Eight Habits Driving Highly Successful **Wireless Deployments**

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JMAwireless.com

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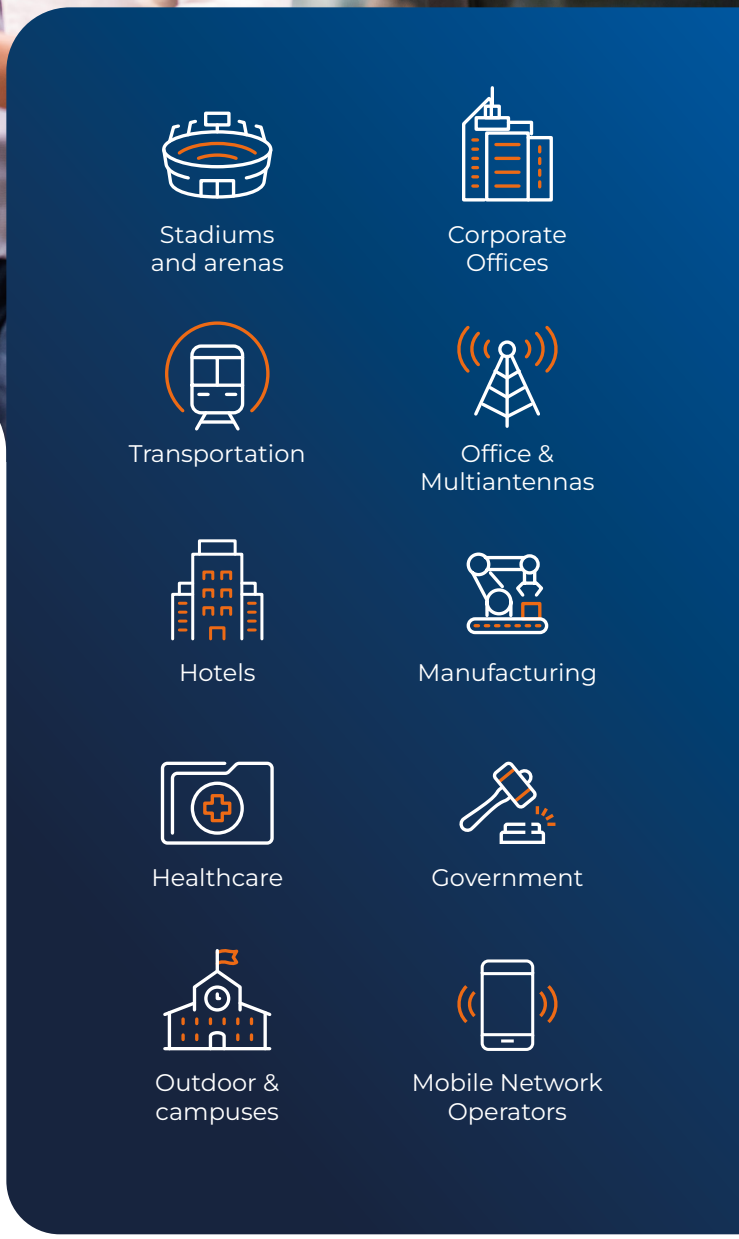

Executive Summary

When it comes to determining the best fit for in-building or outdoor wireless needs it is best to discount the hype and really think about what you are trying to accomplish. In all good practices we can come back to the fundamentals that say the data speaks for itself, and sound research founded on good principle will serve you well in meeting your objectives.

If you are in IT management it's best to learn from previous successes and construct your plans using this data. You should assess how well the solutions will benefit the needs of your business. If you are consulting, and selling solutions to organizations, it also benefits you to understand the options completely and how to translate these to best serve your client's needs. The following represents some of the key areas that should be considered when deploying cellular solutions in a business.

1. End User and Venue Needs

The starting point should be where the money is ultimately generated and real benefits are achieved for the business - the end users. The decision maker within a facility is becoming increasingly responsible for ensuring the wireless communication goals of mobile users in the business.

When you look at most facilities, especially public ones, you find users with various types of mobile devices subscribing to different carriers. Considering devices is key because older hardware only supports certain technologies. For example, iPhone 4 users do not enjoy the high speed capabilities of LTE. Many enterprises are implementing a BYOD (Bring Your Own Device) strategy so we are back to the same needs as a public venue.

