

A large red abstract sculpture, resembling a stylized arrow or a wing, is mounted on a white, sloping base. In the background, a city skyline with several tall buildings is visible under a blue sky with scattered white clouds. A group of people is walking along the base of the sculpture in the lower right corner.

EVOLVING THE INTERNET THROUGH COVID-19 AND BEYOND



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INTERNET EVOLUTION

- › Past and present evolution & future challenges
- › What was the impact of COVID-19?
- › How Internet evolution happens
- › What can we learn from all this?

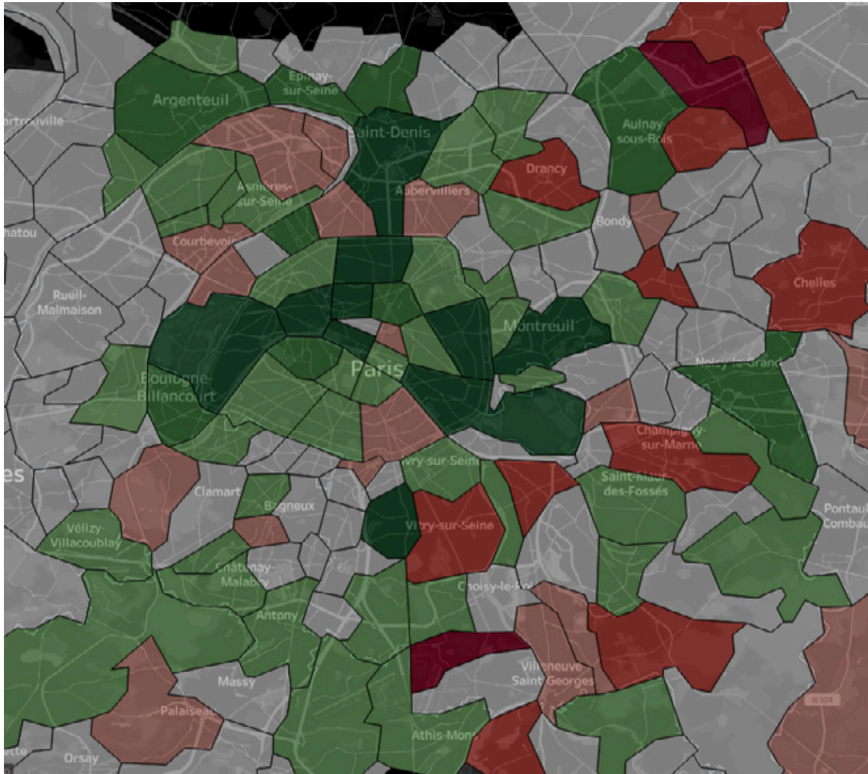


COVID-19 & INTERNET

Highest traffic
level increase

Traffic levels
similar

Highest traffic
level decrease



Picture credit: Ericsson Mobility Report June 2020

Immediate changes in March

- › Fixed networks Comcast +30%. NCTA +20%
- › Mobile networks Vodafone +15..30% Ericsson -10..+20%
- › IXPs +10..30%
- › ...
- › Some more predictable growth later

