UW-IT Wi-Fi Services Requirements Guide:
ARCHITECTURE AND ENGINEERING DESIGNS
UW Facilities - Section 27 17 53 Wireless Communications

CONTENT

OVERVIEW - UW-IT Wireless Services Requirements Guides

All UW projects for new construction and space renovations of 50,000 sq ft or more must incorporate the design and installation of the following Wireless and Mobile Communications Services:

WI-FI SERVICE - Service managed and operated by UW-IT Wireless Services Team.

PUBLIC SAFETY DISTRIBUTED ANTENNA SYSTEM ("PS DAS") - Service managed and operated by EH&S with UW-IT Mobile Communications Team consulting.

CELLULAR DISTRIBUTED ANTENNA SYSTEM ("Cellular DAS") - Service managed and operated by cellular carrier with UW-IT Mobile Communications Team consulting.

The following collection of requirements guides should help project participants better understand these services and how UW-IT Wireless Services and Mobile Communications teams are engaged and integrated into the overall project. While all

guides should be helpful for the Project Manager, some are geared toward specific teams.

UW-IT Wi-Fi Services Requirements Guide: Project Management
- Provides the UW Project Manager with information to help integrate the design and deployment of UW-IT Wi-Fi Services into the project plan.

UW-IT Wi-Fi Services Requirements Guide: Architecture and Engineering Designs
- Provides the Wi-Fi Design Engineer with information needed to create and deliver a Wi-Fi service design.

UW-IT Wi-Fi Services Requirements Guide: Service Installations
- Provides the Wi-Fi service installation team with information needed to install a UW-IT Wi-Fi service based on the final pre-installation design.

UW-IT Wi-Fi Services Requirements Guide: Post-Installation Surveys
- Provides the Wi-Fi post-installation survey team with information needed to test the installed UW-IT Wi-Fi service to ensure it meets service standards and all vetted service requirements.

UW-IT Requirements Guide: Public Safety Distributed Antenna Systems (Public Safety DAS)
- Provides EH&S and the Project Manager with information needed for the inclusion of a Public Safety DAS.

UW-IT Requirements Guide: Cellular Distributed Antenna Systems (Cellular DAS)
- Provides the Project Manager with information needed for the inclusion of a Cellular DAS.

REQUIREMENTS

R1 - Required UW-IT Wireless Services and Mobile Communications Change Reviews and Approvals

> Once service requirements have been collected and the service design process starts, any subsequent changes with the potential to impact the service requires review and advanced approval by the appropriate UW-IT service team before incorporation in the design and service implementation.

Service quality can be affected by many environmental and use-specific factors, all of which are considered in the service design process. Proposed changes to these factors - inclusive of customer requirements - after the onset of the design work will

be reviewed by the UW-IT Wireless Services team or Mobile Communications team, as appropriate, and considered in the context of the overall design. Some of the many factors considered in the design include the following:

- architecture (e.g., new room, change in wall location, stairwells, elevators, etc.);
- environment (e.g., building materials, furniture, cabling);
- space type (e.g., office space, lab, auditorium);
- people using the service (e.g., students, medical staff, researchers, guests);
- devices (other than laptops, tables, and phones) using the service (e.g., cameras, freezers);
- apps using the service (e.g., Wayfinder);
- density of devices by location (e.g., 50 devices in small room vs 2 devices in large room);
- use profiles in each location (e.g., sporadic video streaming; students in large lecture hall simultaneously accessing Internet sites; big data uploads/downloads);
- appropriate RF frequencies;
- target delivery dates and project delays of six or more months which may require updates to equipment and equipment costs.

The UW-IT service teams appreciate your cooperative communication throughout the project regarding changes that have the potential to impact the resulting quality and delivery of the services.

R2 - UW-IT Wireless Services and Mobile Communications Project-Related Communications and Coordination

Collaboration Space and Document Sharing. At the outset of each project, a UW-IT Partner Project Services team member will create a dedicated online shared-access space where project-related information and documents can be accessed and managed by project team members. Documents in this space will include materials from the project's architecture team; UW-IT forms related to service requirements and installation details; the service design package; and more as needed.

