CHAPTER 1

Voice over WLAN Introduction

About the Guide

Document Purpose and Audience

This guide is intended for systems design engineers who are responsible for designing, implementing, and operating the Cisco Voice over Wireless LAN (VoWLAN) solution.

Document Organization

This guide contains the following chapters:

Section	Description
This chapter	Provides an overview of the VoWLAN 4.1 solution.
Chapter 2, "WLAN Quality of Service."	Provides an overview of WLAN QoS and its implementation in the Cisco Unified Wireless Network.
Chapter 3, "Voice over WLAN Radio Frequency Design."	Provides an overview of the RF network requirements of VoWLAN deployments and a discussion of the RF deployment issues.
Chapter 4, "Voice over WLAN Security."	Provides an overview of WLAN Security as it applies to VoWLAN deployments.
Chapter 5, "Voice over WLAN Roaming."	Provides an overview of WLAN roaming fundamentals.
Chapter 6, "Voice over WLAN Campus Test Architecture."	Provides the configuration and design information for campus network design and configuration used in this design guide.
Chapter 7, "Voice over WLAN Unified Communications Test Architecture."	Provides configuration and design information for Unified Communications Architecture design and configuration used in this guide
Chapter 8, "Voice over WLAN Wireless LAN Controller Design and Configuration."	Provides configuration and design information for Cisco Unified Wireless Network design and configuration used in this guide
Chapter 9, "Voice over WLAN Troubleshooting and Management Tools."	Provides troubleshooting and management tools for the VoWLAN solution.
Chapter 10, "Cisco Unified IP Phone 7921 Implementation for Voice over WLAN."	Provides design and configuration information for the Cisco Unified Wireless IP Phone 7921G in the context of a VoWLAN environment.

Section	Description
Chapter 11, "Voice over WLAN Vocera Implementation."	Provides details for the Vocera Communication system used in this design guide.
Appendix A, "Deploying and Operating a Secure Voice over Wireless LAN Solution with Cisco Lifecycle Services."	Describes how to deploy and operating a secure voice over wireless LAN solution.

VoWLAN Solution Overview

The mobile user needs the same applications and services with the same accessibility, security, quality-of-service (QoS), and high availability delivered to wired users. Many users now enjoy the benefits of mobile access to their key enterprise applications through the Cisco Unified Wireless Network, but these applications are primarily based on data communications. Equally important within an enterprise is voice communication. The purpose of this design guide is to assist customers and systems engineers design, implement, and operate VoWLAN applications in an enterprise campus. To demonstrate these features this guide uses the Cisco 7921G VoWLAN Handset and Vocera B1000A badges, and builds upon the mobility, campus, unified communication, and location design guides from: http://www.cisco.com/en/US/netsol/ns742/networking_solutions_program_category_home.html

