May 2021
[44] Analysys Mason, *South Korean operators' enterprise revenue grew strongly in 2021 and they have ambitious plans for future growth*, March 2022

7.3 Cloud services help support the 5G business case

There is great interest in the combination of 5G networks with edge computing to deliver cloud services. A typical context might be a factory, with multiple sensors generating large volumes of data to be analysed. Edge computing - processing on premise - allows this data to be analysed (or distilled) on site, reducing latency and expense compared to transporting all the data to a remote cloud server. Further, 5G networks are themselves low latency, and in combination with edge computing keep overall latency low, ensuring near-immediate responsiveness to data coming in from sensors.

Such cloud applications create a high-value use case for 5G, generating extra revenue for mobile operators. This in turn improves the return on mobile operators' investment in 5G networks, and supports wider coverage.

7.4 Provides revenue streams through partnerships

Cloud providers have numerous partnership deals with telcos to provide services. The telco partner may consult on initial solution design, build applications, provide ongoing optimization and support and so on. The telco may also integrate its own network products into the solution for the customer. It may act as a reseller of the cloud services on an on-going basis.

For example, in APAC, AWS's telco partners include Chunghwa Telecom, Far Eastone, HKBN, NTT, Singtel, SK and Telstra. These partnerships create new, diverse revenue streams for telcos as well as potentially driving revenue to existing connectivity products.

7.5 Provides revenue through cloud providers' own spend

As we have seen, a robust, global and diverse network is essential to the provision of cloud services. Cloud providers procure capacity from telcos to connect multiple data centres in country, to connect to internet exchange points, to reach cable landing stations and so on. (They may also procure international subsea capacity, though increasingly they build or co-build their own international cables).

7.6 Data closer to end users reduces the need for telco spend on connectivity

In order to provide the best service for end-users, cloud providers have multiple locations to bring data closer to those users. This increases reliability and reduces latency.

However, it also results in a cost reduction for broadband providers. If data is being served to (say) Indonesian users from a cloud data centre in Jakarta, rather than an overseas corporate data centre, then the broadband provider only needs to provide national connectivity. Otherwise, they might need to pay for international capacity and transit charges to provide connectivity to that overseas location.

7.7 Supports demand through wider economic growth

As we have seen, cloud services support an efficient economy. This underpins economic growth and thriving local businesses. In turn, this supports telco revenues. High employment and growing companies all drive spend on telecoms services.

7.8 Supports the efficiency of their own operations

Telcos are themselves customers of cloud services. These services support scalable, fully configurable software defined networks; improve IT operations and support systems; and enhance customer experience (e.g., using artificial intelligence to enable for predictive network maintenance and fraud reduction).

Thus cloud services are very positive for telcos, with a range of direct and indirect benefits.

8 Traffic charges and cloud services

Despite the mutually beneficial telco - cloud provider relationship, an increasing number of telcos are now seeking traffic charges – cash payments from large internet companies. In Australia (for example) Optus has petitioned the ACCC for a bargaining code to apply to large digital players, to support telcos' pursuit of traffic charges.[45]

While telcos often point to content providers such as Netflix when discussing traffic charges, they often expect them to apply to a range of internet companies, including cloud providers. (Cloud providers do not have their own data or content to deliver to consumers, but do send traffic on behalf of their customers).

The arguments telcos make for traffic charges typically include:

- "The cost of traffic growth is becoming unmanageable, and traffic charges are needed to offset it"
- "Broadband is a two-sided market (serving consumers and content & application providers - CAPs) and in such markets its wrong that only one side pay - CAPs are free-riding"
- "Traffic charges would support socially beneficial investment, such as improved broadband coverage"
- "Absent traffic charges, CAPs lack incentives to be efficient with their traffic"

In this section we consider these arguments in turn, and in particular how they apply to cloud services.

8.1 "Traffic growth necessitates traffic charges"

Telcos claim that traffic (in their eyes driven by CAPs) is growing very rapidly, and that this is necessitating significant capex to grow capacity in their networks. They further argue that this burden is so great that traffic charges are essential.

