Installing Wi-Fi Access Points and Wireless Networks in Educational Facilities and Residence Halls

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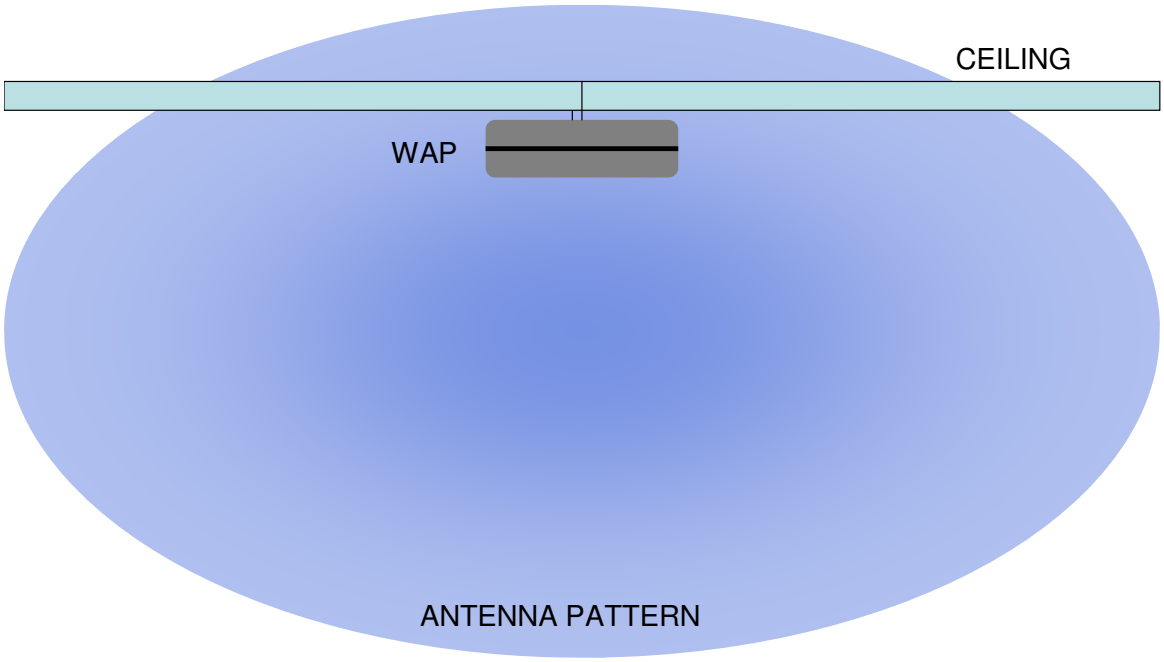
Wi-Fi and wireless networks are ubiquitous on college campuses and residence halls. Campuses provide an extra challenge to the network designer and installer because these facilities are comprised of many types of construction, including historically and architecturally sensitive buildings, and older construction. The installation may be in classrooms, libraries, laboratories, administration buildings, residence halls, auditoriums, stadiums and outdoor areas, often challenging the installer to use "every tool in the tool box". Because of the mission critical nature of the wireless network in education, the wireless infrastructure design must consider the following:

- Protect Wi-Fi access points from theft, vandalism, tampering, accidental damage and unauthorized moves and disconnects
- Protect access points from weather, spilling liquids, and impact, where appropriate
- Provide superior wireless coverage
- Blend aesthetically with the environment- particularly important in historical buildings
- Permit convenient, authorized access to the wireless access point

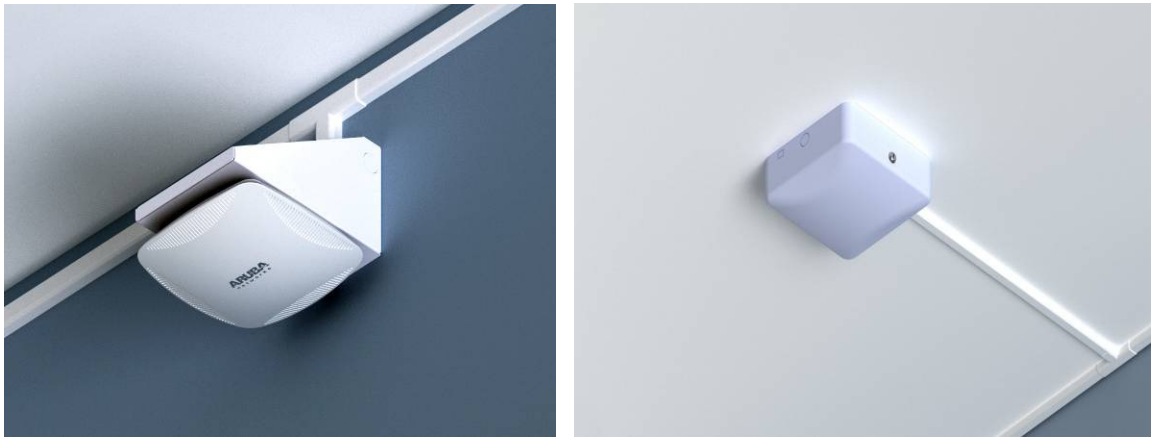
In addition to access points, these same criteria may be applied to Apple TVs and other multimedia gateways which may be deployed in classrooms and other open areas.

