



QoE using a mobile application approach: a solution from Ciqua to qualify the quality of experience of end users on mobile networks



What is Ciqual and what is it for ?

- Ciqual is a solution that permits to collect and analyze the KPIs from the end user's device regarding data, voice, coverage, OTT and its custom feedbacks.
- It is a mobile application approach used to qualify the quality of experience of the customers.

Truly independent view of consumers within a country

- neutral and independent measuring tool

No more need of satisfaction campaigns and questionnaires from users

- This system is expensive and may be inconclusive

Ease of Deployment

- Deployed as a downloadable mobile app on the Google Play Store or iTunes, or as SDK into existing App

Industry recognised KPIs

- The tool analyzes and takes advantage of KPIs used in IOS and Android operating systems. It's not about tool-specific KPIs

1:1 Relationship with Consumer

- If required, data could be linked to a user to enable faster issue resolution e.g. if a consumer escalates a complaint.

End users actors in the quality of the network



A mobile application to put the user as a major actor in the improvement of QoS and QoE.

Thanks to user's data, Ciqua provides all the necessary information about voice quality, mobile cells, the device used (hardware and software), data, coverage and even direct user feedback.

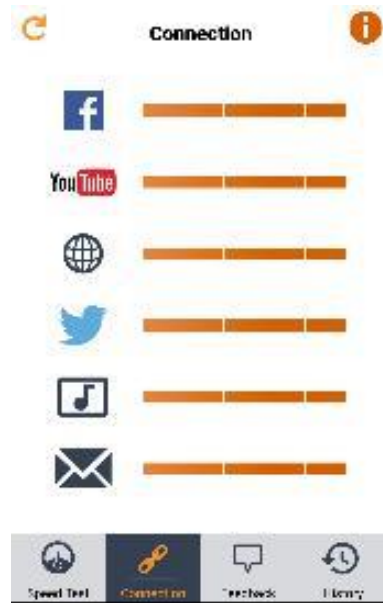


A data analysis software to interpret all the data collected and proactively manage user issues

User data analysis via dashboards, graphs and statistics, as well as maps to be able to correlate and understand more effectively any network issues.



2 ways to integrate the mobile app



Standalone version Ciqual MyConnection

The standalone app of Ciqual is available on the Apple Store and Play Store. Ideal for PoC for hundreds or thousands of users., the app is ready to use.

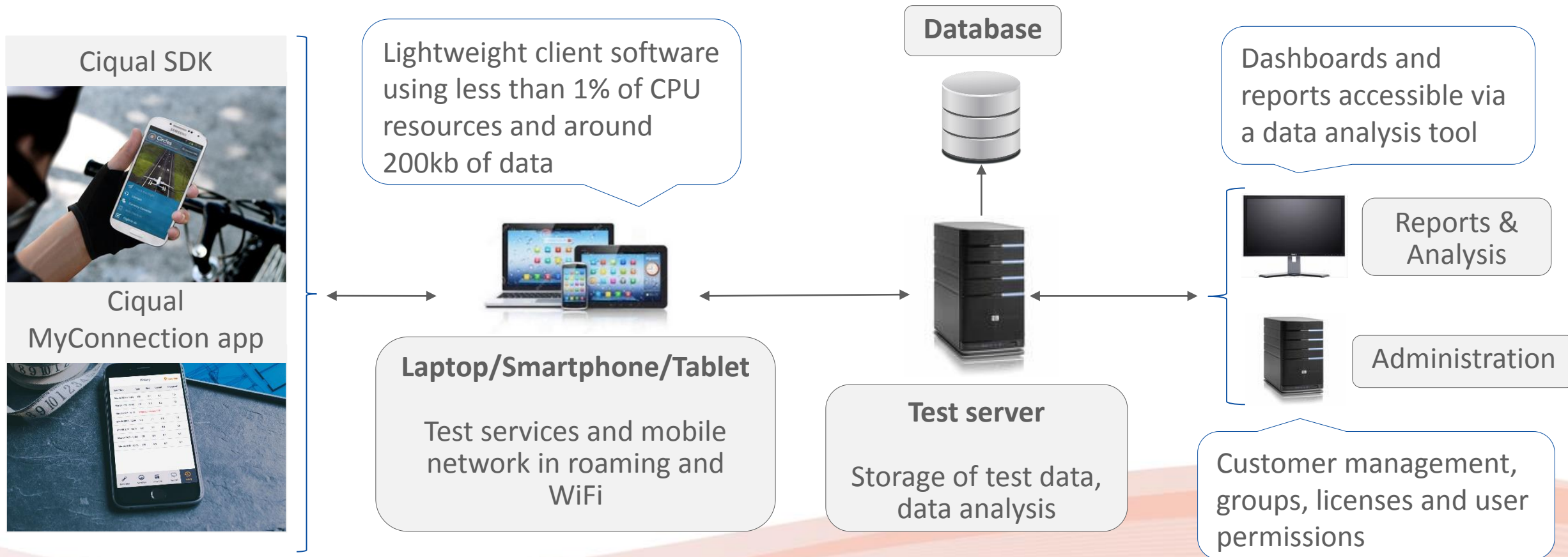


Integrated solution to an already existing app

The Ciqual system is integrated with an already existing application through a Software Development Kit (SDK). Ideal for a wide development. The advantage of this method is to benefit from the client base that already uses the original application.

Global network architecture

CIQUAL reports the quality of experience data, voice and coverage of **each user**, as well as the use of mobile applications if the user authorizes it.



- **Speed Test** : upload and download link done from a FTP server

Speed Test

Speed Test interface showing a gauge with 'START' and '0.0 Mbps', a line graph, and summary statistics for PING (41.0 ms), DOWNLOAD (28.90 Mbps), and UPLOAD (0.56 Mbps). Includes a share icon and a bottom navigation bar with 'Speed Test', 'Connection', 'Feedback', and 'History'.

Metric	Value
PING	41.0 ms
DOWNLOAD	28.90 Mbps
UPLOAD	0.56 Mbps

- **Connection** : Predefined services availability test such as social networks, web browsing, email client, streaming and online video, etc.
- The software will ping the service and depending on the response time will assign a rating of 0 to 5



Connection



- **Feedback** : allows the user to evaluate their quality of experience on calls, data (speed, audio or video streaming), network coverage (signal strength, access technology) and to report directly any problem

Feedback


I'm having problems with calls ▼

I'm having problems with coverage ▼


I'm having problems using data ▲

- I can't access any data
- Data throughput is very slow
- Data throughput keeps stalling
- I can't stream audio
- I can't stream video
- Other - please specify


I'm having problems with my phone ▼




Speed Test



Connection



Feedback



History

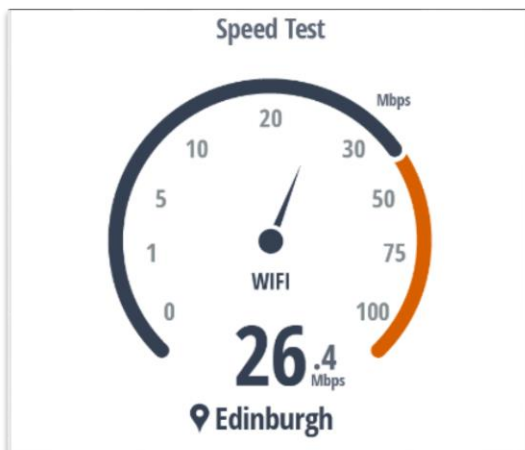
Archived Results

- Events and tests performed by the user are archived

Date/Time	Type	Ping	Upload	Download
13/06/17 - 15:32	LTE	41 ms	683 Kbps	33 Mbps
12/06/17 - 17:03	LTE	49 ms	3,8 Mbps	23 Mbps
07/06/17 - 00:53	LTE	40 ms	16 Mbps	4,4 Mbps
24/05/17 - 16:43		Dropped call: Out of service		
24/05/17 - 14:59		Dropped call: Out of service		
24/05/17 - 14:44		Dropped call: Out of service		
21/03/17 - 13:40		Dropped call: Low rssi		



User-Triggered Tests



Speed and latency tests triggered by the user

'Star tests' on availability of 6 predefined services, launched when the app is opened.

Scheduled Tests



- DNS
- Ping
- Reachability
- FTP, HTTP download
- Triggered automatically by the client during any data session, even when running in the background.

Passive Observations



- Data
- Voice (Android only)
- Coverage (Android only)
- Measurements collected in the background without user intervention

Subjective Feedback

Feedback	
I'm having problems with calls	▼
I'm having problems with coverage	▼
I'm having problems using data	▲
I can't access any data	
Data throughput is very slow	

- Emoticon-based feedback
- Direct subjective feedback via a customized questionnaire.
- Allows NPS questions and free-text feedback from the end customer
- Correlate perceived customer experience with actual KPIs.

Data

- Throughput
- Latency

ains KPIs importants

et Promoter Score

ed by the feedbacks

Internet Connection

access activated on the phone but no is exchanged with the network

Voice Connectivity

Voice*

rompt due to lack of

Coverage*

- In coverage
- Out of coverage
- Name of the mobile operator

Failure Rate

onnectivity or bad

emained covered by erator

:h, interruptions, cuts)

User

Device type

- Model, Make, OS release

Apps*

- Foreground app QoE
- Background app usage
- Custom reporting layers (districts, areas...)

*Android only

Dimensions and filters

Time

- Year
- Month
- Week
- Day
- Hour
- Date

Participants

- User groups
- IMEI/Device ID

Service provider

- Country
- Network
- Access technology

Localisation

- GPS coordinates
- Cell location (CGI)
- APN/SSID

Device

- Brand
- Model
- OS
- Firmware
- CPU

Privacy – what Ciqua does NOT collect

Contacts

Content of messages or
conversations

URLs, browsing history

Keystrokes, Camera

EXAMPLE : POC WITH THE REGULATOR OF MALI

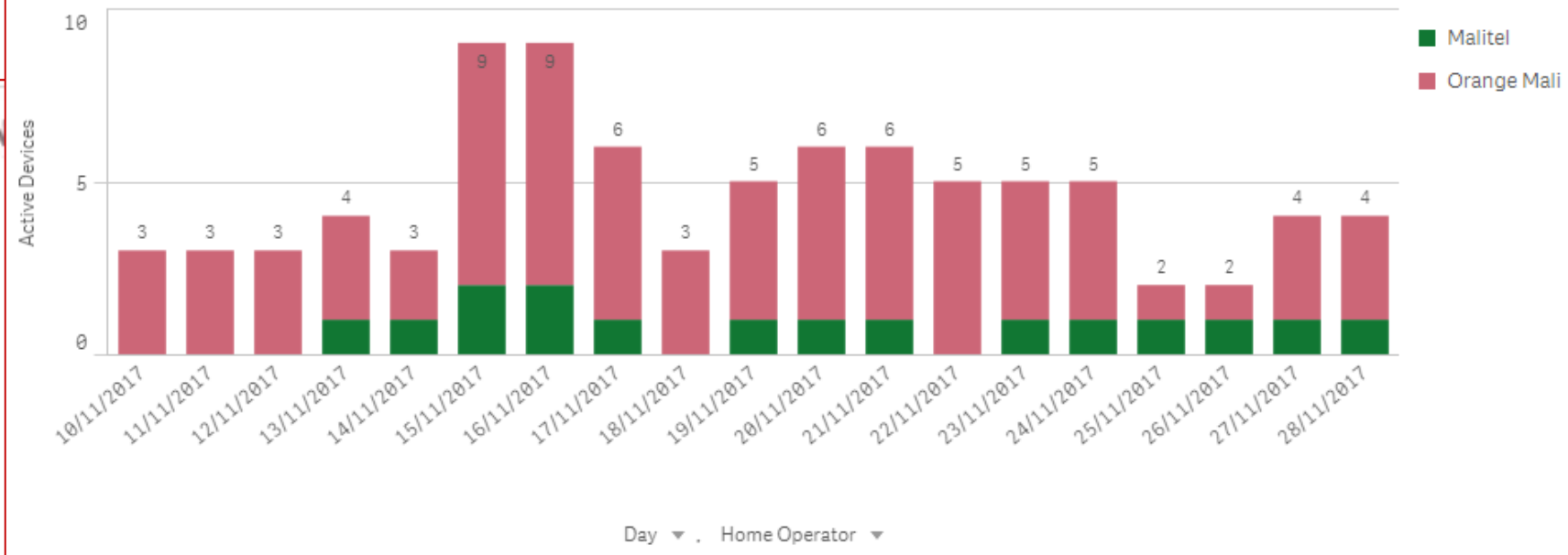
Preface

- PoC report with real measurements from **9 AMRTP employees** using Ciqual's MyConnection app.
- Data collection November 10th- 28th
- It comprises **five** separate sections:
 - Data
 - Voice
 - Coverage
 - Customer Feedback
 - App Usage.