Meetings. Project team members are required to attend various meetings relevant to their roles and project coordination efforts. These meetings may include one or more on-site walkthroughs; pre-design requirements identification; post-installation review; and regular (usually weekly) project team meetings. Meetings may be called by the Project Manager, the UW-IT Partner Project Services team member, or other project team members. Each participating project team – UW teams and third–party contractors – must ensure that an appropriate team member and/or leader attend all required meetings. The designated meeting attendees will be informed and up to date on the status of their team's responsibilities and work.

Professional and Timely Communications. Each project participant is responsible for appropriate and timely communications via email, document sharing, ticket systems, etc. If in doubt as to who to contact, send email to help@uw.edu and specify the project name in the subject line.

R3 – Wi-Fi Design Service General Requirements

A - Coverage, Capacity and Signal Strength

The specified equipment and placement must provide coverage for those 802.11 protocols that will be relevant and current at the time of project delivery and using the 2.4 GHz, 5 GHz and 6 GHz bands throughout the designated coverage area(s).

The design must take into consideration capacity and signal strength within the context of the following requirements:

1. The design must provide sufficient signal strength:
    a) Minimum signal to noise ratio ("SNR") of 35dB.
    b) Minimum receive signal strength (power threshold) of –62dBm.
2. Users must be able to roam throughout the coverage area with no loss of connectivity. Each client must:
    a) See a minimum of 2 WAPs at any location within the coverage area,
    b) Primary WAP must have receive signal strength of –62dBm or higher,
    c) Second strongest WAP must have receive signal strength of –67dBm or higher.
    d) One WAP per channel with received signal strength of –82dBm or higher.
3. Via the Wi-Fi Site Functionality Form, the Wi-Fi design engineer must identify expected usage throughout the coverage area and define areas that have different usage characteristics. The design must support the following requirement:
    a) WAPs must support up to 20 users; a user may have 2-3 devices.
4. Areas where user density exceeds 16 sq ft per user require special consideration and may deviate from normal guidelines. Consult with UW-IT Wireless Services Team.
    a) Designs must be based on UW-IT standard settings:
        1. Transmit power:
            a. 2.4 GHz 7 dBm
            b. 5 GHz 14 dBm
            c. 6 GHz 11 dBm
        2. Channel width:
            a. 2.5GHz 20 MHz
            b. 5 GHz 40MHz
            c. 6 GHz 80MHz
        3. DFS channels in all locations - campus and medicine

4. Initial design should be based on 6GHz specifications; 2.4GHz and 5GHz will be adjusted based on that to meet requirements.
5. Client distribution ratios:
    a. IOS 40%
    b. Mac OSX 20%
    c. Window 15%
    d. Android 15%
    e. Other 10%

B - Service Locations

In addition to the standard interior locations, the design must also address the following:

1. Outdoor Wi-Fi coverage
Each outdoor location will be considered an area in the Wi-Fi design for the building. Designs for outdoor Wi-Fi locations are generally based on requirements defined in A-E above with appropriate modifications made where relevant to the location or usage. Outdoor areas that are in scope include:
    a. green spaces around the building;
    b. walkways to the building and major pathways;
    c. indoor courtyards, terraces, and patios.
2. Mechanical and electrical spaces.
3. Elevator cars and stairwells wherever feasible.

C – UW Design Review Board and/or Grounds Improvement Advisory Committee

The project PM will know or be advised of situations that may require review of proposed solutions by UW's Design Review Board and Grounds Improvement Advisory Committee. The former will pay attention to aesthetics related to the installed Wi–Fi equipment within the scope of the architected environment – indoors and/or outdoors. The latter will pay particular attention to preserving the integrity of the UW's landscape. Other considerations may involve the need for coordinated traffic management (e.g., when installing APs on light poles adjacent to roadways). Review by these boards may result in additional requirements that should be documented in the Wi-Fi Site Functionality Requirements Form and then addressed during the Wi-Fi design's creation.

