

Draft

Further Guidance on 5G Network Slicing

**Annex to the BEREC Guidelines
on the implementation of the Open Internet Regulation**

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1. Introduction and context

The principle of the open internet is embedded in Regulation (EU) 2015/2120¹, the “Open Internet Regulation” (hereafter OIR), which has applied in all Member States since 30 April 2016.

Pursuant to Art. 5(3) OIR, BEREC has provided guidance on its implementation², including on the rules to safeguard equal and non-discriminatory treatment of traffic in the provision of internet access services (“IASs”) and related end-users’ rights as laid down in Art. 3 and 4 OIR. The OI Guidelines also offered further clarifications that are relevant for 5G technologies. More specifically, they elaborated on the compatibility with the OIR of relevant mobile technologies, explaining, on the one hand, how internet access service providers can differentiate the Quality of Service (“QoS”) level of IASs and, on the other hand, detailing the conditions for providing specialised services under the OIR.

In addition, while acknowledging the dynamic nature of the internet and of IAS³, BEREC has further noted that the OIR seems to leave considerable room for innovation and that no concrete evidence suggests that implementation of network slicing is being impeded by the OIR⁴.

Since 2022, when the OI Guidelines were last updated to reflect several rulings of the European Court of Justice on ‘zero tariff’ offers, there have been several relevant developments, notably:

- The European Commission (EC)’s second report on the implementation of the OIR observed, inter alia, that some stakeholders felt that *“the current rules and approach do not provide sufficient certainty to enable them to launch services based on network slicing or define specialised services”* and *“[g]reater legal certainty could therefore be beneficial to both innovators and consumers in the future”*;
- The EC’s proposal for a Digital Networks Act⁵ indicated that *“specialised business services are becoming integral part of network offering for interconnecting data centres, in provision of edge computing and for AI services. The provision of low latency and guaranteed quality of service are essential features of specialised business services”* (recital 255).

¹ [Regulation \(EU\) 2015/2120](#) of the European Parliament and of the Council of 25 November 2015 laying down measures concerning open internet access and amending Directive 2002/22/EC on universal service and users’ rights relating to electronic communications networks and services and Regulation (EU) No 531/2012 on roaming on public mobile communications networks within the Union.

² BoR (22) 81 (hereinafter the “OI Guidelines”).

³ BoR (22) 81, paragraph 112.

⁴ See already BEREC Opinion for the evaluation of the application of the Open Internet Regulation, [BoR \(22\) 163](#).

⁵ [Proposal](#) for a Regulation for the Digital Networks Act (DNA)

- The Impact assessment underlying the proposal for a Digital Networks Act further states, inter alia, that “*legal uncertainty has arisen regarding the interpretation of the OIR provisions on high quality specialised services. Stakeholders report difficulties in assessing ex ante whether an innovative service would comply with the OIR. Consequently, they highlight the need for more guidance and predictability in order to minimise a chilling effect on investments and innovation, particularly in relation to network slicing used to implement specialised services (pp. 22-23)*”

Against this backdrop, this document sets out BEREC’s updated guidance on how the OIR applies to 5G network slicing. It complements the OI Guidelines in assisting providers to self-assess their services and practices, which do not require *ex ante* clearance by national regulatory authorities (NRAs) under the OIR. While this guidance specifically focuses on 5G standalone network slicing, the underlying principles of logical network partitioning and differentiated QoS treatment are not exclusive to 5G: QoS differentiation mechanisms exist in 4G networks and are available in fixed-access networks; future 6G architectures are likewise expected to further extend slicing concepts. Given the principle of technological neutrality underlying the OIR, the approach set out in the following chapters, while developed with reference to 5G slicing, is equally relevant for similar QoS differentiation mechanisms in other network technologies.

In case of any conflict between the main document of the BEREC Open Internet Guidelines and this annex, the main document shall take precedence.

[Chapter 2](#) briefly addresses the relevant technological aspects of slicing and ongoing developments in this area. [Chapter 3](#) builds upon the OI Guidelines and follows the structure of the OIR. In particular, it clarifies how 5G network slicing fits within the scope of the OIR (section 3.1). BEREC then elaborates on how the technology can be used to provide IAS and specialised services in an OIR-compliant manner (sections 3.2 and 3.3, respectively). [Chapter 4](#) provides a list of generic slicing-based examples with BEREC’s preliminary remarks.

2. Technological aspects of slicing

2.1. Generic description of slicing

Network slicing is a technology used in 5G Standalone networks to divide the physical network infrastructure into several logically separate networks, known as slices. A single physical network infrastructure thus provides multiple virtual networks.

For each slice, the network operator has the technical capabilities to set different conditions for the transmission of data traffic via capacity allocations and traffic management measures. For example, data transmission rates, packet latency, jitter and packet loss could be guaranteed.

