Collaborative Measurement of Internet Quality in Lebanon

Marc Ibrahim, Maroun Chamoun
Saint Joseph University of Beirut - Lebanon

marc.ibrahim@usj.edu.lb
maroun.chamoun@usj.edu.lb

http://comiqual.usj.edu.lb
Overview on large-scale measurement Platform

Comiququal Platform description

Demo
Could live a week or more without

<table>
<thead>
<tr>
<th>Item</th>
<th>U.S. Adults (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>11</td>
</tr>
<tr>
<td>Spouse/significant other</td>
<td>29</td>
</tr>
<tr>
<td>Car</td>
<td>30</td>
</tr>
<tr>
<td>Internet access</td>
<td>44</td>
</tr>
<tr>
<td>Computer/Laptop</td>
<td>49</td>
</tr>
<tr>
<td>Mobile phone</td>
<td>51</td>
</tr>
<tr>
<td>Television</td>
<td>55</td>
</tr>
<tr>
<td>Sex</td>
<td>58</td>
</tr>
<tr>
<td>Tablet computer</td>
<td>59</td>
</tr>
<tr>
<td>eReader</td>
<td>63</td>
</tr>
<tr>
<td>Navigation system</td>
<td>69</td>
</tr>
<tr>
<td>Social networking sites</td>
<td>78</td>
</tr>
</tbody>
</table>

Source: Harris Interactive. The Harris Poll® #13, January 30, 2014
Internet stakeholders: iEyes

- Assess QoS offer
- Compare to others
- Understand the user

Consumer
- Quantify QoE
- Check SLA (corporate)
- Diagnose faults
- Compare offers

Provider

Service

Regulator
- Foster competition
- Quality requirements and enforcement
- Compare to other countries

Need for capturing the «state» of the Internet
Measuring the hidden part of the i-ceberg

Large-scale measurement (LSM) platforms:

- Large number of measurement points
- Measurement collection
- Analysis and visualization
- Get a deep insight about Internet performance
Classification of LSM platforms

Agent Type
- Soft
  - Speedtest
- Hard
  - RIPE Atlas

Large-Scale Platforms

User Type
- EndUser
  - Speedtest
- ISP
  - Samknows

Metric Type
- Perf.
  - NetaLyzr
- Coverage
  - OpenSignal
- Topology
  - Portolan

Access Type
- Mobile
  - Netradar
- Fixed
  - Bismark

Classification of LSM platforms
- Speedtest
- RIPE Atlas
- Netradar
- OpenSignal
- Portolan
- Netalyzr
- Speedtest
- Samknows
Towards LSM standardization

LMAP IETF working group

• Large-Scale Measurement of Broadband Performance
• Leave metrics definition and measurement methodologies for IPPM WG.
• Focusing on control and report protocols

IEEE 802.16.3 project

• Mobile Broadband Network Performance Measurements
• Metrics specifications and test procedures
• Communication protocols for managing operations and data collection
Comiqual in one slide

**ID**
- Platform for measuring the Internet

**Target**
- Lebanon
- But can be used anywhere

**Attributes**
- Independent, neutral
- Collaborative: crowd-sourcing

**Objectives**
- A tool for users to assess and compare
- User feedback to operators/ISPs

**Support**
- USJ: Saint-Joseph University of Beirut
- ISOC: Internet Society

http://comiqual.usj.edu.lb
COMIQUAL main characteristics

Measurement agents types

• Software: smartphone app.
• Hardware: small wireless router with openWrt system. Connected to the user’s network

Active measurements

• Latency (ICMP, DNS, HTTP), TCP throughput, Signal strength

Measuring Internet and national IXP performance

• Measurement server installed at Beirut IXP
COMIQUAL main characteristics

Open data access
- Aggregated data via map and online statistics tool
- Raw data access.