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our objectives for enabling a facility with technology that is flexible enough to address short and long term needs, such as enabling multiple operators with multiple technologies (e.g. 2G, 3G, LTE).

More importantly, since mobile technologies are constantly evolving you should take into consideration how the system will be ready to support newer technologies with minimal disruption. For example, there are forthcoming frequency bands such as AWS-3 or WCS that will need to be supported. You will need to ensure your network can easily support these changes without ripping out and replacing equipment.

2. Bars Versus Data

Be sure not to confuse having good coverage (all bars visible on the phone), or signal, with good capacity (data throughput). Ninety percent of mobile device usage in a business or entertainment setting is driven by data exchange. This clearly indicates that a solution needs enough baseband processing within a given area to provide good data performance to a certain number of users. In the cellular world these areas are called sectors, and the dimensions of a sector can vary based on the nature of the venue and the typical high-density locations. Multiple users will be connected to a single baseband processor. Its performance determines the number of active users - the more users, the lower performance per user. More importantly, if the baseband processor for a given area has a limit on the number of active users that is below typical demands the performance per user will drop off sharply.

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your objectives for reviewing the user base, its typical locations, high-density areas, etc. This data provides the benchmarks for the number of users in an area that need to be supported. Keep in mind the baseband is different for each mobile operator and thus you should consider estimating your users based on each one as well. Now consider the flexibility of the system when delivering quality signal to different areas within your facility with these baseband sectors. Antenna, power, and quality of the solution will be critical here.

3. Noise Versus Audiophile

Wireless ultimately means signals in the air modulated with information. These signals are analog by definition. More importantly, the antennas that transmit them must be designed for your facility. For example, when signals overlap it creates interference; therefore, we must thread the edges of wireless cell service in a venue like a fine, detailed quilt. When the edges overlap too much, users are in a handover state from one signal (cell) to another. Performance is degraded during this time.

Furthermore, the quality of these signals is a critical element of the quality of the service (QoS). These signals are produced and delivered into the air via antennas, which are powered by amplifiers. In some approaches these two components are separate and can be mixed and matched based on a venue's needs. However, in others they are integrated and your options to optimize are limited. In many ways these elements are similar to your speakers and amplifier in your home audio system.

Your speakers come in numerous sizes to better articulate various sounds, and the amplifiers have different quality specs to reproduce sounds accordingly. If you skimp on speakers or on your amplifier how well will your favorite

track sound? Asking the right questions regarding signal production is a key data point. Keep in mind that a given set of antennas and amplifiers (known as Remote Units in a distributed antenna system or DAS) can be designed to support many different signals (or bands), thus enabling multiple mobile operators if designed correctly.

Now, one last thought on antennas. They operate much like balloons! Yes, balloons – or at least they should. If you add air to a balloon it will swell in a specific direction, based on the type of balloon. The air is like the cellular signal energy being delivered from the amplifier. The shape is determined by the quality of the "phaser" design of the antenna. This shape is known as the antenna pattern, and some antenna designs can have strange artifacts such as "back lobe" or "side lobe" patterns that interfere with other antennas.

