CHAPTER 4 Snapshots of Internet around 2020

2020.3.8

The Internet is 51 years old in 2020 with 7.8 billion users in the world with more than half of them in Asia [InternetWorldStats 2020]. Coronavirus-19 pandemic has changed the Internet landscape substantially with much activities being done online; work, education, meeting among others. Zoom, a video communication platform ranked the 14th most popular website in 2020 [Alexa 2020].

USA and China dominate the Internet activities. The top 10 sites on the websites include seven websites in USA and 3 websites in China [Alexa 2020]. In term of market capitalization, USA and China dominate the top sites. The market capitalization of four companies in USA are more than one trillion dollars [CorporateInformation 2020]. E-commerce is also similarly dominated by China and USA. Please refer Chapter 6 E-commerce for detail.

Short message services started from short texts through telephones, Internet and mobile devices in the last 50 years [SMS 2020]. We are having a major new development based on short video services which is called TikTok after short text services such as Twitter, and short picture services like Instagram in the past.

Chapter 4 Snapshots of Internet covers various countries in Asia around 2020, similarly to all previous Asia Internet History publications for 1980s, 1990s, and 2000s. In this chapter, we have snapshot articles around 2020 on the following countries;

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4.1 Snapshot of the Internet in Bangladesh around 2020

Hakikur Rahman

Internet in Bangladesh

Like many other developed and developing countries, the Internet in Bangladesh has witnessed a significant growth in recent years. Despite facing numerous constraints in expanding Internet access and usage, development of the Internet and information technology are high government priorities. In April 2019, Internet users in Bangladesh increased to 96 million [Internet 2020]. Furthermore, on 19 February 2018, Bangladesh started 4G network service.

While the Internet speed in Bangladesh may not be among the fastest in the world, it has significantly improved in recent years [OpenNet 2012]. As of July 2015, Bangladesh ranked 90th out of 198 countries on the Household Download Index by Net Index [Okla 2016]. The completion of the Kuakata submarine cable (Regional Submarine Telecommunications Project, Bangladesh) of BSCCL has added a significant amount of transmission capacity (through SEA-ME-WE 5 Cable) and provided redundancy and low-latency with PoP (Point of Presence) to PoP connectivity. This has increased the Internet penetration at the grassroot level.

At the same time, the government sees information and communication technologies (ICTs) as a key driver of socioeconomic development. This is reflected in the government's "Digital Bangladesh" plan as well as the National Information and Communication Technology Policy [OpenNet 2012]. Bangladesh is slowly moving up in the worldwide ICT rankings, rising from 130th in 2009 and 113th in 2012 in the "networked readiness index" to 101th in 2019 [Network Readiness Index 2019]. While its ITC ranking has improved, Bangladesh still lags behind other low-income countries of its stature. Progress is limited due to deficiencies in the regulatory framework and infrastructure development. Also, ICT leaders are concerned that the annual budget does not support the government's ICT goals.

All Internet service providers (ISPs) and equivalent service providers in Bangladesh exchange traffic via two systems: the National Internet Exchange (NIX) and International Internet Gateways (IIGs). The IIGs provide global Internet connectivity, while all domestic Internet traffic is routed via the NIX to minimize usage of international bandwidth. The NIX consists of two exchange points known as the Bangladesh Internet Exchange (BDIX) established in August 2004 and operated by the Sustainable Development Networking Programme and the Peering Society of Bangladesh and the Bangladesh Society of Internet Exchange (BSIX) established in May 2004. In June 2012 the Bangladesh Telecommunication Regulatory Commission (BTRC) announced plans to issue an unrestricted number of additional NIX licenses. There are two IIGs in service operated by Mango Teleservices Limited and the government owned Bangladesh Telecommunications Company Limited [Wikipedia 2020].

ICT has brought about a major transformation in the everyday lives of the global population. In this aspect, new innovations and reformation of ICT are wonders in the modern society. In particular, mobile phones and the Internet have changed the lives of people of Bangladesh as well as millions around the world. BTRC is playing a vital role in the economic development of the country. Since its inception till June 2017, BTRC has deposited a total of BangladeshiTaka 470 billion in government exchequer in pre-tax revenue [BTRC 2018]. The amount was

Bangladeshi Taka 42 billion alone last year [BTRC 2018]. *Bangladesh* ranked 131st in the world for mobile speeds and 101st for fixed broadband speeds in July *2020* [Speedtest 2020].

The total number of Internet subscribers reached 80.89 million at the end of July 2018 [Dhaka Tribune 2018]. The number of the country's total Internet users increased to 90.05 million at the end of July 2018, according to statistics published on the Bangladesh Telecommunication Regulatory Commission's (BTRC) website. Of the total users, 80.47 million are mobile phone internet users, 570,000 are broadband internet (ISP + PSTN) users, and the rest 83,000 are WiMax users.

The number of Internet users in Bangladesh has exceeded 100 million for the first time to reach 103.253 million users, according to newly released data from the country's regulator, the Bangladesh Telecommunication Regulatory Commission (BTRC). Of the 103 million people accessing services in March, 95.16 million did so via the web or mobile phone network. Hence, in a country of 161.4 million people, the growth has been relatively sharp [Capacity Media 2020].

Coronavirus and Internet usage

During the coronavirus pandemic, housebound people have been using 50 percent more data since the holidays began to stem the outbreak started on 26 March 2020. The users are not facing any problem as corporate use of the Internet has dropped to zero with all offices shut across the country until April 4. A source has provided the information after analyzing data from over 800 members of the association of ISPs. However, some of the ISPs, whose clients are mostly corporate users, have to contend with losses as many of the small firms stopped subscription for a month. In the meantime, the number of broadband internet connections in the country was over 5.7 million as of February, according to the Bangladesh Telecommunications Regulatory Commission [Bdnews 2020].

According to an international study, the mobile Internet speed is slowing down in Bangladesh amid the coronavirus pandemic, which has found download speed in the country is the lowest among the 42 markets it has covered. However, the country's mobile operators said that the Internet use has gone up following the government-announced holiday as people are using more mobile data than before, which has made it hard for them to offer better Internet services with the existing spectrum. During the first week of February 2020 in Bangladesh, the download speed of mobile Internet was 9.3 Mbps, and it came down to 7.8 Mbps in the last week of March 2020, according to a study conducted by Opensignal, a Hong-Kong-based international mobile analytics organization specializing in quantifying mobile network experience [The Daily Star 2020].

Coronavirus and online learning

BioTED is a novel training and research initiative that is provided for students from different universities across the country. As they closed their regular training activities on the 2nd week of March and decided to continue one training programme online, they have faced some challenges. Some of the students who moved out from Dhaka, the capital city of the country, to their native

town/village could not attend the sessions due to poor Internet connectivity as well as lack of access to devices. Moreover, some private universities started providing online classes and online examinations as well. This situation intrigued them to conduct a survey on university students with a view to understanding their situation and preparedness for online classes. Through their students' network, BioTED conducted a quick survey where they received responses from 42 public and private universities and affiliated colleges. In three days (9-11 May 2020), 2038 students participated in the survey where the students were asked some simple questions. Students from science (55%), arts and humanities (12.1%), social sciences (11.2%), business studies (12%), and other disciplines (4.7%) responded to the survey from both public (58.8%) and private (41.2%) universities. Among them, 34% are currently located in a rural area and 66% in an urban location. Noticeably, only 23% of the students were in favor of taking online classes in this situation, while the other 77% opposed the idea [Tbsnews 2020]. However, it is expected that the situation will eventually improve as an increasing number of students are aware of the online learning system and its easy availability.

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4.2 Snapshot of the Internet in Cambodia around 2020

Norbert KLEIN

Looking at the recent Internet history anywhere in the world surely shows an amazing speed of development. But this is not only true for economically developed countries, where the Internet development is embedded in a wider and longer history of technological modernization. Comparing Cambodia's space is therefore even more surprising when considering that the first access to the Internet was in 1994, using the UUCP.

Infrastructure

It is worthwhile to look at the beginning of the Internet in Cambodia in 1994 to appreciate the tremendous development achieved by now. The ITU *"KHMER INTERNET - CAMBODIA CASE STUDY"* of 2002 explains Cambodia's case as follows:

> "Cambodia is a textbook example of wireless technology boosting telecommunications development. It was the first country in the world where mobile telephone subscribers passed fixed ones way back in 1993. As with so much else in Cambodia, the international development community – bilateral and multilateral agencies and non-governmental organizations (NGOs) – have played a critical role in introducing and nurturing the Internet in the Kingdom…These low profile organizations have done as much if not more than anyone else to launch Cambodia into cyberspace."

A report from the Telecommunication Regulator of Cambodia from May 2020 shows that a multitude of enterprises serve the nation's population of over 16 million on the Internet:

20,481,054	registered users with 5 mobile phone operators: (some users have multiple SIM cards)
52,380	registered users with 4 wired phone line operators
10,950,000	Facebook users

This enables the following coverage of the population:

2G Mobile Network Coverage 99.2%

3G Mobile Network Coverage 85.1%

4G Mobile Network Coverage 80.3%

This is based on the following fiber optic services' cable lengths:

2,292 km Telecom Cambodia (TC)

16,841 km Cambodia Fiber Optic Communication Network (CFOCN)

25,119 km Viettel (Cambodia)

There are numerous general information sites on Cambodia, offering orientation about Internet options, such as *"(Recommended) Best Internet Providers in Cambodia"* with technical details and advice how to set-up connections, etc.

Cambodia is on the way to develop a national Internet exchange called a DIX (Domestic Internet Exchange) [TRC 2020]. At present, Cambodia Network Exchange (CNX) exists. Their services are explained as follows: "*By meeting all major ISP and carriers at CNX the chances are high you will find multiple new peers to which you weren't interconnected before, meaning that network performance will increase. Internet exchanges are also about redundancy, by adding multiple routes to peers at several exchanges you increase the redundancy in your network, not just relying on one point of interconnect or your transit provider*" [CNX 2020]. Such IXPs are local, saving costs by allowing local data exchanges between multiple externally collected operators, and improving speedy exchanges. Finally, in February 2021, the Cambodian Prime Minister signed a sub-decree establishing a National Internet Gateway (NIG) "to direct and facilitate all of the nation's local and international internet traffic… It must also 'take immediate action to block or disconnect any network connection that affects national revenue, security [or] social order' in collaboration with the country's authorities. Cambodia's move to set up a NIG was first proposed in July 2020, but came under fire from the Asia Internet Coalition (AIC), which claimed that gateway could be used to restrict internet access for civilians, posing a threat to businesses and internet platforms as well as freedom of expression and user privacy" [Barton 2021].

Emerging technological efforts

The easy availability of Internet access resulted in an ever-widening practical engagement in Internet operations by many people. Barcamps played an important role in this. The first Barcamp in Cambodia was organized in 2008 with a team of only 4 leaders and 4 volunteers in Phnom Penh. After hosting Barcamps in 12 provinces with over 70,000 participants, with the support by 25 universities and over 1000 companies, Barcamps have become a breeding ground for many young Internet related entrepreneurs. The goals of Barcamps as follows;

- To join the network of tech and startup movement in Cambodia and ASEAN.
- To inspire youth across the nation on entrepreneurial mindset and career in digital economy era.
- To provide a platform for startups and talents to present and showcase their ideas and business.
- To build a better connection between talents, startups and corporates.
- To equip students with the understanding of significance of digital readiness.

● To bridge talent and knowledge on digital technology, innovation and business all across the nation.

● To introduce digital tools to help everyone achieve better lifestyle and sustainable family business and career development [Cambopedia 2020].

In the study "Startup Kingdom – Cambodia's Vibrant Tech Startup Ecosystem In 2018", the editor of this study had to struggle, as "digital data is extremely scarce in Cambodia as the country is still undergoing early stages of digital transformation," while the editor of this study is estimating that there were more than 300 active tech startups in 2018. But there is a general hope that technology has the possibility to fundamentally alter consumers' orientations and activities, creating growing and leading to social transformation. This belief is held in spite of the fact that high-skilled technical talent is not abundant, and "policy and regulatory clarity can be developed further to provide certainty and incentives to both startups and investors domestically and internationally."

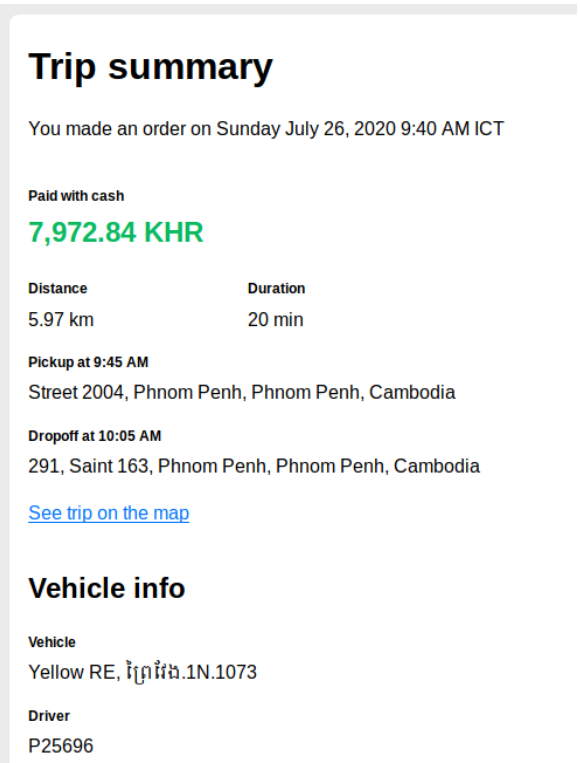
As of 2019, there were 23 co-working spaces in Phnom Penh, where anybody can use an Internet connected computer; the availability of such spaces is especially important for program start-up developers who do not yet have their own technical space.

In May 2020, a "Women in Tek Network: Cambodian First Co-working Space for Women-run Tech Start-ups" was opened with the assistance of The Asia Foundation's Women in TeK Network (WTN) project, to enable "start-ups to operate their business and hold trainings, conduct meetings with partners and customers"; these spaces have already benefited 18 women-led businesses.

There is still a long way still to go into the future of the Cambodian economy, where the annual growth rate over many years has been about 7% (before the coronavirus pandemic), but e-commerce is estimated to be only about 0.51% of the GDP, and Domestic e-Commerce is about 6%, while Cross-border e-Commerce is 94%, or about US$106.4 million ("MSMEs in Cambodia Digital Economy" – a training session presentation).

To the general public in Phnom Penh, the most visible presence of an Internet-based business economy are the ubiquitous personal transport services provided by *tuktuks*:

A customer can call a vehicle by a mobile phone app, the driver's software can identify the caller by their app, which is different for every company, using GPS, also find any address in town, and at the end of the journey, the customer gets a map of the way covered, the time used, and the price, delivered onto their mobile phone.



Trip summary

You made an order on Sunday July 26, 2020 9:40 AM ICT

Paid with cash

7,972.84 KHR

Distance	Duration
5.97 km	20 min

Pickup at 9:45 AM

Street 2004, Phnom Penh, Phnom Penh, Cambodia

Dropoff at 10:05 AM

291, Saint 163, Phnom Penh, Phnom Penh, Cambodia

See trip on the map

Vehicle info

Vehicle

Yellow RE, ព្រៃវែង.1N.1073

Driver

P25696

While there are many different educational opportunities offered, especially in the field of the various aspects of Internet use, the efforts of the Ministry of Education, Youth, and Sport, in cooperation with the NGO Open Institute, deserve special attention. Since at least five years ago, the Ministry had a bilingual Krou Website, offering "Materials for Classroom, Reference Documents for Teachers, Useful Links, and Support". The content can be selected according to *Grade, Level, Subject, Main Topic, Document Type*, and *Keyword*. For the handling of courseware, the Ministry has installed a Moodle course management system, which the Open Institute has translated and updated in the Khmer language, so that it is now fully available in the national language, satisfying an increasing interest in course content for teachers. Of course, to develop e-learning courses was nevertheless not easy, as it requires a clear understanding of the value of developing content, and that e-learning content is not just copying what is in textbooks. Developing new media (e.g., videos) requires new pedagogical approaches that are engaging, and the methodology must be easy to understand by the teachers who are the target users of these materials. Even videos are only a part of e-learning. There is an additional layer of pedagogy to make the students think and critically reflect about the content.

KounSvaChhlat (translated as "The Clever Monkey Child") is a series of booklets – supported financially by Manos Unidas, the Spanish Freedom-from-Hunger-Campaign – that help children learn Khmer language and math better, supporting school learning in preschool in grades 1 and 2. The booklets are developed by the NGO Open Institute in close coordination with the Ministry of Education, Youth, and Sport, and are also available online. By using KounSvaChhlat booklets, children learn easily how to hold a crayon, to follow straight lines, to follow curved lines, and finally to follow the lines of the Cambodian script. Then children learn to read and write Khmer. The booklets also provide extra practice in math, helping children to understand better the practice and concepts that they will use in order to succeed in their later studies. It is noteworthy that *Manos Unidas – Campaña contre el hambre* is an initiative to raise awareness of the problem of hunger and malnutrition. This supported program shows that the underlying problems are seen to be basically the result of a lack of proper early childhood education.

Some problematic aspects of the Internet development

Since the beginning of the spread of the Internet, the "digital divide" became a problem: there were some geographical regions, and there were some sections of people for their economic weakness, excluded from the participating in these new possibilities of communication. While these general problems continue to exist, there are also some new aspects that deserve attention. They can be considered separately related to technical aspects, social and economic position, or political environment.

There are still regions of the country with poor Internet access, though the coverage has been expending regularly. But even where the coverage has extended, access or non-access to public e-government services (receiving government information, doing online registrations, etc.), or access to online educational programs, becomes only available if you have the necessary tools –

but the access to them are important elements of the quality of life in society. While those with the technical and economic abilities are more and more advantaged, those who are less educated or less aware and motivated sink into a deeper "digital divide".

The Cambodian population was estimated in 2018 to be roughly 16,3 million, with over 50 % under the age of 25 years. At the same time, it is estimated that about 62 % of the population are using Facebook, and 15 % YouTube (estimations varying). While YouTube tends to be more for passive consumption of information, the high number of Facebook users indicate an ever increasing flow of personal information and opinion. The *Constitution of the Kingdom of Cambodia* declares that citizens "shall have freedom of expression, press, publication and assembly. No one shall exercise this right to infringe upon the rights of others, to affect the good traditions of the society, to violate public law and order and national security." The increased use of these freedoms, made possible especially by Social Media on the Internet, has also led to an increased number of conflicts, because the authorities interpret what "affect the good traditions of the society," and what "violates public law and order and national security" differently from what some citizens consider to be their rights. Without the wide us of social media, especially the Facebook, some of the following conflicts would not have become acute.

As it happened also in other countries, the coronavirus crisis let also to wrong and misleading information on social networks in Cambodia, too. This is just an extension of the problem, that unreliable, misleading, and sometime dangerous medical or cosmetic advertisements are spread through social media – and there are no regular and clear measures to prevent this. But there is another growing fields of conflicts, where the expression of personal opinions is punished: quoting expressions used, declaring them to be defamation, incitement to public disorder, or social chaos. Some examples: in 2020, three people have been arrested and "educated" over their criticism of the implementation of a new traffic law, which started to impose strict punishments – including the confiscation of vehicles – of poor people who could not pay the fines. Public efforts to get specific information - "What did it mean to get educated?", in order to have clearer guidelines how to avoid being accused - did not find broad public answers. A similar conflict, which could not happen in this form without the Internet, was when the Prime Minister "ordered the authorities to take immediate action against women who allegedly wear 'revealing' clothing while selling products in Facebook," blaming the women for "eroding Cambodian cultural values" leading to sexual violence. The Prime Minister ordered the authorities "to find these women and 'educate' them" as the authorities have "the ability to track them down based on their online activity."

The problem of Internet addiction in Cambodia is so far not yet much discussed. There are no data available about the degree of Internet addiction in Cambodia. This is quite different from China, where an estimated 24 million people between the ages of 14 and 29 were classified as Internet addicts. In 2008, China's health officials became the first to officially identify it as a clinical disorder. There is no common definition of Internet addiction, but in general it is considered to be a combination of

- Information overload. Too much online surfing leads to decreased productivity at work and fewer interactions with family members.
- Compulsions. Excessive time spent in online activities

- Cybersex addiction possibility. Surfing of porn sites can affect real relationships.
- Cyber-relationship addiction. Excessive use of social networking sites to create relationships rather than spending time with family or friends may destroy real-life relationships.

It is, however, easy to be aware of the degree of Internet addiction in Cambodia – either induced by parents to their children by replacing their parental role with handing it over to a smart phone – often while being themselves Internet addicted. It's hardly uncommon for parents to be worried their teenagers are spending too much time online. - In 2019, the World Health Organization added Video Game Addiction to its official list of Mental Disorders. While not much systematic research is available in Cambodia, some general information is available: "World health officials take a hard line on screen time for kids."- "How much should parents resort to videos and online games to entertain, educate or simply distract their young children?" "according to the World Health Organization, is never good for children in their first year of life and rarely in their second. Those aged two to four, the international health agency said, should spend no more than an hour a day in front of a screen," related to "one of the most anxiety-producing issues of 21st century family life" - as the acquisition of language and social skills normally developed by interacting with parents and others people most important for the development of cognitive skills are in danger. Into what kind of a future will the future society be? While there are no research data available for Cambodia, the reality can easily be observed:

Final considerations

Looking back from 2020 to the beginnings of the Internet in Cambodia, and looking ahead, results in somewhat ambiguous or even contradictory results. The infrastructure development is excellent for a not so rich developing country. On the other hand, the tremendous development of Internet use, especially the use of Social Media, especially Facebook and Twitter, led to an increasing interest to use these new possibilities to express one's opinion and share and discuss it with others. It is understandable that the authorities are concerned about misuses of these constitutionally guaranteed freedoms. The more clear and transparent the legal limits - instead of general concerns expressed in terms of "incitement" and "social disorder", the more there is hope that present frictions will not be in the way of the further development of the Cambodian Internet society, into a future that is envisioned in the Preamble of the Constitution of the Kingdom of Cambodia:

"To restore Cambodia into an "Island of Peace" based on a multi-party liberal democratic regime guaranteeing human rights and the respect of law, and responsible for the destiny of the nation always evolving toward progress, development, prosperity, and glory."

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4.3 Snapshot of the Internet in China around 2020

Zhong, Rui

As of March 2020, Internet penetration in China reached 64.5%. The number of Internet users in China reached 904 million and mobile Internet users reached 897 million, with rural Internet users accounting for 28.2% of China's total Internet population. As of March 2020, China had a total of 5.094 billion domain names. As of December 2019, there were 4.97 million websites in China, of which 3.41 million websites had the domain name of ".CN". Meanwhile, the number of subscribers of broadband at the speed of 100 Mbps or above accounted for 85.4% of all broadband subscribers (449 million), and the users of Fiber-To-The Home (FTTH) or Fiber-To-The-Office (FTTO) reached 417 million [CNNIC 2020].

As the Internet is entering into a high-traffic and wide-connectivity era, business needs and technological innovations are accelerating the transformation of the network architecture. Cloud computing services and networks work together in a highly collaborative manner. The development of cloud services requires support from powerful network capabilities, while the optimization of network resources will draw from the concept of cloud computing. China's cloud computing market reached 96.28 billion yuan in 2018 [State 2018]. In terms of the segment market of the public cloud industry, the Infrastructure-as-a-Service (IaaS) market size reached 27 billion yuan, the Platform-as-a-Service (PaaS) market size reached 2.2 billion yuan, the hardware market reached 37.1 billion yuan, and the software market reached 8.3 billion yuan in 2018.

The market scale of the big data industry in China was estimated to be about 540.5 billion yuan as of 2018 [ISC 2019]. To carry out practical exploration and to optimize the regional layout in big data, China built 8 comprehensive big data demonstration areas and 5 industrialization big data demonstration bases. The eight demonstration areas included the following China's first big data comprehensive pilot area – Guizhou; two cross-regional comprehensive pilot areas – Beijing-Tianjin-Hebei and the Pearl River Delta; four regional demonstration comprehensive pilot areas – Shanghai, Henan, Chongqing, Shenyang; and a comprehensive pilot zone for big data infrastructure development – Inner Mongolia. The five demonstration bases were respectively located in Chengde County of Hebei, Horinger New Area of Inner Mongolia, Jing'an District of Shanghai, Chongzhou Economic Development Zone of Sichuan, and Guian New Area of Guizhou. These demonstration areas/bases will be used to conduct research on big

data system innovation, open/sharing of public data, big data innovation and application, big data industry aggregation, big data factor flow, integration/utilization of data center, and international cooperation. The main application of big-data-dedicated services on the enterprise side is risk control, followed by operation optimization, and enterprise management. On the industry side, the application hot spots are relatively concentrated in the fields of the Internet, government, finance, and transportation, followed by social governance and telecommunications.

In 2018, China's Artificial Intelligence (AI) market scale was approximately 33.9 billion yuan. As of February 2019, there were 745 AI companies in China, where businesses engaged in technology integration & solution services (15.7%) and where key technology R&D and application platforms (10.5%) accounted for the top 2 of 18 application fields [Chinese 2019]. The application of AI has penetrated into all walks of life in China and further promoted the development of smart security, smart manufacturing, smart education, smart finance, smart travel, and related fields. AI has also become a huge driving force for the nation's real economy. However, China's AI is still at the early stages of development, and many key indicators, such as basic research, human resources, and microchip technologies, are still lagging behind those of developed countries.

