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BEREC Report on the outcome of the public consultation on the draft BEREC Report on Internet of Things Indicators

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Contents

Executive Summary

This report summarises the responses received to the public consultation on the draft BEREC Report on Internet of Things ('IoT') Indicators. The public consultation ran from 12 December to 23 January 2019 with the objective to gather stakeholders' comments and observations on the content of the draft BEREC Report.

BEREC has prepared this draft report with the aim of summarizing the insights from all types of actors (consumers, companies in the telecommunications sector, digital companies, other companies, institutions) on issues to be taken into account by National Regulatory Authorities ('NRAs') in the context of BEREC's approach to monitoring and collecting statistical information on the IoT.

The contributions received will be used in the preparation of the final report, which is expected to be completed and submitted for adoption to the BEREC Plenary meeting in Budapest on 6-8 March 2019.

In response to the consultation on the draft report, BEREC received contributions from the following stakeholders:

1. AT&T
2. European Competitive Telecommunications Association ('ECTA')
3. European Digital Rights ('EDRI')
4. Global System Mobile Association ('GSMA')
5. MVNO Europe
6. Transatel
7. Vodafone

In general, stakeholders welcomed the opportunity to comment on the draft BEREC Report on Internet of Things Indicators. The following sections provide further comments, observations and recommendations expressed within the contributions during the public consultations.

1. Comments to Question 1

Question 1.1: Do you consider that the European Commission's definition of the IoT is sufficiently appropriate to collect relevant statistical information on the IoT? If not, how should the definition be changed?

AT&T does not consider the European Commission ('EC') definition to be appropriate as the basis for collecting statistical information on the IoT. AT&T believes that BEREC should build a bottom-up view of how the IoT is being used in different sectors of the economy, such as energy, manufacturing, healthcare, automotive, agriculture so that it could gain real-world

insights about how the IoT is being used, which will better inform BEREC's policymaking in the future. If BEREC determines that it needs to rely on an existing definition, AT&T would refer BEREC to the October 2018 Organisation for Economic Co-operation and Development ('OECD') report on IoT Measurement and Applications.

ECTA and MVNO Europe consider that the EC's definition is broadly appropriate, and appreciate its wide scope. However, ECTA believes that BEREC and NRAs need to make sure that indicators distinguish: (i) objects/devices which come with their own (Internet) connectivity services, from those that do not, and (ii) objects/devices connected to the Internet (implying potential connectivity to/from any end-point on the Internet) from those that are not connected to the Internet but use some other form of connectivity.

According to EDRI, the EC's definition is limited in so far it assumes devices/objects interact autonomously, and that they must create action and value. EDRI points out that one could imagine an IoT network is able to create action but no value, or value (in the form of a data asset) but no action (meaning that it only passively monitors a surrounding or environment). In addition, the EC definition does not consider the data gathering aspects of any IoT object. If such details should present problems to BEREC while collecting statistics, EDRI proposes to alter the EC's definition in the following way: "objects collecting and sharing information with other objects/members in the network, recognizing events and changes so to react autonomously in an appropriate manner, or to solicit human feedback. The IoT therefore builds on communication between things (machines, buildings, cars, animals, etc.) that leads to action or value creation."

The GSMA believes that the OECD definition or the GSMA definition are more helpful than the EC's in providing indications on how to collect relevant statistical information on the IoT. A similar view is expressed by Vodafone who considers the EC definition too generic and not providing a clear indication on how to collect relevant statistical information on the IoT market.

Moreover, the GSMA and Vodafone point at the fact that the EC definition does not capture recent developments of the IoT applications, such as the inclusion of limited human interaction. They both suggest that the machine to machine communications ('M2M') definition considered by BEREC should reflect the new European Electronic Communications Code (Directive (EU) 2018/1972) ('EECC') definition and encompass some limited human interaction and as well voice/SMS communications as an ancillary feature of those communications.

1.1. BEREC response:

First of all, BEREC agrees with the stakeholders who argue that BEREC's M2M definition must be updated so that it reflects the new EECC. So far, BEREC has used a 2010 definition, which stated that M2M was "a generic concept that indicates the exchange of information in data format between two remote machines, through a mobile or fixed network, without human

intervention". Therefore, BEREC will now use the definition provided by recital (249) EECC[1], although for statistical purposes BEREC will need to further qualify this definition.

Moreover, the EECC also distinguishes the M2M concept and the IoT concept in its recital (12). Indeed BEREC agrees with the spirit of the OECD definition of IoT in the sense that it provides a wide view of the IoT phenomena and distinguishes the concept from the notion of M2M communications. Indeed, some NRAs have pursued studies about this matter and taking into account their experience BEREC considers that the IoT encompasses:

- specialized devices[2] connected to either the internet in order to reach other devices, platforms or individuals or to other specialized devices through peer-to-peer technologies or number based technologies;
- the technical ecosystem allowing such connectivity;
- the services provided by such specialized devices and technical ecosystem.

It should be noted that the previous paragraph provides an extended description of the IoT and draws the attention to its different components. Also, that it recognizes the fact (pointed out by ECTA) that some objects/devices are connected to each other via the Internet (end to end connectivity) whilst others may use other forms of connectivity. Indeed, BEREC believes it would be necessary to understand better how the different IoT services are supported by the different connectivity solutions in order to assess what are the requirements that these services pose on services and networks.

Regarding ECTA's comment that there should be a distinction between objects/devices which come with their own (Internet) connectivity services, from those that do not, BEREC's judgement is that this is clearly the case but that it is premature to decide on a statistical categorization based on this idea.

Finally, BEREC is of the opinion that EDRI's discussion about IoT services creating value and/or action is interesting, but that it is not necessary to resort to these qualifying concepts in order to collect statistical information about the IoT.

Question 1.2: Please suggest any available sources for information on measures/indicators of the IoT, in addition to the information mentioned above.

