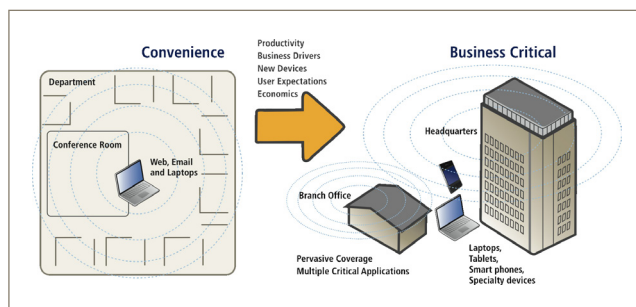


WIRELESS LAN OPERATIONS: FROM REACTIVE TO PROACTIVE

Wireless LAN Operations: From Reactive to Proactive

Enterprises everywhere are turning to wireless networks (WLANs) as their primary network to provide users mobility, increase productivity and lower infrastructure cost. The recent ratification of 802.11n has added fuel to that fire, by providing most users a faster connection over the air than they can get plugged in at their desk. Though enterprises were originally driven to wireless by the need for mobility, today they are now driven by the lower installation costs of wireless compared to new fixed desk ports. IT departments are finding they can leverage the pervasiveness of Wi-Fi enabled laptops, Netbook PCs, and other devices to keep cost down and increase employee productivity. With this convenience, WLANs are beginning to edge out Ethernet as the preferred user access mode. No one wants to plug in anymore.



The adoption of WLAN for primary access transitions business critical applications from wired to wireless, introducing a growing number and variety of applications and devices that rely on wireless for connectivity. Hence, reliable user connection is critical and application performance is paramount. This transition creates a new challenge for IT managers to ensure that all users can connect and all applications work reliably, as required, all the time, and over large distributed WLANs

However, as these wireless networks have been deployed, enterprises have not been paying attention to the true costs of operating these ever-growing, business critical networks. WLANs are more convenient than wired networks and now faster with 802.11n, but they can also be more costly to operate than their wired predecessors.

An August 2009 Aberdeen report, Multi-site and Campus

Area WLAN 2009: Benefits of a Centralized Approach, found enterprises reported a 63% increase in WLAN management costs and 69% increase in management employees over last 2 years. Another recently-conducted survey of over 800 enterprises using WLANs from all major WLAN vendors asked "What are your top priorities for WLAN?" The winners: client troubleshooting (56%) and application delivery (37%)—over the expected favorites like security and integration of wired and wireless networks.

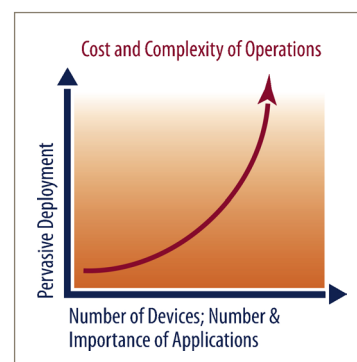
Enterprise IT managers are now experiencing a burden on their organizations commensurate with the growth in number of users and applications on their wireless LANs. Traditional network monitoring is not meeting the challenge to ensure reliable network operations and availability. Enterprises need tools that not only ensure that networks are operating properly, but reduce operational expense; something that changes the WLAN model from reacting to downtime to preventing it in the first place. They want tools that ensure users reliable connectivity and that their application requirements will be met, end-to-end. Enterprises want to change the role of IT from chasing down the wireless problems that impact business to detecting problems before the real business gets underway—every day. They want Wireless LAN management to evolve, to be simple, intelligent, and proactive.

Business Drivers

As enterprise wireless networks grow, the number of devices, along with the number and type of business critical applications grows exponentially. Enterprises are finding the complexity of managing all these devices and applications difficult and costly.

They are also discovering that their wireless LAN has transitioned to more than a network of convenience, that WLAN downtime impacts business.

Wireless LAN equipment, software and support contracts



are a known cost. However, variable expense shows up once users start depending on the network. Unpredictable application performance and connectivity is downtime to the users, preventing them from doing their jobs. As the number of problem tickets increases, IT turns to additional management tools and increases headcount to improve time-to-resolution, as network outages and downtime are impacting productivity and hurting the bottom line.

