Resilience Guidance Consultation and Call for Input on Mobile RAN Power Back up

BT response – Non-Confidential

1 March 2024

BT Group

1. Executive Summary

1.1 We broadly support Ofcom's objective of ensuring communications networks have a high degree of resilience so that end users can benefit from the best possible experience when accessing electronic communications services.

1.2 We agree with the conclusion of the Call for Inputs – that the cost of ubiquitous battery back-up would be 'disproportionate' for operators to bear alone and are reassured that Ofcom has already provisionally concluded this at such an early stage in the process.

- We agree that widespread deployment of non mains power back up across the RAN is disproportionate given Ofcom's estimate of costs of c £0.9-£1.8bn; and
- We believe including such a measure in the guidance is outside the intent and scope of s105A of the Communications Act

1.3 Given the above it is critical Ofcom's evaluation of these issues is well structured with a clear articulation of the policy issue and assessment of potential solutions and how they should be funded.

1.4 Given the substantive upgrades taking place in UK electronic communications networks, as well as the possibility of a higher number extreme weather events in future, we agree that the time is right for policymakers and businesses to consider what measures are appropriate to ensure a continued positive end user experience.

1.5 BT aims to be the best network in the UK. We have invested heavily in a range of technologies over many years to deliver on this promise. Specifically, in mobile:

- We were the first operator to launch 5G in the UK and the first to roll it out to over 50% of the country;
- We have been named as the UK's number one mobile network for ten years in a row by RootMetrics® and were also cited as the most reliable network for accessibility, speed, data, calls and texts by them in July 2023;
- We were the only network to deliver on our Phase One Shared Rural Network ahead of time, meaning we now provide mobile coverage and internet access to 99% of the population and 88% of the UK's entire landmass.

1.6 These successes have been delivered during a period when BT, in common with other market participants, has faced an increasingly challenging macroeconomic environment, linked to rising inflation and constrained supply chains. New legislation has also required us to deliver enhanced standards in telecommunications security, all while maintaining the integrity and performance of our network.

1.7 We are proud of our successes in recent years and are confident that we are equipped to meet the future needs of our customers as they demand ever increasing network availability and capacity[1].

[1] In December 2023, we managed a new peak hour demand of 30.1Tbps

1.8 We believe that Ofcom's Consultation on Best Practice Guidance strikes the right balance between:

- ensuring communications providers deliver on minimum resilience standards;
- retaining flexibility to provision their networks based on customer need and provider-specific considerations.

Indeed, we have already implemented the majority of the measures outlined in the draft Guidance.

1.9 We understand the intent of Ofcom's Call for Inputs and are keen to engage in this debate with Ofcom and other policymakers. We are concerned, however, that the suggestion of widespread deployment of non-mains power back-up across the entire mobile estate – as modelled in Ofcom's Illustrative Case Study – will go well beyond the intent of section 105A of the Communications Act.

1.10 To ensure that the regulatory framework continues to best meet the needs of citizens and consumers, we urge Ofcom to perform a detailed impact analysis before proposing specific measures requiring providers to introduce new power back-up measures in the mobile RAN. This could include:

a) A clear definition of the problem (consumer harm) Ofcom believes needs to be addressed;

b) An analysis of the full suite of possible solutions – including those which sit outside the electronic communications sector;

c) Proper consideration of how obligations which go beyond those which customers are willing to pay for might be considered.

We deal with each of these in more detail in this response.

1.11 The rest of this document is structured as follows:

- We provide a brief synopsis of our concerns around points (a), (b) and (c) above;
- We respond to Ofcom's CFI questions on mobile RAN power back up (Q1 – Q12) in Annex 1;
- We answer Ofcom's consultation questions on its proposed network and service resilience guidance in Annex 2 (Q1 – Q6).

1.12 Please note that Openreach will respond separately to this consultation.

2. Ofcom needs to define a problem in the mobile RAN

2.1 Between them, Mobile Network Operators (MNOs) already take a range of measures to ensure that customers are able to benefit from the best possible service in the event of a power outage in their networks. Indeed, there are two different legislative/regulatory requirements – section 105A of the Communications Act and General Condition A3 – which expressly require them to do so.

