

BT welcomes the chance to respond to the Ofcom consultation on Next Generation Networks (NGN).

BT supports a number of the Regulator's broad proposals put forward in the document, including the views that the design of BT's NGN, its 21st Century Network [21CN], should not be a matter for Ofcom and that, where possible, industry agreement on the implementation of next generation networks be reached through commercial negotiation across the industry, rather than through regulatory intervention.

BT also strongly supports Ofcom's acknowledgement that any businesses considering NGN investments will require regulatory certainty on the potential to realize commensurate financial returns on those investments before making major capital commitments. Indeed, this will be a critical consideration when the BT plc Board meets to approve the 21CN business case.

It is clearly appropriate that the industry regulator should be involved at an early stage of development of the next stage of infrastructure development, given the strategic significance to the UK of ensuring that a series of world class, interlinked, networks are in place.

Telecommunications is fundamental to today's society and economy. The availability of advanced secure communications services provides the heartbeat for any modern society and economy, and networks are a vital part of any nation's infrastructure.

BT's 21CN programme is set to put the UK at the forefront of innovation worldwide, releasing the full potential of next generation communications services to improve the quality of people's personal and professional lives - through better access to information. 21CN can also support the delivery of e-government services, including, for example, the enablement of on-line healthcare and education.

21CN has the potential to fuel the UK the economy and to foster an environment where associated investments and innovation cluster around it, while the availability of advanced next generation services enabled through 21CN can support the work of those institutions tasked with retaining and attracting inward investment to the UK economy, and the jobs, the opportunities and wealth that that investment would bring.

21CN has been designed to make British businesses more competitive in the global marketplace, and more flexible because of the inherent flexibility that integrated, seamless next generation services will afford corporate and small and medium-size businesses alike.

However, BT would express the concern that BT's version of the NGN is at such an early stage of development that many of the fundamental questions posed here simply cannot be answered with certainty yet.

We would suggest that this Consultation should be seen as providing helpful input to the discussion which is currently underway between BT and all areas of the industry as denoted by the Consult21 process, and that Ofcom will wish to return to these areas at a slightly later stage as the industry and BT's shared understanding grows and it is possible to make informed judgements.

Further, BT would suggest that this would enable Ofcom to make a better assessment as to whether some aspects of the regulatory regime it appears to be moving towards will be appropriate as that greater understanding emerges.

In particular, as the industry and BT digests Ofcom's new principles and as these are confirmed by the outcome of the Telecoms Strategic Review, Ofcom may wish to review these against the approach it is taking to potentially regulating NGNs and consider whether it will be appropriate to contemplate regulating a new technology in an increasingly competitive market.

In particular, Ofcom may wish to reflect on whether the imposition of a complex regulatory regime, as is implied in this Consultation and at odds with its stated intent for commercial industry agreement where possible, will meet one of its key principles of promoting a favourable climate for efficient and timely investment, that will stimulate innovation, by ensuring a consistent and transparent regulatory approach.

Finally BT observes that some key aspects of the strategic positioning, NGN access and interconnect, are not addressed in Ofcom's questions. We wish to point to the following specific points.

1. We would expect that NGNs will blur many of the boundaries all of us in the industry currently take for granted. For example, the distinction between "operators" and "service providers" will diminish; and one could foresee an increase in pan-European alternative providers leveraging their IP infrastructure using next-generation interconnection more effectively. Further, as the barriers to market entry are lowered through technology advances and open standards, we would expect many new entrants to change the landscape - some with innovative value propositions and others by identifying and exploiting new arbitrage angles.
2. We believe end user customers will soon demand seamless, 'any to any' interworking between mobile and fixed networks. Operators will require the ability to roam on, and interconnect to, other national and international fixed and mobile networks in order to facilitate the provision of next generation services. The regulatory regime needs to become more technologically neutral and focus on economic bottlenecks, irrespective of the underlying network technology.
3. We believe that innovative services will be heavily reliant on intelligent interworking to provide coherent services. Therefore, cross platform access (including roaming and interconnect) to intelligence capabilities will be essential in ensuring further development of services and competition in the convergent marketplace.
4. BT is disappointed to see the level of potential regulatory intervention and micromanagement, both in commercial and technical terms, demonstrated in this Consultation. This is particularly inappropriate as it followed so soon after the second phase of the Telecoms Strategic Review, which promulgated a deregulatory agenda and a focus on regulating only

bottlenecks. This Consultation also includes some substantive inconsistencies of approach which will need to be addressed.

5. It is critical that the outcome of this - and any later - consultation processes should be a regulatory regime which rewards investment and does not leave BT with a significant proportion of the 21CN investment risk,, whilst distributing the investment returns across the industry. Ofcom will wish to consider this issue as they contemplate the responses to the Consultation.

1. What are your views on the potential for competition based on access at different geographic levels (local/metro/core) and the way this may vary depending on geography?

BT is of the view that the distinction between the economic terms of access and core are wholly arbitrary and must not be set out by regulatory intervention. Different operators may choose very different network architectures in any case.

The advent of 21CN for BT will necessitate a very clear and unambiguous framework of cost-oriented tariffs in which the developments in the industry of the last two decades are fully represented. The nature of the products, the tariffs and the network architecture are inextricably interlinked.

In the Consultation (and the Strategic Review) Ofcom appears to take a particular stance which revolves around the potential for industry demand at the MSAN to delineate economic market boundaries and regulatory intervention. BT does not share Ofcom's assessment on this matter and we will respond in detail in the Strategic Review.

2. In what areas might regulatory withdrawal be feasible if 21CN enabled the delivery of improved equivalence, including 'equivalence of inputs'?

