
# Kyrgyz Internet Environment Assessment

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Internet Society™

# Executive Summary

The Internet Society is pleased to present its first report focusing on Internet development in Central Asia. The objective of this report is to contribute to the Internet development efforts in the Kyrgyz Republic by providing an analysis of the current Internet environment, and by proposing recommendations to reinforce the local Internet ecosystem. This report also aims to provide input to the regional discussions on Internet infrastructure development in order to promote economic and social progress across Central Asia.

The report focuses on the key opportunities and potential barriers to Internet development on both the supply and demand sides by examining recent progress in Internet infrastructure development and local content creation. We highlight selected policy and regulatory issues that have proven to be crucial in a global context when creating an enabling environment for Internet development. The report references key information and communication technology (ICT) indicators, global benchmarks, and best practices to support both the analysis and our recommendations.

## Key Recommendations

- **International connectivity.** Develop a long-term strategy to increase the capacity and redundancy of international connectivity by taking regulatory and policy action to reduce current cross-border price markups, promote competition, and engage internationally to support new fiber routes to reach submarine cable landing stations.
- **Domestic connectivity.** Promote the shared deployment of, and access to, domestic fibre backbones, and work to build the role of the Internet exchange point (IXP) in allowing the exchange of domestic and international traffic and content.
- **Last-mile connectivity.** Ensure that operators, mobile in particular, have sufficient spectrum, and gain economies of scale by sharing existing and new infrastructure to help extend networks, while supporting new initiatives to reach un- or underserved rural areas.
- **Content.** Promote the development and hosting of local content to help make content delivery more efficient and to increase demand for Internet services among those currently unconnected.

# Background

This project is a result of more than 18 months of successful cooperation among a number of Kyrgyz and regional stakeholders, most notably the National Institute for Strategic Studies of the Kyrgyz Republic (NISI), the Kyrgyz Ministry of Transport and Communication, and the State Communications Agency, as well as key Internet providers, members of academia and civil society, and a number of international financial institutions and development organisations.

Much of the evidence and insights found in this report stems from regional engagements conducted in Central Asia by the European Regional Bureau of the Internet Society, starting in December 2014 at the Central Asian Internet Symposium[1] organized by the Internet Society. In April 2015, NISI organized a roundtable discussion with the Internet Society and approximately 30 other Internet stakeholders in Bishkek to better understand local views and concerns. At that time, the Internet Society team also interviewed representatives from the Kyrgyz government, business, academia, civil society, and international institutions for the purposes of this report.

The authors thank Talant Sultanov, Ermek Niyazov, and Bermet Imanalieva from the National Institute for Strategic Studies; Deputy Minister Ernis Mamyrkanov and Aida Ailchieva from the Ministry of Transport and Communication; State Secretary Abdisamat Sagymbaev and his team from the State Communications Agency; Tattu Mambetalieva and Artem Goryainov (Civil Initiative for Internet Policy); James Cowie (Dyn); Aibek Bakanov (Kyrgyz Association of Telecommunication Operators); Siddhartha Raja, Natalija Gelvanovska, Mikhail Bunchuk, and Samagan Aitymbetov (World Bank); Martin Naegele and Chris Miller (IFC); Chynara Suiumbaeva (UNDP); Lellis Braganza (European Commission); Istvan Tetenyi and David West (DANTE); Karim Zerhouni and Almaz Bakenov (American University of Central Asia); Azis Abakirov (Kyrgyz Software Association); Azis Soltobaev (KG Labs); Ruslan Karabukaev (Namba Taxi); Dmitriy Vetlugin (Beeline); Edouard Janserikov (Megaline); and the Internet Society team.

[1] http://www.internetsociety.org/blog/europe-bureau/2014/12/partnering-kyrgyz-republic-stakeholders-develop-regional-internet

# Regional Comparison

The Internet Society's core vision statement is "The Internet is for everyone." Thus, we believe a key indicator of any Internet environment is the percentage of its population using the Internet. This Internet penetration level is affected by a number of variables: demographic, such as income levels, and market factors, including key policies and regulations. For the purposes of this report, we grouped benchmark indicators into the following three categories for comparisons with other countries in the region:

- **Demographics**. Indicators such as population, income, and population density that can affect the demand for, or supply of, Internet access services. While these factors are not under the control of telecommunications policymakers, they must be taken into account when both assessing the level of Internet access and making policy recommendations.
- **Market environment**. Policy and regulatory indicators that create the environment in which Internet access services are made available. These indicators are under the control of policymakers and regulators seeking to lower barriers to Internet access.
- **Internet indicators**. Measures relating to Internet adoption and usage, as well as measures of affordability of access services. These indicators are affected by those in the previous two categories. Understanding current Internet indicators in the Kyrgyz Republic, in light of the demographics and market environment, is critical to making recommendations and in formulating a longer-term sustainable development strategy.

As noted, the degree of Internet usage among the population is one of the fundamental Internet environment indicators. Increased penetration of Internet usage tends to be the consequence of a variety of factors, including the cost of Internet access and the quality of the experience (e.g., download speeds). It is critical that countries collect Internet environment indicator data and publish them online, so they can benchmark progress from year to year and can reliably assist in national and regional assessments.


The following section compares the Kyrgyz Republic to its Central Asian neighbours and Russia in order to examine the development of its Internet ecosystem relative to countries that are comparable based on history, geography, and level of economic and/or Internet development.

To situate the comparisons, we noted the Internet penetration levels in the following benchmark countries: Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Turkmenistan, and Uzbekistan (Figure 1). Kazakhstan and Russia are significantly ahead of the other countries in the region, followed by Uzbekistan. Of the remaining three countries, Kyrgyzstan is ahead of both Tajikistan and Turkmenistan. These differences are partly attributable to demographic and economic factors, as we explain next.

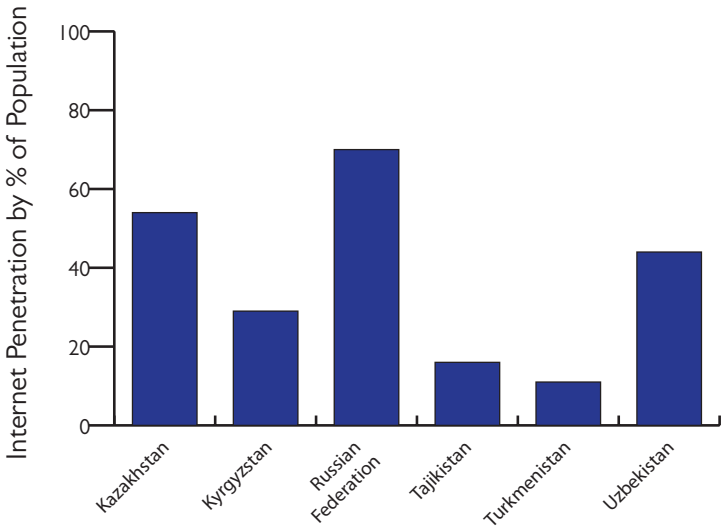


Figure 1. Internet Penetration Levels by Country Population (Source: International Telecommunication Union, 2014)

# Key Indicators of Development

We used the following data and graphs to help determine each country's key contributing factors to the development of an Internet ecosystem.

