SUPERHIGHWAYS AND THE FUTURE OF PUBLIC SERVICES AND CITIZENSHIP IN THE INFORMATION AGE

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Povzetek:

V informacijski dobi je nujno potrebno, da opredelijo ponudniki javnih storitev in izvajalci telekomunikacij potrebno povezovanje svojih dejavnosti. Tako sodelovanje omogoča ponudnikom javnih storitev ustrezno strateško in operativno načrtovanju elektronskih storitev. Izvajalcem telekomunikacij pa zagotavlja globlje razumevanje povpraševanja po razširitvi infrastrukture; ob tem se jasno postavlja tudi vprašanje, kako naj se pokrivajo stroški takih infrastrukturnih naložb.

Abstract:

In the information age it is imperative that public service providers, on the one hand, and telecommunications operators, on the other, identify the need to integrate their activities. For the public service provider this will open the way for proper strategic and operational planning of electronic services delivery. For the telecommunications operator it will secure a better understanding of market demand for enhanced infrastructure provision as well as bringing forward the question of how the cost of such infrastructure investments should be met.

The Coming of the Superhighway

The rhetoric has never been stronger than it is at present within debates about the information society. The heady images which gave rise to great optimism in the late 1970s about the beneficial 'impact' of information and communication technologies [ICTs] on society have returned with great force in the 1990s.

Undoubtedly augmenting these contemporary visions has been their championing from the G7 governments, the EU and the US. In the US in particular there is strong championing from the top of the administration, with the National Information Infrastructure [NII] initiative being strongly promoted from the White House. The NII is being promoted by government for the social and economic benefits which such an infrastructure might bring with it, including those deriving from the "reinvention of government".

The potential for cost-saving, productivity-improving and service quality-enhancing innovations, contained in newly developing *electronic relationships* within government organisations, and between them and their customers and citizens, is being sustained by these visions. The construction of the superhighway takes on a direct significance for governments, therefore, in that it offers opportunities for innovations around their organisations, as well as around their provision of service and their attempts to secure democratic enhancements. These information age visions are translating into a core debate about ICTs and their use in and by government. The delivery of electronic public services and citizenship is, for its **universal** expression, dependent upon the development of a high quality, spatially even telecommunications infrastructure, that is an information superhighway.

In turn a full-blown electronic superhighway is at least in part contingent upon the presence of strong demand by public agencies for new applications. For the telecommunications operators to invest in their networks on a scale which will accommodate the needs of public service organisations then they have to be assured about return on investment through the development of applications which will yield high revenues, or they have to be compensated for their investments through arrangements for public subsidy. It is an imperative for governments therefore that they are able to show demand for telecommunications infrastructures and that funding and regulatory arrangements are in train through which those infrastructures can be achieved. A core question concerns whether governments, local, national or supra-national, in seeking fully to exploit ICTs in the production and delivery of their own services and in the enhancement of democratic processes, can secure the presence of appropriate infrastructure in order to do so.

Public services have been developed to accomodate 'reach', with provision of services being designed so as to

overcome the problems associated with customers and citizens living at a distance. Historically the structure of government has clearly reflected the importance of geography as an organising principle. The recipients of public services, it is assumed, should have access to services regardless of the recipients location, and equally, participation in democratic processes should be unimpeded by locational factors. A key question, however, is whether, as service development and delivery becomes ineluctably intertwined with a new technical infrastructure, the dominant telecommunications paradigm in Europe and the US of 'competition and choice' can deliver these requirements.

Can a liberalized telecommunications policy regime, predicated on the competitive development of infrastructures, provide for the access, availability, and raised levels of producer and consumer awareness which are vital to the realisation of visions of the information age?

The debate which is engaged in this article is based upon evidence from the 'telecommunications experiment' which has been occurring in the UK, particularly in the period since privatisation and the introduction of network competition in the mid 1980s. The relevance of the article goes beyond this analysis of recent history, however, for its themes are of immense relevance to future debates and policy shifts in those eastern European countries which have not yet liberalized their telecommunications provision and for whom their remains a widespread belief in the efficacy of publicly provided service.

Electronic Services and Citizenship.

Innovation in public services using ICTs and information systems is occurring in a number of ways, some highly visible, and some less so. There are five main types of innovative activity:

- the commodification of information
- electronic transactions
- the development of electronic services
- informatisation processes
- electronic communications and citizenship

The *'commodification of information' is t*he most commonly found and highly visible example of these sorts of innovations in government service. For example, public access terminals in libraries and other public places, which are used to display information on local services, have become a familiar sight in many countries during the 1990's. Similarly more and more public service organisations are using the Internet to provide information on their activities and, as they do so, issues such as access and price become important. In the UK, for example, there is currently a debate about whether the proceedings of Parliament should be on the Internet, available in principle to all at low cost, or whether those proceedings should remain in hardcopy form and be sold at comparatively high prices, as at present.

