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RETHINKING UNIVERSAL SERVICE FOR A NEXT GENERATION NETWORK ENVIRONMENT

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FOREWORD

This report was discussed by the Working Party on Telecommunication and Information Services Policy at its meeting in December 2005. The Working party agreed to recommend the declassification of the report to the ICCP Committee. The report was declassified on 24 March 2006.

The report was prepared by Dr. Patrick Xavier, Swinburne University (Australia) and is published under the responsibility of the Secretary-General of the OECD.

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MAIN POINTS

There is a clear need, in view of significant competitive, technological and service changes taking place in the telecommunications sector, to review universal service obligations, their coverage, how they are financed and who is responsible for providing them. In many OECD countries, a primary longer term issue is how to provide universal service in the new competitive environment where voice is ubiquitous and cheap, voice revenues low and where voice has become just one of many applications provided on networks. Access too is changing, with more choice in platforms available that allow access to voice applications. This paper overviews the main issues that need to be examined in such a review with a view to the reform of universal service in a way consistent with emerging technological realities and competitive circumstances. The paper draws a number of conclusions outlined below.

Important changes have already taken place in universal service in OECD countries, where market liberalization and technological developments in the telecommunications sector have resulted in improvements in telecommunications availability (through increased penetration of fixed line and wireless as well as enhanced quality of service), affordability (through lower prices, in overall terms, and through pre-paid mobile) and accessibility (improved through voluntary but also through regulatory schemes). As a result, there has been significant progress towards universal service. In an NGN environment where new technologies are competing, a question that arises is whether an approach towards universal service that was framed for a legacy network is still the appropriate policy?

An increase in communications facilities and service competition is expected over the next ten years as the communications sector converges, shifts technology to one based on IP protocol and gravitates towards new kinds of networks built with technologies such as wireless, wireline, fibre, cable, powerline, and satellite. With such technological developments and a more competitive environment, cross-subsidy practices are likely to be increasingly unsustainable and an increasing number of countries are turning to the use of Universal Service Funds in order that the burden of 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 erodes the revenue base of telecommunications operators, Universal Service Funds too may come under pressure. The growing diversity of technologies and the capabilities of these new technologies require more precise reflection on what it is about telecommunications services that justifies a universal service policy, and how these telecommunications services should be defined.

With the technological changes on the horizon, there seems significant potential for ‘availability’ of telecommunications access, and hence services, in rural and remote areas to be largely achieved over the next ten years. Whether this potential materialises will depend importantly on the removal of disincentives to invest and barriers to entry (including those due to spectrum policy that generates artificial scarcity). This includes minimising price controls and subsidies that discourage competitive entry. All this is consistent with forbearance of regulation in a dynamic, increasingly competitive and convergent communications sector. If availability of telecommunications access is achieved, is universal service policy still necessary? If so, would access alone achieve the goals of universal service, or is it some package of affordable services that require access which should be the objective?

Universal service policies in an NGN environment should be constrained by the recognition that USOs should be specifically defined and targeted, transparent, competitively and technology neutral and cost-effective. Universal service objectives such as 'affordability' and 'accessibility' may be addressed by specifically targeted subsidies (including vouchers) that allow consumers in a multi-platform NGN environment to themselves choose the service provider and technology most suitable to their needs. In appropriate competitive circumstances, the use of well-designed competitive tenders can help generate incentives to contain costs, innovate, and reveal the true cost of delivering universal service thus minimising the subsidy required. At the same time, it needs to be recalled that, in most OECD countries, the PSTN incumbent is still dominant in terms of access to traditional telephone service and the only operator with national (regional) coverage.

As broadband access matures, it is becoming clearer that not all broadband access is the same. Each broadband technology has its own performance and economic characteristics, and positive or negative technical aspects. For example, cable, fibre, and DSL technologies have significant bandwidth advantages over broadband wireless local loop, BPL, and VSAT. However, cable, DSL, and fibre work best in high population density areas and may be uneconomic in less densely populated areas. A potential scenario in many OECD countries, therefore, is an environment where metropolitan areas have significantly richer capabilities than the rural areas. This may have long-term effects on social and economic opportunities in rural areas. Moreover, in the future, the quality of access, not merely the availability of access, may become the major consideration in setting policy.

In rethinking 'universal' access to the range of NGN services, a core issue is whether broadband should be part of USOs. The EU has already moved from voice USOs to include a data USO with a "functional Internet access" provision in its current USO Directive. No doubt there will be close examination of whether 'functional access' in an NGN environment necessitates an upgrade to broadband access. Indeed, there are strident calls for such a policy already. But — at least at this early stage of broadband penetration — there are strong reasons to be wary of using a 'blunt', blanket USO approach that could distort competition and investment incentives. However, this view may require regular reconsideration because universal service is an evolving concept. More generally, as competition develops through the use of unbundling in a number of countries, it may be necessary to determine the role of unbundled lines in the provision of universal service.

In an NGN environment, current funding arrangements for USOs may be unsustainable. A variety of alternative arrangements can be envisaged ranging from a tax on each telephone number to financing through general taxation revenue. They should be thoroughly assessed against a number of criteria, such as economic efficiency, equity and competitive entry as well as against current practice where the infrastructure and service providers directly fund universal service.

As part of this assessment, governments may want to consider advantages that could be gained by funding the cost of pursuing the 'social' objectives of USOs from government general taxation revenue. Importantly, government funding would link decisions concerning the nature and scope of universal service closely with financial responsibility for such decisions. This could prevail against excessive growth by installing in-built incentives to restrain political disposition for widening universal service expenditure. Certainly, while political advantages flowing from universal service programmes 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 programmes and to minimise the distortions that can arise from excessive USO programmes) is less likely.

1. INTRODUCTION

1.1 Introduction

The voice market in recent years has a seen a shift in emphasis as traffic moved from the fixed network to mobile networks. This is primarily because competition in mobile networks provided consumers with a greater variety of services, quality, and prices as compared to fixed networks. As a result, traditional voice telephony services provided over fixed networks have become less important relative to "data services" that now often include voice over Internet Protocol (VoIP) services. The Internet is spawning new applications, advanced wireless and media services are promising platform competition, all with IP at their core.

Looking ahead, there is an expectation of further dramatic change in telecommunications. Voice services may become one of many applications provided on networks and may be bundled with a range of other services. Fixed and mobile voice are expected to become integrated. Already wireless communications have established themselves as important in providing widespread coverage of communications services. The emergence of new services delivered over cable television networks, fibre networks, satellite and powerlines all suggest that the previous reliance on wireline telecommunications networks may well diminish, although new DSL technologies have helped in rejuvenating fixed networks and widening the scope of applications they can provide.

Many incumbent telecommunications operators are announcing a transition to so-called Next Generation Networks (NGN) to replace their existing circuit-switched networks. Such changes are expected to have significant implications in the way voice services are provided and the characteristics of these services. In turn, this will impact on the longer-term nature and scope of universal service obligations (USOs), including the definition and financing of USOs. However, NGN technologies may not reduce the high costs of access for some geographic areas that are presently considered unprofitable in the context of universal service.

What is NGN?

NGN is a concept rather than a single network. It is a packet-switched network providing a range of communications services, which uses transport technologies for several bandwidths and classes of service and in which service-related functions are independent of the underlying transport technologies. NGN covers multiple networks and layers – serving fixed, mobile and "nomadic" users. It is a means of providing services across a range of technologies giving users unrestricted access to different service providers. It supports general mobility, giving users consistent and ubiquitous service provision. At the heart of the concept is the integration of existing separate voice and data networks into a simpler and more flexible network using packet switch and IP protocols. This will enable voice, text and visual messages to be carried on the same network and for each type of message to be responded to in any of these formats on that network.

Revenue erosion

The liberalisation of telecommunications markets and the resulting competition has resulted in significantly lower prices for telecommunications services, in particular voice services. In addition, the rapid growth of mobile services across the OECD has meant that mobile penetration rates are for most OECD countries greater than fixed line penetration with mobile voice revenues accounting for more than

half of telecommunications revenue in many countries. The growth in the mobile voice market has also led to mobile services being substituted for fixed services resulting in many incumbent PSTN operators facing an overall decline in the number of subscriber lines. Voice over Internet Protocol (VoIP)[1] is also impacting on traditional voice telephony services using public switched telecommunications networks (PSTN). This may mean that the definition of universal service may have to be reviewed, new forms of funding may have to be found where it is considered necessary to support universal service or the present scope of USOs may have to be curtailed.

Transition from PSTN to NGN

The expected transition from PSTN to NGN is itself raising concerns. This is because the shift to NGN is likely to take place unevenly across customer groups or geography since it will probably occur last in less commercially attractive locations such as rural and remote areas. Moreover, the migration from PSTN networks could increase average per line costs of existing networks, lead to a deterioration in quality of service and even make their closure a possibility (unless obliged to remain in operation due to a USO). As a result, this transition to NGN could raise significant universal service issues. This transition also raises the issue of what attributes of the PSTN will endure. Is the PSTN to be totally displaced by competitive, market-based NGNs or are there functions, such as addressing, that should continue under regulatory authorities?

1.2 Objectives of this paper

The shift from a primarily wireline telecommunications network environment to a competitive telecommunications market with ever-changing players and new technologies requires a fundamental rethinking about coverage, funding and other arrangements pertaining to universal service. The primary objective of this paper is to stimulate such wider rethinking on this issue.

- In an NGN environment with competing technologies, to what degree will universal service objectives be met by the market?
- If universal service programmes are necessary in an NGN environment with a competitive market and new technologies, what is the role of USOs?
- How do we secure USOs (and, indeed, whether we want to secure them) at a time of rapidly changing telecommunications technologies and potential substantial shifts in the revenue stream of PSTN operators?
- What funding and other arrangements for USOs may be necessary in what is likely to be a very different telecommunications industry?

This paper does not dwell on the problems faced in specific countries (*e.g.* the United States) due to specific USO mechanisms in those countries. Rather it is concerned with the impact of competition and technological developments (such as VoIP and Broadband wireless local loop) and of convergence on USO arrangements that is of concern to all OECD countries. In particular, the focus of the paper is on a longer-term (within a decade?) 'conceptual' consideration of the impact of new IP-based services on USOs.

But in drawing attention to longer-term issues, the paper has a shorter-term aim: to focus attention on the need for policies being developed to address more immediate short-term USO issues to also bear in mind these longer term issues. This is because mechanisms to address short-term problems should be consistent with and flexible enough to accommodate longer-term issues. This message seems timely

because a number of OECD countries have started reviews of USO arrangements and others are likely to follow.

In Australia, a review of the operation of Australia's USOs was conducted during 2004[2] to determine whether the 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 Japan, a review of the universal service fund system was launched in November 2004 by the Telecommunications Council[3] with the report completed in October 2005. In 2004, Ofcom's strategic review of the UK telecommunications sector recognised the need to consider longer-term USO issues and in January 2005, Ofcom issued a complementary consultation to review universal service arrangements. In the European Union and United States, a review of universal service is expected over the next 12 months. In Canada, the government announced in April 2005 the formation of a panel to review telecommunications policy.

To summarise, this paper aims to:

- Identify problems that are developing for current approaches used to deliver USOs resulting from developments in competition (*e.g.* from wireless operators) and new technology (*e.g.* VoIP).

- Analyse whether USOs should be maintained in an environment with many competing technologies, and if so in what form, and how it should be funded?

- Identify developments related to the increasing importance of broadband that are likely to increase the importance of broadband capacity; should the scope of universal service be widened to include broadband?

- Examine policy initiatives designed to promote availability, affordability and accessibility of telecommunications in an environment with competing technologies and communications services; and

- Stimulate rethinking on universal service.

1.3 Structure of the paper

The paper is structured as follows. Following this introduction, section 2 discusses the rationale and examples of the present scope of USOs. Section 3 discusses how market liberalisation, complemented by regulatory mechanisms, has impacted on the achievement of USO goals. The section reports considerable evidence of success in terms of increased penetration of telecommunications service, particularly as a consequence of the explosive growth in wireless services. There have also been significant price reductions and quality of service improvements. However, for some parts of the market, including service provision to inhabitants of rural and remote areas, support from regulatory mechanisms to encourage service provision has been required. Section 4 discusses problems with the current arrangements for funding and delivering USOs. These include "revenue erosion" resulting from competition, including competition from wireless and VoIP operators. Section 5 discusses longer-term issues relating to the nature and scope of USOs in an NGN era. One issue examined is whether broadband should be defined within the scope of USO. It discusses the proposition that if subsidy mechanisms are deemed necessary, funding from general government resources (rather than/as well as levies on telecommunications operators or consumers) be considered.