It is the existence or otherwise of Significant Market Power (SMP) which determines whether or not regulation may be warranted. Equivalence is proposed in Ofcom's Strategic review as a remedy for SMP. BT expects that the execution of Ofcom's strategy and adherence to the principle of regulating only at the deepest feasible point in networks will lead to substantial deregulation of all but a small number of access bottlenecks which competition is unlikely to replicate in the medium term.

3. What opportunities are there for generic access products to enable withdrawal of regulation from existing service specific products?

BT believes that the principles set out in the second consultation of the Strategic Review for withdrawing regulation are the appropriate way forward. Regulation should be focussed on bottlenecks, which will allow a reduction of interventions elsewhere in the value chain.

4. What approaches should be considered for focusing regulation on enduring economic bottlenecks?

Regulation should be focused on a limited number of points where replication is unlikely to be economic over the medium term: i.e. enduring economic bottlenecks. The delivery of equivalence at these points should then allow the removal of access regulation downstream of the bottleneck.

The current position of regulated products at multiple points in the value chain makes it difficult to establish the deepest point at where competition is sustainable. There are limited incentives for players to invest in their own infrastructure since they can purchase inputs at a low regulated price with relatively little risk.

We also believe there is a role for Ofcom to establish a clear regulatory trigger that would set out the terms for withdrawal or imposition of regulation. This would send a signal to both facilities and service-based competitors regarding how regulation will respond to market conduct, thereby establishing consistency between regulatory and business strategy. Further, this would provide an incentive for investment to be made at the deepest infrastructure level at which competition is sustainable with the market revealing this point, rather than the regulator trying to second guess it.

5. What principles should Ofcom adopt in order to promote a favourable climate for efficient and timely investment by all operators in Next Generation Networks?

- 1 Ensure that any 21CN regulatory decisions are congruent with the Strategic Review principles:
 - a. promote competition at the deepest levels of infrastructure where it will be effective and sustainable;
 - b. focus regulation to deliver equality of access beyond those levels;
 - c. as soon as competitive conditions allow, withdraw from regulation at other levels;
 - d. promote a favourable climate for efficient and timely investment and stimulate innovation, in particular by ensuring a consistent and transparent regulatory approach;
 - e. accommodate varying regulatory solutions for different products and where appropriate, different geographies;
 - f. create scope for market entry that could, over time, remove economic bottlenecks; and
 - g. in the wider communications value chain, unless there are enduring bottlenecks, adopt light-touch economic regulation based on competition law and the promotion of interoperability.
- 2 Where applicable, technical standards will comply with the requirements of international standards bodies, or cross-industry bodies in the UK, where standardisation is required ahead of the timescales delivered through international bodies.
- 3 BT commits to two-way equivalence in systems and access to components in the SMP elements of the core 21CN network, between operators and BT's downstream businesses
- 4 Unless there is a clear tie to a persisting SMP or future bottleneck obligation, the working assumption is that any new downstream product or service is free of SMP obligations at the downstream level
- 5 Any changes to existing tariff arrangements of persisting SMP products will be made with full consultation among Ofcom, industry, and BT.
- 6 BT will cease the parallel running of its 21CN and current network technology only after consultation with industry and Ofcom. BT will recover all associated costs, spread across users of both new and old technology, but with a bias towards rewarding those choosing to take up the new network technology faster. In order to incentivise BT, the costs of the legacy platforms will only be recovered up until the agreed closure date
- 7 Regulated prices for 21CN-derived products will be cost-related and reflect an appropriate risk premium.

6. Do you think there may be demand for products offering access at the MSAN in addition or as an alternative to LLU? Are there relevant issues other than LLU migration processes and enabling backhaul competition?

In BT's proposed 21CN architecture, the MSAN is an access aggregation point in which the only organic altnet access would be the copper wire bundle used to interconnect frames for LLU.

Demand for access products at the MSAN will be predicated on the cost of such functionality. In the case of the PSTN voice service, the media, control and management planes are all

affected; in the case of broadband services, only the media and management planes are affected.

Given industry interests in exploring interconnect at the MSAN level; however, BT has agreed to explore with industry the platform implications of 'MSAN interconnect' so as to inform product working group discussions. A meeting was held on 10 January to reach a shared understanding of: possible architectures, platform implications and indicative cost impact on products and discussions will continue.

7. What is the potential impact on LLU operators and competition in broadband access of the widespread availability of broadband dialtone?

"Broadband Dialtone" was announced by BT as a target for on-demand broadband delivery in some 5 years time. As it is a vision without detailed planning and design behind it, there is no impact to LLU operators and competition at present; speculating on potential impact at this stage is premature.

8. Is it likely to be sufficient for LLU operators to have 'near-equivalence' compared to broadband dial tone, and if so, how short must provisioning timescales be?

BT's aspiration for on-demand broadband in the future is a vision for the entire industry. BT recognises that it will have a part to play in ensuring reasonable equivalence for LLU operators as this vision takes shape in the coming years.

9. What is the shortest provisioning timescale that might reasonably be delivered by a re-engineered manual migration process for LLU? If a re-engineered manual migration process is likely to be inadequate, then what alternative means should be considered to ensure operators can compete on an equal basis with a broadband dial tone (e.g. copper cross-connect, 'soft LLU')?

As above, it is premature to start defining a process for a visionary aspiration. That being said, BT is favourably disposed toward consideration of 'active MDF' as a potential technological aid in LLU provisioning if such a deployment proves viable and cost-effective, with the ability of BT to recover costs appropriately. Theoretically, this technology would remove the need to re-jumper customers manually to LLU equipment by maintaining permanent wiring in the exchange with LLU operators and switching customers electronically on demand.

10. If some form of 'soft LLU' was made available, might it be practical to provide alternative providers with an ability to configure line cards independently of each other, based on an 'operator profile'?

With regard to technical feasibility, BT is unable to determine the degree to which this would be possible at this stage in the 21CN vendor selection process. Commercially, BT's incentive is to maximise utilisation of its 21CN network. If alternative providers were interested in such a product, and it was technically and commercially feasible, BT would consider offering it through its wholesale channel.

