



a new era in WLAN testing: driving performance and profitability

The Leader in Wireless LAN Testing

New Trends, New Challenges

The WLAN deployment landscape is changing

- ❖ The number of APs per enterprise installation is increasing
- ❖ Client densities and mobile user counts are rising
- ❖ VoWLAN, mixed data-voice networks, and meeting SLAs are driving new performance needs

A new approach to WLAN testing is required

- ❖ Performance testing with air-rate traffic is crucial
- ❖ Automated testing of *real* APs and WLAN switches key to successful rollouts

Agenda

• **Trends in Large-Scale Wi-Fi Network Deployments**

- Craig Mathias, Principal, Farpoint Group

• **A new era in WLAN testing**

- Tom Alexander, CTO, VeriWave
 - WLAN infrastructure equipment - development & QA methodologies
 - Performance testing – what's required
 - Case studies in WLAN testing - scalability, mobility, VoWLAN, total cost of ownership

Trends in Large-Scale Wi-Fi Network Deployments

Craig J. Mathias

September 2006



Wireless LANs: Where Are We Now?

- Tremendous progress over the past 15 years
 - Standard (802.11) and interoperability spec (Wi-Fi)
 - Amazing improvements in price/performance (with .11n on the way...)
 - Centralized architectures and management
 - Meshes and unified architectures
 - The ability to handle essentially *all* data types and classes of service
- WLANs are well on their way to becoming the *default* connectivity in the office, in the residence, and in public spaces
 - Increasing emphasis on *large-scale* and *service-provider* rollouts

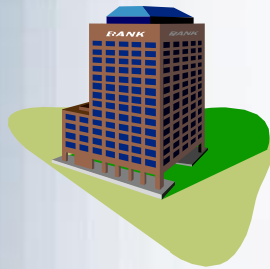
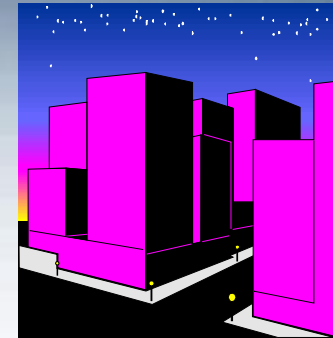
WLANs – Constituencies and Core Applications