Thus, the network operator can use the configured slices to provide end-user services with contractually guaranteed quality characteristics. Such slices can be assigned to specific access services, e.g. IASs, the implementation of private Wide Area Networks (WANs), or communication channels for specific organisations (law enforcement, fire service, ambulance service, etc.). However, they can also simultaneously provide end-users with different access options (slices), each with different quality levels, which can be selected by the end-user/application/operating system (OS) based on the quality requirements of specific applications (e.g. real-time communication, priority services).

Network operators have the option of configuring slices in such a way that, for example, in the event of an overload, one slice can use the radio sector/cell's capacity as a priority (at the expense of the other slices). Furthermore, slicing enables the dynamic allocation of resources (dynamic slicing, see below).

2.2. Dynamic slicing

The 5G system architecture supports the dynamic lifecycle management of network slices, including their creation, modification, scaling, and termination in real time. This means that, in addition to slices that are statically provisioned at subscription time with their QoS parameters, operators may deploy slices that can be activated, reconfigured, or deactivated on demand, for example, enabling an end-user to temporarily access a higher-quality slice for a limited duration. Slices might also share the same capacity instead of having static capacity reservations, thereby allowing the unused bandwidth to be temporarily allocated to another slice in the event that a particular slice does not fully utilise its allocated bandwidth. This may happen largely autonomously according to predefined rules.

Dynamic slicing introduces a temporal dimension of QoS differentiation that is not present in traditional static subscription models. QoS levels associated with a given slice may therefore vary over time, driven by end-user requests or, potentially, by automated triggers originating from applications or network management systems. In its full dynamic form, slices are provisioned by an operator according to Network Slice as a Service (NSaaS) model. The slicing and its realisation rely on standardisation efforts to build a common approach led by relevant organisations.

2.3. Standardised network APIs

A recent development is the emergence of standardised network Application Programming Interfaces (APIs) that expose programmable 5G core network functions to third-party applications. This technology is relevant to this guidance because, similar to 5G slicing capabilities, differentiated QoS can be technically assigned to specific applications in a dynamic fashion. Through these interfaces, application providers can request specific QoS treatments, such as reduced latency, guaranteed bandwidth, or dedicated slice resources. These can either be automated or occur on a per-session basis.

3. Assessing compliance with the Open Internet Regulation

3.1. Scope

The OIR establishes common rules to safeguard equal and non-discriminatory treatment of traffic in the provision of IAS⁶ with a view to protecting end-users while simultaneously guaranteeing the continued functioning of the internet ecosystem as an engine of innovation⁷. To this end, the OIR not only regulates IASs, including IAS traffic management measures used for this purpose, but it also (i) frames the provision of what are known as “specialised services” (“SpS”), which, when offered by IAS providers, compete for network resources⁸, and (ii) prevents practices aimed at circumventing the OIR⁹.

Services implemented via 5G network slicing are however not necessarily of concern with regard to the OIR: a mobile network operator can slice its network to construct separate mobile networks or reserve network capacity for the provision of different types of services other than IAS (if they do not impact on the IAS) over distinct network slices.

An example could be slices for electronic communication services (ECSs) that are not publicly available and provided over infrastructure or capacities independent of IAS, such as connectivity services offered only to predetermined and closed end-user groups, so that access is limited to specific end-users (e.g. particular institutions or corporate networks, even at multiple locations) which is explained in BEREC OI Guidelines paragraph 12. If a non-publicly available service is using a dedicated network slice on network resources of an IAS provider, and may adversely affect the provision of the IAS, the provider of the IAS must ensure that the provision of IAS is not affected in a way that it breaches the OIR requirements.

On the other hand, where an ECS provider offers only “private” connectivity services through dedicated infrastructure which is not shared with publicly available ECS (for example, a fully private 5G network deployed within a large industrial facility using dedicated local spectrum), such services should be considered outside the scope of the OIR, as they cannot have any detrimental impact on IAS.

BEREC therefore notes that the logical isolation of a slice does not alter the fact that the underlying network resources are limited and might be shared with other services including IAS. Where slices carrying services other than IAS are deployed on the same physical infrastructure as IASs, the IAS provider remains bound by its obligations under the OIR regarding the IAS it provides, including the obligation to ensure sufficient network capacity for

⁶ See Art. 1 OIR.

⁷ See to this effect recital 1 OIR.

⁸ See Art. 3(5) OIR

⁹ See recitals 7 and 15-17 OIR.

the provision of high-quality non-discriminatory IAS and to deliver the IAS at the contractually specified quality levels pursuant to Art. 4(1) (d) OIR.

The OIR, as an instrument aimed at promoting innovation, does not preclude the use of network slicing to provide services falling within its scope. As long as they comply with the substantive prescription of Art. 3(1)-(4) and 3(5) OIR, operators are, accordingly, free to offer distinct network slices for different IASs (e.g. mobile broadband and fixed-wireless access broadband) alongside one or more SpS.