2.2 The key measures deployed by BT in our mobile RAN include:

- Overlapping cell site coverage;
- Deployment of targeted non-mains power back-up to appropriate ["high risk"] sites;
- Use of 'roving' engineering teams and equipment to provide power back-up where needed;
- Development of new tools and processes to enhance coordination with energy companies;
- Availability of limited national roaming to allow continued emergency access where coverage allows.

2.3 While this will not necessarily guarantee no loss of service in all cases, there are a range of solutions available on the market to end users wishing to improve/enhance the resilience of the service they receive, such as satellite.

2.4 Given power resilience solutions are already deployed so widely across mobile networks, we believe a clearer problem definition is needed before any full exchange of views on what improvements might be made.

2.5 While we recognise that Ofcom's intention is to provide a high-level framework for comment at this stage, without some clarity on what consumer harm Ofcom believes exists, it is very difficult for communications providers and other stakeholders to comment on the relative merits of the current approach compared to the counterfactual Ofcom sets out in its 'Illustrative Example', other than to note that:

- Our current approach meets the needs of our customers and our obligations under the Communications Act and/relevant General Conditions, and;

- We agree with Ofcom that the illustrative example of ubiquitous 1hr non-mains power back up is wholly disproportionate on the grounds of cost. To this we would add that such a measure:
    a) would result in redundancy for the majority of battery assets deployed, given cell site overlap resilience is available to ensure continued end user access to services in most outages, and;
    b) would have an environmental impact from the procurement and deployment of battery solutions, without necessarily delivering any substantive end user benefit if deployed across the network.

2.6 The above notwithstanding, we recognise that creating a clear and simple framework to assess whether existing power resilience in the RAN is sufficient presents a challenge.

2.7 We therefore suggest Ofcom builds on the work done to date by considering what mobile RAN power outages are most likely to cause a 'security compromise' or undermine 'uninterrupted access to emergency services' – i.e., the tests in s105A and GC3 respectively. Indeed, it is only this question which can be the basis of any consideration of what measures are 'appropriate and proportionate' to prevent security compromises. Such an assessment should not be limited to measures on individual mobile network operators and should also consider holistic industry-wide solutions.

2.8 When these types of outages do occur on BT's network, they typically require a coordinated response by a range of stakeholders, but most notably by specialist energy companies who are the only ones with the resources and expertise to reconnect cell sites quickly to mains power. Some recent experiences of outages in the mobile sector, however, suggest that coordination between stakeholders proves to be challenging and can mean services take longer to restore. We believe this should be the starting point of any problem definition by Ofcom and Government.

3. Ofcom should consider the full suite of possible solutions and their costs/benefits

3.1 Absent a clear identification of consumer and harm and therefore problem definition/objective, it is difficult to weigh up the relative merits of any given intervention in the mobile market. We note that the Call for Inputs – as a 'framing' document - does not attempt at this stage to set all solutions which might be available to policymakers seeking to improve power resilience in the mobile RAN.

3.2 We believe Ofcom should attempt to perform this exercise once a problem has been clearly defined, as set out Ofcom's Impact Assessment Guidance and the Government's Better Regulation Framework Guidance. As part of this process, we emphasise the importance of considering the relative costs and benefits of ***all*** measures before consulting on a preferred intervention – rather than focusing on a small number of possible solutions (such as non-mains power back-up).

3.3 Against this backdrop, it is difficult to understand what benefit to citizens or consumers would derive from 1hr battery back-up in urban locations given the majority of these outages cover a single sites, there is cell site overlap resilience alongside Distribution Network Owners (DNO's) resilience, which means a security compromise is unlikely to occur.

3.4 Given our view that the current framework broadly works well but that, where issues do arise, they tend to be the result of a coordination challenges, we believe Ofcom should – in the first instance – consider what solutions might be appropriate to address this specific issue. This should include interventions which are most appropriately aimed at the performance of the energy sector, which should necessarily be the primary site for addressing power-related issues. We think Ofcom, as an expert adviser to Government, is well-positioned to consider – for example – how electronic communications networks could be more promptly reconnected to mains power, or what tools might be made available from energy networks to assist in mobile network planning.

