

Cutting the Cords: Making a Case for **WIRELESS** Communications





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Introduction

If you could step back in time just a single decade, you would find yourself living in a very different world, from a communications technology point of view at least.

Dial-up access using a modem would still be the most used way to connect to the internet. Only a small percentage of people had a personal email address. Fax machines, not email, were the preferred instant communications business tool.

We didn't have streamlined social media sites like Facebook to keep in touch with our friends and family, and the idea of storing data somewhere that wasn't physically on or under your desk, was almost unfathomable.

Back then, the major wall faced by people who wanted to develop new internet enabled technology was bandwidth. The ideas of cloud storage, file sharing, real-time audio and video communication, and all of these other internet technologies we take for granted these days were there. But they just couldn't be developed because we didn't have the available bandwidth at an affordable enough price to do it.

And then, within a short span of years, two very important consumer technologies were developed. ADSL and Cable Internet. These technologies spawned enterprise counterparts, and everyone, and every business, began to gain access to a high speed internet connection. But this still wasn't enough.

Corporate users began to develop enterprise applications that relied upon WAN technology. This resulted in a decentralization of infrastructure. Then we took things a little further; we adopted cloud storage, offsite backups, VOIP and other bandwidth intensive applications. Everything was fine... for a while... and then we hit another wall.

So many people now required access to ever increasing volumes of corporate bandwidth, we got stuck. Our business networks, usually LAN based, just couldn't cope. Those business that embraced Wi-Fi early, found that as time went by, and as more people connected devices to the network, performance began to plummet.

This problem still exists today, and it is getting worse. Within this eBook, we will take a look at how this problem came about, and how it can be solved for any and all businesses.

The Rise of Wireless

Wireless has spawned a revolution, one which will continue to influence the landscape of business and personal communication. As more and more people are opting for the flexibility and mobility of wireless, landlines are largely in decline. To best understand why so many are cutting the cord, it's important to review a bit of history.

The Early Days

The origins of Wi-Fi can be traced to 1985, when a technology called 802.11 was made available for unlicensed use. Soon after, the IEEE (Institute of Electrical and Electronics Engineers) and the Wi-Fi Alliance joined forces to regulate wireless technology and direct the development of protocols and procedures.



This landmark work extended the influence of the Internet in the 1990s and gave rise to integrated IT services. In the early days, deployments were largely focused on reducing costs and enhancing competitiveness by speeding up communications. But a majority of data transfer still required cords. By today's standards, the connection was slow.

Bringing Things Up to Speed

In the mid-2000s, following years of innovation, new protocols sped up the transfer of data and allowed individuals to surf the web at quicker speeds. Following updates in dual-band technology, the transfer of data across multiple signals and bandwidths was made possible.

As the Internet became more reliable, wireless, integrated communication became an option for both businesses users and the consumer market. As wireless grew, telecommunications became a formidable industry, as integrated communications become a feasible option for businesses and consumer use.

Wireless was also the catalyst for a new type of worker: the mobile employee. By the end of 2015, the world's mobile-worker population is forecasted to reach 1.3 billion, according to the International Data Corporation. And according to a recent Forbes Insights article, 51% of business will be done primarily over mobile devices by 2016.

Simply put, wireless integrated communication is the future for businesses. While it may not seem like an obvious path to savings and increased efficiency, cutting the cord on your tethered network and making the switch to wireless is an opportunity for businesses to achieve both.

The Wireless Revolution

Wireless is shifting the focus of objectives: modern demands are targeted at supporting not just business needs, but also those of the consumers. And the demand for integrated media and communications has never been higher. If the first wave of wireless was all about the transfer of data, and the current landscape of wireless is largely dominated by mobility, than the next wave will center on seamless integration.