3.2. 5G slicing and IAS provision

BEREC recalls that the substantive core of the OIR aims to safeguard equal and non-discriminatory treatment of traffic in the provision of IAS and related end-users' rights¹⁰. It follows that all possibilities for providing different QoS, regardless whether their implementation is based on slicing, have to comply with Art. 3(2) OIR (which precludes the restriction of end-user rights by agreements and commercial practices) and Art. 3(3) OIR (which precludes any measure inconsistent with the equal treatment of traffic where such a measure is based on commercial considerations).

3.2.1. Equal treatment of traffic (Art. 3(3) OIR)

The deployment of advanced features in 5G networks across Europe is anticipated to grow in the coming years. 5G Standalone is the enabling infrastructure for more advanced features of 5G network slicing, such as the tailoring of service-based slices specifically to service types with similar requirements¹¹. 5G slicing techniques can separate mobile network traffic based either on subscription information, i.e. the treatment of traffic depends on the subscriber profile (subscriber-based slicing), or on the specific application generating the traffic (application-based slicing). The granular logical separation achievable by 5G application-based slicing could nonetheless be one way of addressing the specific technical QoS requirements of individual applications.

BEREC recalls in this regard that each IAS has to be treated with regard to the “*general obligation*”¹² of equal treatment laid down in Art. 3(3) OIR¹³. IAS providers may offer optimisation of the overall transmission quality with reasonable traffic management measures according to Art. 3(3) (ii) OIR, i.e., the IAS provider, and not the end-user, could identify and control the assignment of traffic categories to certain QoS levels. In this case, BEREC emphasises that regardless of whether slicing techniques are utilised in this manner, the traffic management measures shall not be based on commercial considerations but on objectively

¹⁰ See CJEU, Case C-367/24, *Telekom România Mobile Communications*, para 17.

¹¹ E.g. eMBB (enhanced mobile broadband), URLLC (ultra-reliable low-latency communications) or mMTC (massive machine-type communications).

¹² CJEU, Case C-34/20, *Telekom Deutschland*, para 30.

¹³ See CJEU, Case C-34/20, *Telekom Deutschland*, paras 25-26.

different technical quality of service requirements of specific categories of traffic in accordance with Art. 3(3) (ii) OIR¹⁴.

3.2.2. Agreements and commercial practices (Art. 3(2) OIR)

The OIR allows IAS providers to offer IAS subscriptions with different QoS parameters to data volumes and speeds, such as latency, jitter and packet loss. Such parameters can be agreed upon under Art. 3(2) OIR¹⁵. Therefore, it is possible to offer multiple IAS subscription tiers with different QoS levels by using 5G slices as long as the practice do not limit the exercise of the rights of end-users laid down in Article 3(1) OIR¹⁶, meaning their ability to access and share the content and services of their choice. A possible use case in this scenario is when a provider commercially offers two or more slice-based IASs with different commercial conditions (for example access speeds or other QoS parameters), while all of them are individually application-agnostic and transparent in accordance with Art. 3(3) OIR¹⁷, each using a network slice with different QoS. Moreover, following Art. 3(2) OIR, IAS subscriptions with better QoS level should not degrade the quality of other IAS subscriptions to a quality below the contract conditions agreed under Art. 4(1) OIR¹⁸.

Under Art. 3(2) OIR, network slices which enable IAS with multiple QoS levels for a single subscription may also be allowed, as long as this practice is application-agnostic and is in line with the requirements of Art. 3(1) and 3(3) OIR¹⁹. Within each IAS, all traffic must be treated equally. Moreover, under Art. 3(2) OIR, where the IAS provider offers more than one level of QoS, the term application-agnostic implies that any application may request any available QoS level and that the selection of the QoS per application is made on the device and depends on user choices and subscriptions²⁰.

Network slices which carry selected applications could additionally be implemented in a manner where the end-user is free to assign any applications to a certain slice. The determination of which applications utilise which QoS level is a decision that shall rest exclusively with the end-user²¹. An example could be an IAS provider offering an IAS slice with standard QoS and another IAS slice with lower latency. IAS providers can control pricing and commercial conditions of IAS (e.g. data caps for specific qualities or technologies) to balance supply and demand for network resources and therefore charge subscribers different

¹⁴ BEREC notes that the other requirements for reasonable traffic management according to Art. 3(3) (ii) OIR apply accordingly if slicing is used.

¹⁵ See OI Guidelines, paragraph 34b.

¹⁶ Ibid.

¹⁷ See OI Guidelines, paragraph 34b.

¹⁸ See OI Guidelines, paragraph 34d.

¹⁹ See also OI Guidelines, paragraph 34c.

²⁰ See also OI Guidelines, paragraph 34a.

²¹ See also OI Guidelines, paragraph 34c.

prices for slices which provide different qualities²². Subscribers could decide to assign any application, or several applications, to the slice with lower latency.

3.3. 5G slicing and SpS provision

Beyond IAS, QoS differentiation can be achieved via the provision of SpS insofar as the cumulative conditions laid down in Art. 3(5) OIR are respected.

