



ATLANTA, GA
OCTOBER 11-14

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UNLEASH THE POWER OF LIMITLESS CONNECTIVITY



**2021 Fall
Technical Forum**
SCTE • NCTA • CABLELABS



Internet of Things, Home Networking, Smart Cities, and Emerging Services

How Working and Schooling from Home has now driven a change in how we view Home Connectivity and Networking

What we did during the Pandemic and how it could define new products and services

Charles Cheevers

Chief Technology Officer, Home Networks
CommScope

18+ months of drastic changes to Working and Schooling

- Has it irrevocably changed how consumers value their Internet connection and home networking ?
- Has it created a new requirement for reliability, latency and prioritization of high value services to the home ?
- Has it created new responsibilities for corporations and schools to be able to invigilate, support and manage their employees/students during the periods they are working or schooling ?
- Has it driven a desire for people to get ahead in work or school life by having the most reliable and highest performing home connectivity solution ?
- Do we now desire to have the Home at the same/better performance than the office or school in terms of internet performance, reliability and redundancy ?



We wanted to see if there was a new home solution emerging

Goal: to better understand the experience of working from home and identify opportunities for service providers and CommScope solutions based on our learning

Method : We used a set of questions to over 2100 CommScope employees across the world about their work from home experience and conditions.

Conducted by the CommScope CTO office

Mid-October to mid-November 2020

~9 Months of working at home in Covid lockdowns

CommScope employees

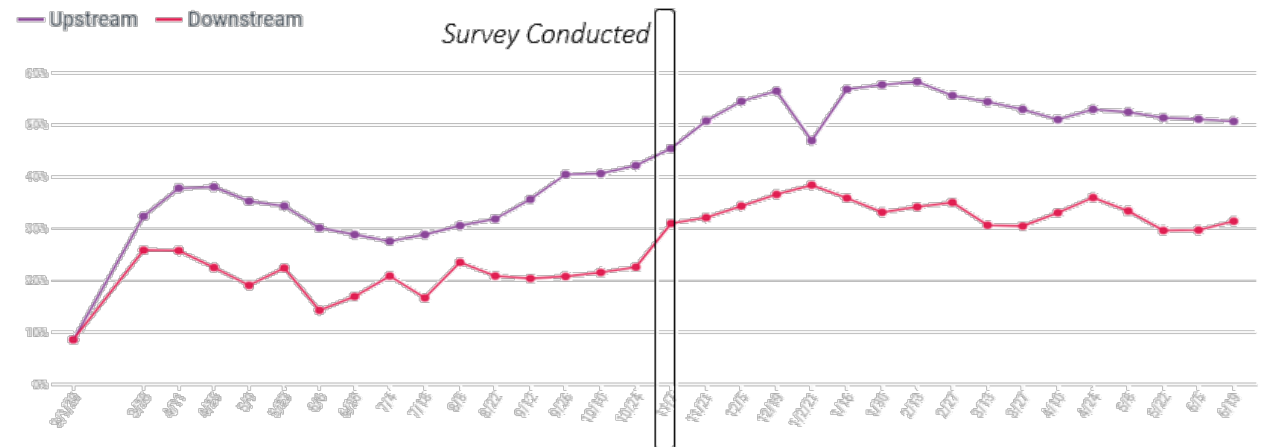
- This may skew some of the results from the general population

Sample size: 2,172 respondents from 11 countries

National Peak Internet Growth During COVID-19

Observed Increase in Peak Consumer Usage Since Early March 2020

Overall change in pre-COVID internet usage since 3/1/20



Source: Data from NCTA member companies and others.

Are new WFH factors driving new requirements

- We wanted to test the theories emerging that
 - Working from Home required improved network and Wi-Fi performance
 - Required more reliability
 - Required more range as people separated for privacy and quietness
- We also wanted to see if there were other potential requirements that emerged from the corporate side
 - Concerns about security and privacy ?
 - Shared home working environments ?
 - Connectivity and Performance level playing field for all employees of a corporation ?
 - HR elements of separation of work and life with more prolonged WFH days in your home ?

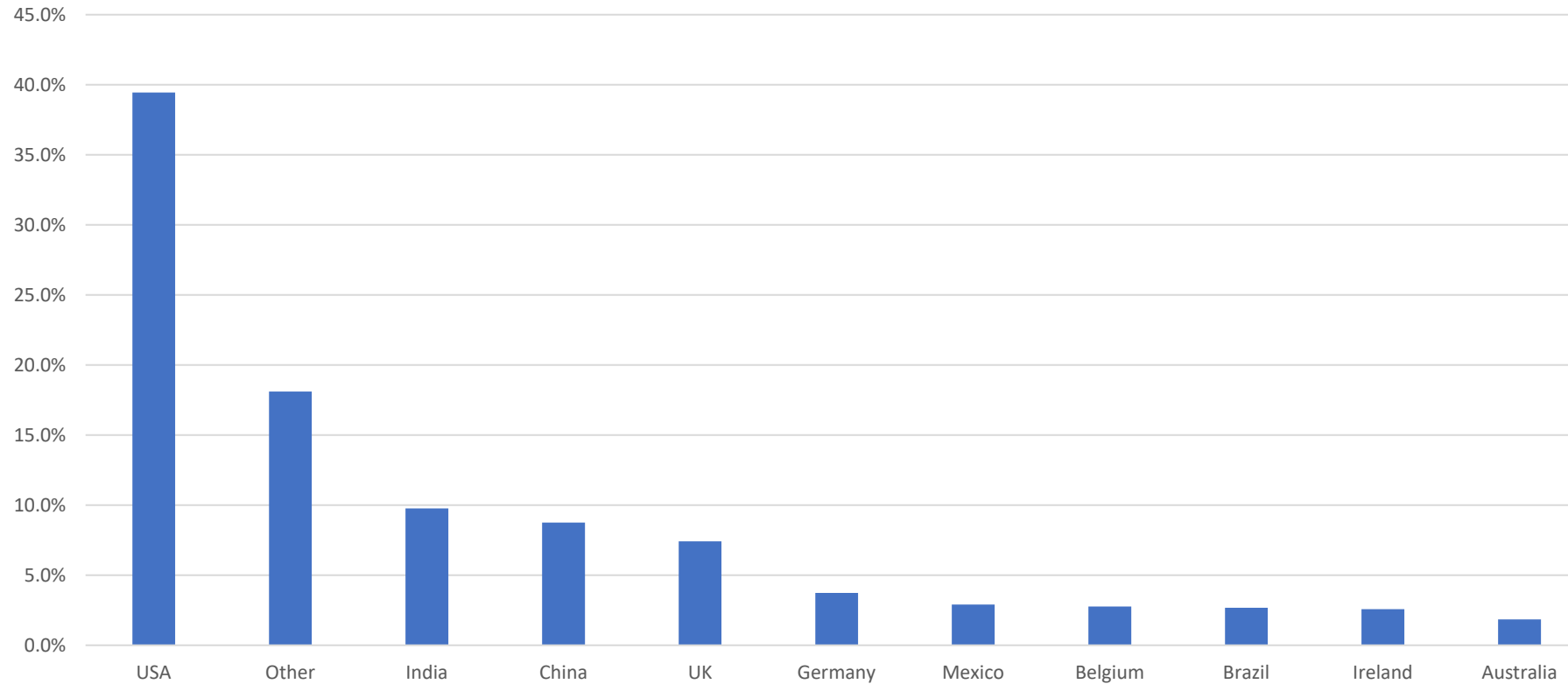
Would separating work and home be something of interest

- Did they value having a separate Wi-Fi network or even a specific use of 6GHz Wi-Fi to create a separate channelized Wi-Fi network completely independent of collisions in the residential network
- Did they value having a room that was specifically for working in and outside the room their work connectivity was diminished as default with specific efforts made to connect to Work outside the 'home office' room.
- Did they favor being able to prioritize their network and applications like Video Conferencing for time of day use over other residential services eg your most important video conference was mapped to low latency and prioritized flows ahead of residential services during work hours.

The Willingness to Pay for these services

- Would consumers be willing to pay for these services
- Would the corporations they work for be willing to pay for these services
- Are there specific factors like Upstream speed and latency that are the high runners for consumers and opportunities for Service Provider ?
- Is there additional ARPU that a Service Provider can generate by providing these services or subsets to the residential WFH consumer OR the corporation or both ?
- The investment for these new solutions driven by the change in behavior of pandemic
- Would the change in our working behavior – now pre-dominantly at home – continue

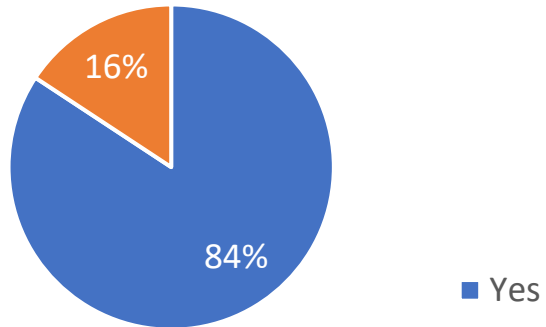
In which country are you currently located?



~1,000 respondents in US

Describe your WFH situation

Are you currently working from home?

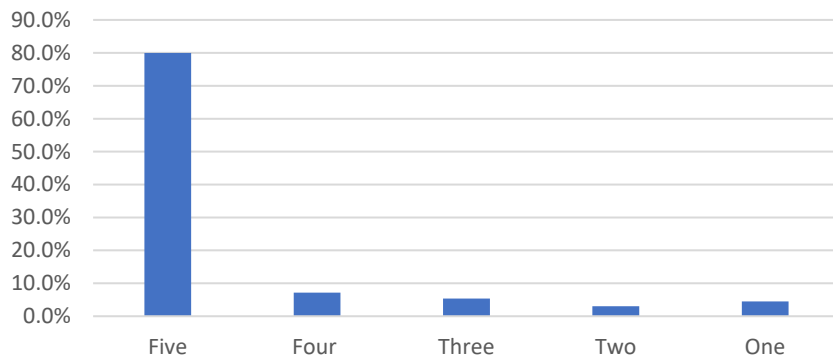


Full-time working from home has become the normal mode of working for most of the people surveyed.

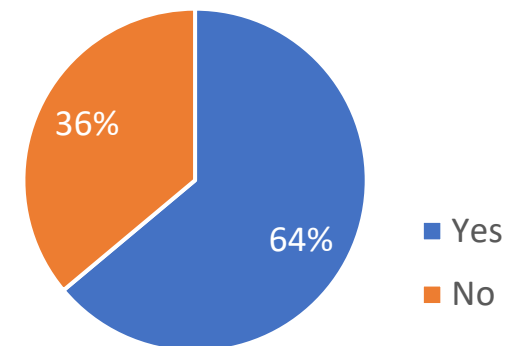
.... and it is a shared experience

64% had at least one other person working or studying at home, requiring the sharing of space and Wi-Fi.

How many days on average do you work from home in a week? (5 days maximum)

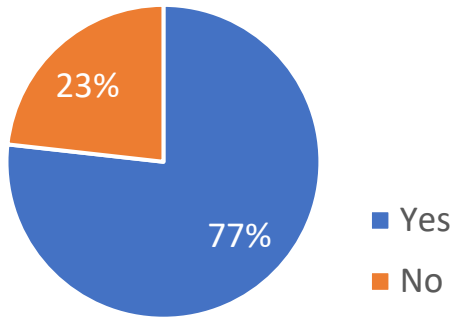


At least one other person working or studying at home

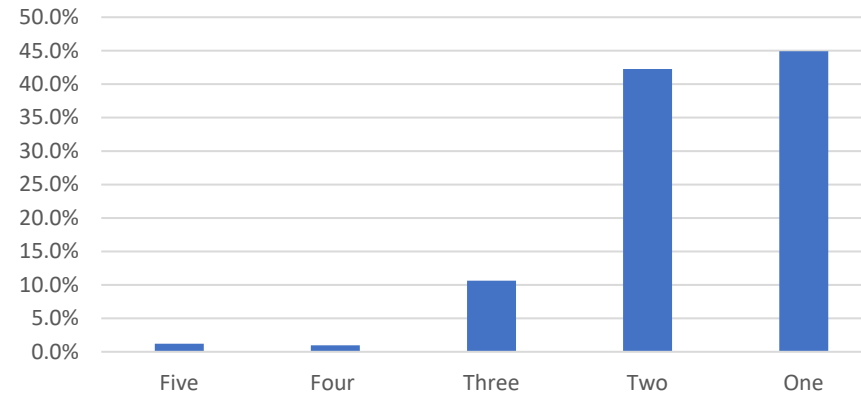


Not everyone has a separate room to school/work from

Is everyone working from home or schooling from home in a different room?



