

Enterprise-grade Voice over Wireless LAN



Delivering on the Promise of Enterprise Mobility

Version 2.0

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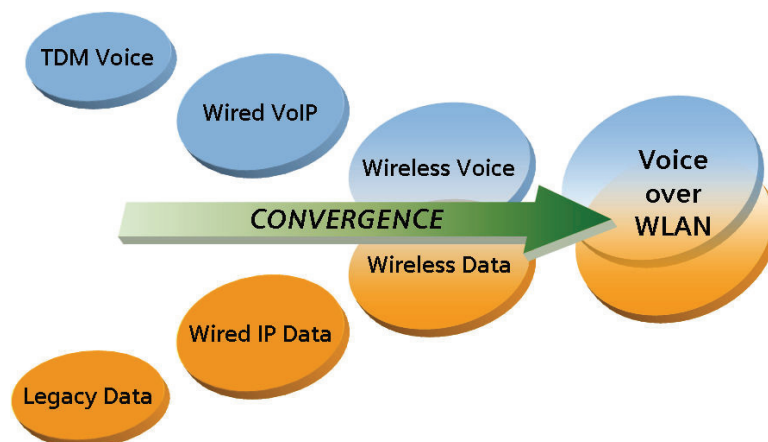
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Introduction

Voice over IP (VoIP) has presented a unique opportunity for enterprises. Convergence – the merging of data networks and voice networks over a common IP infrastructure – can offer a dramatic reduction in the capital and operational expense of maintaining separate voice and data infrastructures. Beyond these cost savings, the ability to host voice and data on the same network can lead to improvements whereby data applications can leverage unique multimedia capabilities, while voice and real-time multimedia applications are able to take advantage of rich enterprise data features that can enhance communications in a manner that can reduce the need for costly face-to-face meetings. Additionally, convergence can lead to a unique synergy resulting in the development of new real-time applications.

An important element that is missing from this equation is mobility. The transition of VoIP to the wireless space is an inevitable extension of this trend, since Voice over WLAN (VoWLAN) extends the reach of a company's IP telephony and multimedia communication systems, "untethering" enterprise workforces from the confines of their offices, and opens the door to a new generation of wireless converged network applications.

Figure 1.
The move towards converged wireless networks.



Given its rapid end-user acceptance, it is not surprising that wireless LANs have come to the fore as a growing part of the enterprise communications landscape. Early issues such as security have been addressed and companies are now systematically consolidating access points into wireless enterprise infrastructures.

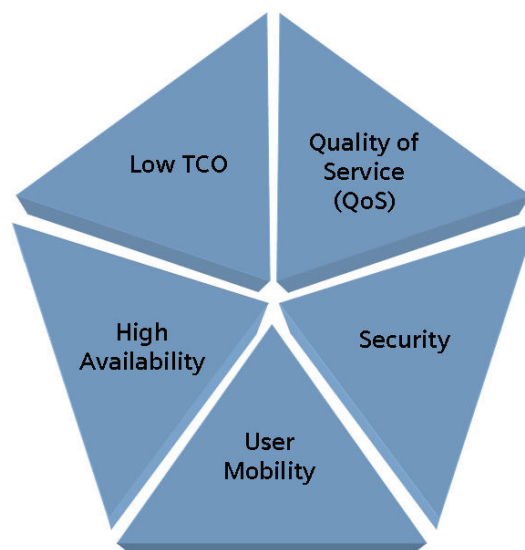
Providing real-time communication like voice or video over WLAN is a technically challenging task. The users of mobile devices expect at least the same functionality and performance they receive from traditional voice solutions. However, wireless networks were originally designed for the wireless transmission of data. Therefore, adding voice presents several challenges that must be resolved before VoWLAN can supplant traditional wireless voice solutions: best-in-class voice quality, robust security embedded in the corporate security model, support for both on and off-site mobility, high availability, and low total cost of ownership (TCO).

