Comments to the Draft BEREC Guidelines on Geographical Surveys of Network Deployments (BoR (19) 179)

Preamble

The following provides the preliminary assessment and questions regarding the Draft BEREC Guidelines on Geographical surveys of network deployments, BoR (19) 182 September 2019. For each of the guidelines a technical discussion is provided, and, if applicable, recommendation and alternate writeup.

This is a preliminary input mainly based on analysis by experts working for the European Commission on a broadband mapping project (Javier Arcil, Ljiljana Simic, Petri Mähönen). Moreover, we emphasise that any alternate writeup is provided for discussion and to emphasise possible technical questions arising from the draft.

Scope of the Guidelines

There are two phases in the writeup of the guidelines:

- Phase One: until March 2020, which just considers QoS1 parameters.
- Phase Two: until December 2020, which includes QoS2 and QoS3 and further methodologies for verification of QoS-1 data. It also includes the procedures to invite undertakings and public authorities to declare their intention to deploy VHCN over the duration of the relevant forecast period for Article 22(3).

The following items are left out of scope:

- Data on physical infrastructure.
- Data on broadband demand or take up.

as they are deemed not to fall within the concept of broadband reach. The issue of mapping physical infrastructures will be dealt with later in this document.

All definitions must be provided along with the verification guidelines. Otherwise, the practical applicability of such definition is not guaranteed, as we will see later throughout this

document. Furthermore, approval of such definitions without validation would run the risk that they would require re-consideration in the second phase, when validation is considered.

Recommendation 1: For each definition and data request, provide means of verification as an integral part of the guidelines, already in this phase.

Definitions

Several definitions are being provided in the BEREC guidelines (paragraph #20) , which include general terms such as building, address, premises or building blocks, geographical information system, household, etc. We have verified that such definitions correspond to standard practices (Eurostat) and we will not comment on them for the sake of brevity. Instead, we will focus on the definitions that may eventually restrict full application of Article 22 of the ECC.

More specifically, we agree with the following definitions:

- Address
- Address passed
- Broadband service mapping
- Building
- Household
- Premises or building parts
- Reach of Fixed Broadband Networks
- Spatial Resolution
- Normally available speed

and have recommendations for the definitions of:

- Premises passed
- Maximum available speed
- Reach of Mobile Broadband Networks,

as follows.

Premises passed

(paragraph 22) *"An operator may report a premise as passed only if, on request of an end-user, it commits to connect the house within normal connection fees, i.e. without any additional cost if it is the standard commercial practice and in any case not exceeding the usual cost in the country, which may be defined by the NRA/OCA. Furthermore, the operator must be able to technically connect the end-user usually within 4 weeks from the date of the request. (These four weeks don't take into account any possible delays due to external, not technical factors, such as delays from the end user side or delays that accrue from operator administrative reasons.)"*

Time to deploy and cost are the only dimensions being considered in this key definition, which makes verification very hard to achieve in practice, if not impossible. Furthermore, according to the definition, the operator may claim *"external, not technical factors"* such as permits, which in practice would extend the four weeks deadline much longer. For example, consider the case of an operator who is willing to promote cell phones or MIFI devices in a geographically isolated area. It would be feasible for that operator to claim that households in the area are passed, as it would take four weeks to connect them, plus the time it would take to obtain permits from the local authorities, which is unbounded.

Especially the last sentence leaves excessive room for 'interpretations' and seems to render the earlier '*usually within 4 weeks*' almost non-operational. This definition separates time to deploy and costs, from the overall time-scale as the operator may claim almost any "*external, not technical*" factors as force majeure, e.g. what if the operator is using a third-party company for technical work, and then defines that this was an *external, non-technical, business related delay.*

Even the issue of administrative delays is sometimes complex. For example, consider a remote location user -- the operator could claim that the technical work for connecting is doable in 4 weeks, and then claim that local planning authorities are slowing their work of setting up the antenna site. Thus one should include enough protection against this sort of misinterpretation of the spirit and intention of this definition to set the time-to-connect to a bounded short-term period. Finally, we note that it may also be that some MSs have a problem with this period being 4 weeks, but this we leave for political discussions as it is strictly out of scope of our technical considerations.

As it turns out, by including more objective criteria within the definition a better data consistency can be achieved. It also helps to provide a fair treatment across operators in the UE, which is cornerstone for making state aid decisions. Actually, the NRA should make consistency checks to ensure that the data provided by one operator is the same than the data provided by other operator, within the QoS-1 definitions.

The proposed definition takes into account availability of network infrastructure, such that time to connect the premise can be safely bounded beforehand.

Recommendation 2: In the definition of premises passed, apart from the time and cost requirements set forth in the BEREC guidelines, consider the additional requirement that all the associated facilities (as per article 2 (10) PE-CONS 52/18) to provide access (as per article 2, (27) of PE-CONS 52/18) to internet services (as per regulation 2015/2120, article 2) are already provided at the address level (address passed according to BEREC definitions). Furthermore, provide an estimation of foreseeable delays, i.e. not only technical work, but also reasonable and experience-based delays for getting planning permits, internal administrative delays. **This definition implies some knowledge of the physical infrastructure of the operator**.

