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OECD FORESIGHT FORUM "NEXT GENERATION NETWORKS: EVOLUTION AND POLICY CONSIDERATIONS"

SUMMARY REPORT

Held in Budapest, 3 October, 2006

This document contains the summary report of the OECD Foresight Forum on next generation networks (NGN), held in Budapest on 3 October 2006.

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OECD FORESIGHT FORUM

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DRAFT SUMMARY REPORT

Budapest, 3 October 2006

INTRODUCTION

This document contains the proceedings of the OECD Technical Foresight Forum "Next Generation Networks: Evolution and Policy Considerations" held in Budapest, Hungary, on 3 October 2006.

The objectives of the workshop can be summarised as follows:

- Provide policy makers with an overview of technical aspects and structure of Next Generation Networks.

- Discuss the evolution of the telecommunication sector, in the light of the development of Next Generation Networks (NGN) and converged services.

- Explore the various technical, regulatory, and economic approaches that are or can be taken to benefit from the innovative opportunities provided by NGN.

- Identify which are the priority issues which should be addressed in the near future.

The event was also aimed at helping develop an integrated vision of the evolution of NGN and to explore key issues and related policy options which could be the subject of further work and discussion by the Working Parties of the OECD's Committee for Information, Computer and Communications Policy (ICCP). The meeting attracted some 150 participants.

The morning sessions concentrated on technical and regulatory trends in the development of Next Generation Networks. The afternoon session focused on policy approaches, with perspectives being offered from the private sector, and on the demand side of NGN. The meeting ended with a session on new security issues in the converged NGN environment and possible solutions.

Meeting agenda and presentations are available online at http://www.oecd.org/document/12/0,2340,en_2649_34223_37392780_1_1_1_1,00.html.

- NGN technologies evolution and characteristics

There are different possible visions of the future. The new IP-enabled, multi-layered, converged communication landscape is generating significant interest among providers, as well as changing users' expectations.

The term "NGN" is most commonly used as a broad description of the plans of telecommunication operators for the generation of networks that will follow the circuit switched PSTN and existing mobile technologies, including developments in access systems. The term is therefore used in contrast to the developments based on the public Internet and the two approaches are in competition, although the access systems may be common to both. Confusingly the term is sometimes also used to describe all future developments including developments related to the Internet.

- Which are the characteristics of this architecture?

NGN is a term widely used by telecommunication operators to represent a number of current and future structural changes in the telecommunication sector.

The main difference between NGNs and today's telecommunication networks is a shift from 'circuit-switched' networks that are traditionally used for voice service to 'packet-based' networks providing a range of services including voice, video and data. These networks present different characteristics. Voice networks are based on circuit-switching and offer end-to-end quality of service and the aim of the NGN is to offer more consistent speech quality service than may be achieved on the Internet. In contrast the Internet provides a "best effort" service, which may be less consistent although in many cases its quality is good and the "self management" of the Internet provides great resilience.

NGN can be seen as a logical evolution from separate network infrastructures into a unified network for electronic communications based on IP. Participants from the telecommunication industry consider NGN as a progression of current technology leading to a multi-service, secure, packet-based global network, which will be able to offer quality of service and ease of access for end-users.

- How is the NGN different from the services we have over the Internet?

While Internet architecture is based on a "best effort" approach, where the quality of transmission varies with the traffic loading and congestion in the network, the NGN aims to simulate the more constant quality achieved by circuit switched networks. There is also a difference in the concept of control. The NGN aims to provide detailed service control and security from within the network, whereas the Internet provides only basic transmission that is unaware of the services supported, and service control is managed from the edge of the network and security is also provided end-end from the edges.

The existence of the network-based "control functions" is what distinguishes the Next Generation Networks from the Internet. From the point of view of telecommunication operators, NGN is an attempt to take the best from both the telephony world and the Internet world, giving an "order to the chaos" by keeping the level of complexity low for users while increasing user value. From the Internet community standpoint, NGN is in contrast with some of the basic principles of the Internet structure, based on a dumb "*cheap and cheerful*" core technology allowing constant and spontaneous innovation at the edges. This is

the contrast between the "intelligent" network and the "stupid" network. By adding a layer of control over the transport layer, NGN may stifle openness and innovation, whereas the Internet supports innovation without permission. Doubts are also expressed on the technical feasibility of ensuring quality of service and security from within an IP-based network.

- Drivers for the shifts towards NGN

Faced with separate infrastructures for voice and data, falling revenues from traditional services, convergence in terminal design and in the roles of organisation, and growing competition, almost all traditional carriers are re-examining their business models, in a move towards common IP-based core infrastructures. Operators are unwilling to simply become the transporters of bits with the content providers capturing all the added value. Operators are therefore trying to move up in the value chain into audio-visual content. The move towards IP-based networks opens the possibility of having a single network platform capable of supporting all traffic types with lower costs. This new platform would be able to provide a range of services such as VoIP, broadband and multimedia services, leading to service innovation for consumers and the possibility of new sources of revenue for operators.