According to EDRI, in addition to the market surveillance reports mentioned in the public consultation document, BEREC could attempt to keep track of standardisation efforts in the field as this would aid BEREC in understanding when there is overlap between activities that fall under its supervision and activities which may fall under the supervisory authority of other public authorities. In view of its priorities in terms of users' protection and empowerment,

[1] Here M2M services are defined as "services involving an automated transfer of data and information between devices or software-based applications with limited or no human interaction".
[2] Specialized devices are considered as devices which have, by design, a limited number of functionalities and uses.

BEREC could also move quickly on societal aspects of IoT by encouraging its members to actively look out for information about home automation misuse.

In answering to this question, the GSMA mentions its figures for total licensed cellular IoT by type (cellular M2M and Licensed Low Power Wide Area networks ('LPWAN')). It estimates that by 2025 there will be 25.2 billion connections globally, out of which "only" 3.1 billion will be cellular (cellular M2M and licensed LPWAN). The GSMA makes the point that cellular connections are only a small but important part of total IoT connections universe.

Vodafone considers the following as useful resources to date: GSMA intelligence, the OECD's 2018 report and the International Data Corporation ('IDC') taxonomy. According to AT&T, BEREC has identified the key sources and ECTA and MVNO Europe had no comments on this question.

1.2. BEREC response

BEREC acknowledges the sources of information mentioned by the contributors in responding to this question and will incorporate those into its knowledge.

2. Comments to Question 2

Question 2.1: Do you agree with the multi-layered approach in Figure 2 above, which seeks to separate M2M/IoT from the underlying connectivity and shows the relationship to ECS?

AT&T does not consider that Figure 2 accurately describes "the boundaries of the Internet of Things". It overstates the role of connectivity, which is only a subset of the IoT and not the reverse as the diagram suggests. In a similar way, the GSMA states that it should be clearer that the diagram is about the connectivity dimension of IoT only and it should be renamed as 'The boundaries of IoT connectivity' whilst the IoT circle should be labelled as 'IoT connectivity'.. Vodafone also records that Figure 2 represents only a fragment of the IoT value chain, which is the connectivity dimension of IoT and mentions that there is a gap in revenue distribution between connectivity and software/services and devices, with connectivity being the lowest revenue contributor in the value chain.

In fact, Vodafone suggests that BEREC should take into account the presence of all the economic actors involved in each enabling layer of the IoT supply chain. The same type of consideration is made by EDRI that points at the fact that M2M and IoT are applications of a chain of technologies existing on various levels of a value chain and that BEREC should anchor its assessment of M2M/IoT market segmentation in which commercial actors are able to operate on which markets. EDRI uses as an example The Things Network which appears to encompass roughly eight actors: the chip vendors, the device manufacturers, the gateway server, the network server, the identity management (including login/join server), application server, monitoring services and integrated services. It argues that from a regulatory perspective, it is most important to understand if all of these eight actors can be commercially

distinct, or whether a full vertical integration (management within a single entity) is required for the service to work.

A separate point made by the GSMA is that the figure places ECS at the centre, suggesting a telco-centric view, which is, in the GSMA's view, not reflective of the true nature of IoT. The IoT connectivity can certainly be provided beyond traditional ECS services including commercial networks in unlicensed solutions spectrum (SigFox etc.) or private networks as defined by BEREC (for example WiFI, Bluetooth, ZigBee). The GSMA thinks that the figure should reflect the types of connectivity that can be provided through various networks (licensed, unlicensed spectrum and private networks) and that the ECS bubble should be deleted. Alternatively, they make the consideration that since the EECC considers now any type of M2M connectivity to be part of the ECS, unlicensed spectrum and private networks should be included within the ECS circle. The same point is made by Vodafone who expresses that: "the EECC considers any type of M2M connectivity to be part of the Electronic Communication Services therefore commercial networks in unlicensed spectrum such as those referenced in the consultation document should be included within the scope of ECS. It is not sufficiently clear from Figure 2 of the BEREC consultation whether this is the case."

According to the GSMA, the key point is that BEREC can no longer rely on traditional telco providers' data, but needs to expand their data collection exercise onto 'adjacent' markets and players, in particular on unlicensed LPWAN that will play an important role in IoT. A similar argument is provided by AT&T who is concerned that BEREC's "multi-layered" approach would inevitably lead to the demand on data falling on regulated electronic communication service ('ECS') providers who will not have insights into other parts of the IoT ecosystem. Further, according to AT&T, if the providers of traditional mobile were subject to IoT statistical reporting requirements and other parts of the ecosystem were not, this would lead to partial data that would be of highly questionable value and also result in technological biases due to the unequal burdens placed on licensed versus unlicensed wireless connectivity.

Moreover, the different stakeholders also comment figure 2 with respect to the categorisations of connectivity, proposing different criteria and granularities.

The GSMA thinks that the figure should reflect the types of connectivity that can be provided through various networks (licensed, unlicensed spectrum and private networks). ECTA and MVNO Europe suggest to take into account: (i) whether connectivity is provided/bundled with the object/device, (ii) whether objects/devices rely on the user's pre-existing or separately purchased fixed or mobile (Internet) connections for communications, (iii) whether the connectivity is in the form of Internet access or another (non-Internet) form, and (iv) distinguishing services provided directly by network operators (Mobile Network Operators - MNOs) or services provided by others (e.g. by Mobile Virtual Network Operators – MVNOs), specific 'verticals' providers, etc. ECTA and MVNO Europe also agree that the distinction needs to go beyond identifying private networks (Wi-Fi/ZigBee etc.) but also needs to identify and distinguish Internet Access Services from specialized services (non-Internet Access Service, which could run over public electronic communications networks ('ECN') (dedicated public networks, network slices, etc.). MVNO Europe emphasises that as well there is need to distinguish the wholesale access provided and to distinguish who is the operator providing the service (an MNO or MVNO). In a similar way, Transatel states that in the study of the IoT market, BEREC should distinguish different kind of connectivity on the cellular network: 3G,

LTE/4G, LTE-M, NBan that, it is important to know who will provide such connectivity, IoT MVNOs or MNOs. It will be interesting for MNOs to know if the ones will provide connectivity on their footprint (or outside of their footprint) through permanent roaming. BEREC should care as well to what extent MNOs are bound by bilateral agreements to exclude MVNOs from the market.