D – Hardware

The Wi-Fi design process will include detailing the specific hardware required to install and provision the Wi-Fi design. This specified hardware must be approved in advance by UW-IT Wireless Services engineers. Equipment identified as part of the design process will include, but not be limited to, the following:

- Access points (APs)
- Brackets
- Enclosures/Accessories/Mounts (for interior and exterior APs)
- AP Antennae

For exterior APs as well as internal APs that must be installed in locations other than 8' to 10' feet above the fixed floor (AFF) the following applies:
- Indoor-rated APs used as exterior APs must be enclosed in a NEMA 4x-rated box SURFACE MOUNTED on the building's exterior. Box dimensions must be sized to accommodate the AP device as well as a 27 17 51 Ethernet box with 27 17 52 faceplate and bend radius/excess length of patch cord. Box dimensions must be sufficient to permit easy access for service and subsequent removal if required.
- For outdoor-rated APs, UW-IT must approve the location, the AP mountings and the orientation.
- "Under the seat" designs (e.g., in some auditoriums) or other exposed locations must accommodate specific requirements for an approved NEMA enclosure. Locking screws must be used for these enclosures. See specification 27 17 53 for recommended products.

E – AP Placement and Mounting
The following placement, mounting and identification requirements must be incorporated into the design.
1. Wireless access points will be mounted between 8 and 10 feet above finished floor ("AFF") so they are accessible from a standard eight-foot ladder.
2. Wall-mounted APs must be designed using a right-angle bracket with a minimum of 6 inches of clearance between the top of the right-angle bracket and the ceiling.
3. AP orientation must be considered, especially noting APs with integrated, down-tilt antennae.
4. If any other alternative placement is required (e.g., 10'-15' AFF or 'under seat,' or on main beam - *not cross 't'* - of suspended ceilings) it must be approved by UW-IT and the project sponsor prior to completion of the design.
5. In all cases, an appropriate mounting bracket approved by UW-IT for the specific AP and situation must be used.

F - AP Identification and Naming Standards
Unique names for each wireless AP in the design must be constructed by the designer and then documented in the WiFi Information Form (WIF) as well as the design. These names must follow the UW-IT naming convention

as follows:

CCC.RRRR.APyy

- CCC is the official building code, in all capital letters (e.g., SAV for Savery Hall and UMSS for the SS wing of UWMC);
- RRRR is the room number that the AP is in, corresponding to the room or corridor number shown on the CAD drawings and building signs;
- yy is a two-digit integer beginning with 01 for the first AP and incrementing by 1 for each additional AP.
- Include add-on designators when specified by UW-IT to clarify the type of space (e.g., AUD for auditorium or EXT for exterior).

Sample AP names include:
HMC.12EH-04.AP01
HUB.203.AP01
HUB.203.AP02
UWTO.O4318.AP01
KNE.120-AUD.AP12
KNE.EXT-REDSQ.AP01

G – Service Design Package
See full list of Service Design Package components below in "P3 - Process Output Materials, Information, Resources" inclusive of the file naming convention to be used.

PROCESS

P1 – Contractor Qualifications and Qualifications Submittals
The UW-IT Wireless Services team will be responsible for all Wi-Fi designs. Designs may be completed by a UW-IT Wireless Services team member or UW-IT Wireless Services may opt to contract the work to a qualified third-party. In the latter case, the Wireless Services team will be responsible for overseeing the work and contributions of the third party.

When contracting with a third party, UW-IT Wireless Services will ensure that the contractor meets the requirements included below.

A) The contracted firm must provide all required software design tools necessary for the Wi-Fi Design Engineer to provide the Wi-Fi Design Process Output Materials as outlined in this document: "Architecture and Engineering Wi-Fi Design Requirements Guide." This includes but is not limited to commercial-grade Wi-Fi site design and survey tools (e.g., Ekahau).

