

NAVIGATE YOUR NEXT



DIAL-Malawi Use Case
EDA – MNO Data (26 Months)

December 20, 2018

Mobile Subscriptions in Malawi

- To obtain population density estimates for 2019-2023 we need to have associated call density for these years.
- Since we do not have call density for 2019-2023, we have to use 2016-17 and project call density for 2019-2023 based on mobile usage growth rate in Malawi.
- The basis on which call density is forecasted is worldbank's mobile number subscriptions data for Malawi.
- When Worldbank mentions mobile number subscriptions, what does it mean?

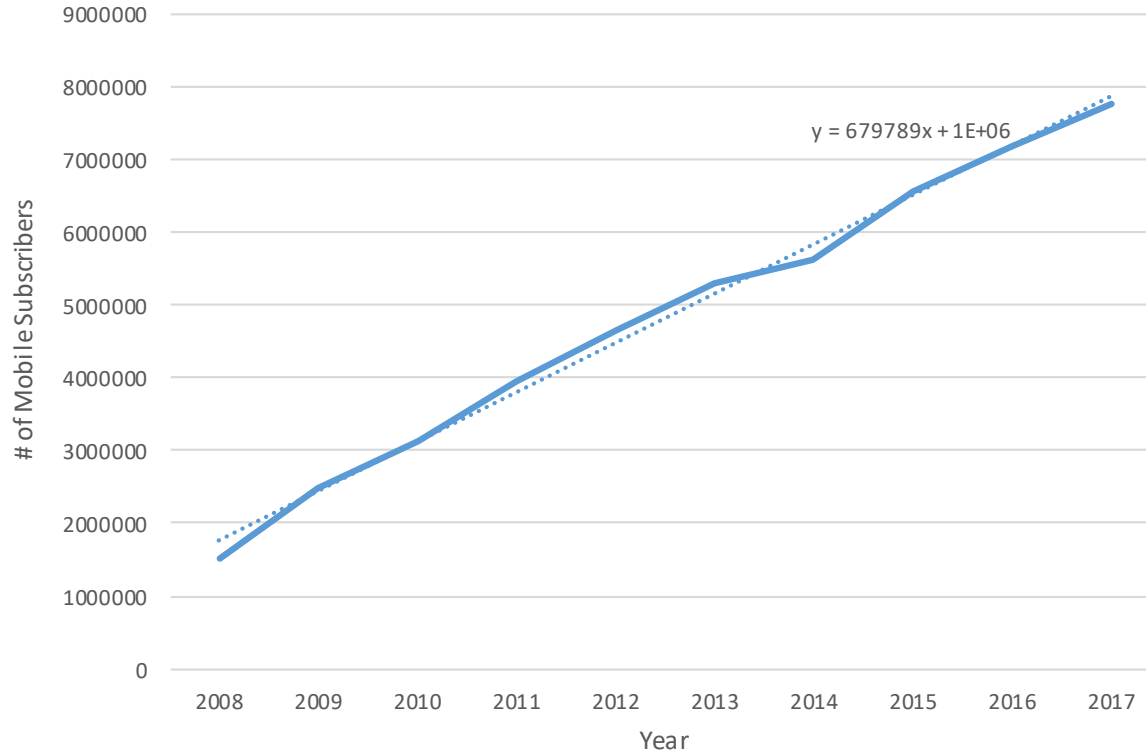
Mobile cellular subscriptions

Mobile cellular telephone subscriptions are subscriptions to a public mobile telephone service that provide access to the PSTN using cellular technology. The Indicator Includes (and is split into) the number of postpaid subscriptions, and the number of active prepaid accounts (i.e. that have been used during the last three months). The Indicator applies to all mobile cellular subscriptions that offer voice communications. It excludes subscriptions via data cards or USB modems, subscriptions to public mobile data services, private trunked mobile radio, telepoint, radio paging and telemetry services.

- This file of worldbank contains information on number of mobile phone subscriptions in Malawi from 1960 to 2017.
- Albeit data is available from 1960s, we would like to consider last 10 years data for our analysis since it is more relevant to consider recent growth in subscriptions than 20 years back in presence of smartphones 3G/4G networks.