- Competition, convergence and consolidation

Prior to convergence, provision of telephony, data and broadcasting services were separate with different players in each, using different networks under different regulations. These networks and services are now converging and the players are expanding into all these areas of business. With the shift to IP-based networks, some traditional regulatory requirements may become obsolete and less relevant, while others should remain, albeit adapted to the new environment.

In considering the appropriate regulatory regime for next generation networks (including options for no regulatory intervention) there are many important and complex issues to be addressed.

- Competition

The move towards next generation networks potentially creates new sources of market power, at the same time that it creates new possibilities for competition.

Participants generally agreed that regulation should focus on markets rather then technology. Future regulation should probably be less specific in terms of services covered, and concentrate more on enabling competition at network and service levels.

While participants recognised the value of infrastructure competition, service competition was considered as playing an important and complementary role, helping competitive entrants to build up sufficient scale. At the same time, service competition may be useful where infrastructure cannot be cost-effectively replicated or when it is not economically appropriate.

Participants stressed that regulators should develop a balanced regulatory framework, with the dual objective of promoting competition while at the same time ensuring efficient investment incentives. Regulation should ideally adopt a technology neutral approach, focusing on creating a regulatory framework ensuring competition. The issue of whether regulators should identify and monitor new network control points in an NGN environment (user access, billing, personal user information, public interest services, non-discriminatory access to networks), and examine their impact on competition was also raised by participants.

In general, participants expressed their belief that unless there are specific bottlenecks, there should be "light-touch" regulation and, where possible, use competition law. The need to promote interoperability was also stressed by participants.

- Interconnection

The convergence towards IP-based networks will lead to changes in interconnection regimes. These changes are only slowly taking place, due mainly to economic/commercial issues. In the PSTN environment international interconnection agreements are currently based on distance and time-based charges, and carriers share the revenues for completing a call. Conversely, the Internet world uses a bill-and-keep model for services, and payments for connectivity that flow from the access providers to the core, where most operators exchange packets on a peering (no charges) basis. The Internet arrangement is much simpler but there is resistance to change from the traditional operators who are used to higher levels of profit with the PSTN model.

A number of participants stressed that if the market is effectively competitive, it is preferable for regulators not to intervene in interconnection issues. Conversely, where markets are not competitive (as with termination rates), it may be necessary to have regulatory intervention on IP interconnection.

- Universal service

Universal service obligations in an NGN environment were discussed by participants. The migration to NGN is taking place at different speeds, as networks are likely to deploy new services and improved access technologies initially in more profitable and densely populated area and only at a later stage in less commercially-viable areas. This may require an eventual review of the concept of universal service.

- NGN applications, use and impacts

NGNs will have major impacts on the creation, delivery and use of digitised goods and services. The development trajectories for NGNs will be driven by the commercial and practical uses to which they are put.

The development of different access, cost, pricing and distribution models for digitised content and services across the economy, including applications for health, education, government, personal and business uses, will be crucial in shaping NGNs. Today, most projections suggest that NGNs will be driven by major increases in video services, both fixed and mobile, and ever-increasing data-intensive applications.

Technological development is not the only driver for the uptake of NGN services. Socio-economic acceptance is likely to have an important impact on the deployment of the networks. Personalisation of application and services (access at different times, on different devices, from different places), for example, is a key element, which will boost content utilisation and allow for the exploitation of the Long Tail of content distribution. At the same time, the evolution from simple e-services to more complex smart converged applications will need to ensure quality of service, trust and security.

Last but not least, ensuring competition, interoperability and appropriate interconnection seem a key concern for participants, in particular when services are delivered across borders, in the wider global market.

- Security in NGN

The attributes of the Internet's architecture that are most currently lacking are arguably those relative to security. With the growing integration of electronic communications in the information society, the Internet is increasingly a critical information infrastructure that will need to guarantee resilient and dependable availability and constitute a trustworthy environment.

Trust, security and confidence are important issues which concern individual consumers and directly impact the deployment and take up of next generation networks' application and services.

In the view of most participants, security problems in the converged environment are similar to those which are already dealt with in the Internet. This could be negative, as security issues are currently multiplying, but also have a positive aspect, as the Internet community is already working on these issues. Participants mentioned the work undertaken by the OECD Working Party on Information Security and Privacy, and stressed the need to continue to work in this field and to elevate some of the security issues at a higher policy level, taking the opportunity of the OECD Ministerial Meeting which will be held in June 2008.

WELCOMING REMARKS AND INTRODUCTION

Mr. Janos Koka, Minister Economy and Transport, Hungary, welcomed the participants to Budapest and stressed the importance for Hungary of hosting such an event. He emphasised the progress of his country in the area of information and communication technologies (ICTs) and their essential role in the "re-engineering" of business and government structures in emerging economies, such as that of Hungary.

Pointing out that under the next EU national development plan for the coming 7 years Hungary will receive EUR 23 billion, Mr. Koka stressed the importance for his government to carefully consider how to invest this money. While the easy choice would be to use these funds to improve social welfare, in a forward looking approach it would be more important to employ them to improve the country's economic competitiveness. Hungary, he said, is committed to the second objective, in order to increase the adoption of new technologies, foster economic growth and employment, and encourage competition and investment.