B) Contractor's Wi-Fi Design Engineer must be a full-time, permanent employee of the Wi-Fi Design Engineering firm with experience using contractor's tools and have the following qualifications:

- A minimum of three (3) years Wi-Fi design engineering experience.
- Must have successfully completed five (5) designs equal in magnitude (in terms of size and construction cost) within the previous three (3) years. For projects with less than 35 access points, these completed projects must have been successfully integrated into a network of at least 400 access points within the previous three (3) years. These projects must have used similar equipment to those specified herein.
- Demonstrated experience in the design of all Wi-Fi components using standard Wi-Fi design utilities and tools.
- Proficiency in the use of firm's Wi-Fi commercial-grade site survey utility tool for predictive RF CAD designs that consider buildings and RF signal propagation in 3 dimensions as well as the necessary capacity.
- Proficiency in assigning RF attenuation and the signal reflection characteristics associated with them in both CAD tool "Layers" and "Objects". This qualification is to ensure designs are predictively accurate.
- Certifications will be evaluated for relevancy based on the type of certification and organization issuing the certification.

Submittal of contractor qualifications must be provided not more than two weeks in advance of the installation project start date and not later than the onset of the work. As the details of these qualifications may change throughout the work (e.g., new contractor staff are brought in and others released), the contractor is responsible for providing timely updates to qualifications.

P2 - Process Input Materials, Information, Resources

The following materials are required to prepare and complete a UW-IT Wi-Fi Services Design:

- This guide;
- The Wi-Fi Information Form (WIF) with appropriate initial sections completed;
- A completed Wi-Fi Service Order Intake Form inclusive of customer requirements;
- Relevant CAD background drawings from the PM:
  - Floor Plans
  - Reflected Ceiling Plans
  - Furniture/Fixture Layouts (if available)
  - Other design materials relevant to the project and Wi-Fi service implementation (e.g., for installation of outside APs)
- UW-IT Wireless Services default Ekahau project report template with predefined survey configurations. (Template pending as of Aug 2024; request information from Wi-Fi Program Coordinator.)

P3 - Process Output Materials, Information, Resources

All documents listed as 'final' must be provided in both 'native' and pdf formats and live in the appropriate Google Drive project directory/folder.

Final Service Design Package will include the following:

- Final completed Wi-Fi Service Order Intake Form (Excel file)
- Final BOM including but not limited to:
  - Wireless Access Points (APs).
  - Hardware required for proper installation and mounting of APs.
  - External antennas including related mounting and installation hardware, as required by the design.
  - Lightning arrestors, mounting poles or other equipment required by the design.
- Final Pre-Installation Design Report - generated from Ekahau template (Template pending as of Aug 2024; request information from Wi-Fi Program Coordinator.)
  - Includes printed tabloid-size paper copies if requested by the installation team
- Created by UW-IT: Final Post Installation and Post Survey "As Builts" Design Report - incorporates install team list of approved and implemented changes to the pre-installation design; generated from template. (Template pending as of Aug 2024; request information from Wi-Fi Program Coordinator.)
- Final Narrative - describes special situations arising during installation or from post installation survey results.
- Final coverage and capacity maps drafted with a commercial-grade Wi-Fi site design and survey tool (e.g., Ekahau) in each of 2.4GHz, 5GHz and 6GHz ranges.

Each iteration of the design must use the following file naming convention:

[FACCODE]-[FACNAME]-[FACNUM]-[EK | HA] - DESv# -YYYYMMDD

FACCODE = Facilities code for the building (e.g., SUZ)
FACNAME = Building Name (e.g, Suzzallo Library)
FACNUM= Facilities number for the building (e.g., 1193)
Survey Type: EK = Ekahau | HA = Hamina
DESv# = Design version number; for final report v# = vFINAL
Date must be provided in this format: YYYYMMDD

Example file names:
SUZ – Suzzallo Library – 1193 – EK – DESv1 – 20240101

P4 - High-Level Service Design Process Stages

A) *Rough Order of Magnitude ("ROM") Cost:* based on initial high-level project information. At the outset of the engagement, the UW-IT Wireless Services team will provide the Project Manager with a ROM cost for the project based on the initial high-level information provided and to include the following:

      a) estimated equipment costs based on square footage plus proposed use of specific areas within and exterior to the building;

      b) 15% base contingency; with 10% additional contingency for each subsequent year (planned or unplanned) beyond year one of the project

      c) estimated costs for design effort.