Alternate writeup: An operator may report a premise as passed only if, on request of an end-user, it commits to connect the end-user premises with electronic communications

networks (as per article 2 (1) of PE-CONS 52/18) within normal connection fees, i.e. without any additional cost if it is the standard commercial practice and in any case not exceeding the usual cost in the country, which may be defined by the NRA/OCA. Additionally, all the associated facilities (as per article 2 (10) PE-CONS 52/18) to provide access (as per article 2, (27) of PE-CONS 52/18) to internet services (as per regulation 2015/2120, article 2) are already provided at the address level, up to the distribution point at the serving location. Furthermore, the operator must be able to technically connect the end-user usually in no more than 4 weeks from the date of the request.

Maximum available speed

(paragraph 22) "*The maximum speed is the speed that an end-user in the address/grid could expect to receive at least some of the time (e.g. at least once a day). The parameters should describe the capability of network and not the parameter of service.*"

A natural question that comes to mind is: For how long? The definition states that "some of the time". Is that in the range of seconds, minutes, tens of minutes? Accumulated or sequential?

Recommendation 3: Definition is not precise enough for consistent reporting or data collection. This would be particularly difficult in the context of state aid and VHCN area. Not only the frequency (at least once a day) should be specified but also the length of the time interval in which the maximum speed is attained. Furthermore, by "once a day" it could be interpreted as "anytime in the day", which includes late at night, when the network is unloaded. **We believe that some statistical bounds are required, similar to the "normally available speed" case.**

Furthermore, include a definition of minimum speed, that should be fulfilled 100% of the time, not just the "normally available speed" which is harder to verify. In practice the "normally available speed" is a minimum speed (95% of the time) and the term "minimum" is easier to understand and verify. We note that such minimum plays a very important role in the upcoming IoT scenario, in which plenty of sensors, cameras and other devices will be continuously sending traffic from the households.Consequently, not only the download but the upload bandwidth should be guaranteed.

Alternate writeup: "*The maximum speed is the speed that an end-user in the address/grid could expect to receive at least some of the time under usual peak-time conditions (e.g. at least once a day) . The parameters should describe the capability of network and not the parameter of service. The minimum speed is the lowest speed that is delivered to the end-user, according to the service delivery contract. In principle, the actual speed should not be lower than the minimum speed at any time, except in cases of service interruption.*

We note the latter definition is consistent with that provided by the BEREC's Net Neutrality Group[1]

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[1]https://berec.europa.eu/eng/document_register/subject_matter/berec/download/0/6075-draft-berec-guidelines-on-implementation_0.pdf

Reach of Mobile Broadband Networks

(paragraph 22) *"The reach of mobile broadband is the availability of a mobile broadband network that permits the delivery of a broadband service with a specific mobile technology available at a specific location."*

The **availability** is not defined in this document. Later the document discusses coverage and speed, but there is no technical basis for the "availability" and thus also the "reach of the mobile broadband networks" becomes ambiguous. Is this definition actually needed? Otherwise it needs to be made precise in terms of coverage and/or capabilities.

Recommendation 4: Clarify "reach of mobile broadband" by explicitly defining "availability" in terms of coverage and/or capabilities (e.g. average/min/max DL/UL speed) of the mobile broadband service delivered.
Alternate writeup: *"The reach of mobile broadband is the availability of a mobile broadband network that permits the delivery of a broadband service <u>of a given speed class (and other relevant network performance parameters)</u> with a specific mobile technology ~~available~~ at a specific location."*

Resolution

BEREC's proposal is to use address-level resolution with exact geocoding for fixed networks and a 100x100 m grid (or polygons with equivalent resolution) for mobile networks. Then, the NRA/OCA must use a single database that identifies each address or grid with a unique code, which should be provided to the operators so that they can all submit information with a common reference, although this may not be possible in all countries.

For fixed networks, however, NRA/OCAs may also choose a less granular level because of the difficulties and the time it may take to collect the data at the address-level. Additionally, there may not be a complete address database with all addresses geocoded or different address databases in use by different operators and/or the NRA/OCA. In such situations, NRAs/OCAs may <u>temporarily</u> apply (at least) a 100x100 m grid, or polygons with similar accuracy, also for fixed broadband.

However**,** for fixed networks, using 100x100 m grid seems acceptable as a temporary solution. However, the guidelines do not specify what temporary means exactly, namely

(paragraph #32) *In such situations, NRAs/OCAs may <u>temporarily</u> apply (at least) a 100m x 100m grid, or polygons with similar accuracy, also for fixed broadband. However, in the medium/long term, to ensure the reliability and comparability of the mapping project, in each Member State one common database with geocoded addresses should be used by both the NRA/OCA and, as far as possible, the operators.*

Recommendation 5: Specify what "temporary" means here; i.e. is this transitionary time period months or years, and how many?