Flexible management interface
- Control existing MAs
- Activate/deactivate measurements
- Create new measurements and parameters

Constrained measurements
- To be executed in a specific context (location, time, operator, etc...)
COMIQUAL Architecture

- **User**
  - **Controller**
    - **Collector**
      - **Database**

- **Meas. Agent**
  - **Prober**
    - **Manager**
      - **Contexter**

- **Meas. Peer**
  - **MP**

- **Channels**
  - **Control channel**: User to Controller
  - **Report channel**: Controller to Collector

- **Web UI**
  - **results**: Collector to Web UI
  - **admin**: Controller to Web UI

**Annotations**
- **Meas. control**: User to Controller
- **Meas. traffic**: Prober to Manager
- **Config / Control**: User to Controller
- **Raw data**: Collector to Database

**Acronyms**
- **MC**: Meas. Center
- **MA**: Meas. Agent
- **MP**: Meas. Peer

**Other**
- **Internet Society**
- **Comiqual.usj.edu.lb**

**MENOQ 2015**
Control protocol

- JSON messages
- via HTTP through REST calls.
- HTTPS secured
- Communication initiated by MAs (behind NAT)
- Two modes
  - Authenticated mode: the MA is identified prior to communication and all subsequent measurements will be related to that MA
  - Anonymous mode
Deployment

- Meas. agent
- Meas. traffic
- Control and collection traffic

 ISP1

Meas. Peer
(Mlab, etc.)

Measurement Center = Controller + Collector

ISP2

Beirut IX
Meas. Server

Standalone
device

mobile
device
Measurement process

MA

- MANAGER
- PROBER
- CONTEXTER

MC

- Controller
- Collector

Optional step: not requested in anonymous mode
Measurement process

**MA**

- MANAGER
  - PROBER
  - CONTEXTER

**MC**

- Controller
- Collector

Optional step:
not requested in anonymous mode
Measurement process

MA

MANAGER

PROBER

CONTEXTER

MC

Controller

Collector

Checkin request
checkin
{
    "ma_id":"418",
    "app_version":"2.0",
    "probeness":1,
    "device":
    {
        "manufacturer":"Sony",
        "model":"C5303",
        "device_os":"NAME:Android, RELEASE:…",
        "interfaces":["3G", "WIFI"],
        "device_id":"XXXXX70595XXXXX"
    },
    "current_tasks":[]
}
//+ cookie in the HTTP header
Measurement process

MA

MANAGER

PROBER

CONTEXTER

MC

Controller

Collector

Instruct

MENOG 2015

http://comiqual.usj.edu.lb
Measurement process

instruct message

```json
{
    "ma_id":418,
    "controller_url":"http://comiqual.usj.edu.lb",
    "collector_url":"http://comiqual.usj.edu.lb",
    "current_app_version":"2.0",
    "keep_tasks_id":[],
    "new_tasks":[
        {
            "task_id":97, "end_date":"2024-12-11",
            "description":"ICMP",
            "repeat_interval":"none",
            "arguments":[
                {"target":"ath02.mlab.org"},{"packets_sent":"5"}],
            "metrics":["target_ip", "loss_ratio",
                        "max_rtt","min_rtt", "stddev_rtt", "mean_rtt"],
            "constraints":[[]]
        }
    ]
}
```

//+ cookie in the HTTP header
Measurement process

MA

MANAGER

PROBER

CONTEXTER

MC

Controller

Collector

http://comiqua.usj.edu.lb
Measurement process

**MA**

- MANAGER
- PROBER
- CONTEXTER

**MC**

- Controller
- Collector

```
ping -i 0.5 -s 56 -w 10 -c 5 83.212.5.142```

http://comiqual.usj.edu.lb
Measurement process

MA

MANAGER

PROBER

CONTEXTER

MC

Controller

Collector

http://comiqual.usj.edu.lb
Measurement process

Packet Loss: 0.0%
Min RTT: 125.0 ms
Mean RTT: 134.4 ms
Max RTT: 148.0 ms
Std dev: 11.1 ms

Carrier: TOUCH
Network Type: 3G
Cell: [415; 03; 932; 19824013]
rssi: 98
ISP: TERRANET
Long: 35.56373315
Lat: 33.86592182
...
Measurement process

