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Impact of COVID-19 on the Internet Ecosystem in the Middle East and North Africa

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Executive summary

The Coronavirus (COVID-19) pandemic has increased reliance on the Internet, in light of widespread lockdowns and requirements to socially distance. It has allowed family and friends to keep in touch, businesses and governments to continue functioning, students to learn, and patients to access healthcare services. This surge in reliance on the Internet highlights the need to both increase Internet infrastructure and close the digital divide.

Internet infrastructure encompasses access (including international and national fiber networks to deliver traffic between and within countries), interconnection between networks at Internet Exchange Points (IXPs), and content and services hosting at data centers. While the Internet has proven to be resilient to the increased demand, governments can still make improvements to address the needs of the crisis, as well as the longer-run requirements to bridge the digital divide and transform to a digital economy.

In the short run, during the crisis, it has generally not been possible to build or update infrastructure, given the time needed, the restrictions on travel, and the need for social distancing. Instead, to accommodate increased demand, regulators in a number of countries have made more spectrum available to operators to provide more bandwidth, and a number of streaming services have reduced the definition of their video to decrease the traffic generated. To make the increased usage more affordable, operators have increased their data caps, and are sometimes not counting access to educational and healthcare services against these caps, often in coordination with the regulator.

In the medium run, when the lockdown and need for social distancing have ended, but before new infrastructure can be built, governments can take additional actions to meet demands for increased Internet infrastructure. These include boosting competition for international and national capacity, providing more spectrum to mobile operators and other providers, and developing regulations to promote more local content hosting. To maximize local traffic exchange, any restrictions on access to a local IXP should be removed. The use of digital payments should also be introduced or increased, in order to promote the digital economy.

Finally, in the long run, when it is possible to build more infrastructure, a national broadband plan should be adopted or updated. The regulator can increase the number of licenses for access infrastructure and help to facilitate building international and national fiber. It can focus on deploying more fixed and mobile broadband, using new technologies where feasible, and new models such as community networks. The plan can also help to expand existing IXPs or support the development of new ones. In addition, government policy should aim to increase digital literacy and help to promote the creation of new content and services.

The COVID-19 crisis has highlighted how much we rely on the Internet for our work, access to government services, communication, and education. Governments should build on their responses to the crisis with longer-term planning for the Internet to become universal and affordable in their countries.

Introduction

The COVID-19 pandemic has been a profound global shock. It has required people to stay at home, if possible, and socially distance themselves from others when outside the home. Businesses, industries, schools and governments closed in many countries, limiting the ability to earn a living, gain an education, and provide important government services. The Internet has bridged the distance in many cases, allowing family and friends to communicate and entertain themselves, enabling people to work at home, helping students do virtual learning, and providing online tools, including health advice, to help fight the pandemic. On the other hand, the impact has not been universal, highlighting the need for policy and regulatory solutions to bridge digital divides.

The response to the pandemic has provided a general validation of the Internet's design, albeit under such unfortunate and unwanted circumstances.[1] The Internet has largely accommodated the increased usage and has proven resilient. However, the increased demand for access and usage has highlighted existing gaps in access and infrastructure, in terms of both the Internet access networks' reach and capacity. At the same time, the demands have changed, pointing toward needs for online content and services, for work, school, government services, socializing, shopping, health, and entertainment.

The crisis has magnified the digital divide within and between countries, while also changing the dimensions. It is important not just to consider users who are online and offline, but also those who are just marginally online. These are people who can afford a minimum level of service, but cannot afford the increased usage required to accommodate their increased needs for access. At the same time, it is not just a question of whether countries have a digital economy that can develop content and services to meet new demands—newly developing digital economies may not be able to deliver the content and services quickly enough to address the needs of the lockdown.

A number of governments and companies are responding to the challenges with innovative solutions that will help address the gaps in the markets. Many of the solutions are aimed at the short run, to address the immediate challenges of the unanticipated lockdowns and need for social distancing. At the same time, they cannot fill all the gaps with short-run solutions. Some of them will require planning, which governments and businesses should address soon. In the longer run it is possible that the new-found familiarity with online tools will result in a "new normal" where online work, education, and socializing become more acceptable and common. The changes being made now can help to make that possible.

This paper focuses on the challenges of addressing the COVID-19 crisis and its potential aftermath in the Middle East and North Africa (MENA), and builds on a previous report that provides more general policy recommendations on the same topics, outside the context of the response to the pandemic.[2]

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1. See David Belson, "The Internet Is Resilient Enough to Withstand Coronavirus – But There's a Catch," Internet Society, 13 May 2020, https://www.internetsociety.org/blog/2020/05/the-internet-is-resilient-enough-to-withstand-coronavirus-but-theres-a-catch. The catch is that last mile broadband is not widely accessible and affordable. See also https://www.washingtonpost.com/technology/2020/04/06/your-internet-is-working-thank-these-cold-war-era-pioneers-who-designed-it-handle-almost-anything
2. Michael Kende, "Middle East & North Africa Internet Infrastructure Report," Internet Society, 18 May 2020, https://www.internetsociety.org/resources/doc/2020/middle-east-north-africa-internet-infrastructure-report

Impact of COVID-19 on the Internet

Internet usage has changed in a number of significant ways throughout the COVID-19 crisis. First, total traffic is up, because of the increased demands on the network for work and personal usage.[3] This is a result of a second change, in the content and services used, in particular, the increased usage of video conferencing for work and education, and of streaming, gaming and other high-bandwidth applications for entertainment. Usage patterns have also shifted, as peak times are now spread across weekdays, with less difference between weekends and weekdays.