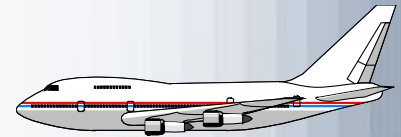
The Residence



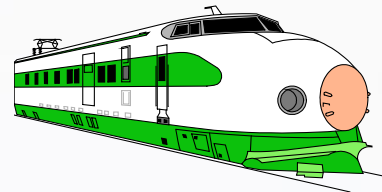
SOHO/Small Business



The Enterprise/
Campus

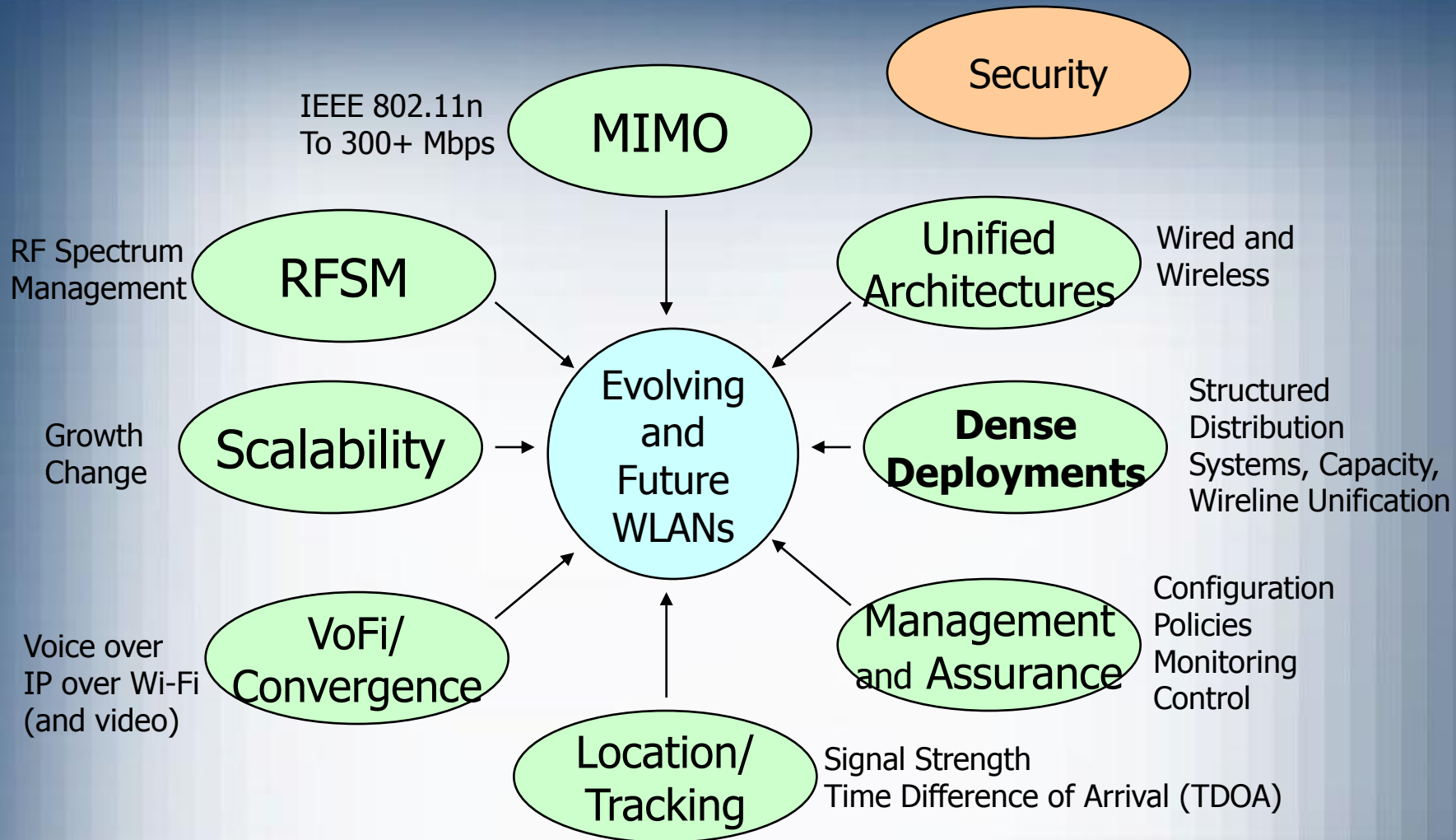


Public Spaces



Source: Farpoint Group

WLANs – Key Trends and Opportunities



Source: Farpoint Group

Why Traditional Deployment Strategies No Longer Work

- The old standby – the site survey
 - Largely unproductive
 - A snapshot in time
 - Does not consider user locations, loads, or traffic types
 - Optimizes for *coverage*, not capacity
 - *Trades inexpensive hardware for expensive labor!*
- Current thinking
 - Survey users
 - Monitor and manage over time – assume incremental refinements
 - Tough for many organizations, especially with respect to budgets
- The next wave
 - *Much* larger installations
 - Greater emphasis on time-bounded traffic and large data objects
 - Stepwise refinement of a very large installation may not be very efficient...
 - A new configuration, testing, and verification metaphor is required...

