Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of

The Emergency Connectivity Fund WC Docket No. 21-93

COMMENTS OF THE CONSORTIUM FOR SCHOOL NETWORKING REGARDING THE EMERGENCY CONNECTIVITY FUND ESTABLISHED BY THE AMERICAN RESCUE PLAN ACT OF 2021

The Consortium of School Networking ("CoSN") respectfully submits these comments regarding the Federal Communications Commission's ("Commission") administration and distribution of funding from the Emergency Connectivity Fund established by the American Rescue Plan Act of 2021 (P.L.117-2). CoSN is a national association of school district chief technology officers and other digital learning leaders serving communities of all sizes, including isolated rural, mixed suburban, and densely populated urban areas. Our members are the expert local leaders responsible for equipping all students and staff with the technology and connectivity required for digital teaching and learning, including remote learning. This longstanding work by our members includes applying for and using the Universal Service Fund's Schools and Libraries Program ("E-rate") to connect schools and on-campus learning spaces to secure, high-capacity broadband. During the COVID-19 pandemic, it has also included the herculean task of finding supplemental emergency funding, providers, and equipment to connect students and staff to broadband and devices where they live.

Given the expense and technical difficulty of meeting this national connectivity challenge, our members eagerly welcomed Congress's decision to create the Emergency

Connectivity Fund. They also appreciate this opportunity to inform the Commission's administration and distribution of this critically needed assistance. Maximizing the Emergency Connectivity Fund's near- and long-term impact on connecting all students and educators to broadband and devices will require the Commission to develop a comprehensive but flexible national framework that: (1) empowers local and state leaders to make decisions about how to best address unique community broadband and device needs; (2) encourages the acquisition of connections and devices of sufficient capacity to support robust digital learning (25 Mbps download and 12 Mbps upload speeds for each student in the home); and (3) distributes the program's limited funding efficiently and equitably using a budget cap model consistent with policy strategies already proven to work through the E-rate program.

Swiftly and successfully implementing the program – as envisioned by Congress – will require deference to local judgment and application of a transparent and equitable method for distributing funding, including by providing supplemental funding and assistance for the most rural remote communities and other high-cost areas. With that goal as our guide, we encourage the Commission to adopt the following recommendations.

THE COMMISSION SHOULD DEFER TO LOCAL AND STATE LEADERS TO MAKE DECISIONS ABOUT HOW TO BEST CONNECT STUDENTS AND TEACHERS AND MAXIMIZE THE PROGRAM'S IMPACT

The Commission should, as the Telecommunications Act of 1996 requires for the E-rate program, adopt competitively neutral rules for the Emergency Connectivity Fund.[1] Consistent with this principle, the program's rules should provide latitude to program recipients to make decisions – according to local and state procurement rules - about how to provide the most cost-effective remote learning access at the speeds required for teaching and learning. Similar to the

[1] 47 U.S.C. §245(h)(2)

E-rate's rules, the Emergency Connectivity Fund should also require funding recipients, service providers, and equipment sellers to provide data about price transparency to promote public accountability and to ensure market forces put downward pressure on local and program costs.[2]

Broadband and device access gaps and their causes often vary, including by income (low-income household disproportionately lack access to broadband), geographic location (urban-rural), costs, and education levels.[3] Given these local differences, and the need to ensure this emergency funding has an immediate and a longer-term impact on connectivity rates, the Emergency Connectivity Fund recipients should have the flexibility to use a variety of technologies and strategies (e.g., local and statewide consortia) to facilitate and expand remote learning access for students, especially for meeting the needs of isolated rural households and other higher cost areas.[4] Flexibility will maximize the program's reach and deliver a longer-term impact for students and rate payers. A budget cap model, like the system used by E-rate Category 2, is particularly well-suited to support this locally driven approach.

CoSN's forthcoming student home learning connectivity study (described later in these comments), which is based on real world remote learning experiences and data for hundreds of thousands of students, shows that the right connectivity solution for a school district is likely not a single technology, but a combination of solutions to reach all students. Program participants

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[2] E-rate Modernization Order (July 2014), 29 FCC Rcd 8870 (11)

[3] Ryan, Camille. 2018. "Computer and Internet Use in the United States: 2016 American Community Survey Reports." https://www.census.gov/content/dam/Census/library/publications/2018/acs/ACS-39.pdf.
See also National Center for Education Statistics, "Student Access to Digital Learning Resources outside of the Classroom." (2017), https://nces.ed.gov/pubs2017/2017098/index.asp.

