Response of ECTA to the public consultation of ERG on IP Interconnect

1 Summary

ECTA welcomes the opportunity to respond to the public consultation opened by the European Regulators' Group on IP Interconnect, and appreciates to be invited to comment at an early stage of assessment by the NRAs.

- ECTA shares the perception that Next Generation Networks are increasingly used by telecommunications providers around the world, which raises a wide variety of legal, commercial and regulatory challenges that have to date not been resolved.

- The term "NGN" it is often used loosely to refer to both Next Generation Core and Next Generation Access Networks. Both can (but do not necessarily have to) be implemented in parallel, and transition processes will raise different competitive issues for Access and Core. ECTA therefore suggests that these developments should be considered in parallel but clearly separately.

- The ERG expects a quick transition to NGNs. Our expectation is rather than the pace will vary substantially, and the transition to PSTN shut-down may be a protracted affair in some cases, but much quicker in others, depending on particular circumstances in each country including:
    - Competitive situations – we would expect more accelerated developments where competition is more intense
    - The urgency of renewal of specific network components whether in the access or core network – it makes sense to replace equipment that is no longer supported by suppliers with more modern equipment
    - The potential for achieving cost-reductions

  The regulators will in any event need to play a vital role in the transition phase, including ensuring adequate transparency and consultation concerning incumbent plans, ensuring that such developments take place pro-competitively and do not result in foreclosure, and addressing questions over the pace of transition and cost recovery.

- We expect in general that a move to NGNs should be accompanied by a 'flatter' charging structure to reflect both the cost-base and retail charging principles that are developing (even in a non-NGN environment). It may be appropriate for different charging principles to apply depending on whether a QoS-guaranteed service or 'best-efforts' service is envisaged:
    - For QoS guaranteed service, interconnect prices on a combination of QoS-based and Element- or Capacity based items are likely to be most appropriate
    - For best effort service, 'bill and keep', may be the most logical solution, although, to deliver PSTN-like quality a 'best effort' environment would require sufficient unrestricted bandwidth to all users, which may not be available in all networks at all times.

- ECTA believes that modifications are needed to the list of relevant markets in the Recommendation on Relevant Markets Susceptible to Ex-Ante Regulation, in order to render the markets to be assessed truly technologically neutral – including the removal of references to 'metallic' (on access networks), and to 'public telephone networks'. Detailed proposals have been provided in ECTA's response to the European Commission's consultation on the review of the Recommendation on Relevant Markets.

- The existing delineation of markets remains largely valid, and the underlying infrastructure bottlenecks remain largely unchanged by the move to NGN. In addition , ECTA expects the issues of Quality of Service and interconnect charging principles (eg whether 'bill and keep' or some other mechanism) and network intelligence to influence SMP positions and bottlenecks in a NGN environment.

- NRAs should take care not to allow over-recovery on traditional PSTN networks on the basis of arguments that traffic has reduced yielding linear effects in static cost models. Price calculations are generally smoothed and should already have factored in asset lives or should be appropriately forward-looking.

2 Transition

The telecommunications industry was primarily technology driven in the past, i.e. the available technology shaped the service offered on the market. Every application required its own network, and service design was not flexible as service changes often required hardware changes. The result was a network structure that is commonly referred to as "spaghetti" – organically grown, not very flexible and relatively expensive to manage. The Internet Protocol (IP) has now developed and matured such that it is now proposed as a universal means for delivering all forms of information to and from the customer, even for incumbent operators. Consequently, one integrated IP based platform is intended to support all services (multi-service access, converged core). On this IP based platform, existing and new services (e.g. voice, television, email) become applications.

This converged platform is, in principle, cost-effective, easy to manage and very flexible towards new services (only few layers – "lasagna"). As the "all-IP" network provides a single platform for any applications, ECTA believes that focusing the debate on the future of PSTN interconnection only captures an important though small fraction of the issues. Interconnected all-IP networks will in the long run replace all existing networks, be that PSTN or data networks. The transition should therefore be viewed as a natural and positive evolution – although it raises substantial competitive and regulatory issues that need to be addressed, including not only voice interconnection, but a wider range of interconnection and interoperability issues for a variety of applications (voice, video, data, access to content, etc.).

2.1 How should the transition from the PSTN number of interconnection points to the probably reduced number of interconnection points in NGNs look like?

The question is phrased generically, but it is not possible to find a generic answer. Thus we have tried to identify some of the motivations for moving to NGNs and the different paths that have been taken as a result of varying motivations.