According to the GSMA (Global System for Mobile Communications, an industry organization that represents the interests of mobile network operators worldwide), there has been a 30 percent increase in mobile data traffic.[4] Egypt, for example, notes that home Internet consumption is up 87 percent and mobile is up 18 percent.[5] This has understandably led to decreases in the speed of fixed and mobile broadband in many countries, as networks try to keep up with increased demand. Nonetheless, operators in some countries have successfully addressed the new demands with even faster measured broadband speeds.[6]

The increase in demand comes predominantly from applications used for work, education, and social interaction and entertainment, with some popular applications seeing triple-digit growth in users and usage.[7]

- Nokia reports that in some markets, WhatsApp usage went up 500 percent in the first week of a lockdown.[8]
- Zoom saw significant increased demand for video conferencing, from 10 million daily meeting participants in December 2019 to more than 300 million in April 2020.[9]
- Facebook notes a 50 percent increase in messaging, with users spending 70 percent more time on its services.
- Microsoft Teams saw a 775 percent increase in traffic in Italy during their severe lockdown.
- In Egypt, there was a 131 percent increase in web browsing, 96 percent in Internet gaming, 69 percent in Netflix usage, 41 percent in YouTube, and 40 percent in Shahid, a Middle Eastern online video service. The Egyptian Prime Minister held a cabinet meeting online for the first time, and the Minister of Education has been active on Facebook.
- The UN Department of Economic and Social Affairs (DESA) reports that soon after the start of the crisis, 86 percent of UN Member States had updated their national portals with information about COVID-19, and were seeing increased traffic for that and other relevant services, such as Digital ID needed for social benefits.[10]

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3. See TeleGeography reports for a summary of the impact on traffic in different countries: https://www2.telegeography.com/network-impact
4. https://www.gsma.com/publicpolicy/eleven-regulatory-recommendations-to-sustain-connectivity-during-the-covid-19-crisis
5. https://www.dailynewssegypt.com/2020/04/20/telecommunications-see-significant-usage-increase-in-april-ntra
6. https://www.speedtest.net/insights/blog/tracking-covid-19-impact-global-internet-performance
7. An application is an online service or computer software that helps users perform an activity, such as communications. See https://en.wikipedia.org/wiki/Application_software
8. https://www.nokia.com/blog/early-effects-covid-19-lockdowns-service-provider-networks-networks-soldier
9. https://www.businessofapps.com/data/zoom-statistics
10. https://www.un.org/development/desa/dpad/publication/un-desa-policy-brief-61-covid-19-embracing-digital-government-during-the-pandemic-and-beyond

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It is not just about more traffic on the Internet. Usage patterns are shifting as people stay at home during the lockdown. Nokia reports that peak demand routinely exceeds the "busy hour" network capacity. For instance, while users are clearly using Netflix more during the evening (always a popular time for viewing), morning usage has gone up almost 100 percent in some markets, and weekend evening usage went up more than 50 percent, putting strain on the networks. In Egypt, the peak usage per day is normally seven hours, but is now up to 15 hours per day, as more people are at home and staying up late using the Internet.

These increases in usage are putting demands on infrastructure that must be addressed. At the same time, households are required to spend more money on Internet services to meet all the new needs for access. As a result, the digital divide is magnified: people with no or not enough access are not able to shift their lives, including work, education, and health needs, online. In many cases, new online tools must also be created or adapted to accommodate home usage, such as distance-learning solutions and frameworks. Experts need to develop these tools, while building or deepening the digital economy, under the most trying circumstances.

Infrastructure

The increased demand for access and usage falls on Internet infrastructure, including access, content, and interconnection infrastructure. Access infrastructure carries traffic from international points through national points to end users, and content infrastructure delivers content and services to end users from data centers through caches and points of presence. Interconnection infrastructure, in the form of Internet exchange points (IXPs), are used to enable interconnection among access providers, and between access providers and content providers. This infrastructure is highlighted in Figure 1.
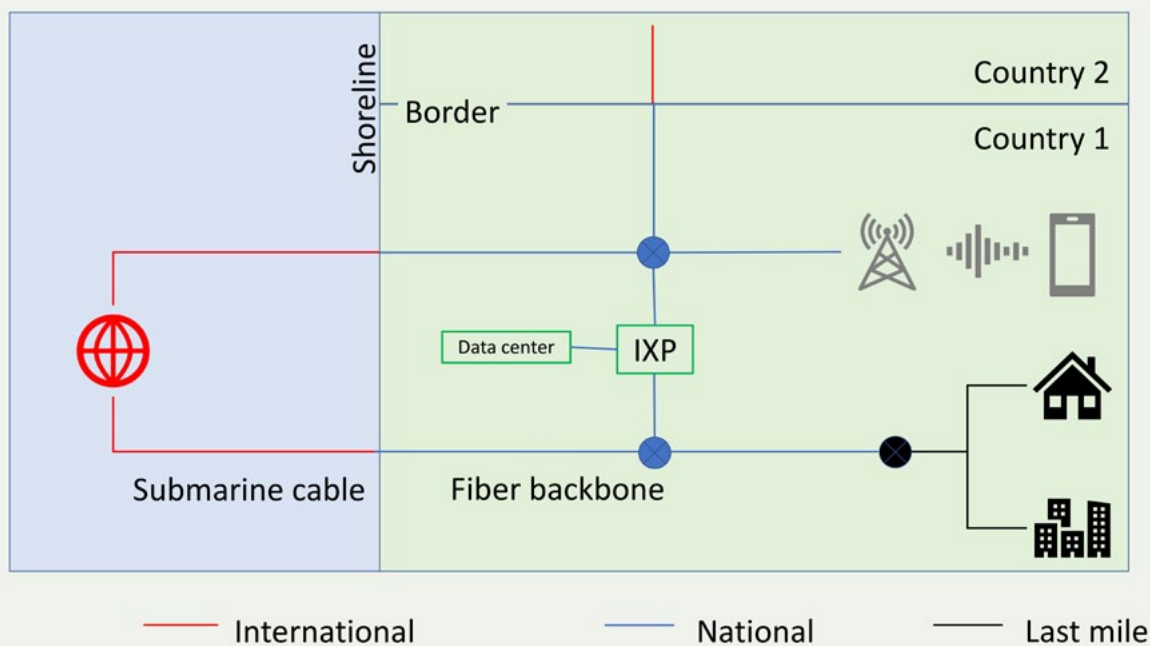

Figure 1: Internet infrastructure (Source: Internet Society)

One challenge in addressing the crisis is that it is difficult to extend or augment much of the Internet infrastructure, at least in the short run, because of the cost and time needed to upgrade existing infrastructure or build new ones. Access infrastructure can require significant civil works that take time, planning, and resources, and likewise a data center is a significant investment. Changes can be made within the infrastructure available, although some require the work of engineers, who must be able to work safely and conform to the social distancing conditions in their country. That said, the present crisis highlights longer-term changes that can be initiated now.

