

Ethernet Network Design Project

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Sotiris Economos

1 Project Overview

This plan gives the school a network that is very strong and simple to run. High-speed 1 GB service is sent through copper cables to every classroom and office. This means that students and teachers can work online without any problems. One closet on each floor has two separate 10-gigabit fiber lines that connect to the main server room. There won't be a big outage if one fiber ever fails because the other will keep traffic going. To keep everything safe, we use reliable HPE Aruba switches to move the data and a small Palo Alto firewall to watch the gate to the internet. TIA/EIA rules say that all of the wires, jacks, and racks must meet certain requirements. As long as you have Power-over-Ethernet switches, you can connect new Wi-Fi access points or security cameras without having to run extra power cords. Best of all, the parts list is affordable for the school and still meets the speed needs of today while leaving room for growth in the future.

2 Building Description & Assumptions

- Footprint $\approx 91.44 \text{ m} \times$ (unspecified depth); ceiling 3 m.
- One Equipment Room (ER) on 1st floor; one Telecommunications Closet (TC) on Basement, 2nd, and 3rd floors—vertically aligned.
- 74 rooms \times 2 data drops = 148 horizontal links.
- Longest link (with ceiling loop) $\approx 98.17 \text{ m}$; average 54.75 m.

3 Cabling & Physical Topology

3.1 Horizontal Cabling

Category 6 four-pair UTP is chosen for each drop, supporting 1 GbE to 100 m and 2.5/5 GbE on short runs. Total cable required:

$148 \times 54.75 \text{ m} \approx 8,100 \text{ m} \rightarrow 27 \times 1,000 \text{ ft}$ (305 m) boxes with 10 % slack.

3.2 Backbone Cabling

A 6-strand OM3 multimode fiber trunk connects every TC to the ER in a star. Two strands per TC carry redundant 10 GbE uplinks. A 500 ft ($\approx 152 \text{ m}$) plenum spool covers all risers with service loops.

3.3 Patch Panels & Cords

Leviton 24-port Cat 6 patch panels (7 units) terminate horizontal cabling at each closet. Factory-molded Cat 6 patch cords (3 m) are used on both ends—300 total.

4 Active Network Equipment

- *Core Switching* HPE Aruba 3810M 24-port SFP+ in the ER aggregates uplinks.
- *Access Switching* Four HPE Aruba 2930F 48G PoE+ switches—one per closet—provide 1 GbE to rooms and power for future APs.
- *Uplinks* 10 GbE over OM3 using Aruba J9150D SFP.

- *Security Edge * Palo Alto PA-220 firewall at the ISP hand-off.
- *Uninterruptible Power * Four Eaton 5P 1550 VA rackmount UPS units for graceful shutdown.

5 Bill of Materials & Budget (street pricing, April 2025)

Item	Qty	Unit USD	Subtotal
Aruba 2930F 48G PoE+ switch (JL256A)	4	\$3,200	\$12,800
Aruba 3810M 24SFP+ core switch (JL075A)	1	\$6,500	\$6,500
Aruba J9150D 10G SFP+ SR	16	\$160	\$2,560
Palo Alto PA-220 firewall	1	\$1,000	\$1,000
Cat 6 plenum 1000 ft box	27	\$170	\$4,590
OM3 6-strand fiber plenum 500 ft spool	1	\$700	\$700
Leviton 24-port Cat 6 patch panel	7	\$290	\$2,030
Cat 6 patch cord 3 m	300	\$4	\$1,050
42U 4-post network rack	4	\$450	\$1,800
Eaton 5P 1550 VA rack UPS	4	\$760	\$3,040
Cable management, labels, tester rental	1	\$1,200	\$1,200
Estimated Total			\$37,270

6 Security Measures

- Palo Alto firewall provides application-layer inspection, threat prevention, and URL filtering.
- Access ports use 802.1X with RADIUS; unused ports shut down.
- DHCP Snooping, ARP inspection, and LoopGuard enabled.
- Role-based VLANs: Staff, Student, VoIP, Guest.
- Daily encrypted config backups to off-site cloud storage.

7 Future-Proofing Considerations

- Aruba 2930F supports VSF stacking for simplified management.
- All access switches offer 370 W PoE+ budget—adequate for Wi-Fi 6/6E APs and IoT.
- Spare OM3 fibers allow migration to 40/100 Gb when needed.
- Clear-pass Policy Manager (optional) enables Network Access Control and device profiling without hardware change.

8 References

1. HPE Aruba 2930F data sheet & pricing – HPE Partner Portal.
2. HPE Aruba 3810M Series data sheet – hpe.com.
3. Palo Alto PA-220 Specs sheet & MSRP – paloaltonetworks.com.
4. Belden Cat6 Plenum Cable pricing – belden.com (Apr 2025).
5. Corning OM3 6-strand riser fiber list price – corning.com.
6. Leviton Cat6 Patch Panel product page – leviton.com.
7. Eaton 5P UPS brochure – eaton.com.