2. THE NATURE AND SCOPE OF UNIVERSAL SERVICE OBLIGATIONS

2.1 The rationale of universal service obligations

An economic, social and political rationale has been offered in support of "Universal Service Obligations" for telecommunications.

Economic rationale

Arguments for USOs based on economic efficiency considerations fall into two categories: those based on direct effects on users of telecommunications services and those relating to the interaction of the telecommunications sector with the broader economy. It is argued that when an additional person joins a communications network, existing members benefit because (*a*) they can contact a new person (a so-called network externality) and (*b*) they can receive calls from the new customer (a call externality). New prospective customers may not take these effects into account, and hence may stay off the network or not make calls, even though it would be efficient for them to join the network.

There may also be other types of economic efficiency that a USO programme can help attain. Use of communications services can have broader effects throughout the economy, such as boosting productivity, enhancing economic growth, promoting regional development; increasing a country's ability to compete globally, and raising standards of living.[4] Low-cost communications can encourage teleworking and reduce congestion costs from travelling to work. These types of effects, while they may be important, are difficult to quantify and value.

Social (equity) rationale

The social rationale for USOs argues that being connected to the telecommunications network is necessary to avoid "social exclusion" and to participate fully in society, for example by accessing public services, and having access to emergency services. A part of the rationale for USOs is also to ensure that people on low incomes, those living in remote rural areas, disabled people and other vulnerable groups are still able to obtain the advantages of telecommunications. Such access is seen to go some way towards equalising conditions between rural and urban communities. It also provides a means by which people can exercise their social and political rights more effectively. However some vulnerable groups may underestimate the benefits of and therefore 'under-consume' telephone services (the so-called 'merit goods' rationale).

Political rationale

The basis of this rationale for USOs is that the nature and extent of USOs for telecommunications is essentially a political decision. For instance, in the United Kingdom it is the Secretary of State for Trade and Industry, not Ofcom, who decides the scope of USOs. Some argue that universal service is also being driven by social inclusion considerations linked with emerging e-governance objectives.[5] For instance, many OECD governments are intending to deliver many public services via the Internet. If a "digital divide" persists, the delivery of public services will not be universal. This in turn could worsen the exclusion of the very social groups reliant on many public services. Such considerations strengthen the case for funding support based on decisions made through the political process (such as those relating to decisions on taxation and budget allocation). This is discussed further later on in this paper.

2.2 The nature and scope of Universal Service Obligations: Examples from selected member countries

Universal service in telecommunications covers real-time voice services, including access to emergency services (in some countries such as the United States) and directory information services. The broad dimensions of universal service and universal access[6] goals include:

- *Availability* – that the level, price and quality of service 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 communications 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, so that a person's level of physical and mental ability does not preclude that person in terms of access to communications services.

No standard universal service definition

Within these broad dimensions, USOs is not a fixed concept and there is no single 'standard' definition of what should be defined within the scope of such obligations.

The scope of USOs in the United Kingdom

An example of the scope of USOs is provided by the obligations imposed on BT as the USO provider in the United Kingdom (with Kingston Communications the designated USO provider in Hull).[7] 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.
- 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 GBP 74.99. If an installation costs BT more than GBP 3 400 (about USD 6 250), then the customer must pay the difference above this figure.

BT and Kingston are 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 who are partially sighted, and a priority fault repair service.

The scope of USOs in the United States

The considerable variation in the scope of USOs can be seen by examining USOs in the United States where they include the following four components:[8]

- *Low-income:* This programme provides telecommunications service discounts to consumers with qualifying low incomes.

- *High-cost:* This programme provides financial support to companies that provide telecommunications services in areas of the United States where the cost of providing service is high.

- *Schools and libraries:* This programme 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 programme 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.

2.3 From voice to data USOs

The ISDN requirement in Australia

In Australia, since 1999 everyone has 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.[9]

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.[10]

The EU's 'Functional Internet Access' provision

Under the terms of the EU Universal Service Directive, the designated universal service provider is required to provide a connection that provides "functional" Internet access (FIA).[11] This obligation is limited to a single narrowband connection and does not extend to ISDN[12] 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 (discussed below). Guidelines have been set in the United Kingdom but these are not legal obligations. Thus, in most cases FIA has been 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).

United Kingdom

In July 2003, Ofcom issued guidelines that specified 28.8 kbit/s as a reasonable minimum data rate.[13] While Ofcom did not mandate a minimum speed, it expressed the view that, at that time, a connection speed of 28.8 kbit/s was a reasonable benchmark for functional Internet access. Ofcom acknowledged that 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 Obligations including functional Internet access and sought opinions regarding the future direction of its policies 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 that time.[14]

Ireland

In Ireland, ComReg (the telecommunications regulator) has specified[15] a requirement that *eircom* adopt 28.8 kbit/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 in the commercial plans for broadband roll out. However, ComReg believes that *eircom* should publicly report on the numbers 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 a 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 that it was likely to divert investment funds from projects that would have a more beneficial consumer impact.

These conclusions have been noted because they are relevant to the discussion later on in this paper about the desirability of including broadband within the scope of USOs.

United States

As noted earlier, the United States has included access to broadband to schools and libraries as part of USOs. In addition, public and non-profit health care providers in rural areas can receive discounts on monthly telecommunications charges, installation charges, and long-distance Internet connection charges so that health care providers serving rural communities pay no more than their urban counterparts for telecommunications services necessary for the provision of health care.

3. IMPACT OF MARKET LIBERALISATION ON UNIVERSAL SERVICE

3.1 Impact of market liberalisation

Experience in OECD countries has shown that the entry of private telecommunications operators into the market improves teledensity, lowers prices (which improves affordability), enhances quality of service, and increases at least the short-run profitability of telecommunications operators by providing incentives for efficient operation, greater levels of investment and network rollout.[16]

Increased teledensity. Total teledensity (*i.e.* both fixed line and mobile) has increased in all OECD countries. But due to the popularity of mobile service (and ADSL which makes a second line for Internet use unnecessary), some economies have seen declines in fixed teledensity. Indeed, mobile teledensity now exceeds fixed line density in most OECD economies. Pre-paid customers have been a major driver of mobile usage increasing sharply to represent an average of over 40% of all mobile customers in OECD countries in 2003 (OECD, *Communications Outlook 2005*) and over 60% in developing economies. These trends are of close relevance to universal service. 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. Although mobile services are not part of universal service obligations, 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.

Lower prices. Lower prices help to attain universal service by improving affordability. In some OECD countries, domestic long-distance prices per minute have fallen by 25% (Australia) to 50% (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 now VoIP services.

A distinctive feature of price changes resulting from market liberalisation has been increases in line rentals as part of price-rebalancing. This is discussed further later. Australia has had the biggest increase in line rentals for residential customers since 2000 with Telstra raising monthly rentals from AUD 11.95 to AUD 26.95.

3.2 Technological change and universal service

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.[17] Mobile operators have translated this lower cost base into affordable pre-paid packages 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 could mean that some operators specialising in the provision of rural service can provide service even in the most remote areas.

In short, competition has resulted in increased 'availability' and lower prices have delivered greater 'affordability'. Mobile has brought other innovations as well, such as public mobile payphones and short messaging service (SMS). Indeed, SMS is cheaper than voice and means that mobile users can engage in a kind of e-mail. 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.[18] Nevertheless, mobile call prices still remain relatively high in most countries, as does the price for short message services so that the concept of "affordability" would need to be more nuanced before mobile services could replace fixed in the context of universal service obligations.

Broadband wireless local loop

There seems widespread expectation that important changes in rural universal service are likely. These changes will stem from the new suite of wireless technologies such as wireless local networks and broadband wireless local loop (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. Broadband wireless local loop has the potential to have significant implications for the delivery of USOs as discussed in more detail in another OECD paper (DSTI/ICCP/TISP(2005)4/FINAL). For instance, long-range broadband wireless local loop technology promises to be capable of expanding the reach of current broadband networks to remote areas and may significantly decrease the need for universal service subsidies.

However, much of the discussion for broadband wireless local loop has been on deployment in high population/high opportunity markets. This is reflected in recent reshaping of the broadband wireless local loop standards to permit mobility, in order to compete with 3G mobile technologies. For the moment, there is little proof that technologies like broadband wireless local loop technologies are immediately leading to investment in rural areas.

The success of broadband wireless local loop will depend on an environment that facilitates digital planning, innovation and creative business initiatives and on the availability of spectrum. Thus spectrum agencies should examine existing allocations to see where space can be made for new broadband wireless technologies such as those used by broadband wireless local loop. Consideration should also be given to the extent to which reforms to introduce spectrum trading and leasing can assist. This issue was examined in detail in another OECD paper (DSTI/ICCP/TISP(2004)11/FINAL).

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 liberalisation. 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.

Very small aperture terminals (VSATs)

Very small aperture terminals (VSATs) can be another effective means of establishing telecommunications 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.

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. However, at this point in time, cable, fibre, and DSL technologies have significant bandwidth advantages over technologies like VSAT. If rural areas were to rely on VSAT, they might still be at a disadvantage compared to urban areas, and this may have social and economic consequences.

In 1998, Peru's telecommunications regulator (FITEL) invited tenders to award a 20-year, subsidised concession to provide rural payphones in a number of remote regions. Participants in the tender submitted bids indicating the lowest government subsidy they would be willing to accept in order to build the network. The winning solution selected by FITEL was based on VSAT technology.[19] GVT del Peru proposed to cover the costs of building, installing and operating the network with a government subsidy of USD 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 USD 11 per inhabitant.

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 United States in October 2004. Advocates of the technology argue that it promises several advantages offering not only voice but also 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 power-line promises to offer far more capacity than today's cable networks. Moreover, the technology will reportedly[20] 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.[21] However, some dispute these advantages. For instance, the FCC's information suggests that capacity offered by broadband over powerline will be less than cable, DSL, and fibre.[22]

"Stratellite" technology. Floating in the stratosphere at an altitude of about 20 km (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.

There is considerable excitement over the prospect that stratellites could be able to provide wireless broadband coverage, akin to Wi-Fi, over large areas. Advocates claim that a single airship could potentially provide coverage over an area of about 800 000 square kilometres. It should thus be possible to create "hot zones" 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 USD 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. It is simply to argue that there is scope to move away from a definition of universal service that is linked only to the PSTN and to emphasise definitions based on the provision of services and characteristics of services. Indeed, the definition of universal service in the European Union Directive is already technologically neutral in that it can include other platforms other than the PSTN. Thus, markets must be kept open and universal service programmes should be competitive and technologically neutral to allow the most cost-effective technology available now and in the future to be introduced to address the challenge of universal service (and for developing countries, the opportunity to "leap-frog" into the technological frontier). With

promising technologies on the horizon, it is crucial that barriers to entry and disincentives to invest be minimised. 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 in a multi-platform NGN regime. There is also no reason why universal service in different geographic areas of a country cannot be provided by different technologies as long as the services provided are functionally similar. For this reason as well, it is not necessary that there be a single USO provider in a country, but there could be a number of different regional providers who provide services with equal functions and conditions as is foreseen in the EU Directive.

The introduction of prepaid packages for mobile has allowed consumers to make calls without paying any fixed line rental. This, coupled with the near ubiquitous coverage of mobile operators, suggests that mobile phones may in effect already be playing a role in delivering universal voice services although in some countries they do not meet all the criteria of USOs *e.g.* they do not always provide location information to emergency services (although the technology exists to do so). The situation is more complicated where there is a requirement to provide data service as part of a USO. For instance, the European Commission's USO provisions require that the telecommunications connection also provides functional access to the Internet (defined at 28.8 kb/s). This data service might not be provided by the current (second) generation of mobile phones. While this facility is promised by 3G technology, 3G may not provide universal coverage. As such, mobile availability might not be a substitute for a fixed-line USO.

