Requirements for Indoor WiFi Predictive Survey:

Introduction:

The process of information and requirements gathering is the first step in designing and implementing a successful WLAN (Wireless LAN) solution. This is often referred to as the *Define Phase* of the project, since this is the phase in which the customers environment and requirements are defined. This is the foundation of the project and the building block of all subsequent phases. Once the Define Phase is completed, we move to the *Design Phase* of the project which includes the Predictive Survey. While the primary focus of this article is the Define Phase, we'll reinforce the importance of these requirements to the overall project.

Before discussing information requirements, we should define what a WiFi Predictive Survey actually is. In short, a Predictive Survey is the visual modeling of a wireless environment using simulation software. A predictive survey is typically created offsite using scaled building floor plans provided by the end customer or building owner. These floor plans are imported into simulation software and attenuation areas such as walls, ceilings, floors, along with client capacity, user applications and proposed AP locations are analyzed. While there are no guarantees to the accuracy of predictive design without a site survey, it's certainly more accurate than estimating the number of AP's based on square footage alone. For the purpose of this document, we'll show how a Predictive Survey is used to estimate the number of AP's required for a project; based on critical information obtained during the customer site visit or building walkthrough.

Sections Included in this Document

Information Gathering (Define Phase):

The information gathering (or Define Phase) is one of the most important phases of WiFi design; but is often overlooked. It's not to say that all requirement details listed are needed for every predictive design, however, the more information you can gather about the customer's environment the more accurately we can predict capacity and coverage.

Step 1 - Preliminary Questions:

- Why is the customer expanding, upgrading, or replacing their existing WiFi solution?
- What are the customer concerns or dissatisfaction with their current WiFi network?
- Does the customer have any critical feature requirements? (e.g. Captive Portal, Social Media login/authentication, PMS & credit card billing, retail analytics, asset tracking, security, etc.)
- Estimate of the customer's budget, prior to advancing to the Design Phase (e.g. predictive survey.)
- Is this customer a candidate for ProCloud Hosted WiFi Services, or do they prefer to host their own vWLAN server/instance?

Step 2 – Requirements Gathering:

- **Customer's typical client device types:** Mobile Phones, Tablets, Laptop computers, WiFi Phones, WiFi Printers, handheld scanners, etc.
  - Why is it important to know the Typical Device Types used on the WiFi Network? Predictive modeling can simulate devices ranging from laptops to smartphones, along with peak usage hours for each device. Additionally, by having some knowledge of the typical device types used, we can better plan and optimize for either 2.4 and 5GHz coverage (or both). Below is a chart listing the channel support and max transmit rate for several common client devices.

Device Category	WiFi Radio Type	Channel Support	Channel Width	Transmit Power Output	Max Data Rate 20/40MHz
Smart Phones	802.11n 1x1:1	1-11	20 MHz Only	11 dBm	65-72 Mbps
Low-End Tablets	802.11n 1x1:1	1-11, 36-48, 149-161	20 MHz Only	11-14 dBm	65-72 Mbps
High-End Tablets	802.11n 1x1:1	1-11, 36-48, 52-64, 100-140, 149-161	20/40 MHz	11-14 dBm	65-72 Mbps / 135-150 Mbps
Netbooks	802.11n 1x2:2	1-11, 36-48, 149-161	20/40 MHz	11-17 dBm	72 Mbps (UP) 144/300 Mbps (DN)
Low-End Laptops	802.11n 2x2:2	1-11	20 MHz Only	17-20 dBm	144 Mbps
Mid-Range Laptops	802.11n 2x3:2	1-11, 36-48, 149-161	20/40 MHz	17-20 dBm	144/300 Mbps
High-End Laptops	802.11n 3x3:3	1-11, 36-48, 52-64, 100-140, 149-161	20/40 MHz	17-20 dBm	216/450 Mbps
VoIP Handsets	802.11a/b/g	1-11, 36-48, 149-161	20 MHz Only	11-16 dBm	54 Mbps

