VoWLAN Overview
With enterprises embracing wireless LAN for network access for data traffic, voice over wireless LAN (VoWLAN) is an increasingly attractive option to enable mobility and manage costs. Enhancements in WLAN technology enable reliable wireless connectivity for real-time applications like voice and video. ShoreTel offers best of class enterprise VoWLAN solutions in addition to unifying enterprise applications like instant messaging, email, voicemail along with contact center capabilities. Ruckus WLAN products based wireless network is well integrated with ShoreTel UC platform to provide highest quality VoWLAN solutions. This document describes the integration aspects in detail.

The Ruckus System
The Ruckus ZoneFlex system is a centrally managed WLAN system comprising controllers and 802.11 a/b/g/n APs. APs house unique antenna features for reliable and enhanced communications for real-time applications such as voice and video, as well as location tracking systems. BeamFlex combines a compact internal antenna array with patented control software to continuously optimize connectivity for each associated client that reconfigures in real-time to bypass interference and physical barriers. This unique feature combined with other features such as Airtime Fairness and SmartCast in Ruckus system ranks it as the Wi-Fi network of choice for real time applications.

ZoneFlex 7300 Series APs
The Ruckus ZoneFlex 7300 series delivers high-performance and reliable 802.11n wireless networking. The ZoneFlex 7300 combines patented dynamic beamforming and automatic interference mitigation to deliver consistent, predictable performance at extended ranges with 4dBi of signal gain and -10dB of interference rejection. The ZoneFlex 7300 delivers up to a 4-fold increase in signal range with lower packet error rates while reducing the number of APs required to deliver dependable Wi-Fi.

Zone Director Series
The Ruckus Wireless ZoneDirector series is the first enterprise-class Smart Wireless LAN management system that delivers a secure, robust and easily expandable WLAN solution. Capable of managing up to 500 ZoneFlex Smart Wi-Fi access points from a single location, the Ruckus ZoneDirector series is designed for simplicity and ease of use.

The ZoneDirector series integrates the Ruckus Smart/OS application engine that delivers advanced features such as smart wireless meshing, hot spot authentication, elegant guest networking and dynamic Wi-Fi security.

The ShoreTel System
ShoreTel offers organizations of all sizes more than mere VoIP services. ShoreTel delivers a complete VoIP business phone system that integrates voice, unified communications (UC), and contact center capabilities. Unlike many providers, ShoreTel’s VoIP telephone system is an all-in-one business communications solution; one that combines a distributed communications platform, intuitive user applications, IP phones, and an easy-to-use management system that integrates with leading business information systems.

ShoreTel Director
ShoreTel Director provides the core management of the ShoreTel UC System. This Web-based tool streamlines the management of all voice applications across locations into one best-in-class interface. ShoreTel’s

APPLICATION NOTE
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easy-to-use management tools simplify the maintenance and monitoring of your ShoreTel unified communications system. These tools permit centralized management from intuitive, Web-based interfaces. ShoreTel Director provides a single-screen view of the entire enterprise system using indicators to graphically notify administrators of the performance of all key components at all times.

Management software is installed on Windows 2008 server.

**ShoreTel Unified Communications Platform**

At the core of ShoreTel’s Unified Communications (UC) solution is a unique distributed platform that provides the system’s core communications capabilities. Purpose-built for IP, this open, highly reliable platform fits right in with your existing infrastructure, works seamlessly with your business applications and processes, and makes integrated business communication easy to deploy and manage. The UC platform integrates multiple facets of communications into a single distributed architecture to provide a range of rich capabilities. Features on the ShoreTel platform are easily accessed through ShoreTel IP Phones and the ShoreTel Communicator application suite, which includes full mobility capabilities. Since the platform is based on open standards, additional popular solutions, including Microsoft Outlook email, interactive voice response systems, voicemail-to-text and leading CRM solutions easily integrate to meet any business requirement.

