Keeping the Internet up and running in times of crisis

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Key messages

- Since the start of the COVID-19 crisis, demand for broadband communication services has soared, with some operators experiencing as much as a 60% increase in Internet traffic compared to before the crisis.
- Network operators and content providers have to date successfully maintained services and efficiently utilised pre-existing capacity, and in certain cases expanded this capacity.
- Additional short term measures are important to further enhance network stability and resilience, and to reduce the digital divide: for example, ensuring access for network operators and content providers to communication equipment, datacentres, and mobility of technicians to customers' homes.
- Policy makers and regulators can alleviate congestion in mobile networks by releasing additional spectrum on a temporary basis, or by approving temporary commercial spectrum transactions between providers that put unused spectrum into service.
- In the medium term, regulators could stimulate broadband providers to deploy more fibre deeper into the networks and gradually phase out xDSL technologies, where possible, and alleviate administrative burdens to ease network deployment.

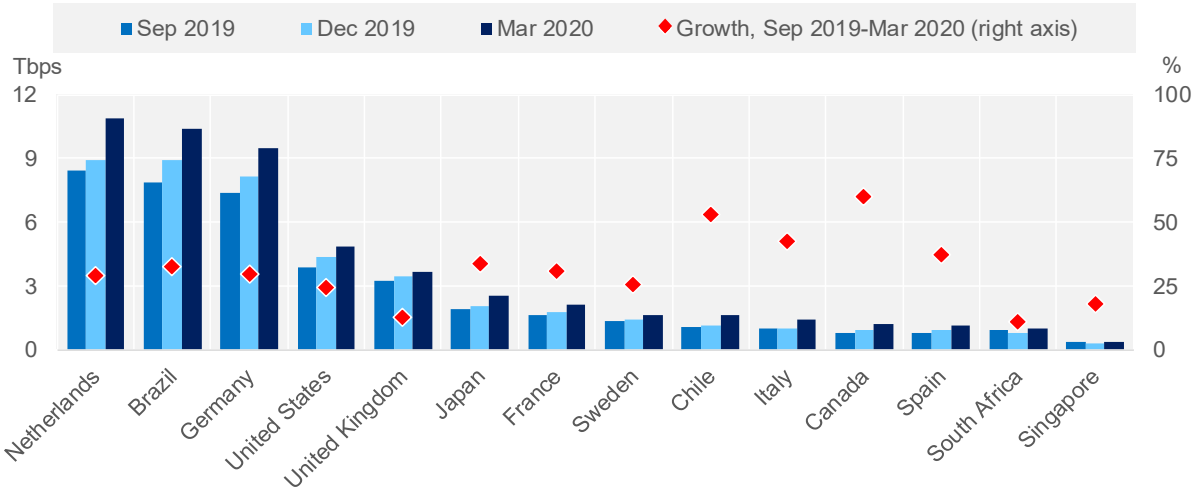
The COVID-19 crisis has placed an unprecedented demand on communication networks

As mobility restrictions are enforced to contain the spread of the novel coronavirus (COVID-19), more and more of the estimated 1.3 billion citizens of OECD countries are working and studying from home; and critical international policy co-ordination is now being conducted online in fora such as the G7 or G20. Along the entire Internet value chain, fixed and mobile broadband operators, content and cloud providers, and points where Internet networks connect to each other to exchange traffic, called Internet exchange points (IXPs), are experiencing as much as 60% more Internet traffic than before the outbreak. In this unprecedented situation, the resilience and capability of broadband networks has become even more critical.

Fixed and mobile operators are witnessing a surge in Internet traffic. In Korea, operators have reported traffic increases of 13%, reaching 45% to 60% of their deployed capacity. In Japan, NTT Communications reports an increase in data usage of 30% to 40%. In the United Kingdom, BT reports a 35% to 60% increase in daytime weekday fixed broadband usage. Telefónica reports nearly 40% more bandwidth in Spain, with mobile traffic growth of 50% and 25% in voice and data, respectively. In Italy, Telecom Italia has experienced a traffic increase of 63% and 36% in the fixed and mobile network, respectively. In France, Orange reports that its international infrastructure has been in high demand with 80% of the traffic generated by users in France going to the United States, where a good part entertainment and content is located.

