APPLICATION NOTE

Optimizing ShoreTel Voice Over Ruckus Wireless

Introduction

Ruckus Wireless is one of the leading wireless LAN manufacturers that provides a reliable and consistent Wi-Fi infrastructure. It is this solid WLAN infrastructure that makes it the ideal platform to extend ShoreTel's VoIP reach beyond the wired environment. The Ruckus infrastructure enables customers to use both purpose-built VoIP phones as well as their new and existing smartphones and tablets to make calls with superb voice quality over the wireless network, even when experiencing heavy data traffic. Ruckus' patented adaptive antenna array (BeamFlex™) and Quality of Service (QoS) (SmartCast™) technologies extends Wi-Fi range, reliability, and performance.

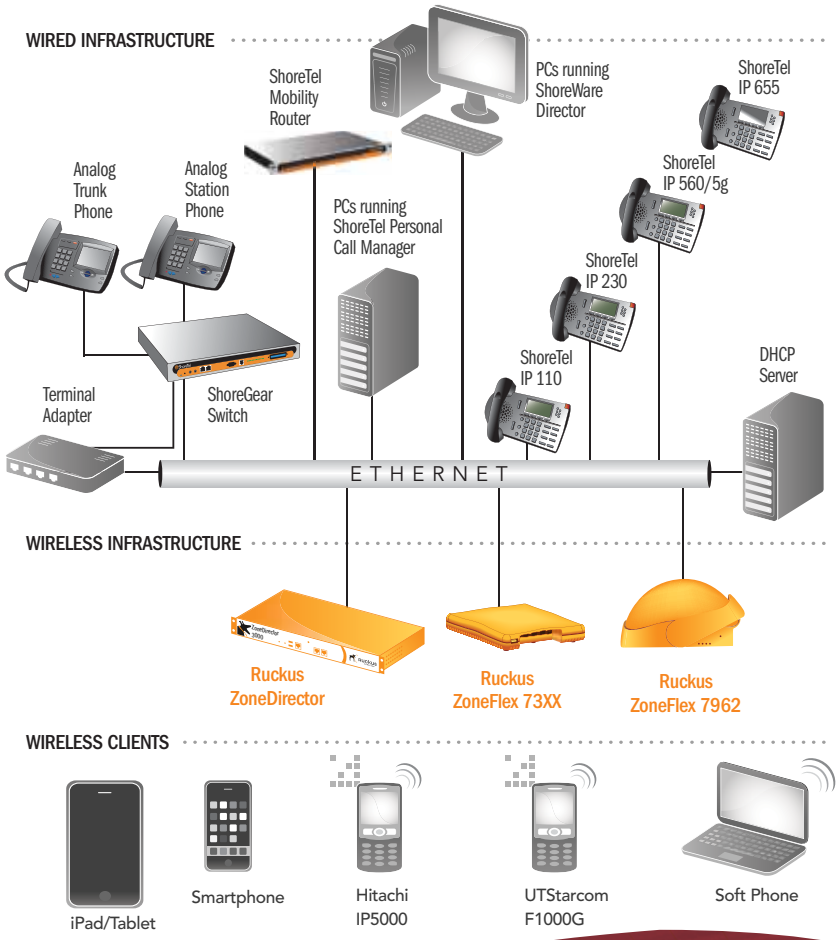
ShoreTel Mobility enables businesses of all sizes to integrate leading and loved smartphones and tablets securely, simply, and cost-effectively - within an enterprise's existing communication and applications infrastructure.

Features and Benefits

- Allows end users to use Wi-Fi-enabled smartphones and tablets as well as certified VoIP phones
- Extends the Wi-Fi coverage area from 2 to 4X using Ruckus' BeamFlex technology
- Ensures voice quality in the presence of other forms of traffic and in the presence of RF interference
- Supports large number (20) of voice clients per access point
- Maintains high data throughput available for other applications
- Employs a user friendly graphic user interface to expedite deployment, trouble-shooting, and maintenance

Architecture Overview

The Ruckus Wi-Fi infrastructure augments wired deployments without disrupting them. The Ruckus ZoneFlex system is optimized for real-time multimedia transmissions — providing adaptive Wi-Fi signaling, interference mitigation, and sophisticated quality of service mechanisms to ensure optimal voice quality. The ZoneFlex system uses patented heuristics to automatically identify, classify, queue, and schedule latency-sensitive traffic. ZoneFlex is the only system to integrate an adaptive



Ruckus
Simply Better Connections.

multi-element antenna array within each access point, providing four queues for each client device, ensuring airtime fairness and consistent performance.

Requirements, Certification and Limitations

The Ruckus Wireless infrastructure is a self-contained (appliance) system. To operate, it requires a standard networking environment that includes an Ethernet switch to plug into and Dynamic Host Configuration Protocol (DHCP) server to allocate addresses. Specific certifications required to operate in particular countries are available directly from Ruckus Wireless.