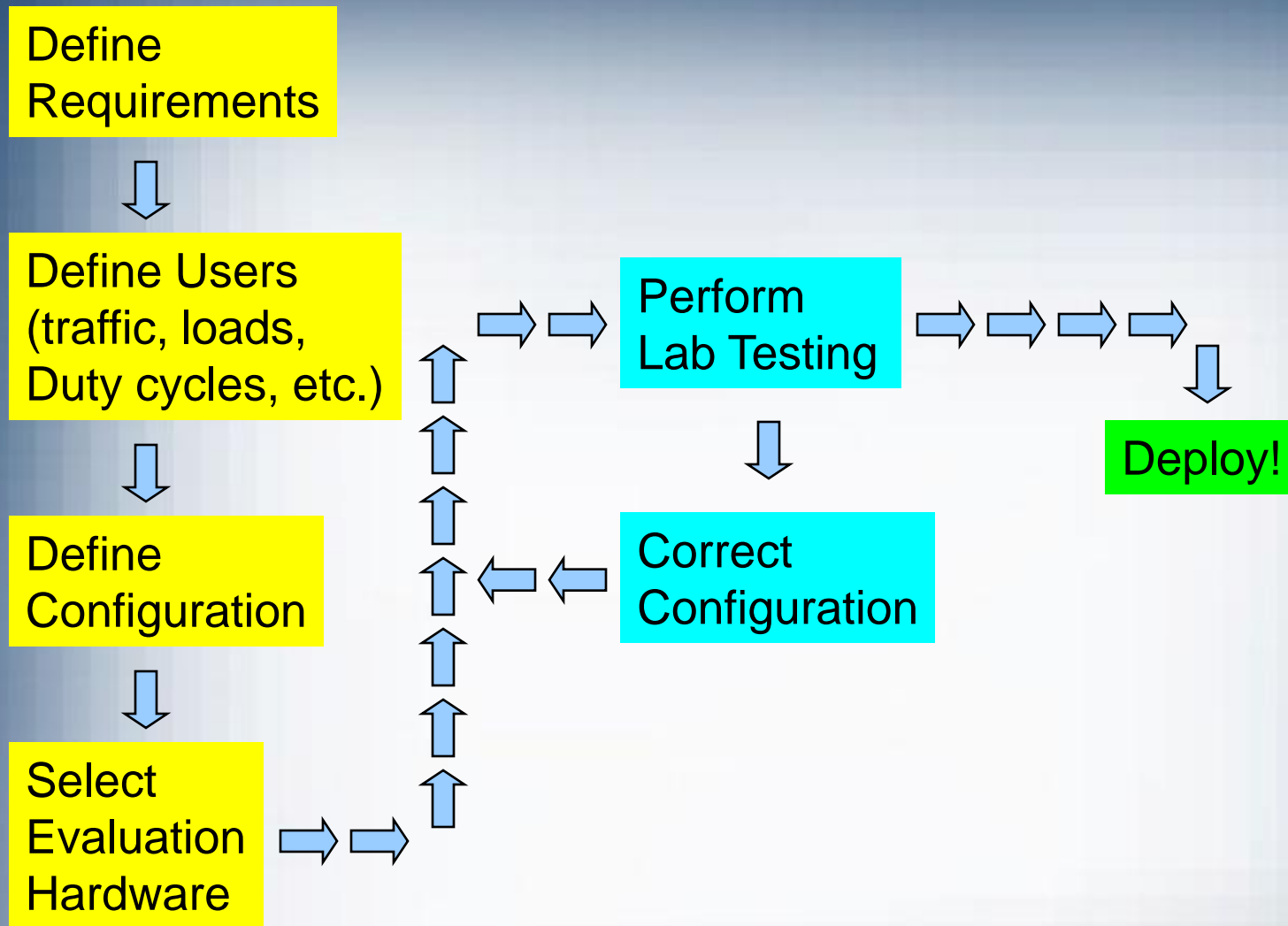
Hardware-Based WLAN Evaluation

- Large installations can be *impossible* to estimate and predict with traditional approaches
 - Insufficient tools and experience
 - No way to estimate the behavior of specific hardware under (a potentially large number of) specific circumstances
- *Hardware-based* evaluation tools are an important new direction in designing and testing large-scale deployments
 - Applying the same tools used by product engineers to enterprise settings
 - Beyond compliance and interoperability - *performance!*
 - *Repeatable, controllable environment* - a level playing field for comparison and evaluation

Benchmarking Wireless LANs

- *The goal:* predict the performance (and not just throughput) of a (potentially *very* large-scale) WLAN installation without in fact doing the installation
- Specifying topology and workload
- Perform comparative benchmarks under *controlled, reproducible* conditions
- Questions that can be answered:
 - Can client capacity targets be met?
 - How effective is the security implementation?
 - What is the impact of increasing number of roaming clients?
 - How is voice quality affected when number of VoIP calls increase and in the presence of data clients?
 - And much more..