Slowing internet traffic growth

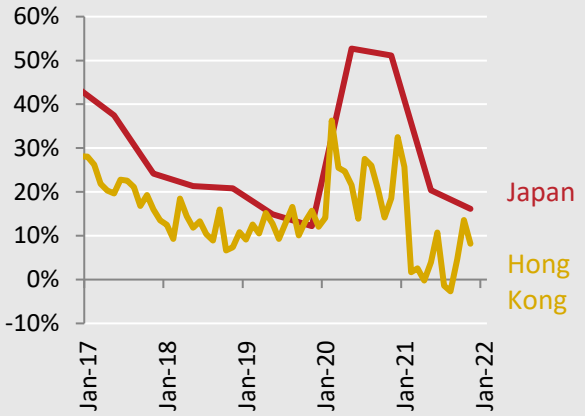
The first weakness in this argument is that traffic growth is now far less significant than it has been. While it is widely believed that

[45] In APAC see, for example, Optus, *Submission in response to Digital Platform Services Inquiry Discussion Paper for Interim Report No. 5: Updating competition and consumer law for digital platform services – Public version*, April 2022. In Korea SK Telecom has an ongoing dispute with Netflix over traffic charges. Korea Herald, *Legal logic takes new twist in SK-Netflix dispute*, 16 June 2022

internet traffic growth is exponential, this is no longer true. Growth in traffic per fixed line is in fact slowing significantly.

Figure 8 shows growth in traffic per fixed line for Japan and Hong Kong. For both, growth was on a long downward trend to the end of 2019, and had dropped to a little over 10% for both. While there was a subsequent pandemic bump (as internet use surged globally), traffic has growth has since dropped back to the modest 2019 levels.

Figure 8: Year-on-year growth in traffic per fixed broadband line[46]

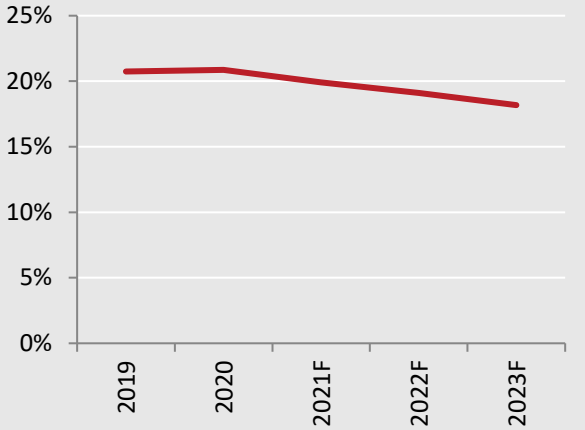


At such modest growth rates, increasing (fixed) traffic will be more than offset by declines in the cost-per-bit for telecoms equipment, which has been falling at approximately 25% annually for many years.[47] Given this, required capex to serve fixed traffic should fall, despite traffic growth. (The picture for mobile traffic is more complex).

Falling capex

Further evidence that traffic is not driving unmanageable capex for telcos comes from their actual spending. Overall, capex (of all types) for APAC telcos is expected to fall as a percentage of revenue in the years ahead (Figure 9), which seems inconsistent with the idea that telcos are facing an unmanageable burden.

Figure 9: APAC Telco capex as %age of revenue[48]



Cloud as a source of traffic

Not only is overall traffic not nearly as problematic as telcos suggest, within this cloud services are only modest contributors. While there is limited data on the internet traffic associated with cloud services, evidence from France suggests it may be modest.

[46] Ministry of Internal Affairs and Communications [Japan], 我が国のインターネ ットにおけるトラヒックの集計・試算, 4 February 2022; OFCA [Hong Kong], *Customer Access via Broadband Networks*; Ofca, *Statistics on Internet Service Subscriptions in Hong Kong*, [accessed 14 April 2022]. Communications Chambers analysis

[47] Ciena, *How near-zero margin networking changes network economics*, 19 August 2020

[48] S&P Global, *Industry Top Trends 2022 – Telecommunications*, 25 January 2022

Figure 10: Traffic origin for main French ISPs (end 2020)[49]

