



Voice over Wi-Fi

Preparing the Wireless LAN for VoIP

Joel Conover
Principal Analyst, Enterprise Infrastructure
Current Analysis, Inc.



Streetwise Intelligence.



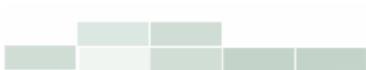
Agenda

- Voice over Wi-Fi: Enterprise Value Proposition
- Technical Challenges
- Impact on Existing Networks
- Network Design Requirements
- Vendor Feature Requirements
- Dual Mode Challenges
- Enterprise Vendor Status Quo
- Design Recommendations
- Summary & Questions



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VoWiFi: The Centerpiece of Enterprise Fixed Mobile Convergence

- Voice over Wi-Fi is the centerpiece of enterprise fixed-mobile convergence
- Voice over Wi-Fi is an issue of growing importance for enterprise IT managers & CXOs
- Voice over Wi-Fi is a complex, multi-vendor issue further confounded by interoperability and design challenges at the enterprise level.



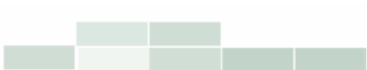
Voice over Wi-Fi Value Proposition Quantifying the technology benefits

- Offers the ability to leverage a single, IP-based access infrastructure for fixed and mobile telephony
- Provides access to Enterprise Telephony features regardless of location
- Promises a new generation of converged, presence aware communication capabilities for enterprise users
- Delivers the capability of truly Mobile data Applications (CRM, ERP)
- Can be used to offset local coverage deficiencies on the public wireless network



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Technical Challenges

IEEE 802.11 Alphabet Soup

■ IEEE 802.11

- .11a – 54 Mbps in the 5.8 Ghz band
- .11b – 11 Mbps in the 2.4 Ghz band
- .11g – 54 Mbps in the 2.4 Ghz band
- .11n – High Throughput (>100 Mbps) access
- .11e – QoS enhancements for the 802.11 MAC
- .11h – Indoor & Outdoor channel selection
- .11i – Security enhancements
- .11r – Roaming Improvements

■ Wi-Fi Alliance

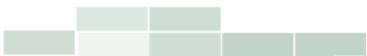
- WMM – Pre-standard 802.11e compliance certification
- WPA2 – 802.11i compatibility and interoperability cert
- Also certify basic 802.11a,b,g behavior, EAP behavior, WPA v1 behavior, and 802.11d/802.11h behavior



Technical Challenges

At the Handset

- QoS Standards Compliance
- Location-Aware Authentication
- Transport Security
- Dual Mode Convergence
- Efficient Power Management

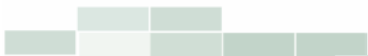




Technical Challenges

On the Wireless Network

- QoS Standards Compliance
- Broad Spectrum Deployment
- Intelligent Spectrum Management
- Multi-Channel APs and Antennae
- Location-Aware Authentication
- Transport Security

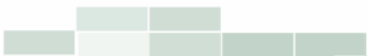




Technical Challenges

On the Wired Network

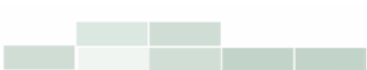
- QoS Standards Compliance
- Wired to Wireless QoS Mapping
- Gatekeeper functionality/bandwidth reservation
- Unified Identity Access Management





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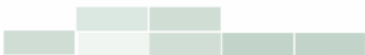




Voice over Wi-Fi : Impact on Existing Networks

Effects on the Wired LAN:

- Bandwidth is cheap and plentiful
- QoS standards well defined
- QoS features are pervasive in modern infrastructure
- Worst case: QoS only really necessary at choke points
- Gatekeeper essential for call admission control
- Security Considerations : Not all users are trusted

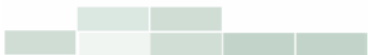




Voice over Wi-Fi : Impact on Existing Networks

Effects on the Wireless LAN:

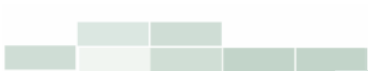
- Bandwidth is limited and under contention
- Transport is a shared medium
- QoS is necessary everywhere
- Calls use up to 350 Kbps with IP overhead
- Most devices today are operating in 802.11b band
- Clients cannot be forcefully load balanced