Figure 2 shows some of the factors that can affect the growth and access of the Internet in Central Asia. Note the marked difference between Russia and Kazakhstan and the other Central Asian countries in most categories. Specifically, Russia and Kazakhstan have the highest per capita income by a significant margin. In addition, while both countries have the lowest population density, which can raise the cost of providing Internet access, this is offset by higher levels of urbanization, particularly in Russia. By comparison, Kyrgyzstan has a higher population density, but a low level of urbanization that is more in line with its neighbours.

Perhaps most revealing is the region's per capita income differences across the Central Asian region. At just more than $7.2 billion, Kyrgyzstan has the lowest gross domestic product (GDP). It also has the second lowest population and GDP per capita at 5.83 million and $1,269.10 respectively. It appears that compared to its neighbours, Kyrgystan's relatively small size and economic output have an impact on its level of online engagement.

| | Population (millions) | Population density per sq. km | Urbanisation % | GDP, current US$ (billions) | GDP per capita, current US$ |
|---|---|---|---|---|---|
| Kyrgyzstan | 5.83 | 30 | 36% | 7.4 | 1,269.1 |
| Tajikistan | 8.4 | 60 | 27% | 9.24 | 1,099.0 |
| Kazakhstan | 1.73 | 6 | 53% | 212.25 | 12,276.4 |
| Russia | 1.44 | 9 | 74% | 1860.6 | 12,735.9 |
| Turkmenistan | 5.31 | 11 | 50% | 47.93 | 9,031.5 |
| Uzbekistan | 3.1 | 72 | 36% | 62.64 | 2,037.7 |

Figure 2. Central Asia Demographics and Income (Source: World Bank, 2014)

## Challenges facing the country

The International Telecommunication Union's (ITU) Information and Communications Technology (ICT) Development Index (IDI) is an indication of technological development in a country. Comparing regional IDI data can provide an indication of the digital divide among countries (the difference between countries in terms of ICT development).[2]

The maximum value from the IDI was 8.86 with the minimum value being 0.96. This indicates a wide spectrum of technological development across all of these countries; this is significant given both the importance of technology to development and general global trends related to Internet development. There is a clear difference between Russia and Kazakhstan and the other Central Asian countries. Kyrgyzstan had an IDI of 3.78 in 2013, below the global average of 4.77.[3]

The World Economic Forum (WEF) Global Information Technology Report (GITR) Network readiness index parallels the figures from the ITU's ICT IDI index. The Network readiness index measures how prepared a country is to apply the benefits of information technology to its economy and further its growth, on a scale from 1 to 7.[4] Using the GITR readiness index measurement, Kyrgyzstan is behind Russia and Kazakhstan (Figure 3).

In addition, Kyrgyzstan ranks 108th out of 166 countries on the ITU's ICT IDI and 98th out of 143 countries in the latest GITR Network readiness index.

[2] MIS report 2014, ITU. Retrieved at: http://www.itu.int/en/ITU-D/Statistics/Documents/publications/mis2014/MIS2014_without_Annex_4.pdf.
[3] Ibid.
[4] GITR 2015, WEF, http://www.weforum.org/reports/global-information-technology-report-2014.

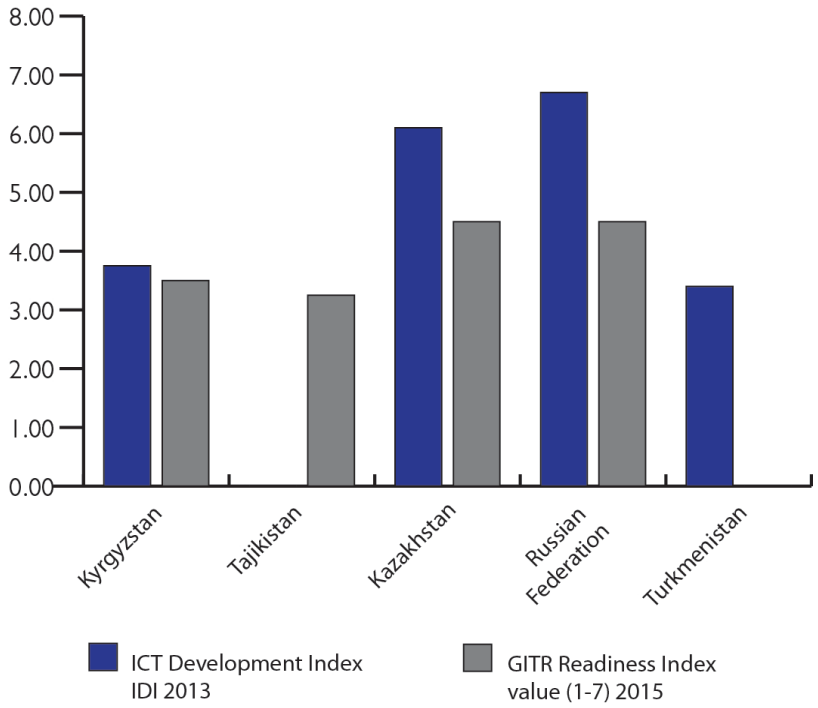


Figure 3. Comparison of IDI and GITR (Source: ITU, MIS Report 2014; WEF, GITR 2015)

More directly related to Internet connectivity and access, we compared the amount of international Internet bandwidth in Kyrgyzstan to that of its neighbours.[5] This is a critical measurement for landlocked countries, as it determines the cost and quality of transmissions to the rest of the global Internet.[6] Although comparable with Tajikistan, Kyrgyzstan's amount of international bandwidth indicates an extremely low amount of Internet traffic coming from the country, as well as a lack of online engagement. One reason for this may be the high cost of international bandwidth in Kyrgyzstan, especially in comparison to Kazakhstan and Russia.

Costs related to international bandwidth are significant because they are passed on to end users. In addition, when the cost of international bandwidth is high, it tends to be under-provisioned—leading to significant delays (latency) when accessing and downloading content overseas. According to one source, the cost of international bandwidth in Kyrgyzstan is estimated at $100 per mbps per month; this is significantly higher than the cost in Kazakhstan ($4) or Russia ($15). Figure 4 shows the correlation between average transit costs per month and amount of international Internet bandwidth; there is, as one might expect, a direct relationship between cost and quantity.