INSTALLATION IN RESIDENCE HALLS

These facilities often lack suspended ceilings into which the Wireless Access Points (WAP) can be mounted, and the above ceiling space through which the horizontal cabling can be conducted. The installer is typically faced with surface mounting the WAP and running surface raceway to it. Leading WAP manufacturers recommend that the WAP should be mounted in a "horizontal" orientation to achieve the best antenna coverage as shown in the figure, making it undesirable to simply mount the WAP on the wall. Common sense suggests that in these open environments, the WAP should be secured from theft, vandalism, tampering and unsolicited moves, adds, and changes. Further compounding the challenge is the higher density of WAPs required to support the higher bandwidth and density requirements of Wi-Fi users, all of must be installed in a secure and aesthetic manner. Oberon offers a number of solutions for mounting and securing the Wi-Fi access points in the preferred horizontal orientation in difficult hard lid environments.



Leading vendors recommend that the (WAP) should be mounted in the horizontal orientation on the ceiling or wall to provide the best antenna coverage



Oberon's model 1011(left) right angle wall bracket mounts the access point in the preferred horizontal orientation where a ceiling installation is impractical. Oberon's model 1015 (right) locking, surface mount box for most vendor's access points, can be mounted on the wall or the ceiling. It is constructed of an impact resistant ABS plastic which is virtually transparent to the wireless signal

ACCESS POINT DENSITY IN CLASSROOMS and AUDITORIUMS

The TIAs' TSB-162 Telecommunications Guidelines for Wireless Access Points recommends providing for placement of at least one WAP within each 60' X 60' building cell. This aligns fairly closely with leading access point manufacturers' recommendation of WAP density of one per 3000 sq. ft. However, schools have many facilities with much higher density requirements such as large classrooms, auditoriums, and stadiums. In these facilities, the TIAs' 4966 Telecommunications Infrastructure for Educational Buildings and Spaces standard recommends WAP density of one access point for every 25 occupants as shown in the chart.

Facility Occupancy	Number of APs
1-25	1
26-50	2
51-75	3
76-100	4
101-125	5
126-200	9
201-300	14
301-400	18
401-500	21

TIA 4966 Telecommunications Infrastructure for Educational Buildings and Spaces Recommended wireless access point density

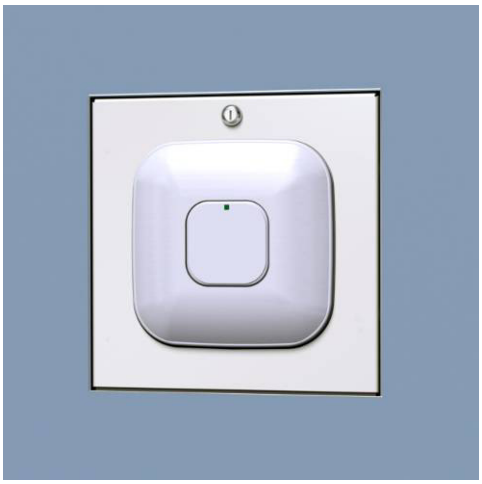
INSTALLATION IN STADIUMS and AUDITORIUMS

Creating a wireless network design with dozens or perhaps even hundreds of access points, as in stadiums, is a challenge. In some cases, the design calls for placement of WAPs underneath seating and on risers, simply because there is no other place to mount the WAP. In these cases, the WAP should be protected by a NEMA 4 enclosure. "NEMA 4" means the enclosure is designed to protect the equipment inside from rain, ice, spilling and spraying liquids. If the installation is outdoors, the NEMA 4 enclosure should also be constructed of a UV resistant plastic so that it is not damaged by sunlight over time. Enclosures used under seating should have tamper resistant screw on covers and, of course, should be as compact as possible so as not to compete for occupant foot room.

Oberon 1020 series access point NEMA 4 enclosures are designed for indoor/outdoor stadium installations. This model is compact enough for under-seat installation

INSTALLATION IN HISTORICAL BUILDINGS

Many campuses have historical buildings which require special attention to the wireless installation, due to the complexity of the construction and the desire to preserve the buildings character and appearance. Typically these buildings lack suspended ceilings, and they do not have convenient pathways for cabling. Oberon offers a line of surface mount and recessed hard lid ceiling and wall mountable access point enclosures. These enclosures are designed to largely blend into the wall so as to be minimally intrusive.



