



**Ofcom consultation on Wholesale Voice Markets
Review 2021-26**

TalkTalk submission

October 2020

NON-CONFIDENTIAL VERSION

1 Introduction

- 1.1 This is TalkTalk Group's response to Ofcom's Wholesale Voice Markets Review 2021-26 published on 13 August 2020.
- 1.2 The response includes comments on Ofcom's proposals in relation to Wholesale Call Origination, Wholesale and Mobile Call Termination and interconnection. We broadly agree with Ofcom's proposals but make some recommendations for modification, particularly in relation to the regulation supporting BT's transition to IP interconnection. We also include comments on call categories that will be affected by the migration to IP, which are not included in the consultation and should be considered when Ofcom makes its statement.

2 Wholesale Call Origination

- 2.1 Ofcom considers Wholesale Call Origination (WCO) at section 4 of its consultation.
- 2.2 Ofcom proposes to define the product market for WCO as wholesale services which enable voice calls over a narrowband network (WFAEL, ISDN2 and ISDN30). It proposes not to include either calls made from mobile phones or calls made using OTT services such as Whatsapp, despite falls of 26% in fixed line call volumes since 2017; an increase in mobile call minutes of 5% (representing an almost equal number of minutes to the fall in fixed call volumes) over the same period; and the proportion of people using OTT voice services rising by a fifth. It proposes to do so primarily because of rises in the price of fixed line voice services, at the same time as the price of mobile voice minutes has declined. TalkTalk notes that this is a somewhat narrow evidentiary basis for concluding that fixed voice is not constrained by mobile voice, and that it would be helpful if Ofcom adduced more evidence to support its position in this regard.
- 2.3 TalkTalk agrees that a geographic market comprising the whole of the UK apart from the Hull Area (£4.25) is appropriate.
- 2.4 TalkTalk also agrees that the three-criteria test for WCO regulation is not met. The market is clearly becoming much more competitive over time, as the competitive pressure from mobile and OTT services increases, and barriers to entry are falling due to technological change, leading to a realistic prospect of effective competition within the review period.
- 2.5 As such, TalkTalk agrees with Ofcom's proposal not to impose regulatory remedies on WCO in the forthcoming period.
- 2.6 While not within the scope of this review, TalkTalk notes that over the next few years, SOTAP will come to be used in the market as WFAEL, ISDN2, and ISDN30 are withdrawn, and as unbundled networks are rationalised leaving gaps in MPF provision. TalkTalk considers that Ofcom should carefully monitor the introduction of SOTAP as part of its ongoing consideration of adherence to WVMR remedies and should launch a supplementary review of SOTAP if it emerges that the shift to SOTAP is causing consumer harm.

3 Fixed line Wholesale Call Termination - domestic

- 3.1 This section responds to Ofcom's assessment of fixed line wholesale call termination (WCT), as set out in sections 5 and 6 of Ofcom's consultation.
- 3.2 TalkTalk agrees with Ofcom's market definition for WCT:
- Ofcom is correct that there will be minimal demand-side substitution in the case of a SSNIP being imposed on a provider's WCT charge (§§5.8-5.11) because a 10% increase in WCT charges will have an immaterial impact on the costs of a telecoms bundle (§5.17);
 - TalkTalk agrees that different lines should be aggregated together for analytical purposes, as they face similar competitive conditions (§5.13-5.14, 5.19);
 - Ofcom is correct that competitive conditions in mobile and fixed line termination differ, and so fixed and mobile should not be aggregated together for market definition purposes (§5.21);
 - it is appropriate to define the market in relation to the number range holder (§5.22).
- 3.3 As such, Ofcom at §5.24 reaches the correct market definition for WCT.
- 3.4 For reasons similar to those in MCT markets, it is clear that, given the market definition, each range holder holds SMP. In particular, this is driven by their 100% market share, the impossibility of entry, and the lack of any countervailing buyer power from purchasers of WCT.
- 3.5 TalkTalk agrees with Ofcom's proposed remedies in WCT markets:
- it is appropriate for Ofcom to impose a requirement on suppliers of WCT to allow network access on fair and reasonable terms (§6.8);
 - it is appropriate for Ofcom to remove the largely redundant requirement to notify changes in termination charges (§6.12);
 - it is appropriate for Ofcom to set a price cap for WCT charges (§6.14).
- 3.6 TalkTalk also agrees with Ofcom's proposal to set the level of the charge control based on its 2017 estimates, adjusted for inflation (§6.21). This is despite the fact that this earlier charge control was based on an inappropriately high estimate of the cost of capital. This is because it would involve a disproportionate level of effort on behalf of both Ofcom and CPs to refine the charge control on WCT so that it was a more cost reflective, lower, level. Most CPs are broadly balanced in inbound and outbound traffic, and WCT rates are very low, so even a 10% change in interconnect rates would change CPs' net profits from WCT by a negligible amount.
- 3.7 Ofcom is right to impose additional remedies on BT, including most importantly the requirement not to unduly discriminate in its provision of WCT. Without this requirement, BT would have both the ability and incentive to discriminate to favour or harm other operators, due to its large share of controlled numbers. This could, for example, be used as a punishment strategy to encourage other operators not to compete too aggressively against BT, or to deter entry in related markets where BT/ Openreach holds a dominant position.