2.1. BEREC response

BEREC is in agreement with the stakeholders that describe Figure 2 as a description of the connectivity underlying the IoT and will relabel the Figure accordingly in its final report. As BEREC's response to question 4.2 states BEREC's report should not focused on the whole IoT ecosystem, but rather on connectivity.

Because of the focus on connectivity, BEREC considers that although it would be useful to have a full characterisation of all the agents operating in the IoT value chain, for the time being it would be sufficient to understand how the different IoT services are supported by the different connectivity solutions and to identify who are the providers of such solutions.

In BEREC's opinion, it is important that BEREC considers the concept of ECN/ECS as NRAs' and BEREC's intervention is basically limited to such ECN/ECS. Currently the legal possibility for an NRA to collect data from suppliers are set by Article 5 (1) of the Framework Directive[3], which provides only a legal umbrella for NRAs to request data from the providers of such services and networks. Whilst, in the future the new EECC gives added powers to NRAs and BEREC to collect data on M2M, in so far it gives way to consider M2M as an ECS, the possibilities to collect data depend on all countries having the same understanding when transposing the Directive into national law.

In any case, not being helpful to understand the entire IoT phenomenon or even the entire IoT connectivity does not prevent the knowledge of a part of it, which is relevant at this stage to inform the regulatory debate. Moreover, in all circumstances, BEREC will argue the needs for any new information requirements and size them appropriately so that they do not result in an unfair burden such as the one described by AT&T.

BEREC notes the different categorisations regarding connectivity made by all the stakeholders. However, it wants so stress that it wants to keep any data requirement as high level as possible in order not to place an excessive burden in its data requirements.

Question 2.2: What is your opinion on the differentiation of IoT and M2M? Do you have any additional proposals regarding such differentiation?

[3] Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services (Framework Directive)

AT&T agrees that M2M is a sub-set of the IoT, however it disagrees that M2M "allows [smart, connected devices] to interact without any human intervention". AT&T points at recital 249 of the Electronic Communications Code (Directive (EU) 2018/1972: "machine-to-machine services, that is to say services involving an automated transfer of data and information between devices or software-based applications with limited or no human interaction."

The GSMA also makes this point and mentions that while it is clear that the term 'machine-to-machine' indeed aims at capturing the communication exchanges happening between machines, it may be complicated to quantify or estimate M2M devices and services as a sub-set of IoT and classify them based on their level of human intervention. Because of this, according to the GSMA it is best to measure IoT connections without differentiating from M2M. Vodafone also considers that differentiating between these concepts is likely to add confusion to the topic and suggests that for practical purposes M2M and IoT to be used interchangeably, both of them a) including limited human intervention and b) limited voice/SMS (closed user group communication) as an ancillary service. Vodafone also believes it will be necessary to be clearer on the concept of 'limited human intervention'.

According to ECTA and to MVNO Europe, M2M may be too restrictive a concept, often tied to E.164 numbering regulation. They argue that the IoT is an ambivalent concept, as it suggests Internet access, whilst most definitions (all those listed in BEREC's consultation document, perhaps except the IEEE definition) actually encompass non-Internet connected objects/devices.

Therefore, ECTA considers that it would be more appropriate to discuss and define connected objects/devices, by distinguishing: (i) Internet and non-Internet connections, (ii) whether the connection is provided/bundled with the object/device, or (iii) whether the object/device relies on (Internet) connectivity supplied by its user. They also quote that connected objects could rely on E.164 numbers, IP (v4 and v6) addresses, and other /future addressing systems and that some members of their organisation have faced regulatory restrictions, which prevent them from making use of numbering ranges for legitimate innovative services and products. Such restrictions should be re-examined, and lifted where appropriate, to avoid stifling innovation, notably by European companies providing pan-European and global services supporting connected objects/devices.

EDRI believes that it is not clear that supervisory activities will benefit from spending a significant amount of time on this. In its opinion the differentiation between M2M and IoT should not justify different regulatory approaches since the privacy and data protection interests as well as the competition risks related to these communications are not materially different. EDRI does not consider whether the presence of human interaction is an important feature of an IoT device. An IoT device without human interaction can collect personal data if the measurements obtained by the device relate to identified or identifiable natural persons.

2.2. BEREC response

First, as mentioned in the answer to question 2.1 BEREC agrees with the stakeholders who argue that BEREC's M2M definition must be updated so that it reflects the new EECC. So far, BEREC has used a 2010 definition, which stated that M2M was "a generic concept that indicates the exchange of information in data format between two remote machines, through a mobile or fixed network, without human intervention". Therefore, BEREC will now use the definition provided by recital (249) EECC[4], although for statistical purposes BEREC will need to further qualify this definition.

Second, BEREC's view is that it is necessary to distinguish M2M connections from any IoT connections as the EECC definition of the concept calls for "limited human interaction". BEREC agrees that "limited human interaction" is a vague concept that needs further qualification so as to avoid to measurement discrepancies.

BEREC notes the comments made by ECTA regarding the regulatory restrictions on numbering. However, these are not in the remit of the public consultation.

Similarly, BEREC also notes EDRI's arguments regarding privacy and data protection and the need to use IoT and M2M interchangeably in consideration of those arguments. However, BEREC considers that it is necessary to clarify the distinction between both concepts as suggested by answer 1.1.

Question 2.3: In relation to application solutions, do you see the three categories "Industrial", "Automotive" and "Consumer" as the most relevant? Would you suggest other categories? If so, please elaborate.

AT&T agrees that these are relevant categories, but mentions that they are not exhaustive and potentially omit significant parts of the IoT ecosystem such as, for example, health and agriculture. Moreover, many IoT applications cut across multiple categories identified by BEREC. Similarly, ECTA and MVNO Europe broadly agree that these are the most relevant categories, but would also caution against BEREC creating too 'closed' boxes as new categories may emerge and because it is difficult to classify some IoT services. For example, smart city, environmental monitoring, transport, security, and in many countries healthcare, may in many cases be public sector functions, or involve both the public and private sectors.

