

IP INTERCONNECTION

– FINAL DECISION –

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1. Framework

By determination of 21.12.2016¹, the Management Board of the Autoridade Nacional de Comunicações (ANACOM) approved the decision on the analysis of the wholesale market for call termination on the public telephone network at a fixed location (hereafter “fixed termination market”), following a public consultation, a prior hearing of stakeholders, and notification to the European Commission (EC) of the draft decision regarding that market. In this context, the obligation to meet all reasonable requests to supply fixed call termination services, applying equally to TDM and IP interconnection, was imposed on all operators with significant market power (SMP). In the same context, it was determined that MEO – Comunicações e Multimédia, S.A. (MEO) must present an IP interconnection architecture proposal within four months of the publication of the final decision that approved the analysis of the aforementioned market.

As established in the decision under consideration, the IP interconnection proposal should propose provisions on: “(i) *the architecture and topology of the new network, which must lead to a reduction of GPls while taking due account of redundancy issues, (ii) the technical characteristics of IP interfaces and description of mechanisms to be implemented to ensure the quality of service and procedures related to number portability, (iii) the expected impact on existing GPls and suggestions of alternatives that could limit such impact, as well as a GPI migration plan*”.

It was also specified that while preparing the proposal MEO should bear in mind “(...) *the contributions that the various OSPs may wish to put forward, which for this purpose must be requested in due time*”.

In order to speed up the process of articulation with the other operators, the decision provided for ANACOM to hold a meeting, open to all interested operators, for MEO to present the outlines of its proposal for the IP interconnection architecture. The meeting took place on 22.2.2017, and MEO presented its proposal while the various operators present had the chance to discuss and express their opinions about it.

¹ Available at https://www.anacom.pt/streaming/FinalDecision21122016Market1.pdf?contentId=1404360&field=ATTACHED_FILE [accessed on 2.5.2017]

Following the meeting, some operators sent MEO, in writing and with the knowledge of ANACOM, their concerns and proposals about IP interconnection, and according to information from MEO there were also meetings with the operators on this matter.

On 24.4.2017 MEO sent ANACOM its technical proposal for IP interconnection, including the positions of several operators about that proposal, and its understanding about the concerns expressed and the identification of the proposals by these operators that were accommodated or rejected, as well as the reasons for same.

Having analysed the technical proposal for IP interconnection presented by MEO, the Management Board of ANACOM approved, on 4.8.2017, the draft decision (DD) on IP interconnection. The DD was submitted to the general consultation procedure and the prior hearing of interested parties, pursuant to Article 8 of the Electronic Communications Law² (ECL) and to Articles 121 and 122 of the Code of Administrative Procedure, respectively.

In the context of the above public consultation and prior hearing of stakeholders, ANACOM received five contributions before the deadline, on behalf of eight entities. A contribution was also received, after the deadline, from a private citizen. After the analysis of the comments received within the time limit, a report on the prior hearing and consultation procedures was drawn up that includes a summary of contributions received as well as the regulator's views thereon. The report is part of the draft decision prepared following the contributions received and is also part of the present decision.

On 16.11.2017, the Management Board of ANACOM approved the aforementioned draft decision as well as its notification to the EC, to the Body of European Regulators for Electronic Communications (BEREC) and to the National Regulatory Authorities (NRAs) of the other Member-States of the European Union (EU).

The draft decision was notified to the EC on 17.11.2017, pursuant to Article 57(1) of the ECL, and registered with number PT/2017/2045.

² Law 5/2004 of 10 February, in its current wording.

By communication of 12.12.2017, the EC stated it had no comments. On that same occasion, it stated that ANACOM could approve the draft decision, in which case this should be communicated to the EC.

The present document consists of the final decision on IP interconnection and took into consideration the contributions received under the abovementioned procedures.

Notwithstanding the considerations set out throughout the document, and in particular the position of ANACOM in relation to the various matters at stake, especially in cases where this position differs from that advanced by MEO, ANACOM does not seek to require changes to proposals based on consensus among the various Operators, on the assumption that this consensus - in terms of interconnection - is the one best suited to the interests of the various operators.

In this context, the explanation presented in this document of the IP interconnection proposal presented by MEO is not exhaustive; the draft decision describes, in general terms, the content of MEO's proposal, highlighting in particular the aspects where there appears to be less consensus or where the regulator's intervention is considered necessary and opportune.

Therefore, a brief summary is given in the points below of the relevant features of the technical proposal for IP interconnection presented by MEO (which is attached to the present document), with reference to the proposals/contributions presented by other operators and sent to MEO, in some cases with the knowledge of ANACOM and included in this Authority's understanding of the various issues raised by them. Point 2 addresses network architecture and topology, as well as the technical characteristics of IP interconnection, quality of service, numbering, and portability, and other issues; point 3 analyses the migration plan; point 4 looks at the matters related to call origination; point 5 examines the other issues raised. Lastly, point 6 presents the conclusions to be submitted to public consultation and the prior hearing of the interested parties.

2. Technical proposal for IP interconnection

2.1. Architecture and topology of the IP interconnection network

2.1.1. MEO's proposal

MEO intends to provide two IP geographic points interconnection (GPIs), one in Lisbon and the other in Porto, and will provide two points of IP interconnection (PI) in each one for the purpose of local redundancy. It should be noted that MEO plans to install Porto's GPI in a temporary location, indicating that location in its proposal (Bonfim), as well as the final location (Boavista). Lisbon's GPI will be in Picoas.

MEO understands that *“each operator should preferably provide two IP GPIs (and respective IP PIs), in different geographical locations for reasons of security, redundancy and robustness (...)”*. In these cases, MEO says there should be at least two physical circuits, one for the connection of MEO's GPI in Porto to the other operator's GPI in the north, and another for the connection of MEO's GPI in Lisbon to the other operator's GPI in the south of the country.

The proposal also envisages the placement of Session Border Controllers (SBCs) in all GPIs in order to assure network security, while MEO requires that the other operators also install SBCs in their IP GPIs. In these cases, *“traffic should be delivered primarily through the corresponding circuits, even though MEO Porto – South OSP and MEO Lisbon – North OSP functional connections are being established in those physical circuits, which may be used if one of the connections fails”*.

The proposal provides that call termination will use the SIP³ protocol and the RTP signalling protocol.

Dedicated connections (Layer 1) will be established based on 1 GbE or 10 GbE interfaces. To maximize resources, the same connection will be used for traffic belonging to both operators, by means of a single Virtual Local Area Network (VLAN), unless agreed otherwise. However, MEO proposes that for signalling purposes there should be different IP addresses for the traffic of each operator, to enable separation of that traffic.

³ Session Initiation Protocol.

According to the proposal, each GPI should have the capacity to process all traffic agreed with each operator, with the possibility of delivering traffic in any GPI for any numbering of the operator. Nonetheless, MEO notes that each operator should try to distribute traffic equitably to ensure load sharing and a minimum impact in case of network failure.