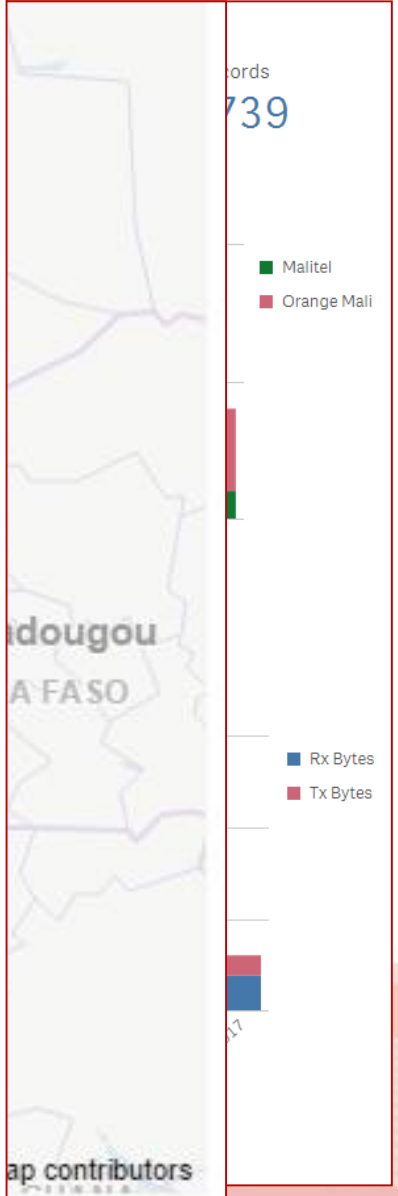
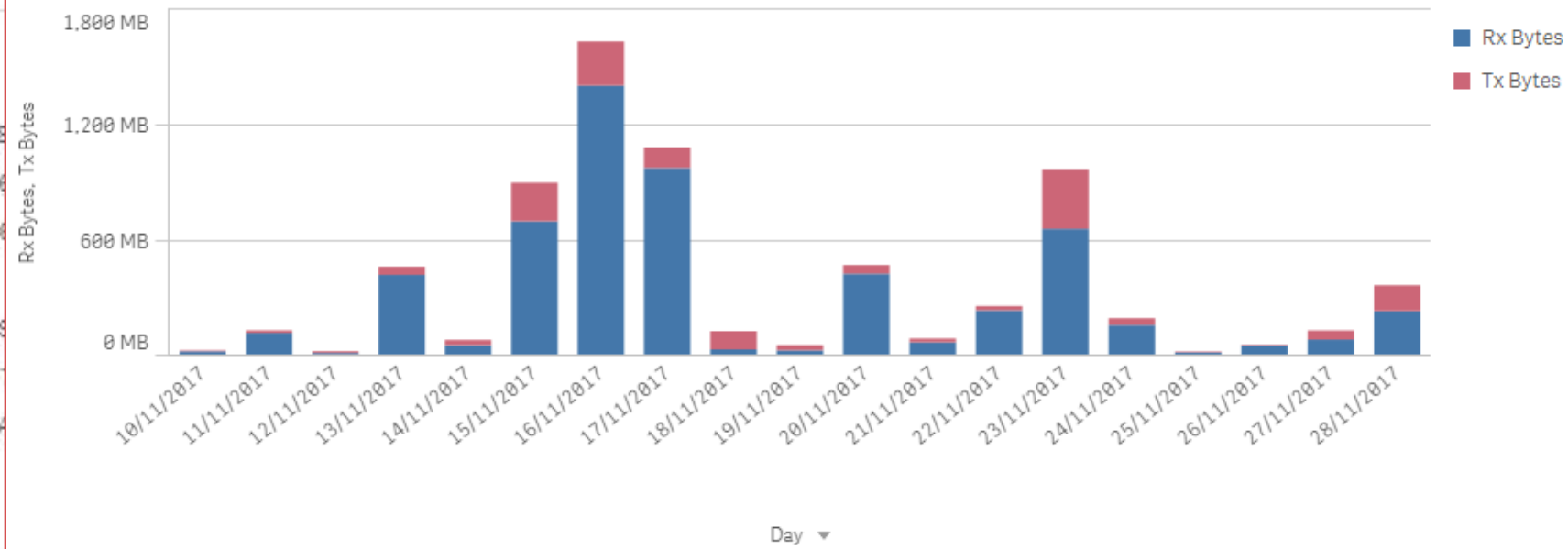
DATA



Active subscribers



Data usage



ap contributors

Access Tech

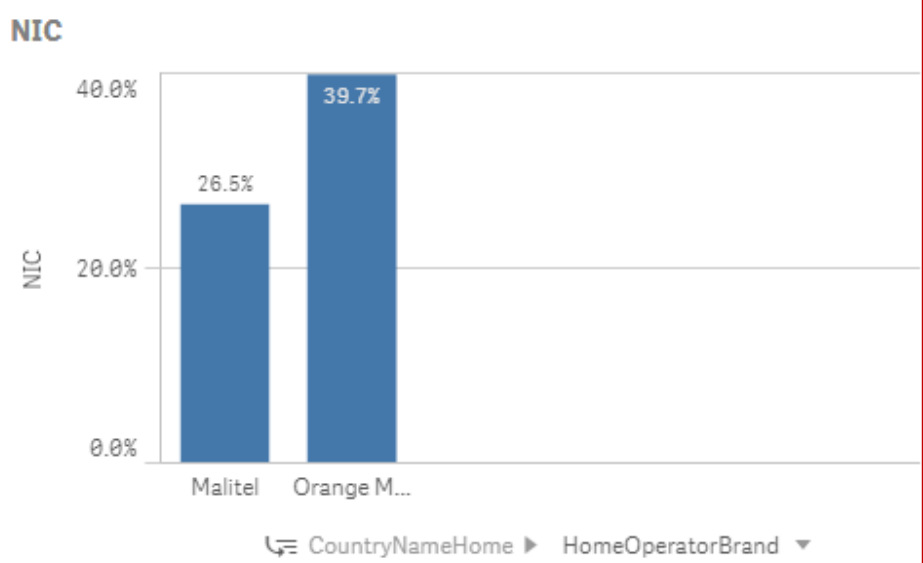
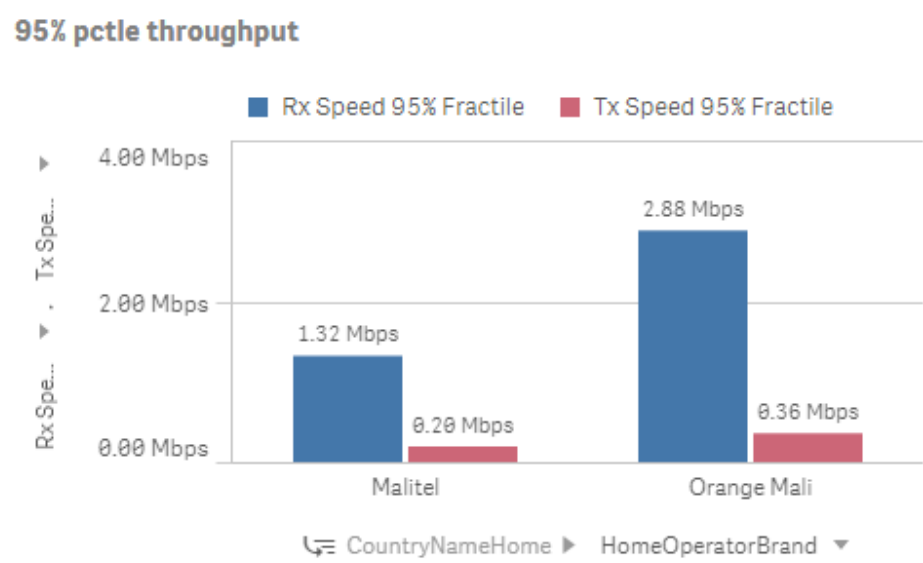
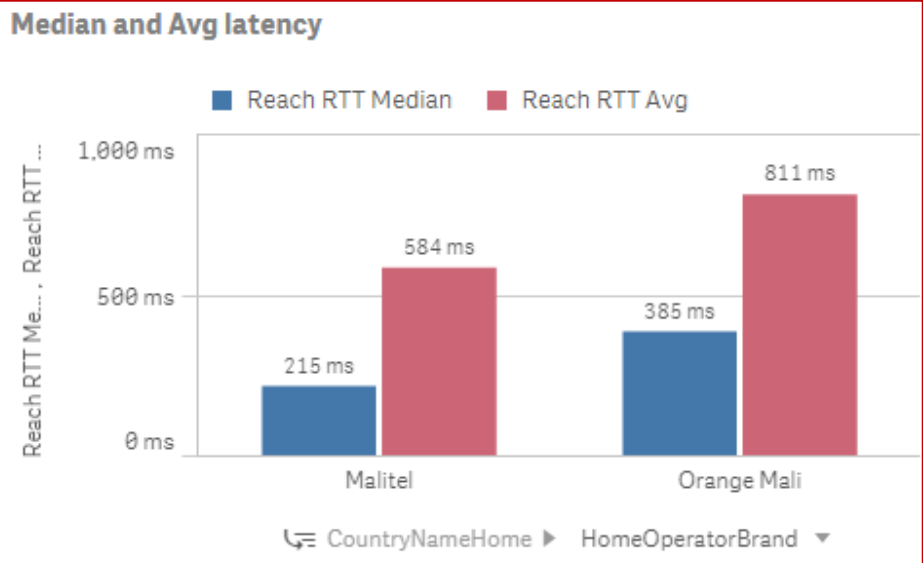
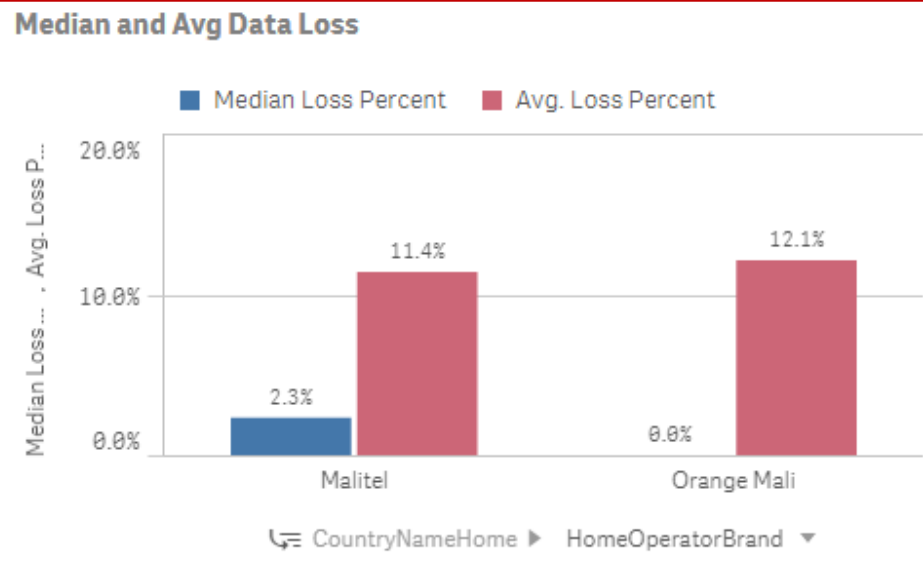
- UMTS
- WiFi
- Unknown
- undefined
- GSM
- MBB