The New WLAN Evaluation Paradigm



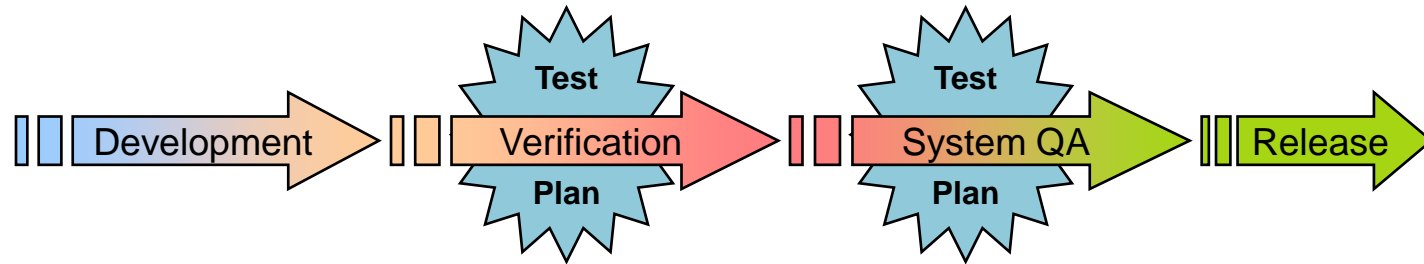


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WLAN Development/QA Today



- ❖ **Resource intensive**

- Verification/QA is expensive, lengthy (3-6 months / release)

- ❖ **Complex WLAN products**

- More protocols, RF issues, security/roaming

- ❖ **Steep learning curve**

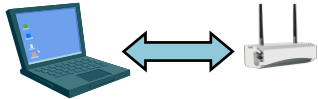
- New hires take months to come up to speed

- ❖ **Result: inadequate test coverage**

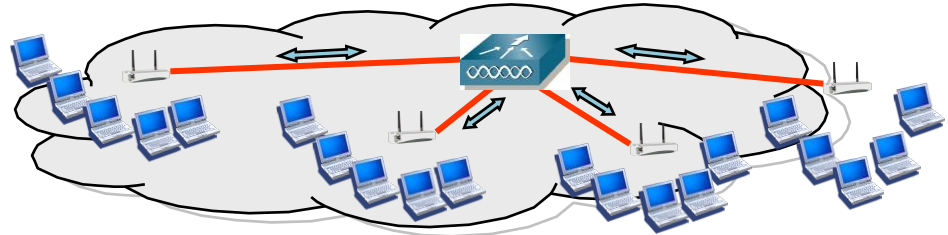
- Products ship with unknown performance bugs

WLAN testing needs a revolution, not an evolution!

Interoperability is Not Performance



Interoperability: “Can my laptop connect to my AP?”



Performance: “How well will my whole WLAN work?”

❖ Interoperability test is handled by the WiFi® Alliance

- Equipment compatibility is now behind us (WiFi Certified)

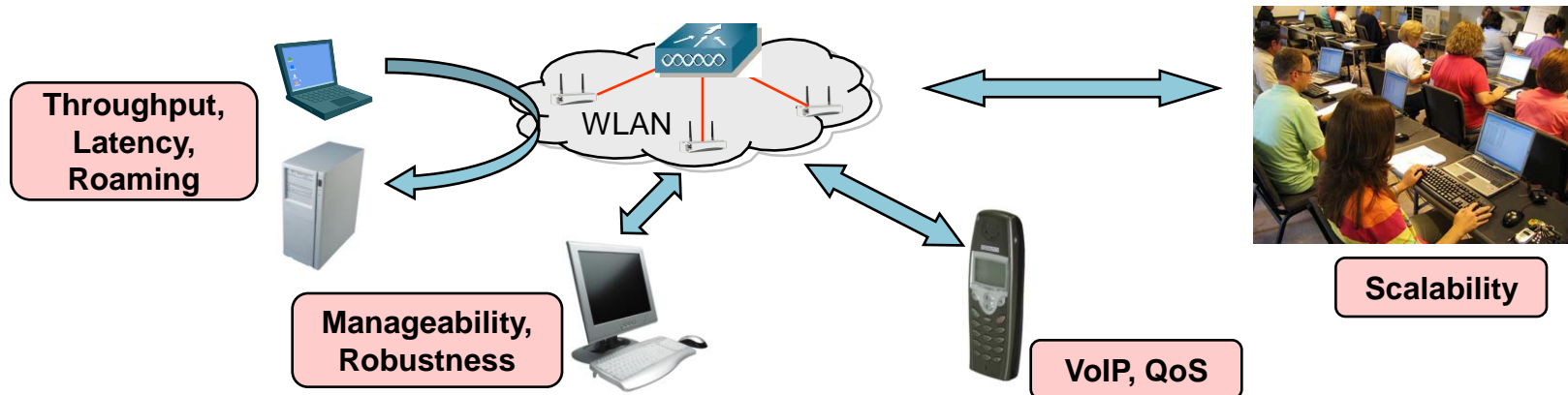
❖ Performance testing is the next challenge