In his conclusions, Mr. Koka restated the importance of OECD's work in drawing the attention of policy makers to major and unavoidable economic and market trends, and in stressing the need to increase competitiveness facing strong emerging economies such as China and India.

Mr. Brian Carpenter, chair of the Internet Engineering Task Force, and distinguished engineer at IBM, introduced the topic of the Forum, Next Generation Networks, pointing at the evolution of the Internet and telecommunication worlds in the past years, and noting that the Next Generation Networks might lead to results different from those expected because of the substantial differences between the telecommunication and the Internet operators' business models.

The success of the Internet is based on its "cheap and cheerful" core technology, aiming to realise universal connectivity, and allowing constant and spontaneous innovation at the edges. This results in natural selection of successful applications by end-users, rather then to monopoly deployment by telecommunication operators. Differently, the basic NGN technical features[1] include Quality of Service enabled packet-based transport with embedded service-related functions layered on the top of transport

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[1]   As described during the ITU/IETF Joint workshop on NGN, hold in Geneva on 1-2 May 2005. Workshop agenda and presentations available online at: http://www.itu.int/ITU-T/worksem/ngn/200505/program.html

functions. Service-related functions are based on IP Multimedia Subsystem (IMS), a protocol initially conceived by the Third Generation Partnership Project (3GPP)[2] for mobile phones.[3]

For the Internet the business model is based on the "Dumb Pipe Paradox" – whereby revenues will fall, but operating and capital expenses will fall even more, together with capital employed in the business, yielding much higher ROI and ROE – in the telecommunication world incumbent operators have a goal to continue to sell profitable and stable services. The move towards IP-based services is due to the possibility of lower marginal costs if all services are run over IP, hence with NGNs telecommunication operators are attempting to reconcile profitability and (cheaper) transport.

In his conclusions, Mr. Carpenter expressed a certain degree of scepticism regarding the possibility to technically implement the promises of NGN to increase quality of service and security in the network, and stressed the need to continue to foster innovation protecting competition and guaranteeing a level playing field for all stakeholders. In his view, in a situation where there is competition, NGN would support a structure whereby a modest number of transport providers will operate marginal business for a very large market, but a large number of services providers will operate at higher margins, totally changing the actual market structure and models.

SESSION 1: NGN TECHNOLOGIES EVOLUTION AND CHARACTERISTICS

NGN has been described as a development of current networks, where different technologies and functional layers – access, transport, control, and services – can be combined to provide all players with innovative opportunities, new sources of revenues and improved quality of service. NGN is therefore not simply about Internet Protocol, but is claimed to constitute a paradigm shift in the sector.

This session was aimed at identifying relevant characteristics of the Next Generation Networks, so as to stimulate and inform discussion on regulatory and policy issues in the following sessions.

Mr. Niekus, Manager Strategic Standardization EMEA, Lucent Technologies and Vice-chair, ETSI/TISPAN, stressed the importance of international standards in the development of NGN. Standardisation contributes to enabling service capabilities, rather then services in themselves, and provides a sort of "yellow box" *i.e.* a set of ground rules which can be used as common tools for the development of services and applications.

Mr. Niekus stressed that Next Generation Networks is about creating a "Converged User Experience" and that it is not going to appear as a new network, but will be the result of the evolution of technology, business models and social aspects. Standardisation work will simply provide a platform for these developments.

Mr. Schink, VP Network Technology Strategy, Siemens and Vice-chair of ITU-T Study Group 13, introduced his topic by discussing user value and the complexity of Internet and telecommunication services. In the speaker's view, NGN can be seen as an attempt to take the best of both telephony and Internet worlds, as it aims at increasing user value, at the same time keeping low the level of complexity for the end-user. From the Internet world NGN will take IP transport, addressing and naming, presence and messaging services, while from the telephone world it will take numbering, mobility, broadband and voice services.

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[2]   Third Generation Partnership Project, online at http://www.3gpp.org.

[3]   From Keith Knightson's presentation at the ITU/IETF NGN workshop: http://www.itu.int/ITU-T/worksem/ngn/200505/program.html.

Mr. Schink listed four factors that should be taken into consideration in the development of Next Generation Networks: end-user interests and business models, regulatory aspects, and technical capabilities and characteristics. This approach is applied when dealing with the development of new NGN services, such as, new natural communication services (see & listen). In this case issues arise under the regulatory point of view, as it will be necessary to consider the provision of public interest services, their definition, and the need to ensure interoperability with legacy services and to allow legal interception. In terms of technology issues, it will be necessary to ensure, for example, low latency for voice services and video codecs, e2e (end to end) performance, etc.

In concluding, Mr. Schink stated that NGNs are bringing a structure to the chaos, providing a solid blend of telecommunication and Internet services. This blend allows for new value-added services, increased QoS, security and ease of use. Thanks to NGN users will have the choice between using the Internet as it is, or decide to benefit from premium NGN offering.

As mentioned by several speakers, NGNs allow for an increased convergence of communication and broadcasting services. Convergence is becoming a global phenomenon, and it is beginning to have an impact on traditional media consumption. In this context **Mr. Levy**, Controller, Public Policy, BBC, United Kingdom, provided a content provider's perspective on the emergence of NGN and the related opportunities and concerns for the broadcasting industry.