Oberon's Model 1078 recess ceiling/wall mount WAP enclosure with mud ring

APPLE TV® in CLASSROOM

Many schools and instructors are incorporating Apple TVs into their classrooms. The Apple TV® is a popular multimedia gateway which plugs into the HDMI port of a projector or TV. Perhaps even more so than WAPs, the Apple TV should be physically secured. Oberon's line of Wi-Fi access point enclosures can also be used to secure the Apple TV® in the ceiling or wall. The enclosure models with "-CP" in the model name have a clear polycarbonate door, enabling the Apple TV®s Wi-Fi and IR remote control to function properly. Note that securing the Apple TV® in the ceiling next to the projector will help to keep the HDMI cable to a minimal length

Locking, ceiling mounted enclosures for most vendor's access points, and Apple TV®. The clear polycarbonate door permits the Apple TV® Wi-Fi and IR remote control to operate properly. Secure mounting solutions for classroom multi-media projectors

INSTALLATION IN UNIVERSITY HEALTH CENTERS AND HOSPITALS

Installing the wireless network in University health centers and hospitals will pose a new set of requirements. Hospitals are very careful to avoid the spread of Airborne Infectious Disease which are a contributor to hospital acquired infections. Airborne Infectious Disease is comprised of mold and fungal spores, airborne dust particles which may bear bacteria and virus, and other airborne nuclei. The space above a ceiling (whether used as a plenum for air handling or not) or in a wall is recognized as a reservoir for these diseases. Hospitals now- especially leading University research hospitals - are very careful to NOT breach the ceiling barrier. Mounting WAPs above a suspended ceiling, or on the ceiling gridwork and poking holes in the ceiling tile for the data cable, is prohibited in some facilities.

Additionally, The Joint Commission (the body that accredits healthcare facilities) has specified that facilities should establish Infection Control Risk Assessment (ICRA) procedures for mitigating the spread of infectious disease and agents. Again, recognizing that the space above a suspended ceiling may accumulate dust and generate mold spores, the ICRA procedures may restrict access to the space above suspended ceilings. If work is to be performed above the suspended ceiling, requiring that ceiling tiles are lifted or moved, it may be necessary to get a permit and "tent-off" the work area using plastic sheets, or use a moveable Negative Air-Pressure Enclosure (NAPE). The tented area needs to ventilated and the air filtered by a HEPA filter. This process is time-consuming, and may be disruptive to work flow in the vicinity. Unfortunately, this space above, or in, the suspended ceiling is precisely where wireless access points are located, due to preferred wireless coverage from the ceiling location. Likewise, the supporting cabling for the wireless is located in this space above the ceiling tiles.

Oberon's line of UL listed suspended ceiling WAP enclosures are designed to preserve the integrity of the ceiling barrier and simplify ICRA procedure compliance. With the WAP mounted in the ceiling enclosure, the WAP can be accessed without requiring a permit, or deploying a NAPE enclosure.

Oberon's suspended ceiling enclosures preserve the integrity of the ceiling system, helping to mitigate the spread of airborne infectious disease, simplifying compliance with ICRA procedures, and maintaining the smoke and fire barrier

WIRELESS SITE SURVEY and CABLING FOR WIRELESS

How to perform a wireless site survey is beyond the scope of this article, but is essential for the mission critical wireless LAN. Based on results below from a large number of site surveys, it is evident that the loss through common building materials can be quite variable. The wireless loss through building material is dependent on material thickness and composition, wireless signal frequency, and the angle at which the signal passes through the material. The table below provides an idea of the variability in building material loss and shows how difficult it can be to "guess" at the coverage of wireless access point. Note that the loss is given in a logarithmic scale (dB). A 3 dB loss is a loss of 50% the power, a 10 dB loss is a loss of 90% of the power, a 20 dB loss is a loss of 99% of the power.

MATERIAL	900 MHz (Cellular)	2.4 GHz (Wi-Fi)	5-6 GHz (Wi-Fi)
Regular Glass	< 1 dB	0.5 - 3 dB	2 - 6 dB
Ceiling tile (5/8")	< 1 dB	0.1 – 2 dB	0.2 - 3 dB
Drywall sheet (1/2")	1 - 3 dB	0.5 - 4 dB	1 - 5 dB
Particle Board/Door	1 - 3 dB	1.6 - 4 dB	2 - 7 dB
Brick Wall	≥ 5 dB	5 - 18 dB	15 – 30 dB
Block wall	≥ 7 dB	7 - 18 dB	10 - 30 dB
Reinforced concrete	≥ 15 dB	≥ 15 dB	≥ 20 dB
Low e glass	≥ 13 dB	≥ 13 dB	≥ 20 dB

Wireless loss through typical building materials in dB.

Most schools are engaging the 5 GHz band to the maximum extent possible, due to the much greater bandwidth available in the 5 GHz band versus the 2.4 GHz band. In theory, attenuation at 5 GHz should be similar to 2.4 GHz, but in practice, some materials attenuate the 5 GHz signal much more than 2.4 GHz, so the wireless coverage is not as large at 5GHz as it is at 2.4 GHz. However, a knowledgeable designer will use the greater attenuation at 5 GHz as an advantage to design high density, high bandwidth Wi-Fi networks

The newly emerging TSB-162A recommends using Category 6A cable to each WAP, and many schools are electing to run two Category 6A cables to each location to anticipate future needs for additional bandwidth, power, or devices at each location. When cabling for the WAP, remember to consider the rapid development in device bandwidth and powering needs.

Additional information on wireless network infrastructure is available at

http://www.oberonwireless.com/faq-resources.php