Comparison



Records
4,739



Data – Cellular technology comparison

Access Tech

- UMTS
- Unknown
- undefined
- GSM
- MBB

Days reported: 19

Last update: 28/11/2017

Active Devices #: 8

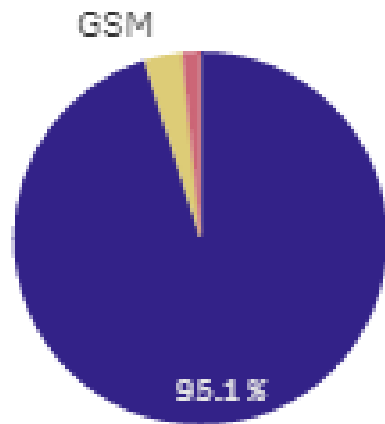
Records: 4,221

Total Session Duration: Rx MB* Tx MB*

AccessTechCatName

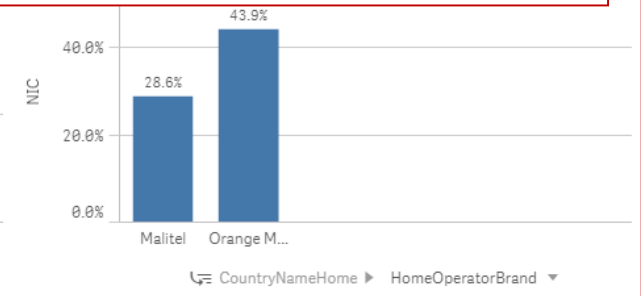
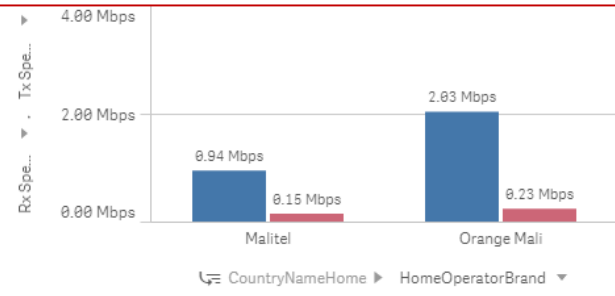
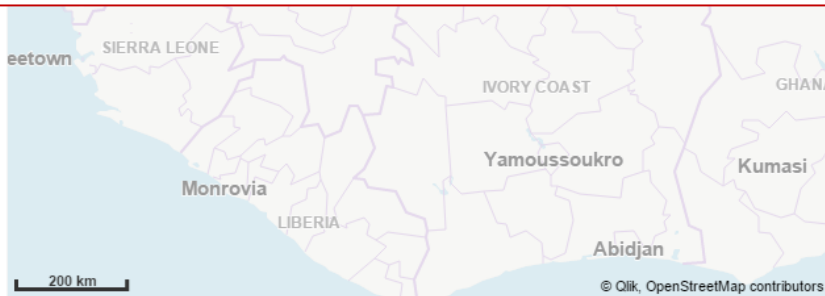
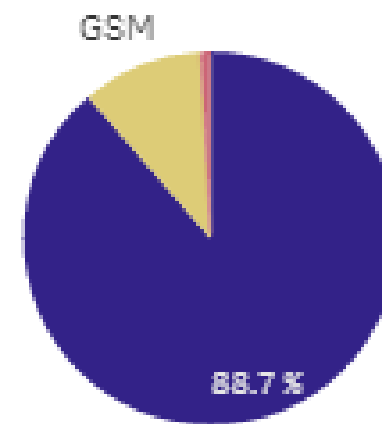
Rx MB *

AccessTechCatName



Tx MB *

AccessTechCatName



Data – Experience of each user

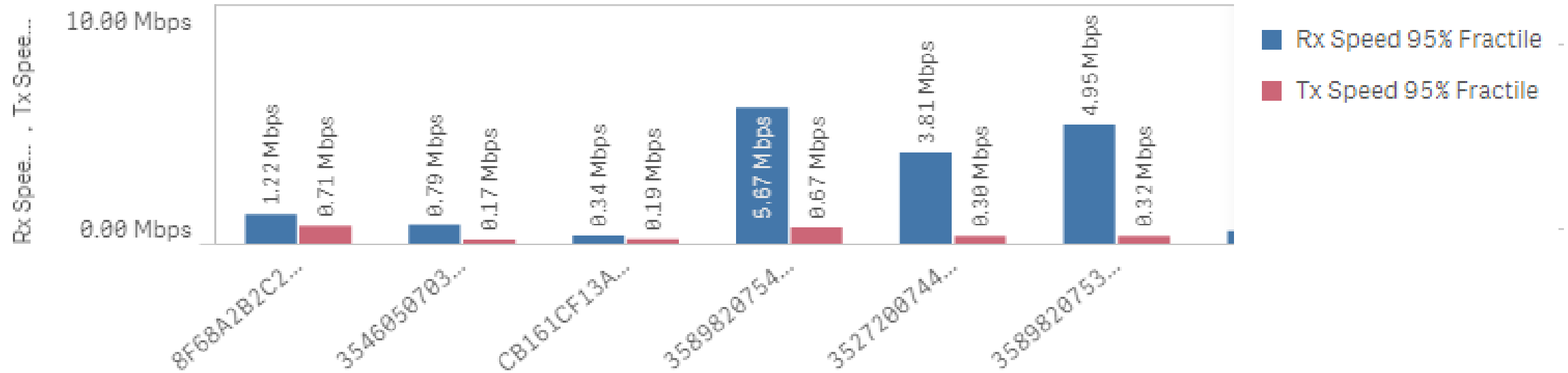
Data Usage

Packet Loss %

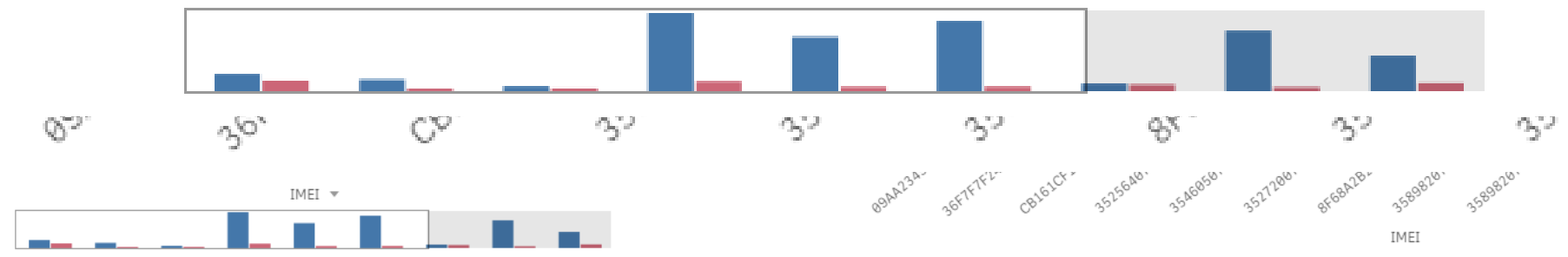
Data Usage

3. Tx MB

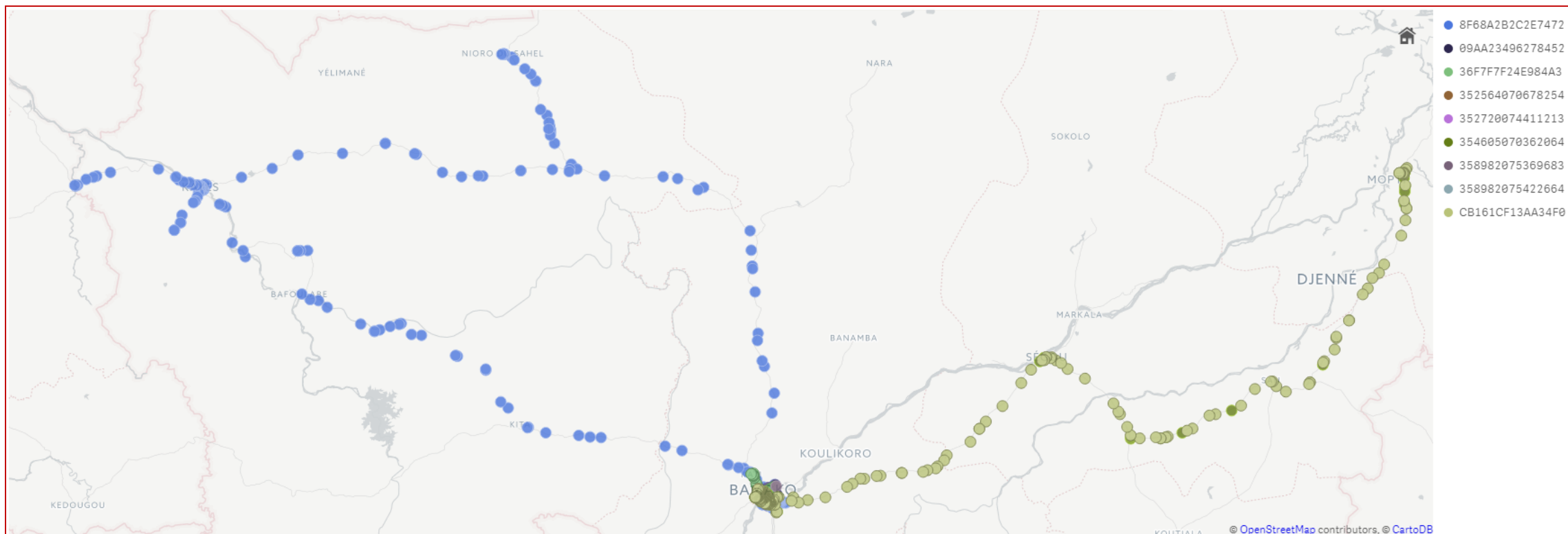
95% Fractile Data throughput (max speed)



IMEI

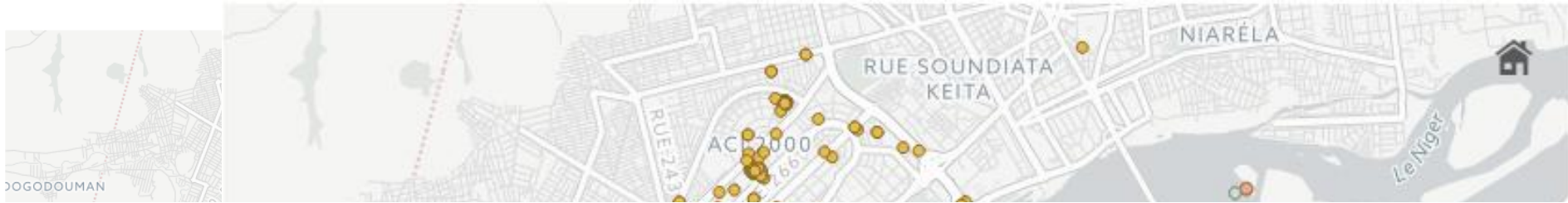


Data – User map



IMEI	Home Operator	Device Make	Device Model	RX Data	TX Data	Active Days	NIC	Rx Speed 95% Fractile	Tx Speed 95% Fractile	Reach RTT Median	Avg Packet Loss	DNS Success Rate	Ping Success Rate	Reach Success Rate
Totales				5,576.73 MB	1,377.14 MB	19	36.3%	2.56 Mbps	0.32 Mbps	316 ms	11.97%	76.9%	97.4%	94.7%
8F68A2B2C2E7472	Orange Mali	Apple	iPhone 7 Plus (CDMA)	199.23 MB	102.75 MB	19	8.4%	1.22 Mbps	0.71 Mbps	473 ms	10.42%	88.8%	98.9%	99.1%
CB161CF13AA34F0	Orange Mali	Apple	iPhone 7	590.77 MB	303.05 MB	17	59.7%	0.34 Mbps	0.19 Mbps	478 ms	8.87%	92.2%	98.6%	98.8%
09AA23496278452	Orange Mali	Apple	iPhone 6S	990.17 MB	171.85 MB	11	70.3%	2.47 Mbps	0.56 Mbps	60 ms	11.29%	78.3%	97.7%	98.4%
354605070362064	Orange Mali	samsung	SM-A800IZ	397.52 MB	47.83 MB	11	64.4%	0.55 Mbps	0.17 Mbps	393 ms	18.71%	58.7%	74.2%	81.7%
354605070362064	Malitel	samsung	SM-A800IZ	425.84 MB	62.89 MB	10	23.8%	0.90 Mbps	0.17 Mbps	211 ms	10.08%	67.5%	82.0%	87.3%
36F7F7F24E984A3	Malitel	Apple	iPhone 7	26.91 MB	7.81 MB	5	69.6%	0.52 Mbps	0.45 Mbps	184 ms	3.69%	68.8%	96.8%	100.0%