Mr. Levy noted that the relationship of content providers to delivery networks is changing. While in the past content providers used to own their transmission network, this is not the case anymore. The emergence of Next Generation Networks could constitute a leap forward for the reliability of service and therefore improve the quality of the delivery. At the same time, as a broadcaster, Mr. Levy is concerned about the possible need of policy intervention to ensure universal access and safeguard competition.

In Mr. Levy's view the key issues for NGN are how widely the network will spread and how open it will be. Public policy intervention should aim at preserving an open and competitive market for both infrastructure and services, ensure interoperability, protect consumer expectations (transparency, access), and guarantee that public interest services remain accessible

Following on the discussion about competition, **Mr. Koos** - Director, Magyar Telecom, Hungary - recognized that the incumbent operator – notwithstanding its significant share in the Hungarian fixed, mobile and broadband communication sectors – is facing growing competition from new entrants, therefore the migration to NGN is considered as a necessary evolution, consenting long-term costs reduction and allowing operators to offer a wider range of value-added services, thus generating new business opportunities and increasing revenues.

Although Magyar Telecom is planning to migrate to NGN, Mr. Koos recognised that for the moment the operator is not ready to replace completely its PSTN/ISDN network with new networks, as the case for investment in next generation infrastructure is still too weak in the country. Instead, the NGN infrastructure will be initially deployed only to serve new areas or to enable new, value-added services, in order for MT to defend its position and develop new business opportunities. Migration from traditional voice platforms, such as PSTN/ISDN and GSM to Next Generation Networks will therefore take place gradually. During the transition period the different platforms will need to be interconnected and will be used in parallel, until the complete deployment of the new networks.

The US telecommunication operator Verizon, explained **Mr. Weller** - Chief Economist, Verizon, United States - has already moved towards NGN, with the deployment of Fibre To The Home Passive Optical Networks (FTTH PON), a point-to-multipoint network architecture in which unpowered (passive) optical splitters are used to enable a single optical fibre to serve a number of premises.

In the Verizon model, to maximise the quality of service, each optical splitter serves a maximum of 32 users, and the fibre is divided into three lasers: one for video broadcasting (including analogue TV, digital TV and HDTV), the other two for upstream and downstream broadband, which includes voice, data and Video on Demand (VOD) services.

Currently Verizon is upgrading its network to go from Broadband PON (BPON), which typically provides 622 megabits per second (Mbit/s) of downstream bandwidth and 155 Mbit/s of upstream traffic, to Gigabit PON (GPON) standard, which supports higher bandwidth and bandwidth efficiency, allowing for improved Quality of Service (QoS), particularly important for delay-sensitive traffic such as voice and video communications. Mr. Weller noted that the capacity of one of these single optical fibres serving 32 users is comparable to the capacity of a backbone network in China serving 2 or 3 entire provinces.

Some participants, citing the Apple/iTunes example, asked speakers' views on set-top boxes – a device needed for receiving digital TV broadcasts – pointing at the discussion currently going on in the United States with the Federal Communication Commission (FCC). Mr. Levy, BBC, considered that the maximum amount of choice for consumers would be preferable, while Mr. Weller, Verizon, affirmed that although more competition in the sector is desirable, it depends to a large measure on standardisation issues, as more proprietary standards are being developed. He also cited the example of a set-top box developed by cable companies that is not compatible with Verizon's new services, or the case of Apple iTV, which, again, uses a specific type of set-top box.

In closing the session Mr. Niekus summarised the discussion noting the presence of two different views of Next Generation Networks. On one side the Internet community seems quite sceptical about the desirability and necessity of Next Generation Networks, seeing this shift as an attempt by telecommunication operators to reconcile the goal to sell stable and profitable services with the lower marginal costs, and to increase the number of value-added services, which can run over IP-based networks. Internet operators particularly criticise the idea of running a sort of replica of the PSTN on the Internet Protocol, virtually eliminating all the characteristics that determined the success of the Internet.

From the telecommunication operators' side, NGN is seen as a technology that will be able to bring an order to the chaos, putting together the best aspects of the telecommunication and Internet worlds. This would allow users to enjoy new value-added services – such as those available through the Internet – at the same time benefiting from increased QoS and security, maintaining ease of use, overall benefiting of what Mr. Niekus defined a "converged user experience".

On the technical side, representatives of operators and content providers showed that NGN are not so much future, but are already part of our present. The concept of NGN seems to refer mainly to IP core modernisation and FTTH deployment, which is allowing for an increased convergence between fixed and mobile communication and between telecommunication and broadcast services. NGN networks are being deployed at different speeds in different countries, and the migration from legacy network to the new networks is gradually happening, raising new issues regarding interconnection, interoperability, new players, control points, and, of course, competition. These topics were addressed more in detail during the second session of the meeting.

SESSION 2: THE 3 C'S- CONVERGENCE, COMPETITION, CONSOLIDATION?

Prof. Jens Arnback, University of Delft, opened the session by noting that the technological change brought by NGN creates additional opportunities for innovative services and applications, but also challenges existing business models. Traditionally regulatory practices were related to specific networks

(*e.g.* PSTN, cable, GSM). With the shift towards NGN, some regulatory requirements became obsolete, or less relevant, while others need to remain, albeit adapted to the new environment.