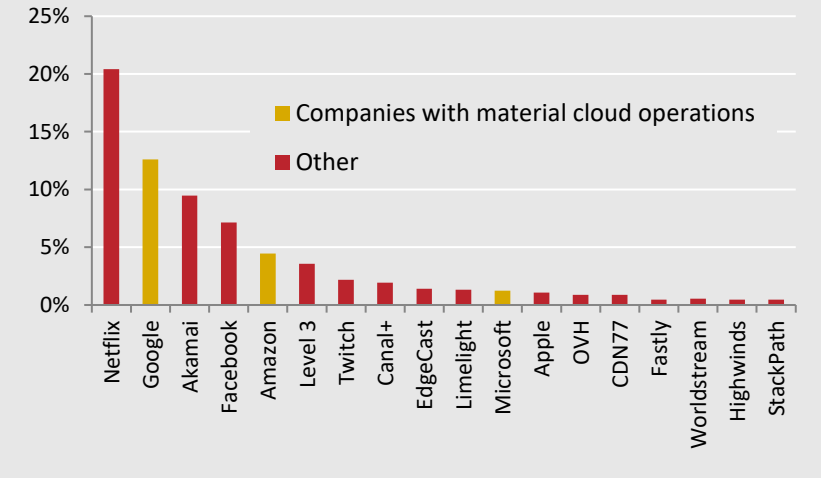


Figure 10 shows traffic sources for French ISPs. Three of the top 10 sources have material cloud operations. However, in aggregate they represent less than 20% of traffic. Moreover, *cloud-related* traffic will only be a portion of these companies' overall traffic. For Google, for instance, YouTube is likely to be a much greater driver of its traffic than its cloud services. (YouTube is responsible for 13% of traffic in both APAC and EMEA, according to Sandvine, roughly equal to the French estimate of Google's *total* traffic).[50]

Microsoft, which has approximately 20% share of the cloud market,[51] represented around 1% of traffic for the ISPs (and this too would include a range of non-cloud services from Microsoft).

Very roughly, this might suggest that all cloud traffic combined is under 5% of overall internet traffic carried by ISPs. (Note this is an estimate of the traffic associated with cloud services provided on a commercial basis – it does not include the total traffic of companies that may happen to offer cloud services. To take an example YouTube traffic is excluded, even though it may make use of some of the same infrastructure Google uses to provide its commercial cloud services).

Cloud services as a driver of network costs

We now consider the specific characteristics of cloud services as regards traffic costs for telcos.

[49] ARCEP, *The state of the internet in France, 2021*, July 2021
[50] Sandvine, *The global internet phenomena report*, January 2022
[51] Canalys, *Global cloud services spend hits US$55.9 billion in Q1 2022*, 28 April 2022

Networks are built to handle peak demand. This is typically in the evening in most markets. People are then at home with the free time to watch streaming video, a key traffic driver. Additional traffic in off-peak periods is costless, since it sits within the capacity put in place for the peak period.[52]

Thus business applications are much less likely to strain broadband networks, since they are used during business hours. This was one of the reasons why the surge to home working was feasible during the pandemic – the additional Zoom calls (say) were taking place at a time when networks would otherwise have been comparatively lightly loaded.

Much cloud traffic is to support just such business applications – they are likely to be in use during business hours, not the evening peak. Thus their impact on peak traffic is relatively low, and they are less likely to trigger a need for network investment by telcos.

Cloud services can also help *reduce* traffic during the evening peak. A key driver of peak traffic for many networks is new game releases or large patches. On their release date, many users will seek to download these very large files simultaneously, creating a 'spike' of traffic that is difficult for the network to handle.

However, cloud-based gaming (such as Amazon Luna and Xbox Cloud Gaming) can mitigate these spikes. Because all the game software runs in the cloud, there is no need to download large files to the end-user. They simply receive a stream of video. In aggregate, and over time this may generate substantial traffic, but it is far less spiky than downloads, and so creates less demand on network capacity in peak hours – the crucial driver of network cost.

Conclusion

Thus traffic growth is not nearly the problem telcos suggest; capex levels are manageable; cloud providers are only modest contributors to overall traffic; and they may help mitigate peak demand. Thus the argument from traffic growth is generally unconvincing, and particularly so when applied to cloud providers

[52] Assuming this additional traffic does not cause the peak period to shift

8.2 "It's wrong that one side pays in a two-sided market"

Two-sided markets are those where a platform brings together two different groups that mutually benefit from an interaction. Broadband is such a market, bringing together consumers and content and application providers.

Telcos suggest that it is inefficient to have a two-sided market where only one party is paying. In fact, it is a very typical outcome, as Figure 11 shows. As the OECD puts it:

> "two-sided platforms may have a price structure such that the price offered on one side is below cost, or even below zero. The empirical evidence indicates that below cost pricing is common."[55]

Figure 11: Examples of two-sided markets with single payer

Market	Charged participant	Uncharged participant
Credit cards	Merchant	Card holder[53]
Job websites	Employer	Job seeker
Literary festival	Readers	Authors[54]
Shopping mall	Merchant	Shopper
PDF documents	Document creators	Document readers
Academic journal	Readers	Authors
Airbnb	Providers	Renters
Air miles (eg Avios)	Merchants	Consumers
eBay	Sellers	Buyers
Airports	Airlines, retailers	Passengers

Of course, just because a platform is not charging one set of participants in a two-sided market, this does not mean they are not receiving great value from them. Broadband is of course worthless to consumers without content and applications, and thus telcos offering broadband receive enormous value form the availability of CAPs on their networks. They would simply have no product to sell without the CAPs. As we discussed in section 7, cloud services are particularly valuable to telcos.

