Comment on the set of common positions on monitoring mobile coverage, proposed in document BoR (18) 115

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Summary

We strongly advocate for incorporating crowd-sourced measurements as additional source of data for monitoring coverage and service quality for mobile networks in the manner already used by some NRAs, e.g. Austria, Norway, and Italy. We also outline how crowd sourced measurements can be used to calibrate other coverage estimation methods to improve their accuracy. We further emphasize the need for proper statistical methodology for data processing to ensure accurate and fair evaluation of operator performance based of crowd sourced as well as theoretical and drive test inputs. For this, we propose to initiate the work on a new Regulatory Best Practices document for quality requirements for coverage estimates or (if option 2 for CP1 is chosen) probabilities of successful user access to a service including statistical guarantees on the results obtained. The same document should also address the data and methodology underlying the produced maps.

General Comments

In the same way signal level is an “indicative measure towards the definition of the level of coverage” the coverage itself is just an indicative measure of mobile services being available to the consumers. The common positions start from the premise that for the monitoring of mobile coverage

a) Coverage information is required for 100% of the country land mass and
b) Coverage information cannot be gathered using measurements with an appropriate land mass coverage

We disagree with both propositions and like to comment as follows:

a) Current regulatory requirements on coverage typically base on population coverage or area coverage. However, ‘population’ and ‘area’ (aka ‘land mass’) are just auxiliary figures to describe the degree of geographical coverage that matter for consumers. Nowadays there is spatial data about the presence of population and built-up infrastructures available that could be used to define coverage requirements much better. Using this data could both improve coverage for consumers where it matters to them, and avoid costs arising from unnecessarily

asking for coverage build out where mobile phone users don't go. Crowd sourcing data contains information about area visited by mobile phone users and their respective coverage conditions. This data could provide good insight into what is a maximum reasonable geographical coverage ambition to contemplate. Furthermore, there is information available from automatic data mining and analytics on satellite images providing spatial data about the presence of population and built-up infrastructures (so-called 'artificial land coverage', e.g. Global Human Settlement (GHS) framework http://ghsl.jrc.ec.europa.eu/). Combining those data sources could create a much better basis for the definition of coverage ambitions than just 'land mass' or 'population'

b) P3 is collecting network coverage and performance data using crowd sourcing on a global scale with currently more than 190 Millions of consumer smartphones having the P3 crowd sourcing technology installed. The P3 solution is integrated into 800+ very diverse Android apps and collects data passively in the background. If one of the applications is installed on the end-user's phone the data collection takes place continuously- 24/7/365 and GDPR compliant- on this device. In EU countries the P3 technology is installed on about every 500th smartphone giving a very detailed view of
    a. Where consumers really need coverage and carry their smartphone
    b. The quality of coverage at these locations
    c. Both the ability to use mobile services and the service performance

    The grade of detail of crowd sourcing data that is available today is indicated by the following picture showing coverage information collected with the P3 crowd sourcing. For the demonstration of the richness of the available data is the figure below shows only a small subset of data from a 7 days collection period.

Figure 1: coverage plot of Budapest generated from 7 days of crowd sourced data

It is obvious that even for less populated areas crowd sourcing can collect enough measurement data for 100% of the consumer-relevant area in a reasonable time frame and with reasonable effort. The following picture illustrates that showing a subset coverage data for a rural area in the Netherlands collected during a 30 day collection period.

