WHITE PAPER

A New Era in Designing and Managing the Wireless Network

What organizations need to know about designing, deploying, monitoring and managing high-speed wireless networks

More and more organizations today are discovering the benefits of trusted wireless communications networks, including integrated indoor/outdoor networking, greater operational agility and exceptional cost effectiveness. At the same time, they're discovering there are major differences between wired and wireless technologies, and that wireless systems call for increased emphasis on upfront design and ongoing network management. Today's advanced wireless network software solutions simplify the design of complex wireless networks, streamline actual deployment and provide centralized remote monitoring and management of the entire network.

Not so long ago, when enterprises thought of wireless technology at all, they tended to think of it as an extension of their indoor wired Local Area Networks (LANs). How things have changed. Today's wireless networks provide versatile capabilities that are emerging as the first choice of organizations ranging from corporations to municipalities to universities to medical centers and more. The new rule of thumb is fast becoming "wireless by default, wired by exception."

Carpet, Concrete and Lawn

Organizations around the world are using today's wireless networks in a variety of ways. Some use them as outdoor extensions of their indoor wired networks. Others use them as strictly outdoor networks connecting facilities across campus, across town and in outlying and rural areas. Others deploy mesh networks that blanket an area, providing high-speed access for municipal employees and public WiFi access.

A growing number of organizations, however, are intrigued by wireless' ability to combine both indoor and outdoor connectivity from common infrastructure elements. Wireless is the technology that's making it possible to go to and from carpet, concrete and lawn easily and cost effectively without the use of a wired network, empowering a mobile workforce of users able to work at their desks or in the field with the same degree of network access. Thanks to wireless, the walls that have hindered ubiquitous connectivity for too many years are finally being torn down.

Keeping Down the Costs

Indoor/outdoor capability is just one of the many advantages of wireless networks. Bottom line, wireless network deployment is also remarkably affordable. There are no wires to relocate, no walls to demolish, no cubicles to reconfigure, no costly trenching. For essentially the same reasons, wireless networks are also exceptionally fast to install. In most cases a wireless network can be deployed in a matter of days as opposed to weeks or months for wired systems. Plus, because the organization owns the network, expensive monthly recurring costs like T-1 lines are eliminated, as is the need to depend on local telecommunications providers for service.

Different Technology, Different Challenges

Of course, wireless technology is different from wired technology. Although this statement might

seem somewhat simplistic, it actually has a great deal of meaning. Wireless networks have their own set of requirements that have nothing to do with wired networks. In terms of technology, equipment, design, deployment and management, wireless networks are not merely extensions of wired networks. They are different animals altogether, with distinct features and special needs, and should be treated as such. Some of the major differences include:

- **Access.** In a wireless network, there are a number of areas that must be taken into consideration, including: RF interference, traffic levels, physical changes to the network, malfunctioning equipment and others. In designing and managing the network, it is crucial to be able to identify and address these issues to ensure maximum throughput, reliability and security.

- **Applications.** The use of multiple applications—such as VoIP, video surveillance, Virtual Private Networks (VPNs), barcode scanning, RFID, location-based functionalities and more—can also affect network performance. In a wireless environment, applications may compete with one another, making the ability to identify and remedy application conflicts critical in wireless network design and management.

- **Design.** Wireless networks are proving their reliability and performance every day in enterprise, government and operator environments around the world. They are complex by nature, however, with a great many variables that must be taken into consideration. Upfront design is essential to assuring high-performance wireless connectivity.

Easier Than It May Seem

Having to deal with all these variables may make designing, deploying and managing a wireless network seem difficult. That's not necessarily the case. Today, more and more organizations are taking advantage of sophisticated software-based wireless network tools provided by industry leaders such as Motorola.

Streamlined Integration of Data

These tools provide interdependent applications that allow you to use comprehensive, real-world data to help eliminate guesswork and ensure that your network delivers—and continues to deliver—exactly what you require. Advanced design and management tools streamline the integration of data to create a seamless back-and-forth data flow covering nearly every aspect of the network.

NETWORK DESIGN

What are some of the variables network design must take into account? First, there are your specific enterprise requirements: number of users, bandwidth requirements, the number and types of applications and ultimately budget. Second, there is the physical environment. The uniqueness of the physical environment has a dramatic impact on the design of every wireless network.