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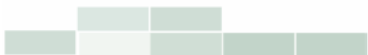




Voice over Wi-Fi : Design Requirements

Moving beyond simple wireless data access

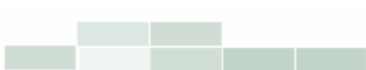
- Universal Coverage (Stairwells, Elevator Shafts, etc...)
- Layered spectrum support... “pancake” coverage
- Location services - asset tracking and emergency response
- Dense coverage for optimized power management
- Manageable authentication layer – this is not a data environment





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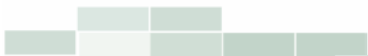
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Vendor Feature Requirements

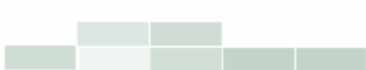
- RF Modeling with Integrated Survey and Dynamic Feedback
- Support for SpectraLink SVP, WMM, and 802.11e
- Fast Roaming support (802.11r)
- ...VoWiFi based diagnostic and monitoring tools
- Location Tracking support





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Enterprise Perspective for Dual-Mode

Dual-Mode Benefits

- Extended reachability for employees
 - improved productivity
- Mobility for primary line appearance
 - delivers a competitive advantage
- Reduction in number of telecom costs and contracts
- Access to enterprise features from mobile device
- Improved Signal Reliability in building/on campus

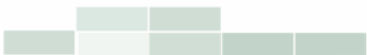
Dual-Mode Challenges

- Battery Life!
- Extending Enterprise Features to Dual-Mode Handsets
- Providing Split Billing for Multi-Line/Multi-Function use
- Seamless handoff between networks
- Intelligent Network Selection



Service Provider Dual-Mode Challenges

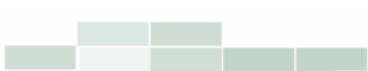
- Dual-Mode is the killer app for voice over Wi-Fi.
 - Some form of dual-mode convergence is inevitable,
 - Starting in the largest enterprises first
- Dual-Mode will move billable voice minutes off the SP grid; “Data minutes” will ultimately dominate this application.
- Dual-mode opens new enterprise integration and integration services revenues
- Dual-mode creates enterprise managed services market
- Today’s wireless carriers are far too focused on fixed line replacement.
- SPs MUST take an active role in crafting fixed-mobile convergence offerings.
- SPs must design a realistic billing model for enterprise usage





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Standards Compliance : QoS

QoS via Wireless Multi-Media (WMM) –IEEE 802.11e

- IEEE 802.11e was finalized in Calendar Q4-05, but Wi-Fi Alliance hasn't defined final certification strategy, and...
- WMM is purely optional Wi-Fi Alliance certification today
- Few vendors have current WMM Certification (Cisco, Symbol as of Friday Nov 11, 2005)
- WMM requires significant changes to the 802.11 MAC. Upgradeability is fairly certain, though performance of older, upgraded APs may be suspect.



Standards Compliance : Security

Security via Wireless Protected Access v2 (WPA2) – IEEE 802.11i

- IEEE 802.11i is an official standard, and has been for just over 1 year (June 24, 2004)
- Aruba, Cisco, Trapeze, Symbol, Proxim have certified their enterprise solutions
- Most other vendors included via partnership: 3Com, Alcatel, Nortel, Enterasys, though they haven't earned certifications
- Some vendors missing WPA2: Siemens, Extreme, Foundry...
- This is the standard, folks. Let's get with it.
- The Truth: Many older APs were not upgradeable due to new encryption requirements.

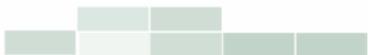


Why vendors have their own WLAN Agenda

Security, Performance, and Roaming Issues

- Why does Cisco, Avaya, Alcatel, Siemens, etc... need its own 'enhanced' WLAN solution?
- Authentication performance (time, capacity) is very low
- "fast" roaming is a myth in uncontrolled environments
- Suppliers have been slow to achieve standards compliance
- Revision tracking creates interoperability nightmares

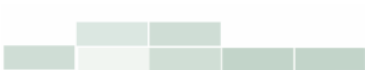
- Standards such as 802.11r (Fast Roaming) will help, but depend on universal adoption and uniform implementation.