After a short introduction of the European Regulatory Group (ERG)[4], **Mr. Gallino,** ERG Secretary, (Belgium), explained how regulatory change is being dealt with at the European level. He specified that the existing European Regulatory Framework, which entered into force in July 2003, is currently under review. He referred to NGNs as "Now" Generation Networks, to underline the urgency of the matter.

Mr. Gallino stressed that, with regard to NGNs in the re-elaboration of the EU regulatory framework, there are three main challenges to be addressed: the re-definition of the list of relevant markets taking into account NGN services, convergence of networks, access and interoperability. Interoperability is at once a basic tenet of EU legislation (single market concept) and a technical obligation; its definition should be clarified and reinforced in the new framework, as currently it is too generic.

An evolution is necessary not only in the rules, but in the "regulatory culture", because the emergence of an "Internet model" (bill and keep instead of termination fees, decentralisation of intelligence and relevance of peer-to-peer relations) at the expense of the traditional "telecommunication" model (centralised/vertical incumbents, interconnections fees, closed networks) has radically altered the business. Also, convergence between telecommunication and broadcasting is posing regulatory challenges outside the realm of many traditional telecommunication regulators, such as distribution issues and access to content (not content regulation, which is outside the EU Framework Review).

Mr. Horrocks, Consultant, Department of Trade and Industry, United Kingdom, recalling the discussion during the first session, noted that NGN constitutes the battleground between the telecommunication commercial model with control of services, and the Internet commercial model, which supports "innovation without permission". NGN seems to redesign a virtual replica of the PSTN over IP, segregated by MPLS from other services, and operators plan to apply old interconnection and cost models (*e.g.* usage-based charges and cost-based termination) in the NGN environment (IP-based) instead of adopting much simpler models along the lines of the charging for the Internet. The telecommunication operators are adding extra costs and complexity that users will not be willing to pay for.

In the operators' view, NGN should become the (single) network in which all services and applications will converge and which will provide higher quality, secure and easily accessible services. In reality, warned Mr. Horrocks, the results can be different. For example, while quality of service can be improved to a certain extent, some determinant factors – such as users connection configurations and terminals – are outside of the operators' control, therefore it will be impossible to guarantee quality at all times. In addition, users have a strong tendency to minimise costs; it is therefore likely that NGN will be only one of the available networks, and that customers will use the Internet (cheaper) when it is working properly, and shift to telecommunication operators' NGN only for short periods if and when the Internet experiences problems. As a consequence, Mr. Horrocks affirmed, traffic for telecommunication operators may become much more "bursty", with the next generation network becoming a sort of "Internet overflow network".

In conclusion, for Mr. Horrocks technological innovation will continue to happen in the Internet, rather then in the operators' controlled NGN environment, and connectivity, though increasingly important, will become a basic utility.

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[4]   The European Regulators Group (ERG) was set up as a forum for advising and assisting the Commission in the electronic communications field. It allows co-operation between the NRAs and the Commission in a transparent manner and serves as a body for reflection, debate and advice on the implementation of the electronic communications framework as required by Article 7(2) of the Framework Directive (2002/21/EC). Members or ERG are the National Regulatory Authorities (NRAs) for electronic communications and networks from 33 European countries.

Mr. Mueller, head of Regulation & Competition Law, BT, noted that regulatory challenges are likely to be different for Next Generation (core) Networks – for which the main business driver is to save cost through a simpler network infrastructure, able to transport a larger array of services – and Next Generation (Access) Networks – delivering the bandwidth for which there is economic demand.

As regards transition to core NGN, moving to an NGN environment may have an impact on a number of legacy parallel networks and protocols, as well as on the number of interconnection points. This will have concrete implications for operators, in particular regarding their competitive position. Operators will need to deal with changes in the interconnection regimes, relocation of existing assets, and with new technical requirements, such as standards, Quality of Service across networks and numbering issues.

As regards regulatory reform, ideally, adopting a technology neutral approach, the same rules applied to legacy networks should also apply to the new infrastructure. The deployment of new technologies should therefore be irrelevant, as long as it is ensured that there is the necessary level of competition and a dynamic and healthy market environment.

Competition and network neutrality are also two elements of the recently adopted Japanese New Competition Promotion Program 2010. The focus of the 2010 Program, outlined by **Mr. Katagiri**, Deputy Director, Ministry of Internal Affairs and Communications (Japan), is to create a basic regulatory framework to ensure competition in the IP age. Service competition and infrastructure competition are both considered essential in a market, such as that of Japan, where the dominant carriers – NTT East & West – together detain 94% of the access lines. In this context, service competition is strongly regulated, while competition at the infrastructure level is promoted by making it easier for competitors to deploy their own infrastructures. Once infrastructure competition is achieved in a certain area, regulatory requirements can be relaxed in such competitive areas.