This is reflected in surveys and can be demonstrated in a Total Cost of Ownership (TCO) analysis. For example, the “true cost” of acquiring a typical 100 access point WLAN shows that 40% is typically the hardware costs (APs, controllers and wiring) while 20% is for software licensing and support. The problem is reflected in the remaining 40% of the TCO as a variable expenditure of IT for dedicating time monitoring the wireless network, reacting to outages, and performing forensics chasing down problems. This added time, which takes away from other, more important activities, impacts business operations and productivity—and time translates to money in the form of higher costs of operating the network. Lastly, any true TCO analysis would not be complete without the inclusion of lost business opportunity due to network downtime, How much does your business lose every minute the network is down?

Why the present WLAN Management paradigm fails

Until now, WLAN vendors have focused their management tools on simplifying deployments, creating automatic tools for channel and power settings. These tools also provide capabilities for setting up security, SSIDs and other profiles, as well as offering monitoring of AP status, system throughput, and RF visualization to predict what the coverage might be. Unfortunately these management tools do not ensure devices can connect reliably and run applications as expected. Networks are deployed and IT managers wait to see what happens. When users experience connectivity issues or poor application performance, they log a ticket with IT, and then wait until the problem is resolved.

When IT gets the ticket, they’ll react, but they may not be able to get to it right away, nor have all the information they need. By time the IT engineer gets around to investigating, the

network problem may have changed, RF interference is gone, network traffic changes, resulting in ‘no problem found’. The network engineer may attempt to recreate whatever can’t be understood from the SNMP history, using sniffers and spectrum analyzers and other tools just to get a handle on the situation. Meanwhile, users will be unproductive creating an impact on business operations.

Remote sites represent a significant challenge for IT engineers. Problems at these sites usually require on-site visits with manual testing of connectivity and application performance, in an attempt to determine if the problem is the wireless, the wired network, the WAN, the user’s device, or the user. If the enterprise is deploying voice, end-to-end metrics must be met. Not having the tools to measure and ensure performance leaves IT engineers wondering which part of the chain is creating the problem.

What Enterprises require

Enterprises are in the business of healthcare, education, retail, manufacturing, or hospitality. Their business is not managing networks. Enterprises deploy a network and run applications to help them run their business, increase productivity, be more competitive, and generate revenues. With each network outage, they lose money. The more they have to spend on IT resources to keep the network operating, the less goes to the bottom line.

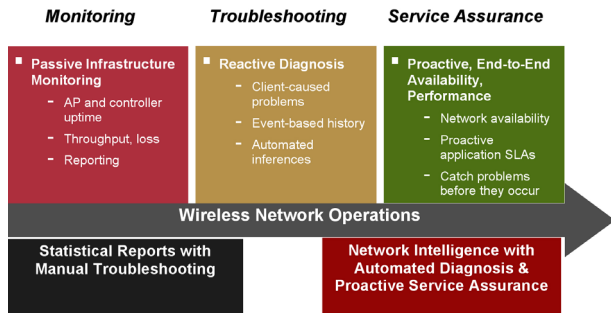
Enterprises want the same type of predictability from a wireless network as they can achieve with a wired network. When they deploy a wireless network, they want to know that users can connect and have end-to-end connectivity without experiencing issues. They also want to know that when they deploy an application such as voice, that delay, latency and jitter requirements will be met. Enterprises want to verify the network when first installed and then continuously while it is in operation. If there are problems, they want to know before it impacts operations.