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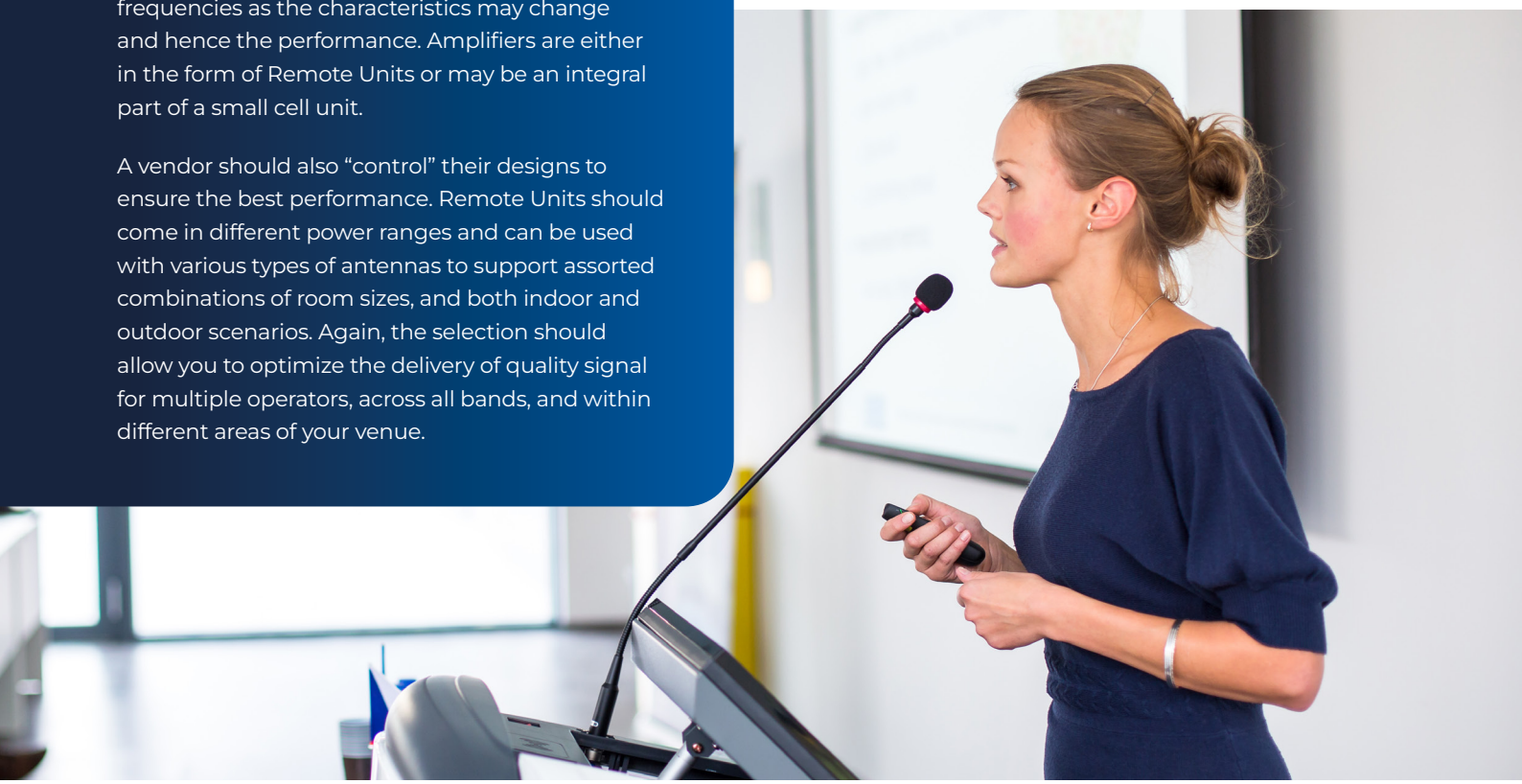
you to ask detailed questions about how a system will reproduce the signals of multiple operators and support all of their bands within the different areas of your facility. Include questions on whether your supplier controls their own antenna designs and ask to see the 3D image of the patterns. Be sure to look at them across a wide range of frequencies as the characteristics may change and hence the performance. Amplifiers are either in the form of Remote Units or may be an integral part of a small cell unit.

A vendor should also "control" their designs to ensure the best performance. Remote Units should come in different power ranges and can be used with various types of antennas to support assorted combinations of room sizes, and both indoor and outdoor scenarios. Again, the selection should allow you to optimize the delivery of quality signal for multiple operators, across all bands, and within different areas of your venue.

4. Centralized Versus Distributed

The choice of centralized or distributed equipment should be based on several environmental factors. First, the available space within your facility should be a key consideration. If you have to build-out special space then it will add cost and time to the project. If it is a space that can best be utilized to generate revenue then using it for wireless equipment may not be the best option. The other factor to consider is how many facilities you are planning to service with wireless and how do end users throughout a given week utilize them. Using a centralized solution in a lower cost facility and then dynamically allocating the wireless resources to different venues as you need them can be a much more effective use of capital dollars.