In the United States, Verizon reported a 47% increase in use of collaboration tools and a 52% increase of virtual private network traffic. AT&T has seen mobile voice and Wi-Fi call minutes up 33% and 75% respectively, while consumer voice minutes were up 64% on fixed lines: a reversal of previous trends. AT&T also reported that its core network traffic was up 23%.

Figure 1. Internet bandwidth at Internet exchange points, by country



Notes: Data shows the median IXP peak traffic aggregated by country in September 2019, December 2019 and March 2020, based on public sources. Tbps = terabits per second.
Source: OECD based on data from Packet Clearing House.

The content and application industries report similar surges. Cisco Webex, the most prevalent cloud-based videoconferencing application, is peaking at 24 times higher volume. According to the New York Times, Facebook experienced increases of 100% on voice calls and 50% on text messaging over its WhatsApp, Facebook Messenger and Instagram platforms, while group calls in Italy increased tenfold. Google similarly

reports increased usage of its videoconferencing products and different usage patterns on YouTube, but indicates that peak traffic levels remain well within their capacity. Due to higher demand, several application providers such as Netflix, Akamai and YouTube agreed to reduce video streaming qualities at peak times in Europe, and some have shifted default settings from high-definition to standard-definition globally.

The underlying Internet infrastructure is also facing unprecedented demands. One critical element of this infrastructure are IXPs, which are bulk traffic exchange crossroads where multiple networks connect (to exchange traffic). IXPs report record net increases of up to 60% in total bandwidth handled per country (Figure 1) from December to March 2020. The Netherlands experienced a net increase of 5.5% between September and December 2019, which can be considered a baseline prior to COVID-19. Between December 2019 and March 2020, bandwidth increased by 22.3%, more than four times that of the prior quarter. Germany experienced an increase from 11.2% to 16.5% while Italy, one of the most severely affected countries in Europe, handled 39.9% more bandwidth between December 2019 and March 2020, up from only 1.8% growth in the prior quarter. In other regions, statistics also show similar trends in traffic increases in the first quarter of 2020. In Japan, the baseline growth of 5.9% increased to 26.2%, while Chile's bandwidth increased dramatically from 10.4% to 38.3%. The United States, Singapore, South Africa and Brazil all report similar trends.

Individual IXPs have also reached new records of peak traffic. DE-CIX Frankfurt, one of the largest IXPs in the world, is now regularly peaking over 9.1 terabits per second (Tbps) data, which equals a simultaneous transmission of up to 2 million high-definition videos. During the COVID-19 health emergency, the exchange has seen a 120% increase in videoconferencing traffic and a 30% increase in online and cloud gaming. Other exchanges such as AMS-IX in Amsterdam and INEX in Dublin have reported 12% and 20% growth, respectively, and LINX in London hit a maximum traffic peak of 5 Tbps on 26 March 2020.

To cope with the significant traffic increases, network operators and governments across the globe are working to ensure that connectivity and communication services operate in a reliable, stable and secure manner. Fixed and mobile broadband operators, as well as content providers, have successfully managed their networks to accommodate changes in utilisation patterns, respond to overall increased demand and avoid congestion that impacts working and studying from home, while supporting critical services such as telemedicine and emergency response.

Most networks are coping with the increased demand and changes in utilisation patterns with peak periods being stretched out during the day as well as the evening. However, different networks have different architectures and vintages, and may operate under different constraints. For example, the technology and business of a residential Internet service provider (ISP) in a dense metropolitan area may be different from those of a residential ISP network in a sparsely populated rural area. Some networks may incorporate more substantial amounts of unused capacity (also called "headroom") than others. In general, operators increase their network capacity when they reach a 50% utilisation rate. In the United Kingdom, for instance, BT's network capacity has had enough headroom to support the evening peak, driven by high-bandwidth applications like video gaming and football streaming. However, the situation might be different for smaller ISPs in rural areas that have thinner margins and are more distant from IXPs.

