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WHAT RULES FOR UNIVERSAL SERVICE IN AN IP-ENABLED NGN ENVIRONMENT?

BACKGROUND PAPER

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NOTE

This paper has been prepared by Dr Patrick Xavier (Faculty of Business, Swinburne University of Technology, Melbourne, <pxavier@swin.edu.au>) to be presented for comments at the ITU New Initiatives Programme workshop on "What rules for IP-enabled NGNs?" held on 23-24 March 2006 at the ITU Headquarters, Geneva. Some of the material in this paper is drawn from a document the author prepared for the OECD entitled "Rethinking USOs for an NGN environment", December 2005. The views expressed in this paper are those of the author, and do not necessarily reflect those of the ITU or its membership.

This paper, together with the others relevant for NGN debate and prepared under ITU New Initiatives Programme, can be found at http://www.itu.int/osg/spu/ngn/event-march-2006.phtml. The New Initiatives Project on "What rules for IP-enabled NGNs?" is managed by Jaroslaw Ponder <jaroslaw.ponder@itu.int> under the direction of Robert Shaw <robert.shaw@itu.int>.

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With falling revenue (due to increasing competition and declining prices) occurring alongside strong demands for funds to deploy Next Generation Networks (NGN), telecommunications operators are less able to provide universal service sustained by cross-subsidisation. Universal service funds, too, may be under pressure. Also, there is likely to be an uneven migration to NGN since it is likely that NGN will be deployed first in more profitable, densely populated areas and then only later (if at all) in relatively less commercially viable rural/remote areas. This could raise concerns that problems of universal service and the 'digital divide' could worsen, especially for some developing countries still struggling to expand infrastructure and penetration of PSTN and mobile service. These developments are necessitating a thorough review of USOs, including their sustainability, scope and funding.

The first concern raised is whether present USOs can be maintained in an NGN environment? Voice service will be supplied through a range of platforms, including legacy PSTN, wireless and, increasingly, voice over Internet protocol (VoIP). But certain features such as the ability to make emergency calls with caller location information may not be available with VoIP. Such concerns could be addressed by a regulator mandating an equivalent quality of service. Problem is, this could raise costs and barriers to entry for service providers using new technology. An alternative approach could be to ensure customers are adequately informed about the differences in quality and to allow them to decide.

Another concern is whether and, if so, how the scope of USOs might need to change? Access to the full range of NGN services, including VoIP, requires broadband access. Therefore, should the scope of USOs be 'upgraded' to include broadband? At this relatively early stage of broadband development and take up, there are sound reasons to be wary of using a 'blunt' standardised USO approach. But broadband availability and take-up is expanding rapidly (at least in developed countries) so that regular systematic reviews of this issue are warranted (especially when NGN have become pervasive) since universal service is an evolving concept.

A range of 'rules' is proposed in the paper, including:

- Rules for the systematic development of universal service strategy (Box 4.3)
- Rules for designing USOs in an NGN environment (Box 5.1)
- Rules for assessing universal access/service delivery mechanisms (Box 5.2)
- Rules for considering USO status for broadband (Box 6.1)
- Rules for appraising USO funding (Box 7.1 & 7.2).

There is also need to think in a less constrained way about universal service for an NGN environment. Thus a question also posed in the paper is: In an NGN environment, to what extent can unshackled market forces be depended upon to resolve USOs concerns? Such rethinking may serve as a reminder that regulation should be the minimum necessary and suggest some basic rules for USOS in an NGN environment, including:

- that primary reliance be placed on market-based approaches
- that subsidies be kept to the minimum necessary
- that USOs policy should not lead the market but address concerns arising from market outcomes
- that regulation: needs to facilitate changes, not to retard them; should not impede entry of new technologies (technology-neutral); should provide a conducive environment for infrastructure investment; needs to be wary of being heavy-handed and be disposed towards 'light-touch' regulation.

Finally, funding. Where support for USOs in an NGN environment is determined by a government on the basis of a policy decision, it seems appropriately funded through the policy process from general taxation revenue, especially since such funding would link decisions concerning the nature and scope of universal service more closely with financial responsibility for such decisions.

1 INTRODUCTION

1.1 Background

The past decade has witnessed a period of significant market liberalization, competition, technological change and restructuring in the telecommunications sector. The rapid technological change is continuing and, indeed, the changes ahead may be even more significant. Among the major drivers of this change are wireless technology, IP-technology, and the convergence of media, computing and telecommunications. This conjunction of technological change and competition is a potent recipe for innovation and higher quality, lower cost services for consumers.

Prior to convergence separate services depended on dedicated networks. The public switched telephone network (PSTN) was designed for person-to-person voice communications. Broadcast networks were optimized for one-way delivery of radio or television. And the Internet was designed for non-real-time transportation of packets. These networks and services are now converging and the digitized bits flowing over the networks are "co-mingling". A progressive replacement of the PSTN's voice-based, circuit-switched networks by IP-enabled "Next Generation Networks" (NGN) appears to be gathering momentum and spreading. For example, IP-based video, telephony, and triple-play services are gaining popularity in an increasing number of countries. IP-enabled NGN is shifting from separate PSTN-and IP-networks to unified networks based on Internet Protocol with 'packet-based' multi-service platforms (in which 'voice' is only one of a range of available services). Of particular note is that after decades of traditional telephone service, there are signs of a fundamental transformation in voice services.

The transition to NGN is expected to bring many benefits making available an extensive range of innovative new services, greater control and personalization and ease of migration between services. But there are also some concerns about these developments, including concerns relating to universal service.

One concern is that the migration from PSTN to NGN is likely to be uneven in both developed as well as developing countries. It is expected that the more profitable densely populated urban areas will be served first, with less commercially viable sparsely populated rural and remote areas, served later (if at all). If a policy of requiring that the same price be charged customers in urban and rural areas is maintained (so-called uniform geographic pricing), this is likely to accentuate the uneven migration to NGN.

Another concern is over whether the quality of service and features of PSTN voice services that consumers have become accustomed to (such as the ability to make emergency calls with caller location information) can be preserved in an NGN environment with voice delivered through Voice over Internet Protocol (VoIP). While as yet a relatively small portion of the total voice market, VoIP is expected to grow sharply and pervasively.

There are also concerns that VoIP provided by Internet Service Providers (ISPs) over the Internet at significantly lower (distance unrelated) prices will threaten the established revenue base for many traditional telephone operators (that typically depend heavily on higher prices for longer distances calls, and especially international calls). Voice revenue still accounts for the major part of total operator revenues and hence is crucial for funding investment in new technologies and services as well as for funding universal service. But revenue in the fixed voice sector is declining because of falling prices, reflecting intensifying competition, the widening use of low price pre-paid calling cards, competition from mobile, and the growth of broadband (resulting in a reduction in revenue from dial-up Internet traffic) as well as broadband based VoIP services.

Another concern (in both developed and developing countries) is the substantial funding requirements to support the costly migration to NGN, especially when viewed against the backdrop of the falling call revenue noted above. Some analysts are suggesting that fixed and mobile market participants have little choice but to invest in new technologies in order to reduce costs and position themselves in a converged environment. Indeed, operators are already beginning to offer portfolios of services, with different combinations of low-cost voice (including mobile), Internet access and audiovisual content, to attract and retain customers.

With such technological, commercial, revenue erosion and investment funding developments, cross-subsidy practices to support universal service programs may become increasingly unsustainable. Indeed, an increasing number of countries are already considering the use of Universal Service Funds in order that the burden of universal service obligations (USOs) can be shared more equitably and flexibly among market participants. But as competition from sources such as VoIP, cable telephony, e-mail, instant messaging, pre-paid mobile and pre-paid cheap long distance/international calling cards erodes the revenue base of telecommunications operators, especially but not just fixed line incumbents, Universal Service Funds, too, are under pressure.

In view of such developments, questions are being asked as to whether an approach to universal service obligations (USOs) that was framed for a voice focused, circuit-switched, legacy network is still the appropriate approach. Indeed, in view of the significant competitive, technological and service changes taking place, there is increasing recognition that a broad review of universal service obligations is required, including their coverage, how they are financed, and who is to be responsible for providing them.

Previous work

In Australia, a review of the operation of Australia's USOs was conducted during 2004[1] to determine whether the USOs regime was meeting its legislative objectives. In particular, the review was required to analyse the USO costing and funding arrangements and the effectiveness of Australia's contestability regime in the provision of universal service. But there was little focus on longer term issues or on the implications of an IP-enabled NGN.

In Japan, a review of the universal service fund mechanism was launched in November 2004 by the Telecommunications Council[2]. Then in October 2005, Japan's Ministry for Information and Communications convened the "Study Group on a Framework for Competition Rules to Address Progress in the Move to IP"[3].

In the US, the need for reform of universal service has been receiving considerable attention in the Federal as well as State administrations[4].

In the United Kingdom (UK), in 2004, Ofcom's "Strategic Review of the UK telecommunications sector"[5] recognised the need to consider longer-term USO issues. Then, in January 2005, Ofcom initiated a complementary consultation specifically to review universal service arrangements[6]. In March 2006, Ofcom released another statement with conclusions from its review of USO policy in the UK (Ofcom 2006) aimed at: ensuring that the universal service obligations continue to meet the needs of consumers as demands and technology change; finding the right balance between the needs of vulnerable customers and changing commercial conditions; and making sure the benefits of measures reach those who need them by targeting and creating incentives.

Among developing countries, India[7] and Brazil[8] have recently reviewed their universal service regimes.

In May 2005, the European Commission issued Communication COM (2005) 203, "On the Review of the Scope of Universal Service in accordance with Article 15 of the Directive 2002/22/EC" [9]. This document sought to launch a broader policy debate on universal service provision in view of the overall assessment of the EU regulatory package for e-communications scheduled for 2006. Notably, in this Consultation document the EC invited comments on whether funding from general taxation would be preferable in the future. In February 2006, the EC published its 11th implementation report "European Electronic Communications Regulation and Markets 2005" which also contains a review of the current status of implementation of the EU's Directive on universal service.

In December 2005, the OECD considered a report it commissioned entitled: "Rethinking Universal Service for an NGN environment".

1.2 Objective of paper

The objective of this paper is to consider the implications of an IP-enabled NGN environment for universal service. To accord with the overall theme of the ITU Workshop: "What rules for an IP-enabled NGN?" this paper set out to address the question: "What rules for universal service in an IP-enabled NGN environment?" The paper does not dwell on the universal service problems faced in particular countries due to specific USO

mechanisms used in those countries (e.g. in the US or in the EU Member States). Rather the paper is concerned with the impact of competition, technological developments and convergence on USO arrangements of concern to all countries (developed as well as developing). More specifically, the objectives of this paper are to:

- identify problems that are developing for current approaches used to deliver USOs resulting from developments in competition, new technology (e.g., NGN, including VoIP) and convergence;
- consider what universal service implies in a broadband-based IP-enabled NGN environment; should present USOs be maintained in an environment with many competing technologies?; should universal service be focussed on access to infrastructure rather than on access to services (e.g., voice)?;
- identify developments in NGN that is increasing the importance of broadband access; should the scope of universal service obligations be 'upgraded' to include broadband?;
- consider initiatives to promote availability, affordability and accessibility of telecommunications in an IP-enabled NGN environment;
- consider issues pertaining to the funding of universal service in an NGN environment; and
- stimulate thinking about the policies required for universal service in an IP-enabled NGN environment.

1.3 Structure of paper

Following this introduction, Section 2 discusses present universal service regimes prevailing in various countries in order to provide background to the discussion of universal service in an NGN environment. Section 3 examines the implications of technological change and competition for universal service, pointing out that the sustainability of cross-subsidisation is being eroded and that pressures are also emerging relating to the use of Universal Service Funds. Then Section 4 considers the essential features of NGN, and the implications of IP-enabled NGN for developing countries. Section 5 examines the implications of NGN on present USOs, such as voice, quality of service, directory assistance and public payphones. It also examines how 'affordability' and 'accessibility' might be addressed in an NGN environment. Section 6 examines the meaning of "functional Internet access" since in an NGN environment, broadband will be required for access to the full range of NGN services. This raises the question about whether "functional Internet access" in an NGN environment means broadband. The answer arrived at is 'no', or at least 'not yet' at this relatively early stage of broadband development. But broadband availability and take-up is expanding rapidly (at least in developed countries) so that regular systematic reviews of this issue are warranted. So Section 6 also proposes a framework for conducting such a systematic review. Section 7 appraises the funding options for USOs in an NGN environment concluding that there should be a shift towards government funding. Finally, Section 8 concludes the paper.

2 THE PRESENT UNIVERSAL SERVICE REGIME

2.1 The nature and scope of universal service obligations

USOs can be used to support a number of different goals. They can help ensure that a basic level of service is available to all at an affordable price; help ensure that cross-subsidies sustain "geographically averaged prices" with retail prices the same in (higher cost) rural and (lower cost) urban areas; and they can provide subsidies for socially (or politically) motivated objectives such as services to schools, libraries and the under-privileged.

Although the terms "universal service" and "universal access" are closely related and are sometimes used interchangeably, they have different meanings. Universal service refers to the provision of telecommunications services to all households within a country, including those in rural and remote (high cost) locations. Universal access policies seek to increase access to telecommunications services on a shared basis, such as on a community or village-wide level. Universal access programs typically promote the

installation of public payphones or public call offices in rural and remote villages or low-income urban areas with the aim of providing a basic and initial connection to the telecommunications network. While universal service may be a realistic policy objective in developed countries, universal access is a more feasible practical goal in many developing countries.

No standard universal service definition

USOs is not a fixed concept and there is no single 'standard' definition of what should be defined within the scope of such obligations. In broad terms, universal service and universal access[10] goals include:

- *Availability* – that the level and quality of service (including reliability) is the same wherever a person lives or works, so that residing in a high cost rural or remote area does not affect a person's ability to access communication services;
- *Affordability* – that maintaining and using the service does not place an unreasonable burden on consumers, particularly on vulnerable disadvantaged consumers; and
- *Accessibility* – that people with disability can use the service.

A more precise appreciation of the objectives and scope of present USOs can be derived from an examination of examples of USOs policies/programs in developed and developing countries.

2.2 Examples of universal service policies/programs in selected developed and developing countries

USOs in the European Union

Member States of the EU must ensure that a minimum set of telecommunications services, defined at EU level, are made available to all end-users in their territory, irrespective of geographical location, and at an affordable price, the level of which is left to the Member States to decide. There are currently four services within that minimum set[11]. These are (i) provision of access at a fixed location upon request, to enable users to make and receive local, national and long distance calls, fax communications, and to enable them to have functional access; (ii) the provision of at least one comprehensive directory and at least one comprehensive directory enquiry service comprising the numbers of all fixed and mobile subscribers who so wish; (iii) the availability of public pay phones over the whole territory; and (iv) putting measures in place which ensure that the disabled have access to the same services at an affordable price.

If the basic set of services currently within the scope of universal service is not being provided under normal commercial conditions at an affordable price, Member States may choose to designate one or more undertakings to provide them in all or parts of the national territory and can fund the universal service either by using public funds (the general governmental budget) or via a sector-specific fund into which other providers of electronic communications networks and services contribute. Such a sector-specific fund can only compensate for the obligations on the universal service provider that are specified in the EU's Universal Service Directive. It is left to Member States to decide if all operators must contribute into this fund or only if operators with revenues above a set limit should do so. (To date, only the designated undertakings in France and Italy receive compensation from a fund to which providers of electronic communications networks and services contribute.) Member States are free to impose other public service obligations but they must then finance them from the government's budget.

Directories and directory enquiry services

The EU's universal service framework includes an obligation on operators to inform customers of their right to include all their details in a directory. Mobile subscribers must be offered the opportunity to opt-in to a directory. Indeed, the EC has launched infringement proceedings against some of its Member States for failing to ensure the provision of at least one comprehensive directory and/or at least one comprehensive directory enquiry service including the numbers of all fixed and mobile subscribers who have not chosen to exclude their numbers.

Emergency Services

The ability for anyone in the EU to call the emergency services by using the same emergency number regardless of where she may be in the European Union is considered to be one of the key safeguards

provided by the framework. The single European emergency number, 112, can now be called free of charge from any telephone, fixed or mobile, in the EU.

Access for people with disabilities

One of the sectors of society targeted by the EU's i2010 initiative are people with disabilities, estimated to constitute about 15% of the European working population[12] and it is considered important for telecommunications products and services to be accessible to them.

USOs in the UK

An example of the scope of USOs is provided by the obligations imposed on BT as the USO provider in the UK (with Kingston Communications designated USO provider in Hull). BT is required to:

- provide a connection to the fixed telephone network at a uniform price following a reasonable request, and provide a connection that allows functional internet access;
- provide at least one scheme for consumers with special social needs who have difficulty affording telephone services;
- provide reasonable geographic coverage of public call box services;
- provide universal services at geographically uniform prices;
- ensure that tariffs for universal services do not entail payment for additional unnecessary services;
- provide a basic level of itemised billing at no extra charge;
- provide universal services that accord with defined quality thresholds;
- provide funds for a relay service for textphone users; and
- supply and maintain directories and databases for the provision of directory services.

The Universal Service Provider must respond to all reasonable requests to install a telephone line, offering the same prices irrespective of location. This obligation upon BT and Kingston is particularly important for those who live in remote areas. BT's standard charge for installing a new line is £74.99. If an installation costs BT more than £3,400 (about US$6,250), then the customer must pay the difference above this figure.

BT and Kingston have to ensure that customers can afford telephone service. Special tariff schemes (e.g., the Light User Schemes and InContact) have been designed aimed at assisting customers on low incomes. BT and Kingston are also required to offer special services to customers with disabilities including text relay service (that translates a person's voice into text) for people who are deaf or hard-of-hearing, special format telephone bills for people who are blind or partially sighted, and a priority fault repair service.

The scope of USOs in the US

The considerable variation in the scope of USOs can be seen by examining USOs in the US where USOs include the following four components:

- *Low-income*: This program provides discounts for telecommunications service to consumers with qualifying low incomes.
- *High-cost*: This program provides financial support to companies that provide telecommunications services in areas of the US where the cost of providing service is high.
- *Schools and libraries*: This program helps to ensure that the nation's classrooms and libraries receive access to educational resources that are accessible through the telecommunications network.
- *Rural health care*: This program helps to link health care providers located in rural areas to urban medical centres so that patients living in rural America will have access to the same advanced diagnostic and other medical services that are enjoyed in urban communities.

USOs in developing countries

Some developing countries are continuing to depend on cross-subsidies, while others are turning to the use of universal service funds. For example, USOs in China involves assigning various telecommunications operators to pursue universal service targets in assigned regions (see Box 2.1) and in India, a Universal

Service Obligations Fund is used (see Box 2.2). USO funds are also used in a number of other countries such as Chile and Peru. And network deployment obligations are used as a licensing condition (Brazil).

Box 2.1: Universal Access Policy in China

In July 2002, the Ministry for Information Industry (MII) unveiled a blueprint for the so-called "village to village project" under which unconnected rural areas across the country were grouped into regions and assigned to one of the major telecommunications operators (China Telecom, China Netcom, China Mobile, China Unicom, China Railcom and China Satcom) in accordance with the company's size and financial capacity.

China Mobile was made responsible for providing universal access to over 6,112 villages in Sichuan Province. China Telecom's responsibility included 3,457 villages in Inner Mongolia, and China Unicom given responsibility for providing universal access in 1,680 villages in Guangxi. China Railcom and China Satcom, two of the smallest operators, were assigned 193 villages in Henan and 132 in Sichuan, respectively.

The main objective of China's universal access policy is the provision of a voice telephone service to all villages.

- The short-term goal is that by the end of 2005, at least 95% of villages would be provided with telephone services.
- The medium-term goal is that by 2010, all villages, hospitals and other organizations be connected to the public telecommunications network.
- The long-term goal is that by 2020, all organizations and families can be connected to the public telecommunications network.

But there have been complaints that the plan is burdensome and unfair. For instance, China Railcom complained that the company's cost for building networks in Henan province was much higher than its competitors. This is because many of the province's counties, unlike those of other provinces, were not pre-laid with fibre-optic cables. While other operators need put in only 5 kilometres of cable from the nearest county seat to the village, China Railcom claimed it may need to install 50 to 100 kilometres. There have also been complaints that the assignment of specific operators to provide universal access to specific provinces impedes flexible solutions to the universal access challenge and does not facilitate use of the most appropriate technology for villages/provinces. For instance, a wireless operator may be able to supply service in mountainous regions more cost-effectively than a fixed line operator.