Wireless LAN Operations Requirements

Wireless LAN Operations needs to evolve from passive monitoring to proactive application assurance, providing enterprise IT managers, help desks, and CIOs better insight into their networks performance and providing users the assurance that

the network is fully operational and ready for service. IT managers want to identify problems before they become outages and have tools to resolve problems quickly. To meet these goals, three core functions must exist:

Enterprise Wireless Operations Requirements



	Requirement	State of the Industry
Monitoring	Provide monitoring of APs and controller with dashboards	Passive infrastructure monitoring provides simple reports on access points and controller, uptime and throughput, estimated RF coverage, and reports on various network attributes and conditions.
Troubleshooting	Ability to identify and perform reactive diagnosis of client connectivity issues with event-based history	Troubleshooting is a manual and labor intensive process, and only performed after the fact, once a user reports a problem. No client state is saved nor available to assist IT in troubleshooting; IT engineers may have to go to the location of the problem to try to recreate the conditions.
Service Assurance	Proactively verify network connectivity and application performance 24x7, enabling SLA level of service	Today this is a labor intensive exercise, which requires IT engineers to manually test for connectivity and application performance via a physical site survey. These tests are typically performed when the network is first installed and thereafter only when problems are reported, putting IT teams in a reactive mode.

Meru Networks E(z)RF Wireless Operations Suite

Meru Networks' E(z)RF Wireless Operations Suite raises the bar with state-of-the-art network and service assurance management systems.

E(z)RF Wireless Operations Suite consists of two applications: E(z)RF Network Manager, which is an industry leading WLAN

management system that captures and saves client historical state, significantly reducing troubleshooting time, and E(z) RF Service Assurance Manager, the industry's first proactive operations and diagnostic system for wireless networks and the applications that run over them. These two management applications leverage the power of Meru's Wireless LAN Virtualization to meet today's wireless operations requirements . They enable enterprises to operate their WLANs with application assurance and simple, quick diagnosis of clients.

E(z)RF Network Manager - Network Monitoring and Diagnosis

Troubleshooting has traditionally been much harder with wireless networks than with their wired counterparts because the radio environment is always changing. Recreating the conditions that led to a problem can take hours of trial-and-error, and may never be able to reproduce the fault exactly. E(z) RF Network Manager simplifies the process dramatically by keeping an exact record of all low-level events in the network, allowing the network manager to rewind the network to its state when the problem occurred, making it easy to diagnose and understand issues even after a user has disconnected.

Rewind and Freeze Frame

E(z)RF Network Manager database maintains a history of every wireless state transition sent over the network as well as performance statistics and events such as associations between clients and access points. Helpdesk staff can rewind the network status to view conditions at any point in the past or track a client's movement, seeing which access points it was connected to and which applications it was running at any time.

Diagnostic Inference

The System Director software that runs on Meru's controllers automates much of the work that other systems force on to IT staff, automatically diagnosing faults as they occur. E(z)RF Network Manager extends this to an entire network spanning multiple controllers. Whether an issue occurs at a controller, an access point or a client, the software can find it. At the controller level, E(z)RF recognizes more than 20 signatures including backend packet loss, RADIUS or DHCP issues and high

client density. At the station level, it recognizes more than 30, including failures with captive portal, repeated reassociations and high loss or airtime utilization. At the access point level, it can recognize more than 50, including missed beacons, transmit timeouts, block-ACK errors and stations stuck at low data rate.

Dashboards Covering Users, Applications

E(z)RF's dashboards offer network managers an at-a-glance view of the entire network or individual stations, showing either real-time or historical statistics. In addition to alarms and alerts, the dashboards show detailed information including each client's data throughput, the numbers of voice clients, the signal quality for each client and associations between clients and access points. Dashboard functionality is available on both the full, workstation-based E(z)RF Network Manager and E(z)RF OnTheGo™, with the latter fully customizable to make the most of a smartphone's limited screen area.

E(z)RF Service Assurance Manager – Proactive Diagnostics and Application Assurance

Meru is leading the industry with Meru's E(z)RF Service Assurance Manager, which leverages the full power of virtualization to provide proactive diagnostics and end-to-end application assurance. Just as dial tone tells users a phone is working, Meru's Service Assurance Manager tells IT managers that the network is working.

Service Level Assurance

Service level assurance is the category of networking where service levels are actively measured by injecting traffic into live networks: constant testing of real, live networks, with traffic that represents the applications that mean the most for that network. Wireless networks can and do change in ways wireline networks don't, and so if the wireless network is critical to your business, they need to be checked regularly to make sure they can deliver as expected.