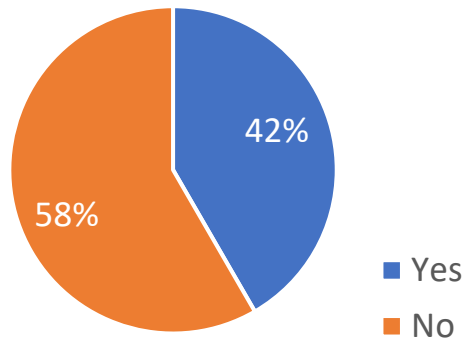
If no, what is the maximum number of people in a room while working / studying?



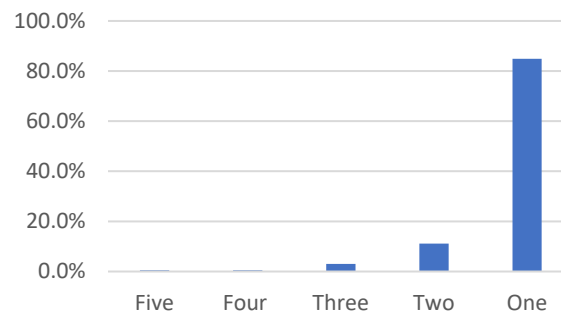
How often and how many people per household WFH

42% had one person working at least one day a week

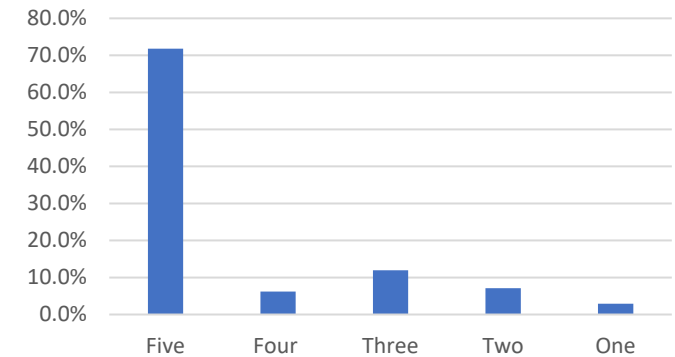
Do you have other household members working from home?



How many Other Household Members are Working from Home?

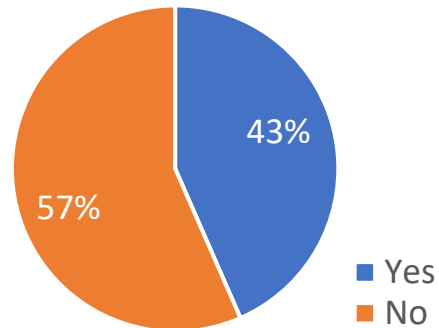


How many days a week are they working from home?

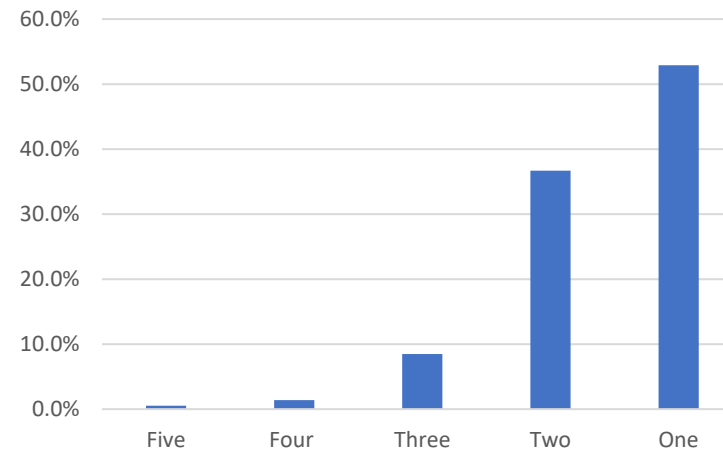


Lots of School Kids were at home during the week

Are there students in the home doing online schooling?



How many days a week are they learning from home?



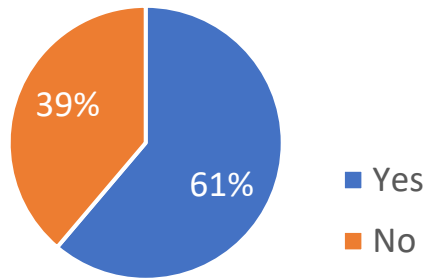
43% of respondents also had kids schooling from home – but few 5 days a week

Additional Purchases for WFH have been necessary

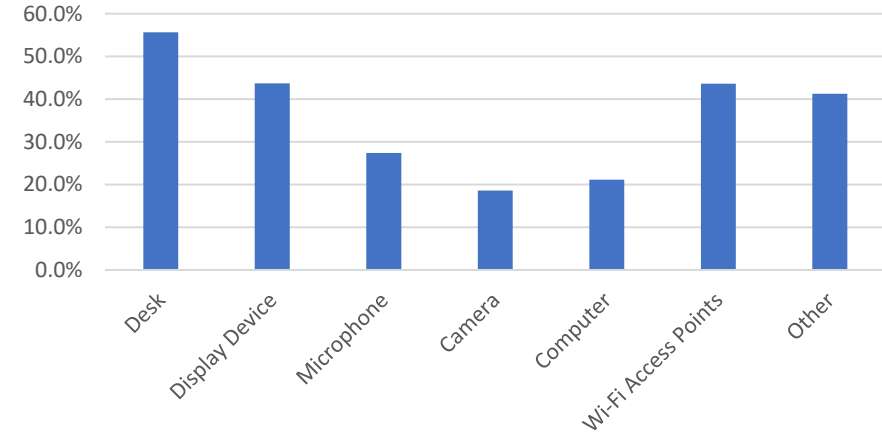
61% purchased new furniture or equipment.

Desk, screen and Wi-Fi being the top three

Have you purchased new devices, equipment, or furniture to be able to better work from home?

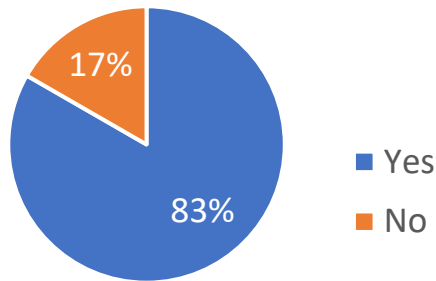


If yes, what did you purchase?

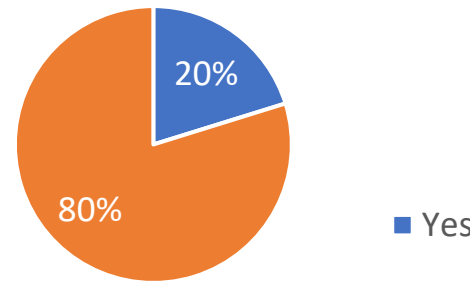


How were they connected and how adequate was it ?

Do you feel your Internet Service Provider (“ISP”) speed is adequate for working from home?

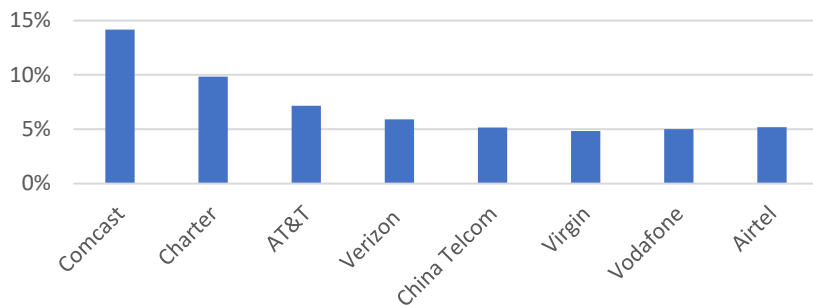


.Is anyone in the household an MMP(Massive Multiple Player) gamer?

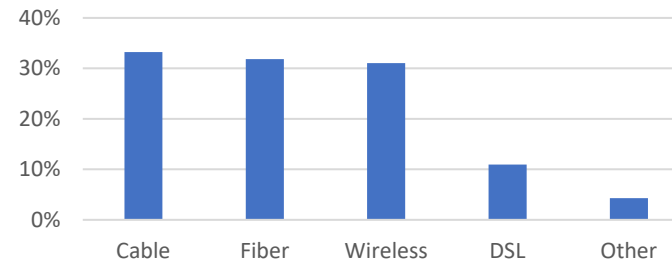


While the majority felt their broadband speed was up to the job, it left 17% feeling their broadband was inadequate

Who is your ISP?



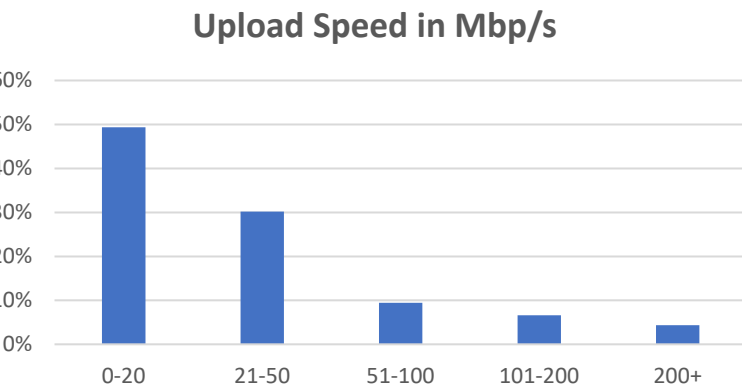
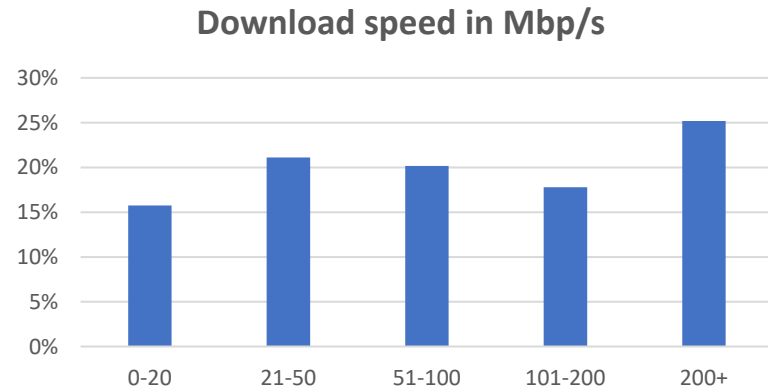
What Access Network are you connected to?



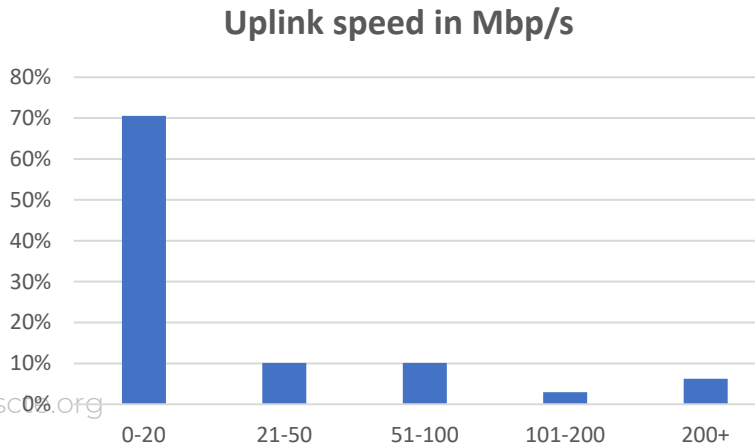
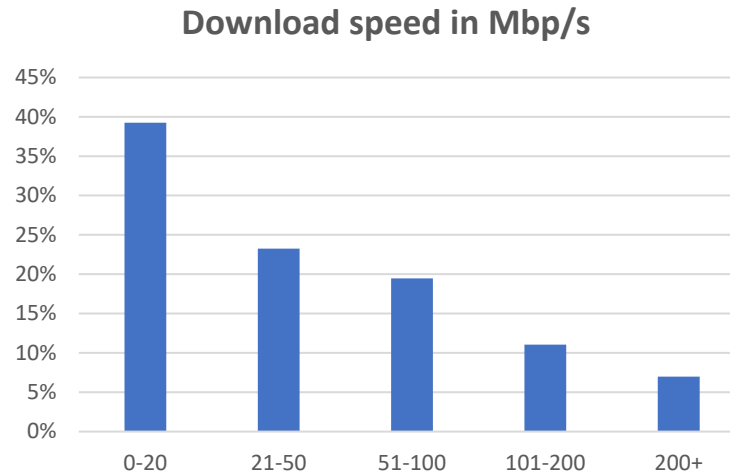
Roughly 30% Cable, Fiber and FWA

What Downstream and Upstream speeds

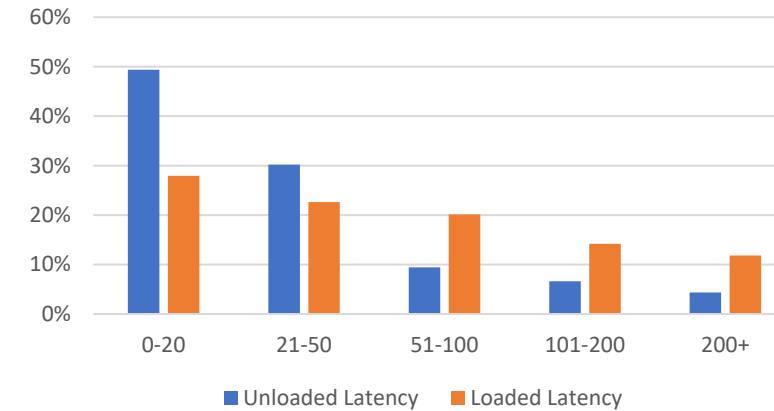
All Respondents



Those who said broadband was inadequate



Combined Latency (ms)

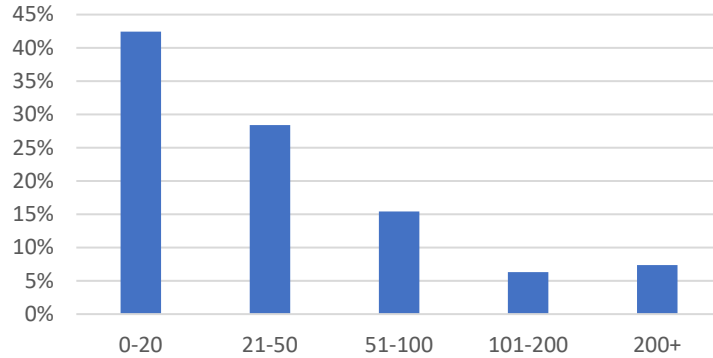


There is a clear link between those who thought speed was inadequate for working from home and actual speed.