TalkTalk therefore considers that the requirement not to unduly discriminate should be retained.

4 Mobile Call Termination - domestic

4.1 This section responds to the elements of sections 5 and 6 of Ofcom's consultation which deal with mobile call termination ('MCT').

Market definition and market power

4.2 TalkTalk agrees with Ofcom's market definition for MCT:

- we agree that a SSNIP in the price of MCT would represent a very small proportion of the average bundle price, and that as such it is unlikely that there would be a meaningful amount of demand-side switching, due to the MCT price increase (§5.27). We agree that it is unlikely that switching to OTT services would be sufficient to make a SSNIP unprofitable given the small size of this increase (§5.28);
- we agree that there is in principle a separate MCT market for each mobile number, but that they can be aggregated for analytical purposes (§5.30);
- we agree the market definition should include calls to UK mobile numbers originated internationally or calls to mobile numbers while customers are roaming abroad (§§5.34-5.35)
- we agree that the geographic market is the area in which the provider offers termination services (§5.31).

4.3 TalkTalk agrees that each number range holder has SMP over the numbers it controls:

- Ofcom is correct that each range holder has a 100% market share in the defined market (§5.43);
- Ofcom is correct that barriers to entry are high; in fact, if anything Ofcom understates the barriers to entry, as TalkTalk considers that there is no realistic prospect of any entry at all, as allowing entry would be commercially irrational (§5.44);
- TalkTalk agrees that there is no scope whatsoever for countervailing buyer power, due to the inability for operators to stop purchasing from operators which set high MCTs without incurring a disproportionate loss of customers (§5.45).

4.4 TalkTalk also supports the remedies proposed by Ofcom in the various MCT markets controlled by number range holders:

- Ofcom is right to impose an obligation on all network operators to provide network access on fair and reasonable terms (§6.34). In the absence of such a requirement, some operators could refuse to deal in order to harm their competitors, particularly when larger operators with a significant customer base deal are approached by smaller operators for access. MNOs might also tacitly collude to deny network access to entrant mobile operators, effectively removing the competitive threat arising from their entry;

- Ofcom is also correct to impose a charge control on MCT rates. This reflects the SMP which each number range holder has, and the scope which operators would therefore have to set termination rates well in excess of efficient costs.