Alternate writeup: *In such situations, NRAs/OCAs may <u>temporarily</u> apply (at least) a 100m x 100m grid, or polygons with similar accuracy, also for fixed broadband. However, ~~in the medium/long term,~~ to ensure the reliability and comparability of the mapping project, in each Member State one common database with geocoded addresses should be used by both the NRA/OCA and, as far as possible, the operators, <u>by 2025</u>.*

Footnote 16 for para 28: "*The areas that divide the territory must be the same for all technologies and do not overlap each other. NRAs should provide such grids or polygon systems to operators.*"

This implies also that there is some sort of data aggregation or averaging in the place -- otherwise exactly the same grids or polygons are not reasonable since for example coverage areas and cell sizes between, say, 3G and 5G networks can be significantly different around the same area.

Technology and Medium Codes for Fixed Broadband (Table 1 in p. 18): These include FWA (3G, 4G, 5G) and FWA using unlicensed (particularly Wi-Fi).

Recommendation 6: We do not think that FWA as provided by wireless should be counted as fixed broadband. Tethered connections (cable, fiber) are very predictable and the medium is not dynamic. In wireless, even in the case of FWA the medium is highly dynamic and is load dependent. Thus it might be useful to move FWA to the mobile broadband domain, while admittedly it is its own third category.

Fixed Broadband Elements

The characterization is performed with definition of households passed, download speed, upload speed and access technology, as follows:

- Network provider code
- Technology code:
- Maximum Download speed class:
- Maximum Upload speed class:
- Normal Download speed class (95% of the time criteria)
- Normal Upload speed class (95% of the time criteria)
- Number of premises passed by the operator at the address
- Determine if that network is VHCN at the address considered

whereby technology codes are:

Description	Codes	Medium Codes
DSL on the copper line	DSL	COPPER

VDSL on the copper line	VDSL	
VDSL-Vectoring on the copper line	VECT	
DOCSIS 1.0 or 2.0 on coaxial cable	DOC1	COAXIAL
DOCSIS 3.0 or 3.1 on coaxial cable	DOC3	
FTTH/FTTB	FTTH/B	FIBER
FWA in licensed spectrum (for example, Wimax, 4G, 5G)	FWA	AIR
FWA in unlicensed spectrum (for example, WLAN (Wifi))	WIFI	
Other	OTHER	OTHER

and speed codes are:

Speed	Code
More or equal to 1 Gbit/s	1000
≥300 Mbit/s < 1 Gbit/s	300
≥100 Mbit/s < 300 Mbit/s	100
≥ 30 Mbit/s < 100 Mbit/s	30
≥ 10 Mbit/s < 30 Mbit/s	10
≥ 2 Mbit/s < 10 Mbit/s	2

Surprisingly, qualification of whether a network is VHCN or not is left to the operator (paragraph #42). However, in case transmission media different that fiber to the premise is deployed, Article 82 of the ECC states that *"by 2020 BEREC shall, after consulting stakeholders and in close cooperation with the Commission, issue guidelines on the criteria that a network is to fulfil in order to be considered a very high capacity network, in particular in terms of down- and uplink bandwidth, resilience, error-related parameters, and latency and its variation. The national regulatory authorities shall take those guidelines into utmost account. BEREC shall update the guidelines by 31 December 2025, and regularly thereafter. "*

Recommendation 7: In order to assess if a network is VHCN or not additional parameters other than bandwidth should be requested, namely resilience, error-related parameters and latency and its variation. Furthermore, some means of verification (QoS-2/3) should be provided. This is again, for data consistency and fair treatment of operators when state-aid is applied, to be able to compare different deployment situations in different member states.

Alternate writeup: (paragraph #42) - Determine if that network is VHCN at the address considered, including *down- and uplink bandwidth, resilience (availability), error-related parameters (packet loss), and latency and its variation (jitter).*

We note that the above alternate writeup proposal allows to better exercise control over the data reported by the operator and supports data consistency across operators.

Mobile Broadband Elements

Ref (paragraphs 61,62,65) BEREC proposes as a first approach to characterize the reach of mobile networks determining the availability of broadband service depending on the technology served at a specific location. Additionally and optionally, NRAs/OCAs may want to refine the characterization of the service and its performance by using multiple speed classes or other physical quantities. The qualification of a mobile network as VHCN is also to be collected from mobile network providers (operators) by NRAs/OCA's.

Ref (paragraph 76) The data to be collected to characterize the reach of mobile networks is specified to be:
- Technology availability (3G, 4G, 5G-SA, 5G-NSA)
- Qualification as VHCN

Additionally and optionally, "*when NRAs/OCAs decide to collect performance information, such as QoS-1 speed information or other technical parameters regarding signal strength*", the BEREC guidelines specify further parameters that may need to be collected:
- Upload/Download Maximum Speed classes
- Other technical parameters regarding signal strength

The BEREC guidelines requiring NRAs/OCAs to *only* collect data from operators on mobile technology availability and (intransparent) qualification as VHCN is neither justified in terms of meeting the requirements and respecting the meaning of Article 22 nor logically consistent.

Firstly, stating the availability of a mobile technology in a specific geographic location necessarily requires the estimation of the received signal strength (RSS) at that location and a comparison against a predefined minimum RSS threshold to receive the given technology service. BEREC states in paragraph 66 that NRAs may refine the service availability/performance of the network by estimating the local value of the received signal strength in each pixel using theoretical radio coverage calculations. We emphasize that RSS data is not a refinement of service availability but the most basic *prerequisite* for determining mobile service availability.

