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Observations on Network User Behaviour During COVID-19  
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## Abstract

COVID-19 has caused significant and abrupt changes in Internet traffic, particularly during the introduction of the initial quarantine and work-from-home arrangements.

This paper discusses the specific case of end-user behaviour changes, based on interviews that the Ericsson Mobility Report and Consumerlab research team made with consumers in several countries.

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## 1. Introduction

COVID-19 has caused significant changes in Internet traffic. These changes appeared rather abruptly, in particular during the introduction of the initial quarantine and work-from-home arrangements. The changes relate to traffic volumes, location of traffic, as well as the types of traffic and applications used.

This paper discusses the specific case of end-user behaviour changes, based on Ericsson Mobility Report and Consumerlab research team's interviews of 11,500 consumers in April 2020, for Ericsson's [Mobility-Report] [Consumerlab-Report].

## 2. Traffic Surge

Changes in traffic volumes were seen across different networks.

- \* Fixed networks saw significant increases, presumably due to people being more inside their homes, and many with various forms fixed Internet connection. For instance, Comcast and NCTA reported 20% downlink traffic increases [Comcast] [NCTA].
- \* Mobile networks saw also an increase, with Vodafone reporting mobile traffic as "increased around 15% across Europe in recent weeks, peaking at 30% in Spain and Italy" [Vodafone]. The increases have been different for different of types of uses and traffic direction, for instance fixed mobile traffic grew 50% in in Spain and Italy [Vodafone]. Ericsson reported that the number and length of mobile voice calls increased, but noted that mobile data traffic changes were moderate and highly variable, depending on market and location. Ericsson reported changes in overall traffic volumes ranging from -10% to +20% [Mobility-Report].
- \* Traffic at IXPs rose as well. Cisco reported that they are seeing a 10% to 30% increase [Cisco].

Some more predictable growth returned later, after the initial impact of the quarantine and work-from-home orders. For instance, Comcast reported the traffic levels plateaued after absorbing the initial impacts [Comcast].

### 2.1. Discussion

NCTA reported that there was no congestion in their members' backbone networks, despite traffic volume growth [NCTA].

Absorbing the growth required some action, of course. For instance, Comcast doubled the upgrades they performed in March and April 2020 compared to the same period in the previous year [Comcast-Preparing], Vodafone brought forward planned upgrades [Vodafone], and so on. At

the same time, some content providers downgraded streaming quality to standard instead of high-definition in some cases, and more aggressive compression and traffic management techniques were used.

Ericsson's Consumerlab surveyed users for their usage and experiences during the crisis (see Section 4.1). Some of the key findings in [Consumerlab-Report] were:

- \* 9 in 10 users increased Internet activities.
- \* Time spent connected increased, by 2.5 hours for fixed broadband and 1 hour for mobile broadband.
- \* Network performance was in general found satisfactory. 6 in 10 were very satisfied with fixed broadband, and 3 in 4 felt that mobile broadband was same or better as before the crisis.
- \* The percentage of users connected only or most often via mobile networks varied internationally, e.g., in Italy 15% and 47% in India.
- \* Among many different service provider actions, maintaining network resilience and quality of service was deemed as the most important activity (64% saw this as very important and 34% as somewhat important).

### 3. Location changes

Obviously, the location where people used Internet services changed along with the quarantines, closures, and work-from-home recommendations. Many mobile networks saw big changes with where their traffic volumes are coming from. Typically, traffic declined in business districts and city centers, and grew in suburban and residential areas [Mobility-Report].

The type of growth seen in different networks depends a lot on type infrastructure deployed in a given market or country, e.g., biggest mobile network traffic increases were seen in markets where there is little fixed broadband deployed [Mobility-Report].

### 4. Changes in types of applications

The COVID-19 impact on networking was not merely about amount of traffic. The type of traffic also changed. For instance, massive increases were reported in the use of teleconferencing, e-learning, and other similar tools.

Upstream traffic has increased due the use of video conferences, remote schooling, and similar applications. The NCTA and Comcast reported that while downstream traffic grew 20%, upstream traffic grew as much as 30% to 37% [NCTA] [Comcast]. Vodafone reported that upstream traffic grew 100% in some markets [Vodafone].

#### 4.1. Study

Ericsson's Mobility Report [Mobility-Report] tracks traffic volumes and trends. The Consumerlab tracks consumer behaviour, e.g, they have researched COVID-19 impacts in [Consumerlab-Report].

The latter report was performed by interviewing consumers, a total of

11,500 consumers across 11 countries, US, Brazil, Sweden, UK, France, Spain, Germany, Italy, India, South Korea, and China. The number of consumers interviewed in each country was 1,000 and 1,500 in US. The data was collected in April 2020. The target group was smartphone users aged 15-69.

#### 4.2. User behaviour

Some observations about high-level user experiences and usage as reported in [Consumerlab-Report]:

- \* 1 in 5 started new activities such as e-learning or video-conferencing
- \* Three quarters of the older generation felt that they were helped by video calling with family and friends.
- \* Three in four parents felt that their children's education was helped by ICT technology.

Smartphone application usage also changed per [Consumerlab-Report]. The fastest growth was seen in COVID-19, remote working, e-learning, wellness, education, remote health consultation, and social shared experience applications.

Biggest decreases were seen (unsurprisingly) in travel and booking, ride hailing, location, and parking applications.