Nonetheless, in certain circumstances (*e.g.* the physical geography of the location), it can be very costly to connect to the fixed network. Consumers in these circumstances are likely to welcome the use of mobile technologies to connect them to voice service, especially where (as in the United Kingdom), they are expected to pay for costs of fixed line connection beyond a reasonable level (GBP 7 000 in the United Kingdom).

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 are now also promising broadband capacity. Continuing to treat local access as an enduring bottleneck will discourage true infrastructure-based competition. In Europe, even though the framework specified "fixed functionality", it did not define the type of technology employed so *a priori* a mobile operator could become a universal service operator if it can assure access to the network for households.

3.3 Universal Service Funds

How have regulators in the OECD sought to implement national access targets and affordability goals, once these have been defined? Generally, governments have imposed two types of universal service obligations (USOs) on operators. The first is a general obligation to provide service to all customers willing to pay for service at the regulated price. This obligation may be limited to certain geographic or population groups, such as a requirement to serve rural areas with a population above a certain level. In addition, policy makers and regulators have imposed obligations to extend certain types of designated services to a pre-specified number of subscribers or localities. These network build-out obligations are often incorporated in operators' licences.

Designating Universal Service Provision

Some examples are provided below in Box 1.

Box 1. Some Examples of Universal Service Provider Designation

In Austria, an auction is to be used, and if there is no tender, the USO will be designated.

In Denmark, the USO provider is designated on the basis of market share (combined with other criteria described in the telecommunications directives), but the legislation also allows a public tender.

In Germany, where a USO is not being adequately provided or there is reason to believe that such provision will not occur – a USO will be imposed. First, a voluntary solution, *i.e.* provision of the universal service without compensation, would be sought. Should there be no voluntary solution, the legislation gives two options: the USO may be imposed on the provider having a dominant position, or the USO provider would be selected by an auction process. Thus far, Deutsche Telekom has been the USO provider without receiving compensation.

In Greece, the incumbent was traditionally the USO provider, but since liberalisation of the telecommunications market, a competitive tender mechanism may be used.

In Ireland, the regulator re-designated the incumbent operator the USO provider following a detailed consultation process. A request for expressions of interest from alternative operators to become a USO provider was also made, but no expressions were received.

In Mexico, the incumbent operator (Telmex) was required as part of its privatisation to install payphones in 20 000 rural areas over a five-year period to meet the policy goal of ensuring some telephone access in all villages with at least 500 residents.

In the Netherlands, the USO is awarded to the operator with the lowest net cost.

In Norway, the USO provider is designated by the Ministry based on criteria described in the regulatory framework.

In Switzerland, Swisscom is the designated USO provider after winning a tender (in which the operator did not ask for a subsidy since it considered that the intangible benefits of being the USOs provider compensated for the costs).

In the UK, BT is the designated USO provider (Kingston, in Hull).

Liberalisation of telecommunications markets has complicated the issue of funding USOs. First, the most desirable markets for new entrants were the most profitable, such as international calls and business calls. These were exactly the sectors where an incumbent was using cross-subsidisation to fund the universal service obligations. Second, because an incumbent's tariffs were unbalanced – that is to say long distance calls were generally significantly above cost and access subsidised, new entrants could easily enter the market and make a profit in the long distance calls part of the market.

As competition continues to erode high margins across a widening set of products, at some point providing the USO may become an 'unfair burden' although in most countries incumbent operators have been allowed to increase the fixed subscriber line charge to reflect costs. Nevertheless, because of such developments it may become appropriate to introduce alternative mechanisms for funding and allocating the USO such as the use of a Universal Service Fund. Use of a Universal Service Fund, as is the case in a number of OECD countries, 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 could be designed to be competitively neutral (*e.g.* by requiring a broad range of operators to contribute to a Fund) and technologically neutral. Indeed, the EU Universal Service Directive requires that where a national regulator finds that an operator is subject to an unfair burden in providing USOs, a mechanism should be introduced either to compensate the USO provider(s) from public funds, or to share the net cost of USOs between communications providers.

In a number of countries, such as the United States, Australia, 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. In many countries, 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 with a turnover above the threshold of EUR 5 million, contribute to the USO fund in proportion to their retail telecommunications revenue, which is then managed by the *Caisse des Dépôts et Consignations*. In the United States, the framework is somewhat more complicated,[23] with services designated 'telecommunications 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 a telecommunications service or an information service (providers of which are not assessed for a contribution to the USO fund).

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 to national economies, some funds are also supporting public access to value-added services, including Internet access. In Chile, the government has redefined the UA Fund, which has been successful in extending basic telecommunications to rural and low-income areas, to support telecentre projects. In India and Kenya too, telecentres are eligible for subsidies from the universal service fund.

Difficulties with estimating the costs of universal service

Difficulties with estimating the "intangible benefits" and net cost of providing universal service have also plagued 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…"[24] (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).

Competitive tendering

There is accumulating evidence that in competitive circumstances with feasible alternative supply of universal service, 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.[25] The competitive tendering approach can reduce the 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 had been a useful, and a reasonably cost-effective, way of testing the potential for contestability of USO subsidies.

3.4 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 US/French model).
- Funding from the proceeds of privatisation and spectrum licence fees.
- Government funding via general taxation revenue.

Contributions from operators

Contributions from operators have been the most commonly used approach. What percentage of revenue should be payable by operators? This would depend importantly of course on the amount of subsidy funding required from the fund. In countries that have installed a universal access fund, the levy has ranged from 0.1% (France) to 1% (Argentina, Brazil), 5% (India), 6% (Malaysia) to over 10% (United States[30]). Box 2 below indicates some examples of required contributions from operators across a range of countries. Most examples are of non-OECD countries because to date, only a few OECD countries have installed universal service funds.

Box 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).

Box 2. Some examples of Universal Service Funds (cont'd)

France	Operators contribute a % of revenue	*Caisse des Dépôts 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	Telecommunications carriers contribute to the USF	Universal Service Administrative Agency (public-interest corporation)	The universal service cost to eligible telecommunications carriers.
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 to 2002), 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, a 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 require 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	10.2% in fourth quarter of 2005 on operators interstate end-user revenue (which can be 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 programmes, 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 can actually require competitive carriers to cross-subsidise the USP's activities, and thus can 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 certain cases, the impact may be marginal insofar as the contribution from operators is only a negligible part of their revenue.

Not all countries have been enthusiastic about establishing a Universal Service Fund. Indeed, in Finland, there are no mandated requirements on operators, with competition expected to achieve universal service objectives.

In the European Union, 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. It is notable that (so far) only France, Italy and Spain have decided to establish such a universal service fund. But other countries (*e.g.* the United Kingdom) are considering this approach as cross-subsidisation is phased out.

But the point that will be made in the following section of this paper is that these funding mechanisms for delivering and funding USOs may come under pressure, and increasingly so as we transit to Next Generation Networks. Indeed, in some countries, current arrangements are likely to be sustainable for no more than say within a decade.

4. CONCERNS OVER CURRENT USO ARRANGEMENTS

4.1 Efficiency constraints on equity

In many countries, universal service has been promoted by the cross-subsidisation of line rentals and local call charges from high prices in international and national long distance call revenues. As competition and regulation have driven prices towards costs, cross-subsidies have to a large extent been significantly reduced if not eliminated. New entrants are largely attracted to providing services where prices are well above costs (for international and long distance) 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 and frequently also local call charges. This is commonly referred to as 'price rebalancing'. However, in the majority of OECD countries, the policy of 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.

Table 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 and residential consumers.

Table 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.

Similar trends in price rebalancing are observable in many other countries,[31] 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 the 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 telecommunications network.

There is also concern that sharp increases in monthly rental charges can cause customers to switch to mobile and/or 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 a 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' and political 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 United Kingdom and Australia.

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 is likely to impede universal service in these markets and the benefits that competition delivers.

Experience in the mobile sector illustrates how flexible pricing to allow innovations (*e.g.* pre-pay and two-part tariffs) can help the market to grow. The development of the low-cost airline industry provides another example of a sector where substantial benefits and market growth have flowed, at least in part, from price flexibility.

In general, to impede price flexibility through price regulation (such as price cap regulation, often with 'sub-caps' on line rentals) because of concern over a few such consumers seems a very blunt inefficient instrument. It would seem more sensible to provide such consumers the requisite insulation through specifically targeted subsidies. As competition strengthens, one approach might be to abandon regulation of end-user prices, then see where and for whom subsidies may be necessary. The concern, however, might be the disruption and impact on the needy in the interim. There are provisions in several OECD countries that allow for a reduction in subscription charges for people with a low income and in some cases (*e.g.* Belgium) the provision is extended to other communication services (mobile services).

4.2 Wireless, VoIP, revenue erosion and the reducing sustainability of Universal Service Funds

The impact of competition from wireless telecommunications on the revenue of fixed-line operators has already received considerable attention elsewhere. For instance, in the United Kingdom, 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.[32]

The data below show some of the developments impacting on fixed-line operators. Figure 1 shows that mobile penetration in OECD countries has risen sharply between 2002 and 2004, while standard analogue fixed-line penetration has declined since about 2000. The increasing use of prepaid cards for

mobile service has helped support the sharp increase in mobile penetration. Figure 2 shows that in many OECD countries, the number of mobile subscribers increased faster than fixed line during 2002-2004. Indeed, in most OECD countries, the number of fixed line subscribers has declined in absolute terms. One factor contributing to the decline in the number of fixed line subscribers is the increasing number of "mobile only" households. Certainly, the number of such households has been increasing in the EU15 countries, as Figure 3 indicates. Figure 4 shows the impact of the different rates of subscribership growth on revenue. Revenue from mobile service has been increasing sharply, while growth in the revenue from fixed line has remained relatively steady.

Figure 1. Penetration of fixed lines and mobile subscribers in the OECD countries

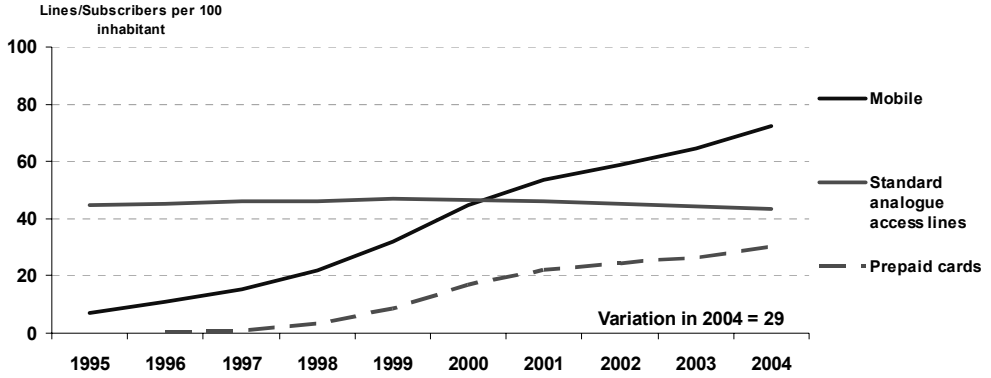


Figure 2. Gain / Loss of fixed lines and mobile subscribers for the 2002-2004 period