3.5 In our view, other interventions which might be ultimately delivered to improve power-related resilience (at potentially lower cost). In its Post Incident Review, following the severe storms of 2022 the EC-RRG[2], recommended four key actions that require Government/Regulator support to improve the resilience of the Telecoms Sector and help accelerate the restoration of critical telecoms infrastructure following unplanned outages:

i. **Improved communication & collaboration between the Sectors** – BEIS, DCMS/DSIT, Ofcom, Ofgem, CP's & Distribution Network Operators (DNO's).

ii. **Improved information about the location of power outages and recovery timescales.** Development of a single source power outages map by the Power Sector of the entire UK would enable mobile operators to make informed decisions about generator and engineer deployments. If the API was made available to Telecoms providers, they could overlay power outages to infrastructure maps to help make operational decisions.

[2] Electronic Communications Resilience & Response Group

iii. **Priority restoration of critical telecoms infrastructure** where it will help the DNO's to communicate when restoring power networks and where there are societal benefits – remote community isolation etc. Currently the DNO's cannot prioritise one customer over another during the restoration of supply - This is a legislative obligation that the DNO's must comply with.

iv. **A higher level priority for CNI providers**, both in information sharing and restoration of supply would be beneficial as the reliance society places on telecoms increases.

4. Any intervention in the RAN requires funding

4.1 Given Ofcom's expertise in the electronic communications sector, and the strong body of work it has produced on the future of the mobile sector, we would strongly encourage Ofcom to consider in any future work, how interventions in this area might be fairly and sustainably funded.

4.2 We agree with the conclusion of the Call for Inputs – that the cost of ubiquitous battery back-up would be 'disproportionate' for operators to bear alone and are reassured that Ofcom has already provisionally concluded this at such an early stage in the process.

4.3 We do not believe mobile operators should be required to provide levels of power resilience beyond those levels demanded by our customers – or at the very least operators should not be required to fund it alone.

4.4 We note that funding examples from other countries (such as Australia) for power resilience have often included a substantial contribution from other actors. As noted in BT's response to Ofcom's mobile market strategy consultation, consideration of how Annual Licence Fees (ALFs) for spectrum might be reformed to encourage operators to invest more in mobile networks might be a fruitful area for further consideration (which we recognise may be a matter for government).

4.5 We urge Ofcom to consider the impact of any intervention on industry in the round by taking full account of the investment environment, wider returns on investment, consumer outcomes in terms of pricing and customer experience and – most importantly – what other obligations are already being delivered following interventions by policymakers.

Annex 1- Our response to Ofcom's questions on its Call for Input

1. *Does this framework accurately capture the factors relevant to assessing what is an appropriate and proportionate measure for MNOs to take with regards to power resilience for RAN cell sites?*

No it does not. Ofcom has failed to (1) properly define a policy problem, and (2) to consider interventions as part of a full cost benefit/impact analysis.

(1) Failure to define the policy problem/consumer harm

- There is little assessment of consumer harm, what specific policy problem Ofcom believes exists and hence what interventions should be introduced to address it. This needs to be done in the context of why the interventions already in place by providers to meet the specific obligations in the Communications Act and General Condition A3 are not adequate.

- Considering if and where any market failure exists could lead Ofcom to the conclusion that a negative externality from the energy sector is being imposed on MNOs and, indeed, across the wider economy (as other energy users may also be forced to fund their own energy resilience solutions). In turn, this would support the view that imposing new regulation on MNOs may not be the least intrusive way of achieving Ofcom and Government objectives (depending on what those objectives are).

(2) Failure to consider interventions as part of a full cost benefit/impact analysis

- Ofcom should follow its Approach to Impact Assessment (IA) and the Government's Better Regulation Framework guidance prior to consulting with industry on any potential new regulation. A robust Impact Assessment would allow Ofcom to identify whether intervention is justified and, if so, the least intrusive means of achieving Ofcom's and the Government's objectives. Otherwise, there is a risk that Ofcom imposes significant costs on MNOs which are not warranted.

- Ofcom asserts in paragraphs A1.3-A1.6 that its analysis in Section 4 and Section 5 constitutes an impact assessment for the purposes of a Call for Inputs. We do not believe that these provide sufficient detail to allow substantive comment at this stage. We would therefore encourage Ofcom – in any future document – to complete a full impact assessment as set out Section 5 of Ofcom's Approach to IA (What stages are involved in an Impact Assessment).