3.3.1. Criterion: “Optimisation is necessary in order to meet requirements ... for a specific level of quality” (Art. 3(5) (i) OIR)

The OIR allows for the provision of SpS, and permits differentiated features for individual or smaller sets of applications if the conditions of Art. 3(5) OIR are met. Notably, according to Art. 5(2) OIR, the necessity for optimisation should be self-assessed.

In particular, operators must therefore be able to justify that the required quality level and other technical requirements cannot be assured by the delivery of IAS, for the concerned content, application or service. This assessment should notably demonstrate that standard IAS is insufficient for this purpose and that differentiated IAS offers are compliant with Art. 3(2) OIR as described in section 3 (e.g. slice-based QoS differentiated IAS). This rule ensures that the provisions regarding traffic management measures applicable to IAS are not circumvented²³.

Under the specialised services definition, such a service could then benefit from different advanced technological capabilities of 5G slicing such as eMBB (enhanced mobile broadband), URLLC (ultra-reliable low-latency communications) or mMTC (massive machine-type communications).

To analyse whether optimisation is necessary to meet the requirements of a service for a specific level of quality and, correspondingly, whether an IAS is sufficient or not, operators could self-assess potential offers by examining the technical requirements for the service (such as speed, latency, and jitter, as well as other relevant parameters), along with an explanation of the extent to which these parameters differ from those observed in practice with internet access offers (standard IAS and differentiated IAS offers compliant with Art. 3(2) OIR). Operators could also analyse whether technically comparable services offered by them or others on the market (using equivalent access technologies) operate over IAS, i.e. without a specialised service. The self-assessment should be realistic and comprehensible, and consistent with the temporal scope of the service provisioning (considering the expected evolution of IAS during that period).

²² And thereby adhering to Art. 3(1), 3(2) and Art. 5(1) OIR.

²³ See in this regard OI Guidelines, paragraph 105.

With respect to the assessment of the necessity for optimisation to meet requirements for a specific level of quality, BEREC reiterates that requirements of an application (e.g. QoS) can be specified by the provider of the SpS, although requirements may also be inherent to the application itself²⁴. A typical example of inherent requirements is low latency for real-time applications, as may be required for virtual and augmented reality ("VR/AR"), where certain applications might already be deployed over IAS, but with worse quality. A general non-obligatory possibility for operators is to test this scenario in service trials. BEREC notes that all elements of a service as well as of any bundled service should be assessed independently from each other regarding the optimisation criterion.

The situation will evolve regarding the assessment of the "optimisation necessity" criterion when considering the improving quality of IAS. Specialised services are the exception to the rule that services are provided via IAS (paragraph 105). BEREC reiterates that when a service no longer qualifies as a specialised service due to the improved quality of IAS, the operator should be allowed a reasonable transitional phase for phasing out of the specialised service²⁵. In these circumstances, national administrative and procedural laws apply, including observing the principle of proportionality.

Both the BEREC OI Guidelines²⁶, as well as recital 16 OIR, mention examples for service categories that might be provided as specialised services such as VoLTE, real-time health services, public interest or M2M services and linear broadcasting IPTV. BEREC reiterates that the requirements for the "necessity" criterion do not only refer to standard parameters such as speed, latency, jitter, but may also apply to other quality parameters, e.g. those related to specific and key features, or to cases in which a device is resource-constrained (e.g. limited processing power, battery lifetime and memory capacity) and the provisioning of services in the network may have to deal with issues such as energy depletion, interference and security to maintain a specific level of quality²⁷.

3.3.2. Criterion: "Not be usable or offered as a replacement for IAS" (Art. 3(5) (ii) OIR)

The provisions relating to specialised services must not be used to justify the circumvention of the OIR²⁸, meaning specialised services do not provide general connectivity to the all end-points of the internet.²⁹ A service which is actually providing access to the internet but in a restricted way would be considered a circumvention of the OIR.³⁰

²⁴ See also OI Guidelines, paragraph 106.

²⁵ See OI Guidelines, paragraph 112.

²⁶ See paragraphs 108a, 110a, 113, 115.

²⁷ See also OI Guidelines, paragraph 108a.

²⁸ See OI Guidelines, paragraph 126. See also paragraph 127 for criteria for assessing whether a specialised service is considered as replacement for an IAS.

²⁹ See OI Guidelines, para 110

³⁰ See OI Guidelines, paragraph 17.

Furthermore, the service's terms and conditions may be also considered to establish whether it can be used as an IAS or is offered as a substitute for such a service.

As regards the provision of a service as a substitute for an IAS, BEREC holds that this requirement for specialised services is related to the requirement that the "optimisation is necessary in order to meet requirements of the content, applications or services for a specific level of quality" (Art. 3(5) (i) OIR). Thus, operators should be able to demonstrate in a plausible and comprehensible manner, with practical elements that optimisation is required (see above). This may indicate that the offer is not usable or offered as replacement for an IAS. However, the operator has to assess all criteria as these apply cumulatively.