Physical Design Issues

Wireless network performance can be affected by a wide range of physical issues that must be addressed in the design. For interior networks, issues include the thickness and composition of interior and exterior walls, the amount of glass and other reflective surfaces, user density and more. For outdoor networks, the types of equipment needed and where each piece will be located have to be taken into account. In addition, the network must be designed to address environmental and terrain realities. These include elevations and obstacles such as the location and height of buildings; trees, foliage and other natural obstacles; the sources of potential interference in various locations on the network and more.

In practice, there are generally three methods of wireless network design. The first is the so-called "spray and pray" method. The second is the use of manual planning. The third is to use today's powerful integrated wireless network software solutions.

DESIGN › DEPLOY › MANAGE › SECURE

HOLISTIC MANAGEMENT OF EACH LAYER OF THE WIRELESS NETWORK

Today's wireless communications networks are most often comprised of various types of technologies. These include point-to-point links, point-to-multipoint links, wireless mesh networks and wireless LANs. Software-based wireless network design and management tools, such as those included in Motorola's One Point Wireless Suite, provide for consolidated and integrated design, deployment and management of each layer of the network.

Spray and Pray

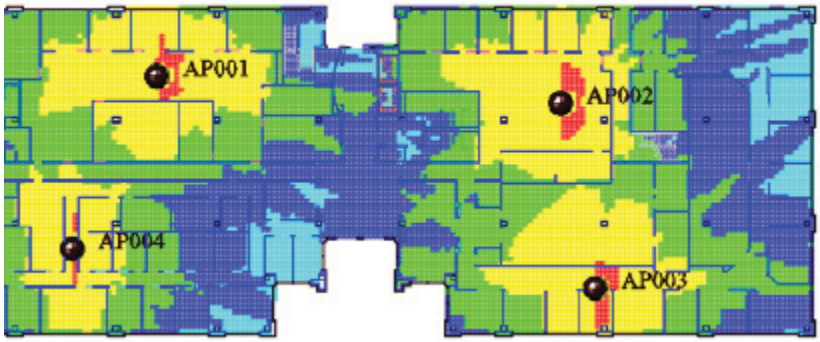
Many network operators still rely on what is essentially guesswork. They look at a street map or building layout and put up wireless equipment where it seems logical. Then they hope it will all work. Unfortunately, this so-called "spray and pray" approach is almost always unsatisfactory.

Manual Planning

Other operators recognize the importance of upfront planning, but choose to plan their wireless network manually. Indoors, this often results in frustrating and costly trial-and-error installations and re-installations. Outdoors it also involves physically exploring the network to note physical obstacles and challenges, with designers attempting to ascertain the equipment types, numbers and locations that will result in satisfactory performance.

Predictive Design

The simpler and better way to design a wireless network is to use advanced software-based design tools to help eliminate guesswork and ensure successful network deployment and continuous high performance. Software-based design solutions take into account all the different environmental variables—such as terrain, buildings, foliage, subscriber densities, application usage and many others—that can affect network performance. The tools then use powerful computer-driven analysis and modeling functionalities to make it much easier to design the optimal network for your specific environment and performance requirements.



Visualizations of indoor and outdoor network coverage

The design tools you use to plot your wireless system can essentially make or break your network. The amount of effort you put into the initial design is going to improve performance and save you money down the road. In integrated wireless network design and management solutions, the design phase is interconnected with management applications to create a seamless loop that facilitates continuous information sharing throughout the deployment phase and beyond, helping to keep the network running smoothly and powerfully at all times.

DEPLOYMENT

Although many operators consider the network deployment process to be trivial compared to design and management, deployment is actually the phase that can often wind up costing the most. Fortunately, with proper planning, you can greatly minimize any potential risk.

Nasty Surprises

The deployment process starts with the design team handing off a network plan to the deployment team. This plan normally includes a map of locations and files for configuring each piece of equipment. Unfortunately, there are almost always a number of surprises that can confront deployment teams when they take to the field.