Under the terms of the proposal operators should negotiate amongst themselves the maximum number of simultaneous sessions and call attempts per second supported by the IP interconnection.

It should also be mentioned that MEO's reference proposal is based on several standards: standard 3GPP TS 29.162 Interworking between the IM CN subsystem and IP networks; standard 3GPP TS 29.165 Inter-IMS Network to Network Interface (NNI); standard RFC IETF 6406 Session PEERing for Multimedia INTerconnect (SPEERMINT) Architecture; and ITU⁴ Recommendation Q.3401: Signalling requirements and protocols for the NGN – Service and session control protocols.

2.1.2. Consideration of the contribution of operators to MEO's proposal

All the operators – AR Telecom – Acessos e Redes de Telecomunicações, S.A. (AR TELECOM), NOS Comunicações, S.A. (NOS), NOWO Communications, S.A. and OniTelecom – Infocomunicações, S.A. (NOWO/ONI), and Vodafone Portugal, Comunicações Pessoais, S.A. (VODAFONE) – which presented contributions to MEO following the meeting of 22.2.2017 expressed their agreement about the existence of two GPIs.

Regarding the existence of redundancy, almost all operators considered that geographical redundancy is very important. NOWO/ONI considered it should be possible to dispense with local redundancy and only retain geographical redundancy, with the possibility of establishing calls between all interconnection SBCs. With particular reference to cross redundancy, NOS further said that it should allow the automatic forwarding of traffic in case of service failure, in all points of interconnection, to occur without hierarchies and with a single tariff scheme.

⁴ International Telecommunication Union

Regarding the issues of redundancy it should be noted that MEO, in the context of a clarification provided to AR TELECOM, stated that the initial proposal would be modified “*to strengthen the perception that there can be crossed connections*”, however it also stated that it would not accept that Porto’s addresses be delivered to Lisbon’s GPI and vice-versa. Additionally, it mentioned that it would change the proposal to express more clearly the operation in terms of physical connections and functional connections, considering this corresponds to operators’ requests. MEO therefore accordingly adapted its proposal to include cross connections in its structure, which in principle will only be functional and not physical, established over the physical connection circuits between GPIs of the same region, and which can be used if one of the connections fails.

Other points of MEO’s proposal were also modified relative to the proposal initially presented at the meeting of 22.2.2017. Besides the 1GbE interfaces, it currently also considers 10 GbE interfaces, following the contributions of operators in along these lines, and the possibility of using a single VLAN for traffic belonging to both operators, while previously it contemplated the use of a different VLAN for each operator’s traffic. Additionally, MEO notes that it agreed with the possibility of using already existing level 1 connections (physical level), without the need to create new connections specifically for the IP interconnection with the fixed network.

It should be noted that both NOS and NOWO/ONI had expressed their preference for 10GbE interfaces, and they all considered that the same VLAN should be used, regardless of traffic ownership, while NOWO/ONI also argued that there should be a possibility of establishing the IP interconnection using circuits supported on already existing physical connections.

It should further be noted that operators that sent contributions to MEO, or discussed their concerns with them, expressed their agreement about the equitable distribution of traffic between GPIs to ensure the load sharing.

2.1.3. ANACOM’s understanding

The architecture proposed by MEO provides for the existence of two GPIs with two IP PIs associated to each one, for the purpose of local redundancy. The IP PIs – located in Picoas (Lisbon) and Boavista (Porto) – are the networks’ physical points of access and,

according to MEO, constitute the limit of the operators' responsibility in terms of IP interconnection.

Considering that in Porto the IP PIs will be in Boavista and that the Bonfim IP GPI is only temporary, MEO should ensure that the existence of a temporary IP GPI in Porto will not affect the IP interconnections that will be established with operators in the IP PI of Boavista, i.e., there will be no additional costs for the operators or service breakdowns resulting from the temporary GPI and the need to migrate that GPI to a final location. It means that from the functional point of view the GPI will be in Bonfim, but from the physical point of view it will already be in Boavista, the connection between Boavista and Bonfim being MEO's responsibility.

As for the level of redundancy for IP interconnections, which according to MEO involves the obligation to provide two circuits for each of the two IP GPIs (so as to guarantee local and geographical redundancy), ANACOM understands that that requirement might be reflected in added costs for operators, which may be disproportionate for smaller operators. Notwithstanding the need to safeguard redundancy, it should be noted that in the current Reference Interconnection Offer (RIO)⁵, with respect to TDM interconnections, it only says that "(...) *the OSP and MEO are mutually obliged to ensure alternative traffic routing if there is a failure in the interconnection beams*", therefore it does not seem justifiable, in the specific context of IP interconnection, to increase the requirement at this level, particularly for smaller operators.

In this context, stressing once more the need to ensure redundancy in IP interconnections, ANACOM considers it reasonable that smaller-size operators (assessed according to the traffic volume in minutes delivered on a monthly average to MEO for termination on that operator) be able to chose to dispense with one of the types of redundancy (local or geographical), while a solution must be guaranteed, between MEO and each of the operators that interconnect with it, which ensures alternative routing of traffic.

The option for one type of redundancy also implies it is up to the smaller operators to specify whether they interconnect in both MEO GPIs or only in a single GPI, and in the latter case, and without prejudice of the migration calendar and its rules about the traffic

⁵ Version 6, of 5.7.2017, available at <http://ptwholesale.pt/pt/servicos-nacionais/trafego/Paginas/ori.aspx>.

volume delivered each year, MEO must guarantee the termination of all traffic delivered in that GPI, regardless of whether or not it is addressed to the same region.

The option to dispense with one of the types of redundancy, which may involve the possibility of interconnecting in a single GPI, will only be available for smaller operators, while the others should interconnect in both GPIs defined by MEO, ensuring local and geographical redundancy with MEO under the terms of the respective proposal.

In this context, it is taken that a smaller operator is an operator that delivers traffic (originating in its customers or transit traffic) to MEO for termination in that company's customers, which does not exceed a monthly average of 5 million minutes, taking as reference the total termination traffic delivered to MEO by that operator in 2016. Note that these operators' traffic should not have represented more than 5% of the total traffic terminated in MEO in that year.

In accordance with the above, it is also understood it would not be reasonable for an operator under those conditions, i.e., a small operator that chooses to interconnect in a single GPI from MEO, to require MEO to interconnect with their network in more than one GPI.

Regarding MEO's suggestion concerning the architecture and topology of the other operators' interconnection network (specifically regarding the number of GPIs that each operator should have), it is noted that in the decision about the fixed termination market ANACOM determined that all operators with SMP should respond to reasonable access requests, which implies the provision of TDM and IP interconnection services.