BT observes, however, that such a product could dis-incent the very infrastructure buildout that Ofcom wishes to promote. A light regulatory touch would better allow the market to determine sustainable competition at this level of infrastructure.

11. To what extent, and over what timescale, might operators realistically build out their own networks to the MDF/MSAN nodes, thereby enabling a competitive market in backhaul services?

The extent and timescale over which operators build out their networks will largely depend on the attractiveness of owning backhaul versus renting backhaul. This in turn will be influenced by a range of factors including, but not limited to:

- the customer segmentation strategies that LLU operators and SPs decide to pursue. In particular whether they plan to target either or all of the corporate market, the mass consumer market (voice and Internet access) and/or the SMEs. (This basic strategic decision will to a large degree determine whether they wish to consider extending from 'core' capability into 'access' capability using LLU or alternatively by purchasing the necessary inputs from BT or another fully integrated network);
- the sourcing strategy which LLU operators and SPs decide to implement. In particular the extent to which SP's are keen to encourage new supply and switch away from single sourcing;
- the extent to LLU operators and SPs are successful in growing revenues from advanced broadband services;
- the availability of funds capital funding to invest in building infrastructure;
- the availability of wholesale products on commercial terms in the market; and,
- the nature of the regulation imposed on BT by Ofcom: particularly, the portfolio of regulated products offered by BT and associated tariffs.

Ultimately, the marketplace should determine the extent, and timing, to which it is viable for third parties to replicate BT's investment in access aggregation nodes and backhaul of their traffic.

12. Are there parts of the UK where backhaul between MSAN nodes and Metro nodes should be regarded as an enduring economic bottleneck?

While the number of exchanges where backhaul is a bottleneck is likely to decline with time, there are some exchanges where backhaul is likely to remain an economic bottleneck.

13. Might MSAN interconnection enable sustainable competition in backhaul in geographies where LLU is not viable?

BT believes that if competition in backhaul is sustainable then LLU should be viable. As a result BT is sceptical that there exist geographies where LLU is not viable but backhaul competition is sustainable.

14. Is it likely to be cost-effective for MSANs to support dynamic routing of IP traffic, and if not, what alternative options should be considered for providing some form of MSAN interconnection?

Given industry interests in exploring interconnect at the MSAN level, BT has agreed to explore with industry the platform implications of 'MSAN interconnect' so as to inform product working group discussions. A meeting was held on 10 January to reach a shared understanding of: possible architectures, platform implications and indicative cost impact on products and discussions will continue.

15. If MSAN interconnection were appropriate, what level of access (eg layer 2 v layer 3 v voice interconnect) is likely to be suitable?

In general terms, the higher the level of routing, the dearer the cost of the MSAN network element will be and which would be reflected in product costs.

16. Is it possible to rule out at this stage the option of providing service specific interconnect at every MSAN?

BT's working assumption has been that providing interconnect at every MSAN is uneconomic, but as stated previously, we are engaged with industry to determine the degree to which there is any commercial feasibility both in scope and in range.

17. Given that MPLS technology is only likely to be deployed within core networks, at least for the immediate future, how might services based on some form of MSAN interconnection provide adequate quality of service?

NGN interconnection protocols are rapidly evolving and being standardised within the global community. BT is working within the Ofcom sponsored NICC (Network Interoperability Consultative Committee) forum to reach agreement on the initial baseline for NGN interconnection in the UK.

NICC has established a study item to specify the physical aspects of interconnecting IP networks. An initial meeting has been held which discussed the general issues of the study but no firm proposals have yet been submitted. This is expected to happen early in the New Year with a target date for completion being mid 2005.

Further, NICC has established an architecture group to consider the requirements for interconnection of NGNs and determine the specifications that NICC will need to develop. These studies have only just commenced and the interconnect NGN architecture has yet to be developed but this is expected by April 2005.

18. What are the aspects of equivalence of input that would need to be considered for MSAN interconnection?

BT will be responding in detail to Ofcom's proposals for equivalence in early February when it comments on the range of issues raised by the second consultation of the Strategic Review.

19. Do you believe that inter metro node conveyance is not an enduring economic bottleneck and therefore, where LLU/MSAN access competition is not viable, that regulation should be focussed on access at the first metro node?

BT believes that inter metro node conveyance will not be an enduring economic bottleneck. Alternative providers are well positioned to provide competing network transport, however, we expect this should be seen primarily as an input into a service provider market (both network and retail) rather than an inter metro node conveyance 'market'.

In light of this, BT agrees that any regulation should be focused on access at the first metro node.

20. Is the ability of operators to build out to metro nodes likely to vary geographically, resulting in the need for conveyance to some nodes to be regulated on an ongoing basis?

As above, BT believes that Inter metro node conveyance will not be an enduring economic bottleneck and any regulation should be focused on access at the first metro node.

21. What would the characteristics be of a metro node access product supporting equivalence of input?

BT will be responding in detail to Ofcom's proposals for equivalence in early February when it comments on the range of issues raised by the second consultation of the Strategic Review.

Clearly, however, BT would provide the mechanism by which an alternative network could be used by operators who so choose, for inter metro node conveyance ensuring equivalence of input for inter metro node conveyance or transit.

22. Under what circumstances should BT face specific access obligations for intelligence capabilities due to its SMP in a related market and what specific examples are there?

BT should only face specific access obligations for intelligence capabilities where these give access to or control over enduring network related bottlenecks. While recognising the emergence of NGNs will give rise to new requirements for interconnection products and services, BT does not believe it's own NGN will create new network related bottlenecks.

BT should not face specific access obligations in relation to intelligence capabilities that other providers can provide themselves. BT expects that alternative providers will have little difficulty in satisfying their own requirements for intelligence capabilities as there exists a base of solution providers keen to sell into the industry.