The Rise of Technology

The dawn of modern communications technology ushered in a new age for humanity. The world suddenly became much smaller. In 1863 Edward A. Calahan revolutionized the stock market with the invention of the stock ticker, highlighting for everyone the importance of electronic communication. Then in 1876 Alexander Graham Bell gave us the telephone and physical boundaries between people started dissolving. Radio meant instant communication with thousands of people around the world at the same time. Then we created television, then computers, then the all mighty internet came along.

The combination of information and technology is called telecommunications, and telecommunications is by far one of the sharpest weapons humanity has ever forged. With this powerful new tool in our toolbox, humanity was able to rapidly make unprecedented technological advancements in nearly every way imaginable. Except that we were still plugged into the wall.

Human beings are a very mobile species. Sure, we've come a long way since the times of hunter-gatherers, but we still require a certain

amount of flexibility in our daily lives. Naturally, being permanently tethered to the wall for communications began to be seen as a huge burden. Something needed to be done. We needed to cut the cords.

Setting the World Free

The idea of taking telecommunications capabilities wireless was the spark that lit the powder keg in terms of technological innovation. Boom! Cell phones, laptops, PDAs, the technology seemed to advance exponentially almost overnight. And the advancements kept happening night after night. Wireless technology had effectually cut the cords and set the world free.

Desktop computers became laptops, and LANs became WANs. Wall phones became smartphones, and congested telephone poles became Distributed Antenna Systems (DAS). All around the world, people are continually upgrading their technology. With wireless technology we are fundamentally transforming how we experience and interact with information, as well as with each other.

Progress Comes with a Cost

Of course the revolution isn't over yet, not by a long shot. In the fight against technological immobility, the battle has just begun. Cell phones continue to advance and take on new roles in our lives. WAN and DAS infrastructure needs to be upgraded regularly to handle the increasing



traffic and offer the required bandwidth. Soon we'll have to make room for things like driverless vehicles, quantum computing, and holographic virtual reality interfaces. All of these things are only made possible through a strong and reliable telecommunications infrastructure.

This is an unprecedented moment in the history of, well, everything. By creating, using and improving on this amazing technology we have ushered in a new type of civilization.

Quality Infrastructure is Crucial

With all of this technological advancement comes the requirement for improved infrastructure. This progression is happening at such a rapid pace that our I.T. systems infrastructure currently needs to be replaced every 3-5 years, just to keep up with demands and achieve a measurable ROI. More users are constantly joining the system, technology is becoming more complex, systems are becoming more flexible and more capable, and upgrades need to be made.

As a society, we truly are only as strong as our weakest link. By acting together and regularly upgrading our telecommunications infrastructure to optimize our systems for current and future developments in wireless technology, we can do amazing things both for ourselves, for our businesses, and for the advancement of our society.



The Development of Distributed Antenna Systems

Are you tired of being that creepy coworker that spends half of their day in the bathroom armed with an iPad and a list of files to download? By your third trip you find yourself trying to explain to everyone about the dead spot near your desk or how the Internet is strongest in the third stall. But no one believes you and now you are stuck eating lunch alone.

Welcome to one of the biggest problems of 21st century office life; inconsistent indoor wireless and cellular network access. Wireless capabilities and reliable cellular network access are almost necessities in this day and age. In fact, according to Cisco, 1 out of 3 college-age and young professionals say the internet is as important as air, food, and shelter. So, not only does a spotty network connection have a negative effect on productivity, it's literally snuffing out all of the young professionals in your office.

Did you know that by 2016 there will be an average of 2.5 mobile devices for every person on the planet? Like it or not, wireless technology is a major component of your daily life. You probably use it for everything from waking up in the morning to connecting with loved ones at night. Maybe you rely on it to get your news fix while on your morning train commute, you might even use it to monitor your blood glucose levels.

Statistically speaking, there's a 65% chance that you're reading this document on a wireless device right now. The fact is, you use it for a lot. And if you don't, the three people closest to you right now probably do. But let's face it. Without that strong network signal,

your smartphone is basically just an expensive paperweight. A better way of making sure wireless coverage is consistent is needed, and this is where a Distributed Antenna System (DAS) comes in.