Ensuring the appropriate degree of competition in both infrastructure and service fields is also one of the objectives of the Hungarian National Regulatory Authority. **Mr. Bahidi,** board member of the National Communications Authority, Hungary, considers that there are four possible future scenarios in the Hungarian telecommunication market, going from the "dominant carrier" scenario, whereby a single operator will control the infrastructure and have a significant competitive advantage on the provision of bundled-services, to a competitive scenario, in which several players will be able to enter the market and provide competing services. If the first scenario prevails, Mr Bahidi considers that the electronic communications market in Hungary might grow at a slower pace.

Reiterating previously expressed, comments, **Mr. Stanstny** – Senior Analyst, OeFEG, Telekom Austria – warned participants about the risk posed by the NGN model. Instead of convergence, in Mr. Stastny's view, NGN could bring to the Internet "Balkanization", *i.e.* a situation in which rather a global system, we will be confronted by a number of VoIP islands, or "federations". Federations are groups of service providers which can agree to receive calls from each other via SIP[5], and that adopt a set of administrative and technical rules for such calls.

Mr. Stastny then focused in particular on numbering, naming and addressing issues in the NGN environment. While PSTN is using E.164[6], the Internet uses IP addresses, Domain Names and Uniform Resource Identifiers (URIs). NGN is using a combination of both of these systems. In order to unify

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[5] SIP is a signalling protocol used for creating, modifying, and terminating sessions with one or more participants. These sessions include Internet telephone calls (VoIP), multimedia distribution, and multimedia conferences. See IETF SIP Charter online at http://www.ietf.org/html.charters/sip-charter.html.

[6] ITU-T Recommendation E.164 Assigned Country Codes (Position on 1 May 2005), online at http://www.itu.int/itudoc/itu-t/ob-lists/icc/e164_763.html.

traditional telephony and next generation IP networks, two IETF Working Groups (ENUM and SPEERMINT)[7] are currently developing standards necessary to transform the telephone (E.164) numbers into URIs and to route the call according to the URI across many different devices and applications (voice, fax, mobile, e-mail, etc).

While these standards will allow the different "islands" of VoIP service providers to communicate, Mr. Stastny questioned whether the result can still be called Internet, and noted that the potential for IMS to create walled gardens is very high. The capability of NGN to allow "…unfettered access for users to … competing service providers and/or services of their choice", as expressed in the ITU definition, might not be achieved, and that instead of convergence, NGN may result in balkanisation.

From the mobile operators' point of view, although the result of convergence is not predictable at this point, there are also a few points for consideration.

For **Mr. Lakaniemi**, Nokia Networks (Finland), while there are many issues related to convergence that are still not totally clear, it is apparent that a fundamental element in the development of new network and services will be the possibility to personalise services. An increasing number of users are able to self-manage their devices, and while in the past "personalization" was mainly limited to changing ring tones, today operators needs to pay attention not only to which services users are willing to invest in, but also on how these services can be customised to be better adapted to users' needs.

Regarding the horizontalisation of the market, Mr. Lakaniemi considers that this process should take place at the global level, so that services like mobile TV offers could transcend national and regional borders and reach global markets.

Ms. Alexandre, Vodafone Group (Belgium), pointed out that there is probably much hype around NGN. In her view, the move towards IP and the pressure for bundling services are not something new. NGN is simply an evolution of network technologies. As regulation is technology neutral, it should be able to automatically cope with this evolution, not justifying the creation of a new regulatory framework.

Ms. Alexandre introduced the new Next Generation Mobile Network (NGMN) initiative, launched by Vodafone together with a number of mobile operators around the world. The reasons underlying the development of NGMN are similar to those pushing for a move to NGN: the need to reduce costs, enable new services, and allow convergence of networks and applications moving towards IP-based networks. Again, there is no need for dramatic changes in the regulatory framework, as the economics of NGMN will be essentially the same as for 3G. The attention of regulators should continue to focus on interoperability and standardisation issues, stated Ms. Alexandre, to guarantee an open and competitive market.

Discussion after this second session focused in particular on whether there was a need for new regulation.

Mr. Gallino restated that it is not necessary to have new regulations, but simply to adjust the current one, based on market analysis to take into account technical evolutions. An example could be the current EU proposed re-definition of relevant markets, whereby it is stated that the developments of Next Generation Networks at the EU level do not alter the technology neutrality of regulations. For Mr. Stastny changes in regulation are needed to face the new global market environment. Services can be provided from anywhere in the world, but regulation is often still defined only at the national level. Mr. Horrocks reiterated that it is not necessary to modify regulation, however he pointed out that operators should move

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[7]   ENUM, Telephone NUmber Mapping, and SPEERMINT, Session PEERing for Multimedia INTerconnect. See Enum Charter at   http://www.ietf.org/html.charters/enum-charter.html   and   Speermint   Charter   at http://www.ietf.org/html.charters/speermint-charter.html.

away from cost-based termination rates. Also, the availability of different forms of access and competition in the Internet environment, he stated, can have a profound impact on this sector, changing the evolution of the market in the next years. Fixed and mobile operators stressed again the fundamental importance of global interconnection agreements.

SESSION 3: NGN APPLICATIONS, USE AND IMPACTS

In the third session, the focus of the discussion shifted from the supply-side of NGN to the demand-side, looking at NGN service capabilities, applications, uses, and impacts.