Secondly, classifying the mobile broadband network as VHCN or otherwise, as required by Article 22, requires as a key input the estimation of speed provided by the network, as indeed the BEREC guidelines outline for fixed broadband networks in §2.4.1. Moreover, in

§2.4.2 paragraph 69, the BEREC guidelines also state that in the case of mobile broadband networks *"QoS-1 data services speed, and more specifically, speed classes … enables setting a grid to a specific broadband category (basic, NRA, VHCN) which would be helpful to establish the mobile coverage gap and to program and implement EU funds for mobile network rollout."* Therefore, making QoS-1 speed information optional for mobile broadband network mapping is neither logically consistent with nonetheless requiring VHCN classification of mobile networks, nor justifiable in terms of meeting the related obligations of Article 22.

Recommendation 8: In addition to the data specified in §2.4.2.3, para. 76 of the BEREC guidelines, the following data should additionally be <u>mandatory</u> to be collected by NRAs/OCAs from mobile network operators in order to: properly and logically characterize and map the reach of mobile broadband networks; enable qualification of the mobile wireless network as VHCN in accordance with Article 22; facilitate verification of data provided by operator to the NRA; and also for consistency with fixed broadband mapping guidelines:

- <u>Maximum</u> Download/Upload speed class (95% of the time for nominal zero cell load)
- <u>Normal</u> Download/Upload speed class (95% of the time for 95th %-ile users over grid area, using peak-time cell-load)
- <u>Minimum</u> RSS in grid (in 95% of the time in at least 95 % of grid area)
- Network provider code

Alternate writeup: (*para. 76*) *Ultimately, the dataset to be collected in order to characterize the mobile network is presented in Table 12 (Annex 4). For each 100m x 100m (or smaller) area,* ***NRAs maintain a structured data to characterize the reach of the mobile broadband network and collect the following information, on a per operator basis:***
- ***- Grid code or polygon ID***
- ***- Technology availability***
- ***- Qualification as a VHCN***
- *- Maximum Download/Upload speed class (95% of the time for nominal zero cell load)*
- *- Normal Download/Upload speed class (95% of the time for 95th %-ile users over grid area, using peak-time cell-load)*
- *- Minimum RSS in grid (in 95% of the time in at least 95 % of grid area)*
- *- Network provider code*

~~*Additionally, other parameters may also be required when NRAs/OCAs decide to collect performance information, such as QoS-1 speed information or other technical parameters regarding signal strength:*~~

- ~~*- Upload Maximum Speed classes   (according to Annex 3)*~~
- ~~*- Download Maximum Speed classes   (according to Annex 3)*~~
- ~~*- Other technical parameters regarding signal strength*~~

*We emphasize that <u>Table 12/Annex 4</u> should then be modified accordingly. Likewise, paragraphs <u>61,62,65,78,79</u> ought to be modified accordingly, in order to reflect the mandatory (rather than, as at present, optional) nature of the **QoS-1 speed data, RSS data, and physical network infrastructure and load data**[2].*

Ref (paragraph 73) BEREC guidelines state that "mobile network operators and authorities use different tools to support their coverage simulations; but their minimum common functionalities/features should take into account international standards and recommendations (ITU, ETSI, CEPT)." We support BEREC's position of seeking a pragmatic extent of harmonization in mobile network capacity and related calculations as to be performed by MNOs. However, we believe that a slightly clearer wording is required, with an explicit reference to the <u>verification</u> by NRAs/OCAs of the data provided by the MNOs.

Recommendation 9: We recommend explicitly making it clear that the mobile broadband data provided should provide as realistic a picture of the deployment's capabilities as possible, by insisting that the MNO use best industry practices, corresponding to the methods used in the planning and management of their own network planning. We believe that such wording will put NRAs/OCAs in a stronger position to challenge data provided by MNOs, should the NRA/OCA question the integrity/validity of that data. Moreover, for verification purposes by the NRA/OCA, the calculation/simulation methods and assumptions used by the NRA should be disclosed upon request of the NRA/OCA. To aid greater harmonization among MS in the future and ensure the fair and transparent verification of MNO data/claims, NRAs/OCAs should in turn **publish** their own methodology, tools, and assumptions. Finally, such a verification exercise by NRA/OCA requires the **MNO to also provide data on: physical radio network infrastructure (including BS tower locations and sectorization and antenna pattern/downtilt), cell load statistics, 3GPP-Release of deployed mobile technology**. We give the corresponding alternative writeup of paragraph 73, but we *emphasize that modifying paragraph 76 in reference to the additional verification data to be collected may be clearer.*

Alternate writeup: (*para. 73*) *… mobile network operators and authorities use different tools to support their coverage simulations; but their minimum common functionalities/features should take into account international standards and recommendations (<u>e.g. ITU, ETSI, CEPT</u>). <u>The mobile network operators, in supplying QoS-1 and other network performance data, shall use for their radio coverage and network capacity calculations the tools and methods corresponding to best industry practice, as used for the routine planning and management of their operational mobile networks. Upon request by the NRA/OCA, the mobile network operator will transparently and fully disclose the tools, methods and assumptions used in generating the mobile broadband data provided to the NRA/OCA. Additionally, to enable such a verification exercise to be carried out by the NRA/OCA, the operator shall provide data on: relevant physical network infrastructure (including BS tower locations, sectorization and antenna pattern/downtilt); cell load statistics; 3GPP-Release of the deployed mobile technology. To ensure fair treatment and transparent verification of</u>*

