# COMIQUAL: Collaborative Measurement of Internet Quality in Lebanon

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## I-    Introduction

With the continuous growth of both fixed and mobile Internet usage, measuring the Internet quality becomes of vital interest for all involved Internet stakeholders, mainly consumers, operators, and regulators. In this context, a recent trend is to deploy large-scale measurement platforms, which consist of a large number of measurement points. The idea is to perform simple individual measurements from different locations and perspectives and combine all these snapshots to get the whole picture. COMIQUAL (Collaborative Measurement of Internet Quality in Lebanon) is an ongoing Internet measurement project. By building a collaborative large-scale measurement platform that coordinates and collects measurements from agents installed on fixed and mobile end-user devices, COMIQUAL is able to quantitatively assess the Internet access quality in Lebanon from the user's perspective. We introduce here the platform architecture with a global overview of its main components, their roles, and their interaction, as well as some of its features such as data access and management flexibility. These features are the main drivers that will lead to the ultimate goal, which is to create a collaborative and neutral observatory of the Internet in Lebanon.

## II-    COMIQUAL positioning and global characteristics

Large-scale measurement platforms can be considered as an important tool to get a deep insight about the Internet access, which is exactly the main purpose of COMIQUAL. These platforms can be characterized according to the nature of measurement agents. Netradar (https://www.netradar.org) and Speedtest (http://www.speedtest.net) use software probes that run on end-user devices. This could result in biased measurements due to the specifications and limitations of the user device as well as the interference with the user cross traffic. Other platforms such as RIPE atlas (https://atlas.ripe.net) use dedicated pieces of hardware with tailored measurement applications that can be put at user premises or any point in the ISP network, but they do not capture user's mobility for mobile Internet.

COMIQUAL platform combines the two approaches by proposing both mobile applications and hardware standalone probes offering the user two different ways of contributing. Although the platform is universal and can be used anywhere, some special features are tailored to the Lebanese context such as the measurement anchor installed in Beirut Internet eXchange Point (IXP) in order to assess performance locally using this important national interconnection point. Currently, COMIQUAL implements active measurements but tries to minimize the measurement traffic, and therefore the user data consumption.

## III-    Platform Architecture and main features

COMIQUAL architecture is similar to that proposed by LMAP, a recent IETF working group working on standardizing large-scale measurement systems (http://tools.ietf.org/html/draft-

ietf-lmap-framework-10). As depicted in Figure 1, the platform consists of the following components:

**- Measurement Agent (MA):** MA is a measurement software installed as a service on a mobile device or as standalone agent on fixed devices such as wireless routers. The MA contains a manager that receives instructions from MC and schedules measurement tasks accordingly. It orders the **prober** to execute the measurements and the **contexter** to find the context parameters of each measurement such as the location, the provider name, the signal strength, the time, etc.
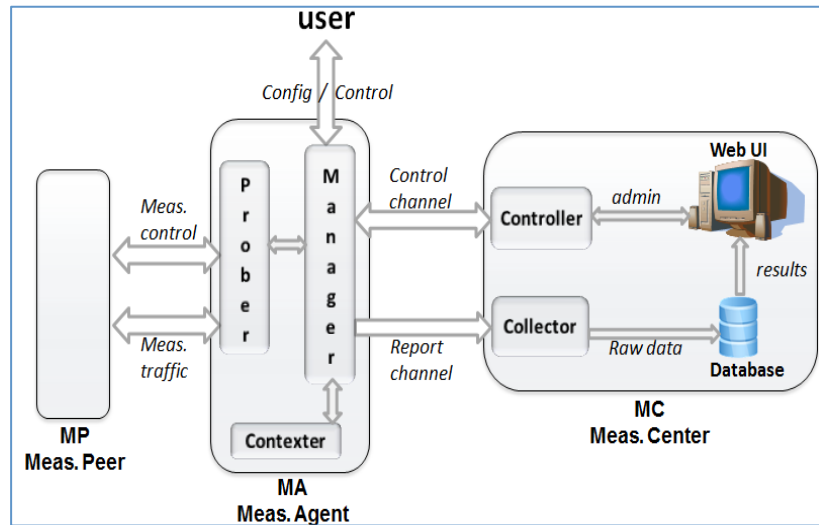


Figure 1: COMIQUAL Architecture

**- Measurement Center (MC):** MC is the central entity that controls MA operations and collects measurement results. The **controller** is responsible of authenticating users, instructing MAs about measurement tasks, and determining MA provider name (for MAs behind NAT). The **collector** receives measurements reports and stores them in the system database.

**- Measurement Peer (MP)**: MP is any server on the Internet measurements are done with. As stated above, a dedicated MP is installed at Beirut IXP. MA and MP exchange two types of data: The measurement traffic that is injected to perform the test and the measurement control data that controls the measurement execution.

The communication protocol between MA and MC is based on JSON messages that are exchanged via HTTP through REST calls. The communication is secured by HTTPS with an optional authentication mode where the user can login to the web site and visualize his measurement history. This is not possible if anonymous mode is used. The platform (http://comiqual.usj.edu.lb) offers open data access to all measurements results through raw csv format, Google map view with comprehensive filtering options, or an online statistics tool that can generate user defined statistics. The flexibility of the platform should be noted. In fact, the web site offers an administrative interface that controls current active tasks and measurement scenarios. For example, the administrator can create a new measurement task that will be instructed to all MAs. Moreover, he can specify some conditions that should be met in a MA in order to execute the measurement.

## IV-    Perspectives

A Java web API that wraps the low level system calls has been developed, as well as an android client. A client and an API for iPhone are currently under development. Moreover, before giving open data access to the collected measurements, the anonymization of data is on the schedule. Finally, we plan to work on more advanced throughput measurements that require a little amount of measurement traffic.