International and national infrastructure is important for users to be able to reach the global Internet. It is costly and time-consuming to deploy, and would certainly take longer than the current crisis—for example, a submarine cable may take two or three years to install, while national capacity can also take a significant amount of time depending on the terrain, rights of way regulations, and length.

Last mile access must be built out in order to reach users. If no infrastructure is in place, fixed broadband needs to be deployed residence by residence. This is a significant cost and requires time to do. Mobile, meanwhile, is easier to deploy, because an antenna on one tower can reach an entire surrounding cell—however, there is still a cost and time of deployment and the need to access the spectrum required to carry the signals. Additional considerations that can further raise the deployment cost include acquiring access to the rights of way, applying for and receiving regulatory permission, and deploying the infrastructure. So, at least in the short run during the crisis, last mile access infrastructure cannot be deployed, and operators must work with what they already have. As noted below, Internet service providers (ISPs) and governments are taking other steps to deliver traffic, given any constraints in their infrastructure.

Content infrastructure was deployed in no small part to lower the cost and latency of accessing content and services locally, rather than using expensive international capacity to access the content from overseas. A data center is used to host content and services, and is a significant investment which takes time to build and furnish. Content delivery networks (CDNs) will deploy caches locally with popular content, such as videos, in order to deliver the content directly to ISPs, or indirectly via an IXP. However, installing a new cache may require importing equipment into the country and installation by engineers who may also have to fly in, which may not be possible due to challenges with import customs and travel restrictions during the crisis.

In thinking about the impact of content infrastructure during the crisis and beyond, it is important to distinguish between static and dynamic content. Static content is that which does not change over time, or depending on the user—for instance, television and movie videos are static content. This type of content can be stored in a cache. Dynamic content is content that changes over time and by user, such as a video call between two or more users. It cannot be put in a cache, because it must go from user to user, and will always need to use the access infrastructure between the users. However, as we will see below, dynamic content can still be made more efficient.

Finally, an IXP (Internet Exchange Point) represents a country's interconnection infrastructure. It allows ISP traffic to be exchanged within a country, rather than using international capacity.[11] It also avoids using backhaul within the country to get to the international capacity points of presence— another significant saving—and allows efficient access to the content and services available in the country.

While developing a new IXP may not be significant from an engineering point of view, it takes time to bring together the ISPs and other stakeholders to agree to participate, before the IXP is even deployed.[12] Given the time it takes to reach agreement, restrictions on meetings, and potential challenges getting equipment, a new IXP could not feasibly be deployed in the short-run crisis.

Investing in interconnection infrastructure (IXPs) and content infrastructure makes the Internet cheaper, faster, and better. It is cheaper because local capacity is used to exchange traffic and access content in place of more expensive international capacity. It is faster because the distance that the traffic travels is shorter, the traffic is handed off fewer times, and the local lines are less congested. Finally, it is better—that is, more resilient—because there are fewer potential points of failure.

In assessing the reaction to the crisis, it is important to differentiate both the time frames in which actions can be taken and the different needs of different types of users.

Time frames: To understand the surge in demand and the required means for mitigation, we must consider three time periods. In the short run, during the crisis, no increases in access, interconnection, or content infrastructure can be built. In the medium run, in the aftermath of the crisis, regulatory changes can be made, and new equipment can be installed to make better use of the existing infrastructure. In the long run, new infrastructure can be deployed to fill gaps and address new demands. The sooner planning can start and be implemented, the better.

Internet users: To understand the nature of the required changes, we need to examine three types of users. First, the advanced user, whose usage of the Internet is already meaningful and affordable. Second, the marginal user, who is online, but cannot afford the additional access needed to meet the demands of at-home usage. And finally, the non user, who is offline for a variety of reasons, including availability, affordability, a lack of perceived need, or lack of digital skills.

These users have a set of cascading needs. The advanced user may just need more capacity to be able to address the increased need for Internet access. This increased capacity may also help the marginal user, who, in addition, needs access to be more affordable. Increased capacity and lower cost, in turn, will benefit the non user, who also needs a device, access, and possibly digital skills training.

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11. In countries without an IXP, Internet Service Providers will often use their international capacity to exchange traffic with each other in a different country. This process is often referred to as "tromboning" because the traffic will leave the country to be exchanged and then returned to the same country, following the shape of the musical instrument.
12. See https://www.internetsociety.org/issues/ixps