[5] https://www.itu.int/ITU-D/finance/work-cost-tariffs/events/tariff-seminars/Maputo-09/pdf/session2-Abosse-Internat_Bandwidth-en.pdf.
[6] Costs associated with being landlocked or "sea-locked" are greater due to cross-border connectivity, distance, and time related to transmission of data across networks, making the case more acute for cheaper local Internet content exchange.

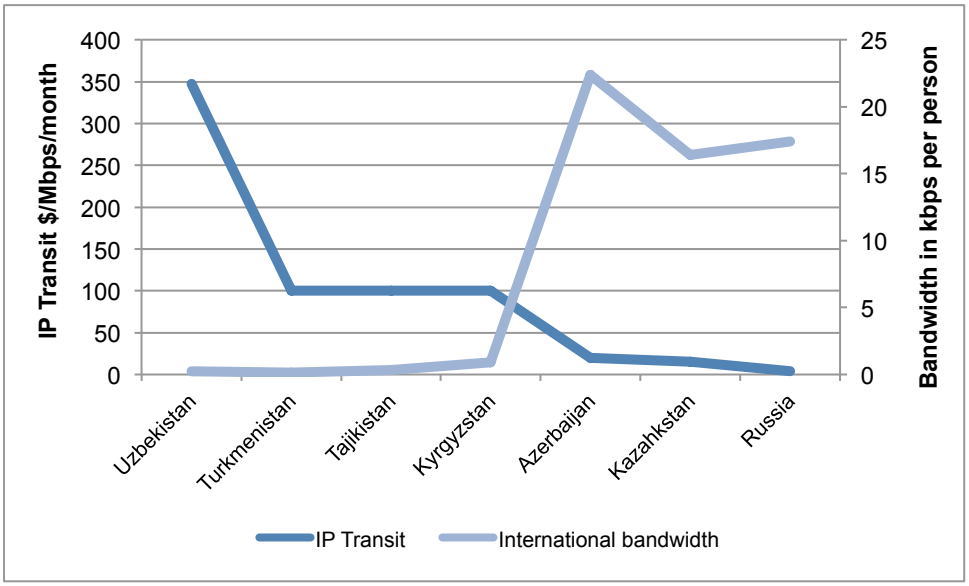


Figure 4. International Internet Bandwidth and Transit Prices (Sources: Terabit Consulting, TeleGeography, Internet Society)

Note that sources in the Kyrgyz Republic have recently reported that the cost of international bandwidth in Bishkek (the capitol) is significantly lower than the cost reflected in Figure 4. According to these more recent indications, the cost in Bishkek may be $40 per mbps per month or even lower, while closer to $100 per mbps in the rural south. This rate still is significantly higher than the rate in several neighboring countries whose rates also may have fallen since the graph's data was gathered.

Kyrgyzstan is a landlocked country; terrestrial access is needed to access submarine-cable landing stations where submarines cables connect to the rest of the world. This need to obtain access through another country adds cost—Kyrgyzstan must buy capacity from a neighboring country to take Internet traffic through those networks. The cost to reach submarine-cables can grow in relationship to the number of countries that must be passed through to reach them. Today, Kyrgyzstan is essentially dependent on purchasing bandwidth through both Kazakhstan and Russia to access Western Europe.[7] See page 11 for more details on international connectivity.

## Internet indicators

Figure 5 offers additional details about the level of Internet-user penetration. Roughly 25% of Kyrgyz citizens are online; 75% of the country is offline. In addition, across the Central Asian countries where data are available, fixed broadband access is low in most countries; it peaks at approximately 15% in Russia. Mobile broadband largely drives Internet access levels across Central Asia. There is a direct correlation between the number of Internet users in a country and the affordability of mobile broadband; Kazakhstan and Russia both have very low broadband costs and the highest mobile broadband adoption levels in the region.

[7] https://opennet.net/research/profiles/kyrgyzstan.

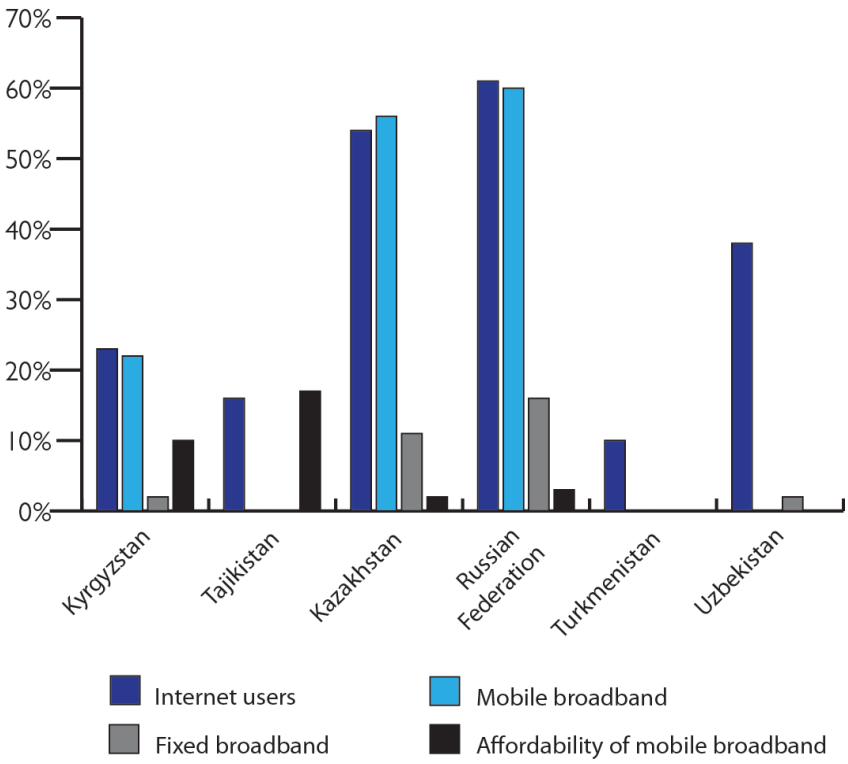


Figure 5. Online Access across Central Asia (Source: ITU, 2014)

Although Kyrgyzstan lags behind in online access in comparison to Kazakhstan and Russia, among the other benchmark countries for which data is available, it has relatively similar figures. The values for fixed broadband penetration are similar across the smaller Central Asian countries.

# Baseline Assessment

Following is a detailed review of the Internet access environment in the Kyrgyz Republic, including the policies and regulations used to increase Internet access. Information was obtained via interviews with Internet stakeholders in the Kyrgyz Republic.