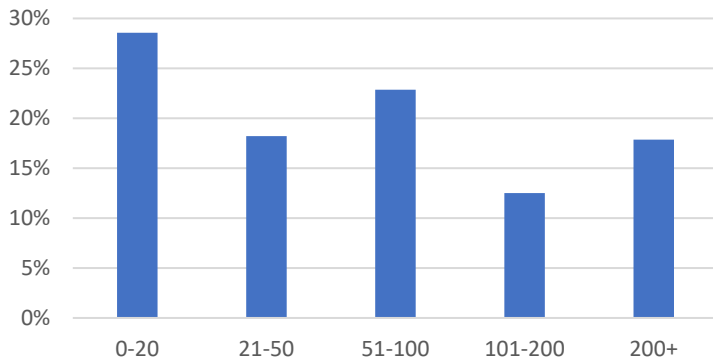
Uplink speed may be more significant than download.

All

Unloaded Latency (ms)

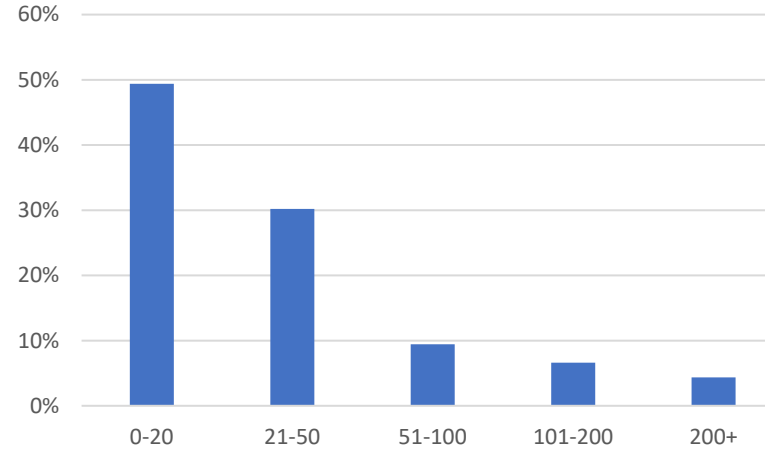


Loaded Latency (ms)

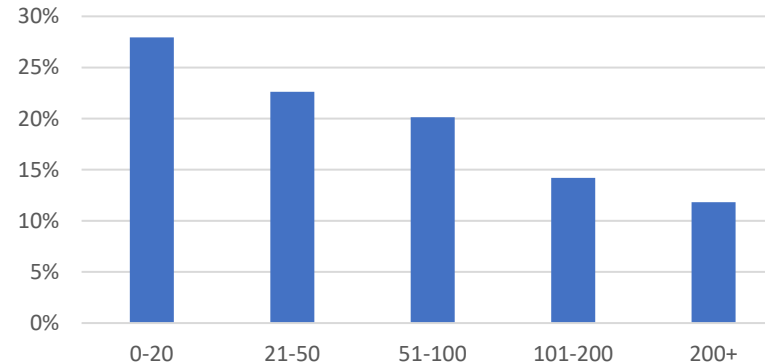


Those who said broadband was inadequate

Unloaded Latency (ms)



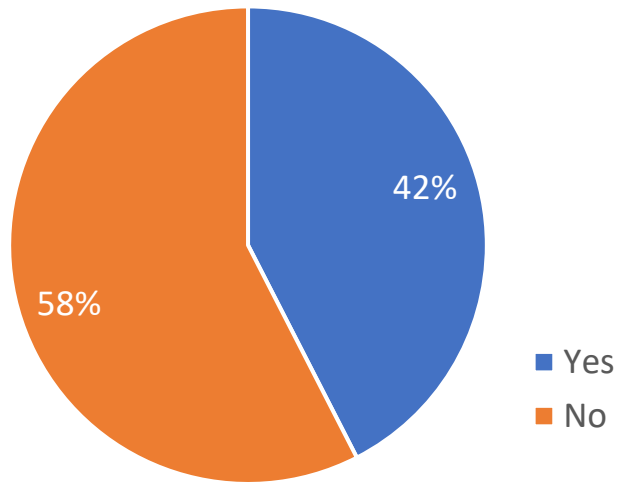
Loaded Latency (ms)



There appears to be less of a linkage between satisfaction and latency.

Does Latency matter for WFH

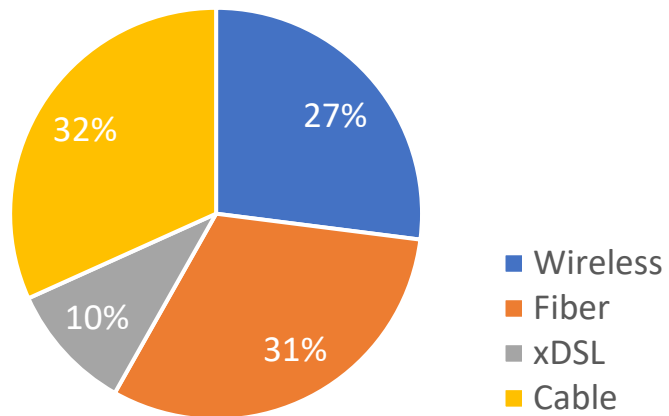
Do you value lower latency in your working from home experience, ex snappiness in services like gaming?



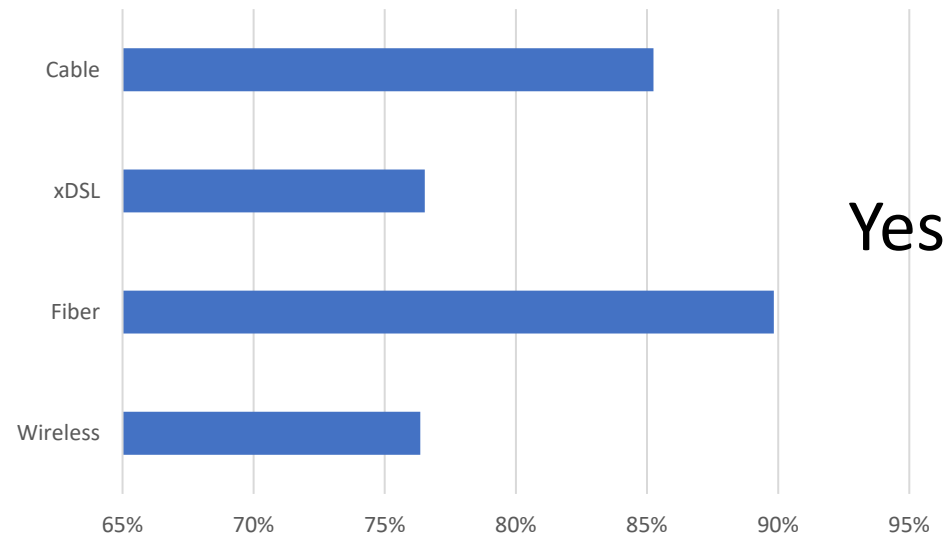
Latency is often a hard thing to define for consumers
Gamers understand it but does a WFH person correlate VC issues with latency or bandwidth

Correlating satisfaction to Network type

Network types used



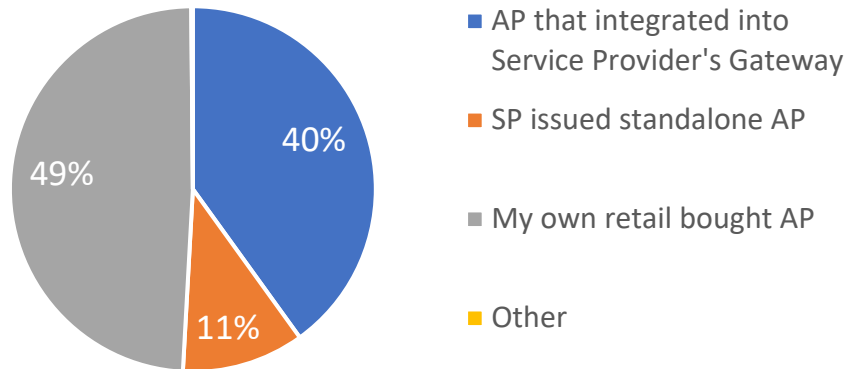
Do you feel your Internet Service Provider (“ISP”) speed is adequate for working from home?



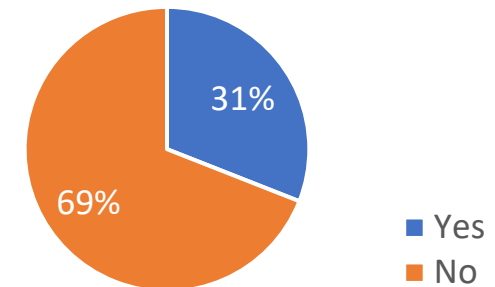
Yes

What type of Wi-Fi setup had our respondents ?

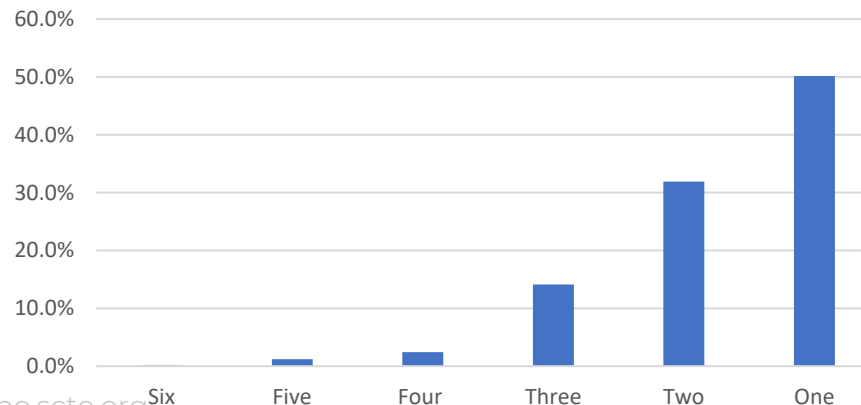
What Wi-Fi AP do you have?



Do you use Wi-Fi extenders to extend your Wi-Fi coverage in the home, examples including Surfboard mAX, Google Wi-Fi?

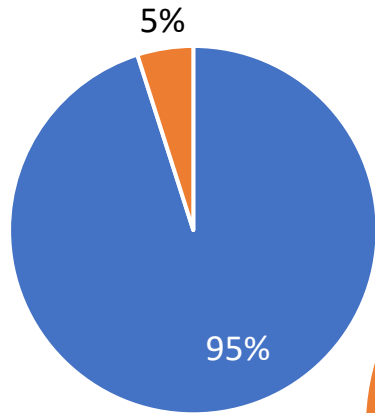


Respondents with Extenders – how many ?

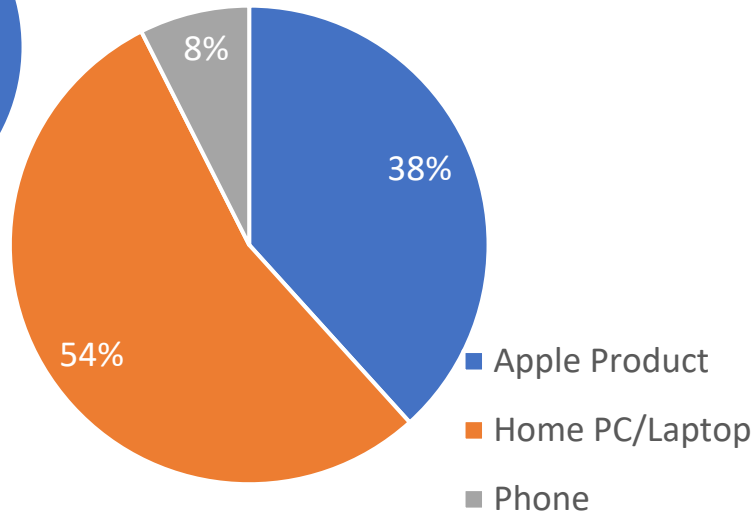


Laptop main WFH device with respondents

Do you primarily use a company issued laptop, tablet, or phone to work?