Furthermore, it is good to evaluate options for bringing different operators' signals into your facilities. A good architecture will allow each operator to host equipment within different sites, while converging them within your venues. One of the common terms today is C-RAN, with the "C" sometimes standing for "Cloud" or "Centralized". The critical factors include the functions of the RAN, which are off-site and have nothing to do with producing that quality signal within your venues. So, the question you still need to address is the best way to deliver



signal – even if derived from a C-RAN, into your facility. One of the approaches that achieves this and compliments C-RAN is C-DAS or Centralized Distributed Antenna System architecture, which enables one or more C-RAN sites to deliver signal into venues in a very precise manner while reducing the onsite equipment footprint by as much as 85 percent. More importantly, C-DAS architectures also have the intelligence to shift cells (sectors) from one location to another – allowing a certain percentage of the C-RAN technology to be reutilized during the ebb and flow of end users across different venues and times.

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you to look at the solution you need holistically, across the entire campus or metropolitan area. If you are a neutral host consider how you may leverage a common site and more cost and time effectively deliver solutions to surrounding businesses and /or entertainment venues.

Moreover, it is critical to understand the flexibility necessary to achieve your multi- operator, multi-band goals across numerous facilities/venues from a central location. If you have a very large facility, such as a multi-tenant office building or entertainment complex, and have the data center footprint to house the head-end equipment this may be a good location to host it.

5. Small Cell Versus DAS

Perhaps the most over-hyped term today is “small cell” and depending on who you speak to its definition will vary. The Small Cell Forum defines it as “an umbrella term for operator- controlled, low-powered radio access nodes, including those that operate in licensed spectrum and unlicensed carrier-grade Wi-Fi”. Small cells include femtocells, picocells and microcells and may deliver signal from 10 meters to several hundred.

On the smaller side (femto and pico), a simple way to comprehend these is to consider them as little base stations for a single cell. Generally each has the base band capability, but they are always limited in three factors: the number of operators and bands they support, the number of active users within the cell, and the control over the antenna beam. Also keep in mind that each of these devices requires power, and most often they are connected via the Ethernet standard PoE (Power over Ethernet), which has an inherent limit of less than 100 meters and limits on the power it can deliver. Another form is a remote radio head (RRH) that is connected via fiber to a central baseband unit (BBU), but these typically require a separate antenna and fit into the “micro” cell category. These RRHs vary, but are typically deployed on an operator-by-operator basis so multiples are needed to create multi-operator coverage.

DAS platforms focus on redistribution of signal from a central location and do not have baseband technology integrated. The better DAS platforms support all mobile operators and all bands in a single system. As noted earlier, DAS solutions separate antennas and their amplifiers (known as Remote Units that include more than just an amplifier) to allow the beams of antennas to be selected based on the room size or shape and the amplifier to be selected based on the required power needed. Remote Units are aggregated at a head-end called a Master Unit, the best of which can run over a single fiber optic strand. Master Units should allow multiple operators to be converged, including all the bands, and should allow for many Remote Units of varying power levels to be connected.

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you to consider the nature of the venues being covered. If they are larger venues, greater than 10,000 square meters (~100K square feet), and you want multiple operators and bands to be supported, a DAS can accomplish this most effectively. If you want to cover more than one facility, including outdoor areas, and the rooms have varying shapes that create signal blocking then the flexibility of a DAS may be more suitable.

If you have a small facility with very open and consistently shaped rooms a small cell may be suitable. However, even for a limited number of operators multiple small cells may be required in each room. Keep in mind that in all cases these require mobile operator cooperation, and none of these systems have evolved to the do-it-yourself level unless you have deep experience in RF (Radio Frequency) Engineering.

Each requires some form of connectivity, either Category n wiring (CAT5, CAT6) or fiber optics. Fiber will inherently provide you with more capacity and most multi-operator solutions that are well designed can minimize the fiber required. Utilizing CAT5/6 wiring that is already in a building is convenient, but unfortunately this limits the capacity and distance.

