

**CAMPUS
NETWORK**

Preparing the K-12 Network for Common Core Testing and Beyond

This paper provides K-12 technology administrators with a blueprint for implementing a Brocade/Aruba Network with inherent Lifetime Warranties, a networking technology that provides a foundation for supporting Common Core testing requirements, BYOD, and other future digital learning initiatives.

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K-12 technology administrators are scrambling to prepare their networks to support Common Core testing, slated to begin in the Spring of 2015. The network requirements to support online testing, as laid out by the two predominant Common Core testing consortiums (the Smarter Balanced Assessment Consortium and the Partnership for Assessment of Readiness for College and Careers [PARCC]), should be relatively easy to support. However, the technology requirements for the testing, as laid out by PARCC and Smarter Balanced, do not go far enough to sufficiently address many of the other potential pitfalls that can occur during online testing to a remote third-party service.

BACKGROUND

K-12 technology administrators are scrambling to prepare their networks to support Common Core testing, slated to begin in the Spring of 2015. The network requirements to support online testing, as laid out by the two predominant Common Core testing consortiums (the Smarter Balanced Assessment Consortium and the Partnership for Assessment of Readiness for College and Careers [PARCC]), should be relatively easy to support.

However, the technology requirements for the testing, as laid out by [PARCC](#) and [Smarter Balanced](#), do not go far enough to sufficiently address many of the other potential pitfalls that can occur during online testing to a remote third-party service. For example, in 2013, [Fairfax County Schools in Virginia](#) experienced an Internet Service Provider (ISP) outage during their online testing window that affected thousands of students. This outage caused the school system to reschedule testing for these students to another unplanned day before the end of the academic year, causing major disruptions across the school system and, ultimately, thousands of lost hours of productivity for teachers, students, and administrators. Neither PARCC nor Smarter Balanced provide recommendations to prevent this type of disruption.

In addition, due to a lack of E-rate funding, many school district networks have not been upgraded in many years. If a school system simply upgraded its network to support the bare minimum requirements for Common Core testing, it would not be prepared to deliver new Common Core curriculum that is delivered via interactive and video-based applications and tools. It also would not be prepared to support Bring Your Own Device (BYOD) or 1:1 learning initiatives that are being implemented now, let alone future digital learning applications.

This paper provides K-12 technology administrators with a blueprint for networking technology that provides a foundation for supporting Common Core testing requirements, including addressing previously unidentified potential pitfalls, as well as supporting BYOD and other future digital learning initiatives.

E-Rate Impact

With E-rate Modernization and the availability of “Category 2” in-building network infrastructure funding beginning in FY2015, simply architecting a network to support minimum Common Core requirements would be shortsighted.

SOLUTION OVERVIEW

The K-12 network architecture blueprint described in this document provides the technology administrator with a background for the challenges that may arise with the implementation of Common Core testing and other digital learning initiatives within the school district. The paper breaks down the network around functional areas within the school and provides suggested network hardware and software solutions to address requirements and potential issues.

THE CONNECTED CLASSROOM OF TODAY AND TOMORROW

Today’s students are connected to the outside world from birth. Much of their learning to date has occurred through the use of personal devices and television. The connected classroom of today and tomorrow embraces this sea change in learning and utilizes devices to augment classroom curriculum.

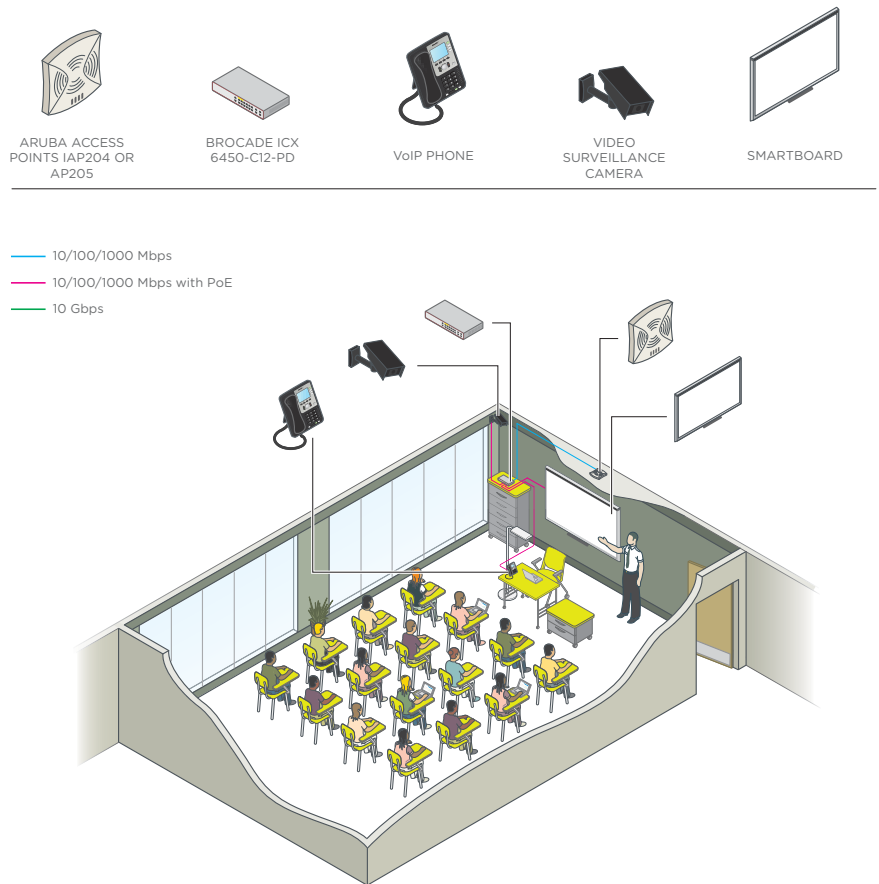


Figure 1.
The Connected Classroom
of Today and Tomorrow.

Supporting a Broad Range of Devices in the Classroom

Most college campus IT departments are reporting that students on average are carrying at least 2.5 connected devices per student with them at all times—including phones, laptops, and tablets or game devices. While the K-12 network environment may not carry that type of burden today, it will become true for the K-12 campus in the near future.

As most school systems are currently implementing BYOD or 1:1 student-to-device programs, a large amount of time and effort has been put into the workflow to register non-district owned devices (onboarding) with safety and security. However, many districts have not done a deep analysis on their aging network infrastructure to see if it can handle the burden of all these additional devices both now and in the future. In the connected classroom, not all devices are created equal. A security camera shooting HD-quality video, or an Apple TV device, is more of a strain on the network than a Voice over IP (VoIP) phone. However, the traffic prioritization of the voice call will be higher than the video from the camera or the streaming video device.