However, this decision did not establish the cause and structure of those operators' interconnection, nor did it determine that it should be the same as or equivalent to MEO's structure. It should be recalled, in this regard, that what the decision does say is that following the presentation by MEO of its IP interconnection proposal and the subsequent approval of that proposal, it will have an impact on the various operators in the market, and determines "*for all the operators, the beginning of the transition period with a view to providing the IP interconnection and the time limit for its provision, in order to include all the traffic requested*". That is, there will necessarily be an impact on the other operators resulting from the approval of the IP interconnection proposal presented by MEO, given that it has the network with the largest capillarity in the country, with which all operators

tend to interconnect. But, from the outset, these operators have the freedom to establish their interconnection structures, most of which are now considerably simpler than MEO's current structure; it is also expected and desirable that they will evolve towards a greater simplification, with fewer GPIs (where there are several), without compromising the required redundancy.

Accordingly, it is deemed not to be justifiable, proportional or reasonable to force MEO, and even less so the other operators that are smaller than MEO, to interconnect with any other operator in more than two IP GPIs for the purpose of delivering termination traffic.

Regarding specifically the IP interconnection network architecture, ANACOM did not identify any additional issues on which it needed to comment.

2.2. Technical characteristics and quality of service

2.2.1. MEO's proposal

As for IP points of interconnection, the proposal anticipates the use of IPv6 and IPv4 protocols, while the use of IPv4 should be in the public range, and it is expected that the selection of protocol will be subject to a bilateral agreement between operators. This interconnection model follows "InterAS"⁶ Option A, as provided for in "RFC 4364"⁷.

Regarding traffic classification, the "DSCP"⁸ field of the IP packets will be used for traffic differentiation and prioritization. Voice traffic, regardless of the use of IPv6 or IPv4, will be classified as a "conversational" class and signalling traffic as an "interactive" class, using the terminology defined in "3GPP TS 23.107 - 3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Quality of Service (QoS) concept and architecture" (Section 6.3). MEO also says that "*without prejudice to the foregoing, each operator may send traffic classified under other terms, which it deems more appropriate, with the destination being able to re-classify that traffic according to what it uses in its network*".

⁶ Inter Autonomous System.

⁷ IETF - Internet Engineering Task Force document regarding BGP/MPLS IP Virtual Private Networks (VPNs).

⁸ Differentiated Services Code Point.

Signalling in the IP interconnection should use the SIP protocol, version 2⁹. The transport protocol should preferably be UDP,¹⁰ with the additional possibility of using TCP.¹¹ Ports 5060 and 5061 (“Registered ports for SIP over UDP and TLS”) are used for signalling transport, with flexibility to use different ports.

MEO’s proposal provides for the support of SIP messages up to 9k bytes, and larger messages that are not supported are rejected with SIP reply “513 Message Too Large”. SIP replies should be processed according to the provisions of “RFC 3261”.¹² Final replies that are not recognized should be treated as an “x00” reply, and unrecognized “18x” temporary replies should be treated as “183 Session Progress”.

According to the proposal, the audio codecs supported by MEO are “G.711”¹³ – versions A and U (IETF¹⁴ “RFC 3551”¹⁵) and “G.729”¹⁶ – versions A and B (ITU – “T G.729”), with the possibility of providing other codecs, through bilateral agreement. When the destination terminal does not support the codecs agreed upon, the destination network will be responsible for the transcoding or transrating.

The proposal provides for the use of “T38” fax *Relay* (version 0), from ITU recommendation “T.38”¹⁷, and the “G.711” transparent mode for sending and receiving faxes, although, however, successful transmission may not be assured. In its proposal, MEO also stresses the importance of configuring terminal equipment for a greater tolerance to delays, errors and lower rates, thus contributing to higher success rates.

The transmission of 64Kbit/s data and video services should use codec CLEARMODE (“RFC 4040”¹⁸), although MEO notes that successful transmission is not guaranteed in this case also, stressing there are aspects potentially beyond the operators’ control, involving

⁹ Defined in RFC IETF 3261 (SIP-Session Initiation Protocol) and extensions RFCs 3262, 3264, 3311, 3323, 3325, 3326, 4028 and 5806.

¹⁰ User Datagram Protocol.

¹¹ Transmission Control Protocol.

¹² IETF – Internet Engineering Task Force document regarding SIP: Session Initiation Protocol.

¹³ International Telecommunications Union (ITU) standard for audio coding.

¹⁴ Internet Engineering Task Force.

¹⁵ IETF document regarding RTP Profile for Audio and Video Conferences with Minimal Control.

¹⁶ ITU standard regarding Audio data compression algorithm for voice.

¹⁷ ITU standard for sending fax through IP networks.

¹⁸ IETF document regarding RTP Payload Format for a 64 kbit/s Transparent Call.

for example customers' terminal equipment, which may affect the performance of communications.

Within the framework of concerns with the quality of service, MEO understands that operators should cooperate with one another in the context of fulfilling their obligations on matters of network and service security and integrity, particularly regarding IP interconnection. It also holds that all the operators should adopt the technical and organizational measures deemed most suitable for the prevention of risks to the security of their network and the networks with which they are interconnected.

In order to ensure resilience in IP interconnections, MEO believes that, whenever possible, operators should preferably have two PGIs, at different geographical locations, and establish more than one connection between the respective networks.

MEO also states that in order to secure the reference levels of quality of service for voice traffic, operators should cooperate to ensure that the Round Trip Delay, Packet Delay Variation (jitter) and loss of packets parameters, within each operator's network and on the IP interconnection (excludes the customer's network), respect the values established in the relevant standards, these being ITU-T "G114"¹⁹, ITU-T "Y.1540"²⁰ and ITU-T "Y.1541".²¹

2.2.2. Consideration of the contribution of operators to MEO's proposal

Regarding "InterAS" Option A, NOWO/ONI considers it should be possible to use it with "eBGP"²² timers with values below the default ones, since it speeds convergence in the event of failure, and therefore proposed a reduction of ¼ in the values of "eBGP" timers.

Regarding this, MEO says that it accepts NOWO/ONI's suggestion, clarifying however that this specification will not be included in the proposal, given the latter's more generic character.

Relative to other contributions, it should be noted that with respect to packet prioritization, NOS said it should be internal to each operator. On this issue, in its reply to VODAFONE,

¹⁹ One-way transmission time.

²⁰ Internet protocol data communication service - IP packet transfer and availability performance parameters.

²¹ Network performance objectives for IP-based services.

²² External Border Gateway Protocol.

MEO states that its understanding is that signalling traffic should have lower priority than voice traffic (“conversational” class traffic), accepting that the originating operator can classify all traffic in the same way and recognizing that the destination operator may undertake a reclassification.

Regarding the contributions sent to MEO about the IP interconnection proposal, specifically regarding the signalling protocol used, NOWO/ONI felt it should be possible to use SIP-I,²³ and was the only operator to express this preference. NOWO/ONI understood that SIP-I is more appropriate for the transition between TDM and IP interconnection, largely because it enables the use of some special services, such as video calls, and equally because it enables the use of “REL#14” in the case of transit to operators who still do not use the “Query on Release” (QoR) method in portability and do not have an IP interconnection.