We highlight the relevant issues in Figure 2 below, using the example of international content or services. Some will be hosted or provided internationally, and will go through an international backbone (path 1), and then a domestic backbone to the ISP in the country, where it is delivered to the end user. This raises issues regarding the capacity and cost of the international and national backbone, as well as the capacity, cost, and availability of the ISP services in the country that deliver the content or services to the end user. Alternatively, the content and services can be hosted in a local data center (path 2) and then delivered to the ISP via an IXP, or even hosted directly with the ISP (path 3). In either case, this saves on the use of the backbone to deliver the content and services into the country each time they are accessed by an end user, while the issues of delivery from the ISP are still relevant.
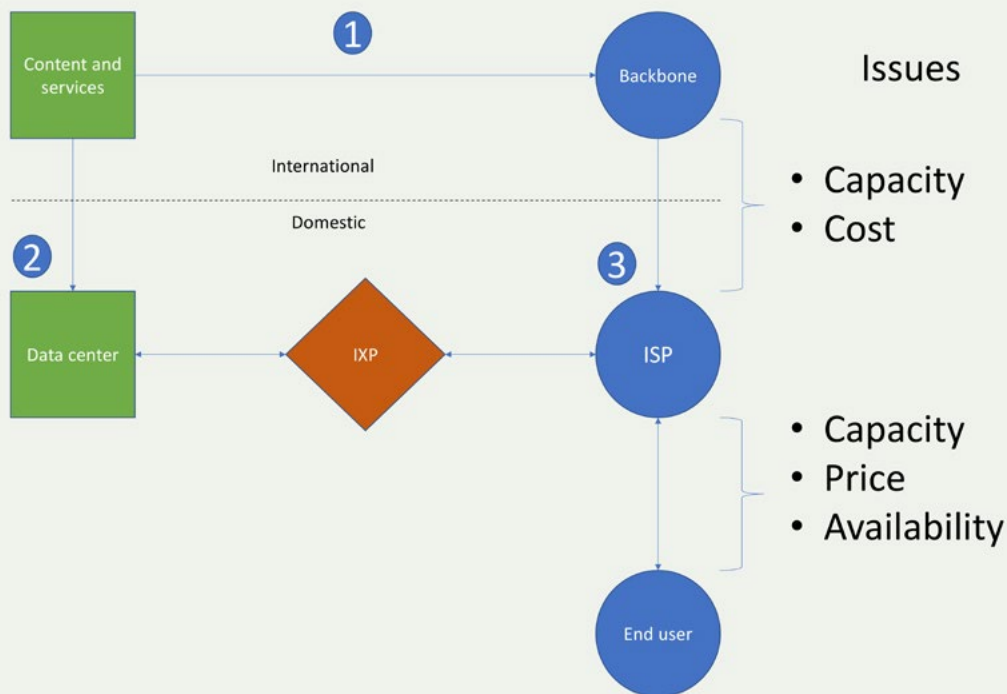
We address these issues in the next section.

Figure 2: Infrastructure issues (Internet Society)

Increased capacity to meet demand

The crisis has increased demands on the Internet, resulting in more Internet traffic, as an increasing amount of activity moves to the Internet. This traffic is flowing through international and national capacity, local data centers and IXPs, and last mile networks to end users. Any bottlenecks result in less bandwidth and slower speeds for end users, which can make services such as video conferencing difficult to use. This section examines how the increased capacity demands can be met in the short run, and over the longer term, for each type of infrastructure.

International and national capacity: In the short run, the amount of international and national capacity is basically capped by the amount of fiber that has been deployed, and it can take

a significant amount of time to deploy new capacity, likely several years, if the financing is available. However, there are other ways to address increases in capacity demand.

Some operators can expand their available capacity to meet demands. It may be that the networks have spare capacity that can be purchased or moved online in the short run—for instance, international submarine cables are typically deployed with far more capacity than is demanded at the time, with excess often available for purchase. In the United Arab Emirates (UAE), Etisalat quickly boosted its capacity, and according to the Speedtest Global Index, it has maintained the fastest mobile download speeds of any country during the crisis.[13]

Even if the capacity exists in the short run, it may be restricted because of the cost for ISPs to access the international or national capacity when buying IP transit. The cost may in turn be high because of a lack of competition or a limit in quantity. In the short run, the government could negotiate with the international and national backbone operator(s) to lower the price in the national interest, or it could provide funds to ISPs to subsidize the purchase of increased IP transit—for instance using universal service obligation (USO) funds.

In the medium run, before new capacity can be deployed, there are several ways to increase the availability of capacity and lower the cost. For example, cable owners could light any remaining fiber capacity or change technology to increase the existing capacity. Where there is little or no competition for international or national IP transit, a wholesale provider could be licensed to buy capacity in bulk and pass the volume discount to local ISPs. This wholesale provider could be developed by the ISPs or initiated as a new company. Over time, the wholesale provider could begin to buy or build capacity to create more sustainable competition. The government could also extend licenses to more operators, for instance by providing a unified license allowing mobile network operators to also access and provide international capacity directly.

In the long run, new international and national capacity, including backhaul, would have to be deployed. This may not be feasible to start during the current crisis, but the framework can be put in place in terms of licensing of new operators, including a wholesale operator. The government can also address any other regulations that may create barriers, such as limits on the ability to share infrastructure, or restrictions on access to rights of way.

Both interconnection infrastructure and content infrastructure can help reduce capacity requirements for international and national backbones. Here there is a big difference between countries with this infrastructure—data centers and IXPs—and those without it, because building it takes time. Once countries acquire this critical infrastructure, they can start to attract investment in data centers and to bring together the industry to develop an IXP in the long run.

In a country with one or more commercial data centers, there is little evidence that any short-run changes are required, other than potentially completing ongoing projects whose engineering is allowed under any social distancing requirements. Data centers are generally engineered to be resilient and address increased demand, and there is no evidence that there are issues with them in the immediate crisis. The same is true for CDNs hosting caches

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13. https://oxfordbusinessgroup.com/news/dubai-s-internet-providers-rise-covid-19-challenge

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in the countries, and although existing IXPs have seen increases in demand, with some large spikes in peak traffic, there is no evidence of any significant challenges in terms of resilience and meeting demand.[14]

In the medium run, steps can be taken to increase the capacity of the content infrastructure. In many countries, more content could be hosted in the local data centers, both provided by international content providers and their own CDNs. Any regulatory roadblocks should be identified and removed to facilitate this, in line with acceptable content, privacy regulations, intermediary liability, and cybersecurity protections.

Likewise, when it comes to interconnection infrastructure, maximizing the use of an existing IXP can also help to further reduce demands on long-distance infrastructure by increasing connections and hosting more content. For instance, in Egypt, the IXP only connects local ISPs and networks at the moment. If CDNs were allowed to directly connect to the IXP then they could deliver their content more efficiently, possibly without significant changes in the infrastructure.