3.3.3. Criterion: "Sufficient capacity for specialised services in addition to IAS" (Art. 3(5) (ii) OIR)

BEREC holds that the clarifications in the OI Guidelines regarding this criterion remain fully applicable³¹. More generally, BEREC holds that competition helps to ensure that providers have incentives to offer sufficient additional capacity for specialised services and to avoid a negative impact on IAS quality.

BEREC already pointed to the relation between this criterion ("in addition") and the requirement not to degrade the IAS³². This implies that the absence of a detriment to the IAS throughout the deployment and operation of the specialised service may indicate that the capacity for specialised services is sufficient to provide them in addition to IAS.

The OI Guidelines refer to a situation where IASs and specialised services could compete for resources³³. BEREC clarifies that resources cannot only be allocated statically, but can also be allocated dynamically between IASs and specialised services. 5G network slicing introduces the concept of dynamic resource allocation. Unlike traditional static provisioning, 5G networks rely on orchestration mechanisms that dynamically allocate radio and transmission resources across slices based on real-time demand, priority policies, and SLA requirements. These mechanisms could be used to ensure sufficient capacity, alongside traditional infrastructure investment. Thus, dynamic resource allocation allows a more efficient use of resources thereby implying that it becomes easier (*ceteris paribus*) to meet this criterion.

In addition, BEREC further clarifies³⁴ that in order to assure that the capacity for specialised services is sufficient to provide them "in addition" to IASs, providers should ensure that the capacity (in absolute terms and/or as a percentage of available capacity) allocated to

³¹ See in this regard OI Guidelines, paragraphs 116 – 120.

³² See OI Guidelines, paragraph 116.

³³ See OI Guidelines, paragraph 117.

³⁴ See OI Guidelines, paragraph 118.

specialised services does not undermine their ability to meet their QoS obligations regarding IAS offers.

Network capacities should be deployed ahead of demand, such that they can handle the predicted traffic volumes - both, for specialised services and IASs – and without detriment to the general IAS quality and before congestion occurs.

BEREC notes that there may be situations where congestion occurs only temporarily or in exceptional circumstances³⁵. Thus, given the unforeseeable nature of such situations, it is not expected that providers can anticipate such situations in their capacity planning according to this criterion. However, in line with Recital 15 OIR, BEREC points out that recurrent and long-lasting network congestion has to be considered and tackled through the expansion of network capacities.

In mobile 5G networks, the capacity impact of a specialised service delivered via a network slice may be highly localised (limited to specific cells or sectors) and/or temporary (limited to specific time periods, such as the duration of a live event). In such scenarios, operators should be able to demonstrate that they have taken adequate measures to manage the capacity impact, which may include examples such as deploying additional temporary infrastructure, and reserving dedicated radio resources or network capacity via network slicing for the specialised service.

Operators engage in network capacity planning in order to provide their customers with the best possible service. BEREC holds that they can use this normal capacity planning to ensure that this criterion “sufficient capacity for specialised services in addition to IAS” is adhered to.

3.3.4. Criterion: “Not to the detriment of the availability or general quality of the IAS” (Art. 3(5) (ii) OIR)

BEREC holds that due to competition (and technological advancement) the availability and general quality of IASs should evolve and improve over time. Thus, competition ensures that the provision of specialised services is not to the detriment of the general availability or general quality of the IAS.

For example, providers may apply monitoring mechanisms and/or conduct prior analyses to ensure that specialised services are provided without compromising the general availability or general quality according to Art. 3(5) OIR. One possible approach would be to monitor the ability of end-users to access the content and services of their choice, in line with Art. 3(1) OIR.

BEREC clarifies that in order to assess this criterion, an increase in end-user complaints may be deemed relevant. Such complaints may relate to the discrepancy between actual and

³⁵ See OI, recital 15.

contractual speeds or to quality parameters (latency, jitter, packet loss) which consistently exceed certain levels. As far as the providers comply with their contractual obligations and no evidence of IAS degradation has been observed, the risks of degradation of the IAS may be considered negligible.

In mobile networks, the general quality of IAS should not be deemed to incur a detriment where the aggregate negative impact of specialised services is unavoidable, minimal and limited to a short duration³⁶. BEREC considers that, in the context of 5G slicing, the geographic scope of a specialised service is a relevant factor in assessing whether such impact is minimal: where a service is deployed over a limited number of cells, the aggregate impact on IAS quality across the network is inherently more contained. This does not, however, exempt operators from ensuring that IAS quality is not persistently degraded for end-users served by the affected cells³⁷. In the context of 5G slicing, the degradation may be deemed not persistent or recurring, and therefore acceptable, if it is limited to the duration of specific events (e.g. a concert), to which slicing-based services are dedicated.³⁸

In their self-assessment, operators could, for example, rely on a certain number of representative data points, such as the number of congested cells, the capacity utilisation factor, busy hour traffic levels, monthly traffic peaks³⁹.