Numbers: Comcast, Vodafone, NCTA, Cisco



COVID-19 & INTERNET

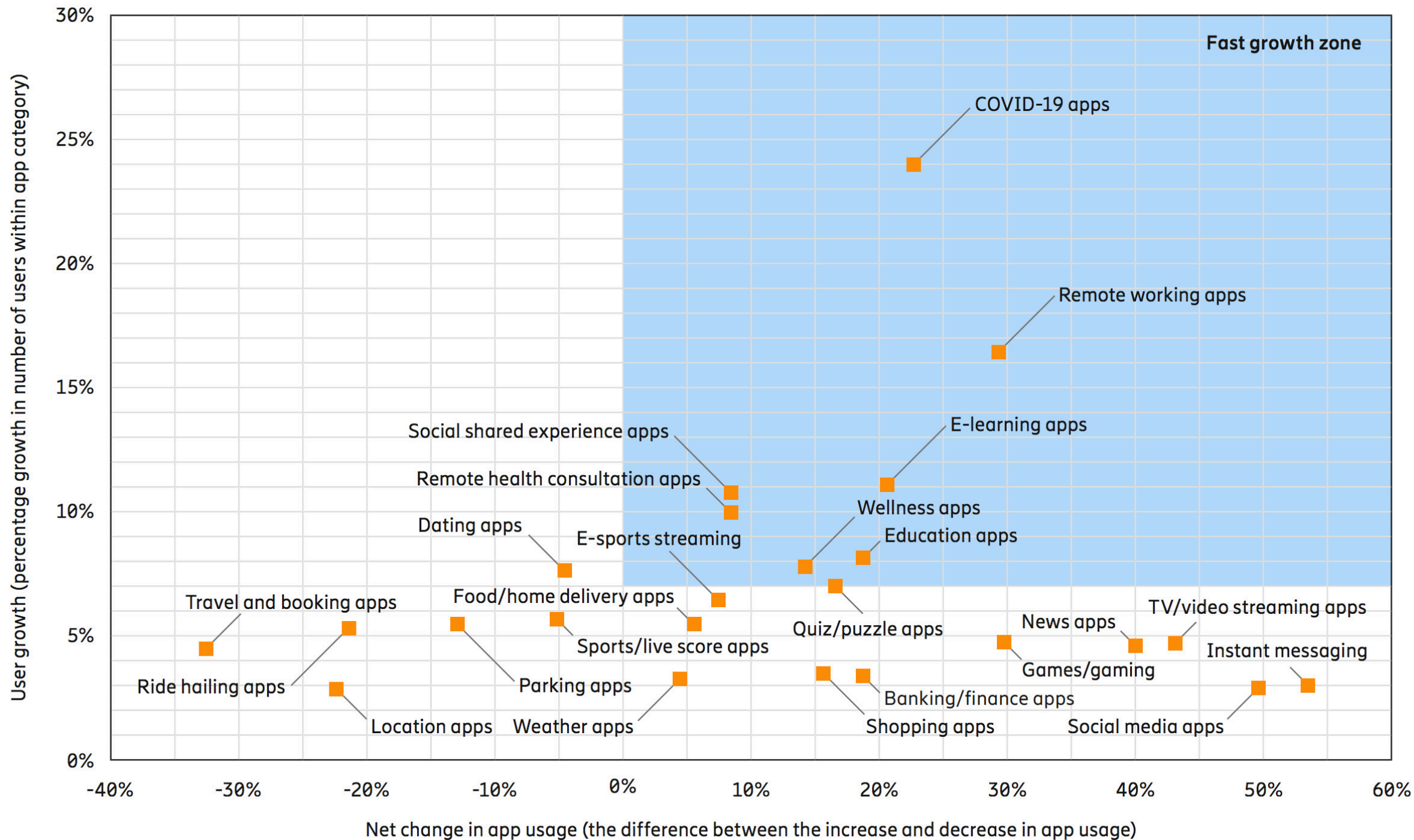
- › Meeting services (Cisco 2-24x, Microsoft +200%, ...)

IAB WORKSHOP ON COVID-19 IMPACTS



Position papers for the workshop soon available at
<https://www.iab.org/activities/workshops/covid-19-network-impacts-workshop-2020/>