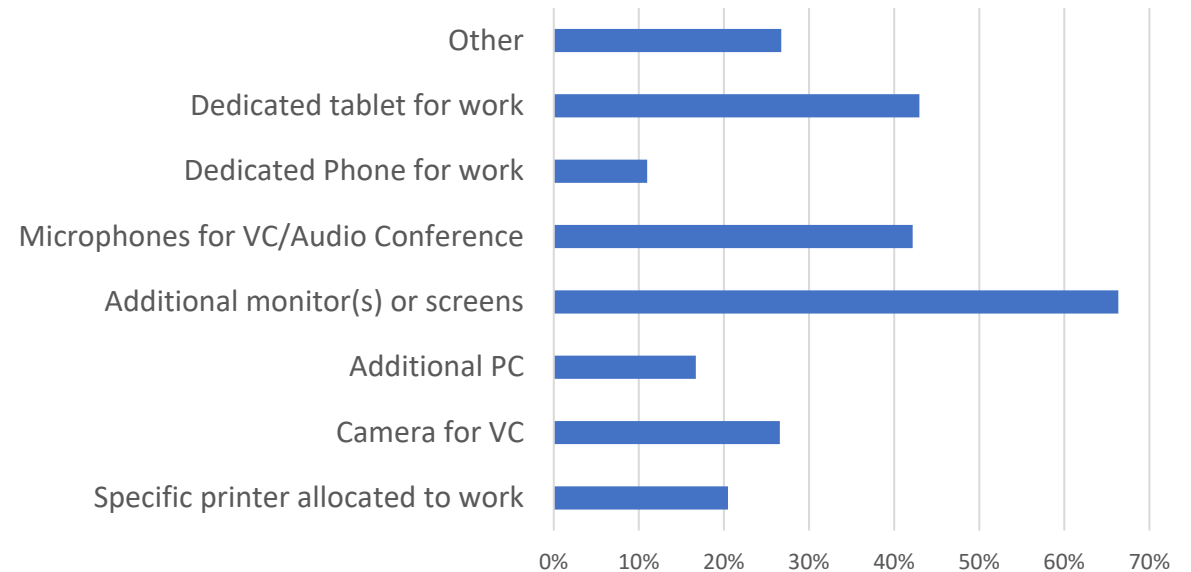
If no, what do you use?



66% use a separate screen

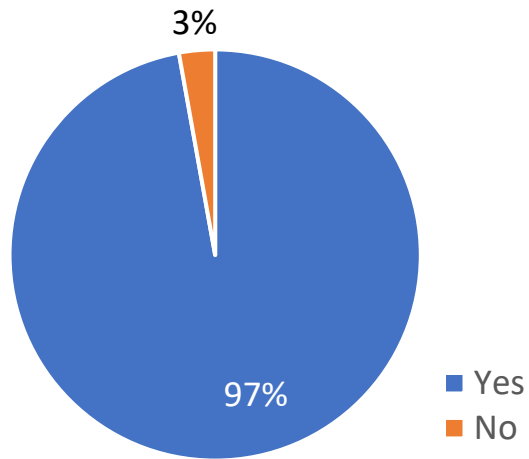
Microphones for video conferencing and a dedicated tablet for work are also popular

What other devices do you use for working from home ?

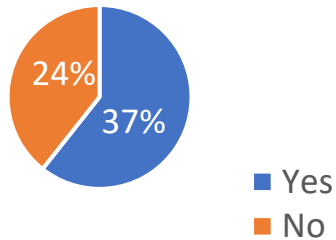


Corporate Security measures – relevance of VPN for WFH

Do you use the VPN to access Company Resources

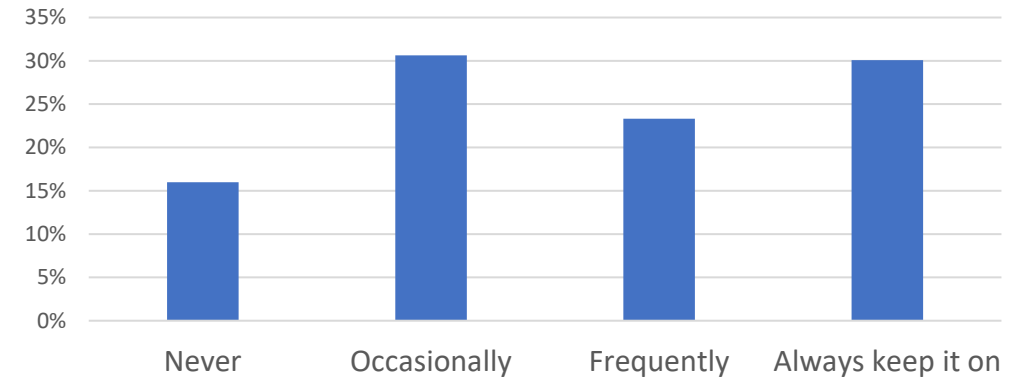


If no, do you use web-based resources/mail?

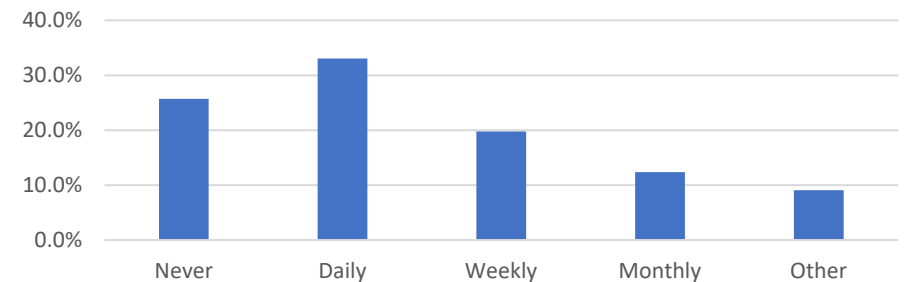


VPN's problematic – increased capacity helped

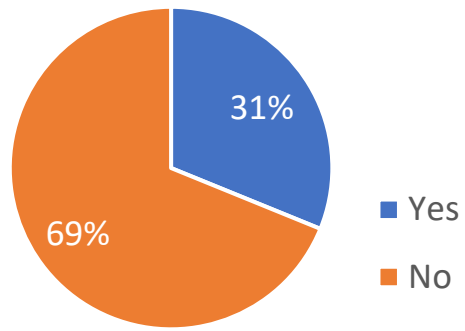
How often do you turn off corporate VPN on your company devices, or do you keep it on all the time?



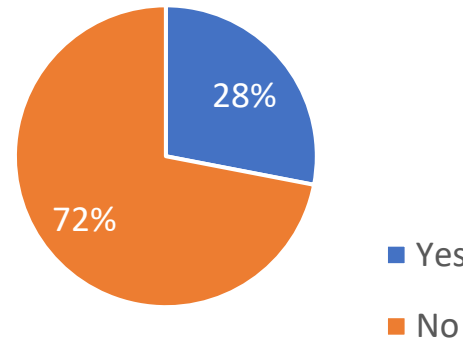
How often do you use LTE or 4G for work? Typically on your smart phone/tablet for voice, or sometimes using phone as hotspot.



Have you had many connectivity issues while Working from Home?

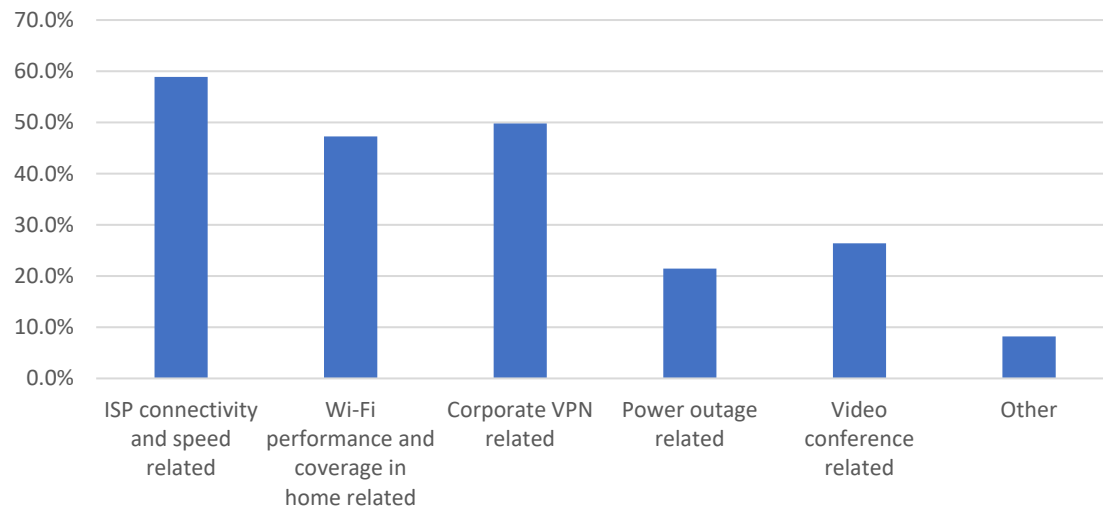


Do you have VPN problems that affect your work?

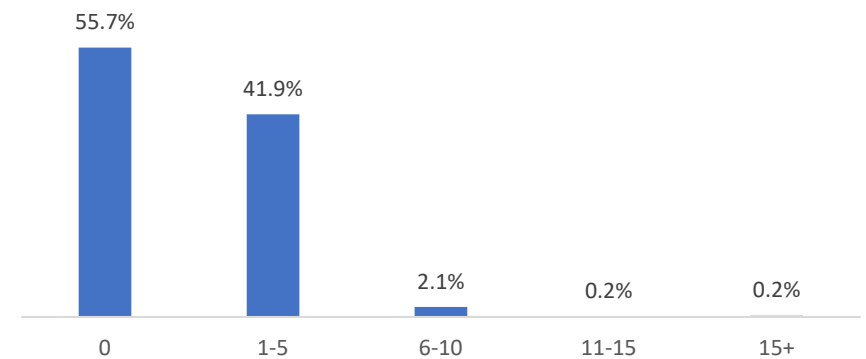


31% experienced some form of connectivity issue, which was the reason for the great majority of calls to the helpdesk.

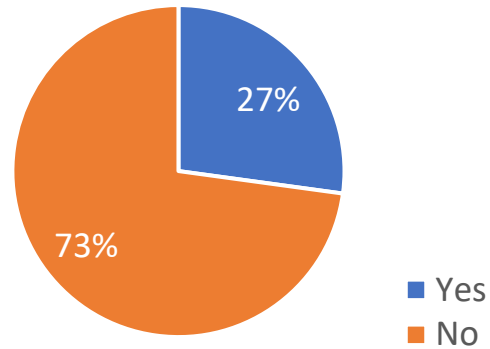
If yes, select issues that apply to you



How many times have you called Company IT to help you from home?

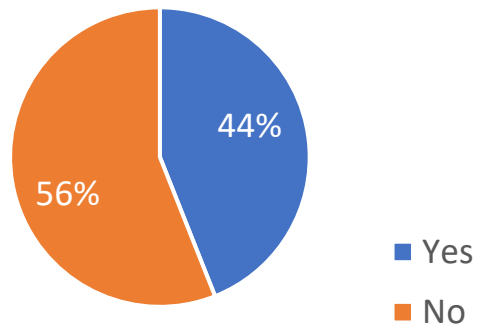


Is your WFH experience impacted by others in your home also using services like Video Streaming or Video Conferencing when you are working?