Support has been increasing for the establishment of a universal access fund that is considered to have the flexibility to compensate operators for the differing costs involved in providing universal access to replace the "village to village project." Reportedly, the Ministry of Finance would be responsible for managing the fund, while the MII would draft the plans for the various universal access projects.

Source: Information gathered by this author during visits to China in November 2004 and August 2005.

Universal Service in India

The approach to universal access in India provides another interesting example of the way that a country with a very large population and number of rural villages is endeavouring to address its universal access concerns.

Box 2.2: Universal Access in India

The USO Fund Administration is proceeding with plans to cover all 570,000 villages with public phones. It has already signed agreements for disbursal of subsidy from the Fund to support the more than 520,000 Village Public Telephones (VPTs) already installed. The bids for the remaining 57,000 villages have been invited. Agreements have also been signed for replacement of more than 180,000 VPTs on Multi Access Radio Relay (MARR) technology.

In addition, the Department of Telecommunications will invite bids to set up Tele-Information Centres to provide access for both voice and data in villages with a population of more than 2,000. So far, over US$100 million has been disbursed as subsidy to the Universal Service Providers.

Support through the USO fund is also being provided to subsidise the capital and operating cost of Direct Exchange Lines (DELs) installed in rural areas after the beginning of 2002. About 3.1 million rural DELs had been installed as of the end of March 2004. Bids have also been invited for providing telecommunications facilities to new rural subscribers.

Source: Telecommunications Regulation Authority of India (TRAI)

2.3 From voice to data USOs: "functional internet access"

EU's 'Functional Internet Access' provision

Under the terms of the EU Universal Service Directive, the designated universal service provider is required to supply a connection that provides "functional" Internet access (FIA)[13]. This obligation is limited to a single narrowband connection and does not extend to ISDN[14] or broadband. It is notable that the Directive avoided setting a minimum data rate for functional Internet access and left it to individual Member States to decide if there was a need to specify this. Most EU Member States have neither defined FIA nor specified a binding minimum data speed in the context of the USO. The only exception to date is Sweden. Guidelines have been set in the UK but these are not legal obligations. Thus, in most cases FIA is equivalent to a dial-up Internet access.

Sweden. In May 2004, the Swedish government issued a regulation that requires connections to the fixed network to be capable of a minimum of 20 kbit/s. Where a subscriber requests a connection with a minimum data speed, this should be provided without adversely affecting the subscriber's ability to obtain access to broadband, e.g., the provider should avoid installing Digital Access Carrier System (DACS).

UK. In July 2003, Ofcom issued guidelines that specified 28.8kbit/s as a reasonable minimum data rate[15]. While Ofcom did not mandate a minimum speed, it is of the view that, at the current time, a connection speed of 28.8 kbit/s is a reasonable benchmark for functional Internet access. Over time, this rate may need to be revised to reflect advances in networks and equipment, and changing social and economic conditions. Subsequently in January 2005, Ofcom launched a review of the Universal Service Obligation including functional Internet access and sought opinion on a number of issues. In relation to the data rate for functional Internet access, Ofcom concluded in its review that the benchmark minimum of 28.8 kbit/s should not be changed at this time[16].

Ireland. In Ireland, ComReg (the Irish regulator) has specified[17] a requirement that eircom adopt 28.8kbit/s as a reasonable minimum data rate for functional Internet access. ComReg believes that it is inappropriate to impose a requirement to enable all lines to achieve the minimum data rate as the necessary investment would be likely to divert resources away from other productive capital works. In particular, ComReg does not wish to cause any interruption to commercial plans for broadband roll out. However, ComReg believes that eircom should publicly report on the number of lines that do not support the target data rate. As with the data rate itself, ComReg considers that there should be a general target set that eircom should strive to meet.

ComReg reported that it had considered the imposition of a binding requirement for 100% of lines to be capable of a reasonable minimum data rate of 28.8kbit/s but that this had raised issues including whether the increased benefits to consumers arising from the imposition of such a requirement could be commensurate with the cost to the Universal Service Provider and whether those benefits could be achieved in an more effective fashion. In both cases, it was felt that the benefit in terms of increased data speed for a specific number of users would be negligible while the costs to *eircom* would be of such a scale as to be likely divert investment funds from projects that would have a more beneficial consumer impact. These conclusions have been noted here because they are relevant to the discussion later on in this paper about the desirability of including broadband within the scope of USOs.

US. In the US, access to broadband for schools and libraries has been included as a part of USOs.

Australia. In Australia, since 1999 everyone can have access, upon request, to a data service with a 64 kbit/s digital data capacity. This is known as the Digital Data Service Obligation (DDSO) and relates to the provision of an ISDN comparable service. About 4% of the Australian population cannot access an ISDN service and therefore require a satellite solution. This is called the Special DDSO and includes an industry-funded rebate that acts as an offset to the cost of satellite equipment and installation that comprise the service.

Korea. When the Korean government sold its final tranche of shares in KT in 2002, it did so on condition KT offered broadband to remote villages. At the time, broadband was specified to be a 1Mbit/s connection.[18].

Switzerland. In Switzerland, the Federal Council published in February 2006 a proposal for the new universal service licence that includes broadband provision. Other changes are better telecommunications services for handicapped people and the dropping of directory information and call-forwarding services from

the universal service licence. The maximum per minute charge for calls within Switzerland is set at CHF 0.075. Market participants have until 31 May 2006 to react to the proposal and the regulator, ComCom, will open the tender for the universal licence in the autumn of 2006.

Developing countries

In developing countries, universal access funds have placed emphasis on ensuring basic public access (i.e. voice-grade fixed access to the public telecommunications network). But with the growing importance of the Internet, some funds are also supporting public access to value-added services, including Internet access. In Chile, the government has redefined the Universal Access Fund, which has been successful in extending basic telecommunications to rural and low-income areas, to support telecentre projects. In India, too, telecentres are eligible for subsidies from the universal service fund.

3 IMPLICATIONS OF TECHNOLOGICAL CHANGE AND COMPETITION FOR UNIVERSAL SERVICE

3.1 Impact of market liberalization and competition

There is now considerable evidence that the entry of private telecommunications operators into the telecommunications market has improved teledensity, provided more flexible pricing packages and lower prices (which has improved affordability), increased incentives for efficient operation, enhanced quality of service, and stimulated greater levels of investment and network rollout[19].

Total teledensity (i.e., both fixed line and mobile) has increased in many countries. A notable feature has been the increase in the popularity of mobile service. Indeed, mobile teledensity now exceeds fixed line density in most economies. Pre-paid services have been a major driver of mobile usage. Mobile service is still a premium service in terms of call prices but it has the attraction of low up-front connection fees (i.e., handset plus SIM card), instant access (i.e., no waiting list) and control of budget with pre-paid comprising an average of about 40% of total mobile customers in OECD countries (and over 60% in developing economies). These trends are of close relevance to universal service. Indeed, in many countries the mobile licence includes provision for geographic and population coverage. In some countries, such as France, governments with the assistance of regional authorities have partially subsidised the extension of network coverage to include geographic areas not previously covered by mobile networks.

Mobile communications is an example of how technological change and market liberalization has extended the ability of the market to reach areas unserved by the fixed network, often at lower cost[20]. Specific innovations in mobile such as pre-paid business models have been particularly effective in reducing administrative and cost barriers through:

- lowering connection costs for low usage customers;
- enabling access for people without a fixed address or a credit history (e.g., migrant workers, students and other young home leavers, or displaced persons);
- enabling access for people who need services that enable budget control; and
- improving usage by visually and hearing impaired persons through SMS related applications.

Mobile operators have translated a lower cost base into affordable pre-paid packages and ‘bucket’ pricing that allow low-income users basic connection to the network. Pre-payment allows operators to lower operational costs and reduce credit risk, but also gives users more control over expenditure than traditional post paid solutions, thus increasing ‘affordability’ for low income users. Mobile services are increasingly ‘available’ to rural users as well. Indeed, the wireless expansion and improvements in satellite service can mean that some operators specializing in the provision of rural service can provide service even in the most remote areas. Mobile has brought other innovations as well, such as public mobile payphones and short messaging service (SMS) which is cheaper than voice and allows mobile users to engage in a kind of email.

Another notable result of market liberalisation and competition is the fall in prices (in overall terms) and revenue. And in general, these lower prices have helped the attainment of universal service by improving

affordability. In some countries domestic long distance prices per minute have fallen by 25 per cent (Australia) to 50 per cent (New Zealand) since 1998. In many countries international prices have fallen more than domestic long distance prices because that is where profit margins are highest and competition is fiercest at the start of competition. Also, there is additional pressure on international prices from call-back operators, simple international resale (where this is permitted) and more recently VoIP services. However, some prices have increased. Indeed, a distinctive feature of price changes resulting from market liberalization has been increases in line rentals as part of price rebalancing. For instance, in Australia, since 2000, Telstra has raised monthly line rentals for residential customers from A$11.95 to A$26.95 and in February 2006 announced a 30% increase in the connection fee for new subscribers.

3.2 Efficiency constraints on equity

Price rebalancing

In many countries, universal service has been supported by the cross-subsidization of line rentals and local call charges from high prices in international and national long distance call revenues. As competition has driven prices towards costs, cross-subsidies are being significantly reduced if not eliminated. New entrants are largely attracted to providing services where prices are well above costs (for international and long distance calls) avoiding local markets where prices are often below costs. To defend market share incumbent operators have been forced to reduce long distance prices thereby reducing the gap between prices and costs that makes them vulnerable to competitive entry. To offset the fall in revenue from long distance calls, incumbents have increased line rentals. This is commonly referred to as 'price rebalancing'. However, in many countries a policy of uniform pricing or geographic averaging of subscriber line prices has been maintained, requiring cross-subsidies from regions where the supply of access is profitable to less profitable regions. For instance, in Australia, Telstra is required to charge uniform prices at a retail level. However, it is interesting to note that although Telstra wants to charge averaged prices at the wholesale level as well, it is being forced by the regulator to provide wholesale access to its unbundled local loop at de-averaged prices that reflect the big difference in its costs in urban and non-urban regions.[21] The regulator's prescription in favour of cost-based pricing may be appropriate in principle. But the government mandated policy of uniform 'averaged' pricing for retail customers complicates the issue. In urban areas, the regulatory policy could result in greater profit margins hence maintaining prospects for competitive entry. But the policy seems likely to reduce the profit margin (if any) in rural areas, hence making it less likely that alternative service providers will find it attractive to enter these rural markets. This may be an example of how universal service policies can distort decisions relating to investment and competitive entry.

Table 3.1 shows the price rebalancing that has occurred in OECD countries as a whole in index form based on current prices. There have been significant rises in fixed charges. But usage prices have declined significantly for both residential as well as business users especially since 1997 although this has been offset to some extent by significant rises in fixed charges. The overall fall in prices has been greater for business users (especially large corporate users) than for residential users. These price decreases do not take into account the price falls made available through the price discount schemes that have been accessible to a growing number of both business as well as residential consumers.

Similar trends in price rebalancing are observable in many other countries[22], including developing countries. Price rebalancing has been accepted by regulators since it is recognized that higher line rentals and local call charges that are more reflective of costs are in accord with economic efficiency and are necessary to make local markets more attractive to new entrants thereby increasing competition/contestability. However, price increases here are also politically unpopular and may be considered inequitable (unfair) since it is in these local markets that subscribers are vulnerable because they are unable to migrate to a competitive supplier (since none exist). Also, the largest beneficiaries of price rebalancing are those who make significant international and long distance calls – often large corporate users and the relatively wealthy, while the costs are borne by low users. Thus, there may be 'universal service' concerns that higher rental charges could force some consumers to become disconnected from the telecommunication network.

Table 3.1: OECD Time Series for Telephone Charges

	1990	1997	2001	2003	2004
Residential					
Fixed	100	112.97	129.13	132.21	145.23
Usage	100	81.29	55.83	53.50	55.75
Total	100	93.97	85.15	84.98	91.54
Business					
Fixed	100	113.07	126.90	126.52	137.73
Usage	100	86.46	55.54	54.65	56.56
Total	100	91.78	69.82	69.02	72.80

Source: OECD, "Communications Outlook 2005", Paris 2005

There is also concern that sharp increases in monthly rental charges can reduce affordability and thereby threaten the quest for universal service on the fixed network. Some might argue that this may not be undesirable if mobile telephony is a cheaper technology to deploy and tariff rebalancing for fixed service makes the cheaper technology relatively more attractive. However, Internet connection, especially high-speed connection is still dependent largely on access to fixed line service. Such concerns have led an increasing number of countries to apply price cap regulation as a means of controlling the nature, extent, speed and direction of price rebalancing permitted by 'equity' considerations. For instance, a price cap regime can limit the increase in monthly charges (e.g., to no more than CPI + 2%) as was done in the UK and Australia. But impediments to price increases in local access markets (line rental and local charges) reduce the incentives for market entry, market growth or maintenance of market share by new entrant service providers, and could reinforce an incumbent's dominance in the residential access market. This could impede universal service in these markets and the benefits that competition delivers.

Improving incentives to market entry and investment

With the technological change on the horizon (such as WiMAX), there is significant potential for 'availability' of telecommunications services in rural and remote areas to be largely achieved over the next 5-10 years as we proceed towards NGN. Whether this potential materialises will depend importantly on the removal of disincentives to invest and barriers to entry. This may include removing price controls on monthly subscriber rentals and local call charges, and subsidies that favour the USO provider (thereby discouraging competitive entry). The problems of 'affordability' and 'accessibility' could remain but these can be addressed by specifically-targeted subsidies that allow consumers in a multi-platform NGN environment to themselves choose the service provider and technology most suitable to their needs.

3.3 Universal Service Funds

Use of a Universal Service Fund allows more flexibility than mandating a particular operator using a specific prescribed technology. Also a universal access fund is more transparent, the cost could be lower, and it can be designed to be competitively neutral (e.g., by requiring a broad range of operators to contribute to a Universal Service Fund) and also technology neutral. Indeed, the EU Universal Service Directive requires that where a national regulator finds that an operator designated to provide USOs is being subjected to an unfair burden, a mechanism should be introduced either to share the net cost of USOs among telecommunications providers or to compensate the USO provider(s) from public funds.

In a number of countries, such as the US, Australia, Japan, Italy and France (but also in an increasing number of developing countries such as Chile, Peru, India and Uganda), a separate universal service fund has been set up. Communications providers are obliged to contribute to this fund. In Australia, only licensed telecommunications carriers are required to contribute to the USO levy. This definition does not include other carriage service providers such as some resellers and internet service providers (ISPs). In France, operators contribute to the USO fund in proportion to their telecommunications revenue, which is then

managed by the *Caisse des Depots et Consignations*. In the US, the framework is somewhat more complicated[23], with services designated 'communications services', paying into a USO fund in proportion to interstate and international revenues. This effectively creates a transfer from long distance carriers to local carriers. While the US framework has had some success in ensuring provision of USOs, it has also generated protracted legal battles over whether a service is designated as communications or information (that do not contribute to the USO fund).

In countries where a compensation fund has been set up to share the costs incurred by universal service provision, experience has shown that this is a system that is not without problems. It is often a source of costly conflict between operators, i.e., between the recipient of the payments from the USO Fund (often the incumbent) and contributors to it (often new entrant competitors struggling to make inroads in the market).

Financing a Universal Service Fund

In principle, a Universal Service Fund could be financed through several means, in particular:

- direct levy on all consumers of communications services (for example, a fixed amount that appears directly on the bill);
- a direct or indirect levy on consumers (via a levy on communications providers that is passed on to customers i.e., the USA/French model);
- funding from the proceeds of privatization and spectrum licence fees; and
- government funding via general taxation revenue.

Contributions from operators

A levy on operators has been the most commonly used approach with the levy ranging from 1% (Argentina, Brazil), to 5% (India), 6% (Malaysia) to over 10% (US[24]). Box 3.2 below indicates some examples of required contributions from operators across in a range of countries.

Table 3.2: Some Examples of Universal Service Funds

Country	Source of Revenue	Administering agency	Method of allocating funds
Argentina	1% of all operators' gross revenues	Operators (virtual fund)	Government to determine based on its goal to increase fixed teledensity and mobile teledensity.
Australia	Levy on licensed operators depending on market share of eligible revenue	Australian Communications and Media Authority (ACMA)	The government determines the level of subsidy paid to the USO provider. A USO model was previously used but subsidy amounts are now administratively determined, broadly based on previous modelled amounts.
Brazil	1% of service providers gross operational revenues earned from the provision of telecom services	Anatel, the regulatory agency	Universal Service Fund (FUST) will support ICT projects consistent with the government's development objectives
Canada	All market participants, both fixed & mobile pay fixed % of eligible telecom revenue (1.1% in 2003 & 2004)	CRTC, regulatory agency	Universal Service Fund to compensate costs estimated on basis of Long Run Marginal Costs plus 15% for joint and common costs.
Chile	Government's budget	Subtel, the regulatory agency	Subsidies distributed through competitive bidding (lowest bid wins)
Colombia	5% of national and long distance operators' revenues plus funds from license fees	Ministry of Communications	Subsidies distributed through competitive bidding (lowest bid wins)
France	Operators contribute a % of revenue	Caisse des Depots et Consignations	Compensation for costs incurred by USO provider (France Telecom)
Italy	Contribution of 1% of revenue by 4 major operators	Ministry of Communications	USO provider (Telecom Italia) makes offer to provide services at specified cost and regulator decides what part(s) of offer to accept

Japan	Operators contribute to Universal Service fund	Ministry	Fund compensates US provider
Malaysia	Fixed and mobile network operators contribute 6% of their weighted revenue from designated services to the Fund	Malaysian Communication and Multimedia Commission (CMC), regulatory agency	During an interim period (1999 to2002), Telekom Malaysia was the only operator with access to funds. Starting in 2002,other operators were invited to submit proposals for USP and be compensated from the fund through a competitive process
Nepal	2% levy on the revenues of the incumbent operator, ISPs and mobile operators.	NTA (Nepal Telecom Authority)	Subsidies distributed through competitive bidding
India	5% levy on the revenue of telecommunication operators	TRAI (the telecom regulator)	Subsidies distributed through competitive bidding (with lowest bid winning)
Peru	1% of all operators' and CATVs' gross revenues	OSIPTEL, regulatory agency	Subsidy goes to lowest bidder
South Africa	0.16% of all operators' revenues	Universal Service Agency, specially created unit to manage fund	Subsidies mainly awarded to telecentre projects and areas of greatest need
Switzerland			USO licence publicly tendered to lowest bidder. Swisscom AG won bid (did not seek any subsidy).
Uganda	1% levy on all sector participants including telecom operators, the postal service, couriers, ISPs	Uganda Communication Commission, the regulatory agency	Subsidies distributed through competitive bidding (lowest bid wins)
United States	11.1% in second quarter of 2005 on operators interstate end-user revenue (which is passed on to customers as a Universal Service Fund fee levied on monthly phone bills)	Universal Service Administrative Company (a private not-for-profit-corporation)	A number of programs, including: high cost support mechanism; low-income support mechanism; rural health care support mechanism; schools and libraries support mechanism (E-rate)

The obligation of non- universal service provider (USP) carriers to fund USP's rural and regional activities can have a number of negative consequences for the promotion of competition. In an environment where competitive carriers are finding it hard to make inroads against the incumbent, the USO regime actually *requires* competitive carriers to cross-subsidise the USP's activities, and thus could strengthen the USP's position. Thus the USO contribution can act as a disincentive for competitive carriers to provide their own regional and rural services. This can impede prospects of alternative technologies, such as wireless, from entering a market even when such delivery systems are more efficient (Hazlett *et al*., p.82) This could result in universal service subsidies helping to perpetuate the maintenance of the oldest features of communications services, instead of providing an incentive for firms to build the most efficient networks.

In the EU, a universal service fund may be established by a Member State if it is concluded that the incumbent would be significantly competitively disadvantaged by being designated the universal service provider. Not all countries have been enthusiastic about establishing a Universal Service Fund. It is notable that (so far) only France, Italy and Spain have decided to establish such a universal service fund. In other countries, such as Finland, there are no mandated requirements on operators, with competition expected to achieve universal service objectives. But some countries (e.g., the UK) are considering a universal service fund approach as competition has increased and cross-subsidisation has been phased out.