In 2018, the overall industrial scale of Internet of Things (IoT) in China reached 1.2 trillion yuan [China 2018]. From the perspective of subdivided industry, IoT has gradually and widely deployed into the fields of transportation, logistics, environmental protection, medical care, security solution, and electric power. The "IoT + Industry Application" market began to diverge into four mainstream segments: smart cities, industrial IoT, Internet of Vehicles, and connected home. The iterative evolution of IoT new technologies on chips, smart identification, sensors, block-chain, and edge computing accelerated the development of IoT application products towards improved intelligence, convenience, power efficiency, and miniaturization.

In 2018, the overall scale of investment and financing in China acquired rapid growth, so that a total of 2,685 investment and financing cases disclosed transaction amounts of 69.7 billion US dollars, mainly concentrated in the fields of Internet finance (26.3 billion), e-commerce (11.8 billion), tourism (5.63 billion), and local life service (4.58 billion). There were 167 listed Internet companies in 2018, with a total market value of about 8 trillion yuan.

In 2018, cyber security product systems industry increasingly grew in China so that its industry scale reached 51.092 billion yuan [China 2019]. In the same year, China monitored a total of 124.34 million cyber security threats as follows: 27.87 million malicious network resources (e.g., malicious IP addresses and malicious domain names); 89.97 million malicious programs such as Trojans, bots, and viruses; 210,000 hidden security risks such as network security vulnerabilities; and 5.36 million security incidents such as host control, data leakage, and webpage tampering. To cope with cyber security threats and challenges, the Chinese government, related institutes, and private sectors joined forces to promote the construction of cyber security threat sharing platforms and an emergency response mechanism. For example, to prevent and combat online fraud, government sectors, telecom operators, banks, and Internet companies worked closely to form a set of practical and efficient mechanisms, cracked down on 131,000 telecom/online fraud cases, and recovered direct economic losses of 2.03 billion yuan.

The transactions of China's e-commerce in 2018 amounted to 31.63 trillion yuan, and online retail sales amounted to 9.01 trillion yuan, of which Business-to-Customer (B2C) accounted for 62.8%. The top three categories of online retail sales were clothing/knitwear, household appliances, and audio-visual equipment. The total export-import volume of cross-border e-commerce reached 134.7 billion yuan [Ministry 2019]. In addition to physical goods, e-commerce platforms extended the sale of service goods. An increasing number of e-commerce platforms began to provide supplementary services for physical goods, such as car maintenance services, as well as providing service-related products, such as tourism and pet services. In 2019, the gross merchandise volume of Alibaba's T-mall in Singles' Day, an annual 24-hour online shopping gala event, came to 268.4 billion yuan, of which 15 brands respectively achieved over 1 billion yuan of sales, including Apple, Midea, Haier, and Huawei. Meanwhile, China's online payment transaction volume reached 2126.30 trillion yuan in 2018, and the mobile payment market scale reached 170.75 trillion yuan. The application of mobile payment expanded to the public transportation, medical, and other sectors, while also accelerating offline commercial Internet application.

Three major Chinese telecom operators began offering 5G services in 2018, and the commercialization of 5G in China entered into the final stage. China Telecomm offered 100 MHz bandwidth of 5G spectrum frequency between 3400 MHz to 3500 MHz. China Mobile offered 5G spectrum frequency between 2515 MHz to 2675 MHz and 4800 MHz to 4900 MHz. China Unicom offered with 100 MHz bandwidth of 5G spectrum frequency between 3500 MHz to 3600 MHz. As 5G had attracted substantial attention since its introduction, a variety of 5G application scenarios emerged. Among these, entertainment, home, transportation and medical applications drew especially high degrees of awareness and expectation from the public. For example, the high reliability and low latency features of 5G could realize real-time communication between vehicles-vehicles, vehicles-roads, and vehicles-people and promote the development of vehicle-road cooperative autonomous driving. The pursuit of ultimate entertainment and life experience was the main reason why most users expect its realization.

As of June 2019, over 758.77 million users were accessing online videos, and 433.22 million users accessed live streaming [CNNIC 2019]. The major live streaming platforms (Douyin, YY, Kuaishou, etc.) explored the “live streaming plus” model and laid out the content ecosystem. E-commerce and short video platforms also took advantage of live streaming to drive their business development. The e-commerce platform lowered the threshold to attract anchors and fans to establish emotional connections between the platform and consumers, thereby accelerating the growth of the market.

As of February 2019, 973 million people were using social networks in China. The installation penetration rate of Tencent's WeChat reached 85.8% with its Monthly Active User (MAU) reaching nearly 1 billion. QQ, another of Tencent's instant message products, reached a MAU of 600 million. The installation penetration rate of Sina's Weibo was 32.6%, with a MAU 300 of million. While WeChat and QQ are for connecting with friends, Momo is an app for connecting with strangers based on interests and location. Momo's installation penetration rate is 5.33%, with a MAU of 50 million. In terms of online community/BBS service, Baidu's Post-Bar occupied the top rank, with a MAU of 40.47 million [Aurora 2019]. Social e-commerce is a term

that is rapidly gaining popularity in China. The act of asking for advice from friends and family or other trusted parties before making an important purchase decision is nothing new. In the digital age, social e-commerce has sometimes been described as the process of turning strangers into friends, friends into customers, and customers into salespeople. Social e-commerce apps (such as PinDuoDuo and Suning Pinguo) that feature social forms, such as bargaining/group-buying, SNS apps (such as WeChat) enabling selling products based on friend groups, Internet celebrity bloggers/anchors selling goods through Weibo content or live broadcasts (such as Douyin and Kuaishou), were commonplace of social e-commerce applications for users. The social e-commerce market size in 2019 was expected to reach 2060.58 billion yuan in China.

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4.4 Snapshot of the Internet in Japan around 2020

(1) Statistics

Shigeki Goto

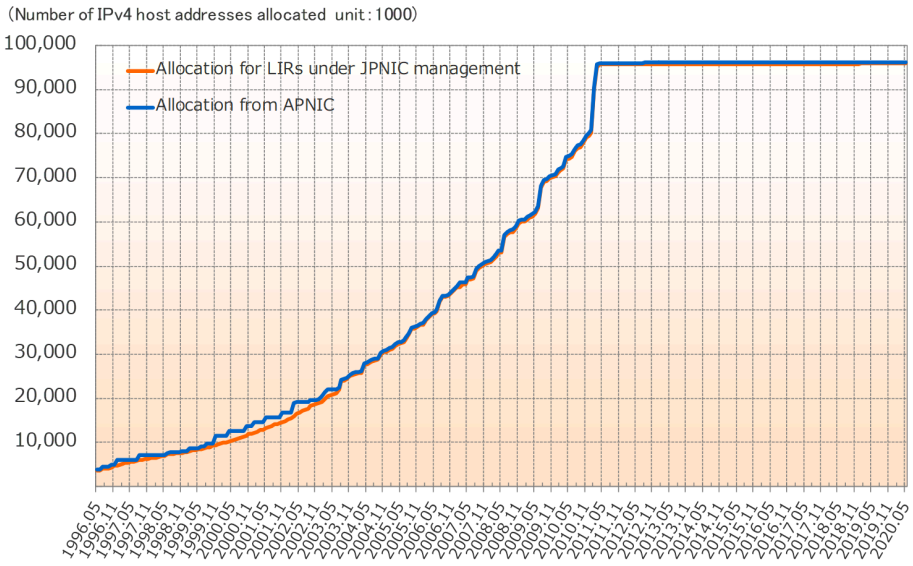
Internet penetration rate in Japan

The Ministry of Internal Affairs and Communication of the Japanese Government makes a series of annual reports on the information & communication statistics database. According to the latest survey, the penetration rate of the Internet was 89.8% in 2019 [MIC 2019]. The English version of the report describes the figures up to 2018 [MIC 2018].

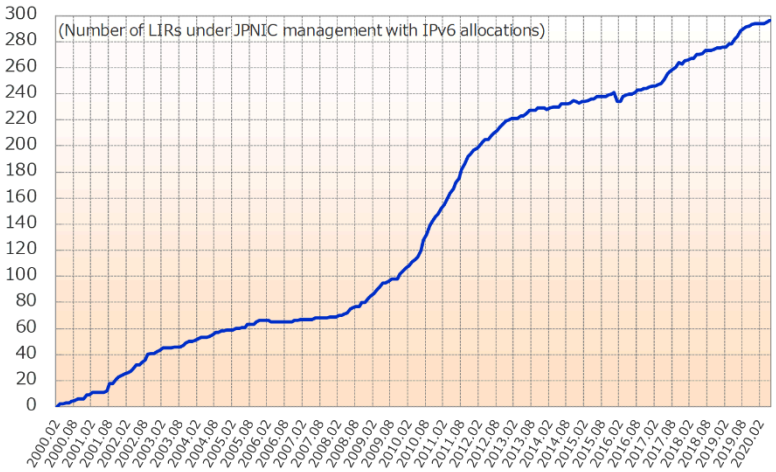
Year	Penetration rate
2015	83.0%
2016	83.5%
2017	80.9%
2018	79.8%
2019	89.8%

IPv4 and IPv6 addresses in Japan

The Japan Network Information Center (JPNIC) draws a graph of IPv4 allocations. The vertical axis shows the number of hosts in the thousands. After the exhaustion of the IPv4 address pool in April 2011, the curve is almost flat, meaning that there were no significant allocations after the exhaustion [JPNIC 2020].



JPNIC also provides a graph for IPv6 addresses. The vertical axis shows the number of Local Internet Registries (LIRs) under JPNIC, which is still increasing [JPNIC 2020].



Domain names in Japan

Japan Registry Services Co., Ltd. (JPRS) regularly publishes a report on the number of JP domain name registrations [JPRS 2020]. There are three types of JP domain names: general-use, prefecture type and organizational, and/or geographic type. Each type is fully described in the document "Guide to JP Doman Name" [JPRS 2020b].

The number of JP domain name registrations (2020/06/01 Total: 1,589,085)				
General-Use JP Domain Name (Total: 1,074,269)				
	ASCII	981,728		ASCII (Alpha-Numeric)
	Japanese	92,541		Japanese (Japanese Domain Names)
Prefecture Type JP Domain Name (Total: 11,298)				
	ASCII	9,575		ASCII (Alpha-Numeric)
	Japanese	1,723		Japanese (Japanese Domain Names)
Organizational Type and Geographic Type JP Domain Name (Total: 503,518)				
	AD	254		Members of JPNIC
	AC	3,684		Universities, Technical schools, Incorporated schools
	CO	433,117		Incorporated companies, Limited companies
	GO	581		Government organizations, Government-affiliated organizations
	OR	37,619		Foundation and Aggregate corporation
	NE	12,927		Network services
	GR	5,778		Arbitrary organization
	ED	5,505		Schools including primary, junior and senior high schools
	LG	1,891		Local Government
	GEO	2,162		Geographic Type

Domain survey

The latest domain survey is dated January 2019 because the Internet Systems Consortium (ISC) thought that their survey was misleading since it was based on IPv4 only [ISC 2019]. The survey shows that Japanese (JP) domains have many connected hosts. The table shows the top five domain names, which have many connected hosts under them.

Domain	#hosts	remarks
net	367,709,849	Networks
com	171,764,916	Commercial
jp	74,749,861	Japan
de	44,753,593	Germany
br	36,307,426	Brazil
—	—	other domains
TOTAL	1,012,695,272	connected hosts

(2) Topics in Domain Names

Takaharu Ui and Atsushi Endo

2011 -- Implemented DNSSEC to .jp

Domain Name System Security Extensions (DNSSEC) is a security extension of DNS that uses digital signatures through public key cryptography and enables Internet users to validate the response with its digital signature(s). By detecting bogus DNS responses, DNSSEC effectively prevents the security threats caused by fraudulent DNS responses.

As DNS forms a hierarchical structure stretched from the root, it is necessary for DNSSEC to be introduced into all the layers of DNS from the highest layer of the root DNS to the DNS at the Top-Level Domain (TLD) level and DNS server for each domain name. DNSSEC requires specific procedures including signing DNS information and registering signing key information in the DNS server for each domain name.

In July 2010, the Internet Corporation for Assigned Names and Numbers (ICANN) introduced DNSSEC in Root DNS Servers, the highest stratum in the DNS. This contributes to the development of an environment promoting DNSSEC deployment among TLDs. Based on these circumstances, JPRS decided to implement DNSSEC in JP domain name services through the following steps.

July 9, 2010	Published a plan to implement DNSSEC into the JP domain name service. https://jprs.co.jp/en/topics/2010/100728.html
October 4, 2010	Conducted .jp DNSSEC Key Ceremony. Created a pair of keys to sign the JP zone.
October 18, 2010	Started signing JP zone with DNSSEC
December 10,2010	Registered the key information (DS resource record) of the JP zone in the root zone
January 14, 2011	Published DNSSEC Practice Statement for the JP Zone (JP DPS). https://jprs.co.jp/en/topics/2011/110114.html
January 16, 2011	Completed implementation of DNSSEC in the JP domain name service. https://jprs.co.jp/en/press/2011/110117.html

2012 - A large number of applications from Japan for the ICANN's new gTLD program

ICANN opened the application window for the new generic Top-Level Domain (gTLD) on 2012, and 1,930 applications were submitted in total [New 2020]. There were 71 applications from Japan. Among statistics by countries/territories, the number of applications from Japan number ranked No. 5 (United States ranked No. 1 with 884 applications), and ranked No. 1 in the Asia Pacific region (Hong Kong SAR ranked No. 2 with 42 applications). Roughly classifying those

71 applications, 54 applications came from distinguished Japanese companies with their company names or service names (so called “Brand TLDs”), 9 were geographical names within Japan, and 8 were generic strings/names.

After evaluating the applications, qualified TLDs were started to be operational after 2014. It allowed new domain name registration services and utilization of company names or services names TLDs (“Brand TLDs”). As of 2020, .shop and .tokyo have more than 100,000 registrations among TLDs submitted from Japan [Shop 2020; Tokyo 2020]. In addition, the companies that positively utilize “Brand TLD” have emerged; for example Canon Inc. adopted “.canon” for the email addresses of all employees around the world [Canon 2018]. By this means, the new gTLD program introduced diversity for usage of domain names.

2016 - DNS operation went under the jurisdiction of Telecommunication Business Law

In Japan, Telecommunications including the Internet are regulated by Telecommunications Business Law. Telecommunications Business Law ensures the smooth provision of telecommunications services and the interests of the users. By providing telecommunications services properly and reasonably, user convenience and public welfare can be increased. Originally, the focus of the Law was telephone services; however, as the importance of the Internet grows, the scope of the Law expands to Internet-related services.

Through the following process, the operation of DNS became under the jurisdiction of the Law.

October 1, 2013	The Ministry of Internal Affairs and Communications submitted “Modalities of Information and Communication Policies Regarding Domain Names” to the Information and Communications Council
December 18, 2014	The Information and Communications Council submitted the report to the Ministry of Internal Affairs and Communications
April 3, 2015	The Ministry of Internal Affairs and Communications of submitted “Law for Partial Amendment to Telecommunications Business Law” to the Diet
May 15, 2015	“Law for Partial Amendment to Telecommunications Business Law” was established
May 22, 2015	“Law for Partial Amendment to Telecommunications Business Law” was issued
May 21, 2016	“Law for Partial Amendment to Telecommunications Business Law” came into effect

Under the discussion at the Information and Communications Council, operation of DNS servers is recognized as an essential component of the Internet infrastructure which was developed through private-sector-led global coordination and which emphasized that new regulation must not harm this point.

As a result, the amendment of the Telecommunication Law applied only to the Domain Name Resolution Services, which needed to be provided robustly and stably. Operation of DNS was defined as Telecommunications Business with Notification and was ordained minimum requirements to ensure reliability and transparency of its services as follows.

a. Domain name telecommunication services（more than 300K users）	
Obligations	notification of Telecommunications Business; documentation of administrative rules for the telecommunications facilities; notification, appointment of a general manager of telecommunication facilities; reporting of significant accidents with respect to telecommunications operations without delay

b. Specified domain name telecommunications services 1. ccTLD: .jp 2. geographic TLD: .nagoya, .tokyo, .okinawa, .yokohama, .osaka, .kyoto	
Obligations	In addition to the obligation for “a.”, continuous provision of its services without refusal and annual publication of the status of income and expenditure for its telecommunications services

2017 - The number of general-use JP domain names exceeded 1 million

The General-use JP Domain Name is the domain name space that allows registration for second-level domains such as "EXAMPLE.JP". Any individuals, groups, or organizations that have postal addresses in Japan may apply for a second-level domain. Any numbers of domain names can be registered in both American Standard Code for Information Exchange (ASCII) and Japanese. JPRS started the registration service of General-use JP Domain Name in February, 2001. The registration service has been well received by many Internet users due to easy registration and utilization therefore exceeded 1 million domain names after 16 years and 7 months.

General-use JP Domain Name has five different features from conventional Organizational Type JP domain name, which has the restriction that each organization is able to register only one domain name in principle.

- Registration of any string for second-level domains is permitted, such as “EXAMPLE.JP”
- Any number of domain names can be registered
- Any person or organization having a residential address in Japan can register any number of domain names
- The registration procedure is simple
- Domain names can be registered in both ASCII and Japanese Characters including *Hiragana*, *Katakana*, and *Kanji*

The name “General-use JP Domain Name” envisions that using the service with those five features in various scenes without limitation leads the development of the Internet.

In the early stages of considering the introduction of General-use JP domain name, some involved parties member feared that Internet users in Japan would exclusively choose General-use JP instead of Organizational Type JP such as “CO.JP” or “GO.JP” due to of convenient features of General-use JP; however, it has become common for many companies in Japan to operate websites not only for their company names with a "CO.JP" domain name but also for each of their products and services using multiple General-use JP domain names.

2018 – The number of JP domain names surpassed 1.5 million

On February 1, 2018, the total number of JP domain name registrations surpassed 1.5 million. Of 1,500,136 registrations, 1,014,301 (68%) are General-use JP domain names (e.g. EXAMPLE.JP), 473,903 (31%) are Organizational Type JP domain names (e.g. EXAMPLE.CO.JP), and 11,932 (1%) are Prefecture Type JP domain names (e.g. EXAMPLE.TOKYO.JP, EXAMPLE.北海道.JP).

The Organizational Type JP Domain Name such as "EXAMPLE.CO.JP" was introduced in 1989 and has the longest history among JP Domain Names. It can be registered only by organizations or companies with postal addresses in Japan, and it allows the expression of the type of the organization by the second level (to the left of “.jp”). CO.JP domain name, which is the most registered category among the Organizational Type JP Domain Names, has been registered by 97% of the companies listed in the first-section of the stock exchanges in Japan, and most people feel that Japanese Companies are synonymous with “CO.JP” [JPRS 2018].

The General-use JP domain name, which has the largest registration, was introduced in 2001. Any individual, group, or organization that has a postal address in Japan may apply for a second-level domain. A second-level domain can be registered in both ASCII and Japanese. General-use JP domain names have become popular among Internet users in Japan due to easy registration and utilization; therefore, this domain type exceeded 1 million registrations on September, 2017.

The Prefecture Type JP Domain Name space was introduced in 2012. It includes the names of the 47 prefectures in Japan, with the structure "EXAMPLE.TOKYO.JP" and "EXAMPLE.NAGASAKI.JP" for example. This enables the address of a website or email to show the relationship with the local community. Any person or organization having a residential address in Japan can register any number of domain names. The third-level domain (the portion "EXAMPLE" in the examples above) can be registered in both ASCII and Japanese. In principle, the applicable service contents and rules conform to those of General-use JP Domain Names ("EXAMPLE.JP").

(3) Internet Timeline and History of Internet Resources Management in Japan

Shigeki Goto

JPNIC complied an “Internet Timeline” in September 2013. The English version is available at the following URL: https://www.nic.ad.jp/timeline/en/. The last update was made in March 2018. In September 2013, JPNIC also published a booklet: *JPNIC's 20 Year History with the Japanese Internet,* which is written in Japanese. Based on the booklet, JPNIC and JPRS jointly edited an enlarged and revised document: *History of Internet Resources Management in Japan*, which are written in Japanese and English. The document covers ten chapters and two appendixes and was published on the Web in April, 2015 (https://www.nic.ad.jp/timeline/en/20th/). This history document was originally written in Japanese. The English version has additional material for international readers to understand the Japanese context.

(4) Great East Japan Earthquake in 2011 and Anti-Disaster Activities

Dai Sato and Hideaki Sone

The Great East Japan Earthquake

The Great East Japan Earthquake and subsequent massive tsunami on March 11, 2011, caused significant damage, particularly in the northeast part of Japan. Mobile communication services were damaged by the power outage more than by the breakages of lines and facilities. The 3G connection was becoming popular in Japan, but coverage in the tsunami-affected coastal areas was insufficient. Smartphones and searching skills to obtain essential information improved the quality of the affected people's lives changed drastically. Newspapers and TV broadcasts were not suitable for collecting current regional information to get food and daily necessities, while social media and web BBS proved more reliable than them. As a result, data from the Internet and temporary disaster broadcasting stations (mini FM), licensed immediately after the earthquake, were the most helpful media. Information transmission skills to call supports, such as disaster volunteers, relief supplies, and donations, also affected the region’s destiny.

Some network engineers and media experts on the Internet vigorously supported affected people to inform the safety of relatives and residents, the transportation status, and where to get daily necessities. On the other hand, requests for help were re-transmit to the Internet through social media and specialized websites. Computers and network environments were installed into support bases by the volunteers, such as "Netvol-Miyagi,"[1] "ICT Shien Ouen Tai,"[2] and "WIDE Project."[3] Some of such groups tried to divide roles based on their specialties or geographical situation, such as equipment collection, configuration, installation, and user support [Sato 2019].

Anti-disaster Activities and the Internet

[1] “Netvol-Miyagi” means NETwork VOLunteers in MIYAGI Pref. http://netvol-myg.w3m.jp/ (This and subsequent URLs are accessed Jul. 21, 2020.)

[2] "ICT Shien Ouen Tai" means ICT support reinforcement squad. https://www.jeita.or.jp/ictot/

[3] “WIDE Project” http://www.wide.ad.jp/

The Great East Japan Earthquake was the first opportunity for large-scale information volunteer activities in Japan. The first frame of the method to respond to a massive disaster was built by experience. Information volunteers started to share their experiences to prepare for the next disaster. A series of nationwide conferences called "IT × Saigai"[4] discussed the idea of systemizing the information volunteer activities, and one of the new supporting groups was "IT DART".[5]

Disaster volunteer systems in Japan were also rearranged after the earthquake. Many disaster support groups, including IT DART, established a new cooperation platform, "JVOAD."[6] While the public sector provides homogeneous and equitable support, NPOs and private supporters carry out attentive support for affected people who have problems to receive the public supports. Japanese Cabinet Office has focused on promoting such volunteer activities. It has become common for the government, NPOs, and volunteers to support affected people under tripartite collaboration until the 2016 Kumamoto Earthquake [COJ 2019]. JVOAD signed a declaration with the Japanese government's Cabinet Office to cooperate in their disaster support activities in 2019. As a result, information volunteers have been incorporated into the anti-disaster system in Japan.

The rate of households with smartphones in Japan was significantly increased from 9.7% to 79.2% from the end of 2010 to 2018 [MIC 2019b], and online information sharing has been essential for anti-disaster activities. Disaster volunteer centers require network environments for recruiting volunteers, public relations, and cooperating with support groups. In disaster situations, a large amount of information overflows, and the S/N ratio decreases. Information volunteers aim to pick useful pieces from the mass of information, organize them, and re-transmit by considering the life span [Sato 2015]. IT DART developed information tools for volunteer groups. The disaster information collection system is one of them, which is to share real-time information about the acting point, short report, and pictures using messaging services and mapping systems [Kayama 2019]. In disaster medicine, Japan DMAT[7] has significantly enhanced its web system and the logistic team with the help of ICT. Smartphones and satellite data communications are now their essential equipment.

With the current spread of COVID-19, the Tokyo Metropolitan Government has adopted an open-source system made by "Code for Japan,"[8] which was established after the earthquake, for their information website of COVID-19 [STOPCOVID 2020]. This system represents the first large-scale use of open-source software for local government services. The source code of the site has been diverted to other prefectures. Meanwhile, the implementation of remote work and remote classes has become popular.

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[4] "IT × Saigai" means IT by disaster. http://itxsaigai.org/

[5] "IT DART" is an abbreviation for IT Disaster Assistance and Response Team. https://itdart.org/

[6] "JVOAD" is an abbreviation for Japan Voluntary Organizations Active in Disaster. http://jvoad.jp/

[7] "DMAT" is an abbreviation for Disaster Medical Assistance Team.

[8] "Code for Japan" https://www.code4japan.org/

(5) Blocking Accesses to Pirated Manga (Cartoon) Sites and the Secrecy of Communications

Shigeki Goto

Telecommunication operators in Japan have faithfully observed the rule for the *protection of secrecy*, which is clearly mentioned in Article 4 of the Telecommunication Business Act.

