D8023 WIRELESS LOCAL AREA NETWORK (WIFI) SYSTEMS

1.1 Goals and Objectives

A. The Wireless Local Area Network (WIFI) System Guidelines shall provide wireless access to the site local area network and district wide area network, as well as the Internet, for all authorized School District users.

B. The WIFI will require connectivity and integration to the Local Area Network (LAN) System. The WIFI will be integrated with the site VLAN configuration.

1.2 Related Specifications and Design Guides

NOTE: Specifications highlighted in YELLOW in this document need to be updated by the architect, design team or consultant.

A. 271523 Communications Copper Horizontal Cabling – Interior Rev 8.1.11.

B. 272123 Data Communications Switches Rev 8.1.11.

C. 272133 Data Communications Wireless Access Points Interior Rev 8.1.11.

D. D8021 Structured Cabling Systems.

E. D8022 Main Distribution Frame Systems.

1.3 Summary

A. The following guidelines are not intended to be universally applied "as-is" to all projects. It remains the responsibility of the Architect to use professional judgment to develop appropriate design and contract documents for the execution of the project specific work.

B. The wireless local area network system (WIFI) is a standard implementation of an 802.11ac wireless local area network with a/b/g/n/ac capabilities designed to provide wireless local area network access to the school and district network, site and district applications, and the Internet. Laptops, tablet computers, and other Bring Your Own Device's (BYOD) will be the primary devices used on the WIFI.

C. The campus-wide WIFI shall provide connectivity to authorized school district users within the boundaries of the school campus. Areas included for coverage are:

1. All instructional areas: Classrooms, Labs, Media Centers, Libraries, Portable Classrooms.
2. Administrative and support areas: Office(s), Cafeteria, Auditorium, and Multi- Purpose Rooms.
3. Other School Buildings: Gymnasium, Performing Arts/Theatres, Stadiums.

4. Exterior Locations: Quads, Patios, Break Areas.
5. Outlying Exterior Locations: Fields, Playgrounds, Parking Lots. Note: Exterior locations to receive wireless only where an access point can be installed on a structure. No trenching is to be done to install the access point.

D. To achieve the level of RF saturation required to support current WIFI functions, a minimum RF threshold of –75dBm has been established. Where practical, this saturation level to be accessible in all points within the campus boundaries.

E. To achieve a base level of bandwidth, a best effort of 450 Mbps per WIFI user must be supported for up to 30 WIFI users for any single designated location. Where practical, this bandwidth should be provided at all points within the campus boundaries.

F. When complying with this standard proves to be cost-prohibitive, the architect shall provide a best-effort alternative to the district for approval.

G. The designer must take into account the WIFI coverage requirements of all interior locations in the Structured Cabling – Horizontal Copper requirements.

H. The designer must perform an assessment for new fiber backbone connections and provision for additional fiber ports on the core switch.

I. Power-over Ethernet (POE) devices shall be 802.3AT standards compliant.

1.4 System Interdependence

A. WIFI will require connectivity and integration to the Local Area Network (LAN) System via the Structured Cabling System. The WIFI will integrate with the on-site data network by way of a VLAN configuration. All deployed Wireless Access Point hardware must be capable of being monitored, managed and configured using the CAPWAP protocol and must be compatible with the already embedded District - based Cisco Network Control System (NCS/PRIME) application and the supporting Cisco Mobility Services Engine (MSE) for location services.

1.5 WIFI Infrastructure

A. The WIFI infrastructure shall consist of cabling or hardware components, and modifications and/or adaptations required to support the WIFI system requirements. Many of these components will already be in place and will require specific assessment for provisioning of fiber, copper, switch ports and bandwidth.

B. WIFI may include:

1. Racks, Cabinets, Enclosures.
2. Fiber Optic Backbone Cabling.
3. Fiber Optic Patch Panels.
4. Copper Horizontal Cabling.
5. Copper Patch Panels.
6. Fiber or Copper Patch Cords.
7. AC power as required for non-POE equipment locations.

1.6 WIFI System

A. The WIFI system includes all the hardware, software, integration with district services and, software configuration required to support the campus-wide WIFI.

B. The system components at the site may include:

1. Wireless Access Points.
   a. Interior.
   b. Exterior.
2. Various Antennas and Configurations.

C. WAPs are controlled and configured by the already embedded district-based Cisco Network Control System (NCS/PRIME) application and Cisco Mobility Services Engine (MSE).

1.7 Placement of WAPS

A. Placement of WAPs is subject to wireless site survey, type of WAP and type of antennae. For purposes of maximum coverage and saturation, wired network drops should be designed to provide maximum coverage.

B. Ceiling mounted WAPs may utilize internal antennas while wall mounted WAPs require external antennas.

C. The following guidelines for wireless location services will provide optimal coverage for standard wireless LAN use and wireless location:

1. To determine the optimal placement of all WAPs in the WIFI coverage areas, consider the access point density and location.
2. Roughly one access point should be placed every 50-60 linear feet. This translates into one access point every 3,000 square feet.
3. Users may need to adjust those parameters to their specific environment and requirements.
4. Devices must be detected at signals greater than -75 dBm for the

controllers to forward information to the location appliance. As such, no fewer than three access points should be able to detect any device at signals below -75 dBm.

5. Place access points along the periphery of coverage areas to help locate devices close to the exterior of rooms and buildings – within 8-10 feet of exterior walls but not closer.

6. By increasing overall access point density and moving access points towards the perimeter of the coverage area, location accuracy is greatly improved.

7. In long and narrow coverage areas, refrain from placing access points in a straight line. Instead, attempt to stagger them such that each access point is more likely to provide a more unique snapshot of device location.