In the longer run, new data centers can be built and existing ones can be expanded. New data centers require ensuring that affordable land and reliable and cost-effective power supplies are available, and addressing any content regulations that may be hindering the localization of content and services. Carrier-neutral data centers are considered best practice by content providers, allowing access to multiple fibers from different operators to provide competition, choice, redundancy, and resilience. Countries without an existing IXP, should bring together all stakeholders in order to develop and deploy one, to make traffic exchange more efficient for both content and services. Those with an IXP should explore expanding it to other neutral data center facilities in the same city and to other cities. The Internet Society stands ready to work with industry to help develop or expand an IXP.[15]

Finally, there are two ways to accommodate increased demand in the last mile—either to reduce the traffic volumes, or increase the capacity. The ability to increase capacity depends on the type of access technology.

First, in a number of countries, content providers volunteered to reduce bandwidth demands during the peak of the crisis until other adjustments were made. This is particularly true for streaming video, which takes a significant amount of bandwidth. In many countries, Netflix temporarily reduced quality in order to use 25 percent less capacity, and Amazon Prime, Disney+, and YouTube took similar steps to reduce demands on the networks.[16] Likewise, the content delivery network Akamai has been working with Sony and Microsoft to reduce the bandwidth used to download video games when there is network congestion, in order to lighten the load on networks.[17]

In addition, operators can take actions to increase capacity, depending on the access technology—which can include fixed broadband, using fiber to the home (FTTH), or the traditional copper telephony lines upgraded with xDSL technology. Mobile broadband includes 3G and 4G connections, with 5G beginning in some MENA countries. There are also

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14. See footnote 2.
15. "Internet Exchange Points (IXPs)," Internet Society, accessed 7 August 2019, https://www.internetsociety.org/issues/ixps
16. See https://www.vice.com/en_us/article/v74nna/youtube-netflix-slowing-services-download-speeds-coronavirus
17. https://www.itu.int/net4/ITU-D/CDS/REG4COVID/Display.asp?ID=50372

fixed wireless connections, which serve a residence using wireless signals, and there are Wi-Fi hotspots that are either public or commercial. In addition, a number of countries are beginning to enable community networks, typically using some form of wireless, an area in which the Internet Society is providing significant assistance.[18]

For fixed broadband, in countries with significant fiber to homes, there are unlikely to be any capacity restrictions in the last mile, given the intrinsic capacity of fiber-optic cables. Cost for users may be an issue, which we look at below. For traditional xDSL and cable TV connections, no short-run upgrades are likely to be possible. These either require upgrades in the technology, which is likely to be a medium-run fix, or extending fiber into the network, which is a longer-term fix.

For mobile broadband, many countries can increase capacity as a short-run solution, and governments can make increased amounts of spectrum available. A number of countries are already doing this:[19]

- In Oman, the Telecommunication Regulatory Authority (TRA-Oman) has provided additional spectrum for the mobile operators.
- Jordan is releasing a broad range of spectrum to Mobile Network Operators (MNOs).
- Saudi Arabia is releasing spectrum in 700 MHz on a short-term basis.
- Tunisia is making spectrum available on a tech-neutral basis.

The question is whether to make these increases long term and whether to seek a concession from the mobile operators in return, such as for lower prices. In Kuwait for instance, the Communication & Information Technology Regulatory Authority (CITRA) has provided additional spectrum to the mobile operators, and in return, the operators provide 5GB of Internet daily and free local calls during the crisis.[20] Other countries, such as Egypt, where relatively little spectrum has been assigned, should also consider increasing the amount of spectrum in the short run, and lowering the cost to enable the increased assignments to be made permanent.

Lower Internet price

The next issue is to lower the price of access and usage for users. Increased Internet usage is a result of individuals and households' increased connectivity needs for work, school, communication, and entertainment. This may require them to buy more expensive data packages, notably for pre-paid mobile broadband data, but also for other mobile and fixed packages which have data caps. As a result, affordability can be an issue for many, particularly those offline or with limited availability.

Many of the actions discussed above can help to indirectly lower the cost of accessing data. Reducing the bandwidth of video applications lowers data usage, which lowers the associated cost. Likewise, lowering the cost of international IP transit can translate into lower data costs as well.

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18. See https://www.internetsociety.org/issues/community-networks
19. https://www.gsma.com/gsmaeurope/news/how-temporary-access-to-spectrum-can-ease-congestion-during-the-covid-19-crisis
20. https://www.itu.int/net4/ITU-D/CDS/REG4COVID/Display.asp?ID=50287

A number of operators in MENA have taken direct steps to make data more affordable by increasing the data cap and/or lowering the price. This is often done in cooperation with the telecommunications ministry or regulator of the country.

- In Egypt, the government asked mobile operators to increase the data packages by 20 percent to accommodate increased usage, a cost that it is covering.
- In discussions with the Communications Regulatory Authority of Qatar, both telecom operators, Ooredoo Qatar and Vodafone Qatar, have increased the speed of fixed broadband and doubled the data in mobile packages, at no extra charge.
- In discussion with the Telecommunications Regulatory Authority (TRA) of the United Arab Emirates, the two operators, Etisalat and Du, provide free mobile broadband to homes without fixed broadband.
- TRA-Oman urged providers to review prices with a view to providing affordable offers.
- In Lebanon, the state-owned fixed operator doubled its customers' data caps free of charge, and doubled the speed of unlimited packages.
- In Saudi Arabia, the three mobile operators are allowing quarantined customers to not pay their bills during the crisis.
- Bahrain's Parliament has asked its TRA to make the telecom providers set special rates that enable citizens to work from home with enough data.[21]

In addition, operators have taken more targeted steps to lower the cost for targeted applications and users, notably students and healthcare workers, which we describe below. There are other ways that governments can help to lower the price of access. They can lower or remove taxes on data packages throughout the crisis. They can also lower or remove taxes on the sale of devices, as well as any import duties and other taxes. This can be done immediately and also in the longer run.