We would like to emphasise that the lack of a clear path makes it even more imperative that ERG strongly advocates transparency of topology to provide a sound basis for both regulator and operators to assess the impact and start the transition phase. It should be recognised for example that in some countries, even though NGN deployment at core level has already been completed, the incumbent is denying access to vital information to its competitors thus hindering the willingness to invest and reducing the pace of innovation.

<u>Incumbents follow different routes</u>

In principle, NGNs offer the promise of a high degree of convergence in the fixed network with a combination of the separate control plane of the PSTN (the IN system) with the unified architecture of the IP network (where no transmission system is dedicated to a given service). Different incumbents appear however to be taking different approaches to how this is achieved – to the extent that their plans are known. Examples are:

- A substitution of PSTN and other networks with NGN Core but without NGN Access (BT 21 CN); traditional local exchanges fully eliminated by 2010/11.
- A substitution of PSTN with NGN Core combined to one form of move to NGN Access (KPN All IP); traditional local exchanges and MDFs fully eliminated by 2010/11 (providing cost savings which offset the investment).
- An overlay of an IP over Ethernet Core with a PSTN; the number of Local Exchanges is being divided by 2 by 2010/11 (France Telecom).
- An overlay of a VDSL access network with PSTN (DTAG, Belgacom); no public plan to eliminate Local Exchanges or to replace the PSTN core.
- A complete lack of information on the NGN architecture, topology and interoperability despite a declaration from the incumbent that its deployment is complete. (Telecom Italia),

Never before have European telecom incumbents shown such diverse evolution paths. Accordingly "*the transition from the PSTN number of interconnection points to the probably reduced number of interconnection points in NGNs*" is likely to look very different from one European country to the other.

<u>Why remove the PSTN?</u>

Incumbents often present the move to NGNs as a radical transformation or innovative development. However, it should be remembered that competitive operators were typically the first in moving to (or in some cases starting with) a converged network. There are several reasons why incumbents are now following this trend – and in some cases are extending it to the access network, where their legacy offers them a significant advantage over competitors in effecting upgrades.

- Replacement of legacy telephone switches which cannot evolve any more because their development teams have been dismantled through industrial restructuring (BT with Marconi, but not FT with Alcatel or DTAG with Siemens).

- Cost-savings associated with reducing multiple networks and associated staff (eg BT, KPN). Building closures can also be a cost-saving factor eg €1bn+ expected by KPN from sale of buildings housing exchanges and MDFs.

- Facing competition in some areas e.g. from cable companies and/or unbundlers (KPN, Belgacom, TDC, Swisscom) with the resulting pressure to cut costs (for core networks, exchange closure) or increase capacity (e.g. through access upgrades) in a manner which will enable them to gain an advantage over competitors.

In addition, competition, and the desire to win back market share through leveraging from bottleneck assets and historic advantages, creates an incentive for incumbents to move to fewer points or to close buildings in a manner which would disrupt competitors. This (the design of NGNs so as to exclude competitors) is a particular risk against which regulators should be vigilant.

Many customers will not notice the change from PSTN to IP – and in the UK for instance, even the analogue telephone interface will remain the same. It should therefore be stressed that this is often primarily an operator-driven, rather than customer-driven evolution.

PSTN still evolves even without NGNs

Whilst NGNs have a clear and direct association with reducing potential points of interconnect, it should be noted that even without introducing NGNs, the number of local switches in the PSTN in a given country can decline. For instance France Telecom operated around 800 Digital Local Exchanges (DLEs) in 1995, still runs slightly over 500 of them today and plans to cut this number by half by 2011.

The current architecture of Central Office PSTN concentrators and of Digital Local Exchanges results from the scarcity of copper-based bandwidth when the PSTN was built. The introduction of DSL to nearly all Central Offices has necessitated the revamping of the connection of the Central Office sites to the DLE sites with optic fibre. In return this has allowed the concentration of the DLE function in a much smaller number of sites.

What barriers may exist to moving to VoIP?

We hope that, following this consultation exercise, regulators will have a clearer understanding of the competitive barriers for the sector to moving fully to VoIP, which include lack of clarity over the interconnect and charging regime, cost structures for LLU and naked DSL bitstream which do not permit voice-only offers, as well as issues with numbering and portability.

In addition, there is a further technical issue which should be considered which is that VoIP quality issues are still not wholly resolvedVoIP needs local power to work, CPEs have to be regularly reset, and sound quality is sometimes less reliable than PSTN.