> *Telecommunications Business Act*
>
> (Protection of Secrecy)
>
> Article 4 (1) The secrecy of communications handled by a telecommunications carrier must not be violated.

This article conforms to the Constitution, which is the supreme law of Japan.

> *The Constitution of Japan*
>
> Article 21. Freedom of assembly and association as well as speech, press, and all other forms of expression are guaranteed.
>
> No censorship shall be maintained, nor shall *the secrecy of any means of communication* be violated.

There is only one exception for the protection of secrecy in communications. In April, 2011, Internet Service Providers (ISPs) started blocking access to child pornography sites. This action was taken based on a new act on child pornography. A new organization, the Internet Content Safety Association, was established in March 2011 to create a list of addresses of child pornography sites.

> *Act on Regulation and Punishment of Acts Relating to Child Prostitution and Child Pornography, and the Protection of Children*
>
> (The Endeavor of Business Operator Relating to the Use of Internet)
>
> Article 16-3 (abbreviated by the editor of this snapshot)
>
> The business operators who provide telecommunication services are to endeavor to cooperate with criminal investigation authorities and take useful measures to prevent the transmission of information relating to child pornography based on the supervisory authority of the business operators or any other measures that contribute to the prevention of such acts using the Internet.

Although the blocking of child pornography sites literally violates the protection of communication secrecy, it is interpreted as *an averting present danger* described in the Penal Code in Japan.

> *Penal Code*
>
> (Averting Present Danger)
>
> Article 37 (1) An act unavoidably performed to avert a present danger to the life, body, liberty, or property of oneself or any other person is not punishable only when the harm produced by such act does not exceed the harm to be averted, provided, however, that an act causing excessive harm may lead to the punishment being reduced or may exculpate the offender in light of the circumstances.

Mangamura is a web site that was opened in 2016 and shut down in 2018. It had a collection of pirated manga (cartoons) as well as some journals, novels, and photography books. *Mura* in Japanese means a village. Since Mangamura was open to the public and free of charge, it became a popular site in Japan. According to a survey, the number of monthly users of Mangamura was around 98,920,000, which made it the 31st most popular website in Japan [Mangamura 2020]. Japanese publishers and manga (comic) artists were frustrated by pirated manga sites including Mangamura. They claimed that they suffered from Mangamura, and they lost 3 billion USD [Mangamura 2020].

On April 13, 2018, Japanese Government requested ISPs to block access to three sites: *Manga-mura*, *Anitube*, and *Miomio*. These sites were known as pirated manga sites. On April 23, the president of NTT (at that time) said that they would block accesses to three pirated manga sites in line with the government request. There were some organizations and experts who expressed their concern about site blocking because it is against the secrecy of communications.

On June 22, a committee was formed to discuss the issue of site blocking at the Intellectual Property Strategy Headquarters within the Prime Minister's Cabinet Office of the Japanese Government. This committee came to an extraordinary closing: they had no formal deliverables. Usually, a committee produces a report even if the members have divergent opinions. The committee consisted of 18 members. Nine members supported site blocking to pirated manga sites. Nine members were against site blocking. Below is a summary of the respective positions of supporters and opponents of site blocking to pirated manga sites.

> *Supporters:* It is hard to trace back the pirated manga sites on the Internet because they use anonymizing techniques. They cause major financial losses. Blocking access is a promising approach to depress their pirating activities.
>
> *Opponents:* Blocking assess apparently violates the constitution. We cannot interpret blocking access as averting a present danger. Pirated manga sites are different from child pornography. There are several countermeasures to pirated sites. Blocking access may not be effective. This committee should not make any report. A government agency may

enact legislation for blocking based on a part of the report, even if there are divergent opinions within the committee.

On October 15, 2018, the committee concluded that they would not produce any report. After the committee was dissolved, the ex-manager of Mangamura was taken into custody in Manila, Philippines on July 7, 2019. He was deported from the Philippines and arrested in Japan on September 24, 2019.

Although one specific incident of Mangamura was closed, the fundamental issue of blocking has not been resolved yet. Masako Wakae described the discussion in detail at the committee under the Intellectual Property Strategy Headquarters [Wakae 2019]. She also drew a lesson from the pirated manga issue. The Internet community in Japan has not successfully persuaded that blocking access violates the spirit of fee and open Internet. They should explain to the people what are technology, philosophy, and the possible risks of the Internet.

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4.5 Snapshot of the Internet in North Korea around 2020

Chan-Mo Park

1. Recent Changes in North Korea

North Korea is one of the very few countries in the world with very strict restrictions in the use of the Internet by its citizens due to fear of political uprisings once the Internet is open to the public like in Middle East and North Africa. Also, DPRK is very reluctant to disclose national

statistics such as population of the Internet users, domestic gross income, government budgets, and so on. Therefore, North Korea was called a Hermit country for many years.

But, since the death of Kim Il Sung in July, 1994, when Kim Jong Il took over, the country has been changing slowly and become slightly more internationalized or globalized. In September 2000 when the author went to Pyongyang for the first time, there was a placard hanging at the gate of Kim Chaek University of Technology (KUT) which said 'Let us materialize the Science–centered ideology of the Great Leader Kim Jong Il to shine brilliantly!' In early 2010's, however, there was a huge board in the foyer of the e-library of Kim Il Sung University (KISU) with Kim Jong Il's writing that began 'Put your feet in your country but see the world with your eyes!'. These days this slogan is everywhere throughout North Korea. After Kim Jong Un took over following Kim Jong Il's death in December, 2011 more changes were seen. For example, since March, 2013, any foreigner can use a mobile phone and access to the global Internet by subscribing a Koryolink phone number. Restrictions on taking photos and videos were relaxed, especially compared to the early 2000's. Use of mobile phones by local people has also been increasing rapidly, and now close to 6 million units have been sold. Travel to North Korea is still difficult, however one can now check luggage directly to Pyongyang from Gimpo or Incheon airport in South Korea. In the old days you had to recheck in Beijing or Shenyang in China.

Benefits and preferences for scientists and engineers have improved remarkably after Kim Jong Un took over. A few examples are: 1) completion of the Unha Scientists' Street (Spetember, 2013) – around the Defense Research Center, 2) completion of residences for Satellite scientists (October, 2014) – location of headquarter of the State Academy of Sciences, 3) completion of Mirae Scientists Street (November, 2015) – around KUT, 4) completion of Sci-Tech Complex (January, 2016) – Ssuk island in Daedong River and 5) completion of Ryomyong Street (April, 2017) – around KISU.

There have been various globalization efforts in scientific and engineering fields in North Korea -- three recent examples are described here. The first (January, 2013) was inviting Google Chairman, Eric Schmidt and his colleagues to consult on the Internet status in North Korea. At a meeting with Korea Computer Center (KCC) scientists it was noticed that the scientists were very much interested with Google Wallet to be used in the e-commerce since they needed e-settlement to sell their IT products outside North Korea. Google Chairman Schmidt advised North Korean Government officials to open up the Internet to its citizens so that it can be utilized to boost the economy of North Korea by communicating with advanced countries through the Internet. Unfortunately, North Korea did not accept his valuable suggestions as of now. The second (April, 2016) was inviting 3 Nobel Laureates in conjunction with KISU's 70th Anniversary celebration throughout the year 2016. Sir Richard Roberts (UK, Biomedicine award in 1993), Dr. Finn Kydland (Norway, Economics award in 2004), and Dr. Aaron Ciechanover (Israel, Chemistry award in 2004) were invited and gave special lectures at KISU, KUT, and Pyongyang University of Science and Technology (PUST). At a press conference in Beijing after the Pyongyang visit Professor Roberts disclosed that while KISU and KUT students were using Intranet the students at PUST were using the global Internet. The third (August, 2018) was that for the first time, North Korean scientists published a research article in a South Korean (ROK) IT journal -- 'Improved Hybrid Symbolic Organism Search Task – Scheduling Algorithm for

Cloud Computing' by Choe Song Il and Li Il Nam of KISU and 3 others (ROK Transactions on Internet and Information Systems Vol. 12, No. 8).

2. Current Status of the Internet in North Korea

It is well known that there are two types of Internet in North Korea, namely domestic Intranet and global Internet. Researches related to the Internet started as early as 1990's such as developing Worluf Broadband Anti-virus program at Computing Center of KISU and researches on firewalls and Intranets by KCC.

Domestic Nationwide Intranet

The first version of Intranet called Kwangmyong, a network for science and technology information started its service in 1997 managed by the Central Information Agency on Science & Technology (CIAST) but later it was expanded to include other data sources such as e-libraries of KISU, KUT and Grand People's Study House (GPSH) in mid-2000 after DPRK government established the Central Information Communication Bureau (중앙정보통신국) that was fully equipped with infrastructure necessary for a national network system. Currently optical fiber communication lines are installed to every province, city and county with ADSL communication using modems to all lower levels. In order to realize the distance education, health of countryside people and smooth commercial activities Education Network (교육망), Public Health Network (보건망) and Trade Network (무역망) are established and in operation on the Intranet. Users are the members of the Central and Local government organizations, Factories, Farms, and Individuals.

The assignment of IP addresses and hierarchical structure of domain names on the Intranet is shown in the following picture (Fig. 1) which was hung on the wall of a computer room of KISU library in 2015.

Fig. 1 IP Addresses and Domain Names on Intranet

Recently North Korean Supreme People's Assembly adopted a law on distance education. This may be related to the Corona Virus pandemic since distance education has been increasingly become important worldwide. Details of the law are not available, though.

Distance learning in North Korea has its roots in the Kim Il Sung era when the 'factory university' (공장대학) was first introduced to encourage factory workers across the nation to learn science and technology in their workplaces. Kim Jong Il launched an Education Network for factory universities. In 2015 Kim Jong Un mentioned that all organizations should build well-equipped Sci-tech dissemination rooms (과학기술보급실). Since most normal North Koreans do not have their own PCs they attend online classes in Sci-tech dissemination rooms in their workplace (e.g., Pyongyang Thermal Power Plant (평양화력발전연합기업소) in Pyongyang, Fig. 2) or go to an e-library in a nearby city (e.g., Public Library of Hamgyong North Province (함경북도 도서관) in Chongjin, Fig. 3)

Fig. 2 Sci-tech Room of Thermal Power Plant in Pyongyang

Fig. 3 Hamgyong North Province Liabrary with computers connected to Intranet

It is noticed in Fig. 2 that was televised in North Korean Central TV in 2020 the workers were sitting widespread with masks on for protection from Corona Virus while Fig. 3 which was taken in 2015 shows students working with computers in the library connected to the Intranet. Learning materials for online lessons are fed from major universities such as KUT, KISU, etc. Fig. 3 also shows organizations that can be accessed.

KUT so called MIT of North Korea founded the country's first Distance Education Center in 2006, which later was expanded to Distance Learning College (원격교육대학) in 2010. According to the university's website (www.kut.edu.kp), the online college offers over 30 courses including computer science and engineering, control engineering, applied electronics, and mining machines engineering. Workers around the country can enroll in online courses and choose to earn a degree or certificate after required years of study. Fig. 4 shows the distance education network of KUT.

Fig. 4 KUT distance education network

Following KUT, other top universities including KISU, Pyongyang University of Mechanical Engineering, and Pyongyang Jang Chol Gu University of Commerce, also opened online courses. The KUT have over 24,000 students enrolled in the distance learning programs according to KUT website in 2020..

Recent technology development has made online courses available on tablet PCs and smart phones. North Korea developed WiFi network, Mirae (meaning future, Fig. 5) so that North Korea's tablet PC such as Daeyang and smart phone such as Pyongyang 2428 could be connected to North Korea's nationwide Intranet. However, you need a WiFi sim card installed in your device. Students can use Daeyang tablet PCs to attend lectures and take exams, and download study materials in their tablets. The Mirae network, which is currently only available in Pyongyang, has been introduced to factories in the capital, which can "turn all factories into classrooms" and "enable the students to study anywhere in the factories," according to Naenara portal.

Fig. 5 The Mirae network app on a smart phone

The Mirae network is now available at various compounds in Pyongyang, including KISU. KUT and Sci-Tech complex, and major streets such as Mirae Scientists, Ryomyong, Yonggwang and Haebangsan streets. The network is scheduled to be introduced to the whole city.

North Korea is very much suffering from shortage of electricity and poor electric power lines in country side. Therefore, researches on alternative energy have been actively carried out and many solar energy panels are installed to light street lights, individual apartment and homes and to supply electricity to wireless communication towers (Fig. 6).

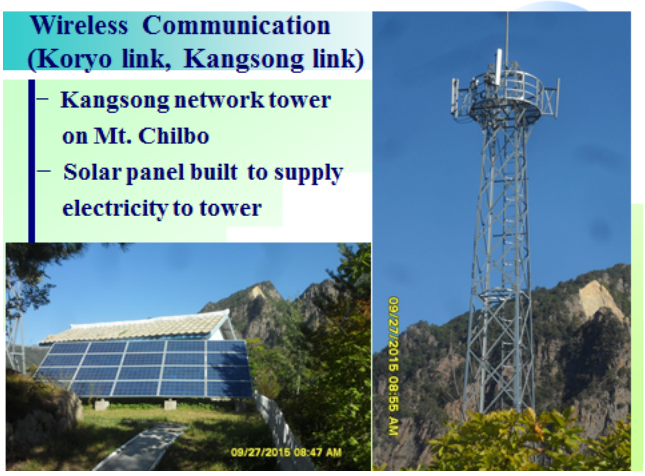

Fig. 6 A Kangsong Network Tower and Solar Panels in Mt. Chilbo

There are close to 200 websites connected to domestic Intranet including Naenara portal, Manmulsang online shopping site (Fig. 7), Korean Central TV, Rodong Newspaper and many universities and research institutes.

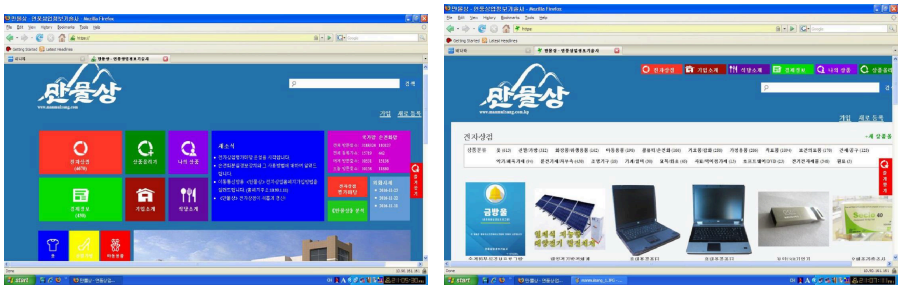

Fig. 7 Manmulsang Online Shopping Portal

Global Internet

North Korea's main connection to the global Internet is through a fiber-optic cable connecting Pyongyang with Dandong, China, crossing the China–North Korea border at Sinuiju. Internet access is provided by China Unicom. Before the fiber optics connection, global Internet access was limited to government-approved dial-up over land lines to China. In 2003 a joint venture between a German businessman in Berlin and the North Korean government was established and started the commercial Internet to North Korea called KCC Europe. The connection was established through an Intelsat satellite link from North Korea to servers located in Germany so there was no need to dial Internet Service Providers (ISPs) in China.

In 2007 North Korea successfully applied to ICANN for approval of the .kp, country code top-level domain (ccTLD). KCC Europe administered the domain from Berlin, and also hosted a large number of websites. In 2009 Star Joint Venture Co., a joint venture, StarJV, between the North Korean government's Post and Telecommunications Corporation and Thailand-based Loxley Pacific was established as an ISP and took control of North Korea's Internet Protocol (IP) address allocation. The satellite link was phased out in favor of the fiber optics connection and is currently only used as a backup line.

In October 2017 a second Internet connection was taken into service. This connects North Korea through a fiber optic cable with Vladivostok, crossing the Russia-North Korea border at Tumangang. Internet access is provided by TransTelekom (TTK), a subsidiary of Russian national railway operator Russian Railways. Since March 2013, foreigners have been able to access the internet using the 3G phone network, Koryolink, a joint venture between North Korea and Orascom Telecom Holding of Egypt. According to a phone directory of foreign members published by Inter Agency Meeting (IAM) in Pyongyang in August, 2017 there were more than 280 foreigners in Pyongyang area who were using mobile phones and global Internet. This number does not include other foreigners who were not registered with IAM, for example more than 100 foreign professors and staff members at PUST.

Foreigners are not allowed to connect to domestic Intranet and mobile phones owned by the foreigners are blocked from calling North Korean people or North Korean organizations in North Korea and vice versa. A foreigner may use the global Internet service with Koryolink by subscribing connection to mobile network by paying 75 Euros for connection fee and 10 Euros per month up to 50 MB. If it exceeds 50 MB you have to pay 0.15 Euros per MB. International phone calls are very expensive, e.g., 5 US dollars per minute to USA and 2 US dollars to China. If your call time to US is 1 minute and 1 second the charge will be 10 US dollars. If you have an access to WiFi you can make free calls to any place in the world via Skype, Kakao talk, WeChat, etc. It was noticed that unprotected WiFi connections were available near foreign Emabssy buildings (e.g., Linksys, TP-Link near British Embassy) sometimes.

Here is a brief information on global Internet in North Korea described in Wikipedia.

- ccTLD: kp (the date of ccTLD delegation: 2007-09-24)
- Internet Population – 14,000 (2016)
- Broadband Population xxx (2010)
- IP Address Allocation (Year) :
  - Number of IPv4 addresses: 1,024 (2012)
  - Number of IPv6/48s: xxx
  - As of 2014 North Korea had one known block of 1,024 IPv4 addresses: 175.45.176.0 -175.45.179.225
- Border Gateway Protocol (BGP) to North Korea
  - StarJV AS131279 from China
  - TTK AS20458 from Russia

Although North Korean government tries very hard to limit access to free-world information for normal citizens it may be very difficult to stop completely since in many cities near the North Korea – China border a foreign smart phone with roaming could receive electronic messages from servers located in China. Fig. 8 shows text messages from South Korea received by a Samsung smart phone in North Korea near Mt. Paekdu as well as at a hotel in Samjiyon city that is located about 20 miles away from Mt. Paekdu.

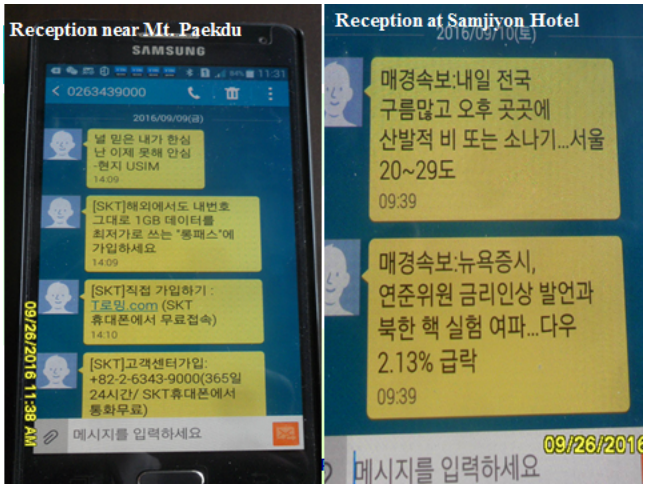

Fig. 8 Messages from South Korea received in North Korea

Recently Kim Jong Un emphasized the use of Virtual Reality in education for young people and to develop application programs for using VR such as automobile driving learning system. North Korea imported many sets of HTC VIVE hardware systems for which application software are developed in North Korea. With an era of Fourth Industrial Revolution approaching North Korea is trying to innovate their education system to cope with new paradigm (Fig. 9).

Fig. 9 Emphasizing use of VR in North Korea

3. Use of Global Internet at PUST

Brief Introduction to PUST

As mentioned earlier students at PUST are allowed to use global Internet inside the campus. It is an exceptional case in North Korea and it is worthwhile to understand background on PUST before actual usages of the Internet at PUST are described. PUST was established by South and

North Korea to foster well trained scientists and engineers with good character and global mind-set who can contribute to boosting North Korea's economy and globalizing the nation.

It is a unique private and international university in North Korea in which all the courses are taught in English by foreign professors. About half the faculty members were US citizens until September 1, 2017 when the US State Department banned travel of US citizens to North Korea. PUST opened in September, 2009 and the first crop of students, 100 undergraduates and 50 graduates (all male) entered in October, 2010. Female students have been admitted since 2015 and now represent approximately 15% of the student body. Currently there are about 600 undergraduate and 100 graduate students. Until September, 2017 there were about 125 foreign faculty and staff members -- all volunteers coming from more than 15 countries including USA, UK, Canada, China, Australia, Albania, Netherlands, Germany, and others. They teach either technical English, Chinese, or subject courses in the various University colleges -- College of Agriculture and Life Sciences (ALS), College of International Finance and Management (IFM), College of Electrical and Computer Engineering (ECE), College of Dentistry (COD) and College of Medicine (COM). The colleges of Public Health, Nursing and Pharmacology will open in near future. There is a church connection; most faulty are Christians who self-identify as having high spirits and love toward world peace. Their perspectives can be summarized as follows: 1) efforts to foster talented young people in agriculture, business, science & technology, and medical areas for economic development of North Korea (teach how to catch fish rather than give fish), 2) teaching soft skills such as ethics, virtues, trust, appreciation, and patience in addition to hard skills, 3) exemplifying in showing love, sacrifice and service by working as volunteers without salary, 4) trying to bridge a gap between North Korea and the West by sending many students to universities in foreign countries as well as inviting many distinguished scholars such as Nobel laureates to PUST by holding international conferences every other year, and 5) guiding PUST graduates to contribute to the globalization of North Korea. Faculty are well aware of UN sanctions and never teach courses related to weapons (e;g;, nuclear and missile development). Cyberattack technologies are not included in PUST curriculum. Most of the male students at PUST are waived from serving military duty of 10 years so that they could pursue their studies to become top-notch scientists and engineers, businessmen and medical doctors.

Approximately 100 students per year graduate with Bachelor degree. Of these, about 35% advance to a graduate program at PUST; others go to work in research institutes, companies, or enter other North Korean graduate schools. Those who graduate with Master degree either pursue PhD at PUST or at a foreign university such as Uppsala, Sweden, or Oxford, UK; others find jobs as instructor or researcher at another university. Some graduates go to industry, banks, or research institutes such as Pyongyang Informatics Center (PIC). Courses taught at PUST (both undergraduate and graduate) may be found at the PUST website, http://pust.com.kp.

Globalization Efforts

The vision of PUST is to globalize their students so that they can contribute to globalization of their country. To achieve this goal PUST initiated an International Conference on Science and Technology (ICoPUST) in October, 2011 and had been holding this on alternate years until US

government banned travel of US citizens to North Korea in September, 2017. That resulted in the cancellation of the 4th ICoPUST originally scheduled for October, 2017 but rescheduled to hold in October, 2019 in conjunction with the 10th Anniversary celebration of the founding of PUST.

Another effort is to send many students abroad to study at foreign universities. These include Westminster, Cambridge, Surrey, and Oxford universities in UK, Uppsala University in Sweden, Zurich University of Applied Sciences in Switzerland, Sao Paulo University in Brazil and various universities in China. Thus far about 30 students received MS or MBA degrees and several students are currently working for their Master or Ph.D. degrees abroad.

For those who cannot pursue advanced study abroad PUST started a program to take 30 to 40 students to China for two weeks each summer for a study tour of academic institutions such as Dalian Polytechnic University and China Agricultural University in Beijing, as well as companies such as IBM, HP, SAP, GE, Dell, Liferay, etc.

Use of the Internet by PUST students and faculty

Foreign faculty and staff members started to use the Internet in Spring semester (March ~ June), 2011 but students began to use the Internet in Fall semester (September ~ December), 2011. PUST is the only university in North Korea where students can have access to the global Internet so that they can access websites such as Google, YouTube, Wikipedia, electronic libraries of foreign universities and Wall Street Journal, etc. for their research and course works. Since there is only one IP address allocated to all users of PUST due to a high price of about 900 US dollars per month per an IP address and there are approximately 700 students as well as 150 foreign faculty and staff members only graduate students are allowed to use the Internet freely at the computer room where 30 desktop computers are connected to the Internet via PUST LAN. There are two helpers in the computer room to assist users with their problems and probably monitoring purposes. Undergraduate students may use the Internet for their research works related to their graduation theses (approximately 3 months before graduation) but there are classrooms connected to the Internet where a lecturer can connect his/her laptop to demonstrate working with the Internet during a classroom lecture. Also, there are two remote conference rooms for Skype and distance education. PUST students are not allowed to use WiFi inside the campus.

However, Foreign faculty and staff members of PUST are allowed to use the Internet through a desktop or laptop computer connected to PUST LAN or via WiFi at their offices as well as apartments. Several routers are installed on the wall of each floor of the faculty apartment. Private routers are also installed in the apartments with permissions from the Foreign Affairs Department of PUST.

Like South Korean government blocked websites of most of the North Korean organizations the websites of many of the South Korean organizations are blocked by North Korean government. Also, the websites of the US government and companies, especially high-tech related and financial organizations are blocked in the USA. If you try to access those websites, they reject your entry with a message saying that ‘You are in a sanctioned area.’ Fortunately, use of VPN (Virtual Private Network) in North Korea is not illegal so some of the blocked websites can be accessed.