8.3 "Traffic charges support investment"

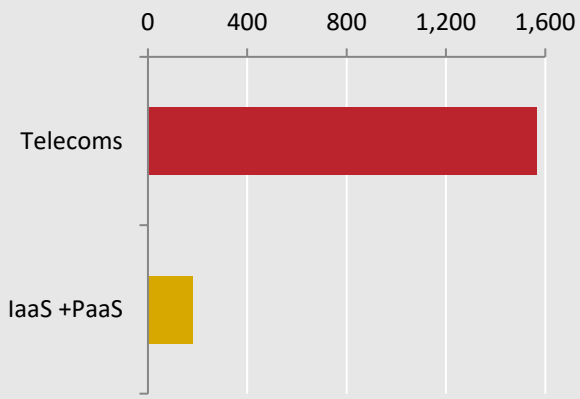
Telcos suggest that if they received traffic charges, this would allow them to materially increase investment in networks (such as FTTH and 5G). This too is a flawed argument.

[53] Certain consumers may pay for premium cards
[54] Such festivals increasingly make small appearance payments *to* authors
[55] OECD, Policy Roundtables: Two-Sided Markets, 2009

Cloud providers are small relative to telcos

The first reason to expect limited investment benefits from traffic charges imposed on cloud providers is that telcos are so much larger than cloud providers in revenue terms. (We focus on IaaS and PaaS revenues, since as far as we are aware there has not been a proposal that traffic charges should be levied on SaaS providers like Salesforce.com or MailChimp).

Figure 12: Global revenues ($bn), 2021[56]



Global revenues of telcos are 9x those of IaaS and PaaS providers. (Figure 12). Thus even a very high traffic charge representing (say) 5% of the sales of these companies would be equivalent to a 0.6% uplift in revenue for telcos. Even this extreme case seems unlikely to make a material difference to telcos' levels of investment.

Use of payments for investment appears unlikely

Further, even if telcos receive additional funds via traffic charges, there is no particular reason to expect them to invest that money rather than - say – returning it to shareholders.

Figure 13: Asian telco yields[57]

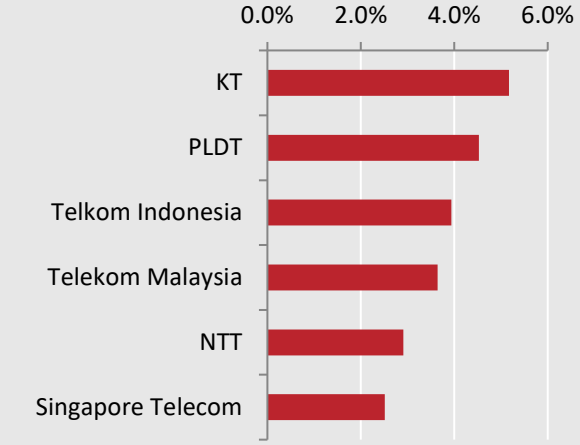


Figure 13 shows dividend yields of leading Asian telcos. These are relatively high. Generally companies will prefer to use capital for dividends when there are not high-quality investment opportunities for that capital. This suggests that incremental income from traffic charges received by telcos would be treated the same way – returned to shareholders rather than spent on improving the relevant country's networks.

Certainly telcos today spend only a very small percentage of their service revenues on backbone capacity. For Korea Telecom the figure was less than 5% in 2021, for example.[58]

[56] IDC, *Worldwide Telecommunications Services Market Saw Higher than Expected Growth in 2021, But the Future is Shadowed by the Looming Economic Slowdown, According to IDC*, 6 May 2022. Gartner, *Gartner Forecasts Worldwide Public Cloud End-User Spending to Reach Nearly $500 Billion in 2022*, 19 April 2022

[57] Google Finance

[58] Korea Telecom, *2022 1Q Financial Indicator*, 2022

8.4 "Lack of Incentives to be efficient with traffic"

Some telcos argue that there is a problem of incentives – that because organisations sending traffic onto their networks don't pay traffic charges, they have no incentive to minimise traffic and thereby use networks efficiently. This is simply wrong.

CAPs already have multiple incentives to minimise traffic

CAPs face multiple incentives to minimise traffic. For example, a CAP wishing to make its service functional on a mobile device will reduce traffic, both to ensure the service works well on a low-bandwidth connection and to avoid creating a large traffic bill for the end-user. One practical example of traffic minimisation is the widespread use of video compression (squeezing a given image quality into the least possible bandwidth). This is used by all online video providers, and there has been substantial investment over the years to continually improve compression algorithms.