Responsible action and planning will ensure this crisis does not significantly increase the likelihood of a general Internet outage. However, some networks will undoubtedly experience congestion at peak times.

How to maintain and support networks to meet the surge and changing demand

The following good practices offer means for maintaining and supporting the networks as they evolve to meet both the surge and the changing nature of demand.

Maintain access to hardware supplies, datacentre facilities and ensure the mobility of engineering staff and skilled workforce

Logistical and supply chain shortages: Network operators need to be able to order and receive new hardware and consumables to implement network upgrades and replace components that fail. If countries close borders, shortages or delays in the global supply chains could prevent network operators from repairing an outage or upgrading their capacity. Governments should ensure the continuity of supplies, particularly during border closures. Efforts to encourage the sharing of critical resources (e.g. the European IX association) are important and should continue.

Access restrictions to key communication facilities: Datacentres play a critical role, but most facilities are restricting access in response to the outbreak in order to prioritise scheduled maintenance by established customers. Some datacentres have gone one step further to prohibit access by customers, requiring the use of datacentre-supplied "remote hands" instead. Governments should ensure that staff can access their equipment under controlled conditions in the case of a critical need. In Sweden, for example, the national crisis co-ordination group for the communication sector is maintaining an active dialogue with the Swedish regulator (PTS) on datacentre access. While PTS does currently not have instruments to legally mandate datacentres to take specific actions, this is under review.

Reduced availability of field engineers and skilled workforce due to mobility restrictions: Some governments have imposed mobility restrictions that could affect the workforce available to perform critical operations in datacentres, on cable paths, at cell sites, and other critical infrastructural locations, as well as customer sites. Governments should explicitly list communication-engineering staff as essential workers and grant them permissions to access datacentres and other critical sites to keep services running. In India, critical network operation centre staff are permitted to travel during confinement and in the United States, all communication workers are considered "essential" and are permitted to travel.

Anticipate demand and prevent congestion

Core switching capacity at IXPs: While individual network-facing ports may become congested, IXPs typically operate their core switching fabric at a fraction of the theoretical capacity of their backplanes and interconnects. In Ireland, the INEX increased its inter-switch interconnection capacity by 100 gigabytes per second and its available port capacity by approximately 30% to 4.2 Tbps in response to the increased traffic. Member ports continue to be upgraded on a near-daily basis. If other exchanges have similar ratios of capacity to utilisation, this would be an encouraging sign that capacity at IXPs will not become a bottleneck.

Network operators with overloaded connection points (ports): Larger network operators connect to one or more IXPs. In many cases, network operators may need to upgrade their capacity by adding additional ports or increasing the speed of their port before it becomes congested. A few of the largest exchange points have automated platforms that allow port upgrades with very limited human interaction. In the more frequent cases that in-person human interaction is needed, governments should ensure that technicians can access IXPs during mobility restrictions.

Congestion in private interconnections: Some larger network operators depend upon private interconnections with their largest counterparts. These private interconnections are fibre cross-connects within datacentres, between the routers of the largest access networks (which deliver bandwidth to users) and the largest or most critical content networks (which provide services such as web sites, gaming, video conferencing and streaming). A congested interconnection harms both networks and should be avoided.

Lack of direct interconnections: In some countries, big communication operators may refuse to interconnect domestically with other networks, forcing smaller networks to send domestic traffic over large distances to IXPs in other countries and back, leading to higher costs and lower quality. Two large operators within Canada, for instance, peer at five and three IXPs, respectively, all within the United States, forcing 64% of Canadian domestic traffic to flow across the border through the United States. This greatly increases the

costs and network instability experienced by Canadian customers. A lack of direct interconnection negatively affects the overall Internet performance in a country, while increasing costs and risk. In Italy, one of the most affected countries, Telecom Italia has agreed to open peering at two exchange points to improve network experience between 6 April and 30 June 2020.