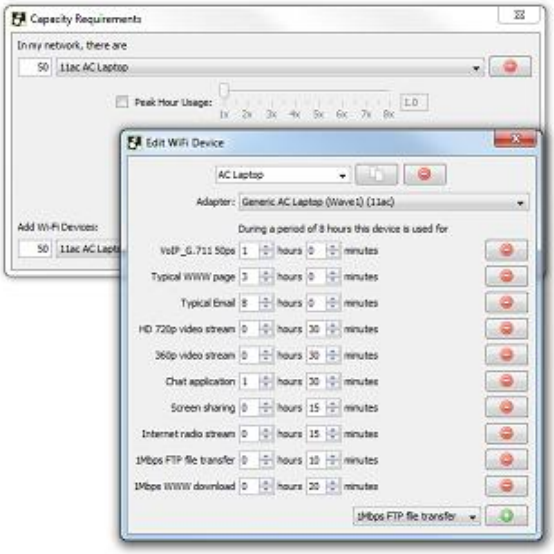
- **<u>Number of client devices supported on the WiFi network</u>**: (Plus anticipated 5-year growth.)
  - Why is it important to know the expected number of client devices on the WiFi network? With the exponential increase of mobile devices over the last several years, the focus of WiFi design has shifted from coverage to capacity. When you consider that most users have 2-3 WiFi devices connected to the network at any given time, it's imperative to design based on the number of client devices, not just the number of users or employees. While coverage-based concepts still apply, it must be used in parallel with capacity planning for a successful WLAN design.

- **<u>Customers typical use applications</u>**: Email & web only, streaming video, graphic downloads, FTP, Wireless VoIP (VoFi), etc…
  - Why is it important to know the customer's typical use applications? Predictive modeling software can simulate not only particular device types, but applications as well. As a general rule, we design for -65dBm coverage for most indoor predictive designs, regardless of the application requirements. However, when you consider the additional bandwidth requirements for applications like video and file sharing, the focus on capacity increases exponentially. This could result in additional AP's, enabling channel bonding, or recommending APs with a greater number of spatial streams. Below are some examples of throughput requirements for several common applications.

Common application throughput requirements (Per User/Stream):

Application Class	Required Throughput
Web-Browsing/Email	500 Kbps–1 Mbps
HD Video Streaming	2–5 Mbps
Apple TV Streaming	2.5–8 Mbps
Apple FaceTime	900 Kbps
YouTube Video Streaming (SD)	500 Kbps
E-Learning and Online Testing	2–4 Mbps
Video Conferencing (example: WebEx)	384 Kbps–1 Mbps
VoIP Call Stream (Codec Dependent/Half Duplex)	27–93 Kbps
Printing	1 Mbps
File Sharing	5 Mbps

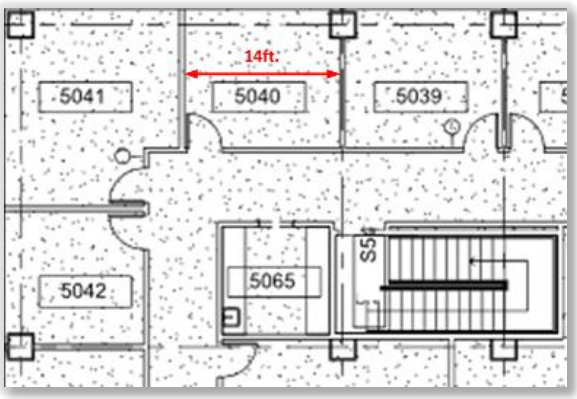
Example of Predictive simulation modeling of device types and applications:



Step 3 – Building Plans:

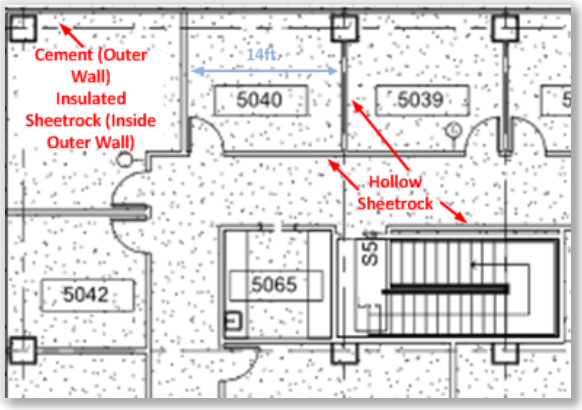
- **<u>Floor plans or building plans in electronic format</u>**: Obviously, there's no way to perform a predictive survey without accurate floor plans. Each floor plan should identify the building name and floor number. The original construction CAD files are preferred, followed by JPEG, BMP, PNG, and PDF. If the scale or room measurements are NOT provided in the plans, you'll need to provide at least one <u>accurate</u> room or wall measurement for each building or floor. Most of the information detailed in the sections below will require a site visit and walk-though, unless of course the information is provided in the building construction plans. If not, we recommend opening the electronic floor plan in some type of drawing or picture editing software, (e.g. Microsoft Paint) to make these notations, then save it as a secondary copy or file. See measurement example highlighted in red below:

Measurement for scale example:



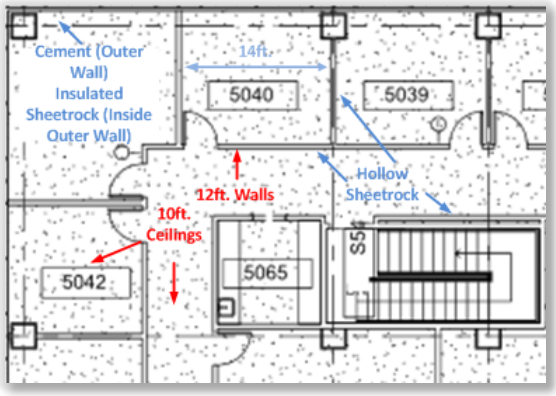
- **<u>Building Construction Materials</u>**: If not provided on the floor plans, the building construction materials for both the interior and exterior walls is required, (e.g. Solid concrete, concrete block, brick, steel, wood, drywall, etc.) Keep in mind that these materials affect RF differently, so knowing where they exist in the facility will help ensure accurate attenuation. See example notations below:

  Building Construction Material example notation:



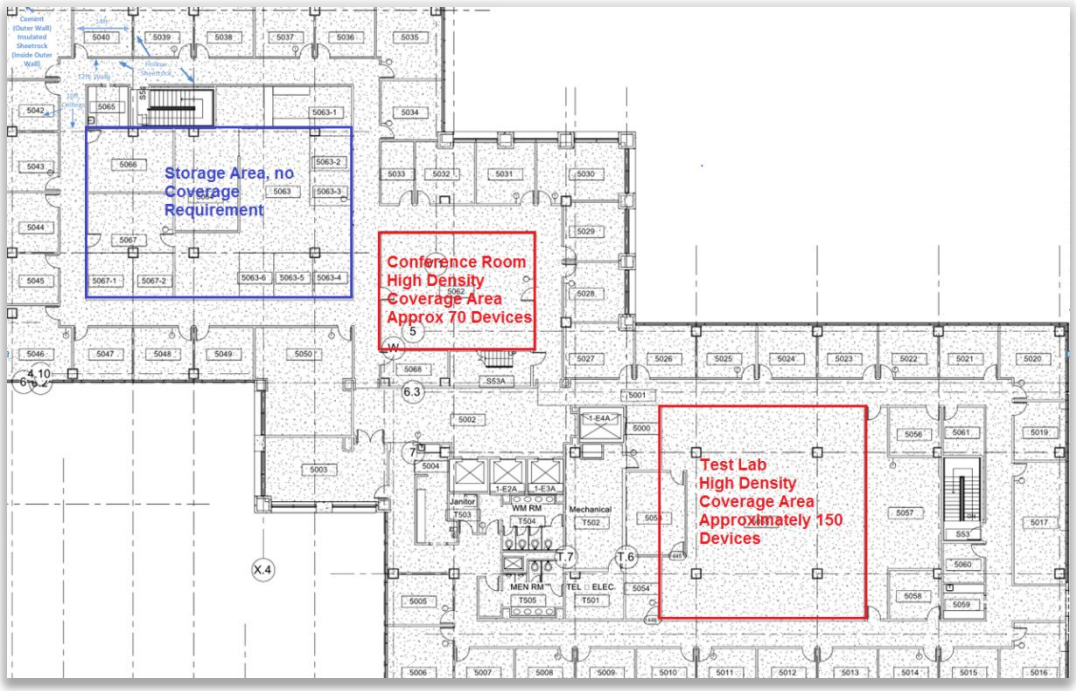
- **<u>Wall and Ceiling Height</u>**: In most cases the AP's are mounted to the ceiling, so it's important to know the ceiling height within a particular building or floor. However, ceiling high and wall height often differ, so wall height is needed as well. See example notation below:

  Wall and Ceiling Height example notation:



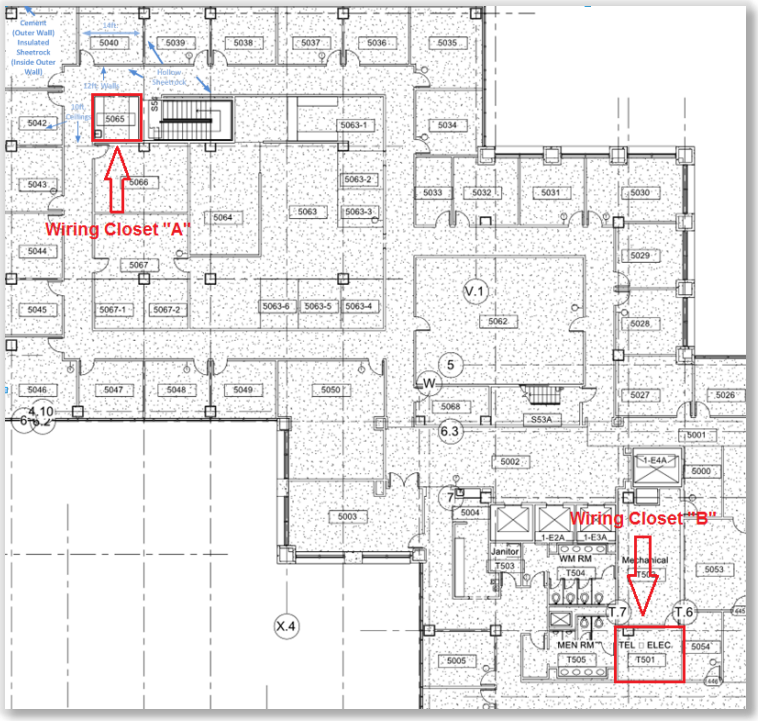
- **<u>Coverage areas and High Density coverage areas requirements</u>**: Using the same copy of the Building Plans in which you've already defined the building scale, wall materials, and ceiling heights; highlight all coverage and non-coverage areas, (notating all High-density coverage areas on the map.) Examples of high density areas include: Conference rooms, auditoriums, libraries, media centers, and classrooms. See example of marked coverage areas below:

Example of high density and non-coverage area notation:



- **<u>Wiring Closet Locations</u>**: This is particularly important for larger buildings or warehouses, as we must ensure the proposed AP locations are within the 100m (300ft.) cable length limitation of CAT5e/CAT6e. Using the same secondary floor plans (as illustrated above), identify all wiring or distribution closet locations. See example below:

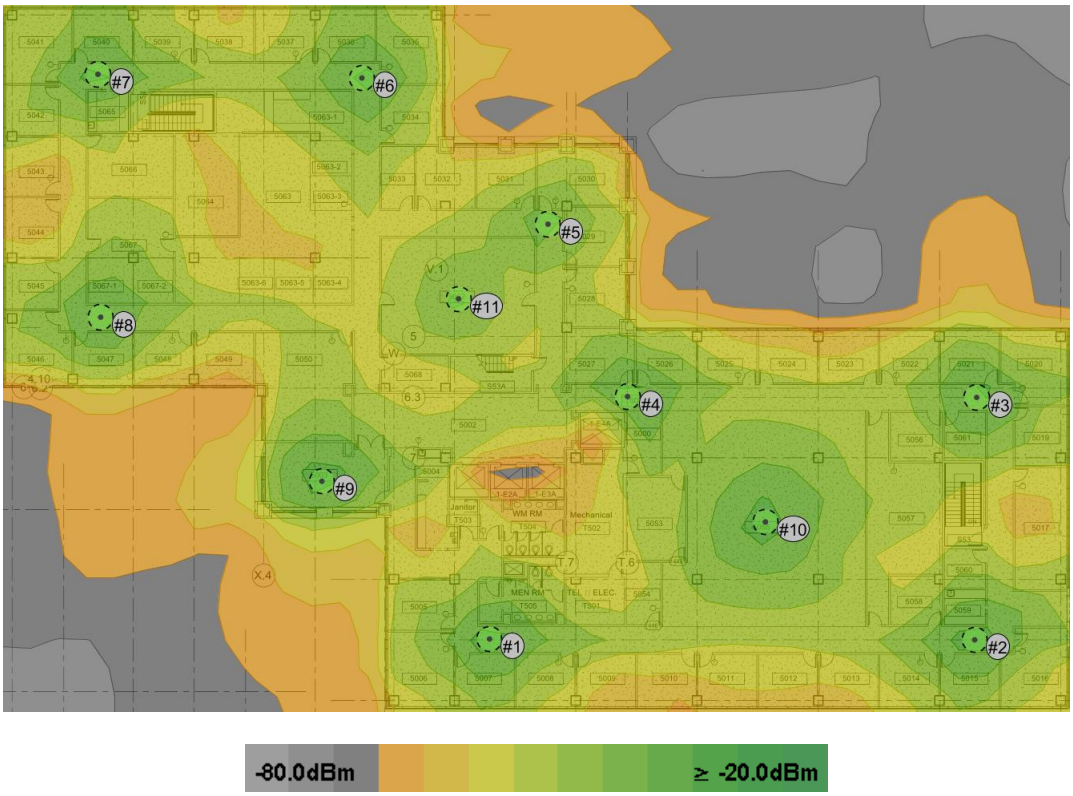
Example or wiring closet notation:



Predictive Analysis Report (Design Phase):

Once the information is gathered and complied, the Design Phase of the project begins. The information above is compiled and analyzed using simulation software and a final predictive report is generated. Below is a sample report, showing only the AP coverage, power, and channel plan.

Coverage and Signal Strength for: 5 North



Access Point Settings for: 5 North

AP #	Access Point	
1	**AP Name:** 5N AP Hall 5007	
	Channel: 1	**Antenna Type:** Adtran Bluesocket 2030 2.4GHz **Power Setting:** 20 mW **Antenna Height:** 7.9 ft **Notes:**
	Channel: 40	**Antenna Type:** Adtran Bluesocket 2030 5GHz **Power Setting:** 32 mW **Antenna Height:** 7.9 ft **Notes:**
2	**AP Name:** 5N AP Hall 5015	
	Channel: 1	**Antenna Type:** Adtran Bluesocket 2030 2.4GHz **Power Setting:** 20 mW **Antenna Height:** 7.9 ft **Notes:**
	Channel: 149	**Antenna Type:** Adtran Bluesocket 2030 5GHz **Power Setting:** 20 mW **Antenna Height:** 7.9 ft **Notes:**