Cloud customers face direct financial incentives

Turning to cloud services in particular, it is the customers of cloud services (companies, governments and so on) who control how much traffic flows to and from cloud providers, and these customers *do* face financial incentives to minimise that traffic. This is because cloud providers generally charge their customers for the traffic that leaves their network. For example, for Singapore egress traffic (traffic from its Singapore data centre for the general internet) Google Cloud charges $0.09-0.14 per GB for most destinations.[59]

Telcos have been moving away from incentives for consumers

Finally, if telcos truly believe that it is important that broadband users face incentives to minimise traffic, it is odd that they have been *removing* them for consumers (who ultimately have the greatest control over traffic volumes). The last decade has seen a significant transition to unlimited data allowances for fixed broadband around the world.[60] This means there is no longer a financial reason for consumers to limit their usage, contributing to the traffic growth the telcos now complain about.

[59] Google Cloud, *All network pricing* [accessed 13 May 2022]

[60] Australia is a notable exception, but this is due to the pricing structure of NBN, which creates an artificial marginal cost of traffic for broadband providers

8.5 Conclusion

As we saw in section 7, telcos derive great benefit from cloud services. They nonetheless claim that they also need cash payments for traffic (from cloud and other CAPs). However, the case for such payments is not well-founded. Traffic growth is not in fact a serious problem; there is no economic principle that suggests CAPs should pay in a two-sided market; there is no reason to expect such payments to lead to greater investment; and nor are they necessary to create appropriate incentives.

9 Impact of traffic charges on cloud services

Not only are traffic charges unnecessary, they are also likely to have negative impacts. In this section we consider these impacts, with a focus on cloud services.

9.1 Increased costs for cloud service users

Such traffic charges will – in the first instance – be borne by the cloud providers themselves. However, the market for cloud services is highly competitive, with significant investment by existing players as well as many new entrants.

In such markets, an increase in input costs that affects all players in a market is likely to be passed through to customers. The increase in traffic charges will ultimately be borne by the organisations using cloud services in the country in question.

9.2 Discouragement of in-country investment by cloud providers

Multi-national cloud providers have some discretion as to where they place their data centres. One of the reasons to site data centres in a given country is to directly connect to telcos in that country, as opposed to delivering traffic via transit (internet backbone connectivity provided by a third party). Direct connection benefits the telco and its customers, and the cloud provider and its customers. However, traffic charges by the telco will make this option significantly less attractive (since these charges could be avoided by connecting via transit). Thus the charges would discourage a cloud provider from locating and investing in-country. This in turn would degrade performance for cloud customers in that country.

Traffic charges are likely to be even more problematic for national cloud providers in the country in question. These local players are likely to have little practical option but to accept them.

9.3 Loss of benefits of the cloud

Thus traffic charges are likely to increase the costs and/or reduce the performance of cloud services in the country in question. This is likely to delay uptake, and by extension lead to a loss of some of the societal and economic benefits of the cloud discussed in section 4.

9.4 Inefficient traffic routing and degraded performance

In the face of in-country traffic charges, a natural response by companies needing to deliver traffic is to use international transit – that is, to give their traffic to an internet backbone provider in another country, who in turn passes it on to the relevant ISP. While this may be necessary to save expense, it is inefficient technically. For instance, it may increase latency and packet loss. Thus it may degrade performance of cloud services to the detriment of end-users. Further, it may impose costs on telcos, who may be charged by the transit provider.

Korea, often held up by telcos as an example of a market to copy in the context of traffic charges, has seen all these problems and more (Figure 14).

Figure 14 Adverse consequences of South Korea's traffic charges

Korea mandated traffic charges in 2016. There have been multiple adverse consequences as a result.

Traffic routing has been distorted and become inefficient. To avoid the charges, some content providers (such as Netflix and Meta) shifted to serving Korea from overseas. Others (such as Twitch) are considering peer-to-peer distribution.

This inefficient delivery **degraded performance for users**. Latency is a key driver of user experience, but is harmed if content is hosted far away. Korea has the worst latency of any OECD country, and is getting worse.[61] (This undoes one of the benefits of investing in FTTP and 5G, which generally have lower latency than other technologies).

Transit prices have been kept artificially high. In Seoul they fell 28%, 2017-2020. In most major markets, prices fell by more than half.[62]

Regulation has become ever more complex, first with a further law to require content providers to maintain stability of their services, and now with a host of bills imposing detailed controls on content provider contracts with ISPs.[63]

9.5 Loss of opportunity to serve as a network hub

Certain countries – Singapore and Japan for example – serve as hubs in the global telecoms network. They are meeting points for subsea cables, and key locations for international network providers and large digital businesses.