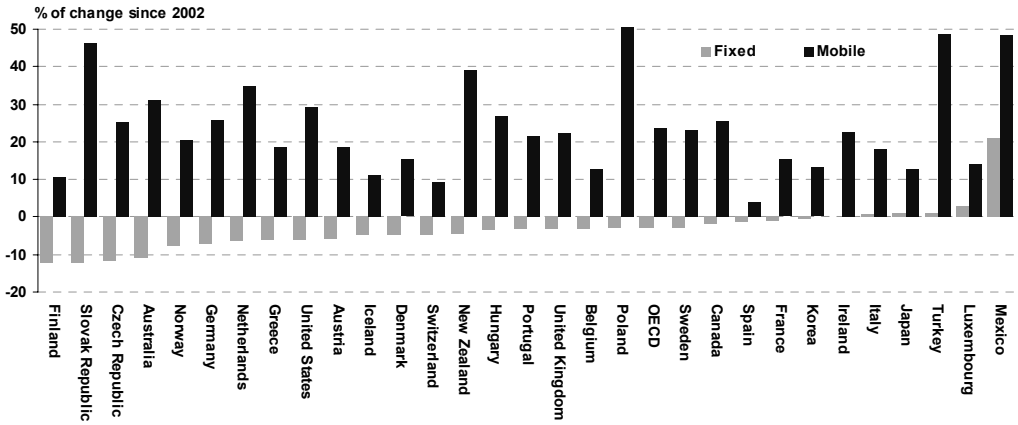
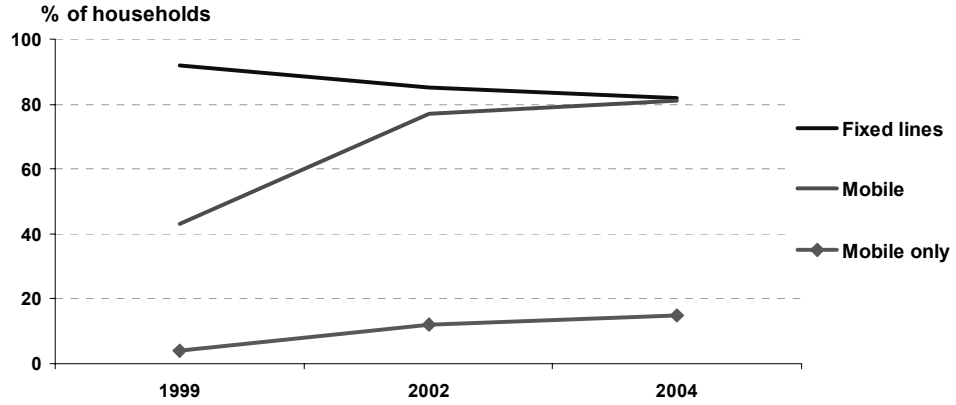
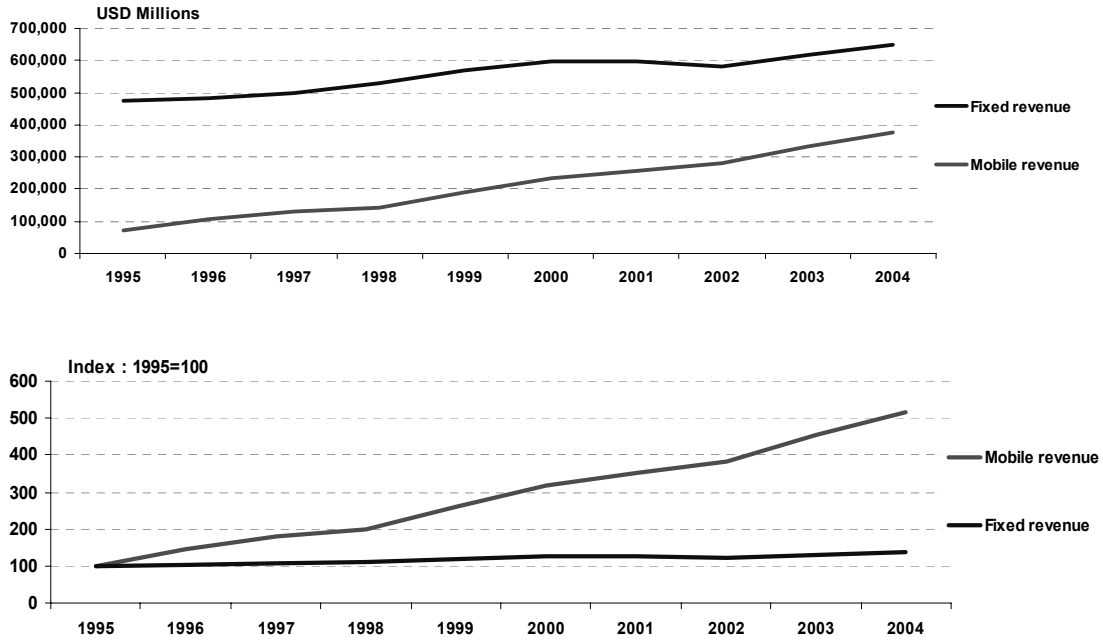


Figure 3. An EU study shows an increasing number of "mobile only" households for EU15



Source : European Commission, DG Information Society.

Figure 4. Evolution of the revenues from fixed lines and mobile services



Note: Data for 2004 are provisional.

The impact of competition from VoIP on fixed-line operators is becoming increasingly apparent not only in the international voice market but also more recently in domestic long distance and local markets. One forecast is that by 2008 over 1 in 10 of broadband-enabled households worldwide and over 1 in 5 broadband-enabled small and medium-sized enterprises (SMEs) will be making VoIP calls. The Analysys forecasts are shown below in Table 2.

Table 2. Adoption of VoIP by broadband users (% of broadband sites)

	2004	2005	2006	2007	2008	2009	2010
Residential penetration							
Access & calls	0.7%	1.3%	1.9%	2.6%	3.2%	3.9%	4.5%
Calls only	0.5%	2.5%	4.5%	5.4%	5.6%	5.1%	4.1%
DIY VoIP (or P2P)	1.0%	1.1%	1.3%	1.5%	2.0%	2.7%	3.9%
Total	**2.2%**	**4.9%**	**7.6%**	**9.5%**	**10.8%**	**11.7%**	**12.5%**
SME penetration							
Access & calls	0.5%	2.0%	4.9%	9.5%	14.1%	18.3%	22.0%
Calls only	0.3%	2.1%	4.2%	5.5%	6.1%	6.4%	6.6%
DIY VoIP (or P2P)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	**0.8%**	**4.1%**	**9.1%**	**15.0%**	**20.2%**	**24.7%**	**28.6%**

Note: P2P = Peer-to-peer calls that offer users more limited access.

Source: Analysys, "The Impact of Voice over Broadband", June 2004.

Other commentators believe there will be higher levels of adoption than those shown in Table 2. According to a report[33] released in May 2005, consumer and small business usage of VoIP will accelerate between 2005 and 2009. As VoIP competition and demand increase, incumbent carriers will increasingly opt for PSTN replacement to lower operating costs.

The new technologies could result in prices falling to very low levels. 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,[34] rather than paying per call. Some VoIP customers do not pay for the number of calls made, but instead pay a flat-rate charge for unlimited calls along the current model for broadband Internet. It is widely predicted that telecommunications operators increasingly will not sell calls as a stand-alone service. 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). For instance, in the United States a broadband telephony company, Vonage, has offered unlimited local and long-distance calling packages for less than USD 35 per month.

These changes could result in a very different voice market. 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 are already offered – such as instant messaging, e-mail, and content services – of which voice will only be one application.

An increasing switch to VoIP could diminish 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).

It is possible that network transformation could change the balance of revenues and costs (*e.g.* a shift between 'access' services and 'conveyance' services; changes in the net cost of serving different consumer groups or regions. At the same time, changes in the competitive environment may put considerable pressure on prices for particular consumer groups and/or geographic areas.

Nomadicity. A VoIP provider can offer service from another country, without being physically present in a country. 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 offer a 'nomadic service' enabling end-users to make and receive calls at numerous locations nationally and internationally, generally with the same service number. For example, the customer is able when travelling to make and receive calls at various locations providing broadband access, such as airports and cafes providing wireless local networks access. As a result, this type of VoIP service breaks the nexus between a person's telephone number and their location, that characterises fixed telephony service.[35]

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.

A number of VoIP service providers are requesting numbers (either geographic or non-geographic) to allow for telephone-to-telephone calling.[36] These services may also be nomadic in the sense that the subscriber to a geographic number may not in fact live in or call from the area where the geographic number is located. Nevertheless, for these services the requirement for a number allows, if deemed necessary, the imposition of a contribution for universal service.

4.3 Migration to NGN and reduced viability/sustainability of PSTN in rural and remote areas

As traffic migrates to IP networks there will be fewer customers generating PSTN revenue from voice service. At some stage in the future, the PSTN could become uneconomical to maintain, especially if the more lucrative customers are the earlier movers to NGN networks. The transition from PSTN to NGN is unlikely to take place evenly across customer groups or geographies. Customers remaining on the old network are likely to be clustered in poorer locations and demographic groups. As a result, this transition could raise concerns in that it may create a digital divide between those with NGN access and those still using the PSTN. In the strict context of universal service, changes to network characteristics and services will not have an impact as long as the definition of universal service remains unchanged.

"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 being 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.

5. RETHINKING UNIVERSAL SERVICE FOR NEXT GENERATION NETWORKS

5.1 What services should be covered by USOs in an NGN environment?

Arguments for assistance to 'uneconomic' subscribers, justified by social reasons, or more generally, by universal service policies, must be constrained by the need not to impose unreasonable costs on other (economic) subscribers. In addition, in determining the scope of universal service, care should be exercised not to raise damaging uncertainty in the minds of operators and investors. To endeavour to minimise these and other potential costs and to maximise the potential benefits derivable, it is crucial that policies and programmes be determined judiciously and systematically. While all this suggests that USO programmes be subjected to thorough cost-benefit analysis, this is seldom done.

While there will be broad agreement that in seeking to maximise the benefits of NGN, it is important that equity is not forgotten, the converse also applies. That is, in striving to achieve equity in access to NGN, it is important that efficient and cost-effective means for doing so are sought.

In the existing PSTN environment, services delivered through universal service policy are uniform (namely POTS) and standardised solutions are implemented nationwide. With the expansion of new services expected in an NGN environment (see Box 3), services may no longer be tied to the network but be an application where there would be a range of choices rather than standardised services. This could imply that policy makers need to choose a minimum number of characteristics to describe a service that will become part of universal service obligations. If there is a wide choice of similar services (*e.g.* voice) the question is whether a single provider of such a service application should be designated as the USO provider or should it be left to the market to provide services?

Services offered in an NGN environment

Various technologies are expected to coexist in NGN. They will both compete with one another (facility-based competition) and complement each other, resulting in hybrid technological solutions expected to facilitate widespread coverage. New technologies, including advances in wireless technologies, the transition to NGNs through horizontal integration (see Figure 5) and 'convergence' (see Figure 6) are promising "platform-based competition" with a profusion of innovation and service differentiation, cost efficient networks with IP at its core and increasing use of wireless technology in the access network to provide fully converged fixed and mobile services resulting in a "ubiquitous network society".[37]

While NGN promises a variety of broadband technologies supporting "platform-based competition", the emerging technologies differ in capabilities and costs. Thus, "platform based competition" will be asymmetric in nature with different platforms offering varying service capabilities and levels of competitiveness affected by demographic and other factors. Simply, 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. The effect of asymmetric platforms on the competitive environment needs to be studied.

Box 3. NGN is expected to support a wide variety of services

Voice telephony – NGNs will likely need to support various existing voice telephony services (*e.g.* call waiting, call forwarding, 3-way calling, various AIN features, various Centrex features, and various CLASS features). But NGNs will not try to duplicate each and every traditional voice telephony service currently offered. Rather, they will likely attempt to support only a small percentage of these traditional services, with an initial focus on the most marketable voice telephony features and the features required from a regulatory perspective.

Data (Connectivity) services – allows for the real-time establishment of connectivity between end points, along with various value-added features (*e.g.* bandwidth-on-demand, connection reliability/resilient Switched Virtual Connections, and bandwidth management/call admission control).

Multimedia Services – allows multiple parties to interact using voice, video, and/or data. This allows customers to converse with each other while displaying visual information. It also allows for collaborative computing and groupware.