Transatel segments markets as follows: (i) consumer devices (such as laptops, tablets or trackers), (ii) automotive, (iii) industrial IoT, and (iv) mobile healthcare devices. Transatel considers that the mobile healthcare devices segment is not developed due to the lack of European harmonized regulation.

According to EDRI, two of the BEREC categories are overlapping in an unfortunate way. EDRI proposes four categories: Industrial, Automotive, Open to the Public Spaces and Home applications, which encompass all IoT technologies that an individual might bring with them

[4] Here M2M services are defined as "services involving an automated transfer of data and information between devices or software-based applications with limited or no human interaction".

into their home (wearables, home automation, smart appliances, smart electricity metres, custom IoT home routers, etc.). Open to the Public Spaces IoT would encompass technologies that individuals are likely to encounter in spaces which are open to the public, such as shopping centres, public squares or government buildings, including sensors or security equipment. For EDRI the main issue in the long term is not so much to fix these categories but to create appropriate participatory processes for the governance of any IoT space, where particular rules may be applied, for example in prioritization of traffic or access to spectrum.

The GSMA notes that at this early stage of the industry, there are many relevant categorizations available and no common agreement on a standard one. It would be the role of a national statistics office, not a telecom regulator, to define one. In addition to that, it is unclear what the need and rationale would be for NRAs and BEREC to collect this information.

Finally, Vodafone and the GSMA consider that the proposed sectorial categorisation is not so relevant from a regulatory perspective and that instead BEREC should focus on categorising connectivity technologies: 1) cellular and 2) non-cellular IoT connectivity technologies (including, fixed, private networks, satellite, etc.). This can help ensure a regulatory level playing between cellular and non-cellular technologies.

Vodafone further suggests considering the following categories, as of relevance for future regulatory considerations: (1) categorisation from a spectrum usage perspective - between IoT applications operating in licensed spectrum as opposed to those operating in unlicensed spectrum and (2) categorisation based on network performance needs – into: 1) ‘massive’ M2M, and 2) critical IoT, which beyond the assurance of message transmission, demand very low latency and availability of reasonable spectrum bandwidth.

2.3. BEREC response:

BEREC admits that several stakeholders have provided good arguments so as to why the boundaries suggested by BEREC are quite blurred. BEREC therefore agrees that these categories are rather fluid and that the list of categories cannot be exhaustive as new services may appear in the future. Indeed, as the GSMA points out official government statistic departments may be better placed than BEREC to provide a full and ongoing categorization of the different IoT services, with regards to their kinds of uses or the economic sectors that they affect.

BEREC agrees with Vodafone and the GSMA that it should use categories for IoT services that are relevant from a regulatory perspective and takes into account their proposal to classify the IoT in so far they depend on different connectivity technologies (for example, cellular versus non cellular connectivity), different spectrum usage (licensed or unlicensed) or its requirements on the network performance.

BEREC notes the contribution of EDRI regarding the governance of the IoT space and the concern expressed by Transatel on the difficulties in the development in mobile healthcare. However, those issues are well beyond the remit of this document.

3. Comments to Question 3

Question 3.1: In your opinion, what effects on spectrum policy is the development of the IoT expected to have, and do you think it's necessary for NRAs to monitor, and BEREC to benchmark, these developments?

EDRI believes that "Spectrum policy influences the choices made by technical standards bodies with respect to what avenues for new features they pursue". EDRI suggests that BEREC could support pro-active changes to spectrum instead of waiting for the development of IoT to influence this policy, drawing attention to the risk of BEREC inadvertently supporting the use of licensed spectrum for the IoT. EDRI states that, by changing the spectrum policy pro-actively, BEREC may encourage actors to make use of unlicensed spectrum for more vertically flexible infrastructures and to develop technologies, which can function on such frequencies.

The GSMA considers it is useful for BEREC and European NRAs to understanding IoT market developments and their impact on spectrum demand. The GSMA suggests that BEREC should takes into consideration that IoT connectivity architecture varies substantially across different services, and so do bandwidth and latency requirements.

For the GSMA it is also important that BEREC and European NRAs maintain a spectrum policy that is technology and service neutral to support IoT, providing a regulatory framework for licensed spectrum that facilitates the development and growth of IoT, and does not impose service or technological restrictions that hold back innovation. The GSMA suggests that BEREC and European NRAs should also refrain from setting aside or assigning ad hoc spectrum bands for specific IoT services, considering that international spectrum harmonisation is vital for a global, affordable cellular IoT market. For the GSMA, an harmonised mobile spectrum is needed to support all wide area IoT use cases including coverage bands for LPWA use cases and capacity bands for high bandwidth applications like video streaming.

The GSMA notes that LPWA technologies (NB-IOT and LTE-M) were designed to be supported in most existing cellular bands. In fact one of the key advantages of these technologies is to be able to operate on existing allocated spectrum resources and to easily integrate into existing radio access so to facilitate IoT deployment. NB-IoT and LTE-M are 3GPP standards that are both set to coexist with other 3GPP 5G technologies, fulfilling the long term 5G LPWA requirements. In order to complete the 5G system support for NB-IoT and LTE, 3GPP is also investigating options for the 5G core network to support these NB-IoT and LTE-M technologies. This will enable a smooth operator migration path to 5G NR (New Radio) frequency bands.

Vodafone suggests that BEREC should identify and measure how many IoT connections/devices are operating in the licensed and unlicensed spectrum, in order to estimate their impact on spectrum usage/allocation. It also considers that international coordination is also vital, so that spectrum authorities around the world ensure that mobile bands are widely harmonised, as they can enable mass market low cost cellular IoT devices by creating a large enough addressable market to support manufacturing economies of scale.

MVNO Europe supports the inclusion of Full MVNO access obligations in spectrum licensing conditions. They note that, where spectrum licences include Full MVNO access obligations imposed on MNOs the market for IoT / connected objects/devices is more diversified and more competitive. MVNO Europe suggests that BEREC and NRAs specifically monitor the availability of fit-for-purpose wholesale access, for MVNOs generally, and specifically with regard to IoT-related services and applications. They consider it will become increasingly relevant for 5G-based industrial IoT/ ”verticals”.