Regarding protocol SIP-I, MEO stated it did not change its proposal to accommodate NOWO/ONI’s contribution, and justified this decision with the fact that the ranges that migrate to the IP interconnection are associated with IP supported customers.

Most of the operators who offered comments following MEO’s presentation of its proposal at the meeting of 22.2.2017 agree with the codecs proposed by that company for IP interconnection.

In particular, NOS agreed that when the destination terminal does not support the codecs agreed upon, the destination network should be responsible for the transcoding or transrating. It also stated that it is up to the originating network to ensure the transcoding of its customers’ calls according to the codecs established in the interconnection.

NOS mentioned that fax and modem communications must necessarily be ensured in the IP interconnection, using codec “G711” or codec “G711u for that purpose”.

Additionally, it does not identify restrictions on conducting communications of the 64K unrestricted data calls type, since MEO stated, at the meeting of 22.2.2017, that the SIP interconnection supports CLEARMODE. Also, NOWO/ONI considered that the proposal could be improved with an explanation of the support for CLEARMODE and data services.

²³ Session Initiation Protocol with encapsulated ISUP.

Regarding the initial proposal, presented at the meeting of 22.2.2017, MEO introduced a change to clarify the support of CLEARMODE (“RFC 4040”) in low speed data modem transmissions, and understood it had therefore accommodated the contributions of the operators on its proposal.

As for specific aspects of quality of service, NOWO/ONI also argued that quality of service in the IP interconnection should guarantee the “BGP” routing protocol in situations of congestion related to an abnormal²⁴ increase of traffic or to abnormal situations. It also advocated the need to define a quality of service policy that protects voice and signalling traffic when there is abnormal traffic:

It should also be noted that NOS argued for keeping the quality of service levels currently existing in TDM interconnection.

2.2.3. ANACOM’s understanding

Considering that in this context only NOWO/ONI commented in favour of adopting signalling protocol SIP-I and that the other operators who submitted contributions to MEO either did not comment on this issue or expressed agreement with the use of SIP protocol, it is held that it is not justifiable or proportional to require MEO to provide this option, without prejudice to the parties being able to arrive at an agreement.

It should also be noted that SIP-I is a transitional rule, therefore in principle its use is only relevant until all traffic is IP supported, and will not replace SIP, therefore there is no justification for imposing the obligation of adopting both protocols, with added costs for all operators. In this context, reducing the migration deadline compared to the one initially proposed by MEO, at the meeting of 22.2.2017, as well as the even greater reduction now planned by ANACOM (*vide* point 3.3) render this issue less relevant.

In addition, one of the justifications presented by NOWO/ONI for the adoption of SIP-I, related to the fact that there are operators who might not have IP interconnection, loses relevance in a context where an IP interconnection obligation applies to all operators, for

²⁴ It should be mentioned that NOWO/ONI, in its communication of 16.3.2017 to MEO, mentions the “*normal increase of traffic*”, however, given the context of this phrase, this is believed to have been a mistake and that the intention must have actually been to mention an abnormal increase of traffic.

which the start of the period of provision is in fact determined with the implementation of this decision.

It should also be mentioned that on previous occasions operators expressed their preference for SIP-I, however they did not reiterate this preference following the meeting of 22.2.2017.

Finally, it should also be noted that most countries in the European context only adopted one SIP version and that, to the best of our knowledge, only three countries use SIP and SIP-I simultaneously.

With respect to the operators' network architecture, particularly regarding the number of APIs, refer to the comments in ANACOM's understanding in point 2.1.3.

As for interconnection model "InterAS" Option A, MEO having agreed with NOWO/ONI's suggestion concerning the values of "eBGP" timers, and having also stated in the comments to the public consultation and prior hearing of interested parties that the other operators' networks might not support the values proposed by NOWO/ONI, it is understood that MEO should incorporate in the reference interconnection offer the possibility of accepting values up to $\frac{1}{4}$ of the default values, for the sake of transparency and legal certainty.

Regarding fax communications, even before the operators' comments, MEO's proposal already provided for it to be based on T.38 and G.711 transmission modes.

As regards 64K unrestricted data calls communications, MEO made a change to its proposal in order to clarify the CLEARMODE support, considering that this accommodated operators' concerns. In this respect, ANACOM feels that at the moment it is not necessary to comment on this matter, without prejudice to any situations related to the non-guarantee of these communications, as well those relating to fax and data services, which may have to be addressed in due course.

Regarding the quality of service, it should be noted that the determination of 21.12.2016 provided that the IP interconnection proposal would incorporate a description of the measures to be implemented to guarantee such quality of service, with MEO providing a general description of the commitment in this context and of the rules that will govern it.

Specific contributions from the other operators on this issue were not very detailed, and no relevant divergent aspects have been identified as yet. However, more development and specification is required on this matter, particularly with reference to the indicators currently established in RIO, such as those relating to network quality and availability, and circuit quality. On this point, the proposal should also establish what is required to secure the “BGP” routing protocol in situations of congestion related to abnormal traffic increases or abnormal situations.

2.3. Numbering and Portability

2.3.1. MEO’s proposal

MEO’s proposal states it is the operators’ obligation to ensure that they only use the numbers assigned to them by ANACOM, under the terms of the National Numbering Plan (NNP), and to ensure the transmission of information about the calling line identification (CLI), including the information needed to enable its restriction, as long as it has been provided by the originating (or transit) operator.

The destination number must be represented by a set of decimal numbers that enable to unequivocally identify the network point where the call should terminate.

The proposal provides that the destination number should use the SIP URI²⁵ format under the terms defined in standard “RFC 3966”,²⁶ it should be a valid “E.164”²⁷ number preceded by the character “+”, and include the “user=phone” parameter pursuant to standard “RFC 3261” (section 19.1.1.). The use of “+” is mandatory and it should be immediately followed by prefix “351” for calls destined for the national network.

In terms of portability, the proposal established the use of the “all call query” (ACQ) by the operator sending the traffic (even in transit situations), and when the destination number has been ported to a new operator, it will receive the “Routing Number” information associated with it and the call should be routed based on this information, and not based on the digits that compose the destination number.

²⁵ Uniform Resource Identifier.

²⁶ IETF document regarding the URI for Telephone Numbers.

²⁷ ITU recommendation relating to the international public telecommunication numbering plan.

MEO also stated that should a call be routed to another operator's interconnection equipment following the reply obtained in the ACQ process, then there should "(...) be added to the request URI of the SIP INVITE message that initiates the dialogue the fields "rn=D0xyabc;rn-context=+351;npdi" or "rn=+351D0xyabc;npdi" ("D0xyabc" represents the NRN – Network Routing Number – "D0xy" represents the operator to which the number was ported, and "abc" is that operator's network element to which the destination number is now connected)". If the destination number has not been ported, the field "npdi" should be added in order to signal that the "query" to the portability database has been made.