Version Support

		ZoneDirector
		9.1.1.0 build 55
ShoreTel Release	11.2	✓

Certification Testing Results Summary

Table 1: Basic Test Cases

ID	NAME	DESCRIPTION	RESULTS
1.1	Initialization	Successful bring-up from power-up to a state where clients can associate and pass traffic through the AP.	PASS
1.2	Reset	Successful re-initialization of device after power loss	PASS
1.3	Verify correct voice classification	Verify that voice settings match PBX TOS settings and voice traffic is assigned high priority	PASS
1.4	Place call	Verify successful call placement with normal dialing to a variety of terminating phones	PASS

Table 2: ShoreTel Mobility Router Test Cases

ID	NAME	DESCRIPTION	RESULTS
2.1	Mobile Device to PSTN	Make an outgoing call from the Mobile Device while on Wi-Fi. Verify that a call can be completed	PASS
2.2		Make an outgoing call using from the Mobile Device while on cell. Verify that the call can be completed.	PASS
2.3	Mobile Device to Local Desk Phone	Make an outgoing call using from the Mobile Device while on cell. Verify that the call can be completed.	PASS
2.4	PSTN to Mobile Device	Receive an incoming call while the Mobile Device is on Wi-Fi. Verify that the call can be completed.	PASS
2.5		Receive an incoming call while the Mobile Device is on cell. Verify that the call can be completed.	PASS
2.6	Mobile Device to PSTN (roaming)	Make a call while on Wi-Fi. Exit the Wi-Fi area and verify call continuity from Wi-Fi to cellular.	PASS
2.7		Make a call while on cell. Enter into the Wi-Fi area and verify call continuity from cellular to Wi-Fi	PASS
2.8	PSTN to Mobile Device (roaming)	Receive a call while on Wi-Fi. Exit the Wi-Fi area and verify call continuity from Wi-Fi to cellular.	PASS
2.9		Receive a call while on cell. Enter into the Wi-Fi area and verify call continuity from cellular to Wi-Fi	PASS
2.10	One Number	Make a call to the Mobile Device using extension dialing while the user is on cellular. Verify that the call is received while on cellular	PASS
2.11		Make a call to the Mobile Device using extension dialing while the user is on Wi-Fi. Verify that the desk phone and cellular phone simultaneously ring.	PASS

ID	NAME	DESCRIPTION	RESULTS
2.12	Calling Line ID	From the Mobile Device on Wi-Fi, make an external call out through the PSTN. Verify that the calling line ID appears to be the enterprise number.	PASS
2.13		From the Mobile Device on cellular, make an external call out through the PSTN. Verify that the calling line ID appears to be the enterprise number.	PASS
2.14	Call Forwarding	From the Mobile Device preferences screen, enable call forward to PSTN endpoint. Make a call to the Mobile Device from PSTN. Verify that the call now arrives at the forwarded number.	PASS
2.15	Do Not Disturb	From the Mobile Device, preference screen, enable DND. Make a call to the Mobile Device from PSTN. Verify that the call goes to voicemail.	PASS
2.16	Transfer to Desk	Make call from PSTN to Mobile Device on Wi-Fi. While the call is on Wi-Fi, transfer the call to the desk phone (in the Options Menu). Verify that the call now can be taken from the desk phone and the cell phone line is no longer active.	PASS
2.17		Make call from PSTN to Mobile Device on cell. While the call is on cell, transfer the call to the desk phone (in the Options Menu). Verify that the call now can be taken from the desk phone and the cell phone line is no longer active.	PASS
2.18		While on a Wi-Fi call (PSTN handover), select mute. Ensure that the line is now muted.	PASS
2.19	Mute	While on a cell call (PSTN handover), select mute. Ensure that the line is now muted.	PASS
2.20	Mobile Device (Wi-Fi) to PSTN	Put on hold, wait 10 sec, take off of hold	PASS
2.21	Mobile Device (cell) to PSTN	Put on hold, wait 10 sec, take off of hold	PASS
2.22	PSTN to Mobile Device (Wi-Fi)	Put on hold, wait 10 sec, take off of hold	PASS
2.23	PSTN to Mobile Device (cell)	Put on hold, wait 10 sec, take off of hold	PASS
2.24	Mobile Device (Wi-Fi) to PSTN	While on a Wi-Fi call, transfer the call to another extension. Verify successful transfer of the call.	PASS
2.25	Mobile Device (cell) to PSTN	While on a cell call, transfer the call to another extension. Verify successful transfer of the call.	PASS
2.26	PSTN to Mobile Device (Wi-Fi)	While on a Wi-Fi call, transfer the call to another extension. Verify successful transfer of the call.	PASS
2.27	PSTN to Mobile Device (cell)	While on a cell call, transfer the call to another extension. Verify successful transfer of the call.	PASS
2.28	Call Swap	Ensure that two calls (PSTN to Mobile Device and PSTN to Mobile Device) can be received on the Mobile Device while in Wi-Fi mode. On BlackBerry, calls may NOT be swapped between cellular and Wi-Fi lines – the cellular call must be completed in order to return to the Wi-Fi call.	PASS
2.29	Mobile Device (Wi-Fi) to PSTN	While on a Wi-Fi call,conference the call with another extension. Verify successful conference of the call.	PASS
2.30	Mobile Device (Wi-Fi) to PSTN	While on a cell call, conference the call with another extension. Verify successful conference of the call.	PASS
2.31	Mobile Device (Wi-Fi) to PSTN	While on a Wi-Fi call, conference the call with another extension. Verify successful conference of the call.	PASS
2.32	Mobile Device (cell) to PSTN	While on a cell call, conference the call with another extension. Verify successful conference of the call.	PASS

