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WiFiMon:
A Tool for Wi-Fi Performance Monitoring and Verification

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ABSTRACT

Measuring network quality of a wireless network as experienced by end-users is quite difficult, as there is not a single tool available that can record measurements on all sides of the system. The approach presented in this research work is based on the end-user feedback, giving the opportunity of visualization of network performance in real time. This paper initially presents an overview of the developed tool, called WiFiMon, which has the ability to capture, record measurements and export statistics on the quality of Wi-Fi network as perceived by the end-users. The measurements are initiated by the end-users—without their intervention—after they visit a webpage or use a mobile application. WiFiMon aims to give a clear understanding of the Wi-Fi network conditions by measuring specific parameters of the network, such as download/upload throughput, and correlate these measurements with raw data from various log files to obtain additional information regarding the performance of specific access points. The results reveal the functionality of the proposed tool and its scalability.

KEYWORDS

Crowdsourced Network Performance, Mobile Application, Performance Monitoring, Performance Verification, Wireless Network

INTRODUCTION

In recent years there has been a significant increase in the number of devices that users spend daily working, surfing on the internet, using for social networks or even using to play mobile applications, which normally need internet access. The last technology step of smart devices like smartphones and tablets are becoming an integral part of human life as effective and convenient communication tools.

Therefore, it is imperative to know the requirements of end-users that are connected to a particular Wi-Fi network in order to satisfy their demands for seamless networking. The ability to measure and verify the quality of the wireless network (Wi-Fi) as experienced by end-users is quite difficult, since

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there isn't a single tool that captures and performs network monitoring and verification from the user's perspective (Nielsen, 2015). From a statistical point of view, the large amount of measured data (by end-user activities) allow us to analyze the performance of a wireless network, even in crowded sites such as university campuses or conference venues. In these extreme cases, users usually face a number of issues with the performance of the wireless network. The WiFiMon tool, which is being implemented by GEANT[1], comes as a solution to this problem and tries to fill in the gap of network performance as experienced by end-users (Cooke et al., 2006).

WiFiMon attempts to push the wireless network monitoring and verification cycle at a higher layer. The main focus is placed on improved measurement verification, user friendly GUI development, mobile device app deployment, and WiFiMon as a Service (service automation). It is a tool mainly targeted for wireless network administrators, since the ability to visualize the collected data and monitoring the network status in real time can lead to improved decision making and efficient access points installation (Le et al., 2015).

The process that WiFiMon utilizes can be described as a process of collecting, storing, analyzing, visualizing and consuming data, which aims to correlate the end-users measurements with the information regarding the Access Point (AP) from where the measurement was initiated (Hernandez-Campos & Papadopouli, 2005). This process is not intended to replace the traditional measurements from hardware probes, which are installed at a fixed location. Instead, our intention is to supplement the hardware-probe measurements with "non-invasive" performance measurements captured by the end-users (through WiFiMon) so as to extract a hybrid solution that combines static (hardware-probe based) objective measurements with opportunistic measurements for end-users' devices.

From the practical point of view WiFiMon supports the network administrators to decide if there is a need to re-deploy their WiFi network. This means that WiFiMon Hybrid approach establishes an alert system, which detects performance degradation in real-time and based on the performance benchmark (history). The main benefit of such a system is the performance verification, which in turn results in efficient decision-making. Furthermore, based on the performance history, the system administrators can make short/mid-term prognoses (and network adjustments) of the network performance depending on the end-user's density. Overall, WiFiMon as a service/product, provides a quality statement that allows for a cost-effective network planning (CAPEX/OPEX).

The remainder of the manuscripts has the following structure: The next Section presents the related work in the wireless network performance monitoring. In Section "WiFiMon Architecture", the architectural view of WiFiMon approach is being described by presenting the building blocks of WiFiMon as well as their functionality for both the web based and the mobile-app concepts. Authors also explain the procedure that enables the correlation of the measurements with the information provided in various log files to obtain access point related information, such as Radius logs accounting. Section "Performance and Testing Results" presents the performance and scalability testing results. Finally, the last two Sections include the conclusions and an overview of the planned future steps respectively.

RELATED WORK

In the scope of monitoring there are several projects and initiatives designed to allow the remote monitoring of Wi-Fi APs. Today most of these approaches have the objective to monitor and verify the performance using controllers or to monitor stand-alone base stations using ping or, in advanced cases, base station scripts (Choffnes et al., 2011). In a controller-based Wireless Local Area Network (WLAN), base station status is generally observed by monitoring and processing Simple Network Management Protocol (SNMP) Trap messages. In addition to monitoring, controllers improve network quality through centralized channel partitioning and transmit power control. Traditionally, the service quality experienced by the user or the user's