What is a Distributed Antenna System?

First described in a paper by Saleh et al. in 1987, the goal behind the idea of a Distributed Antenna System (DAS) was to improve indoor wireless network coverage by utilizing a group of low-powered antennas to cover an area that, traditionally, a single high-powered antenna was covering (or failing to cover, as it were). They tested the idea. It worked beautifully. And DAS was born!

Essentially, a DAS is a technique of radio frequency distribution designed to increase coverage, reduce power output, and eliminate wireless signal “dead zones” by seamlessly distributing network frequency signal throughout a large building or complex outdoor environment by using a network of strategically positioned antennas.

Generally speaking, the body of a DAS can be crudely broken down into three major components: the brain, the nervous system, and the limbs. First up is the brain. Often called the “Head-End” room or “Base Station,” this room is usually located in the basement of a building and serves as a sort of control center. The head-end houses all of the active equipment required to integrate the network signal from outside the building to inside of the building, and feed the rest of the system. This DAS cortex is made up of many hi-tech components that work together control the rest of the system.

The next layer to the DAS anatomy is the sprawling nervous system. This is the part that transmits the signal from the Head-End room to the antennas. For the sake of simplicity, this layer usually consists of (but is in no way limited to) cables, signal combiners, repeaters, splitters, and connectors. It is not uncommon for this layer of a DAS to include hundreds of connectors, thousands of feet of fiber optic cable and, quite literally, miles of half inch coaxial cables. This part of the system is the most difficult to install and, depending on the size of the building, its existing infrastructure, and scope of the project, this phase can take many months of strenuous work to complete.



The last part of the DAS is (to keep the metaphor alive) all of the vital organs. Luckily, there are significantly less DAS components in this layer than there are organs in a body. In fact, this part of the DAS is made up entirely of all the antennas. That's it. Just antennas. Don't underestimate them though, these antennas are probably the most important part of the system. Without them we wouldn't get any signal and thus the rest of the system would be pointless. These antennas are usually small, discreet, easily placed in just about any location, and capable of hosting multiple frequency bandwidths.

A quality DAS is a versatile DAS. Great systems will provide network coverage from multiple wireless service providers, utilize multiple frequency bands, meet public safety network (PSN) requirements, and even incorporate Wi-Fi, all in the same infrastructure. Systems can either be active, passive or hybrid, and the system type will largely depend on the location and the required function of the DAS. The system type will also help determine the necessary components that will be required. For example, an active DAS will be able to service a larger area than a passive DAS. It will utilize fiber optic cables as well as copper cables and will likely require certain electrical components, often called hubs or remote units (RUs), to boost the signal in between the base station and the antennas.



How Important Is Improving Indoor Cellular Coverage?

The downside of having poor indoor cellular capabilities goes far beyond the headache of having to find just the right spot to put your phone so a message will send. At its face value this probably seems like a trivial and unavoidable problem of modern existence. But if you dig a little deeper it can actually be having some significant effects on the success of your business. In fact, these little headaches are actually more like tumors, and they are slowly killing your business's productivity.

After Saleh et al. solved the coverage issue in 1987, there exists one major hurdle for cell systems, capacity. To help illustrate the importance of this hurdle let's do some simple math. Take all of the aforementioned facts and add them to your outdated wireless infrastructure.

Lots of people using personal devices at work.

+

Rapidly increasing data traffic year after year.

+

Shocking statistic about YouTube & cell phones that both blows my mind and confuses me.

+

Outdated wireless infrastructure.

+

*(if you want to get fancy you can add in the new **BYOD** (bring your own device) trend that's got offices around the world buzzing, employees everywhere jumping for joy, and CFOs addicted to the easy reduction in capital expenditure)*

And what do you get? Well, here's what I got.