**ShoreTel Mobility Router**

ShoreTel Mobility Router is an innovative network appliance that extends voice and UC capabilities to mobile devices, while supporting leading enterprise PBXs, wireless LANs and cellular carriers. ShoreTel Mobility extends voice and unified communications (UC) applications to a wide range of mobile platforms. ShoreTel Mobility enables businesses of all sizes to integrate leading smartphones and tablets with existing enterprise communication applications and infrastructure securely, simply and cost effectively. The solution consists of the patent-pending and highly scalable ShoreTel Mobility Router and the integrated RoamAnywhere Client application for mobile devices. Additionally, the solution’s fast and automatic selection of the best network (Wi-Fi or cellular, voice over 3G/4G) allows for optimization of cost, call quality and coverage.

**ShoreTel Softphone Client**

RoamAnywhere Client application for iPhone is used to verify integration with Ruckus WLAN gear. This softphone client can be downloaded from the app store.

**VoWLAN — Best Practices**

Voice being a real-time application over WLAN, extra care needs to be taken to follow best practices in designing the wireless network. Strictly following the below mentioned steps is a precursor to a better VoWLAN deployment.

**Signal Strength**

The site survey is a crucial component of Wi-Fi network design for voice applications. During site surveys, special attention needs to be given to signal strength.

Within the voice handset roaming space, make sure that signal strength is -65 dBm with Signal to Noise Ratio (SNR) between 20-25 dBm. Ruckus recommends that site survey for signal strength be performed using the actual handset instead of a laptop. Using the right client device will help ensure the survey is useful and yields accurate results.

Voice typically requires 100% coverage to ensure seamless voice service. This means it is particularly important to ensure minimum signal strength is available everywhere.

**Number of APs**

For roaming to be achieved, pay attention to place APs such that there is enough overlap of about 10-15 dBm in signals from both the APs.

**Power Symmetry**

AP and handset transmit power need to be matched. When Tx power is not balanced, a situation occurs wherein handset can hear AP and not vice versa as Tx power of handset is relatively low. Symptoms of this condition are client stickiness (client does not roam), dropped calls and constant connects/disconnects form the WLAN.
The simplest way to address this problem is by reducing the Tx power of the AP. Ruckus recommends not reducing the power less than half the maximum power on any given AP.

**Ruckus Configuration**

The following sections describe best practices and ways to configure Ruckus Wireless AP and Ruckus ZoneDirector WLAN.

**AP Configuration**

It is recommended to create a separate WLAN for the ShoreTel UC system — separate from other data WLANs. Typically traffic from this WLAN is also tagged with a unique VLAN for voice traffic over the wired network.

To create a separate SSID/VLAN for ShoreTel system on ZoneDirector, go to Configure-->WLAN-->Create New and create an SSID with required security settings.

**Tunnel Mode**

If the network setup is such that the APs are in separate subnets, it is recommended to tunnel voice traffic through the ZoneDirector. This can be enabled through “Tunnel Mode” option under advanced options setting for that particular voice WLAN as shown below.

Next, under the Advanced Options, select Attach VLAN Tag and enter the appropriate VLAN number, as shown above.

**Additional Configurations and Settings**

In addition to the above settings, there are a few advanced settings to consider:

**DTIM Configuration**

A Delivery Traffic Indication Message is included in AP beacon to notify the client that there is data waiting. This is important for handsets that use power save mode to conserve battery life. So, DTIM value is dependent on the handset. However, it is recommended to start with 1 or 2.

This configuration is done via command line interface on AP using the following command,

```
set dtim-period <wlan name> 2
```

**Mesh Mode**

Ruckus does not recommend running ShoreTel Mobility over a mesh network due to increased latency constituted by the mesh configuration. Hence mesh must be disabled on the controller for a VoWLAN application.