But the point that will be made in the following section of this paper is that these universal service funding mechanisms for delivering and funding USOs are under threat, and increasingly so as the transition to Next Generation Networks progresses. Indeed, current arrangements may be unsustainable. Thus a longer-term question is what to do about the delivery and funding of universal service as telecommunications transits to IP-based NGN?

Competitive tendering

Competitive tendering or 'reverse auctions', properly designed, can generate incentives to contain costs, to innovate, and to reveal the true cost of delivering universal service thus minimising the subsidy required. This can be a significant advantage since difficulties with estimating the "intangible benefits" and net cost of providing universal service can plague the designation of a universal service provider. Indeed, in Australia, the DCITA review of universal service concluded that the problems relating to costing USOs based on a cost-modelling approach: "…are to the point where there are significant doubts about whether the theoretical benefits of a cost-modelling approach are capable of being realized or captured in practice in Australia…"[25] (p.xiv). The DCITA review commented that the "…uncertainty and radical unpredictability about USO costs itself feeds into the broader investment climate for the industry." (p.xiv) The review concluded that if the principle of general industry funding is retained, there is need to "…find a simpler way of determining a reasonable level of subsidy de-linked from a calculation of costs." (p. xvi).

The competitive tendering approach can reduce arguments about the correct cost basis for setting subsidies as well as the 'asymmetric information' problems of identifying the cost of universal service. However, while the experience with designating universal service providers on the basis of competitive tendering in some countries[26] has been encouraging (e.g., Chile[27] and Peru[28]), there has been some less positive experience in Australia. Here trials in the use of competitive tendering resulted in no competitive entry. Some analysts have explained that this could be due to Telstra's substantial economies of scale in the pilot areas (and the poor investment climate at the time) that could have discouraged potential entrants. At any rate, the DCITA Review of the universal service obligation and customer service guarantee[29] concluded that the experience suggests that there was probably little value in continuing the existing pilots beyond their end date (30 June 2004). Nevertheless, the review also found that the existence of the contestability arrangements has been a useful, and a reasonably cost-effective way, of testing the potential for contestability of USO subsidies.

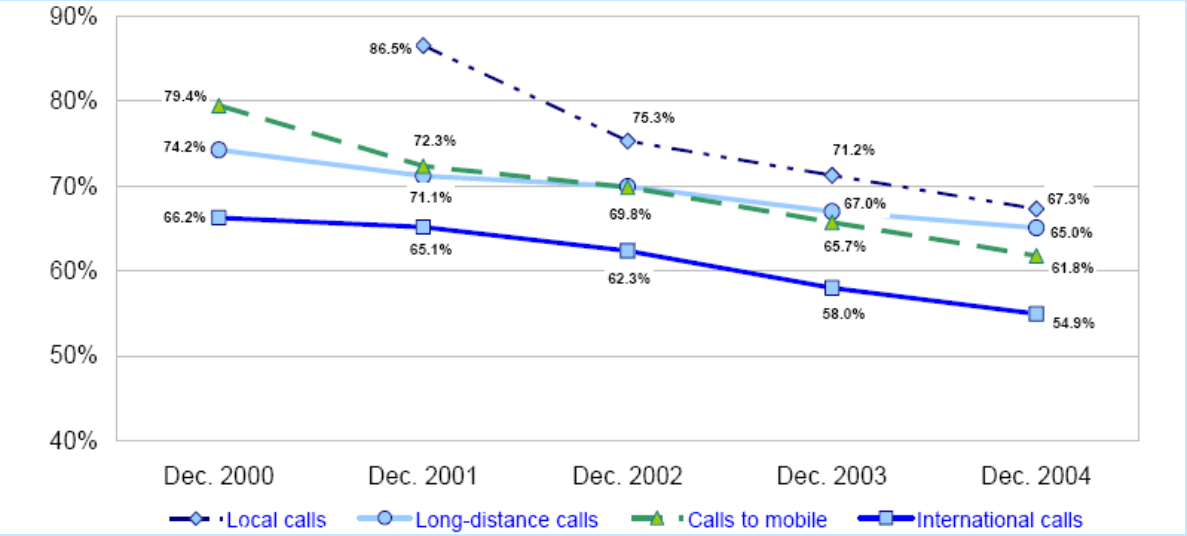
3.4 Revenue erosion and the prospective impact on USOs funding

The impact of competition from wireless telecommunications on the revenue of fixed line operators has already received considerable attention. For instance, in the UK, there has been an average decline of nearly 2% in the number of geographic voice call minutes from fixed line phones since 2000. This compares with annual average growth in the number of mobile voice call minutes of 17%. The above figure excludes SMS services, which would have reduced other means of communication, including fixed calls. Relative growth rates have pushed mobile call minutes to about 28% of total voice call minutes, compared with 4% in 1997. One prediction is that, by 2009, about 50% of voice call minutes in Western Europe will be generated using mobile phones[30].

The impact of competition on fixed line incumbent operators is becoming increasingly apparent not only in the international voice market but also more recently in domestic long distance and local markets. Figure 1 shows the sharp decline in market share and revenue of incumbents in the EU15 countries for the voice telephony market. The growth in the use of VoIP is adding to the competitive pressure. And these developments in competition and technology in the voice telephony market have also resulted in an erosion of the incumbent's ability to cross-subsidise loss-making USO programs and also their ability to contribute to universal service funds.

In France, VoIP telephony reportedly now accounts for about 15% of all voice traffic and the penetration of VoIP is so rapid that it is expected to account for more than 30% of all voice traffic by the end of 2006[31]. Another forecast is that by 2008 over 1 in 10 of broadband-enabled households and over 1 in 5 broadband-enabled small and medium sized enterprises (SMEs) will be making VoIP calls. Other commentators believe there will be even higher levels of adoption. According to a report[32] released in May 2005, consumer and small business usage of VoIP will accelerate between 2005 and 2009. There is strengthening expectation that as VoIP competition and demand increases, incumbent carriers will increasingly opt for PSTN replacement as a means of lowering operating costs. Initially reluctant to 'cannibalise' their own voice services, incumbents, alarmed by developments in the use of VoIP, have been joining the move to VoIP offering service to both business and residential customers.

Figure 3.1: EU15 incumbents' average market share on the voice telephony market
Basket on market shares of revenues



Source: Commission of the European Communities, "European Electronic Communications Regulation and Markets 2005", (11th Report) COM(2006)68 final, p. 12

These changes could result in a very different voice market in the future. The price of VoIP voice service is already significantly less than PSTN service. In an NGN future, there is likely to be vigorous competition to supply access to consumers – from an incumbent, cable operators, operators using local loop unbundling (LLU), mobile operators, fixed wireless access suppliers and others. Over these various access mechanisms, packages of services may be offered – such as instant messaging, email, and content services – of which voice will only be one application.

The widening supply of voice service through new technologies could result in prices falling to very low levels. Indeed, analysts are predicting major changes to tariff structures for voice services as a result of VoIP and NGN. It may be increasingly common for customers to buy large 'buckets' of calls at a flat rate, rather than paying per call. For instance, in the US, a broadband telephony company, Vonage, has offered unlimited local and long-distance calling packages for less than $35 per month. Telecommunications operators elsewhere (e.g., Singapore) are also considering this competitive strategy. Some analysts predict that voice calls might even be provided free, bundled in with broadband Internet access and other services (such as firewall protection and security). Hence, an increasing switch to VoIP could erode the core revenues of traditional telecommunications operators (despite the fact that the growth in broadband usage is giving a new revenue stream to operators whether from wholesale demand for unbundled lines/bitstream or from retail demand).

Nomadicity. Because service can be provided independently of a fixed DSL line at home, the end customer, with a VoIP phone, can use the service wherever a broadband connection is available. Thus, VoIP services can offer a 'nomadic service' enabling end-users to make and receive calls at numerous locations nationally and internationally, generally with the same service number. A VoIP provider can offer service from another country, without being physically present in a country. And the customer is able when travelling to make and receive calls at various locations providing broadband access, such as airports and cafes providing WiFi access. Thus VoIP service breaks the nexus between a person's telephone number and her location, that characterises fixed telephony service[33]. This nomadicity also makes it harder to enforce a contribution for the cost of USOs from VoIP providers if such a contribution is considered appropriate. Thus VoIP service offers not only low cost service but service outside the reach of Universal Service Fund mechanisms. For example, some analysts point out that, in the US, not only is Skype not regulated by the FCC – it probably cannot be regulated[34].

A number of VoIP service providers are requesting numbers (either geographic or non-geographic) to allow for telephone to telephone calling[35]. For these services, the requirement for a number allows for, if deemed necessary, the imposition of a contribution for universal service.

"Access deficit" charges and "Asymmetric" interconnection charges are unsustainable. Some countries have used so-called "Access Deficit" charges to compensate an operator for maintaining high cost networks. In some developing countries (Chile and Peru, for example, although other countries are considering this approach), 'asymmetric' interconnection fees are used to increase the revenue from rural service. In short, higher interconnection charges are levied for termination in rural and remote areas to reflect the higher costs of providing termination service in these areas. Asymmetric interconnection regimes can be of particular importance to rural operators. Since rural operators' income can be largely based on incoming calls, asymmetric interconnection rates can affect financial viability and can reduce dependence on government subsidies.

Such funding schemes may not be sustainable in an IP based system. There may be no obligation to interconnect since bilateral interconnection may not be required to achieve universal connectivity of IP networks. The system could be based on voluntary agreements among networks based on peering or transit arrangements. Moreover, as the shift from circuit-switched to IP occurs, small rural or regional networks could go from charging access to paying transit charges. (The important issue of interconnection in an NGN environment is the subject of other papers to this Workshop.)

4 USOs IN AN NGN ENVIRONMENT

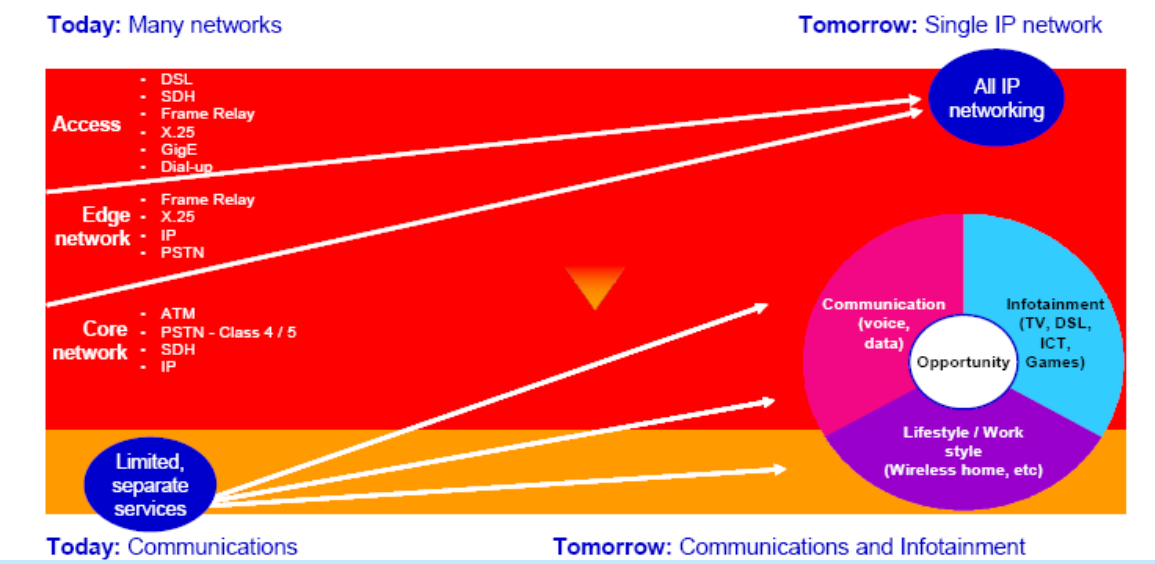
4.1 Essential features of NGN

The PSTN was designed to carry only voice. As demand for data communications developed, the incumbents built new "overlay networks" designed specifically to carry data traffic. And as network technology developed, the number of networks too multiplied, with many operators running several different network platforms (ATM, IP, Frame Relay, ISDN, PSTN, X.25 etc.). This multi-network approach resulted in management complexity, operational inefficiency, reduced economies of scale, high cost maintenance issues, and duplication of capital expenditure. The attraction of moving to an NGN from such a multi-network system is that it is expected to result in one single network platform capable of supporting all traffic types with lower costs of providing advanced services such as VoIP, broadband and multimedia applications. This is expected, in turn, to lead to reduced charges and greater innovation in services for consumers. This network simplification is illustrated in Figure 4.1.

There are two types of network deployment currently referred to as NGN[36]. The first is the deployment of fibre into the local loop, either to the incumbent's street cabinet (+/- max 1 km from the customer premises) in conjunction with VDSL (2) deployment or the deployment of fibre all the way to customer premises (typically apartment blocks rather than individual houses). These have been referred to as "access NGNs". This access evolution is being driven primarily by strong demand for increasing bandwidth to support a growing variety of multimedia services. One of the drivers is triple-play services and, in particular, home entertainment, including TV services, gaming and video on demand. Video can also be embedded in other applications as, for instance, in video telephony or video conferencing.

The second type of network deployment is the replacement of legacy transmission and switching equipment by IP technology in the core, or backbone, network. This involves changing telephony switches and installing routers and VoIP equipment. These have been referred to as "core NGNs". A next generation core is in substance a converged IP infrastructure capable of carrying voice, video and data services over the same physical network – in essence the evolution from a "one network-one service" approach to a "one network-many services" one.

Figure 4.1: NGN will simplify networks
SPU_Box_heading_i



Source: ECTA Comments on NGN Public Policy, February 2006

IP-enabled NGN permits a clear separation between network facilities and services (such as data, pictures, audio, video and private and public voice communication). The access plane provides the infrastructure, i.e. the access network, between the end-user and the transport network. This access plane may be wireless or wireline, and it can be based on different transmission media e.g., copper wires, cable TV and fibre optic. Technologies in the access plane can be circuit-switched or packet-switched. The access network is connected to network nodes at the edge of the backbone (core) network. Since the technological means to achieve higher bandwidth can occur via several access technologies, this is expected to enable platform competition in the access network.

Box 4.1: The ITU's definition of Next Generation Networks

Next Generation Network (NGN): a packet-based network able to provide telecommunication services and able to make use of multiple broadband, QoS-enabled transport technologies and in which service-related functions are independent from underlying transport-related technologies. It enables unfettered access for users to networks and to competing service providers and/or services of their choice. It supports generalized mobility that will allow consistent and ubiquitous provision of services to users.

Source: ITU-T Recommendation Y.2001 (2005)

Layering

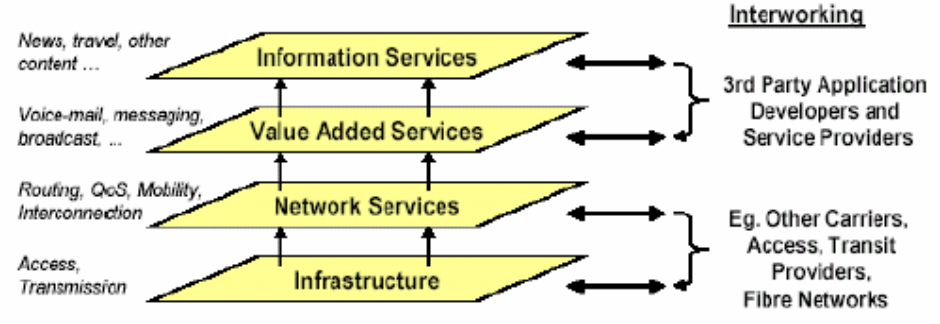
The layered network model implicit in an IP network is depicted in Figure 4.2. As Figure 4.2 illustrates, IP services depend on a physical infrastructure layer.[37] For instance, VoIP service providers cannot deliver their services without infrastructure provided by facility-based carriers. And since access to the full range of NGN services will be possible only with broadband Internet access, broadband will be even more important.

Currently, broadband access is mostly offered via legacy infrastructure, DSL technology and cable TV networks using cable modems. But broadband access can also be offered over new infrastructure, both fixed and wireless. The advantage of the new platforms is that they can offer vastly increased bandwidth (fibre optic), flexibility (WLAN), coverage (satellite), and access on the move (3G and beyond). Wireless technologies, are emerging as attractive alternatives for the coverage of rural and remote areas, where the upgrading of existing infrastructure can be particularly costly.

In a converged NGN network, there should be no differentiation between the types of technology that can be used to access the network. In an environment where telecommunications access can be provided over a variety of alternative means, using universal service contributions to support a single technology platform (wireline at a fixed location) would seem a violation of technological and competitive neutrality. Because consumers are diverse in regard to their circumstances and requirements for NGN services, as far as possible they should have the flexibility to select what is for them the most appropriate/attractive service provider(s).

Since the emerging technologies will differ in capabilities and costs, "platform-based competition" can be asymmetric in nature with different platforms offering varying service capabilities and levels of competitiveness depending on demographic and other factors. Thus, within a specific marketplace, competition may favour only a few or even a single platform and, similarly, only a few or even a single NGN provider. In these circumstances, the effect of such asymmetric platforms on the competitive environment would appear to be somewhat uncertain.[38].

Figure 4.2: Architectural Layering in NGN



Source: Australian Communications Industry Forum, "Policy and Regulatory Considerations for New and Emerging Services", Final Report, Canberra, July 2004

4.2 Migration from PSTN to NGN

The expected migration from PSTN to NGN could itself raise universal service concerns. For instance, the transition from PSTN to NGN is unlikely to take place evenly across customer groups or geographical areas. The more profitable customers are likely to be the earlier movers to NGN networks. As traffic migrates to IP networks there will be fewer customers generating PSTN revenue from voice service. Customers remaining on the old network are likely to be clustered in poorer locations and demographic groups. Moreover, the migration from PSTN networks could increase average per line costs of existing networks and lead to a deterioration in quality of service. At some stage in the future, the PSTN could become uneconomic to maintain and their closure would become a possibility (unless obliged to remain in operation due to a USO). Indeed, closure of PSTN legacy networks would be a distinct prospect since the cost reduction benefits from migration to an NGN network can only be appropriated by an operator that is not burdened by the costs of also having to continue to maintain the PSTN network. As a result, the transition to NGN could raise significant universal service issues. There may be pro-competition reasons why the regulator may force the incumbent to continue operating the PSTN (at least for some time). [39] But even where the PSTN is not permitted to be "switched –off" there could be concerns that the migration to NGN may create a 'digital divide' in regard to the quality and range of services between those with NGN access and those still using the PSTN.

4.3 Implications of IP-enabled NGN for developing countries

Developing countries that are able to develop NGN infrastructure will be able to close the technology gap with developed countries. For instance, the Indian telecommunications regulator considers (Telecom Regulatory Authority of India, 2006) that: "In the Indian context, NGN offers scope for meeting an important national objective of rural connectivity. It may be possible that with optimal network planning and innovative applications, NGN access could provide affordable converged services (multimedia including voice, e-education, e-employment, e-health, e-governance) in small towns and rural areas at lower costs."(p.

23) However, as Figure 3 indicates, the availability of IP-enabled infrastructure is a precondition for the provision of NGN services, including VoIP. And the development of this infrastructure would be challenging for developing countries, especially those where the majority of the population has poor or no access to telecommunications services. This may raise concerns about whether the transition from PSTN to NGN could widen the gap between (developed and developing) countries as well as within a country. Deploying NGN infrastructure to sparsely populated rural/remote areas of a developing country is likely to be more costly and less commercially attractive than in densely populated areas. But if NGN migration takes place only (or much faster) in urban areas of a country, it may widen the technology gap between urban and rural instead of bridging it.

On the other hand, there is a more optimistic view that the dim prospects for commercially viable rural telecommunications service may be exaggerated, even for developing countries. Proponents of this view suggest that there is increasing evidence that untapped rural and remote markets can be surprisingly vibrant, especially where appropriate regulatory conditions exist. For example, in India, the Telecommunication Regulatory Authority (TRAI) has pointed to the popularity of cable TV in India (which has connections far in excess of fixed line telephones) as an indication that even poor people in rural and remote areas will manifest a capacity to pay for a service they value. Thus the development of converged services packages facilitated by NGN, such as triple-play networks, may offer a better value proposition and lower priced access to basic voice communications service than the traditional model of fixed network extensions for traditional telephone service. In addition, investment in IP-enabled infrastructure could be attractive since, as noted earlier, such infrastructure promises significant potential savings e.g., in operating costs. Moreover, it may provide new opportunities for extending network access in rural areas in an economically sustainable manner[40].