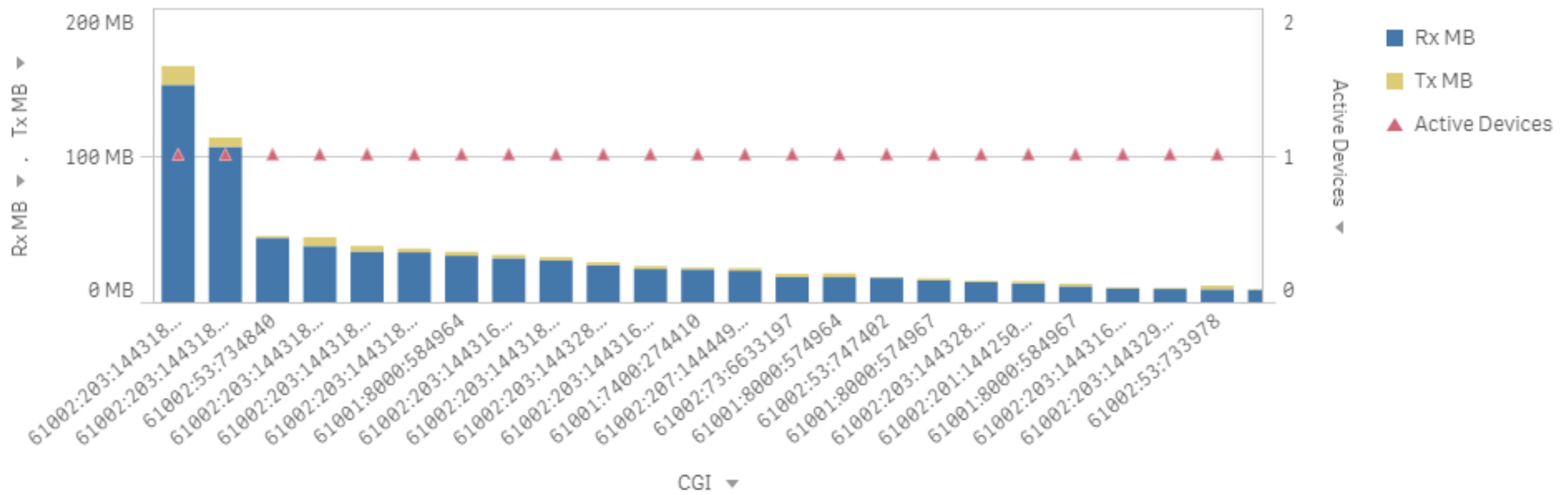
Data – 3G Radio



- 53
- 73
- 201
- 203

3G Records
1,562

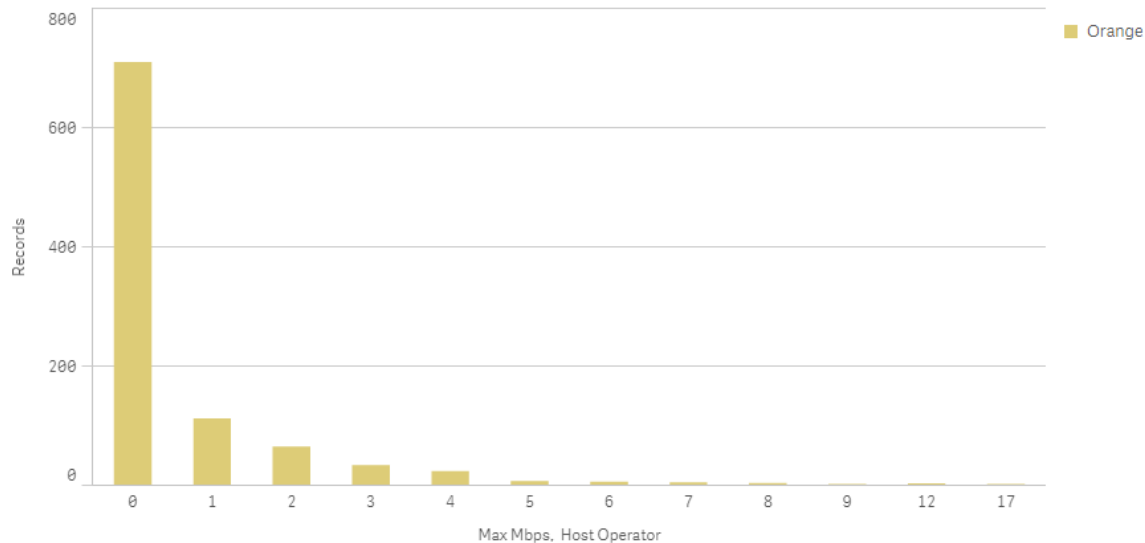
Most Used 3G Cells



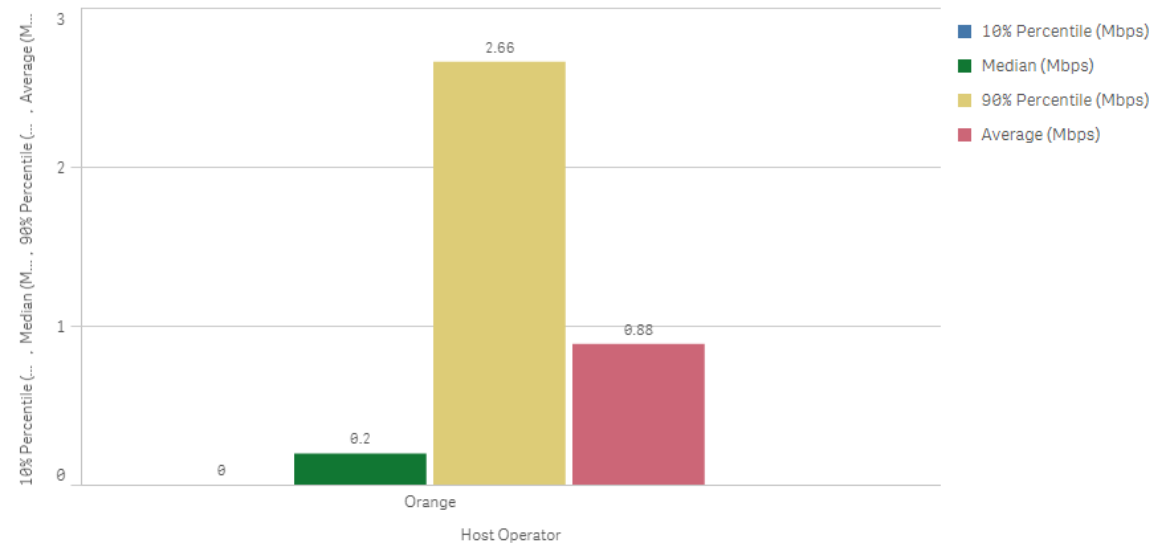
61002:203:144318376
61002:203:144318379

Orange throughput and latency

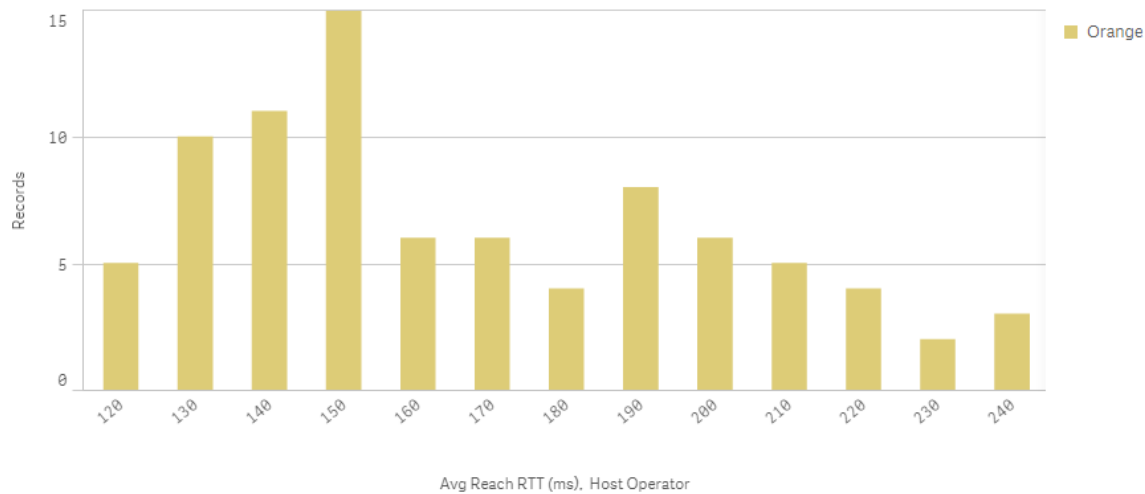
Throughput Session Distribution



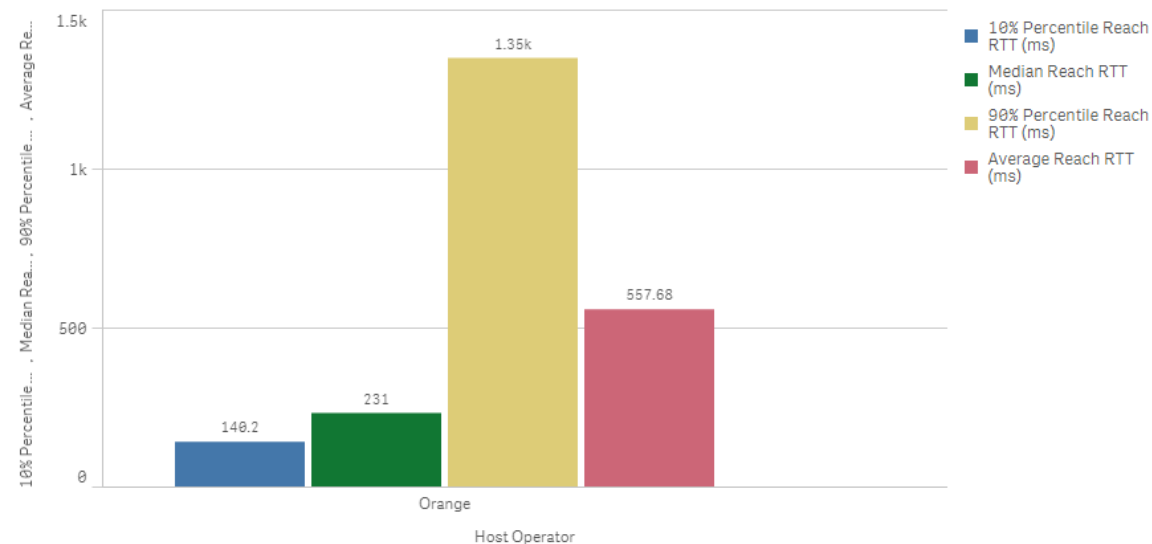
Max. Throughput per Session distribution