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[2] **Regarding "physical network infrastructure and load data" see Recommendation 9 and alternative write-up of paragraph 73.**

*MNO data/claims, NRAs/OCAs should in turn **publish** their own own methodology, tools, and assumptions used in their verification calculations."*

*The dataset to aid **verification** of the collected mobile network characterization data, as given paragraph 76, is presented in Table 12 (Annex 4). For each 100m x 100m (or smaller) area, **NRAs shall maintain structured data on the relevant physical architecture of the mobile broadband network and collect the following information, on a per BS (per operator) basis:***
- *- BS tower location (coordinates)*
- *- sectorization and antenna pattern/downtilt*
- *- 3GPP-Release of deployed mobile technology*
- *- cell-load statistics/estimate*

Ref (paragraph 75) BEREC guidelines state that for estimating mobile broadband coverage, "data traffic demand on the network, based on statistical models that take into account demand for broadband services." This statement is a good start, but should be strengthened to emphasize **realistic cell load estimate** being used in providing mobile network performance data, in particular for QoS-1 speed classes.

Recommendation 10: The guidelines should explicitly specify that the MNO should use **realistic estimates of cell load** in calculating mobile network performance data to be provided to the NRA/OCA. It should also be emphasized that data may come from statistical models of mobile broadband demand **and/or MNO data on the typical peak-time load per cell as given by the planning and/or operational network management data.**

Alternate writeup: (*para. 75*) *In order to calculate/estimate a broadband service coverage map ... data traffic demand on the network, <u>based on realistic peak-time cell load estimates, as given by</u> statistical models that take into account demand for broadband services <u>and/or operator's own per-cell network planning and operational management data</u>."*

Ref (paragraph 79) Stating that *"QoS-1 speed data is only a broad qualitifier used to compare data service performance … unrelated to the end user experience"* is an odd justification of why QoS-1 data should not be collected, using the flawed logic of "if it is not perfect, let's not try at all". Indeed it is expected that QoS-1 theoretical speed data estimates will differ from QoS-2/QoS-3 measurements, but to state that QoS-1 speed data -- if carefully calculated -- is **entirely *unrelated* to the end user performance is patently false**. We emphasize that QoS-1 and QoS-2 data differ in their accuracy but also in their scope of geographic granularity (as indeed stated in Footnote 32 of the draft BEREC guidelines) and are for this reason **both necessary, *complementary* elements of the overall mobile broadband mapping and verification thereof**. QoS-2 data is particularly crucial as one means of verification of whether the calculated QoS-1 estimates are within a reasonable margin of QoS-2 active network measurements; not collecting QoS-1 data (which offers high geographic coverage and granularity that is in practice infeasible for QoS-2 data) would also fundamentally put into question the value and validity of QoS-2 data.

Recommendation 11: Delete paragraph 79, or re-write it to instead outline the relationship between QoS-1 and QoS-2 mobile network coverage mapping data and its verification, as outlined above (also consistent with our Recommendation 1).

Ref (paragraph 72) BEREC guidelines state that NRAs/OCAs should provide information about the area being covered by a VHCN, as per the definition provided in Article 2 of EECC and the corresponding definition provided by future BEREC guidelines. We emphasize that this will require considering, in addition to the data collected on DL/UL speed, also resilience, error-related and latency parameters, as per Article 2.

Recommendation 12: In line with our Recommendation 7 for fixed line networks, we recommend that, in order to assess if a mobile network is VHCN or not, additional parameters other than bandwidth should be requested, namely resilience, error-related parameters and latency and its variation. Furthermore, some means of verification (QoS-2/3) should be provided. This is again, for data consistency and fair treatment of operators when state-aid is applied, to be able to compare different deployment situations in different member states.

Alternate writeup: *add new paragraph (e.g. following para. 72) stating additional data to be requested from the mobile network operator by the NRA/OCA.*

Forecasts

BEREC recognises that the "*operator's roll out plans may change with time, because of unforeseen events or as a result of changes in the strategies of investors*". Thus, there is trade-off between forecast timeframe and certainty.

In this light, BEREC's recommendation for the frequency of the collection of forecast data of areas of interest is once a year and the forecast period if three years (Art 22 (2) ECC).

Data to be collected

The information on forecasts should be provided according to the following table (same for fixed and mobile forecasts):

Variable	Grid or address	Zone code (optional)	Operator	Technology code	Maximum Download speed category	VHCN	(Expected) Start date of the roll-out	Expected end date of the roll-out
				Data to be requested from network providers				

Descri ption	Inform ation identif ying the grid or addres s provid ed by the NRA/ OCA	Code of the zone, consideri ng the lowest administr ative unit in the country	Netw ork provi der code accor ding to a list provi ded by the NRA/ OCA	Codes in table 1.	Speed categor y after roll-out. Code in table 6, Annex 3.	Boolea n (0/1) that charac terizes if the rollout is of a VHCN	Date (may be in the past)	Date (befo re the end of the three year perio d)

If the data is provided in grid resolution then the actual percentage of premises to be passed with the investment is unknown and may leave many users, specially those geographically isolated, without broadband reach.