23. Under what circumstances should access to intelligence capabilities be regulated on a reciprocal basis and what specific examples are there?

BT believes that regulated access to intelligence capabilities on a reciprocal basis should only apply when the following conditions hold: (1) the providers without access would not be able to fulfil a regulatory obligation (e.g. interconnection); (2) the intelligence capabilities relate to enduring network-related bottlenecks; and (3) providers cannot reach agreement on reciprocal access.

24. To what extent might commercially negotiated access to intelligence capabilities remove the need for regulation?

The BT 21CN architecture is designed to expose intelligence capabilities to alternative providers so that broader solutions can be constructed for the benefit of end customers. BT believes that regulation should be limited to those instances where providers are unable to reach commercial agreement on access and the intelligence capabilities related to enduring network related bottlenecks.

25. Is it important to consider the provision of deeper hooks to directly access intelligence capabilities and is this access likely to be practical?

As above, operators should only face specific access obligations for intelligence capabilities where these give access to, or control over, enduring bottleneck assets. Any obligation to provide deeper hooks directly to the intelligence layer needs to be economically viable, and it is BT's belief that this will not pass a cost-benefit analysis. Further, any obligations must pay heed to the need of operators to maintain the security, integrity and reliability of its network.

26. What might be the benefits from achieving equality of access to 21CN OSS, and do these require adoption of 'equivalence of inputs', or is some form of compromise appropriate?

BT will make clear its final views on input equivalence in its reply to Ofcom's second consultation on the Strategic Review. Subject to what may be said then, the following is offered as a provisional response.

By the time the C21N architecture is implemented BT expects services supplied as a result of findings of significant market power to have reduced to a reasonably small number of products. For such a reduced portfolio, input based equivalence is feasible provided the portfolio is determined sufficiently early to inform system design.

27. What might be the practical barriers to achieving 'equivalence of inputs' in relation to 21CN OSS, and do you believe that these are likely to be surmountable?

Following on from above:

Successful implementation requires early agreement on the portfolio, broadly based consultation on the OSS and the interfaces to it, and agreement on those service aspects which would be appropriate to an OSS accessed by all and those which would be appropriate to the CRMs operated by competing retailers. This should not prove insurmountable.

28. What do believe the appropriate guiding principles should be for the transition from existing access and interconnection arrangements to new arrangements? Do you agree with Ofcom's proposed principles?

BT has proposed the following principles regarding interconnect migration to industry:

- An equitable, but affordable commercial agreement.
- BT can not indemnify altnets from investment risk due to obsolescence (e.g. Dial IP over the coming years)
- Recognise Ofcom's policy of encouraging infrastructure build-out.
- Recognise the re-arrangement process is years long and the interconnect picture will be changing between offer and implementation.

The biggest concern raised has been about a perceived commercial uncertainty beyond the scope of the proposed migrations: a concern that BT has taken on board and will address.

The above differs slightly from Ofcom's proposed principles as written, but we believe that the gap is due more to summarisation rather than in underlying meaning.

29. What types of product migrations are there likely to be for 21CN and what general issues do they raise?

BT has committed to provide Ofcom and industry with a summary of products, BT's view of initial migration and long-term trajectory, both for obligatory and unregulated products, articulating impact from 21CN programme, with initial priority on obligatory products. The first tranche summary is scheduled for 31 January 2005.

30. What might be the impact of geographic migration of points of interconnect for alternative network providers?

BT will be shutting down the DLE switches as an integral part of the 21CN deployment and this is expected to require a re-arrangement of alternative network provider interconnection. BT has made an initial commercial proposal to industry on 17 December 2004 with an expected firming up of that proposal at the end of January 2005 based on feedback from industry.

31. Might this be mitigated, by for example continued provision of interconnect at some existing sites?

Yes. BT has proposed that interconnect to existing NGS tandem switches could remain in place until there is greater clarity about Next-Gen IP-based interconnection. As the vast majority of alternative network providers are interconnected at these NGS tandems, this strongly mitigates disruption.

32. Where the impact cannot be mitigated, what principles should determine the level of compensation paid by BT?

The basis for compensation due to a unilaterally requested re-arrangement is the Standard Interconnect Agreement. BT and industry recognise the contract terms are not well-suited for complex network changes and are working to reach a commercial agreement to meet the needs of both sides. The principles for such an agreement are outlined above in response to Question 28.

33. Would it still be relevant for future IP based versions of voice interconnect services to be charged on a pence per minute basis or should other charging schemes (e.g. flat-rate origination and termination included within the line rental) be considered?

Converged networks, especially within their global context, can break down many barriers that led to the evolution of the current pricing regime. BT believes that a well functioning market will find its own price points. Attempting to set these in advance by the regulatory process is inferior to a market based approach. BT welcomes Ofcom's initiatives in the Strategic Review, the implementation of which will provide a competitive market and will remove the need for detailed, forward-looking, regulatory intervention.

34. Given that 21CN will result in narrowband and broadband access being supported using almost identical platforms, is it sensible to continue to make a distinction between wholesale narrowband access (WLR) and wholesale broadband access (Broadband EUA), or should consideration be given to a single wholesale access transport service supporting narrowband and broadband?

BT's 21CN design philosophy is to reduce costs by building complex products from modular components, both at the physical hardware level as well as in software. It would be an oversimplification, however, to extrapolate that because both narrowband and broadband access products share some of these modules that they are similar enough to treat as a single wholesale access transport service for regulatory purposes.

Narrowband and Broadband products will utilise different network and systems services to different degrees, for example: different degrees of transport bandwidth reserved for resilience, different QoS requirements and different service wrap (customer initiated OAM, billing data).

35. Is it likely that take-up of 'Voice over Broadband' will eventually allow the withdrawal of voice-specific regulation, and if so, under what conditions and over what timescale might this occur?