Domestic faculty and staff members at PUST may use the Internet with a permission of North Korean Vice President for Academic Affairs at the computer room.

Students at other universities are still using an Intranet. However, it is known that KISU is technically ready for its students to use the Internet in 2015 according to Director of Foreign Affairs of KISU although implementation has not occurred yet.

The following tables show the activity records on Google gmail account at PUST in Spring semester, 2015.

Table 1. Activity Record (2015-3-20 8:40 a.m.)

Activity on this account

This feature provides information about the last activity on this mail account and any concurrent activity. Learn more

This account does not seem to be open in any other location. However, there may be sessions that have not been signed out.

Recent activity:

Access Type [?] (Browser, mobile, POP3, etc.)	**Location (IP address) [?]**	**Date/Time** (Displayed in your time zone)
Browser (Chrome) Hide details *"Mozilla/5.0 (Windows NT 5.1) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/39.0.2171.65 Safari/537.36,gzip(gfe),gzip(gfe)"*	* North Korea (175.45.177.143)	7:38 am (0 minutes ago)
Browser (Chrome) Show details	North Korea (175.45.177.143)	5:52 am (1.5 hours ago)

Browser (Chrome) Show details	North Korea (175.45.177.143)	10:25 pm (9 hours ago)
IMAP () Show details	North Korea (175.45.177.143)	9:19 pm (10 hours ago)
Browser (Chrome) Show details	North Korea (175.45.177.143)	Mar 19 (13 hours ago)
Browser (Chrome) Show details	* North Korea (175.45.177.143)	Mar 19 (14 hours ago)
Browser (Chrome) Show details	* North Korea (175.45.177.143)	Mar 19 (19 hours ago)
Browser (Chrome) Show details	* North Korea (175.45.177.143)	Mar 19 (20 hours ago)
Browser (Chrome) Show details	* North Korea (175.45.177.143)	Mar 19 (21 hours ago)
Browser (Chrome) Show details	* North Korea (175.45.177.143)	Mar 19 (23 hours ago)

Alert preference: Show an alert for unusual activity. change

* indicates activity from the current session.

This computer is using IP address 175.45.177.143. (North Korea)

Table 2. Activity Records (2015-5-1 3:30 p.m.)

Activity on this account

This feature provides information about the last activity on this mail account and any concurrent activity. Learn more

This account does not seem to be open in any other location. However, there may be sessions that have not been signed out.

Recent activity:

Access Type [?] (Browser, mobile, POP3, etc.)	**Location (IP address) [?]**	**Date/Time** (Displayed in your time zone)
Browser (Chrome) Hide details *"Mozilla/5.0 (Windows NT 6.1) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/42.0.2311.135 Safari/537.36,gzip(gfe),gzip(gfe)"*	* North Korea (175.45.177.159)	3:22 pm (0 minutes ago)
Browser (Chrome) Show details	North Korea (175.45.177.159)	5:39 am (9 hours ago)
Browser (Chrome) Hide details *"Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/42.0.2311.135 Safari/537.36,gzip(gfe),gzip(gfe)"*	United States (175.45.177.149)	May 13 (1 day ago)
Browser (Chrome) Show details	* United States (175.45.177.149)	May 13 (1 day ago)

Browser (Chrome) Show details	United States (175.45.177.149)	May 13 (1 day ago)
Browser (Chrome) Show details	United States (175.45.177.149)	May 12 (2 days ago)
Browser (Chrome) Show details	United States (175.45.177.149)	May 12 (2 days ago)
Browser (Chrome) Show details	* United States (175.45.177.149)	May 12 (2 days ago)
Browser (Chrome) Show details	United States (175.45.177.149)	May 12 (2 days ago)
Browser (Chrome) Show details	United States (175.45.177.149)	May 12 (2 days ago)

Alert preference: Show an alert for unusual activity. change

* indicates activity from the current session.

This computer is using IP address 175.45.177.159 (North Korea)

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4.6 Snapshot of the Internet in South Korea around 2020

DaeYoung Kim

Taxi and Ridesharing

Services like Uber X are illegal in South Korea. This is due not only to resistance from the existing business sectors but also to some peculiarities of the taxi services in South Korea. It is fairly easy to hail a taxi on metropolitan streets, and the fares are among the lowest in the world; therefore, there is little room left for new entries. Also, the public transportation system, which includes subways and buses, is quite convenient and cheap, providing users with a comfortable option. The only Uber service allowed in South Korea is Uber Black, a luxury vehicle service.

A seemingly similar but in fact different legal service is Kakao Taxi, officially branded as Kakao T Taxi. It is one of the transportation services run by Kakao, a major Internet service company under the grouped brand of Kakao T, which include services for luxury vehicles (Black), bikes, parking, carpool, shuttle, navigation, as well as proxy driving wherein a customer can hire a professional designated driver when the customer is inebriated and cannot drive. Kakao Taxi is legal because it does not hire new drivers without taxi-driving licenses, but instead provides call service to the existing licensed taxi drivers; thus, business conflicts are avoided. In this manner, Kakao Taxi is currently running quite a successful business.

A recent controversial issue was banning of a short-term rental car service called TADA, a new service spun off SOCAR which is a legal rental car service based on manned eleven-seat minivans offered as six-customer rental cars. The difference between TADA and SOCAR is the basic length of service terms; the former is on an hour-basis whereas the latter is on daily basis. That is, TADA is seemingly not any different from the regular taxi service. As soon as TADA was launched in 2018, there was huge resistance from the existing taxi business sector, claiming that TADA is nothing but a disguised taxi business without a legal license. Although a related lawsuit found TADA not guilty of any such charges, the South Korean Parliament has recently passed a new law banning the business type that TADA introduced. Public opinion is split. Some feel that TADA is a futuristic service providing better working conditions for drivers, while other believe that such a business model is stealing the jobs of the taxi drivers, who are already experiencing financial hardship.

Network Neutrality

The usual dispute in regard to network neutrally has been content providers' alleged free riding on the network providers' infrastructure. A somewhat more persuasive argument that domestic content providers recently have raised is that they suffer from unfair and unbalanced taxes in comparison to locally registered branch companies of global competitors. Local branches of global companies like Facebook and Google, among others, are almost effectively free from many kinds of domestic business restrictions and local taxes. This claim is difficult to prove, however, because the business reports of such companies to tax offices are said to lack transparency. The complaints and allegations of domestic companies have not yet been fully addressed in market practice, but it is a contentious issue that needs to be watched for future development.

Another aspect of neutrality has recently become a topic of dispute. That is, aggressive business expansion of major portal companies like Naver and Kakao to on-line shopping, banking, insurance, and even to transportation among others, has raised red warning to the society. They have by now become big brothers themselves, and complaints on unfair business practices are frequently reported. They are also subject to suspicion of distorting public opinion by shrewd posting of news articles in favor of a particular political group. They might face increasing antitrust legal troubles just as big brothers of the former generation have gone through.

Bye to Windows 7 and Active X

As support for Windows 7 and Internet Explorer (IE) ended on January 14, 2020, South Korea is finally forced to abandon Active X. Against the image of the IT-strong country, South Korea has made perhaps one of the worst 'soaked and locked in Active X' cases across practically all public Internet services for the last 20 years.

The story began when the government launched the E-Government project around 2003. Although there were serious considerations for open-source alternatives, the final choice for the platform was Microsoft Windows geared with IE, which provides extended features by use of plugins implemented through proprietary Active X. As E-Government provided a leading example, all public services, most importantly bank services, followed the same practice;

however, the result was that the whole nation became effectively monopolized by MS Windows/IE/Active X. No other OSs, browsers, and plugin methods would work with public Internet services. One particular policy introduced was the enforcement of a Korean-made authentication method under the name of ‘Authorized Authentication’ which accelerated the ubiquitous penetration of Active X into every corner of South Korean daily on-line activities.

As the world was rapidly moving towards platform-free HTML 5, South Korea could not make any step forward since the whole country was so deeply locked into Windows/IE/Active X that established business interest blocked any trials to escape from the trap. An alternative offered at a time was downloading .exe files instead, which was but an evasion; downloading itself is a bad practice in the first place, and those files were also still coded with Active X, keeping the trap locked tightly in place. Some sites provided services independent of OS and browsers, only to switch to NPAPI (of defunct Netscape), an even older plugin method wherein the plugin itself is a bad practice.

After almost a decade-long struggle to escape, relief was attained with the final suspension of IE along with Windows 7. South Korea is left with no other choices than switching to the global web-standard, thereby entering the cross-OS and cross-browser Internet world.

The transition the South Korean Internet community will have to go through will be extremely painful and costly, which makes a clear case for how a single wrong choice and indecisive corrective actions can lead to a social as well as an economic mass-misfortune, just as with the COVID-19 pandemic.

As of Nov. 10, 2020, the exclusive status of ‘Authorized Authentication’ aka ‘Official Certificate’ has ceased and will remain just an option in the new law-enforced system of ‘open authorization infrastructure’.

Internet Service

In search engines, Naver occupies about 70% of the total queries, followed by Daum (as part of Kakao business sectors) with 16%, and Google with 12%. In the instant messenger market, Kakao Talk occupies about 80% of the total traffic, followed by Facebook Messenger with some 7%, Snapchat with about 3%, and others. In social networking, the major players are BAND by Naver, Instagram, Facebook, and Kakao Story in that order, followed by Twitter with a smaller share. In email services, Naver and Google are the two main players.

Internet-only Banks

Two direct banks started in 2017: K-bank and Kakao Bank. K-bank is a consortium of 21 rather balanced shareholders, and it provides service both on mobile phones and desktops. Kakao Bank consists of two big and nine small shareholders, with Kakao possessing the biggest share of 30%, providing only mobile service, i.e., only on smartphones. Of the two, Kakao Bank has shown impressive growth with more than 10 million customers (some 20% of the Korean population), including total deposits of about 20 trillion KRW and total loans of 14 trillion KRW as of November 2019.

Infrastructure

As for the number of IPv4 addresses and that of IPv6 /32 blocks, there has been little change since 2014, with some 112 million (6th in the global IPv4 standing) and some 5,000 (13th in the global IPv6 standing), respectively.

As for subscriber links, a substantial portion of South Korean homes now enjoy a Gbps connection per household, implemented through IEEE 802.3ah EPON (Ethernet Passive Optical Network), and ITU-T G.984 GPON (Gigabit Passive Optical Network). 10 Gbps connections were introduced in 2018, reaching 10% of the total households as of the end of 2019. The governmental plan is to provide 10 Gbps connections to 50% of all households by 2022.

As for WiFi, IEEE 802.11ac Wave2 with a maximum of 1.73 Gbps has been in nationwide service since 2016, while IEEE 802.11ax (WiFi6) with a maximum of 4.8 Gbps has started commercial service in April, 2019. On the other hand, about 30% of the Seoul area enjoys free public WiFi access, to be boosted to a 100% coverage by 2022.

COVID-19 and Online Education

After a five-week delay of the opening of the spring semester due to COVID-19, South Korea started online schooling on April 9, first with grade 9-12 students. Grade 4-6, grade 8 and 9, and grade 10 and 11 started school a week later, with the entire grade 1-12 classes finally going online on April 20. All South Korean universities provided online education for the Spring 2020 semester, but kindergartens were kept closed.

Although there was much chaotic confusion the first few days, the system, including students and teachers, seem to adapt to the abrupt transition more smoothly than feared by many. Online schooling was done in three modes: real-time interactive, Q&A with recorded contents, and self-executed projects. Two platforms were used: Online Class by Educational Broadcasting System (EBS) and e-Learning by Korea Education and Research Information Service (KERIS), an agency of Ministry of Education. The former is provided by Microsoft while the latter by a consortium led by Naver, which showed a smoother takeoff.

It is not clear how long this online schooling will last, as COVID-19 seems to be rather under control in South Korea, with less than 30 confirmed infected patients per day as of April 10, spawning an optimistic prospect that onsite schools might be able to open fully in the Fall semester. However, it is obvious that, through this experience, Korea will be tasked with rethinking and reengineering the whole educational system to make it all-time online ready.

The transition to online-ready might not be limited to education. With the prevalent pessimistic view that Corona-like pandemic can hit the globe anytime in the future, we might perhaps have to reengineer every corner of our society online-ready, in the form of smart work, smart offices, smart manufacturing, etc.

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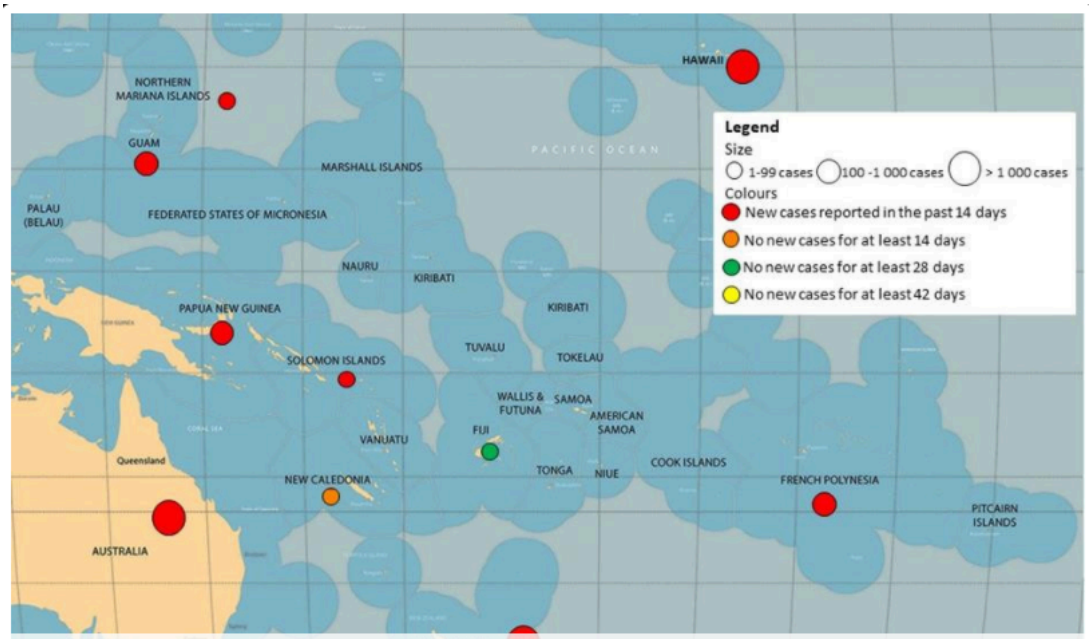
4.7 Snapshot of the Internet in the Pacific around 2020

Maureen Hilyard

INTRODUCTION

2020 will be remembered in historical records as the year the populations of the world reeled under the impact of COVID-19 – the coronavirus. The impact that the coronavirus had on populations, especially in developed countries which had the highest rates of active COVID-19 cases and the number of deaths, was devastating. Reporting on the status of COVID-19 in the Pacific was often incomplete and sometimes unreliable [BBCNews 2020; BusinessInsider 2020; SydneyMorningHerald 2020]. Even the World Health Organisation (WHO) only reported on Pacific countries that were UN members so that they excluded the Cook Islands, Niue and the Tokelau [WHOCOVID 2020; Filho 2020].



Coronavirus Disease 2019 (COVID-19) cases in the Pacific as of 13 October 2020

The most accurate information that is regularly updated is from the Secretariat of the South Pacific Community (SPC) site (above) which reported that only seven of the 22 Pacific countries and territories, namely Fiji, French Polynesia, Guam, New Caledonia, Northern Marianas, Solomons and Papua New Guinea were not so successful in avoiding the pandemic, with some

suffering fatalities [Wikipedia 2020; SPC 2020]. Yet, while isolation may have helped the smaller island nations to keep them safe from some of these distressing impacts of COVID-19, border closures and lockdowns had an equally devastating effect on their economies [IMF 2020]. While governments were deploying available financial resources towards safeguarding and supporting their citizens on-island during the lockdowns to ensure continued non-COVID-19 contact, income generation from tourism operations came to a standstill [CIMFEM 2020; CITravel 2020]. Strict adherence to border restrictions against the unpredictability of the pandemic and banning entry to tourists and other visitors, caused a drain of the lifeblood of many of our small island developing states [RNZ 2020]. In the interim, island communities banded together to ensure that families, especially the elderly and youngsters, were catered for during a time where government and private resources continuing to be depleted during the pandemic with little sight of relief in the near future as borders remain closed. In the Cook Islands, social media was used extensively during the first months of the global upsurge of the pandemic to keep people informed and aware of all safety precautions despite the fact that our islands were COVID-free [CITravel 2020]. However, in light of the economic crisis, New Zealand and the Cook Islands continue to work on a way to address the island country's economic development and health safety issues [Stuff 2020].

IT professionals all over their globe have been working on helping us cope with the fallout of the coronavirus (COVID-19) pandemic. The lack of warning meant that there was no real opportunity to test the infrastructure for adapting to the whole-scale online communication activity that was to take place and which was less than ideal for some. Meanwhile, an organisation within the Pacific has taken advantage of the pandemic and the increased use of the internet by its members to use its major channel of communication to develop opportunities that can enhance the lives for people within the Pacific region. The Pacific Islands Chapter of the Internet Society (PICISOC) has connected with its members using its picisoc@picisoc.org mailing list for nearly 25 years and the activity among pacific members since the beginning of 2020, has really proved its worth during the course of the pandemic [PICISOC 2020a]. Its main purpose is to facilitate discussion among the members of issues of interest or of concern to the region. Most times, these matters are raised by the members themselves and they can come from any corner of the Pacific because the Chapter members which number nearly 400 members is unique [ISOC 2020] within the Internet Society (ISOC) in that it is members are not from one city or even one country, but are from the 22 Pacific Islands Countries and Territories (PICTs) that are members of the Pacific Island Forum which includes American Samoa, Cook Islands, The Federated States of Micronesia, Fiji, French Polynesia, Guam, Kiribati, Marshall Islands, Nauru, New Caledonia, Niue, Northern Marianas, Palau, Papua New Guinea, Pitcairn, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu, and Wallis and Futuna PIFS 2020].

PICISOC was first established in 1994 when two IT managers of the Forum Fisheries Agency (FFA) and SOPAC decided to hold a formal meeting for Pacific IT administrators and managers. The IT-PacNet was formed and held annual meetings until 1999 when the creation of a Pacific Islands Chapter of the Internet Society (PICISOC) was recommended. This finally happened in 2002 which allowed the IT-PacNet to become a CROP (Council of Regional Organisations of the Pacific) ICT Working Group concentrating more on dealing with CROP policies. PICISOC grew until its annual general meetings became more popular each year so that PacINET was created which evolved over the years into the premier ICT conference for the Pacific region, incorporating discussions about Pacific-related internet governance issues as well as offering training opportunities for the more technically-inclined, courtesy of the Asia Pacific Network Information Centre [APNIC2020]. PICISOC focuses on Internet-related issues of interest to the Pacific Islands region and works with various organisations and governments to ensure the continued development of ICT within the region. Its greatest asset is the mailing list that has been the communication channel that connects members of the ISOC Chapter from around the Pacific region, and incorporating the countries of the Pacific Forum. The Chapter grew to nearly 700 members from across the Pan-Pacific. Changes of personnel on the Board created a situation after a brief hiatus, experienced leaders, many of them former Board Chairs, decided to take action to rekindle the interest in developments were occurring in the Pacific and to re-engage its members more actively and to restore the Chapter to its former position as the hub of ICT activity in the Pacific

In 2018, a new Board of PICISOC was elected with an important aim during the pandemic - rekindle the use of the PICISOC mailing list as the focal point for raising concerns and discussions across the Pacific, and developing solutions from within the Pacific, for the Pacific. These included:

Emani Fakaotimanava-Lui (PICISOC Chair 2019-20) who had established what was said to be the first WiFi system in the world, on his island of Niue when he managed Niue's internet to ensure that everyone on his small island was connected. After gaining more experience with large telecom companies in New Zealand as well as working with Kacific Broadband Satellites [Kacific 2020], he set up his own network [MakaNet 2020), and now connects Pacific Island families to the internet in the Auckland region. A major initiative that he established during the pandemic was ***FamilyNet*** where he collaborated with other sponsors to provide six-months Fibre Unlimited internet connection to the homes of Pacific Island families who had children who needed to do their schoolwork online during national lockdowns. Through his connections with Kacific and his return during 2019-20, his home country of Niue is now upgraded to the Kacific satellite and fully connected to a faster and more affordable internet service. His company, MakaNet (NZ) operates out of the Pacific Business Hub, which is a Manukau-City-based centre for Pacific business start-ups to rent space and work together to test the market for their products. A great innovation to support Pacific initiatives.

Maureen Hilyard (PICISOC Chair 2011-14) returned to the PICISOC Board with more organisational experience since she was in the Board 4 years earlier, now as the Chair of the At-Large Advisory Council (ALAC) of **ICANN** (the

Internet Corporation of Names and Numbers), a member of DNS Women in ICANN, the Chair of the Board of DotAsia, and a member of the Advisory Council of the Public Interest Registry [PIR 2020]. She is also the founder of the **Cook Islands Internet Action Group** which is a member organisation of ICANN [CIIAG 2020]. In collaboration with the Tracy Hackshaw of ISOC Trinidad and Tobago in the Caribbean, she is a co-founder of the UN Internet Governance Forum's (UNIGF) **Dynamic Coalition of Small Island Developing States** in the Internet Economy (DC-SIDS). Her association with PICISOC and organising regional PacINET events were driven by an interest in **capacity building development** and raising awareness about ICANN and ISOC Internet issues that relate to Pacific Island internet users. During 2020, 14 PICISOC members participated in a **Pacific ICANN Learn programme** to understand how ICANN works – on topics such as Cybersecurity, and Introduction to ICANN, DNS and Policy Fundamentals, as well as introductions to various sections of the ICANN community. About 20 PICISOC members enlisted in the first global cohort of students for the first **Virtual School of Internet Governance** [VSIG 2020]. While Maureen's IT engagements are all volunteer positions, as a day job she is a strategic development consultant working mainly for government agencies. She is also keeping a watching brief over developments related to the fibre optic cable that was landed on Rarotonga, Cook Islands in January 2020, yet in October, was still awaiting connection of the cable network due to the government's lack of preparedness to ensure that the required infrastructure was in place to facilitate the last mile connection into users' homes. Redirection of funding to support safekeeping of citizens during the pandemic mean that this activity is now in the hands of the private sector which does not bode well for future affordability expectations of Cook Islands internet users.

Andrew Molivurae (PICISOC Chair 2009-2011) is Ni-Vanuatu works as an Internet Governance & Child Online Protection Officer with the Telecommunications & Radiocommunications Regulator (TRR). He is also engaged in Cyber-security awareness around Vanuatu under the TRR Consumer Protection Regulation. Prior to that he was IT Billing Engineer for Digicel Vanuatu Ltd, IT Manager for Vanuatu SDA Mission, Internet Technician for Telecom Vanuatu Ltd and Systems Administrator for Vanuatu Financial Services Commission. Apart from his full-time jobs, he was also founding Chair of **Vanuatu IT Users Society** (VITUS) which is a legal ICT Charitable Association in Vanuatu and an ICANN At-Large organisational member (with over 200 members) that was formed in 2005 [VITUS 2020]. As a member of the Vanuatu ICT Development Committee, Andrew has been an advocate for ICT development in Vanuatu for over 10 years. During 2020, Vanuatu Internet users have benefited from the introduction of **the Kacific network** to previously unconnected areas of Vanuatu, particularly the rural areas.

Anju Mangal (PICISOC Vice Chair 2019-20) spent many years with the Secretariat of the Pacific Community (SPC) a regional inter-governmental organisation providing technical assistance to the 22 PICTs [SPC 2020]. She worked on **cross-sectoral ICT projects** such as e-Agriculture, e-Health, before joining SPC's digital transformation team. She is an alumna of the Internet Governance (IG) Capacity Building Programme, an ISOC ambassador as well as a former Fellow of the Commonwealth IGF, ICANN, APRIGF, APNOG and the UN IGF Secretariat in Geneva. All of which she maintains contact with to strengthen Pacific links. In 2020 she moved

to the World Wide Web Foundation to work as their Asia and Pacific Regional Lead, coordinating activities in the Pacific Region. While on the PICISOC Board, Anju has been a strong advocate for the interests **of women and youth in ICT**, as well as ICT for disability. She has launched a **social media campaign** to increase engagement via the PICISOC Facebook page which in turn has led to an increase of PICISOC mailing list subscribers. **PICISOC website** and social media pages are regularly updated with ICT news, announcements, and capacity building efforts from the region. ICANN and ISOC events and newsletters are also included. She was a former member of the UN IGF **Multistakeholder Advisory Group** (MAG) and continues to maintain contact with former MAG members to support the interests of the people of the Pacific.

Cherie Lagakali (Board Member 2017-2019, PICISOC Chair – 2020+) started her ICT career in the private sector as a webmaster for FijiLive Group of companies, then as a programmer - part of a team that developed an in-house Bank Management System at the Fiji Development Bank. Later she developed Internet-related applications for resorts and SMEs in the Fiji Tourism industry, eventually becoming an increasingly active member of the Pacific Internet community. As an alumna of the ICANN Fellowship programme she keeps the region up to date on At-Large engagement and outreach programmes as well as ISOC activities.