We also note that maximum speed, as defined, is just a theoretical maximum attainable speed, but does not reflect the quality of service that will indeed be provided to the end-user. To this end, the normally available speed should also be declared.

Finally, and in order to better assess if the forecasts are realistic or not. The operator should at least declare distance to the current closests active network element available.

Recommendation 13: Include percentage of premises to be served if grid-level reporting is selected.

Alternate writeup (paragraph #96, table 3): Include columns with:
- Percentage of premises to be served per grid.
- Normally available speed.
- Upstream from the distribution point at the serving location, distance to the closest traffic concentration and O/E conversion units, where applicable.
- The media specification (cable/fiber) from the distribution point at the serving location all the way up to the closests traffic distribution point.

The following figure provides a network diagram with the traffic concentration and O/E conversion units. The latter only exists if the last-mile access network (drop) is cable.
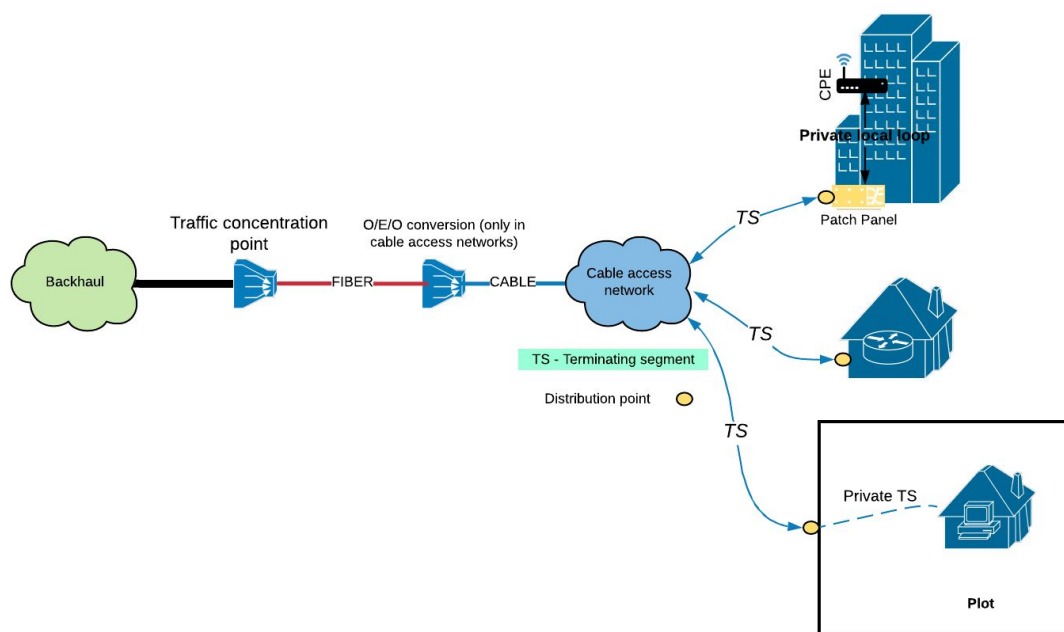
Resolution of data collection

For network deployments expected to be finished within the first year, detailed forecasts with the same resolution as for broadband reach should be provided. For network deployments expected to be finished within the second and third year (or any subsequent years) the granularity of the data should be (at least) at a level of grids of 1000x1000 meters (or polygons achieving the same accuracy of information).

Means of verification

Some ex-ante and ex-post qualitative verification checks are provided. Ex-ante checks are based on track record of investments, comparing size of investment versus size of company and assessment of the planned project schedule.

Ex-post verification compares forecasts with actual execution of the project and, in case of large deviation the operator may be asked for a reasonable justification and (paragraph #102):

- "*NRAs/OCAs may check whether large deviations occur repeatedly for the same operator*
- *Understand whether there was an incentive to deliberately provide a wrong forecast, e.g. due to effects on state aid and/or competition.*"

In practice, there is no consequence for an operator that declares roll-out of broadband infrastructure and does not deliver. Furthermore, if an operator repeatedly fails to provide

accurate information then a record should be kept such that, for subsequent state-aid applications, stricter controls are imposed.

Recommendation 14: Develop guidelines to keep a record of operators repeatedly failing to provide accurate information.

Alternate writeup (addition in Forecasts section): <u>If major deviations from the forecast provided by a given operator happen, a record will be created such that, for the next forecast, further means of verification will be applied. Such means of verification may possibly include asking the operator for insights of its network topology, including the location of active and passive network elements. Milestones for assessment of progress will be established at the time epochs corresponding to the 25%, 50%, 75% and 100% of project execution plan and/or planned coverage.</u>

Publication, confidentiality, aggregation and representation of data

The guidelines provide state that NRAs/OCAs have several options to publish the survey data:
- Interactive maps published in a dynamic web application;
- Application programming interfaces ('**API**') providing access to the data;
- Datasets in open and generalised formats, such as CSV; and
- Statistical reports, including tables and analysis.