Subscriptions graph- Malawi

Malawi Mobile Subscriber base

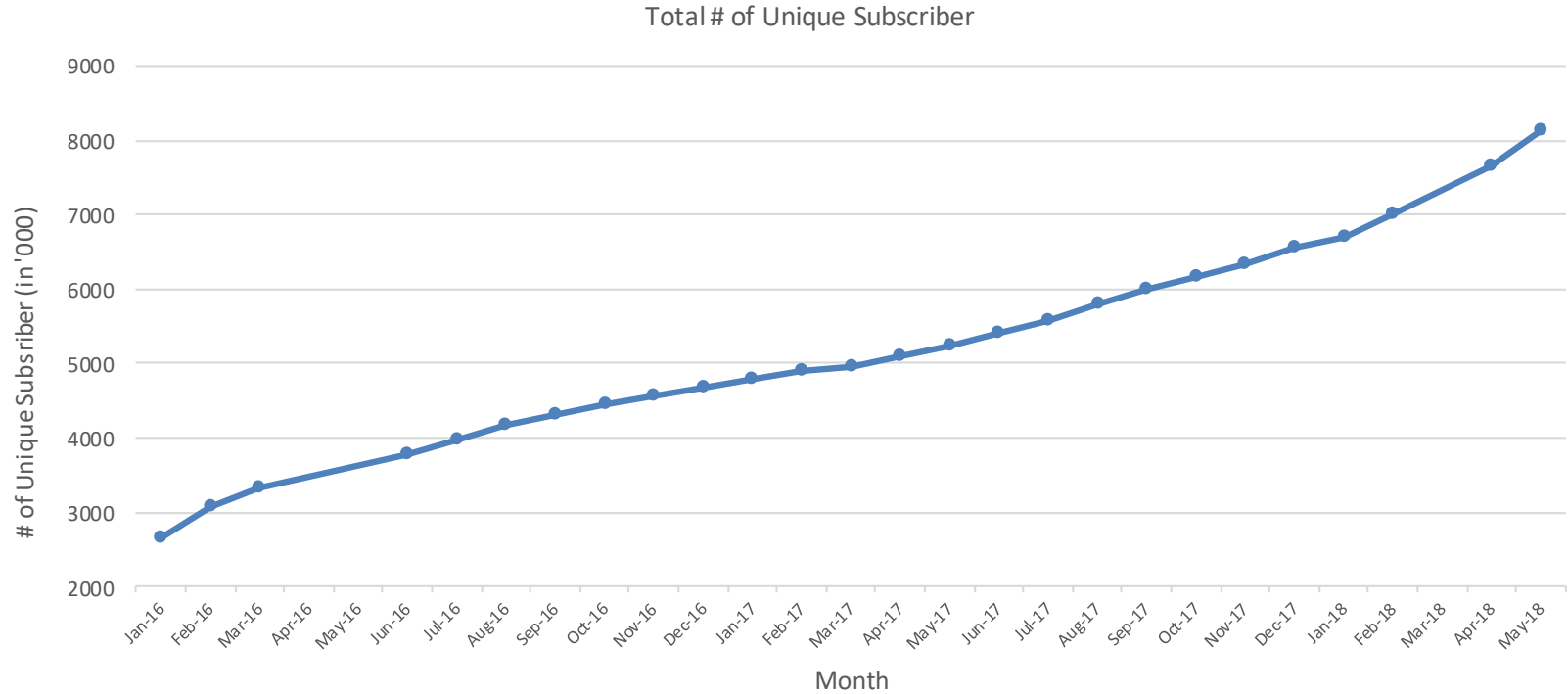


- We see an increasing trend in mobile subscription from 2008-2017.
- Using the trend line in this time interval we forecast the subscriptions from 2019-2023.
- This obtained value can be used to project the call density for 2019-2023 and thus providing population density for 2019-2023.