This is largely for historic reasons: while TDM offered “built-in QoS”, packet networks began as best effort networks. Their primary benefit was in offering much more bandwidth and service versatility for the same price. However, it has been a major struggle to implant quality of service mechanisms into packet switching networks: ATM delivered this but was so complex that only a small proportion of its QoS capabilities have been used in practice; QoS mechanisms in IP networks were introduced around the same time as MPLS, but it is rare for public Internet networks to truly provide more than one level of service quality. Initiatives like the Metro Ethernet Forum[1] or new technologies like PBT[2] are being developed to manage QoS over Ethernet but there is still some way to go.

Issues of quality and reliability are particularly important for businesses along with the need to maintain backward compatibility with other systems such as fax, Electronic Point of Sale terminals, stamping machines, alarm systems. So this is one non-regulatory barrier that has to date held some businesses back from making a complete transition.

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[1] MEF (http://www.metroethernetforum.org/) is a group of 90+ carriers, equipment vendors and end-users who are driving the definition of and applications for a truly carrier-class Ethernet. Specifications are available, describing the required attributes to make Ethernet Carrier Class, like the MEF 14 technical specifications focusing on Class of Service. Compliance of Vendors or Carriers to these specifications is certified via a Certifications programme.

[2] Provider Backbone Transport (PBT) is a new flavour of Ethernet promoted by BT and Nortel as a backhaul transport technology between its access nodes and metro nodes. However PBT is still in infancy and not adapted to any-to-any networks. PBT strips out some of the complexity of Ethernet by using existing Ethernet switches, while turning off certain Ethernet functions, such as Spanning Tree Protocol and MAC learning, and deploying Ethernet OAM (operations, administration, maintenance) functions

Preliminary conclusion

Different situations in different countries and different driving factors make it impossible to predict on a pan-European scale how the transition will look. Our expectation is rather that the pace will vary substantially from country to country, and that the transition to PSTN shut-down may be a protracted affair in some cases, but much quicker in other cases depending on particular circumstances in each country including:

- Competitive situations – we would expect more accelerated developments where competition is more intense

- The urgency of renewal of specific network components whether in the access or core network – it makes sense to replace defunct or unsupported equipment with more modern equipment

- The potential for achieving cost-reductions e.g.

In addition, regulatory issues (such as appropriate access and number portability frameworks) and technical issues over QoS guarantees may limit developments to some extent.

The regulators will play a vital role in determining the success of the transition – including through establishing the right regulatory framework to encourage fair competition and seamless switching. Regulators will also need to understand the incumbents' plans, provide for transparency with affected parties and carefully manage the transition including by addressing questions over the pace of transition, cost recovery and any requirements for parallel running of networks.

2.2 Which are the implications for the price structure and price level of interconnection rates?

One would expect that, whereas traditional per-minute charging could continue to be appropriate for some types of service where feasible (perhaps as a payment mechanism for some types of premium retail service), NGNs should in general lend themselves to flatter charging regimes (whether based on QoS, element or capacity, or bill and keep). This should more accurately reflect both the seller's cost stack and the commercial structure of the wholesale products themselves.

In addition, one would expect the cost savings that are driving the introduction of NGNs to be reflected in prices charged to external wholesale customers on a non-discriminatory basis, and if there are fewer interconnect points one would also expect fewer charging 'bands'.

We would make the following additional observations on the implications of IP interconnect on charging for services over PSTN and existing broadband networks.

Implications on the PSTN

First, as we have seen above, the PSTN can still evolve. The reduction in the number of DLEs combined with the sharing of the transmission network between PSTN & broadband in the backhaul and core networks can reduce costs.

Second, more significantly, the regulatory accounting systems and cost models used to set interconnect prices tend to divide the total annual cost of a network by the number of billing items in it (e.g. of minutes) over one year. This fraction however is founded on an inconsistent approach.

- On the numerator, the work done to move away from straightforward historic accounts to regulatory accounts tends to make the annual cost of the network a permanent figure, smoothing out the effects of major capex outlay or the end of the accounting life of a set of equipment.
- On the denominator, however, one tends to only consider the current usage of the assets (e.g. the number of minutes flowing through the network during the considered year).

A consistent and forward-looking approach for the cost is appropriate for an incumbent enjoying economies of scale and historic advantages with a consistent (if lumpy) record of expenditure. However, in this case the usage should also be forward-looking, which means that it should be smoothed over the expected asset life and not over-recovered during the period of evolution to upgraded technologies.