One interesting result of the changes is that some of the behaviours are likely permanent changes. According to [Consumerlab-Report] 6 in 10 working people in US wants to switch to video-based conferences, even after the crisis has passed. And 4 in 10 students in US plan to continue taking online courses. The adoption of video calls and other new services by many consumers, such as the older generation, is also likely going to have a long-lasting effect.

Similarly, anecdotal evidence and local surveys in various organizations point to a likely long-term increase in the number of people interested in remote work in their work arrangements [Workplace-Analytics] [McKinsey-Reimagining].

#### 5. Concluding Remarks

This paper discussed measurements about the effects of the crisis on network traffic and consumer behaviour.

##### 5.1. User behaviour

The main conclusion from the various measurements is that fairly large shifts occurred. And those shifts were not merely about changing one application for another, they actually impacted traffic flows and directions, and caused in many cases a significant traffic increase. Early reports also seem to indicate that the shifts have went relatively smoothly from the point of view overall consumer experience.

There is also good reason to expect that many of the changes will have a permanent effect, be it about people learning to use new tools or the eagerness to continue to new ways of working or education. Based on the Consumerlab research, it also seems clear that consumer

expectations on network providers have put resilient and well-working Internet connectivity as most critical during a crisis.

Going forward, the critical nature that Internet plays in our lives means that the health of the Internet needs to receive significant attention. Understanding how well networks work is not just a technical matter, it is also of crucial importance to the people and economy of the societies using it. Projects and research that monitor Internet and services performance in a broad scale and across different networks are therefore important.

## 5.2. Technology

Are there conclusions that can be drawn about the impact of these observations when it comes to technology and architecture?

The author's tentative hypothesis is that the Internet's good track record in coping with growth and change is due to two fairly simple things:

First off, practical handling of issues and good network management has been a key ingredient of the resilience of Internet, more than any specific technical arrangement.

But secondly, the Internet's generality has played a role. The Internet is designed for any application and situation, rather than optimized for today's particular traffic. This makes it possible to use it for many applications, in many deployment situations, and make changes as needed. The generality is present in many parts of the overall system, from basic Internet technology to browsers, from name servers to content delivery networks and cloud platforms. When needs change, what is needed is often merely different services, perhaps some re-allocation of resources, but not fundamental technology or hardware changes.

But back to the practical issues, and good network management for a moment. To make this possible, we need:

- \* The ability of the various service and content providers to observe how they and their users are doing is important, as that forms the basis of any action.
- \* The willingness of each individual party to take action for improvements, be it about some fine-tuning of the service or moving capacity to where it is needed.

Informal collaboration between different parties has also played an important role, based on anecdotal evidence.

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## 7. Informative References

- [Cisco] Jonathan Davidson, ., "Global Traffic Spikes. No Panic at the Cisco!", <https://blogs.cisco.com/news/global-traffic-spikes-no-panic-at-the-cisco> , March 2020.
- [Collaboration] Jim Salter, ., "Yesterday's corporate network design isn't working for working from home", Ars Technica, <https://arstechnica.com/gadgets/2020/10/future-of-collaboration-01/> , October 2020.
- [Comcast] Comcast, ., "COVID-19 Network Update", <https://corporate.comcast.com/covid-19/network/may-20-2020> , May 2020.
- [Comcast-Preparing] Jan Hofmeyr, ., "COVID-19 Network Report: How Investing for the Future Prepared Us for the Unexpected", <https://corporate.comcast.com/stories/how-investing-for-an-uncertain-future-network-equipped-covid-19> , June 2020.
- [Consumerlab-Report] Ericsson Consumer & IndustryLab, ., "Keeping consumers connected in a COVID-19 context", <https://www.ericsson.com/en/reports-and-papers/consumerlab/reports/keeping-consumers-connected-during-the-covid-19-crisis> , June 2020.
- [Evolution] Jari Arkko, ., Alissa Cooper, ., Tommy Pauly, ., and . Colin Perkins, "Evolving the Internet Through COVID-19 and Beyond", CircleID, <http://www.circleid.com/posts/20200707-evolving-the-internet-through-covid-19-and-beyond/> , July 2020.
- [McKinsey-Reimagining] Brodie Boland, ., Aaron De Smet, ., Rob Palter, ., and . Aditya Sanghvi, "Reimagining the office and work life after COVID-19", <https://www.mckinsey.com/~media/McKinsey/Business%20Functions/Organization/Our%20Insights/Reimagining%20the%20office%20and%20work%20life%20after%20COVID%2019/Reimagining-the-office-and-work-life-after-COVID-19-final.pdf> , June 2020.
- [Mobility-Report] Ericsson, Inc., "Ericsson Mobility Report", <https://www.ericsson.com/en/mobility-report> , June 2020.
- [NCTA] NCTA, ., "COVID-19: How Cable's Internet Networks Are Performing: Metrics, Trends & Observations", <https://www.ncta.com/COVIDdashboard> , October 2020.
- [Vodafone] Vodafone, ., "An update on Vodafone's networks", <https://www.vodafone.com/covid19/news/update-on-vodafone-networks> , April 2020.

[Workplace-Analytics]

Kate Lister, ., "Work-At-Home After Covid-19â€œOur  
Forecast", [https://globalworkplaceanalytics.com/  
work-at-home-after-covid-19-our-forecast](https://globalworkplaceanalytics.com/work-at-home-after-covid-19-our-forecast) , October 2020.

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