6. Infrastructure and Operations

Regardless of the approach you take you will need to utilize existing infrastructure or add new hardware. Similar to most IT systems, it will need to be optimized over a period of time and typically monitored, updated, etc. You can look at two areas as you study the impact of a system on your facility – and both can drive costs and disruption. The first is the transport methods used to connect antennas into the mobile operators network.

Most often the solution warrants fiber optics to achieve the capacity to carry the RF signals. Some systems are better than others at converging multiple bands of signals from multiple operators onto common fiber, thus reducing the amount you need and potentially allowing you to utilize existing fibers. Some will operate over CAT5 copper wiring, although it will have limited capacity and limited distance – again you need to consider the multi-operator and multi-band requirements.

Also be aware that all of these systems require power and various additional power outlets, and consumption is required. The second area is the tools that are part of the system that help commission, monitor and adjust it over time. Some systems integrate automation techniques that eliminate the need for technicians to visit your businesses. Others include tools that are accessed remotely. Be wary of systems that require mounting of active and powered equipment in office ceilings or areas that will disrupt your workforce. A good system can be serviced from locations that will not disrupt your business.

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you to create a set of questions around installation and infrastructure requirements. They should cover initial power, transport, and mounting locations as well as servicing plans that avoid potential disruption. Ask about each component of the system in your facility and how and when it needs to be accessed.

You will need to ensure technicians can access your facility. Inquire about the administration tools, reporting, and monitoring capabilities. A good system should provide remote visibility of the RF performance and allow many of the adjustments to be handled remotely as well. This can save on costly repeat visits.

7. Mobile Versus Desk Phone

Yes, the mobile device has replaced your office phone system – whether your PBX team admits it or not. Today enterprises spend millions of dollars on fixed in-building telephone systems – many of which sit idle while users reach for their mobile devices to make and receive phone calls. The consumer industry has seen a mass exodus from the wired home phone with only 59% of U.S. households still using a land line and a cell phone.

Now enterprises are considering the same move. There are some areas such as call centers where fixed is necessary, but the majority of business users prefer mobile and businesses can benefit from enabling an untethered workforce. Many organizations have moved to BYOD (Bring Your Own Device) programs that save money and enhance workforce efficiency.

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you to consider your communications plan and program holistically. Perhaps making the move to an all-wireless, untethered business is a natural and innovative next step.

Balancing in building mobile coverage and capacity when reviewing the overall program and budgeting has become a key topic among CIO teams. There can be significant benefits, both economically and in productivity, when you make the move to a wireless enterprise.

8. Compatibility and Future Readiness

The only constant in the wireless industry is change. There will be new technologies you will need after you deploy your facility's system. As highlighted in point #1, ensuring the proper end user experience is crucial, and as a result you should pay attention to how well a solution within your facility can support a range of current options, while at the same time readily transform and support forthcoming technologies. As previously noted, systems that can be maintained (this includes upgrades) in a manner that is not disruptive to your business is important.

However, you need to consider other factors such as how easily the system can be modified to support new modulations while using the same hardware. Can the technology be augmented to support MIMO (multiple input multiple output) in order to increase the bandwidth per user? If you are considering one or a subset of available mobile operators then does the system easily migrate across them, or can you add other operators if your business model changes? Recently, new spectrum was acquired by several operators (such as AWS-3 as mentioned in point #1) and you should ensure your system supports these changes.

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you to take a good look at the different mobile operators and their supported technologies. This may be a challenge if you are not up to date on the latest technologies, but a good consultant can guide you. You absolutely should have your supplier walk through as many change scenarios as you can possibly think of to fully comprehend the additional costs (services, infrastructure, etc.) and the potential disruption that will occur.

About JMA Wireless

JMA Wireless is the leading global innovator in mobile wireless connectivity solutions that ensure infrastructure reliability, streamline service operations, and maximize wireless performance. Employing powerful, patented innovations, their solutions portfolio is proven to lower the cost of operations while ensuring lifetime quality levels in equipment and unrivaled performance for coverage and high-speed mobile data.

JMA Wireless solutions cover macro infrastructure, outdoor and indoor distributed antenna systems, small cell solutions, and virtualized RAN software. JMA Wireless corporate headquarters are located in Liverpool, NY, with manufacturing, R&D, and sales operations in over 20 locations worldwide.

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