This estimate will not include the installation costs for cabling supplies and installation or Wi-Fi device installations. Those cost estimates should be provided to the Project Manager from the relevant group(s) – usually, the UW-IT Cable Infrastructure (CI) team and the selected low-voltage contractor.

B) *Predictive Design:* This design is created using high-level project information available at the outset of the project and generated through a commercial-grade Wi-Fi site design and survey tool (e.g., Ekahau).

C) *Wi-Fi Service Order Intake Form:* provided by the project team and the customer, this document should include all requirements for the service including vetted customer requirements.

D) *Integrated Design*: This stage will likely require several iterations as requirements are refined using information from the Wi-Fi Service Order Intake form. The approved culminating version of this document will become the proposed Pre-Installation Design. See next item.

E) *Pre-Installation Design:* To create the Pre-Installation Design from the Integrated Design have the project architect create the DWG files (CAD drawings) that include the locations of the APs and AP identifiers.

    NOTE For the Architect regarding CAD drawings: the Wi-Fi design engineer will provide the necessary AP location information along with a UW-IT-supplied DWG template file to the Project Manager. The Project Manager will provide these materials to the project's architectural team who will enter the information into the latest CAD file using a DWG format. The resulting DWG file must include the following information:

        • A block object with attributes which represent each AP location. (The

block to be used should be taken from the UW-IT DWG template file where it is defined.)

- Text label with values taken from AP object attributes which include:
  - The AP name as provided by the design engineer; and
  - The mounting style as designated by the design engineer. Acceptable values for this attribute include WALL, CEILING, ENCLOSURE, BELOW ENCLOSURE, NEMA, HARDLID.
- AP icons and labels must be separated into drawing layers in the E-COMM layer name space. Only layers defined in the UW-IT supplied template may be used.
- The layer colors must not be altered from the template colors, and the AP block objects must not be altered.

The resulting DWG files (paper and electronic) must be approved by the design engineer, the UW-IT Wi-Fi Services team, and the Project Manager. Once approved, the installation team is provided with a paper copy of the DWG pre-install design files to use in their work.

F) *Bill of Materials ("BOM"):* The BOM is based on the approved pre-installation design.

The Wireless Services team will coordinate with the PM to facilitate the placement by UW-IT of an equipment order per the BOM. Equipment will be paid for via direct charge to the designated project or departmental budget or via internal UW charge-back processes.

G) *Low-Voltage Contractor:* The low-voltage contractor will use the final pre-installation design to complete their work.

The low-voltage contractor hired by the project must be approved in advance of the installation work. If the project has already selected a low-voltage contractor, UW-IT Wireless Services Wi-Fi Program Coordinator must assess whether the selected contractor is a viable choice for the installation work in the context of the design. If yes, approval is provided. If not, then UW-IT must provide the project with names of alternative low-voltage contractors for the work. If the project has not yet selected a low-voltage contractor, or if UW-IT has not approved an engaged contractor, then the project must put the installation work out to bid using the information from the completed design.

H) *Final Service Design Package:* This collection of final design and design-related documents will be provided to UW-IT in native and pdf file formats in the provided Google project drive.

- Final Completed Wi-Fi Service Order Intake Form (Excel file)
- Site Survey Files: iterative site survey electronic used to create and/or validate the design. These files must be properly configured with applicable wall, building and other elements and settings to ensure an accurate RF module of the proposed design. The files must also be configured with the applicable coverage, capacity and signal requirements for the project.
- Final BOM
- Final Pre-Installation Design Report - generated from Ekahau template (Template pending as of Aug 2024; request information from Wi-Fi Program Coordinator.)
- Created by UW-IT: Final Post Installation and Post Survey "As Builts" Design Report - incorporates install team notations; generated from template (Template pending as of Aug 2024; request information from Wi-Fi Program Coordinator.)
- Final narrative - describes special situations arising during installation or from post installation survey results.