[4] CoSN recommends that the Commission review the locale codes assigned by the National Center for Education Statistics to identify the most geographically isolated schools. See, *Informational Document on the Rural Education Achievement Program (REAP)*, p.9, U.S. Department of Education (January 19, 2021). Available at: https://bit.ly/31ELdAU

need the ability to innovate and find the solution or solutions that work best for them. This flexibility should include permitting the deployment of additional network facilities when they are the most cost-effective way to provide remote learning at the required broadband speeds and device powers described in the next section.

The Emergency Connectivity Fund's statutory language permits the purchase of a list of eligible equipment along with a wide array of advanced telecommunications and information services. The law does not specify every type of eligible technology or service, when applications should be filed, how to prioritize the distribution of funding, and other program parameters. The following examples of advanced telecommunications and information services that school districts are already using (CoSN is vendor and technology neutral) should be among the permitted flexible uses of the Emergency Connectivity Fund:

- **School District Provided Citizens Band Radio Service:** Citizens Band Radio Service (CBRS) is a private, two-way communications service that traditionally provides voice services but that can also transmit data packages and extend internet connectivity. School districts can use CBRS to stand up private CBRS 4G & 5G networks. School districts using this technology or a variation of this solution with private sector partners, include Santa Fe Public Schools (NM) and Boulder Valley School District (CO). McAllen ISD (TX) has partnered with the City of McAllen to use this technology. 25 districts in Utah are deploying private Long-Term Evolution (LTE) Broadband using CBRS in partnership with the state education network. Arlington County Public Schools in VA is using CBRS in partnership with their county government.

- **LTE Broadband:** LTE Broadband is a 4G wireless connection that is similar to school district provided CBRS. It may be carrier provided or owned and operated by the district. Carrier provided approaches leverage a provider owned LTE radio access network (RAN) to connect end user devices in homes via carrier provided radio transmissions. Districts using carrier provided LTE Broadband include Ukiah School District (OR) and Huntington School District (OR). Districts self-provisioning LTE Broadband include Desert Sands USD (CA), Spring Branch ISD (TX), Austin ISD (TX), San Antonio ISD (TX), Dallas ISD (TX) and Pasadena ISD (TX).
- **Satellite:** Offering internet access via satellite connectivity is an increasingly viable option, particularly for access in rural areas where connectivity reliant on transmission via cable, fiber, or cellular service is less likely. Internet access through satellite eliminates the need to build miles of infrastructure to deploy services to remote locations. Satellite internet can also be leveraged to connect those students living in locations where other options are not available. Districts using satellite include Ector School District (TX), Monroe County School District (WV) and many highly remote districts across the U.S.
- **Wireless Mesh Networks:** Wireless mesh networks (WMN) are designed to cover a large geographic region (a town, school district, or other locale). WMNs rely on a web of wireless access points deployed in the geographic area and utilize a multi-hop configuration to allow for the network to remain up and running if an individual Wi-Fi radio becomes unavailable. Several school districts in the Pittsburgh (PA) area (Coraopolis, New Kensington-Arnold, and Homewood) are partnering with Every1online, the nation's first non-profit fixed wireless Internet model in a one-year

pilot program prioritizing K-12 students. Lindsay Unified School District (CA) is using a Mesh Network with EBS spectrum. Palm Beach County School District (FL) also has a Mesh Network to provide Wi-Fi.

- **Point-to-Point Microwave:** Point-to-point microwave systems connect devices wirelessly back to a centrally located internet connection. Point-to-point is heavily dependent upon line of sight, so the approach is most useful in areas where there is excellent visibility and no interference from tall buildings, hills, or impediments. Umatilla School District (OR) has used this technology for many years to serve unconnected neighborhoods by using the high school to solve the problem of line of sight due to mountains.
- **District Provided Mobile Wi-Fi, Often Via School Buses:** This approach uses mobile Wi-Fi delivery points, often located on school buses. The model works particularly well for providing Wi-Fi access to high density residences such as apartment complexes and mobile home parks. Using this model, the district implements high speed, dependable Wi-Fi on a school bus that can broadcast Wi-Fi capabilities to households in the surrounding area. Optimally, connections are limited to school owned devices to ensure bandwidth is preserved for school related activities. Many districts are doing this application. One example, Spring Branch ISD (TX) deployed 15 Wi-Fi enabled buses since the start of COVID and stationed them with community partners and apartment complexes.
- **Drone Powered Internet:** Northland Pines School District (WI) partnered with a start-up using state funds to test using drones to deliver cellular internet to their unconnected rural students. The tethered drones boost cellular service and now enable

streaming video and the use of other educational software. Prior to this testbed, the district provided hotspots and Chromebooks did not work in many of their students' homes.