In part this is a matter of geography, but policy is also an important factor. Competitive telecoms markets and the absence of arbitrary traffic charges are essential factors in companies' choices regarding capacity investment and where they site their Asian operations.

Thus, traffic charges are deeply counter-productive for any country wishing to serve as a telecoms hub.

[61] OECD, *Broadband Networks of the Future*, July 2022
[62] Telegeography
[63] Internet Society, *Internet Impact Brief: South Korea's Interconnection Rules*, 11 May 2022

9.6 Conclusion

Traffic charges on cloud providers appear to have a poor balance of costs and benefits. They may delay the uptake and usage of cloud services, to the detriment of Asian economies, and as we have seen, they are unlikely to lead to any offsetting benefit from increased infrastructure investment.

10 Universal service funds and the cloud

Instead of traffic charges, in some markets it has been proposed that cloud providers should contribute to universal service funds (USFs). For example, in Korea an amendment[64] has been put forward that would extend to the scope of USF funders to include 'large value-added telecommunications service providers',[65] which would include a number of the major digital players. Vietnam has also considered an expansion of USF funders.

USFs have traditionally been based on levies on telcos, and have been deployed to support availability and use of telecoms services. This has included:

- Financial support for deployment of networks to otherwise unprofitable areas
- Support for underlying infrastructure (such as fibre backbones or towers)
- Connectivity for 'anchor tenants' (such as educational institutions)
- Provision of free access (such as wifi hotspots, community internet centres and so on)
- Price subsidies for end users (such as vouchers, or discounted rates for certain disadvantaged groups)
- Training and digital skills

USFs have been widely used around the world, and *can* have a positive impact. However, they are not without risk, and there have been some notable failures.[66] In this section we set out some of the considerations for such an intervention regarding cloud providers.

These are only general observations. In practice, appropriate approaches will differ significantly from country to country. For example, in some parts of APAC, there is already almost universal coverage of fibre broadband and very high uptake. Other countries still require major investment in coverage, and high uptake will depend on much improved digital skills.

[64] *방송통신발전 기본법 일부개정법률안* [의안번호 2112697], 27 September 2021
[65] 대형 부가통신사업자
[66] See, for instance, ESAP, *Toward meaningful connectivity – Insights from Asia-Pacific case studies*, September 2021

10.1 Sources of funds

USFs can be funded by governments (national or regional) by industry levies, by bodies such as the World Bank and so on.

In the past, the choice to use industry levies on telcos for funding was justified in part on the basis that an extra person with telephone service (as a result of the USF) created value for all providers via network effects. For instance, that extra person would receive calls, and the calling party's network would receive call charges as a result, recouping some of their contribution to the USF.

This logic is far weaker for cloud providers. Their customers are primarily organisations, who are online with or without a USF. While a cloud provider may draw some benefit from additional end-users being online – to the extent this benefits the provider's customers – this benefit may only be modest. For instance, the person brought online by a subsidised tariff may not be the heaviest user of cloud enabled services.

(That is not to say that cloud providers have no interest in internet availability and adoption. On the contrary, AWS – for example – is investing heavily in digital skills and projects to support SDGs. But this is as a matter of social responsibility rather than commercial interest).

Further, a USF levy on cloud providers have many of the same disadvantages of traffic charges discussed above. It represents a tax on a valuable enabling technology, and as such risks delaying investment and uptake, thereby jeopardising the social and economic benefits.

10.2 Deployment of USF

Any plan for USF funds needs extremely careful design to ensure it is actually delivering incremental benefits, relative to what the market would provide anyway.

Support for network deployment

If USFs are to be used to subsidise network deployment, is the deployment in question truly incremental? For example, various countries have subsidised deployment of fibre-to-the-premise. However, the cost to deploy FTTP is steadily falling, and consumer demand is rising. As a result the scope of commercially viable deployment is constantly expanding. In this context, a subsidy for

deployment may be a very expensive way to slightly accelerate coverage in an area that would have received it soon anyway. (A key challenge for policy makers here is that they inevitably have far less knowledge of a telco's investment incentives and plans than the telco does itself).

Further, does the deployment deliver meaningful societal benefits? For example, upgrading fixed connectivity to FTTP will bring extra speed – but if that speed is primarily used for (say) gaming and video entertainment, it's not clear there's a case to subsidise it.

Another challenge for support for fixed deployment is that in some markets fixed uptake is low, with consumers preferring mobile. In such markets improving fixed availability will inevitably have less impact, since the new network will only be lightly used.