- Performance is not just throughput!
 - Performance = productivity, convenience, future-proofing
 - Answers the enterprise customer’s question: “How do I build a cost-effective network that meets my needs, without a lot of effort?”

❖ Requires lab-quality equipment

- This is the next level of evolution in the QA system

Benefits of Performance Test



❖ Performance testing measures *all* dimensions of product

- Predicts how well the product will work in the real world
- Finds issues before the product hits the field

❖ Improves the end-user experience

- Higher throughput, lower latency more responsive network
- Better QoS, faster roaming high-quality VoIP calls
- Robust and scalable less outages and downtime

Performance, Scalability, Predictability

Challenge #1: Scalable QA Tests

Enterprises = hundreds of APs, thousands of clients

Challenge #2: Repeatable QA Tests

Unpredictable results = Manual analysis
Manual analysis = Delayed product releases

❖ Test equipment must meet both challenges

- Repeatable performance testing of very large systems

❖ Can only be achieved with a controlled lab-quality test environment

- Testing with 1000's of real laptops / handsets is expensive, unmanageable

❖ Enterprise performance test equipment must:

- Automatically create thousands of clients offering real-world traffic patterns, analyze tens of thousands of traffic flows, stress to >100% capacity
- Test enterprise-class WLAN features on a large scale
 - Throughput, packet loss, latency, QoS, roaming, load-balancing, rate-vs-range, etc.
- Enable quick, simple, repeatable, large-scale testing for all QA/verification test plans

❖ *This is what VeriWave offers*

VeriWave's approach is *better* than the real-world environment!

VoIP – The Next Level

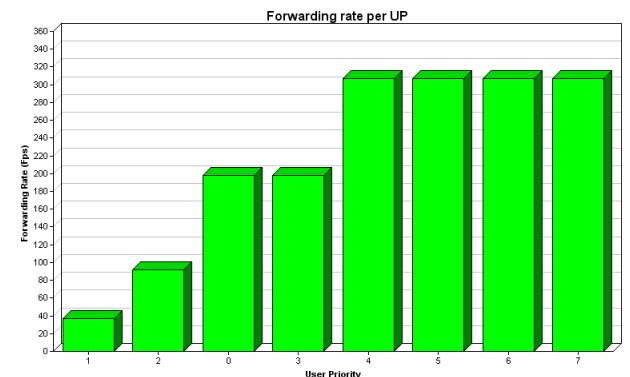
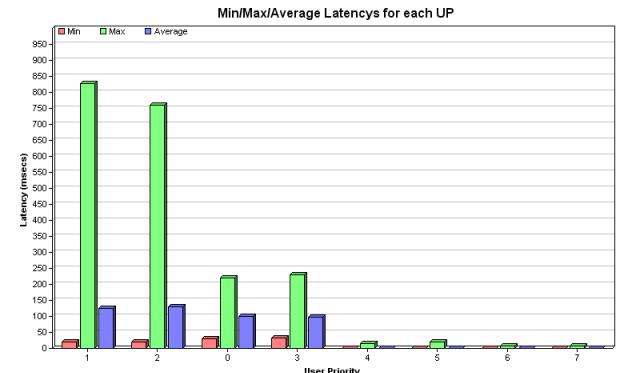
• VoIP places heavy demands on WLAN infrastructure