In Macedonia, there are plans to build a wireless Internet network (of Wi-Fi and WiMAX) that would cover the entire nation[41]. At a more general level, Milne (2006) concludes: "Our study suggests that the technology exists to enable mobile service to be provided profitably in rural areas of developing countries – which has to mean at prices which are affordable to many if not most rural residents. If existing operators cannot or choose not to offer low-priced service in rural areas, there is a clear case for offering these opportunities to other companies, including to local start-ups with NGO or community support whose primary objective might be service, rather than profit." (p.6)

Market forces and technological development

The technological change on the horizon is contributing to this less pessimistic view since a 'revolution' in rural universal access is seen to be increasingly likely. This revolution will stem from the new suite of wireless technologies such as WiFi and WiMax (which promises telecommunications coverage over a radius of about 50 km) that could provide Internet access and voice service cheaply to rural and under-served communities. Such developments can assist in making rural and low-income markets profitable, affordable, and sustainable. But this also requires an environment in which market forces can facilitate innovation and creative business initiatives. A concern that universal service programs do not impede or distort the entry of new technology and services is particularly legitimate when considering the deployment of NGN. This involves encouraging rather than resisting the erosion of barriers and artificial distinctions among technologies, services and markets. Thus developing countries that impede communications sector development risk placing themselves at a disadvantage.

Mobile communications is an example of how technology has extended the limits of market forces in reaching areas unserved by the fixed network, often at lower cost[42]. Mobile operators have translated this lower cost base into affordable pre-paid packages that allow low income users a basic connection to the network. Pre-payment allows operators to lower operational costs and reduce credit risk, but also gives users more control over expenditure than traditional post paid solutions, thus increasing affordability to low income users. Mobile services are increasingly available to rural users as well. Indeed, the wireless expansion can mean that some operators specializing in the provision of rural service can provide service even in the most remote areas. Competition has resulted in lower prices, and lower prices have meant greater affordability which has resulted in better access. Mobile has brought other innovations as well, such as public mobile payphones and SMS. Indeed, SMS is cheaper than voice and allows mobile users to engage in a type of email. In fact, some even argue that mobile has virtually eliminated the universal access problem for many of the urban poor and for many rural users as well.

Price flexibility

An essential challenge to be addressed by developing countries is that of providing a more attractive environment for investment. The task includes a range of improvements including regulatory transparency, certainty and stability. And it also includes attractive returns on investment. In this context, there seems considerable scope for developing countries to review their present methods of price regulation. A price regulation system based on direction from government is not appropriate in an increasingly competitive market. Experience in the mobile sector illustrates how flexible pricing to allow innovations (e.g., pre-pay and two-part tariffs, capped or maximum bills, etc) can help grow the market in a sustainable way. The development of the low cost airline industry provides another example of a sector where substantial benefits and market growth have resulted at least in important part, from price flexibility. Mandating a reduction in the price of calls from rural and remote areas so that these calls are at the same tariff as calls within urban areas (as has occurred in China, for example) will make service to rural areas even less commercially attractive. This action (while understandable for social and political reasons) runs contrary to the price rebalancing required to make prices more reflective of costs (a policy that many countries have seen necessary to implement). Indeed, cost-reflective price re-balancing to allow higher prices to reflect higher costs of service to rural areas is deemed necessary to help make high costs areas more attractive to operators (thereby stimulating service provision and competition).

Technological-neutrality for cost-effective delivery of universal access in rural areas

Wireless communication technologies, such as fixed wireless access and very small aperture terminals (VSATs), can be effective means of establishing telecommunication networks in rural areas due to their advantages over wired telecommunications in terms of cost and ease of installation. For example, when installing telephones in sparsely populated rural areas, wireless communication technologies can be used in conjunction with satellite stations to achieve coverage of isolated settlements over long distances.

In suggesting that mobile technology be permitted to play a role in delivering USOs, the suggestion is not that mobile technologies should be subject to an additional USO, but that a USO couched in terms of basic voice and data services might be delivered through either fixed or wireless technologies or, indeed, a combination of these and other technologies. In short, the choice of technology should not be specified. A specification that fixed line be used may have been justified at the time it was introduced e.g., because it allowed provision of data services, including broadband. But other technologies, including wireless mobile technologies, are now also promising broadband capacity.

Box 4.2: An example of VSAT-based provision of rural telephony

In 1998, Peru's telecommunications regulator (FITEL) invited tenders to award a 20-year, subsidized concession to provide rural payphones in the remote regions of Tumbes, Piura, Cajamarca and Amazonas. Participants in the tender submitted bids indicating the lowest government subsidy they would be willing to accept in order to build the network. The solution selected by FITEL was based on VSAT technology. The cost-reducing principles behind the winning solution, submitted by GVT del Peru, included the following:

- VSAT-based thin route telephony with up to three voice channels per VSAT
- low power consumption of approximately 40 watts per VSAT, since 90% of sites lacked commercial electricity supply
- star network topology using 7.6 m Hub station in the capital city and a 1.2 m or 1.8 m remote VSAT station in each town
- use of simple, rugged payphones with a prepaid system instead of coins, to reduce the number of field trips to payphone installations
- centralised network management system at the Hub.

Based on this configuration, GVT del Peru proposed to cover the costs of building, installing and operating the network with a government subsidy of US$4,909,292 over 5 years. The remaining costs would be borne by the operator and recovered from service revenues. According to FITEL, the subsidy amounted to public expenditure of US$ 11 per inhabitant.

Source: OSIPTEL "Telecommunications Sector in Peru presentation to APEC TEL28" Presented by Liliana Ruiz de Alonso www.apectelwg.org/apec/atwg/previous.html#16 , 2003

With spectrum becoming an increasingly important resource, there is need to review spectrum allocation and management policy with a view to allowing more flexible use of spectrum, including spectrum trading and liberalization. This will enable: a bigger role for the market in deciding how much spectrum should be allocated to different uses; faster flexible access to spectrum, including unused and underused spectrum; the development of new, spectrum efficient technologies; and innovation in the use of the spectrum and spectrum-based products and services.

Satellite systems have also been developing technologically enhancing ability to serve rural areas. Prices for VSATs have fallen rapidly allowing manufacturers to expand sales of VSAT systems into low-end applications such as rural telephony.

Power-line. Use of the power grid as a communications network – known as "broadband over power lines" (BPL) in the US, and "power-line communications" (PLC) in Europe – appears to be receiving official acceptance with the FCC approving the use of power-line technology in the US in October 2004. Advocates of the technology argue that it promises several advantages offering not only voice but broadband with connection speed not dependent on distance from the telephone exchange (as with DSL), or on the number of customers (as with cable). Also, unlike its rivals, power-line offers uploads at the same speed as downloads and promises to offer far more capacity than today's cable networks. Moreover, the technology will reportedly[43] allow utilities to: monitor what is happening on their power grids in real time, down to local substations; read power and water meters without entering customers' premises; and manage peak loads by, for example, turning down a residential air conditioner remotely while a customer is at the office, in return for a lower tariff.

"Stratellite" technology. Floating in the stratosphere at an altitude of about 20km (13 miles), a "stratellite" would behave just like a geostationary satellite, hovering over a particular spot and relaying radio signals to and from the ground. Like satellites, these airships will be able to provide wide-area mobile telephone coverage, paging and other communications services. However, it is claimed that such airships will be much cheaper to launch and maintain than satellites and can do things that satellites cannot. Advocates claim that a single airship could potentially provide coverage over an area of about 800,000 square kilometers. It should thus be possible to create "hotzones" of coverage encapsulating entire cities and their surrounding countryside, rather than the smaller "hotspots" of Wi-Fi coverage found in airports and coffee shops. Moreover, Stratellites are expected to cost much less than satellites (about US$20 million each) and can be reused. After hovering for 18 months they can be recovered for servicing and then re-launched.

All this is not meant to argue that the technologies mentioned above will live up to their promises, or that one should be preferred to another. It is simply to argue that the market must be kept open and universal service programs maintain technological-neutrality to allow the most cost-effective technology available now and in the future to be introduced to address the challenge of universal access/service and the opportunity for developing countries to move speedily into the technological frontier. With promising technologies and NGN on the horizon, it is crucial that barriers to entry and disincentives to invest be minimized. And certainly it argues that a preference for fixed line operators over mobile or other technologies as the universal service provider makes little sense in a technologically dynamic, increasingly wireless era and, indeed, transgresses the principle of technological neutrality. Rather, where deemed to be necessary, a service to be covered under a universal service provision should be specified, with provision of the service allowed to occur by whatever technology is appropriate/cost-effective. This would be especially important to facilitate development of a multi-platform NGN environment.

Pro-competition regulation

Pro-competition regulation is also important to make rural and remote markets more attractive to prospective new entrants. But there should also be vigilance to eliminate regulations (including local government regulations) that serve as a barrier to new entry. Countries that have committed to apply the pro-competitive regulatory guidelines espoused in the WTO Reference Paper attached to the February 1997 Agreement on Basic Telecommunications need to apply these principles vigorously.

Incentives for NGN roll-out in rural areas

In some areas (especially in rural areas of developing countries) incentives and subsidies may be necessary. The Telecommunications Regulatory Authority of India (TRAI) has made a number of recommendations[44] in regard to providing incentives for telecommunications infrastructure roll out in rural areas of India (which

are worth noting here since these recommendations may also be relevant to other developing countries), including:

- Providing financial support from a universal service fund for sharing of infrastructure
- Supporting backbone infrastructure through a USO fund
- Discounting annual license fee and spectrum charges linked to rural coverage
- Reducing rural VSAT license fees and spectrum charges and provision of transponders at affordable rates
- Abandoning rights of way charges for networks in rural areas
- Supporting niche operators from a USO Fund and through exemption from spectrum charges
- Abstaining from charging spectrum fees for usage of innovative new technologies in rural areas as well as for usage of 450 MHz
- Requiring no prior permission for deployment of telecommunications towers of up to 40 metres in rural areas
- Making available funds collected as universal access levies to the USO Fund rather than to general revenue.

But, as noted earlier, there may be increasing pressure on the ability of telecommunications operators to contribute to USO funds. In these circumstances, even more effort will need to be made to encourage private sector investment. In this context, the World Bank Group has suggested a number of guidelines relating to the development of initiatives to support private-government partnerships in the deployment of ICT infrastructure in developing economies[45] that deserve attention.

Spectrum Related Issues. Improved spectrum allocation and management is especially important in facilitating network deployment in the rural areas of developing countries. In this context, the best practice guidelines for spectrum management to promote broadband access tabled by the ITU's 6th Global Symposium for regulators[46] are noteworthy. The broad dimensions of the guidelines include:

- Facilitating deployment of innovative broadband technologies
- Promoting transparency
- Embracing technology neutrality
- Adopting flexible use measures
- Ensuring affordability
- Optimizing spectrum availability on a timely basis
- Managing spectrum efficiently
- Ensuring a level playing field
- Harmonizing international and regional practices and standards
- Adopting a broad approach to promoting broadband access.

Delicensing spectrum for Wi-Fi and WiMax. Consideration could be given to creating more unlicensed spectrum bands that will encourage innovation and deployment of advanced wireless communication technologies across a country, but especially in rural and remote areas. To provide connectivity at affordable prices and to encourage use of advanced wireless technologies such as Wi-Max, spectrum in 5.7 GHz, 3.5 GHz and 700 MHz frequency range could be de-licensed or made available at nominal charges. Consideration could also be given to the use of spectrum trading[47] to allow spectrum to go to the highest-valued uses.

4.4 Systematic development of universal service strategy

In facing the challenge of a IP-enabled NGN environment, a sensible rule for developing countries (as well as developed countries) is to prepare a strategy for achieving universal access (UA) in a transparent, systematic manner. This will help in establishing clear goals, specific targets and performance measures

before the start of the universal access program. The development of such a strategy is also necessary to answer many of the questions that could be raised about a UA policy, including: (i) what the coverage of universal access programs should be (that is, apart from the basic provision of one or two public payphones, should UA programs also cover telecentres and subsidization of uneconomic service to individual rural households)?; (ii) is a Universal Service Fund necessary, and if so, what should the size of the Fund be?; (iii) whether the telecommunications operators should be required to contribute to the UA Fund and, if so, what the basis of the contribution should be, e.g., what percentage of revenue should they be asked to contribute?

The strategy should have the 'transparency' required by the WTO Reference Paper (that many countries have committed to). Such a strategic approach will help to ensure that a country is thinking about longer-term policies and how shorter-term UA programs support longer-term universal service policies.

A number of countries have adopted such a systematic approach to identifying universal service/access objectives and solutions, including the UK, Hungary, Australia and India. The components of such a strategy are set out in Box 4.3.

Box 4.3: Rules for systematic development of universal access/service strategy

A systematic review of universal access/service programs should be based on (at least) the following considerations.

1) Clear and specific articulation of the objectives and coverage of universal service

It is crucial to specify the intended beneficiaries clearly. In this regard, it would help to break down the broad objective of universal access into a range of distinct, realisable and measurable targets for its sub-components. For example, these targets may include: universal geographic service; universal affordable access; universal access to the disabled; universal quality of service, etc.

2) Identification of barriers to universal service

Such information is necessary to guide the development of effective universal service policies.

3) Identify schemes that could cost-effectively address the identified barriers to universal service

To maintain the benefits of a competitive or 'contestable' market in the delivery of universal service, the option for a universal service provider to be replaced by a more cost-effective supplier should be preserved.

4) Estimate the cost of programs for universal service

The costing principles, process and outcomes should be transparent and subject to audit; it should be subject to regular disclosure.

5) The relative merits of alternative mechanisms for funding universal service should be considered

The funds to support universal access schemes can come e.g., from taxation revenue, levies on telecommunications users, from telecommunications operators, from licensing and spectrum auction receipts, etc. Whatever, the mechanism chosen, it is important to ensure that it is carefully structured and targeted so as to minimise market distortions.

6) Ensure regular public reporting of progress in achieving universal service

7) Ensure regular monitoring and evaluation of performance in the delivery of universal service

The evaluation should include comparison of achievements in delivery against a pre-set delivery schedule and targets.

8) Set suitable universal service objectives based on the level of access provision likely to be sustainable and defining the scope of access

9) Identify regulatory mechanisms for reaching universal service objectives

10) Establish a mechanism to raise universal service funds

11) Facilitate public-private co-financing of infrastructure investments; and

12) Promote local participation in community based access centre initiatives.

Note: SPU_note

5 WHAT RULES FOR UNIVERSAL SERVICE IN AN NGN ENVIRONMENT

5.1 Good practice guidelines for USOs in an NGN environment

The lessons of experience suggest a number of best practice guidelines for cost-effective delivery of USOs. Some of these best practice guidelines are collated in the ITU's Global Symposium for Regulators Guidelines for 2003[48], 2004[49] and 2005[50]. These and other guidelines remain relevant for USOs in an IP-enabled NGN environment and are worth reiterating as we address the question: "What rules for universal service in an IP-enable NGN environment?" Three basic rules are repeated here, followed by a set of "best practice" guidelines distilled in Box 5.1. Rules for the delivery of USOs are also important and, at the expense of some repetition, these are summarized in Box 5.2.

Basic rule 1: Recognise that universal service obligations can cause inefficiencies

A review of USOs for an IP-enabled NGN should bear in mind that universal service programs can generate inefficiencies. USO programs can, for instance:

- restrict or distort competition and availability/choice of technology in rural/remote areas
- discourage potential market entrants facing the prospect of competition against a subsidized provider (offering services at prices below cost)
- suppress market signals and, accordingly, market development
- benefit those who do not need subsidies (because many USO programs are generally not means-tested)
- be wasteful since USOs applies a blunt "one size fits all" approach whereas consumer preferences can differ markedly
- provide or subsidise services which many users may be able to pay for on a normal commercial basis
- deter market entry due to the additional costs that universal service policies impose on market participants, especially if they are made to contribute to a universal service fund that is used to transfer funds to the designated USO provider (usually the incumbent)
- impose a considerable cost on consumers (who may bear the final incidence of universal service levies and costs imposed on operators).

Basic rule 2: Keep subsidies to the minimum necessary

Market restructuring, rapid and unpredictable technological change, convergence, and the onset of NGN, all argue that regulation and subsidies be the minimum necessary. USO programs may turn out to have only short-term advantages if they result in adverse long run outcomes including distortions to the nature, extent and speed of technological innovation and investment. Moreover, arguments on behalf of uneconomic telecommunications consumers should be constrained by the need not to impose an unreasonable cost burden on other (economic) consumers and market participants. All this suggests that subsidies and regulation be kept to the minimum necessary.

Basic rule 3: Place primary reliance on market-based approaches

Primary reliance should be paced on market-based approaches that are competition and technology neutral. Indeed, the most effective way of addressing universal access and universal service objectives in a *sustainable* way is to facilitate the development of market-based, commercially attractive, businesses around this task. The greater is market supply, the fewer the areas/people needing subsidy (and, accordingly, the greater the capacity to assist them).

Primary reliance on the market seems especially appropriate in the case of NGN since policy makers are unlikely to be in a position to reliably predict the unprecedented technological progress and commercial

innovation over the coming years (in developing as well as developed countries). In an increasingly complex communications environment, a greater reliance on the marketplace and consumers to select the best providers and technologies to deliver service, including universal service, seems sensible.

Box 5.1: Some Guidelines for USOs in an NGN environment

Aim to expand communications infrastructure, especially in rural and remote areas, by keeping the market open and ensuring competitive and technological neutrality. This would be consistent with the 'light-touch' regulation (including regulatory 'forebearance') that seems needed in a dynamic, competitive, convergent communications sector that is expected to characterise an IP-enabled NGN.

Governments can stimulate and facilitate a maximum role of the private sector (while recognizing that government-private sector partnerships can be cost-effective, especially in the case of developing countries[51]) and encourage effective competition that can serve to minimize the subsidies required).

Base universal service programs on clearly defined transparent goals and policy objectives and keep subsidies to the minimum necessary to meet these objectives.

All providers should be able to compete equally for the right to fulfill universal service orders.

The criteria for carriers to be eligible for universal service support should be open, transparent, competitively neutral, and designed so that it does not exclude new entry in favor of legacy monopoly providers. The geographic area that carriers are required to serve should not be so large as to effectively limit support to new entrants/alternative service providers and to exclude other facilities-based providers (other than the incumbent).

Deployment of innovative broadband technologies should be facilitated.

Competitive and technology neutrality should be embraced. Adopt technology-neutral licensing practices that encourage new investments in telecommunication infrastructures and facilitate competition within the sector.

Design USO programs to put competitive pressure on suppliers to supply services at the lowest possible cost.

The use of well-designed competitive tenders can (in certain competitive circumstances) help to generate incentives to contain costs, innovate, and reveal the true cost of delivering universal service (thus helping to minimise the subsidy required).

Minimise intervention since, while more substantial intervention might lead to greater short-term benefits, it could potentially stifle a dynamic market process with adverse competitive, economic and even social consequences in the longer term.

Where feasible, target (means-tested?) subsidies directly to those in need.

In countries where there is no ubiquitous fixed line coverage already available, it may be cost effective to encourage widespread roll out by a mobile operator.

Allocate spectrum on the basis of achieving economically efficient, competitive and structurally desirable outcomes (rather than to maximise revenue for government).

Encourage improved spectrum allocation and management; optimise spectrum availability on a timely basis; and adopt flexible use measures, including consideration of spectrum liberalisation and secondary trading.

Facilitate sharing of facilities and infrastructure (where sharing can be beneficial, for instance, through accelerated network rollout, potential elimination of unnecessary cost duplication, and minimization of adverse environmental impacts).

In an NGN environment, where effective competition is established or where there is a reasonable prospect of a effectively competitive market in the near term, there are strong arguments for being wary of heavy-handed regulation and the disposition should sensibly be towards light-touch regulation, including regulatory 'forebearance'.

Note: SPU_note

USO delivery mechanisms. Rules for USO delivery mechanisms are also important and could be guided with the criteria in Box 5.2.