School districts across the country are implementing video surveillance systems. The need for increased security in the wake of recent tragedies and the need to decrease school liability are the driving factors behind these deployments. Districts have been implementing VoIP systems for many years. If they have not done so already, districts will be highly encouraged to implement such systems in the near future, as support for traditional Private Branch Exchange (PBX) systems is phased out with E-rate Modernization.

In a BYOD environment, the students' devices are not created equal, either. For instance, one type of tablet might pull more bandwidth from an Access Point (AP) than another tablet. This presents an interesting challenge during Common Core testing, ensuring that each student and device has an equitable amount of bandwidth during the testing window. The next section provides some network and software architecture considerations and recommendations for the connected classroom.

NETWORK AND SOFTWARE ARCHITECTURE OF THE CONNECTED CLASSROOM

The connected classroom contains a mix of wired and wireless devices. The wired devices are generally fixed-position and utilize more bandwidth. Examples of these devices are VoIP phones, security cameras, smartboards, or smart televisions. To support this mix of wired and wireless devices, the combined network infrastructure must work in concert. Each element is only as strong as the weakest link of both.

For example, [Huntington Beach Union High School District in Southern California](#) began a project to upgrade their wireless infrastructure in support of Common Core testing. They quickly discovered the need to upgrade the wired infrastructure that was supporting the more than 10,000 devices that connected to the network daily.

With the wired and wireless infrastructure working in tandem, the user experience improves, and network operation and maintenance works more smoothly. In the connected classroom, the wireless end user devices are connected to wireless APs. In turn, the APs are connected to the classroom switch and also receive power from the classroom switch.

Classroom Switch

Within the classroom, certain features of a classroom switch are paramount.

- **The switch has to be quiet.** Teachers do not want to have to talk over fan noise in their classrooms.
- **The switch has to be low cost.** The sheer number of devices deployed in classrooms can overrun a school budget if the device is too expensive.
- **The switch has to provide Power over Ethernet (PoE/PoE+).** Many devices in the classroom are powered off the switch, and running electric circuits to their respective locations is too expensive.
- **The switch has to be remotely manageable.** When issues occur, the IT staff must be able to get a remote view into the network from a central location. Dispatching tech support to classrooms to fix issues proves too costly.

The [Brocade® ICX® 6450-C12](#) Switch provides the classroom connectivity needed for today and tomorrow. The unit is fanless and compact, so it is extremely quiet and can be inconspicuously placed on a shelf in the classroom. In fact, the switch itself can be powered through PoE uplink ports, so there is no need for an AC outlet in the location where the switch is placed.

With 12 10/100/1000 Mbps Ethernet ports, four of which can support PoE+ (30-Watt, or 30W) devices, the Brocade ICX 6450 Switch can power and deliver the bandwidth to the AP in the classroom, as well as to the other fixed devices in the classroom, like video surveillance cameras, smartboards, and VoIP phones.

The uplink ports in the switch provide media flexibility and can uplink to upstream switches via 1 gigabit-per-second (Gbps) connections via copper or fiber Small Form-Factor Pluggable (SFP) modules.

Classroom Access Point

Within the classroom, APs that provide signal coverage and varied device radio support at a low cost are paramount. The [Aruba IAP 204 and 205](#) APs are compact and cost-effective dual-radio APs that deliver wireless data rates of up to 867 Mbps to 5-Gigahertz (GHz) devices with 802.11ac technology leveraging two spatial Multiple Input and Multiple Output (MIMO) streams, while simultaneously supporting 2.4-GHz 802.11n clients with data rates of up to 300 Mbps.

The Aruba IAP-205 features four integrated omnidirectional down tilt antennas, while the IAP-204 supports external detachable dual-band antennas using two RP-SMA antenna connectors. The IAP-205s are best suited for ceiling deployments in the middle of the classroom, and the IAP-204s are best suited for wall mounting, with the external antennas being adjusted for optimal signal coverage in the room.

The advent of BYOD necessitates handling an explosion in the number of devices seen within the classroom. By deploying an AP per classroom, a school district will be able to keep up with the increase in the number of devices in the years to come. The Aruba line also includes Adaptive Radio Management (ARM) technology, which is essential to creating the most reliable, high-performance Wireless Local Area Networks (WLANs). ARM manages the 2.4-GHz and 5-GHz radio bands to optimize Wi-Fi client performance and ensures that APs stay clear of Radio Frequency (RF) interference. This technology is key to connect students wirelessly for seamless Common Core testing experience.

The AP can be managed by a controller and or can utilize Aruba Instant mode for controllerless quick configuration. Aruba Instant mode is a great option for K-12 school districts. With Aruba Instant APs, school districts can significantly reduce deployment, maintenance, and build-out efforts. The technology provides zero-touch, self-provisioning capabilities enabling a single “master” AP to communicate configurations to all other similar APs on the network. Further, if an AP needs to be replaced, or additional APs are required to meet new demands, the process is simple. Anyone, including field staff, can simply plug in a new Instant AP, and the master sends the appropriate configuration information to that AP.

Ease of Deployment

Most school districts have a limited IT staff responsible for a large geographic area. The number of networking “experts” on the IT staff is even more limited within a district. Any features within the networking components and management systems that can be leveraged to relieve stress on IT resources is very welcome. The Brocade ICX switch series and the Aruba IAP series both make deployment of the network stress-free. The Aruba IAP 205 includes two mounting options: molded mounting tabs for attaching to 15/16” T-bar drop-tile ceiling, or slotted tabs for screw mounting to a wall, ceiling, or other flat surface. Brocade ICX switches are compact, less than 11” wide and 9” deep, extremely quiet (since they are fanless), and weigh less than 5 lbs. All this means that Brocade ICX switches can be placed in many inconspicuous places in the classroom.

Both the Brocade and Aruba devices also support Zero Touch Provisioning (ZTP) and autoconfiguration. When the switches are powered up, they automatically receive an IP address and configuration from Dynamic Host Configuration Protocol (DHCP) and Trivial File Transport Protocol (TFTP) servers. At this time, the switches can also automatically receive a software update to be at the same code revision as currently installed switches. This ZTP option alleviates the need for highly trained network engineers to be on site for the deployment of the network or replacement of a device, enabling the IT staff to focus on more mission-critical tasks.

Device Management and Security Policy

One of the more difficult aspects of a K-12 school district is onboarding student and faculty devices while keeping the students safe, keeping the network secure, and adhering to school district device use policies. Seamless network connectivity and simplified policy-based access to learning resources are critical for successful digital classrooms. Spending precious classroom time waiting to connect or for troubleshooting can be very frustrating to teachers and often leads them to abandon technology tools.

E-Rate Impact

Brocade and Aruba support for Zero Touch Provisioning of switches and APs reduces the amount of Category 2 funding that needs to be spent on installation services.