In an indoor deployment, the team might run into interference from another system operating in the same area, or discover that a wall is made of concrete when it was expected to be dry wall. Maybe there's a huge air conditioning vent where the equipment should be installed. Outdoors, a light pole may have been knocked down in a traffic accident. Foliage has obscured a rooftop site, causing a box to be mounted facing in a slightly wrong direction. These and other issues can force deployment teams to locate equipment in different spots than called for in the design.

That can be a problem. Imprecisely located equipment can have an enormous effect on the network because every piece of equipment has a specific role and a specific location. Deviations can be costly in terms of network performance, reliability and cost efficiency.

Streamlined Deployment Features

Today's sophisticated wireless software solutions were developed to make the deployment process more efficient in a number of ways. They provide detailed information about exactly where equipment should be placed. They provide files that simplify configuration of each piece of equipment. In addition, the design tools are portable for use on laptops in the field. When obstacles are encountered during the deployment process, field personnel can address

the problem instantly and on site, saving time and minimizing impact on network performance and deployment cost. Equally important, they offer critical two-way communications links between deployment teams and designers.

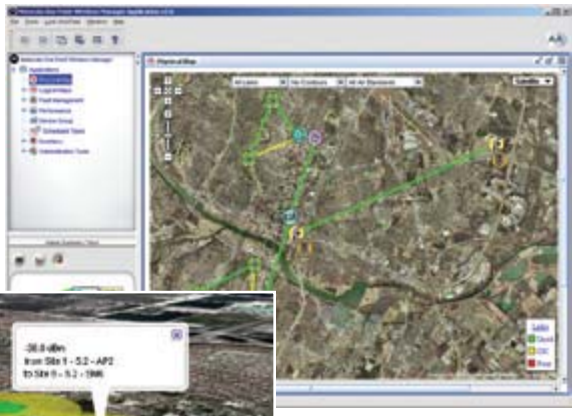
Feedback Loop

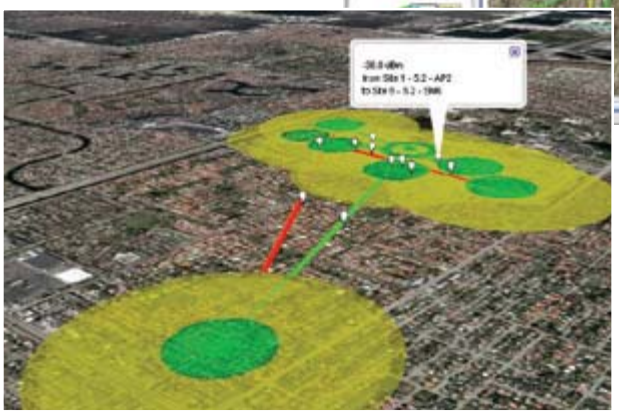
When a deployment team says something like, "okay, here's where we actually put the boxes," that can be scary for a design team to hear. But the new design and development tool sets can help in these cases, too. They create a streamlined feedback loop from the field to the designers who can input the new location and check to make sure the changes haven't caused problems in network performance. The feedback loop is also important for providing regular updates and allowing the design team to get the big picture of the network as it is being deployed.

Field personnel perform network verification tests to confirm performance levels on the actual deployment. When issues are found, some design tools can incorporate real measurements to adjust and adapt the design to bring performance back up to desired levels.

MANAGEMENT

Network management is an ongoing task that involves monitoring, maintaining and managing the network to ensure optimum performance throughout the system. The focus is maintaining total control and visibility of issues affecting performance. When a network experiences an outage, you have to be notified immediately in real-time—preferably before users notify you through complaints—identify the problem, locate it and remedy it as quickly as possible to minimize downtime and lessen the number of users who are affected.





Dynamic network coverage mapping

One Point of Management

Effective network management, other than for very small networks, isn't really something you should do manually. Fortunately, today's new management tools—such as Motorola's Wireless Manager—allow organizations to dynamically monitor and control their entire wireless network in real time from one computer screen. These management applications pull together diverse information and data from all tiers of the network, consolidate it and deliver a unified view to network management personnel.