Increase availability and adoption

Perhaps the greatest challenge, particularly in the short run, is to increase Internet adoption, although this is a long-standing issue. It is particularly challenging because some of the ways to accomplish this are difficult under conditions of lockdown and social distancing. For instance, shared access to the Internet, such as in an Internet café, is not feasible, nor are public Wi-Fi hotspots if they are in locations that do not reach households under a lockdown. Likewise, in-person training in digital skills is also not feasible, other than by members of the same household.

There are two solutions to the issue of increased adoption, which vary in feasibility based on existing network deployments and the conditions of lockdown in a country. The first is to try to maximize adoption of existing deployments of fixed and mobile networks.
The second is to build out where no networks exist and then, again, work to maximize adoption of the newly available service. In both cases, where there is availability, the issues are the affordability, availability of relevant content, and the digital skills to be comfortable going online.

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21. https://www.zawya.com/mena/en/business/story/Special_Internet_rates_proposal_approved_in_Bahrain_during_Cov-id19-SNG_173385901

One source of Internet access that is already widely available in all countries in MENA, but not adopted, is mobile broadband. Essentially every country has availability covering at least 90 percent of the population, so the safest and quickest way to increase access is to increase use of mobile broadband.[22] In addition, some of the countries have widespread fixed broadband networks, either built off the existing fixed network, or newer fiber networks, which are also not fully adopted.

In this light, the steps above to lower price and increase capacity will be helpful, but may not be sufficient. One of the barriers to wider adoption in countries is the price of access. The steps above to decrease quality of streaming video and lower taxes will help to lower the cost of access and devices. Governments may need to further subsidize access for lower income users, which may be the most cost-efficient way to bring people online. For instance, in Qatar the two mobile operators are waiving connection fees for new subscribers and also introducing new affordable mobile broadband services.

Regardless of the type of connection, a household without access also needs the essential equipment, including a modem for fixed broadband and at least one device for accessing it. The same is true of mobile broadband—at least one device is needed. The device could be picked up in countries where the relevant shops are open, or it could be delivered where they're not. In some countries, telecom has been declared an essential service, which enables telecom workers to travel and help install or maintain equipment at residences.

To upgrade existing broadband networks and extend them in the longer run, a national broadband plan is important.[23] Many countries have these plans, but they should be updated and/or implemented. The plans should include ways to lower costs through shared infrastructure for deployment and upgrades, mapping and measurements of broadband availability and services, and how to reach the new areas. They should also include a broad range of technologies, including Wi-Fi connections to enable further access, as well as exploring satellites, balloons or drones where relevant and feasible. The plans should focus on access and cost of access, but also ensure resilience of access in a future crisis.

In addition, new models for provision should be considered. Public Wi-Fi hotspots are a common way to provide access in popular areas, including airports and other transportation terminals, government buildings, and outdoor areas. Community networks can also help to address connectivity gaps in urban, remote, and rural areas. These are do-it-yourself networks built by people for the use of people, and here again the Internet Society stands ready to assist with policy and regulatory considerations, including spectrum issues and licensing, and to also provide assistance to the communities seeking to deploy networks.[24] In particular, unlicensed spectrum should be made available to enable Wi-Fi solutions to be implemented.

Another barrier is skills. It would be difficult to provide training under any conditions of lockdown— it would need to be carried out through the device itself and build on existing digital skills programs. This will be the subject of a forthcoming Internet Society report.

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22. See footnote 2.
23. For further details, see https://www.broadbandcommission.org/publications/Pages/SOB-2019.aspx
24. For more information, see https://www.internetsociety.org/issues/community-networks

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Summary

Much of the Internet infrastructure—both for access and content—is fixed for the duration of the current crisis. That is partly because it takes significant time and resources to build the infrastructure, and partly because of the challenges of deploying infrastructure safely during a pandemic, and the financial pressure that operators are facing. Nonetheless, a number of mitigation tools are available to accommodate increased use at affordable rates for users, while also bringing new users online.

In the medium run, while the pandemic continues to affect countries across the world, it is still difficult to build significant new infrastructure. However, policies and regulations can be implemented to help to use existing infrastructure more efficiently and affordably. Finally, for the long run, new infrastructure is needed in many countries. This was already much needed to ensure digital inclusion and develop a fully digital economy, but it will also help people adapt to a "new normal" of Internet uses and habits that outlast the pandemic.[25]

Content and services

Affordable access to the Internet is critical because of the increased need to use content and services during the crisis while staying at home and social distancing when leaving the house. In addition, new content and services are helping to address the pandemic itself, notably tele-health services.

Content and services, by nature of being virtual, do not have the same cost constraints as physical infrastructure. If a movie can be streamed once, it can be streamed a million times—it no longer has to be printed on a disc, boxed, and shipped. Of course, increased use puts a strain on the networks, as addressed above, but CDNs are engineered to deliver such content efficiently. Likewise, once an application such as video conferencing has been developed, it can be downloaded and used around the world, with no limits. Again, the service must be able to accommodate increased demand, but the underlying systems are generally engineered for this.

Thus, in the short run, existing content and services can meet the new demands for individuals and households at home. What cannot be done so quickly is filling local gaps in content and services. This could be because existing content isn't in the right language, or a particular e-government service hasn't been developed yet. A country with a growing digital economy could likely begin to fill these gaps in the medium term; a country without a digital economy may take longer, as first it must develop the innovation infrastructure needed to create the tools.

The content and services required for the crisis and its aftermath fill a number of needs, for communications, work, socializing, entertainment, education, and healthcare, among other categories.

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25. See footnote 2 for a link to a description of long-run efforts needed to increase deployment of infrastructure in MENA.