PICISOC INITIATIVES AND PARTNERSHIPS

During the APTLD meeting in Melbourne in February 2020, Cherie signed an **MOU with APTLD** to formalise strategic partnership to explore possible areas of cooperation in the field of outreach and engagement of, and capacity building for, ccTLD managers across the PICTs. This was in preparation for a collaborative event with InternetNZ to be held in Fiji in September 2021. As PICISOC is also a member of At-Large of ICANN, Leonid Todorov, APTLD General Manager said "*PICISOC has been a key player in the Pacific region and we believe this partnership will allow us to collaborate in holding public activities, as well as aim at education and awareness raising among the At-Large community and ccTLD managers in the Pacific*." Also, while in Melbourne, Cherie attended the 2020 **Global Cyber Security Capacity Building Conference** (GSCCC) where she and other Pacific participants made presentations on cybersecurity in the Pacific region as well as engaged in panel discussions on future national capacity building and international collaboration. Alongside that meeting, the Global Forum on Cyber Expertise (GFCE) organized a Pacific Regional Forum to discuss the way forward on cyber capacity building across the region. Cherie was later appointed to the Advisory Board of the GFCE [GFCE 2020].

PACIFIC WOMEN IN ICT

During 2020, Cherie has been a strong advocate for the formation of the **Pacific Women in ICT,** and in September held an inaugural meeting of Pacific women at which nearly 40 women participated, including two who were later elected to the PICISOC Board [PICISOC 2020c]. As a follow-up, the ITU Regional Office for Asia and the Pacific, DTC-PNG and APCICT of United Nation's ESCAP jointly co-organised virtual training sessions on

"Leveraging ICTs for Women Entrepreneurship in Papua New Guinea" [UNESCAP 2020]. Pacific Women are also discussing the World Wide Web Foundation report "Closing the Gender Gap for a more equal world"(2020) which illustrates the barriers that prevent women globally from accessing and using the internet and the challenges limiting their experiences [WWWF 2020]. The findings of the report reflected many of the experiences in the Pacific relating to access, privacy issues and employment opportunities.

"I strongly believe the key challenges for the Pacific women in ICT today is keeping up with the current and trending technologies, and constantly upgrading your skillset as technology evolves… and reversing the whole mentality and perception that women only belong in administration and documentation field." Bandana Elisha Devi (Fiji)

"*I have a BSc in Computer Science and been in the industry for almost seven years after graduating in 2013. The challenge I face, is trying to fit into the industry. Women lack opportunities to further our careers and be certified in specific fields and a lack of mentorship for young women and girls in the ICT space. I would like to see more government support towards the growth of women and girls in this industry."* Samanaia Ned (Papua New Guinea)

"*Women in rural areas have limited access to basic resources and literacy. Lack of access to information makes digital inclusion a major challenge, as it impedes their growth and well-being in many facets of their lives*." Swaran Ravindra (Fiji)

"*The Papua New Guinea ICT Cluster has had several successes this year as more females are starting to work in the fields of Computer Science, ICT, Engineering, Life and Social Sciences, Maths and Physics; one of their women has recently been appointed to a major company as their Technical Solutions Specialist PNG; four of their top female Computer Science & Communication Engineering students from PNG University of Technology have been selected for a three month technical training course, where if they pass the end of training exam, they will be awarded a 2 year contract to work on global, regional and domestic software engineering projects; six of their female youth have been invited to join the Get Safe Online Ambassador program; and finally, PNG women have been invited to sign up to the recent Women in ICT Frontier Initiative (WiFI) training by ITU DTC in October 2020.*" From Priscilla Kevin (PNG ICT Cluster)

Georgina Sakimi-Naigulevu (2020 Board member) brings a strong background in banking for her role as Board Treasurer. Georgina is a strong advocate for the regional Pacific Disability Forum [PDF 2020] in Fiji. She is pictured speaking in March 2020 at the Fiji National University's conference "Leveraging Technology for Productivity Growth and Sustainability" about a community engagement project that promotes digital inclusion for persons with disabilities. She attended the APRICOT

meeting in Melbourne [PICISOC 2020d] and brought the perspective of the disabled into many of her interventions. She has since established links with ISOC's Accessibility SIG [A11YSIG 2020] and Gunela Astbrink (Vice President of the SIG in Australia) who has had a long association with PICISOC. "When PICISOC ran annual PacINETs, I was invited to hold workshops and presentations on accessibility for persons with disability over several years. Maureen was a champion in ensuring that the disability voice was heard at these events". Now, PICISOC, the PDF team, ISOC's Accessibility SIG and the IGF Dynamic Coalition on Accessibility and Disability (DCAD) [IGF, 2020a], are collaborating to develop ways to meaningfully dialogue online with audiences that include people with disabilities. The inclusion of captioning and sign language interpretation, using interpreters from the PDF team, are being proposed to ensure that all virtual meetings are accessible for people with disabilities.

Kanaan Ngutu is the Senior ICT Officer at the Ministry of Information, Communication, Transport and Tourism Development, Government of Kiribati. His background brings Cybersecurity and e-Government initiatives and experience to the Board, but he is also involved in the buildup of e-Commerce environment for Kiribati, ICT in Education, and the improvement of the Government Finance Management Information System. He also serves as the correspondent on Cybersecurity works with regional and global bodies such as Oceania Cybersecurity Center (OSCS) and Get Safe Online (GSO) [OSCS 2020; GSO 2020]. He has attended various ICANN and Internet Society meetings as well as actively represented the Pacific at the DC-SIDS sessions of the Global IGF.

e-TALANOA

Supported by the Board, PICISOC member and former Board member, **Will Tibben** from the University of Wollongong organised an e-Talanoa which is a traditional discussion forum (but online) discuss "FOSS: it's free, its open but how does it work?" His speakers came from Tonga, Fiji, and Australia, and discussed issues raised by the 16 participants in true talanoa tradition. **Edwin Liava'a** (Former PICISOC Board Chair, 2014), from Tonga works for Kacific Broadband Satellites as Regional Director for the Pacific and collaborates with a number of regional agencies in the Pacific in project delivery and capacity building. **Kenneth Katafono** (PICISOC member, from Fiji) founded a Fijian traceability tech start-up, TraSeable Solutions, which supports global food sustainability by providing a blockchain-ready software-as-a-service (SaaS) platform for fisheries and agriculture traceability. Both Kenneth and Edwin believe that accessibility and affordability in the Pacific, are connected to "bigger picture" issues about wholesale and retail availability of broadband, and more particularly by government regulation. **Ashley Maher,** a Director to the Australian Computer Society, concluded that with regards to the uptake of FOSS in the Pacific, "*It takes time for new ideas to emerge, be communicated and then be accepted. One factor that constrains FOSS is the reality that many IT specialists who have developed their careers on Windows are not going to voluntarily make their store of knowledge redundant by introducing new concepts. Learning new concepts takes time and effort - it's much easier to stick with the familiar*."

ASIA FOUNDATION – PICISOC MISINFORMATION PROJECT

Online misinformation and harmful rumours related to the COVID-19 pandemic have spread quickly within Pacific Island nations, threatening citizens' health and safety and encumbering health authorities' efforts to protect against the virus. To better understand and respond to this challenge, The Asia Foundation worked with PICISOC to convene a group of local stakeholders to conduct a regional study and support public information-sharing efforts focused on how false and harmful COVID-related information is being created, shared, and consumed online in the Pacific. Activities implemented under the project include research and policy analysis, data collection, and support for information-sharing and dialogue related to the COVID-19 pandemic and the problem of online misinformation more generally. The project also established a partnership with the University of California, San Francisco COVID-19 Fact Check project to share validated COVID-19 information in three Pacific languages: Tongan, Bislama, and Tok Pisin.

PICISOC EDUCATION SPECIAL INTEREST GROUP

The PICISOC Education SIG was established in May 2020 and currently has 21 members from 11 Pacific SIDS [PICISOC 2020b]. The discussions will centre around key topics relevant to ICT in Education including:

- Access and Infrastructure – Networks/Devices/Phones/Tablets/Electrification
- Human Resources – Digital Literacy and ICT Competency for Educators and Leaders
- Information Systems – Software, Databases and Learning Management Systems
- Policy and Planning – Short, medium and long term planning and financial considerations

Members of the SIG have contributed examples from their own countries and discussed common challenges drawing on examples of education technology adoption from other parts of the world. Discussions are underpinned by international standards and aim to support informed decisions in terms of education technology investments, recognising that the SIDS face unique challenges in terms of geography and infrastructure that need well considered solutions involving Governments and Ministries of Education around the Pacific.

ACRONYMS

ALAC	At-Large Advisory Committee
APNOG	Asia Pacific Network Operators' Group
APNIC	Asia Pacific Network Information Centre
APRIGF	Asia Pacific Regional Internet Governance Forum
APTLD	Asia Pacific Top Level Domains
ccTLD	Country Code Top Level Domains
CIIAG	Cook Islands Internet Action Group
CROP	Council of Regional Organisations of the Pacific
DCAD	Dynamic Coalition on Accessibility and Disability
DC-SIDS	Dynamic Coalition of Small Island Developing States
DNS	Domain Name System
DTC	Digital Transformation Centre
FFA	Forum Fisheries Agency

FOSS	Free and Open Source Software
GFCE	GLOBAL Forum on Cyber Expertise
GSCCC	Global Cyber Security Capacity-Building Conference
ICANN	Internet Corporation of Assigned Names and Numbers
ICT	Information and Communication Technology
IGF	Internet Governance Forum
ISOC	Internet Society
IT	Internet Technology
ITU	Internet Telecommunications Union
MAG	Multistakeholder Advisory Group
MIS	Management Information Systems
MOU	Memorandum of Understanding
NZ	New Zealand
PDF	Pacific Disability Forum
PICISOC	Pacific Islands Chapter of the Internet Society
PICTs	Pacific Island Countries and Territories
PIR	Public Interest Registry
PNG	Papua New Guinea
SDA	Seventh Day Adventist
SIG (ISOC)	Internet Society Special Interest Group
SIG (Virtual)	Virtual School of Internet Governance
SOPAC	Pacific Islands Applied Geoscience Commission
SPC	Secretariat of the Pacific Community
TRR	Telecommunications & Radiocommunications Regulator
UN	United Nations
VITUS	Vanuatu Internet Technology Users Society
WiFI	Women in ICT Frontier Initiative

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Closing the Digital Gender Gap for a More Equal World

4.8 Snapshot of the Internet in Pakistan around 2020

Waqas Hassan

The decade of 2010-2020 can be considered as truly transformative for Internet development in Pakistan. In June 2010, there were 0.9 million broadband subscribers in the country as compared to 82 million subscribers at the end of May 2020 [PTA 2020]. The broadband subscription rate was 0.5% in 2010, and now stands at 39% as of May 2020. This sharp rise in Internet adoption is a result of many technical, policy, regulatory, and market phenomena, the majority of which took place after mid-2014.

The introduction of mobile broadband by 3G, 4G LTE spectrum auction in 2014 became a game-changer for broadband proliferation in Pakistan. This landmark step enabled broadband provision for the existing 2G cellular subscriber base of 140 million users and opened the broadband market to effective competition [PTA 2010]. The existing fixed broadband infrastructure had failed to capitalize on the potential of Internet opportunities despite being the dominant market technology since the early 2000s. This is evident by the fact that among the total broadband subscribers at the end of May 2020, 97.5% have subscribed to mobile broadband (3G, 4G LTE). Pakistan is connected to the rest of the world by six undersea cable systems with a combined Internet Bandwidth of 3.12 Tbps, out of which 1.76 Tbps is being utilized by the operators. More than 90,000 km of backhaul fiber optics have been deployed across the country as of 2020. Internet Exchange Points have been established at Islamabad and Karachi while third one in Lahore is being established [PTA 2020]. The government also introduced the Telecom Policy 2015, the Digital Pakistan Policy 2018, and legislation to build user confidence and trust in the online space. Mobile broadband also spurred other socioeconomic activities as well, such as digital financial services, e-commerce, smartphone adoption, entrepreneurship, and e-governance.

Despite rapid increase in Internet adoption, several factors hampered the ideal growth of the Internet during the last decade. Taxation on the Internet and data services in Pakistan is among the highest in the world [GSMA 2019]. Affordability of the Internet services and the cost of devices is still quite high as compared to the rest of the region. Extrinsic factors include lack of local content, low literacy rate, language barrier, sociocultural taboos, and electricity shortage.

Looking at the future, Pakistan's plans look promising, as it became the first country in South Asia to test 5G in 2019 [CMPAK 2019]. The E-commerce Policy was recently approved while a draft of the Data Protection Bill is under the consultation phase [MoC 2020; MoITT 2010]. Issues around privacy, freedom of speech, fake news, Internet shutdowns & restrictions, consumer protection, surveillance, and cyber fraud are the key challenges that all stakeholders have to deal with, preferably through progressive dialogue.

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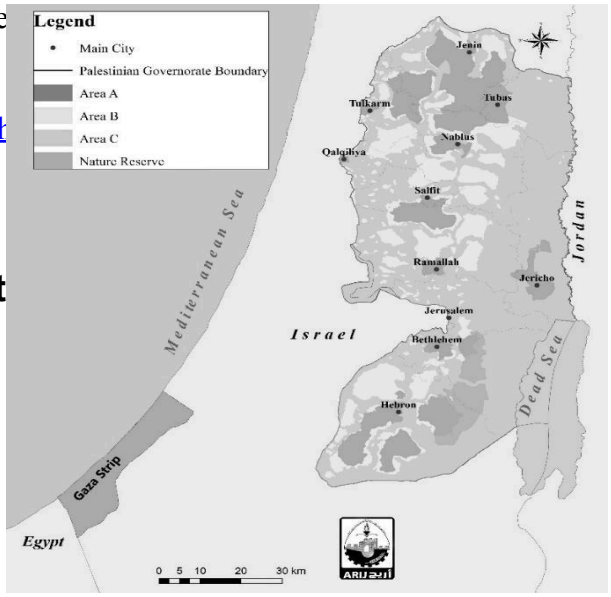


4.9 Snapshot of the Telecommunicat

Nadira AL-Araj

Background

After the 1967 war, the Israeli military authority captured both the West Bank and Gaza Strip and took over the civil affairs of the Palestinians. Bezeq, the Israeli government telecommunication company, gained management over an existing old scattered telephone network and controlled the international gateways for both the West Bank and Gaza Strip.

The turning point in the telecommunication and information technology (T&IT) sector towards Palestinian autonomy occurred after signing the Israeli-Palestinian Interim Agreement on the West Bank and the Gaza Strip (also known as "Oslo II") on September 28, 1995. At that time, the Palestinians gained some very limited liberty in managing the telecom sector.

To understand the restricted environment in which the Palestinian T&IT sector was permitted to function, it is worthwhile to consider how Oslo II classified the West Bank into three different areas. The map included here provides visual clarification [ARIJ 2020]. Area A comprises approximately 18% of the West Bank and theoretically falls under the jurisdiction of the Palestinian Authority (PA). It is composed of the big cities in Gaza and the West Bank. Area

B forms 22% of the West Bank, where the PA administer the civil affairs of the Palestinians living in these areas, while the Israelis control its security. Area C is about 60% of the West Bank, where Israel retained its full control. As for Jerusalem, Israel seized it and gave it a permanent status as part of Israel. On a side note, Palestinians living in any of those areas are not allowed to travel without going through the Israeli military checkpoints.

Readings in Article 36 – "Telecommunications of Oslo II"

Article 36 of "Telecommunications from Oslo II Annex III: The Protocol Concerning Civil Affairs" forms the legal reference that necessitates challenging ongoing negotiations between the Palestinian and the Israeli sides to develop the Palestinian T&IT sector.

The first principle of Article 36 states clearly, *"Israel recognizes that the Palestinian side has the right to build and operate separate and independent communication systems and infrastructures including telecommunication networks, a television network, and a radio network."* This sounds promising, but on the other hand, the restrictions come in the following sections. The General Section Item A.2.a does not allow the Palestinians to dig, build, or install any telecommunication equipment in Area C without the prior confirmation from the Israeli side thus putting serious restrictions upon developing and installing a Palestinian telecommunications network.

As we can see from the map, the intertwined of Areas A, B, and C make it difficult to construct equipment between cities in Area A or between Area A and the villages in Area B because doing so requires approval from the Israeli side. Often times, gaining confirmation takes several years, and on many occasions, pressure from the international community speeds up the process. Often, to complete network connections the Israelis would only accept if the Palestinians use the Israeli telecoms backbone.

The other item in the General Section deals with the Israeli Settlements in Area C, despite the fact that these settlements were constructed illegally according to international law. Item A.2.b gives the full telecommunication service for the Settlement to Israel.

When mobile operators started and became common in Israel because they controlled the frequencies, Palestinians used the Israeli mobile networks being the only ones available. However, in 1999, when the first mobile operator started, Jawwal, coupled with more Israeli restrictions for people to commute and work in Israel, the Palestinian network became quickly more popular among Palestinians despite the act that allocated frequencies only allowed basic G2 functions. Hence, the Israeli mobile operators functioning in area C can easily cover the Palestinian area without authorization given the fact that they have more highly-advanced telecommunications technologies than their Palestinian counterpart can provide.

The Principles in Article 36 provide in facilitation to Palestinians to run their T&IT sector, but there is a catch in most of them. For example, Principle 2 gives the Palestinians the right to establish their satellite networks for various purposes, but it excludes international services. The Palestinians are given the "the right to choose any and all kinds of communication systems (including broadcasting systems) and technologies, suitable for its future," which is the bright side. The dark side that Israel is responsible for granting the needed spectrum of frequencies and for the approval of the standards of advanced equipment required by the Palestinian

telecommunication companies, not to mention that any equipment ordered by any Palestinian company or the Ministry of Telecoms and Information Technology (MTIT) must be approved by Israel. Therefore, the easiest thing for Israel was to block the import of any telecoms gear that might improve the Palestinian network if this does not fit into Israeli policy of keeping the Palestinian networks way below their Israeli ones in technology, speed, broadband, access and other services.

Principle 5 demands both sides to refrain from behavior "that interferes with the communication and broadcasting systems and infrastructures of the other side," assuming the two parties are on equal footings. However, in this case, Israel holds the upper hand in terms of infrastructure. Given the fact that all Palestinian information traffic has to pass through Israeli network operators, continued surveillance by Israel is possible, was, and still is the norm.

The negotiators also anticipated the contentious issues of the Principles. Article 36 has an item to form a Joint Technical Committee (JTC) by members from both sides to meet regularly to solve urgent problems. However, time has shown that many of the decisions taken by the JTC needed the approval of the Israeli government. However, for the JTC to meet, both sides must agree. The Israeli side hardly ever accepted to meet despite numerous official letters asking for the meeting. Therefore, nothing happened to resolve the numerous issues and problems that such a technology and requirements demand. The JTC agreed on the required frequency for 3G and the frequency-sharing model, but it took ten years to grant this frequency to the two Palestinian operators.

Article 36 handled the electromagnetic sphere and allocated the frequencies or sections of frequencies to technologies that existed in that time and limited the areas to cover. The JTC is in charge of decisions regarding future frequency needs, but these decisions need to be confirmed by Israel. Section D under Telecommunications states how the Palestinian have to govern their T&IT sector but under the following conditions.

To establish an independent Palestinian telephone network, they must enter a commercial agreement with Bezeq or any other licensed Israeli companies. The Palestinian must be in full technical compliance with the standards adopted by the Israeli "ministry of communications and will coordinate with the Israeli side any changes to the structure and form of telephone exchanges and transmission equipment."

To continue enabling Bezeq services to the Settlements and the military installations, as well as the maintenance of any infrastructure that passes through the Palestinian jurisdiction areas. In the meantime, the Palestinian connections between the West Bank and Gaza Strip and the operation of an international gateway shall be under Israel's responsibility. The final comment in the section regards taxes, which forbids Palestinians from collecting taxes on telecommunications services from Israeli operators functioning in Area A without any license.

Milestones of the T&IT sector development in Palestine

Each of the events on the timeline listed below represent a case worth documenting by itself. Nothing comes so easy to Palestinians. Through consultations and support of international bodies, and the Israelis themselves, there were successful steps of progress amid the difficulties. When the PA took over the telecommunication network initially in Gaza and Jericho then from

the remaining main West Bank cities, the total number of fixed lines was only 82,000 lines for a population of many millions. The Palestinian Authority put a condition on Paltel, the company that won establishing the Palestinian network, to reach 250,000 in three years, a figure they reached before that date because it used to take a Palestinian family almost 10 years of waiting for the Israelis to allow them to have a fixed telephone line.

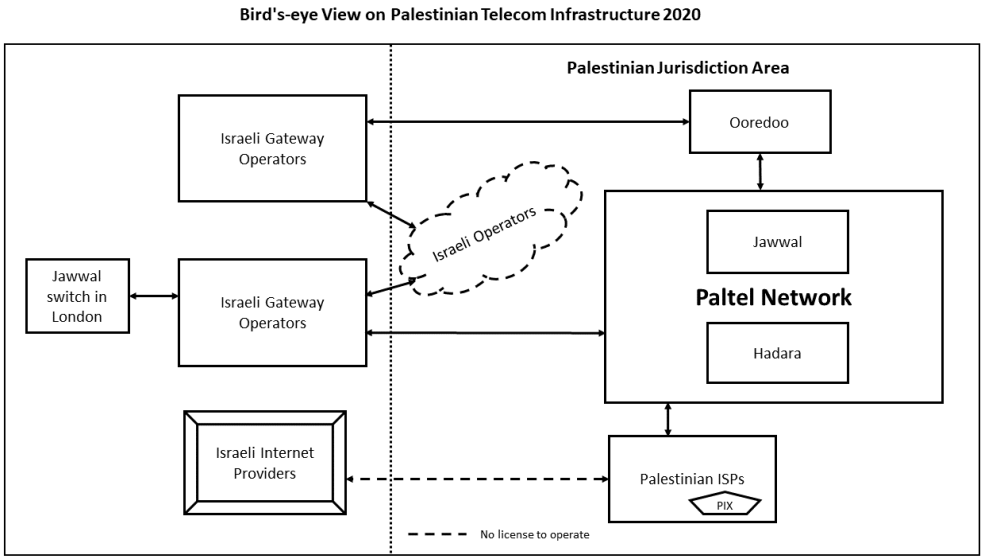
Starting in 1995, from a rundown telephone network with 82,000 fixed landlines to 2019, when 467,000 fixed telephone lines provided service and 3,381,787 users accessed the Internet among a total population of 5,101,414 in the West Bank and Gaza Strip, representing a 66.3% penetration rate.

As for the 2G mobile lines, there are 4.304 million subscribers (distributed as 1.294 million subscribers with Ooredoo, formerly Wataniya, and 3.01 million with Jawwal), and 363,000 lines for Jawwal 3G.

1995	Israel handed the PA the telephone network after 28 years of control occupation and only 82K fixed landlines subscribers.
1996	The PA granted an exclusive 20-year license to the Palestine Telecommunications Company (Paltel) group to build and manage the telecommunications infrastructure in the West Bank and Gaza Strip.
1999	Paltel group launch Jawwal mobile network operators after Israel released the 2G frequency to the Palestinian. This frequency shared with Israeli operators in accordance with Article 36. (970) assigned as the Palestinian international dialling country code.
2000	The International Organization for Standardization officially designated the code .PS for Palestine.
2003	The Palestinian National Internet Naming Authority became the official domain registry for the Palestinian country code Top-Level-Domain.
2005	Paltel Group launched Hadara Internet service provider. The PA, through the JTC, requested the following from Israel: - Frequencies for building 3G networks - Microwaves on several bands to use to a link between sites and cities. - Frequencies for building a WiMAX network - Frequencies for building a trunking System
2009	A second mobile operator, Wataniya Mobile launched its commercial services in the West Bank only.
2015	After 10 years of request, Israel allocated the frequency of 10MHz to both Jawwal and Wataniya shared with Israeli operators.

	Launching of the Palestinian Internet Exchange Point as a community initiative from small ISPs.
2016	The MTIT renewed the licenses for Paltel and Jawwal for another 20 years.
2017	Wataniya launched its business in the Gaza Strip.
2018	Jawwal and Ooredoo launches their 3G services in the West Bank.

The following figure broadly summarizes the current infrastructure in Palestine. It does follow the Article 36 conditions of not allowing access to international networks without passing through Israeli networks switch. It limits the companies to provide their services within the Palestinian Jurisdiction Area. At the same time, the Israeli operators are capturing some of the Palestinian market shares for its advanced 4G services and cheaper data plans without paying any license fees or taxes to the Palestinians. It is likely that individuals who buy the Israeli SIM could be those who travel daily to work and do business in Israel, and others whose nature of work needs faster data streaming.