The proposal also mentioned that in the context of TDM interconnection MEO intends to continue to use the "Query on Release" (QoR) method, which it mentions being in accordance with the provisions of the Portability Regulation.

2.3.2. Consideration of the contribution of operators to MEO's proposal

In relation to numbering, VODAFONE raised issues concerning the use of the international numbering format provided for in the offer, since its network is not configured under the terms proposed. MEO claims that the proposed format is the international format, and in accordance with the relevant standards ("RFC 3261", "RFC 3966" and ITU-T "E.164"), matching the format adopted for its own network, therefore any changes in this context would incur costs.

Regarding portability, without prejudice to agreement on the use of ACQ method, especially from NOS on the use of the SIP URI format, VODAFONE and NOWO/ONI made proposals that differ from what MEO presented. They claimed that the appropriate field for sending the NRN is next to the destination number, as happens with TDM interconnection, with NOWO/ONI specifying that the NRN should be added to the "user part" or to the "called party number" field, indicating that this has already been successfully tested and would not imply any changes in the network providing voice service, or in the measurement/billing systems.

In reply to these proposals, MEO stated that its proposal – sending the information next to the routing number field – follows what is provided in the rule ("RFC 4694"²⁸), which is why it did not accommodate the contributions of the operators. It was nonetheless willing until

²⁸ IETF document regarding Number Portability Parameters for the "tel" URI.

the completion of the migration process to accept that ported numbers might be delivered in the TDM interconnection, thus giving other operators more time to change their network settings to comply with the aforementioned recommendation.

NOWO/ONI supports the adoption of SIP-I because it enables the use of REL#14 in the case of transit to operators which do not use ACQ, since there might be cases of transit to operators who still use QoR and do not have VoIP interconnection.

Finally, it should be noted that NOS stated it intended to extend the ACQ method to the TDM interconnection, while NOWO/ONI said it would continue to use QoR in that type of interconnection; MEO stated it was not possible to change the method it uses in the TDM interconnection, claiming it would incur costs and that it might not be possible in some switches.

2.3.3. ANACOM's understanding

In relation to numbering, only one question was raised regarding its format, and it is felt that this may not be a relevant problem for most operators since they provided no comments on it. But it should be stressed that the proposal is in compliance with the relevant rules. Accordingly, it is deemed not to be justified to determine any changes to MEO's proposal, without prejudice to any possible regulation by ANACOM on the use of the CLI.

Concerning portability, MEO's proposal and the comments presented by the various operators converge with respect to the method used – ACQ - with differences arising, however, with respect to the field in which the NRN should appear, with MEO stressing that its proposal follows the relevant rule. In any case, MEO's willingness to accept that ported numbers can be delivered in the TDM interconnection until the end of the migration process seems appropriate, since it helps to reduce the costs of adapting the operators' network configurations. Meanwhile, the operators involved during that period should negotiate the solution(s) to be implemented after the migration period, with a view to lower costs for the market. It should also be noted, in this context, that two of the operators who presented contributions to MEO's IP interconnection proposal did not identify any problem with this issue.

As for NOWO/ONI's comment about the advantages of using SIP-I when there are operators using transit services and still using QoR, as mentioned in **Error! Reference source not found.**, it would not be proportional to require MEO to provide SIP-I, with reference to ANACOM's understanding on that point.

As for the portability solution used in TDM interconnection, this is outside the scope of this document.

2.4. Emergency communications

2.4.1. MEO's proposal

At the meeting held on 22.2.2017, MEO stated that emergency communications should be routed exclusively through TDM interconnection. Following the comments presented by operators, MEO's proposal was modified in order to also provide the routing of emergency communications through IP interconnection.

The proposal establishes that the interconnection for these calls should be preferably use TDM during the transition period, by virtue of their critical nature and the fact that the connection to the public-safety answering points (PSAPs) is made over primary accesses. It accepts, however, that voice emergency calls received in the IP interconnection can be routed to the PSAPs, as long as ANACOM and the Ministry of Internal Affairs (*Ministério da Administração Interna - MAI*) approve. It also stressed that the routing of these calls through an IP interconnection should only become effective after the successful completion of specific tests involving the PSAP and the operators in question.

The proposal also establishes that emergency calls have a differentiated treatment at the level of SBCs, since they are not subject to the "call admission control" mechanism.

2.4.2. Consideration of the contribution of operators to MEO's proposal

The majority of operators who commented on this at the meeting held on 22.2.2017, or did so later in communications to MEO, say they believe that it should be possible to route emergency calls through IP interconnections.

Specifically on this matter, it should be noted that NOWO/ONI agreed with MEO about the critical nature of these communications and stated its view as to the need to involve other

entities in the process. Nonetheless, it argued that this should be done while allowing time for the integration of these communications into the general schedule of testing and migration of traffic from TDM to IP.

NOS, on the other hand, did not identify any restriction on the use of IP interconnection for routing emergency calls to 112, understanding that field “diversion” should be used for mobile originated calls, while the method of inserting the geographical area suffix should be maintained for calls originating on fixed networks.

As already explained in the previous point, MEO accommodated the claims of operators on its interconnection proposal by enabling the routing of emergency calls to 112 through IP interconnection, which was not in its initial proposal presented and discussed at the meeting of 22.2.2017.

2.4.3. ANACOM’s understanding

ANACOM notes that operators agreed upon the importance and care that these calls inspire. This Authority notes that all operators are in agreement about the transition of these calls to IP interconnection, and therefore sees no reason to oppose the proposal of migrating these calls to IP interconnection. Nevertheless, considering the nature of the communications in question, it is understood that their migration should be subject to a specific ANACOM decision, which will be completely independent of the one relative to IP interconnection, and which should involve the entities who also have responsibilities in this area, following the successful performance of specific testes involving the PSAPs and operators in question.

The autonomous decision on the process of migration to IP interconnection specifically regarding emergency communications does not necessarily imply that the migration schedule associated with it will be different from the general migration calendar explained in point 3.3, safeguarding the specific aspects relating to issues including the interconnection architecture, numbering and portability, with impact on emergency communications, as well as the performance of tests, as already mentioned.

The result of that decision, just like what results from the present decision, which is a specific interconnection matter, should be reflected in the RIO.

3. Migration plan

3.1. MEO's proposal

Following the contributions of several operators, MEO's IP interconnection proposal considers a substantially shorter migration period than that initially presented at the meeting of 22.2.2017, which between the testing and migration period envisaged a total of 5 years for completion of the migration. This way, MEO states it will take six months after approval by ANACOM of its IP interconnection proposal to provide it, stressing that this deadline depends on having no significant changes to the proposal. After this period, operational testing will be initiated as well as the migration of traffic terminated in its fixed network from the TDM interconnection to IP interconnection, in a process estimated to occur within two years, at a rate of 50% of the volume of termination traffic each year.