In opening the session, **Mr. Richard Simpson**, Electronic Commerce Branch, Industry Canada (Canada), noted how the process of technological convergence has opened doors for telecommunication operators to compete with media companies and vice versa. A growing, competitive marketplace for the supply of digital content, as well as widespread access to content, are critical to the emergence of new business opportunities and to spurring technical and marketplace innovation within a globally networked economy. In this context, the deployment of Next Generation Networks could bring important economic benefits, through the development of new services, and by increasing productivity and competitiveness. It could also have a positive social impact by allowing greater access to information and public services. NGN is also expected to have a major impact on the creation, delivery and use of digitized goods and services. Many have also forecast that NGNs will be driven by major increases in video applications, both fixed and mobile, and ever-increasing data-intensive applications.

Mr. Colombo, Long Term Research, Telecom Italia (Italy), noted that we should not look at NGN in terms of services offered, but in terms of service-enabling characteristics. He highlighted that thanks to the consolidation of different services into the IP model, NGN are fulfilling the operators' dream to have a single and efficient transport network for a variety of services and requirements. This evolution creates additional opportunities for the ICT sector and new emerging communication/entertainment business models.

The essential factor for the successful development of NGN is the control layer added in the infrastructure, which allow operators to ensure QoS, guarantee security, and allow interactive services. Also, the ability to open service interfaces to third parties, said Mr. Colombo, should be seen by operators as an advantage, not as a threat. The possibility to allow for the personalisation of application and services (access at different times, on different devices, from different places), is also considered a key element, which will boost content utilisation and allow for the exploitation of the Long Tail of content distribution

Mr. Jong-Sung Hwang, IT Strategy Division, National Computerization Agency (Korea), noted that the future of NGN might depend more on social and economic issues than on technology. Thanks to integrated and easily accessible services, person-to-person and object-to-object communications, and the development of mobile broadband, NGN constitutes an important step towards the creation of a ubiquitous society. NGN allows for the evolution from simple e-services to the more complex u-services, *i.e.* smart converged applications offering increased security and QoS and a broader array of value-added services and applications.

In this framework, noted Mr. Hwang, particular attention should be paid to the creation of a high level of trust, as an essential element to promote the utilisation of new services and applications.

Mr. Coutière, *Direction de la Stratégie et du Développement*, Vivendi (France), stated that the potential of NGN lies in particular in the possibility to provide bandwidth-intensive content and allow for increased interactivity. Broadband users today are not any more a small niche of technical experts, but the

average citizen. The average age of broadband subscribers in France is 45 years old, and 12% of the total number of subscribers are retired people. He stressed that many operators in France are already proposing 50Mbit/s symmetrical access and that in Paris several operators, including Erenis, Citefibre, Orange, and soon Free, are deploying fibre networks.

An issue which will need further attention in the future is, Mr Coutière affirmed, is the increasingly thinner frontier between private and public life, and the consequent necessity to develop appropriate mechanisms to guarantee privacy and to ensure protection of personal data, all along the value chain.

The issue of privacy raised the attention of participants, who in the discussion following the session expressed concerns regarding the collection of sensitive data by telecommunication operators and service providers. For data protection authorities, data collection is not and should not be the responsibility of private companies. Informed consent, and clearly stated purposed for the collection and utilisation of personal data are the two elements at the basis of an appropriate data protection policy.

SESSION 4: SECURITY IN NGN

In opening this fourth and final session, **Mr. Keith Besgrove**, Department of Communications, Information Technology, and the Arts (Australia), recalled that NGN does not only offer new opportunities for innovative services and applications, but also has the potential to provide a broader field of action for cybercriminals. Mobile and nomadic services and the possibility to access the same content from different devices, create new privacy security concerns for users and operators alike.

Mr. Skordas, ICT for Trust and Security, DG Information Society, European Commission, agreed with Mr. Besgrove, and affirmed that what is at stake is users' trust in the information society. Users are increasingly threatened by events such as loss of personal information, viruses, malware, spyware, identity theft and other criminal activities of growing severity and sophistication. Businesses are also challenged, and their operation, infrastructure, and commercial transactions are increasingly at risk. The worst part is that the evolution of this "threat landscape" is so rapid that security experts have difficulty in keeping pace with it.

He noted that governments and industry today are implementing only short-term responses to the above problems, focusing on patching of identified security holes and the development of virtual networks and new service platforms for NGNs. What would be needed from a security point of view in NGNs is to design and build new open interconnected and resilient networks with *built-in and scalable security*. Additional sensing and detection mechanisms would be needed for *monitoring and assessing*, in real time, the *dependability and/or security status* of NGNs at every level of the network(s), including the end-devices, for very rapidly detecting intrusions and malfunctions and for fighting against spam, phishing and other forms of malware.

Mr. Carpenter expressed some doubts regarding the possibility of building security in the infrastructure. He affirmed that the technical community is well aware of the problem and is working on it, but there is no magic solution to fix the protocol. He gave the example of trusted computing, which Mr. Skordas mentioned in his presentation. In this case, once users entered the "trusted" system, he said, they may become careless, *e.g.* not check for viruses anymore, potentially creating further, if different, opportunities for malicious attacks.