ID	NAME	DESCRIPTION	RESULTS
2.33	Voice mail	Leave a voicemail for the Mobile Device using PSTN.	PASS
2.34		Ensure that voicemail may be retrieved using the short key. Retrieve voice mail while on Wi-Fi.	PASS
2.36		Ensure that voicemail may be retrieved using the short key. Retrieve voice mail while on cell.	PASS
2.37		Leave voice mail for another extension while on Wi-Fi.	PASS
2.38		Leave voice mail for another extension while on cell.	PASS
2.39	Message Waiting Indicator	Ensure that the voicemail icon appears when a voicemail has been left in the enterprise voice mailbox. Verify that the voicemail icon disappears after the voicemail has been retrieved.	PASS

Table 3: Extended Feature Test Cases

ID	NAME	DESCRIPTION	NOTES
3.1	Call waiting	Verify appropriate notification and successful connection of incoming call while busy with another party	PASS
3.2	Park	Verify successful park and retrieval of connected call	PASS
3.3	Extended forward	Verify extended call forwarding options – busy forwarding, no-answer forwarding	PASS
3.5	Transfer – blind	Verify successful blind transfer of connected call	PASS
3.6	Transfer – monitored	Verify successful monitored transfer of connected call	PASS
3.7	Conference – ad hoc	Verify successful ad hoc conference of three parties	PASS

Configuration Overview

The Ruckus ZoneFlex Quick Start Guide (available online at http://support.ruckuswireless.com/documents) contains the set up/configuration information for the ZoneFlex Product Suite.

The Ruckus administration server requires Windows XP/ Service Pack 2-equipped PC with Sun Java Runtime Environment (v5 or later) installed.; and the Web browser should be either Internet Explorer (v6 or later) or Mozilla Firefox (v1.4 or later). The ZoneDirector's IP address, netmask, gateway and Domain Name System (DNS) server addresses assigned — must be identified if it has a static network address.

ShoreTel Configuration

It is assumed that the ShoreTel IP PBX and the ShoreTel Mobility Router are configured and otherwise fully operational.

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: *(see Table 4 on the following page)*