Implications on broadband networks

Most telecommunications operator-designed networks clearly distinguish the control plane from the transport plane on the one hand and the application plane on the other:

- The PSTN has been isolating Signalling System #7 and the Intelligent network since the late 1980s

- First generation (ATM-based) DSL backhaul networks also managed QoS control (precisely through built-in ATM QoS parameters)

- the NGN model clearly separates transport, control and application.

By contrast, present second-generation (IPTV-enabled) broadband (IP over Ethernet) networks often tend to manage transport and application without a proper control plane. This is successful as long as the limits of best effort are not reached.

However experience shows that, for a given best effort level (e.g. a given maximum bandwidth level), capacity allowed for QoS control can have a significant impact on network cost. As such, it may make sense, for VoB and other quality-reliant traffic to follow the cost driver and charge interconnect prices on a combination of QoS-based and Element- or Capacity based items as the ERG is proposing in the last paragraph of section 4.2.5 of the public consultation document.

3 What is the equivalent to “local” interconnection in NGNs?

NGNs should in theory allow for easier interconnect, if effectively designed. This is because there is no such thing as a pure concentrator in Ethernet networks. It is always technically possible (unless the network has been structurally engineered to prevent interconnection or the regulator is not empowered or unwilling to intervene) to open the concentrator and convert it to a switch into which another network provider can plug his interconnect wire. A fully flexible system allowing investment up to the maximum efficient point (which would differ in different geographic areas/or to different types of customer) would include options at the central office or the street cabinet level for copper, or the optical distribution frame level for FTTB networks.

However, duplicating investment to higher-level points in the network is only economically rational in a model in which charges are distance and/or quality dependent – i.e. there is some scarcity of bandwidth. In this circumstance, where it is not possible to give unrestricted bandwidth to all users at all times, specific channels should be paid for, thus creating a make-or-buy alternative to the originators of voice traffic.

If, however, the network provides so much bandwidth that no QoS is needed, then it makes sense to have only one point of interconnect (or a small number to ensure resiliency of the interconnect) and to practise Bill & Keep (or peering). One of the major challenges with Bill & Keep is to design the regime in a way which will provide appropriate incentives to provide a guaranteed level of QoS as Bill & Keep tends to incentivise operators to take less care with inbound traffic as payment is not being made to carry it.

4 How do you evaluate the advantages and disadvantages of different charging principles discussed in the paper?

Charging principles create/remove SMP positions and bottlenecks

This question is the fourth and last one in the consultation by ERG. However ECTA chooses to answer to it before dealing with SMP positions and bottlenecks. The reason is that some of these SMP positions & bottlenecks exist because given charging principles are in place.

Firstly for communications between identified individuals, a bottleneck will apply for termination wherever there is a "Calling Party Network Pays" (CPNP) charging scheme, and this will apply regardless of whether we are in a PSTN or IP environment.

Secondly, the extent to which investments are encouraged on an efficient basis (but not otherwise) depends on regulators making an accurate assessment on the cost-drivers for services and what are therefore the appropriate prices for both access and interconnect. Considerable care will thus be needed in the assumptions used for pricing services, particularly where these involve any 'value add' to the basic underlying infrastructure.

Whilst the first consideration would tend to favour bill and keep as a mechanism which could over-come the CPP termination bottleneck, the second highlights the need to make sure that the mechanism used really does reflect the 'real' value of bandwidth and any costs incurred in maintaining QoS levels. Using a bill and keep model in circumstances where one or more parties did not recover their costs may tend to lead to under-investment. The conclusion may be that different models are appropriate in different circumstances – and possibly for different aspects of the network.

Allocation of costs

Another important consideration that can make all the difference for efficient investment decisions concerns the allocation of costs to different aspects of the network. The figures below come from one LRIC model but, not so surprisingly, the cost of most full size fixed networks is more or less distributed in the same way:

%	Access	Aggregation	Metro	Core	Total
Application (switching,…) equipment	3,6%	2,0%	4,5%	1,2%	11,4%
Transmission equipment	**21,3%**	0,9%	0,3%	1,0%	23,6%
Passive network (trenches, cables, buildings)	**47,1%**	9,6%	5,2%	3,2%	65,0%
Total	72,1%	12,5%	10,0%	5,5%	100,0%

NGN Core programmes aim at renewing the yellow-highlighted parts of the network (a total of 33.4% of direct network costs) while NGN Access programmes aim at renewing the **bold** parts of the network (68.4% of direct network costs). One can notice that:

- NGN Access is twice as expensive as NGN Core.
- Transmission equipment at the access level belongs to both NGN Access (1/3 of it) & NGN Core (2/3 of it).