Moving forward

The year 2020 posed a new challenge to the Palestinians, as the ongoing negotiations and unimplemented agreements of the Oslo Accords came to a halt for reasons outside of the scope of this chapter. The JTC will not be able to discuss the specifications of 4G/5G networks or other Palestinian requests. While the negotiations are halted, Palestinians are able to continue developing their T&IT sector in their jurisdiction. They can establish the independent telecommunication regulatory body to facilitate market competition and fair service pricing. The Ministry of Telecoms and Information Technology can allow additional companies to provide telecommunication infrastructure such as the use of fiber-optic networks owned by the electricity companies. This will help attract entrepreneurs with more innovative communication solutions. The new entrants can have some market share by targeting the 33.7% of the citizens who are still

unconnected to the Internet. The Palestinians under the current circumstances have no choice but to continue their dialog with international bodies such as the International Telecommunication Union (ITU). It is the only option available to make Israel grant the Palestinians their rights of frequencies. A better solution would obviously be for Israel to cease its occupation of the Palestinian territory, and in the meantime, for the Quartet[9] to sponsor a brand-new Israeli-Palestinian peace agreement containing a fair new Article on Telecommunication to grant Palestinian liberty to manage their T&IT sector nationally and internationally.

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4.10 Snapshot of Internet in Sri Lanka around 2020

Abhaya Induruwa, Mahee Kirindigoda and Roshan Ragel

Sri Lanka, a democratic socialist republic island nation in the Indian Ocean with a population of 21 million, has continued to experience the impact of Internet on all spheres of socio-economic activities, the major areas being: education & research, commerce & banking, health, agriculture, environment, industry & innovation, social media, and politics. State sector education and research is primarily taken care of by LEARN, the Sri Lankan National Research and Education Network (NREN), and the demand in the public and private sector is largely met by private sector Internet initiatives.

2015 saw the completion of twenty years of Internet in Sri Lanka. ISOC Sri Lanka Chapter hosted the INET 2015 in Colombo [INETColombo 2015] to coincide with the celebrations to mark the twentieth anniversary of Internet in Sri Lanka. An award ceremony was held in June 2015 to honour the Sri Lanka Internet pioneers [Biyagamage 2015].

This article documents how the Internet infrastructure services as well as access have grown and supported during the decade 2010 – 2020.

(1) Connectivity Aspects

To sustain the steady growth of web access, use of email, and most of all the increased use of social media, it has become essential to provide suitable local and international connectivity both in terms of speed (or bandwidth) and spatial spread. During this decade therefore, major investments on infrastructure development have been made by the government and the private sector. In particular, the government has identified eight thematic areas including connectivity, security, legislation and digital content under its digitalisation programme and the Information and Communication Technology Agency (ICTA) has been allocated Rs. 15 billion from the 2017 national budget [CBSL 2017]. In terms of spatial spread, albeit at a lower bandwidth, mobile Internet continues to play a major role.

It is evident from Figure 1 [Hootsuite 2020] that while only 18% of the 21 million people account for urban population, the Internet penetration is 47% (10 million). It follows from this that more than 30% of the Internet users are semi-urban and rural. Similarly, 30% of the population are active social media users of which 12% accounts for semi-urban and rural users. For a developing country this is an important indicator and the high level of Internet penetration within rural and semi-urban population can be attributed to the reasonably widespread 3G/4G mobile communication and telecom infrastructure, low ownership cost of devices, and low tariffs. In this respect it is important to note that Sri Lanka launched the first 3G mobile network in 2006 and 4G/4G-LTE adoption started in 2013 thus creating a bubble in the Internet market place. As the cost of 4G enabled devices drops the ownership of a device with Internet connectivity becomes easily affordable thereby contributing to a higher Internet penetration.

Another dominant factor is the very high competition among mobile communication service providers in Sri Lanka resulting in reduced subscription fees for fixed/mobile broadband access thereby breaking another potential barrier for Internet growth. Galpaya gives an account of the development of broadband communication in Sri Lanka around 2011[Galpaya 2011]. At present Dialog, and Sri Lanka Telecom (SLT) are the leading owners of telecom infrastructure networks in Sri Lanka. Dialog leads mobile coverage in the country whilst SLT leads in fixed line coverage, owning the largest fibre optic cable network. As can be seen from Figures 2 and 3 [SLT 2018], Sri Lanka, when compared to other developing, developed and least developed countries, has continued to operate for a number of years as a country with low fixed broadband and mobile subscription fees.

Figure 4 shows the continued growth of fixed and mobile Internet subscriptions as compiled by the Telecommunications Regulatory Commission of Sri Lanka [SLT 2018]. Although the subscriptions are steadily increasing the view expressed by Hutch CEO is that "Even though 4G has been around in Sri Lanka since 2014, mass adoption of 4G has not yet occurred with only 40% of mobile subscribers on 4G networks today. There were multiple reasons for this slow uptake including expensive 4G handsets and perceived high cost of using 4G services" [MENAFN 2020].

This leads to the observation that the full utilization of available technology is still far remote from the reality. Although this can be a positive for future investors on Infrastructure, as a nation it is a negative signal. Moreover there is no distinction made between owners of multiple devices and facilities and the assumption is that approximately 30% access is covered by the population.

The table and chart in Figure 5 show how the Internet penetration has been impacted by the introduction of mobile broadband around 2009-10 [TRCSL 2020]. As can be seen this, aided by the decreasing costs of device ownership and connection, have been responsible for the exponential growth of mobile broadband subscriptions in the decade 2010-20. As mentioned before Internet tariffs are lower in comparison to other developing countries resulting in 30 million mobile subscriptions while the population is around 20 million. The Telecom Regulatory Commission (TRC) of Sri Lanka has reported 5.5 million mobile broadband connections in Sri Lanka by the end of 2019. At the same time, 35% growth in sales of smartphones and tablet pcs has been marked by a major retailer in the country in 2018. This shift towards smart devices with mobile connectivity has been attributed to a fall of computer literacy while increasing digital literacy in the first half of 2018 [ECONOMYNEXT 2020].

LIRNEasia in their AfterAccess report presented following findings [LIRNEasia 2019]:

- Out of a population of about 21.4 million in Sri Lanka, 13.5 million use mobile phones equipped with 17.9 million active SIM cards. (Number of SIM cards is higher because of multiple SIM use)
- Nearly half of Sri Lanka's mobile phone users own smartphones
- Sri Lanka's internet users are more urban men

In 2010, ITU and UNESCO started the Broadband Commission for Digital Development to boost broadband usage as an international policy with the belief of expanding access to achieve accelerated progress [BroadbandCommission 2020]. Sri Lanka became the first south Asian country to launch 3G in the year 2006 and, even though the technology and devices are available at lower cost, the mobile coverage aspect in the country is not satisfactory. Two major mobile broadband provider's coverage maps are given in Figure 6 [NPERF 2020]. It is very clear that the coverage outside of the main cities is minimal.

(2) Mobile App based Internet Services

During this decade the growth of traditional Internet based services has continued both in the public sector and the private sector. Many public services have created portals for public use. E-Revenue Licence, Lanka Government Network (LGN), EPF / ETF, Gov.lk, are few examples. In the private sector hotel booking systems, transport booking systems, banking systems, etc., have gone online. The Central Bank of Sri Lanka (CBSL) reports a volume of 26.9 million Internet banking transactions with a total value of Rs. 2940 billion in 2018 [CBSL 2019]. During the same year the mobile phone banking had amounted to a volume of 8.16 million transactions with a value of Rs. 142 billion.

The growth of Internet based Mobile Apps has made people to glue in to mobile solutions such as mobile banking for easing their day-to-day life. Internet based shopping has become a very familiar feature during the decade and many consumers have shown a preference to do online shopping for less expensive products.

Internet banking in Sri Lanka was introduced in 1999 but the usage was less than 1% of the banking customers in general by the year 2010. Figure 7, an excerpt from the Payment Bulletin of the Central Bank of Sri Lanka [CBSL 2019], indicates the volume of Internet based payments in Sri Lanka and the percentage increase between 2018Q1 and 2019Q1 which amounts to 32%. It was increased due to the combined effects of lower device ownership cost and Internet ownership cost, and also the boom in ICT literacy in the country. However, there is a 39% decrease in the value of Internet banking indicating that there is an increase in transactions with low monetary value. Kariyawasam examines the level of usage of Internet Banking among banking customers in Sri Lanka [Kariyawasam 2016].

As with many developing nations, the use and availability of credit cards in Sri Lanka is below average. Online payments via credit card for the purchase of goods and services is only possible for a small percentage of the population. However, an alternate payment mechanism exists through mobile cash enabling the transfer of money to anyone, anywhere in Sri Lanka via mobile or CDMA network based on which Cash on Delivery was introduced. Going further Sampath Bank PLC has introduced an innovative cash delivery system by entering into a ground breaking partnership with PickMe Digital Mobility Solutions Lanka (PVT) Ltd enabling the delivery of the cash withdrawn from an ATM directly to the doorstep of a customer [DailyNews 2020].

(3) Internet Entrepreneurship

The period 2010-2020 has witnessed a boom in Internet based entrepreneurs in Sri Lanka, especially freelancing that requires a different skill set. It has been a key area to be discovered during this decade and around 20,000 freelancers [Fiverr 2020] are involved in the sector bringing foreign projects via platforms like Fiverr, described as "the world's largest marketplace for digital services" and is the most popular locally [Echelon 2017]. It is said that freelancing is an old practice that has received a new boost with the roll-out of broadband Internet that enables freelancers to access opportunities anywhere in the world [Echelon 2017].

There is also 'micro work' that can be done by new and low-skilled workers. Based on a nationally representative survey conducted among 16 to 40 year olds, LIRNEasia estimates [Echelon 2017] that there could be 17,000 to 22,000 freelancers in Sri Lanka registered with various platforms and selling their skills online. With an average monthly earning of $200, and with 7800 active freelancers [Galpaya 2017] estimates that the revenue per year from online freelancing to be around $18.7 million. In [Echelon 2017] Nalaka Gunawardene identifies the absence of fully fledged international micro payment services like PayPal accounts to conveniently receive remittances as the main barrier for Internet Entrepreneurship to flourish in Sri Lanka. Although the Sri Lankan government is keen it appears that PayPal is not that keen. Additionally, uneven quality of broadband Internet and frequent disruptions to electricity supply are major issues when working to tight deadlines. Otherwise, this will be a higher revenue model for Sri Lanka.

IT/BPO (Business Process Outsourcing) Sector (Knowledge) also boomed during the 2010-2018. Sri Lanka's knowledge services industry was the fifth largest export earner for Sri Lanka in 2018 and is currently estimated to be USD 1.2 billion. There are over 300 IT / BPM (Business Process Management) companies, mostly small and medium companies and few large global players that operate in Sri Lanka with an estimated 80,000 fulltime workforce contributing $10,625 per employee annually.

(4) Internet of Things (IoT)

The concept of Internet of Things (IoT) is that the Internet enables digital devices – the so called "*Things*" – to connect in order to communicate and exchange information involuntarily for numerous purposes. IoT can be defined as "the interconnection via the Internet of computing devices embedded in everyday objects, enabling them to send and receive data". The IoT revolution would make converting new and innovative business ideas to reality that much easier [Induruwa 2016].

IoT has created new market opportunities for Sri Lankan developers of industrial automation solutions, embedded systems, etc [Induruwa 2019a]. It has been identified that to deliver seamless IoT, connectivity is a crucial element. The demand thus created has prompted network operators to launch new services such as low power wide area (LPWA) networks, and use NB-IoT and LTE-M technologies to create added value and ensure sustainable growth.

To help with the development of new network infrastructure the government's Board of Investment of Sri Lanka in 2018 formally approved a significant investment for network expansion and upgrade work on 4G mobile and fixed broadband services [DevelopingTelecoms 2018]. The market is now moving from 4G towards 5G mobile services. Dialog Axiata has carried out a 5G network capability trial in Colombo with technology partners Ericsson and Huawei. The demonstration included a range of 5G solutions including Massive MIMO, cloud radio and IoT-based smart parking and real time 4K video streaming. Dialog Axiata has claimed South Asia's first launch of a NB-IoT-enabled network supporting IoT solutions [DevelopingTelecoms 2018]. Mobitel has completed a further round of proof-of-concept (PoC) tests of LTE-Advanced Pro (LTE-A Pro) technology in Colombo [Businesswire 2018].

IoT Initiatives led by Government and private organizations had created a significant momentum. Start-up incubators are too assisted with the growth of IoT development within Sri Lanka while technology facilitators support. The Ministry of Digital Infrastructure led a project on Awareness of Internet of Things (IOT) through use of basic hardware which 1,930 IoT kits and 7,720 micro:bit kits were distributed. Other institutions, for example University of Moratuwa, have organised and conducted training workshops

McKinsey forecasts that IoT will generate up to $11trillion a year in economic value by 2025, i.e. 15% of the current global GDP [McKinsey 2015]. This translates to substantial growth potential for Sri Lanka too. According to McKinsey predictive maintenance using IIoT (Industrial IoT) is estimated to reduce maintenance costs by 10-40% and reduce downtime by 50% in industries.

Now leading IoT operators and ISPs are building on this and capitalising on their reputation as trusted industry partners by delivering value added services beyond connectivity. These transformative solutions include services across IoT, IIoT, big data, machine learning, analytics, edge computing and enablement platforms.

Although IoT has immense potential in creating new innovative business opportunities for creating intelligent infrastructure, such as building smart cities for example, the security threats emanating from vulnerabilities in IoT infrastructure is a major concern [Hussain 2020a].

(5) Internet and Health

eHealth in Sri Lanka began with the establishment of the National eHealth Steering Committee in the Ministry of Health in June 2010 and the Sri Lankan Health Sector has developed the following national eHealth Base Documents:

- National eHealth Policy;
- National eHealth Standards and Guidelines;
- National eHealth Strategy.

Ministry of Health has also transformed its paper based Indoor Morbidity and Mortality Record system into a web-based system eIMMR [eIMMR 2009] to form an integral part of their health information system which supports management of healthcare, monitoring of disease patterns and evaluation of treatment and prevention [Kariyawasam 2011]. Important eIMMR milestones up to 2016 are show in Figure 8.

Due to the farsightedness of the Ministry of Health Sri Lanka became the first country to successfully deploy a DHIS2 (District Health Information Software 2) [DHIS2 2020] tracker instance specifically designed for Covid-19 surveillance within just two days after the first suspected Corona virus case was registered in Sri Lanka on 27 January 2020. DHIS2 instance was operational at country's airports - thanks to the support and training provided by HISP (Health Information System Programme) Sri Lanka - to register and track incoming travellers from areas with high risk of Covid-19 infection.

Later, in May 2020, TraceMe [TraceMe 2020], an Android based tracing app developed by Redot Pvt Ltd [Redot 2020a] as a social project to support the government efforts in tracing was released. TraceMe claims that it is the first contact tracing platform built in Sri Lanka to help stop the spread of COVID-19. An iOS version for Apple iPhones is promised in the near future. Around the same time, eWIS (e-w Information Systems Ltd) as part of their corporate social responsibility during Covid-19 [eWIS 2020] has supported the government efforts by launching the following initiatives:

- A video conferencing facility for Health Ministry officials;
- 24/7 uninterrupted support in ensuring the availability of medical supplies across the country;
- Technical and Engineering support to telecast the "National Corona Awareness Programme" in all the local TV channels simultaneously.

(6) Internet and Education

One of the pillars of sustainable development in any country is education. The deployment of Internet in a country has immense potential to improve the quality of modern education in that country.

The Internet has affected all types of education: formal, informal and non-formal. During the period after 2010 there is a noticeable improvement in the education content online and many formal institutes, both in the public and private sectors, have started offering online education and certifications. In the state sector, Open University of Sri Lanka (OUSL) has been operating distance education nodes for many years now. Private sector engagement in online education has also created a hype in Internet based education during the period.

The impact of online education was clearly seen with the onset of Covid-19 pandemic. As a precaution all schools were closed but the government has made efforts to provide education

using online channels more frequently [Hussain 2020b]. The Internet has opened a window of opportunity to facilitate the educators and students. Teachers have created YouTube channels, Facebook pages and groups, and delivered educational material via social media such as WhatsApp. These were of immense support to the students and parents who were kept out of any sort of f2f education for months. Now most of the schools have created online education systems using popular Learning Management Systems (LMSs).

The online program is being proceeded by the Ministry of Education in Sri Lanka with the collaboration of Microsoft Sri Lanka and EWIS and the program has been phenomenally successful, growing from just 1 student to 100,000 students, 1 school to 330 more schools, and just 1 teacher to 2800 more teachers within 03 months, with high rates of retention and satisfaction.

In the Sri Lankan Higher Education sector online education was a feature even before Covid-19 but the delivery and consumption of online content, and the conduct of assessment and examinations, have seen a dramatic increase during 2020. The 15 state sector Universities were fully supported by LEARN – the Sri Lankan NREN – (see next section) and those in the private sector were supported by the fixed-line and mobile communication service providers such as Sri Lanka Telecom, Mobitel, Dialog, etc. In doing so they have introduced many subsidies for students accessing an institutional LMS for their learning.

(7) Further development of LEARN and its role in online education

In the year 2019, Lanka Education And Research Network (LEARN) completed 30 years since its conceptualisation in 1989 [Hussain, 2019]. LEARN's vision is not only to provide comprehensive network-related services to the academic and research community but to bring the community together [Ragel 2019]. The pioneers of LEARN, those who worked on the implementation of the concept over the years, have identified its development into five phases namely:

Phase I - the mid to late 90s when the Government funded the project via University Grants Commission (UGC);

Phase II - the late 90s to early 2000s when LEARN was able to secure funding from the Swedish International Development Agency (SIDA);

Phase III - during the mid-2000s when the institutions were connected using IP-VPN over MPLS network;

Phase IV - during late 2000s to early 2010 when the member institutions got connected through fibre and LEARN was formed into a company limited by guarantee in 2009; and

Phase V - 2010 onwards where LEARN is now owned by 16 of its members (15 State Universities and the UGC). As of 2020, LEARN also has 15 associate and 18 affiliate member institutions.

Since its formation into a company, LEARN has come a long way. In the year 2010, LEARN got connected to the Trans-Eurasia Information Network (TEIN) with a 45 Mbps link. Later, in the year 2011, LEARN was registered as an Internet Service Provider (ISP) in Sri Lanka and has maintained its status since then. In the year 2012, 20 more member sites were connected to LEARN and then in 2013 the total commodity Internet bandwidth was increased to 1.65 Gbps.

The year 2015 was of significance as LEARN made its presence (point of presence, PoP) outside Sri Lanka when it purchased a 2.5 Gbps link to Singapore Global Switch and connected the TEIN network, SingAREN, Internet2 and Google via this link. The following year, 2016, LEARN upgraded its commodity Internet bandwidth to 7 Gbps, increasing the total LEARN backbone bandwidth to 9.5 Gbps. The same year, LEARN joined eduroam, the global educational roaming facility. Since then, LEARN promotes eduroam amongst its members which has made both the local and global mobility of users of the member institutions easier.

In the year 2017, LEARN introduced the Asi@Connect project, which is a successor of the TEIN4 project to its members by performing a local launch event in Sri Lanka. In the following years, LEARN also engaged stronger with the regional and international NRENs and learned from each other through more enhanced training and workshop opportunities. LEARN is part of the European Union-funded Asi@Connect project in which Sri Lanka is running two sub-projects related to education and training targeting engineers in the region. Further, Sri Lanka/LEARN is also listed as a direct beneficiary country on a number of other Asi@Connect sub-projects. The present TEIN network diagram which is now called the Asi@Connect network is shown in Figure 9.

In the year 2018, LEARN got connected to India's National Knowledge Network (NKN) via a 1 Gbps link. In the same year, LEARN also formed its Identity Federation, known as LEARN Identity Access Federation (LIAF) and later, in the following year, joined eduGAIN, an international inter-federation service interconnecting research and education identity federations. The same year, LEARN upgraded its commodity Internet bandwidth to 14 Gbps and its Singapore link to 5 Gbps.

Figure 10 depicts the LEARN network diagram as of 2019. The LEARN backbone is also connected to the Lanka Government Network (LGN2) and India's NKN (National Knowledge Network) via separate 1 Gbps links. LEARN maintains two main routers at Dialog and SLT IDCs. The members are connected to the network via Primary and Backup VPLS (Virtual Private Line Service) links as shown in Figure 10.

In the year 2019, LEARN celebrated its 30th anniversary since inception [Induruwa 2019b] and also the 10th anniversary of its formation into a company. In the same year, LEARN has hosted two international workshops (one in Sri Lanka and one overseas), one local seminar and a local workshop and has supported about 25 foreign training and engagement opportunities for our members. Technical topics covered included hosting video conference solutions and building the campus area networks based on community best practices. In 2020, LEARN hosted its first workshop abroad in Laos extending LEARN technical assistance to the region. This workshop helped the deployment of IPv6 in Laos and Bhutan NRENs. By introducing our own

Identity Access Federation (LIAF), LEARN plans to support its members with their applications and research.

In recognizing that sharing network operation technical expertise and knowledge can serve a very important role in community building and engagement in Asia, the South Asian Network Operators Group (SANOG) [SANOG 2020] has been formed as a sub-regional, community-led initiative in 2003 [Choudhury 2019]. Realizing the benefits of bringing network operators and networking professionals in Sri Lanka together in terms of educational, knowledge sharing and collaborative aspects, the LKNOG (Lanka Network Operators Group) was formed in 2017 with the objective of providing a local and regional platform to discuss operational issues and technologies that interest network operators in Sri Lanka [LKNOG 2020]. LEARN has actively supported and promoted the work of SANOG and LKNOG. During the decade 2010-20, LEARN has hosted two SANOG meetings in Sri Lanka, one in 2011 (SANOG 17) and the other in 2015 (SANOG 25). LEARN is planning to host the next SANOG meeting in Sri Lanka in July 2021.

The year 2020 has brought more challenges than before for both the Higher Education and Research sector and therefore for LEARN. COVID-19 pandemic forced all physical interaction of the sector on hold and LEARN with its local and international connectivity was able to come for the rescue of its member institutions at these trying times. Before the COVID-19 pandemic, the majority of the State Universities practised blended learning using Learning Management Systems (LMS, such as Moodle). LEARN connects these LMS servers through high-speed Internet. State University members had access to these servers on the LEARN network through public Internet facilities by using paid services offered by Internet Service Providers (ISPs) in Sri Lanka. Under the guidance of the President of the country, and in collaboration with Telecommunication Regulatory Commission (TRC) and the ISPs, the UGC was able to obtain free data access to those servers in the LEARN network of Universities. This initiative motivated the Study From Home (SFH) practices of staff and students of the State Universities in the current situation. The foregoing highlights the progress made in 21 weeks since the resumption of online learning activities on the 23rd of March 2020. The UGC decided to go back to "normalcy" on the 17th of August 2020.

Accessing the Learning Management System (LMS) with free data provided has become the norm for asynchronous teaching and learning within the State University sector now. The last 21 weeks usage statistics are in Figure 11. This Figure presents two types of data, namely:

1. **#Participants**: The number of users (teachers/students) who access the University LMSs on a daily basis, aggregated to a week;

2. **#Online Activities:** The number of online activities performed by the users weekly; an activity could be accessing a reading material, following a lecture slide, attending an online quiz, etc.

It is seen from Figure 11 that both the total number of users accessing the system and the total number of LMS activities carried out by users have increased during the first three weeks, then dropped a little during the New Year week and again picked up in the next few weeks. In week

eight numbers reached a peak of *13 million* activities and the following weeks have recorded more than *10 million* activities each. The statistics show a gradual decrease in the last 5 weeks and numbers have dropped down to *5 million* activities. The total number of activities performed by the LMS users from the State Universities is about *186 million* during the said 21 week period with nearly *4.5 million* aggregated user logins.

For synchronous teaching and learning at State Universities, LEARN offered a video conferencing solution (LEARN.zoom.us). During the present situation, LEARN set up its own media servers with its member network and provided a faster and cheaper solution to its members (teachers and students). As a result, it was possible to keep the video conferencing data traffic within the LEARN network saving international data bandwidth. The solution has become a livewire of the synchronous teaching method for the State Universities. The video conferencing activities illustrated here for the last 21 weeks is the evidence for the claim.

Figure 12 presents two types of data, namely:

1. #**Sessions:** the number of online sessions (lectures, discussions, meetings, etc.) weekly;
2. **#Participants:** the number of participants attended such sessions weekly.

As per Figure 12, both the total number of sessions per week and also the total number of weekly participants for such sessions has increased during the last 21 weeks although it shows a little decrease in 20th week due to election vacations. The numbers have again increased vastly week by week and recorded the peak number of participants in the eighteenth week with about *540,000* participants (more than 27x since week 1). During these 21 weeks, the State University users had about *160,000* sessions with a total of nearly *6.7 million* participants.

LEARN official blog gives more complete analysis of the online teaching and learning activities of state universities under the UGC during the Covid 19 lockdown in Sri Lanka [LEARN 2020].

In Phase V, LEARN not only tries to maintain and improve on the initial vision of the establishment but also work on providing economically viable and state-of-the-art network connectivity and services to its members. At present, LEARN's backbone accounts for more than 20 Gbps bandwidth including 3 Gbps access to the regional and global NREN network. LEARN member connections stand at about 80 with around one-third of them having separate backup links through secondary physical circuits for redundancy. LEARN's directions for the next decade is to go beyond the connectivity provider and be the ICT infrastructure and service provider for the research and education community. Such services will include state-of-the-art video conferencing facilities, in-house learning management system, other media servers and services, digital learning environment, student management system, digital assessment, learning analytics, etc., [Ragel 2019].