MVNO Europe and ECTA agree that IoT MVNOs (and all IoT market participants, such as MNOs, MVNOs or others) require Pan-European coverage, on all technology generations (2G to 5G), to be able to provide innovative solutions integrating connectivity and IT, and their own unique solutions, across the EU (and indeed globally), for all types of connected objects/devices.

Regarding the need of exceptional requirement for specific applications (e-health), ECTA notes that if BEREC or NRAs (or other stakeholders) are claiming that spectrum bands need to be dedicated, or other extreme regulatory measures are needed, this should be properly justified.

ECTA agrees that monitoring, including in terms of spectrum requirements, is appropriate, however BEREC’s statement at page 18 lacks clarity in terms of what exactly is targeted for monitoring and potential regulation. ECTA also considers that it may be premature to categorize or pre-determine spectrum bands for connected objects. ECTA considers that a neutral technology approach may be preferable, at least until proof of the contrary.

Transatel strongly believes “freedom to innovate” is key to the development of this market. To do so, IoT MVNOs must play a significant role in this expansion, along with MNOs. The harmonization of the regulation across Europe regarding access to the infrastructures” must be completed to enable IoT MVNOs to have a Pan-European development and have the same conditions of network access in Europe.

3.1 BEREC’s response

BEREC notes that most of the comments and responses relate to spectrum policy and spectrum licensing, which fall well beyond the objectives of the project on IoT indicators. BEREC agrees that the issues relating to the need for a proactive spectrum policy, the “technological and service” neutral allocation of spectrum bands, the features of spectrum licensing conditions or the international coordination and harmonisation of spectrum are important issues that may feed in future BEREC projects. However, they are not in the remit of the current piece of work, which is to assess the need for collecting and benchmarking on IoT indicators.

BEREC agrees with Vodafone’s suggestion to measure how many IoT connections are operating in the licensed and unlicensed spectrum, in order to estimate their impact on

spectrum usage/allocation, and consider that it would be a possible way to establish the demand on spectrum demands. However, note that, as many NRAs mentioned in the preliminary questionnaire, there are a number of organizations, such as CEPT, ETSI and ITU-R are already monitoring the developments that may affect spectrum needs and that spectrum management developments take place at the EU level.

Responding to ECTA's comments, as mentioned in a previous BEREC report[5], in the longer term and as the market develops, the spectrum requirements for IoT services may change and it is therefore important for NRAs to monitor market developments and spectrum use.

Indeed, as reported by Analysis Mason in a recent study, the rapid increase in MBB traffic could make it challenging to support IoT and MBB within the same carrier without compromising network performance. Quality of service depends on the spectrum being used – the possibility of mobile operators capturing a significant share of IoT traffic is important in this regard, since as traffic levels grow the quality of service for both IoT and MBB may decline.[6]

Question 3.2: With regard to the expected growth in the use of IoT devices, do you see the necessity for NRAs to monitor, and BEREC to benchmark, these developments, particularly with respect to numbering? If so, why?

Both the GSMA and Vodafone do not foresee an immediate problem of scarcity of numbering resources caused by IoT.

Vodafone notes that a number of global mobile operators deploy IoT services using the ITU assigned IoT supranational numbering ranges, but still subject to national fragmentation. Therefore, Vodafone considers that this is a matter that BEREC should continue to monitor and address.

For GSMA, only a small part of existing and future connected IoT services will have a dedicated number and the existing E.164 and E.212 resources do not seem scarce in the region. GSMA states that there may be specific country circumstances where, due to the configuration of the numbering system, potential situations of scarcity may manifest.

GSMA also notes that IoT devices may use national, foreign or global numbering resources and thus, encourage BEREC to support the use of supra-national numbering which does not place any pressure on national numbering resource.

ECTA supports numbering monitoring however, disagrees with the BEREC working hypothesis (at pages 18 and 19) stating that addressing resources are not intrinsically scarce and clarifies that they are only scarce when not adequately structured or improperly managed. ECTA suggests that policy-makers and NRAs/BEREC should first and foremost ensure that scarcity of addressing resources for connected objects/devices is structurally avoided, rather than finding themselves in a position of managing scarcity, which could impede innovation and

[5] BEREC Report on enabling the internet of things.
[6] Analysis Mason, Intermet of Things, Opportunities for Telecom Operators.

the success of European companies, including those offering pan-European and global solutions.

MVNO Europe therefore agrees that NRAs need to monitor the use of national numbers for IoT, but most of all, NRAs need to lift restrictions on the use of any type of numbering resources, to enable pan-European IoT.

MVNO Europe and ECTA argue that numbering-related matters have been invoked to restrict IoT service provision, notably in Germany. For MVNO Europe, if wholesale network access in the context of IoT / connected objects/devices is withheld in any EU Member State, including on the grounds of numbering rules, this will impede pan-European and global expansion for Europe-based companies.

Transatel encourages BEREC to be more specific when it comes to network access regulation. They consider there is no need to monitor numbering unless it has the purpose of preventing unethical use of such numbers. Transatel suggests that NRAs must ensure that IoT MVNOs can have network access across Europe, stating that the diversity of regulations through Europe is an issue.

EDRI does not believe that national numberings plans will affect the growth of IoT deployment in any way. According to EDRI, “IoT devices are likely to use several different electronic communications networks, and only some of these, mainly mobile networks, will involve the national numberings plan.”

AT&T does not see a need for BEREC to benchmark the growth of IoT devices with respect to numbering. AT&T believes that the impact of IoT/M2M on national numbering plans will vary by country depending on the resilience of the relevant plan. Some NRAs have anticipated the need to create additional numbering resources by introducing dedicated, longer M2M number ranges while others believe this is not required.

3.2 BEREC’s response

BEREC takes note that most of the public consultation respondents are of the view that there is no immediate problem of scarcity of numbering resources and that this should not be a problem in the future, as long as numbering is properly managed.

As mentioned in the previous BEREC report on IoT[7], at present and under the current numbering plans, the possible scarcity of numbering resources does not appear to be the main obstacle to the development of IoT.

