



# Holden R-III School District

## Network Review and Recommendations

March 18, 2016



## **Overview:**

Midwest Computech was asked by the Administration at Holden R-III Schools to perform a review of current network infrastructure and make recommendations to the District for current and future network needs.

All recommendations are according to the Districts technology plan as discussed with Technical staff. The main goal according to staff is to move the district to a “one to one” device to student ratio with wireless devices. The time frame of achieving the one to one seems to be uncertain but estimated to be implemented in the 2016-2017 school year.

## **Current Network:**

1. The current District Wide Area Network (WAN) is a standard compliant “star” network with the main core of distribution located in the Middle School. All other building connections are distributed from this core with 10 gigabit multimode fiber with the exception of the bus barn and multi-purpose building. The multi-purpose building is branched off from the High School with a 10 gigabit fiber. The bus barn is connected from the Middle School, but has only 1 gigabit fiber connection. Although this bus barn connection is only a 1 gigabit, the speed is quite acceptable given the amount of users, data flow needed, and logistic location. The speed could be increased easily to 10 gig with upgraded transceivers (g-bics).
2. The internal distributions in the buildings are a combination of 10 gig and 1 gig multimode fiber connections that have been determined by user density in each portion of edge distribution. From edge locations and building core switches to devices, connectivity is achieved using a combination of Category 5, 5e, and 6 copper data cable. Most of this was designed to achieve 1 gig speed to devices, although some Cat 5 connections are still at 100mbps.
3. The District core located in the Middle School contains the access to the internet with an 80mbps connection through Morenet. The district firewall / router / content filter appliance is a Sophos SG 450. The core equipment is powered through an APC UPS (Uninterrupted Power Supply).



4. All district switching is performed by various models of layer 3 managed HP Procurve technology. All switches are equipped with 1gig copper PoE+ (Power over Ethernet) distribution ports and 10 gig capable fiber (SFP) ports. Switches are powered through various sizes of UPS's (Uninterrupted Power Supplies) with the exception of 3 locations where they are plugged directly into the wall.
  
5. The wireless network is comprised of Aerohive wireless AP 121 and AP 170 access points and a central web based control manager. The access points are both rated 802.11a,b,g,n (up to 300 mbps) using dual radios.

### **Current Known Expansion Plan:**

In Current discussions with the Tech staff at Holden, Midwest Computech has learned of plans in place for upgrades in areas to accommodate a move toward a “one to one” initiative. Currently the District has applied for Erate grants to gain purchase assistance for the following equipment and purpose:

- 25 Qty – Aerohive model AP 230ac access points
  - These are planned to be disbursed throughout the district to cover additional devices to be added to students (approximately 800 wireless devices, most likely Chromebooks)
- 5 Qty – 24 port PoE modules for existing 5400 series HP Procurve switches
  - These would add power and ports for added wireless devices

### **Recommendations:**

#### **Structured Cabling:**

Upgrading speeds of fiber optics that are currently at 1gig to 10 gig could easily be done by changing out transceivers. This would ensure even speeds to edge switching to prevent overloads of traffic for access points and wired devices added in the future. If deemed necessary due to increased traffic from the addition of wireless devices, speeds between buildings (currently at 10 gig) could be increased to 20gig with existing fiber pairs and creating a



LAG (Link Aggregation) between ports on the current switches. This would require additional gbics and modules for existing switches.

The current copper cabling of the Category 5 should be replaced with Category 6 to ensure 1 gig connectivity to wired devices. The category 5e currently installed could be replaced with Category 6 as well, but only necessary where lengths exceed 150 feet. All new wireless access points should be wired to the network with Category 6 cable. In cases where higher density and speeds are needed, with new Aps, two Cat 6 cables should be installed to each AP, to utilize up to 2 gigabit connectivity.

### **District Core:**

With the additional number of wireless devices planned, it would be advisable to upgrade the ISP (MoreNet) speed from 80 mbps to 100 mbps. Re-evaluation from that point should be done frequently as more web based curriculum is utilized.

