

Technology Infrastructure: Network Services

What are the main things to know?

- Just like all of us, our systems are growing older every day
- Unfortunately, as with milk and eggs, the majority of our infrastructure systems reach a date they no longer operate, are supported, or a combination of both
- We do everything possible to maximize the lifespan of our equipment
- We are behind on the replacement of many systems as in the 2019 bond referendum technology was cut



Why does the network really matter for delivering instruction to students?

- Impact of network outage to students, parents, teachers and employees:
 - No internet or email access on district network
 - No access to assignments (Canvas and Seesaw), applications, and other programs
 - No access to the Single Sign On (SSO), applications, and programs
 - Online testing



Why does the network really matter for the safety of students and staff?

- The fidelity of the network hardware is critical to protecting an asset perhaps second only to the physical health of our students and staff including:
 - Their data and personal information
 - Recording of security cameras
 - Phones and wi-fi can be impacted
 - Badge card reader doors could be impacted



Why does the network really matter for delivering services to students, staff, and parents?

- The fidelity of the network hardware is critical to providing services to the level and response time needed including:
 - Point of sale in the cafeteria
 - Hub campuses going down impact many other schools
 - Inhibits our ability to transmit car pick up arrival information
 - Impacts our ability to provide bus arrival information to:
 - Students
 - Teachers
 - Parents and Guardians



Flow of a Network Request for Data (left to right)



Network Operations Center (NOC)





- All network, internet and voice communications
- Core networking components
- Server applications, security servers, district storage and databases
- Finance and student systems
- Virtualization systems
- Call managers and telecommunications carrier equipment
- Management and monitoring devices



NOC Firewalls and Network Protection Safety

- District Firewall
 - Internet protection
 - Routes all internal and external network activity
 - Virus and malware protection
 - Secure virtual private network (VPN) access
- Distributed Denial of Service (DDoS) Appliance
 - DDoS attacks flood networks with internet traffic preventing students and employees from accessing connected systems and resources
 - Appliance shields and reduces CISD network from exposure to DDoS attacks
- Internet capacity of 20 Gigabit (GB)
- Playing defense against attacks involves two components
 - Updated technology capable of repelling attacks of all kinds
 - Education of our staff and students





Main Distribution Frame/Facility (MDF)



• Controls all connectivity for the campus or building

- Main room for connecting campus to the network and district resources
- Each campus or location only has one MDF
- Networking equipment:
 - Core network distribution router
 - Network switches
 - Patch panels
 - Air conditioning (HVAC)
 - Battery backup (UPS)
 - Temperature sensors
 - Video distribution
 - Security servers



Average number of switches per location IDF and MDF						
Elementary	Intermediate	Junior High	High School	Other		
30	30	55	88	2 - 40		

Campus Networking – MDF Pictures





Campus Networking



- Intermediate Distribution Frame/Facility (IDF)-
- Smaller rooms located throughout location to connect classrooms and offices
 - Connectivity provided via single fiber connection to the MDF
 - Networking equipment:
 - Network switches
 - Patch panels
 - Air conditioning (HVAC)
 - Battery backup (UPS)



Average number of IDF rooms at each location						
Elementary	Intermediate	Junior High	High School	Other		
2	3	7	18	0 - 1		

Campus Networking – IDF Pictures





Conroe HS



Collins Int



CP HS



Hub Campuses

- Multiple connections to help minimize outages due to fiber cuts or other outages
- Hub campuses have larger MDF rooms for equipment and HVAC
- MDF's are on backup generators for power outages
- Hub locations in CISD:
 - McCullough Junior High School
 - Oak Ridge High School
 - College Park High School
 - York Junior High School
 - Caney Creek High School
 - Administration Building
 - The Woodlands High School





Cabling and Fiber



- Campuses have a minimum of 1 gigabit(GB) to each wired connection port (including wireless access points)
- There are 88 point to point fiber links in the district
- Approximately 430 miles of Fiber (1,200 miles of individual strands)
 - Would stretch from CISD central office to Miami Florida
- Fiber connections between all campuses
- HUB campuses have redundant routes to minimize outages

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Approximate Number of Wired Ports Per Location						
Elementary	Intermediate	Junior High	High School	Other		
1,940	1,940	3,540	7,225	200 - 2,500		

Typical Classroom



- Classroom projector
 - Most projectors were updated 2017-2018
- Teacher setup:
 - Computer, monitor and speakers
 - Document camera
 - IP phone mounted on wall (some rooms have secondary phone on teacher desk)
 - Chromebook or iPad
 - Mimio (new construction only)
- Students
 - PK 1st grade iPads
 - 2nd grade and above Chromebooks
 - Very few student desktop computers (except for CTE programs)
 - iPad and Chromebook carts

Approximate Number of Classrooms per Campus (Excluding Portables)						
Elementary	Intermediate	Junior High	High School	Portables		
45	60	75	135	251 (Total)		



Wireless access



- Access points provide wall to wall coverage in all buildings to connect all student employee mobile devices
- Essential for Chromebook, iPad and laptop use
- Additional access points are placed in dense areas (more students in one location)
- Wireless controllers are located at multiple hub campuses to configure and control access points (Admin, College Park, York, Caney Creek)
- Wireless is not the same as cellular signals

Average Number of Access Points per Location						
Elementary	Intermediate	Junior High	High School	Other		
100	100	200	500	50		



Internet Protocol (IP) Phones

- IP phones are connected to the network and function as regular telephones
- Call Manager and Unity Connection process all calls for the phones and voicemail solutions





Model	Total	Avg Year Acquired
79xx	6,993	2002
78xx	310	2009
88xx (Current Model)	1,037	2017-2022
99xx / Other	167	2019

Security Cameras, Servers, and Safety



- Security cameras located inside and outside campuses and buildings
- Recent campuses have more cameras
- Camera servers located at each campus constantly record motion and activity
- Essential for school safety and security and solving problems for students





	Elementary	Intermediate	Junior High	High School	Other	Total
Camera Views	4,811	2,587	2,401	4,035	2,023	15,857
Security Servers	89	27	17	46	27	206

Electronic Doors, Access Cards, and Safety



- Controls access to doors using secure access cards utilizing electronic door locking equipment for safety and security
- 10,001 access cards have been issued in CISD (includes contractors, cards for portables, fire department Knox box, etc.)





Doors with Electronic Access							
Elementary	Intermediate	Junior High	High School	Other	Total		
659 240 193 334 55 1,481							

Summary of Needed Technology Infrastructure Equipment

	2023-2024	2024-2025	2025-20266	2026-2027	Total
Network Equipment, NOC, Wireless	\$8,562,500	\$10,262,500	\$17,162,500	\$19,762,500	\$55,750,000
Life Cycle, Systems, Upgrades	\$2,187,500	\$3,162,500	\$2,337,500	\$3,487,500	\$11,175,000
Safety, Security and A/V	\$950,000	\$800,000	\$600,000	\$600,000	\$2,950,000
Totals	\$11,700,000	\$14,225,000	\$20,100,000	\$23,850,000	\$69,875,000