Reference:-

<https://data.worldbank.org/indicator/IT.CEL.SETS>

of Active Unique Subscribers Month-on-Month



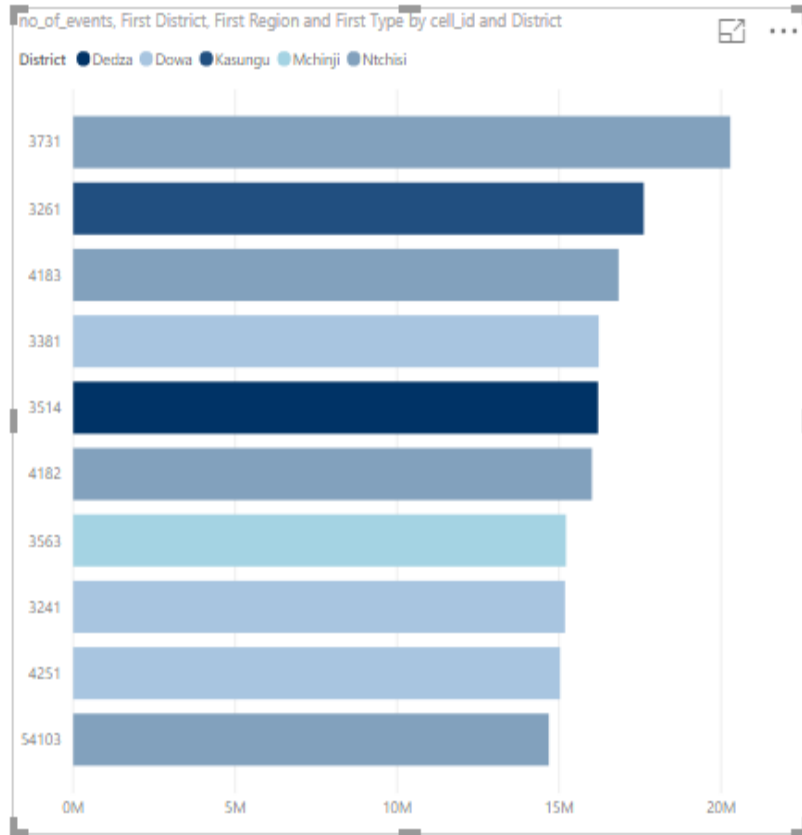
- # of active unique subscribers are increasing as month increases

Distribution of Cell id year-wise

| # of Distinct Cell id | | | | |
|-----------------------|-------------|-------------|-------------|-------------|
| Type of cell Id | 2016 | 2017 | 2018 | Total |
| 2G | 1696 | 59 | 158 | 1913 |
| 3G | 2156 | 1175 | 791 | 4122 |
| 4G | 0 | 2 | 6 | 8 |
| Missing type* | 13 | 27 | 11 | 51 |
| (blank) | 60 | 242 | 309 | 611 |
| Total | 3925 | 1505 | 1275 | 6705 |

* Missing type are those cell_id which has latitude / longitude but not cell Type information in master dataset

Highest used Cell towers (by events)

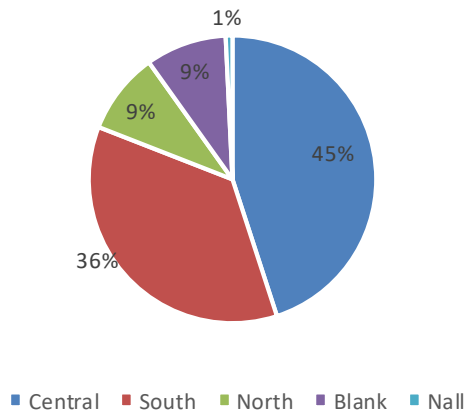


- Based on total events generated for entire 26 months of data from a cell id we find cell id 3731 to most event generated tower. This tower is present in Ntchisi district.
- Close observation suggests that top 10 cell ids catering to maximum events are all from central region and all are 2G towers.

Cell Id Distribution

- There are 6705 Cell Id in mno_daily_agg
- Lilongwe and Blantyre are top two district having maximum # of Cell Id
- Lilongwe City and Blantyre City are top TAs having maximum # of Cell Id

Cell Tower distribution by Region

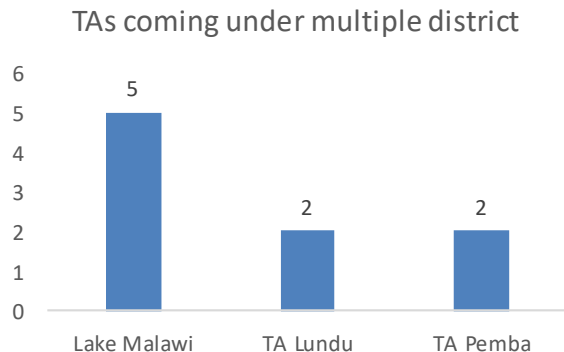


| # of cell_id | # of District |
|--------------|---------------|
| 0-50 | 6 |
| 50-100 | 9 |
| 100-150 | 4 |
| 150-200 | 4 |
| 200-250 | 1 |
| 250-300 | 1 |
| 300-350 | 1 |
| 350-600 | 1 |
| 600-1100 | 1 |
| 1100-1850 | 1 |
| >1850 | 1 |

| # of cell_id | # of TAs |
|--------------|----------|
| 0-10 | 64 |
| 10-20 | 60 |
| 20-30 | 26 |
| 30-40 | 15 |
| 40-50 | 4 |
| 50-60 | 6 |
| 60-70 | 2 |
| 70-80 | 1 |
| 90-130 | 1 |
| 130-240 | 1 |
| 240-610 | 1 |
| 610-930 | 1 |
| 930-1620 | 1 |
| >1620 | 1 |