The workshop will be streamed during week of Nov 9



COVID-19 & INTERNET OBSERVATIONS

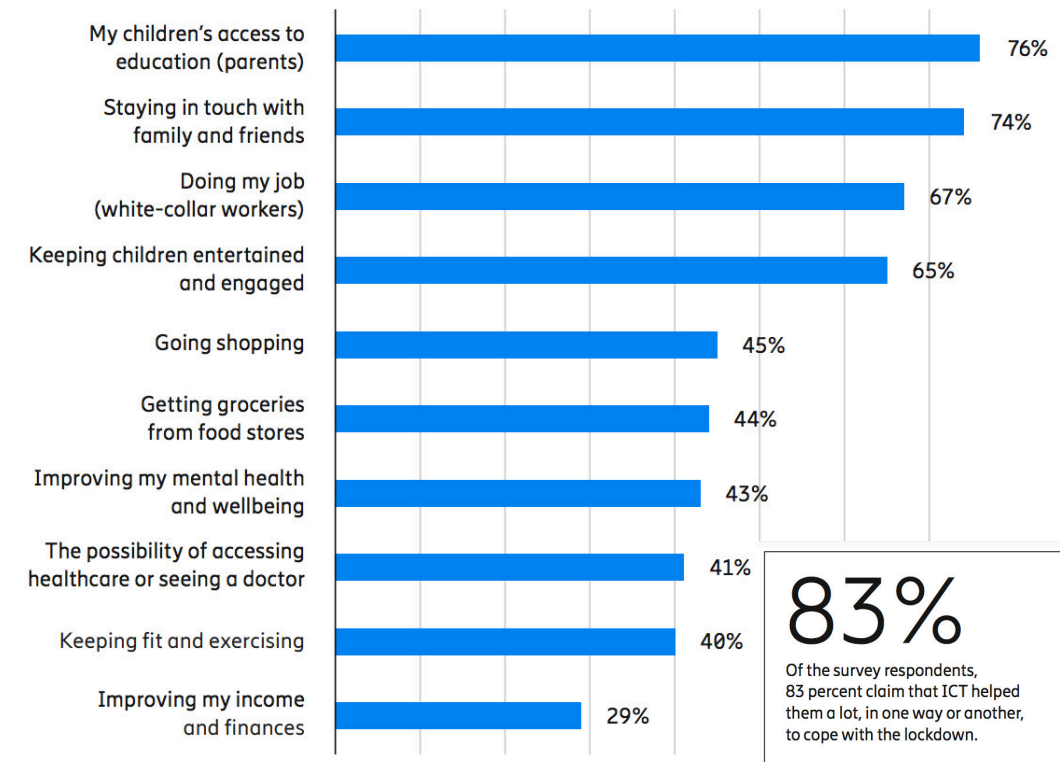


- › Fairly big immediate shifts
- › Relatively smooth process (?)
 - Why? Capacity & other improvements in the background, but also cloud/cdn deployment models + Internet model

6 in 10 were very satisfied with fixed broadband
3 in 4 felt that mobile broadband was same or better as before the crisis

- › Likely long-term impacts
 - Further growth of video, new user groups & organizations & more familiarity with apps
 - Importance of resiliency

Figure 3: Share of smartphone users who consider ICT has helped them a lot with different tasks in their daily lives during the COVID-19 pandemic



Base: Smartphone users aged 15–69 who claim their daily life is highly impacted by the lockdown restrictions, in Brazil, China, France, Germany, India, Italy, South Korea, Spain, Sweden, the UK and the US

Graph: Ericsson Mobility Report June 2020

EXAMPLES OF EVOLUTION



- › DNS
- › IPv6
- › Web protocol stack
- › Transport protocols
- › Encryption
- › Cloud
- › CDN
- › Mobile + apps
- › Consolidation
- › Virtualization
- › Open source

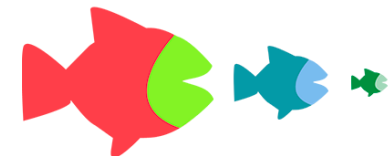


$\left(\frac{DNS}{HTTPS} \right)$

Web  RTC

http2

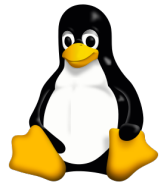
 TLS 1.3



SPEED OF EVOLUTION



- › What does it give for me?
- › Version updates now and before
- › Necessary enablers
- › Consolidation
- › Who can change code
- › Protocol engineering (wire image, greasing)





KEYS TO SUCCESSFUL EVOLUTION

- “Changing engines in flight”

Was Internet designed to evolve?

Keys:

- › Solves a concrete and immediate need
- › Business incentive alignment for everyone who has to make a change (e.g., encryption)
 - Implies minimization of involved parties?
- › Community with implementations, testing, applications adopting, etc.

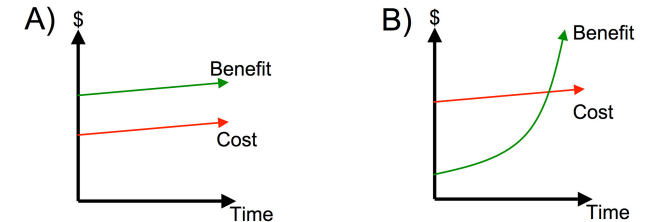
KEYS TO SUCCESSFUL EVOLUTION



- “Changing engines in flight”

Was Internet designed to evolve?

Protocol success per RFC 5218



Important initially

- Very positive net value
- Incremental deployability
- Availability of code, specs

Less important initially

- Technical design
- Maintenance

Important for wild success

- Extensibility
- No hard scalability limits
- Good enough security

How do these rate?

- › IPv6
- › TLS 1.3
- › QUIC
- › Security in H2
- › Long-term maintenance

UPCOMING CHALLENGES



› Security

- Not just about communications!

- › IAB threat model "Model-T" program

- Collecting data about users

- Resilience, denial-of-service



› Performance

› Device diversity

› Consolidation

› Centralization

What about:

- › QoS

- › Clean-slate

- › Programmability



EVALUATING DIFFERENT CHANGES

Warning signs:

- › No involvement from those who have to change
- › Top down approach, not collaboration
- › Lack of justification data ("of course we need XYZ")
- › Misunderstanding or ignoring business aspects
- › Deployment incentives exist, but in conflict with user interests

And remember: Details matter!

Examples

- › Various security improvements



SUMMARY

- › The Internet is alive and kicking! 😊
- › Speed of changes is increasing
- › Changes that have clear demand can happen rapidly
 - Other changes may go slow or not happen at all
- › Looking forward to the next episodes in the evolution saga – many opportunities but also challenges ahead
- › Don't always believe what it is said on the Internet, even about the Internet!



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