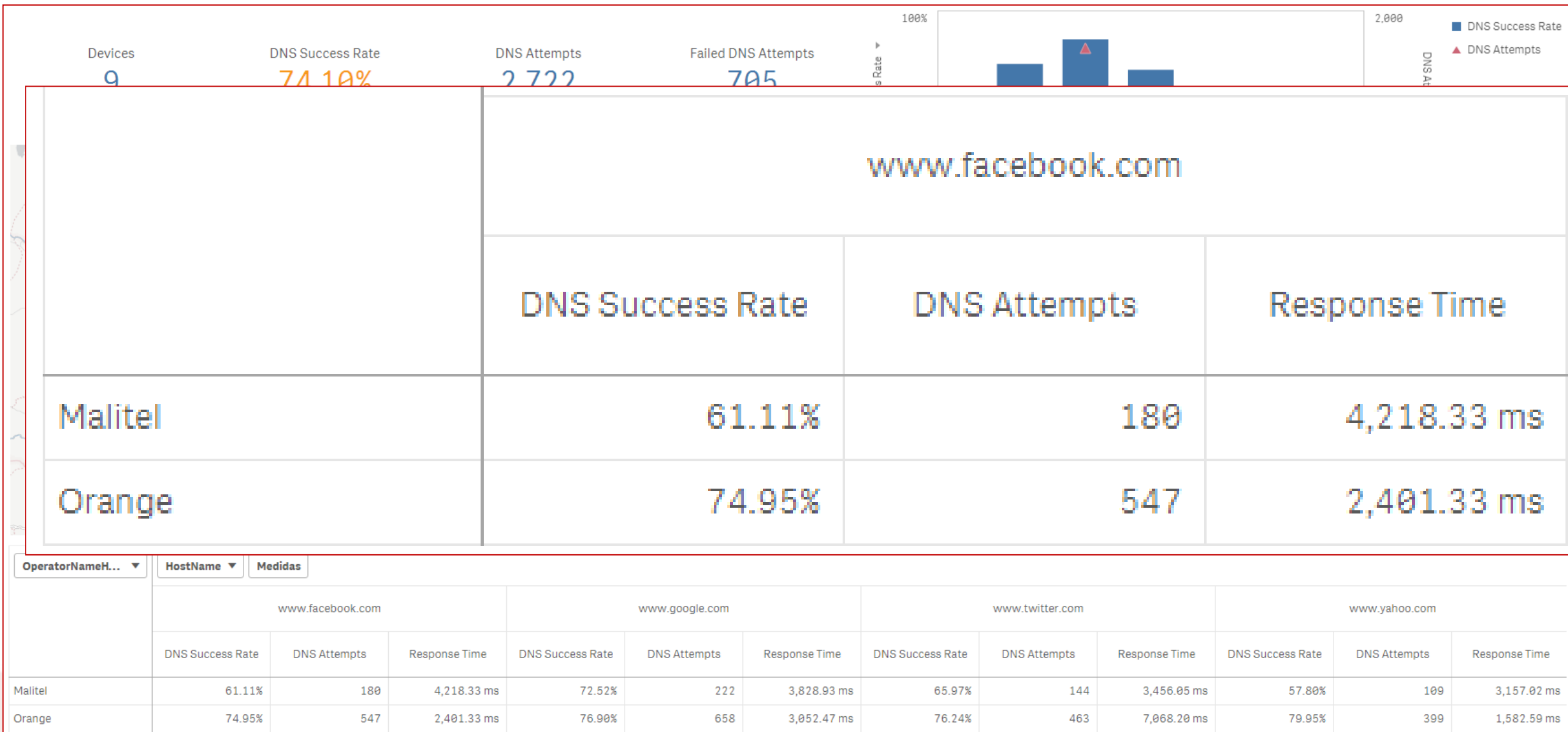
Latency Session distribution



Latency per Session distribution



DNS Performance per technology



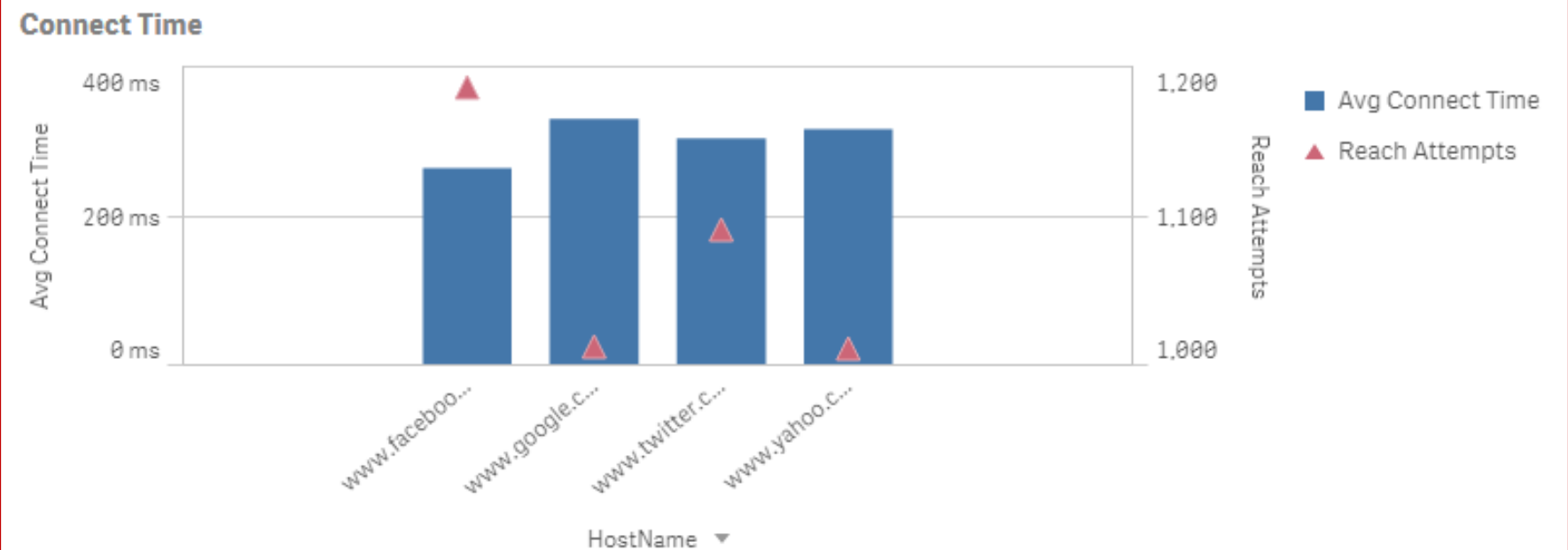
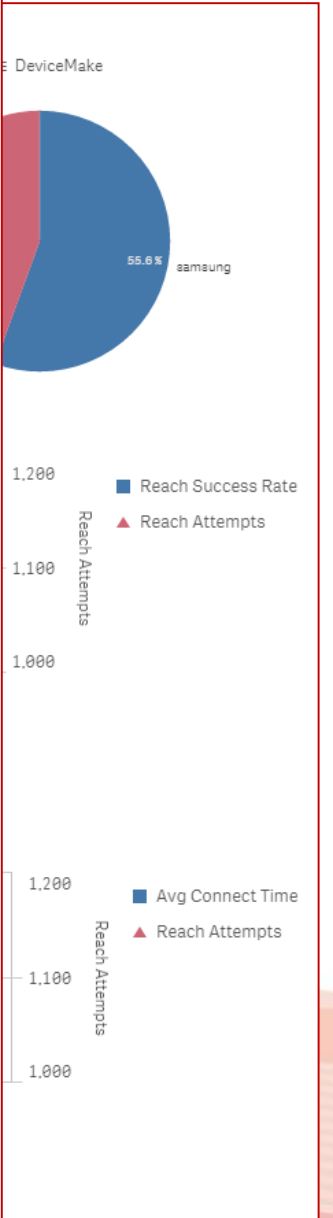
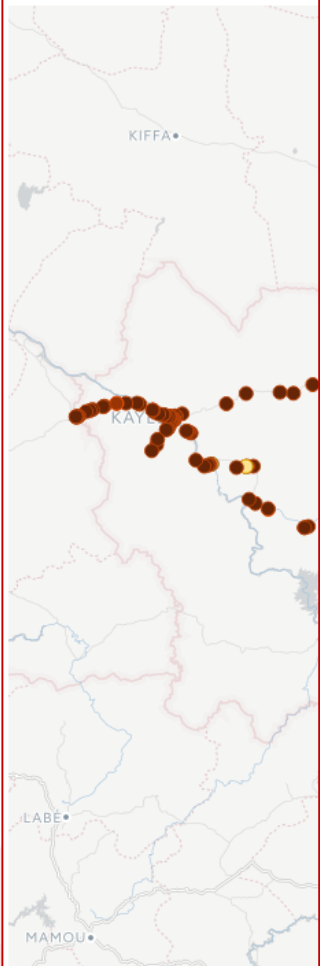
Ping Performance per technology and hostname



Reach performance

Devices
9

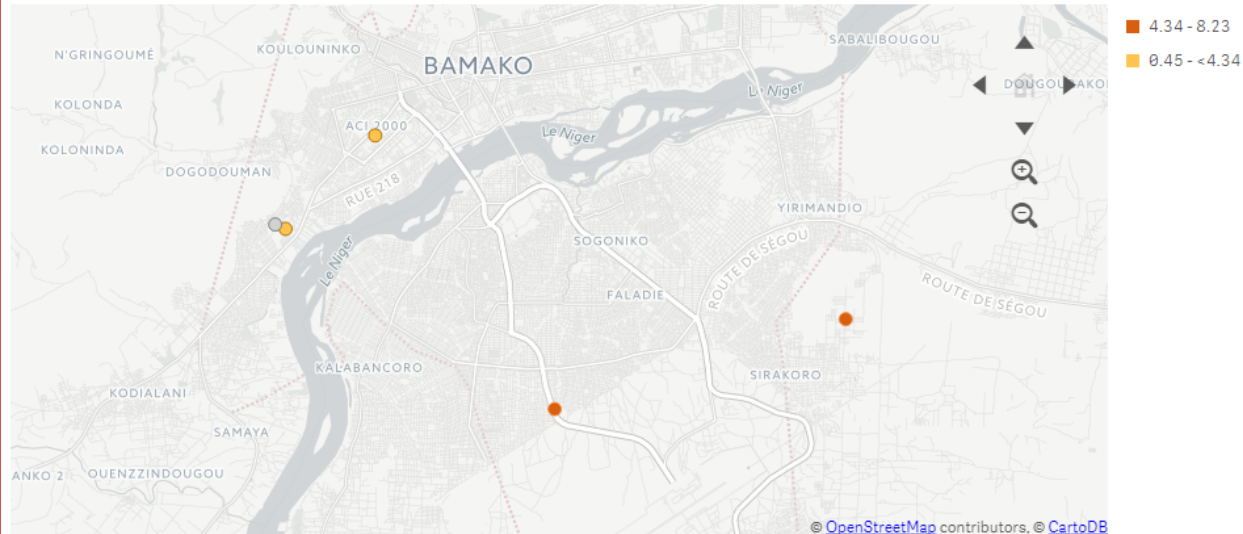
Reach Success Rate



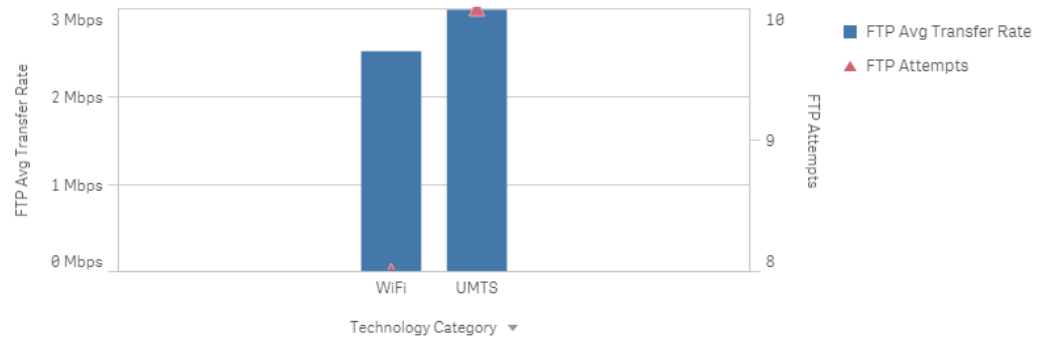
FTP Tests

Devices: 4
 FTP Success Rate: 61.11%
 FTP Avg Transfer Rate: 2.90 Mbps
 FTP Attempts: 18