A critical question for a subsidised deployment is does it crowd out commercial investment? Even the prospect of competition from a subsidised rival can have a chilling effect on investment by other telcos. In Australia, for instance, the creation of the NBN (a government owned entity deploying FTTP nearly nationwide) caused investment in broadband upgrades by commercial telcos to grind to a halt. Particularly if the USF does not ultimately fund deployment in a given region, then in such cases USFs can do more harm than good, by delaying when citizens might otherwise have received improved service.

Support for network uptake

USFs may instead be used with the goal of supporting digital inclusion by seeking to encouraging uptake via subsidised prices. Here too there are important questions to ask.

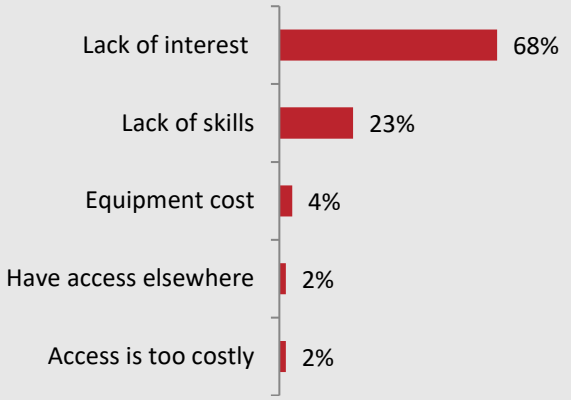
Will reduced price encourage uptake? While it may seem intuitive that lower prices will increase demand, in many markets price is actually quite an unimportant barrier to internet adoption. According to the ITU and UNESCAP:

> "while price levels for mobile-voice, mobile-broadband and fixed-broadband services have been on the decline and increasingly affordable over the past decade, and though the declines are even more dramatic when measured relative to incomes, these trends do not directly lead to rapid increases in Internet penetration. This suggests that other issues are

posing significant barriers to Internet adoption. Greater affordability alone does not result in increased access."[67]

The value of being online is so great that for the vast majority of consumers the cost of access is well worth paying. In middle and upper income countries, people are offline because they don't perceive the value of the internet, not because they can't afford it. As Figure 15 shows, the cost of access is the main challenge for just 2% of those offline. Lack of interest or skills is far more important.

Figure 15: Main reason for being offline at home, Singapore[68]



Is subsidy necessary to provide lower prices?

In many markets telcos provide targeted reduced prices for select groups worthy of additional support (sometimes called 'social tariffs'). These may be available only to those in receipt of certain government benefits, over a certain age or with a particular disability, say. Very often telcos provide these offers as part of their Corporate Social Responsibility. In practice, this is not particularly burdensome. Since telecoms services (particularly fixed services) have relatively low marginal costs, discounted offers can still be profitable as long as they don't cannibalise higher priced offers. Eligibility criteria for the discounted offers minimises any such cannibalisation.

Thus these social tariffs are often provided without subsidy, from a USF or otherwise. Indeed, USF funding has the potential to be counterproductive, since a telco will not wish to jeopardise the case for this funding by providing social tariffs *not* funded by the USF. (This would undercut the idea that the subsidy was necessary).

At minimum, telcos should be required to demonstrate that any social tariffs are materially under the marginal cost to provide service before any subsidy is considered.

Implementation of USF programmes

Even if a proposed USF passes the above tests, the risks of and costs of implementation remain. Designing programmes to support deployment can be a complex, multi-year task. Which regions need support? Which technologies will be supported? What is the service specification? What auction process or other mechanism will be used

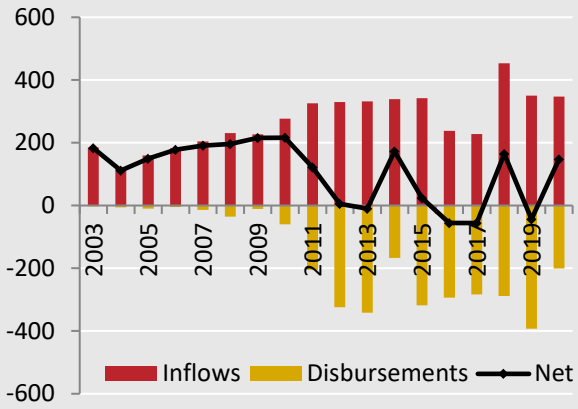
[67] ITU & UNESCAP, *The State of Broadband 2020: Tackling digital inequalities A decade of action*, September 2020
[68] NUS & IPS, *State of Digital Inclusion in Singapore -A Landscape Review*, 2021

to identify the best provider? How will required subsidies be minimised? How will performance be monitored? How will breaches be remedied? Will there be clawback mechanisms in the event that costs are lower or demand higher than expected?

Working through such issues inevitably delays the benefits of the programme in question, and can create material administrative burden.