Centralized device management and security policy distribution can be accomplished by using the Aruba ClearPass Solution [Aruba ClearPass solution](#), regardless of connection type—wired or wireless. From this single ClearPass policy and AAA (Authentication, Authorization, and Access Control) platform, contextual data is leveraged across the network to ensure that users and devices are granted the right access privileges. For contextual data, the ClearPass server leverages user roles, device types, available mobile device management data, automatic sign-on privileges, location, day-of-week and time-of-day, as well as other parameters. With ClearPass, the school district IT administration can centrally manage network policies, automatically configure devices and distribute security certificates, admit guest users, assess device health, and even share information with third-party solutions—through a “single pane of glass” on either the Aruba or Brocade networks—without changing the current infrastructure.

Defending the Learning and Testing Environment

Today’s classrooms are challenged to keep students focused on the learning objectives at hand by blocking outside influences. Some of these influences are deliberate attempts to stray outside the curriculum, and others are a product of applications that can cause unknowing harm to the network. Aruba has developed two significant technologies to assist K-12 educators in this endeavor.

When the APs are used in Aruba Instant mode, they come integrated with a suite of firewall and deep packet inspection capabilities. With these capabilities enabled, the APs can defend against intrusions coming into the network and attempting to harm the devices on the network. The APs can also prevent students and teachers from accessing internal and external web destinations that are not allowed under the district’s security policy. With web content filtering and application-aware traffic management that can categorize and block communication as needed, the school district can ensure a safe learning environment that adheres to mandated security policies.

As digital learning is embraced in more school districts, new devices are being used to assist the learning experience. Some of these new devices bring with them characteristics that are detrimental to the performance of the overall network. Devices such as Apple TV, Apple Print, Google Chromecast, or a myriad of devices from the Digital Living Network Alliance (DLNA) use broadcast protocols that can have adverse effects on the entire network when in use. To combat this issue while still enabling the digital learning experience, Aruba has created AirGroup. Using registration information, Aruba ClearPass automatically creates an AirGroup that associates individuals to their personal devices and user groups to their shared devices. These ownership and location associations are then available to Aruba WLANs, acting as DLNA and Bonjour (Apple Services) gateways to make forwarding and blocking decisions.

As a result, IT departments can deliver a personal network experience where, for instance, only the teacher in a classroom has access to the classroom LCD television and only a person on the second floor of a building can see the printer located on the same floor.

AirGroups allow for a personalized digital learning experience without sacrificing the performance of the entire network, a benefit that is especially key during Common Core testing.

Cost-Effective Today and Tomorrow

Even with increased E-rate support, school districts are continually challenged to keep the cost of network deployments and maintenance under control. The Brocade ICX 6450-C Switch and the Aruba IAP 204/205 Access Points allow school districts to stretch their E-rate dollars further. With E-rate reform, many school districts will have access to some level of E-rate funding for the first time in years. It remains to be seen how far those dollars will go, but it is clear that the \$2 Billion funding that is earmarked in 2015 and 2016 will not meet the full demand of all the school districts that have delayed upgrades for many years.

Both the Brocade ICX Switch Series and the Aruba IAP 204/205 Access Points are priced very competitively and have the capability to support the connected classroom for years to come. But the huge advantage these products bring to the school district is the Brocade and Aruba Limited Lifetime hardware and software warranties.

The Brocade ICX 6450 is covered by the [Brocade Assurance® Limited Lifetime Warranty](#). [Brocade Assurance® Limited Lifetime Warranty](#). This warranty provides advanced replacement of faulty hardware for the lifetime of the equipment, as well as software upgrades through the end of the product support date. The Aruba IAP 204/205 is covered by [Aruba's Limited Lifetime Warranty](#) and that provides access to the latest shipping software images.

E-Rate Impact

By alleviating the need for basic maintenance E-rate support, Brocade and Aruba Limited Lifetime warranties allow the K-12 school district to stretch their Category 2 and operating expense budget dollars further.

COMPUTER LAB/TESTING AREA

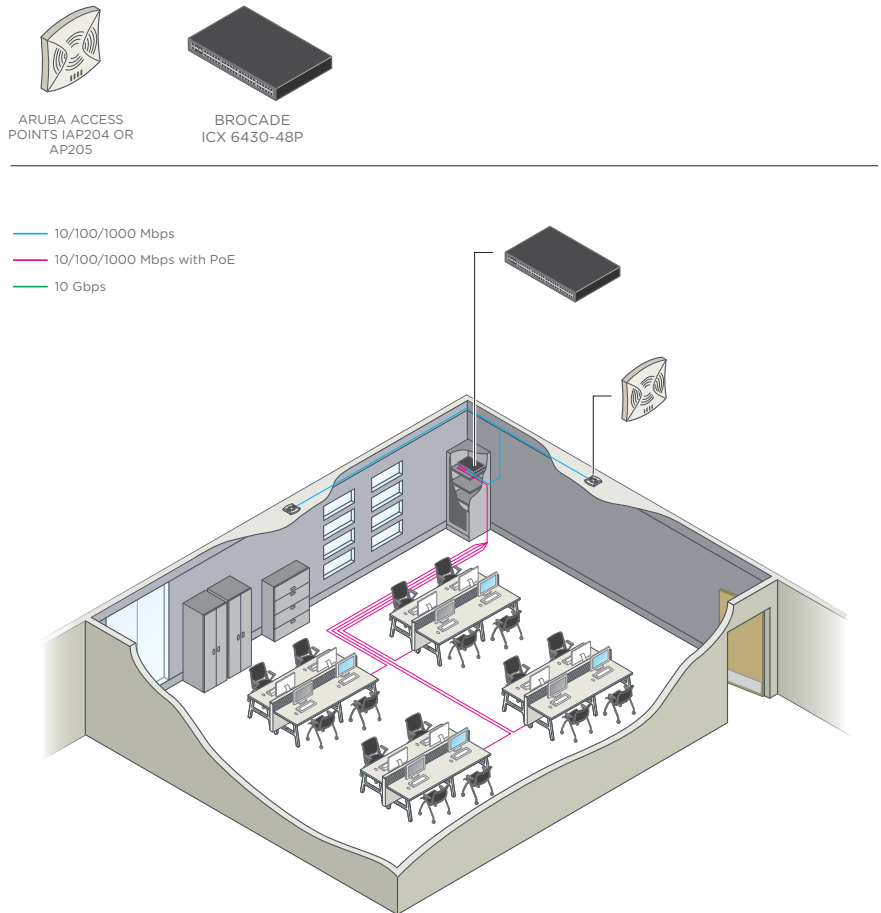


Figure 2.
Computer Lab/Testing Area.