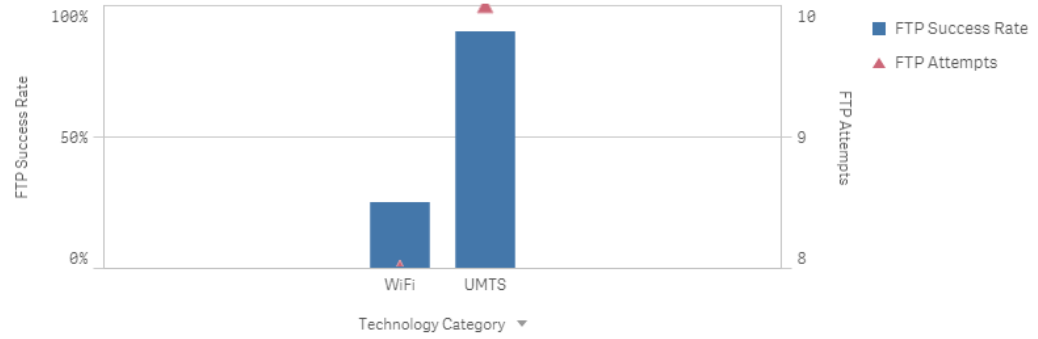
FTP Avg Transfer rate



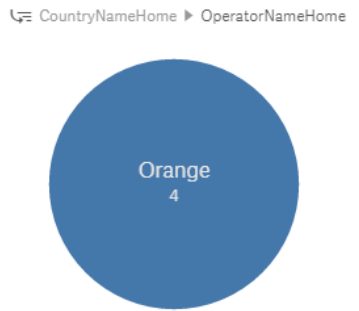
Transfer Rate



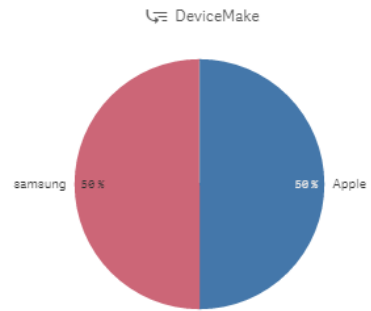
FTP Success Rate



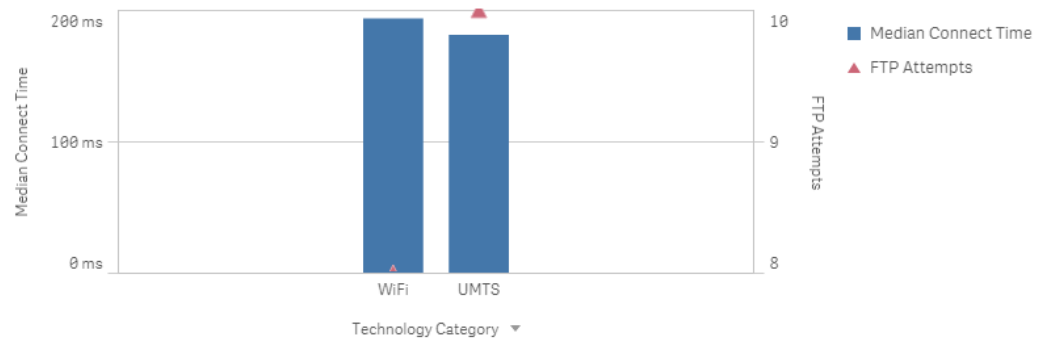
Devices per Home Country/Operator



Devices per Make/Model



FTP Median Connect Time



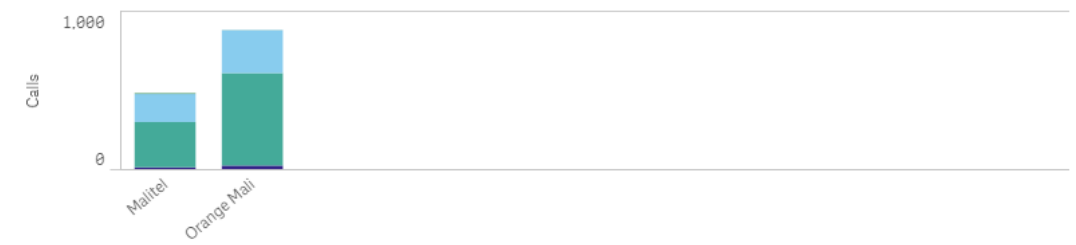
VOICE



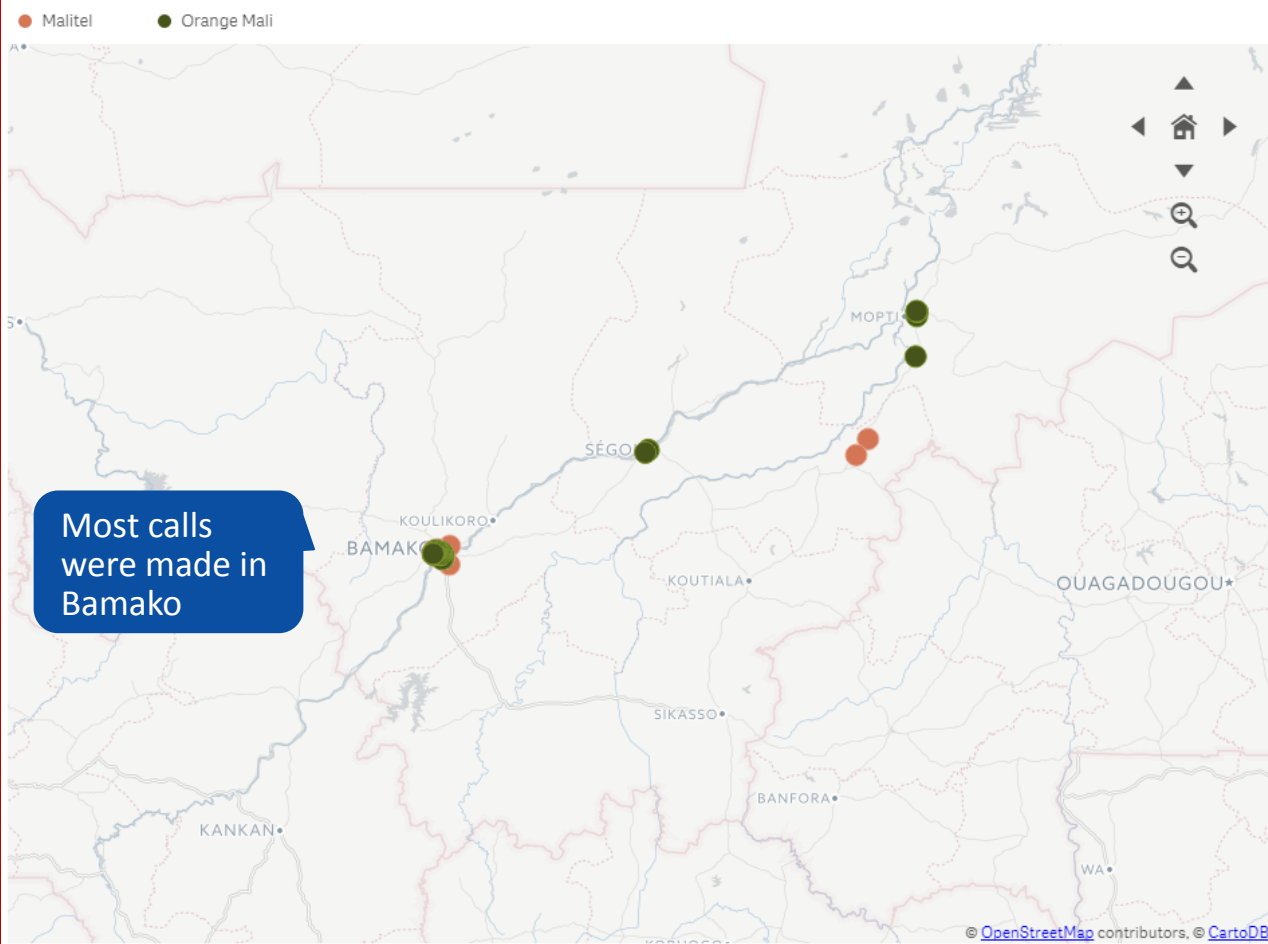
Voice – overall performance

Subscribers: 8
Calls: 1,357
Drops: 5
Perceived Call Failure Rate: 0.4%

Call attempts per operator

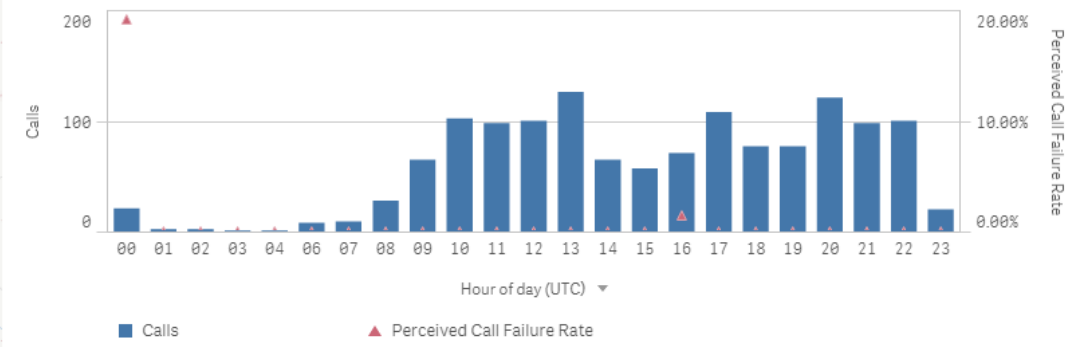


Visited network

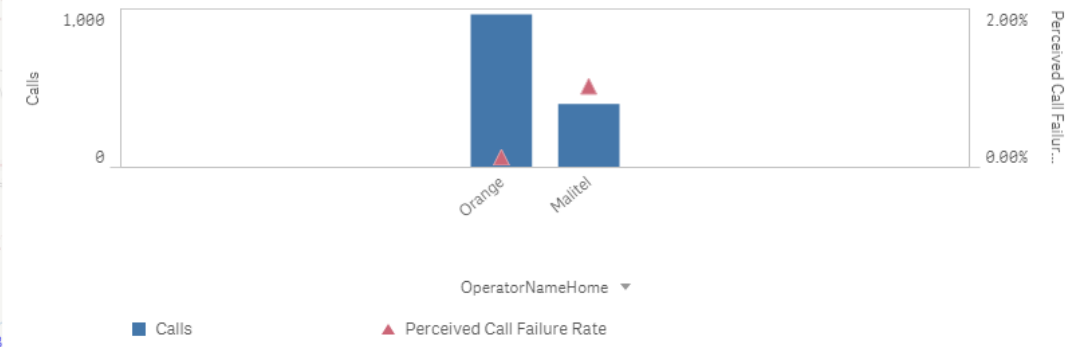


Most calls were made in Bamako

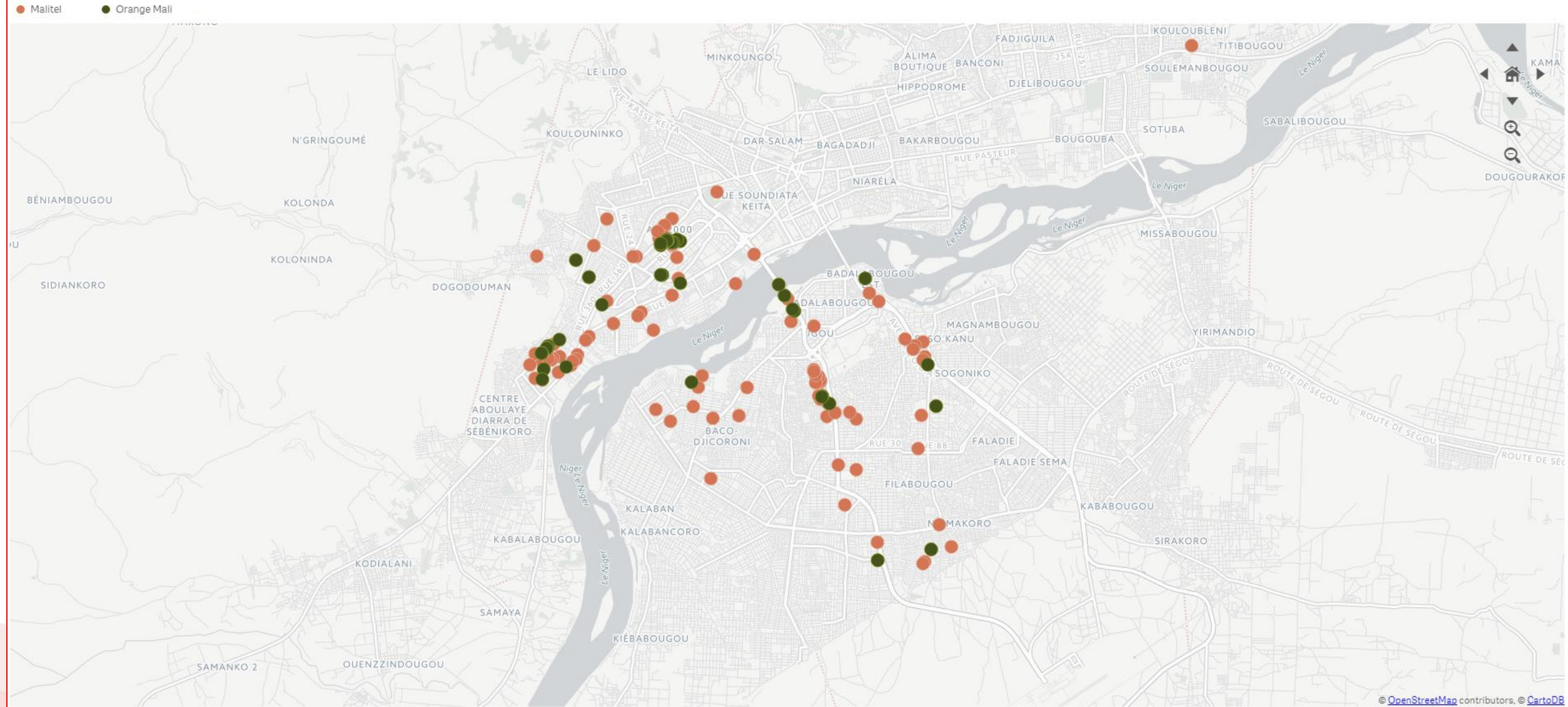
Call Performance



Call Performance



Details on Bamako



Voice - Technology

Release reason per technology

End Tech Category ▼

Reason ▼

Reason	Answered	Low RSSI	Missed	Out of service	Unknown reason
					4
					14
					19

Technology transition performance

StartAccessTech... ▼

EndAccessTechC... ▼

Medidas

GSM
UMTS

Call Durat

End Tech C

	GSM		UMTS	
	Calls	Perceived Call Failure	Calls	Perceived Call Failure
		Rate		Rate
GSM	250	1.60%	28	0.00%
LTE	4	0.00%	28	0.00%
UMTS	120	0.83%	925	0.00%

	GSM	UMTS	LTE	Changes	GSM	UMTS	LTE	Changes
GSM	14947	4887	10	133	3887	419	0	37
UMTS	22	37316	101	142	18	15411	0	45