Consistent with the locally driven, strategically flexible approach described above, the Commission should also not impose restrictions on the community locations that can receive wireline and fixed wireless services supported by the Emergency Connectivity Fund. Promoting equitable student broadband access will depend on an applicant's ability to reach all students including students who do not have permanent homes; student that may frequently move; or students that rely on emergency locations for shelter and care. The National Center for Education Statistics reported that for school year 2015-16, 2.6% of public elementary and secondary students were homeless.[5] This location flexibility is particularly important given the economic hardship caused by the pandemic and local leaders are best situated to identify flexible strategies for serving these vulnerable learners.

The Commission should not require that Emergency Connectivity Fund supported equipment and services be used only for educational purposes but should instead defer to school district practices which are sound and well developed based on long standing local practices. A sweeping federal limitation would not serve any meaningful government interest and would unnecessarily complicate the program's administration and operations for schools, students, and educators. Furthermore, households should have the ability to use this connectivity for other purposes including work, accessing government and other community resources, and more. A single, sweeping federal requirement would be akin to burdening a 20th Century rural

[5] National Center for Education Statistics, Digest of Education Statistics, Table 204.75a. Homeless students enrolled in public elementary and secondary schools, by grade, primary nighttime residence, and selected student characteristics: 2009-10 through 2015-16. Available online:

electrification initiative with a requirement that electricity could only be used for light bulbs but not refrigerators or ovens. The Commission should also defer to current school district CIPA practices for remote learning. Remote learning is not new and school districts, working closely with their families, have developed lawful CIPA implementation strategies that align well with their local community perspectives and standards. Requiring a one size fits all approach for the Emergency Connectivity Fund would significantly and unnecessarily disrupt this settled policy area.

THE COMMISSION SHOULD ADOPT A NEW BROADBAND GUIDELINE (25 MBPS DOWNLOAD AND 12 MBPS UPLOAD SPEEDS FOR EACH STUDENT IN THE HOME) AND REQUIRE ROUTERS AND CONNECTED DEVICES OF SUFFICIENT CAPACITY TO SUPPORT REMOTE LEARNING

Earlier this year, CoSN initiated a student home learning and connectivity study based on the data of approximately 750,000 students. The study was supported and informed by an advisory group of school district technology leaders. The first-of-its-kind study is designed to analyze students' remote learning experiences and needs for the purpose of developing bandwidth, device, and other guidelines for remote learning. Twelve urban, suburban and rural school districts from across the United States participated in the study.

Participating districts shared anonymized information about internet usage, latency, and performance from network filter logs and video conferencing solutions. The districts include Aldine Independent School District (TX), Beaverton School District (OR), Dallas Independent School District (TX), Ector County Independent School District (TX), Fauquier County Public Schools (VA), Forest Ridge School District 142 (IL), Hillsborough County Public Schools (FL), MSD of Wayne Township (IN), Rock Hill Schools York 3 (SC), Santa Fe Public Schools (NM),

St. Charles CUSD 303 (IL), and Wake County Public Schools (NC).[6] Analysts extracted and analyzed hundreds of millions of records and used APIs to determine access locations and Internet Service Providers for each online class and meeting conducted. The analysts used advanced geospatial capabilities to determine geographic areas with suboptimal internet connections.