Virtual Private Networks (VPNs) – *voice VPNs improve the interlocation networking capabilities of businesses by allowing large, geographically dispersed organizations to combine with their existing private networks with portions of the PSTN thus providing subscribers with uniform capabilities. Data VPNs provide added security and networking features that allow customers to use a shared IP network as a VPN.*

Public network computing – *provides public network-based computing services for businesses and consumer. For example, the public network provider could provide generic processing and storage capabilities (*e.g. *to host a web page, store/maintain/backup data files, or run a computing application).*

Unified Messaging – *supports the delivery of voice mail, email, fax mail, and pages through common interfaces independent of the means of access (*i.e. *wireline or mobile phone, computer, or wireless data device).*

Information Brokering – *involves advertising, finding, and providing information to match consumers with providers. For example, consumers could receive information based on pre-specified criteria or based on personal preferences and behaviour patterns.*

E-commerce – *allows consumers to purchase goods electronically over the network.*

Call Centre Services

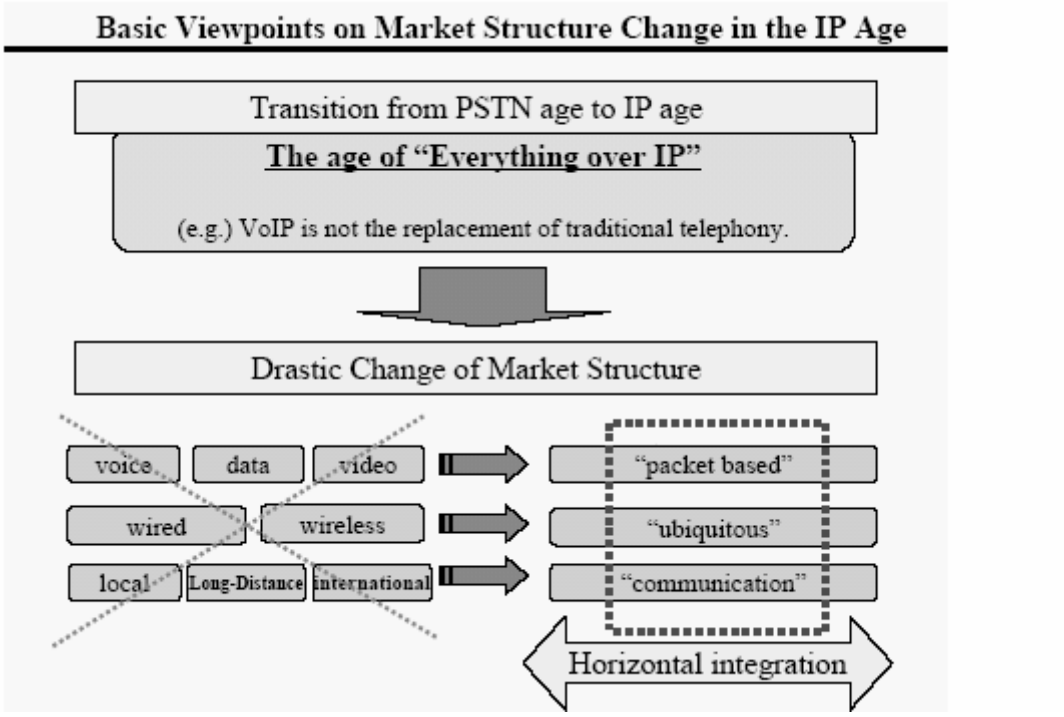
Inter-active gaming

Distributed virtual reality

Home manager—*with the advent of in-home networking and intelligent appliances, these services could monitor and control home security systems, energy systems, home entertainment systems, and other home appliances.*

Source: J.C. Crimi, "Next Generation Network (NGN) Services". A Telcordia Technologies White Paper 2004.

Figure 5



Source: Yasu Taniwaki, Broadband Deployment in Japan: Challenges for u-Japan", Progressive Policy Institute, November 2004.

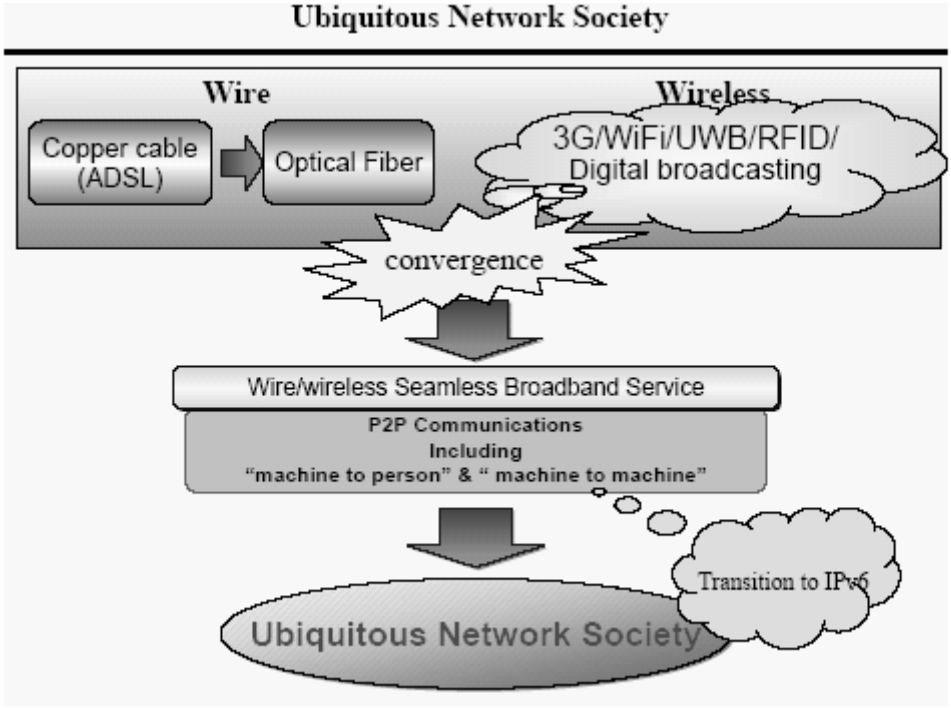
Layering

The layered network model implicit in all IP networks (depicted in Figure 7) is essentially the separation between the transmission and control layers on the one hand and the service creation layers on the other hand. The technical configuration of the service layer and the network on which it rides may have policy implications for the future that regulators should consider, such as issues of network access and control and how "network neutrality" is to be defined.

As Figure 7 illustrates, IP services depend on a physical infrastructure layer.[38] In other words, VoIP service providers cannot deliver their services without infrastructure provided by facility-based carriers. And broadband Internet access will be even more important to facilitate access to VoIP and the full range of NGN services.

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 new platforms is that they can offer almost unlimited 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.

Figure 6.

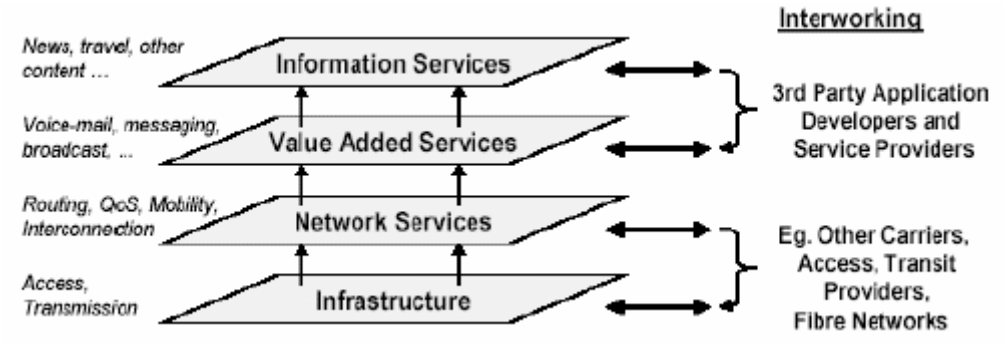


Source: Yasu Taniwaki, "Broadband Deployment in Japan: Challenges for u-Japan", Progressive Policy Institute, November 2004.

When telecommunications access can be provided over a variety of alternative means, using universal service contributions to support a single technology platform (wireline) would seem a violation of the technological and competitive neutrality that can yield further improvements in the availability, quality and price.

The essential need is that access facility of some kind can be obtained and maintained. In a converged NGN network, there should be no differentiation between the types of technology used to access the network. And because consumers are diverse in regard to their circumstances and requirement for NGN services, as far as possible they should have the flexibility to select what is for them the most attractive service provider(s). In the future, residential consumers and SMEs will probably pay a capital sum and 'line rental' for access through a technology that will provide the speed of service they require and on top of this be charged for the amount of data they transfer. Within this overall telecommunications capacity, service operators will compete to provide voice, data, video, gaming, streaming audio, conferencing and remote working services. As the distinction between fixed and mobile access to telecommunications becomes increasingly blurred, it is likely that service provision will become a cross-platform mechanism that ensures the delivery and support of applications and content to consumers as and when required. In this context USOs may need to focus on providing customers with access that supports a given range of services and, in particular, provides location-based emergency services (see below).

Figure 7. Architectural Layering in NGN



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

This layered view of NGN must be subject to questioning and 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 by comparison with 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? Does the functional unbundling proposed in Figure 7 align with the business models implied in NGN architectures brought to standards organisations such as the ITU?

5.2 Can present USO services be maintained in an NGN environment?

What about the other services that have long been designated under USOs? It is possible that some services in the current suite of USOs may be difficult and/or costly to replicate in an IP-based NGN. Some of these services are discussed below.

Quality of service

There are problems associated with VoIP that are not present for PSTN calls, including reliable access to emergency services, interruptions to normal service and reliance on the power supply to maintain the service. Moreover, for VoIP services using the Internet 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. These problems may be less likely to appear from broadband access providers who offer VoIP on dedicated links.

As a consequence industry should be encouraged to develop self-regulation 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 problem with ensuring quality of service is that the infrastructure access provider is only supplying a carriage service at the IP packet level and could be unaware of the contents of the IP packets or IP applications being provisioned over its access link. Therefore, regulators should be wary of imposing regulations for carriage services onto the infrastructure access provider that require or imply knowledge of the contents of IP packets by the infrastructure provider.[39]

Emergency services

Traditional wireline and wireless public telecommunications operators generally provide a service that routes emergency calls to the nearest emergency call centre over dedicated emergency lines. However, the emergency calling capabilities available through some VoIP services may not provide the reliability, caller identification and proper routing generally understood to exist with traditional telephony.

There have been difficulties in bridging traditional phones with those using VoIP technology that allow an Internet connection to double as a phone line. In the face of these difficulties, some net-phone companies have implemented less-effective ways of routing 911 calls. Rather than being routed via dedicated emergency lines directly to trained emergency dispatchers, the calls have frequently been relayed to "administrative" lines at call centres, which may not be manned full time and require time to transfer the calls (if it is possible to do so) to trained emergency dispatchers. The concern is that in an emergency, the few seconds lost could be the difference between life and death.

Some blame the difficulties faced by VoIP providers on the nascent state of the technology needed to route Internet phone calls over the traditional, dedicated, copper-based phone infrastructure serving emergency dispatch centres. Because some VoIP calls can be made from any Internet connection in the world, a major question to be faced is how to provide dispatchers with information regarding the caller's location, which generally is provided with traditional 911 calls.

The approach taken by two OECD countries in addressing this issue (the United States and Canada) are of interest.

United States. In the United States, calls to 911 with traditional phones generally provide emergency service dispatchers with the caller's number and location. Not all Internet-based phone providers have obtained full access to the systems connecting those calls to dedicated emergency lines and location information is not always available. In May 2005, the FCC adopted rules requiring "interconnected" VoIP providers to provide 911 service.[40] In the United States, VoIP providers have not obtained unrestricted access to the dedicated emergency lines that are used to route calls to the nation's approximately 6 100 emergency calling centres. So they still cannot always successfully route a 911 call to the right emergency calling centre via dedicated emergency lines. Further, some interconnected VoIP providers cannot provide emergency operators with the caller's phone number and location. A number of interconnected VoIP providers have, however, concluded agreements with the big local telephone carriers for their customers who dial 911 to be connected to the dedicated emergency lines to emergency call centres and have developed means of obtaining and delivering the caller's phone number and location.

Canada. In April 2005, the Canadian Radio-television and Telecommunications Commission (CRTC) announced its decision 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 services.

Hong Kong, China. In Hong Kong, China, 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 optimal.[41]

Directory assistance and phone books

Telephone customers are used to finding numbers by looking them up in a book or telephoning a Directory Assistance service. To some extent this has become easier in an IP environment where Internet services provide directory assistance. However, for nomadic VoIP services centralised number resources are difficult to obtain.

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 broadband connection to customers. 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.[42]

Disability

The widespread availability of text over IP capabilities is likely to facilitate the use of this service by deaf users. The use of mainstream services means that users do not have to negotiate for special equipment and a broader community of users can be contacted. Regulators should consider measures that will promote the availability of Text over IP in stand alone VoIP phones and in PC-based software programmes that provide VoIP capability.