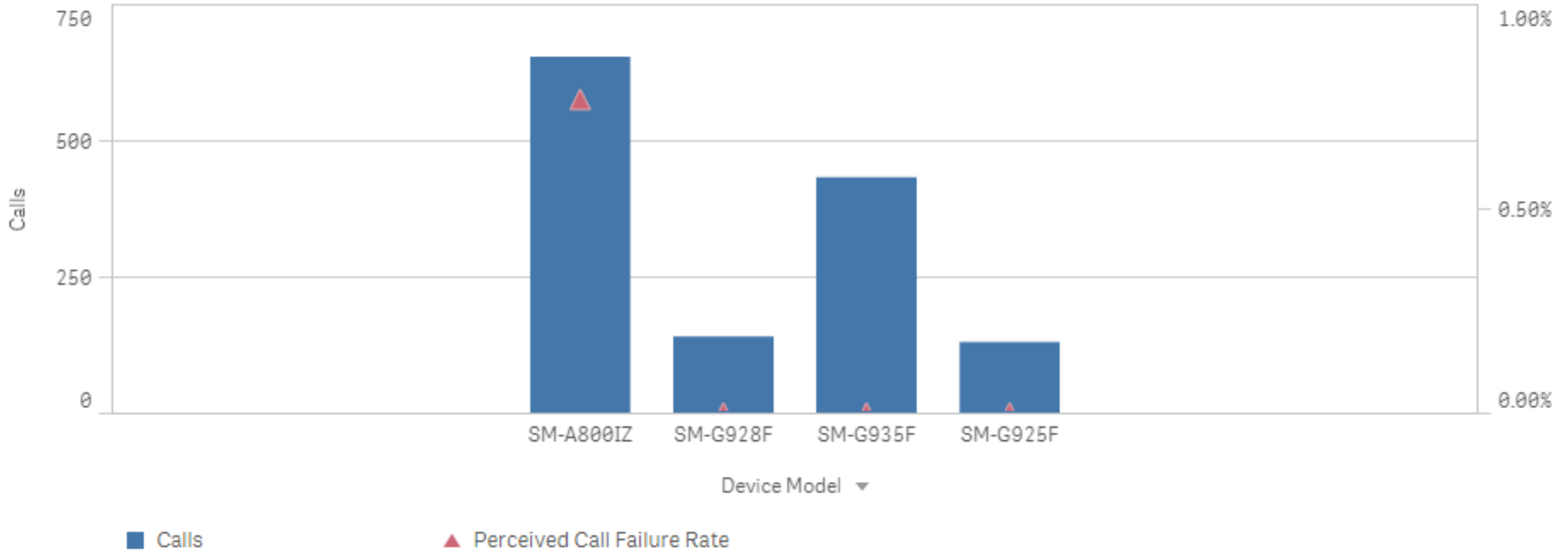
	Calls	Perceived Call Failure Rate	Calls	Perceived Call Failure Rate
GSM	250	1.60%	28	0.00%
LTE	4	0.00%	28	0.00%
UMTS	120	0.83%	925	0.00%

Duration	Cell Changes
LTE	0
LTE	37
LTE	45

Voice – device performance

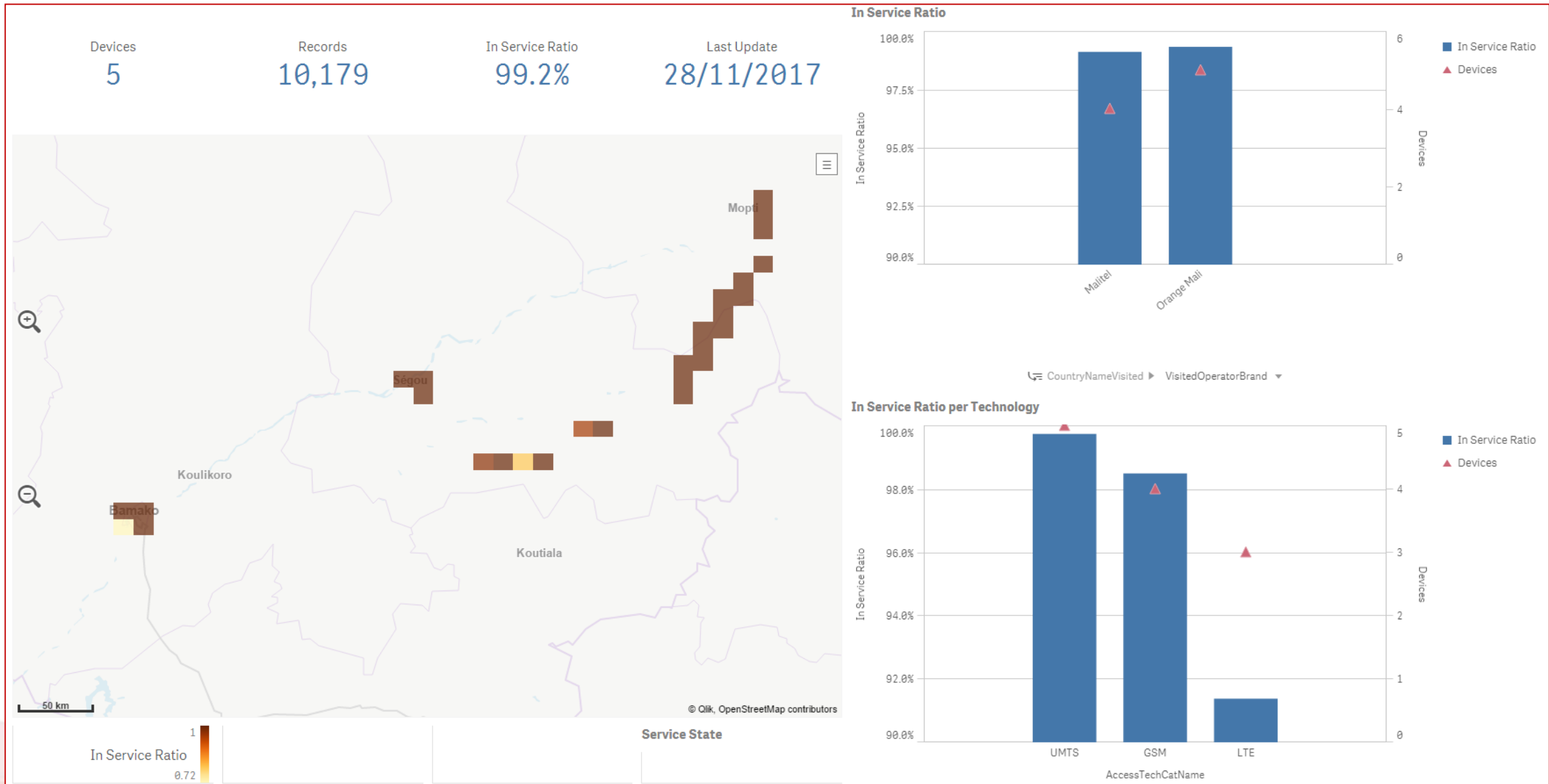
Subscribers 8	Calls 1,35	Devices per Model
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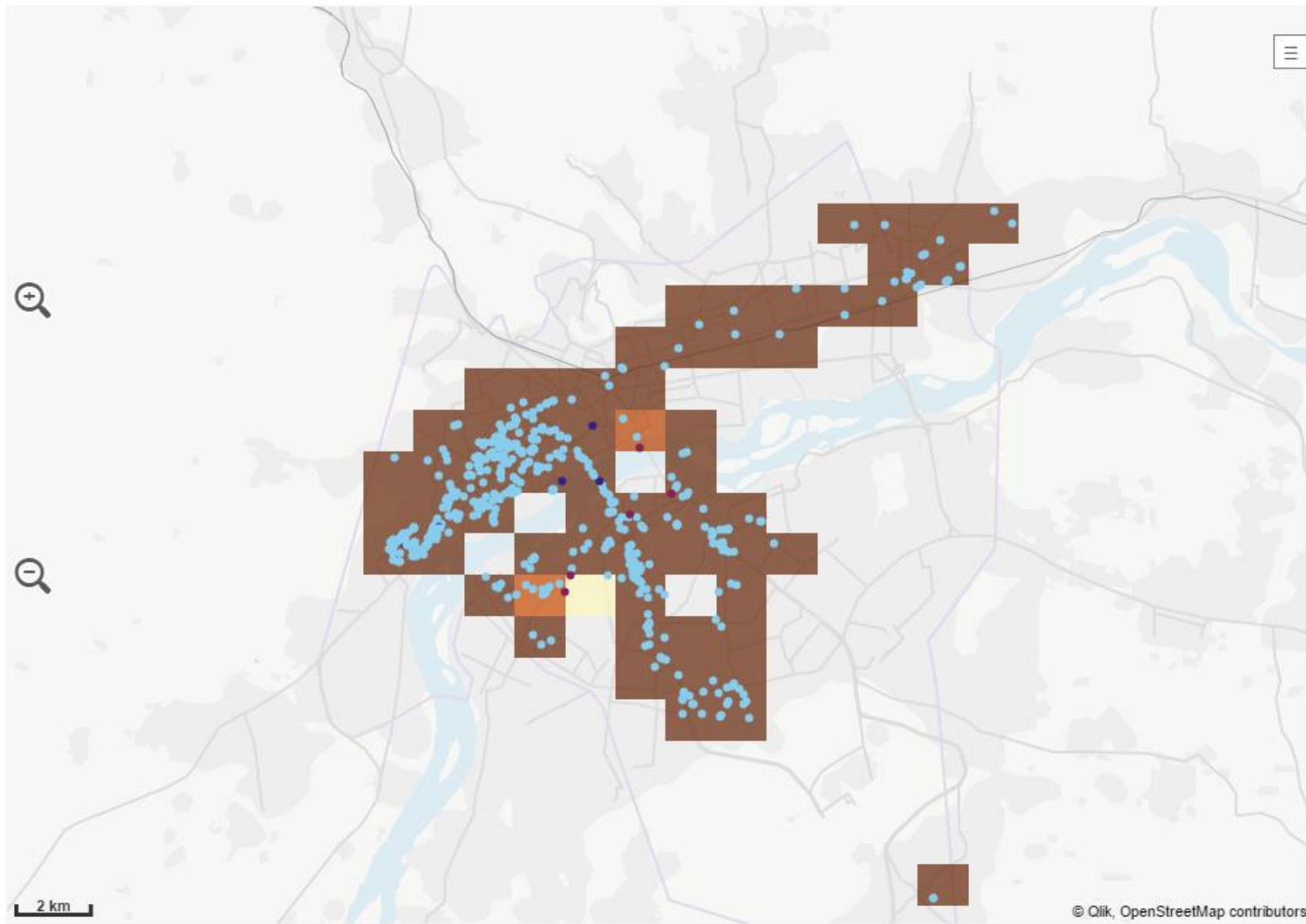
Call Performance per device model



