WiSense: A client based framework for wireless diagnosis

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1. INTRODUCTION

In recent years, there has been a rapid growth in the adoption and usage of WiFi enabled networked devices at homes and enterprises such as laptops, handheld device and wireless entertainment devices. In such environments, WiFi networks can suffer from intermittent performance issues such as wireless packet losses, interference from WiFi and non-WiFi sources (e.g., cordless phones, microwave ovens) due to the increasing diversity of devices that share the spectrum. While the Access Points deployed within enterprise as well as home WLANs are static, the associated clients using are usually mobile and access these networks from multiple locations. Client assisted approaches can be used to debug location-specific issues such as poor network coverage/performance in WLANs and detecting the presence and location of non-WiFi interferers. Also, by aggregating data from such tools across multiple enterprise and home WLANs, we can improve our understanding of performance and management related issues that exist across different deployments.

2. WiSense FRAMEWORK

We plan to demonstrate our system called WiSense, which is an Android based platform for wireless debugging and diagnosis for both enterprise and home WLANs. The platform allows users to analyze real-time RF activity across different WiFi channels, monitor the signal quality of neighboring WLANs and detect the presence of neighboring non-WiFi activity. The ease of usage and mobility provided by hand-held smartphone and tablet platforms can allow network administrators as well as users to identify location specific wireless performance issues in their WLANs.

To build the RF analytics capabilities of WiSense, we have augmented the Android kernel to support the ath9k driver. The ath9k driver uses a portable USB WiFi card attached to an Android device to obtain fine-grained information about RF activity. Ideally, if other wireless drivers expose this fine grained spectrum information, it is possible to use these devices' internal WiFi cards as well.

To the best of our knowledge, WiSense is the most comprehensive client based WLAN diagnostic framework. WiSense enables client devices to capture the following statistics:

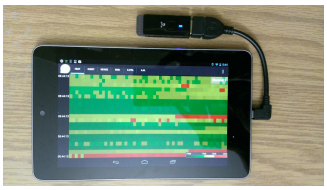

Figure 1: A Nexus 7 device using the WiSense application. The external USB card is used to collect fine grained RF statistics.

Spectrum heatmap. This feature reports information about subcarrier level RF activity across different WiFi channels. For example, WiSense reports energy levels per 312.5 KHz subcarrier in a 20 MHz WiFi channel. This provides a fine-grained view into the RF activity per channel.

Non-WiFi activity. WiSense also records information about non-WiFi activity (e.g., microwave ovens) in the client's vicinity. It uses Airshark [2], which is a software based solution to detect this activity.

Per-Channel airtime utilization. WiSense also captures the aggregate airtime utilization (0 - 100%) per WiFi channel to record channel occupancy due to all WiFi and non-WiFi activity at the client's location.

Neighboring WiFi networks. WiSense captures information about the neighboring WiFi networks such as SSID, channel and signal strengths. This provides a fingerprint [1] for the client location within a home or enterprise building. This information can be correlated with the wireless statistics to reveal location specific wireless problems.

Aggregate per-link statistics. Per-link statistics consist of MAC layer information (e.g., retransmissions and PHY rates).

Active network measurements. Active measurements capture throughput and latency to measure clients' link quality under different wireless conditions and locations.

We have recently made this tool available for general use. Our goal is to provide insights to users as well as crowd-source data about WLAN related issues such as interference, congestion, coverage and reveal location specific problems.

3. REFERENCES

[1] P. Bahl and V. N. Padmanabhan. RADAR: An In-Building RF-Based User Location and Tracking System. In *INFOCOM*, 2000.
[2] S. Rayanchu, A. Patro, and S. Banerjee. Airshark: Detecting non-WiFi RF devices using commodity WiFi hardware. IMC '11.