Box 5.2: Criteria for assessing universal access/service delivery mechanisms

In principle, the selection of implementation mechanisms for universal access/service delivery can be guided by a range of criteria, including:

Sufficiency: Does the mechanism help to ensure comparability of service and rates between urban and rural customers?

Affordability: Does the mechanism enable providers to offer the supported services in an affordable manner?

Competition: Does the mechanism minimize distortions to competition; does it encourage and facilitate competition by precisely targeting support to high cost customers?

Flexibility: Is the mechanism able to evolve as new technologies are introduced, as competition develops and as the definition of universal access/service changes over time?

Protection and advancement: Does the mechanism prevent degradation of the existing infrastructure and the current level of service? Does the mechanism produce an investment incentive to upgrade facilities used to provide universal service?

Portability: Can the mechanism provide all eligible operators with an appropriate amount of support in a competitively neutral manner?

Predictability: Does the mechanism enable an operator to determine in advance the amount of support it will receive on behalf of a customer?

Practicality: Is the mechanism economically and administratively viable?

Transparency: Is the mechanism transparent and open to monitoring and review?

Cost-effectiveness: Does the mechanism enable objectives to be achieved at least cost?

Note: SPU_note

5.2 Impact of NGN on present USOs: voice; quality of service, emergency services; directory service; and public payphones

How might the transition to NGN impact on present USOs? What is likely to happen if market forces were unshackled? What (if any) regulation will be required to complement or supplant the market?

5.2.1 Voice

Curently USOs commonly require that all can access voice service at acceptable quality of service at an 'affordable' price. The entry of VoIP is raising some challenging issues in this regard. While VoIP is still only a small portion of total voice calls, analysts are predicting an increasing switch to VoIP. Indeed, some analysts expect that in time, almost all voice communication will be through VoIP. What are the USO implications of this shift? As a preamble to answering this question, the essential features of VoIP service need to be examined.

There are a number of different types of VoIP services available at the retail level:

- voice over broadband ("VoB") managed by the broadband access provider
- VoB managed by an independent voice service provider
- VoIP as a "personal voice application".

VoIP use is expected to grow rapidly since it is delivering substantial benefits to consumers, including:

- lower network costs, lower user prices and new pricing structures
- cheaper calls (sometimes more than 50% less) than standard phone calls
- operators that mostly do not require fixed-term contracts
- free calls for friends and family who use the same provider

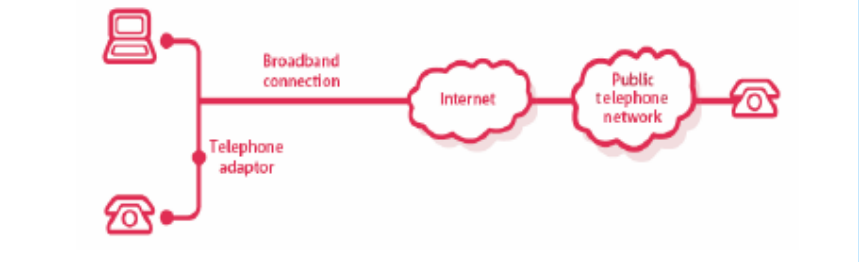
- cost-effective service if a lot of calls are made overseas or during peak times
- new features such as unified messaging, conferencing, video and personalised call handling
- greater choice of innovative and differentiated services as entry barriers fall and competition in the voice market increases
- more competition in broadband as ISPs will be able to offer consumers more attractive propositions combining voice with Internet access.

In NGN, broadband subscribers can access VoIP at low prices, bundled with subscription. However, those without broadband will be dependent on voice service from PSTN (which is likely to be degraded as migration to NGN proceeds) or wireless, and this could raise USO concerns related to availability or quality of voice service. In theory, any Internet connection could be used, including dial-up, but dial-up is not widely used to provide VoIP services. VoIP services typically use a broadband connection to provide voice call services using VoIP technology from either a personal computer ("PC") and dedicated handset/headset or a traditional telephone handset using an adaptor as shown in Figure 5.1. There are now a wide and increasing number and variety of VoIP service propositions in the marketplace. For instance, in the UK[52] these include:

- PC–based services that allow calls from one personal computer to another (such as Skype PC-to-PC and Google Talk) commonly referred to as PC-to-PC services;
- Services marketed as secondary line services that allow calls to and from traditional telephone numbers (such as Freetalk, Wanadoo, BT Communicator, Tesco and Gossitel); some of these services include the ability to make calls to emergency services (e.g., 999 in the UK) and some do not;
- Other services that are marketed as replacements for traditional PSTN based call services; typically, the PSTN line remains in place and the VoIP service is then used only for long distance calls; and
- Services targeted for nomadic and mobile use have also begun to enter the market. Voice over Wireless ("VoWLAN") services are being developed and other services are being deployed that rely on wireless access solutions using licensed radio spectrum.

These services are being offered by a range of providers. In some cases they are offered bundled with Internet access services and in others as stand-alone services.

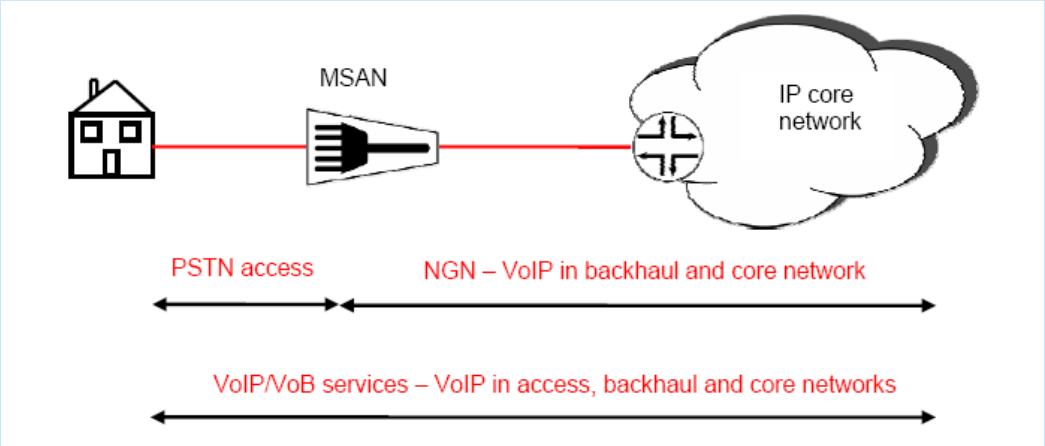
Figure 5.1: VoIP Service



Source: Ofcom (2006), p. 4

Some providers with existing PSTN networks, and with end-users connected to those networks, are migrating to NGN. These leave existing end-user connections in place, but migrate the remainder of the network to IP based transmission. Other providers who currently provide broadband services to end-users are now starting to use this broadband access to deliver voice services (typically referred to as 'Voice over Broadband – VoB). The two different models are illustrated in Figure 5.2.

Figure 5.2: VoIP in Access, Backhaul and Core Networks



Source: Ofcom (2006), p.10

Quality of VoIP service

Voice services can impose more stringent demands on the network than other services. For instance, voice operates within relatively tight bounds of total latency, imposed jitter, signal distortion and data loss parameters, while other services (e.g., data) are more tolerant of various forms of vagaries in network service responses. Thus VoIP services may offer different features and capabilities by comparison with the features of PSTN-based services that consumers have come to expect as standard. For instance, there are problems associated with VoIP that are not present for PSTN calls, including reliable access to emergency calls, interruptions to normal service and reliance on the power supply to maintain the service[53]. Moreover, as with any Internet-enabled system, VoIP can suffer from a number of technical problems related to using the Internet such as jitter on the line, access difficulties, virus attack, security, etc. Thus there is concern that the widespread adoption of VoIP could result in a degradation in the quality of voice service.

Emergency services

The possibility to make emergency calls and to route the call to the nearest authority (fire department, police, hospitals, etc) is a mandatory element of telecommunications service in a number of countries. Also caller location information is increasingly becoming a requirement for both fixed and mobile telephony. Because VoIP calls can be made from any Internet connection, a major question to be faced is how to provide emergency services with information regarding the caller's location, which must accompany emergency calls. In VoIP it is possible to maintain the positioning and routing information for emergency calls from a fixed location. However, in nomadic use, at the present level of technological development, the caller position information cannot be made available with the emergency call.

The approach taken by a number of countries to address the calls to emergency service is noteworthy.

US. In the US, calls to 911 with traditional phones provide emergency service dispatchers with the caller's number and address. Internet-based phone providers have limited access to the systems connecting those calls to primary emergency lines and location information is not always available. In May 2005, the FCC adopted rules requiring interconnected VoIP providers such as Vonage to provide emergency E911 service. Vonage has reportedly concluded agreements with the big local telephone carriers for its customers who dial 911 to be connected to the primary lines in emergency call centres. In the US, VoIP providers do not have unrestricted access to the telephone system built for the nation's 3,200 emergency calling centres that are owned and controlled by Verizon and the three other Bell operating companies. So they still cannot successfully route a 911 call to the right emergency calling centre or provide emergency operators with the caller's phone number and location. This can force the Net-phone companies into less-effective ways of routing 911 calls. Rather than being routed directly to trained emergency dispatchers, the calls are typically relayed to administrative lines at call centres, which then transfer them to dispatchers. The concern is that in an emergency, the few seconds lost could be the difference between life and death.

Canada. In April 2005, the Canadian Radio-television and Telecommunications Commission (CRTC) decided that VoIP service providers had to offer emergency 911 services comparable to incumbent carriers. In its decision, the CRTC said VoIP service providers must notify customers about any limitations to their emergency services, as well as make sure their subscribers acknowledge they are aware of limitations. The CRTC also requires that all VoIP providers provide ongoing customer notification during service provisioning, by issuing warning stickers to be placed on telephone sets, through any subsequent advertising and billing inserts.

The CRTC distinguished between three types of VoIP service that will be required to offer emergency services. These include fixed VoIP service where users can only place a telephone call from the location where their service is being provided, nomadic VoIP where calls can be made from any location that offers Internet access, and foreign exchange VoIP service, which allows users in one exchange to receive telephone calls dialled as local calls in another exchange. Fixed providers must offer either enhanced or basic 911 services, while nomadic or foreign exchange must simply provide an interim solution with basic 911 service.

European Union. The European emergency number "112" can now be used free of charge throughout the EU, from fixed or mobile phones. The aim is to enable EU citizens traveling within the EU to call the emergency services using a single number. The EC Universal Service Directive (2002) places the onus on Member States to inform citizens about the existence and use of 112. Many EU Member States are upgrading the organization of their emergency systems to provide a better service to those calling the emergency number. For instance, Finland has centralized emergency centres with a maximum response time of 90 seconds. And the Czech Republic has implemented a system whereby an emergency operator is able to transfer a call to another centre that can assist in the language of the caller. Spain, too, has improved the quality of its emergency response by ensuring that caller location information is available to the emergency services.

In the EU, operators are obliged to provide caller location information to emergency services, to the extent that this is technically feasible[54]. And in March 2005[55] the EC further stated that, from then on, the Commission would regard the provision of caller location as technically feasible, since it is available in a majority of Member States[56]. An increasing number of EU Member States are also taking steps to provide a better service to those who call 112 in an emergency situation. The most common action is the creation of centralised Public Safety Answering Points or PSAPs, able to deal with virtually all emergency situations, whether they fall under the remit of the police, the fire brigade or an ambulance service. In some countries, there is also improved access to certain helpline numbers that are useful for consumers, not only the emergency number. For instance, in Belgium, services that can be reached include medical emergencies, firemen, police, anti-poison centres, child focus, and suicide prevention.

Hong Kong. In Hong Kong, the Telecommunications Authority concluded that IP Telephony providers supplying the broadband connection to the customer or service providers that assign their customers with numbers from the Hong Kong Numbering Plan should be required to provide customers with free access to emergency services. For other services, provision of free access to emergency services is optional.[57]

Regulation of VoIP quality of service or informed consumer choice?

Should regulation be depended upon to mandate certain QoS such as caller location for emergency calls? A regulator can specify QoS parameters that all companies with a network and offering voice services (directly to customers or indirectly via service providers) must abide by, imposing QoS standards to all voice services, PSTN, mobile and VoIP. For instance, consumer protection regulation could be amended to establish a set of quality of service benchmarks for the measurement of voice quality that would be equally applicable to all voice services, including mobile and VoIP.

Where regulation is to be used to prescribe QoS standards, the task could include determining what services should be subject to regulation and what that regulation should be. For example, a distinction could be made between the treatment of publicly available telephony services (PATS) and other forms of non-conventional voice service, with basic telephony access required to include:

- minimum voice quality
- service reliability (e.g. voice services to be unavailable to customers for an average of no
- more than 10 minutes per year)

- telephony users being able to make emergency calls if there is a failure in the local
- power supply.

In this context, an important issue is whether the facility-based operator will be willing to offer access to QoS provision to non-facility based operators. NGN is expected to enable greater service layer independence from the main network such that third party service providers can provide customers access to a range of IP based application services without revenues necessarily flowing to the network provider. In this scenario, some network operators may have incentives to resort to degrading the quality of service provided by these non facility based service providers so that customers switch back to procuring application services from the network provider.

Another problem with trying to ensure quality of service is that an infrastructure access provider only supplying a carriage service could be unaware of the contents of the IP packets or IP applications being provisioned over its access link. Thus, the IP Telephony service provider might not be able to control or maintain the service quality. This suggests that regulators should be wary of imposing regulations for carriage services onto the infrastructure access provider that requires or implies knowledge of the content on the part of the infrastructure provider.[58]

Could the market be left to determine prices and conditions in the context of quality of service?

As discussed earlier, a basic rule for regulatory policy in the dynamic NGN environment is to focus more on the market and on consumer choice. This would mean refraining from heavy handed regulation wherever possible. Not all broadband access is the same. For example, cable, fibre and DSL technologies have significant bandwidth advantages over WiMax, BPL, and VSAT. In addition, cable, DSL, and fibre work best in high population density areas and are less economic otherwise. Thus, in the future, the *quality* of access, not merely the availability of access, may become a major consideration in setting policy.

Mandating VoIP to have the same quality of service and features (such as caller location information for emergency services) would increase costs and barriers, especially for new entrants and could make it more difficult for them to compete (e.g. against the incumbent). In this view, it might be preferable for regulation to ensure that consumers are aware of the differences in quality and features and also of prices allowing them to choose. Certainly, for markets to work well, consumers need good information and any deficiencies of VoIP should be well understood by users of the service, including:

- variability in the reliability and quality of VoIP calls
- some providers not allowing emergency calls
- many operators having non-interchangeable software and locking their adaptors for use only with that provider
- the fact that VoIP service can contribute to a user's overall download limit.

Some regulators (e.g., Ofcom) are advocating provision of adequate information on service capabilities so consumers can make "informed choices" (e.g., numbers with more digits for services not meeting minimum requirements). This would enable consumers to trade off quality of service against price. Regulators could encourage the industry to develop self-regulation, including industry codes, to implement consumer protection and education measures i.e., labelling of equipment and services and marketing practices in order to help ensure that consumers are provided with sufficient and clear information about the limitations and capabilities of IP telephony services before contracts are signed. A VoIP service that does not comply with QoS standards, could be labelled a "secondary service" with requirements for full disclosure of the VoIP service limitations to customers by the VoIP service provider. Examples include: service suspension during power outage on customer premises[59]; the need to update location information on relocation; end-to-end quality of service may not be guaranteed where the customer acquires his own broadband connection to access the services; and unavailability of number portability. Where providers are able to use quality as a differentiator[60] in an NGN environment, markets for low quality and for high quality of service could then develop in accord with customers' QoS requirements.

5.2.2 Directories and Directory Enquiry Services

In many countries, e.g., the EU Member States, the universal service obligations in regard to directory information includes:

- • the provision of a comprehensive printed directory of subscribers to all end users free of charge and at least one a year
- • the provision of a comprehensive national and international telephone directory enquiry service to all end users, including users of public pay telephones
- • the obligation to keep a record of all subscribers of publicly available telephone services in the Member State, including those with fixed and mobile numbers.

Telephone customers are accustomed to ready access to a directory and Directory Assistance service. Will such services be provided in an IP-enabled NGN environment without the need for regulation?

In some countries, the directory assistance market has been opened up to competition but this competition relies upon information being provided from communication providers that allocate numbers to both small businesses and residential customers. The requirement to collect and pass on data is distinct from the requirement to provide access to directory services. For instance, Ofcom believes that in relation to the former, the requirement should continue to be a necessary part of the USO. In regard to the latter, Ofcom points out that the UK market for directory enquiry services was liberalised in 2003 and currently has 120 providers in addition to BT. However, according to the UK National Consumer Council, the result has not been good for consumers, having led to confusion and higher costs that are often not clear to consumers. In Italy, too, the removal of directory enquiry service from the USO in September 2003 is reported to have led to a doubling of prices, while the complete liberalisation of this sector in October 2005 has not yet produced a significant decrease in prices.

If considered necessary, regulators could oblige all telecommunications providers, including mobile and VoIP providers, to publish the relevant number/data of their clients, in such directories without any increase in the price charged for it.

In Hong Kong, the Telecommunications Authority decided that provision of directory enquiry service and printed directory to customers free of charge should be a mandatory requirement for IP telephony providers supplying the broadband connection to the customer. Such service providers should incorporate the directory information of its customers such as names and telephone numbers into the unified directory database. It would be voluntary for other service providers whether to offer the directory enquiry service and printed directory to their customers. [61]

This issue can be important because a point of contention could be the high price competing providers are required to pay to obtain the comprehensive database from an incumbent. In the Netherlands, a judgment of the Court of Justice in the *KPN* case[62], determined that the price an operator can charge for access to the data in the database must be cost-oriented and reflect the cost of making the data available. The approach taken in Spain is also noteworthy. The Spanish NRA, as opposed to the designated undertaking, controls the database and gives access to the database without charge to any operator seeking it.

5.2.3 Public pay phones

With the widespread availability and enhanced affordability of mobile services, the use of public payphones has seen a dramatic decrease. Accordingly, usage revenue has fallen, increasing the subsidy cost of providing and maintaining public payphones. For example, in Norway, the revenue raised from public payphones was at NOK 300 million (approx 40 million Euros) in the mid-1990s, by 2000 it had fallen to NOK 154 million (19 million Euros), and by 2004 it was NOK 70 million (9 million Euros), while estimates for 2005 indicate revenue at NOK 42 million (5 million Euros)[63]. In Australia, Telstra disclosed in February 2006 that it had been experiencing a significant fall in revenue from payphones and unveiled plans to reduce the number of its 32,000 pay phones across the country by about 5,000.

This has led to the suggestion that a USO provision of a “wide spread national coverage” of public payphones is less necessary, at least in developed countries. In developing countries payphones will continue to provide a key service and remain critical for universal access. But even in developed countries, public pay

phones can continue to be important in case of emergency calls when, for instance, using mobile telephony is not possible (e.g. due to no battery, low battery, loss of the handset, temporary or permanent limited coverage, etc). Moreover, accessibility to public pay phones in locations of "social relevance" (such as hospitals, prisons, places where there is not mobile coverage or where mobile usage is forbidden) has raised arguments that such payphones might be left within the scope of a USO. In addition, high roaming charges and problems with networks make public pay phones a useful facility for those traveling abroad.

If operation of payphones were no longer a USO, it is likely that many loss-making ones would be removed. The concern is that these payphones may well be the ones located in rural and remote areas that are probably amongst the most needed. Rather than discontinuing pay phones, ways might be sought to limit the financial costs of maintaining pay phones. For instance in Germany, Deutsche Telekom has introduced "basic phones" with reduced functionality (including free emergency calls) decided upon in consultation with the public. Moreover, some argue that rather than eliminating public payphones from the universal service obligation they could be improved by incorporating public pay phones as part of a telecentre providing various facilities, including Internet access. These telecentres could also provide a public access point to the IP-enabled network.

Alternatively a public pay phone box that is not covering its costs might be subjected to a predetermined review process, and then allowed to be removed or replaced e.g., with a much simpler, cashless, emergency only call box, which would be easier to maintain and less of a target for vandalism. For instance, in the UK, the universal service providers have to publish plans to remove the last remaining public pay phone from a particular local call area then consult on those plans for 42 days (during which time local public bodies can veto a proposed removal). In its consultation document on universal service (Ofcom 2005)[64], Ofcom proposes that this local veto system be retained, with an extended 90 day consultation period and an appeals process to help resolve disputes. Ofcom is also consulting on the need for new guidelines regarding the obligation to provide pay phones to make the system clear and consistent. These guidelines would take account of the:

- number of households in the area;
- distance from the nearest alternative public call box;
- number of calls made from a call box and its profitability; and
- status of mobile phone coverage in the area.