³⁶ See OI, recital 17.

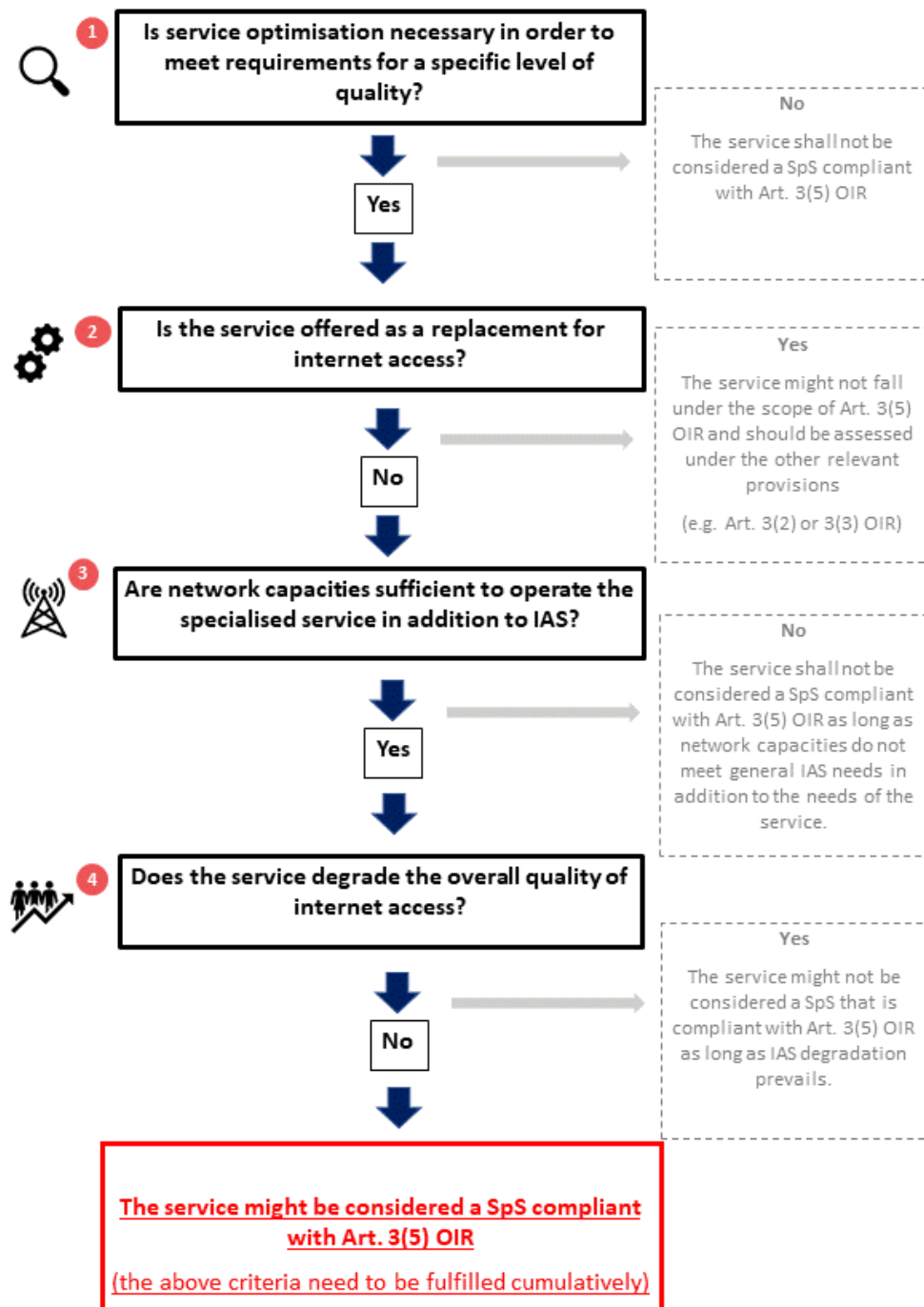
³⁷ See also OI Guidelines, paragraph 125.

³⁸ See also OI, recital 17.

³⁹ See also OI Guidelines, paragraph 121a.

3.3.5. Heuristics of the main criteria to assess for compliance with Art. 3(5) OIR

The diagram below maps out the reasoning steps to self-assess a given use-case against Article 3(5) of the OIR. The proposed order is not mandatory.



4. Potential examples

To make the preceding chapter more practical, this section introduces a list of generic slicing-based situations with BEREC's preliminary remarks. It is neither intended to be exhaustive, comprehensive nor conclusive. Operators should instead use the list as a guide to navigate the most important regulatory questions these situations may raise and, accordingly, feel better placed to self-assess their offers on a case-by-case basis.

Example 1 – Provision of premium IAS offers

An operator offers a “premium” 5G package as part of its offerings, for example business offerings, allowing subscribing companies to benefit from enhanced service quality for all IAS traffic via a dedicated slice.

