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MOBILE BROADBAND WHITEBOX
SAMKNOWS CONFIDENTIAL BRIEFING

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Contents

1 Important Notice

IMPORTANT NOTICE

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2 Mobile Broadband Whitebox

SamKnows offers hardware probes (termed herein as "Whiteboxes") for the purpose of accurately measuring end-user broadband performance. There are three types of probes: two for fixed-line broadband, and one for mobile broadband. This document focuses on the Mobile Broadband Whitebox.

The Whiteboxes execute a series of software tests over their broadband connection they are connected to. The results of these tests are reported securely up to hosted backend infrastructure.

The majority of tests run against SamKnows's network of test nodes. These are dedicated servers either on-net (on the local ISP's network) or off-net (on the public Internet). Some tests will execute against real applications hosted on the Internet, mimicking their behaviour and measuring key performance variables.

When a testing cycle has completed, the results are encrypted and transmitted over SSL to hosted backend infrastructure for processing and presentation through a web interface to each panellist and other interested parties.

2.1 Firmware

All SamKnows Whiteboxes run a custom distribution of Linux, derived from OpenWrt. Many standard OpenWrt features have been removed to save space on the device, and some additional features have been added to support the measurements.

The custom firmware is flashed at the factory and is not directly upgradeable by the user hosting the Mobile Whitebox. The firmware is remotely upgradeable by SamKnows.

This cut-down operating system provides network connectivity and the measurement applications alone – there is no web interface and the Whitebox provides no routing functionality. Panellists have no ability to disable, reconfigure or influence the SamKnows software in any way through normal usage.

SamKnows' firmware makes use of GPL v2.0 licenced code. The source code for SamKnows' firmware build is available at:

`https://files.samknows.com/~gpl/.`

2.2 Whitebox Communications

All communications between the Whitebox and the Data Collection Service on the backend hosted infrastructure are initiated by the Whitebox, encrypted over SSL and subject to authentication

The Whitebox communicates with the target test nodes over a variety of TCP and UDP ports. The Whitebox will also communicate with some unmanaged services over both TCP and UDP.

2.3 Software Updates

The SamKnows software suite has the ability to auto-update itself, downloading updated binaries and testing schedules from the Data Collection Service and storing locally in RAM or flash.

2.4 Mobile Broadband Whitebox

The Mobile Whitebox is designed to be deployed in a dedicated fashion, with one or more USB mobile broadband dongles attached. Unlike the fixed-line Whitebox, its Internet connectivity is not shared with the panellist hosting the device; the Mobile Whitebox's dongles are used purely for performance measurement.

If multiple USB mobile broadband dongles are attached, tests will be performed over them sequentially – not concurrently. This is designed to reduce RF interference between the dongles.

2.5 Hardware Support

A wide variety of mobile broadband dongles have been tested successfully with the Mobile Whitebox. Owing to the fact that the Mobile Whitebox runs a standard Linux kernel, supporting new dongles is typically straightforward.

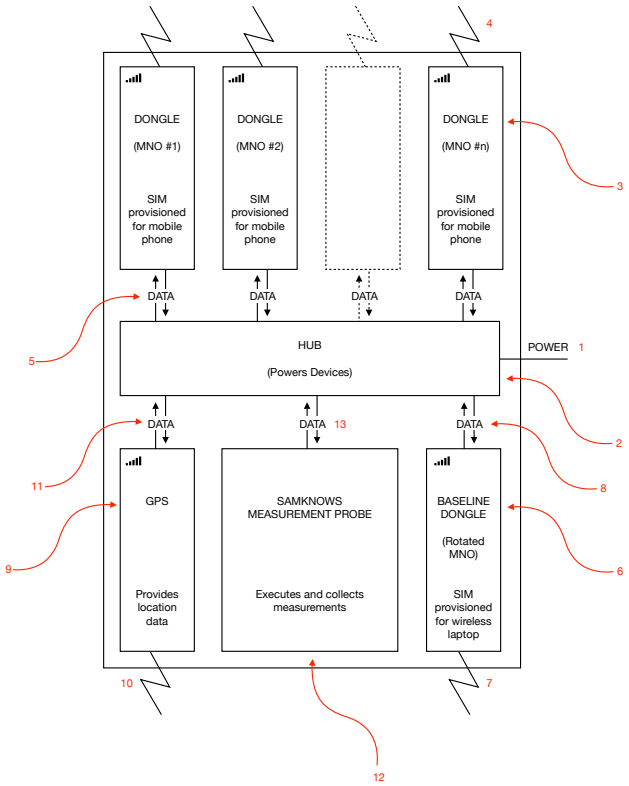
Power may be supplied either from a wall socket (110V and 220V adaptors are available) or from 12V cigarette lighter adaptors in vehicles.

The specifications for the measurement device inside the Mobile Whitebox are as follows:

- 1x 100Mbps Ethernet
- 1x internal 802.11n wireless interface
- 1x USB 2.0
- Micro-USB power
- Dimensions: 57mm x 57mm x 18mm
- Power draw: 1W
- Weight: 188g

2.6 Installation and Operation

The diagram on the following page illustrates how the Mobile Whitebox's components interconnect.



2.7 Location-triggered Testing

The Mobile Whitebox has a GPS device internally that is used to accurately record the location of where a measurement took place. However, it may also be used to trigger measurements too. For example, if the Mobile Whitebox has been deployed inside a taxi or a car, it could be configured to run measurements whenever you cross over London Bridge. This provides you the certainty that you're always comparing measurements at the same location.

In case the GPS is not available, WiFi triangulation may be used instead. This has lower accuracy, typically in the range of ~500m.

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