Cell Id features in Multiple Regions @ TA level

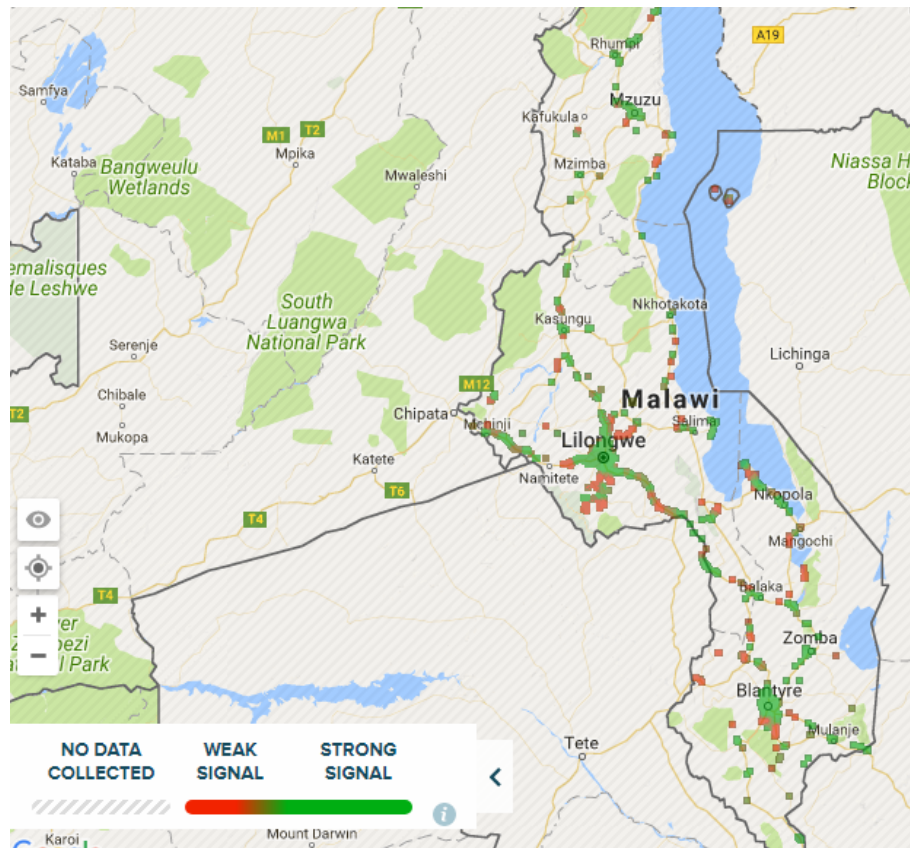
- There are 256 TAs in 28 Districts
- In Master dataset we have 182 Distinct TAs but there are TAs which comes under multiple districts and multiple regions
- These TAs are mostly found to be in border region



of Cell id features in multiple Region

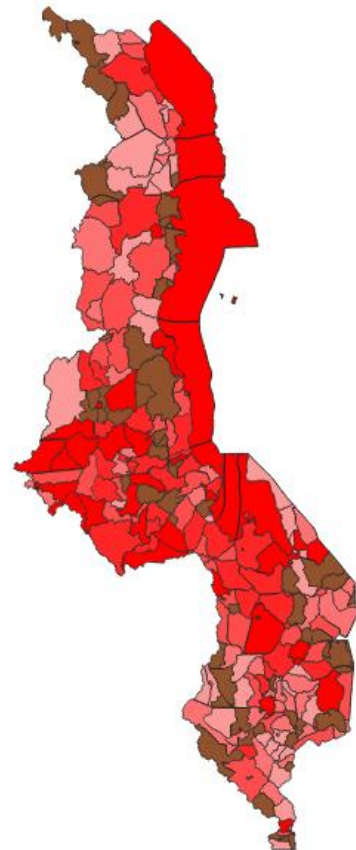
| Row Labels | North | Central | South |
|------------------|-------|---------|-------|
| Lake Malawi | 55 | 33 | 15 |
| Ntcheu Boma | | 18 | 12 |
| Rumphi Boma | 15 | 3 | |
| SC Goodson Ganya | | 18 | 6 |
| SC Kambwiri | | 3 | 3 |
| SC Makwangwala | | 9 | 9 |
| SC Mbiza | | 3 | 27 |
| TA Chadza | | 41 | 3 |
| TA Chakhumbira | | 12 | 9 |
| TA Kwataine | | 3 | 3 |
| TA Mabulabo | 15 | 3 | |
| TA Maganga | | 37 | 3 |
| TA Malili | | 27 | 3 |
| TA Mazengera | | 18 | 3 |
| TA Mlonyeni | | 12 | 2 |
| TA Mpando | | 6 | 6 |
| TA Njolomole | | 24 | 15 |
| TA Phambala | | 15 | 9 |
| TA Zulu | | 51 | 3 |