Under the terms of the reply, the traffic to be migrated each year will be controlled by numbering ranges. MEO states it will define each year the numbering ranges to migrate (from the "2" and "3" ranges) and will plan the phasing of the respective migration with the various operators, which should be bound by this, according to a sequence based on order of request. Regarding the traffic to be terminated in the networks of other operators, MEO proposes to deliver the traffic originating in its IP customers primarily through IP interconnection, continuing to deliver traffic originating in TDM customers in TDM.

After the migration of all the interconnection traffic with MEO's fixed network, including origination traffic, MEO states it will proceed with the deactivation of the TDM GPIs.

As the migration proceeds, the proposal establishes the definition of a maximum number of simultaneous sessions to be supported in the IP interconnection, based on the expected traffic, answer to seizure ratio (ASR) and a service degree with a 1% loss, and on a maximum number of call attempts per second. If the traffic exceeds the predefined limit, according to the proposal there should be a spillover to the TDM interconnection. For the implementation of that transfer, MEO will reject the calls exceeding the established limit with the reply "SIP 500".

Lastly, the proposal stresses that MEO does not secure the delivery of traffic outside the rules as set out, that is, if it is destined for numbering ranges that have not migrated. In

these cases, should delivery be viable, it will apply a higher price to that traffic, to be fixed considering the need to convert IP traffic into TDM.

3.2. Consideration of the contribution of operators to MEO's proposal

The majority of operators considered the 5 year period initially proposed at the meeting of 22.2.2017 for the implementation of IP interconnection to be excessive.

AR TELECOM proposed a period of 6 months after the completion of tests for the migration of operators with a small traffic volume. NOWO/ONI stated two and a half years would be enough. VODAFONE considered a total period of two years to be appropriate. NOS supported even shorter time limits, considering that this was both desirable and feasible, and proposed a one year calendar for total traffic migration – six months for the operationalization and provision of the offer, 2 months to perform the interoperability tests, and 4 months for the phased migration of traffic (12 months overall, finishing in March 2018 – assuming that the negotiation process would be already under way, having started in April 2017).

NOS also raises certain considerations relative to the migration process, which are briefly presented below:

- it does not agree with MEO influencing the pace of migration to IP to suit its own internal schedule of investment in fibre, and says that currently NOS itself already bears high costs in the transcoding of TDM to IP;
- it considers it is common practice for transcoding to be ensured by the destination network, and therefore it rejects the imposition of prices for traffic conversion/transcoding;
- it rejects any traffic barring, claiming that all ranges should be delivered in SIP, regardless of the technology, and that it anticipates no problems requiring the transition to IP interconnection to be limited to specific ranges;
- it considers that MEO's proposal to use TDM interconnection for redundancy implies the imposition of an interconnection cost equivalent to double transit, and

understands that redundancy should be ensured through redundant SIP interconnections, and at different geographical locations;

- it considers that the migration plan should be bilateral, contemplating numbering ranges of both operators;
- it considers that the migration of traffic of both operators should be coordinated between the parties, with the definition of a maximum number of simultaneous sessions and call attempts in the interconnections.

Finally, this operator understands that after the migration the TDM interconnection between its network and MEO's should be discontinued.

Taking into consideration the comments of the operators, MEO reduced the time limit for migration initially proposed (at the meeting of 22.2.2017) from 5 years (12 months + 4 years) to half (6 months + 2 years), in the belief that this tries to meet the proposals of the various operators, its understanding being aligned with the proposals of NOWO/ONI and VODAFONE. It also says that its plan compares well with what has been carried out in other countries (with time limits raging from 3 to 5 years, it notes), and that the deadlines established are appropriate for rationalizing their investment in TDM-IP conversion equipment.

3.3. ANACOM's understanding

In the process of hearing the interests of the several parties involved in the transition to IP interconnection, it can be seen that various operators want traffic migration at different rates. MEO, with the purpose of minimising its investments in transcoding equipment, supports a longer period; other operators, which already bear the transcoding costs at this time, especially NOS, who considers them high, want a faster migration.

Regarding the time limit for migration, ANACOM understands that, whereas that MEO already has a not inconsiderable percentage of customers of the telephone service provided at a fixed location supported in IP, and thus could have already started planning for migration to IP interconnection, an obligation which it has known about since the adoption of the final decision on the fixed termination market in 2016, and particularly whereas that the other operators who expressed an opinion on this matter, with the

exception of NOWO/ONI that agrees with the schedule proposed by MEO, are interested in a much faster migration bearing in mind the transcoding/transrating costs they claim to already support, the time limit proposed for migration should be reduced to a total of 2 years.

With respect to MEO's proposal, this represents a reduction of 6 months, with the understanding that it has more advantages for all operators, who made comments along these lines, and that it will not have a negative impact on MEO. It should be noted that the DD established a migration plan whose timetable provided an initial testing period of 4 months, followed by a period of 12 months for the migration of 50% of the traffic, and a final period of 8 months for the migration of the remaining 50% of traffic. Given MEO's comments, it is understood that the overall migration period should remain at 2 years, with the need to change the timetable of the various migration phases, increasing the initial testing period, and cutting the time limit for the migration of the remaining 50% of traffic.

Accordingly, MEO will have 6 months to implement and configure the solution for IP interconnection in its network, being required to migrate 50% of the traffic terminated on its network in the following 12 months, while the remaining traffic should be migrated in the subsequent 6 months, i.e., by the end of the second year (counted from the moment the proposal is incorporated in RIO). This solution will make it possible to rationalize migration among the present operators, lowering costs related to the maintenance of the TDM network and contributing to a faster implementation of an efficient technology, which benefits operators and the market as a whole.

Thus, after ANACOM's final decision, and following the integration by MEO of this proposal in RIO, with the changes now planned, with the understanding it should be done within 10 working days after communication of the final decision, MEO is required to start the IP interconnection migration process.

The interoperability tests that may prove necessary should not mean adding extra time periods for the migration, and should be carried out in the first 12 months during which the 50% of the traffic terminated on MEO migrates to IP interconnection. From the moment that the IP interconnection proposal is included in RIO, MEO must define a plan of interconnection and testing with the operators who request IP interconnection, and

schedule the tests in the order the interconnection requests are received from the operators.

At the end of the 12-month period, counted from the end of the initial 6 months for the implementation and configuration of the IP solution, the 50% of the total traffic terminated in MEO should, as far as possible, include 50% of the traffic of each operator with which MEO is interconnected.

Regarding MEO's intention to charge a price supplement for traffic delivered outside the rules established for IP interconnection migration, it is understood that as established for traffic exceeding the predefined limit for IP interconnection, in this case, too, there should be rules that enable the operator to choose the traffic delivery alternative, and therefore it is considered that MEO should return to the origination operator any IP interconnection traffic that has not yet been migrated to IP interconnection. For that purpose, MEO should give operators, in advance, the technical procedure to be adopted in those situations, and this should be agreed by the parties.