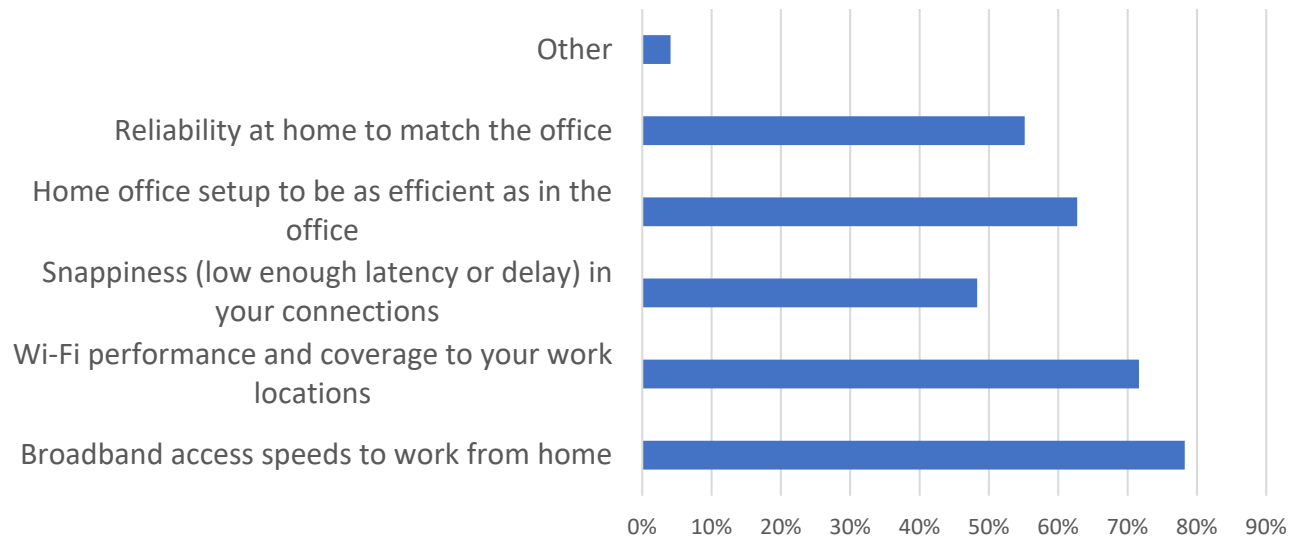
27% felt they were impacted by others using the network while working and video conferencing drop-outs are common.

Have you experienced video conferencing drop outs, which made it more difficult for you to do your job ?



Is the home working environment adequate?

Select item(s) which you think are adequate for current work from home situation:

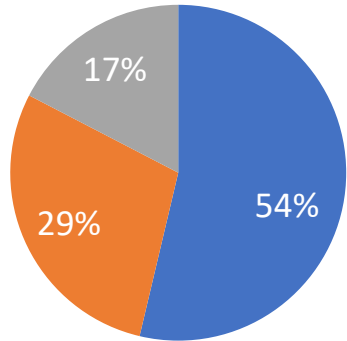


While the majority feel the environment is adequate, there is significant gaps to address to match an office environment:

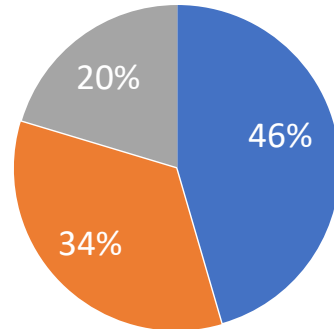
- **45% need more reliability**
- **37% need a better home office set-up**
- **52% could benefit from lower latency**
- **28% have Wi-Fi coverage and performance issues**
- **and 22% suffer from inadequate broadband speeds**

Enhanced solutions ranked – High Medium and Low

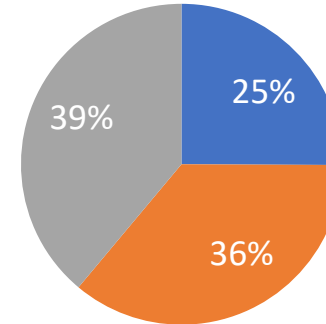
Additional screens to work from



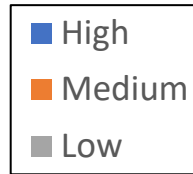
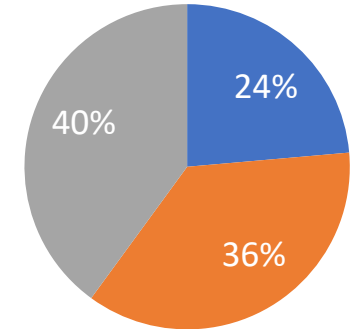
Security on your connection to the office



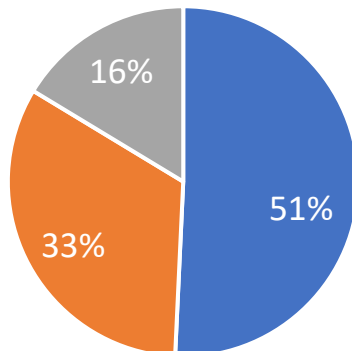
Power backup solution



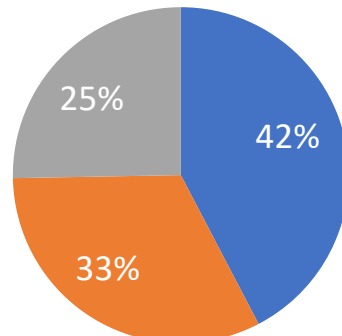
Separate Wi-Fi SSIDS for company work and for your personal work



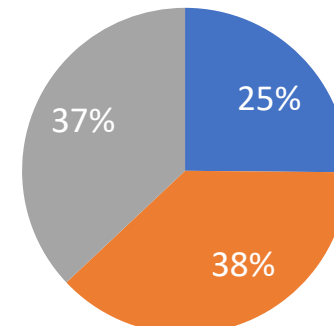
Higher reliability on your ISP connection with a backup connection



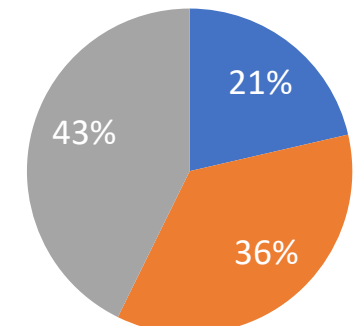
Better hands-free microphone



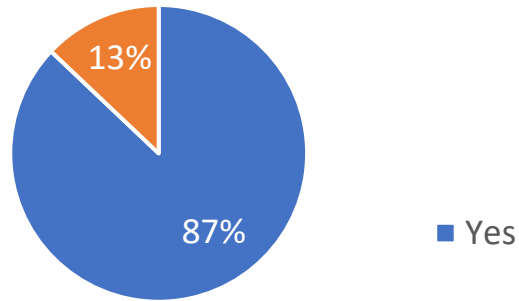
Having a separate corporate network and service to your residential service



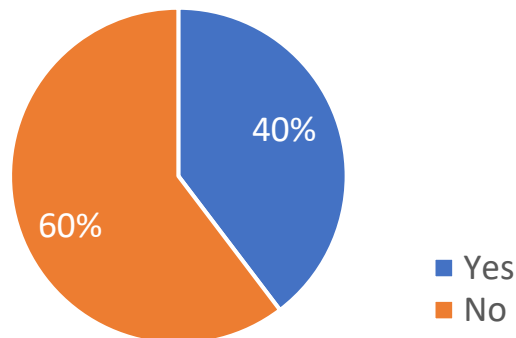
Better cameras or additional cameras for Video Conferencing



Do you tend to stay in the same room when you work?

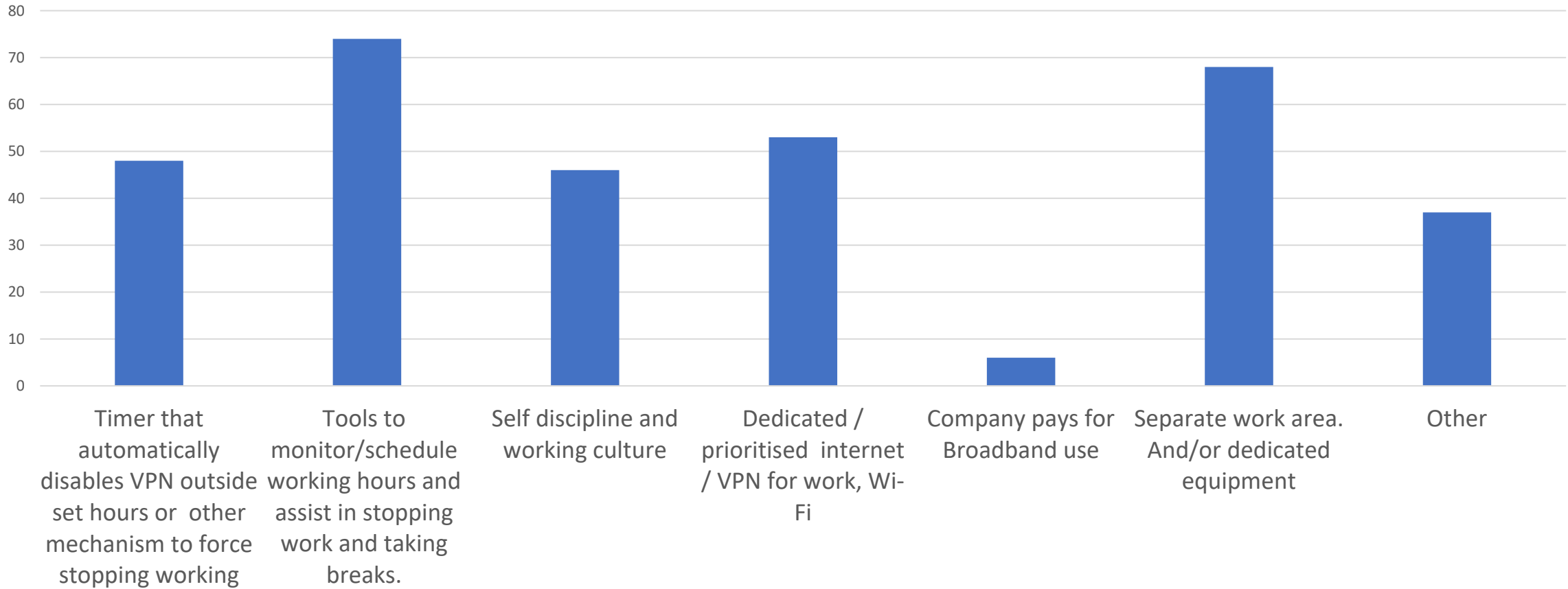


Would you value a working from home solution that tries to separate work time from off-work time?

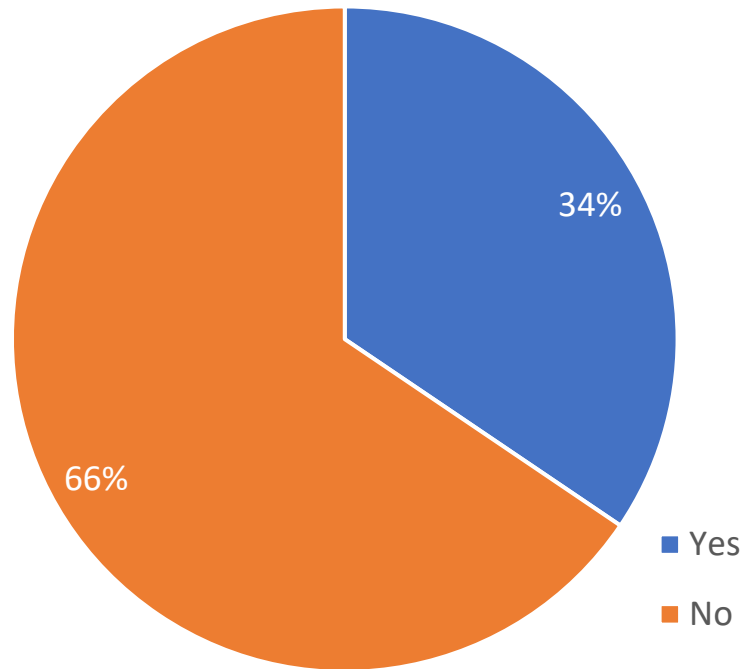


40% would value a solution that separates work and personal time.

If yes, what are the product or connectivity ideas you have to improve separating work time from off-work time? *Open question*



Would you use a TV in your house for video conferencing if the right Camera and Microphones were added?