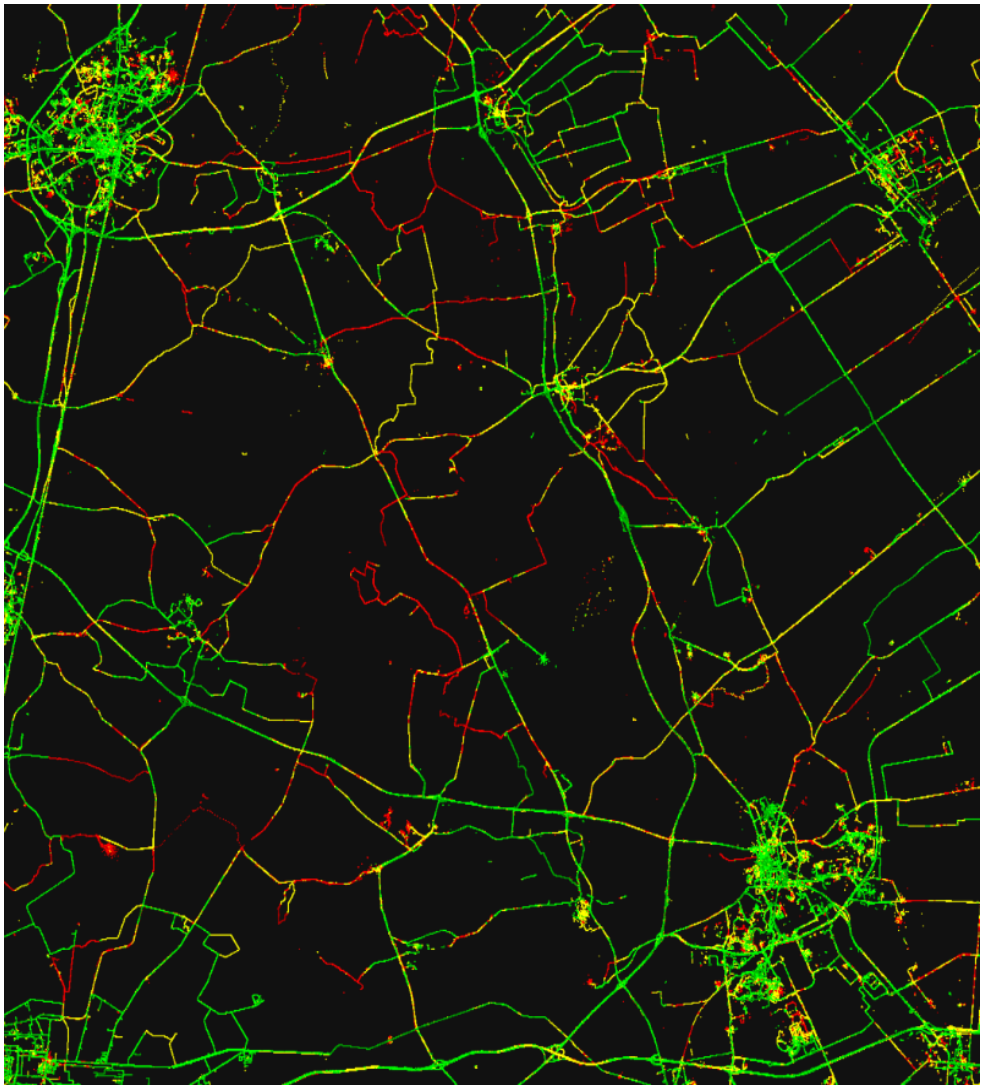

Figure 2: coverage plot of rural area (Emmen/Assen, The Netherlands) generated from 30 days of crowd sourced data

It is worth to add that the crowd data contains the coverage information for both 2G, 3G and 4G (and not the least WiFi). Furthermore, the crowd data does not only contain coverage but also information about the accessibility and performance of mobile services in one consistent data set.

CP1: Technical specifications for monitoring mobile coverage in Europe

It is proposed that NRAs should choose either of the criteria strength of the signal received or the minimum probability of successful service.

When looking at mobile coverage we think that the effective coverage is the coverage as perceived by the consumer. It can be expressed as the probability of camping on a specific technology layer (2G/3G/4G) at a specific location. If assessed by measurements (e.g. crowd sourcing or a large amount of drive tests) this probability can be approximated by the observed relative frequency that mobile devices camp on the respective network layer. It is essential to take into account the interdependencies of the different technology

layers and not to evaluate the layers independently from each other. Otherwise, in an extreme case, a coverage layer could be available on one technology, e.g. 4G, but never seen by the consumer device due to network parameterization that forces all devices to another layer, e.g. 3G. In reality, the crowd data show that at all locations where multiple technologies are available there is always a portion of devices camping on either of the layers depending on the very local environment and the network dynamics.

Therefore, we propose to evaluate both

1) The area covered with a technology (2G/3G/4G) by applying a technology specific binary signal level threshold and
2) The probability (or in case of measurements relative frequency) that a device is camping on the technology at the location given the fact that at the same location there is alternative technology layers from the same network available.

We like to stress the fact that crowd sourced data is perfectly capable of providing this information.

“From a consumer perspective, the signal power received may be of less relevance than the probability of successfully connect to the service.” We like to endorse this point of view. Again, crowd sourcing is capable of providing this information combining passive and active measurements and rigorous statistical processing.

CP3: Ensuring the accuracy of coverage information provided to the public

It is stated that NRSs carry out measurements to “verify the reliability of the mobile coverage maps provided or/and published by the MNOs by collecting in-field measurements through drive testing across a representative sample of a given country where appropriate.”

We like to comment that crowd sourcing data can be used to

a) Verify the reliability of mobile coverage maps and
b) Calibrate coverage predictions from different sources and make them comparable

Coverage predictions calibrated with extensive crowd measurements can be used to improve predictions especially for those areas where no crowd data is available (e.g. for areas where consumers just don’t go). In turn validity of crowd sourced measurements can be verified by drive tests. Such cross-validation is important to ensure the accuracy of the coverage information provided to the public.

CP4: Availability and presentation of mobile coverage information

When publishing coverage predictions, we recommend verifying and calibrating them with crowd data (or comparable other consistent measurement data sources if available). This is especially required when consumers want to use these prediction maps for comparison and not just for specific coverage / no coverage information.

Ideally measurements from different sources (drive tests, crowd sourced measurements, and theoretical estimates) need to be combined, aligned, and comply to statistical guarantees to provide customers with reliable non- contradictory information. For this, as stated on the summary section in the beginning of the document, we strongly advocate BEREC to initiate new Regulatory Best Practices document outlining these procedures, and also to establish quality criteria for coverage predictions that different NRAs and consumers could refer to when using or contracting coverage maps or service accessibility maps.

About P3 communications GmbH

P3 is a provider of network measurement, benchmarking and engineering services. P3's mobile network benchmarking services are based on highly developed expertise in the area of mobile, fixed networks, and related services. P3's holistic approach consists of in-depth knowledge of network performance - gained through a unique testing methodology that has been established as the de-facto industry standard in more than 80 countries worldwide applying both drive testing and crowdsourcing methods.

Being a fully independent and privately-owned company with all major players as its customers, P3 communications is widely/globally accepted as a completely neutral authority. As the de-facto industry standard, the P3 benchmarking methodology focuses on customer-perceived network coverage and quality.