To address these challenges, the entire wireless infrastructure must be carefully engineered to deliver an integrated end-to-end voice solution. With its broad portfolio of leading-edge wireless LAN infrastructure equipment, wireless handsets, and voice communications systems – as well as a range of service offerings that bring a wealth of experience in delivering enterprise-grade voice solutions with attention to application integration and the unique needs of vertical markets – Siemens is uniquely able to provide an integrated VoWLAN solution that meets the real-time voice communication requirements of the modern enterprise.

What is Enterprise-grade VoWLAN?

Creating an enterprise-grade VoWLAN solution is a technological challenge that effectively sets the bar higher for WLAN design and performance than for data-only implementations. Some vendors have introduced enterprise-grade VoWLAN solutions at the expense of the data services that WLAN was originally intended for, rather than balancing the two. Voice networks handle mission-critical conversations among employees, with customers and with partners. Enterprise-grade communication must serve these users' requirements. For WLAN to become capable of delivering enterprise-grade voice, it must excel in the five key areas outlined below:

Figure 2.
Key VoWLAN Requirements



Quality of Service (QoS) and Performance

With few exceptions, traditional phone systems consistently provide high quality voice calls, and users will consider this as the benchmark for any voice technology. It is therefore incumbent upon WLAN vendors to deliver to this standard. End-to-end Quality of Service (QoS) – from the handset to the target application or network resource – is vital to achieving this.

The problem lies in the fact that, like previous generations of wired Ethernet, 802.11 wireless LANs utilize a shared medium where all traffic is prone to queues and collisions. A series of mechanisms to avoid or compensate for collisions are available through the standard, but because bandwidth is in contention between a number of data and voice users, traffic queues still form at wireless devices, and this can introduce noticeable delays between packet transmissions. Without a standardized traffic prioritization scheme, it is not possible to distinguish between voice and data traffic. While occasional disruptions might be acceptable for data applications as long as overall throughput is high, real-time voice demands a constant stream of throughput to maintain call quality.

There are two different yet complementary ways to resolve this issue:

- Devise mechanisms to prioritize and synchronize the transmission of voice packets.
- Create mechanisms that look directly at the air interface and optimize radio frequency (RF) transmission to minimize contention.

The differences between how data is transported along wired LANs and wireless LANs are significant enough to prevent the two from sharing a common QoS scheme. In contrast to the relatively mature QoS standards for wired LANs, many wireless QoS packet prioritization mechanisms used today are proprietary, with WLAN infrastructure or handset vendors trying to establish partnerships around their solutions. Of note here is VoWLAN handset vendor

SpectraLink, whose SVP protocol has become a de facto standard to support QoS using its VoIP handsets.

Siemens is strongly in favor of adopting a standards-based approach to WLAN QoS. Siemens supports the newly ratified IEEE 802.11e specification, particularly the aspects that are addressed by the Wi-Fi Alliance's WMM (Wi-Fi Multimedia) standard. These standards are devised with the intention of satisfying the industry's most urgent WLAN QoS needs, but in end-to-end Siemens VoWLAN environments, Siemens also sees the potential to build upon the 802.11e foundation to deliver enhanced value.

Because enterprise WLAN implementations can span multiple physical locations, with each one being connected to the other through the wired network, it is also vital that the QoS mechanisms applied at the WLAN level are easily integrated with QoS mechanisms in the wired network in order to provide end-to-end quality of service.

Efficiently managing RF transmission is the other way to address voice quality issues. Because collisions and queues are inherent to the technology, one of the best ways to improve voice quality over the WLAN is to prevent these things from happening by minimizing network congestion. By cooperatively adjusting signal strength and channels, access points can make sure that the network is not overly saturated in any one area.

Siemens HiPath Wireless products focus on both packet prioritization and RF management to offer rich QoS. The HiPath Wireless Portfolio includes support for the 802.11e and WMM industry standards for wireless LAN QoS, and has a unique Radio Frequency management capability that dynamically reduces channel and frequency conflicts. While this standards-based approach is the preferred solution, Siemens also supports SpectraLink SVP. As a result, Siemens helps to maintain high-quality enterprise-grade voice communications with minimal jitter, delay, or packet loss.