(8) Internet Governance Activities

Among the main policy decisions in the period is acceding to the Budapest Convention in 2015 which is the Convention on Cybercrime of the Council of Europe (CETS No. 185). This is the only binding international instrument on Cybercrime in Sri Lanka. It serves as a guideline for any country developing comprehensive national legislation against Cybercrime and as a framework for international cooperation between state parties to this treaty. This augments the portfolio of previously enacted cybercrime prevention Acts namely: Computer Crime Act of 2007; Intellectual Property Act of 2003 and subsequent Penal Code Amendment in 2006; Information Communication and Technology Act of 2003; Payment Devices Frauds Act of 2006; and Electronic Transactions Act of 2006.

In the period 2016 -2017 Sri Lanka had inaugurated the Internet Governance Forum and the School on Internet Governance has been a beneficial new experience for the local community.

In 2018 the government accused the Internet for amplifying hate speech and allowing groups to coordinate attacks against Muslim residents during riots in district of Kandy. As a controlling measure the Government then decided to restrict the Internet within the country. It is estimated that the blockage of Social Media and messenger apps by the Government had resulted in an economic loss around 30 million dollars [Gross 2018]. Internet rights activists had taken action against this decision of the Government to shutdown Internet and it is claimed that the advocacy campaigns organised by them were responsible for being able to lift the ban.

In 2019 the government, with the aim to create a trusted and resilient cybersecurity ecosystem, prepared "Cyber Security Act" for adoption in the parliament and invited public comments. The Internet Society and Internet community engaged with draft bill [ISOCSriLanka 2019] and, while identifying and supporting the need of an act to protect critical infrastructure in the country, informed the authorities of issues that the proposed bill had. It was found that the bill was aiming to protect the Critical Infrastructures through establishing a National Cybersecurity Agency (NCA) as an independent apex authority for cyber security, but the definitions of some of the main terms were too open, for example the definition for Critical Infrastructure given in the bill. Commenting on the proposed bill, the Meta Defence Labs [Vithana 2019] have felt that the "Agency have such a vast portfolio of responsibilities that it can't possibly give the attention and resources required to achieve cyber resilience". The discussion and advocacy on such issues had delayed the process of adopting the bill.

Sri Lanka held its first ever Internet Governance Forum (IGF) in March 2016, supported by ISOC Sri Lanka Chapter, the IGFSA (Internet Governance Forum Support Association), the Sri Lanka Ministry of Telecommunication and Digital Infrastructure, and many more stakeholders. The main goal has been to allow the voice of people to be heard by policy makers on issues related to Internet Governance and to help citizens to take an active part in decision-making processes. Particular attention has been paid to the participation of people from vulnerable groups and those with fewer opportunities for better social inclusion [IGFLK 2016]. The second IGFLK was held in May 2017 focusing on Cyber Security and Safer Internet [IGFLK 2017].

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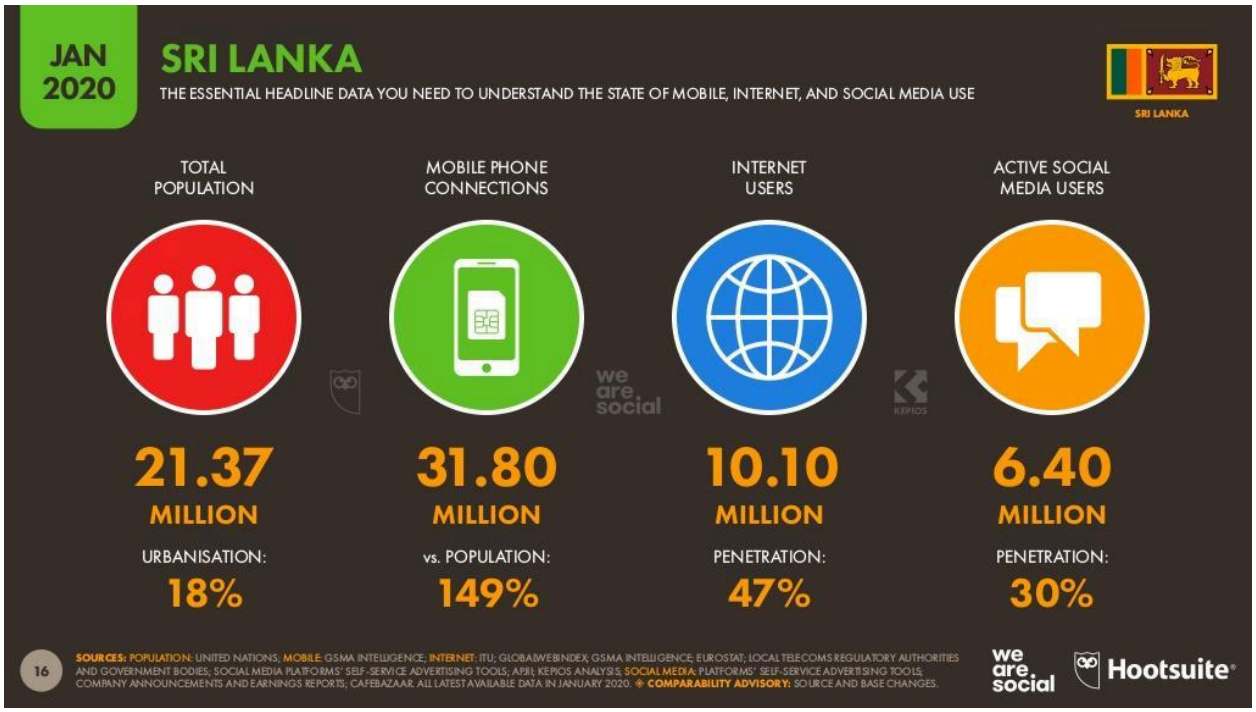


Figure 1. Mobile, Internet & Social Media use in Sri Lanka in January 2020

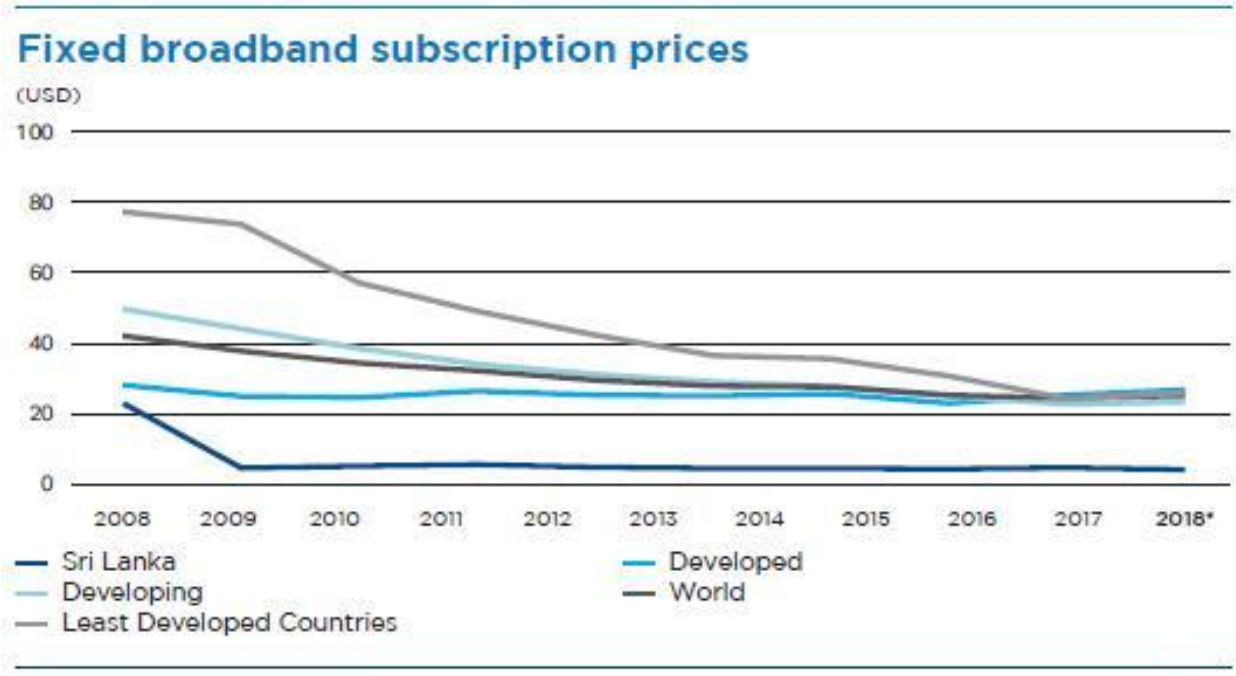


Figure 2. Comparison of fixed broadband subscription prices

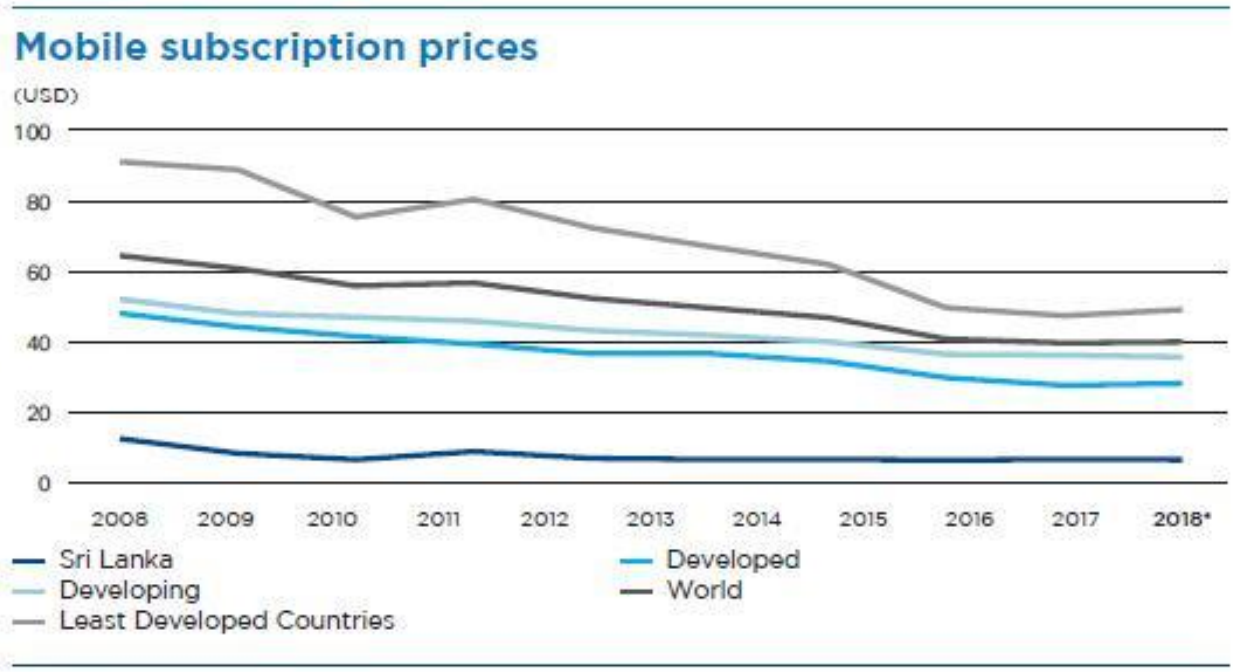


Figure 3. Comparison of mobile subscription prices

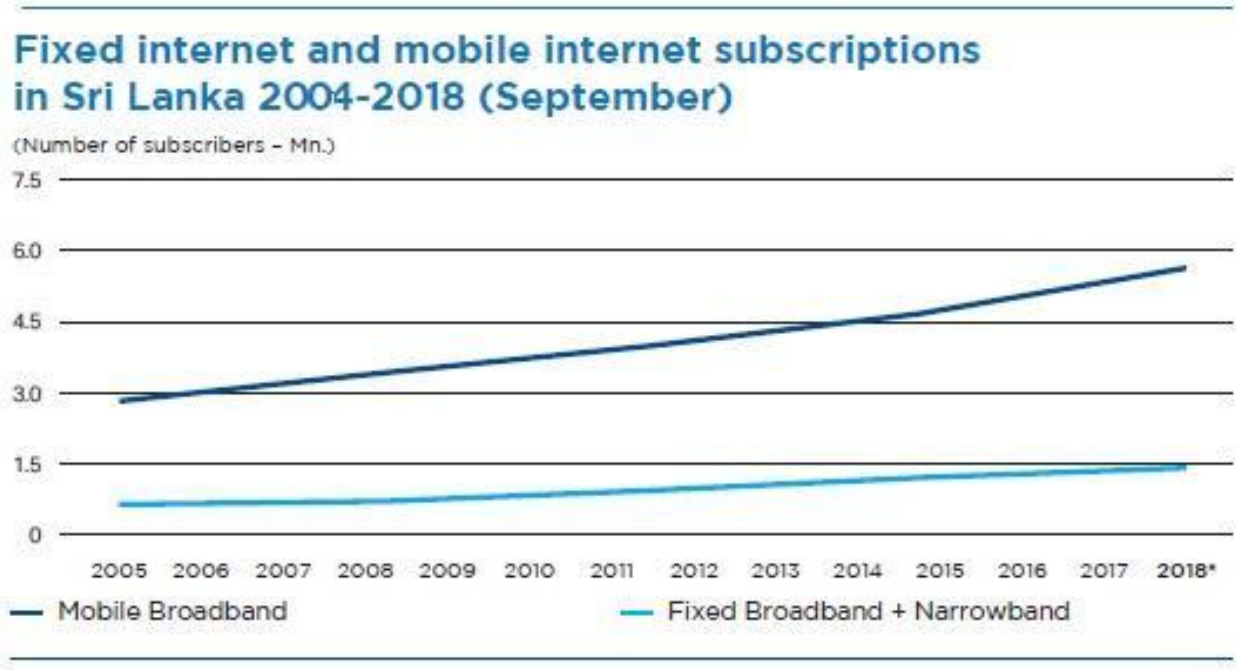
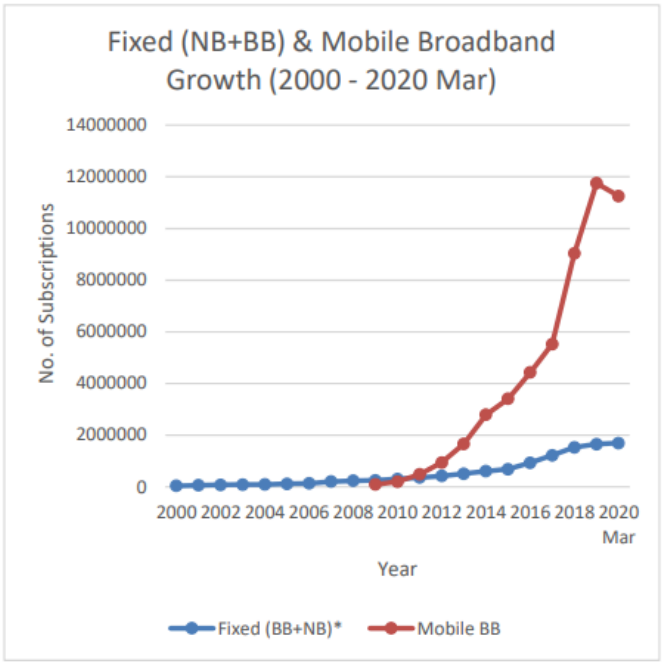


Figure 4. Growth of Internet subscriptions

Year	Fixed (BB+NB)	Mobile BB
2000	40,497	
2001	61,532	
2002	73,468	
2003	85,500	
2004	93,444	
2005	115,000	
2006	130,000	
2007	202,348	
2008	234,000	
2009	249,756	91,359
2010	302,000	200,000
2011	359,000	485,000
2012	423,194	942,461
2013	507,845	1,664,003
2014	606,100	2,790,195
2015	682,512	3,408,408
2016	929,089	4,429,344*
2017	1,221,960	5,525,194*
2018	1,530,099	9,032,576*
2019	1,654,237*	11,754,166*
2020 Mar	1,686,824*	11,392,156**

** - estimated, * - Provisional



Note: BB – Broadband, NB – Narrow Band

Figure 5. Impact of introducing mobile broadband subscriptions, March 2000-2020

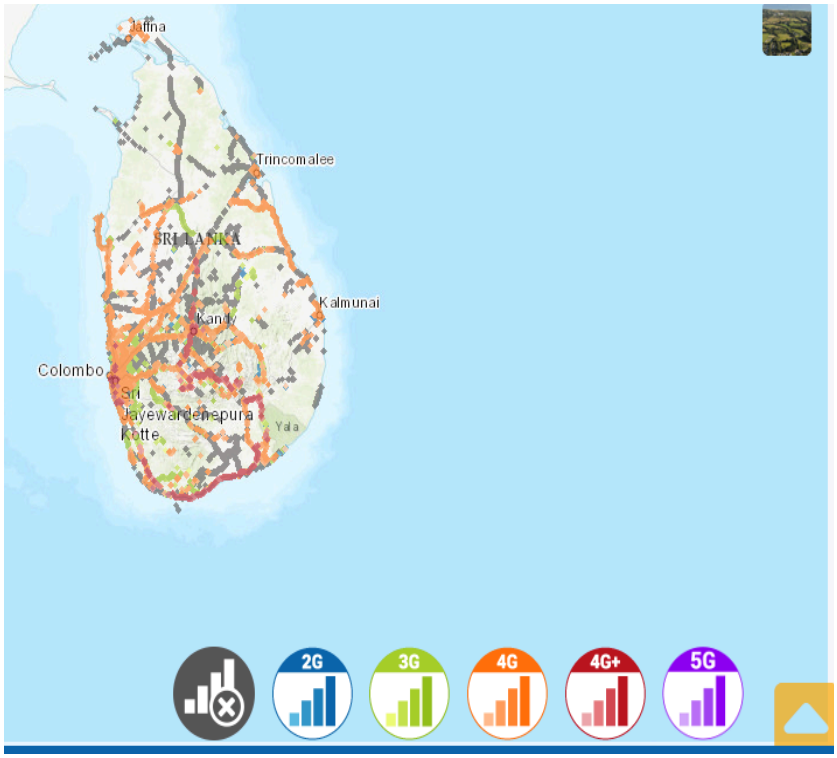


Figure 6. Mobile coverage (of two mobile providers)

- *Internet banking which allows bank customers to access banking services in a convenient and efficient manner through Internet was introduced in Sri Lanka in 1999.*
- *Financial institutions offer facilities through Internet banking, for customers mainly to obtain account information, apply or subscribe for financial products/services, perform own account/ third party fund transfers and pay utility bills.*

Table: 16 **Internet based Payment Systems**

Description	Volume ('000)				Value (Rs. billion)			
	2018	Q1 2018	Q1 2019 (a)	Percentage Change Q1 19/18	2018	Q1 2018	Q1 2019 (a)	Percentage Change Q1 19/18
Total financial transactions (during the period)	26,930.4	5,987.8	7,959.4	32.9	2,939.3	1,106.5	674.0	-39.1

(a) Provisional

Sources: Licensed Commercial Banks
Licensed Specialised Banks
Finance Companies

Figure 7. Comparison of volume and value of Internet based payments in Sri Lanka between 2018Q1 and 2019Q1

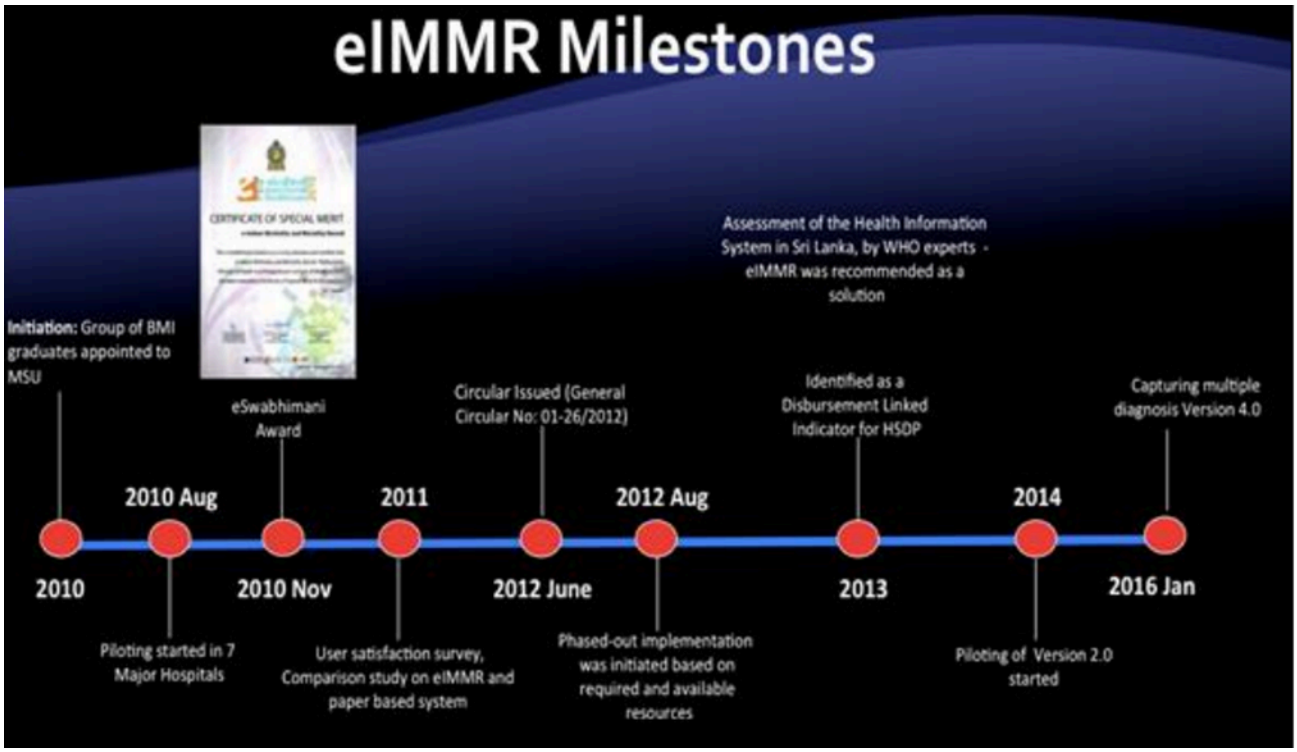


Figure 8. eIMMR milestones

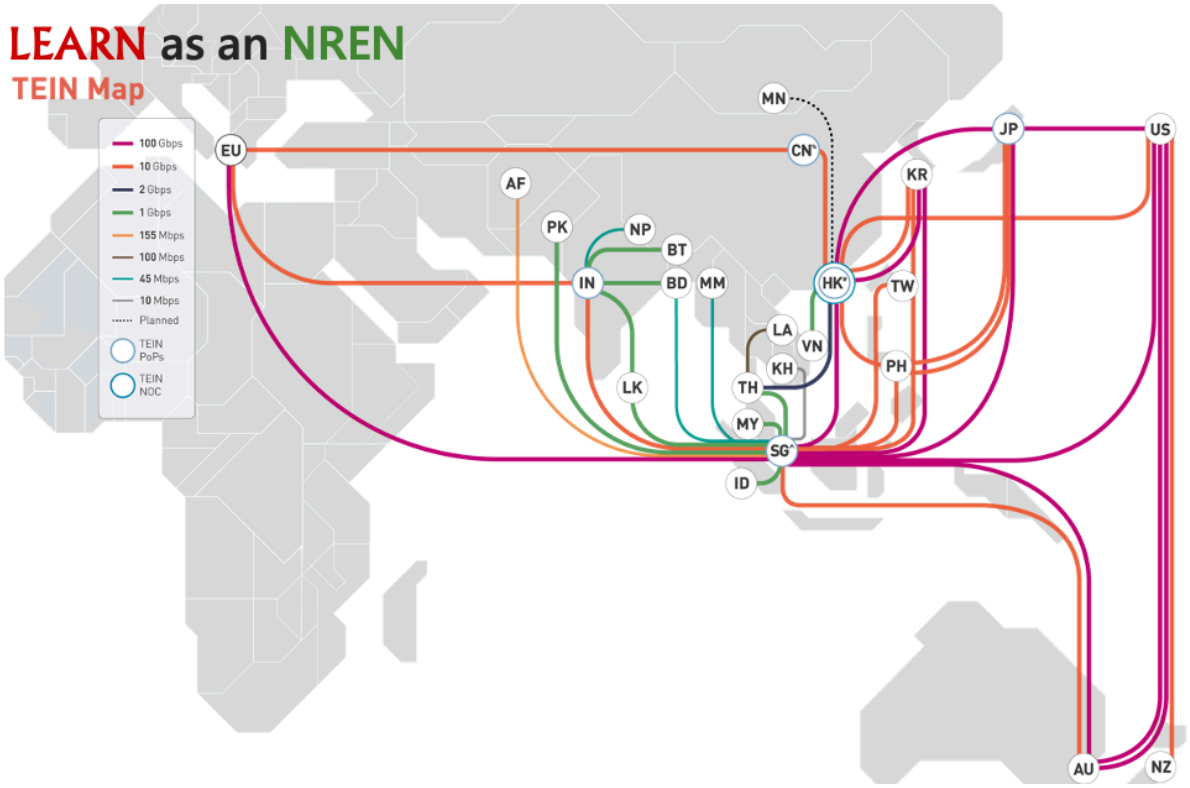


Figure 9. Present TEIN network diagram

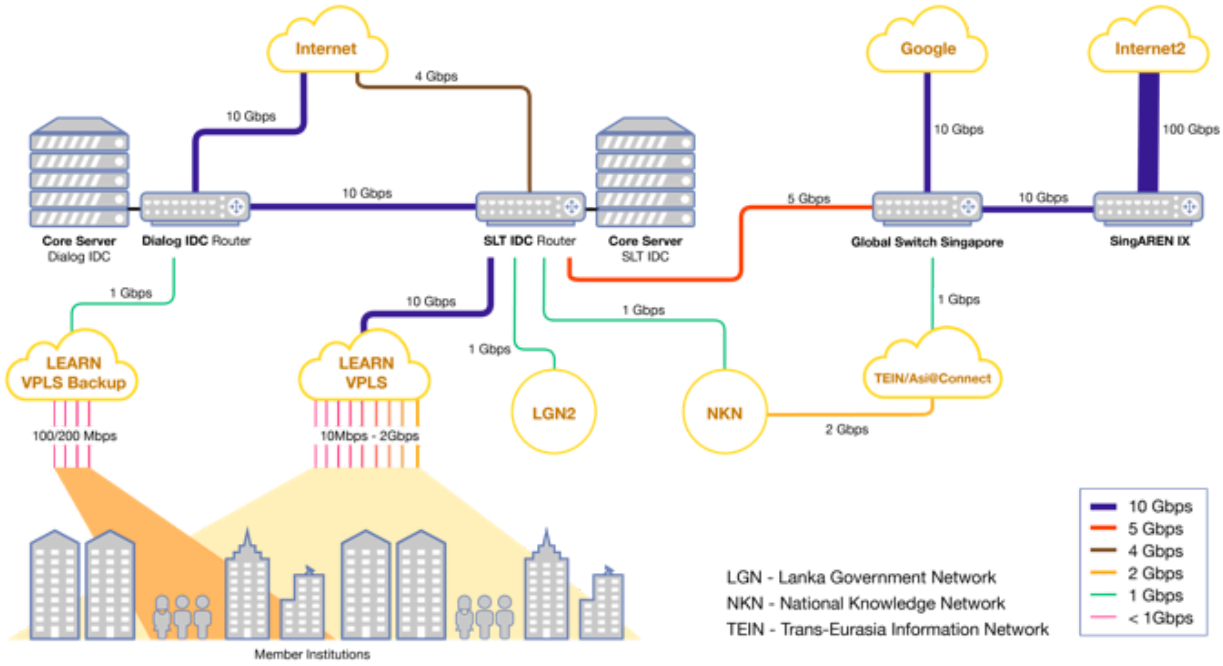


Figure 10. LEARN network diagram showing both local and international backbone connectivity as of 2019