Regarding confidentiality, some pieces of information from the operator are considered confidential, such as deployment plans, location of network elements and production secrets and processes, including the tools and methods it uses to calculate coverage information.

As for coverage, broadband networks cannot be efficiently deployed to target individual addresses Consequently, geocoded address data should be aggregated into areas that are large enough to justify state-aided network deployment. Since there may be different operators and technologies involved, a certain degree of overlap is possible. In order to treat such overlaps, "NRAs/OCAs shall estimate the aggregated coverage at grid level using the highest coverage rate in the grid. This corresponds to the coverage rate of the operator having the highest coverage rate in the grid."

For mobile networks, a grid of 100m x 100m is deemed to be covered if broadband service is available at least in 95% of the grid area.

Finally, as for access to information by public authorities different aggregation levels will be offered (NUTS-3, LAU, etc) depending on which authority is accessing the data. However, for the application of state aid rules (Article 22(1)) and identification of market failure areas (Article 22(5)) geocoded address-level data will be provided.

Overall, we are in agreement with the guidelines in this section.

Questions

The following questions were posed by BEREC to NRAs/OCAs and operators' audience. We are cordially providing the following perspectives for these questions:

Question 1

In BEREC's current Public Consultation on the implementation of the Open Internet Regulation (paragraph 140), BEREC is requiring that the speed values required by Article 4(1) (d) of the Regulation EU 2015/2020[1] should be specified on the transport layer protocol payload, and not based on a lower layer protocol. Is there any reason why this layer should not be used in proving information about speeds in the context of a Geographical Survey of Broadband reach?

By transport layer we understand TCP, as it is the most common transport protocol in the Internet. If that's the case, special care should be exercised as the throughput obtained depends on spurious packet losses that can make the TCP transmission window decrease sharply. It also depends on the performance of the endpoints, which may slow down transmission with zero window announcements. Generally, we note that that there are many transport layer protocols and dominance of TCP is not anymore unchallenged, for example there is research indications that while TCP dominates in terms of packets and bytes, UDP is often responsible for the largest number of flows.

Thus while we believe that the approach of considering the transport layer protocol payload is a well justified from many different perspectives, we caution that the collection and interpretation of such data is non-trivial and collecting data from lower layer speeds could provide highly valuable complementary data. We also note that the transport layer QoS-1 calculation would require some extra assumptions and is not as straightforward as lower level capabilities estimation.

Question 2

BEREC has considered several methods to calculate speed information according to the relevant fixed network. The development of these methods often requires information on the position of network infrastructure (for example, collecting the distance to the street cabinet or the switching centre). Do you consider information on location of infrastructures strictly required for the purpose of art 22? If so, what is the minimum information level related to network infrastructure that the Geographic Survey should collect and why?

At least the distance to the closest active node from the operator should be required. It can serve as a means of verification for a declared bandwidth, especially for wireless and DSL networks. Even though there are other factors such as line attenuation or vectoring frequency, large distances to closest network elements entail that the household simply cannot be served. To this end, GIS systems can be used to calculate the distance following roads or pedestrian ways, not just line of sight, if the network elements position are known.

It is also necessary for characterizing VHCN as the endpoints for measuring latency or packet loss (CPE to OLT or metro POP, for example) should be declared beforehand. Clearly, latency depends on the propagation delay, which in turn depends on the distance, which must be known to actually derive the latency due to congestion.

Furthermore, it allows to identify isolated households, as the ones which have the closest network element far away. This is useful to classify coverage areas as black, grey or white.

Similarly, in the case of wireless systems the distance to the closest base stations or access points provides very valuable information for verification purposes.

Apart of the verification and calculation points, we emphasise that such minimal infrastructure information even beyond distribution point distances seems to be required for consistent and reliable *state aid decisions.* We fully recognise that the infrastructure information is highly sensitive and in larger scale has also national security implications — thus collection of such data should be done in member state level with due diligence, for particular purposes, and perhaps some of the data should be deleted after it is used for a particular purpose (e.g. state aid decisions). We strongly encourage further discussion and due consideration in BEREC WG on these issues to find the right balance between ambition, due use and collection of data, and confidentiality.

Question 3

As explained above, BEREC considers that the characterization of the mobile network is reliant mainly on technology (subsection 2.4.2.1), and that NRAs/OCAs may collect performance information, such as QoS-1 speed information (subsection 2.4.2.2.) as they see fit for their own needs.30 That is, each MS may decide on the performance information suitable for its own national circumstances.

However, BEREC would like to hear views on the following issues:

A) Does such optionality compromise the purposes of Article 22, or should BEREC consider making some performance information non-optional? If so, why, and which information should be mandatory?
B) Which kind of performance information may be better to inform end users? (Note that in all circumstances NRAs/OCAs should consider that BoR (18) 237 has already recommended that "In order to improve the information on mobile coverage given to the public, NRAs may want to consider specifying at least four levels of mobile coverage. Generally, the levels of mobile coverage could be chosen to reflect the different probabilities of successful service reception which equates to service availability". As an example, a service could be characterized by the following graded approach: capability to the end user to: 1.) browse traditional web pages and consult emails, 2) to view enriched web content and to stream standard quality video, 3.) to stream high definition videos.