Security

For a more detailed analysis of WLAN security issues and Siemens' security implementation, the Siemens white paper "Enterprise-grade Wireless LAN Security" is recommended.

Largely because wireless traffic travels through the open air, the perception of WLAN as being inherently insecure has been a major barrier to widespread adoption in the enterprise. This perception wasn't helped by the fact that there were security flaws in early standards and implementations – as well as widely publicized security incidents. However, today's standards and technologies have greatly improved to the point of making WLANs secure for the enterprise.

These issues are even more intense in the context of voice. Proponents of VoIP – both the wired and wireless variety – have had to grapple with the fact that, because traditional voice solutions reside on their own infrastructure, many people have been led to believe that communications are somehow more secure than a voice solution that shares the medium with data traffic. This is largely a misconception, as experts can clearly demonstrate that someone with malicious intent can compromise a traditional voice session with equal ease. Nonetheless, this perception has created a baseline expectation of security that VoWLAN solutions must meet or exceed.

Regardless of whether the wireless LAN is delivering voice or data traffic – or both – security is centered on three core elements:

Data Confidentiality and Integrity. Ensures that data can only be read by the intended recipient(s) and that messages are unaltered during transport. This is achieved through encryption and hashing, respectively.

User Authentication and Access Control. Controls who can use the network, and what resources they are allowed to access.

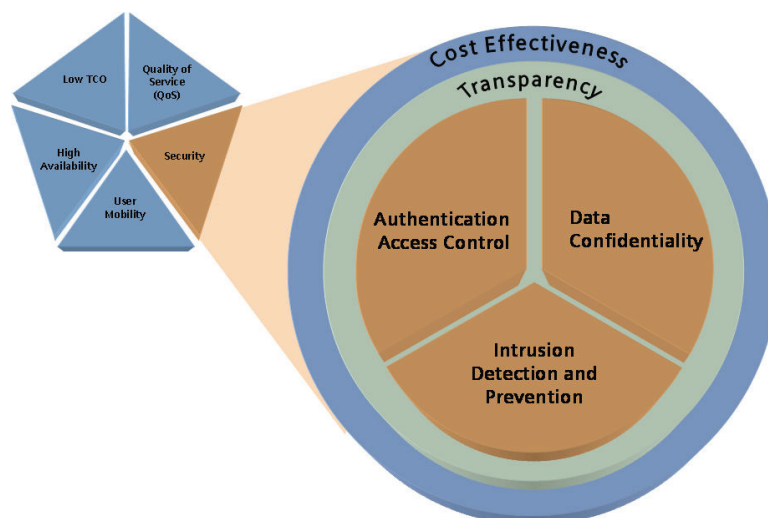
Intrusion Detection and Prevention. Makes sure that all wireless access points and clients within the airspace are identified, and unauthorized entities can be prohibited.

The recently IEEE-ratified 802.11i security standard addresses the first two issues by mandating the use of highly sophisticated data encryption and user authentication mechanisms. The Wi-Fi Alliance certifies vendor compliance with 802.11i through its WPA2 (Wi-Fi Protected Access version 2) program. Siemens is an active proponent of these standards, and is continually developing its wireless security solutions as they mature. Beyond this, Siemens has also taken measures to make it easy to integrate with existing wired LAN security mechanisms like RADIUS authentication or IPSec VPNs.

The third security element – intrusion detection and prevention – doesn't have the luxury of an open standard to provide guidance, so vendors generally approach it through proprietary means. While implementations may vary, they all generally utilize access points as "sensors" to continually probe the airspace for rogue access points or "ad hoc" wireless networks that may be attempting to infiltrate the corporate network infrastructure, and then report them to a central server upon detection.

Implementing these three security elements also needs to take two other factors into consideration. First, security policies must be easy to implement and manage to ensure that they are cost effective. Second, the solution must be transparent enough to ensure that legitimate users are not impeded by slow or complex security mechanisms.