Many school districts have not yet implemented a BYOD or 1:1 plan, and these districts use testing rooms or computer labs to perform online Common Core testing. The requirements for these rooms vary slightly from the classroom, as labs generally implement a higher density of wired connected devices with a wireless overlay.

Computer Lab/Testing Area Switch

For areas with a higher density of fixed workstations, such as computer labs and testing areas, the rooms require a higher density switch than classrooms that are dominated by wireless devices. The Brocade ICX 6450-48P Switch provides 48 1-GbE ports for connectivity to workstations. With up to 780W of PoE+ power support, the Brocade ICX 6450-48P can power a large number of devices (for example, APs, VoIP phones, security cameras, and so on). In fact, all ports on the switch can provide PoE+ (30W) when paired with an external power supply. A nonblocking switch architecture and high throughput uplinks to the school core ensure that bandwidth-intensive workstations in the lab perform without network bandwidth hindrance.

To encourage uninterrupted testing, the Brocade ICX 6400 Series has an optional external redundant power supply option (the Brocade ICX 6400-EPS1500). This low-profile unit provides additional redundancy and availability in case of power supply failure on the switch. The unit can provide power backup to up to three Brocade ICX switches. It also provides additional power injection capabilities for PoE+ devices.

The Brocade ICX 6450 Family supports eight priority queues. By enabling traffic prioritization, testing applications can be given a higher priority, to ensure that students have the best testing experience possible.

ZTP is also supported on the Brocade ICX 6450, to reduce specially trained network installation resources and speed deployments.

Computer Lab/Testing Area Access Point

The same AP used in the classroom environment, the Aruba IAP 204/205, can be used in the computer lab as well. The Aruba product line enjoys some unique features that are key to enabling a stress-free Common Core testing experience for the wirelessly connected student in the computer lab.

ClientMatch technology from Aruba is a patented, standards-based RF management technology that puts the WLAN infrastructure in control of client connectivity and roaming. Leveraging a system-level view of the network, ClientMatch monitors clients and automatically matches them to the right radio on the right AP, boosting overall WLAN performance and delivering consistent, predictable performance to every user and client while eliminating the “sticky client” problem for good.

As an example of how ClientMatch is relevant for the K-12 environment, imagine a student with a wirelessly connected tablet going from the classroom to the computer lab/testing area. Without ClientMatch technology, that student might remain connected to the AP in the classroom instead of connecting to the better performing AP in the lab.

The documents posted by [PARCC](#) and [Smarter Balanced](#) indicate that the amount of bandwidth required per user for Common Core testing is not estimated to be very great. But how does a district ensure that Student A, who has an 802.11ac-enabled tablet, is not starving the wireless connection from Student B, who has an 802.11g-enabled tablet? The answer is through a combination of Aruba’s ARM and AppRF technology.

Because Wi-Fi is a shared resource, it is important that all clients have fair airtime access. ARM maximizes client performance by giving each client fair access and ensuring that no single client or group of clients monopolizes resources at the expense of others. Aruba AppRF technology continuously evaluates mobile app usage and performance and makes configuration adjustments in real-time to ensure optimal bandwidth, priority, and network paths on a per-application basis. So district IT administrators can prioritize testing applications and ensure that a guaranteed amount of bandwidth is allocated during testing windows.

COMMON AREAS: MANY DEVICES, UNIQUE CHALLENGES

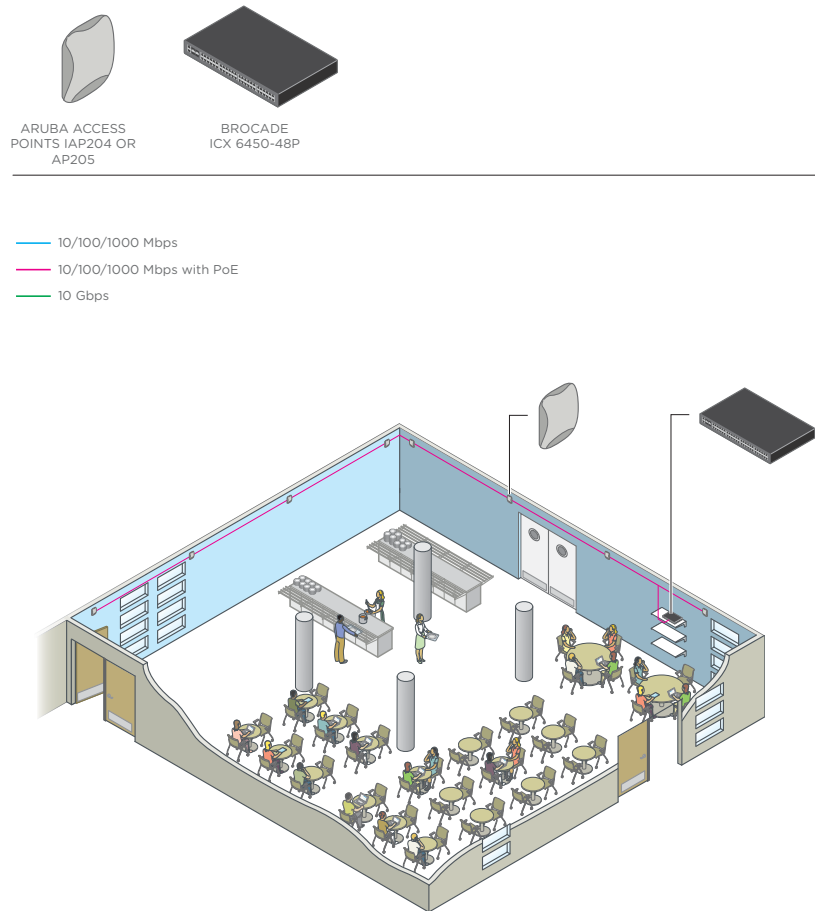


Figure 3.
Common Areas: Many Devices,
Unique Challenges.

Some of the most difficult areas to support with optimal network coverage are large common areas, such as auditoriums, cafeterias, gyms, and even outdoor stadiums. The importance of providing excellent network access in these areas continues to increase. In fact, some K-12 school districts are using gyms as their Common Core testing area.

Brocade and Aruba combine a vast amount of experience in this area, including a recent deployment at the San Francisco 49ers new home, Levi's Stadium. Brocade and Aruba joined together to deliver stadium-goers an unprecedented network experience to more than 70,000 fans on game day.

For the K-12 network, more and more students and faculty are bringing devices on campus, and they expect those devices to have connectivity anywhere on campus. In a large common area, device congestion can cause poor performance and a poor user experience. Supporting a dense number of devices in an open area can be accomplished through [Aruba's ClientMatch AP](#) technology, which steers wireless clients to the best-performing APs instead of keeping them connected to their most recent AP.