## The Value Chain of Internet Infrastructure

Internet access depends on a value chain of Internet infrastructure stretching from international connectivity to last mile Internet service. The metaphor of the chain is fitting here, as the weakest link in the chain can have a significant impact on the cost and availability of Internet access.[8]

This value chain is important to assess; it explains three basic parts of the delivery of traffic in Kyrgyzstan: international connectivity to bring traffic from the rest of the world; domestic connectivity, including interconnection arrangements between providers; and last mile delivery by Internet service providers (ISPs) to end-users.

Although important, this view of the value chain paints an incomplete picture—it focuses only on the supply-side. We also review the demand-side, which includes 1) the generation and delivery of content that both attracts non-users to the Internet, increases the usage of those already online, and encourages business and government use, and 2) security issues that encourage trust in the Internet and thereby support the uptake of Internet services and applications.

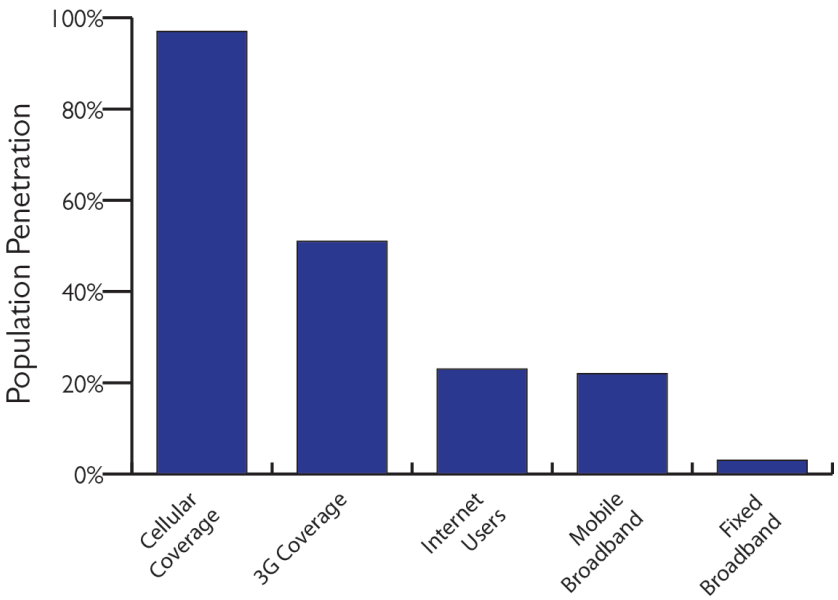


Figure 6. Internet Availability and Adoption in Kyrgyzstan (Source: ITU, 2014)

[8] Geography plays an important role in connectivity and this is factored in our analysis below.

Figure 6 shows that the availability of Internet access in Kyrgyzstan far outpaces its adoption. This is a result of widespread mobile network penetration—a phenomenon typical of most, if not all, countries. In Kyrgyzstan, almost 90% of the country lives within range of a mobile phone signal, and many citizens have subscriptions.[9] The cost of upgrading a mobile network to provide Internet access is relatively marginal compared to the cost of initially deploying a network. As indicated in Figure 6, 50% of the population of Kyrgyzstan is covered by a 3G mobile broadband signal; however, only 20% of the population are Internet users, overwhelmingly represented by mobile subscribers.

According to our analysis, there are two reasons for the gap between Internet availability and adoption: affordability and relevance. Affordability, as measured by the ITU/UNESCO Broadband Commission for Digital Development[10], is the cost of broadband as a percentage of average monthly per capita income; the Commission has set a target of 5%. According to the latest ITU numbers, the cost of mobile broadband in Kyrgyzstan is just over 10% of average income; the level of fixed broadband is 2.4%. The low price of fixed broadband suggests that adoption rates should be higher, thereby indicating that fixed broadband availability is relatively low, particularly in comparison to mobile broadband availability.

The relevance of Internet access to Kyrgyz users may also be keeping non-Internet users from going online. In this case, relevance is derived from a number of factors including the number of family and friends who are online with whom one can correspond via social media, the amount of content available in the user's language, and the amount of content available relating to local or national issues of interest.

# Supply-Side Issues

## International capacity

International connectivity is of utmost importance for countries with developing Internet ecosystems. According to interviews with two experts, 80% of the Internet traffic in the Kyrgyz Republic is international and 20% is domestic. These numbers indicate that Internet access is dependent on the quality and cost of international connectivity.

For a landlocked country like the Kyrgyz Republic, international connectivity takes on additional significance because the country has no direct connection to submarine cables. Recent years have seen a wave of submarine-cable deployments that provide some countries with their first submarine-cable landing stations and other countries with additional new submarine-cable landing stations, thereby generally increasing competition and network redundancy. The Kyrgyz Republic, however, is dependent on both factors—where submarine cables land and having terrestrial connections across more than one country to reach submarine-cable landing stations.[11] Figure 7, a map from TeleGeography[12], shows Central Asia's geography and access to submarine-cable landing stations.

[9] We have not had access to any coverage maps for Kyrgyzstan, but based on experience, mobile coverage will not be available in areas where coverage costs are high and/or population density is low, characteristics that certainly cover the mountain regions of Kyrgyzstan. Regardless of location of the coverage gaps, providing service to remote and underserved communities is critical.
[10] ITU/UNESCO Broadband Commission for Digital Development, http://www.broadbandcommission.org/Pages/default.aspx.
[11] Affordable terrestrial fibre access to submarine-cable landing stations is critical to driving down local prices.
[12] TeleGeography, https://www.telegeography.com/.


Figure 7. Submarine-Cable Access in Central Asia (Source: TeleGeography)

Other than direct access via China, at least two countries stand between the Kyrgyz Republic and a submarine-cable landing station. Options for reaching submarine-cable landing stations are as follows:

- To the east, transit traffic through China is subject to the same firewall as domestic Chinese traffic; this route is not favored because it does not provide full access to the open Internet.
- To the south, India, Pakistan, and Iran each have multiple submarine cables. Access to those countries and their cables, however, first depends on access through at least Tajikistan and possibly also Afghanistan. There may be connections from the Kyrgyz Republic to Tajikistan, but it is unclear whether they extend to other countries to the south.[13]
- To the west, there are submarine-cable landing stations in Turkey and Georgia. Access to these countries, however, depends on access through multiple countries; to our knowledge, there is no such terrestrial cable that does this.
- To the north, access into Russia is attractive for two reasons: a commonly shared language means that a significant amount of content is available in Russian, and the relative size of the Russian Internet ecosystem offers sufficient connectivity from Russia to Europe and beyond. Access to Russia must be made through Kazakhstan.

Based on our discussions, the bulk of international capacity from the Kyrgyz Republic goes via Kazakhstan to Russia. Given the dependence of Kyrgyz ISPs on this international connectivity, the price of international connectivity is a significant factor. Price is also an indicator of the level of competition in a country and the regulatory challenges related to international capacity. On page 6, we cite a price of more than $100 per Mbps per month for international transit service in the Kyrgyz Republic. We also were told that prices for international connectivity were $40 per Mbps per month or lower during our visit, while a number of operators felt this was commercially sensitive data and would not discuss it with us.