Figure 3.
WLAN Security Requirements



Siemens' WLAN is architected for enterprise-grade security through its support for the latest security standards and an innovative approach to intrusion prevention. Coupled with an intuitive management interface, the HiPath Wireless Portfolio secures enterprise voice communications in a cost-effective manner that does not compromise usability.

User Mobility

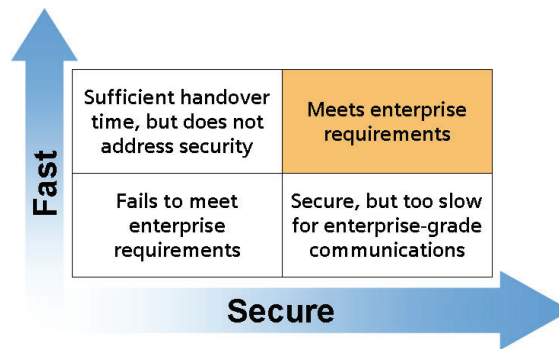
Regardless of the technology, wireless users expect to be able to roam freely through the enterprise and have communication services available without interruption or service degradation. In VoWLAN terms, roaming is when a user session moves from one access point to another. Because of user expectations for mobility, it is vital that VoWLAN solutions seamlessly bridge voice communications when users move across the enterprise, even as they move across the coverage range of access points.

Voice session roaming and access point handover are critical features for enterprise-grade user mobility, and a VoWLAN solution must do so in a manner that is both fast and secure. A "fast" VoWLAN handover is one where there would be an imperceptible disruption to a voice session when the user migrates from one access point to another. Roaming delays exceeding 100 ms are considered unacceptable for communications. The base 802.11 standard provides a mechanism that enables fast roaming and handover by allowing client devices to associate with a new access point if the signal

strength of the current one decreases – for example, if the client is roaming out of the range of its current access point. However, this mechanism does not satisfy enterprise-grade voice requirements, as it doesn't take the overhead introduced by security into account. As explained in the previous section, enterprise VoWLAN requires robust security, of which user authentication is a vital component. The process of handing a user off to a new access point would require re-authentication that would introduce enough delay to disrupt voice sessions.

To address the issue of slow hand-offs associated with re-authentication during roaming, the 802.11i security standard has introduced the concept of pre-authentication, which makes it possible for handsets to proactively authenticate with adjacent access points before they move out of the range of the original access point. By implementing this standard, Siemens solutions make it possible for secure handover to occur in less than 40 ms. Furthermore, Siemens is actively engaged with the IEEE 802.11r working group, which is dedicated to developing a highly-efficient standard for roaming within a wireless network.

Figure 4.
Roaming Requirements



The Siemens Wireless Portfolio also includes a WLAN controller that can be deployed flexibly across a company's virtual network to coordinate access points. As a result, fast and secure access point handover is possible across the distributed enterprise, even at remote or branch offices.

High Availability and Reliability

Wireless real-time communication must provide the availability and reliability of wired communication. With any telephony system, it is unacceptable to pick up the phone and not have a dial tone; this demand is even more vital for local-area phone systems. This imposes requirements not only on the WLAN infrastructure but also on the WLAN devices.

Availability is critical to enterprise-grade real-time voice communication. All technical components of the network must allow for a fail-over strategy in case of an outage. If access points become unavailable, automated fail-over mechanisms following the lines of the RF management may be used. Similarly, fail-over mechanisms are required for WLAN controllers. Siemens enterprise-grade WLAN solutions provide the availability and reliability enterprises expect from communication solutions.

Availability also hinges on device-level power management. Cell phones and cordless telephones achieve much of their extended talk and on-air time by elaborate power management schemes provided by the corresponding wireless standards. These schemes allow the phone to reduce power consumption and stay in sleep mode as much as possible, only "awakening" if a frame transmission occurs. To derive benefits from a power management scheme, there must be tight integration between handsets and the wireless infrastructure, and Siemens is in a unique position to deliver both solution components, with integrated features during stand-by and during calls.