In the United Kingdom, 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 next generation networks from the design stage. And Ofcom itself argued that 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 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 can be accommodated early in the design process and thus reduce the cost of providing special services *post facto*. There is also an opportunity to address any limitations of existing requirements and to revisit the overall approach taken."[43]

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

Universal service is generally based on the assumption that consumers use network access at a fixed location for voice-related (and, in the European Union, also basic functional Internet access) that are provided over the public switched telephone network (PSTN). This assumption is in turn based on a vertically integrated model whereby the universal service provider is usually also the provider of the telecommunications network infrastructure. The growth of IP-based services, in particular VoIP services, may challenge this vertically integrated model, since those with a broadband connection could have access to a range of competing IP voice service providers. In such a scenario, availability and affordability of

(cheap) voice service (now only one of many applications provided on networks) becomes less of an issue, and the focus of universal service might move towards provision of an affordable broadband access link."[44]

The development of Internet Protocol (IP) technology allows delivery of a number of previously separate communications services using only one transmission platform. Internet-based communications allow consumers greater choice in selecting service providers. Accordingly, the question arises as to whether in the future access to the infrastructure itself would suffice as a universal service, on the grounds that competitive provision of services (*e.g.* telephone service provided using Voice over IP) will ensure their availability and affordability.

Not surprisingly, the response to this question has varied, since future developments in NGN remain uncertain. For instance, it has been noted that in the United States, the infrastructure providers are also service providers and that this affects the competitive environment for other service providers. While in the past broadband access has primarily meant access to the Internet, now it is increasingly a bundle of services – video, voice, data, and mobility – that may become the most competitive business model. Infrastructure providers may choose to leverage their position in the market by reserving capacity for their exclusive use and making available only a fraction of it for Internet access. In other words, going forward it cannot be assumed that broadband access in the future will necessarily mean unfettered access to service providers.

Box 4 summarises some considerations relating to the provision of USOs in an NGN environment.

Box 4. Rethinking USOs in an NGN environment

Current USO	Will service be provided in NGN if not a USO provision?	What could be done to maintain present USO?	Expand USO?
That all users regardless of location can access quality voice service at 'affordable' price.	A broadband subscriber can access VoIP probably at a low price bundled with broadband subscription. However, consumers without access to broadband dependent on increasingly obsolete (as transition to NGN progresses) voice service from PSTN or wireless.	For those without access to wireless or VoIP service, it would be possible to oblige a PSTN operator to continue service (but also allow/encourage entry of alternative technology providers) in rural and remote areas.	Include mobile service in USO? Not in the sense of mandating universal availability. But a USO defined in terms of basic voice (and data?) service without specifying the means would allow technology-neutrality and flexibility for USO to be cost-effectively delivered by fixed wireless, mobile or other means.
Public payphones.	Fixed and mobile diffusion, Internet cafes, etc., could make it unnecessary for an USO obligation requiring blanket national coverage with a large number of payphones.	Regulators could continue to oblige public payphones to be provided as a USO but this will be increasingly costly due to decreased usage and revenue generated from payphones. Nevertheless, provision of public payphones in specific locations — such as hospitals, prisons, emergency contact points on roadways, places where mobile coverage is absent or where mobile usage is forbidden — may continue to be necessary.	Encourage/subsidise commercial operation of telecentres, including provision of subsides to needy to support 'affordability' of access to telecentres in rural and remote areas; this would be consistent with objective of "universal access". In certain cases the provision of a telecentre may be less expensive than providing a dedicated public phone.
Quality of service.	Quality of large range of value-added NGN services may be left to competitive provision/choice. Extent of quality of service depends on the NGN system that develops in 5-10 years time (although at present subject to 'Internet problems' of jitter, security, delay, power outage, security, virus attacks, etc). One problem is that infrastructure access provider only supplying a carriage service at the IP packet level may be unaware of the content of IP packets or IP applications being provisioned over its access link. Moreover, quality of service is often subjective and one could envisage having services of different quality.	Might need to specify that certain services meet quality standards. USO concern is with ensuring access of a minimum capacity/speed that allows access to NGN services. 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.	Any lower quality of service features of VoIP service should be made transparent to consumers (who could then make "informed choices" on the basis of such information). Methods could be devised to allow consumers to readily ascertain whether an IP service meets minimum QoS requirements. For example, one approach is to allocate numbers with more digits to voice services not meeting the minimum QoS requirements.
Access to emergency contact service.	Uncertain since provision of emergency contact service could be a problem for VoIP (and also for mobile).	Can require (as in US and Canada) that NGN operators provide emergency service. Analysts consider that if required, operators can do so.	

Box 4. Rethinking USOs in an NGN environment (cont'd)

Current USO	Will service be provided in NGN if not a USO provision?	What could be done to maintain present USO?	Expand USO?
Directory and directory assistance service.	Will probably be commercially provided.	If necessary, obligations in relation to directories and directory assistance could be specified (and could be varied depending on type of operator).	
Itemised billing.	Yes.	No action needed.	
Accessibility: Services to the hearing, sight etc., impaired *e.g.* relay service that translates voice into text for hearing impaired.	Yes, to extent required by general legislation concerning assurance of service to disabled. Moreover, the widespread availability of text over IP capabilities will facilitate the use of this service by deaf and hearing-impaired users.	Regulators could require measures to ensure availability of text over IP in stand alone VoIP phones and in PC-based software programs providing VoIP capability. Likewise schemes to aid other disabled *e.g.* special format telephone bills for blind or partially sighted, priority fault repair service.	New NGN networks provide an opportunity for service providers to adopt a 'design for all' approach to ensure that the needs of disabled users can be accommodated early in the design process and thus reduce the cost of providing special services.
Affordability	No. But some question whether Voice service will be cheap and affordable to all (boosted by pre-paid) except the very poor. At any rate it is questionable if the USO should be regarded as a solution for the problem of poverty. In this view, such consumers unable to afford services in a competitive market require support through the welfare system, not USO schemes?	"Affordability" could be maintained as a USO provision. Affordability could be enhanced by targeted direct subsidies to needy consumers *e.g.* through pre-paid vouchers (that allow them to choose services and service providers in a competitively and technology-neutral way).	Affordability could be enhanced by targeted direct subsidies to needy consumers (that allow them to make own choice of services and service providers in a competitively and technology-neutral way). Affordability of broadband a problem (see below). Government subsidies on basis of 'income thresholds' rather than low usage proxies of low income.
Functional Internet Access (which is a provision in the EU Directive on USOs).	Broadband, required for access to VoIP and full range of NGN services, is increasing considerably in many countries.	If USOs approach to broadband deemed necessary, can use geographic averaging, competitive tendering, etc. But rather than on services, focus could be on adequate access to platform(s) to enable access to NGN services to be pursued through competition, complemented with targeted subsidies, leaving choice of platform, capacity/speed and services to consumers.	Inclusion of broadband as a USO provision? No, at least not yet (see more detailed discussion elsewhere in this paper). A policy decision that broadband not be part of universal service does not undermine case for policies to encourage competitive provision of broadband coupled with broadband diffusion policies to address the "digital divide".

5.4 Should broadband be part of USOs?

The question of whether USOs should include broadband was discussed in detail in a previous OECD paper (DSTI/ICCP/TISP(2002)4/FINAL).[45] It is pertinent to briefly revisit the issue here since in rethinking 'universal access' to the range of NGN services, it turns out that the core issue is whether access to high-speed networks (broadband) should be part of USOs. 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? No doubt there will be close examination of whether this provision should be upgraded to include broadband access. Indeed, there are already strident calls for such a policy.[46] Is it appropriate (or necessary) to use such a 'blanket', blunt USO approach to support broadband diffusion?

Criteria for appraising USO status

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

In the United States, the threshold legal requirement triggering a decision that a service must be supported relates to the four "factors" outlined in section 254(c)(1) of the 1996 Telecommunications Act: *(i)* the service is "essential" to education, public health, or public safety; *(ii)* the service is subscribed to by a "substantial majority of residential customers"; *(iii)* the service is being deployed in public telecommunications networks; and *(iv)* the decision to support the service is in the public interest. Satisfaction of the four criteria does not necessarily require 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:

i) Adequately identifying and defining the product.

ii) Determining that the product is sufficiently 'essential' to justify the major policy interventions associated with a USO designation.

iii) Determining that costs are reasonable relative to benefits.

iv) Finding a practical and efficient implementing mechanism.

v) Working through any likely effects on other policy goals.

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

i) The degree of popularisation of the service.

ii) The social need for the service.

iii) Technological advances.

In Switzerland, a working group set up to undertake a comprehensive review of the scope of universal service is to report by 30 June 2006. The review is to include an examination of the potential to remove some services from universal service obligations as well as the need to include new services within the scope of universal service.

EU review of the scope of USOs

In Europe, the EC's Directive on Universal Service and Users' Rights[47] concluded that the scope of universal service should not be extended to include higher bandwidth services (at this stage of its development). However, the Directive 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 should 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 or 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.

- 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.

- Propose that specific services should become mandatory services to be provided under cost-oriented obligations.

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". 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.

A systematic process for considering USO status for broadband

Drawing on the range of issues and the criteria proposed above, Box 5 indicates a framework for systematically considering whether to re-define the USO to include broadband.

Box 5. A systematic procedure for considering USO status for broadband

A systematic process for considering the need to re-define 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.)

Broadband as a part of USOs – some sceptical views

It is likely that some would regard an upgrade to broadband as a 'natural extension' of "functional Internet access" in an NGN era. So it may be constructive to balance such views by offering some sceptical views here.

Broadband access unevenness symptomatic of a broader divide?

There are those who argue that concerns about a broadband access are no different from other technology divides with different rates of diffusion according to household/individual by income, education, location, age, gender.[48] 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 will be available for over 98% of subscriber lines by the end of the year (*e.g.* the United Kingdom), the majority of Internet users are still currently using a narrowband service to connect to the Internet. By the end of 2003 there were, on average for the OECD, 22 Internet subscribers to fixed networks per 100 inhabitants of which dial-up subscribers accounted for 68%. In 1999 dial-up subscribers accounted for 99% of Internet subscribers to the fixed network. Although broadband penetration rates are growing rapidly the OECD average is relatively low at 12 subscribers per 100 inhabitants (with only 4 OECD countries having a penetration rate over 20%). Even though prices are dropping, a broadband subscription still requires a premium over a dial-up subscription. Given present rates of broadband penetration, it would be difficult to argue that broadband meets the criteria mentioned earlier which would result in it being classified as an essential service.

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 programmes 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 programmes.

It is notable that a number of studies have shown that a "blanket" universal service system can actually benefit high-income users as opposed to those on low incomes. It is unfair and potentially damaging to the development of the telecommunications sector.[49]

Benefits have not been shown to persuasively exceed costs

In general, across the OECD, with the exception of some countries, local switches have been upgraded relatively rapidly to support xDSL technology. This has occurred without the need to designate broadband as part of universal service. Many incumbents have indicated that by the end of 2006 a high percentage of main distribution frames will be able to support xDSL. For the relatively small percentage of lines which cannot be upgraded to xDSL, or the percentage of the population that cannot be provided with broadband, other solutions need to be found. In some cases these solutions may be forthcoming through Wi-Fi, and in the future may be available through broadband wireless local loop technology. At any rate, it appears that at this stage of network development the market seems to have been able to provide significant broadband coverage without the need to have broadband designated as an USO. Moreover, it is too early to determine whether the market will be able to complete national broadband coverage using emerging alternative technologies. Accordingly, it is still unclear that incorporating a broadband requirement as part of the USO will have a net benefit. At this stage, the benefits of providing subsidies seem uncertain and certainly difficult to estimate. And this suggests that it would be difficult to make a persuasive case based on a thorough cost-benefit analysis.

Social inclusion

Broadband penetration rates in OECD countries 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. In addition, information about why households may not have Internet or broadband access could provide useful insights for public policy makers.[50]

Discouragement of competitive entry

Subsidisation programmes can have the effect of limiting and distorting competition because potential market entrants could be discouraged if they have to compete against a subsidised broadband provider offering high capability services at prices significantly below costs. For instance, incorporating a minimum data requirement into the USO can impact adversely on the development of competition in the industry, both through an imposition of higher USO levies on an incumbent's competitors, and by further entrenching subsidisation of the incumbent's services in USO net cost areas. This development may well

have the effect of dissuading innovative alternative providers from entering a market. Thus subsidisation programmes may turn out to have only short run advantages if they result in adverse long-run outcomes, including distortions to the nature, extent, and speed of technological innovation and investment.