This offer guarantees that employees of the company subscribing to it, will benefit from an enhanced IAS offer, in order to avoid service interruptions, thus ensuring a higher quality of service (QoS) for the company's employees.

BEREC preliminary remarks: this type of offer seems likely to be admissible as a slice-based QoS enhanced IAS offer. It would therefore need to be assessed in light of Art. 3(1), 3(2) and 3(3) OIR laying down the rules for differentiated offers. Notably, they should not limit end-users' capacity to exercise the rights laid down by Art. 3(1) OIR, be application-agnostic (see [section 3.2.2.](#)). For detailed guidance regarding such service offers, refer to BEREC OI Guidelines paragraphs 32-38.

Example 2a – VR/AR glasses for the benefit of accessing specific immersive content

The operator provides a special package with boosted upload/download speed and improved latency/jitter that would be used for VR/AR glasses. This may be implemented with a specific slice. In the first variant, users are wearing VR/AR glasses to remotely access a specific content or application (e.g. VR/AR made available as part of a specific exhibition in a museum to enjoy an immersive experience).

In this case, the slice made available concerns specific content, applications or services requiring a specific level of quality, which is optimised (the network latency is below a certain threshold, in order for end-users to enjoy a smooth VR experience).

BEREC preliminary remarks: such an example may meet the criteria set out in Art. 3(5) OIR for specialised services. It is likely permissible, provided that optimisation of the service is necessary when taking into account its specific QoS requirements.

Furthermore, the operator must have sufficient capacity in the radio cell(s)/sector(s) used by the service to ensure an adequate level of quality for all end-users, thereby preventing a degradation of the quality or availability of internet access services.

Example 2b – End-user subscription for accessing all immersive applications

Here, the end-users are subscribing to an offer, marketed for immersive applications, that is designed so all applications that meet a specific set quality of service parameters, notably in terms of speed and latency; benefit from a reserved slice, given the fact that these services could not be delivered efficiently over the normal IAS.

In this case, the service is provided to all end-users who subscribed to this offer, and the slice might be used for any service with equivalent QoS requirements, regardless of the provider of the service.

BEREC preliminary remarks: this example could be comparable to a quality-differentiated IAS, given the scope of the service, and thus should be assessed in light of Art. 3(1), 3(2) and 3(3) OIR which set out the rules for differentiated access offers. They should notably not limit end-users' capacity to exercise the rights laid down by Art. 3(1) OIR, be application-agnostic (cf. [part 3.2.2.](#) of the document).

Example 2c – A subscription for accessing a specific immersive application or content

In this case, the end user is in possession with an AR/VR terminal that is able to access to all the contents and application available on the internet. He subscribes to a 5G offer that is made in partnership with a VR application provider: the service is comparable to 2b but here the slice is provided only for this specific VR application, and not the comparable applications that meet the same QoS parameters.

BEREC preliminary remarks: in this example, end-users' capacity to exercise the rights laid down by Art. 3(1) OIR, could be limited and the offers appears not to be application-agnostic, so it is likely not permissible.

Example 3 – Video transmission between stadium cameras and the control room

As part of a sports event taking place in a stadium, an operator wants to allocate a dedicated slice to the stream connecting the broadcast cameras to the broadcaster's central control room on its 5G network.

This would enable images of the event to be transmitted to the control room in real time, with significantly reduced latency and high throughput, and would allow the operator to offer the service with specific, improved QoS. This could be particularly useful / relevant in situations of peak traffic congestion around the stadium, where IAS (particularly in the uplink) could be degraded due to the limited uplink capacity of the cells serving the area, and where real time traffic from the video transmission service could compete with the uplink traffic of certain IAS uses (such as video and photo uploads).

The implementation of the offer would be limited to the timing of the sports event and the vicinity of the stadium to connect the cameras to the control room.

BEREC preliminary remarks: such an example may meet the criteria set out in Art. 3(5) OIR for specialised services, and might be permissible provided there is sufficient capacity which ensures an adequate level of quality for all end-users, thereby preventing a degradation of the general quality or availability of IASs.

Particular attention should be given to the fact that, in this example, the service is deployed in highly congested environments. When the risk of saturation is persistent, sufficient capacity must be deployed to prevent congestion situations and ensure a satisfactory level of general IAS quality.

Example 4a – Remote control of a crane on a construction site

A company is marketing a remote driving system for connected cranes, which requires low latency and high upload speeds. Another company, specialising in public works, would like to use this system for a temporary construction site in a moderately dense area.

BEREC preliminary remarks: this example is likely permissible and meets the criteria set out in Art. 3(5) OIR for specialised services. However, providers must ensure sufficient capacity for an adequate level of quality for all end-users, thereby preventing any degradation of the general quality of IASs. As the service is not deployed in a particularly congested area in this example, the risks of degradation of IAS would appear lower than example 3.