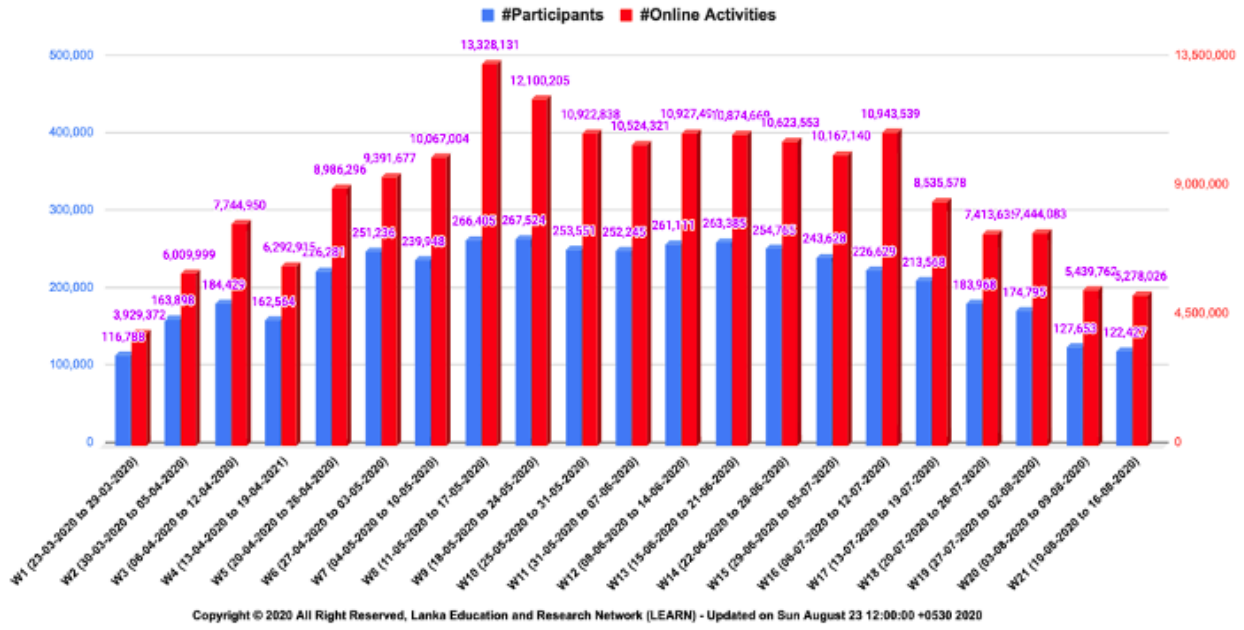


Figure 11. State Universities: Weekly Asynchronous Activities (LMS)

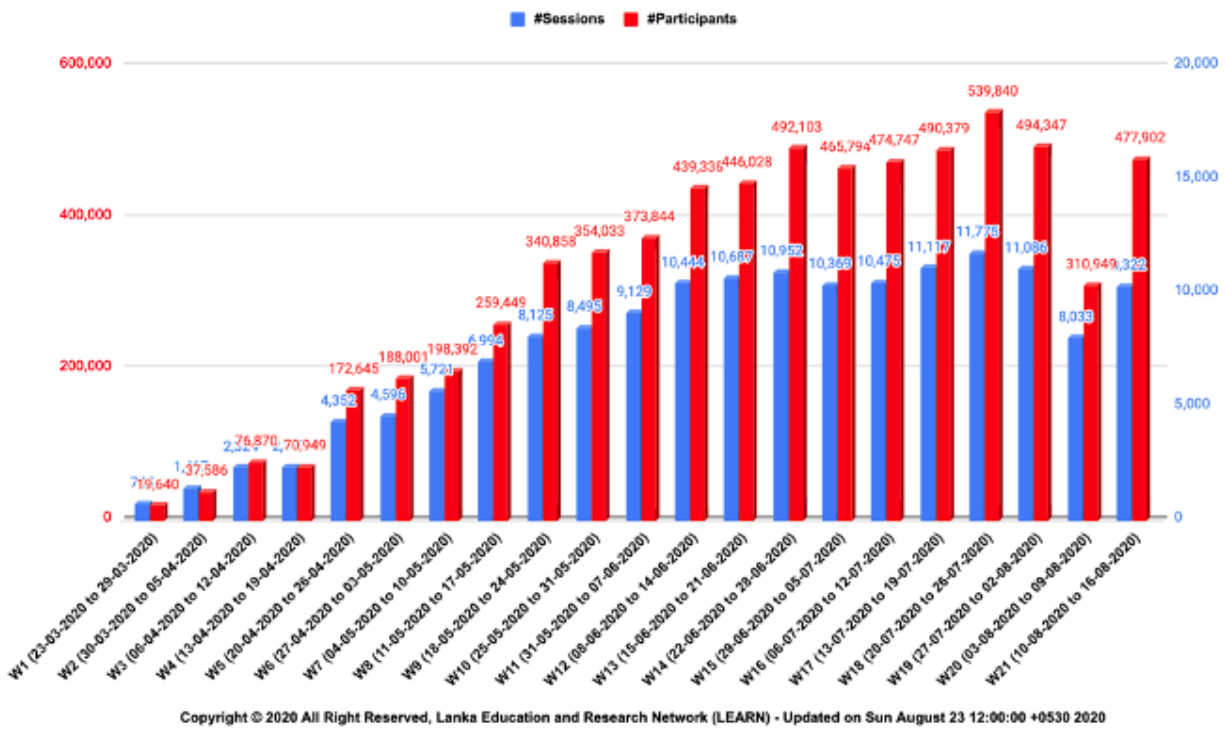


Figure 12. State Universities: Weekly Synchronous Activities (LEARN.Zoom.US)

4.11 Snapshot of Internet in Uzbekistan around 2020

Sang Chul Shin

Information

* ccTLD: UZ (the date of ccTLD delegation: 1995-04-29)
* Population (Year)
  1,288,307,100 (2000) / 1,330,141,295 (2010) / 33,376,000 (2019)
* Internet Population (Year)
  2,250,000 (2000) / 4,200,000 (2010) / 15,500,000 (2018)
* Broadband Population (Year)
  126,337,000 (2010) / 22,700,000 (2018)
* IP Address Allocation (Year):
  Number of IPv4 addresses: 81 blocks with 301,351 IPv4 addresses assigned (2019)
  Number of IPv6/48s: 27 blocks (2019)
* 5 Popular Websites [from alexa.com]:
  Портал Mail.Ru : mail.ru
  google : google.com

Яндекс : yandex.ru
Одноклассники.ru : odnoklassniki.ru
google.co.uz : google.co.uz

Overview

Since the country's independence in 1991, the development of the Internet sector has been one of the Government priorities. Private Internet services began in the late 1990s, and the number of Internet users increased from 855,000 as of February 2006 to 7.7 million in 2011 and 9.5 million in 2012, and 15.5 million (48%) as of 2018.

As of June 2018, the international circuit gate has a capacity of 140Gbps (54.9Gbps/2015), and the backbone was completed with the construction of an optical cable of 22,350km nationwide (1,800km/2015). As of September 2018, the total length of the optical cable was 35,000 Km, the number of Internet users was 20 million, and the international network gate speed was 140 Gbps.

According to the president's special order, in November 2018, efforts were made to dramatically increase bandwidth by 10 times and reduce rates by 2-3 times. As of September 2019, the Internet speed is 129th with 11Mbps for mobile and 116th with 19.9Mbps for wired. There are almost no optical cables to the house, and 40Mbps is the physical limit as A/VDSL using telephone lines is the mainstream. In order to provide a bandwidth of 100M and 1Gbps, it is expected that it will take about 10 years to build GPON and optical cables.

However, the telecommunications (internet), computer, and software sector is a growing trend, and the current Internet and telecommunications market is over 30% per year, and the growth rate of computer and software services is 12.2%, which is very noteworthy.

At the beginning of 2018, the number of Small and Medium Enterprises (SMEs) totaled 230,000, of which 149 companies related to information and communication were.

Key indicators for Uzbekistan (2017)		CIS	World
Fixed-telephone sub. per 100 inhab.	10.8	19.8	13.0
Mobile-cellular sub. per 100 inhab.	76.0	138.3	103.6
Active mobile-broadband sub. per 100 inhab.	59.4	72.0	61.9
3G coverage (% of population)	75.0	80.3	87.9
LTE/WiMAX coverage (% of population)	43.0	61.1	76.3
Individuals using the Internet (%)	*52.3*	68.6	48.6
Households with a computer (%)	38.5	68.1	47.1
Households with Internet access (%)	79.9	73.6	54.7
International bandwidth per Internet user (kbit/s)	9.6	66.8	76.6
Fixed-broadband sub. per 100 inhab.	10.4	17.8	13.6
Fixed-broadband sub. by speed tiers, % distribution			
-256 kbit/s to 2 Mbit/s	56.0	12.2	4.2
-2 to 10 Mbit/s	35.1	25.1	13.2
-equal to or above 10 Mbit/s	8.9	62.7	82.6

Note: Data in italics are ITU estimates. Source: ITU (as of June 2018).

The status of Internet Infrastructure

Rates of internet penetration continue to rise in Uzbekistan. Internet access is based primarily on asymmetric digital subscriber line (ADSL) technology. The International Telecommunication Union (ITU) estimates that internet access was available to 79.9 percent of households as of 2018, though only 52.3 percent of the population uses the internet. Users increasingly access the internet through their mobile devices, with the number of mobile internet users reaching 20 million in April 2018 (in a country of 32.9 million people). That year, the ITU estimated Uzbekistan's mobile broadband penetration rate at 62.4 percent, while the country's fixed broadband penetration rate was just 12.7 percent. Internet connection speeds remain relatively slow. Subscribers experience poor connection quality and frequent disconnections. According to Speedtest, as of May 2019, the average fixed broadband download speed was 14.37 Mbps (putting Uzbekistan in 131st place globally), while the average mobile broadband download speed was 9.77 Mbps (129th globally). In 2018, Uztelecom, the state-run telecommunications monopoly, completed a modernization plan to expand the capacity of Uzbekistan's two international internet traffic nodes, which increased the capacity tenfold, to 1.2 Tbps. In 2018, Uztelecom launched a project called Transformation 2020, which aims to expand and improve internet access throughout the country, as well as make it more affordable. Uztelecom and at least two private mobile service providers offer public Wi-Fi hotspots in limited locations. In February 2018, President Mirziyoyev signed a decree that introduced tax relief and advertisement rights for businesses investing in Wi-Fi hotspots. In December 2018, SOLA, a private company working in partnership with state authorities, reported that 1,200 hotspots were available in Tashkent, with another 3,000 on the way. SOLA also outlined its plans to set up 45,000 Wi-Fi hotspots in the regions, as part of a plan to boost international tourism. Public access points are popular, particularly among young internet users.

In general, access to the internet remains expensive relative to household income in Uzbekistan. Prices for communications services including internet subscriptions increased slightly during the coverage period, according to government statistics. The government reported in July 2018 that the average monthly income was about $190. The average monthly cost of a fixed-line broadband connection in 2018 was $21.26, while 1 GB of mobile data cost $3.27 on average. According to the ITU, Uzbekistan has the second most expensive mobile internet in the Commonwealth of Independent States, after Tajikistan. Internet penetration rates are significantly lower outside of Tashkent. Tashkent has the highest rate of internet penetration and fiber to the building (FTTB) broadband connectivity in Uzbekistan, significantly higher than the country's 12 regions and the autonomous Republic of Karakalpakstan.

According to the latest data available, Uztelecom's FTTB broadband service reaches 4,500 buildings in Tashkent, compared to just four in Termez, a city in the remote Surkhandariya region on the border with Afghanistan, with a population of 136,000. Information and communication technology (ICT) facilities also depend on a stable electricity supply, which further disadvantages rural areas.

Uztelecom runs the International Packet Switching Center to aggregate international internet traffic at a single point within its infrastructure. Uztelecom is also an upstream internet service provider (ISP) and sells internet traffic to domestic ISPs at wholesale prices. Private ISPs are prohibited by law from bypassing Uztelecom's infrastructure to connect to the international internet, and from installing and maintaining their own satellite stations to establish internet connectivity. However, the government reportedly plans to permit private ISPs to establish their

own gateways to the international internet in 2020. The TAS-IX peering center and content delivery network, established in 2004, interconnects the networks of private ISPs to enable traffic conveyance and exchange at no mutual charge, and without the need to establish international internet connections via Uztelecom. Private ISPs provide no traffic limitations to websites hosted within the TAS-IX networks but filter and block other websites to the same extent as Uztelecom.

Uztelecom enjoys a monopoly in the fixed broadband market. Five mobile service providers operate in the mobile market, including three state-owned firms: Ucell, UMS (Mobiuz), and UzMobile, as well as two privately owned operators: Perfectum Mobile (owned by the Uzbek company Rubicon Wireless Communication) and Beeline (owned by VEON, which is based in the Netherlands but is primarily owned by a Russian investment group). Ucell, one of the largest mobile service providers (along with Beeline), was acquired by the government in November 2018 after its former owner, Sweden's Telia Company, announced in 2015 that it would exit Uzbekistan.

The total IPv4 addresses in Uzbekistan is 285,533 in 2020 [IP2Location 2020]. Its global ranking is 127 in 2019. There are 72 hosting companies in Uzbekistan, and the number of websites in Uzebekistan is 2,834, which ranks 61st globally.

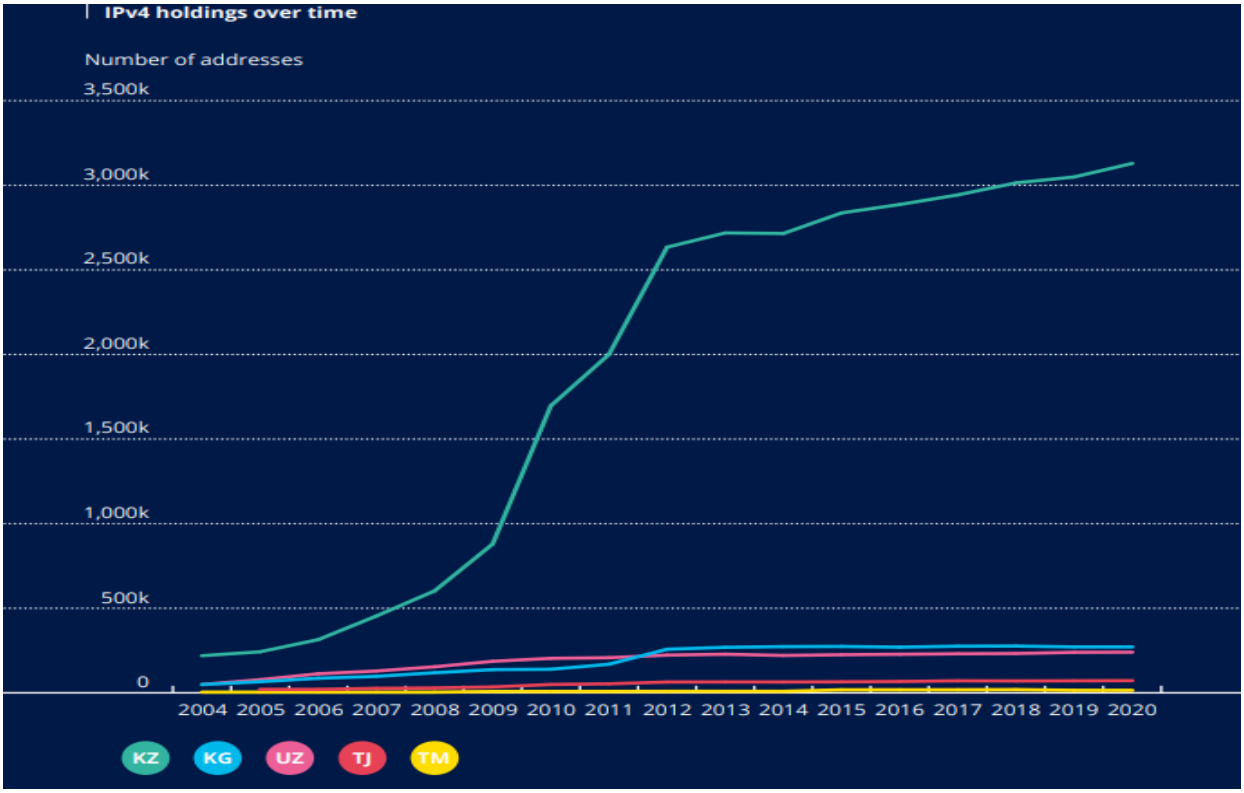


Figure 1 RIPE NCC Internet Country Report: Central Asia – IPv4

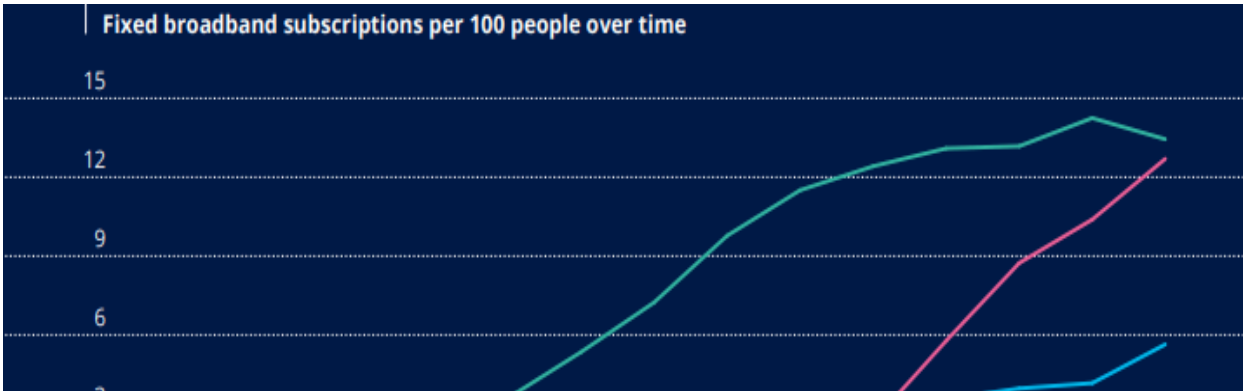


Figure 2 World Bank: Fixed broadband subscriptions per 100

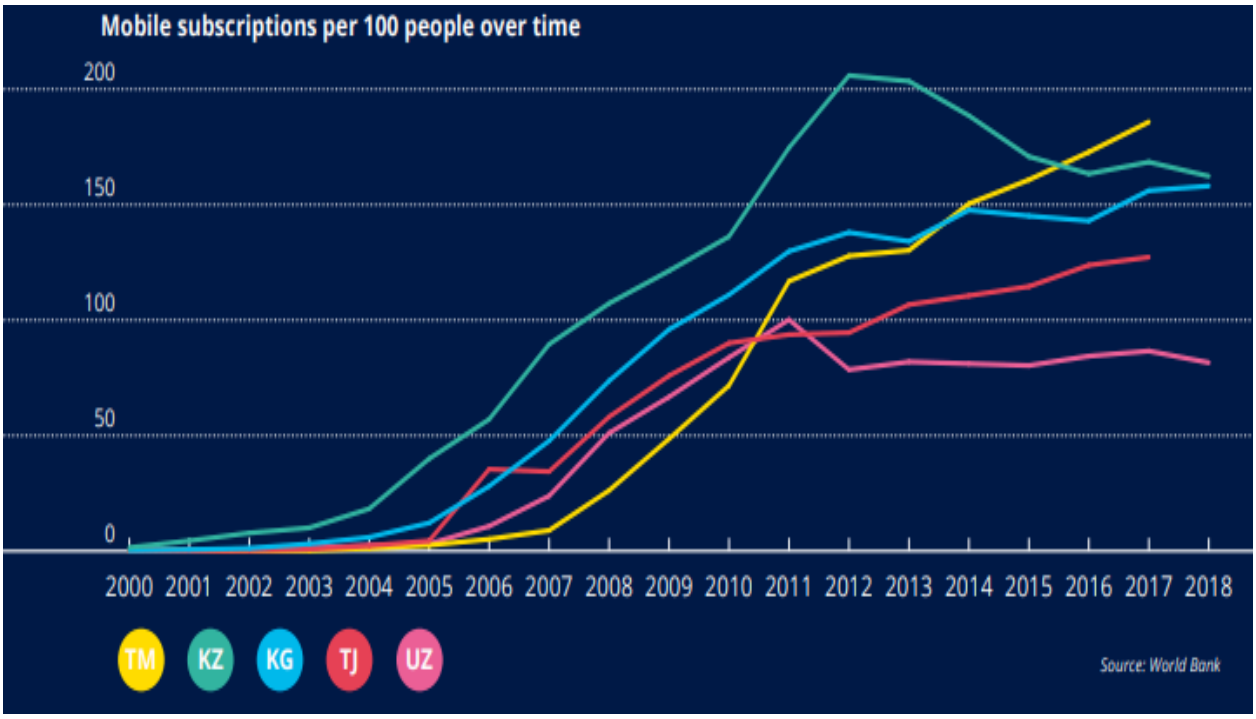


Figure 3 World Bank: Mobile subscriptions per 100 people

Table 1 History of Internet in Uzbekistan [Uzbekistan 2020]

	2014	2016	2017	2018
Speed External Internet (Gbps)	13	29		165
Coverage of population with Digital TV	45%	(60%)		100%
Internet Penetration (ITU)	35.5%	46.8%		-
Mobile Penetration (ITU)	73%	77%		-
Internet Subscribers	36.5%/100 households	14 mil.		15.5 mil.
Internet Domains	-	29,000		52,000
Fixed (Wired) Phones	8.2%/100 households 2.5 mil.	10.9%/100 households 3.4 mil.	10.8%/100 households 3.4 mil.	
Mobile Subscribers	66%/100 N/A	74%/100 20.8 mil.	76%/100 22.7 mil.	
Fixed Broadband Subscribers	2.7%/100 0.8 mil.	8.7%/100 2.7 mil.	10.4%/100 3.3 mil.	
Mobile Internet Subscribers	-	-		9.5 mil.
eGov Development Index	N/A	80th		81st
eGov online participation Index	N/A	47th		59th

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