Pricing decisions made by regulators should ensure that only appropriate costs are reflected for particular components, take particular account of savings due to NGNs, and do not reward mere replacement. Only through careful and consistent pricing at each level of the network, will investments occur to the deepest extent economically feasible, whilst not encouraging inefficient duplication or waste of resources. .

Preliminary conclusions

In principle ECTA favours pricing mechanisms for IP Interconnect that facilitate flatter charging models, rather than time-based which becomes increasingly removed from the underlying cost-base in an NGN world. Implications for charging for particular end-user services should nonetheless be considered, as the current charging system (including the potential for time-based charging) has proved useful in enabling the development of services such as directory enquiry and other premium services.

In selecting between a port-based, capacity-based and/or QoS based charging system and bill and keep it is necessary to weigh the benefits of bill and keep (no termination bottleneck) against the need to ensure that costs are properly assessed and covered, so as to encourage efficient investment – but without allowing over-recovery or inefficient investments. It is possible that multiple solutions could be adopted for different elements, or in parallel, depending on the circumstances.

In setting prices, it is also vital for regulators to ensure that cost-savings are passed on in a non-discriminatory manner and that costs in establishing interconnect and access are not loaded onto entrants. Likewise entrants' investments made necessary as a result of the incumbent's migration (eg in moving the points of interconnect) should be appropriately compensated.

5 SMP positions and bottlenecks

5.1 Reflecting the transition towards NGNs what are the implications for existing SMP products and bottleneck facilities?

The Recommendation on Relevant Markets has identified the following wholesale SMP products and bottleneck facilities on fixed networks that are potentially susceptible to ex ante regulation:
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- Market 8: PSTN call origination
- Market 9: PSTN call termination
- Market 10: PSTN transit services
- Market 11: Wholesale Unbundled Access
- Market 12: Wholesale Broadband Access
- Market 13: Wholesale terminating segment for leased lines
- Market 14: Wholesale trunk segment for leased lines

See 'ECTA Relevant market recommendation response (October 2006)' for more detail on the evolution of this list desired by ECTA members.

Additionally, it can be helpful to map the SMP relevant markets as they are currently considered to apply in a PSTN environment against the layers that will characterise NGNs (passive, transmission, application) and node locations (core, metro, aggregation, access).

At a basic level, the characteristics of the markets (in terms of components used and their location in the network) remain broadly similar regardless of whether PSTN or IP technologies are used and the existing infrastructure bottlenecks are also likely to remain similar, although some lines between markets may blur (see below) and for some of the markets (and in particular termination and transit) charging principles and QoS will also have a significant impact on the presence and nature of bottlenecks.

Market 8: PSTN call origination

%	Access	Aggregation	Metro	Core	Total
Application (switching,…) equipment	**3,6%**	**2,0%**	4,5%	1,2%	11,4%
Transmission equipment	**21,3%**	**0,9%**	0,3%	1,0%	23,6%
Passive network (trenches, cables, buildings)	**47,1%**	**9,6%**	5,2%	3,2%	65,0%
Total	**72,1%**	**12,5%**	10,0%	5,5%	100,0%

Market 9: PSTN call termination

%	Access	Aggregation	Metro	Core	Total
Application (switching,…) equipment	**3,6%**	**2,0%**	4,5%	1,2%	11,4%
Transmission equipment	**21,3%**	**0,9%**	0,3%	1,0%	23,6%
Passive network (trenches, cables, buildings)	**47,1%**	**9,6%**	5,2%	3,2%	65,0%
Total	**72,1%**	**12,5%**	10,0%	5,5%	100,0%

Market 10: PSTN transit services

%	Access	Aggregation	Metro	Core	Total
Application (switching,…) equipment	3,6%	2,0%	**4,5%**	1,2%	11,4%
Transmission equipment	21,3%	0,9%	**0,3%**	1,0%	23,6%
Passive network (trenches, cables, buildings)	47,1%	9,6%	**5,2%**	3,2%	65,0%
Total	72,1%	12,5%	**10,0%**	5,5%	100,0%