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 (DCITA) "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 programmes 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".[51] (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".[52]

A USO approach to providing access to NGN assumes a common set of needs and would overlook the ability and incentives of a competitive market to tailor the price and capability of service to specific user needs and socio-economic constraints. For instance, broadband technologies can be made available to end consumers by means of various technologies with each technology more appropriate to specific customer groups and applications. Thus it is doubtful that the USO would be an efficient or effective policy mechanism for promoting supply to uneconomic areas that are heterogeneous in terms of either their:

- Supply-side characteristics (for example, PSTN features, broadband services and mobile applications); or

- Demand-side profiles (recognising that communications requirements differ markedly across age, income and educational groupings).

Thus a 'standardised' blanket 'one size fits all' mechanism such as the USO seems unsuitable to assist access in an NGN environment that is expected to spawn a huge range of services. Mere provision of a service to all areas/customers could be ineffective, indeed wasteful, if the intended beneficiary does not use it for lack of either need or skill.

This suggests that there may be scope for a shift from a focus on uniform provision through a USOs approach to more 'customised' solutions to support availability, including more targeted programmes to support affordability and accessibility (that, in turn, can support availability).

5.5 How can 'affordability' and 'accessibility' be supported in an NGN environment?

In considering this question, the essential strands of thought in this paper may be worth drawing together. With the technological change on the horizon (such as broadband wireless local loop), 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 includes 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.

It seems appropriate that, as in other sectors of the economy, the cost of pursuing such 'social' objectives be met by government general revenue since funding from this source would accord best with efficiency and equity.

Assisting 'affordability' and 'accessibility' through targeted programmes

In fact, targeted programmes are already being used on a small scale, such as Lifeline and Link-up in the United States, and so-called "low user" schemes in the United Kingdom. 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 constrained. In the United Kingdom, 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 Australia, for example, 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 programmes 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 United States, United Kingdom and Ireland. Information on these schemes is presented in Box 6 to indicate the type of targeted schemes that might be used to support 'affordability' and 'accessibility' in an NGN environment.

Box 6. Subsidies to support affordability directed at low-income consumers

Country	Scheme details
Ireland	Vulnerable user scheme.[1] Customer gets line rental and EUR 5 worth of calls for EUR 23.65 per month. Once the EUR 5 worth of calls is used up, the user pays double the usual rates for the next EUR 6 worth of calls. Caller will therefore not be more than EUR 1 a month worse off under the scheme. The aim of the scheme is to limit increases in the size of vulnerable users' telephone bills where they have relatively low levels of usage. The median bill of those customers who use the scheme will not increase by more than CPI-0%, which is the cap on the current Lower Quartile bill.
UK	Light user scheme.[2] Eligible consumers get a rebate on line rental as long as they spend less than GBP 15.07 a quarter on calls. The amount of the rebate increases as the call bill gets smaller. This scheme uses low usage as a proxy for low income. BT has proposed an alternative scheme targeted at households with annual household income below GBP 10 400 (about USD 19 110).
US	Lifeline.[3] A federally funded scheme wherein carriers are reimbursed for providing discounts on monthly phone bills. The scheme allows low income consumers to save up to USD 10.00 a month off their monthly phone bills. Some US states (*e.g.* Nebraska[4], New Jersey[5], Tennessee[6]) provide additional support of an amount up to USD 3.50. People living in indigenous tribal lands can also receive up to an additional USD 25 per month in support. The scheme is open to low-income consumers based on their participation in other low-income assistance programmes such as food stamps or energy assistance programmes.
US	Linkup.[7] Provides savings of up to 50% of the installation fees of a new line, up to USD 30. People living in indigenous tribal lands can also receive additional support of up to USD 70.

Notes: [1] Details available at http://www.comreg.ie/_fileupload/publications/ComReg0348.pdf

[2] Details available at http://www.bt.com/Pricing/index.jsp and then clicking on Residential – Other Call Schemes – Light User Scheme

[3] Details available at http://www.lifelinesupport.org/li/components/lifeline.asp

[4] http://www.psc.state.ne.us/home/NPSC/usf/ntap_usf/ntap_usf.html

[5] http://www.bpu.state.nj.us/home/TelephoneAssistance.shtml

[6] http://www.state.tn.us/tra/teleassist.htm

[7] Details available at http://www.lifelinesupport.org/li/components/linkup.asp.

The phoneless

In many countries there remains a percentage of the population without access to a telephone service sometimes because they are disconnected. This is true even in countries like the United States and Canada where telephone penetration exceeds 90% of the population. Studies in a number of countries, including the United States[53] and Canada,[54] indicate that phonelessness is usually associated with multiple contributing factors, such as poverty and unemployment. Many of the problems of the phoneless go beyond the scope of programmes to support affordability of telecommunications service and might be overcome only through appropriately designed social, employment and incomes policies. Nevertheless, there is scope for well-targeted assistance provided as part of a universal service programme to alleviate some of the barriers to telephony. And this also applies to well-targeted assistance for access to NGN.

Some options that have been used to assist the needy to access telephony that could also be considered to assist 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 instalment 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 programmes through public announcements and targeted advertising.

More attention is needed as to how a combination of subsidies can best help ensure 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 assist affordability); and special schemes to assist the disabled (to assist accessibility). In addition, some shift in focus may be 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.[55]

Competition in the delivery of service to support affordability and accessibility

In the United Kingdom, 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 group(s) 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.

Box 7 summarises some key aspects of the foregoing discussion.

Box 7. Maintaining USOs: How provided and funded?

USO service to be maintained	How provided?	How funded?
Specified basic voice service (without specifying means/technology)	Fixed, wireless, fixed-wireless, including Broadband wireless local loop, Powerline, satellite, etc operators. Allow/encourage entry of alternative technology providers in rural and remote areas. If necessary, subsidise provider selected by competitive tender.	By Universal Service Fund?
Public payphones (in reduced numbers, in selected locations) In longer-term as part of telecentres?	Operator selected on basis of competitive tender.	By government, including local government.
Quality of service	Service provider.	By service provider.
Access to emergency contact service	Service provider.	By service provider.
Directory and directory assistance	Commercially provided.	No funding required.
Itemised billing	Commercially provided.	No funding required.
Affordability: voice will be cheap, but 'functional' Internet access could be a problem	Commercially provided. Affordability supported by specifically targeted 'vouchers' provided to needy consumers allowed to choose the service provider/technology/capacity to suit their requirements. For 'high-cost' areas, operator providing functional Internet access could be selected on the basis of competitive tender.	By government since this is primarily a social welfare objective.
Accessibility: Services to the hearing, sight etc., impaired *e.g.* relay service that translates voice into text for hearing impaired	Service provider to the extent required by general legislation concerning provision of service to disabled. Requirements over and above these to be provided on the basis of competitive tender.	By government since assistance to disabled beyond general requirements (that apply to all sectors) is a social welfare objective (appropriately funded by government).
Functional Internet Access. Although Broadband is required to enable functional access to NGN services, it is not part of USO at least not yet (see discussion elsewhere in this paper)	Commercially provided. Affordability supported by specifically targeted 'vouchers' provided to needy consumers allowed to choose the service provider/technology/capacity to suit their requirements. For 'high-cost' areas, operator providing functional Internet access could be selected on the basis of competitive tender.	A policy decision that broadband not be part of universal service does not undermine case for government policies to encourage competitive provision of broadband coupled with broadband diffusion policies aimed at addressing the digital divide.

5.6 How should USOs be funded?

As noted earlier, the speed and inevitability of widespread adoption of IP and wireless services are raising questions about the future funding of universal service.[56]

One way of addressing the prospect of declining contribution from operators to the universal service fund is to curtail the scope of the USO programme. If curtailment is not politically feasible, an option is to expand the revenue base by applying a charge to all telecommunications services, including local and long-distance calls and Internet access. This approach could allow a reduction in the percentage surcharge and would make the USF tax less distorting. Financing by operators could arguably constrain universal service

programmes to relatively efficient levels since it would probably encourage operators to sustain pressure on regulators/policy makers to justify the costs of universal service obligations they are forced to bear against evidence of the benefits generated. But the task of calculating an equitable scheme for sharing USO costs has become challenging. Extending the range of companies that need to contribute to universal service is one option, as was done recently by France where all suppliers of electronic communication services contribute to universal service (where retail sales exceed a given threshold). Indeed, the Australian Government has moved to a more administrative determination of the level of subsidy paid to the USO provider in preference to costing the USO based on economic modelling. The Australian difficulties in calculating the cost of the USO were highlighted in the DCITA "Review of the Operation of the Universal Service Obligation and Customer Service Guarantee" (2004).[57]

A tax on each telephone number

An alternative is to charge a fixed fee for each telephone number assigned in the country whether fixed line or wireless.[58] It 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. For instance, in the United States there are approximately 500 million such numbers. As an example, a USD 1 per month charge (far less than the current subscriber line charge for fixed line phones of USD 5.96) would generate USD 6 billion in revenue per year. (One estimate is that the initial amount of the numbers tax that would be needed would range from between USD 0.59 and USD 0.77 per month.[59]) 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).

Hazlett, *et al.,*[60] argue that this approach minimises the distorting effect of the universal service fund on prices and utilisation of services and also makes the tax more transparent. A broad-based numbers tax is a tax on access rather than usage. Since the demand for access generally is considered to be less price sensitive than the demand for usage, the distortions to economic behaviour are likely to be less. 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 since the tax is a small one.[61] Such a tax would, however, serve as an incentive to large businesses which have direct numbers for each employee to reduce their use of numbers by reconfiguring their PBXs. In addition, funding universal service should be based on the cost of providing universal service, costs which should decline over time based on experiences in many countries. If funded through a tax there could be little incentive for authorities to reduce this tax over time. 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 *e.g.* 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. Also, there are questions about the extent to which a numbers-based system that does not cover IP/"ENUM" addressing would encourage and speed adaptation of telephone numbering to the Internet's domain name system. Distortions in the market could also result because what the revenue operators earn from each number is quite variable, there would be an incentive to use foreign numbers or addresses and other attempts to bypass a tax.

A connections-based system

Another option is a 'connections-based' system through which any connection to a network, whether it is a data or telephone network, is taxed with revenue channelled towards universal service programmes.

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' (United Kingdom) 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 in this way makes it easier for the public to assess the costs of universal service.

Financing through general taxation revenue

In considering this option, it is important to bear in mind that many governments pay for, or subsidise, the purchase of food, shelter, clothing, and education for specific socio-economic groups out of general taxation revenue without imposing the cost on the suppliers or retailers of those products. Funding based on taxation revenue would help ensure that the burden is shared in the most equitable manner. Are the reasons why arrangements should be different in communications compelling enough? With telecommunications operators increasingly operating in intensively competitive markets and circumstances similar to those in other industries, they should be increasingly treated in a similar way with similar obligations and rights. As the telecommunications industry converges with the broadcasting and information technology industries, this need for symmetric treatment becomes even more important.

In this context, governments should ensure that telecommunications consumers and companies are not subject to a range of taxes over and above the normal taxes that companies pay. In the United States, for example, the communications excise tax (FET) is imposed on communications services (defined to include local as well as long distance telephone service) at a rate of 3%, with revenue flowing into general revenue. (It is interesting to note that the FET was first introduced as a "temporary" luxury tax way back in 1898 to fund the Spanish American War.)

An FET increases the cost of communications services for all consumers and seems contrary to the goal of having an advanced, efficient, low cost communications network that achieves universal service. Placing an extra cost on communications services use discourages not only the expansion and improvement of the communications infrastructure but also the technologies that build upon the infrastructure.

It is estimated that telecommunications is one of the most heavily excise-taxed local services in the United States, yielding about USD 22 billion annually. Depending on where the consumer lives, taxes can account for roughly 2% to 21% of a monthly phone bill.[62]

Moreover, the FET is arguably a regressive, inequitable, inefficient and difficult to administer tax.[63] With the wide array of communications technologies and service options available to consumers, leaving the current tax in place results in some consumers paying the tax while other consumers purchasing comparable communications services do not.

