In-Building Wireless – A Step-by-Step Guide

6 STEPS TO DEPLOYING AN IN-BUILDING WIRELESS INFRASTRUCTURE

Implementing a new in-building wireless system is a large project that can be overwhelming. This document will guide you through the steps involved in designing and implementing an in-building wireless infrastructure for both new and existing buildings, and will highlight some common errors to avoid.

1. Needs assessment and requirements gathering
The telecommunications market is fast-changing and newly installed wireless networks can quickly become obsolete if future requirements are not considered up front. In order to help determine what your current and future goals and requirements are, here are some things to consider:

- Do you need coverage throughout the entire building or just in certain areas?
- What are the capacity requirements for dense areas?
- What are your required frequency bands, and technologies (2G, 3G, 4G or even 5G)?
- Does your building have existing fiber and cabling infrastructure?
- What are your aesthetics concerns?
- Do you need all mobile operators on the system, or just one? Do you anticipate additional mobile operators will be added in the future?
- Is first responder in-building wireless coverage required to obtain an occupancy permit (for new buildings or major remodelling)?
- Does the in-building wireless system need to support wireless devices such as Wi-Fi access points or security cameras over the same network?

Thinking about present AND future needs is recommended. This helps avoid the unpleasant situation where decision-makers have to inform their management that their sizable investment no longer satisfies the company’s needs and requirements.

2. Site survey and RF system design

EXISTING BUILDINGS
For existing buildings, a site survey should be conducted to evaluate the signal quality of the different mobile operators and to identify optimum installation locations for radio remote units and antennas. This will require access to building floor plans and the use of site survey tools that can test for signal quality and RF interference.

Once the site survey is completed, an iWave® certified designer will use the floor plan, together with the site survey data, to generate a coverage or heat map based on the iWave software's predictions of RF propagation within performance parameters and criteria that have been predefined in line with your specific situation or commercial wireless operator requirements. Factors such as the structural layout of the building, building codes, aesthetics of the building and security issues will also be incorporated into the final design. Based on the final design, the designer will then create a Bill of Materials (BOM) – a comprehensive list of all the components required for the recommended in-building wireless infrastructure.

NEW BUILDINGS
A provisional RF design is recommended for buildings that are still under construction. LEED glass is often used in new-builds to improve a building's energy efficiency but the reflective coating can also block out cellular signals. It is not uncommon that, during construction, the construction crew can freely use their mobile phones without any challenges, but once the framing, walls and windows are installed, the wireless signal is no longer available.
To avoid this situation, the building construction and design team should prepare a preliminary RF design to be included with the initial building plans. A provisional RF design can provide a best estimation of RF penetration based on the structure, materials and floor plan of the building. The cellular infrastructure cabling design can also be included with other low voltage schematics that are intended for computer or Wi-Fi networks and High Speed Internet Access (HSIA).

Even if there is no immediate plan to install in-building cellular infrastructure, it’s still ideal to include the cable and fiber runs in the initial building plans in case a cellular wireless infrastructure is needed in the future. This will ensure that the costs and headache of having to retrofit later on are avoided. Retrofitting could require expensive cutting into walls or ceilings to run the cables. Once a venue is up and running, the cost of pulling cables increases even more due its impact on business operations.

The advantage of including the cabling and fiber in the initial building plan is that in-building wireless infrastructure can also be added on an incremental basis. Remote radio units can be added on floors where cellular coverage is needed, or in certain problematic areas – for example, meeting rooms and conference centers. Finally, if the cellular infrastructure is included in the initial planning phase, the cost of that infrastructure can be rolled into the total cost of the building, making budgeting simpler.

3. Mobile operator coordination
Obtaining mobile operator participation and approval to rebroadcast their licensed spectrum is required for in-building wireless deployments. Mobile operators have invested billions of dollars building out their networks to give their users the best mobile experience possible. If the aim of the in-building wireless system is to improve users’ wireless experience, then you will need access to licensed frequencies from the mobile operators.

According to the HTNG Converged Infrastructure Survey in 2010, “a major obstacle to cellular technology adaptation is carrier cooperation”. Obtaining permission for RF retransmission from operators involves numerous steps, from business case development and RF retransmission agreement coordination, to the integration and commissioning of the RF source. Enterprises often don’t have available resources to manage the process or know where to start. Working with an experienced third party that can act as the liaison between the mobile operators and the enterprise, can help keep the process moving as quickly and smoothly as possible. Mobile operators understand this concern as well and are working to make this process as painless as possible.