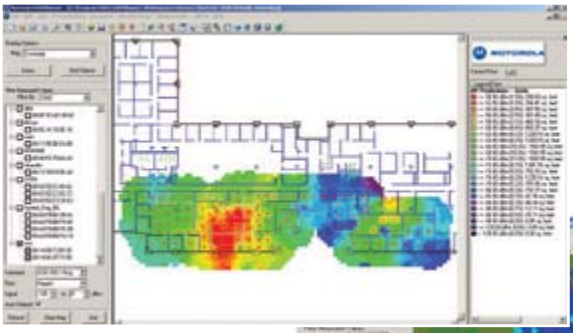
Omnipresence

These powerful management solutions, in effect, make you omnipresent in terms of your network. They reside on a server and continually poll every wireless network element, perform continuous status checks and report the information back in real time. The systems monitor every tier of the network, providing information from long-range point-to-point links, point-to-multipoint links, street-level mesh networking and indoor wireless LANs. Many management systems also provide two-way communication between the control center and the network, allowing managers to make changes, such as altering configurations or scheduling firmware updates, remotely.

Dynamic Network Visualization

Many management systems allow you to request and run multiple reports that provide charts, graphs and plots to assist you in identifying and locating the issue. Actually determining the problem, however, can ultimately be quite difficult and time-consuming. Management solutions such as Motorola's Wireless Manager are leveraging new visualization and mapping technologies to offer a better, more efficient process for understanding the root cause of network issues.

These management solutions are able to show your entire network on, for example, a Google Earth map. No multiple reports are necessary. You see a dynamic rendering of the network in real time, showing where each piece of equipment is located and its status, as well as the links between elements. You can also see the quality of the links, and if there is an issue with any piece of equipment. When a problem occurs, the map shows you its exact location, which equipment and links are affected and what geographical area is experiencing the issue. It also provides one-click access to detailed information about the equipment and alerts to help with the diagnosis and repair process.



Measurement and monitoring of network operations

MOTOROLA ONE POINT WIRELESS SUITE

Motorola's One Point Wireless Suite is a set of advanced, integrated network design and management tools. These powerful applications help you design, deploy, monitor and manage your wireless network from its earliest stages through ongoing operations. Guesswork and expensive manual planning operations are eliminated, allowing you to quickly and easily design and deploy wireless networks that deliver optimal coverage, capacity, reliability, security and performance. The One Point Wireless Suite includes the PTP LINKPlanner, the BroadbandPlanner, the LANPlanner, RF Management Software for WLANs, the Wireless Manager and the Motorola AirDefense Solutions.

Managing Security

Because you have little or no control of where wireless signals will reach, especially in unlicensed frequencies, security can be a major network management challenge. In a wireless environment, information is vulnerable in numerous ways, including hackers and others who try to shut down networks through interference or Internet attack. According to one major transportation company, their organization experiences an average of about one attack every month. Sophisticated solutions are readily available. For example, encryption through DES and AES standards is a highly effective method of ensuring wireless network integrity. Also available are powerful wireless LAN intrusion protection systems for real-time detection and denial of unauthorized access. Today's network management tools also help enhance security by allowing network operators to monitor and respond to security issues in real time, 24 hours a day, seven days a week.

The Future: Performance Management

In the not too distant future, automated wireless network management systems will provide managers with unlimited access not only to the location and configuration of each piece of equipment, but also to its designated role in the network design. If you know that a specific piece of equipment is designed to serve a certain number of VoIP customers simultaneously, and needs to be able to handle 10 to 15 large uploads at the same time, and you can validate the equipment's performance, it opens the door to a new era in network management.

Today's wireless network management software tools allow you to view network elements and their locations on a single screen. You can also see the quality of the communications links between elements. This allows you to monitor and manage network problems and issues that affect access and availability. Before long, you'll be able to add performance parameters to this mix, and proactively monitor and manage how the network is actually performing. You'll be able to validate actual performance and verify whether or not each element of the network is meeting the goals set for it during design. That's a capability that will enable wireless operators of all kinds to become even more efficient, more cost effective and, most of all, more productive.

MOTOROLA

Motorola, Inc. 1301 E. Algonquin Road, Schaumburg, Illinois 60196 U.S.A.

www.motorola.com/wirelessbroadband

MOTOROLA and the stylized M Logo are registered in the U.S. Patent and Trademark Office. All other products or service names are the property of their registered owners.

© Motorola, Inc. 2008