As an example, imagine an auditorium where the main entrances are at the back of the auditorium. As people enter the room, their device attaches to the APs located closest to the doors of the venue. The APs at the rear of the auditorium quickly become overloaded with devices that attach to them instead of to the AP that is closest to the user's seat. ClientMatch takes a holistic view of such a network and distributes the clients out to the best-performing APs based on proximity and available bandwidth, leading to a better user experience.

Wireless infrastructure can be supported through [Aruba IAP-224/225 802.11ac APs](#). These APs provide greater range and more bandwidth than the IAP 204/205 APs used in the classroom environment. With a maximum data rate of 1.3 Gbps in the 5-GHz band and 600 Mbps in the 2.4-GHz band, 220 series APs are up to three times faster than 802.11n APs, providing performance similar to a wired connection. The additional capacity and performance is required to share the radio spectrum across a large number of devices.

The backend wired infrastructure is supported through the [Brocade ICX 6450-48P](#). The Brocade ICX 6450 provides the bandwidth and PoE+ power to support the avalanche of devices needed in a large K-12 meeting area. With up to 780W of PoE+ power support, the Brocade ICX 6450-48P can power a large number of AP-224/225s on a single switch. The Brocade ICX 6450 also has multiple Gigabit Uplinks to provide sufficient bandwidth between the common area and the school core network and that the northbound connection to the upstream switch will not be a gating factor in slowing down the client's connection.

FLOOR AGGREGATION CLOSET AND IDF

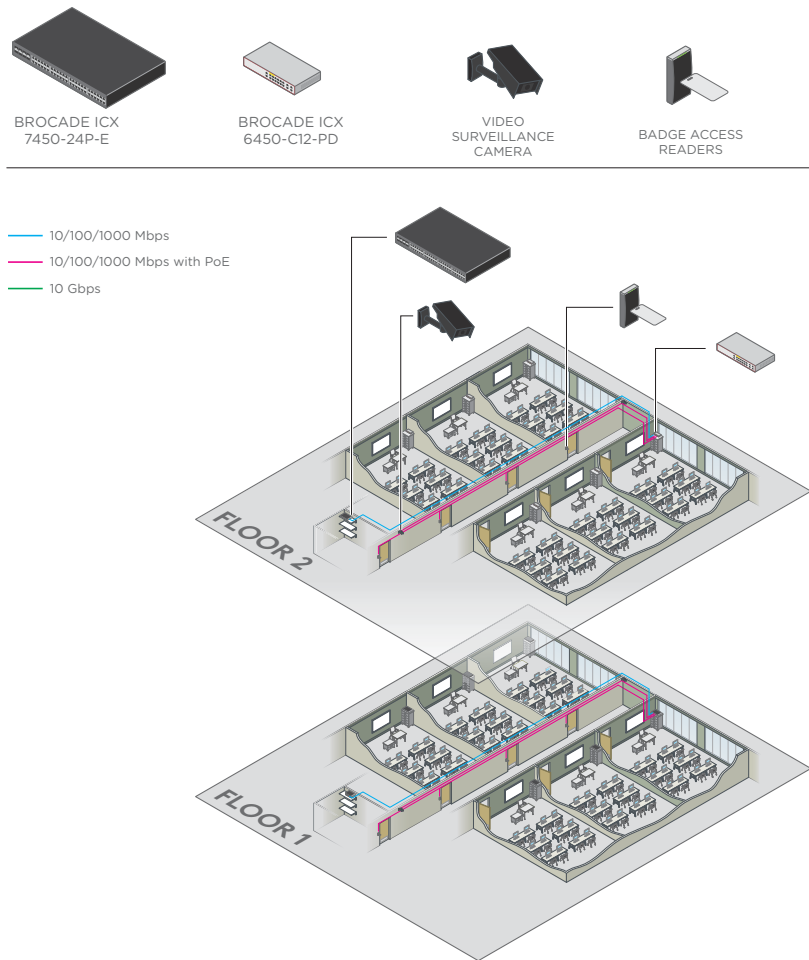


Figure 4.
Floor Aggregation Closet and IDF.

Most schools have an Intermediate Distribution Frame (IDF) on each floor. Also known as the electrical closet or the Telco closet, this is an aggregation point for the network switches and devices on a single floor.

The IDF switch aggregates (and potentially powers) the Brocade ICX 6450-C12 switches in the classrooms on their respective floors, along with any Brocade ICX 6450-48s deployed for the computer labs/testing areas and the common areas. These switches also provide wired connectivity to physical security devices on a floor, such as badge readers and video surveillance cameras in the hallways. Due to the larger number of end devices supported off of the IDF switch, such as new application types with rich media and high bandwidth needs, the availability requirements of these switches are greater.

The [Brocade ICX 7450-24P](#) Switch is the ideal IDF switch. This cost-effective device has 24 ports of 1 gigabit Ethernet (GbE) via RJ-45 ports, supports 2 internal redundant power supplies and 2 fan trays that can be swapped out in the field without downtime. This extra level of redundancy is a necessity during Common Core testing time to prevent a power supply failure from causing a major outage.

The Brocade ICX 7450 line has a modular uplink option that is flexible and scalable. Four different optional port modules are offered for the Brocade ICX 7450 with a choice of 1 GbE SFP, 10 GbE SFP/SFP+, 10 GBASE-T, and 40 GbE Quad SFP+ (QSFP+) options. These options are great for school sites with varied cabling installations (for example, no fiber optic cabling available between floors). They allow a school to scale their infrastructure from a 1 Gbps backbone all the way to a 40 Gbps backbone as bandwidth demands necessitate.

In addition to supporting the PoE/PoE+ standards, the Brocade ICX 7450 also supports Power over HDBaseT (PoH). This new, high-power standard delivers up to 95W per port through a standard Ethernet cable, simplifying the wiring of next-generation Ethernet-connected devices such as large HD displays, video surveillance equipment, and Virtual Desktop Infrastructure (VDI) thin terminals. PoH enables data and power to be carried by a single Ethernet wire. The PoE/PoE+ and PoH capabilities reduce the number of required power receptacles and power adapters, while increasing reliability and wiring flexibility.

The Brocade ICX 7450 is covered by the Brocade Assurance Limited Lifetime Warranty. This warranty provides advanced replacement of faulty hardware for the lifetime of the equipment, as well as software upgrades through the end-of-product support date. This allows K-12 school districts to stretch their E-rate basic maintenance and operating expense budget dollars further, without having to spend resources on network infrastructure.