Further, the programme may not run to plan. Indeed, there are a number of instances where USFs do not appear to have operated effectively. For instance, Malaysia's Universal Service Provision Fund receives income from an industry levy, and undertakes a range of projects to support network deployment and digital inclusion. However, it has taken in significantly more from industry than it has been able to put to work on these projects (Figure 16).

Figure 16: Malaysian Universal Service Fund inflows and disbursements (US$ m)[69]



As a result, it now has a balance of $2.3bn. This represents stranded funds that otherwise could have been used by industry, potentially for investments or lower prices. If there is not the capacity (or worthwhile opportunities) for the USPF to put all its receipts to work, this argues for a reduction in levies, not an expansion.

The Malaysian case is not unique. USFs in Pakistan and India have faced similar challenges, for example.[70]

10.3 Conclusion

USFs have a very mixed track record. A UN ESCAP study of USFs in Asia and the Pacific concluded:

> "[C]ountries with UASFs targeting broadband/Internet expansion have not experienced better results in fixed-broadband and Internet growth than the countries without such fund. Based on the review of existing literature and

[69] Malaysian Communications and Multimedia Commission, *Universal Service Provision annual reports*

[70] LIRNEasia (for IDRC & DFID), *Performance of universal service funds: India, Malaysia & Pakistan*, 9 October 2016

publicly available documents, the effectiveness of UASFs seems to have been limited".[71]

Universal service funds need extremely careful structuring if they are not simply to represent 'free money' for telcos received in exchange for investments (or price reductions) that they would have been willing to undertake anyway. This risk is all the greater given that: investment economics for network deployment are gradually improving; market prices are on a downward trajectory; and the low fixed costs of telecoms makes targeted discounts commercially viable.

The expansion of USFs needs particularly careful thought, since (assuming money has been deployed rationally to date), less attractive opportunities for intervention will now be available, which are less likely to provide a worthwhile social return.

This is all the more true if funding is to come from cloud services, which risks reducing the social returns *those* services might provide.

[71] UN ESCAP, *The Impact of Universal Service Funds on Fixed-Broadband Deployment and Internet Adoption in Asia and the Pacific*, October 2017

11 Conclusion

Cloud services are enabling fundamental changes to how organisations in Asia deliver their product and services – be they governments, companies or charities. Broad and effective use of the cloud is likely to be a key driver of economic growth and national competitiveness in the years ahead. The rapid uptake of cloud services in Asia shows this is well understood by organisations in the region.

The network is essential to the provision of cloud services, and cloud providers and telcos have a highly mutually beneficial relationship. Cloud services could not operate without broadband, and conversely the cloud generates revenues for telcos in a variety of different ways. Cloud providers and telcos are two pillars upon which the digital infrastructure of a country is built.

Despite the valuable and mutually beneficial relationship between the two, some telcos have argued for traffic charges that would transfer value to them from cloud providers. They claim this would enable greater investment in networks, which could support digital inclusion by improving network availability for people. In reality, in most APAC networks, network uptake is a much bigger challenge to digital inclusion than network availability.

Moreover, the arguments for traffic charges are based on problem statements which we have disproved in earlier sections of the paper. Traffic charges are likely to cause more harm to the digital ecosystem of a country than good. USF levies do not fare any better as they have a very mixed track record. Both risk eroding the substantial societal advantages of the transition to the cloud.

Cloud services also already support digital inclusion in multiple ways:

- Cloud based services do not require installation of software on a user's device, making them simpler for those with limited digital skills. One example is Zoom (cloud-based video calling), which has seen wide uptake in part because of its ease of use.
- By shifting storage and processing from the device to the cloud, cloud services mean that cheaper devices can still deliver sophisticated services. This helps those on low budgets.

- Certain services built on cloud platforms, such as certain eHealth or eGov services may be 'must have' services, that persuade late adopters to come online.
- Use of the cloud can reduce costs and speed innovation for digital service providers, which flows through to end-users. More attractive, cheaper digital services will encourage more people online.
- Cloud service providers invest alongside telcos in subsea cables. The combined volume brings down unit-costs for both groups. Lower international capacity costs for telcos translates to lower costs to provide internet traffic, and can flow through to lower prices for consumers.

Given all the above, regulators will wish to carefully define what problem they are seeking to address, before intervening in the existing rich and symbiotic relationship between cloud providers and telcos. Any impact on one is bound to have an effect on the other and may disrupt the relationship between the two. In this context they can assess what remedies – if any – may be appropriate, given the risks.

Based on the case made by telcos to date, both traffic charges and USF levies on cloud providers appear to have a poor balance of costs and benefits.

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