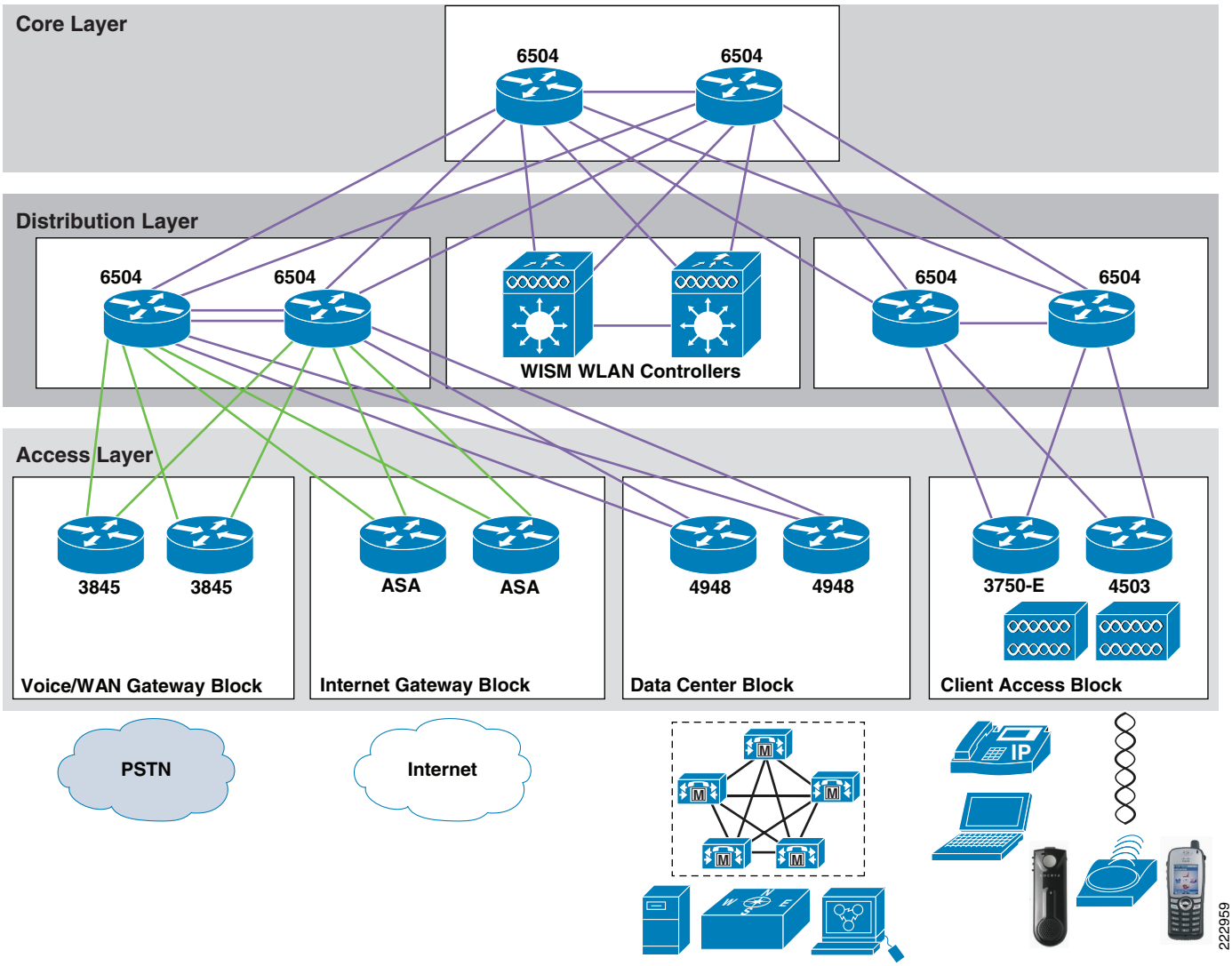
VoWLAN Solution Network Design Overview

The Cisco campus design (see Figure 1-1) is the platform used for testing and design of the VoWLAN solution. This Cisco campus design uses a typical hierarchical, access, distribution, core design. The following additional modules were included to this design for the VoWLAN solution:

- Services module to provide the Cisco Unified Wireless Network
- Data center module
- Voice WAN Gateway module
- Internet Gateway module

The VoWLAN solutions installed and tested for this design were the Cisco 7921G with the Cisco Unified Communications Manager, and the Vocera Communications System.

Figure 1-1 VoWLAN Solution Network Overview



Solution Benefits

Enterprises today are faster paced than ever before. Staying ahead of competition, success, and growth are dependent upon efficient employees, collaboration, and a timely business process. Today, we see that enterprises have a strong drive for efficiency, are looking to eliminate delays, and are dependent on team collaboration to support complex business processes. While maintaining a secure corporate data and voice infrastructure, enterprises are encouraging a mobile work style to get more done. Additionally, enterprises are not just streamlining processes through technology, but are also looking to increase their revenue and reduce costs with the latest technological trends.

Customer Requirements

The following are the customer requirements for deploying the VoWLAN solution:

- Reduce mobile cellular minutes—VoWLAN calls are free and employees would now use their VoWLAN handset on campus instead of their cell phone.
- Integrate Mobile and Enterprise Telephony systems—Mobile WiFi handsets can now be integrated with IP-PBX features and numbering plans and thus not have to return to their desk phone for certain features.
- No difficulty with cellular coverage since enterprises can deploy adequate access points to improve coverage.
- Provide mobile handsets for users that are not personal phones, in many enterprises it is inappropriate to be taking personal calls. A cell phones merges the personal and work phone into the same device, and despite the good will of the employee, many people do not feel that calling you on your cell phone is the same as calling you at work.
- In many industries the employee turn over makes the provision of a cell phones and expensing of cell phone calls difficult; therefore, the management of cell phone usage difficult. At the same time, communication with mobile employees is critical to business success. It is simpler and more cost efficient to provide a VoWLAN handset.
- Provide communications when other communications infrastructure is unavailable either due to emergency or lack of local services.

The need for a VoWLAN solution has grown because of the demand in different industry organizations as well. Industry organizations can take this solution and customize according to their needs. Two examples of industry organization that are looking to meet everyday requirements with VoWLAN are healthcare and retail organizations.