[13] The Casa-1000 hydroelectric energy transmission project could provide an infrastructure platform for an "additional connectivity road" as it intends to connect Kyrgyzstan, Tajikistan, Pakistan, and Afghanistan, http://www.casa-1000.org/.

Nonetheless, based on the numbers available to us, there is a significant markup between the transit prices in Russia and Kazakhstan and the transit price in the Kyrgyz Republic. This suggests that the market is not yet dynamic. Specifically, the price is $4 per Mbps in Russia, and $15 per Mbps in Kazakhstan—between Russia and Kazakhstan, $11 per Mbps is added. In the Kyrgyz Republic, transit costs may be three times the costs in Kazakhstan, adding a significant amount to the price of international capacity in the Kyrgyz Republic.

We understand that any licensed provider in the Kyrgyz Republic can build capacity from Bishkek to the border with Kazakhstan, and that they are free to buy capacity from any provider in Kazakhstan. We also understand that up to six operators may currently connect at that border, which suggests a competitive market. It is critical that we understand *why* this cost is so marked up—only then can we address it. This review would require additional access to prices paid and other sensitive operator-specific data.

Interviews held in Bishkek revealed that there is proposed legislation to create a monopoly (by imposing a "gateway") at the Kazakh border. Such a scenario potentially would drive the cost of international connectivity even higher, particularly if there is no oversight of the final price. Given the importance of price related to Internet affordability and availability, we assume that international best practices to liberalize international border gateways and drive down the cost of cross-border connectivity would be integrated into future Kyrgyz legislation. We recommend that the antitrust authority play a role in ensuring that prices are monitored, thereby safeguarding more affordable connectivity, regardless of the number of operators allowed to interconnect at the border. We also recommend that prices be published, so the data is readily available.

## Domestic connectivity

As discussed previously, it appears that multiple operators have built capacity from Bishkek to the border with Kazakhstan, and that at least one operator has done so to reach the border with China. Further, we understand that anyone with a license is free to build additional capacity, thereby increasing competition and choice.

However, connectivity between Bishkek and other population centers within the country, notably Osh, should be improved. It is our understanding that both the incumbent Kyrgyz Telecom and now Elcat own and operate terrestrial fibre between Bishkek and Osh. We suspect that Elcat's fibre network has helped to further lower prices, but we have no access to that data. As it is the incumbent provider for that route, Kyrgyz Telecom tariffs are subject to review by the antitrust authority. We recommend that the authority continue to monitor prices until competition has been firmly established in order to ensure all companies have access to available connectivity at fair and reasonable prices.

From discussions with ISPs, it seems that domestic capacity is relatively expensive and fibre quality is poor. Alternatives include microwave for mobile backhaul, and building a new fibre network to both compete and provide additional redundancy in the country. Fibre is a challenge, however, given weather that makes it hard or impossible to deploy fibre in the winter, and mountainous terrain that offers deployment challenges year-round.

Internet exchange points (IXPs) also are part of the domestic connectivity infrastructure. IXPs are particularly important for lowering price and latency, as they enable Internet traffic to be exchanged domestically without

using international links. The Kyrgyz Republic has had an IXP in Bishkek since 2002, when it was established with the support of the Soros Foundation.

The Kyrgyz IXP is governed and managed by the Kyrgyz Association of Telecommunication Operators (Operators Association). The Operators Association created a set of rules that governs the IXP and establishes an organizational foundation, membership parameters, and technical parameters.[14] Under these rules, the IXP is accessible for members of the association; according to the association's website, there are 18 members—all of whom exchange traffic at the IXP. The rules seem to provide a neutral basis for local ISPs who operate and participate in the IXP. Operators who provide local service are able to bring their own fibre to the IXP in order to peer with each other and to exchange local traffic.

It is our understanding that most of the operators exchange traffic across the exchange point either multilaterally and/or bilaterally (mandatory multilateral peering is not enforced). However, it was pointed out on several occasions that local operators also have parallel private-peering agreements amongst themselves that may be preferable at times due to reasons linked to redundancy, load balancing, and commercial arrangements.

Currently, according to its rules, the Kyrgyz Association of Telecommunication Operators does not allow international ISPs, content providers, or data-centre operators to exchange traffic at the IXP. In our view, this limits opportunities for Internet development in the Kyrgyz Republic.

Finally, Kyrgyz Telekom owns the facility where the IXP is located, which may call into question the neutrality of the IXP from a competitors' or potential new entrants' point of view.[15] Current participants did not seem to feel that this was an issue—a good sign for future growth when or if new operators seek to peer at the IXP and when international networks are allowed to peer at the IXP.

## Last mile connectivity

There appears to be a good deal of competition between ISPs, mainly in Bishkek and the Chuy region, using wireless technology. The main constraint within Bishkek appears to be spectrum assignments, particularly in the 800 MHz band for advanced LTE (long-term evolution) service, which will become available after the digital TV broadcast switchover. In addition, we understand that there is little sharing of communications infrastructure, including towers, ducts, or the radio access network (RAN)—all of which could help lower costs.[16]

Outside Bishkek, the constraints on last mile access relate to domestic connectivity, as discussed, as well as a smaller potential market size, typical of rural areas in every country. We believe that constraints on spectrum are fewer given the lower demand, and that the ability to roll out a network with the latest LTE technology can lower the upgrade costs in the future.

[14] Kyrgyz IXP Regulation Minutes No. 2, 26 June 2013.
[15] We have observed—around the world—that neutral location and neutral management is critical to the success of an IXP.
[16] Infrastructure sharing is a well-recognized international best practice to stimulate competition and avoid unnecessary construction in urban areas.

We also understand that there are several fixed Internet providers, including the incumbent; but we did not hear of plans to expand their coverage, nor of roadblocks that might prevent them from doing so if they wished. It appears that no company currently has plans to significantly expand their fixed access network.

# Demand-Side Issues

## Content

Locally relevant content is a key way to increase the benefits of those already online, while also helping to encourage nonusers to get online for the first time. We generally adopt the expansive view that, ultimately, users decide what content is relevant to them, whether it is locally produced or foreign; but we note that several aspects are critical to content being deemed relevant.

1. **Language.** The dominant language for the majority of online content is English, which may only be relevant to a small portion of the Kyrgyz population. While there is a significant amount of online content available in Russian, not all of it is necessarily relevant to Russian speakers in the Kyrgyz Republic. According to our understanding of the local situation, content in the Kyrgyz language, which may be particularly important to attract rural users, is lagging behind.