The migration timetable intends to minimize the transcoding costs that will necessarily be incurred during this period, without at the same time imposing a disproportionate investment effort on the operators who are still not completely prepared for IP interconnection. However, it is recognized that at the moment several operators that have customers supported in IP already bear transcoding costs, since they have to convert the traffic they receive for these customers in the TDM interconnections to IP, and these costs are not subject to specific compensation, other than what results from charging the termination price. Accordingly, it is understood it would not make sense to allow MEO, since the traffic in question is outside the scope of the established migration process, to charge a sum resulting from the need to convert traffic in the opposite direction, i.e., from IP to TDM.

MEO's proposal about traffic terminated in the remaining operators, where the company says it prioritizes the traffic originating in its IP customers, seems reasonable, since for an operator who has all or the vast majority of IP customers the ranges selected may be relatively irrelevant. In any case, MEO should give the opportunity to operators with which it is interconnected to agree on the numbering ranges that primarily receive IP traffic, which is particularly relevant in the cases where the operators do not have all customers

in IP. In addition, with migration being implemented in 2 years, traffic delivered by MEO to the other operators should also evolve similarly, with MEO being required to ensure that 50% of traffic be delivered in IP by the end of the 12 months subsequent to the initial 6 month period.

As for the deactivation of TDM GPls after the migration of all the interconnection traffic with MEO's fixed network, including originating traffic, ANACOM understands that in the absence of TDM traffic it might be reasonable for MEO to proceed accordingly. Nonetheless, this deactivation should also be analysed in the specific framework of the autonomous decision to be adopted regarding the migration to IP interconnection with respect to emergency communications, in which context it could be appropriate to retain some capacity for TDM interconnection, an issue that will be evaluated as part of an autonomous decision.

4. Call origination

4.1. MEO's proposal

As explained by MEO, the technical proposal for IP interconnection only applies to voice traffic terminated on MEO's public telephone network at a fixed location, and under its terms all calls to MEO customers of the 2 and 3 numbering ranges will be accepted, safeguarding the restrictions existing during the migration period.

About the proposal not including the traffic originating in its network, MEO states that *"even if on a preliminary assessment there are no technical restrictions to the application of the proposed solution to originated traffic, its implementation depends on aspects which have not yet been defined, and which are within ANACOM's sphere of activity. Besides the fact that the Decision that underpins the proposal concerns the Wholesale market for call termination on the public telephone network at a fixed location, the mere reference included in the 2014 decision about the ex-M2 is not enough to enable MEO to contemplate that traffic, since it does not respond, in particular, to the issue of moving from TDM interconnection and the respective hierarchized tariff scheme (L, TS, TD) to single price IP interconnection"*.

MEO thus says it is waiting for ANACOM's decision to deregulate the market for call origination in the public telephone network at a fixed location in order to set the prices equitably in the context a negotiation process with the other operators.

4.2. Consideration of the contribution of operators to MEO's proposal

Most of the operators that commented on MEO's proposal consider that IP interconnection should include termination traffic (included) and origination traffic (not included). For operators, that limitation is a serious flaw (as NOWO/ONI notes) that requires the maintenance of two forms of interconnection – TDM and IP - reminding that ANACOM determined, in its latest decision on the market of call origination in the public telephone network at a fixed location that *“regarding the obligation of IP interconnection, the same conditions apply as are determined in that respect for Grupo PT, as an operator with significant market power in the wholesale markets of call termination in the public telephone network at a fixed location.”*

4.3. ANACOM's understanding

ANACOM's decisions about the aforementioned call termination and origination markets are intended to see that the process of migration to IP interconnection occurs for both origination traffic and termination traffic of calls in the public telephone network at a fixed location.

In any case, without prejudice to ANACOM's decision relative to the market of call origination in the public telephone network at a fixed location, in the DD approved on 18.5.2017 and put to public consultation regarding that market, this Authority has the following to say on this matter *“(…) what is to be decided for the termination markets at a fixed location should also have an impact on the present market, even if the schedule for implementing IP interconnection does not necessarily have to coincide with that applicable to the termination and origination of calls. (...). Following the decision on this market, and within two months after the approval of this decision, MEO should present, if it still has not done so in the context of the IP interconnection proposal for the fixed termination market, the specific migration plan for call origination, which must take into due account what was decided regarding termination, for reasons of overall efficiency of the interconnection process, which usually links both services, with many common characteristics, in terms of*

*operation. It should be noted that in the context of this migration plan, the existing TDM interconnection structure will undergo changes, which should as much as possible be in line with the changes introduced in the context of call terminations in the public telephone network at a fixed location”.*²⁹

In addition, the DD approaches the issue raised by MEO regarding the transition from a hierarchical interconnection structure to an IP interconnection structure by providing for the origination of calls in the public telephone network for the provision of retail telephone services, to the existence of a single price for the local and simple traffic interconnection levels, and by deregulating double traffic origination. These decisions, together with the reduction in the number of PIs, will allow alignment with the transition structure that is being used for termination traffic and that will enable IP interconnection.

In these circumstances, there is nothing to prevent MEO from starting to prepare the migration process right away, in particular the negotiations leading to the implementation of this process, even if the decision on the call origination market has not yet been adopted, and therefore the specific deadlines have not yet been specified for the presentation of the respective IP interconnection proposal.

It should be mentioned that the DD does not anticipate there being obligations for the origination of calls in the public telephone network at a fixed location for the special services supported on non-geographical numbers, although, obviously, this traffic will also be considered under interconnection, together with the remaining origination traffic.

5. Other issues

5.1. Traffic to mobile networks

In the context of the meeting of 22.2.2017 some operators asked MEO about the evolution of IP interconnection for mobile network traffic. MEO says that this matter will have to be studied, particularly regarding the number and location of PGIs, and with respect to the specificities of the mobile network, giving audio codecs as an example.

²⁹ Vide DD on the analysis of the wholesale market for call origination in the public telephone network at a fixed location p. 123.

5.1.1. ANACOM's understanding

ANACOM clarifies that the IP interconnection obligation was only specified in the context of fixed markets. Nonetheless, nothing prevents the operators from negotiating with one another the technological solutions that seem most appropriate for their realities and specificities.

5.2. Costs

NOWO/ONI requires a clarification about "*the costing model used in IP interconnection*", claiming it is common practice for costs to be shared equally between MEO and each operator with which it interconnects.

MEO understands that matters relating to costs are outside the scope of the interconnection proposal it is required to present in the context of ANACOM's decision of 22.12.2016, and proposes that these costs are negotiated with the operators in due course. It should be noted that in the context of the meeting of 22.2.2017, MEO also stated that the prices to be considered were those given in the current reference offers (Reference Ethernet Leased Line Offer – RELLO and Reference Unbundling Offer – RUO) for the services related to IP interconnection. This was also mentioned in the context of a clarification provided to an operator, where MEO stated that interconnection support connections may be based on connections provided in RELLO or others to be agreed upon between the operators.