Indicates TA units with cell ids
Brightness of red varies on total events generated



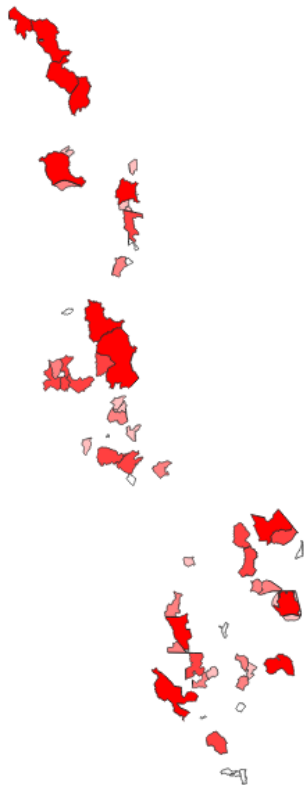
Airtel coverage map

Source:-<https://opensignal.com/networks>



Brown areas indicate TA units without cell ids

TAs without Cell Ids zone wise

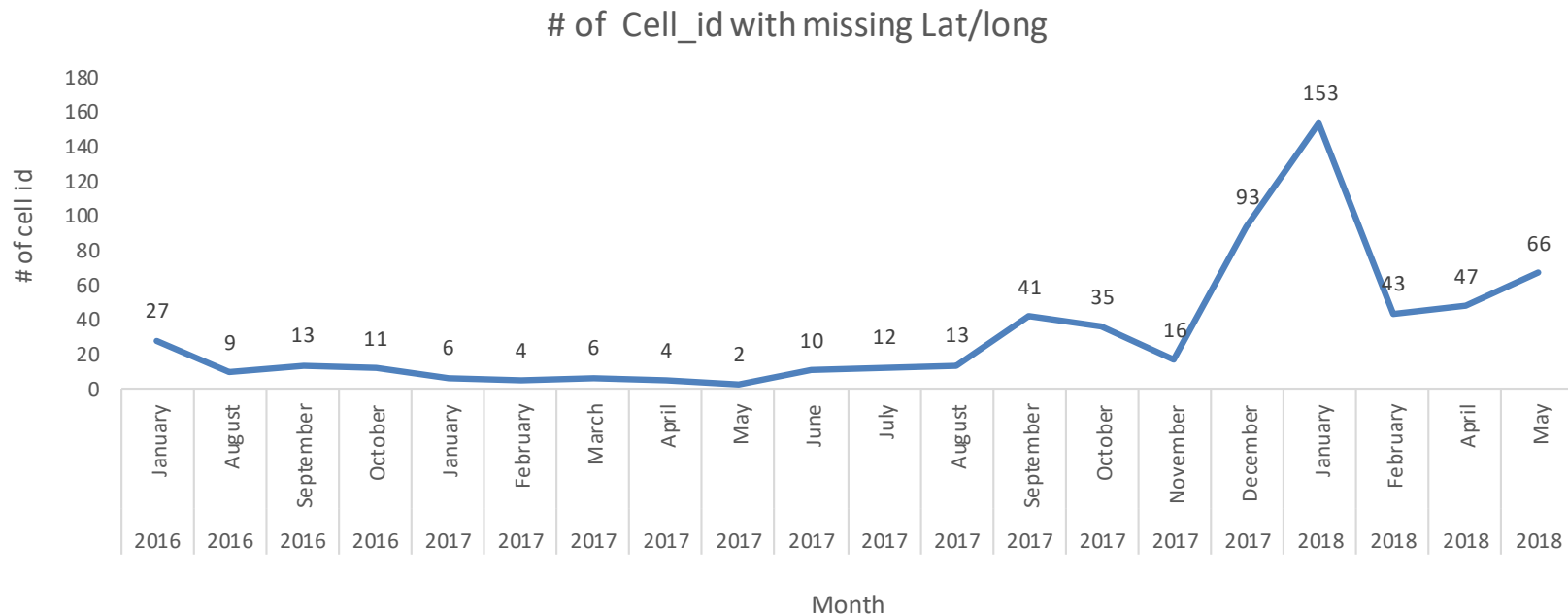


| Region | Total TAs present | TAs without cell ids | % TAs without cell ids |
|--------------|-------------------|----------------------|------------------------|
| South | 107 | 29 | 27.10 |
| Central | 95 | 18 | 18.94 |
| North | 48 | 15 | 31.25 |
| Total | 255 | 62 | 24.31 |

- A total of 24.3% of TAs units don't have a cell id in its boundary. This 24.3 % of TAs unit translates to a total of around 15.66% of Malawi area.