Low Total Cost of Ownership (TCO)

The financial impact converged networks bring about in terms of increased availability and productivity are significant, but most managers also want to

be sure that there is a cost benefit. The TCO of wireless solutions is largely driven by installation and set-up, management and administration, and investment protection. The cost justification for implementing any wireless solution is derived largely from operational efficiencies in these areas, and well-designed solutions should address them through automated deployment mechanisms, streamlined administration, powerful management and service tools, and a scalable, future-proof architecture. While these elements are essential in determining the TCO of any data or voice solution, VoWLAN is also subject to another criterion: the TCO of a converged voice and data WLAN infrastructure should be significantly lower than the TCO of managing wireless voice and data separately.

Siemens offers a solution that addresses all of these issues. A powerful yet simple deployment capability means that the WLAN infrastructure can be deployed across the enterprise with ease. The technology can be deployed on top of any existing wired network infrastructure, leveraging and even extending existing investments. A broad range of unique policies for voice and data users can be configured from the same powerful management interface. HiPath Wireless uses a centralized architecture that makes it easy for the solution to grow along with the enterprise's demand for wireless service, ensuring that companies don't need to replace equipment as they grow. The fact that Siemens is able to efficiently deliver all of these elements for both voice and data by using a single management interface and WLAN infrastructure also creates a highly efficient converged architecture that can yield considerable TCO savings over separate dedicated solutions.

The VoWLAN Balancing Act

In an ideal world, wireless LANs would be able to deliver voice with the highest level of quality, security, mobility, and reliability, all in a cost-effective manner. However, the reality is that there are a number of interdependencies between these elements, meaning that excellence in one area may require compromise in another. For example, deciding to implement an air-tight security solution may mean having to accept lower call quality or higher latency times. In the event that a manager was unwilling to compromise on any of these areas, they could compensate by spending more on infrastructure, but this would come at the price of a higher TCO. As a result, it is important for managers to be aware of the interplay between all five of these elements, and determine what is required of each element to deploy voice in their specific enterprise environment. Siemens helps make this balancing act easier by offering a strong and flexible solution that allows managers to customize VoWLAN solutions to their needs.

The Siemens VoWLAN Solution

To achieve enterprise-grade WLAN solutions Siemens HiPath has architected a unique portfolio of WLAN infrastructure, WLAN hard and soft phones, applications, and WLAN services complementing each other in an optimal way to deliver end-to-end mobility solutions for the enterprise.

Figure 5.
The Siemens HiPath Wireless Architecture



The HiPath Wireless Portfolio

Unlike the previous generation's WLAN products that were designed primarily to accommodate data traffic and, therefore, have been unable to deliver the functionality and quality of service necessary to provide enterprise-grade voice, the HiPath Wireless solution is based on the next generation of WLAN architectures. A device called the controller coordinates access points to achieve a powerful, centralized enterprise-grade solution. This centralized coordination is similar to that used in cellular networks, and provides a number of benefits – like fast handover – that are unachievable with older decentralized solutions.

The controller and access points intelligently share functionality to achieve the optimal balance of performance, security, and ease of management. While complex, time sensitive functions that demand continual scanning or packet processing – including QoS, encryption, and dynamic radio frequency management – are handled by the access point, the controller handles global functions like user segmentation, configuration, roaming, and security policy enforcement. By balancing functionality in this manner, the HiPath Wireless solution delivers optimal voice performance that can affordably scale up to the largest enterprise deployments.

WLAN Clients and Devices

Siemens has a long history as a leader in the mobile and wireless phone markets. Siemens has also been an innovator in VoIP wired phone technology. This combination of phone development expertise and innovative WLAN technology is the key to achieving success in the client market.

The optiPoint WL1 and WL2 series of VoWLAN phones – as well as the optiClient range of software phones that run on a variety of PC and PDA platforms – exhibit many of the existing features that wireless phones provide today (e.g. polyphonic ringer melodies, graphical display and several applications on the phone). CorNet-enabled phones will make all the rich enterprise telephony features and applications of the HiPath wire line environment available in wireless installations. Thus, the end-user experience of WLAN phones will be equivalent to wired IP phones from Siemens. Furthermore, optiPoint phones feature a number of sophisticated power management capabilities to ensure availability for extended periods.