- Low latency & jitter
 - Even with high data traffic load
- Hundreds of mobile users
 - Efficient QoS & roaming mandatory

• Performance testing is critical

- Failure to perform dropped calls, poor voice quality
 - Cannot merely roll out the network and expect it to work
- Scalability is also important
 - Many more handsets than laptops

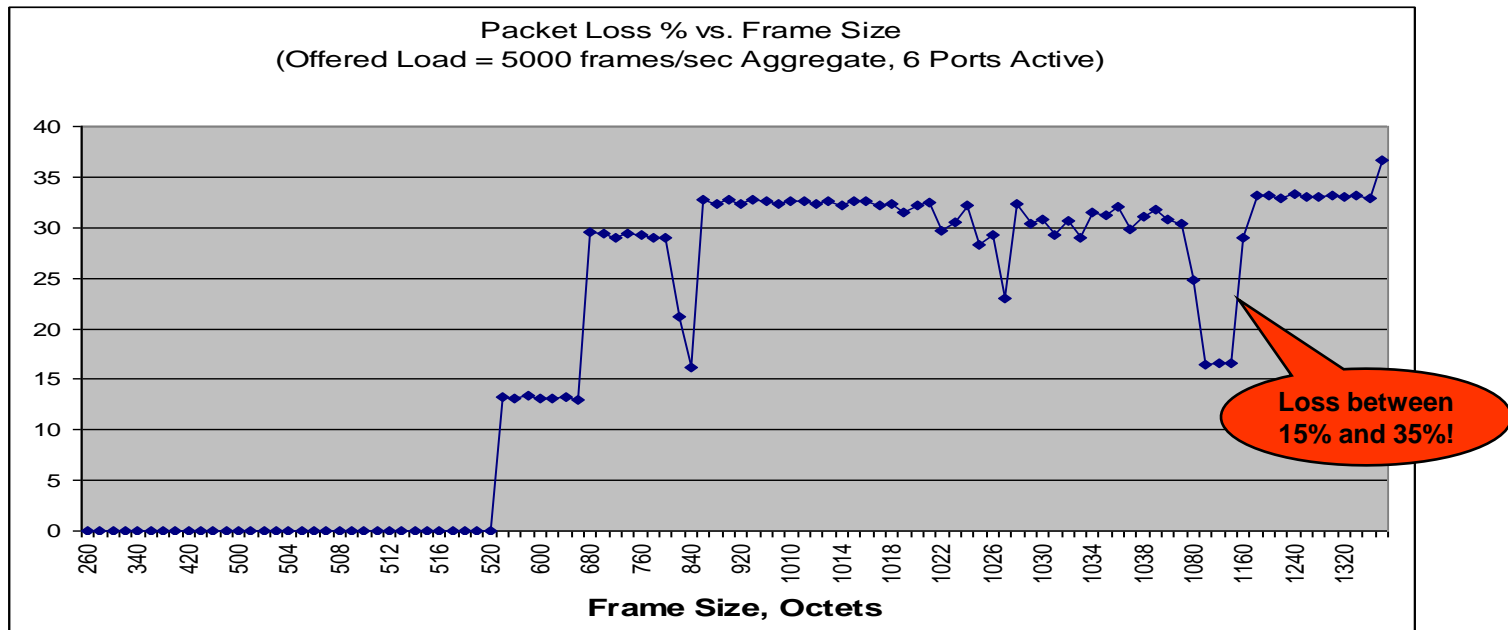
Enterprise VoWLAN raises the bar



Actual Example of a Scalability Issue

❖ 10-AP throughput test revealed unexpected performance issue

- With less than 5 APs loaded, equipment behaved perfectly
- With >5 APs active, upstream packet loss reached 35% even at light loads!