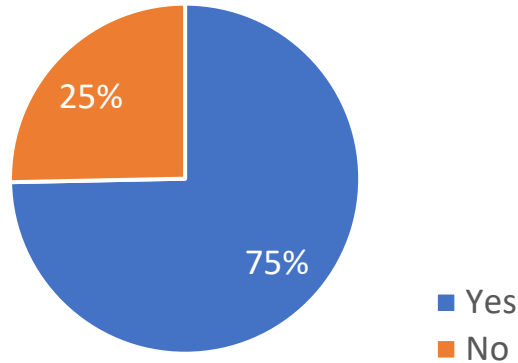
Can we use the TV Screen + STB and Microphone/Camera solution as a Work Video Conferencing or additional screen platform

The 34% of respondents who said yes – typically had a home office with ability to use existing TV or add TV

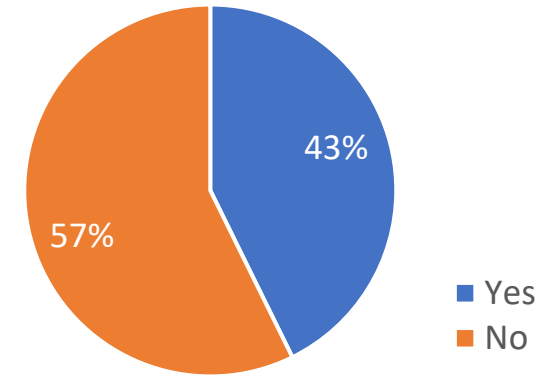
Others cannot because of shared work and living spaces

There is a market for a better working from home solution

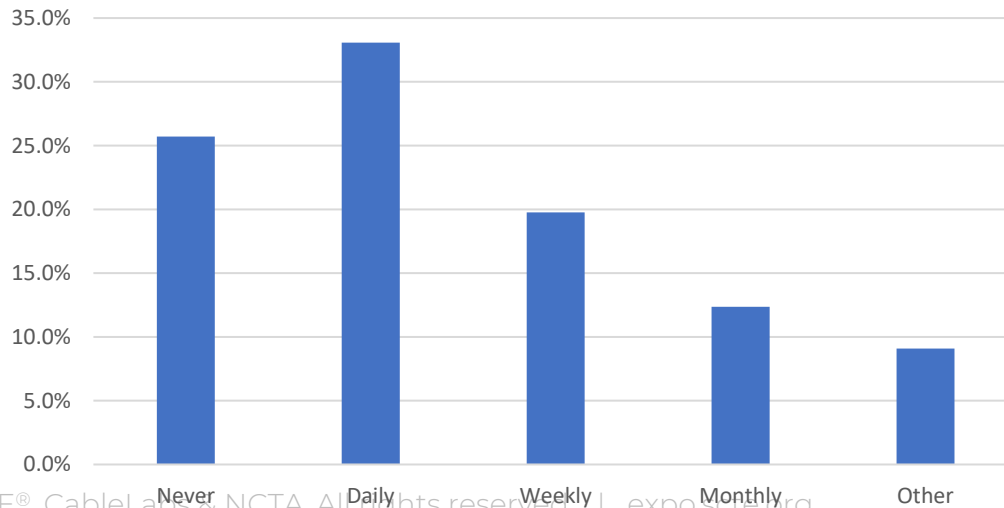
Would you be interested if your ISP provider offered you a better WFH solution with higher downlink and uplink speed, more reliability, and a better Wi-Fi home connection?



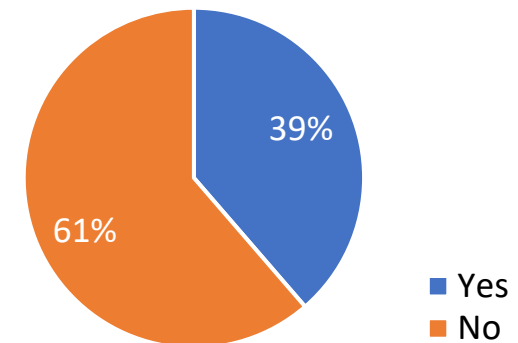
Are you likely to upgrade your Wi-Fi solution because of the issues encountered working from home?



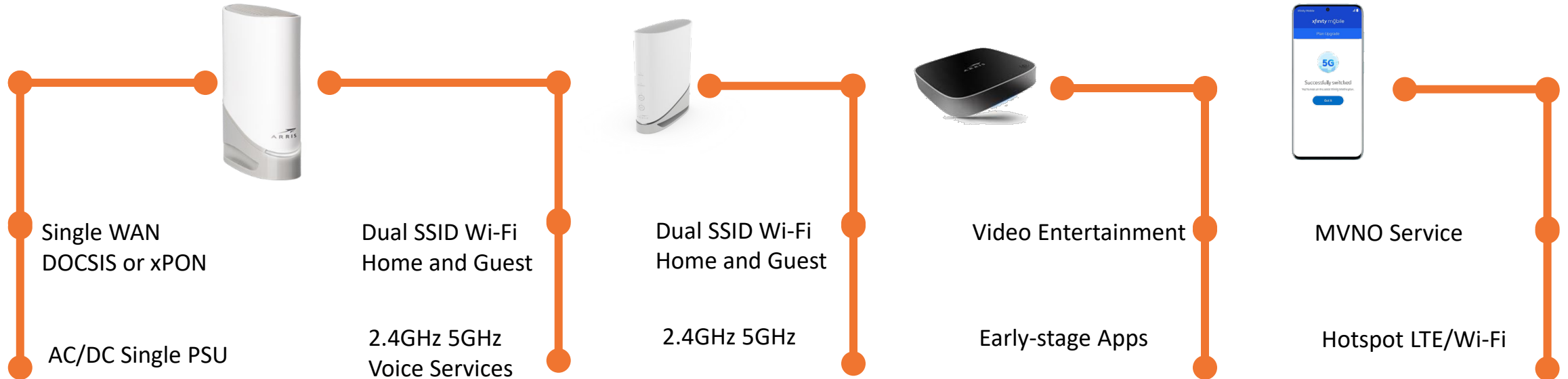
How often do you use 4G or LTE for work?



Are you likely to upgrade your ISP connection because of the issues encountered working from home?



Predominant device and services offered today



- Cable Operators provide primarily 3 devices today for Broadband
- Have been adding additional MVNO Mobile services – Hotspot capable
- Some have access to shared spectrum – CBRS – potential for some FWA based WAN redundancy services
- While eMTA Voice services are offered – WFH users tended to use Work issues smartphone

Key items to consider for WFH business opportunity

Consumer demand for

- Increased Reliability
- Better Wi-Fi
- Separation from Work and Home
- Better equipment to Work From Home

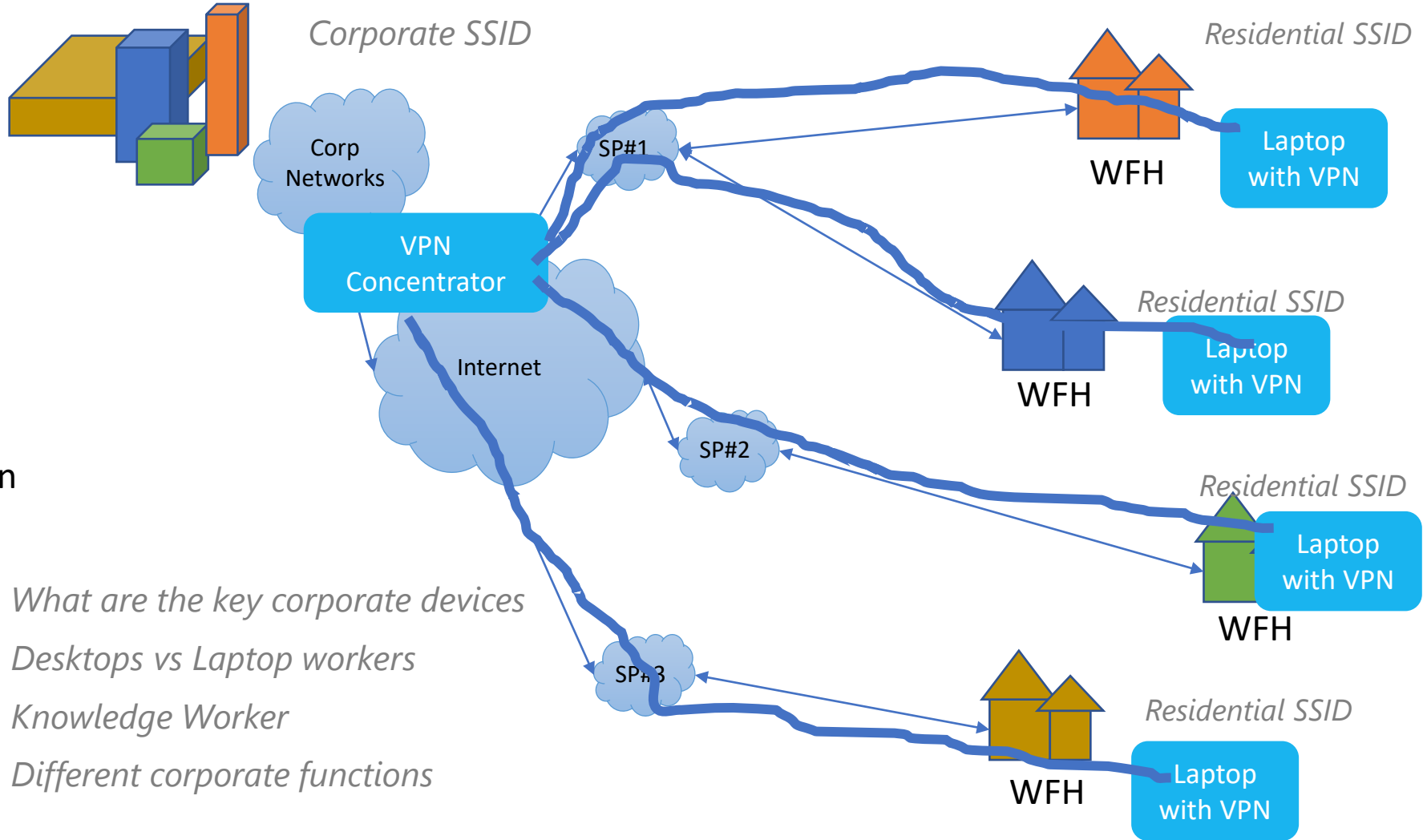
Service Provider opportunity

- Create a WFH pack of services
- Work to develop 2 tier sale process to home – Consumer and Corporations with WFH employees

Work at home - the way we do it today



Businesses



Monitor

- Laptop/Workstation
- Tablet
- Speaker phone
- Video camera
- Printer

What are the key corporate devices
Desktops vs Laptop workers
Knowledge Worker
Different corporate functions

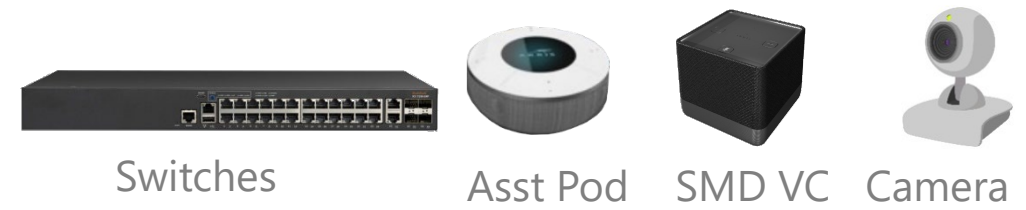
Is this the better WFH device and accessories ?

- LTE/5G backup WAN
- UPS Power backup
- Integrated VPN
- Integrated File Cache
- IT dept control
- Anti Eaves dropping
- Low Latency
- Anti Theft



- HR tools**
- Worker Presence
 - Worker Tracking
 - Office/Home separation
 - Shared Home support