Following this discussion, **Mr. Ingram**, AusCERT (Australia), reiterated the concept that the TCP/IP protocol was not designed for security, excepted redundancy, and added that while some protocols able to significantly improve security actually exists (*e.g.* IPsec, DNSsec, or secure BGP), uptake is still limited.

Mr. Ingram pointed out that with the growing number of access points and IP connected devices, it will be increasingly difficult to create a secure environment. Additional challenges for operators in the NGN environment derive from the need to ensure security at the same time guaranteeing Quality of Service. This is a sensitive issue in particular for latency-sensitive voice and video services, such as VoIP. The utilization of encryption for VoIP services could provide a higher degree of security, however at the same time it may increase packet size and latency, therefore diminishing QoS.

In conclusion, Mr. Ingram stressed that ensuring the security of IP connected devices (end-points) is essential, as the security of an entire network can be undermined simply by the failure to implement security at one of the end-points. To this end, client hosts should adopt and implement acceptable user policies.

Mr. Besgrove, in closing the session, listed the problematic factors for security in the NGN environment. These include connectivity to open and public communication infrastructure of services previously carried-out on dedicated networks, the increasing number of nomadic users and providers, and the difficulty to control access in an environment where there are a large number of different access points, including computers, phones or set-top boxes. These elements, affirmed Mr. Besgrove, contribute to create a broader playing field for cybercrime to develop.

CONCLUDING REMARKS

The new IP-enabled, multi-layered, converged communication landscape is generating significant interest among providers, as well as changing users' expectations.

On the basis of the presentations and discussion in the previous sessions, this last panel identified a set of priority issues which should be addressed by policymakers, and which could be the object of further work and analysis by the OECD.

Mr. Besgrove stressed that NGN is providing great new opportunities, but also increasing security concerns. The planned OECD Ministerial meeting in 2008 could provide a good opportunity to raise attention on trust and security issues at a higher policy level.

Mr. Carpenter reaffirmed the need for the development of a regulatory environment encouraging service providers to flourish, without regard to underlying transport provision. He also agreed with Mr. Besgrove that possible threats models in the NGN environment are similar to those the Internet community is currently dealing with, so there is already an idea of the possible issues and impacts, and work will continue.

Mr. Simpson underlined the need to move from a supply-side perspective to a demand-side perspective in the next generation of networks. Users' needs and expectations are central elements in the deployment of the new platform and services. In the future, there will be a dynamic mixture of communication models, and the OECD could contribute to examine how business models will develop and what roadblocks and policy issues may emerge.

Mr. Arnbak recalled the importance of addressing the issue of interconnection of IP-based networks. The migration to NGN creates new possibilities for competition and horizontal markets, at the same time it potentially generates new sources of market power. In a competitive market, regulators and policymakers will not need to intervene on interconnection regimes. Conversely, in case of vertical integration or competitive bottlenecks, obligations to interconnect at the IP level may need to be considered.

Mr. Niekus stressed the benefits of NGN, which he considers as a blend taking the best of the telephony and Internet worlds, as it increases user value, at the same time keeping low the level of complexity for the end-user.

Mr. Parr, Chair of the Information, Computer and Communication Policy Committee, concluded the meeting listing what he considered the main points arising from the conference. First of all, new developments will need to be centred on users. Today Internet is not a tool for technicians, but it is used by average citizens. Users are not only using the content, but are increasingly creating it. In addition, personalised access to and use of services is considered fundamental for future communication models.

The chair stressed the multiple regulatory and policy elements which will need to be reconsidered with the migration to next generation networks, such as which kind of regulatory intervention is needed, the preference for technology neutral regulation, and how to ensure legal intercept and allow emergency calls.

During the meeting it also emerged that the concept of next generation networks does not necessarily refer to a specific vision, but it is an umbrella under which a number of issues can be approached. In addition, the technicalities proper to the subject make it particularly difficult to grasp by policymakers and regulators. In this framework, OECD have the role to explain in simpler and less technical terms the main issues at stake, so that all participants can be appropriately informed.

Last but not least, trust, security and confidence are fundamental issues which concern individual consumers and will directly impact the deployment and take up of next generation networks' application and services.

ACRONYMS

3GPP	Third Generation Partnership Project
BPON	Broadband Passive Optical Networks
ENUM	Telephone NUmber Mapping (IETF)
ERG	European Regulatory Group
FTTC	Fibre To The Curb
FTTH	Fibre To The Home
FTTP	Fibre To The Premises
GPON	Gigabit Passive Optical Networks
HDTV	High Definition Television
IMS	IP Multimedia Subsystem
MPLS	Multi-Protocol Label Switching (IETF)
NGN	Next Generation Networks
NRA	National Regulatory Authority
P2P	Peer To Peer
PSTN	Packet Switched Telephone Network
QoS	Quality of Service
RFID	Radio Frequency Identification tags
SIP	Session Initiation Protocol
SPEERMINT	Session PEEring for Multimedia INTerconnect (IETF)
TCP/IP	Transmission Control Protocol (TCP), Internet Protocol (IP)
URIs	Uniform Resource Identifier
VOD	Video On Demand
VoIP	Voice Over Internet Protocol
WiBro	Wireless Broadband