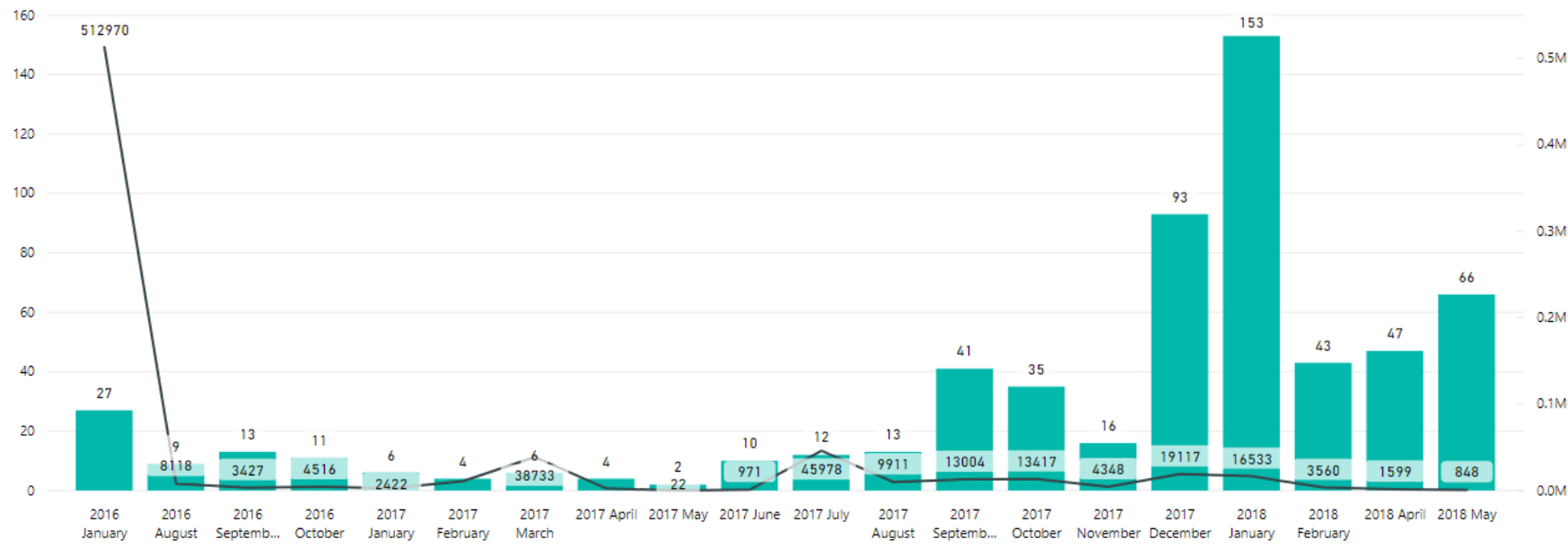
Uncovered TAs units with respect to cell ids.
Brightness of red varies according to the area of the unit.

Cell Id Distribution with Missing lat/long



- We found that after November 2017' huge surge in # of cell_id with missing lat/long

Distribution of Cell Id with missing Lat/Long as per Month



- Bar chart refers to # of cell id without lat/long getting its first call on that month (X-axis)
- Line chart refer to # of calls made from respective cell id on that month
- We found that after November 2017' huge surge in # of cell_id with missing lat/long

Distribution of Cell id with missing lat/long across # Active Subscribers and # of calls made

| # of Unique Active subscriber (SIM -Id) | # of Cell_id |
|---|--------------|
| 0-1000 | 554 |
| 1000-2000 | 23 |
| 2000-3000 | 2 |
| 3000-4000 | 3 |
| 4000-5000 | 6 |
| 5000-6000 | 4 |
| 6000-8000 | 1 |
| 8000-9000 | 5 |
| 9000-10000 | 1 |
| 10000-11000 | 2 |
| 11000-13000 | 2 |
| 13000-15000 | 1 |
| 15000-16000 | 1 |
| 16000-19000 | 3 |
| 19000-20000 | 1 |
| 20000-318000 | 1 |
| >318000 | 1 |