Healthcare

Many healthcare organizations today are burdened by multiple disjointed communication systems. A typical hospital may have several in-house phone systems, overhead paging systems, and pagers, and typically more than one data network. As the Forrestor 2006 survey –below- illustrates, these communication inefficiencies exacerbate staff shortages and impact care delivery. According to a study done by Forrester (2006):

- 65% of healthcare employees spend about 20-60 minutes / day just trying to reach staff.
- 66% search more than one channel to reach staff
- 84% said that time spent trying to reach staff impacts patient care. "Every minute engaged in tracking and locating others reduces a nurses availability for the patient."

Retail

Retail organizations can realize many benefits from deploying the VoWLAN solution, including:

- Improved customer service by freeing personnel from having to provide personalized service only from fixed locations
- Increased profits through operational efficiency and improved customer satisfaction
- Improved communication by giving phone services and voicemail to each store employee
- Improved responsiveness by making business applications, like inventory management, mobile with wireless phones

The Cisco VoWLAN solution can meet these requirements . Many businesses are turning to WLAN networking to give employees immediate access to the business applications and communication tools they need. By adding voice over IP capability to their wireless networks, they can further improve collaboration and responsiveness, and unlock the door to new cost savings. The Cisco wireless network is ready to support voice applications. VoWLAN allows businesses and other organizations to bring the mobility and flexibility of WLAN networking to their voice communications systems. With robust quality-of-service, diverse client support, and manageability, the solution enables the enterprise to take immediate advantage of IP communications to a campus workforce. The Cisco Enterprise Mobility solution streamlines business processes by providing anytime, anywhere access to critical information, and safeguarding information and network integrity in the new era of wireless threats. It delivers applications that transform business operations to deliver compelling benefits and are enabled on a simple, secure, and scalable unified platform for the lowest total cost of ownership. This VoWLAN solution is designed for businesses of all sizes that need to improve business processes, safeguard information and improve customer, partner and employee experience and loyalty.

Recommendations

During the research and development of this design guide, the following key findings were made:

- Planning, RF design, and site survey are critical parts of an optimal VoWLAN deployment.
- Auto-RF should be enabled in most cases for VoWLAN, but to allow Auto-RF to perform its role effectively, it requires a best practice RF design and site survey for VoWLAN. Just as in a static RF deployment, extra effort is required to maximize VoWLAN success.
- A simple choice between Auto-RF and no-Auto-RF is not required. There are a number of different options that may be a best fit for customers requirements. For example, there are the options when the Transmit Power Control (TPC) algorithms are run, and there are options upon the sensitivity settings for the Dynamic Channel Allocation (DCA), TPC, and Coverage Hole algorithms.
- Location and VoWLAN deployments are not incompatible. The required spacing of APs for VoWLAN deployment is very similar to that of a Location-Based Services (LBS) deployment. Additional APs may be required to meet the perimeter requirements of LBS. These additional APs are unlikely to add capacity to the WLAN system (particularly in the 2.4GHz band), and the additional APs are unlikely to have great impact upon the overall co-channel interference characteristics of the deployment.
- Depending on the shape of the WLAN deployment there may be little difference between a VoWLAN deployment and an LBS deployment, but is advisable to follow the LBS practice of ensuring there is perimeter placement of APs. This provides optimal location accuracy and likely assists in optimal Auto-RF behavior.
- The best strategy to address the co-channel issues that increase due to the higher density deployments of VoWLAN and LBS in 2.4GHz systems is to migrate as many devices as possible to the 5GHz spectrum which has more non-overlapping channels, and therefore less co-channel issues and higher capacity.

Table 1-1 lists the devices, roles, and releases of the products used in the VoWLAN 4.1 solution.

Table 1-1 Device and Roles

Device	Role	Software
6504	Campus Core	12.2(18)SXF9
6504	Campus Distribution	12.2(18)SXF9
6504	WLAN	12.2(18)SXF9
WiSM	WLAN	4.1.185
3845	Voice WAN gateway	12.4(15)T1
ASA	Internet gateway	7.2(2)
4948	Data center	12.2(25)EWA8
4503	Access	12.2(37)SG
3750-E	Access	12.2(37)SE1
2821	Branch Router	12.4(15)T1
MC7800	Unified CM	CM 6.0.1
7960	VoIP Handset	SCCP41.8-3-1S
7921G	VoWLAN Handset	CP7921G-1.0.4
MCS7800	Vocera Server	Vocera Server 4.0 [Build 1279] Vocera Telephony Server 4.0 [Build 1279]
B1000A	Vocera Badge	Vocera Badge V4.0 1273