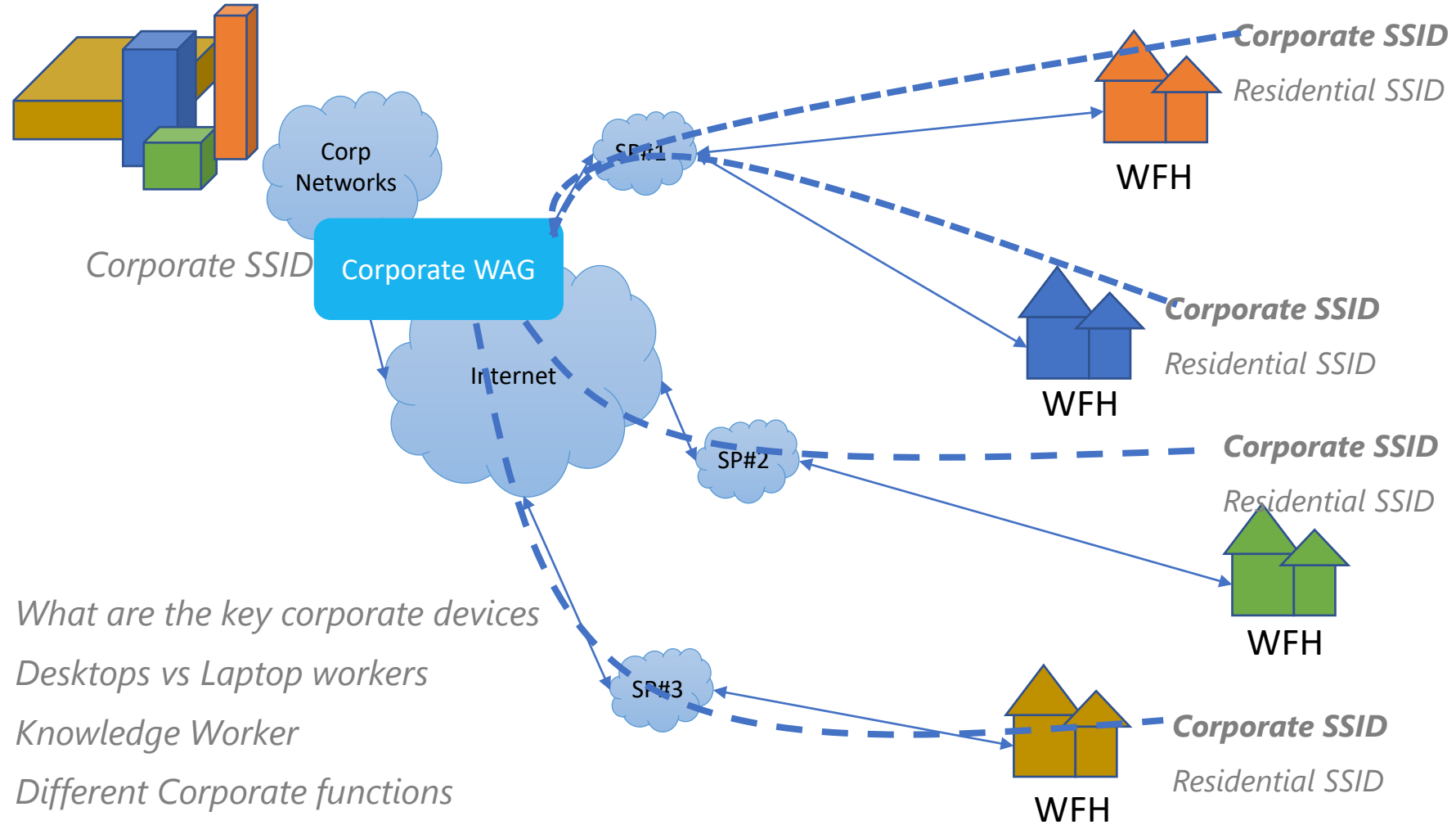
Accessories



Work at home like the office – extension of office

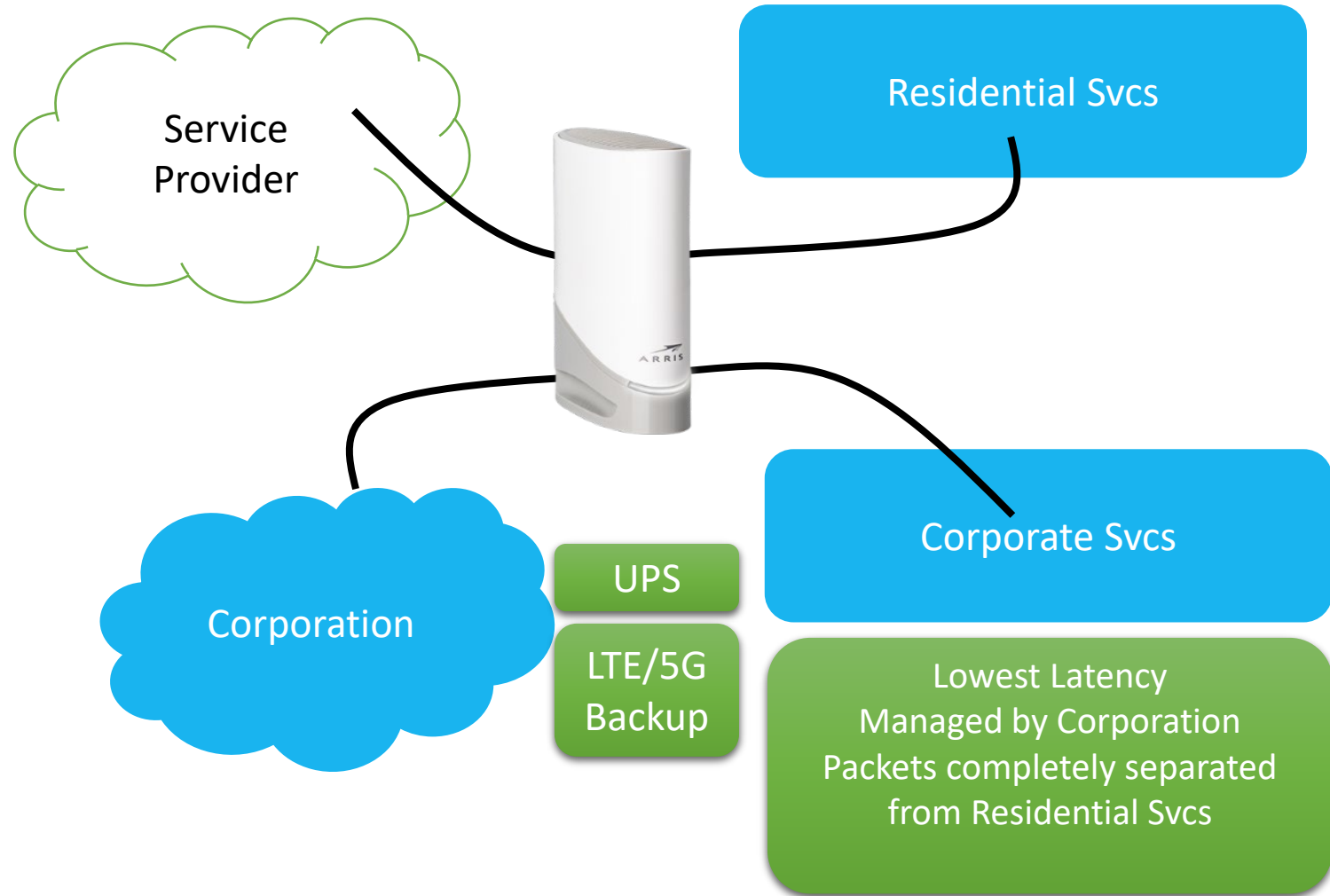


Businesses



What are the key corporate devices
Desktops vs Laptop workers
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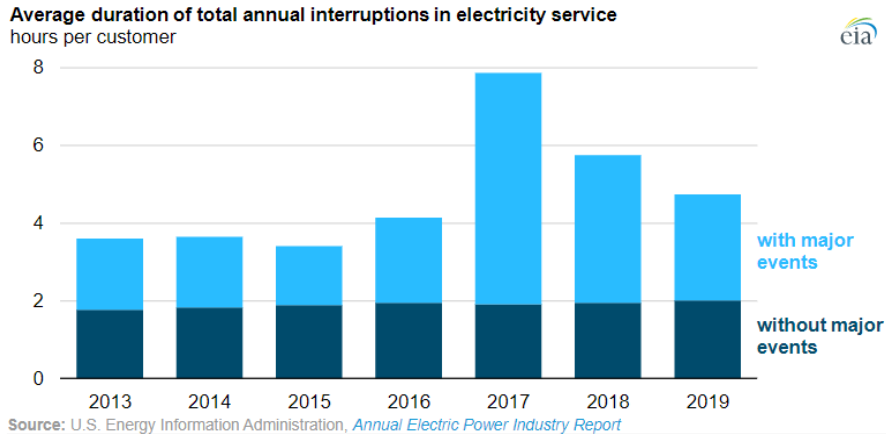
- Giving Corporations the Security, Performance and Reliability that they offer their employees in the Office
- Providing differential QoS and Separation for Residential and Corporate Svcs
- Two Services through one Home Gateway or 2 separate sets of products for the home – one Residential and one Corporate sponsored



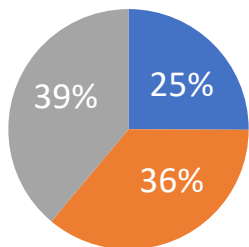
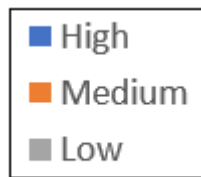
New App Service Delivery Opportunities

Will consumers value power redundancy for WFH

U.S. power customers experienced an average of nearly five hours of interruptions in 2019



Power backup solution



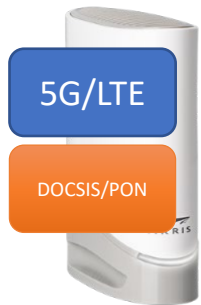
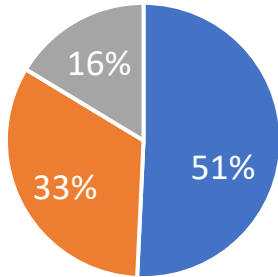
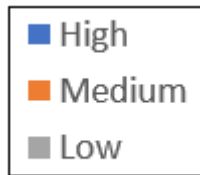
61% interested

- Most consumers don't experience long power outages – average total time power out for consumer in US – 5 hours. Most experience short brownouts and annoying interruptions.
- Power and Broadband concurrent outages tend to be high – especially with Aerial HFC plant
- Cellular Basestations are fiber backhauled by the same Fiber bundle as the HFC plant
- Keeping your Broadband and Wi-Fi connection going is not useful if your working devices are without power. Battery based devices like laptops tablets and phones tend to be used for WFH and so have potentially 2-10 hours use during power outage
- In areas with frequent power outages – Many Consumers use generators vs market for battery hold up devices. Hold up times of GW services from 600VA/330W for 1-2 hours to 3000VA/850W to sustain a working day are feasible
- Pandemic WFH has made consumers aware that even if power outages are short in duration they happen at the worst times and a solution would be desirable to most WFH
- Does this manifest itself as a battery backup solution optimized for WFH broadband services only ?

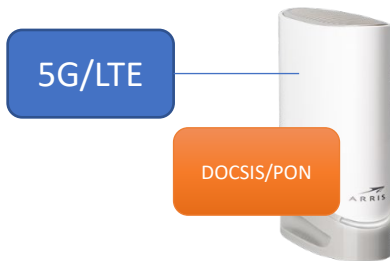
Will consumers value power redundancy for WFH

Higher reliability on your ISP connection with a backup connection

84% interested

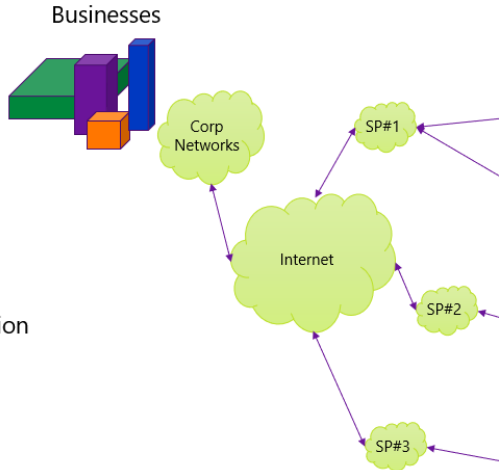


Integrated FWA/Wired



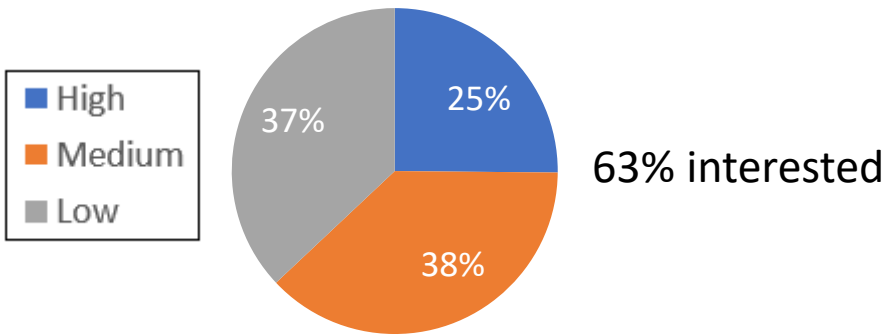
External FWA

- Potential to include FWA solution with Wired Gateway for WFH solutions
 - Increased cost/size and power of GW
 - Complexities of Indoor Unit (Desired) vs Outdoor Unit (Higher Opex and Capex costs)
- External Modular addition for 5G/LTE FWA solution
 - IDU and ODU options potential
- 5G/LTE data plans and costs key for marketing and selling solution
 - No costs when not used
 - Initial consumer purchase cost or driven by usage
 - Usage and Service tiers when WFH redundancy kicks in
 - MVNO services more difficult to prioritize WFH traffic than MNO
- Consumers use Mi-Fi Hotspot on their corporate issued Smartphone or personal smart phones when they have issues. For single laptop tether or just office use – Wi-Fi performance can work to sustain the internet outage.
- Pandemic WFH has made consumers aware that reliable broadband is essential. High recalls of the one Video Conference that stressed them out.
- How is wireless redundancy marketed and sold and what is the optimal home architecture ?