- For reference, the table below sets out our concerns with the current document:

Stage 1: Defining the issue and identifying the citizen or consumer interest **Stage 2: Defining the policy objective**	• Ofcom provides little reasoning or evidence supporting the view that there is consumer harm or a market failure that needs to be addressed. • It is not clear what Ofcom's desired objective is. Is it that all UK households and businesses should be able to make emergency calls, contact friends or family, or go online during power outages? Should this be for any duration of up to an hour? With what degree of reliability? Should there be a different approach depending on the likelihood of an outage or the volume of end users likely to be impacted?
Stage 3 – Identifying the options	• An integral part of a well-functioning IA is ensuring that all feasible options (including non-regulatory options) are systematically considered and assessed. • We set out in response to question 4 below some cost-effective options for Ofcom to consider which may reduce or remove the need for more intrusive measures (such as mandating provision of a minimum of one hour of back-up power resilience at every mobile RAN cell site).
Stage 4 – Identifying the impacts on different types of stakeholders **Stage 5 – Identifying any impacts on competition** **Stage 6 – Assessing the impacts and choosing the best option**	• Given the range of power resilience interventions available not only to mobile network operators but also DNO's, Government, and customers, beyond battery back-up, it is incumbent on Ofcom to set out a clear framework for assessing the relative costs and benefits of each to deliver whatever the most appropriate/proportionate outcome is for end users. • For example, as stated above in section 3.3, it is difficult to understand what benefit citizens or consumers would derive from 1hr battery back-up in urban locations given the majority of these outages cover a single sites and there is cell site overlap resilience alongside DNO resilience, which means a security compromise is unlikely to occur.

2. *Do you agree that at a minimum MNO's networks should be able to operationally withstand short term power-related incidents?*

We agree in principle, but note that:

- It is not clear what 'withstand' means in this context as there is no consumer harm/policy problem defined (see stage 2 in the table used to our answer to question 1).

- Ofcom's focus on 'short-term power-related incidents' does not account for the fact that the duration of an outage is only one relevant factor when considering what provision providers might put in place to meet their obligations under the Act. For example, providers are also required to consider whether an incident occurs at only one or multiple sites, whether an outage occurs at a site which is urban, rural, or remote, and whether the energy network to a site is highly resilient. Any intervention put in place by providers is likely to be highly contingent on these factors.

3. *What mobile services should consumers be able to expect during a power outage, what consumer harms should power backup up focus on mitigating and does this vary depending on the type or duration of the outage?*

It is difficult to create a simple framework for assessing consumer harms because:

- All mobile services will be affected by power shortages but for some locations and services the impact is greater. Ofcom should consider different scenarios in any assessment of end user experience, encompassing site type (urban/rural/remote), outage type (long/short, wide area/localised), and the resilience of energy networks (in major urban centres, for example, reconnection to mains power is likely to be much faster compared with remote sites);
- More broadly, the value consumers place on different services varies (data/SMS/voice) meaning prioritising a single service is difficult. This is exacerbated by use of data services to make calls and SMS to contact emergency services;
- The starting point of any framework , however, should be the importance of emergency access as far as possible – within limits of what MNOs can deliver. Indeed, Ofcom's General Condition A3 already makes this approach explicit.

4. *What technical choices are available to MNOs to reduce power consumption, and should be considered as part of assessment of appropriate and proportionate measures?*

MNOs are limited in their choices by the data available from energy companies. Currently this does not provide sufficient detail to allow assessment of where outages are most likely to occur on a forward-looking basis and how quickly we can expect mains reconnection in the event of power loss. We are working on new data tools which might provide this.

Generally, mobile network operators need to strike a balance between different service availability/coverage options and the need to provide capacity when managing limited power resources (e.g. when managing networks via non-mains power where available).

BT's preferred approach is to keep our core frequency spectrum bands on air for as long as possible - and therefore we do not use power resilience to support high frequency spectrum bands. This is on the basis that this:

- Limits end user impact in the short term; and
- Allows for prompt mains reconnection – which is by far the most likely scenario.

5. *How many sites would it be feasible to upgrade and maintain and why?*

It is not appropriate for BT or Ofcom to specify number of sites which should be maintained, at least until a clear policy problem has been identified.

Instead, once Ofcom has adequately defined the issue it is trying to address, the focus should be on:

- Which interventions would have the greatest impact for the lowest cost. These might include:

- Better information sharing by energy industry;
- Providing information to end users on limits of mobile network resilience in current context;
- Categorising mobile networks as priority for reconnection;
- Improving resilience of energy networks.

- Only once the impact of these interventions has been exhausted and Ofcom has demonstrated within the intent of s105A of the Communications Act that providers are not taking appropriate and proportionate measures should any further enhancements be considered.