- 4.5 As regards the level of the MCT price cap, TalkTalk agrees that the correct approach is to set MCT price caps at the LRIC (\$6.44). It is appropriate not to provide mobile operators with an allowance to reflect a share of common costs within MCT rates; this provides the most high-powered incentives for mobile operators to act to reduce their cost base, as otherwise operators might be concerned that any cost savings would at least partially be clawed back through lower MCT rates in future years. Ofcom is also correct to focus on reducing barriers to entry by lowering MCT rates, which historically were set well in excess of costs. The costs of a mobile network should be recovered from the customers of that network, rather than distorting competition by being recovered from other firms' customers. This remains the case even if it leads to slightly higher charges for outbound calls or monthly charges for operators which are forced to reduce their MCTs due to price regulation.
- 4.6 Ofcom should continue to review whether a 'bill and keep' arrangement for MCTs would be efficiency enhancing (\$6.46). Such an approach has the potential to reduce transaction costs in the telecoms industry, by removing administrative costs arising from operators having to bill each other for termination rates. Given that there is a substantial externality benefit to call recipients from being able to be contacted, it is entirely plausible that the externality is higher than the termination rates which Ofcom is now proposing. Such a bill and keep regime merits further study by Ofcom, rather than being dismissed in a single paragraph as in Ofcom's current consultation. TalkTalk disagrees that a bill and keep regime will necessarily be agreed between operators even if it is efficiency-enhancing at an industry level; there will be incentives for any operator with significantly more inbound than outbound calls to hold up such an agreement, and operators may refuse to agree bill and keep arrangements in order to raise rivals' costs, even in cases where the impact on that operator's own profits from bill and keep is slightly positive, because it fears cost savings across the industry will be passed on to consumers.
- 4.7 TalkTalk agrees that it is appropriate for Ofcom to use its own MCT model, rather than the pan-European model being developed by the European Commission, as by doing so Ofcom is likely to be able to generate more accurate estimates of the costs of mobile call termination to a UK number range holder.
- 4.8 TalkTalk in general supports the methodology adopted by Ofcom to estimate MCT charge controls. However, we are concerned that Ofcom has adopted an excessive WACC estimate in the calculation of its charge control, and has failed to reflect adequately the changes in risk free rate and the cost of debt which have been seen in UK financial markets in recent years:
- Ofcom should adopt a debt indexation approach for its cost of debt allowance, with a single allowance covering both new and embedded debt. This would improve the consistency of Ofcom's approach with that of other regulators, supporting regulatory certainty;
 - Ofcom's proposed nominal RFR is radically divorced from market evidence and the approach of other regulators. In its RIIO-2 proposals, Ofgem sets out an estimated real RFR of -1.48% (Table 9)– a figure nearly 1% below that proposed by Ofcom once

2% CPI is taken into account. TalkTalk considers Ofcom's estimate of the RFR to be untenable and legally unsustainable in light of market evidence. Ofcom should reconsider its proposals in this regard; ideally it would use an approach aligned with that of Ofwat and Ofgem, leading to significant reductions in the RFR.

- 4.9 Ofcom's proposed wedge between RPI and CPI is excessive, and poorly justified compared to the approach adopted by other regulators. Ofcom should adopt the same approach as Ofgem, which in its RIIO-2 proposals has set a wedge of 0.813%, in line with OBR forecasts for 2024.
- 4.10 Ofcom should reduce its estimate of the nominal expected market return (EMR), which has been proposed as being increased without any justification being provided. Ofcom's nominal EMR estimate is above the top end of the range set out by Ofgem in RIIO-2, where a real range of 6.25%-6.75% was proposed. In the absence of any specific evidence regarding the EMR, Ofcom should seek to ensure regulatory consistency by adopting a point from within the range set out by Ofgem.
- 4.11 Other than the changes to the WACC, which Ofcom can easily make without the need for significant additional work, TalkTalk agrees with Ofcom's argument at §6.57 that the additional accuracy provided by a more detailed modelling exercise would be insignificant, and involve disproportionate effort on Ofcom's behalf.
- 4.12 TalkTalk therefore supports the ranges for the MCT set out in Table 6.2 of the consultation, but considers that the point estimate chosen from within the range should be lower, reflecting the lower cost of capital which Ofcom should adopt in order to be consistent with market evidence and with other UK regulators.

5 Call termination - international

- 5.1 Ofcom proposes a somewhat different set of remedies on the termination of international calls from those on domestic calls (§§6.62-6.102). This section therefore deals with Ofcom's remedies proposal in this regard.
- 5.2 TalkTalk agrees that, in principle, the best approach for UK consumers would be for there to be low termination rates in both directions, and in particular there would be improved outcomes if overseas telecoms operators charged lower rates to UK telecoms providers. However, we suggest that the following factors require further consideration by Ofcom and industry prior to implementation:
- How the new rule would apply to negotiating agreements with transit carriers; and
 - The risk of international providers making it appear as if calls originated from a different country in order to access a lower reciprocal termination rate from a UK operator.

6 Interconnection

- 6.1 This section addresses Ofcom's proposals for interconnection set out in Section 7 of its consultation.
- 6.2 We agree with Ofcom's proposal to apply specific interconnection remedies to address BT's SMP in the WCT market. In particular, we support the proposal to introduce regulation of BT's IP interconnection services given that BT will be migrating to an IP-based network during the market review period in preparation for the withdrawal of its TDM network.

