Whitepaper: Site Survey

The importance of a site survey in POS WiFi installations

What is WiFi?

WiFi is a relatively new technology that has further extended the usability of IP by allowing Ethernet data to be transmitted without having to use cables. **WiFi** uses standardized radio transmissions in the 2.4GHz public range to establish a wireless LAN. **A** merchant who has a broadband connection can extend his LAN through out his location with little installation cost and eliminates the need to run Ethernet cable from the router to the IP device, so LAN installations are quicker and less expensive and provide merchants with greater flexibility.

Factors affecting WiFi:

There are a number of factors that will impact how well you're WiFi network will operate. **R**adio interference, antenna placement, physical barriers, and equipment quality are things to consider.

In the US, 802.11b/g devices have 11 distinct channels, but the technology operates in a spread spectrum mode. **T**his means a radio tuned to channel 6, will impact channels 4 through 8, and a radio tuned to channel 4 will impact channels 2 through 6 and there are other devices in addition to WiFi radios using the same 2.4 Ghz range as you. **C**ordless phones, Bluetooth devices, and microwaves all transmit in the 2.4 GHz band. **K**nowing what the radio spectrum looks like will help you "tune" your network.

Physical barriers are another common issue in the WiFi world. Walls, doors, floors, walk-in freezers etc, all have absorption and reflective properties that will impact how the radio signal is received at the terminal. **K**nowing where potential dead spots are will allow you to move the transmitter around to optimize your coverage area.

Site Surveys

A site survey looks at both the physical and RF environments and provides an idea of the operating parameters in which you are going to be exposed. **R**ecently, VeriFone contracted **Renaissance Network Solutions (www.rnetworksolutions.com)** to do a site survey for a ServPos installation. **RNS** arrived on site and performed an RF sweep of the restaurant to look for other WiFi radios, rogue devices, and interference. **T**he following was taken from the survey:

Scan current RF Coverage
Time 10:15- 11:30 Empty restaurant

The restaurant is 70' across the front (wide) and 90' long. The seating area is approximately 70' wide and 70' long.

The access point being used was a D-Link DI-524 and was located in the back of the serving area near the kitchen door, by the cash registers. The access point was placed under a counter 2 feet above floor level.

Upon the initial scan we could not see the AP because the SSID was turned off. In previous tests where the SSID was turned of (same device, DI-524) we were able to see the device and its signal strength, but the SSID came as the MAC address. In this case, when the SSID was turned on we were able to see and measure the device.
Signal strength measurements were found to be good or very good in a variety of measurements that were made around the restaurant. At the far corner of the bar was the longest distance and the signal strength there was measured to be -73 dbm. All other measurements were stronger than -73 dbm.

Channel 1 was being used and there were other access points using this channel that could be detected inside of the restaurant, however, when measuring outside of the restaurant area where the pickup location was we saw another access point on the same channel with the same signal strength (-76 dbm). This will cause the POS terminals, or any other WiFi device, to have very slow or no throughput operation.

Because of this we changed the AP channel to 11. The downside to using channel 11 in a restaurant is that the microwave oven also operates in this same band. While we did see the microwave oven when using our spectrum analyzer, we did not see that it had enough energy to cause interference to the WiFi signal.

The survey was able to uncover another radio across the street that impacted the pay at the curb transactions. **T**he channel of the radio was set from 1 to 11 and the issue went away. **T**he location also uses a paging system to notify customers when their table is available which caused no interference. **M**icrowaves are also in use, but the site survey determined that the signal output was not a factor in the operation. **S**ignal levels were taken at all points in the restaurant to insure that there were no physical issues with the network.

In addition to the physical survey, **RNS** provided a RF survey. **T**his survey, using a spectrum analyzer, looked at the 2.4 GHz bandwidth. **T**he RF survey was looking for rouge devices, 2.4 GHz cordless phones, Bluetooth devices, and microwave ovens. **T**he picture below was taken from the site survey. **O**n the second graph, you see a spike on channel 7. **T**his would impact channel 6, but not channel 1 or 11. **A**t the time of the trace, the radio CE00 was tuned to channel 1, and you notice there were two other rogue devices on channel 5 and 9. **F**rom the lower graph, there was some minimal noise on channel 3 and 7. **H**ad the microwave been turned on, or any Bluetooth devices been seen, they would have showed up on the analysis.

(image)

Radio and Antenna Placement

After the physical and RF environments were analyzed, **RNS** looked at the floor plan of the location and the current placement of the radio. **B**ased on the equipment and environment, a coverage plot was made:

(Image)

From the trace, the front part of the restaurant gets weaker coverage, and a good amount of the signal is broadcasted in to areas that are not used for service (such as the kitchen). **T**o optimize the coverage area, RNS recommended relocating the AP to the center of the seating area, and moving the radio to a level above 10 feet. **T**his would change the coverage plot to boost the signal in the bar area, and the corners of the location

(image)

Other recommendations were to look at Power over Ethernet to simplify the relocation, Commercial grade routers, and different antenna configurations.

Other locations

The above was an example of a location that could be covered with a single radio. Other sites may require multiple Access Points or additional routers. **K**nowing channel allocation, overlapping coverage area and traffic patterns will be critical in those locations. **S**ports arenas, malls, and other large area locations will require a site survey to insure proper coverage and setup of the radio network.

For smaller locations, you may have a radio and a terminal. A pre-site survey may consist of putting a radio in its location and walking around with a terminal. **T**hough not as detailed as above, it will give you a rough idea of what to expect when the location goes live, i.e. will you have coverage?

(image)

Conclusion

With a number of factors, both physical and RF affecting performance, a pre-site survey is critical. **K**nowing how the network will perform before going live will insure success and wider acceptance of WiFi solutions.