HiPath Integration

In addition to providing rich telephony functionality over WLAN, these end-to-end solutions are architected to integrate with the Siemens' HiPath OpenScape suite of real-time, presence-aware applications. Real-time collaboration, presence-awareness, and wireless mobility solutions are powerful concepts that become even more beneficial to enterprises when integrated.

Wireless IP telephony is also a key component of Siemens' LifeWorks concept. LifeWorks unifies IP communication across the traditional boundaries between home, public, and enterprise networks, providing a seamless user experience. WLANs will in fact play a dominant role in all those LifeWorks domains. Application functionality may be enhanced if used over wireless LANs. A powerful example is presence. Users may allow the presence mechanism to retrieve presence (i.e. location) and availability information from the WLAN system.

While standards and partnerships will enable interoperability between systems of different vendors, end-to-end solutions provided by Siemens have unique advantages. Integrated solutions from Siemens allow HiPath products – HiPath Real-Time IP Communication Systems, HiPath WLAN infrastructure, HiPath WLAN phone/soft-client, HiPath Management, and HiPath Applications – to complement each other to deliver converged VoWLAN solutions that achieve unparalleled performance and integration. Customers will see the result in superior quality, functionality, and TCO as their data and voice are run over a single wireless infrastructure from a single vendor.

HiPath Professional Services are also available to bring the entire solution together through a full line of consulting services. From preliminary consulting all the way to future-proof project implementation, HiPath Professional Services

For more details on HiPath OpenScape, the Siemens white paper "Real-time Communication meets Real-time Information" is recommended.

For further reading on LifeWorks, the Siemens white paper "LifeWorks – Unified Domains and Unified User Experiences" is recommended.

can intelligently integrate wireless solutions into your existing infrastructure. These services are delivered through an efficient worldwide network, meeting the broad needs of enterprises across the globe.

Siemens enjoys a strong position in vertical markets such as Hospitality, Manufacturing, Transportation, Medical, and Education, and the numerous benefits of WLAN applications become even more powerful when applied to those verticals. Unlike dedicated data and voice competitors, Siemens has the advantage of having built lasting relationships with hotels, convention centers, factories, logistics companies, and hospitals across the globe. As a result, Siemens has developed an intimate understanding of the business and technology needs that are driving these verticals, which has led to the ability to deliver unique integrated solutions that competitors simply can not match.

Conclusion

Real-time VoIP communication is going wireless, and Siemens is positioned to provide true enterprise-grade converged solutions. This paper has established that VoWLAN implementation decisions should take the following criteria into consideration:

1. **Quality of Service.** Can the WLAN adequately handle the unique requirements of voice?
2. **Security.** Does the WLAN ensure that only authorized users can access it, and that voice calls are confidential?
3. **Mobility.** Can voice sessions maintain quality as users move across the enterprise in a manner that is both transparent (fast) and secure?
4. **High Availability.** Will users always be able to get a dial tone, even in the event of failures or extended usage?
5. **TCO.** Will the VoWLAN solution easily integrate into an existing network environment to minimize ongoing operating costs and leverage existing capital investments? Will convergence of voice and data yield TCO advantages over maintaining two separate infrastructures?

In conjunction with the broad HiPath enterprise portfolio, Siemens is able to offer enterprise customers truly unique end-to-end converged solutions. Such converged wireless solutions can voice-enable a number of business units or processes, giving rise to new applications as well as improved productivity and availability. Siemens' extensive background in vertical applications ensures that these solutions are tailored to meet detailed and complex business needs.

Wireless LAN is rapidly evolving yet maturing technology, and is now ready for enterprise-grade deployment. Integrating voice is a logical and important step in the deployment process, as it unleashes the potential of wireless LAN and provides a distinct TCO justification. Customers must rely on future-proof technology architected for growth and expansion, and Siemens ensures that HiPath Wireless LAN solutions will provide real-time voice communications that are truly enterprise-grade today and in the future.

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