The current Sophos firewall is adequate but adding 800 devices in use would bring the recommendation of adding a separate content filter appliance to remove the added filtering traffic load and prevent a bottleneck.

### **Switching and Configuration:**

The District's current HP Procurve switching platform is healthy. It is a single platform, good for ease of maintenance and internal communication and traffic routing. It is our recommendation to continue with the single HP platform and add modules when needed and re-evaluate each year of new models and upgrades. Some form of UPS should be added to all of the 3 switch locations where there currently are none. To handle the projected one to one initiative, and the addition process, these switches are quite capable with proper configuration. A different configuration of VLAN's (Virtual Local Area Network) could be considered with the large increase of wireless traffic.

It is generally recommended to separate your wired and wireless devices on different VLANs, but every school district has unique circumstances that need to be taken in to consideration. Since Holden School District utilizes Apple devices, the issue of Bonjour has to be addressed. Bonjour is the service used for Air Print, Airplay and other services Apple devices use for communication. Therefore, the network design needs to take these considerations in to account. Currently the wired and wireless devices for each build are on one VLAN, this enables Apple devices to utilize Airplay for screen sharing on Apple TVs and Air Print to print to the



building printers. There are a few options the district has to setup a separate VLAN for wireless devices and maintain the same functionality they have currently with Bonjour services:

- The district could move all wireless devices to a new VLAN in each building as well as move the wired Apple TV's and print servers for each building to that VLAN.
  - This would be the least complicated way to achieve the separation without a loss of functionality and ease of day to day management of the network.
- The district could move all wireless devices to a new VLAN in each building, but leave the Apple TV's and print servers on the wired VLAN, this would then require a Bonjour gateway be configured as well as multicast routing enabled on the core (5400 series) switches.
  - The setup for this will be a little more complex and could require the district to purchase additional equipment for the Bonjour gateway and require that the switching is capable of multicast routing.
  - Enabling multicast routing also negates some of the benefits of separate VLANs as it will allow all broadcast traffic to route between VLANs it is configured for.

### **Wireless:**

It is our opinion that the District's wireless platform is a perfect fit for now and moving forward to a one to one initiative. We have installed and currently manage one to one school applications. The Aerohive platform allows very granular management and flexibility of products for different applications. It would not be our recommendation to "get rid of" and/or replace your current AP's. With some thought and strategic placement, the current AP's should be utilized. All new AP's purchased should be 802.11ac moving forward. This does not mean that the current 802.11n AP's are out. The n AP's are still capable of handling up to 50 authentications (users) and many devices aren't yet capable of using the ac technology. The District has already applied for grants to help with 25 new ac AP's. This is definitely the right approach. However, 25 new AP's may be too few. Our recommendation would be to install more AP's as user density grows after the 25 new ones are placed. Placement can be critical, as the more AP's added, the more interference comes in to play. With the Aerohive features, and flexibility, all of these issues can be overcome with controller management.

- The District could move all of the older n AP's to less demanding buildings and place the newer ac APs in high density and demand areas (Middle and High School).
- The District could mix the new in with the old and use the manager to control



In either scenario, to achieve the desired one to one or BYOD (Bring Your Own Device), it is recommended to place an AP in every classroom, and some of the Higher Density handling AP 230's in very high density areas (public events areas) where many users are to be accommodated.

## **Summary:**

The Holden School District is currently not ready for a "one to one" implementation. The proposed purchases of additional equipment (AP's and modules) will help greatly. There will most likely be a need for upgraded power supplies in some of the switches to aid with the added PoE needs.

Because of forward thinking of previously purchased equipment in use, the platforms of infrastructure are capable of being improved to accommodate growth without a complete "rip and replace" and not to mention a very expensive approach.

With technology advancing daily, school districts are often faced with weighing options of choosing technologies with some degree of predictability. The return on investment is always a consideration. Holden Schools has to implement some improvements to accomplish some planned future needs, but has made some good decisions to make this possible without a great amount of change and pain.