New voice services such as 'Voice over Broadband' clearly illustrate the power of technology to transform markets, introduce greater competition, and render existing SMP regulation for voice calls inappropriate. Similarly, BT believes that the technology of mobile telephony has already caused existing regulation on fixed telephony to become outdated.

The voice market needs to be looked at as a single entity, within which no supplier has SMP and consumers can use different media to make voice calls.

36. Would it be appropriate to consider refocusing voice specific regulation on those low-spending customer deciles least likely to take 'Voice over Broadband' service, and if so, how and when might this be done?

New voice services will allow greater choice and innovative solutions for customers who are price-driven in lower deciles, with a much greater range of services on offer. While it is appropriate to consider what consumer protection measures will be required, it should not be

axiomatic that economic or social regulation is retained or reintroduced in respect of lower-spending deciles. There are other concerns, such as establishing a definition of a 'lower use customer' that addresses those in need, rather than those who elect to not purchase fixed telephony services.

37. Which legacy voice services and line features provided by the current PSTN might not be supported by the 21CN PSTN replacement service, what should be the process for producing a definitive list, and what should be the process and timescale for withdrawing services on this list?

Following on to our response to Question 29, BT has committed to provide Ofcom and industry with a first tranche summary of product migration at the end of January 2005 concentrating first on obligatory products. As of late December, the initial view is that two features are almost certain to be withdrawn: 30k ohm loop detection and Analogue DDI. Additional features that are also being considered for withdrawal are: ISDN2 (legacy pre-ETSI variant), Home Highway, Midband, ISDNConnect and Meter Pulse Facility.

38. What compensation arrangements should be considered when alternative operators are forced by BT to re-arrange their PSTN points of interconnection?

As per our responses to Questions 28 and 32, the basis for compensation due to a unilaterally requested re-arrangement is the Standard Interconnect Agreement. BT and industry recognise the contract terms are not well-suited for complex network changes and are working to reach a commercial agreement to meet the needs of both sides.

39. Might it be possible to mitigate the impact of the withdrawal of local exchange interconnection, either by providing TDM gateways at more locations, or by establishing a charging structure under which those operators capable of providing backhaul for themselves would not be charged if they were forced by the new interconnection arrangements to use BT backhaul?

As per our responses to Questions 30 and 31, BT has made an initial commercial proposal to industry on 17 December 2004 with an expected firming up of that proposal at the end of January 2005 based on feedback from industry.

BT has proposed that interconnect to existing NGS tandem switches could remain in place until there is greater clarity about Next-Gen IP-based interconnection. As the vast majority of alternative network providers are interconnected at these NGS tandems, this strongly mitigates disruption.

40. What issues need to be considered relating to signalling used for PSTN interconnection with 21CN? (for example the SIP specification to be adopted, the availability of SS7 as well as SIP interconnection, the availability of IUP as well as ISUP, the availability to interconnecting operators of H248, support for a UK specific feature set)

Following on our response to Question 17, NGN interconnection protocols are rapidly evolving and being standardised within the global community. BT is working within the Ofcom sponsored NICC (Network Interoperability Consultative Committee) forum to reach agreement on the initial baseline for NGN interconnection in the UK. With respect to the issues raised in this question:

IP Interconnect Signalling for PSTN/ISDN Services

NICC is already addressing the signalling specification to support PSTN/ISDN services between 2 NGN networks using IP. BT fully supports the NICC work and its agreements to

date, namely:

- As a priority, NICC has agreed to develop a SIP(I) specification for the UK. This specification will be based on the international standard ITU-T Q1912.5, but there is a need for NICC to resolve some detailed issues relating to security, SIP protocol options, and UK ISUP;
- There are a number of features including 999/112 service, number portability, operator services and some features of CLI that are UK specific and are likely to remain different to the global feature set, hence the need for UK-ISUP rather than ETSI-ISUP; and,
- Only services that are, or will be, supported by the UK-ISUP protocol (in contradistinction to IUP) will be taken forward in an NGN interconnect protocol.

NICC have also recognised that there are additional interconnect signalling issues that need to be considered and studies are being initiated to cover:

- Security e.g. the need for firewalls;
- Management (resource control);
- Transport for interconnect signalling including physical topology (e.g. point-to-point, ring), signalling transport protocol (UDP or SCTP); and
- Availability and resilience.

BT agrees that these issues need to be addressed and look forward to working with the rest of the UK industry in NICC to resolve these issues.

Interconnect Signalling for Service other than ISDN/PSTN

BT expect SIP (i.e. SIP without the encapsulated ISUP) to be the basis for interconnect signalling between IP networks to support multimedia services and voice services not requiring the full PASTS feature set. This again will be the subject of study in NICC, once the initial priority of defining SIP(I) has been completed.

Need to Support IUP as well as ISUP

The introduction of 21CN offers a unique opportunity for conversion from the legacy, non-internationally standard IUP signalling in UK networks to the UK-ISUP standard. BT recognises this is a major change as the vast majority of interconnect currently employs IUP and will work in cooperation with industry to achieve this mutually desirable goal. BT suggests that withdrawal of IUP signalling be carried out under recommendation by NICC and to timescales agreed under that body.

Use of H.248 for Interconnect Signalling

There does not appear to be any interest in ITU-T in developing H.248 for interconnect signalling, hence BT does not consider H.248 signalling as appropriate for interconnect.

41. What transmission interfaces need to be considered for TDM gateways used for PSTN interconnection?

PSTN Interconnection using TDM has traditionally used an E1 interface. BT would encourage interconnection to 21CN TDM gateways using STM-1 to the extent that alternative providers have routes of sufficient size to justify the economy of scale. As described in our response to Question 31, interconnection to NGS Tandem platforms will continue as is today.

