

Hotspot Monitor Requirements

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Table of Contents

- 1 Introduction..... 3
 - 1.1 Scope..... 3
 - 1.2 Features..... 3
 - 1.3 Acronyms..... 3
- 2 General Overview..... 3
- 3 HSM..... 4
 - 3.1 Theory of Operation..... 4
 - 3.2 External Interface Requirements..... 4
 - 3.3 Processing Requirements..... 4
 - 3.3.1 On Boot..... 4
 - 3.3.2 On Tether Connection..... 5
 - 3.3.3 File Server Capabilities..... 5
 - 3.4 Provisioning Requirements..... 5
 - 3.5 Performance Requirements..... 5

1 Introduction

The purpose of this document is to define the requirements for an application that implements a hotspot monitor – a device that is a hotspot connected to the Internet and provides tools to watch connections for analysis of abnormal data transfers.

1.1 Scope

This document defines the interface, processing, and displays for an application that implements a monitored hotspot. Monitored means that the hotspot's traffic between a phone's network and devices attached to the hotspot are logged. The purpose of this application is to help isolate the source of unexpected traffic between devices and web sites. An example of when this is necessary is as follows:

While traveling, I used my Nexus 6P phone on Google's Fi network. During one trip I was tethering my laptop to my phone for Internet access. I don't typically use much data, but during one twelve minute session, Google claimed that I use 1.5 Gbytes of data. During that session I had only used my browser to navigate to my county's property tax web site. Since I did not expect this much usage over such a small interval, I asked Google to tell me which of my tethered devices received or sent that much data. To my knowledge, neither my wife's phone (also tethered to my phone) nor my laptop should have transferred that much data unless there was a setting problem or a software error that ignored a setting (eg automatic OS update). Google was not helpful and instructed me to get a court order for the information I requested. Since it was my phone, this was likely a flippant means of telling me to go away.

This appliance is being built to provide the information that Google would not provide me. I will use this while tethering to either provide evidence of a Google metering problem or to help me identify the cause of these unexpected data spurts.

1.2 Features

HSM will consist of software to implement an access point/hotspot, kernel settings to trace IP connections, and a server to display real time transfer rates and "connection" information.

1.3 Acronyms

HSM	Hotspot Monitor
I/O	Input/Output

2 General Overview

The HSM will be a Raspberry PI appliance that, on boot, starts an access point and an Express based file server. When the appliance is connected to a smart phone with USB tethering, the messages forwarded between the phone's network and the access point will be

logged. If a user connects to the file server, a real time display will be accessible and so will plots of previously recorded data. The plots will show the IP address of the connected devices and the web sites the devices are connected to.

3 HSM

The following paragraphs outline the operation of HSM and define the requirements of it's behavior.

3.1 Theory of Operation

A Raspberry PI 3 will host the HSM application. The PI 3 has been selected because it has the wireless and USB interfaces needed to support the job and, when properly powered, can provide power to the tethered phone.

When powered on, this appliance will start an access point, a file server, and wait for a phone tether connection.

IP tables will be configured to trace traffic forwarded between the tethered phone and the devices that attach to the access point. The traces will be recorded in the kernel.log file under /var/log/.

Using a browser, a user can attach to the file server and watch the traffic flow between devices and sites. Traffic local to the access point network will not be monitored since it will not go through the phone's network.

3.2 External Interface Requirements

ID::HSM-UI-EXT-IF-010 The normal HSM user interface shall be a browser connected to the appliance file server.

ID::HSM-UI-EXT-IF-020 The HSM access point SSID shall be user configurable.

ID::HSM-UI-EXT-IF-030 The HSM access point password shall be user configurable.

ID::HSM-UI-EXT-IF-040 The HSM access point local network shall be user configurable.

3.3 Processing Requirements

The following paragraphs identify the processing to be performed by the HSM.

3.3.1 On Boot

ID::HSM-PR-BOOT-010 On boot, the HSM shall start a wireless access point that implements DHCP.

ID::HSM-PR-BOOT-020 On boot, the HSM shall start a file server.

ID::HSM-PR-BOOT-030 On boot, the HSM shall configure the IP tables to collect data forwarded between a tether connection and a device on the access point.

3.3.2 On Tether Connection

ID::HSM-PR-TETHER-010 When a USB connection is made to a smart phone and the phone enables tethering, the HSM shall configure the interface to use the connection.

ID::HSM-PR-TETHER-020 When a USB connection is broken from a smart phone, the HSM shall configure the connection out of the appliance.

3.3.3 File Server Capabilities

ID::HSM-PR-FS-010 The file sever shall be able to display real time usage.

ID::HSM-PR-FS-020 The file server shall be able to display historical detailed usage data.

ID::HSM-PR-FS-030 The file server shall be able to command the generation of historical detailed usage data.

3.4 Provisioning Requirements

ID::HSM-PROV-010 The hotspot local address shall be provisioned via the /etc/network/interfaces file.

ID::HSM-PROV-020 The hotspot SSID shall be provisioned via the /etc/hostapd/hostapd.conf file.

ID::HSM-PROV-030 The hotspot password shall be provisioned via the /etc/hostapd/hostapd.conf file.

3.5 Performance Requirements

ID::HSM-PERF-010 The HSM is not expected to exactly match the traffic measurements recorded since there may be some overhead on the phone network side. It is expected, however, that the phone network metering shall be proportional to the monitor metering.

ID::HSM-PERF-020 Logging of network traffic can put quite a drain on throughput and mass storage resources. That said, if the use of the appliance is found to be a burden to the user, it won't be used, so the HSM shall only store connection related data (source and destination IP and MACs and packet lengths – no data packets) and post processing of historical data shall be performed when requested by the user (during low utilization times).