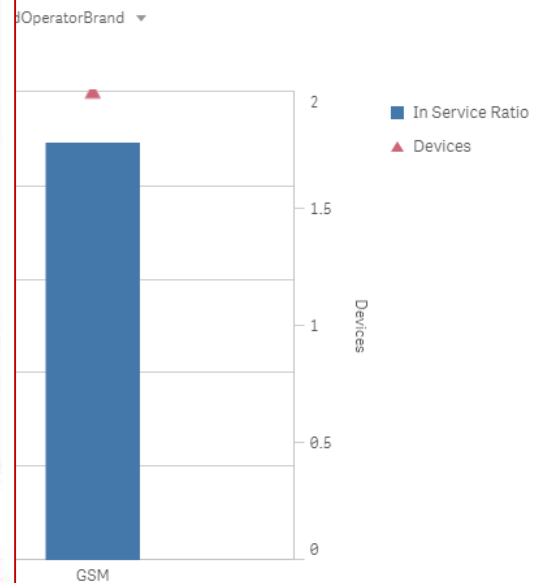
SERVICE STATE

Overall service state





Service State



FEEDBACKS

Example of customer feedback



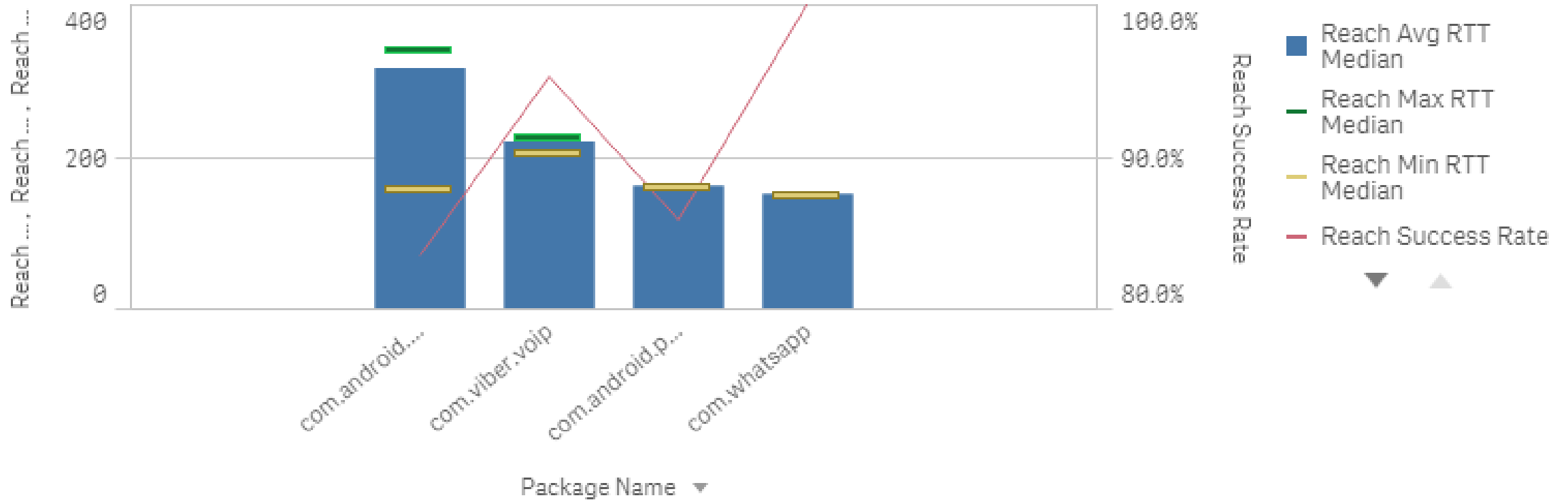
● Call drops ● Data speed

APP USAGE

OTT app usage



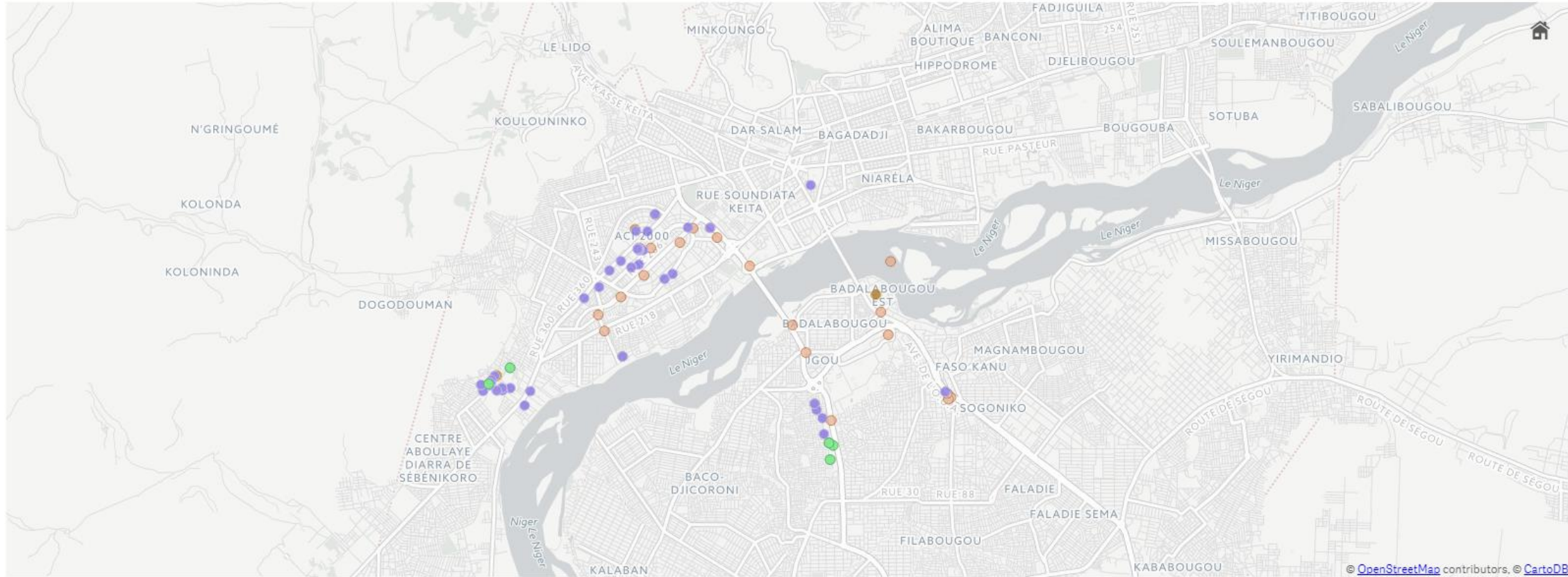
Reach RTT



com.android.mms	1	1,68 MB	1,22 MB
com.android.phone	1	0,54 MB	0,35 MB
com.viber.voip	1	17,52 MB	6,89 MB
com.whatsapp	1	0,12 MB	0,10 MB

Package Name	Ping Success Rate
com.android.mms	0%

OTT app performance in Bamako



- com.android.mms
- com.android.phone
- com.viber.voip
- com.whatsapp

PackageName	Q	Devices	App RX MB	App TX MB	Ping Avg RTT Median	Ping Success Rate	DNS Avg RTT Median	DNS Success Rate	Reach Avg RTT Median	Reach Success Rate	App Duration
Totales		1	19,86 MB	8,55 MB	226.00 ms	82.7%	384.00 ms	66.4%	217.00 ms	89.9%	15,774 s
com.viber.voip		1	17,52 MB	6,89 MB	222.00 ms	89.7%	383.00 ms	72.8%	219.50 ms	95.1%	12,992 s
com.android.mms		1	1,68 MB	1,22 MB	321.50 ms	71.8%	773.00 ms	59.6%	316.50 ms	83.3%	2,407 s
com.whatsapp		1	0,12 MB	0,10 MB	200.00 ms	100.0%	135.00 ms	100.0%	151.00 ms	100.0%	192 s
com.android.phone		1	0,54 MB	0,35 MB	888.00 ms	80.0%	566.50 ms	42.9%	161.50 ms	85.7%	183 s

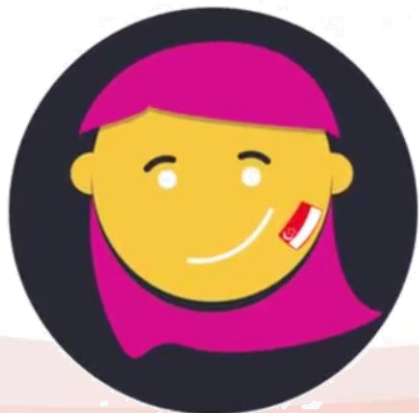
**A major reference of CiquaI : IMDA
the regulator of Singapour**



IMDA Singapore - App based QoE Approach

- Operators in Singapore did provide standard QoS results to IMDA, BUT IMDA were concerned that the results:
 - weren't independent
 - subject to manipulation by the telco
- IMDA decided they needed objective and independent view of the Customer Experience.
- IMconnected: IMDA decided upon the app approach:
 - IMconnected App is lightweight and non-intrusive
 - Easy to brand and distribute (Google Play / iTunes)
 - Little interaction from the end user

EMPOWERING
POSSIBILITIES

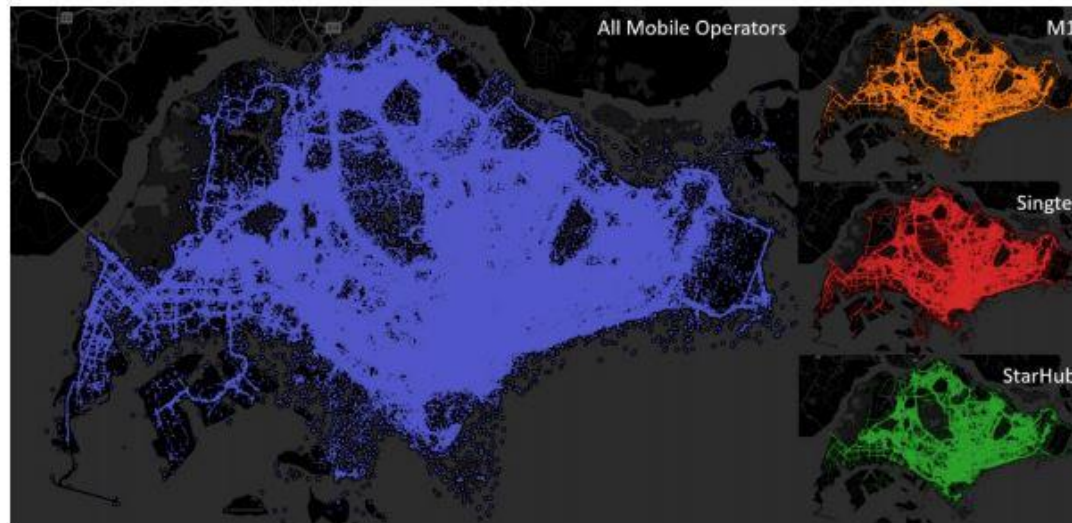


IMDA Singapore

Distribution of Data Points

IMconnected is able to locate the position of a device with reasonable accuracy where the measurement is taken.

Figure 7: Distribution of Data Points



Data points collected were well distributed across Singapore.
Results are representative of the wider public experience.

IMDA use the data gathered from their mobile application “IMConnected” to complement their current QoS framework.

The data collected, including user feedback, enable IMDA to publish independent bi-annual reports to consumers advising of the state of the mobile and public Wi-Fi networks across Singapore.

Using the mobile application approach enables timely data collection and ensures QoE KPIs are collected in as many locations as possible – providing full coverage across Singapore.

IMDA Singapore

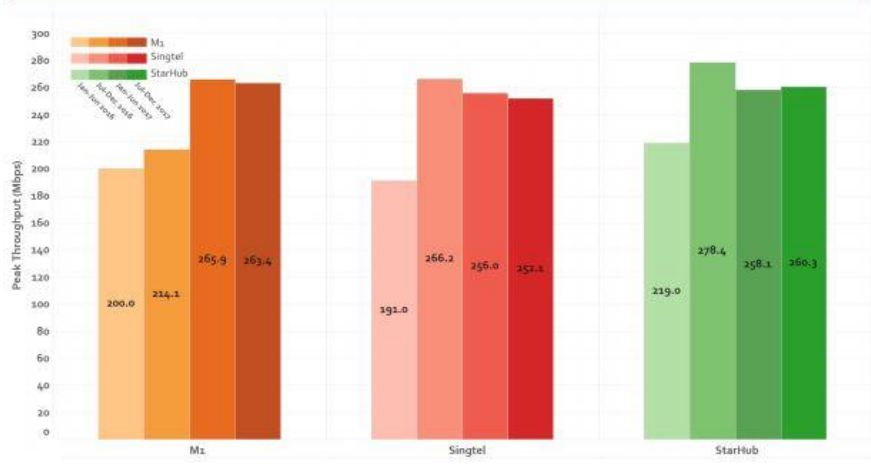
Figure 25: 4G Average Latency by Operators Table (Figures for July 2017 – December 2017)

Jul'16-Dec'17: 4G Average Latency (ms)		
M1	Singtel	StarHub
44.0	47.8	51.3

Figure 20: 4G Peak Throughput by Operators Table (Figures for July 2017 – December 2017)

Jul'17-Dec'17: 4G Peak Throughput (Mbps)		
M1	Singtel	StarHub
263.4	252.1	260.3

Figure 21: 4G Peak Throughput by Operators Graph (Comparison Across Periods)



What is Wireless@SG?

Wireless@SG is part of IMDA's initiatives to facilitate the provision of free and seamless wireless broadband services in public places.

Wireless@SG Experience

Wireless@SG users may experience faster access speeds due to operators and venue owners providing higher capacity or higher speed fixed-line or backhaul connectivity at each WiFi access point. Users can enjoy a better surfing experience as a result.

Throughput

1.3-25.3
Mbps

Latency

49.29
milliseconds

To conclude

- Ciqua is a mobile approach application for regulators or operators that analyzes the QoE of the customers
- It can be used :
 - to get trends of the network 24/7 in a whole country
 - to focus on some users (recurrent complaints in one sector for example)
 - to identify a problem on a specific brand or model of smartphone
- Easier to deploy through a mobile app to download
- The end user is getting involved to the improvement of the quality of the network

Thank you for your attention

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