   Wikipedia, the online, user-generated encyclopedia, is a leading website with content in Kyrgyz. This is due, in part, to the efforts of the Soros Foundation. But, the results are nonetheless telling: there are currently almost 5 million articles in English that may be of little value, and 1.2 million in Russian that would be of more value locally. The number of articles in Kyrgyz is 30,201; with 41 active users.[17]

2. **Location.** Where content is hosted is important for two reasons. First, content hosted abroad must be delivered into the country via relatively expensive international connectivity (see page 10); this cost is paid by local ISPs and passed on to Kyrgyz end users. Second, content hosted abroad may be slow to upload in the Kyrgyz Republic; this latency makes the content less attractive to users.

In August 2015, Dyn[18] tested the latency of accessing a number of websites from the perspective of a user in the Kyrgyz Republic (Figure 8). Website rankings are based on the Alexa list of Kyrgyz websites.[19] For the most part, the results were encouraging.

Results indicate that there is already significant content hosted locally (e.g., Elcat.kg and Ts.kg), and that the latency for accessing those websites locally is extremely low. Further, other websites are accessed in Russia, such as Google.com and Mail.ru, and the latency for accessing these websites is also quite low, although Google.com is much faster when accessed on a server hosted in Bishkek. Websites hosted further abroad, such as Facebook, are noticeably slow, which impacts throughput[20] and likely suppresses usage.

[17] See https://en.wikipedia.org/wiki/List_of_Wikipedias for more details.
[18] http://www.dyn.com.
[19] http://www.alexa.com/topsites/category/Top/Regional/Asia/Kyrgyzstan.
[20] Throughput is affected by how far content has to travel across networks (distance), how long it takes for the content to travel (time), and the quality of the networks that the traffic travels across (latency). See also, Wikipedia, https://en.wikipedia.org/wiki/Throughput.

| Ranking | Website | Location | Latency |
|---|---|---|---|
| 1 | Google.com | Kazakhstan | 48ms |
| | | Bishkek | <1ms |
| | | Russia | 59ms |
| 3 | Elcat.kg | Bishkek | <1ms |
| 4 | Mail.ru | Russia | 56ms |
| 5 | Facebook.com | US | 195-262ms |
| 9 | Ts.kg | Bishkek | <1ms |
| 12 | Wikipedia.org | US | 180ms |
| 23 | Kinogo.net | Netherlands | 121ms |
| 31 | Valuta.kg | US | 258ms |

Figure 8. Website Latencies for Kyrgyzstan (Sources: Dyn, Alexa 2015)

Although it is true that the content hosted in Russia has reasonable latency, given the proximity the cost of access over international transit connections is the same for content in Russia or in the United States. This cost can be significant, particularly given the amount of Internet traffic that is coming in from abroad—as high as 80% of all traffic. Latency can have a significant impact on usage. For example, we know that when Akamai installs a cache[21] locally, throughput significantly increases; as a result, usage can up to double within months as users enjoy faster content-upload speeds.[22]

The minimum prerequisites for hosting content locally are a data centre and an IXP. The data centre will host servers that contain content, provide backup power and technical support, and the ability either to connect directly to other data centre customers or to transit to access ISPs outside the data centre. The IXP enables the content to be exchanged domestically within the country, rather than being exchanged outside the country over expensive international links.

While each ISP in the Kyrgyz Republic has its own data centre, we understand that, as yet, there is no carrier-neutral data centre—a common scenario in markets where the Internet ecosystem is growing. A neutral data centre will typically be connected to at least two separate ISPs for transit; customers benefit from competitive transit offers, which is not the case at ISP-owned data centers.[23] Nonetheless, there is at least a choice of data centers between the ISPs. Further, each ISP is connected to the national IXP, thus all content hosted locally can be exchanged through the IXP for local end users.

Foreign content, such as YouTube videos, may be stored locally in caches on servers that keep copies of each video viewed locally; the next time the locally cached videos are requested, they are accessed from the local cache instead of internationally. There are at least two Google caches in the Kyrgyz Republic hosted by ISPs. We understand that the content from these caches is shared through the IXP to benefit the other ISPs.

[21] https://en.wikipedia.org/wiki/Cache_(computing); Latency: "Typically measured in milliseconds (ms), latency is a measure of the delay in the round trip time (RTT) required for a packet of data to reach and return from its destination, see http://www.internetsociety.org/ixptoolkitguide.
[22] For more details, see http://www.internetsociety.org/news/local-internet-hosting-opportunities-key-furthering-internet-development-emerging-economies.
[23] The term *neutral* also generally means that a data centre will not discriminate among the networks connected to it.

More-dynamic content, such as Facebook, that changes frequently (unlike the YouTube videos), can efficiently be delivered via content delivery networks (CDNs). One of the largest of these CDNs is Akamai Technologies. We understand that today there are no such CDN nodes in the Kyrgyz Republic. One large provider—mail.ru—considered placing a cache locally, but requested a payment for it; no ISP was willing to pay.

### Security

Another key consideration of a healthy Internet environment—one that is critical to promoting trust and usage of the Internet—is security. Security surfaced as an important issue during several discussions we had with local stakeholders. The main threats mentioned were linked to cyber crime, extremism, and terrorism.

While the Kyrgyz government recognizes the importance of cyber security, according to two sources interviewed the criminal code should be updated in this regard: the means to penalize cyber criminals should be developed for national authorities. The current lack of legal certainty creates space for cyber criminals to operate in ways that, in the long term, may hamper users' trust in the Internet. While the government has a specific role, it is important to include and consult all affected parties (e.g., businesses, the technical community, and civil society) in discussions regarding potential security solutions. The Internet is a network of networks without a centralized control. Security of the Internet cannot be attained or maintained by any one entity; it should be a collaborative effort[24].

In line with global developments, the Kyrgyz Republic is experiencing an increase in the use of the Internet as a platform for extremist and terrorist activity. We understand that the government has introduced new measures in an effort to counter this threat, including increased surveillance and interception of Internet traffic. Extrajudicial blocking of websites on the basis of extremism has also been discussed. While we recognize that the cyber security threat is present and widely felt across the globe, some of the measures taken or to be taken risk harming users' confidence in the Internet and, consequently, compromise opportunities for economic and social prosperity. We believe it is essential to continue the global, regional, and national discussions among the different stakeholders in order to find an acceptable balance between security and other considerations, such as user privacy.

## Government Issues

Even with market dynamics in full play, the Kyrgyz government remains a key stakeholder in promoting both national Internet connectivity and the digital transition, as well as in safeguarding an open and competitive telecommunications market. Governments can be key drivers of Internet technology. We recommend widespread use of technology in government offices, so that access to and use of the Internet becomes more common and part of daily internal operations.

[24] For more details, see http://www.internetsociety.org/collaborativesecurity.