Non-pricing remedies must be retained for TDM interconnect, and introduced for IP

- 6.3 As Ofcom proposes, it should continue to require BT to deliver the following in relation to interconnection and accommodation: provide network access on reasonable request; not to unduly discriminate; to publish a Reference Offer; to give 56-days' notice of any changes to charges and to publish KPIs in relation to quality of service (QoS). We agree that these remedies must also extend to IP interconnection and accommodation as well as TDM.
- 6.4 We note that Ofcom has asked for evidence about the residual scope for BT to unduly discriminate given the other remedies it is proposing. We maintain that the 'no undue discrimination' requirement is still needed in relation to interconnection and accommodation to prevent BT from discriminatory practice between other providers.
- 6.5 We support the continuation of the QoS KPIs for BT's provisioning of TDM interconnect services and the proposal to introduce a broadly comparable set of KPIs for IP interconnect. Ofcom's proposed set of KPIs for IP interconnect appears to be reasonable.

Transparency requirements must apply for BT's migration timetable

- 6.6 Ofcom has proposed transparency requirements in respect of BT's timetable for migration of its number blocks from TDM to IP in recognition of the potential distortion to competition that would arise from uncertainty or unexpected changes to its plans. The proposal to require BT to give 12-months' notice of migration from TDM interconnection at the DLE to IP interconnection, and to give 90 days' notice of any postponement of the migration date, is in line with the expectations we set out in response to the 2019 consultation. This is a large transformation project for BT and TalkTalk. We need long term planning to ensure we have resources and capacity in place to design, provision, execute and test the migration. We note that Ofcom proposes 30 days' parallel running of the FTR on TDM and IP from the date of migration and suggest that this should be extended to 90 days to account for the risk of operational delays affecting CPs' ability to migrate within a narrow time window. Operational delays could arise from BT's readiness to accept new IP traffic, data freezes over business critical periods, prioritisation of other technological change and contracting with third parties (e.g. the removal of physical equipment, which could be affected by COVID-19).
- 6.7 Ofcom implies that BT will redesignate its number blocks on a DLE-by-DLE basis. We consider that migration by DLE should be more explicitly incentivised by the regulation to ensure CPs do not face a situation where they have to maintain TDM interconnection within a DLE area or "DLE Grouping" if only a proportion of the number blocks have been migrated

to IP within that “DLE Grouping”. We consider that this could be achieved by applying the FTR on IP interconnection for all the number blocks within a “DLE Grouping” from the day the first DLE in that “DLE Grouping” has its number blocks migrated. We believe that this will support more efficient migration by BT overall.

- 6.8 We agree with Ofcom’s proposal that BT should be required to consult with industry on the timetable and the information provided to support orderly migration. Ofcom suggests that BT should consult by 1 April 2022 at the latest and publish its timetable by 1 June to begin migration in early 2023. Given Ofcom’s proposal to require BT to give 12 months’ notice of migration, we think that it would be more appropriate for Ofcom to require it to consult by 1 October 2021 at the latest and publish its timetable by 1 January 2022.

Ofcom should set charge controls as if BT’s migration to IP is complete from 1 April 2023

- 6.9 Ofcom sets out at §§7.83-7.94 a set of proposals around the switch over from TDM to IP delivery of voice calls to BT. In particular, it proposes that from 1 April 2025, all calls should be charged for as if BT’s migration to IP was complete, even if some DLEs remained on TDM, and there should no longer be media conversion charges imposed on CPs providing IP voice traffic to BT. It justified the choice of 1 April 2025 as an appropriate date on the following basis:¹

...a lack of a gradual, managed migration is likely to result in unnecessary costs to BT, and at the extreme may have an impact on the stability of BT’s network, to the detriment of customers.

This is because if BT had to provide WCT from an IP POC for all numbers from the 1 April 2021, a lot of telecoms providers would be likely to switch all of their interconnections to BT’s IP network ahead of BT’s end-user migration. BT would in turn have to convey an increased amount of calls between its TDM and IP networks. In order to deal with this increase in calls conveyed to its IP network, we expect BT would have to invest in extra media conversion capacity in the short-term, which would become immediately redundant after BT’s migration is complete.