We always recommend that coordination with mobile operators should start very early in the in-building wireless implementation process. This will help the enterprise to fully understand the scope and the cost of the in-building wireless implementation, and ensure that the in-building wireless system deployed does not conflict with the standards and processes of the operators’ networks. Based on the mobile operators’ level of participation, a finalized Bill of Material (BOM) is generated which includes the equipment, passive components, installation cost, and optimization cost. This finalized BOM will give the enterprise a better understanding of the entire cost of the in-building wireless network, from equipment, to installation and optimization.

4. Financing options
Financing options are available to accommodate a wide range of needs for implementing in-building wireless solutions within existing buildings. While some enterprises may find an outright purchase or capital expenditure most suitable, for many enterprises, equipment leasing presents a much more accessible approach.

With leasing, a financial service company owns and finances the equipment, and payments are made by the enterprise to the financial services company, typically on a monthly basis. Leasing shifts the in-building wireless system from being considered a capital expenditure (CAPEX) to an operational expenditure (OPEX). From an accounting standpoint, CAPEX shows up on the balance sheet and is depreciated over the life of the asset. OPEX is registered in the profit and loss account as an ongoing expense.

Key benefits of taking an OPEX approach:

**IMPROVED CASH FLOW MANAGEMENT**
Replacing substantial upfront payments with the smaller regular payments of a lease provides for even, predictable expenses simplifying cash-flow management. Frequently, lease payments are also fully tax deductible.

**TIMING FLEXIBILITY**
CAPEX is usually budgeted once per year and enterprises may have to wait for the next budget cycle to implement a system. As lease payments recur monthly, companies may be more flexible with the timing of their lease-based purchase. This may, in some cases, even make the purchase more favorable to the executive team as the initiative promises not to tie up precious capital.

**REVENUE ALIGNMENT**
Treating in-building wireless as an operating expense positions it as an essential cost of doing business. That is, with in-building wireless as an operating expense, it appears alongside other costs of sales and aligns with the recognition of related revenues such as an increase in tenancy rate or customer satisfaction.
With that said, no two businesses are alike. We recommend that each organization consider their financial situation and determine a payment method that best aligns with their capital utilization model and business requirements.

5. System installation, integration and commissioning
Based on the RF design and the Bill of Materials (BOM), additional documentation will be developed to clearly lay out the system installation, integration and commissioning information. These may include a fiber plan, rack layout plan, clock distribution plan, network design plan and gain lineup.

With a full set of documents in hand, the typical process for installing, integrating and commissioning the in-building wireless system goes as follows:

1. Install fiber and cable, as per the site survey and RF system design.
2. Install passive components/equipment.
3. Verify that all fiber, cable and passive components are operating correctly and optimally.
4. Install the Distributed Antenna System (host and remotes).
5. Verify that the system is operating as per design parameters.
6. Verify that the system meets the requirements of each mobile operator and that the system has no negative impact on operator macro networks.
7. Document measurements based on a walk through may be required.
8. Finalize mobile operator re-transmission agreements. These agreements provide the right to redistribute or retransmit the mobile operators’ RF signals within the building. They also provide reassurance to the mobile operators that the new network is designed and operating correctly and should not cause any issues for their users.

Once the above steps are successfully completed, the in-building wireless solution is operational and users will have an optimal mobile experience throughout the building.

6. System monitoring and maintenance
Getting from purchase decision to operation is just the beginning. System monitoring and maintenance are important to ensuring that your system is operating optimally at all times. These should include:

- Monitoring
- Remote access troubleshooting
- On-site replacement parts and repairs
- Preventive maintenance

Most enterprises will negotiate a service agreement with a 3rd party. The in-building wireless system is then connected to the Network Operating Center (NOC) of the 3rd party so they can monitor the system remotely. If issues are identified, their support team can remotely access the system to assess the alarm and fault level. If the issue can’t be fixed remotely, they will usually dispatch a technician to fix the issue on site.

We strongly recommend having an in-building wireless system monitoring and maintenance plan in place. This will ensure that your wireless service is operating optimally and is uninterrupted while allowing you to focus on your own area of expertise, running your business.

Conclusion
The demand for continuous, uninterrupted cellular service is no longer a nice to have, it’s a must have for the “always-on” lifestyle of mobile users. Today, in-building wireless systems are an essential part of many businesses – be it to improve productivity or customer and staff satisfaction.

We understand that implementing a new technology infrastructure such as an in-building wireless system can be overwhelming as there are so many variables to consider. Use this article as a guide for understanding the scope of your in-building wireless solution project. Then you can decide if you are ready to ① manage the deployment in-house, ② entrust the project to several parties that specialize in each area, or ③ opt for the entire project to be handled by one firm – a turnkey solution.

For more information or guidance, please contact Dali Wireless at the address below.