Market 11: Wholesale Unbundled Access

%	Access	Aggregation	Metro	Core	Total
Application (switching,…) equipment	3,6%	2,0%	4,5%	1,2%	11,4%
Transmission equipment	21,3%	0,9%	0,3%	1,0%	23,6%
Passive network (trenches, cables, buildings)	**47,1%**	9,6%	5,2%	3,2%	65,0%
Total	72,1%	12,5%	10,0%	5,5%	100,0%

Market 12: Wholesale Broadband Access

%	Access	Aggregation	Metro	Core	Total
Application (switching,…) equipment	3,6%	2,0%	4,5%	1,2%	11,4%
Transmission equipment	**21,3%**	**0,9%**	**0,3%**	1,0%	23,6%
Passive network (trenches, cables, buildings)	**47,1%**	**9,6%**	**5,2%**	3,2%	65,0%
Total	72,1%	12,5%	10,0%	5,5%	100,0%

Market 13: Wholesale terminating segment for leased lines

%	Access	Aggregation	Metro	Core	Total
Application (switching,…) equipment	3,6%	2,0%	4,5%	1,2%	11,4%
Transmission equipment	**21,3%**	**0,9%**	0,3%	1,0%	23,6%
Passive network (trenches, cables, buildings)	**47,1%**	**9,6%**	5,2%	3,2%	65,0%
Total	72,1%	12,5%	10,0%	5,5%	100,0%

Market 14: Wholesale trunk segment for leased lines

%	Access	Aggregation	Metro	Core	Total
Application (switching,…) equipment	3,6%	2,0%	4,5%	1,2%	11,4%
Transmission equipment	21,3%	0,9%	**0,3%**	1,0%	23,6%
Passive network (trenches, cables, buildings)	47,1%	9,6%	**5,2%**	3,2%	65,0%
Total	72,1%	12,5%	10,0%	5,5%	100,0%

5.2 Does this technological change remove existing SMP positions or bottlenecks or could new ones emerge in NGNs?

Because the technological change is unlikely to reflect the replicability of assets, existing bottlenecks where replicability is an issue, will remain. Where on the other hand, existing bottlenecks depend on pricing principles, these could change, depending on the pricing principles to be adopted under the NGN regime. New bottlenecks may also emerge for intelligent features associated with NGNs. A market by market assessment follows:

Market 11 in particular will remain as a separate SMP building block (likely regardless of material used for service delivery). Although the distinction between market 12 and market 13 & 14 on the other may start to blur, it is likely to remain necessary to maintain these as separate markets, partly due to the different treatment of QoS and service issues in these markets.

Market 9 is purely justified by QoS: while Voice over Internet comes without QoS guarantee and does not justify any termination monopoly, Voice over Broadband, if linked to a guaranteed QoS, justifies a termination charge. In other words: if I, as a broadband user, can build as many voice over internet addresses as I want over the same broadband link and use them without any priority, my broadband provider shouldn't get much of a termination charge for this. By contrast, if my broadband supplier had built a guaranteed bandwidth tunnel on my broadband link, to ensure that my voice conversation does not get bungled by the simultaneous download of a HDTV movie, then my broadband provider should be able to charge a termination charge.

Market 8 is justified for two reasons:

- In the PSTN, if an operator is not the provider of the access segment, a wholesale call origination service is the only way to be able to offer a retail voice service. This reason should, in principle, not be valid any more on a broadband network (where, in principle, any voice provider can offer his service on top of the broadband access service chosen by the end-user). In an NGN environment, if the emulation of the POTS system is so invisible that the user has no choice of voice providers, and SMP still exists, then the wholesale call origination service should be maintained, although priority should rather be given to stimulating competition in the access segment through appropriately priced LLU and naked bitstream (current pricing often deters voice-only usage).

- In some countries the wholesale call origination service is also the basis of the Intelligent Network services (free calls, shared cost, shared revenue services). This remains valid in an NGN environment.

Market 10 is useful in case there is a need to transit traffic with given parameters such as quality Bottleneck characteristics are likely to remain unchanged from the present situation, with thin or thick routes having different prospects for competition. Providing any single route is uncompetitive however, it will be necessary to maintain this market to ensure a possibility for full geographic coverage.

Further into the future, additional bottlenecks could emerge around control over network signalling information (sometime referred to as ‘network hooks’). It may be necessary to share certain information over interconnects in order to be able to set up end-to-end services, for example, information about QoS parameters, or end-user location data (not only for voice, but also for video, data and access to content). The network operator necessarily has a monopoly over this information, and this could create new competition issues. It should be clarified how, in the context of the market analysis process, these would be addressed.