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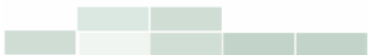
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Design Recommendations

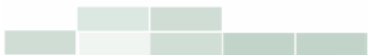
- What recommendations can you offer me?
- How can I ensure adequate coverage?
- How can I ensure adequate performance?
- How can I ensure adequate security?
- How can I ensure reliable roaming?
- How can I ensure reliable emergency services?





What recommendations can you offer me? Best Practices for WLAN design and deployment

- Deploy dual-mode a+bg access points everywhere
- Standardize on a single corporate WLAN client for PCs
- Deploy extra access points to be used for security
- Use a WLAN modeling tool
- Standardize on WPA2 as a security model where possible

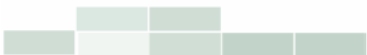




Design Recommendations

How can ensure adequate coverage?

- Start with WLAN modeling, pre-site qualification
- Deploy, then site survey
- Deploy a solution that does real-time tuning
- Be prepared to augment coverage with APs for dead spots
- Anticipate hot spots – the water cooler effect
- → This is where spectral capacity is crucial





Design Recommendations

How can I ensure adequate performance?

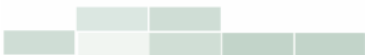
- Design with the assumption you will get one level less performance than you architect for.
- Why?
 - As WLAN usage grows, background noise will rise.
 - This affects SNR.
 - SNR directly impacts range.
 - Performance decreases with range.
- Site planning and survey tools
 - 100 foot rule
 - Beware of rogue RF sources
 - Performance is much more deterministic in an environment where spectral crowding is not an issue



Design Recommendations

How can I ensure adequate security?

- Use the strongest security available for a device.
- WPA2 for windows based clients
- Know that WEP is not secure in any case, WEP-40 and WEP-128 provide obscurity only, not security
- Deploy a supplicant if security is critical
- Deploy a security overlay, or better, use a vendor that can offer a third party security overlay using existing APs.
- Basic security vs. compliance-driven security
- Don't count on IPsec or SSL





Design Recommendations

How can I ensure reliable roaming?

- Roaming is easy
- Roaming + Security is not so easy
- Look for Pairwise Master Key pre-caching (PMK precache)
- This is a significant part of the 802.11r draft
- Ask for documented benchmarks for roaming in WPA2 environments
- Check your specs – many handhelds don't do WPA2 yet...
- Will your access architecture be capable of protocol-aware call admission control?
- Proprietary mechanisms have the best performance today



Design Recommendations

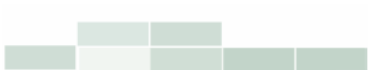
How can I ensure availability of emergency services?

- Location Awareness
- Location Awareness must be integrated with e911 responder systems.
- All solutions today require heavy custom integration
- Look for an architecture with a solid location tracking system and an API for accessing that data on the fly.



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Conclusions

- Fixed Mobile Convergence will drive the demand for Voice over Wi-Fi and dual-mode applications
- Enterprise customers need to re-think sparse deployment model for Wi-Fi if voice is going to be a consideration
- Handset vendors and PBX vendors need to accelerate FMC efforts
- Service Providers should be developing a fixed-mobile convergence battle plan that isn't shadowed by fixed line replacement strategies.
- WLAN equipment vendors need to implement and certify to the latest standards. There is no excuse for not supporting a year-old security standard.
- PBX vendors need to continue to package solutions in a way that ensures a reliable and high quality mobile experience.



Conclusions

- The WLAN handset market is immature.
- The WLAN infrastructure market is maturing, but even standards compliance (which is often lacking today) does not ensure quality communications.
- Additional standards are required to improve roaming performance in Wi-Fi environments.
- Native support for PBX functionality is still largely only a vision.
- The vendor community needs to stop depending on proprietary standards, proprietary implementations, and legacy standards.
- Despite all this, we need to architect today for a next generation voice-over-WLAN capable network