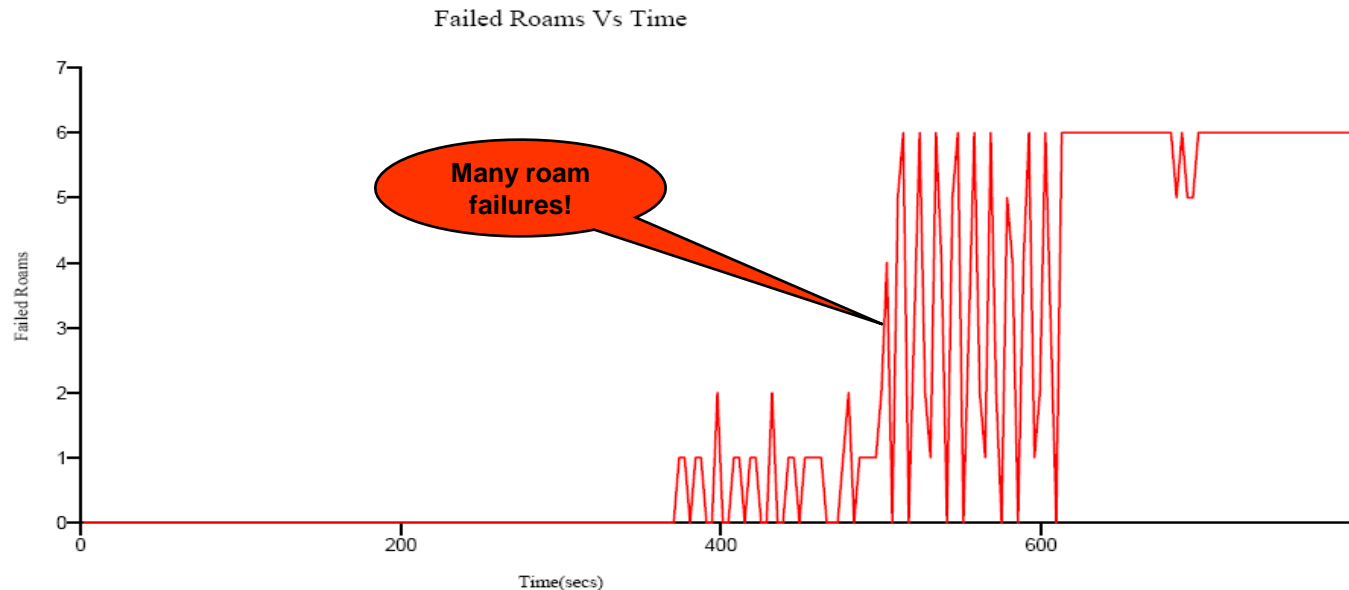
❖ This problem was traced to a WLAN controller bug

- Could not have been found without VeriWave's performance test equipment

Example 2: A Roaming Catastrophe

❖ 20-AP roaming test with 200 clients failed after 10 minutes

- With less clients, or less APs, equipment worked fine
- When number of clients went up, roam failures (dropped client connections) seen
 - 450 roams failed out of 1400



❖ Problem was also traced to a WLAN controller bug

- EAP processing failures occurring after sustained high roaming loads

Total Cost of Ownership

Performance test equipment pays dividends in many ways

❖ **Increased test coverage**

- Reduces hidden bugs, customer issues

❖ **Automated tests of every release**

- Speeds up routine testing
- Improves time to market

❖ **Reduced setup time**

- Run tests in minutes, rather than spend hours setting up

❖ **Elimination of manual analysis**

- Automated reports avoid human error & data reduction



What Happens Next?

WiFi testing is only getting more complex

- ❖ **802.11n equipment on the horizon**
 - RF issues will be multiplied
- ❖ **WiFi equipment increasing in scope & complexity**
 - Meshes, load balancing, fast roaming, stateful firewalling, ...
- ❖ **WiFi technology embedding itself everywhere**
 - Other kinds of LAN equipment: routers, services blades, ...
 - Vertical applications: retail, hospitals, warehouses, factories, ...
- ❖ **Scalability & performance test needs keep increasing**
 - New technologies = new challenges, but time-to-market remains
 - We need to address many more real-world issues

VeriWave enables real-world performance problems to be addressed in a controlled and repeatable test environment

Conclusions

The WLAN deployment landscape is changing

Sophisticated applications & increasingly complex standards raise the bar on WLAN performance

A new approach to WLAN testing is required

Scalable & automated performance testing essential for time-to-market & profitability