42. For call types that traverse multiple TDM gateways what is the likely impact on end-to-end QoS, and what options should be considered for mitigating this impact (a new approach to number portability, for example)?

The biggest known issue for the proposed 21CN architecture is the potential QoS impairment arising from traversal of multiple TDM-IP gateways is additional delay. BT will work with the technical community via the NICC forum to identify and resolve the technical issues related to NGN deployment.

With regard to number portability, onward routing is the currently agreed industry technical solution and therefore 21CN must have this capability. Other technical solutions such as use of a central database (CDB) are possible but would require industry agreement on implementation. To enable full deployment a CDB solution for number portability (in the sense of interchange of porting data via a 3rd party CDB) to work, all operators would have to interface with it. There are a large number of issues (technical, commercial, legal and economic) that need to be resolved before implementation of a CDB solution could be agreed. BT will participate in industry discussions, taking into account recommendations from NICC, on this issue for potential future incorporation into 21CN.

43. What other technical issues need to be considered in relation to PSTN interconnection with 21CN?

As above, significant work within the NICC forum is required for successful deployment of NGN networks in the UK. To illustrate, a few examples follow:

PSTN interconnection with 21CN includes both the existing standardised E1 TDM interconnect, and any future standardised interconnect, including both TDM interconnect at higher bandwidths and SIP(I) PSTN interconnect. Transport issues include support in TDM-IP gateways for modem, fax, and text phones including detection that one of these services is using the voice-band connection, followed by appropriate control of echo cancellation and adaptive jitter buffering. It is also necessary to support ISDN services in TDM-IP gateways. ISDN 64kbit/s clear mode has particularly challenging requirements on packet loss, requiring either extremely low packet loss in the IP network (of order 10^{-7}), or use of some form of redundant packet transmission or forward error correction across IP segments of the connection. 64kbit/s clear mode also requires gateway controllers to disable echo cancellation and any adaptive jitter buffering. When SIP(I) PSTN interconnect is used, standards will be required as follows:

- for the physical, Layer 1, Layer 2 and Layer 3 characteristics;
- for delay across each provider's IP network, for the QoS class used for PSTN traffic;
- for the codec to be used across the interface, or for a minimum set of codecs to be available in network endpoints as a basis for codec negotiation, the selection of codec to give the most appropriate trade-off between call quality and bandwidth used;
- number of transcodings in the end-to-end connection for packet size across the interface (e.g. 10ms voice media data per packet to support a low-delay service);
- limits on packet loss, possibly on a per-service basis;
- limits on the jitter of packet streams sent into a peer network, to allow dimensioning of fixed jitter buffers for fax, modem, text-phones and clear mode; and
- standards for network synchronization.

44. Would broadband access and interconnection need to evolve to allow derived voice services to be provided in an efficient manner over an entry-level broadband connection, and still provide similar quality of service to PSTN voice?

If we define an entry level broadband connection as broadly encompassing today's (cable modem or DSL-based) internet access services, then BT does not believe that setting the minimum standard at a level to support voice would be appropriate. BT expects there to be a range of quality, functionality, and cost parameters in the broadband space and for the regulatory regime to attempt to determine the minimum set is prejudging the market outcome.

45. What other issues need to be considered in relation to derived voice services?

The existing voice network and a number of the consumer-facing regulatory obligations hark back to a world where the incumbent's TDM voice fixed network was the only available option for providing voice services. Technical, commercial, and regulatory developments have brought us to a position where we may consider revisiting a number of these obligations. In particular, the link between geographic number and location is already showing signs of fracturing in today's voice services and will only increase with NGN developments. This has implications not only for emergency services, but also for tariffing and number portability.

This may also be an opportune time to revisit the need to power a phone line, given the development in the market for battery-powered mobile telephones.

46. What range of business ISDN services is there a need for 21CN to support?

Following on to our response to Question 29, BT has committed to provide Ofcom and industry with a first tranche summary of product migration at the end of January 2005 concentrating first on obligatory products. BT currently perceives there to be a need for 21CN to support ISDN2e, ISDN30e and ISDN30 DASS.

47. What scope is there for withdrawal of some legacy ISDN services?

As above, BT believes there is scope for withdrawal of some legacy ISDN services such as ISDN2 (pre-ETSI), ISDN30 I.421, Home Highway, Business Highway and ISDN Connect. As part of our product migration planning, BT is exploring ways in which its existing customer base can be served should these services not be supported by 21CN. It is BT's intention to focus on addressing customer needs as well as technical expedience

48. Do next generation Voice VPNs raise any service-specific requirements in relation to 21CN?

BT agrees with Ofcom's summary in paragraph 5.25. There are a number of other operators providing such services, so the principles of separation of Service from Network still apply.

49. What options should be considered for managing the migration of current generation Voice VPNs to next generation Voice VPNs and IP VPNs?

With regard to VPN migration, BT believes that the migration of service to our NGN should be invisible to our end customers. The intention is to apply these principles to Featurenet migration as far as is possible. Our preference is that end user customers choose to migrate to an IP-based Voice VPN, but at a time of their choosing. BT has no plans to force-migrate customers to an IP-delivered VPN service. Any migration will be complex and will involve detailed dialogue with customers before commencement, to ensure that service is not adversely impacted.

As regards to any interworking issues between operators, eg 'off-net' type calls, the normal procedures applying to these services would apply. Access will still be required, and in very broad terms the (PPC) access would be unchanged when an operator migrates its customers from current technology to an NGN VPN. The main changes would be at the service layer, where operators compete to provide customers with the service that meets their needs.

50. What other issues need to be considered in relation to next generation business voice services?

BT expects that, over time, business voice customers will demand new products and features that will change the scope of the market. We would expect these to include:

- Variable QoS;
- New services (video, multimedia);
- Delivery of voice over multi-service access products; and,
- Inherent mobility – increased market overlap between Fixed and Mobile.