The study shows that the FCC's current broadband definition – 25 Mbps download and 3 Mbps upload – significantly underestimates the amount of home bandwidth required for remote learning, especially when a household includes more than one student. The study also shows that student remote learning experiences are negatively impacted by outdated and under-powered computing devices, routers, and other connected devices. Based on these results, CoSN recommends that the Commission adopt higher minimum service and device standards for the Emergency Connectivity Fund to ensure that the program's limited resources are used, whenever technically possible, for equipment and service that meet student needs. Specifically, the Commission should:

- **Adopt an Enhanced Broadband Definition.** The Emergency Connectivity Fund should utilize a 25 Mbps per student download and 12 Mbps per student upload broadband definition (See Attachment A). This level should be a guideline for Emergency Connectivity Fund participants, because some rural and other communities do not have sufficient service options available due to infrastructure gaps or other special local conditions. The guideline should not impede the program's support for students living in some of the hardest to connect communities,

[6] Procedures are built into the study to ensure the privacy and confidentiality of data. Student records were de-identified prior to performing the study's statistical analyses. Public data sets and reports are available only at the aggregated level and are de-identified using appropriate and industry accepted techniques.

especially remote rural locations, who may need the most assistance. We also note that higher resolution video, such as 1080p HD and 4K, will most likely be required by students and educators in the future. In addition, we expect new technologies such as AR and VR be used to deliver instruction in the future, which will require upload and download speeds of 25 Mbps for SD and up to 500 Mbps for 4K. Thus, the Commission should revisit this remote learning broadband definition at least every three years.

- **Focus on Home Network Capacity.** The Emergency Connectivity Fund rules should include a requirement or at least clear guidelines designed to ensure that households are equipped with a modern router (802.11ac and preferably 802.11ax) that is sufficient for video-based learning and to support the number of users and devices in the home. Older Wi-Fi standards, such as 802.11g or 80211.n, should not be supported by the program.
- **Ensure Access to Sufficiently Powerful Learning Devices.** The Emergency Connectivity Fund rules should also provide guidance to school districts about the minimum capabilities of devices to be supported the program, including a focus on CPU type (preferably Intel i3 or equivalent); amount of memory (preferably 4 GB or better); internal Wi-Fi connection (preferably 802.11ax); integrated webcam, headphone port.

Rather than establishing a device spending cap or a range of costs that could inadvertently hobble the program's ability to support remote learning by equipping students with under-powered devices, the Emergency Connectivity Fund should use a budget cap system (see recommendations below). Funding recipients should also be tasked with ensuring program costs

are reasonable based on local practice and consistent with market for covered services and equipment. The reasonableness test should balance the remote learning capacity requirements described above and other connectivity initiative costs so as to maximize the program's penetration (number of students and educators connected) and ability to support learning, especially video, consistent with present remote learning practices. Given the extensive use of, and requirements for, video conferencing, internet connectivity plans that are supported by the Emergency Connectivity Fund should not have data caps and companies should not be permitted to throttle service.

CoSN will publish the complete results of the home connectivity benchmarks study in May 2021 but given the study's relevance to the Commission's implementation of the Emergency Connectivity Fund, we are releasing these preliminary findings. The findings underpinning our above recommendations show that video accounts for most network demand associated with remote learning and that outdated and under-powered Wi-Fi and devices negatively impact the student experience. The CoSN study shows that:

- **Video consumes the vast majority of network traffic and therefore upload speed is vitally important.** Network log data shows that video (synchronous and asynchronous) accounts for 85% of network traffic for remote learning. (See Attachment B). Educators are also adopting video intensive applications both for direct instruction and instructional supports. These applications use a significant amount of data and are often run concurrent with the synchronous video classroom sessions. However, video is used for more than direct instruction. Students use video to interact with each other, to engage educators, and to submit homework. Educators also often ask or require students to leave cameras on to monitor and support student engagement and participation.

- **Most students connect to the internet at home via outdated home wi-fi.** Data compiled for the CoSN study by online meeting software shows that approximately 92% of students connect to remote learning using Wi-Fi rather than through wired connections. Many users believe they have slow internet connection, but in some cases the real problem is slow Wi-Fi delivered through routers using outdated wireless standards. Wi-Fi standards have changed significantly over the last 10 years, yet many household routers may have not been updated to reflect these changes.
- **A student's remote learning experience is significantly impacted by device quality.** Upload and download kbps vary significantly by device type. Device age and type significantly impact the student experience. Students that were provided with older and less powerful equipment did not have the same experience as students with newer devices. Students that received newer devices with limited specifications (memory and processor) also did not have the same experience as students that were provided with devices with better specifications. The actual causes of poor performance are most likely attributed to:
    - Type and speed of processor
    - Amount of memory
    - CPU utilization
    - Number of applications running at one time
    - Quality of Wi-Fi Antenna and signal strength received
    - Wi-Fi standard used and access frequency
- **There are multiple students in most student households.** The study shows that 70% of students live in a household with one or more other students. Concurrently supporting

multiple students from the same internet connection requires increased bandwidth for each student added to the home network. For this reason, it is essential that the Commission adopt a per student, not per household, bandwidth recommendation.