- Broadly, any intervention should focus on:
  - strategically important hub sites, which receive transit traffic from four or more child sites or where a child site is in an isolated unique coverage site, and;
  - isolated sites where cell site overlap (either from a provider's own network to a third-party network is not available and not likely to be made available by new deployments);
  - sites where the topology means there is a higher chance of outage in the power distribution network.

6. *Do you consider that providing a minimum of 1 hr backup to all RAN cell sites would to be proportionate to meet the security duties under s.105A to D of the Communications Act 2003?*

No, a minimum of 1 hour back up to all RAN cell sites is wholly disproportionate for the reasons set out in our response to question 1.

7. *What cost effective solutions do you consider could meet consumers' needs during a power outage?*

This question requires some understanding of consumer need and why this extends beyond what is currently available today. Such analysis should consider differing cohorts depending on location and use case, etc. See our response to question 1.

8. *a) Is it more cost efficient to increase power backup up to any space, weight, or planning limitations, i.e., increasing power backup as much as is feasible provides the lowest £ per hour? b) do the benefits of any power backup solution have diminishing returns, i.e., the benefit per hour decreases as you increase the amount of power backup*

No. BT is not in a position to respond to this question without a better understanding of Ofcom's desired goal.

9. *Does the mobile market fail to capture the value or importance of power backup, and if so, why?*

The mobile market has not failed to capture the importance of power back solutions. The market has evolved over recent years with new services introduced that increase data consumption and with legacy technologies retired. As a result of these market dynamics, BT has already taken measures to provide power resilience in line with our obligations and to meet customer demand where it exists.

As commercial organisations in a highly competitive market where network quality is a key feature to compete effectively, MNOs have an incentive to offer a reliable mobile network connection to its customers including –to an extent– during power outages.

10. *Should improvements in power backup be focused on solutions at sites which are identified as higher risk of outages?*

See answer to question 5

11. *Why would any requirement lower than a minimum of 1 hour be sufficient in future? What duration do you consider would be sufficient and why?*

We do not agree that Ofcom has demonstrated there is a clear policy need which requires deployment of ubiquitous power back-up. We note that other interventions might be sufficient – we set this out in further detail in our response to question 5.

12. *Over what time period could industry make upgrades to provide a minimum of 1 hour at every cell site or other cost-effective solutions to address potential consumer harm?*

This question is based on the premise that there is a need to deploy ubiquitous battery back-up. As noted above, we do not agree with this.

We note that new non-mains power requirements would be yet another infrastructure cost on communications providers at a time when many market participants are faced with a high number of extraordinary costs, including those related to the TSA and DVD process, the SRN programme. In order to provide power back up for all sites additional funding is required. Representatives from the mobile industry, including BT, have already proposed Annual Licence Fee reform to Ofcom as one possible solution to this problem in response to its Mobile Strategy Work.

Annex 2 – Our response to Ofcom's proposed resilience guidance questions

BT's responses to Ofcom's specific questions on its proposed resilience guidance (sections 4 and 5) are set out below.

Additionally, BT notes that in section 1.2.2, Ofcom suggests that the effect of PSTN customers moving to 'All-IP' services may result in a significantly less available telephony service during power failures – and further steps are required to provide a suitable level of availability.

BT believes it has already taken the required steps to manage resilience issues as customers move away from PSTN by meeting the requirements of Ofcom's 2018 guidance "*Protecting access to emergency organisations when there is a power cut at the customer's premises*".

Ofcom's 2018 guidance is specifically designed to ensure customers are protected as they move from the PSTN, with its own power back-up, to IP voice services dependent on mains power. We are continuing to work closely with Ofcom and DSIT to ensure customers moving off PSTN remain protected as they move to IP-based voice services.

Question 1: Do you consider the measures in the proposed guidance relating to the resilience of the physical infrastructure domains to be appropriate and proportionate?

We broadly agree that the proposed measures on the resilience of physical infrastructure domains in Ofcom's guidance are appropriate and proportionate, however we set out below a number of comments on the detailed proposals.