Monitor the performance of key Internet infrastructure services

Essential Internet infrastructure services such as the domain name system (DNS) are seeing an increase in utilisation. Given that the performance of the DNS is a prerequisite to reaching any service on the Internet, maintaining unimpeded access to the DNS is of crucial importance. Operators of DNS authoritative servers should monitor the load to ensure service availability as some operators, particularly of country-code top-level domains, perform domain resolution for public health awareness websites and related online emergency services. Governments could also review the configuration and standards-compliance of their national top-level domains.

Put unused spectrum into service

Reduced mobility of people and the consumption of bandwidth intensive applications (i.e. video streaming) over mobile networks that are sometimes used as a substitute for fixed broadband may generate congestion as there will be more devices competing for the same cell capacity. In addition to edge capacity, there might also be capacity issues when transferring the unexpectedly high load from the cell to the mobile operator network. Regulators and policy makers could consider making additional spectrum available on a temporary basis for mobile operators to add capacity to the over-the-air interface. In the United States, AT&T, Verizon and T-Mobile were granted approval from the regulator, the Federal Communication Commission (FCC), to reach a commercial agreement with satellite TV provider Dish to borrow the company's unused wireless spectrum to add capacity to address congestion created by COVID-19 quarantines. In addition, the FCC granted operators temporary access to spectrum in the 5.9 gigahertz (GHz) band to meet increased rural broadband demand and granted use of spectrum for 60 days in the AWS-4 and AWS-3 band. In Ireland, the regulator ComReg has approved plans to release extra radio spectrum in the 700 megahertz and 2.6 GHz bands to add capacity for mobile phone and data connectivity. Another measure to expand mobile connectivity consists in alleviating administration burdens and streamlining rights of way for a more rapid deployment of networks.

Accelerate the transition from copper to fibre to address congestion in xDSL networks

Residential broadband operators might suffer from congestion due to the inherent asymmetrical capacity of xDSL technology and oversubscription. xDSL networks use the telephone infrastructure that was primarily built for low-speed analogue voice service. Most xDSL broadband services have moderate download speeds but very low upload speeds. This makes them poorly suited for services requiring higher upload speeds which are necessary to support work from home and use. While transitioning from copper to fibre takes longer-term planning, broadband providers could be encouraged in the medium term to deploy fibre deeper into their networks to gradually phase out xDSL technology and replace it with FTTx technologies. Such investments would add resilience to combatting epidemics like COVID-19 and prepare for a post-crisis environment which is likely to require more connectivity and network capacity.

Summary of key recommendations

- Network operators and content providers should have access to the equipment supply chain and maintain controlled and prioritised access to datacentre facilities.
- The engineering workforce of network operators and content providers should be granted the mobility necessary to maintain functionality of the core and access networks and still be able to

connect homes at customers' sites. Alleviating administrative burdens would also help operators to deploy networks rapidly.

- Policy makers and regulators can alleviate congestion in mobile networks by releasing additional spectrum on a temporary basis or approving temporary commercial spectrum transactions between providers that put unused spectrum into service.
- Network operators should anticipate increased demand and prevent congestion by upgrading their interconnection capacity with other providers, including adding additional direct traffic exchange between networks (peering).
- Network operators should track key performance indicators of the Internet infrastructure such as the Domain Name System, particularly when they are provided externally.
- In the medium term, regulators could stimulate broadband providers to deploy more fibre deeper into the networks and gradually phase out xDSL technologies, where possible.

Further reading

OECD (2020), "Dealing with digital security risk during the coronavirus (COVID-19)", OECD, Paris, https://read.oecd-ilibrary.org/view/?ref=128_128227-6a62c37d6b&title=Dealing-with-digital-security-risk-during-the-coronavirus-%28COVID-19%29-crisis.

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