Major Network Capacity Issues

And like the old saying goes, “Where there’s capacity issues, there’s fire” (or something like that). In this case, the fire just so happens to be your wireless infrastructure. And the smoke is literally choking the life out of your business by creating disgruntled and unproductive employees.

Seem a little far-fetched? Disgruntled employees equal less productive employees. Less productive employees equal a less productive business. Less productive businesses get left in the dust by more productive businesses. These suffocating businesses are then usually forced to make radical steps in order to survive. But most don’t. They die. This isn’t rocket science, its business 101.

If you want your business to succeed in this rapidly changing, technologically-advance world you need to be able to successfully ride the wave of change. Like Socrates said, “The secret of change is to focus all of your energy, not on fighting the old, but on building the new.” And if you’ve been paying attention, the change is probably pretty obvious by now; you need to upgrade your building’s wireless infrastructure.

It may seem like the “college-age and young professionals” are crazy when they compare the internet to food, water and shelter, but the fact is our lives have become so entwined with the internet and our businesses are so dependent on the freedom that wireless technology provides, that reliable cellular networks need to be considered a necessity. Right after water, gas and electricity, wireless cellular networks are starting to be considered the 4th utility.

Is DAS right for you?

Distributed Antenna Systems are actually not for everyone. Sorry to burst your bubble, I know you must really want one by now, but that’s just not how it works. A DAS is intended to supply network coverage to large capacity venues - like hospitals, stadiums and campuses - and hard to reach locations - like the Holland Tunnel, the northern Taconic Parkway, or the tunnels and platforms of Grand Central Terminal (fingers crossed). Smaller buildings need smaller system applications.

Examples of common DAS venues:

- Corporate Offices
- Multi-tenant high-rise buildings
- University campuses
- Hospitals / Health Care facilities
- Stadiums / Sports venues
- Upscale hotels and high-rise condos Etc.



If you want to learn if a DAS is right for your business, or if you want to learn what other wireless system is right for your business, you should contact a qualified and experienced DAS design and installation firm.

Breathe New Life into Your Wireless Network

Wireless networks have become so powerful over the past few years that a lot of businesses have traded in the spaghetti wiring that comes with a hard-lined network, for the freedom and simplicity of a wireless network. But as businesses grow, and wireless systems age, the network starts to slow down. It's inevitable. But this is a problem that can be fixed.

The problem goes a little something like this; your business gets bigger and the number of employees begins to increase. As the number of employees increases, so does the number of computers the employees use and the number of confined work spaces they are placed in. These employees also bring along their personal devices and likely connect them to the network. All these devices accessing your network means there's an increase in the amount of bandwidth required, and all of those workspaces means more Radio Frequency (RF) obstacles. Requiring an old system to handle a radical increase in bandwidth, while also requiring your network signal to navigate all of these RF barriers will undoubtedly decrease the speed, consistency and reliability of your wireless network. It's really as simple as that.

Now, before you start firing employees, banning cell phones in the office and tearing down walls in an effort to beef up your wireless network, there are a few ways in which you go about strategically breathing some new life into that old wireless network of yours. (One actually does involve tearing down some walls, so get the hammers ready).

When trying to improve an existing wireless infrastructure you should always have a qualified telecommunications professional troubleshoot your system. Troubleshooting your network's wireless performance is the easiest way to identify areas for improvement. While some improvements will be costly, others can be surprisingly inexpensive. But as a general rule of thumb, you get what you pay for.



Keep in mind that most real network improvements should be immediately apparent and easily measurable in terms of network speed and signal coverage. Not to mention the added bonuses when it comes to increases in user satisfaction, raising employee morale and improving work productivity (this isn't as easy to measure). Now let's talk about how we get there.