Another alternative is for the government (or local government) to pay a subsidy for the provision and maintenance of payphones on the basis of a competitive tender.

Play or pay. Yet another alternative is to give new entrants the option of providing their own USO services, to a value equivalent to that of their former (or prospective) USO contributions. New entrant operators might consider it more advantageous to subsidise loss making payphones if they could do this directly and advertise that they were doing this (in the public payphones they provide) rather than simply be required to subsidise an incumbent's loss making payphones (with the incumbents often getting all the credit). (This rationale would apply equally to allowing new entrants to themselves provide other types of USO services e.g., voice and data through satellite technology, rather than be compelled to contribute to a universal service fund that then subsidises the USO provider -- often the incumbent.)

5.3 Supporting 'affordability' and 'accessibility' in a NGN environment

How will the migration from the PSTN to NGNs affect the affordability and accessibility provisions of the USO? To what extent will the market provide solutions to affordability and accessibility and with what implications, if any, for regulation? If 'availability' is largely addressed (or at least prospectively so) what could be needed in an NGN world are specifically targeted schemes to support 'affordability' and 'accessibility' for the needy[65]. Examples of such schemes are already in use and could be extended in an NGN environment.

Assisting 'affordability' and 'accessibility' through targeted programs. Some countries are already using targeted programs on a small scale, such as Lifeline and Link-up in the US, and so-called "low user" schemes in the UK. Some schemes offer a concession on certain charges to eligible old-age, disadvantaged, disabled or low income consumers for basic telecommunications services. Discounts are offered in respect to

connection charges, monthly access charges and usage charges so that the rate of growth of a "lower quartile bill" is contained. In the UK, the universal service provider is required to offer special services to customers with disabilities including text relay (that translates voice into text) for people who are deaf or hard-of-hearing, special format telephone bills for people who are blind or partially sighted, and a priority fault repair service.

In the EU, designated undertakings may also be required to provide tariff options or packages to consumers that differ from those provided under normal commercial conditions, in particular to ensure that those on low incomes or with special social needs are not prevented from accessing or using the publicly available telephone service. However concern has been raised that people entitled to these tariff packages are not necessarily aware they exist.

In Spain, the retired and those receiving social benefits are entitled to a special tariff plan for low-income users. In Austria, the government finances special tariff schemes available from fixed and mobile operators, whereby users receive one hour of free local or national calls as well as free subscription. In Hungary, a fund has been set up that allows certified low income subscribers to obtain a lump sum that goes towards their monthly telephone bills. In Belgium, all operators have to offer social tariffs to eligible customers and also have to contribute to a fund that will pay for the cost of these tariffs.

Services for the disabled

New technologies could bring benefits but also challenges for users with disabilities. In the European Union, one of the sectors targeted by the EU's i2010 initiative are people with disabilities, estimated to constitute about 15% of the European working population[66]. This is considered to be a significant proportion of the population, making it important for products and services to be accessible to these end-users. Action is encouraged rather than mandated.

The open specification of new, IP-based networks provides a significant opportunity for providers to design and deliver special services independent of the usual telecommunications operator product development process. New networks could provide an opportunity for service providers to adopt a 'design for all' approach and ensure that services are accessible to all users from the outset. Thus, the needs of disabled users could be accommodated early in the design process so as to reduce the cost of providing special services later on. In the UK, a number of respondents to Ofcom's Strategic Review of Telecommunications: Phase 2 consultation argued that Ofcom should extend USOs to telecommunications equipment as well as services, including requirements that the needs of disabled people be built into NGN from the design stage.[67]

It is likely that some of the new communication services made possible by NGN will improve the ability of disabled users to communicate in an effective way, choosing the service which best suits them. For example, text relay services can be provided as instant messaging service; speech to text conversion by unified messaging; conversation based sign languages by means of webcams and videophones; public pay phones could be built to accommodate wheel-chair users; the hard-of-hearing could be assisted through the use of amplification systems; and the sight impaired by installing special keyboards.

The Italian NRA has set general principles that fixed line operators are encouraged to follow so as to assist disabled access to basic services. These measures consist, for example, in giving priority to the users with disabilities in relation to new connections, reducing repair times and ensuring appropriate customer assistance.

The Irish regulator has created a specialised website listing the measures the incumbent has put in place for users who are hearing-impaired (e.g. amplifier phones, visual alert phones), for users who are hearing and/or speech-impaired (e.g. a text relay service and rebates on such phones since it takes longer to make a call on them), for users with limited dexterity or mobility (e.g. hands free phones) and for users with restricted vision (e.g. Braille billing, special directory enquiries).

In Australia, the incumbent carrier, Telstra, is obliged under its Carrier Licence Conditions, to offer a package of products and services to address the needs of low-income customers. Telstra's "Access for Everyone" scheme contains programs that target low-income Australians within the following seven segments: age pensioners; people with a disability; transient and homeless people; job seekers; people from non-English speaking backgrounds; indigenous Australians; and low-income families. Similar schemes exist in a number of other countries such as the US, UK and Ireland.

Some options that have been used to assist the needy to access telephony that could also be considered for assisting access to NGN include:

- reviewing disconnection procedures to help customers unable to pay to stay connected to some more essential/emergency services
- improving provision of and ability to use pre-paid services (used by Telmex in Mexico); such a service is along the lines of mobile pre-paid services but now also the increasingly common use of pre-paid cards to make low-cost international calls
- providing low cost or free blocking services for expensive information-related services
- requiring telephone operators to offer the option of an installment payment plan or a bad debt repayment plan to customers, thus allowing customers to maintain service while making repayments
- providing more substantial discounts off monthly access fees for those meeting eligibility requirements
- ensuring greater awareness of assistance programs through public announcements and targeted advertising.

More attention is needed as to how a combination of subsidies can best help ensure cost-effective support: to firms serving the highest-cost areas (to improve availability), direct (means-tested) subsidies to the most needy consumers including through 'vouchers' that they can spend on an operator of their choice (to enhance affordability), and special schemes to assist the disabled (to assist accessibility). In addition, some shift in focus is needed away from who pays for what to a more people-centred approach, such as what do people need by way of access to affordable communications?[68]

Competition in the delivery of service to support affordability and accessibility

In the UK, the incumbent universal service provider, BT, has suggested that a regulator introduce competition in the delivery of support for affordability by inviting operators to propose bids for funding to introduce and operate these schemes. A number of schemes, each from a different operator, could be selected, the adjudication based on overall value for money, including a consideration of the amount of funding sought and the number of customers in the target groups predicted to use the schemes. This suggestion is worth further consideration since there could be distinct advantages in having competing schemes provided by different operators in the market. It would give choice of supplier to all consumers, not only those able to afford standard tariffs, and would enable the efficiency of each service to be compared. The requirement to bid for funds could also provide empirical evidence on the benefits of delivering the USOs. If the market fails to deliver inventive improvements to affordability and accessibility for the disabled, regulators could consider measures to promote this.

6 "FUNCTIONAL INTERNET ACCESS" IN AN IP-ENABLED NGN ENVIRONMENT

6.1 Could USOs cover only access to telecommunications infrastructure rather than services?

The present system of USOs has its origins in the time when both access and services were only available from a single supplier. With NGN there is a separation between networks and services. The development of Internet Protocol (IP) technology allows delivery of a number of previously separate communications services using only one transmission platform. Thus, Internet-based communications could allow consumers greater choice in choosing service providers. In an NGN scenario of greatly increased availability and affordability of (cheap) voice service (now only one of many applications provided on networks) should the focus of universal service move towards provision of an affordable broadband access link?[69] In other words, should universal service be concerned only with ensuring access to a minimum capacity/speed? Could universal service programs at some point in the future separate the access to infrastructure element from the service provision element and address only access to the communications infrastructure, on the grounds that

competitive provision of services (e.g., telephone service provided using Voice over IP) will ensure their availability and affordability?

There is considerable disagreement the answers to these questions.

One view (e.g., put by KPN in its response to the EU Consultation on universal service (2005)) is that users will not be interested in access only since for users it is the services (communication, content, transactions) they can use. In this view, access to infrastructure as such has no value for the user. In its submission to the EC consultation on Universal Service (European Commission, May 2005), Vodafone argues that: "The focus should be on services, because social exclusion derives from lack of access to services rather than from not having access to specific communications infrastructure. For example, the satisfaction of the demand for real-time, two-way communication between individuals can be met by several technologies other than simply voice communications over a fixed line. In a data environment, it is even more important to retain the focus on the services that are considered essential for participation in society, rather than any particular delivery infrastructure. There is a high risk of market distortion if there were a bias through intervention towards a particular type of infrastructure access." (Vodafone (2005) p. 4)

On the other hand, the UK Department of Trade and Industry declared in its submission to the EU consultation on universal service (May 2005) that:

"We are somewhat attracted to the idea of moving towards an environment where it is the *access* (to perhaps broadband connection) that is specified as an obligation rather than a specific service".

Ofcom concurs that there may be a case for separating the two elements but raises a number of issues that are pertinent to this decision:

(i) it may be premature to conclude that the provision of services will de facto ensure the availability and affordability of services to the standard required by the USO; and

(ii) an assessment of affordability would need to look beyond the cost of the services themselves and include the cost of devices required to connect to the service. This may be an additional barrier for some vulnerable customers.

Ofcom's position seems sensible. It seems too early to ascertain the extent to which the availability, affordability and accessibility of services defined within the scope of universal service will be met only by access to infrastructure in an NGN environment. A related issue is the question of broadband access.

6.2 Should broadband be part of USOs?

Broadband is a precondition for access to the full range of NGN services, including high quality VoIP services. Thus, broadband penetration is likely to be a key issue as many converged services enabled by NGN can be delivered only through broadband. Thus the question arises as to whether the scope of the USO should be upgraded to include broadband?

As noted earlier, the EU has already included data access (albeit at low speeds) in the definition of USO with a "Functional Internet Access" provision in its current USO Directive. Does "functional access" in an NGN environment necessitate an upgrade to broadband access?

There does not seem to be a persuasive case for including broadband as a universal service at least not at the present time. While there is little doubt that there are potential benefits from expanding high-bandwidth broadband penetration (such as significantly faster access to the Internet, heightened attraction of new interactive services and e-commerce). But broadband is not yet so pervasive that those without broadband access can be considered to be "socially excluded".

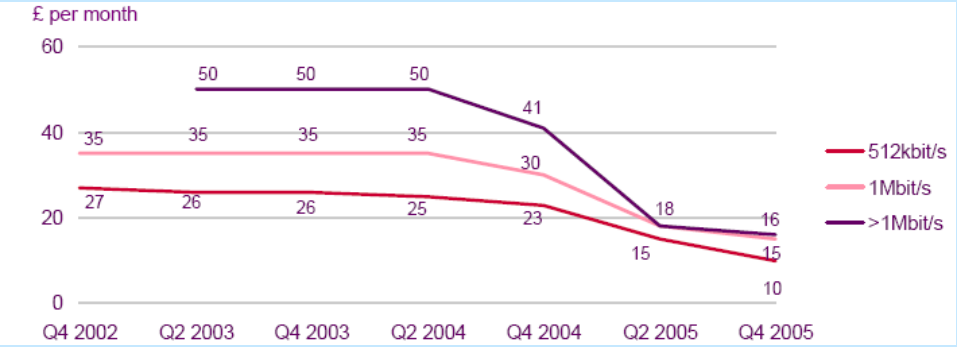
Broadband Trends

However, broadband penetration is continuing to grow rapidly in developed economies and current trends show that broadband take-up will continue to accelerate. Competition is already driving down prices and increasing availability. Growth in take-up is being accelerated by the significant price cuts that have occurred in some countries, such as the UK, particularly for the higher bandwidth services. The fall in broadband prices over 2002-2005 in the UK is illustrated in Figure 6.1 below. Further, VoIP and other IP applications

will be a key driver of broadband take-up in the coming years and a vastly increased take-up of broadband in the future could justify a reconsideration of broadband's USO status.

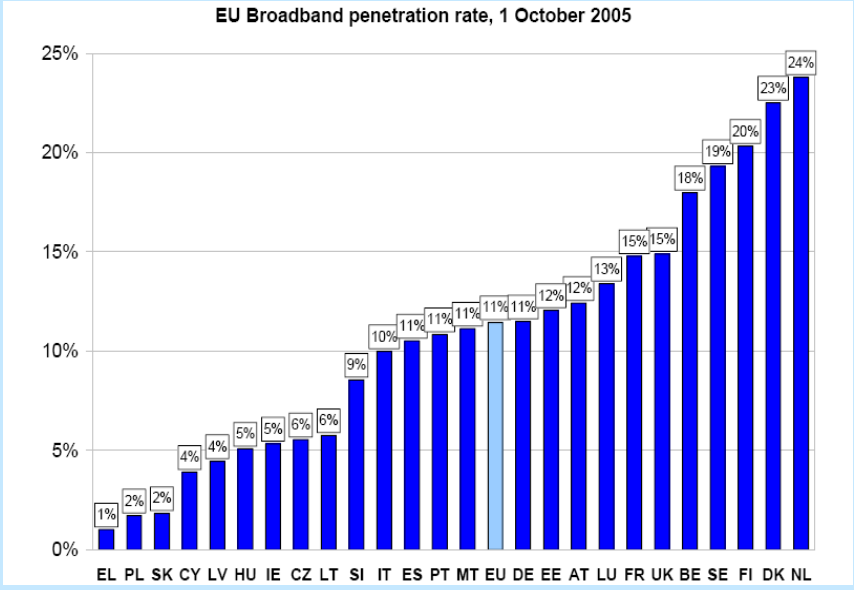
In the EU, the broadband penetration rate has reached 11.5% of the population (almost 53 million lines), up from 7.3% last year. Figure 6.2 and Table 6.1 indicate that countries like the Netherlands, Denmark, Finland, Belgium and Sweden are among the best-performing countries in the world in terms of broadband take-up. Broadband is rapidly replacing dial-up and in some EU Member States dial-up access already accounts for less than half of total fixed Internet access. However, as a result of uneven broadband growth across the EU, the gap between EU Member States has increased. Moreover, the EU still lags behind some other countries in terms of penetration rates such as South Korea, where take-up reached 25.5% in July 2005, but with growth slowing down to 1.26% over 2004-2005. If this is an indication that the penetration rate may be approaching saturation level it throws up some questions about how universal service in regard to broadband is to be defined. Is it 100%, or some level well below this?

Figure 6.1: Broadband prices over 2002-2005 in the UK



Source: Ofcom, *The Communications Market*, February 2006, p. 71

Figure 6.2: EU Broadband penetration rate, 1 October 2005



Source: Commission of the European Communities, "European Electronic Communications Regulation and Markets 2005", (11th Report), SEC(2006)193.

Table 6.1: International Comparison of Broadband Penetration (June/July 2005)

Country	Broadband Population Penetration Rate (June/July 2005)	Annual Increase in Penetration Rate (% points)	Source
South Korea	25.5%	1.26	OECD, June 2005
The Netherlands	22.4%	7.8	COCOM, July 2005
Denmark	22.0%	4.9	COCOM, July 2005
Iceland	21.7%	6.41	OECD, June 2005
Switzerland	20.3%	5.86	OECD, June 2005
Canada	19.2%	2.65	OECD, June 2005
Finland	18.7%	7.74	COCOM, July 2005
Norway	18.2%	6.89	OECD, June 2005
Belgium	17.4%	3.5	COCOM, July 2005
Sweden	17.1%	4.49	COCOM, July 2005
Japan	16.4%	3.73	OECD, June 2005
US	14.5%	3.48	OECD, June 2005
EU15	**12.0%**	**4.4**	**COCOM, July 2005**
Australia	10.9%	5.68	OECD, June 2005
EU	**10.6%**	**4.1**	**COCOM, July 2005**
EU10	**3.1%**	**1.8**	**COCOM, July 2005**

Source: Commission of the European Communities, "European Electronic Communications Regulation and Markets 2005", (11th Report), SEC(2006)193, p. 34.

Social inclusion

Broadband penetration rates are at present well under the penetration level where a household's inability to access broadband services at a 'reasonable rate' could be considered a form of social exclusion. In addition, it is doubtful if there are currently services available over broadband networks that are essential for a household to function in society. However, the situation may well change in an NGN world, especially if governments use broadband to deliver certain education, health and other public services. These might become as essential for households as the emergency services, now contactable by telephone, are today. There should therefore be regular monitoring for evidence of significant unevenness in the availability and take up of telecommunications, including broadband Internet access, among different regions and social groups. An exacerbation of such unevenness could heighten concerns regarding social exclusion.

Broadband unevenness symptomatic of a broader divide?

There are those who argue that concerns about broadband access is no different from other technology divides with different rates of diffusion according to household/individual by income, education, location, age, gender. For instance, they point to the fact that subscribers to cable TV include a large representation of lower-income families to support the argument that when people view broadband to be as important as cable TV, they will find a way to pay for the entertainment it provides. They consider that market forces appear to be delivering broadband deployment at a reasonable pace and broadband prices are falling. Indeed, they point out that although in some countries broadband services are available for over 98% of subscriber lines (e.g., the UK), the majority of Internet users are still currently using a narrowband service to connect to the Internet.

Some have pointed out that the broadband divide is a symptom of much deeper social, economic and educational gaps that have long existed. They ask why special programs should be put in place for broadband Internet access? Where, for equity reasons, certain socio-demographic groups are deemed to require assistance, why should special broadband subsidies for these groups exist as a separate regime outside means-tested, targeted, general welfare programs. Indeed, it is notable that a number of studies has shown

that a "blanket" universal service system can actually benefit high-income users as opposed to those on low incomes. Hence it can be unfair and potentially damaging to the development of the telecommunications sector.[70]

Discouragement of competitive entry

A requirement to provide national coverage of broadband in the context of a universal service framework could result in strengthening the incumbent's position since at present it may only be the incumbent that would have the ability to provide broadband on a national basis. For instance, the Australian Department of Communications, Information Technology and the Arts review of the operation of the universal service obligation and Customer Service Guarantee in Australia (2004) arrived at conclusions confirming these concerns:

"Finding 8.1 To some extent the current [USO] funding arrangements reduce the incentives for market entry, market growth or maintenance of market share by non-Telstra service providers, and this is a factor reinforcing Telstra's dominance in the residential access market.

Finding 8.2 The current [USO] funding arrangements potentially inhibit the development of advanced services in regional, rural and remote areas, and raise efficiency concerns in the design and implementation of non-USO programs and initiatives." (p. xv)

The DCITA review was not required to consider whether the scope of the USO should be expanded to include services other than fixed telephone services and payphones. This is because the Australian Regional Telecommunications Inquiry (2002) concluded that the USO "is not an effective mechanism to provide broad consumer access to an increased range of services into the future" and the Australian Government evidently accepted this conclusion.

Ofcom's conclusion regarding the justification for extending USOs to include broadband

Ofcom undertook a preliminary review of the case for extending USOs to include broadband (applying some of the criteria outlined earlier) and concluded that: "…as yet, the efficiency case for a broadband USO is not compelling" due to the "…still limited take-up, the dangers of distorting the market (through non-technology neutral intervention at an early stage of market development), the lack of convincing efficiency or social policy arguments for universal broadband access and the number of existing private and public broadband initiatives"[71]. (Ofcom 2005)

The Broadband Stakeholders Group concluded similarly:

"Heavy-handed intervention, either through the imposition of a universal service obligation or through large-scale subsidies would be inappropriate at this stage"[72].

While there seems a widespread view that a USO for consumer broadband services is not warranted at the present time, nevertheless, in the NGN environment that is expected to develop in the future, the issue will need to be reconsidered since universal service is not a static but an evolving concept. But at least for the present, there are strong reasons to be wary of using a 'blunt', blanket USO approach that could distort competition and investment incentives. Moreover, the conclusion that broadband should not be part of USOs does not necessarily argue that the government should not be supporting broadband deployment and take-up through various demand and supply side measures. Only that this should not be done through a USO approach. This is not an idiosyncratic approach since the EU, for instance, allows government assistance initiatives outside the scope of the universal service definition as long as they are not funded out of a universal service fund (that telecommunications operators are obliged to contribute to).