SCHOOL SITE CORE AND MDF AND THE CONNECTION TO THE DISTRICT CENTRAL OFFICE

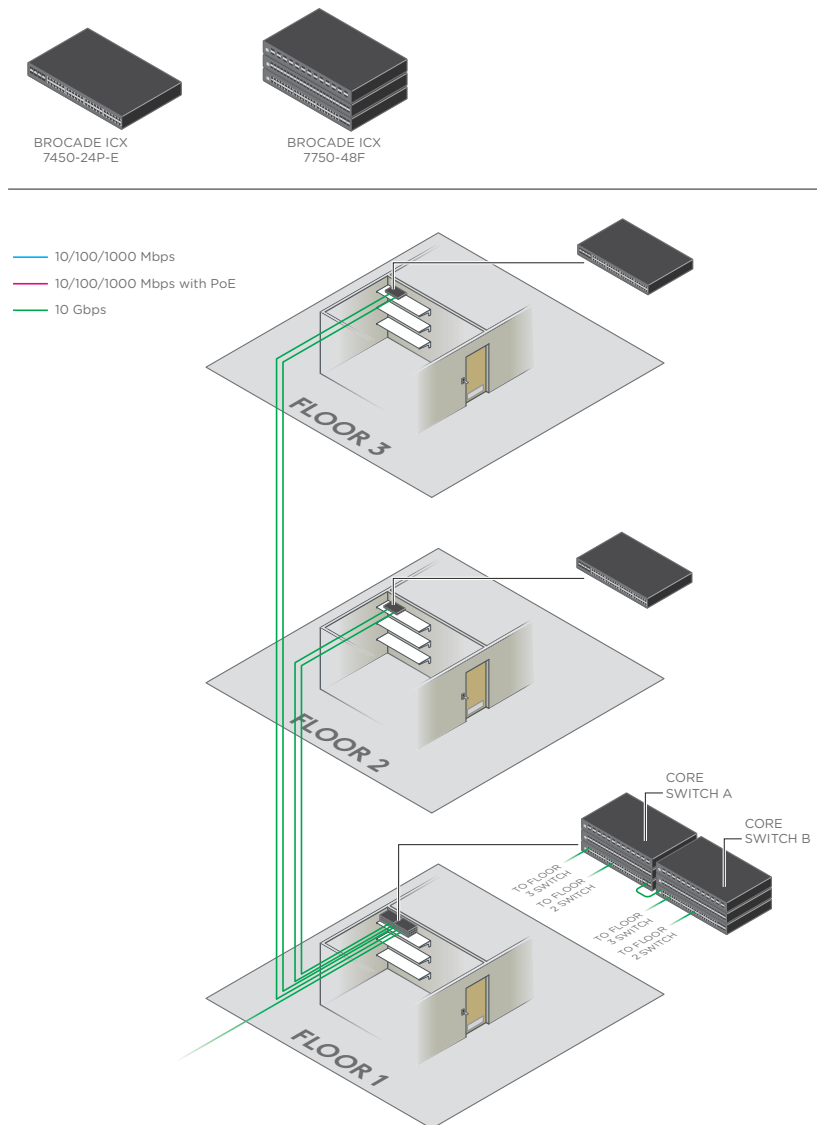


Figure 5.
School Site Core and MDF and the The Connection to the District Central Office.

The Main Distribution Frame (MDF) or the core of a school site network is the aggregation point of each of the IDF locations (or floor aggregation switches). The MDF provides connections to any centralized servers or resources for the school, as well as to the connection point to the school district Wide Area Network (WAN). As with the IDF, the MDF location requires a high level of redundancy and availability, as it is the main aggregation point to the outside world for the school.

The [Brocade ICX 7750 Switch](#) delivers industry-leading 10/40 GbE port density, advanced high-availability capabilities, and flexible stacking architecture, making it the most robust Brocade aggregation and core distributed chassis switch offering for enterprise LANs. In addition to rich Layer 3 features, the Brocade ICX 7750 supports up to a 12-unit distributed chassis stacking or Multi-Chassis Trunking (MCT) and forms an integral part of the [Brocade HyperEdge® Architecture](#) for campus LANs. The MCT capability of the Brocade ICX 7750s provides redundancy and more efficient utilization of switch connectivity links by making both links active. MCT also alleviates the need for Spanning Tree Protocol (STP), which is susceptible to large reconvergence times in the event of switch or port failure. From a K-12 school network architecture, this technology could be used by the school to provide redundant links from each of the IDF or floor switches to each of the core switches in the MDF. This architecture provides redundancy and capacity from each of the floors to the core network.

The Brocade ICX 7750 distributed chassis technology with Brocade HyperEdge Architecture in the Brocade ICX line allows for extra reliability without the added cost. With HyperEdge, administrators have the ability to stack through regular ports and the ability to remove failed components of the stack or insert new members to the stack without interruption to the rest of the stack. Administrators can apply all configuration changes, firmware updates, and policy settings to every member of the switch stack from a single point of management. This significantly reduces the time and cost associated with these frequent tasks and reduces the time required to deploy new applications.

Connecting to the District-Wide Network

[President Obama's ConnectED initiative](#) advocates for 99 percent of all schools to be connected via a minimum of 100 Mbps. This initiative means that the vast majority of school districts either have moved to, or will be moving to, Carrier Ethernet WAN and Metropolitan Area Network (MAN) connections to support the increased bandwidth targets. The Brocade ICX 7750 supports the Carrier Ethernet features and services needed to meet this initiative, whether the network is provided by a local service provider or whether the district owns its own physical plant (connected over dark fiber).

The Brocade ICX 7750 is covered by the Brocade Assurance Limited Lifetime Warranty. This warranty provides advanced replacement of faulty hardware for the lifetime of the equipment, as well as software upgrades through the end-of-product support date. This type of warranty on a core switch device is unheard of in the networking industry, and it allows K-12 school districts to stretch their E-rate basic maintenance and operating expense budget dollars further, without having to use resources on network infrastructure.