3	**AP Name:** 5N AP Hall 5021	
	Channel: 6	**Antenna Type:** Adtran Bluesocket 2030 2.4GHz **Power Setting:** 20 mW **Antenna Height:** 7.9 ft **Notes:**
	Channel: 40	**Antenna Type:** Adtran Bluesocket 2030 5GHz **Power Setting:** 20 mW **Antenna Height:** 7.9 ft **Notes:**
4	**AP Name:** 5N AP Hall 5027	
	Channel: 6	**Antenna Type:** Adtran Bluesocket 2030 2.4GHz **Power Setting:** 20 mW **Antenna Height:** 7.9 ft **Notes:**
	Channel: 153	**Antenna Type:** Adtran Bluesocket 2030 5GHz **Power Setting:** 20 mW **Antenna Height:** 7.9 ft **Notes:**
5	**AP Name:** 5N AP Hall 5029	
	Channel: 11	**Antenna Type:** Adtran Bluesocket 2030 2.4GHz **Power Setting:** 8 mW **Antenna Height:** 7.9 ft **Notes:**
	Channel: 36	**Antenna Type:** Adtran Bluesocket 2030 5GHz **Power Setting:** 8 mW **Antenna Height:** 7.9 ft **Notes:**
6	**AP Name:** 5N AP Hall 5036	
	Channel: 6	**Antenna Type:** Adtran Bluesocket 2030 2.4GHz **Power Setting:** 20 mW **Antenna Height:** 7.9 ft **Notes:**
	Channel: 44	**Antenna Type:** Adtran Bluesocket 2030 5GHz **Power Setting:** 20 mW **Antenna Height:** 7.9 ft **Notes:**
7	**AP Name:** 5N AP Hall 5040	
	Channel: 1	**Antenna Type:** Adtran Bluesocket 2030 2.4GHz **Power Setting:** 20 mW **Antenna Height:** 7.9 ft **Notes:**
	Channel: 40	**Antenna Type:** Adtran Bluesocket 2030 5GHz **Power Setting:** 20 mW **Antenna Height:** 7.9 ft **Notes:**
8	**AP Name:** 5N AP Hall 5047	
	Channel: 11	**Antenna Type:** Adtran Bluesocket 2030 2.4GHz

		Power Setting: 20 mW **Antenna Height:** 7.9 ft **Notes:**
	Channel: 149	**Antenna Type:** Adtran Bluesocket 2030 5GHz **Power Setting:** 32 mW **Antenna Height:** 7.9 ft **Notes:**
9	**AP Name:** 5N AP RM 5003	
	Channel: 6	**Antenna Type:** Adtran Bluesocket 2030 2.4GHz **Power Setting:** 20 mW **Antenna Height:** 7.9 ft **Notes:**
	Channel: 36	**Antenna Type:** Adtran Bluesocket 2030 5GHz **Power Setting:** 20 mW **Antenna Height:** 7.9 ft **Notes:**
10	**AP Name:** 5N AP RM 5055	
	Channel: 11	**Antenna Type:** Adtran Bluesocket 2030 2.4GHz **Power Setting:** 20 mW **Antenna Height:** 7.9 ft **Notes:**
	Channel: 161	**Antenna Type:** Adtran Bluesocket 2030 5GHz **Power Setting:** 20 mW **Antenna Height:** 7.9 ft **Notes:**
11	**AP Name:** 5N AP RM 5062	
	Channel: 1	**Antenna Type:** Adtran Bluesocket 2030 2.4GHz **Power Setting:** 4 mW **Antenna Height:** 7.9 ft **Notes:**
	Channel: 157	**Antenna Type:** Adtran Bluesocket 2030 5GHz **Power Setting:** 4 mW **Antenna Height:** 7.9 ft **Notes:**

Useful Links:

- For information regarding site surveys and spectrum analyzers, please see Site Survey's and their place in Wireless Network Design and Maintenance.
- For information regarding RF planning and design around avoiding RF interference, please see Avoiding RF Interference with a Successful BlueSocket Wireless Deployment