Indeed, BEREC is currently working to develop the guidelines on common criteria for the assessment of the ability to manage numbering resources by undertakings other than providers of ECN/ECS and of the risk of exhaustion of numbering resources if numbers are

[7] BEREC Report on enabling the internet of things.

assigned to such undertakings. These guidelines shall cover all kind of services and numbers, including IoT/M2M services and possibly provided special numbering resources for such services.

MVNO Europe suggested that NRAs should lift restrictions to enable pan-European IoT. BEREC takes note of such concern, however it is not the objective of this public consultation, as the report only intends to assess the need for collecting and benchmarking on IoT indicators.

Question 3.3:Do you see the need for NRAs to monitor which national numbers for IoT devices are used outside their domestic market/territory (and vice-versa, which numbers assigned in other countries are used in the NRA's territory)? If so, please elaborate.

The GSMA and AT&T considers sufficient the obligation deriving from the new EECC for BEREC to monitor such use. As noted in the Consultation, the new EECC assigns to BEREC a mandatory task to develop a database of numbering resources with a right of extraterritorial use. AT&T believes that completing this task should be prioritised before assessing whether the new database provides sufficient monitoring.

AT&T does not see a need for NRAs to monitor which national numbers for IoT devices are used outside their domestic market territory (or vice versa). AT&T notes that, in an effort to introduce such monitoring, BNetzA introduced a requirement for all foreign E.164 number ranges being used for M2M in Germany to be notified in advance. If this practice was replicated by all EU NRAs and other regulators around the world, keeping this kind of information updated would represent a significant burden for service providers.

Transatel thinks IoT players should be free to use either national or international mobile number resources and potentially, one day, European mobile number resources.

ECTA sees no strong need for such monitoring, but does not object to such monitoring being performed. ECTA considers that in a European Digital Single Market, the choice of numbering or addressing resources should not matter with regard to the services and applications being offered and delivered.

EDRI does not see a need for NRAs to monitor which national numbers for IoT devices are used outside their domestic market territory (or vice versa), considering that there are no important management/statistical benefits, while big risks exist of misuse/abuse of this information for technical control.

3.3 BEREC's response

BEREC agrees with most contributors that argued that there is no need for BEREC to monitor national numbers for IoT services that are used outside domestic markets. As mentioned by

GSMA and AT&T, the new EECC assigns BEREC with the task to develop and maintain a database on numbering resources with an extraterritorial use. BEREC is in agreement with the positions of these two respondents that for the time being this tool is sufficient to gather information on this respect.

Moreover, BEREC will be analyzing within the tasks regarding the guidelines on common criteria for the assessment of the ability to manage numbering resources by undertakings other than providers of ECN/ECS and of the risk of exhaustion of numbering resources, the possible impacts on numbering resources in case those are assigned to undertakings other than providers of ECN/ECS with extra-territorial use rights.

Question 3.4: In your opinion, in addition to NRAs, for which entities (EU and non-EU) are the following individual matters relevant:

- ***(a) The effect of IoT on spectrum policy***
- ***(b) The effect of IoT on scarce resources, i.e. numbering***
- ***(c) The monitoring of national numbers for IoT devices used on an extraterritorial basis***

Both GSMA and Vodafone urge BEREC to take a proactive role in monitoring and participating in these IoT spectrum policy discussions to ensure that technology neutrality principle is guaranteed and customers benefit from the most efficient and advanced technology that meets their needs. Both respondents note that European sector-specific policymakers are developing regulation that risks excluding usage of cellular IoT standards limiting the potential of 5G (for example in the automotive and drone sectors).

ECTA has no comments on this question, but they understand that emergency services and security organizations could have legitimate interests with regard to IoT/connected objects/devices.

EDRI considers it is not clear in which direction influence flows concerning spectrum policies. Spectrum policies are interesting for SDOs (IETF, IEEE, ETSI), CSOs (notably community networks and open developer communities such as OpenWRT) and the usual market agents. Spectrum policies determine the liberty to act for each of these actors. Notably, a European municipality could not decide to erect a local LTE-based network for IoT at this time - why is that? More flexible spectrum policies, such as spectrum sharing in unlicensed bands, could open a big commercial space for smaller entities in the European Union and could be an important driver for innovation in the IoT/M2M area. For example, the LoRaWan technology operates in the unlicensed radio spectrum.

3.4 BEREC's response

BEREC acknowledges the different organisations and institutions mentioned by the contributors in responding to this question and will use this list in the final report on IoT indicators.

There are as well a number of comments that express a concern with the development of regulation of sector specific policymakers that may risk excluding the usage of cellular IoT standards and request for BEREC to participate in this fora so that technological neutrality is upheld. EDRI requested for a more flexible spectrum policy, for example by allowing spectrum sharing in unlicensed bands. BEREC takes note of this request, however spectrum policy does not fall in the remit of this work, although they may feed in other BEREC's future tasks.

4. Comments to Question 4

Question 4.1: What is your opinion on the benefit of a BEREC common approach regarding the IoT?

EDRI considers pertinent that the least integrated part of the markets that BEREC supervises is the spectrum allocation. Because of territorial constraints on spectrum licenses, any licensed network provision is de facto constrained to the territory of the spectrum license and this effectively causes the European telecoms markets to be markets plural, rather than market singular. That said, every other aspect of IoT is European or global: data management, the corporations supplying hardware, software or services, cloud services, data collection, the consumer base and even the entities which own and operate the networking infrastructures under different spectrum licenses. A common approach regarding IoT could be motivated from this fact.

ECTA considers that monitoring developments in the area of Internet of Things / connected objects/devices should be conducted by NRAs, jointly through BEREC, or with aggregation performed by BEREC, using a harmonized set of indicators, for the purposes of benchmarking, and to provide a statistical overview of the connected objects/devices landscape in Europe.

AT&T and the GSMA consider that any data collection requests of BEREC must be proportionate and genuinely necessary, considering their impact on businesses.
The GSMA notes that each information request to a service provider represents an additional administrative burden, multiplied if the provider operates across multiple Member State markets. Thus, a common format to be used by all NRAs is recommended as this would reduce administrative costs. Similarly AT&T sees (as long as data collection is genuinely necessary) a role for BEREC in developing a common data collection format to be used by all NRAs for such requests to streamline processes and aid comparative analysis.