- **Students often access learning resources from locations other than home.** Many students participated in school activities from locations outside of the home. It was also common to observe students access the internet from multiple locations during the six-week period of the study. In addition, many children come from split family environments and thus live in multiple households or learning settings.
- **Many students used their phone or tablet in addition to their computers to participate in online meetings.** Even though many students in the study had a district assigned device and access to home internet, many used their phone or tablet along with their district assigned device to participate in online meetings. These additional devices contribute to increased home bandwidth requirements.
- **Remote and rural areas do not have the internet speeds of urban areas.** Generally, data showed that most cities and suburban areas where students lived had high speed internet available (FCC Form 407 data) and deployed (Speed Test Data). However, students living in more rural areas or on the edges of suburban areas had more limited internet access. Likewise, users within certain areas of a city also experienced limited internet speeds. This condition may be attributed to capacity issues on the part of ISPs brought about by oversubscribing or capacity issues related to overloaded network switching equipment.

THE COMMISSION SHOULD DISTRIBUTE THE PROGRAM'S LIMITED FUNDING EFFICIENTLY, TRANSPARENTLY, AND EQUITABLY CONSISTENT WITH BUDGET CAP MODELS ALREADY PROVEN TO WORK THROUGH THE EXISTING E-RATE PROGRAM.

Demand for the Emergency Connectivity Fund may exceed the program's available $7.1 billion in funding. Last July, a study conducted by the Alliance for Excellent Education (All4Ed), the National Indian Education Association, the National Urban League and UnidosUS showed that as many as 17 million students lacked access to home broadband and many educators also require connections.[7] School districts and their state partners likely have made progress in connecting more households and raising the connectivity speeds of other households since that time, but the problem remains vast. For reference, Common Sense and the Boston Consulting Group estimated in January 2021 that "[c]losing the divide requires $6 to $11 billion for the first year, and $4 to $8 billion annually thereafter to address affordability and adoption gaps, as well as additional investment in universal broadband infrastructure."[8]

Given the scale of the connectivity challenge, and the need to provide Emergency Connectivity Fund recipients predictable, flexible, and meaningful levels of support (accounting for the American Rescue Plan's new Critical Infrastructure Program and other pandemic emergency support provided to school districts and governors), CoSN urges the Commission to adopt a per-student cap model, weighted to provide additional resources to high poverty and rural school districts, for distributing program funds. A well-designed cap-based model would be efficient, equitable, and offer a much lower-burden application process. It would also be consistent with policy strategies already proven to work through the E-rate program. The Commission should consider establishing budget caps for applicants based on a modified E-rate

[7] New Analysis Shows Students of Color Far More Likely to Be Cut off from Online Learning, AEE, NIEA, NUL, and UNIDOSUS, (July 2020). Report available online at https://bit.ly/3u69XP0.

[8] Ali, T., Chandra, S., Cherukumilli, S., Fazlullah, A., Galicia, E., Hill, H., McAlpine, N., McBride, L., Vaduganathan, N., Weiss, D., Wu, M. (2021). Looking back, looking forward: What it will take to permanently close the K–12 digital divide. San Francisco, CA: Common Sense Media.

Category 2 approach. The successful E-rate Category 2 budget system that the Commission carefully analyzed, sought public comment on, and agreed to continue in November 2019 is widely supported by CoSN's members and has only grown in popularity.[9]

The Emergency Connectivity Fund should include a mechanism to distribute supplemental connectivity funding – beyond the prescribed caps – for isolated rural and other very high-cost areas. A companion state level initiative or special needs fund within the Emergency Connectivity Fund could provide rural and other specially situated locations with the additional investment required to ensure all students benefit from the program. Among other advantages, supplemental statewide and intra-state regional approaches would help program recipients take advantage of cost efficiencies associated with bulk purchasing.

