Body of European Regulators for Electronic Communications
BEREC

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Feasibility study on development of coverage information for 5G deployments

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1. Introduction and aims of this feasibility study

Previous network generations have been designed as general-purpose communication networks with limited differentiation capabilities across use cases. 5G is expected to create an ecosystem for technical and business innovation involving vertical markets such as energy, agriculture, city management, government, healthcare, manufacturing, public transportation, to say the least. It will serve a larger portfolio of applications with requirements ranging from high reliability to ultra-low latency to high bandwidth and mobility.

The 5G ecosystem is likely to become the cornerstone for digital connectivity which is a major driver of economic growth and serving societal needs. Many of the proposed 5G services and use cases and their respective providers are part of a particular vertical market (i.e. services which are specific to an industry or a group of customers), some of which have been broadly classified by the 5G Infrastructure Public Private Partnership (5G PPP) as 'verticals'[1], but which BEREC considers are businesses with connectivity requirements. Businesses with connectivity requirements / vertical industries are expected to be the main driver of making the 5G ecosystem sustainable.

Since 5G technology is designed to support a large range of use cases, the 5G ecosystem is likely to be broader than earlier generations of mobile communications systems as the needs of different users may be specific to particular sectors. In addition, different business models may arise in 5G, with new players/actors in the market. For example, in some cases the mobile network operators may have a direct customer relationship with the customer in the vertical. In other use cases, one or more intermediate parties may arise that are specialised in fulfilling the specific connectivity needs of a vertical.

In this new large ecosystem where multi-vendors seek to serve the communications needs of multi-use-cases, it is envisaged that NRAs may have a role to play for example in the provisioning of coverage information and Quality-of-Service (QoS) aspects of future 5G networks that cater for the needs of the verticals.

This project is part of BEREC' aims to facilitate early stakeholder engagement exploring the potential of publishing coverage and/or QoS information and metrics, in particular BEREC is conducting an initial feasibility study whose aims are to:

1. Describe the expected benefits from NRAs' presentation of coverage information and QoS aspects for use by verticals implementing use cases such as automotive, industrial, environmental monitoring, etc.

2. Attempt to describe the metrics that are of relevance to the verticals.

[1] https://5g-ppp.eu/verticals

Essentially, this work may be viewed as being akin to BEREC's previous work on Common Position on information to consumers on mobile coverage in 2018 (BoR(18) 237). In that body of work, the potential benefit for consumers was recognised in terms of harmonising coverage maps in Europe so that consumers may them make informed choices about coverage service levels.

The timing of this feasibility study is also relevant, as preparations for the roll out of 5G networks are already under way in most European countries.

1.1 Scope and approach

BEREC considers that the connectivity requirements for verticals may be dependent on the particular use case and could be achieved in two primary ways:

(1) Self-build: It is expected that some verticals will seek to build their own communications infrastructure from the grass roots and upwards in order to manage their own risks. Such verticals will need their own dedicated spectrum resources or license exempt spectrum for self-provisioning their 5G connectivity[2];

(2) Outsource: Other verticals will want to outsource their connectivity needs to a 3rd party connectivity provider (e.g. mobile networks, etc.). Here, NRAs could also provide coverage and QoS information which is of relevance for such verticals.

5G mobile networks enable a single network to support different virtual networks ('slices') with different performance characteristics. This feature enables a mobile network operator, acting as a third-party supplier of connectivity, to provide connectivity to different verticals with different geographic coverage and QoS needs, by assigning a particular QoS-implementing slice to that particular vertical.

The focus of this document is to obtain evidence and stakeholder views on the benefits NRAs could potentially provide to verticals wishing to outsource their connectivity needs to 3rd party connectivity service providers, and what information NRAs could provide to such verticals, but in order to keep the scope targeted BEREC may select one vertical to explore in greater detail.

For verticals that wish to build their own networks supported by 5G networks, BEREC encourages competent authorities to provide information on the choice of available spectrum which includes licensed spectrum, shared spectrum (potentially in the future), and/or license-exempt spectrum.

The current study raises many questions, for which BEREC seeks stakeholder input so that it can understand the benefits of advancing any such project either now or in the future; who would benefit from such coverage information, what type of information would they need;

[2] Noting that this would be contingent on the verticals acquiring their spectrum resources such as by sharing, leasing, transfers in the secondary market, or directly in a competitive award process enabling them to roll out their own, usually local, private network.

when would the timing of availability of such information be best (i.e. soonest or in the more medium term), and so forth. To this end, the approach taken in this study has been a consultative one along the following steps:

1. NRA survey[3];
2. Call for input from targeted set of verticals[4].

1.2 Structure of the study

Chapter 2 sets out context on the potential benefits of coverage information for 5G deployments and Chapter 3 sets out BEREC's call for further stakeholder input.

To note, BEREC's preliminary view is that new lines of engagement with verticals and businesses with connectivity requirements may be required before any definitive next steps can be set out for consultation.

2 Views on the benefits of NRA provisioned information for verticals

2.1 What information verticals / businesses with connectivity requirements may need

In 2018, BEREC commissioned the DotEcon and Axon study which presented an overview of verticals and their use cases.[5] Interest raised by verticals however seems to differ between European countries. Depending on the nature of of the vertical, the requirement metrics revolved around signal coverage and various QoS parameters such as latency, jitter, data throughput, reliability and mobility, to name a few.

For the large majority, the 5G vertical ecosystem models were not ready yet and plans were therefore not yet concrete. Interested verticals stressed that where there is a high need for secured networks with a guaranteed QoS, where they may need dedicated spectrum. Many verticals indicated that they are reluctant to exchange sensitive data over public networks.

