Introduction

- Introduction on the purpose and scope of this report.
- Why BITAG is writing it
- Target audience
- Structure of document

Recap of Pandemic Shutdowns in 2020 and the Impacts to the Internet

- Discuss here a short recap of the COVID-19 pandemic in 2020, government ordered shutdowns when they occurred and for how long, how this impacted society with a sudden shift to WFH, distance learning, social distancing, etc.
- High level observed changes in how the internet was used - more bandwidth, more usage, potential shifts in peak hour, changes in popular applications
- List and cite some of the key reported metrics, observations (e.g. 1 year's worth of bw growth in one month, peak hour shifting from 8pm to 2pm in some markets, etc.)
    - Nokia Deepfield Networks
    - Sandvine
    - Trade Associations (NCTA, CTIA, USTelecom, ACA, etc.)

Closer Look at How the End-to-End Internet Ecosystem Responded

Short description of the E2E internet ecosystem and the key actors in this report

Content/Platforms <-+-> Transit/CDNS/Infrastructure <-+-> ISPs <--> Home networks <--> Applications

(Note add here a real diagram)

Content/Platforms

[Netflix, NBCU, etc.]

[

- Describe here how the content/platforms responded and why
- How traffic was changing
  - peak hour,
  - peak traffic,
  - traffic growth
  - geographic changes,
  - concurrency/household,
- Describe actions taken
  - scaling up,
  - shifting resources,
  - adding/changing routes,
  - adding/changing CDNs,
  - changing streaming rates
  - limiting or providing access

]

Transit Providers

[ATT. Lumens Technologies (aka CenturyLink), Others]

[

- Describe here how the transit providers responded and why
- How traffic was changing
  - peak hour,
  - peak traffic,
  - traffic growth
  - geographic changes,
  - concurrency/household,

- Describe actions taken
  - scaling up,
  - shifting resources,
  - adding/changing routes,
  - adding/changing CDNs,
  - changing streaming rates
  - limiting or providing access

]

Content Delivery Networks

[Netflix, Akamai, Amazon]

[

- Describe here any observed changes in CDNS
- How traffic was changing
  - peak hour,
  - peak traffic,
  - traffic growth
  - geographic changes,
  - concurrency/household,
  - Hit rate on caches before the shutdown and during shutdown
- Describe actions taken
  - scaling up,
  - shifting resources,
  - adding/changing routes,
  - adding/changing CDNs,
  - changing streaming rates
  - limiting or providing access

]

Infrastructure

[

[DNS providers, speed test providers]

Discuss here the observed and reported changes by the network infrastructure

- Capture here some of the reports from RIPE - Measured RTT, DNS latency
- Speed Test Measurement Platforms - Discuss changes is measured download and upload speeds

]

Internet Service Providers

Wired (Comcast, Charter, Century)

[

- Describe here how the ISPS responded and why
- How traffic was changing
  - peak hour,
  - peak traffic,
  - traffic growth
  - geographic changes,
  - concurrency/household,
  - cellular offload to wifi
- Call hold times, hand-off rates (mobile)
- Describe actions taken
  - scaling up,
  - shifting resources,
  - adding/changing routes,
  - adding/changing CDNs,
  - changing streaming rates
  - limiting or providing access
  - providing connectivity (e.g. Keep America Connected Pledge)

]

Wireless (Vistabeam)

[

- Describe here how the ISPS responded and why
- How traffic was changing
  - peak hour,
  - peak traffic,
  - traffic growth
  - geographic changes,
  - concurrency/household,
  - cellular offload to wifi
- Call hold times, hand-off rates (mobile)
- Describe actions taken
  - scaling up,
  - shifting resources,
  - adding/changing routes,
  - adding/changing CDNs,
  - changing streaming rates
  - limiting or providing access
  - providing connectivity (e.g. Keep America Connected Pledge)

]

Mobile (ATT, Comcast, Charter)

[

- Describe here how the ISPS responded and why
- How traffic was changing
  - peak hour,
  - peak traffic,
  - traffic growth
  - geographic changes,
  - concurrency/household,
  - cellular offload to wifi

- Call hold times, hand-off rates (mobile)
- Describe actions taken
    - scaling up,
    - shifting resources,
    - adding/changing routes,
    - adding/changing CDNs,
    - changing streaming rates
    - limiting or providing access
    - providing connectivity (e.g. Keep America Connected Pledge)

]

Home Networks

[If possible describe here observations and reports on home network peformance]

Applications

- Mozilla Firefox
- Zoom
- Cisco Webex
- Netflix
- VPNs
- Social Networking (FB, WhatsApp, TikTok, etc.)
- Dropbox

[

Describe here how the application providers responded

- Temporarily disabling features such as HD or UHD video?
- Adding more security
- Re-routing through different data centers
- Opening up to make it easier for new users to sign on and use

]

Observations

[Discuss here BITAG observations gleaned from the data]

- Traffic went up in access networks, but did not measurably change on the transit networks indicating that the CDN and peering networks were working as designed
- Impact videoconferencing on the network
  - how much bandwidth videoconferencing really use on the upstream,
  - Traffic ratios (DS:US)- pre-shutdown they were ~20:1 and during the shutdown went down to ~16:1
- Cooperation across the ecosystem by actors

Recommendations

[Any possible BITAG recommendations]

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Glossary