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VIA ELECTRONIC FILING

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

Re: **Ex Parte Communication**
Modernizing the E-rate Program for Schools and Libraries -- WC Docket No. 13-184

Dear Ms. Dortch:

On November 1, 2018 on behalf of ApplianSys, Harry Clayton and I met with the following staff from the Telecommunications Access Policy Division (TAPD) of the Wireline Competition Bureau - Ryan Palmer, Division Chief, Gabby Cross, Kate Dumouchel, Special Counsel and Stephanie Minnock, Attorney Advisor - to discuss the findings of ApplianSys' research into the impact of caching on the cost and efficacy of school district internet access, as it relates to the above referenced docket.

In summary, ApplianSys delivered in-depth findings and arguments to support our contention that:

- **1. For schools that deploy caches, the Return on Investment goes well beyond financial savings.** To this end, we began by sharing evidence of the broad impact of caching beyond network-level improvements.

  CACHEBOX customers described the impact that caching has had in their district, highlighting the direct relationship between deploying caches and the ability of teachers and students to benefit from classroom web access as intended. Feedback demonstrated six core benefits:

  - An increased ability to use modern teaching methods and tools
  - Accelerated web content in class
  - Better engaged students
  - Lesson plans remaining on track
  - Trouble-free online testing
  - Fewer complaints about internet access from teachers to technical teams

- **2. Caching performance remains high in school districts... and is improving.**
  ApplianSys **CACHE**BOXes are delivering a high return on investment in more than 40 US states. Based on the aggregated performance data, as well as critical observations from customers both new to caching and long-time users, we have reported that caching in school districts continues to:
    - Lower a school's bandwidth usage, effectively reducing the need for more broadband spend
    - Enable schools to do more with less bandwidth by multiplying effective capacity by as much as 10 times
    - Slow the rate at which schools need to renew infrastructure

  To evidence these findings, ApplianSys walked Commission staff through data that shows even better caching performance figures than 2017, for all districts – rural, suburban or urban.

  Data from three example districts showed that:
    - Internet requests served by caches at peak times provided districts with far more capacity than their internet connections could allow. With bandwidth alone, this peak traffic would result in heavy congestion, slowing web access.
    - The cost of effective capacity served by a combination of bandwidth and caching is significantly lower than the cost of bandwidth alone.

  ApplianSys provided an extensive dossier of additional case studies for review in a handout and report, which is attached to our ex-parte electronic filing.

  In addition, anonymized data from ApplianSys' performance reporting system shows that the proportion of content delivered by **CACHE**BOXes at over 200 districts has grown by more than 15% between September 2017 and July 2018.

  A large spike in caching performance in September 2018 demonstrates the impact of new student devices, deployed over summer, accessing operating system software updates. This illustrates the ability of a schools-focused, vendor-neutral cache to tackle these large files from a multitude of software vendors. At times, these consume a high proportion of a district's internet capacity.

- **3. Awareness of caching is low, and this is reflected in the number of districts that take it up**
  ApplianSys conducted a survey of US school districts via online and telephone questionnaires, gathering 56 responses from E-rate applicants. The findings confirm that:
    - awareness of the benefits of caching technology within the E-rate program is low
    - low awareness affects the likelihood of districts applying for funding to deploy caches.

  Key findings presented include:
    - Less than half of respondents have a reasonable understanding of what web caching is, and less than a quarter felt well informed enough to determine its relevance to their district.
    - Only 18% of those with a poor understanding of caching plan to file an E-rate 470 and/or 471, compared to 76% of those that are well-informed

Extrapolating these findings to the whole school population: low take-up of caching on E-rate does not equate to a low need for caching, but rather a poor understanding of the benefits it delivers.

- **4. Universal take-up of caching would save US School Districts hundreds of millions of dollars each year**
  ApplianSys delivered findings from analysis of current bandwidth provision and costs at 13,275 districts to highlight the potential savings that would be achieved if all districts deployed a cache. The analysis used performance data from school districts with a **CACHE**BOX to extrapolate the potential return on investment nationwide.

  Firstly, we described how much bandwidth would have been needed if schools were all already equipped with caching.

  - Such a reduction in bandwidth would save a total $9.32m per month, $112m per annum.

  Next, we projected the value of additional capacity that would be provided by nationwide caching in terms of:

  - the additional peak-serving capacity that schools would no longer need to provision via bandwidth upgrades
  - improvement in bandwidth affordability when the cost of caching and the value of capacity is delivers is in included in monthly per-Mbps calculations
  - the delivery of 'effective' bandwidth provision per pupil

  Key findings presented include:

  - The annual cost to deliver estimated peak demand with bandwidth alone would be over $2.2bn compared with $648m with caching. Caching would deliver a $1.6bn annual saving.
  - Districts currently pay significantly more than the FCC affordability targets for all but one of the defined thresholds. With caching, the average cost per Mbps would go from $5.77 to $1.77 and prices in all but one threshold would be below FCC's target.
  - Caching can help the FCC to meet its own targets for delivering 1Mbps per student in 2018
    - If all districts retained their current internet connections and added a cache, average capacity per student would jump to more than 2.44Mbps.
    - This would be sufficient to cater for 50% year-on-year growth in demand (from the current 480Kbps per student) for the next 4 years without the requirement to upgrade internet connections.

- **In conclusion, ApplianSys recommended that, during its review of 2014 E-rate Modernization Order, FCC reconsider recommendations made by ApplianSys in 2017:**
    - Make caching available for Category One funding
    - Refine measurements of affordability to consider capacity delivered by caches
    - Modify bid evaluation methodology to help districts avoid bandwidth overspend
    - Take steps to avoid WiFi and caching competing for the same funding
    - Further research the cost-performance of the use of caching

ApplianSys additionally proposed that FCC develops and publishes a more nuanced approach to bandwidth per student targets to avoid encouraging wasteful investment in excessive capacity.

Following structured presentation, we briefly discussed the possibility that FCC could, as it has with Lit and Dark fiber requests, develop a value test to ensure that bandwidth requests are properly compared with caching alternatives. The relevant paragraph from the 2014 e-rate Modernization follows:

> The Order adopts safeguards to ensure that applicants properly compare dark fiber with other options and treat price as the primary factor in selecting winning bids. Applicants that seek bids for dark fiber must also seek bids for lit fiber over a comparable time period. Applicants also must include equipment and maintenance costs associated with lighting dark fiber in the same application with the dark fiber lease. Additionally, applicants will not receive support for excess capacity and may only receive special construction support for dark fiber lit in the same funding year.

Respectfully submitted,

/s/ Roger Clark

Head of Education Technologies

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cc: Ryan Palmer
Kate Dumouchel
Gabby Cross
Stephanie Minnock

Attachments:

ApplianSys research findings - the impact of caching on US school districts - Full Report.pdf

ApplianSys Ex Parte Meeting Presentation Handout – TAPD.pdf

ApplianSys research findings - impact of web caching on US school districts data.xlsx (REDACTED TO PROTECT COMMERCIAL INFORMATION)