SCHOOL DISTRICT DATA CENTER

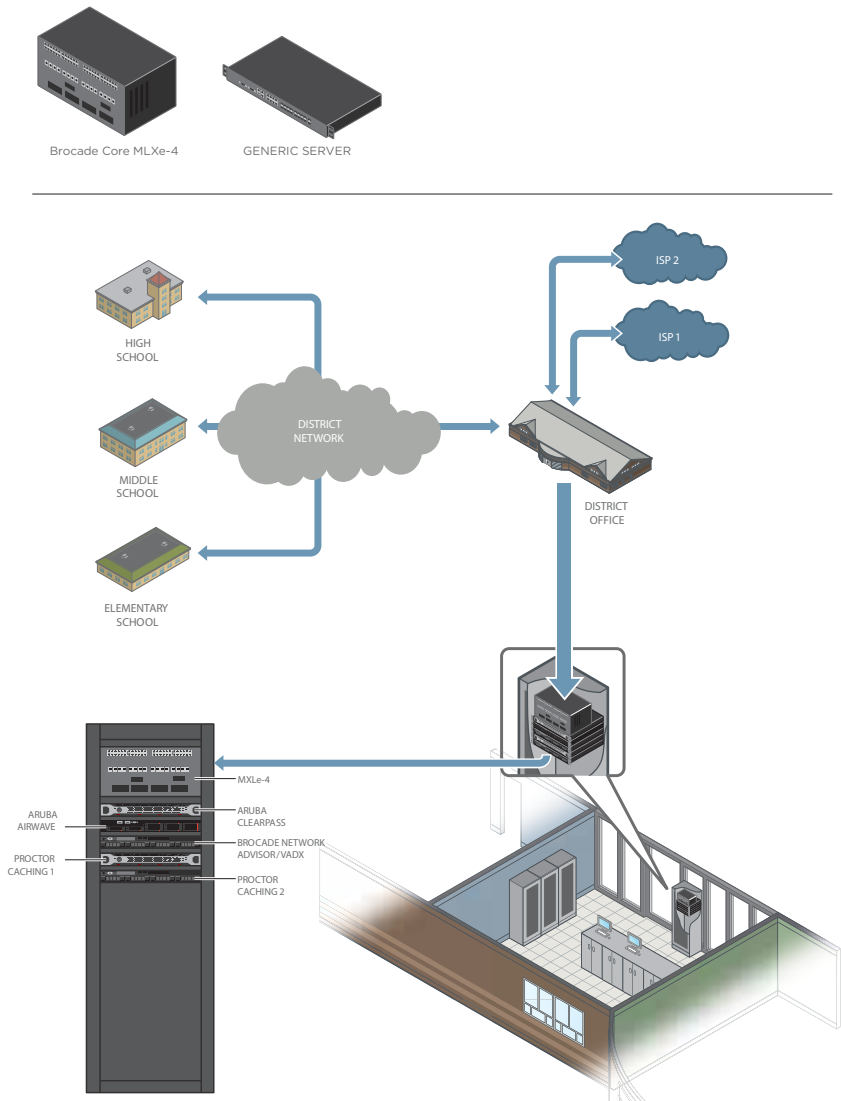


Figure 6.
School District Data Center.

A school district's central office is usually the hub of the district's metro or regional network. The Carrier Ethernet connections to all the school sites aggregate here and provide upstream connectivity to the district's chosen ISPs. Generally, the district office is also where the vast majority of IT personnel are situated. It is the central site for district-wide shared resources and network management and administration.

Whether the district network is configured in a star topology (with individual direct connections to the school sites from the central site) or, more often, configured in a ring topology (with one direct connection to the next school site to the "east" and one direct connection to the "west"), a pair of Brocade MLXe-4 Core Routers provide the services to the district network and upstream service provider in a highly available and redundant fashion. The core MLXe-4s have a connection between themselves to announce the current state with each other. If one system fails, the other continues to

provide core network services to school sites and to the upstream ISPs. The Brocade MLXe® Series Routers scale to meet the district's needs for many years to come. The platform provides high-density 1GbE, 10GbE, 40GbE, and 100 GbE module options. As a district's bandwidth demands increase, the platform scales to meet those needs. With a very advanced feature set that includes Multi-Protocol Label Switching (MPLS), IPv6, and OpenFlow v1.3, this platform allows for the deployment of new applications with unique requirements for years to come.

As depicted in the diagram above, a school district should have at minimum a primary and a backup service provider, especially during testing time. The [Brocade Virtual Application Delivery Switch \(vADX\)](#) contains a feature called Link Load Balancing. Link Load Balancing is used to provide continuous health checks to the primary upstream provider, ensuring that no outages occur. If the health check fails, traffic can be shifted to the backup provider without service interruption for the user. For instance, in the Fairfax County example provided in the Introduction to this document, having a backup service provider and implementing Link Load Balancing could have alleviated the testing issues experienced. The Brocade vADX can be installed on a generic server or a virtual machine, and that server can be directly connected to the Brocade MLXe-4.

If a school district is a participating member of the PARCC consortium, the use of Proctor Caching Servers is recommended for districts with low bandwidth connections to upstream providers. (Caching servers are not recommended for members of the Smarter Balanced Assessment Consortium.) For added redundancy and performance, a good policy is to implement caching on multiple servers, because a district would not want to rely on a single server to support all the students who are testing at one time. The Brocade vADX can be used to distribute load between the servers and ensure the health of the servers and the application. The Proctor Caching Servers are directly connected to the Brocade MLXe via a 1 GbE.

The district office is typically the where the central IT department resides and performs day-to-day network management and administration. A number of options exist for administrative applications. The decisions about which applications to use are often dependent upon the size of the school district and the execution of school district security and access policies.

Network Management and Policy Enforcement

A number of tools are available to K-12 school districts when implementing a Brocade/ Aruba Network. These companies together have made strategic efforts to cross-implement management capabilities in each of their respective platforms, to ensure a "single pane of glass" for management.

Aruba Central: Cloud-Based Wireless Network Management

For school districts that want to leverage a subscription-based, cloud-hosted management solution for the wireless network, Aruba offers the Aruba Central platform. The Aruba Central services platform is an "always on" service that provides simplified network operations and installation by providing the following:

- Zero-touch setup
- Centralized management
- Configuration of multiple Aruba Instant networks, compliance records, and historical data reporting
- Proactive troubleshooting of networks across all school district sites

E-Rate Impact

Proctor Caching Servers are Category 2 Eligible Services, as of FY2015.

Aruba Airwave: Wired and Wireless Network Management

For school districts that want to leverage the scalability of an on-premises network management platform, Aruba AirWave software provides a consolidated wired/wireless network management platform.

AirWave network management lets the school district IT department improve the application and device experience on wired and wireless multivendor networks. Unlike traditional port-based network management, AirWave employs a user-centric approach for identifying who is connected, where they are connected, the mobile devices they are using, and how much bandwidth specific devices are consuming. With visibility into everything that affects wireless and mobility Service-Level Agreements (SLAs), AirWave network management lets clients proactively plan for capacity, visualize client performance, and troubleshoot application issues before a helpdesk ticket is generated. With AirWave, the entire school district network is easily and efficiently managed through a “single pane of glass,” making it easy to keep SLAs on track.

Brocade Network Advisor: Wired and Wireless Network Management

Brocade Network Advisor is an excellent on-premises option for wired and wireless network management for school districts with a smaller wireless deployment that want a “single pane of glass” for managing the network.

Brocade Network Advisor helps proactively manage end-to-end network health and performance and helps with troubleshooting. Administrators can quickly identify network issues with customizable dashboards and can drill down to isolate and fix problems. Brocade Network Advisor supports the entire Brocade IP and Aruba portfolio of products, for unified network visibility and control.