It is envisaged that it will not be possible to specify a single set of requirements for all given vertical because the connectivity requirements for each vertical depend on the nature of the respective use case and different use cases may exist within a given single vertical. Thus,

[3] Launched on 15 February, 2019. In total, 26 respones were received and considered by BEREC: 23 from EU Member States (AT, BG, CY, CZ, DK, ES, FI, FR, DE, GR, HR, HU, IE, IT, LV, MT, NL, PL, PT, RO, SK, SI, and UK) and 3 from non - EU Member States (ME, NO and RS).

[4] Four responses received and considered:Facebook, Huawei, M3Connect, and UIPT (which provided a concise note on the call for inputs).

[5] "Study on Implications of 5G Deployment on Future Business Models", report by DotEcon Ltd and Axon Partners Group, No BEREC/2017/02/NP3, March 2018.

further effort is needed to establish the information needs by verticals over above and beyond what is currently available.

Furthermore, it could be considered that two type of connectivity information may be needed for companies depending on their situation:

- Regarding their own connectivity needs (for internal business or manufacturing process for instance);
- Regarding their customers' needs: a company that plan to sell a product or service that relies on a specific 5G connectivity may need to know where this connectivity is available to better understand the market size it could potentially address.

2.2 What benefits may NRAs bring to such verticals

In light of the above, BEREC is considering if there would be benefits in regulatory actions to stimulate the roll-out and take-up of 5G such as by providing information on coverage and QoS of 5G networks, which could include 'coverage maps' which could display the QoS characteristics of 5G networks over location and trends over time if there were benefits to providing information in this way and if it was technically feasible to do so.

One benefit could be to assist verticals and/or system integrators for end solutions in verticals optimise their connectivity decisions (i.e. it may be beneficial if there is consistent and coherent coverage information, spectrum availability information, across Europe which verticals can consult, this could include maps or other suitable look up tables).

Another benefit could be that the availability of such information could play an important role in the negotiation process between the vertical and the provider of the connectivity solution (in the case of using third party networks). There is also a likely to be a positive impact on competition, enabling bargaining power for verticals to choose between providers.

Other benefits of providing highly-accessible independent and reliable information on the state of connectivity for verticals also extend to consumers, respective policy makers and/or national governments, the European Commission, industry and the wider public. Whilst outside the scope of this paper, such information may also assist NRAs in ensuring service providers meet their obligations, if any.

3 BEREC's call for further information, observing views from preliminary surveys

In February 2019, BEREC launched an early call for inputs from NRAs, which was well responded to by NRAs, however, the results of that survey showed that NRAs generally considered it to be premature to consider providing information on coverage of 5G deployments aimed at verticals.

In June 2019, BEREC also launched an early call for inputs to gather views of specific verticals on some relevant issues including connectivity requirements such as in terms of

network coverage and specific Quality of Service ("QoS") requirements. Four submissions[6] were received. In BEREC's view this level of response reflects the fact that verticals are part of a highly diverse set of industry sectors working on future business cases, which could be facilitated within the context of a 5G ecosystem but that it is too early to set out specific details on same now.

BEREC is grateful for the submissions received to its preliminary call for inputs. BEREC intends to use the relevant information to inform its future thinking on the feasibility of providing coverage information for 5G deployments. However, as regards verticals' use cases, BEREC does not have any additional insights to add at this time (see various commentaries such as those at 5GPP, the 3rd RSPG Opinion on 5G implementation challenges[7], and the study for BEREC by DotEcon and Axon).

BEREC considers that marketing information on the commercial capabilities and associated key parameters of 5G is being provided by industry equipment vendors but 'vertical specific' use case needs and requirements information are not yet widely vailable. This may create an issue from a mobile network and service providers' point-of-view as they also need to know the verticals needs and requirements. However, such information or requirements may not be made readily available due to business confidentiality issues.

In light of the above, BEREC is asking if it is necessary that in order to make qualified decisions regarding the electronic communications networks and services suited best for their current and future business, verticals need information on coverage of 5G? To advance BEREC's thinking on this, BEREC calls on verticals to make relevant responses in the following Table 1 below.

[6] Facebook (which set out that connectivity goals will not be achieved by 5G in isolation but instead by a combination of technologies), Huawei (which set out that its interest cover ICT industry, including ICT Equipment and Smart Device and provided general views on capabilities of 5G in terms of uplink, E2E latency and reliability), M3Connect (which set out that its interest in four vertical sectors; industry, manufacturing, logistics and transport needs but did not provide specific use case connectivity requirements), and UIPT (which set out its high level initiative to develop communication based train control systems for the rail industry)[7]
http://rspg-spectrum.eu/wp-content/uploads/2013/05/RSPG19-007final-3rd_opinion_on_5G.pdf

[7] http://rspg-spectrum.eu/wp-content/uploads/2013/05/RSPG19-007final-3rd_opinion_on_5G.pdf

Table 1 Questions to verticals / businesses with connectivity requirements

Vertical	**Please specify your specific use case**	**Likely main source of connectivity requirement** **1.Self-build or 2.Outsource**	**Reason(s) supporting connectivity requirement (why self-build or outsource?)**	**Likely main coverage required (local/regional/national – mix please specify)**	**Reason(s) supporting stated coverage requirement**	**Specific main parameter of requirement (if known, e.g. latency at % level)**	**Benefit of coverage information on 5G deployments (if known)**	**Free text comment**
Transport	1 […]							
	2 […]							
	3 […]							
Logistics	1 […]							
	2 […]							
	3 […]							
Audio Visual and Virtual Reality / Other entertainment	1 […]							
	2[…]							
Agricultural	1 [...]							
Emergency and disaster relief	1 […]							