



September 8, 2017

## **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 September 6, 2017 on behalf of ApplianSys, Frances Walker-Baptist and I met with Claude Aiken, Legal Advisor, Wireline to Commissioner Mignon Clyburn and then with Dr. Jay Schwarz, Wireline Advisor to Chairman Pai — to discuss our observations, comments and recommendations on the above-referenced docket<sup>1</sup>.

The presentation document given to the Commission staff is included as an attachment to our filing. Also, during the meetings, ApplianSys referenced the data and arguments submitted as part of its Comments on the proposed FY2018 Eligible Services List (ESL)<sup>1</sup> on July 21 2017.

In summary, ApplianSys discussed the evidence and arguments that support our contention that:

- **Caching has had a far greater impact on bridging the Digital Divide than the Commission originally envisaged.** To this end, we began by sharing key insights on caching technology and highlighting the unique profile of K-12 web traffic and its consequences in bandwidth management.
  - K-12 web traffic is characterized by large 'start-of-lesson peaks' in demand for largely duplicate requests. These peaks effectively define how much bandwidth capacity a school needs. However, these same peaks are highly cachable. Consequently, caching in schools can significantly reduce the amount of capacity needed.

By providing the 'virtual' capacity to accommodate these peaks, caching makes 1:1 internet-enabled independent learning viable which in turn improves learning outcomes. We then discussed the four distinct groups of performance and value outcomes of caching deployment in K-12 schools. Namely:

- Improved Functionality
  - Digital access for bandwidth-constrained schools, including remote schools
  - Speed improvements for both metropolitan and rural schools
- Improved Return on Investment (ROI)
  - Savings on bandwidth costs
  - Savings on infrastructure upgrade costs

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<sup>1</sup> See *Wireline Competition Bureau Seeks Comment on Proposed Eligible Services List for the E-Rate Program*, WC Docket 13-184, DA 17-602 (June 21 2017)



ApplianSys shared real-world data, including costs from schools with E-Rate-funded caching, which illustrated those performance and value outcomes. We also provided an extensive dossier of additional case studies of K-12 schools for the Commission's review in the handout.

- **The FCC has a significant opportunity to accelerate the bridging of the Digital Divide while eliminating wasteful spending of E-Rate funds on excessive bandwidth, as well as improving the targeted use of E-Rate funds. We stressed that the key outcomes needed to achieve this are for:**
  - Schools and districts to base their bandwidth upgrade decisions on a proper sense of the relative value for money of bandwidth upgrades versus caching
  - Funding for caching to be as readily accessible as funds for bandwidth

As context for these key outcomes, we walked Commission staff through a detailed analysis of the factors behind wasteful E-Rate spending, as well as the current low rate of adoption of E-Rate funded caching. Factors explored in the discussion include:

- The fact that the odds are, to an extent, stacked in favor of broadband overspend – bandwidth is prioritized because it is in Category 1. This status quo is reinforced by the existing (and future) connectivity targets for schools set by the FCC, the efficacy of which, from our analysis, looks to be questionable in terms of both need and affordability. Consequently appropriate return on investment (ROI) is not properly considered by schools: the hidden costs of bandwidth upgrades (related to upgrading other network equipment) are discounted or unknown, and the benefits that caching can deliver are not considered.
  - Out-of-date perceptions about caching continue to limit uptake, e.g. mistakenly believing that HTTPS (a principal component of e-learning content) cannot be cached.
  - The data presented relates to the benefits delivered by 'whole-school' caching solutions that handle *all* of the constantly evolving K-12 web-traffic. 'Partial' caches that act only on a single application or website, or a single software type, will likely offer lower levels of functional improvement and thus lower ROI. Their potential benefits need careful consideration in order to make a sensible comparison with bandwidth capacity, or indeed other caching solutions.
  - Caching has to compete for funding in Category 2 against Wi-Fi, even though both are essential for the proper delivery of digital access. In reality, caching is a substitute for bandwidth capacity: schools should have to choose between bandwidth and caching – not between Wi-Fi and caching. By having Wi-Fi and caching compete in the same funding pool, we risk under-resourcing one of them.
  - The reality for E-learning is that capacity is not the real goal – speed of classroom browsing is. Capacity is a *contributor*, along with the acceleration of slow content (through caching), and its internal distribution (through Wi-Fi). Affordability remains an important and constant goal, and caching is key to this. Bandwidth however is not, and certainly there is no upside to excessive bandwidth.
- **Potentially, the FCC has several powerful levers at its disposal that can be used simultaneously to effect this change: funding, targets and education. Of these, ApplianSys focused the discussion on funding frameworks, showing three scenarios for funding across Categories 1 and 2 that pitch caching against bandwidth. We believe any of these would counter the de facto bias towards broadband overspend and thus result in better ROI for bandwidth purchasing by schools. However, of the three, we lean most strongly towards the first scenario of moving caching into Category 1, under which schools would be prompted to consider the relative ROI of bandwidth, of caching, and of smaller bandwidth increments *together with* caching.**



With regard to the additional levers:

- We explored adjusting connectivity targets to develop a more nuanced approach to the annual bandwidth upgrade cycle. To this end, we advanced the concept of a 'with caching' capacity target to replace today's purely bandwidth-oriented approach.
- We touched on the potential role for USAC, under the direction of the Commission, to evaluate the factors behind the lag in uptake of caching and recommended a proactive role in disseminating caching education and guidance to school IT teams.
- **The clarifications currently under consideration around mixed eligibility equipment in the proposed FY2018 ESL could be the fastest and simplest vehicle for pitching bandwidth against caching, in order to deliver widespread savings, and, at the same time, improve connectivity for rural schools.**
  - We explained that Wi-Fi and other Category 2 LAN devices, while key to the distribution, or safe distribution, of digital access, don't have the right credentials to be considered "essential" for the correct functioning of external links and therefore, for eligibility for Category 1 funding.
  - We reviewed the basis of our recommendation for clarifying language submitted as part of our Comments on July 21 2017. Specifically, how caching serves to make broadband functional, including where it compensates for inadequate link capacity, or offers the same end result as increasing the capacity of the link.

### In Closing

The data now available from hundreds of deployments across both rural and metropolitan K-12 makes a unique contribution to the nation's connectivity debate. This explains for the first time to the FCC how K-12 is a special case; 'start-of-lesson peak' traffic profiles mean that relying solely on increasing bandwidth capacity is delivering diminishing returns on public funds.

As clarified at the close of our discussions, the impact of the sequenced combination of the actions we advocate won't obviate the need for bandwidth upgrades. But the nuanced use of caching with smaller bandwidth upgrades will slow down the growth in bandwidth capacity requirements, helping schools avoid excessive increments, as well as the resulting premature infrastructure-upgrade spend.

This would shift the focus towards helping a school get the best possible value from its bandwidth investment before addressing any need to increase bandwidth capacity in due course. Furthermore, when caching is utilized to upgrade the functionality of the internet, the resulting improved reliability and increased speed in the classroom will drive both equality of access and better learning outcomes for all.

Respectfully submitted,

/s/ Roger Clark

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Attachment: *Caching to Improve E-Rate ROI* Document

CC (by email): Claude Aiken  
Dr. Jay Schwarz