- **Improve agility and responsiveness:** Anticipate network issues with continuous monitoring of network health and performance indicators. Administrators can quickly drill down to troubleshoot issues, identify changes, and adapt configurations to avoid downtime and scale capacity.
- **Share network insights:** Visualize network insights using out-of-the-box, customizable dashboard and topology views. Share that critical data with peers through a browser-accessible interface, or use REST APIs to represent network data in other tools.
- **Optimize resources:** Dramatically reduce administration time by standardizing and automating critical network management tasks. Simplify this process transition using built-in best-practice content, an easy-to-use interface, and group management of devices and fabrics.
- **Simplify integrations:** Manage the entire network from a single tool, from edge to core, incorporating data from Aruba wireless devices.

As Patrick Gittisriboongul (Director of Educational Technology and Information Services, [Huntington Beach Union High School District](#)) says, the Brocade Network Advisor software made network management simpler for everyone on his team. Even those without networking experience quickly adapted to the Brocade Network Advisor configuration process and user-friendly interface.

Aruba ClearPass: Authentication, Authorization, and Access Control (AAA)

As previously mentioned in the Device Management and Security Policy section, ClearPass provides a window into the network and covers network security and access control requirements from a single platform. School districts get complete views of mobile devices and users with total control over what they can access. ClearPass works

with any multivendor infrastructure and is easily extended to network security business and IT systems already in place within the district. To improve the end-user experience, ClearPass delivers a wide range of self-service network security capabilities. Users can securely onboard their own devices, which is mandatory for the influx of new devices to be supported consistently in the K-12 environment. Users can sponsor guest Wi-Fi access and set up sharing for Apple TV and Google Chromecast without a single call to the helpdesk—freeing up valuable and scarce IT resources. The power of ClearPass network control comes from integrating ultrascaleable AAA with policy management, guest network access, device onboarding, and device health checks, with a complete understanding of context. ClearPass leverages a user's role, device, location, application use, and time-of-day to execute custom security policies, accelerate device deployments, and streamline network operations across wired and wireless networks and VPNs.

E-Rate Impact

Category 2 Managed Services are E-rate eligible services at a prediscount rate of \$30 per student per year, for up to 5 years. Category 2 support levels have been extended through FY2019.

E-RATE MODERNIZATION AND FINANCIAL ACQUISITION OPTIONS

In July 2014, the FCC approved E-rate Modernization measures aimed at improving the internal connections and broadband capabilities to end-user students within the schools. Included in these measures are \$2 Billion of funds in each FY15 and FY16 earmarked for what are now called Category 2 funds. On December 11, 2014, the FCC also increased the size of the E-rate fund by \$1.5 Billion and affirmed Category 2 support levels through FY2019.

The products from Brocade and Aruba detailed in this document are included in the [FY2015 Approved Eligible Services List](#) for the E-rate program as Category 2 funds. While the additional \$2 Billion of funds in FY15 and FY16 are certainly welcome by the K-12 community, it is expected that the [pent-up demand for in-building network upgrades will outstrip the supply of available funds](#). Additionally, depending on the upgrade requirements of particular school districts, it is very likely that the funding caps implemented for these funds will not fully cover the cost of needed upgrades.

The funding caps for Category 2 Eligible Services (equipment and basic maintenance for equipment) are \$150 per student over 5 years on a prediscount basis. Discounts are calculated the same as before (that is, based off the percentage of students eligible for the National School Lunch Program), with two major changes. First, the maximum discount for a district is 85 percent (down from 90 percent). Second, the percentage is calculated on a district-wide basis instead of a school site by school site basis. Both of these measures were put in place to stretch the pool of funds to cover more districts and more students.

To assist school districts that will not receive Category 2 funding because of funding pool exhaustion, or for those school districts that find their funding eligibility to be short of what is needed, Brocade has developed a unique network acquisition model. The program is called [Brocade Network Subscription](#). Brocade Network Subscription is an Infrastructure as a Service (IaaS) model, where the end user pays a monthly fee based on the infrastructure that is currently required by the school district. The program differs from a lease, because there is no calendar term, so end users can return equipment without penalty if they no longer need it—or they can upgrade their infrastructure as their needs change, again without penalty. Another great benefit of Brocade Network Subscription is that it can [now include Aruba equipment](#) as part of the subscription, so school districts that are unable to get full coverage of their network upgrades via E-rate or capital improvement bonds have a viable financial vehicle through which to upgrade their networks to support Common Core testing.

As an example of the financial power Brocade Network Subscription can bring to a school district, look at the results of Brocade Network Subscription utilization at an Illinois school district. Like many IT organizations, this district's Information Services department's annual maintenance contract from their incumbent networking vendor placed a huge burden on the operations expense budget. After a review of the district's network requirements to support Common Core testing and other digital learning initiatives for the future, the district chose to implement a Brocade network. They also chose to acquire the network through the Brocade Network Subscription program.

What were the results?

- A brand-new network that prepared the district for Common Core testing and future digital learning initiatives
- No capital expense
- Reduced annual operating expenses through canceling the former support contract and implementing Brocade Network Subscription
- Flexibility to expand or contract the network capability as required in the future, without penalty

SUMMARY

Common Core testing presents a number of new challenges to school district IT administrators. The baseline networking requirements that the Common Core consortiums (PARCC and Smarter Balanced) offer to their constituents do not go far enough in outlining the architecture of a highly available network during testing periods. As discussed, a number of outside factors can inhibit the performance of the network during this crucial time. By implementing the network architecture referenced in this paper, school districts can be prepared for Common Core testing.

The impetus to prepare for Common Core testing, combined with the additional funding possibilities available through E-rate reform, presents an opportunity for school districts to perform long-needed network upgrades. For those districts in which available E-rate funds fall short of their requirements, the reduction in current annual maintenance contracts by means of implementing a Brocade/Aruba Network with inherent Lifetime Warranties makes a network refresh possible. If capital expense dollars within the district are still restricted, Brocade Network Subscription can assist those districts in making that new network a reality.

The vast majority of K-12 school district networks have been neglected for far too long. Use the Common Core Initiative and the E-rate Modernization opportunity to prepare your network for digital learning initiatives for years to come.

ABOUT BROCADE

Brocade networking solutions help organizations achieve their critical business initiatives as they transition to a world where applications and information reside anywhere. Today, Brocade is extending its proven data center expertise across the entire network with open, virtual, and efficient solutions built for consolidation, virtualization, and cloud computing. Learn more at www.brocade.com.

ABOUT ARUBA

Aruba Networks is a leading provider of next-generation network solutions for mobile organizations including educational institutions. The company designs and delivers Mobility-Defined Networks that ensure student success with digital learning and empower teachers with rich classroom tools, while empowering IT departments to make smart investments in next-generation infrastructure.

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For further information on how to prepare your school district for Common Core Testing and beyond, please contact your Brocade Authorized Partner.

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