

Maury High School's wired network shall be a centralized structured cabling system, consisting of 1 Main Distribution Frame (MDF) and 2 Intermediate Distribution Frames (IDFs). The MDF will be installed in the small office closest to the center of the first floor by the auditorium, and two IDFs will be placed in both left and right classroom wings at the small offices. This setup also ensures that all cable lengths are 100 meters or less--the maximum recommended Ethernet distances. Given the school is 300 feet wide, with this scale, if all outlets are taken into account, we calculate an average horizontal cable run to be 60 – 80 feet.

Every classroom and office will have two Cat6 network outlets, 1 for students, 1 for staff. If we rely on the floor plans, around 44 rooms exist in total within the building, and as such, we need a total of 88 outlets. Including the vertical riser cabling, backbone connections, and slack, we need about 8000 feet of Cat6 plenum cable.

Cabling and termination materials include:

- 8 spools of 1,000-ft Cat6 plenum cable $\approx$ \$1,000 - \$2,000 depending on brand of wire
- 88 Cat6 keystone jacks (100 purchased for spares) $\approx$ \$85-\$125
- 46 dual-port wall plates $\approx$ \$60
- Four 24-port Cat6 patch panels $\approx$ \$350

Total estimated Part 1 wiring cost: $\approx$ \$1,495-\$2,535

To accommodate all of the Ethernet connections, three managed 48-port Ethernet switches are used, with one located in the MDF and another in each IDF. This would give 144 switches, which is more than the 10% buffer over the 88 network outlets. The switches will be TP-Link JetStream TL-SG3452 managed 1 Gbps switches.

Equipment placement:

- **MDF (center office):**
 - 1 $\times$ 48-port managed switch
 - Connects all central classrooms
 - Handles uplinks to both IDFs
 - Connects directly to the firewall
- **Left IDF and Right IDF:**
 - 1 $\times$ 48-port managed switch each
 - Serve classroom outlets in each wing
 - Uplink back to MDF using trunk ports

Additional networking components include:

- 100 Cat6 patch cables for switch-to-patch-panel connections $\approx$ \$250
- 3 managed switches at $\sim$ \$500 each $\approx$ \$1,500

Total estimated Part 2 equipment cost: $\approx$ \$1,750

Maury High School will protect its internal network with a Fortinet FortiGate 60F firewall, which is rated for 200-300 active users and includes support for VLAN routing, firewall filtering and intrusion prevention capabilities. The other day I thought about trying to take the linux server out of the mix and stick in a "real" firewall, which we already had lying around. It will go in the MDF directly connected to the ISP modem. There should be no internet-facing servers.

The network will be segmented using Virtual LANs (VLANs) for security and traffic control:

- **VLAN 10 – Staff Network**
 - Subnet: 10.10.10.0/24
 - Used for teacher and administrative devices
- **VLAN 20 – Student Network**
 - Subnet: 10.10.20.0/24
 - Used for classroom student devices
- **VLAN 99 – Network Management**
 - Subnet: 10.10.99.0/24
 - Used only for managing switches and the firewall

Firewall security rules will include:

- Students are allowed to access the Internet only
- Students are blocked from accessing the staff network
- Students will also be blocked from accessing certain websites
- Staff are allowed Internet access and internal resources
- Management VLAN allowed to monitor all network devices

Firewall cost: $\approx$ estimated to be \$2,500