The Emergency Connectivity Fund should reimburse purchases of eligible equipment and services made by schools and libraries since July 1, 2020. Adopting this approach would recognize the significant investments and efforts by school districts and states to connect students to remote learning for the 2020-21 school year and align administratively with school district fiscal years. Most jurisdictions made substantial unexpected broadband and device investments outside their normal budget cycle and need assistance from this fund to continue and expand their remote learning initiatives. The Commission should also allow districts to purchase spare devices to address when equipment breaks. In addition, many districts have well developed spare equipment policies, and they should be allowed to follow these local practices. CoSN has found districts often purchase 5%-10% spare devices. This approach will ensure that learning continues seamless when devices fail.

[9] In the Matter of Modernizing the E-Rate Program for Schools and Libraries, Report and Order, WC Docket No. 13-184, (Adopted November 2019).

CONCLUSION

CoSN urges the Commission to defer to local and state decision-making as much as possible to ensure that the program achieves its full potential impact in closing remote learning connectivity and device gaps; encourage the acquisition of connections and devices of sufficient capacity to support video and the other most common remote learning practices; and to distribute the program's funding using a budget cap model consistent with policy concepts already proven to work through E-rate Category 2, which is effective and widely supported. CoSN and our members would be pleased to provide any additional information required by the Commission to support implementation of this important new program.

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ATTACHMENT A

CoSN HOME LEARNING AND CONNECTIVITY STUDY BANDWIDTH USAGE TABLE

Based on the estimates below that were gathered through the CoSN study, we recommend that the Commission adopt a minimum remote learning guideline of 25 Mbps download for each student and 12 Mbps upload speeds for each student.

Student Bandwidth Usage	Resolution	Download (Mbps)	Upload (Mbps)
Email -- Is used to communicate to students by teachers, administrators, and other students.	n/a	1	1
Web Browsing -- Students access the Internet frequently to research topics using a browser and search engine such as Google or to read blog articles. Ad services related to various websites also consume a significant amount of bandwidth.	n/a	1	0.5
Learning Management System -- Students use a Learning Management system such as Canvas, Google Classroom, or Schoology to access and submit assignments and communicate with their teacher and other students.	n/a	1	1
Video Instructional Content -- Students access video instructional content from sources such as PBS Kids, Khan Academy, Newsela, McGraw Hill, Discovery, National Geographic, YouTube, etc.	SD	3	0.5
Online Assessments -- Assessments for essential skills and content knowledge are provided online and taken at home. Assessment software can be divided into broad categories: Formative and Benchmark. Examples of formative assessment software is Edpuzzle and Edulastic. Example of benchmark assessments include iReady and Renaissance	n/a	1.5	0.5
Cloud Storage -- Students download and upload homework assignments using cloud storage such as Google Drive or Office 365.	n/a	5	2
Online Meetings -- Students participate in daily online meetings with Teachers using an online video tool such as Google Meet, Zoom, or Microsoft Teams. In addition, online meetings are used for counseling and	SD	3.2	3.2

providing services for English Learners and Students with disabilities. Students frequently participate in small group instruction sessions and use video to communicate with teachers and other students.			
Feedback -- Asynchronous video is frequently used by teachers and students to communicate and provide feedback to each other. Teachers and students often record videos using software from companies such as Loom and Screencastify to communicate. Other feedback tools are provided by companies such Class Dojo and Edmodo.	SD	2	2
Instructional Support -- Interventions and instructional support for areas such as reading, credit recovery, math, etc. are provided through online resources. Many companies such as Edgenuity, Renaissance an Illuminate provide solutions in this category.	n/a	3	1
Multiple Devices -- Students frequently use two or more devices to access the internet (e.g. Computer, Tablet, Smart phone, etc.)	n/a	1	1
Educational Gaming Technology -- Instruction is often provided through software such as Kahoots, BrainNook, FunSchool, Socrates, ZooWhiz that utilize gaming technologies.	HD	5	1

ATTACHMENT B

Network Traffic and Video Usage for One School District Participating in the CoSN Study