```json
ma_report = {
    "context": {
        "start_date": "02-27-2015 09:04:30 AM",
        "end_date": "02-27-2015 09:04:30 AM",
        "carrier": "TOUCH",
        "network_type": "3G",
        "cell_info": "[415;03;932;19824013]",
        "rssi": "98",
        "isp": "TERRANET",
        "location_type": "gps",
        "location_long": "35.56373315",
        "location_lat": "33.86592182"
    },
    "meas_result": {
        "task_id": "97",
        "success": "OK",
        "metrics": [{"target_ip": "83.212.5.142"},
                     {"loss_ratio": "0.0"},
                     {"mean_rtt": "134.4"},
                     {"min_rtt": "125.0"},
                     {"max_rtt": "148.0"},
                     {"stddev_rtt": "11.11"}],
        "arguments": [{"target": "ath02.mlab.org"},
                       {"packet_size": "56"},
                       {"packets_sent": "10"}]
    }
}
```

//+cookie in the HTTP header
## How to use the platform?

| Public portal          | • View quality results on map  
<table>
<thead>
<tr>
<th></th>
<th>• Analyze available raw data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contribute to measurements</td>
<td>• Install the <strong>comiqual</strong> APP</td>
</tr>
<tr>
<td></td>
<td>• Use it as a speed test APP</td>
</tr>
<tr>
<td></td>
<td>• Let it run alone</td>
</tr>
<tr>
<td>Do measurements</td>
<td>• Anonymously</td>
</tr>
<tr>
<td></td>
<td>• Using a google/facebook/comiqual account</td>
</tr>
<tr>
<td>Personal page</td>
<td>• View your own measurements</td>
</tr>
</tbody>
</table>

[http://comiqual.usj.edu.lb](http://comiqual.usj.edu.lb)
Android agent
Measurements on map (1)
Measurements on map (2)
### Results for Measurement Agent 417

<table>
<thead>
<tr>
<th>Date</th>
<th>Task ID</th>
<th>Type</th>
<th>Status</th>
<th>Arguments</th>
<th>Metrics</th>
<th>Provider</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/26/2015 2:38:24 PM</td>
<td>91</td>
<td>TCP Down (Mlab)</td>
<td>OK</td>
<td>Target=1.michigan.mlab1.ath01.measurement-lab.org</td>
<td>throughput=1,412.19 kbps</td>
<td>touch</td>
</tr>
<tr>
<td>2/26/2015 2:38:32 PM</td>
<td>92</td>
<td>TCP UP (Mlab)</td>
<td>OK</td>
<td>Target=1.michigan.mlab3.ath02.measurement-lab.org</td>
<td>throughput=218.19 kbps</td>
<td>touch</td>
</tr>
</tbody>
</table>

Map data ©2015 Basersoft, Google, Maps GISrael, ORION-ME Terms of Use.
## Measurement Details

### Measurement Information

<table>
<thead>
<tr>
<th>Measurement Key</th>
<th>17852</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement Name</td>
<td>RTT</td>
</tr>
<tr>
<td>Measurement Descri...</td>
<td>ICMP</td>
</tr>
<tr>
<td>task ID</td>
<td>97</td>
</tr>
<tr>
<td>MA ID</td>
<td>417</td>
</tr>
<tr>
<td>Status</td>
<td>OK</td>
</tr>
</tbody>
</table>

### Context

<table>
<thead>
<tr>
<th>app version</th>
<th>2.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>battery level</td>
<td>80 %</td>
</tr>
<tr>
<td>is battery charging</td>
<td>false</td>
</tr>
<tr>
<td>carrier</td>
<td>touch</td>
</tr>
<tr>
<td>network type</td>
<td>3G</td>
</tr>
<tr>