5.2.1. ANACOM's understanding

As with the current TDP interconnections, the service for support and connection between MEO GPIs and the GPIs of an operator, for IP interconnection may be provided by MEO (based on regulated or other offers) or by another operator, either itself or resorting to third parties.

Considering that the circuits for IP interconnection will be used to route traffic owned by the two interconnecting operators, ANACOM understands it is reasonable to have cost sharing to be agreed between the parties, considering the proportion of traffic owned by each operator and the installation and operation costs of the physical circuit.

Following the comments received during the public consultation and prior hearing of interested parties, ANACOM considers that, as currently happens in RIO for TDM interconnection, MEO should update that reference offer so that the conditions of IP interconnection in own buildings include the models available for that interconnection, the respective implementation, and reference to the use of other reference offers that are relevant to IP, particularly RUO and RELLO.

6. Conclusion and proposed decision

Considering the reasons explained in the previous points, the Management Board of ANACOM, under the terms of Articles 63, 64, 66 and 68 of the Electronic Communications Law (ECL), pursuant to Article 26(1)(q) of its Statutes, approved by Decree-Law 39/2015 of 16 March, following the determination of 21.12.2016, after market consultation about the draft decision approved on 4.8.2017 in the context of the public consultation and prior hearing of stakeholders, whose contributions were considered in the report on the public consultation and prior hearing of stakeholders, which was part of the draft decision and is an integral part of the present decision, and with the approval by decision of the Management Board of 16.11.2017 of the draft decision notified to the EC on 17.11.2017, on which the EC presented no comments, determines:

- a. That MEO must ensure that the existence of a temporary IP GPI in Porto has no impact on IP interconnections, and that there will be no costs associated with it.
- b. To establish that only smaller operators that are interconnected with MEO or become interconnected for purposes of the delivery of voice termination traffic, which is those who deliver MEO a monthly average of termination traffic not exceeding 5 million minutes, with reference to the overall termination traffic delivered by these operators to MEO in 2016 (or with respect to the first 12 months of activity if this started after 1.1.2016), may dispense with one of the types of redundancy, local or geographical. They are required, however, to guarantee a solution that ensures alternative traffic routing.
- c. To establish that the operators mentioned in b) may choose to interconnect to a single MEO IP PGI, in which case they can deliver all termination traffic in that

- GPI, while, in this case, MEO can also deliver termination traffic in a single IP GPI of those operators.
- d. To determine that no operator interconnected with another for the purpose of the delivery of voice termination traffic, or who becomes interconnected, can be required to interconnect with more than two IP GPIs of each operator.
 - e. That the overall migration timetable be reduced by six months, with MEO having 6 months to implement and configure the solution for IP interconnection in its network, being required to migrate 50% of the traffic terminated in its network to IP within the following 12 months, and the other 50% in the subsequent 6 months.
 - f. That traffic delivered in numbering ranges different from those identified by MEO under the process of migration to IP interconnection be returned to the originating operator to enable them to opt for other traffic delivery alternatives. MEO is required to present, in advance, the technical procedure to be adopted in those situations, to be agreed between the parties.
 - g. That termination traffic delivered by MEO to the other operators will also evolve in a way equivalent to that determined in e), with MEO being required to ensure that 50% of traffic will be delivered in IP by the end of the first 12 months after the 6-month testing period used by MEO to implement and configure the solution for IP interconnection in its network.
 - h. That MEO should specify the possibility of accepting values up to $\frac{1}{4}$ of the default values of the “eBGP” timers, as mentioned in point 2.2.3.
 - i. That MEO should define the quality of service indicators with reference to the indicators currently provided in RIO, such as those relating to network quality and availability and to the quality of circuits, the proposal being required also to establish what is needed to ensure the “BGP” routing protocol in situations of congestion related to an abnormal increase of traffic or other abnormal situations.
 - j. That MEO will include the IP interconnection proposal in RIO, with the changes determined and identified in the previous paragraphs, within 10 working days after the communication of the final decision to MEO, informing ANACOM of the

modifications introduced and, in particular, any new elements that have not been explained in MEO's proposal.

- k. That MEO should update RIO so that the conditions of IP interconnection in own buildings include the models available for this interconnection, the respective implementation, and the reference to the use of other reference offers that are relevant in the context of IP interconnection, particularly RUO and RELLO,
- l. That MEO will define an interconnection and testing plan with the operators that request IP interconnection, scheduling the tests in the order the operators' interconnection requests are received, and being required to respond to operators requests from the moment that the IP interconnection proposal is included in RIO.
- m. To determine that future changes to RIO relative to IP interconnection, notably involving specifications of a more technical nature not yet in the proposal, should, as far as possible, be agreed with the operators involved, and later communicated to ANACOM.
- n. That the changes to RIO resulting from the inclusion of the IP interconnection proposal, modified according to the above provisions, should be carried out independently of what is to be specifically decided with regard to the process of migration of emergency communications.

Appendix

List of acronyms and abbreviations

ACQ	All Call Query
BGP	Border Gateway Protocol.
CLI	Calling Line Identification
eBGP	External Border Gateway Protocol.
GbE	Gigabit Ethernet
IP	Internet Protocol
ECL	Electronic Communications Law
OSP	Other service providers
RUO	Reference Unbundling Offer
RELLO	Reference Ethernet Leased Lines Offer
RIO	Reference Interconnection Offer
GPI	Geographic point of interconnection
PI	Point of interconnection
SMP	Significant Market Power
NNP	National Numbering Plan
PSAP	Public-safety answering point
QoR	Query on Release
QoS	Quality of Service
SBC	Session Border Controllers
SIP	Session Initiation Protocol
SIP-I	Session Initiation Protocol with encapsulated ISUP
DD	Draft decision
TCP	Transmission Control Protocol
TDM	Time Division Multiplexing
UDP	User Datagram Protocol
URI	Uniform Resource Identifier
VLAN	Virtual Local Area Network

VOIP Voice Over Internet Protocol

List of operators and entities

ANACOM	Autoridade Nacional de Comunicações
NRA	National Regulatory Authority
AR TELECOM	AR Telecom – Acessos e Redes de Telecomunicações, S.A.
BEREC	Body of European Regulators for Electronic Communications
EC	European Commission
IETF	Internet Engineering Task Force
ITU	International Telecommunication Union
MAI	Ministério da Administração Interna – Ministry of Internal Affairs
MEO	MEO – Serviços de Comunicações e Multimédia, S.A.
NOS	NOS Comunicações, S.A.
NOWO	NOWO Communications, S.A.
ONITELECOM	OniTelecom – Infocomunicações, S.A.
EU	European Union
UIT/ITU	International Telecommunication Union
VODAFONE	Vodafone Portugal – Comunicações Pessoais, S.A.