The GSMA considers that what is considered relevant at this stage to inform the regulatory debate and support spectrum efficient allocation is the collection of statistics regarding: 1) IoT applications and devices that operate in licensed vs. unlicensed; and 2) data on cellular and non-cellular IoT devices and respective connectivity technologies.

Vodafone welcomes BEREC's initiative on a common approach regarding IoT because it provides further regulatory certainty and will help to ensure scale and quick adoption. Vodafone would also welcome a wider regulatory harmonisation related to IoT (beyond data collection), because it considers fragmentation as a critical barrier that we need to overcome within EU.

In alignment with Vodafone, the GSMA welcomes a common approach in providing regulatory certainty and in establishing a harmonised regional framework. The GSMA members experience intense and constant challenges during the deployment of enterprise and consumer IoT applications, because of the existing fragmentation, as they navigate through different EU markets and respective variations of regulations' interpretation.

Transatel considers that BEREC must ensure the reality of an European Digital Single Market, especially when it comes the issue of access for IoT MVNOs. Transatel states that the IoT market is a worldwide market and any European player must consider Europe as their domestic market.

4.1 BEREC's response

Most contributors acknowledge the goodness of having harmonised statistics and a common approach guided by BEREC. In particular, ECTA considers that the monitoring developments in the area of IoT should be conducted by NRAs through BEREC. However, AT&T, the GSMA and Vodafone describe the costs of such data collections and request for those to be properly substantiated and proportional to the need pursued. Being aware of these costs, in proposing any new statistical measurements, BEREC will endeavour to reason its needs and to size requests in an appropriate manner[8].

The GSMA considers that at this stage the relevant indicators to inform the regulatory policy and support the efficient allocation of spectrum would be a collection of statistics on 1) IoT applications and devices that operate in licensed vs. unlicensed spectrum; and 2) data on cellular and non-cellular IoT devices and respective connectivity technologies. Indeed, BEREC agrees with the GSMA and supports the idea that the focus of any possible data gathering exercise it undertakes is related to the connectivity requirements of the IoT phenomena.

In response to final comments of Vodafone, the GSMA and Transatel, BEREC wants to underline that the public consultation is circumscribed to the need for harmonised data and does not extend into other regulatory considerations, which may be examined within other BEREC's initiatives.

[8] Note also that every new collection of data is also a burden for NRAs, as normally those require upgrading information systems and entail a larger workload.

Question 4.2: Do you agree with the general areas of interest for future indicators (to be collected), presented in Figure 4 above? Could you suggest any specific IoT indicators that BEREC should consider for collection?

The GSMA considers it would be important to have an understanding of IoT beyond the connectivity market to put the phenomenon in the right context, however in the public consultation it is not clear what the exact purpose of any new data collection would be. The GSMA notes that information requests represent an administrative burden and a cost. If they were to be placed only on a limited number of players in the IoT connectivity value chain, they would be unjustifiable and disproportionate. They would also not be helpful to understand the entire IoT phenomenon.

In the GSMA's view, BEREC expresses uncertainty on the extent to which the new regulatory framework (Directive 2018/1972), allows data collection beyond traditional connectivity providers. In this regard, the GSMA mentioned that IoT connectivity is an important but relatively small part of the overall IoT revenue opportunity. As such, a data collection exercise focusing only on a sub-set of connectivity providers would be of little value.

Vodafone refers they are interested to understand better what the exact purpose(s) of collection is, considering the many aspects of IoT in figure 4. Vodafone consider relevant at this stage to inform the regulatory debate the collection of: (1) data on IoT applications and devices that operate in licensed vs. unlicensed; (2) data on cellular and non-cellular IoT devices and respective connectivity technologies and (3) data on network impact indicators (e.g. signalling traffic generated from IoT devices).

Transatel considers that BEREC should have statistics regarding the number of lines used by MNOs and IoT MVNOs in Europe. Especially, BEREC should focus on what part of the traffic falls into the category of "permanent roaming" and by which operator this is provided so that knowledge is gain with respect to whether some MNOs in Europe have bilateral agreements on permanent roaming, which is, with no doubt, detrimental for the competition.

ECTA agrees with the areas of interest presented in Figure 4. ECTA believes that, for the data collection to be reflective of market developments and relevant going forward, it should:

(1) Go beyond traditional Machine-to-Machine (M2M) communications and reliance upon E.164 numbering resources, and go beyond studying "the total number of IoT subscribers emanating from ECS undertakings and/or the quantity of national numbering resources allocated specifically to IoT" as soon as NRAs have the powers to conduct wider data collection.
(2) Examine not only ECN/ECS markets, but also related markets, distinguishing configurations where an electronic communications service is provided/bundled (e.g. objects/devices that come with their own connectivity service), and where that is not the case.
(3) Distinguish Internet-based communications (implying potential connectivity to/from any end-point on the Internet) from non-Internet-based communications.
(4) Distinguish services provided directly by network operators (MNOs) and services provided by others (e.g. MVNOs).

(4) Distinguish mobile/wireless connectivity at the level of the generations of mobile connectivity provided, notably 2G, 3G, LTE/4G, LTE-M, NB-LTE, and '5G' in all its emerging modalities, with a specific focus on wholesale access being provided to these connectivity modalities.
(5) Include dedicated measurements that examine the functioning of the wholesale roaming access market, given that IoT connectivity relies in many cases on SIMs that are permanently roaming.

4.2 BEREC's response

BEREC acknowledges the comment from GSMA that it would be important to have an understanding of IoT beyond the connectivity market to put the phenomenon in the right context. The report is however not focused on the whole IoT ecosystem, but on connectivity. Whilst BEREC admits that connectivity is only a part of the fuller system, still, it is indispensable for the delivery of IoT services and, more crucially, it is the concept that lies at the core of NRAs' and BEREC's functions and capabilities. Not being helpful to understand the entire IoT phenomenon does not prevent the knowledge of a part of this ecosystem, which is relevant at this stage to inform the regulatory debate.