Centre for the Protection of National Infrastructure (CPNI) guidance

- The third paragraph of the introduction section says *"Physical security of network infrastructure is also an important factor in ensuring network and service resilience. For further guidance on appropriate and proportionate measures to be taken, communications providers should refer to the Security Code of Practice".*

- Whilst we understand that the Security Code of Practice references out to the Centre for the Protection of National Infrastructure (CPNI) advice, it is primarily concerned with cyber security and not physical security. We therefore think it would be more appropriate for Ofcom's guidance to refer directly to the CPNI advice on physical infrastructure, rather than to the Security Code of Practice.

Section 4.2.3 on Core:

- "*Metro sites should have resilient connections to at least 3 other metro/core sites*".

In our view best practice would be connections to at least 2 metro sites, not 3 metro sites. It is unrealistic to expect providers to have connections to at least 3. BT's dual core network means that if a metro site has connections to two other core sites, it actually has 4 separate connections. There will be 2 connections to Site A with diversity and 2 to site B with diversity.

If the minimum number of other sites we connect to is 3, that means BT should have 6 connections, with diversity between each pair. This appears to be unnecessarily high for 'best practice'. We may of course elect to do this at specific sites for other reasons where appropriate but should not be required across the network.

- "*Power at core sites should include at a minimum: Dual resilient mains feed*".

  We would welcome further clarity on Ofcom's definition of "dual-resilient". Whilst we may have dual resilience mains feeds at some key sites, we do not have them across all sites. Local energy operators cannot reasonably provide dual feeds and serving a site from two different local transformers (for example) would be extremely challenging for over 100 locations. When exploring the implementation of dual-resilient mains feeds in the past, the costs have been extremely high.

- "*Core site locations should consider geo fibre route diversity and separation, geo hazards, extreme weather vulnerability etc, Be able to have power back up for at least 5 days*".

  While a provider may choose to have power back up for at least 5 days in some or all core site locations, Ofcom should maintain flexibility for providers to balance cost and risk at an individual site. It is more proportionate to state that a suitable minimum is at least 3 days power back up. Risks are limited as long as providers can deliver fuel to a site within 3 days.

Section 4.2.4 Internet Peering and Non-Internet Interconnection:

Ofcom should make it clear in its guidance that multiple geographically separate paths to third-party networks with appropriate capacity is not the only way to ensure general reliability of services, applications and content on a providers' network and beyond its network.

Ofcom's updated guidelines on Net Neutrality[3] states that providers can use ""*reasonable*" traffic management measures to contribute to an efficient use of network resources, ensuring appropriate capacity. And "*exceptional*" traffic management to preserve the integrity and security of the network or mitigate the effects of network congestion. We suggest that Ofcom acknowledges there are other methods to ensure there is sufficient capacity in the network in its final resilience guidance.

Question 2: Do you consider the measures in the proposed guidance relating to the resilience at the Control Plane to be appropriate and proportionate?

We broadly agree that the proposed measures in Ofcom's guidance are appropriate and proportionate, however we have the following specific comments:

Section 4.3.1 Control plane:

[3] Ofcom guidelines on Net Neutrality, Statement: Net Neutrality Review - Ofcom

We think the language in this section is too binary and should be reconsidered. Whilst we can seek to remove service impacts if one or more elements of special control functions fail/malfunction/overload, it is not possible to "*eliminate*" all services impacts or all possible failure modes.

We of course endeavour to build a resilient network to limit service impact, but if a provider were to lose for example BGP Routing, then the service cannot be supported and will fail.

Section 4.3.2 CPE/Device signalling overload

We agree it is important to protect our network against overload of the network authentication mechanism. We have historically seen risks arising, for example when widespread power outages generate mass re-authentication of CPE to the network, which can occur in fixed and mobile networks.

However, Ofcom's resilience guidance proposes that the CPE itself should be configured "*to prevent mass synchronisation of connection/reconnection attempts… to avoid signalling overload*". Controls embedded in the CPE are useful but potentially unreliable. The market for CPE is highly diverse and not all manufacturers follow best practice. Customers often opt to use third party CPE not provided by the communications provider, therefore communications providers will have very limited visibility or control of the CPE.

We believe the primary and most effective control that protects the network against overload in these instances should be at the network edge, rather than in CPE. This allows the communications provider complete control and visibility of mechanism such as traffic rate limiting. In addition, any assurance activity or standards should also be applied at the network edge.

We continuously work with industry and technical standards authorities to understand and implement best practice in both CPE and network controls, for example WiFi Alliance standards. We are also implementing the requirements of the Security Code of Practice for CPE.