BT would also expect significant competition for these added-value services from both traditional alternative providers as well as new entrants.

51. Once broadband is available to most UK consumers would it be appropriate to agree a process and timetable for the withdrawal of FRIACO?

Commercial market pressures will dictate the longevity of the FRIACO products and ISPs will manage their respective customer base to effect a smooth transition to either BB or alternative Narrowband data products as commercial models dictate. Consequently we expect FRIACO to be withdrawn in the relatively short term.

52. If FRIACO is withdrawn, over what timescale should this take place in order to allow an orderly migration, and what process issues need to be considered?

The now inevitable decline in FRIACO volumes is being driven by end user behaviour and, in some cases, ISPs that are actively migrating their customers from narrowband to Broadband services to mitigate customer churn. At an appropriate stage the remaining FRIACO products will be formally withdrawn following dialogue with both industry and Ofcom.

53. Is there likely to be a long-term need for some form of flat-rate dial-up internet access service, to cater for those consumers unable to receive broadband services?

Given BT's current Broadband plans, the number of customers unable to receive broadband services is currently very small, and will reduce further as BT's ADSL rollout programme is completed during 2005.

As the number of customers dwindles, the overall unit costs of continuing to support a flat-rate service would rise. Any residual customer base that for either technical or personal economic reasons remains on Narrowband access will be more economically catered for using ppm services based on freephone, IDA etc.

BT, therefore, believes it unlikely that there will be a long term need for flat rated narrowband internet access services.

54. What form of entry-level internet access service would be appropriate for those consumers who only occasionally access the internet, and who therefore do not have a strong incentive to migrate to broadband?

BT believes the consumer Broadband and Dial IP market has reached the maturity to offer end-user product packages that are appropriately price discriminated for the needs of different customer segments, including the entry-level.

55. What other issues need to be considered in relation to consumer narrowband data services?

In relation to pay-as-you-go narrowband internet services, ISPs base their business models almost exclusively on the NTS regulatory framework. BT is supportive of continued use of such a micro-payment mechanism as the means by which pay-as-you-go internet services are funded. However, delivery of all narrowband and broadband data over a single IP link may make such a payment system impossible to administer for this single traffic type, particularly between communications providers and their ISP customers. BT will work with

industry to achieve an agreeable balance between commercial requirements and technical efficiencies and suggests that regulation should not foreclose any options in this area.

56. Is it likely that consumer broadband services will in the future require some form of managed QoS, or some other specialised capability, due to the introduction of new multimedia services such as real-time video?

Current consumer broadband services are generally 'best efforts', in which the performance of the applications, the Internet and the access is not assured. They do allow (particularly in the case of DataStream and IP Stream CBC) the service provider to modify the level of 'best efforts' experience by setting the average bandwidth per user. However, this has no bearing on the performance of the applications access or the intervening networks such as the Internet.

Some projected new wave applications are sensitive to factors such as packet loss, delay and jitter and hence are not suited to a 'best efforts' approach even if the average performance of the best efforts network is reasonably good. BT would expect that network providers will want to develop more granular QoS management over time, both within their own networks and, in time, across interconnect points. There is a vast amount of work being exerted within standards bodies to develop open standards that will allow QoS to be managed in NGN networks.

57. If so, might this be best delivered through changes to the underlying generic access and interconnection services associated with 21CN, or by the introduction of new forms of access and interconnection specifically designed to support such requirements as real-time video?

BT believes strongly that the default position for technical and market developments should be regulatory forbearance unless there is clear evidence of market failure. Market forces are the most effective regulator and the approach taken by Ofcom in the second consultation of the Strategic Review to provide sustainable infrastructure-based competition will generate these forces. Attempting to manage this market at points higher in the value chain risks inhibiting development of effective competition in the upstream market; thus, BT does not believe that higher function products such as real-time video should attract further access regulation.

58. Is it reasonable to consider replacing the two existing forms of broadband interconnection (IPStream and DataStream) with a single converged IP interconnection service, incorporating the option of MPLS-based QoS management, in addition to a basic 'best-efforts' service?

As above, BT believes strongly that the default position for technical and market developments should be regulatory forbearance unless there is clear evidence of market failure.

Also, the second consultation of the Strategic Review envisages some Datastream obligations falling away as effective infrastructure-based competition takes hold. The timing is not yet clear, but it would be unusual for the regulator to consider extending managed broadband access obligations on one hand, whilst taking them away with the other.

59. If some form of layer 2 (e.g. ATM or Ethernet) broadband interconnection continues to be required, as well as IP interconnection, how is this likely to be affected by the migration from ATM to Gigabit Ethernet?

The presentation of ATM over an Ethernet interface is not yet at a robust enough standard and there are both commercial and technical issues to consider. BT believes that the NICC is the appropriate forum to consider the appropriate technical standards.

60. What other issues need to be considered in relation to consumer broadband data services?

BT would expect that over time consumer broadband customers will demand new products and features that will change the scope of the market. The consultation has concentrated on access capabilities for these services; however, the end-to-end solutions for consumers also need to be considered:

- Where the applications and services are in relation to the consumers and what are is the most appropriate method for delivering them?
- What about content hosting and distribution...and what if the content delivery servers are on a different network to that providing the user access? And,
- How is the end-to-end experience assured and who is responsible for assuring it?

There will naturally be many specific issues that will affect network design over time. BT is concerned that the regulatory environment should, in the first instance, allow the market to evolve solutions and designs as appropriate and Ofcom should avoid the temptation to set wide ranging and detailed requirements in advance.

61. Which legacy leased line services are likely to continue to be provided directly over optical transmission network, and which might be provided using circuit emulation technology over NGNs?