6.3 A systematic process for considering USO status for broadband

How might the need to apply a universal service provision to a particular service (e.g., broadband) be appraised? The first step might be to review criteria that have been proposed for use in appraising services that qualify for USO status.

In the US, the threshold legal requirement triggering a decision that a service must be supported, demand that the service have characteristics that are substantially related to the four "factors" outlined in section 254(c)(1) of the 1996 Telecommunications Act: *(1)* the service is "essential" to education, public health, or

public safety; *(2)* the service is subscribed to by a "substantial majority of residential customers"; *(3)* the service is being deployed in public telecommunications networks; and *(4)* the decision to support the service is in the public interest. Satisfaction of the four criteria does not necessarily trigger a decision that a service must be added to the list of supported services. Instead, before deciding whether to include or remove telecommunications services from the definition of supported services, the statute requires that the extent to which such services satisfy the four criteria be considered.

The Australian Bureau of Transport and Communications Economics suggested a five-step framework for considering a possible contender for an upgraded USO that involved:

- Adequately identifying and defining the product
- Determining that the product is sufficiently 'essential' to justify the major policy interventions associated with a USO designation
- Determining that costs are reasonable relative to benefits
- Finding a practical and efficient implementing mechanism
- Working through any likely effects on other policy goals.

In Japan, the scope of universal service is to be periodically reviewed approximately every two years taking into consideration:

- the degree of popularisation of the service
- the social need for the service
- technological advances.

EU review of the scope of USOs

In Europe, the EC's Directive on Universal Service and Users' Rights (2002)[73] requires that the European Commission carry out a review of the scope of universal service obligations "within two years of 2003". In considering whether the scope of universal service obligations be changed or re-defined, the Commission is required to take into consideration the following elements:

- . are the specific services available to and used by a majority of consumers and does the lack of availability of non-use by a minority of consumers result in social exclusion
- . does the availability and use of the specific services convey a general net benefit to all consumers such that public intervention is warranted in circumstances where the specific services are not provided to the public under normal commercial circumstances?

In proposing any change or re-definition of the scope of universal service obligations, the Commission may:

- . propose a change or re-definition of the scope of universal service obligations but require that any net costs are financed only via general government budgets; or
- . propose a change or re-definition of the scope of universal service obligations and permit any net costs to be financed by mechanisms in conformity with the EU Directive; or
- propose that specific services should become mandatory services to be provided under cost-oriented obligations.

Questions relating to the inclusion of broadband as a part of USOs

In considering whether a service should be included in the definition of universal service, a range of questions need to be addressed. The list of questions below is not exhaustive, but indicate some key issues that need to be considered. It seems reasonable to argue that those who wish to extend the USO to include broadband should provide persuasive answers to the questions posed.

- Is broadband essential e.g. to education, health care, or public safety, such that its provision needs to be made mandatory? If so, in what way?
- Are certain, identifiable segments of the population not subscribing to advanced services? Why are these segments not subscribing? Price? Availability of service? Low perceived value?

- What are the market trends regarding adoption rates of broadband services? Have broadband services been adopted at a rate comparable to other technologies?
- What role should governments play in the diffusion of broadband service?
- What exactly is meant by the proposal that broadband be included as a part of universal service obligations?
- If the government was to subsidise advanced services, what services would be subsidised? How would "advanced services" be defined for universal service purposes?
- Should a minimum data transmission capability be specified or should some other approach be used?
- At what point might it become appropriate to upgrade the level of universal service in the future? What is the nature of broadband service that would qualify it for USO status?
- What criteria are appropriate in assessing whether the level of universal service should be raised to include broadband?
- Would a USO concerning broadband cover only DSL or would substitute technologies such as satellite (the Australian case) and wireless (or some combination) be adequate?
- What cost implications would an upgrade of the USO to include broadband have?
- If there is a cost involved, who should pay for it, operators or government (from e.g. general tax revenue; a part of receipts from the privatisation of a telecommunications operator, spectrum pricing based on "opportunity cost", or from 3G licensing)?
- Should a universal service policy be adapted to include a wider variety of service providers and technologies?
- Would this suggest a 'pay or play' model in which a range of operators contribute to the provision of universal service through direct provision as well as, or instead of, contributing to a universal service fund?
- What would the direct costs of any subsidisation be? How would this affect charges to customers?
- Can the costs of broadband USOs be demonstrated to persuasively outweigh the benefits in a properly conducted cost-benefit analysis?
- What would the indirect costs of subsidisation be, e.g. would the subsidies be technologically and competitively neutral? How would subsidies affect competition?
- What funding mechanisms would need to be established?
- What changes to any existing funding mechanism would need to be made?
- What are the alternatives to the use of universal service obligations to support broadband and would they produce equal or better benefits with less costs? What about greater state and local government intervention? Community-based programs? What about grants, loans, and tax credits? Increased incentives for private investment? Market forces?
- If universal service support is provided for advanced services, how would support levels be determined?
- To what extent can subsidies be provided in a competitively and technologically neutral way and in a manner that achieves certainty and predictability for industry and consumers?
- What systems should be put in place to monitor and assess cost-effective delivery of broadband USOs?

Drawing on the range of issues discussed and the questions and criteria noted above, Box 6.1 indicates a framework for systematically considering whether to re-define the USO to include broadband.

Box 6.1: Rules for systematically considering whether broadband should be a USO

A systematic process for considering whether broadband should be a USO should include:

1. Consideration of whether broadband is an essential service of significant 'social importance'

2. Estimation of the degree of expected market penetration of broadband service

3. Assessment of the nature and extent to which broadband will not be made available by the market and why

4. Identification and specification of objectives and desired outcomes clearly and specifically

5. Assessment of the extent to which market demand and delivery can/will meet the specified objectives.

6. Consideration of the social and economic disadvantages incurred by those without access to

broadband if there is no government intervention in this expected market situation.

7. Estimation of the costs of intervention to widen broadband deployment through the use of the USO mechanism

8. Estimation of the costs of intervention through the use of the USO mechanism compared against the use of other approaches to establish that the USO mechanism is superior.

9. Establishment that the benefits of intervention through the USO exceed the costs of doing so, taking into account the incidence of such benefits and costs (especially those on unsubsidised telecommunications/Internet/broadband Internet customers); and of effects on other communications and broader policy objectives. (Intervention should only occur where overall benefits persuasively outweigh overall costs and where a substantial increase in the level of USO expenditure would not result.)

7 FUNDING USOs IN AN NGN ENVIRONMENT

Apart from operator contributions, universal service could be funded from a range of sources, including:

- a tax on each telephone number
- a connections-based system
- from general taxation revenue
- contribution from local government and other government departments
- contribution from spectrum auctions (3G), spectrum pricing and privatization
- donor funds (for developing countries)

A tax on each telephone number

A fixed fee for each telephone number assigned, whether fixed line or wireless, would be relatively easy to administer, readily understood by consumers, promote telephone number conservation and has the ability to raise predictable amounts of revenue through relatively small imposts on each number. [74] Such a fixed fee would make the funds supporting universal service competitively and technology neutral since all providers using numbers from a national numbering plan can be included (including wireless, cable and VoIP providers).

Moreover, a small, broad-based tax is unlikely to distort economic decisions significantly. The tax may create incentives to adopt technologies that bypass the tax, but such incentives are likely to be small if the tax is a small one[75]. A concern about a flat fee on each number is that it is a 'regressive tax' since low users and the poor would pay as much as high users and the rich. But this concern might be addressed by exempting the poor, including 'lifeline users' etc., from paying the numbers tax. There are other concerns such as the potential for bypass. A telephone number is not essential for voice communications as Skype and some other VoIP operators are demonstrating. Such bypass could become a significant problem if there is increased use of this system.

A connections-based system

A 'connections-based' system is one through which any connection to a network, whether it is a data or telephone network, is taxed, with revenue channelled towards universal service programs. While a connections/line approach is similar to a numbers-based system in that contributions to universal service would be based on the number of connections, it raises a number of questions regarding the definition of a connection, including simple residential telephone lines and high-capacity business lines with dozens/hundreds of voice-grade equivalents.

Another option is some sort of hybrid approach that seeks to combine a number of schemes e.g., a combination of a levy on each number and usage charge. A numbers-based plan could miss the revenue from high-capacity data pipes without some sort of connections allowance. Alternatively, funds could be raised through a supplementary levy on consumers' (residential and business) bills. This is done in other sectors such as the airline industry where 'air passenger duty' (UK) or airport taxes (Australia) are levied on each ticket with funds raised used to support the airline sector. Making the contribution to the USO fund transparent makes it easier for the public to assess the costs of universal service.

Financing through general taxation revenue

Economic analysis provides support for financing USO through general taxation revenue on the basis that it is likely to be less distortive (US Congress Budget Office report, 2005). The economic ('excess burden') cost of raising a dollar in general revenues (in terms of distortions to the supply and use of factors of production) is generally less than the economic cost of raising a dollar from sector-specific taxes, which tend to distort consumers' choices by affecting the prices of goods and services. [76] Indeed, a number of economic analysts have recommended that future universal service support should come from general tax revenues[77].

In Australia, the government-appointed Independent Regional Telecommunications Inquiry recommended (Rec 9.5) that the government should provide funding for future service improvements in regional, rural and remote Australia, rather than imposing financial obligations on the telecommunications industry:

"The Inquiry does not consider industry subsidisation of future sharing arrangements is appropriate. It considers industry funding to meet the costs of non-commercial telecommunications needs would impose a significant financial burden on the industry, and would negatively affect investment incentives, not just in regional Australia but nationally. Ultimately, it would also impact negatively on prices paid by consumers for telecommunications services. Government funding is preferred by the Inquiry."[78] (p. 249). And a little later the report states: "It is appropriate for Government to directly fund its social and economic telecommunications policy objectives, as it does other policy priorities."[79] (p. 250)

The Australian Government's response was to "accept the principle that support for non-commercial service improvements in regional Australia should be provided transparently by government, and should aim to promote competition and minimize market distortions"[80]

A major concern regarding government funding is that the predictability of subsidy amounts is an important characteristic of a subsidy and funding scheme and that the competing demands for government funding could make such funding more uncertain in the longer term and susceptible to change. But there is a strong argument that this is as it should be. That is, that continued support for telecommunications subsidies should be regularly justified against such competing demands.

Contribution from local government and other government departments. Support for telecommunications is widely rationalized on the grounds that it can help deliver improved service to education, health, agriculture, e-government and telecentres in rural and remote regions. This suggests that a number of government agencies might contribute to a Universal Service Fund to support telecommunications access. Allocating responsibility for delivering program outcomes to key spending ministries can have other benefits such as a shared sense of ownership across all participating ministries and local government. In addition, telecommunications operators can form partnerships with local government agencies to help ensure the initiative contributes to local economic development.

Contribution from spectrum auctions (3G), spectrum pricing and privatization. Some of the proceeds from telecommunications licence fees, including spectrum pricing fees, could be contributed to a USF. Also, part of the proceeds of spectrum auctions might be allocated to USO purposes. In addition, a proportion of the proceeds of privatization of telecommunications operators could be allocated to support universal access and

universal service programs. For instance, in Australia, 5% of the proceeds from privatising the second tranche of Telstra's shares was allocated to improving conditions in rural areas based on the rationale that this constitutes an equitable sharing. In a submission to the DCITA's review of universal service[81], the Australian Telecommunications Users Group (ATUG) proposed that part of the proceeds of a further sale of Telstra be put into a Trust Fund the earnings from which could be used to pay subsidies for telecommunications. (Where a country has already fully privatized its telecommunications operators, or where this is not a feasible option, the government could, alternatively, contribute an amount out of general revenue to establish such a Trust Fund.)

Whatever the funding mechanism chosen, it is important to ensure that it is carefully structured and targeted so as to minimise market distortions. The UK National Consumer Council has provided a set of criteria that is worth reiterating in Box 7.1. Moreover, the funding mechanism should score relatively well (compared with alternatives) on the basis of the criteria listed in Box 7.2.

Box 7.1: UK National Consumer Council criteria/principles for appraising USO funding

Clarity

- Relevance: Do significant numbers of consumers have a need for, or experience problems accessing, this good or service? Are the individual and community costs of this unmet need unacceptable?
- Policy objectives and performance: is it clear there is a need for a subsidy and what is it trying to achieve? Does it recognise diversity?
- Roles and responsibilities: is it clear to suppliers, regulators and consumers who is providing and paying for universal access?
- Movement of funds: can we trace the direction and quantity of subsidy from those who pay through to those who receive it?

Equity

- Affordability: in meeting the costs of providing universal access, are the costs affordable to all?
- Is any cross-subsidy of one group of consumers by another justifiable?
- Accessibility: are essential goods and services available and affordable to all on an ongoing basis?
- Effectiveness
- Targeting coverage: does the funding mechanism reach all of those in need?
- Maximising take up: do barriers exist preventing those in need from taking advantage of access opportunities?
- Ensuring predictable, secure and reliable supply: can suppliers and consumers achieve the desired nature of supply in the short, medium and long term?
- Encouraging innovation: are there sufficient incentives to encourage the supplier and other parties to find better ways of ensuring universal access?

Efficiency

- Minimising waste of resources: could those in need be better helped through other means? Are subsidies funding access for people who are not in need?
- Minimising distortions: does the funding approach affect demand for goods and services, employment or the price of goods and services?
- Minimising administration costs: are there opportunities to reduce duplication, bureaucracy and processing time?
- Minimising supplier/consumer costs.
- Minimising cost to taxpayers.

Source: http://www.ncc.org.uk/access/ppm2privatesector.pdf

A preliminary consideration of funding options suggests that several funding sources appear to score well against these criteria. For instance, funding from general revenue scores well, except perhaps on the basis of certainty (at least in the longer term) and, some assert, political feasibility (at least in the short term?). By contrast with such assertions, many of the submissions in response to the EU's consultation document on universal service favoured government funding[82].

A tax on telephone numbers also appears to score relatively well. As mentioned earlier, the primary concern here seems to be the perceived 'inequity' of this financing approach. There might also be concerns that it does not contain adequate safeguards to constrain governments from increasing the levy per telephone number in order to enable (politically popular) expansion of the scope of universal service. While political gains flowing from universal service programs can be preserved/gained at the expense of operators and/or consumers, restraint over universal service (needed to stimulate innovation and cost-effective USO programs) is less likely. Government funding would link decisions concerning the nature and scope of universal service more closely with financial responsibility for such decisions. This would help prevail against excessive growth by installing in-built incentives to cap (or at least to restrain) political disposition for universal service expenditure.

For pragmatic reasons, including political realities, it might be sensible to draw on a combination of funding sources, especially in the short-term. However, in the longer-term, there seems a strong case for universal service to be funded from general taxation revenue. Since it is the political process that will decide on what the warranted level of universal service will be, it seems appropriate that the case for continued funding of universal service programs be assessed against arguments in favour of competing government expenditure programs such as those for health, education and housing.

Box 7.2: Criteria for assessing a sustainable funding mechanism
SPU_Box_heading_i

Broadly, the merits of a funding arrangement can be judged according to its implications for:

- *economic efficiency* – the financing of universal service should distort economic behaviour as little as possible
- *equity* – equity is a contentious 'normative' criterion' that may be variously defined/assessed e.g., whether there are similar costs for people with similar abilities to pay, and whether contributions are fair and reasonable
- *competitive neutrality* – does not discriminate in favour of any company
- *technology neutrality* – does not discriminate in favour of any technology
- *certainty* – specific, predictable and sustainable arrangements
- *transparency*—the opportunity for public scrutiny of information, to the maximum extent possible
- *cost effectiveness* – cost effective to introduce (if a new scheme), and cost effective to administer on an on-going basis
- *avoidance* – scope for avoidance minimised.

8 CONCLUSION

The onset of an IP-enabled NGN environment is requiring a thorough review of regulation, including regulations pertaining to universal service. This paper set out to consider the implications of an IP-enabled NGN environment on universal service in an effort to address the question: "What rules for universal service in an NGN environment?" A range of 'rules' is proposed, including:

- rules for the systematic development of universal service strategy (Box 4.3)
- rules for designing USOs in an NGN environment (Box 5.1)
- rules for assessing universal access/service delivery mechanisms (Box 5.2)
- rules for considering USO status for broadband (Box 6.1)
- rules for appraising USO funding (Box 7.1 & 7.2).

Many of the rules proposed are drawn from experience with USOs in legacy networks. Moreover, the rules are proposed as a modest, tentative step towards the systematic reconsideration of USOs in an NGN environment. This tentativeness is in part because there are still considerable uncertainties about precisely what circumstances (e.g., technology, competitive, services) will prevail in an NGN environment that does not yet exist and perhaps will not exist for some years yet. Nonetheless the rules and the conclusions drawn by the paper may be useful in stimulating the requisite reconsideration of USOs.

The paper concludes that with falling revenue (due to increasing competition and declining prices) occurring alongside strong demands for funds for deploying NGN infrastructure, there may be a reduced ability of telecommunications operators to provide universal service funded by cross-subsidisation. And universal service funds, too, will be under pressure. There is also likely to be an uneven migration to NGN since NGN will be deployed first in more profitable, densely populated areas and then only later (if at all) in relatively less commercially viable rural/remote areas. This could raise concerns that problems of universal service and the 'digital divide' could worsen, especially for some developing countries still struggling to expand infrastructure and penetration of PSTN and mobile service.

It is expected that in an NGN environment, voice service will be supplied through a range of platforms, including legacy PSTN, wireless and increasingly VoIP. But certain features such as the ability to make emergency calls with caller location information may not be available with VoIP. Thus the shift to NGN and VoIP may mean that the standards of voice service provided through PSTN could deteriorate in terms of quality of service (a provision of universal service in many countries). This could be addressed by vigorously mandating equivalent quality of service by regulatory prescription. But this could raise costs and barriers to entry for service providers using new technology. An alternative approach could be to allow customers to evaluate quality of service differences against prices: to inform consumers about the differences in quality and to allow them to decide. However, it is difficult to say confidently how well this more market oriented approach would work since we are peering into a NGN scenario that is still somewhat uncertain. But for a highly dynamic communications sector whose future development is difficult to confidently predict, it seems sensible that the disposition be to rely on the market, with regulation being introduced only if it becomes clear that such intervention is necessary.

Access to the full range of NGN services, including VoIP, requires broadband access. Therefore, should the scope of USOs be 'upgraded' to include broadband? The conclusion reached in this paper is 'no', or at least 'not yet'. For one thing, at this relatively early stage of broadband development and take up, it cannot be said that those who do not have broadband are at risk of being "socially excluded". But a conclusion that broadband should not be part of USOs does not necessarily argue that the government should not support broadband deployment and take-up through various demand and supply side measures. Only that this should not be done through a 'blunt', blanket USO approach. Moreover, since broadband availability and take-up is expanding rapidly (at least in developed countries) so that regular systematic reviews of this issue are warranted (certainly at the stage when NGN have become pervasive) since the concept of USOs is an evolving one.

Finally, funding. For pragmatic reasons, including political realities, it might be sensible to draw on a combination of funding sources, especially in the short-term. However, in the longer-term, there seems a strong case for universal service to be funded from general taxation revenue. Where support for access to NGN is determined by a government on the basis of a policy decision, it seems appropriately funded through the policy process from general taxation revenue, especially since funding from this source accords best with efficiency and equity. Importantly, such government funding would link decisions concerning the nature and scope of universal service more closely with financial responsibility for such decisions. And this would prevail against excessive growth by installing in-built incentives to restrain political disposition for widening universal service expenditure. Certainly, while political gains flowing from universal service programs can be gained at the expense of operators and/or consumers, restraint over universal service (needed to stimulate innovation, best practice and cost-effective USO programs and to minimise the distortions that arise from excessive USO programs) is less likely.

REFERENCES

Autorite de Regulation des Communications electroniques et des Postes (ARCEP), "L'evolution du Coeur de reseau des operateurs fixe," Etude realisee par le cabinet Ovum pour le compte de l'Autorite regulation des Communications electroniques et ds Postes, Janvier 2006. Available at http://www.arcep.fr/publications/etudes/etude-ovum-ngn-0106.htm

Aspen Institute (Rapporteur: Robert Entman), "Reforming Telecommunications Regulation", A report of the Nineteenth Annual Aspen Institute conference on Telecommunications Policy, Washington 2005.