BEREC welcomes the suggestions on the indicators to collect and will consider them in the final report. However, despite that NRAs may have soon the powers to conduct wider data collection, it should be noted that intervention by NRAs and BEREC is basically limited to ECN/ECS. Currently the legal possibility for an NRA to collect data from suppliers is set by Article 5 (1) of the Framework Directive[9], which provides only a legal umbrella for NRAs to request data from the providers of electronic communication services and networks. Article 20 in the EECC also establishes that primarily NRAs can collect information from the providers of electronic communication services and networks in a proportionate manner and when motivated for a regulatory reason, and defines M2M as an electronic communication service[10]: Article 20 goes on to establish: "Where the information collected in accordance with the first subparagraph is insufficient for NRAs, other competent authorities and BEREC to carry out their regulatory tasks under Union law, such information may be inquired from other relevant undertakings active in the electronic communications or closely related sectors". In conclusion, the EECC may extend the current rights to gather information. However, the main issue regarding the possibility to gather harmonised statistics is on granting that all countries have the same understanding when transposing the directive into national law. BEREC disagrees that request for information on a limited number of players in the IoT connectivity value chain would be unjustifiable and disproportionate.

Finally BEREC notes the different categorisations regarding connectivity made by all the stakeholders. However, it wants so stress that it wants to keep any data requirement as high level as possible in order not to place an excessive burden in its data requirements.

[9] Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services (Framework Directive)
[10] Article 21 establishes further rights to request information from the undertakings, which are subject to the general authorization established in Article 12; this is, providers of electronic communication network and services, other than number-independent interpersonal communication services.

Question 4.3: Do you support the gathering of statistical information on IoT by BEREC? Please substantiate your answer.

ECTA and Transatel support the gathering of statistical information in all areas proposed by BEREC. ECTA suggests more granular data gathering, the specifics of which are outlined in ECTA's comments above.

Both ECTA and Transatel add state that data gathering by category of market participants (MNOs/MVNOs – industrial verticals, etc.) is relevant on the model of the ARCEP trimestral report (known as SIM – Suivi des Indicateurs Mobiles), including SIMs used on a "permanent roaming" basis.

Vodafone states that any information collection should serve a clear purpose, be proportionate and not excessively burdensome for information providers. As an example, Vodafone notes that information related to IoT applications using roaming cellular connectivity can be very difficult to collect (e.g. revenues, number of connections, traffic volume). For this reason, Vodafone and also the GSMA are interested to better understand the exact purpose(s) of such data collection. Otherwise, they consider that any additional data collection, beyond what is already taking place at national level, would be premature.

The GSMA argues that under Directive 2018/1972 it is unclear whether BEREC remits extends beyond traditional ECN /ECS providers. The GSMA considers that if data collection was exclusively on these subjects it would only capture a fraction of the IoT connectivity market and as such pointless.

AT&T sees no issue with BEREC gathering data from other bodies that research and forecast the growth on the IoT (e.g., Gartner, Cisco indices, IDC, IHS). AT&T agrees that gathering information from regulated ECS providers at the granularity of service/application would be very taxing for them. It is therefore essential that data collection requests are proportionate and genuinely necessary.

AT&T argues that NRAs responses to BEREC questionnaires consider "interesting to collect" a set of indicators and this does not appear to be a sufficient justification for imposing burdensome data collection demands on service providers.

AT&T also considers that, because of BEREC's limited abilities to collect information from the complete IoT ecosystem – or even the complete ecosystem of wireless connectivity providers – it is highly questionable whether BEREC's proposed data collections will lead to probative information that could guide useful IoT policies.

EDRI has no objection to the collection of statistical information on IoT at the aggregate level by BEREC. Given the global nature of the industry and the heterogeneous offerings of IoT devices, it is not clear how it could effectively be regulated at a national level in the EU. All providers of services on the IoT market are already under obligation to follow European

harmonized regulatory frameworks in their respective sectors, in terms of communications technologies and services and in terms of consumer rights law.

EDRI also draw the attention to the conditions for the collection of such "statistical" data. "Aggregate" data collection is acceptable, while, for example "pseudo-anonymized" or "anonymized" data is not. Methods of deanonymization of "anonymized" data are mature, powerful and widely used, so risks outlined in the Q1.1 answer must be minimized.

4.3 BEREC's response

Most contributors acknowledge the goodness of having harmonised statistics and a common approach guided by BEREC as long as the request for information is justifiable, proportionate and not excessively burdensome for information providers. In proposing any new statistical measurements, BEREC will endeavour to reason its needs and to size requests in an appropriate manner.

BEREC does not discuss whether using data from other bodies that research and forecast the growth on the IoT are sufficient. In any case, BEREC believes that there are major advantages of collecting data in a harmonized way, using the same definitions and criteria's, sources.

BEREC disagrees with Vodafone and GSMA that consider that any additional data collection, beyond what is already taking place at national level, would be premature. Measuring IoT devices, especially with respect to their implications for telecommunications networks requires prioritization, considering the policy relevance and feasibility of the data collection. IoT's demands may develop in a way that will place strong implications for the location, deployment and capabilities of infrastructures, comprising issues that are of high priority for communication policy and regulation.

5. General comments/Other Issues

Question 5.1: ***Are there any additional issues relating to collection of statistical information on the IoT which have not been included in previous questions that you would like to address?***

The GSMA states that the potential economic impact of IoT is promising to be substantial and far beyond the connectivity market: from improving productivity, to reducing public administration costs in deploying public services, monitoring and reducing pollution, to improving and facilitating the delivery of public services.

The GSMA considers that while BEREC responsibilities and powers lie exclusively within the remit of electronic communications, it is important that, beyond BEREC and NRAs, official government statistic departments capture the overall IoT phenomenon and measure its economic impact on society. This is at macro level, beyond electronic communications.

The GSMA suggests that overall estimates of the economic impact of IoT, beyond the pure IoT connectivity dimension, are necessary at national and regional level to inform better, evidence-based policy making.

5.1. BEREC response

The suggestion from GSMA to estimate the economic impact of IoT by BEREC is an interesting one and may be part of a future BEREC assessment.