## Regulatory Environment

As noted, the Kyrgyz Republic has a separate regulatory authority, the State Communications Agency.[25] The regulator has licensing, monitoring, and analytics functions, that guide and support national Internet development efforts. The telecommunications licensing rules in the Kyrgyz Republic appear to be transparent and nondiscriminatory. According to the regulator, the same procedures and licensing fees apply to both domestic and foreign companies.

The State Communications Agency also gathers Internet traffic data. However, this information is not public; it cannot be used to analyze the local Internet ecosystem. Based on our research, the Kyrgyz Republic is the only country in the Central Asian region that does not allow the ITU to share its Internet traffic data with wider audiences. The trend internationally is for regulators to make data available about the local communications environment on their website, ideally in multiple languages.

In addition to the State Communications Agency, several other state agencies play a role in overseeing different components of the domestic Internet environment. The Antimonopoly Committee controls prices for Kyrgyz Telekom; the State Agency for Architecture and Construction handles permits for laying fibre and setting up ducts, masts, and mobile towers; and the Border Control Agency oversees border area construction including fibre crossing over international borders. Whereas the tariffs for Kyrgyz Telekom are public, we heard from several sources that the rules and procedures for fibre crossings on international borders are not always clear. International best practices emphasize the efficacy of establishing rules, procedures, and guidelines that are clear, transparent, and publicly available in multiple languages.

## Government Policy

During our discussions, the Kyrgyz Ministry of Transport and Communication outlined three priorities in the communications sector, in line with the National Sustainable Development Strategy 2013-17 (NSDS)[26]: construction of new fibre-optic infrastructure; development of e-government services; and transition to digital television and radio broadcasting.

These policy pillars can significantly help reinforce the national connectivity infrastructure and increase the nationwide adoption of the Internet. Specifically, the Programme and Action Plan for introducing e-governance in the Kyrgyz Republic in 2014–2017 [27] (adopted by the government in November 2014) has great potential to contribute to the national Internet environment in the following areas:

- **Reinforcement of nationwide Internet infrastructure.** E-government programmes are only effective if they are accessible to all citizens and businesses. The Kyrgyz programme recognizes that it may be necessary to create a secure national telecommunications network to ensure the uninterrupted performance of e-governance systems. We understand that this network would be established based on existing public and private networks, with extensions based on public-private partnerships where

[25] ITU: http://www.itu.int/ITU-D/icteye/DisplayCountry.aspx?code=KGZ.
[26] https://www.imf.org/external/pubs/ft/scr/2014/cr14247.pdf.
[27] http://mineconom.gov.kg/Docs/1/PPEU.pdf.

necessary. The programme also foresees the creation of a dedicated data processing centre to serve the e-governance programme. We would assume that there will be a redundant facility for this programme.

- **Local content and Internet services.** E-government programmes in general help increase Internet adoption by offering locally relevant content and services in the local language(s). The Kyrgyz programme rightly emphasizes the need for interactive services, which would raise the level of openness of the public administration and increase citizen participation. Examples of such services are Internet-based public consultations and streaming political hearings, both of which give citizens and businesses new opportunities to engage and influence. The development of mobile applications is another critical way to promote high mobile broadband penetration in the country.
- **E-skills and digital literacy.** ICT skills, both related to government staff capacity and to digital literacy and skills amongst the population, play an important role in delivering effective and sustainable outcomes. While the e-governance action plan emphasizes businesses as a key partner, wider partnerships with the nonprofit, academic, and technical communities may also prove beneficial in the longer term.
- **Community access centers.** In order to promote Internet use and stimulate small business development, the government could partner with, for instance, international partners to create Internet hubs in existing community gathering places; access would need to be open and affordable. These community access centers are a natural location for local training events and mentoring programmes where youth could help train each other and help increase local technical capacity.

The Kyrgyz Republic still experiences challenges with connectivity in rural and remote areas. Based on the discussions we had, these challenges are primarily linked to the weak business case for investment, low levels of digital literacy, the geography, and an inconsistent energy supply in some rural areas. In addition, despite the fact that, in general, the government is aware of the benefits of infrastructure sharing and open access, these strategies have not been systematically pursued. Looking at the planned national and international transport and energy infrastructure projects listed in the NSDS 2013–17, there appears to be plenty of potential for cost and resource rationalization, as well as for additional competitive terrestrial fibre development.

While the Ministry of Transport and Communications carries the responsibility for the implementation of the national policies and programmes in the areas of connectivity improvement and e-governance, international organizations such as the United Nations Development Programme (UNDP), the World Bank, and the International Financial Corporation (IFC) remain key advocates and resources on the ground. Given that the UN's new Sustainable Development Goals (SDGs) include horizontal ICT objectives and funding that will be distributed to UN agencies, there should be an opportunity to work with UN agencies to augment or develop ICT projects and digital literacy.

It is commendable that the Kyrgyz government has established such wide global partnerships in its efforts to develop its Internet environment. Ultimately, however, to make real progress the highest levels of the Kyrgyz government must be willing to take ownership of its national initiatives in the area of ICT, to reassess the cost of international connectivity and competitiveness, and to mobilize its resources.

# Recommendations

Based on our review and subject to further consultations with stakeholders, we recommend that the following policies and regulations be employed to increase Internet connectivity and usage in the Kyrgyz Republic.

## Supply-Side

### International connectivity

Following are three potential ways to increase international capacity and lower prices:

1. **Short term.** Investigate on the Kyrgyz side why currently there is such a difference between the cost of capacity in Kazakhstan and that in the Kyrgyz Republic; and work to remove barriers to lower the cost in the Kyrgyz Republic. We also recommend avoiding a monopoly at the border, even if the resulting prices are regulated.

2. **Medium term.** The next step could be for the government to arrange for the purchase of bulk capacity across the border at a suitable volume discount, and then to pass that discount on to ISPs and other operators, possibly with the help of international donor organizations.

3. **Long term.** Work with international financial institutions to agree to regional connectivity and electricity projects, including a terrestrial cable that passes through Kyrgyzstan to the south and connects with Pakistan, either via an electricity transmission project or a separate network. If this is done, open access to the resulting capacity is critical, so that artificial bottlenecks cannot increase prices.

### Domestic connectivity

It is our understanding that the existing terrestrial capacity is available to all providers, and that providers are allowed to develop their own infrastructure—a daunting task, given the expense. The most effective way to increase domestic connectivity is to share infrastructure via the following two strategies:

- **Have the government make existing and new national networks available for fibre deployment.** This includes road, rail, and electricity networks, which can be built to include fibre links. As the government is building a new road to Osh, we recommend that an open access fibre duct be deployed at the same time.
- **Encourage operators to share access.** When operators build networks themselves, allow them—even encourage them—to share construction costs in order to build more capacity and enable competition. Any deployment undertaken with government resources should make provisions to enable open access by other operators at reasonable rates.