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Communications

Communications services have seen a significant increase in usage, including enabling voice and video calling. These can be used for work as well as social interactions, and the main providers such as Zoom, Microsoft (Skype, Teams), Cisco (WebEx), Apple (Facetime), and others have seen triple-digit growth in usage. These services are banned in some countries in MENA because of their impact on the revenues of traditional providers, but the UAE, Oman, and Bahrain have recognized the value of such services and temporarily lifted those bans. Because these are end-to-end communications, they cannot be cached. They are also sensitive to latency, requiring a significant amount of bandwidth, particularly for video calls. In this respect they benefit significantly from the policies above to increase capacity and lower the costs of data packages. The likelihood is that, with the increased familiarity and comfort with such tools, and with lingering worries about travel and human contact, their use will not revert back to previous levels, even post crisis. Therefore, stakeholders should plan for a higher baseline of usage.

Social media applications, including Facebook, Instagram, WhatsApp, Twitter, Snapchat, and others, have also seen increases in usage. While these are often used for social purposes, they have also been used to convey news and information about COVID-19—for instance, the World Health Organization (WHO) has been using WhatsApp.[26] As these social media services have audio and video communications built in, the same regulatory and usage imperatives apply to them as other communication services. Countries not allowing WhatsApp are blocking access to this information, among other communications.

e-Government services

Critical government services must be delivered online during any shutdown. This allows the government's internal functions—including the executive and legislative branches, which face many of the same constraints as other enterprises in moving work online and use many of the same tools—to stay in touch. Here we focus on the delivery of two particular services relevant to the crisis: education and healthcare.

Education: According to a United Nations Educational, Scientific and Cultural Organization (UNESCO) estimate, 1.2 billion students have not attended school during the crisis.[27] This has put extreme stress on even the most advanced educational systems. Teachers have had to transfer their classes online, while students must have a device and Internet access in order to follow the classes. In many cases, online tools are required or helpful to provide free access. Stakeholders, both international and domestic, have made a concerted effort to assist in this challenge.

In Egypt, for example, in addition to increasing the amount of data in Internet packages by 20 percent at no extra cost to the subscriber, the government allowed educational websites to be accessed without counting against the data package at all. These websites have seen a usage increase by almost 400 percent. Avaya, in conjunction with Orange Egypt, has offered Egyptian

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26. https://www.who.int/news-room/feature-stories/detail/who-health-alert-brings-covid-19-facts-to-billions-via-whatsapp
27. https://en.unesco.org/covid19/educationresponse/globalcoalition

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educational institutions free access to a collaboration app that allows students to access materials and interact with teachers, and also lets parents and teachers communicate.[28]

In Oman, the Ministry of Education and TRA-Oman have provided free access to all educational institution websites. Likewise, in Bahrain, TRA has ensured free web browsing for students to promote distance education. In Morocco, all the mobile operators, in conjunction with the Ministries of Education and Trade, offer free Internet access to online educational portals.[29]

Lowering the cost of accessing educational websites can be done quickly, and existing websites and educational tools can be scaled up or adapted to the current crisis. In addition, many international online teaching resources are available, which can be fairly quickly adopted, along with online courses that already exist. That said, if the courses need to be adapted to the local language and curriculum this would take more time to implement. And, of course, the household needs sufficient Internet access and enough devices to accommodate parents and extended family who need to work and siblings who may also need to study online.

Healthcare: Health applications are critical for a number of reasons during this health crisis. Individuals can use them to research public health information, self-diagnose for COVID-19 and learn what to do in case of symptoms, and receive tele-medicine services for COVID-19, as well as other conditions. The relevant platforms need to be available and users will need to use the Internet to access the platforms, as covered above. In the UAE, for instance, the two operators; Etisalat and Du are providing free mobile broadband data to reach health applications.

Likewise, healthcare workers and institutions need Internet access in order to keep in touch with each other and with other patients, and to collaborate with other healthcare facilities and learn from their experiences, within the same country or abroad. In Egypt, for instance, the National Telecom Regulatory Authority (NTRA), along with the Ministry of Health and Population, worked with the mobile operators to provide 10 GB of mobile data free per month (along with 3,000 minutes) to all doctors, nurses, and hospital workers. The operators in Qatar are also providing upgrades for employees in the health sector and increasing Internet capacity for the health sector.

At the same time, new apps have been developed to help manage the crisis—such as contact tracing, to help track people who have been in contact with people diagnosed positively with COVID-19. Many of these apps are international (such as WHO's use of WhatsApp) and are being made globally available. However, domestic services are also needed, which can be built on existing healthcare online services. Countries without sufficient baseline online services must start to build them to address future stages of this crisis and to help with long-term health issues.

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28. https://www.tahawultech.com/vendor/orange-egypt-avaya-support-distance-learning-to-contain-coronavirus-outbreak
29. https://www.moroccoworldnews.com/2020/03/297143/moroccos-telecommunication-operators-offer-free-internet-access-to-education-websites

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Digital economy

The COVID-19 crisis has heightened the role that a digital economy can play in a country. First, it helps during the immediate crisis by delivering content and services to those isolated at home, and helping those who must be in public to socially distance. It can also help companies sell goods and services online, and help to develop critical government services. Countries with a strong digital economy can react relatively quickly to the needs of the crisis, and those with a developing digital economy should use the crisis as further incentive to develop it.

Here we address the immediate needs from the digital economy across the Middle East and North Africa. Please refer to our previous report[30] for longer-term needs to develop the region's digital economy.

Digital payments: These are a key part of any digital economy and can play a number of important roles during the crisis. First, they allow remote e-commerce transactions to take place, so that people can make purchases from their homes. Second, e-payments can ensure social distancing when people must pay for something in person, by avoiding the need to pass money from hand to hand. Third, they can allow for direct cash transfer from the government for payments to people, particularly those who have lost their jobs, to ensure that they have enough income to pay for their essentials.