- 554 cell id are used by around 1000 active unique subscribers.

| # of Calls | # of Cell_id |
|----------------|--------------|
| 0-7500 | 461 |
| 7500-15000 | 79 |
| 15000-22500 | 21 |
| 22500-30000 | 6 |
| 30000-37500 | 5 |
| 37500-45000 | 6 |
| 45000-52500 | 3 |
| 52500-60000 | 1 |
| 60000-67500 | 4 |
| 67500-75000 | 4 |
| 75000-82500 | 3 |
| 82500-97500 | 3 |
| 97500-105000 | 2 |
| 105000-135000 | 5 |
| 135000-165000 | 1 |
| 165000-195000 | 1 |
| 195000-202500 | 4 |
| 202500-2640000 | 1 |
| >2640000 | 1 |

- 461 cell id are used to make upto 7500 calls.

Distribution of Cell id with missing Lat/long as per # of Active Days

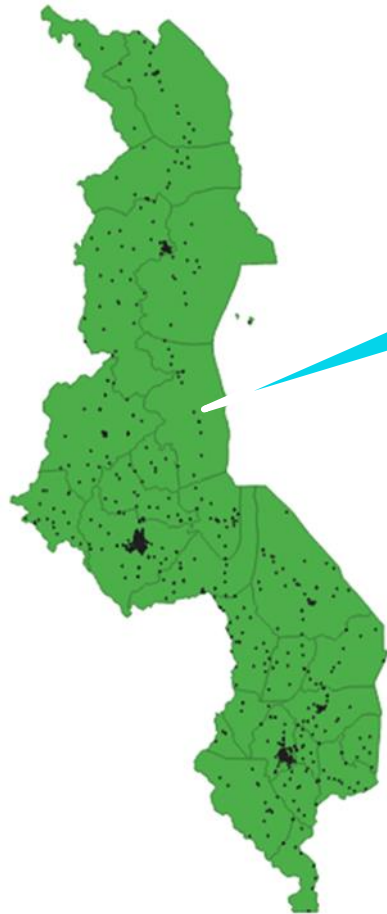
| # of Active days | # of cell_id |
|------------------|--------------|
| 0-50 | 170 |
| 50-100 | 42 |
| 100-150 | 169 |
| 150-200 | 107 |
| 200-250 | 51 |
| 250-300 | 38 |
| 300-350 | 2 |
| 350-400 | 6 |
| 400-450 | 1 |
| 450-550 | 7 |
| 550-850 | 8 |
| >850 | 10 |



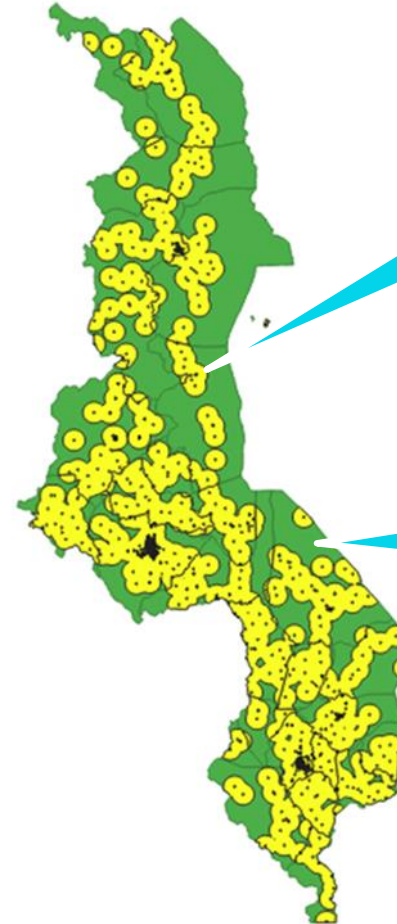
Microsoft Excel
ma Separated Valu

- Earliest and latest calls made through of Cell Id with missing Lat/ Long and number of calls is stored in the excel object.
- Number of active days=(Earliest call date –last call date) for a particular cell id.
- 170 cell id was active for a maximum of 50 days