Australian Communications Authority, "Regulatory Issues Associated with Provision of Voice Services Using Internet Protocol in Australia", Discussion Paper, October 2004.

Australian Competition & Consumer Commission (ACCC), "A strategic review of the regulation of fixed network services", An ACCC Discussion Paper, December 2005

Australian Department of Communications, Information Technology and the Arts, "Review of the Universal Service Obligation and Customer Service Guarantee", Canberra 2004.

Comptel, "A Roadmap for Universal Service Reform", May 2005.

European Commission, *Directive of the European Parliament and Council of 7 March 2002 on Universal Service and Users rights relating to Electronic Communications Networks and Services*, (O.J. No L 108, 24.4.2002)

European Commission, "Connecting Europe at High Speed: National Broadband Strategies", SEC(2004)599. Brussels, 12.5.2004. COM(2004)369Final.

European Commission, "On the Review of the Scope of Universal Service in accordance with Article 15 of the Directive 2002/22/EC", COM(2005)203, 24 May 2005.

European Commission, Commission of the European Communities, "European Electronic Communications Regulation and Markets 2005", (11th Report) COM(2006)68 final.

European Telecommunications Platform, "On the technology, business models and regulatory aspects of NGN", 17 January 2006.

Federal Communications Commission (FCC), *In the Matter of IP-Enabled Services*, Notice of Proposed Rulemaking. WC Docket No. 04-36, March 10, 2004.

Federal Communications Commission (FCC), *Eligible Telecommunications Carrier Designation Order*, FCC 06-46 (2005).

Hazlett, T. W., Bazelon, C., Rutledge J, and Hewitt, D. A, "Sending the Right Signals: Promoting Competition through Telecommunications Reform". A report to the US Chamber of Commerce, 22 September 2004.

Human Resources Development Canada, "Eliminating Phonelessness in Canada: Possible Approaches", March 2002.

Independent Regulators Group, "Universal Service Designation", October 2003, (03)38.

International Telecommunications Union (ITU), "Trends in telecommunication reform 2003: Promoting Universal Access to ICTs: Practical tools for regulators". http://www.itu.int/publications/docs/trends2003.html

International Telecommunications Union (ITU), 6th Global Symposium for Regulators 2005, "Best Practice Guidelines for Spectrum Management to promote Broadband Access", Tunisia, 14-15 November 2005.

Marcus, J. Scott, "Is the U.S. Dancing to a Different Drummer?", *Communications Strategies*, No. 60, 4th Quarter 2005, p.39.

Melody, W, Sutherland, E and Reza, T, "Convergence, IP Telephony and Telecom Regulation: Challenges & Opportunities for Network Development, with particular reference to India." Paper prepared for *infoDev* based upon the issues examined at a Workshop on Convergence, VoIP and Regulation, sponsored by *infoDev* in association with Telecommunications Regulatory of India (TRAI), New Delhi. 11 March 2005.

Milne, C "Telecoms demand: measures for improving affordability in developiong countries – A toolkit for action" Main report, Media@LSE, January 2006.

Ministry for Information and Communications (Japan), *Agenda for Consideration Concerning a Framework for Competition Rules to Address Progress in the Move to IP*, February 2006.

Ofcom (UK Office of Communications), Strategic Review of Telecommunications, Phase 1, Consultation Document. 2004. Available at http://www.ofcom.org.uk.

Ofcom, (UK Office of Communications), Strategic Review Telecommunications, Phase 2, Consultation Document 2004. Annex K, "Universal Service: Future Scope and Funding". Available at http://www.ofcom.org.uk

Ofcom, (UK Office of Communications), "Review of the Universal Service Obligation," 10 January 2005. Available at http://www.ofcom.gov.org.uk

Ofcom, (UK Office of Communications), "Next Generation Networks: Further Consultation", 30 June 2005, http://www.ofcom.org.uk/consult/condocs/nxgnfc/

Ofcom, (UK Office of Communications), "Regulation of VoIP Services, Statement and Further Consultation", February 2006.

Ofcom, (UK Office of Communications), Statement "Review of the Universal Service Obligation," 14 March 2006. Available at http://www.ofcom.gov.org.uk

Oestmann, S, "Mobile operators: their contribution to universal service and public access", January 2003.

OECD, "Universal Service Obligations and Broadband", Paris 2003. DSTI/ICCP/TISP(2002)4/FINAL.

OSIPTEL, "Telecommunications Sector in Peru presentation to APEC TEL28", Paper presented by

Liliana Ruiz de Alonso www.apectelwg.org/apec/atwg/previous.html#16, 2003.

Simpson, S, "Universal service issues in converging communications environment: the case of the UK", *Telecommunications Policy*, 2004, 28:233-248.

Telecom Regulatory Authority of India, (TRAI), *Consultation Paper on Issues pertaining to Next Generation Networks (NGN),* 12th January 2006. Consultation Paper No: 2/2006.

United States Congress Budget Office, "Financing Universal Telephone Service," March 2005.

Vodafone, "Submission to European Commission's Consultation On the Review of the Scope of Universal Service in accordance with Article 15 of the Directive 2002/22/EC, COM(2005)203, 24 May 2005" June 2005.

World Bank Group, "Financing Information and Communication Infrastructure Needs in the Developing World: Public and Private Roles" (Draft for Discussion) February 2005.

Xavier, P, "Universal Service Obligations and Broadband," *Info*, May 2003.

Xavier, P and Ypsilanti, D "Secondary markets for spectrum: policy issues", *Info*, March 2006.

ENDNOTES

1 Australian Department of Communications, Information Technology and the Arts, "Review of the operation of the Universal Service Obligation and Customer Service Guarantee", Canberra 2004.

2 In Japan, a Universal Service Fund was introduced in June 2002 with the provision that a review be conducted two years after its introduction. A review commenced in November 2004 with issues reviewed including: (i) the range of the universal service.(2) calculation methods of the net cost of providing universal service (3) methods for funding the cost.

3 Consideration Agenda Concerning a Framework for Competition Rules to Address Progress in the Move to IP

4 See for example, United States Congress, "Financing Universal Telephone Service," Report prepared by the US Congress Budget Office, March 2005.

5 Ofcom, "Strategic Review of Telecommunications, Phase 1, Consultation Document". 2004. Available at http://www.ofcom.org.uk; and Ofcom, Strategic Review Telecommunications, Phase 2, Consultation Document 2004. Especially Annex K, "Universal Service: Future Scope and Funding". Available at http://www.ofcom.org.uk.

6 Ofcom, "Review of the Universal Service Obligation," 10 January 2005. Available at http://www.ofcom.gov.org.uk.

7 Telecom Regulatory Authority of India, (TRAI), Consultation Paper on Issues pertaining to Next Generation Networks (NGN), 12th January 2006. Consultation Paper No: 2/2006.

8 Helena de Araujo Lopes Xavier, The Process of liberalization and the Legal Model of Competition in the Brazilian Telecommunications Market, in Dennis Campbell (ed), "Comparative Law Yearbook of International Business", vol. 26, 2004, Kluwer, The Hague 2005.

9 European Commission, "On the Review of the Scope of Universal Service in accordance with Article 15 of the Directive 2002/22/EC", COM(2005)203, 24 May 2005.

10 USOs constitute a requirement that telecommunications operators provide basic voice telephone service to all who request it at a uniform and affordable price even though there may be significant differences in the costs of supply. By comparison, a policy of "universal access" generally refers to a situation where every person has a reasonable means of access to a publicly available broadband service. Universal access may be provided through community telecommunications centres, teleboutiques, community broadband Internet access terminals and similar means. While universal service and universal access policies can be quite different, the concepts are closely related and the terms are sometimes used interchangeably. Universal access may also be interpreted as not addressing the issue of "affordable price".

11 The following discussion draws on Commission of the European Communities, "European Electronic Communications Regulation and Markets 2005", (11th Report) COM(2006)68 final, p. 12.

12 Commission Recommendation of 21 January 2005 (2005/57/EC) and Commission Recommendation of 29 March 2005 (2005/268/EC) on the provision of leased lines in the EU.

13 European Commission, Directive of the European Parliament and Council of 7 March 2002 on Universal Service and Users rights relating to Electronic Communications Networks and Services, (O.J. No L 108, 24.4.2002)

14 Available at http://europa.eu.int/information_society/topics/telecoms/regulatory/new_rf/documents/l_10820020424en00510077.pdf

15 The transmission capability of a line is most frequently expressed as a data rate, in bits per second (bit/s or bps) or sometimes bytes per second (byte/s or Bps). One byte is equal to 8 bits, so that a data rate of 3.6 kbyte/s is equivalent to 28.8 kbit/s and a rate of 6.25 kbyte/s is equivalent to 50 kbit/s. This different terminology can sometimes be confusing, giving the misleading impression that an end-user is experiencing lower connection speeds than is in fact the case.

16 Available at http://www.ofcom.org.uk/consult/condocs/uso/main_web.pdf

17 http://www.comreg.ie/_fileupload/publications/ComReg0387.pdf

18 ITU, "Ubiquitous Network Societies: The Case of the Republic of Korea", Paper presented to the ITU Workshop on Ubiquitous Network Societies, Document: UNS/08, Geneva, 6-8 April 2005.

19 More detailed analyses of the impact of market liberalization, including impacts on productivity, investment, quality of service, etc., are available in the various editions of the OECD's Communications Outlook (updated every two years). Here there is a wealth of data and analyses providing evidence that market liberalization has been fundamental to the growth of the telecommunications sector in OECD countries, "Communications Outlook 2005" OECD, Paris 2005.

20 The role of mobile communications in universal access is covered in greater depth in Sonja Oestmann, "Mobile operators: their contribution to universal service and public access", January 2003.

21 See Australian Competition & Consumer Commission (ACCC), "A strategic review of the regulation of fixed network services", An ACCC Discussion Paper, December 2005.

22 OECD, "Communications Outlook 2005", Paris 2005.

23 See, for instance, the conclusion of two long-time analysts, Robert E. Litan and Roger G. Noll, in "The Uncertain Future of the Telecommunications Industry," The Brookings Institution, Policy Brief 129. Litan and Noll conclude: "The USF as currently designed is highly inefficient. Economists definitively have shown that USF subsidies are poorly targeted. Relatively little of the fund is spent on low-income households or even communities with a large number of poor residents, and much of the subsidy goes to high-income communities with low population density, such as wealthy suburbs with large minimum lot sizes or ski resorts. Indeed, much of the subsidy goes to the same people from whom the tax is collected. Yet despite its gross inefficiency, the USF is politically popular because it has an array of constituencies that receive a net subsidy." (p.7)

24 The US contribution factor for the first quarter 2005 was 11.1%; there is some seasonal variation, but in general it is above 10%.

25 Australian Department of Communications, Information Technology and the Arts, "Review of the operation of the Universal Service Obligation and Customer Service Guarantee", Canberra 2004. (p. xiv)

26 Bjorn Wellenius, Vivien Foster & Christina Malmberg-Calvo, "Private Provision of Rural Infrastructure Services: Competing for Subsidies", World Bank Policy Research Working Paper 3365 (Aug 2004).

27 Wellenius, Bjorn, "Chile: Closing the Gap in Access to Rural Communications: Chile 1995-2002", Nov 2002.

28 OSIPTEL "Telecommunications Sector in Peru presentation to APEC TEL28" Presented by Liliana Ruiz de Alonso www.apectelwg.org/apec/atwg/previous.html#16 , 2003.

29 Australian Department of Communications, Information Technology and the Arts, "Review of the operation of the Universal Service Obligation and Customer Service Guarantee", Canberra 2004.

30 Analysys, "The Road to Fixed-Mobile Substitution Starts with 3G," April 2004.

31 The Age, "Trujillo must overhaul the cost base of Telstra's core network," 10 February 2006.

32 In-Stat, "Mass Migration to VoIP Expected within a Decade", 2 May 2005. Available at http://www.in-stat.com.

33 Australian Communications Authority, "Regulatory Issues Associated with Provision of Voice Services Using Internet Protocol in Australia", Discussion Paper, October 2004, p. 15)

34 Note that not all VoIP services are like Skype (ie a piece of downloaded software where no 'service' as such is being delivered). Some VoIP services will be ECS (including 'Skype Out' and 'Skype In' which break out onto the PSTN and for which consumers pay to make calls). And some will be PATS.

35 All ECS and PATS are entitled to numbers in the UK – both geographic and non-geographic (056 range).

36 ECTA, "Comments on NGN public policy", February 2006.

37 This layered view of NGN must be tested against other market based scenarios. Is it likely that NGN service providers will offer unbundled access and allow unfettered competition at a service level? When some broadband access technologies have limited bandwidth in comparison to other technologies (e.g. BPL vs. fibre to the home), might infrastructure providers reserve a majority of bandwidth and other resources for NGN services they intend to bring to market? Where vertical integration exists, what marketing or technical mechanisms may impede competition?

38 For a detailed discussion see e.g., Australian Competition & Consumer Commission (ACCC), "A strategic review of the regulation of fixed network services", An ACCC Discussion Paper, December 2005.

39 For a detailed discussion see Australian Competition & Consumer Commission (ACCC), "A strategic review of the regulation of fixed network services", An ACCC Discussion Paper, December 2005.

40 For a discussion of this issue, see Melody, W, Sutherland, E and Reza, T, "Convergence, IP Telephony and Telecom Regulation: Challenges & Opportunities for Network Development, with particular reference to India." Paper prepared for infoDev based upon the issues examined at a Workshop on Convergence, VoIP and Regulation, sponsored by infoDev in association with Telecommunications Regulatory of India (TRAI), New Delhi. 11 March 2005.

41 The New York Times (Europe), "Macedonia Dreams of One Nation, Wireless," 3 April 2006.

42 Much of the cost advantage of mobile telephony networks stems from the fact that the access network is shared between subscribers. Once this access network is in place, the marginal cost of adding another subscriber is very low, being mainly the cost of a handset. This contrasts with traditional fixed wireline networks where the incremental cost of adding additional subscribers is significant as each subscriber has dedicated access network infrastructure. Hence the cost of adding a mobile subscriber is much less than that of adding a fixed wireline subscriber. The role of mobile communications in universal access is covered in greater depth in Sonja Oestmann, "Mobile operators: their contribution to universal service and public access", January 2003.

43 For a discussion of promising new telecommunications technologies, see for instance, The Economist, Technology Quarterly, December 4th, 2004.

44 Full details are available at TRAI's website : www.trai.gov.in

45 World Bank Group, "Financing Information and Communication Infrastructure Needs in the Developing World: Public and Private Roles" (Draft for Discussion) February 2005.

46 ITU, 6th Global Symposium for Regulators 2005, "Best Practice Guidelines for Spectrum Management to promote Broadband Access", Tunisia, 14-15 November 2005.

47 Xavier, P and Ypsilanti, D, "Secondary markets for spectrum: policy issues", Info, March 2006.

48 ITU, Universal Access Regulatory Best Practice Guidelines, Global Symposium for Regulators, Geneva, 8-9 December 2003.

49 ITU, GSR Best Practice Gidelines 2004. Available at http://www.itu.int/ITU-D/treg/Events/seminars/2004/GSR04/consultation.html

50 ITU, "Best Practice Guidelines for Spectrum Management to Promote Broadband Access" Global Symposium for Regulators 2005.

51 World Bank Group, "Financing Information and Communication Infrastructure Needs in the Developing World: Public and Private Roles" (Draft for Discussion) February 2005.

52 The following discussion draws on Ofcom, (UK Office of Communications), "Regulation of VoIP Services, Statement and Further Consultation", February 2006.

1. 53 Basic telephony service continues to work in case of electricity power failure. However, the current VoIP services/terminals are dependent on a functioning power supply. Requiring in-line powering of terminals could place a considerable burden on the VoIP operators and slow development.

54 Commission Recommendation on the processing of caller location information in electronic communication networks for the purpose of location-enhanced emergency call services, C(2003)2657, 25 July 2003.

55 Working document of the Commission services COCOM05-07, "Implementation of the single European emergency number 112: follow-up", 18 March 2005.

56 The EC (2006) discloses that caller location information is not available in the following countries: Greece (for mobile phones), Italy (for mobile phones), Cyprus (for mobile phones), Latvia (not before 2007 for all phones), Lithuania (for mobile phones), Luxembourg (for mobile phones), Hungary (for all phones), the Netherlands (for mobile phones only in 2007), Portugal (for mobile phones) and Slovakia (for all phones).

57 Statement of the Hong Kong Telecommunications Authority, "Regulation of Internet Protocol (IP) Telephony" 20 June 2005.

58 Optus submission to Australian Communications Authority, VoIP Regulation Consultation, 24 December 2004.

59 In this context it should be noted that many present day customers only have DECT phones at home which are also susceptible to power outages.

60 Competitive Carriers' Coalition Inc, "VoIP and the Regulatory Priorities: A summary of the CCC views", December 2004.

61 Statement of the Hong Kong Telecommunications Authority, "Regulation of Internet Protocol (IP) Telephony" 20 June 2005.

62 Case C-109/03 KPN Telecom BV v OPTA [2004] ECR 00000

63 Telenor, Submission to the EU Consultation Paper, July 2005.

64 Ofcom, "Review of the Universal Service Obligation," 10 January 2005. Available at http://www.ofcom.org.uk.

65 For a comprehensive discussion on measures for improving affordability in developing countries, see Claire Milne, "Telecoms demand: measures for improving affordability in developing countries" A tool for action. Main report. Media@LSE, January 2006.

66 Commission Recommendation of 21 January 2005 (2005/57/EC) and Commission Recommendation of 29 March 2005 (2005/268/EC) on the provision of leased lines in the EU.

67 Ofcom submission to the European Commission, "On the Review of the Scope of Universal Service in Accordance with Article 15 of Directive 2002/22/EC," 24 May 2005, (COM(2005)203)

68 Ofcom Consumer Panel, "Consumers and the Communications market: where we are now", 2005. Available at: http://www.ofcomconsumerpanel.org.uk/publications.htm

69 European Commission Staff Working Document, Annex to the Review of the Scope of the Universal Service in Accordance with Article 15 of Directive 2002/22/EC COM(2005)203}

70 See, for instance, Robert E. Litan and Roger G. Noll, in "The Uncertain Future of the Telecommunications Industry," The Brookings Institution, Policy Brief 129.

71 Ofcom's response to the European Commission's "On the Review of the Scope of Universal Service in Accordance with Article 15 of Directive 2002/22/EC" 24 May 2005, (COM(2005)203, 24 May 2005.

72 Broadband Stakeholders Group, Third Annual Report and Strategic Recommendations, January 2004.

73 European Commission, Directive of the European Parliament and Council of 7 March 2002 on Universal Service and Users rights relating to Electronic Communications Networks and Services, (O.J. No L 108, 24.4.2002)

74 This approach is favoured by the FCC chairman. See Remarks of FCC Chairman Kevin J. Martin to the TELECOM 05 Conference of the United States Telecom Association,26 October 2005, Las Vegas, NV,

75 The Progress & Freedom Foundation, Digital Age Communications Act – Preliminary Proposal of the Umiversal Service Working Group, Release 1.0 October 2005.

76 Michael H. Riordan, "Universal Residential Telephone Service," in Cave and others, eds., Handbook of Telecommunications Economics, vol. 1, p. 438, available at www.columbia.edu/~mhr21/ US-aug-29.pdf; and Jerry Hausman, "Taxation by Telecommunications Regulation: The Economics of the E-Rate", (Washington, D.C.: AEI Press, 1998), p. 15, available at www.aei.org/docLib/ 20040218_book245.pdf.

77 Hazlett, T. W., Bazelon, C, Rutledge J, and Hewitt, D. A, "Sending the Right Signals: Promoting Competition through Telecommunications Reform", A report to the US Chamber of Commerce, 22 September 2004.

78 "Connecting Regional Australia" The Report of the Regional Telecommunications Inquiry, Canberra, November 2002.

79 "Connecting Regional Australia", The Report of the Regional Telecommunications Inquiry, Canberra, November 2002.

80 The Australian Government's response to the recommendations of the Regional Telecommunications Inquiry. Available at http://www.dcita.gov.au

81 Australian Department of Communications, Information Technology and the Arts, Review of the Universal Service Obligation and Customer Service Guarantee, Canberra 2004.

82 Responses to the European Commission, "On the Review of the Scope of Universal Service in Accordance with Article 15 of Directive 2002/22/EC," 24 May 2005, (COM(2005)203)