Increasingly innovations of this kind are being supplemented by others which allow for interactive applications directed at end consumers, including financial transactions. These innovations might best be described as *'electronic transactions'* for their whole form lies in the interactions involved in the service chain from electronic production to delivery and consumption. For example, the *Vereda* project in Spain allows people to interact remotely with a number of public services including renewing and paying for a driving licence. The *'InfoCal'* project in the state of California offers very similar interactivity to *Vereda*, with facilities for making remote requests for personal documentation such as birth certificates, using a driving licence to verify identity. In Scotland the *Lambda* project, underway in the Highlands and Islands, is designed, for example, to offer a wide variety of applications including online access to museums and library services, and two-way videoconferencing interactions between a central ministry [Social Security] and its clients and claimants. This, in effect, replaces the previous requirement for one side in this relationship to travel to the other.

A third form of innovation which is occurring is stronger than the second in that it provides wholly new dimensions to services and falls under the category of *'electronic services'*. Thus, whilst the second form of innovation permits existing transactions to occur in electronic form, in this third form of innovation public services are intrinsically augmented. Telemedecine, surveillance systems and educational provision to the home, provide examples of this kind of innovation. In these cases the nature of aspects of health service, protection services, and educational services is being fundamentally redesigned, specifically around the multimedia capabilities of new ICTs.

Much less visibly, though no less significantly, public services as diverse as library provision, traffic management and school meals are being profoundly reshaped through *'informatisation processes'*. As information systems deliver new capabilities for the gathering, creation and management of new forms of information so that information becomes suffused substantively into the services themselves, as well as into the administrative processes which support them. The new capabilities for librarians to shape their bookstocks and book distribution; the monitoring of traffic movements in towns, permitting real-time responsive traffic management; and experiments in creating more consumer responsiveness in school meals, provide examples of the profound importance of ICTs and systems in the informatisation of government. In this example of innovation government organisations are becoming more informed about the nature of their service delivery, including about the quality of service which they are delivering to their customers and citizens, and are thereby enabled to reshape and improve their services.

Additionally, there are applications of ICTs by governments which are aimed explicitly at enhancing com-

munications and democratic processes in the state, aimed, that is at the realisation of *'electronic citizenship'*. Some of the most challenging of these, such as the *City Talks* project in the 'digital city' of Amsterdam, are centred upon attempts to offer more widespread access to citizens into the decision processes of government, through combinations of local cable broadcasting, and interactive facilities at the television set which permit the recording of citizen preference.

The issues for governments which flow from these types of innovation and from these examples are legion. An underlying issue however, which in many senses has the status of *sine qua non*, concerns the universal availability within the geographical area of governance, of technical infrastructures which will be sufficient, in capacity, quality, geographical availability and cost, for the full exploitation of ICTs and information systems in the relationships between customer, citizen and the state.

Information Superhighways

One of the most trumpeted aspects of the 'vision thing' in the US is what the American government, with uncharacteristic verbal restraint, has called the National Information Infrastructure. Government in both the UK and Europe has been more inclined to more hyperbolic terms - the superhighway, the infobahn, les autoroutes de l'information.

At the heart of the EU's proposed superhighways strategy is a "broadband infrastructure as the backbone of the information society". Such an infrastructure development is seen as integral to the economic and social health of Europe and, in order to deliver such a backbone and to realise its full potential, network interconnection and service inter-operability must be assured.

Ultimately the US government, the EU and the British government are becoming concerned that the range of applications of ICTs which are potentially available to them should be realisable throughout their territories, though there are different degrees of concern being expressed about issues of equity and efficiency in both infrastructure development and service delivery.

For the US Executive there are two related issues. The first of these is that

> *"For electronic service delivery to occur on a large scale, all geographic areas of the nation must have access to advanced digital telecommunications services".*

The second and related issue is that the definition of 'universal service' be revisited "to reflect advancing telecommunications technologies", at least insofar as telephony is concerned.

In the first report on superhighways produced for the British government the issues of geographical spread of any superhighway, as well as universal access to it, received only scant attention. However, in their report 'Optical Fibre Networks' the Trade & Industry Committee of the House of Commons came closer to the concern of the US Office of Technology Assessment and the EU with their observation that

> *"Until broadband infrastructure is widely available, many potential services are unlikely to be developed".*

The Committee went on to recommend that government policy must recognise "that the networks and services need to be developed together", thereby arguing the case that a virtuous circle, between the technical infrastructure and the services which it conveys, can and should be established and exploited.

Infrastructure provision is thus being recognised as an issue amongst politicians and governments, yet perhaps more centrally in the US and the EU than in the UK. In the UK the telecommunications experiment is largely deemed to have succeeded in putting into place enhanced infrastructure, a view which will be questioned throughout this paper.

So how seriously should governments take these questions of infrastructure development? Should the governments rest broadly content that a strategy for telecommunications provision, based around the regulatory stimulation of both "competition and choice' is the best one? Or should governments be broadening the emphasis of regulation to embrace explicitly higher order universal service obligation [USO] than those which presently apply?

Universal Service in Telecommunications

In keeping with this latter question the UK regulator, OFTEL, is presently investigating the definition of universal service for telecommunications. Figure 1 below captures the parameters of this investigation, looking both at existing principles of the universal service obligation [USO] and at the prospects for additions.