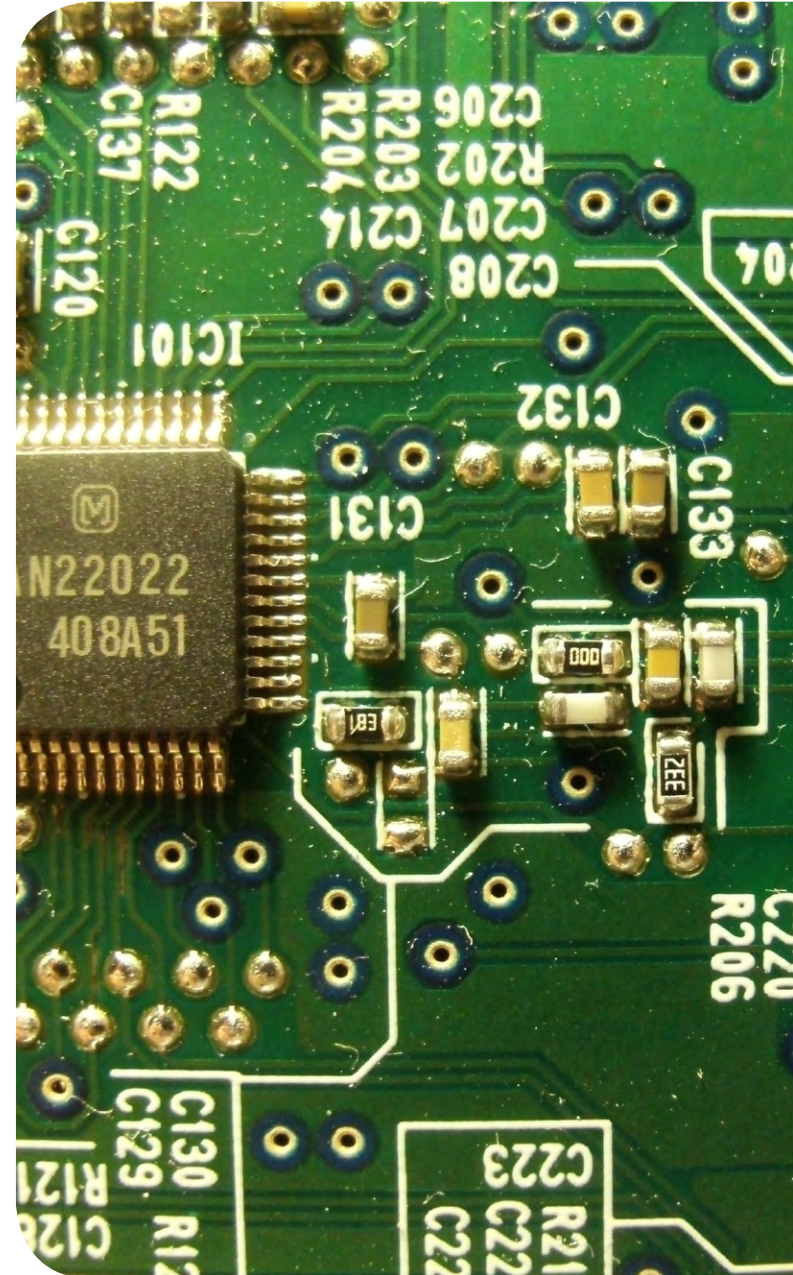
Architectural Considerations

Although mobility is a key element of wireless networks, the central network components are generally located in-house and will be stationary. Older or more traditional building structures such as office complexes, schools, government buildings, and homes, often use wooden wall-studs that generate lower resistance to passage of wireless signals. More recently constructed and modern buildings frequently use metal wall components and studs that substantially interfere with network signals. Poor signal transmission means your system has to work harder to do less.

Accurate signal diagnosis requires a thorough evaluation of the type of structure (and structural components) the wireless system is providing network access to and some of its key infrastructural components. Many businesses oftentimes rent their commercial space and are probably not in a position to locate and remove whatever is blocking the signal, which most likely would entail major structural renovation. But there are other ways to go about boosting your network signal.