Example 4b – Remote driving of connected vehicles in freight transport

A company has specialized in freight transport vehicles that can be remote controlled. An industrial site plans to deploy them between two of its factories. To ensure a reliable connection between the vehicles and the control centre, the communication service is delivered by an operator via a dedicated slice.

BEREC preliminary remarks: in this example, the geographic scale where the service is deployed is larger, and covers regions that are unevenly congested, so the degradation of IAS

has to be evaluated on this scale and not on the factories alone; the risks of degradation could be higher than in example 4a. This said, as for example 4a, this example is likely permissible and could meet the criteria set out in Art. 3(5) OIR for specialised services.

Example 5 – Transmission of information (images, documents and video calls) to hospitals from a connected ambulance

A company is marketing video call and information transmission solutions between ambulances and hospitals for patient transfers, provided over a specific slice of a public electronic communications network. This allows paramedics to communicate with doctors while in ambulances on the move, facilitating and speeding up patient care. Low latency, high upload speeds and guaranteed bandwidth are required.

BEREC preliminary remarks: such examples are likely permissible and may meet the criteria set out in Art. 3(5) OIR for specialised services. However, providers must ensure sufficient capacity for an adequate level of quality for all end-users, thereby preventing any degradation of the general quality of IASs. As long as the providers comply with their coverage targets and that no evidence of IAS degradation has been collected, the risks of degradation of the IAS might be considered negligible.

Overview table

	Existing OI Guidelines	Further clarification
	Scope	
1	Paragraphs 7-18	Statement on scope (elaborate on scope by interpreting key definitions).
2	Paragraphs 8-12	Clarification on private 5G slicing-based services.
	Safeguarding of the Open Internet	
3	Art. 3(2) OIR	Clarification: Where slicing is used to offer IAS subscriptions with different QoS levels, the requirements as explained in paragraphs 34a-d OI Guidelines apply.
4	Art. 3(2) OIR	Clarification: 5G slices carrying selected applications can be compatible with Art. 3(2) OIR if it is a user choice which application is mapped to the slice with differentiated QoS.
5	Art. 3(3) (ii) OIR	Clarification: the requirement for reasonable traffic management to be based on objectively different QoS requirements of specific categories of traffic and not on commercial considerations also applies if slicing is used.
	Specialised services	
6	Art. 3(5) OIR “optimisation necessary in order to meet requirements for a specific level of quality”	Recommendations for how to demonstrate that optimisation is necessary.

7	Art. 3(5) OIR “optimisation necessary in order to meet requirements for a specific level of quality”	Requirements of an application and its elements to be an SpS.
8	Art. 3(5) OIR “optimisation necessary in order to meet requirements for a specific level of quality”	Reference to non-standard parameters that could lead to a service being classified as SpS.
9	Art. 3(5) OIR “optimisation necessary in order to meet requirements for a specific level of quality”	Clarification that reasonable transitional phase for SpS that are no longer SpS.
10	Art. 3(5) OIR “not usable or offered as replacement for IAS” paras 3-6	Clarification that operators may review the terms and conditions to assess this criterion.
11	Art. 3(5) OIR “not usable or offered as replacement for IAS” paras 99-100	If it can be demonstrated that there is a need for optimisation, this may indicate that this criterion is met. Defines what SpS are, building upon paragraphs 99 (explicitly) and 100 (implicitly).
12	Art. 3(5) OIR “sufficient capacity for specialised services in addition to IAS” para 116	Clarification that absence of detriment to the IAS may indicate that capacity for SpS may be sufficient to provide them in addition to IAS.
13	Art. 3(5) OIR “sufficient capacity for specialised services in addition to IAS” para 117	Clarification that resources may be dynamically allocated making it easier (<i>ceteris paribus</i>) to meet this criterion.
14	Art. 3(5) OIR “sufficient capacity for specialised services in addition to IAS” para 118	Clarification of options how to assess that the capacity provided for specialised services is “in addition”.

15	Art. 3(5) OIR “sufficient capacity for specialised services in addition to IAS”	Clarification: capacity deployment ahead of demand, that network capacities should handle the predicted traffic volumes and before congestion occurs.
16	Art. 3(5) OIR “sufficient capacity for specialised services in addition to IAS”	Clarification: providers do not have to anticipate temporary or exceptional congestion according to Recital 15 OIR.
17	Art. 3(5) OIR “sufficient capacity for specialised services in addition to IAS”	Clarification how to deal with situations where the impact of specialised services is localised and/or temporary.
18	Art. 3(5) OIR “sufficient capacity for specialised services in addition to IAS”	Clarification: normal capacity planning sufficient.
19	Art. 3(5) OIR “not to the detriment of the availability or general quality of the IAS”	Clarification how providers may ensure that there is no such detriment.
20	Art. 3(5) OIR “not to the detriment of the availability or general quality of the IAS”	Clarification: NRAs could consider whether there is an increase in end-user complaints.
21	Art. 3(5) OIR “not to the detriment of the availability or general quality of the IAS”	Clarification as regards specialised service offers that are offered with a limited geographic area.