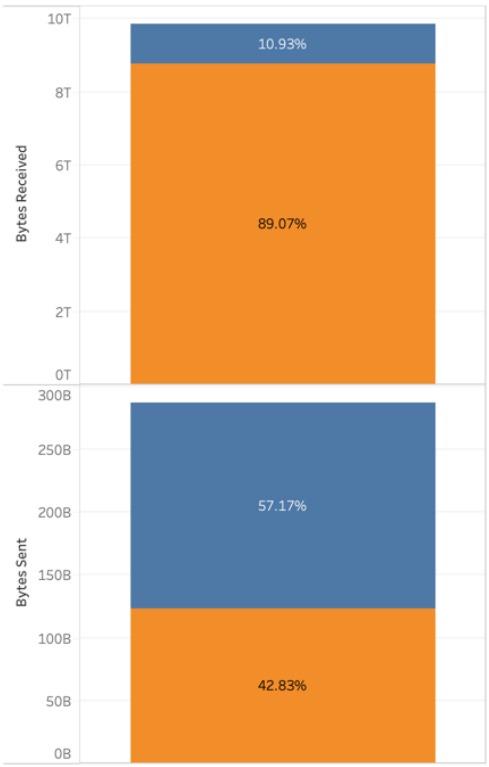
Network Traffice by Category

Traffic Category	Bytes Received	Bytes Sent	Total Bytes
Google Meet	7,414,822,937,642	23,934,073,917	7,438,757,011,559
Insructional Content	679,033,300,430	11,098,523,836	690,131,824,266
Ads	228,198,631,149	32,233,441,050	260,432,072,199
Video Streaming	254,216,844,691	2,715,252,125	256,932,096,816
Google	182,232,331,187	37,520,371,752	219,752,702,939
Other	188,995,720,591	25,948,847,366	214,944,567,957
Amaazon AWS	174,706,502,428	29,884,630,346	204,591,132,774
Utility	140,406,314,303	19,046,869,909	159,453,184,212
You Tube	80,040,317,886	48,890,966,527	128,931,284,413
LMS	65,871,050,233	34,469,960,325	100,341,010,558
Leaning Tool	88,327,920,930	4,621,928,713	92,949,849,643
Gaming	85,228,568,937	2,230,158,689	87,458,727,626
CDN	81,397,674,350	1,774,671,604	83,172,345,954
Feedback	79,843,407,334	1,042,471,361	80,885,878,695
Assessments	62,948,633,425	5,497,094,452	68,445,727,877
Access	33,658,808,449	1,436,100,380	35,094,908,829
Social Media	13,061,662,951	457,870,567	13,519,533,518
Malware	3,683,952,232	2,914,977,612	6,598,929,844
Shopping	3,365,973,178	843,585,199	4,209,558,377
Search Engines	286,468,165	615,792,861	902,261,026
Universities	817,859,092	42,238,265	860,097,357
Streaming Video	810,791,453	8,636,193	819,427,646
Audio Podastig	53,715,516	173,697	53,889,213
Grand Total	9,862,009,386,552	287,228,636,746	10,149,238,023,298

Video Usage

Category	Bytes Received	Bytes Sent
Google Meet	7,414,822,937,642	23,934,073,917
Insructional Content	561,925,815,528	4,561,478,056
Video Streaming	254,216,844,691	2,715,252,125
Utility	86,721,394,565	78,750,792
You Tube	79,301,386,224	48,882,343,309
Gaming	73,395,035,833	1,821,105,588
Feedback	65,312,210,943	701,074,602
LMS	60,005,459,754	32,522,303,839
Assessments	58,593,306,357	5,199,461,555
Google	56,648,175,732	1,399,954,557
CDN	55,514,078,406	753,896,835
Leaning Tool	8,631,360,961	374,577,335
Amaazon AWS	5,021,976,642	76,571,491
Social Media	2,777,769,244	1,883,840
Streaming Video	810,791,453	8,636,193

Analysis of Video Use



Video Use
N
Y

Video Usage

Category	Bytes Received	Bytes Sent
Google Meet	7,414,822,937,642	23,934,073,917
Insructional Content	561,925,815,528	4,561,478,056
Video Streaming	254,216,844,691	2,715,252,125
Utility	86,721,394,565	78,750,792
You Tube	79,301,386,224	48,882,343,309
Gaming	73,395,035,833	1,821,105,588
Feedback	65,312,210,943	701,074,602
LMS	60,005,459,754	32,522,303,839
Assessments	58,593,306,357	5,199,461,555
Google	56,648,175,732	1,399,954,557
CDN	55,514,078,406	753,896,835
Leaning Tool	8,631,360,961	374,577,335
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