Potential Solutions

- Technological Improvements - Using signal-enhancing devices and multiple Access Points (APs) to improve network transmission. Signals become weak when they have to travel long distances and go through obstacles. Making some technological improvements to the system's hardware and software can significantly improve your network's strength and reliability.
- Infrastructural Improvements - Opening up the office floor-plan to remove internal transmission obstacles. RF signals that must travel through walls, around corners and into cubicles will have their range significantly impeded by these obstacles, and grow weaker. Much weaker.



Infrastructure Improvements

- When your wireless network is struggling to meet demands, sometimes all that's required to revitalize the network is a few minor changes to the floor plan or repositioning some key hardware components of your system. Here are a couple of suggestions:
- Open up the floor: Anything that isn't air will obstruct your network signal (in fact, even air will eventually slow down your network signal). Walls, windows, and even carpeted floors can contribute to signal loss. Therefore, the simplest way to ensure optimal performance of your wireless network is by having an open floor plan. Or at least by minimizing the amount of stuff between your wireless device and the access point.
- Relocate your Access Points: Optimal transmission of network signals require strategic Access Point (AP) location. These APs perform best when placed in an open area, unconstrained by walls, cubicles or similar obstructions. If multiple APs are being used, have one centrally-positioned to maximize coverage and at least one at either end of the office. Having too many APs can be a problem and lead to something called "leaking." Always consult a wireless network professional when trying to optimize your network through AP placement

Technology Improvements

- If your network is plagued by poor reception, slow speeds and other similar issues, improving the quality of wireless network's technology can significantly enhance its performance. Some ways to go about doing this include:
- Installing APs: APs are hard-wired to routers and

positioned at specific locations around an indoor environment in order to provide adequate network coverage. When optimally distributed and properly positioned, APs will allow wireless devices to reliably access to your office LAN through WiFi.

- Increasing Operating Frequency for better data speeds: Some standard network technology, operating in the 2.4 GHz band, may be unable to adequately breathe new life into your existing wireless network. Upgrading to a higher level can improve your network's performance. Routers and APs using the 802.11ac technology and transmitting on the 5 GHz band will effectively enhance users' wireless experiences in the form of increased data throughput of at least 1 gigabit per second!
- Installing a Wi-Fi Repeater: This hardware expands your network's capacity by boosting its wireless signal, increasing its range and the distance the signal travels. Repeaters are affordable and readily available online or through retail box stores but should always be installed and optimized by a trained professional.
- Installing a Wireless Amplifier: More affordable than a repeater, a wireless amplifier attaches directly to your router. Bi-directional amplifiers can successfully enhance your network's inward and outbound speeds simultaneously.
- Firmware Updates: Firmware products like Linux's DD-WRT transform your old wireless router into an extender, improving performance.
- Update Software: Firmware updates may be insufficient to enhance network performance; in these cases, software updates can improve network functionality.

The greatest improvements in your wireless network's capabilities will come from updating the technology. Whenever possible, replace older components with the latest wireless technologies. If you're using the same hardware you were more than 5 years ago, then you should seriously consider upgrading your technology. As is the nature of the technological beast, improvements are being made all the time.

In 2011 a new wireless networking standard, called IEEE 802.11ac, was developed and in January of 2014 it was approved. If at all possible, upgrade your wireless system's hardware to support 802.11ac Wi-Fi

networking technology. Doing this will ensure that you are getting the fastest available speeds and maximizing your network's performance by using the 5 GHz band.

Implementing Solutions

Whenever you're looking to optimize your existing wireless systems infrastructure you should consult a trained telecommunications specialist. Some of these fixes seem like they're strikingly simple and



that you can easily do them yourself, and while you certainly have the right to try it on your own, it's always best to get a professional opinion first. At face value, it may like removing a tumor seems pretty straight forward, right? But you're probably better off consulting a trained surgeon before you make any rash decisions. Just saying.