- Monitor
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 - Tablet
 - Speaker phone
 - Video camera
 - Printer

Having a separate corporate network and service to your residential service



Employees Home or Apartment

Residential Services and Wi-Fi

Keeping your Office separate from your home

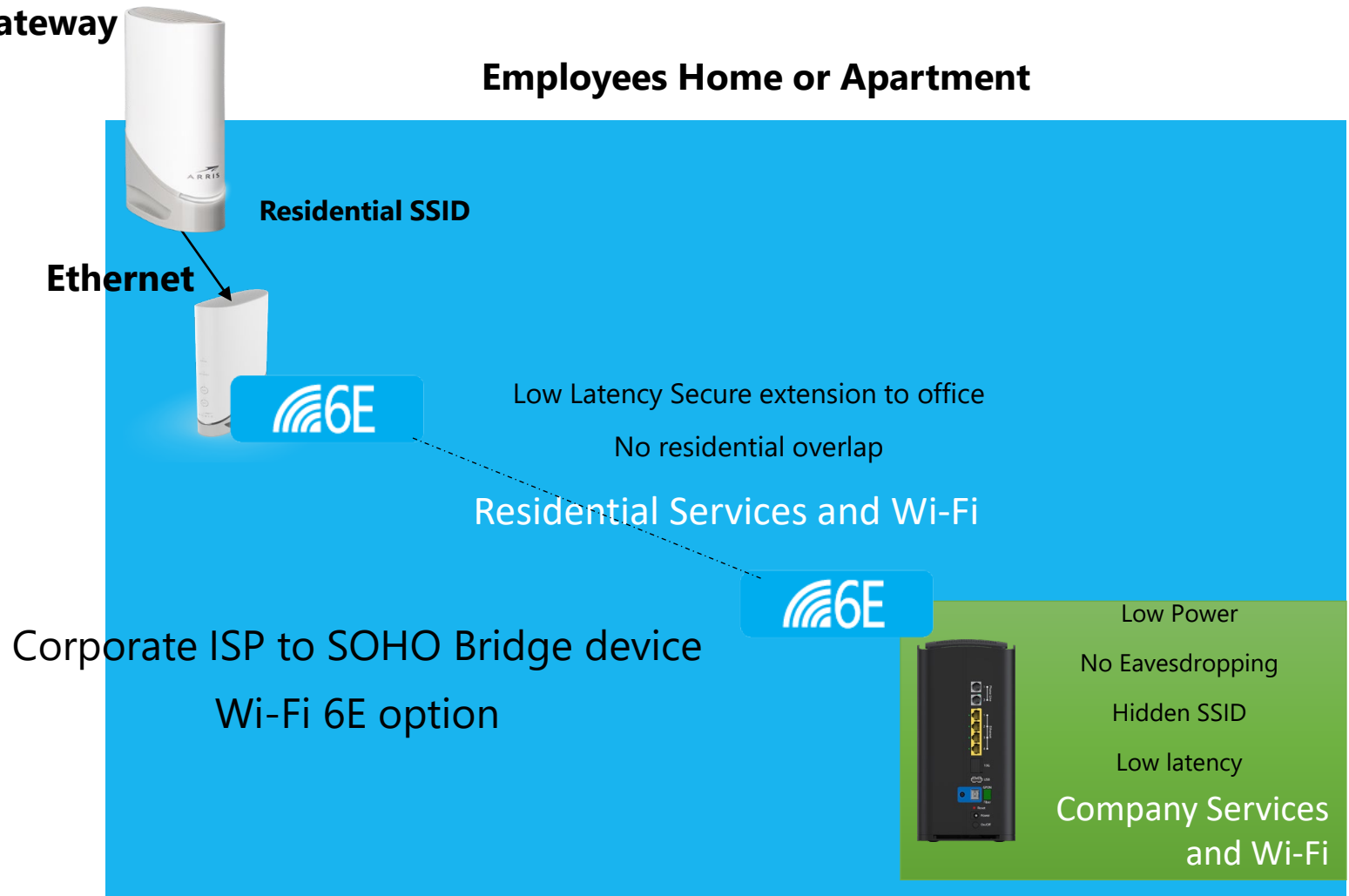
- Your house mates
- Your Neighbors

Company Services and Wi-Fi

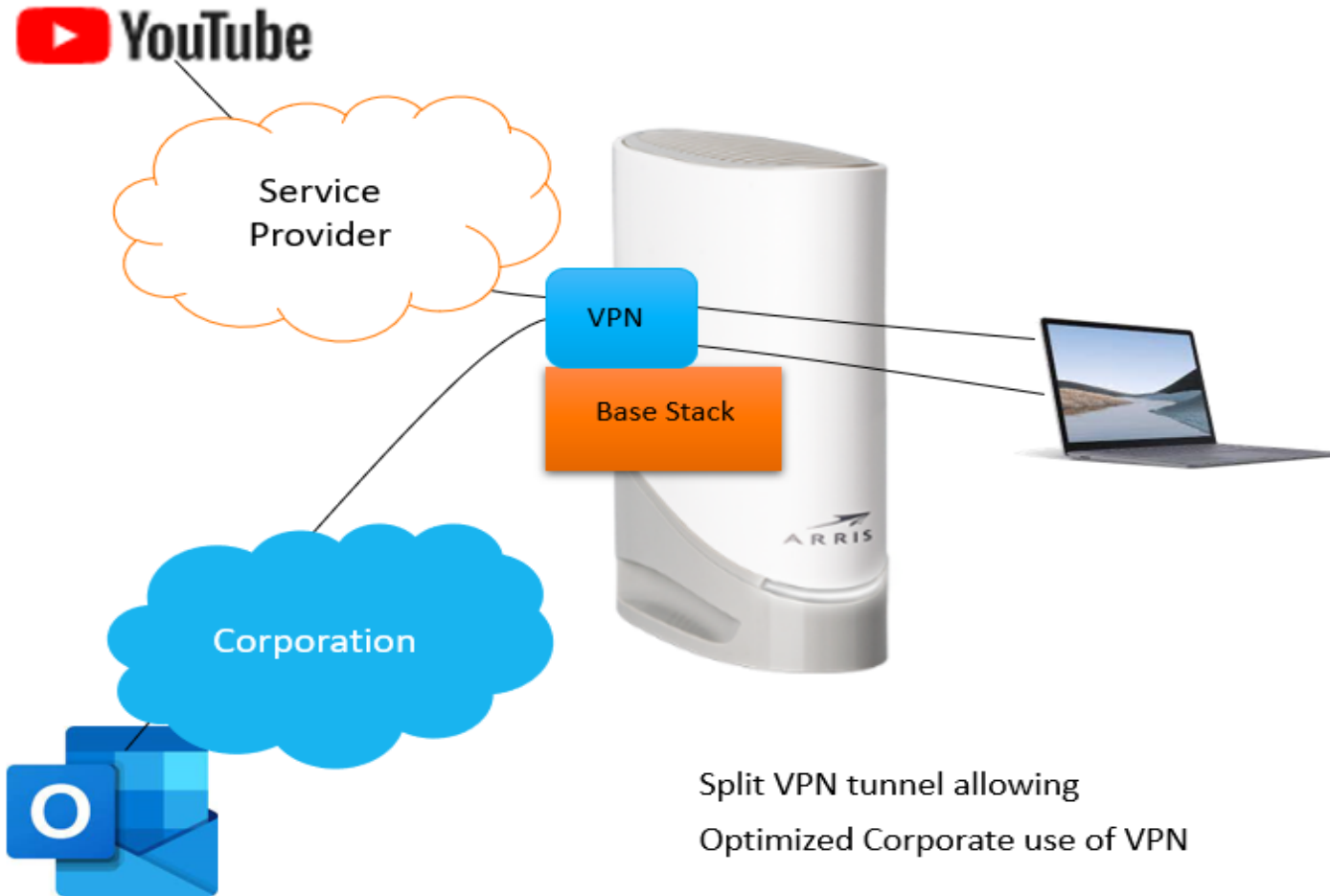
Opportunity - Using Wi-Fi 6E for private WFH Wi-Fi Network

- Using Wi-Fi 6E to ensure corporate services are lowest latency, congestion free and harder to eavesdrop.
- Dedicated 160MHz, 1ms latency capable channel for WFH services
- QoS and SLAs applied to this Wi-Fi SSID and Low Latency DOCSIS
- Separating the home office from the rest of the home with only 6E coverage!

SP Gateway



Can we create a solution that completely separates Home and SOHO Network



- When at home – using VPN from the GW vs the laptop
- Split Tunnel support
- Is this now a relevant feature
- Future of VPN vs other authentication/softkey methods

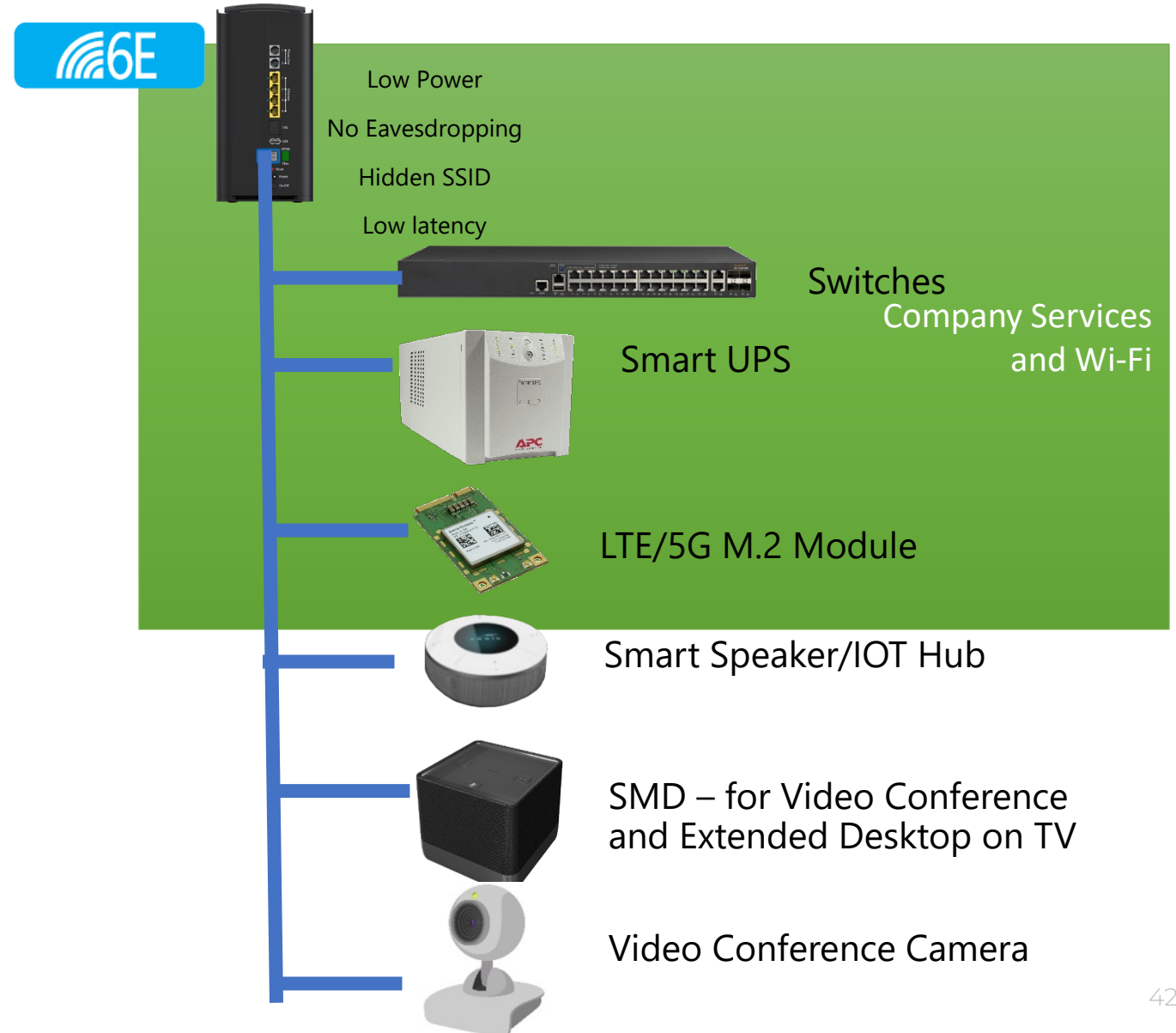
WFH worker presence tools – security and productivity



- WFH services only present when worker is present
 - Using BLE – SmartPhone has to be present
 - Using Wi-Fi Motion in home office area
 - Correlating activity on WFH issued equipment
- Connectivity services disabled when presence is not detected
- Security improvements for shared work from home environments
- New Authentication methods to define user and connectivity trust
- HR tools for helping to regulate working hours
- Potentially controversial area of tracking workers presence in their WFH environment but has additional benefits for employee to regulate working and show productivity. Needs some definition of Privacy as well as opt-in or corporate requirements to drive the use of such a solution.
- Service driven more by Corporations and enabled by CSP presence services in the home ?

Additional CSP accessories that could be bundled ?

- Is there value in driving connectivity including Wi-Fi to be contained in the SOHO vs more than one room in the home.
- Is the complete separation of Work area/location from rest of home valuable to corporations and acceptable to WFH employees ?
- Additional devices and accessories supported



Is there a new WFH Services and Home Architecture

- Potential is there to define a new level of WFH service to consumer that is more than just extending SMB SD-WAN services to the home.
- Investment in the service seems to only have risk if the number of WFH employees of corporations drops to pre-pandemic levels. Even then the increased reliability and performance seem to be options residential broadband customers will want.
- The role of the Corporation to desire the CSP to offer these services and for Corporations to subsidize/pay for employees is important. Although we have seen that employees have paid themselves to be able to work from home and show its not an issue.
- Any initial capital costs and ongoing price for these services is also something that needs to be examined for elasticity and willingness to pay. Most of our respondents were happier to pay one time costs vs recurring costs – but also willing to pay more when they needed backup or more performance temporarily
- 2022 will give more visibility to the longer-term use of the home as a major working environment and drive clearer decisions on investments for CSP SOHO services.



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Thank You!