In general, it is true that the very first characterization level of mobile networks is technology-dependent. However, for the purposes of these guidelines, one has to consider what is the sufficient description of technology and how accurately technology labeling alone can fulfill different policy aims at the European Community level or even when considering the end users in the member states.

Here, we are emphasizing again that the ambition should be not only to inform end users in each member state. Preferably there is enough harmonization in methods so that member state capabilities can be compared at the European Community level, and also that the end users moving between member states could rely on reasonably harmonized information. Apart from these issues, Article 22 is specifically mentioning state aid, which means that there should be a reasonably good way to compare different technologies also across the fixed and mobile networks boundary. Using only coarse technology definitions for mobile networks - which e.g. does not give sufficient information to classify networks as VHCN - will compromize fulfilling these goals.

We further note that the current proposal to collect technology information at the level of "mobile generations", while being easy, leads to a rather large variance in corresponding network performance if this were to be the only information collected. As an example, just considering the present 3G and 4G technologies, depending on which specific 3GPP standardization release is deployed in the network can lead to even order of magnitude difference on provided speeds — and this already just considering *QoS-1 advertised speeds.* Such a large variance, combined with the fact that emerging 5G deployments will most likely lead to very heterogeneous networks and an even larger variance between "5G labelled" technologies,[3] leads to a situation where characterizing mobile networks solely based on 3G/4G/5G availability will almost certainly compromise the purposes of Article 22. BEREC is thus urged to make more performance information non-optional so that the current and future purposes of Article 22 can be fulfilled. In our analysis of the BEREC draft guidelines above, we give specific recommendations on the additional mandatory data to be requested to sufficiently characterize mobile broadband networks.

Here we also note that the issue is not related only to being able to treat fixed and mobile technologies more equally, e.g. in state aid and user expectation domain. Rather, this goes even to the matter of treating the mobile technologies fairly and comparably. For example, there are situations that certain 5G networks in more narrowband frequency deployments could indeed provide poorer end-user performance than advanced 4G systems operating over their frequency bands.

As to considering what information is **useful for end-user**, **but also for other Article 22 purposes, and particularly also for comparing technologies for state aid purposes** we believe that information already considered in the *Draft BEREC Guidelines on the*

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[3] For example, 5G systems are to be deployed in two very different frequency band ranges, which have larger than ever differences in available channel bandwidth - and thus maximum achievable speeds - and geographical coverage.

Implementation of Open Internet Regulation would be highly recommended. Thus we recommend considering that apart from mobile technology information and speed category, one should collect **information on the normal and maximum expected speeds**. Having information on delay, and possibly in jitter, obviously can become important for the future applications - in particular VHCN classification - but arguably one could consider these to be less important in the short term, and particularly at this stage where QoS-1 information is considered, the information on delay and jitter would be much less reliable.

In summary, we believe that the current BEREC draft guidelines are going towards the right direction of collecting download and upload speed information, but we emphasize that it is crucial to make the collection of this data mandatory, not optional, and that considering both normal and maximum speed would be needed for fulfilling Article 22 purposes.

In summary:

For Question 3.A: Having only technology-level information available is highly likely to compromise the purposes of Article 22. QoS-1 information on speeds (normal and maximum) should be mandatory, and then having additional but optional information available on latency or other network performance parameters considered useful by individual MS NRAs/OCAs.

For Question 3.B: When considering just end-users, who might be also commercial end-users or public entities such as schools, they are likely to be interested in knowing the coverage (availability) in each different speed class — and even preferably having information in each pixel on normal and maximum speed that they can expect. The minimum information would be download (downlink) speed, although increasingly the end-users are also interested in knowing about upload speed and in some cases also about delay. Tthe typical end-user in Europe is increasingly sophisticated, and describing a service with terms like "*stream standard quality video*" etc. is unlikely to meet their expectations or provide sufficient information. The real Mbps values or Mbps classes should be provided (ideally, corresponding to the values that end-users themselves would observe when using e.g. speed test apps). Using "service classes" is also open for interpretation, and may easily become obsolete as application demands evolve, so we recommend using real e.g. DL speed values.

Question 4

Should BEREC seek to harmonize the assumptions made by operators and NRAs throughout Europe? Should BEREC encourage NRAs/OCAs to seek this harmonization at a national level? Which assumptions should be considered to be harmonized and how? (For example, should BEREC consider data service speed coverage calculations without cell load, considering that the network is available for at least one user at a specific location at a

specific time? Or should BEREC consider network load and, if so, based on which parameters?)

The only possible way to fairly distribute European budget through state aids is to use a common methodology. For example, considering cell load as a factor in the speed calculation models or not makes a huge difference. Needless to say, a single user in a cell is served with the whole capacity of the base station, whereas many users in the same cell share such capacity.

Harmonization would be very useful for also other policy aims at European level and having availability of harmonised data certainly would help also making member state level policy decisions and comparisons.

The level of harmonisation does not require that the calculation or measurement methods are precisely defined at European level, e.g. defining tools or approaches for propagation calculations. The harmonization could be also reached by agreeing on the common acceptable assumptions, goals, and error bounds (reliability) that the employed methodology should reach.