When looking for someone qualified in the design, installation and troubleshooting of wireless systems in the New York area, you should look for a reputable company with years of experience in the wireless industry. A company that has proved their professional mettle through the successful completion of countless projects for customers ranging from small independent businesses to large fortune 500 companies. A company with an outstanding customer service track record, which focuses their energy on working directly with clients to get the job done right the first time. A company like Telecom Infrastructure Corp.



The Main Benefits of Wi-Fi

Wireless networks have numerous benefits over wired networks. They include;

- **Easy & Convenient Use:** accessing the network is as easy as turning Wi-Fi capability on, on your device.
- **Expandable and scalable:** You can easily expand wireless networks with existing equipment by increasing the range, and it's cheaper since no cables are required.
- **Security:** Wireless networks have numerous & unlimited security protection options
- **Cost Effective:** wireless require no cables hence will be cheaper to install and operate because cable infrastructure building and maintenance costs are eliminated.
- **Increased Productivity:** Communication between you and coworkers and employees will also be more fluid increasing group collaboration.
- **Clean Setup:** no more pesky cables consuming valuable office space for a cleaner, leaner and streamlined office look.
- **Easy Setup:** with significantly less cables required, installation is quick.
- **Locational Convenience:** You can readily access your network from any location within your unwired network's coverage area.
- **Mobility:** You can now work from anywhere being that you can get all the data and network resources on the go. Say goodbye to long days of stuck behind your desk!

In Conclusion

As we have discovered within the pages of this eBook so far, wireless communication is no longer the one stop technology it used to be. Simply connecting up a series of wireless routers to a fixed internet connection doesn't cut it from a performance point of view these days, especially not in a demanding corporate environment.

We have seen how the demands of communications technology, have begun to outstrip the performance capabilities of first generation corporate Wi-Fi networks. The reasons for this has been thoroughly explained and documented. These reasons include the ever increasing demands on bandwidth made by advances in technology, and the exponentially rising number of devices being hooked up to existing networks.

Shortcomings of existing first generation wireless technology have been identified, which has proven to be obsolete when faced with the demands that modern, mobile workers, place upon the bandwidth and service coverage available.

We have examined the current challenges faced by corporate I.T. departments to deliver a robust and speedy service. We have also discussed in-depth, a number of potential solutions that could help to overcome these challenges. And where appropriate, pointed out that many of these quick fixes are not a long-term solution.



We have concluded that what is needed as a long-term solution, is a significant improvement in the way that wireless services are distributed within the workplace. And we have introduced some of the technology that can deliver these improvements.

What remains now, is to give some advice on how to move forward. How to breathe new, sustainable life in to your creaking corporate wireless infrastructure.

In reality, the only real solution is to install modern, high capacity wireless equipment. To build a new telecommunications backbone, designed specifically to handle all current and future demands. To do this, you will need to invest in new infrastructure, provided and installed by a trusted telecommunications firm. A firm like Telecom Infrastructure Corp.

The Right Team for the Job

Telecom Infrastructure Corp has been in the world of wireless since the beginning and has established a reputation as one of the foremost experts on wireless integration. In fact, Ed Donelan - President of Telecom Infrastructure Corp and former President of BICSI - regularly speaks at seminars around the world and discusses case studies about projects his company has successfully completed.

When it comes to Distributed Antenna Systems, Telecom Infrastructure Corp of New York is THE most trusted name in DAS design & installation. "Team Telecom" has successfully integrated modern Distributed Antenna Systems into many of New York's most well-known buildings. Some of these buildings including the famed Waldorf Astoria, the esteemed Barclay's Capital building, the Prudential Arena (just in time for Superbowl XLVIII), and one of the most modern and remarkable buildings in New York, 4 World Trade Center.

When it comes to customer service, professionalism, and getting the job done right the first time, Telecom Infrastructure Corp has a proven track record of dependability and excellence. Give Telecom a call today to find out how they can help you and your business prosper by upgrading your wireless telecommunications infrastructure.





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