Area covered by Cell Towers within 10 Km



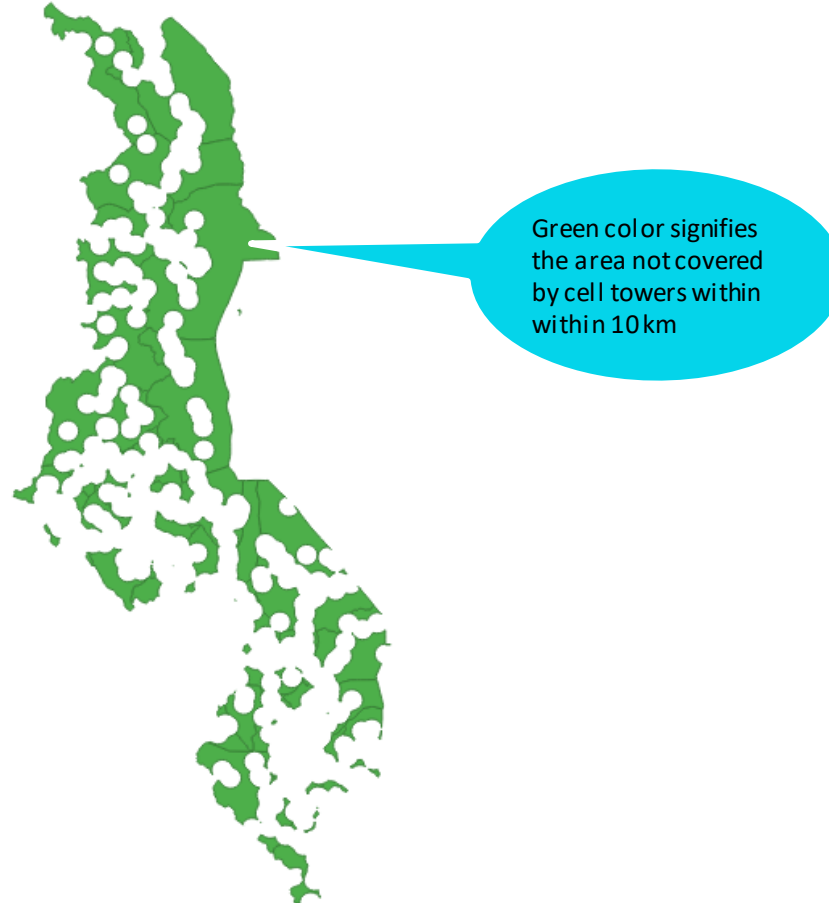
Black spots
signifies the
presence of
cell towers



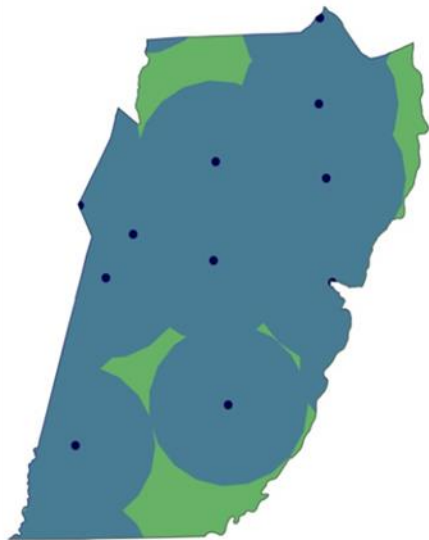
Yellow color
signifies area
covered within
10 km radius of
cell towers

Green color
signifies the area
not covered by
cell towers within
10km

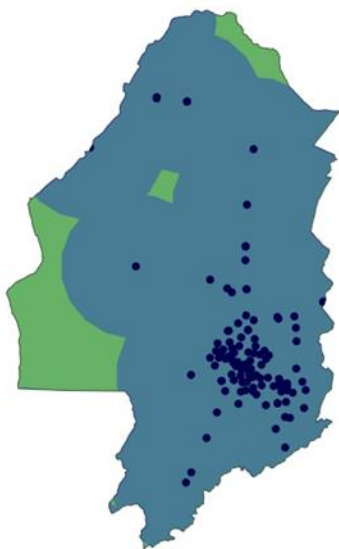
Area not covered by Cell Towers within 10 Km



Area covered by Cell Tower within 10 Km @ ADM1



Balaka district



Blantyre district



Lilongwe district



Salima district

- **Black** spot signifies location of cell towers
- **Blue** color signifies the area covered by cell towers within 10 Km of radius
- **Green** color signifies the area not covered by the cell tower within 10 Km of radius

Malawi population coverage as per Health Posts and Cell Towers

| Malawi population coverage | |
|--|-------------------------|
| Description | Population coverage (%) |
| Population coverage within 5 km radius of the Health posts | 74.12 |
| Population coverage within 10 km radius of the cell towers | 84.65 |

**Only Dispensary, Health Centre, Health Post and Hospital facilities are in our scope of health services

THANK YOU