In countries with existing mobile money services, there may be relatively little to do, although incentives can be provided to use them. In Egypt, for example, to promote e-payments mobile operators are rewarding users with 30 times the number of minutes or data units that were billed using online payments. In Jordan, the government is taking steps to make mobile digital wallets more widely accepted and to increase usage to help avoid the use of cash.[31]

Governments can also lower taxes on mobile money transactions, where relevant, to increase their usage, and accept mobile payments for government services, as a way to develop consumer confidence and promote adoption.

Developing digital payments in countries without them may take longer, as there may be an interplay between regulatory barriers and the cost of developing the services; however, the crisis may provide the needed impetus to begin the process—a necessary one in the development of the digital economy in any case.

Business continuity: Many businesses have had to close to accommodate social distancing, while others are severely limited in what they can do. Efforts by the Internet industry to help businesses are welcome and in some ways, essential.

For businesses that have moved online, their employees need access, which we have covered above. That said, the businesses themselves also need Internet access and possibly access to the tools required to run the business virtually. For instance, Qatar is giving small

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30. See footnote 2.
31. http://www.jopacc.com/DetailsPage/AnnouncementsDetails?ID=19

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and medium-sized enterprises (SMEs) access to business collaboration tools for free through Microsoft's cloud platform.[32]

At the same time, businesses under financial pressure may find it difficult to keep up with payments, even for vital online services. In response, TRA-Oman required telecom operators not to withhold service to small businesses, nor stop service for lack of payment. The Telecommunications Regulatory Authority of Bahrain removed fixed Internet data caps to help ensure business continuity.

These are all appropriate short-term responses. In the longer run, businesses must develop continuity plans to address any future lockdowns and perhaps plans to run the businesses differently post pandemic. A domestic digital economy can help to create these online tools.

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32. https://www.cra.gov.qa/en/Consumer/Work-from-Home

Conclusion

The steps to increase Internet infrastructure in a country, and to develop a digital economy on top of this infrastructure, are needed to ensure all citizens and countries can benefit fully from the Internet and its economic and social opportunities. The COVID-19 crisis has drastically highlighted these needs and, in many cases, rapidly accelerated solutions.

In the short run during the crisis, with its lockdowns and social distancing, Internet infrastructure and content and services are largely fixed, while demand is increasing for online work, education, healthcare, entertainment, and social interactions. Building new infrastructure takes time and finances that may not be available. New content and services also require time and finances to be developed, which is particularly hard with a developing digital economy. Instead, existing infrastructure must be supplemented and made affordable, while existing content and services are adapted and adopted for immediate use.

In the medium run, after the crisis has passed, more can be done with the existing infrastructure. New policies and regulations can be passed that permanently lower costs and increase capacity of existing infrastructure, from international and national fiber networks, through to last mile networks. Likewise, existing data centers and IXPs can attract more content and service providers in order to see the benefits of content and interconnection infrastructure on lowering the latency and cost of accessing content and services. This should not just include international providers, but also local content providers hosting their content locally.

Finally, in the long run there is time to build new infrastructure, which in many ways is addressing existing needs, but also adapting to new uses of the Internet adopted during the crisis. Governments can begin to plan for this phase by developing or adapting a national broadband plan to increase Internet infrastructure availability and ensure broader digital inclusion. The plan can reduce roadblocks for commercial or community development of Internet infrastructure, reserving government intervention for where investment would otherwise not take place, in partnerships with operators.

The broadband strategy should include a broader digital development plan that goes beyond Internet infrastructure to address demand, thereby promoting adoption and usage. For instance, the government can offer e-government services to attract users, provide digital skills training, and also help develop an ecosystem that promotes content development. In particular, the digital economy should be enhanced with widespread use of digital payments, e-commerce, and other digital tools, as well as support for innovation and startups. Individuals and companies, particularly small ones, should be given the skills to use and develop these digital tools.

The table on the following page summarizes a roadmap of actions.

Table key: Increase capacity; Lower price; Increase availability; increase adoption and usage.

Timescale	International and national	Last mile	Data center	IXP	End user	Content and service	Digital economy
Short run	Infrastructure is fixed in the short run; actions to take during crisis				Actions aimed at existing end users with existing uses		
	Lower resolution of streaming services. Ask consumers to be mindful of their use.		Generally resilient and able to address increased usage.		Lower taxes on access and devices.	Remove restrictions on the use of VoIP.	Remove taxes on digital payments.
	Use Universal Service Funds to help subsidize costs.	Increase spectrum available to mobile operators.	Ensure reliable power is available.		Increase data caps to enable increased usage; do not count access to educational and healthcare against data cap.		Lower Internet costs for SMEs during the crisis.
Medium run	Post-crisis actions to take before new infrastructure can be built				Actions to bring new users and uses online		
	Implement a wholesale operator to lower IP transit price by aggregating ISP demand. Make universal licenses available to ISPs to access this capacity.	Provide mobile operators with long-run access to more spectrum. Ensure access to unlicensed spectrum for Wi-Fi. Work with communications operators to upgrade fixed broadband, notably xDSL.	Take actions to increase local hosting for both international and local content.	Facilitate more members, such as content providers and enterprises.	Increased digital skills training to ensure those who could go online are able to go online and have meaningful usage.	Consider ways to enable communications services using VoIP to be made available. Pass regulations to attract content and service providers.	Introduce digital payments in countries without them, and facilitate more e-commerce.
Long run	Actions to increase the amount of infrastructure available				Actions to ensure all usage is meaningful		
	Take actions to facilitate building more fiber, including infrastructure. Increase the number of licenses, including a wholesale operator.	Develop a broadband plan to increase deployment of fixed and mobile broadband, as well as community networks.	Develop conditions to attract investment in new data centers, and to upgrade existing data centers as needed.	Work with industry to develop an IXP if there is none, or to increase deployment of an existing IXP to new sites.	Increased literacy and remove other barriers to bring new users online.	Ensure that all users have the skills not just to use these services, but to develop them.	Develop ecosystem for innovation and entrepreneurship to create new content and services and bring the rest of the economy online.

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