<td>mobile country code</td>
<td>415</td>
</tr>
<tr>
<td>mobile network code</td>
<td>03</td>
</tr>
<tr>
<td>location area code</td>
<td>932</td>
</tr>
<tr>
<td>cell id</td>
<td>19855123</td>
</tr>
<tr>
<td>RSSI</td>
<td>1 dB</td>
</tr>
<tr>
<td>network technology</td>
<td>HSPA+</td>
</tr>
<tr>
<td>DNS resolvability</td>
<td>IPv4 only</td>
</tr>
<tr>
<td>IP connectivity</td>
<td>IPv4 only</td>
</tr>
<tr>
<td>ISP</td>
<td>TERRANET</td>
</tr>
<tr>
<td>initial longitude</td>
<td>35.56373221 deg</td>
</tr>
<tr>
<td>initial latitude</td>
<td>33.86568644 deg</td>
</tr>
<tr>
<td>final longitude</td>
<td>35.56373221 deg</td>
</tr>
<tr>
<td>final latitude</td>
<td>33.86568644 deg</td>
</tr>
<tr>
<td>initial location type</td>
<td>gps</td>
</tr>
<tr>
<td>final location type</td>
<td>gps</td>
</tr>
<tr>
<td>start date</td>
<td>02-26-2015 02:38:48 PM</td>
</tr>
<tr>
<td>end date</td>
<td>02-26-2015 02:38:48 PM</td>
</tr>
</tbody>
</table>

### Arguments

- **target**: 1.michigan.mlab1.ath02.measurement-lab.org
- **timeout**: 10 sec
- **packet size**: 56 byte
- **number of sent packets**: 10
- **measurement tool**: /system/bin/ping

### Metrics

<table>
<thead>
<tr>
<th>target IP</th>
<th>&quot;83.212.5.142&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>max RTT</td>
<td>153.0 ms</td>
</tr>
<tr>
<td>min RTT</td>
<td>128.0 ms</td>
</tr>
<tr>
<td>stddev RTT</td>
<td>9.221713506718803 ms</td>
</tr>
<tr>
<td>mean RTT</td>
<td>139.4 ms</td>
</tr>
<tr>
<td>loss ratio</td>
<td>0.0 %</td>
</tr>
</tbody>
</table>
Platform management interface

Manage Tasks

Create New

TCP Down (Mlab) [Delete]

<table>
<thead>
<tr>
<th>Version</th>
<th>Date of Creation</th>
<th>End Date</th>
<th>Is Valid?</th>
<th>Repeat Interval</th>
<th>Scenario Name</th>
<th>Details</th>
<th>Unvalidate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7/31/2014 5:17:43 PM</td>
<td>7/31/2024 12:00:00 AM</td>
<td>✔</td>
<td>none</td>
<td>default</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DNS lookup [Delete]

<table>
<thead>
<tr>
<th>Version</th>
<th>Date of Creation</th>
<th>End Date</th>
<th>Is Valid?</th>
<th>Repeat Interval</th>
<th>Scenario Name</th>
<th>Details</th>
<th>Validate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7/31/2014 4:16:04 PM</td>
<td>7/30/2024 12:00:00 AM</td>
<td>✔</td>
<td>none</td>
<td>default</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RTT [Delete]

<table>
<thead>
<tr>
<th>Version</th>
<th>Date of Creation</th>
<th>End Date</th>
<th>Is Valid?</th>
<th>Repeat Interval</th>
<th>Scenario Name</th>
<th>Details</th>
<th>Validate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7/31/2014 4:15:16 PM</td>
<td>7/31/2024 12:00:00 AM</td>
<td>✔</td>
<td>none</td>
<td>default</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Conclusion

Issues

• Perform throughput measurement with minimum TCP traffic
• Find incentives to make people contribute

Perspectives

• Converge towards LMAP standard
• Anonymization of the data
• Under development:
  • An API and a client for iPhone.
  • Online statistical tool.
THANK YOU