

Ethernet Network School Design

Overview

The plan I have here is a full ethernet network design plan for a school with three floors and a basement. This network will use a hierarchical star topology that has a fiber backbone going in between the floors and Cat6A copper cabling that connects to all the outlets.

Measurements

Footprint: 95 m wide

Ceiling H 3m high

Outlets: 148 total and 2 live RJ-45 ports

TC closets on each floor

Equipment Room on first floor

Topology

Hierarchical Star which is the professional standard

Core Layer: holds the ISP router, the fiber cable panel, and all the backbone fiber is here

Distribution Layer: Every TC connects to the ER with OS2 fiber cables and will connect each room with Cat6A horizontal runs

Access Layer: Each room will have two keystone jack in the wall plate

Cable design

Horizontal Cabling - CAT6A, UTP, Plenum Rated

The Category 6A is utilized for horizontal cabling to support 10GBase-T over a distance of 100 meters, as defined by the TIA-568.2-D Standard. Since the longest horizontal cable run in this building will be 98.17 meters, it meets the requirement. Fire code requires cable with a Plenum rating for all cable located in air handling ceiling spaces of schools.

Backbone/Riser Cabling - OS2 Single-Mode Fiber, Plenum Rated

The Backbone cabling is used to connect all Equipment Rooms to all Telecommunications Closets.. The SMF OS2 cabling supports data rates of 10/40/100 Gbps and is immune to EMI, and utilizes LC connectors in duplex configuration with two strands.

Patch Cables - 3 ft. Cat6A Snagless

Patch cables are used to connect devices at the patch panels and device outlets. A relatively short patch cable length can keep the rack cable management clean.

Because the longest run is only 98.17m long the Cat6A cable can support a max of 100m which will work perfectly.

Equipment

Cisco Catalyst 9300-48T Center of the star

Cisco ISR 1100-4G WAN router Supports LTE WAN interfaces.

Fortinet FortiGate 200F Firewall that will be between the Router and internal network and will help with security

48-Port Cat6A Patch Panels

24U Floor Mount frame rack will hold all the ER stuff with good cable management

APC Smart-UPS 1500VA Rack mount battery backup in the case of a power outage.

Network Security

- Fortigate 200F Firewall will control all the network passing thorough it including IPS signatures that will block malicious traffic

- Content filtering of certain nsfw websites and known malware domains

- FortiGuard Subscription

- Different VLANS for staff and students

- Unused Port shutdown by default

- Locked TC rooms

Costs

Cat6A Cable 30x \$4800

OS2 single mode Fiber 200x \$500

Cat6A keystone jacks 150x \$1200

Dualport wall plates 75x \$300

48 port Cat6A patch panel 3x \$900

Cisco Catalyst 9200-48P 3x \$8400

FortiGate 200F 1x \$3500

Cisco 9300 core switch \$4200
Cisco ISR router \$1200
24U Floor mount rack 1x \$800
APC smart ups 1500va Rm 4x \$2400
Fortigaurd 1yr subscription \$1200
TOTAL: \$27800

Sources:

Cat6A Cabling (Belden 10GX)	CDW.com
Keystone Jacks & Wall Plates	Legrand (legrand.us) / Amazon Business
Patch Panels (48-port Cat6A)	Monoprice.com
Fortinet FortiGate 200F	Fortinet.com / CDW.com
APC Smart-UPS 1500VA RM	APC.com (Schneider Electric)
Floor & Wall-Mount Racks	Middle Atlantic Products / Amazon Business
FortiGuard Subscription	Fortinet.com/fortiguard
OS2 Fiber / LC Patch Cables	fs.com (Fiber Store)

Complies with CIPA internet protection act, c

Summary

This design will provide the school with a legitimate wired Ethernet network that meets all relevant standards, is safe and can be rated as professionally installed. The hierarchical star topologies separate the core edges from the access layers which will make it easier to troubleshoot problems or to add more networks in the future. The Cat6A horizontal cable runs from the building's location, with plenty of cable left over for future [runs. It](#) has complete all access security and internal security needs and will only allow authorized devices to connect to the network at any port or connection point within the building.