Furthermore, there is a risk that an upsurge in traffic between BT’s IP and TDM networks could cause network congestion, leading to call failures and, in the extreme, to destabilise BT’s voice network. In a recent submission, BT has highlighted the risk of a significant impact on overall service due to the potential for network congestion.

- 6.10 Effectively, therefore, Ofcom seeks to argue that a date earlier than 1 April 2025 would risk swamping the available capacity of BT to deal with such traffic, either requiring increased—and subsequently stranded—investments, or leading to a meaningful reduction in quality of service to consumers.
- 6.11 However, Ofcom has presented no specific evidence that deals with the capacity of BT’s network to handle IP calls, which is the appropriate evidential base to determine the correct

¹ Consultation §§7.87-7.89

date by which BT should be able to handle all call traffic being delivered as IP traffic, without needing to invest in additional media translation capacity.

- 6.12 There are two considerations which mean that over time BT will have the ability to absorb an increasing proportion of the total voice traffic as IP-delivered.
- 6.13 Most importantly, the number of minutes delivered to UK geographic numbers each year is falling rapidly. Ofcom’s Communications Market Report 2020 sets out the number of annual minutes as follows:

Table 1: Annual call minutes to UK geographic numbers (bn)

	2013	2014	2015	2016	2017	2018	2019
UK geographic mins	61.3	54.3	48.2	41.7	34.4	31.2	26.2

Source: Ofcom Communications Market Report 2020

- 6.14 That is, over the past five years, the number of annual call minutes has halved, falling by 16% between 2018 and 2019 alone. [§]. If anything, the shift, related to Covid, to video calling apps such as Teams and Zoom is likely to exacerbate the rate of decline of voice minutes to landlines. Similarly, increased working from home is likely to diminish voice traffic to business premises, as employees move to being contacted on their mobile devices, and businesses question the need to retain desk-based telephony and its associated costs.
- 6.15 Secondly, BT is itself extending its IP network over the intervening period as DLEs are moved to taking IP traffic. This means that the total number of minutes of TDM traffic will in any case be reducing over time, gradually lowering the risk that BT’s network will be overwhelmed by an influx of IP traffic, as there is a decreasing volume of TDM traffic remaining. Ofcom itself makes this point in §7.92 of its consultation.
- 6.16 The impact of the first of these two developments is substantial. TalkTalk has estimated that by some point in the calendar year 2022, BT will have sufficient media translation capacity to take voice traffic for all remaining TDM exchanges without a need to undertake further investments. The exchange migration programme, which is due to commence in early 2023, will provide a further capacity margin. If Ofcom wishes to assert that BT will incur additional costs as a result of having to receive all traffic as terminating on IP then it should provide evidence for this, rather than simply asserting it. We note that CPs have already funded a significant proportion of BT’s existing media translation capacity via IPEX usage charges, while also investing in their own.
- 6.17 As such, Ofcom should amend its proposal such that it will set charge controls as if BT’s migration to IP is complete from 1 April 2023. We estimate that this should leave BT with substantial excess media translation capacity even with an immediate shift of all TDM traffic to IP delivery. In reality, there will not be an instant switch of all traffic, which will take some time to complete, providing further time for voice traffic to decline and BT’s shift to IP exchanges to roll out.