Section 4.3.6 on DNS Resilience:

Ofcom should ensure that its guidance is future-proofed to allow for the development of new techniques in this space. For example, whilst we are currently in line with Ofcom's guidance and customer facing and infrastructure DNS is logically separated and protected, future models for DNS will likely move to shared cloud infrastructure and therefore will not be physically separate. We suggest that Ofcom acknowledges that it is likely there will be shared cloud infrastructure in the future.

Question 3: Do you consider the measures in the proposed guidance relating to the resilience of the Management Plane to be appropriate and proportionate?

We broadly agree that the proposed measures in Ofcom's guidance are appropriate and proportionate and have no further comments on this section.

Question 4: Do you consider the measures in the proposed guidance relating to communications providers' own managed services to be appropriate and proportionate?

We broadly agree that the proposed measures in Ofcom's guidance are appropriate and proportionate, however we have the following comments:

We wrote to Ofcom on 8 January 2024 to clarify the definition of CP-managed services, which is unclear in the draft guidance. The guidance includes a broad definition of services run by CPs independent of the internet as well as authentication/authorisation functions. There is a later definition that specifically refers to "mobile services" and "critical services". We welcome Ofcom's clarification of this requirement, posted on the Ofcom website on 9 February. We understand that this section considers that all specialised services are CP-managed services, but not all will require a high level of resilience – it is up to providers to run an assessment of the types of services that are critical and therefore require a higher level of resilience.

Section 4.5.2 QoS and Prioritisation mechanisms:

We would welcome additional clarity from Ofcom on what it expects from providers in this section of the guidance and whether it intends to follow the approach it has already set out in the Net Neutrality guidelines. The resilience guidance says:

"*The types of services and approaches mentioned in this section will typically be implemented with enhanced traffic prioritisation and failover/handover resilience mechanisms. This can only be done for a limited number of services due to limitations of scalability and complexity of these mechanisms, and increased cost often due to sacrificed efficiency.* "

The Net Neutrality regulations already require that when prioritising traffic for specific services, there is "*no significant detriment to the general internet*". Therefore, as long as this requirement is met there should be no issue with how many services that have enhanced traffic prioritisation.

Section 4.5.3 Resilience Mechanism and approaches:

We thank Ofcom for responding to our clarificatory question on the definition of "optimising under load". We welcome the confirmation that "under load" can include other testing such as connections-per-second or messages-per-second. We often do other things to test e.g with pilots or friendly users where we cannot test with load. There are many reasons that it might be able to be tested under load including a third party being involved e.g. our interconnect with other operators, technical limitations and funding.

Section 4.5.4 Network Slicing and Telco Cloud:

There appears to be an inconsistency between Ofcom's resilience guidance and Net Neutrality guidelines on whether 5G slicing is a specialised service.

The resilience guidance notes "*that services built using 5G network slices are expected to be considered 'Specialised Services'*". Whilst this may be true of some services, there will also be services outside the net neutrality rules for instance private networks (see Ofcom's Net Neutrality statement[4]).

In relation to Telco Cloud, whilst we agree that 'cloud-native' technologies are still evolving, we do not agree that these technologies cannot yet achieve a high level of resilience, security, scale and throughput.

BT has re-built its mobile Packet core network on a network "cloud", which is now live with the bulk of BT's mobile users and traffic. The cloud model opens up the possibility of new end-to-end architectures that enhance rather than undermine resilience. For example, our cloud model uses Container based network functions. We would urge Ofcom to amend the language in this paragraph "some" cloud technologies may not be mature enough to achieve a high level of resilience, but not all.

[4] Ofcom guidelines on Net Neutrality, See paragraph 10.110, p. 142 Statement: Net Neutrality Review - Ofcom

Question 5: Do you consider the measures in the proposed guidance relating to communications providers' arrangements for preparing for adequate process, skills and training to be appropriate and proportionate?

We broadly agree that the proposed measures in Ofcom's guidance are appropriate and proportionate, however we have the following specific comments:

Network Oversight Functions

We note in paragraph 5.2.2 and 5.3.2 of the guidance sets out the types of services or tools which are likely to comprise NOFs (Network Oversight Functions) as defined in the Security Code of Practice. We are surprised to see the types of services/tools listed in the guidance. The inclusion of these services/tools is inappropriate as it is for providers to define what their NOFs are and even the Security Code of Practice does not specify which services fall into scope.