Different applications have different requirements to deliver optimum user experience. To ensure the service levels are being met, Wireless LANs need regular, if not continual proactive testing, for throughput, loss, and delay. This way IT managers can determine whether the network is still meeting the SLA for

the various applications, before users find out there are problems. Commercial web sites do this all of the time. Utilities do this too. If your network services are critical, you too should be proactively testing your network.

This capability has to be built in to the network. IT managers and network engineers don't have the time to drag around laptops. And most organizations do not have the extra budget to install another complete network of sensors. Instead, IT managers want the network to test itself, with no additional wireless radios. Until now, there has been no practical solution.

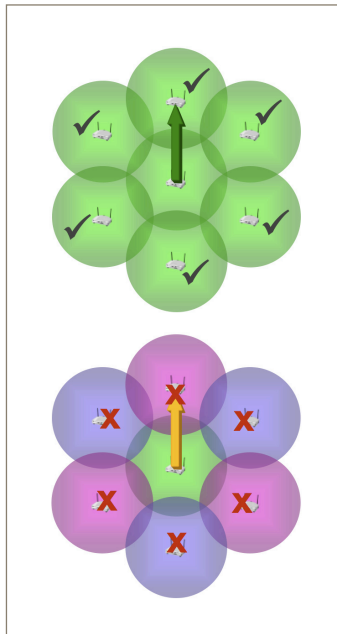
Meru E(z)RF Service Assurance Manager™

Meru E(z)RF Service Assurance Manager™ (SAM) delivers what IT managers have been looking for. SAM overlays onto an existing deployed Meru network, sitting on already-installed hardware as a software blade, proactively injecting end-to-end traffic onto the wireless network. In order for the traffic to get on the air, each access point creates a virtual client. While the access point is running, serving its users, it also is able to act as a client and connect to the access points surrounding it, without disruption. These virtual clients connect from every access point in the network, sending real traffic through the air.

The traffic starts from the Meru services appliance (SA), which already hosts the E(z)RF Network Manager™. From there, it goes to an access point's virtual client, which connects to another access point and sends that traffic. That traffic then crosses the entire wireless and wireline networks—exactly as real client traffic does, passing through controllers, switches, and routers—before arriving back at the services appliance. In other words, SAM injects live traffic on each access point, sending it back to itself over the complete network, so that it can now measure service levels. Since these are real connections, SAM tests the real network services, including DHCP, security, routing, and quality of service, and reports back on any changes or violations of expected service levels. Every day, SAM sends out a health check email, reporting on the service levels for every access point in the network.

Technology unique to Meru

Meru Virtualized Wireless LAN uses channel layering. This allows a Meru access point to communicate with its neighbors without disruption. Both it and its neighbors are always on the



same channel. This way, a Meru access point can perform a “neighborhood watch”, checking on its neighbors by connecting and sending traffic with no penalty to the existing network.

Microcell networks cannot do this. They require that each access point be tuned to a different channel, as they have to minimize any possibility of co-channel interference. Any communication between APs will require that the radio channel be

changed, forcing an access point to disconnect all of its clients and change channels to communicate with its neighbors. This is disruptive to connectivity and prevents the possibility of achieving a true picture of the networks performance under normal operation.

Service level assurance is the key to making wireless networks as dependable as wired networks. Proactive assurance, versus the reactive “detect-then-diagnose” method familiar to legions of wireless network administrators today, prevents IT from being caught off-guard by wireless problems. Users can depend on the network providing the level of service they need for their applications—they know the network has already been verified that day. And IT staff can rely on the network being up to the task, without having to put in any additional effort on their part.