**Quality of Service Settings**

Ruckus prides itself on being simple to deploy and manage. In the case of QoS, traffic will be automatically classified by the SmartCast traffic engine and placed in the appropriate 802.11e queue.
Background Scanning

Background scans are performed by APs to evaluate radio channel usage. The process is progressive; one frequency is scanned at a time. This scanning enables rogue device detection, AP load balancing and self-healing. The default background scan setting is 20 seconds. Ruckus recommends the following settings.

1. During system configuration and initial setup of WLAN – Set background scanning to 20 secs (default value)
2. Once network is fully configured and has stabilized – Set background scanning to a value between 300 - 3600 secs

To change background scanning, go to Configure -> Services -> Background Scanning and change values as shown below.

AP Automatic Channel Settings

The Ruckus ZoneFlex system will automatically select the best channel settings for the APs in the WLAN. These automatic settings work well for ShoreTel Mobility implementations. However, there are times when a hard-coded channel plan may be desired when signal floor is noisy or standard channels have a lot of interference. Do this by going to Configure- ->Access Points and selecting a specific channel, as shown below:

Security

ShoreTel Mobility Wi-Fi RoamAnywhere client security is based on the smartphone where the soft client resides for iPhone, Android phones, Blackberry etc. Most smartphones support WPA2 security and this security procedure is recommended for maximum protection against devices connecting to that particular voice WLAN.

ShoreTel Configuration

For basic installation of the ShoreTel system, refer to “Planning and Installation Guide” from ShoreTel. Some of the best practices to be aware of during installation are:

- IIS – Enable IIS service
- FTP – Enable FTP service
- Static IP addresses for Management Server, ShoreTel Switch & Mobility Server

TOS bit setting

To ensure interoperability, the TOS setting used to classify voice traffic should match between the ShoreTel IP PBX and the Ruckus networking infrastructure. The Wi-Fi alliance recommendations for Differentiated Services Code Point (DSCP) settings are:
Table 1: Recommended DSCP to 802.1d mapping (based on 3.3.1 of WMM specifications)

<table>
<thead>
<tr>
<th>DSCP P2</th>
<th>DSCP P1</th>
<th>DSCP P0</th>
<th>DSCP —</th>
<th>DSCP —</th>
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<td>0x00</td>
<td>0</td>
<td>AC_BE</td>
</tr>
</tbody>
</table>

As seen in the table above, for voice priority (AC_VO), the recommended DSCP setting is 0x38 or 0x30, which translates to a TOS setting of 0xE0 or 0xC0.

A Ruckus AP will automatically classify traffic with a TOS marking of 0xE0 or 0xC0 for voice queue and a video queue of 0xA0 or 0x80. If traffic is not TOS marked (i.e. TOS = 0), heuristic classification will attempt to automatically classify the traffic by its patterns.

TOS is configured on the ShoreTel IP PBX through the ShoreWare Director, navigate to Administration > Call Control > Options, as illustrated below. Since the numbers are in decimal, the **TOS should be configured for 192 or 224.**
Configuring Jitter Buffer

Unlike TDM voice where voice is carried through a particular channel and always follows the same path, IP voice packets can be routed through different paths. Jitter buffer is a temporary storage to enhance voice quality by mitigating delay variations between arriving packets that take different route paths. If jitter buffer is too small, packets can be discarded. When jitter buffer is too large, it takes longer to process voice packets and hence impeding with conversational voice quality. Optimal value of jitter buffer is important and can be configured in the ShoreTel system as follows:

1. In ShoreWare Director, select Administration > Call Control > Options.

2. In the Maximum Inter-Site Jitter Buffer (msec) field, enter 300 to optimize voice quality for Wi-Fi networks.

Conclusion

VoWLAN is gaining grounds on account of the omnipresence of Wi-Fi and the proliferation of gadgets like smartphones, tablets and the like. It has extended from enterprises to healthcare, retail, hospitality etc. For real-time application such as voice, reliability and performance of the IP transport medium (wireless LAN) are critical to quality conversation. Ruckus Wireless and ShoreTel are fully integrated to address this growing VoWLAN segment with a suite of voice applications to meet market needs for reliable and good quality voice.