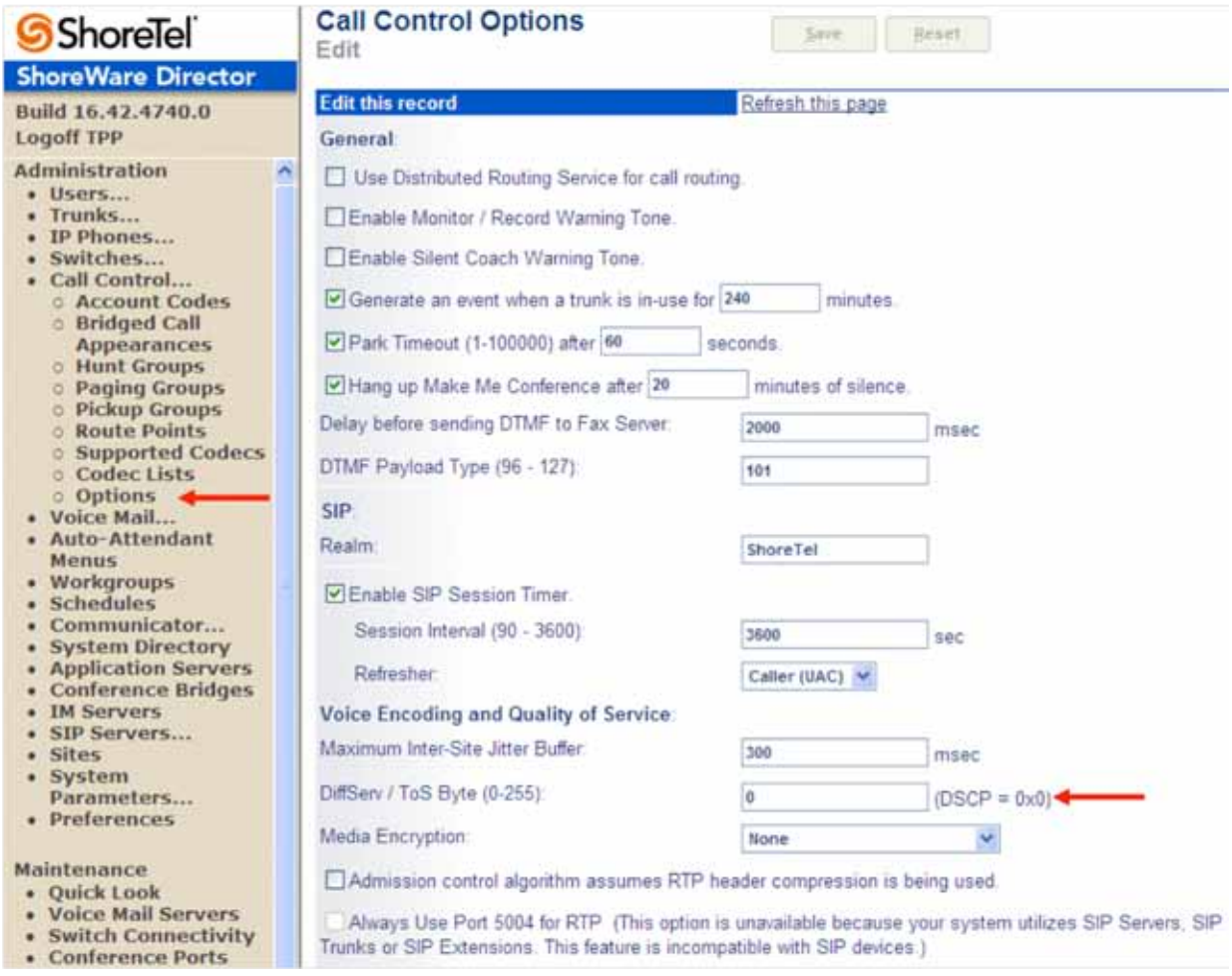
Table 4: Recommended DSCP to 802.1d mapping (based on 3.3.1 of WMM specifications)

DSCP P2	DSCP P1	DSCP P0	DSCP —	DSCP —	DSCP —	DSCP hex	802.1d	WMM AC
1	1	1	0	0	0	0x38	7	AC_VO
1	1	0	0	0	0	0x30	6	AC_VO
1	0	1	0	0	0	0x28	5	AC_VI
1	0	0	0	0	0	0x20	4	AC_VI
0	1	1	0	0	0	0x18	3	AC_BE
0	1	0	0	0	0	0x10	2	AC_BK
0	0	1	0	0	0	0x08	1	AC_BK
0	0	0	0	0	0	0x00	0	AC_BE

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.**



ShoreTel Mobility Router

The ShoreTel Mobility Router (SMR) connects to the ShoreTel IP PBX using both line-side mode (for internal Wi-Fi calls) and trunk-side mode (for cell calls via the SMR enterprise access and handover numbers. Features that this topology will support includes short number dialing, automatic, (sub-100 msec) handover between Wi-Fi and cellular networks, call forwarding, three-way conferencing, music on hold, RoamAnywhere Dual Persona™, Secure Remote Voice, Secure Enterprise Services, remote over-the-air provisioning, simultaneous ring of the desk phone and dual-mode devices. Additionally, the SMR registers to the ShoreGear switch on the SIP line side as a SIP Extension on behalf of each of the mobile users.

Note: Refer to the ShoreTel Mobility Router Solution Platform Supportability Guide for more information on supported handsets. http://www.shoretel.com/products/user_apps/roamanywhere_client/handsets

Ruckus Wireless Configuration and Troubleshooting

Release Notes and User Guides are available online at:

ZoneDirector 1100 Series: http://support.ruckuswireless.com/products/29-zonedirector-1100

ZoneDirector 3000 Series: http://support.ruckuswireless.com/products/14-zonedirector-3000

ZoneFlex 9.1 AP User Guide: http://support.ruckuswireless.com/documents/165-zoneflex-release-9-1-ap-user-guide

ZoneFlex 7962 802.11n Access Point: http://support.ruckuswireless.com/products/18-zoneflex-7962

ZoneFlex 7363 802.11n Access Point: http://support.ruckuswireless.com/products/21-zoneflex-7363

Ruckus Wireless Technical Support

Self-support via the Ruckus Support Web is at http://support.ruckuswireless.com. This site contains a comprehensive set of information including product manuals, technical documents and software updates. Technical support from a Ruckus Technical Support Engineer is available via phone or email. Telephone Support is provided to customers who have purchased any of the Ruckus Support packages.

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