Legacy Leased Line services are currently provided over both optical and copper networks. As per our response to Question 29, BT has committed to provide Ofcom and industry with a first tranche summary of product migration at the end of January 2005 concentrating first on obligatory products. BT expects to offer whichever transmission method best satisfies customer requirements for functionality and cost. As of late December 2004, plans call for TDM leased line services at speeds above E1 to be provided over SDH transport infrastructure. Lower speeds might be provided using circuit emulation technology. WaveStream products will be directly supported on optical technology.

62. What technical and commercial issues might be raised if BT were to use circuit emulation technology to provide leased line services over 21CN?

BT believes that the needs of the business data services market will continue to evolve so that a cost effective emulation product could at some stage fully address the market. There are a number of technical issues in the use of circuit emulation technology to meet the more onerous requirements of leased line services: e.g. latency and the transport of customer-provided synchronisation.

As circuit emulation technology matures, BT will want to cease the parallel running of legacy platforms along side 21CN. This would happen only after consultation with industry, but may introduce commercial issues at the point when the majority of customers for a given product have successfully moved to the new platform; but, a small number of users wish to remain on the old platform potentially making cost recovery for the old platform problematic.

63. Which legacy leased line services are likely no longer to be needed over 21CN?

BT will listen to its customers and does not intend to withdraw products for which there is a reasonable demand. However, it is clear that there is a move towards higher bit rate products with the demand for lower speed and analogue circuits tailing off.

64. Would it be appropriate for next generation leased line services provided over 21CN to focus on new transmission technologies such as Gigabit Ethernet?

BT already provides a number of Ethernet services and expects this portfolio to expand to meet market demand. However, as Ofcom refers to in section 5.39, Gigabit Ethernet as currently defined is only one way of delivering Business connectivity and it would be inappropriate for BT to focus exclusively on one solution given the rapid rate of technical advances in this market sector.

65. What would be the desirable characteristics of an Ethernet based wholesale leased line, and which variants of the Ethernet technical standards should be considered (100Mbps Fast Ethernet, Gigabit, 10 Gigabit, Long Reach Ethernet, Resilient Packet Ring, etc)?

It is still early days in the development of new Business connectivity products and BT must be prepared to support a range of Ethernet, IP, MPLS and other standards until a clear preference emerges in the market. As Ofcom notes, technical standards for delivery of Ethernet based wholesale leased line services are rapidly evolving and, as above, and it would be inappropriate for BT to focus exclusively on one solution given the rapid rate of technical advances in this market sector.

66. Are there certain types of business services that will continue to need PDH/SDH-based transmission, or will PDH and SDH increasingly become legacy services?

BT expects that continuing development of alternative transmission standards will mean that fewer and fewer applications will have to rely upon existing PDH/SDH characteristics and that these services will become increasingly eclipsed by newer alternatives. As stated in our response to Question 63, there may be groups of customers who are less inclined to migrate to alternative products and we shall continue to discuss their detailed requirements with them.

As circuit emulation technology matures, however, BT will want to cease the parallel running of legacy platforms along side 21CN. This would happen only after consultation with industry, but may introduce commercial issues at the point when the majority of customers for a given product have successfully moved to the new platform; but, a small number of users wish to remain on the old platform potentially making cost recovery for the old platform problematic.

67. Might selective access to dark fibre, in those geographies where there is no alternative supply, be a more targeted means of addressing the underlying access bottleneck than a general requirement to provide wholesale leased lines?

BT expects to make clear its views on this issue in response to Ofcom's second consultation on the Strategic Review. Because of the complex inter-relationship between this and other questions in both this consultation and the strategic review we are still analysing our position on these matters.

Without prejudice to our more detailed response to the Strategic Review, we observe a quantum leap being made between an assumption of SMP in some markets and the suggested access to dark fibre; yet, this is not a market which has been subject to Ofcom analysis, nor one included in the EU's list of relevant markets. In any event we do not believe that BT's fibre should be singled out for treatment in this manner.

68. Might access to dark fibre be more likely to result in significant service innovation, because of the ability to deploy new transmission technologies (e.g. new variants of Ethernet)?

As above, without prejudice to any further response we may make in the Strategic Review we remain to be convinced that access to dark fibre is intrinsically likely to stimulate further competitive infrastructure build or spur significant service innovation.

69. Might some form of QoS-enabled bitstream interconnection, similar to the current DataStream service, be an effective means of enabling competition in the market for business data services?

BT expects that Next-Generation data interconnect products will need to be developed for multi-operator NGN interworking. BT believes strongly that the default position for technical and market developments should be regulatory forbearance unless there is clear evidence of market failure. Market forces are the most effective regulator and the approach taken by Ofcom in the second consultation of the Strategic Review to provide sustainable infrastructure-based competition will generate these forces.

70. If so, would ATM or IP/MPLS be appropriate, and what technical issues would need to be resolved in order for the service to be effective?

BT would expect the freedom to exploit the most appropriate technology options within the network in order to meet any identified requirements.

71. If Ofcom was to focus regulation on just one of the three different means of addressing the access bottleneck associated with the business market (dark fibre, leased lines, QoS-enabled bitstream), which would you choose?

As per our response to questions 67 and 68, BT expects to make clear its views on this issue in its response to Ofcom's second consultation on the strategic review. Without prejudice to any further response we may make, BT does not accept that there is an "access bottleneck associated with the business market" in most geographies of the UK.

72. What other issues need to be considered in relation to business data services?

As per our previous responses to Ofcom's questions regarding technical and market developments, BT believes strongly that the default position for technical and market developments should be regulatory forbearance unless there is clear evidence of market failure. Market forces are the most effective regulator and the approach taken by Ofcom in the second consultation of the Strategic Review to provide sustainable infrastructure-based competition will generate these forces. BT would expect the freedom to exploit the most appropriate technology options within its network in order to meet any identified requirements, as would any other operator. Finally, BT will listen to its customers to set the direction for product transformation as industry evolved the current infrastructure to Next Generation Networks.