Requiring telecommunications operators to bear the cost of providing support for advanced services to schools and libraries (as in the United States) was a significant change in USO principles and practice. Even where the reasoning in favour of special support for these institutions is accepted, the requirement

that telecommunications operators or consumers bear the cost of subsidised provision is open to challenge. As noted earlier, in the European Union the guidelines in the Universal Service Directive prohibit funding of schemes outside the scope of the formal USO definition from a Universal Service Fund. This does not prohibit national governments from designing assistance schemes for access to Information Society programmes, including broadband, so long as they are funded separately (*e.g.* from general revenue).

While acknowledging the arguments of some economic analysts that direct government taxation is likely to be a cost-effective means (US Congress Budget Office report, 2005), indeed, perhaps *the* most cost-effective means, regulators sometimes pre-empt discussion of direct government funding from taxation revenue on the grounds that it is 'too hard'. For instance, Ofcom states that: "…while direct government taxation is likely to be the most effective means, it is probably one of the most difficult to implement"[64] and then proceeds to discuss other sources of funding. Regulators may need to be more aggressive in pushing for the direct support of universal service through government funding (at least in part).

Economic analysis provides support for financing USO through general taxation revenue on the basis that it is likely to be less distortive. 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 consumer choice by affecting the price of goods and services.[65] Indeed, a number of economic analysts have recommended that future universal service support should come from general tax revenues.[66]

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."[67] (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."[68] (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 minimise market distortions".[69]

There is also political support for this position in other OECD countries. For instance, the Chairman of the US House Energy and Commerce Committee said the E-rate program in the US should be funded out of general revenue through the general appropriations process, not through a specific contributions process.[70]

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 rationalised 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 programme 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. Small business support could also be enlisted. For instance, any telecentres established are likely to be in a central location probably suitable for business activities. During the day a telecentre could be used for training for Internet use, etc, while at night it could be used for business activities. For example, it could be a suitable location for telecommunications operators to market their products, sell their pre-paid cards, etc., along the lines of one-stop shopping.

Contribution from spectrum auctions (3G), spectrum pricing and privatisation. 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 programmes. For instance, in Australia, 5% of the proceeds from privatising the second tranche of Telstra's shares were allocated to improving conditions in rural areas based on the rationale that this constitutes an equitable sharing.

There may be concerns about using a once-only contribution from privatisation receipts to fund recurring expenditure on universal service. However, this concern might be addressed by using the contribution to generate a time stream of revenue. For instance, in a submission to the DCITA's review of universal service,[71] 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 privatised 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. Moreover, it should score relatively well (compared with alternatives) on the basis of the criteria listed in Box 8.

Box 8. Criteria for assessing a funding mechanism

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.

A preliminary consideration of funding options summarised in Box 9 suggests that several funding sources appear to score well against these criteria. For instance, using part of the proceeds of privatisation or of spectrum auctions or spectrum pricing scores highly. Funding from general revenue also 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.[72]

A "connections-based" tax scores well too. And 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 programmes can be preserved/gained at the expense of operators and/or consumers, restraint over universal service (needed to stimulate innovation and cost-effective USO programmes) 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.

Nonetheless, 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, the option of funding universal service from general taxation revenue needs careful consideration. Since it is the political process that will decide on what the warranted level of universal service will be, it may seem appropriate that the case for continued funding of universal service programmes be assessed against arguments in favour of competing government expenditure programmes, such as those for health, education and housing.

Box 9. Preliminary assessment of alternative sources of funding for universal service

Funding Source	Economic Efficiency	Equity	Certainty	Transparency	Minimum bypassability	Competitive neutral	Technology neutral
Cross-subsidy	No. Considerable distortions to economic decisions	No	No. Increasingly unsustainable with increasing competition	No. Nature, extent and direction of subsidy sometimes unclear	No. Increasing bypass being experienced	No. Subsidy can discourage competitive entry	No. Subsidy to fixed line can discourage entry of alternative technology operators.
Tax on telephone numbers	Allows scope for expanding USOs. Imposes further burden on consumers with resulting distortions to economic decisions	No. Considered a regressive tax since burden greater on low income, low users	Yes	Yes	Yes, but VoIP providers not using numbers could bypass (and this could increase significantly over time)	Yes, except for operators not using numbers	Yes, except that it favours operators not using numbers and may therefore stimulate growth here
Connections	Allows scope for expanding USOs. Conflicts with the "don't tax the Internet" arguments	Yes, all operators taxed	Yes	Yes, except that the methodology for calculating "connections" likely to be contentious	Yes	Yes	Yes
General tax revenue	Yes. Probably least distortive. Links decisions on USOs with financial responsibility for decisions thereby injecting restraint	Yes	No, not in longer term *e.g.* if a govt. with different USO policy wins power	Yes	Yes	Yes	Yes
Part of proceeds of privatisation	Yes, especially if privatisation would have proceeded anyway	Yes, since this way poor share in the proceeds of privatisation	Yes, especially if channelled into a Trust Fund proceeds of which are used for universal service	Yes	Yes	Yes	Yes
Part of proceeds of spectrum licensing & pricing	Yes	Yes, since this way poor share in the revenue raised from use of spectrum (a public resource)	Yes	Yes	Yes	Yes, if revenue from spectrum licensing & pricing would have been raised anyway (and is no higher than imposts on other telecom operators)	Yes, if revenue from spectrum licensing & pricing would have been raised anyway (and is no higher than imposts on other telecom operators)

The distribution of USO funds

This topic is not a primary focus of this paper.[73] Nonetheless, a number of points in regard to the distribution of funds has been made. A few are worth reiteration. The first point is that there is need to strive for cost-effectiveness in the distribution of USO funds as in other aspects of USO programmes. Accordingly, various means of improving the cost-effective distribution of funds should be explored, such as competitive tendering. Because of information asymmetry in regard to the costs of providing universal service, the use of competitive tendering can have advantages and should be considered. Also, *i*) incumbents can no longer be viewed as being the sole providers responsible for USOs; and *ii*) that USOs should be narrowly defined such that if there are other areas that governments want to support (*e.g.* access to high-speed networks by schools, libraries, hospitals, etc. they should be funded outside of the scope of USO policies and preferably through direct funding). Moreover, that there is need for systematic monitoring and evaluation of the effectiveness of the distribution of funds (and other aspects of universal service).

5.7 The need for systematic monitoring and evaluation

Any redefinition of the scope, delivery and funding of universal service should be conducted on the basis of a transparent systematic review to clarify objectives and targets pertinent to that country. In some countries, *e.g.* Australia, Hungary, the United Kingdom and India, the USOs strategy development procedure commenced with a public consultation that sought the views of various stakeholders. This approach to defining universal service would be consistent with the transparency required by the WTO Reference Paper provision relating to universal service.

Systematic monitoring and evaluation based on good up-to-date data is also critically important to ensure that targets are being achieved cost-effectively according to schedule. Also important are regular "audits" of the economy, efficiency, and effectiveness of the administration of a programme to distribute USO funds in order to guard against inefficiency and fraud. These should include audits of the recipients of universal service subsidies to assess the extent to which USO programmes are achieving intended outcomes. Reports of such assessments could be tabled in Parliament at regular intervals (*e.g.* once every three(?) years). As part of this periodic review process, the regulator would be required *inter alia,* to assess the impact of universal service support on availability, affordability and accessibility, as well as the continuing need for universal service support in view of developments in competition and technology, especially if the promise of new technologies such as broadband wireless local loop, Powerline, etc., begins to materialise.

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NOTES

1. VoIP allows telephone calls to be made using a computer network over a data network like the Internet. VoIP converts the voice signal from the caller's telephone into a digital signal that travels over the Internet then converts it back at the other end to enable voice communication with anyone with a regular phone number.

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

3. In Japan, a Universal Service Fund System 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:
   (1) Scope of Universal Service
   (2) Cost calculation methodology
   (3) Contributions methodology

4. For a detailed examination of the potential beneficial effects of communications capabilities, see *e.g.* US National Telecommunications and Information Administration (NTIA) report "The NTIA Infrastructure Report: Thelecommunications in the Information Age", October 1991.

5. See for example John Huntley, Nick McKerrell and Shez Asghar, "Universal Service, the Internet and the Access Deficit," SCRIPT-ed Open Licence (SOL) 2004.

6. 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".

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

8. United States Congress, "Financing Universal Telephone Service," Report prepared by the US Congress. Note that US law includes disability access obligations (see *e.g.* Section 255 of the 1996 Telecommunications Act) and other provisions similar to some of those in the UK USO, but these are not denominated as part of the USO according to the US scheme.

9. Australian Department of Communications, Information Technology and the Arts, op. cit.

10. 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.

11. 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).

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

13. 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.

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

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

16. More detailed analyses of the impact of market liberalisation, 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 liberalisation has been fundamental to the growth of the telecommunications sector in OECD countries, "*Communications Outlook 2005*" OECD, Paris 2005.

17. 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.

18. See responses to European Commission 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.

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

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

21. Savings in other areas could help offset some of the universal service costs.

22. Written comment from the US government dated 2 December 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. Australian Department of Communications, Information Technology and the Arts, op.cit. (p. xiv)

25. See *e.g.* The World Bank, "Financing Information and Communication Infrastructure Needs in the Developing World: Public and Private Roles". Draft for discussion. February 2005.

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", November 2002.

28. OSIPTEL Op.cit.

29. Australian Department of Communications, Information Technology and the Arts, Op.cit.

30. The US contribution factor for the fourth quarter 2005 was 10.2%; there is some seasonal variation, but recently it has been above 10%.

31. OECD, "*Communications Outlook 2005*", Paris 2005.

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

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

34. Flat rate calling is also common throughout several OECD countries for fixed wireline services. Further, some VoIP service providers, such as SKYPE, charge on a per-minute basis.

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

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

37. For detailed discussion on a "ubiquitous network society", see papers presented at the ITU Workshop on Ubiquitous Network Societies", ITU New Initiatives Programme, 6-8 April 2005.

38. 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? Does the functional unbundling align with the business models implied in NGN architectures brought to standards organisations such as the ITU?

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

40. An "interconnected VoIP service" is defined by the US Federal Communications Commission as bearing the following characteristics: (*i*) the service enables real-time, two-way voice communications; (*ii*) the service requires a broadband connection from the user's location; (*iii*) the service requires IP-compatible customer premises equipment; and (*iv*) the service offering permits users generally to receive calls that originate on the PSTN and to terminate calls to the PSTN, See 47 C.F.R. 9.3; see also IP-Enabled Services and E911 Requirements for IP-Enabled Service Providers, First Report and Order and Notice of Proposed Rulemaking, 20 FCC Red 10245, 10257-58 (rel. June 3, 2005) at 24.

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

42. Ibid.

43. 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).

44. 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.

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

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48. See responses to European Commission consultation, Op.Cit..

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

50. See, *e.g.* US Department of Commerce, "A Nation Online: Entering the Broadband Age", pp. 13-15, September 2004.

51. 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.

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

53. See for example, FCC Common Carrier Bureau, "A Review of Current Interstate Support Mechanisms", February 1996; Telecommunications Industries Analysis Project, Closing the Gap: Universal Service for Low Income Households, August 2000; FCC, Industry Analysis and Technology Division, Wireline Competition Bureau, Telephone Penetration by Income by State, May 2003.

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

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

56. *Wall Street Journal*, "Phone Industry Faces Upheaval as ways of Calling Change Fast?", 25 August 2004.

57. Australian Department of Communications, Information Technology and the Arts, op.cit.

58. 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,

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

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61. The Progress & Freedom Foundation, Digital Age Communications Act – op.cit.

62. USA Today, "VoIP no Bargain for Cities Losing Tax Revenue", 21 June 2005.

63. AT&T, "The Federal Excise Tax on Communications" July 2005.

64. Ofcom Strategic Review of Telecommunications, Phase 2, Annex K, para K. p. 40.

65. 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. An early mention of this point is found in the NTIA Infrastructure Report, op cit., p.314.

66. Hazlett, T. W., Bazelon, C, Rutledge J, and Hewitt, D. A, "op.cit.

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

68. Ibid.

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71. Australian Department of Communications, Information Technology and the Arts, op.cit.

72. 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).

73. For a discussion on distribution of universal service funds, see: "Leveraging telecommunications policies for pro-poor growth: universal access funds with minimum subsidy auctions', OECD DCD/DAC/POVNET(2004)13