The existing IXP fills its technical function in a satisfactory manner, but there remains room to expand and diversify its role to strengthen the Kyrgyz Republic's Internet ecosystem. In light of the importance of content

and the increasing and expanding membership of the IXP, we offer the following ways to 1) increase the value of the IXP to its members, 2) diversify the IXP's membership base, and 3) attract more content.

- The Kyrgyz Association of Telecommunications operators could change the association's General Provisions to enable government networks and other nontraditional operators (e.g., banks, national research and education networks, and content-delivery networks) to peer at the IXP, and to work with government ministries to change related rules, regulations, and laws to accommodate this change.
- In order to attract international and regional networks and content, consider allowing international operators and CDNs to peer at the Kyrgyz IXP.
- In order to better plan for long-term business sustainability, establish separate business and technical committees. Also, publishing the IXP members' agreed peering policy, traffic statistics, contact information, and any other relevant information on the association's website is considered an international best practice and will help the IXP attract new members, especially global operators.
- In order to increase technical resiliency, consider establishing additional Points of Presence (POPs) in Bishkek both for redundancy and to provide association members in various parts of the city with a shorter fibre path to the IXP.
- In order to provide better connectivity in secondary cities, consider setting up an IXP in Osh to help provide faster and cheaper local traffic exchange in the south.

The Internet Society is well connected in the global IXP community; it can support these efforts by sharing international best practices, equipment provision, and training, and by facilitating contact with international stakeholders.

## Last Mile Connectivity

The recommendations outlined in this report will trickle down to the ISPs, who will benefit from more domestic and international capacity and lower prices. In addition, several measures can be undertaken by local stakeholders to further promote and advance connectivity in Kyrgyzstan's remote and rural areas.

- It is important to ensure 1) that mobile providers have sufficient spectrum available, and 2) that spectrum is assigned in a way that ensures competition, efficient use, and fair access, and includes the publishing of spectrum tables as suggested by the ITU following international best practices.
- The government should consider the adoption or revision of regulations to enable—or even facilitate—the sharing of infrastructure, including towers, back-haul networks, and the radio access network (RAN).
- Community-based connectivity projects and public private partnerships can help connect and empower remote local communities. The Wireless for Communities[28] project in India, an initiative by the Internet Society and the Digital Empowerment Foundation, is an example of how to create local sustainable businesses and provide service to schools and community centers. The CASA-1000 project and other ongoing infrastructure projects may offer a means for additional energy options and fibre rollout.

[28] Wireless for Communities, http://wforc.in.

# Demand-Side

## Content

To increase the amount of locally accessed content, we strongly encourage members of the local data-centre ecosystem to seek opportunities to host and share more caches and CDN nodes. It is very common in many countries to have several CDN caches both at IXPs and in individual service-provider networks. The government can help by developing more content and hosting it locally. This could make the Internet more relevant for local users and could help to train developers who, in turn, could develop more content for other enterprises or start their own companies.

## Security

Collaboration among a broad set of stakeholders is central to achieving effective, trust-enhancing security solutions. Practical ideas for platforms on which different parties can cooperate and exchange information include Computer Emergency Response Teams (CERTs), other taskforces, and public/private partnerships comprising experts from government, business, and the technical community.

# Government

The government can play an important role in promoting national Internet ecosystem, on both the supply- and demand-side, and to plan for longer-term strategic development. Following are several steps the government should take to accelerate Internet development efforts in the Kyrgyz Republic.

- By implementing the recent e-governance strategy, the Kyrgyz government can contribute to the creation of locally relevant content and services and promote the adoption of the Internet among all local communities. Ideally, the implementation of the e-governance strategy would also include campaigns to increase digital literacy.
- Collecting and sharing Internet traffic data is critical for establishing where the country stands and how it is progressing with respect to its Internet ecosystem and any corollary economic analyses that are required.
- To accelerate and rationalize efforts to expand the domestic Internet infrastructure, the government or the State Communications Agency should consider mapping existing and planned optical fibre infrastructure. This would provide a base for further investment to the ISP community and illuminate areas where government support is needed.

# Conclusion

Kyrgyzstan's well-trained technical community holds strong promise for a growing Internet ecosystem. Stakeholders, including the government, the private sector, and international organisations, should work together to continue liberalization of the communications infrastructure and to provide more accessible connectivity for both local and international operators. As is evidenced around the world, connectivity and Internet access are commensurate to economic well-being, innovation, and efficiencies.

While Kyrgyzstan's land-locked status and geographic location present challenges, there exist ways to leverage today's technology, government policies, and regulatory actions in order to provide the country with greater Internet access, create regional bridges across Central Asia and Russia, and improve regional connectivity.

# Additional Resources

The Internet Society has published a number of papers and additional content related to this issue. These and other relevant documents are available for free access on the Internet Society website.

- Internet Society: Internet exchange point (IXP) information Web page, http://www.internetsociety.org/what-we-do/issues/internet-exchange-points-ixps.
- *The Internet exchange Point (IXP) Toolkit and Best Practices Guide,* http://www.internetsociety.org/ixptoolkitguide and www.ixptoolkit.org.
- *Promoting the Use of Internet Exchange Points: A Guide to Policy, Management, and Technical Issues,* by Mike Jensen, http://www.isoc.org/educpillar/resources/docs/promote-ixp-guide.pdf.
- *Assessment of the Impact of Internet Exchange Points (IXPs): Empirical Study of Kenya and Nigeria*, http://www.internetsociety.org/ixpimpact.
- *Connectivity in Latin America and the Caribbean: The Role of Internet Exchange Points,* http://www.internetsociety.org/sites/default/files/rpt-LACIXPvrt-201311-eng_0_0.pdf.
- *Report from the IGF Rio Best Practices Session Internet Traffic Exchange in Less Developed Internet Markets and the Role of Internet Exchange Points,* http://www.isoc.org/educpillar/resources/docs/igf-ixp-report-2007.pdf.
- *Towards Efficiencies in Canadian Internet Traffic Exchange,* http://cira.ca/sites/default/files/attachments/publications/toward-efficiencies-in-canadian-internet-traffic-exchange.pdf.
- OECD's report on Internet Traffic Exchange, http://www.oecd-ilibrary.org/science-and-technology/internet-traffic-exchange_5k918gpt130q-en.
- Internet Society *Global Internet Report 2014,* http://www.internetsociety.org/doc/global-internet-report-2014, and *Global Internet Report 2015,* http://www.internetsociety.org/globalinternetreport/.
- *Promoting Local Content Hosting to Develop the Internet Ecosystem,* http://www.internetsociety.org/news/local-internet-hosting-opportunities-key-furthering-internet-development-emerging-economies.

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