Pricing remedies

- 6.18 Ofcom proposes to maintain the existing charge control in relation to TDM interconnect circuits at the DLE until 1 April 2025 or one month from when the FTR is moved to IP. We consider that the charge control should apply to TDM circuits at the DLE until 1 April 2025, alongside our proposal to make the FTR available on IP from 1 April 2023. As noted above, we consider that the period of parallel running of the FTR on TDM and IP (following BT migrating a number block to IP) should be extended to 90 days and therefore argue that the charge control on TDM interconnect circuits should apply up until this point too. We agree with Ofcom’s proposal to maintain the current charge control design as far as possible.
- 6.19 Ofcom proposes to apply a fair and reasonable charges obligation for IP interconnection and accommodation prior to applying the FTR on IP and prohibiting additional charges for media conversion and conveyance. We agree that regulation is required to prevent BT charging excessively for the IP interconnection and accommodation services required to obtain the FTR prior to completion of BT’s migration. Given the relatively short period before the FTR will apply on IP, especially if our proposal to bring this forward to 1 April 2023 is adopted, we agree a fair and reasonable obligation, with guidance, is more proportionate than setting detailed charge controls.
- 6.20 We have the following comments on the proposed guidance:
- We cannot foresee circumstances in which BT will bear greater costs for set-up and interoperability testing than other providers, as referred to at §§7.111 – 7.112. We therefore consider that the guidance on these charges should be limited to the principle that both parties should bear their own costs without the need for the exchange of charges as set out at §7.110. If Ofcom wishes to include guidance on circumstances where BT bears greater costs than the other party for set-up and interoperability testing, it should provide specific examples of when this situation may arise.
 - Similarly, we expect that both BT and other providers will bear interconnect port costs and therefore do not consider it is necessary for BT to levy charges for any additional costs, as envisaged at §§7.113 -7.119. We suggest the guidance should be amended to indicate that each party should bear their own costs without the need for the exchange of charges.
 - We welcome and agree with Ofcom stating its expectation that BT will have “to revise some of the terms, conditions and prices of its IPEX services for regulated services, at the minimum, in relation to IP interconnection charges” (§7.128). Importantly the principle of reciprocity should apply as a baseline for all IPEX services, not just those affected by regulation. Specifically, Ofcom should stipulate in the guidance that BT must discontinue its current IPEX pricing practices that do not conform with this principle. [§<].

Other call scenarios

- 6.21 The move to IP provides an opportunity to simplify and streamline call routing and termination arrangements between networks and the commercial arrangements that underpin them. The transition should support the removal of distanced based charging and

any complicated billing arrangements with BT (e.g. Element-Based Charging) that will become redundant.

6.22 Ofcom's consultation addresses the transition risks for CPs associated with making calls to BT customers on geographic number ranges that belong to BT as it migrates its voice service from TDM to IP. TalkTalk considers that the following call scenarios (relating to non-geographic calls and calls to ported out numbers) also require consideration by Ofcom in order to prevent adverse impacts on CPs and their customers:

[REDACTED].

6.23 [REDACTED].

6.24 TalkTalk also notes that the approach of recipients paying for transit costs of NTS ingress traffic differs from other types of non-geographic traffic, such as traffic to 03 numbers, where the originator pays all of the costs of the call, and recipients pay none.

6.25 As such, TalkTalk considers that to avoid inefficient retention of DLEs by operators such as TalkTalk, and to ensure regulatory consistency between similar types of traffic, Ofcom should amend its regulation such that following the migration of a number range to IP but when some BT customers within the number range remain on the DLE as they have not yet migrated to voice services over IP:

- all of the costs of NTS traffic (excluding freephone) are paid by the originating party (call scenario (a)). This should lower industry costs overall and will also provide improved incentives for BT to migrate all customers within a number range to IP as expeditiously as possible;
- The same principle should apply to calls by BT customers to BT number ranges ported out to non-BT customers (call scenario (c)); and
- Calls by non-BT customers to numbers ported out to BT from other operators should be charged at the FTR (call scenario (b)).

Other

6.26 We agree with Ofcom's assessment that, for telecoms providers other than BT, no specific interconnection remedies are required beyond the network access condition that requires these providers to enable access on the basis of fair and reasonable terms, conditions and charges.

Technical standards for IP interconnection

6.27 This sub-section addresses Ofcom's proposals for technical standards for IP interconnection set out in Section 9.

6.28 TalkTalk supports the development of the NICC IP interconnection standards to ensure interoperability, reliability, and call quality, as industry transitions fully to IP networks. We note that the standards have not yet been agreed and that these standards must stipulate a

single consistent approach to IP interconnection to be effective. We would encourage Ofcom to make this point clear when endorsing the standards in its Statement.

- 6.29 We agree with Ofcom's proposal to issue guidance to encourage and incentivise the use of the NICC IP interconnection standards, rather than mandating a full set of standards. However, we consider that there is a case for mandating standards for Network to Network interfaces, while allowing variance for User to Network interfaces to enable the use of different customer equipment. Common standards for Network to Network interfaces are required to ensure interoperability across networks and limit the risks of call failure. It will also minimise the impact of moving to VOIP on services which are dependent on the reliable throughput of DTMF tones.
- 6.30 We consider it is appropriate to give providers the flexibility to adopt different options across User to Network interfaces if they wish but set the expectation that they would bear any additional costs associated with deviating from the NICC IP interconnection standards.