E(z)RF Wireless Operations Benefits Summary

Meru’s E(z)RF Wireless Operations Suite		
Comprehensive wireless application suite which changes wireless management paradigm from reactive to proactive, delivering greater network and application service with faster time-to-resolution		
E(z)RF Network Manager		E(z)RF Service Assurance Manager
Provides passive and proactive management, finding problems as they are developing, saving client state, reducing downtime and simplifying troubleshooting		Ensures client connectivity and application performance, across both wireless and wired networks
Monitoring	Troubleshooting	Service Assurance
APs and Controllers	Client state recorded	End-to-End Service Assurance
Interactive Timelines	Diagnostic Inference	Virtual Clients – real traffic
RF Visualization	Rewind and Freeze Frame	Checks throughput, loss, and delay
Trend Analysis	Event Search	Automated or On-Demand
Customizable Reports	E(z)RF OnTheGo™	Scales to global networks
E(z)RF OnTheGo™		

Benefits for the Entire Enterprise

Meru Networks’ EzRF Wireless Operations Suite provides benefits at all levels within any enterprise:

- Wireless Operations Staff: Network Manager and Helpdesk – changes the management paradigm from reactive firefighting mode to proactive operations, with intelligent reactive management and application assurance.
- CIO: Can do More with Less - can deploy and scale pervasive wireless with limited resources, lower cost of operations, reduce end-user downtime, and increased wireless application adoption rates.
- Users: Best wireless experience – Greater availability and higher reliability with reduced downtime, providing higher productivity with improved service levels

For The Network Manager and Helpdesk

IT Managers and Helpdesk personnel are faced with two WLAN management challenges, 1) verifying the network connectivity and application performance on a regular basis, 2) troubleshooting client and application problems quickly.

ABOUT MERU NETWORKS



Meru Networks develops and markets wireless infrastructure solutions that enable the All-Wireless Enterprise. Its industry-leading innovations deliver pervasive, wireless service fidelity for business-critical applications to major Fortune 500 enterprises, universities, healthcare organisations and local, state and federal government agencies. Meru's award-winning Air Traffic Control technology brings the benefits of the cellular world to the wireless LAN environment, and its WLAN System is the only solution on the market that delivers predictable bandwidth and over-the-air quality of service with the reliability, scalability and security necessary to deliver converged voice and data services over a single WLAN infrastructure.

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Meru's E(z)RF Wireless Operations Suite takes everything to another level by providing these functions the tools they have been desperately seeking – verification of network connectivity, application assurance, and quick problem resolution. Instead of sending network engineers out with various devices to perform costly site surveys, they can use a virtual workforce of virtual clients, to conduct verifications continuously, or on demand, 24x7, reporting on any network issues and ensuring the network is ready and available when needed.

For the CIO

E(z)RF Wireless Operations Suite is not just for hands-on troubleshooting. It enables CIOs to do more with less, increasing the proficiency of their teams, reducing downtime and increasing the productivity of all users. E(z)RF Wireless Operations Suite enables delivery of enterprise wide services with SLA-like capabilities, providing the assurance that when the network is needed, it will perform as required. It also aids in long-term planning, producing customized reports for both IT and executive management at every level. Whether a high-level summary or a detailed report is need, E(z)RF can provide it.

For the User

With Meru Networks wireless LAN and E(z)RF Wireless Operations Suite, users will experience wireless with wired reliability. Users will have better connectivity and have the confidence to use the devices and applications, increasing wireless adoption rates which improve the enterprises bottom line.

For the Bottom Line

With wireless replacing wires for business critical connectivity, wireless networks have to be available 24x7 and management can-

not just be passive monitoring. It needs to be proactive, ensuring the network is always meeting application requirements and identifying when there is degradation in service so the IT team can be proactive in resolution, rather than waiting for an outage. The management needs to be as intuitive and as accessible to all IT staff as wired network management.

E(z)RF Wireless Operations Suite delivers on that promise, with a state-of-the-art proactive diagnostic to ensure network operations and a network administration tool that is both intuitive to people who are used to managing wired networks yet built to handle both mobility and virtualization. Its intuitive Web 2.0 user interface and customized views for all IT staff mean that it can extend the scope of network management to everyone with an interest in improving wireless network performance.

But E(z)RF Wireless Operations Suite is not just a front-end for network managers, help-desk staff and CIOs. Its automated diagnostic tools actually perform many of the tasks that previously had to be handled manually, while its station-level history and searchable event database speed up resolution of problems that require human intervention, troubleshooting times is reduced from days to minutes. The network spends less time as a drain on resources and more time as a productive asset.