We do not believe this should be included and suggest the draft guidance is amended to avoid the unintended consequence of expanding the scope of NOFs. We suggest Ofcom remove the list of services from the guidance.

5.1.1.5 Supplier Management

We agree that proper Supplier Management is critical and we have SLAs (Service Level Agreements) in place with our suppliers for the performance of the equipment and spares. We assess what is needed based on the requirements for reliability and take into account the quality of the equipment. This assessment is often completed via the contract and we rely on information provided by the supplier.

Where we do carry out testing, we take into consideration the elements set out by Ofcom in the bullet points of section 5.1.1.5 i.e *"Load performance and scalability. link/card/hardware failure detection and resulting failover performance/speed/stability (while under load), IP reconvergence speed and stability for each relevant IP networking protocol used in the network (while under load)*".

Proper testing does not need to include all of these activities for every piece of software, hardware or solution. Ofcom should amend its guidance to state clearly that whilst these are the types of tests that should be considered, but it is not appropriate for all of them to be conducted for each piece of software, hardware or solution.

5.1.1.2 Capacity Management

Ofcom's guidance includes the expectation that communications providers take capacity management measures to ensure any increase in scale is understood and planned in a timely manner, including building the capacity needed to maintain reliable service during significant network failures and high signalling load conditions.

We believe Ofcom's resilience guidance should recognise that decisions to increase capacity are a commercial choice and made alongside other measures to optimise existing network capacity such as traffic management or time-shifting of elastic traffic.

As outlined in Ofcom's own updated Net Neutrality guidelines[5], ISPs are permitted to use reasonable traffic management measures in order to mitigate congestion and exceptional traffic management to preserve the integrity and security of the network (e.g. in the event of loss of a core site).

[5] Ofcom guidelines on Net Neutrality, Statement Net Neutrality Review (ofcom.org.uk)

Further to this we'd like to highlight the issues with building capacity being the only answer to maintain reliable service:

- There is **significant cost** involved in increasing capacity, especially where this capacity is necessary to accommodate occasional "super-peaks", usually driven by Live TV events such as football coinciding with gaming downloads;
- In the case of super-peaks, investment in additional capacity is **inefficient**, as the capacity will go unused after the event, and with the right incentives, there may be other measures that can be taken to reduce the overall impact of the peak such as time-shifting software downloads and use of emerging multicast technologies

This creates a significant investment gap. Ofcom should, at the same time, promote reasonable behaviour by all actors as this will also maintain the resilience of the network. For further information regarding the cost of increasing capacity for future traffic demand and in particular Live TV traffic, we refer to our responses to Ofcom's 2022 Consultation on Net Neutrality and Ofcom's 2023 Call for Evidence on the Future of TV. [6]

5.2.1.1 – Change Management

We suggest that the first bullet in this paragraph should be amended from :

"*Is the impact of the change understood? E.g. has it been tested in a representative environment at full load?*"

to

"*has it been load tested in a representative environment?*"

It is not possible to test at "full load" in a representative environment, as it is by definition 'representative' of all subscribers.

5.3.1.1 – Network control plane monitoring

Whilst we can accurately identify in most cases how many subscribers we expect are impacted during network or service fault, there is a well-known challenge when it comes to voice. We can predict (based on previous usage data and how many short connections there have been during the outage) how many customers have attempted to make a call during an outage.

However, some of these may have connected and others may have dropped. In addition customers may have mis-dialled, received a busy tone, or pocket called, which shows up as a call failure. Therefore, whilst we can be as accurate as possible, we cannot provide exact numbers. We would welcome Ofcom's recognition of this in its final guidance.

5.3.1.2 – Network User-Plane Monitoring

Whilst Ofcom can expect network user-plane monitoring from providers, this type of monitoring is not essential for capacity planning. We constantly monitor throughput of the user-plane across the network and it is used for capacity planning, along with other metrics and tools such as CPU (Central Processing Unit), threshold alarming, anomaly detection, automated KPIs with alerting.

However, user-plane monitoring for packet capture and more detailed and forensic analysis may not be used in all parts of providers networks. Whilst it does it does give a richer view of capacity planning it is not realistic or proportionate to expect that this is in place across the whole network.

[6] BT response to Ofcom's consultation on Net Neutrality BT (ofcom.org.uk)

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