8. Configure wall mounted WAP antennas for best beam form and coverage.

1.8 General WIFI Infrastructure Placement Guidelines

A. Also see D8021 Structured Cabling.

B. Use these guidelines to determine the appropriate locations to provide wired network drops to facilitate WAP connectivity.

C. It is assumed that wired network drops shall be used to provide WAP connectivity in all interior locations connected to school buildings.

D. Each classroom shall have two (2) network drops designated for WIFI.

E. For drop-ceiling applications, terminate copper horizontal cabling in a surface mount termination block above the drop-ceiling.

F. If a single surface mount termination block is used above drop-ceilings, mount near the center of the classroom. Patch cables may then be used to locate the actual WAP in the drop-ceiling.

G. For surface mounting applications, use “wire mold” type plastic raceway and terminate in secured junction boxes appropriate for direct-mounting of the WAP.

H. In buildings with adequate interior WIFI network drop provision but no ceiling- mounted network drops, locate WAPs in optimal building-wide WIFI saturation location.

I. In locations with inadequate interior network drop provision, install new wired network drops in locations to optimize WIFI saturation. Either above the drop ceiling near the building perimeter wall (preferably, not closer than 8 feet), and staggered to the opposite building perimeter wall for adjacent classrooms.

J. In locations with high ceilings, use wall-mounts located no higher than

twelve (12) feet above the floor and directional antennas to provide adequate coverage and saturation.

1.9 Classrooms, Labs and Instructional Areas

A. Also see D8021 Structured Cabling.

B. Current standard installation for Structured Cabling with new and modernization schools call for a total of eight (8) category 6 network drops in each classroom, lab, or instructional zone; two (2) ceiling drops for WAPS and six (6) wall drops for general use.

C. Vendors may encounter classrooms with:

1. No permanently mounted wall drops.
2. No ceiling-mounted drops.
3. Wall drops and no ceiling drops.

D. Ceiling-mounted network drops shall be placed above the drop ceiling near the center of the room.

1.10 Administrative Offices and Support Areas (Cafeteria, Auditorium, Multi-Purpose Room – Interior)

A. Also see D8021 Structured Cabling.

B. Existing installations for structured cabling in most schools DO NOT have ceiling- mounted network drops in administrative offices and other support areas. These areas will need ceiling-mounted network drops installed.

C. As a general rule, each administrative office area and other support areas, such as cafeterias, auditoriums, multi-purpose rooms, shall have two (2) ceiling-mounted network drop to support WAPs for approximately every 3,000 square feet.

1.11 Other School Buildings (Gym, Theatre)

A. Also see D8021 Structured Cabling.

B. Many other school buildings have minimal or no network connectivity. In order to provide total WIFI saturation within school buildings, some buildings will need to be provisioned for basic network connectivity, and WIFI connectivity.

C. The designer may encounter other school buildings with:

1. No fiber backbone connectivity.
2. Inadequate fiber backbone connectivity.
3. Adequate Fiber backbone connectivity but inadequate network drops.

D. As a general rule, all Other School Buildings shall be provisioned for multiple

interior WAPs to support Wireless Location services. All Other School Buildings shall have two (2) ceiling-mounted network drop to support WAPs for areas approximately every 3,000 square feet.

1.12 Exterior Locations within Campus Perimeter

A. The designer should make a "best-effort" to provide wireless coverage to all exterior locations within the campus perimeter, particularly common areas such as Quads, Patios, Lunch and Break areas, as well as student and faculty parking areas.

B. The designer shall specifically include cafeteria Point-of-Sale cart locations.

C. Exterior WAPs shall be placed within nonmetallic Nema enclosures specifically designed to house access points (NEMA 3R type) and facing exterior locations at a height appropriate to avoid vandalism to the WAP and the antennas.

D. Exterior WAPs shall have two (2) supporting network drops.

1.13 Commissioning

A. The vendor is responsible for providing a standard for operational testing for each individual wireless component and the operation of the Wireless LAN system as a whole.

B. The verification testing and documentation deliverables will be utilized to acknowledge system and sub-system operational for handoffs between vendors and the district.

C. Whereas contractors install building infrastructure components, such as: structured cabling, power, mounts, racks, AV cabling. These systems shall be commissioned based on industry standard diagnostics and deliverable documentation, as well as associated warrantees and certifications.

D. Vendors install equipment using the building infrastructure components. The vendor must acknowledge handoff of contractor commissioning documentation before undertaking integration scopes of work.

E. The vendor shall define testing suites that include the inter-operation of sub-systems to achieve the operational objectives for commissioning of the entire system. Upon completion of integration work, the vendor shall provide the district with supporting documentation of total system commissioning.

1.14 Wireless Access Points

A. The vendor shall require industry standard verification testing of the operation of each WAP. The test may require site RF surveys and

connectivity tests. The verification testing of WAPs require the operation with data communications equipment, and structured cabling.

1.15 Wireless LAN Controllers

A. Each site will require the configuration of the Wireless LAN Controller (WLC) at the district central facility. The vendor shall require documentation supporting the configuration and operation of the WLC and each associated WAP. The contractor will coordinate delivery, labeling, configuration and installation with District.

2.1 Exceptions

E-Rate FY2015 projects include the installation of WIFI access points and copper horizontal cabling as follows:

A. Exhibit 1 Schools:

1. New 802.11ac Wave 2 WIFI access points to be installed in classrooms and instructional areas where 1142 APs are not present
2. Non-instructional areas and exterior APs are excluded
3. Two (2) CAT 6 copper horizontal drops per classroom to the ceiling
4. No link aggregation is necessary at this time.

B. Exhibit 2 Schools:

1. Existing WIFI access points replaced with 802.11ac Wave 2 devices for classrooms and instructional areas only.
2. Non-instructional areas and exterior APs are excluded
3. No link aggregation is necessary at this time.