Figure 1

OFTEL'S GOVERNING PRINCIPLES FOR THE EXISTING USO

1. Access to basic telephony
   - Unimpeded by location
   - Affordable
   - Sensitive to special needs
2. Access to free public emergency call services
3. Access to public call boxes

OFTEL, 1994

OFTEL'S PROPOSALS FOR ADDITIONS TO THE USO

1. Access to digital telecoms
2. Free services of itemised billing and selective call barring
3. Outgoing calls barred service rather than disconnection
4. "Educational, training and certain other public service organisations should have the right to be connected to affordable ISDN or wideband service levels"

OFTEL, 1995

OFTEL has argued therefore that three governing principles apply in the existing USO:

- access to basic telephony, should be available regardless of location
- access to basic telephony should be affordable
- access to basic telephony should be sensitive to those with special needs

OFTEL goes on to argue that the concept of universal service should be addressed flexibly through time, as technological change, together with changes in lifestyles and consumption patterns, create conditions where higher levels of universal service [ie broadly those requiring higher bandwidth than basic telephony] should come inside the operational definition of USO. At present only basic voice telephony accessed by analogue or digital switches is included in the USO though a second level of sophistication which adds some supplementary services such as itemised billing and call forwarding should be available universally during the next few years, OFTEL has said. OFTEL is presently advocating a significant shift in the USO in the UK, to one which assumes ubiquitous digital infrastructures and therefore embraces itemised billing as standard. Moreover, OFTEL is beginning to rehearse a view of the USO which is stronger still and which bears closely upon public services. OFTEL is asking whether

> *Educational, training and certain other public service organisations should have the right to be connected to affordable ISDN or wideband service levels.*

OFTEL, like the OTA in the US, is raising the core question of the universal presence and availability of high quality, high capacity telecommunications. What OFTEL is only just beginning to address however is the peculiar issue facing public service organisations; that they are uniquely required in many instances to provide 'reach'. Is a higher level of USO [ie higher than basic telephony] essential if public services, with their inherent requirement to reach all parts of the population, are to exploit fully the technologies of the information age? Do public service obligations force on to the superhighways agenda consideration of the need for the universal availability of high bandwidth telecommunications which are increasingly necessary for a myriad of multi-media public service applications?

Furthermore, if public information services and other provisions are to be increasingly disseminated over the wires with a view to uptake in the home then the issue of universal access to telephony will need to be addressed. In the UK, for example, about 10% of homes are currently without telephony, about 3-4% of which are explained by a combination of conscious choice to remain 'unphoned', and frictional reasons [ie people moving between homes]. The remaining 6-7% want telephony but cannot afford it. Only when many of these low income households take up telephone line rental will the UK be at the levels of domestic telephone penetration of the US [94%] and Australia [95%]. This point is given further emphasis from the data in Figure 2 below. Here we see that there is a clear relationship between household income and access to telephony, with penetration rate for the lowest income groups being around 60% for the UK as a whole.

FIGURE 2

Telephone Pentration by Gross Weekly Household Income, Great Britain [1992]

Weekly Household Income	% households with 'phone	% without 'phone
£0 - £50	60	40
£50 - £100	73	27
£100 - £150	84	16
£150 - £200	88	12
£200 - £250	90	10
£250 - £300	91	9
£300 - £350	94	6
£350 - £400	95	5
£400 - £450	96	4
£450 - £500	95	5
£500+	99	1

Source: OPCS - General Household Survey, 1992

These UK-wide figures mask considerable differences in regional and local penetration rates for telephony. They also reveal nothing of BT's practice of disconnection for those failing to pay telephone bills on time. There are many small areas in the UK where telephone penetration is well below 50% and moreover the current rate of net disconnections from telephone service runs at 25-30000 per month. Here lies a paradox for public service delivery in the information age. That is that the areas in which the uptake of telephony is lowest may well be areas where the need for consumption of public services is most intensive, and where the benefits which might derive from electronic citizenship might be greatest.

Electronic Service Delivery and the Superhighway: Some Evidence from Scotland.

In a number of recent studies related both to telecommunications infrastructure provision, and public service development and innovation in Scotland, our findings give rise to considerable reservations about the adequacy of present telecommunications policy to provide an infrastructure which will serve as a universalist underpinning for electronically enhanced public services. These findings are, therefore, of pertinence to all countries which are in the process of liberalising their telecommunications provision.

The development of the hard-wired telecommunications infrastructure in Scotland, from which the country's superhighway might derive, is emerging from four sets of sources. Three of these - infrastructure development by the 'old' duopoly providers, BT and Mercury [MCL]; developments emerging from other more recently licensed operators such as Scotland's two electricity companies; and the laying down of cable by companies franchised and regulated to provide [usually] a combination of cable television and local telephony services - have a commercial basis to their operations. The fourth source of telecommunications infrastructure in Scotland has its origins in a unique venture in the UK context, the laying down in the period from 1989 of a digital telecommunications network in the North of the country and across its main northern and western islands. This integrated services digital network [ISDN] is the consequence of a joint venture between BT and the economic and social development agency in this part of Scotland, the Highlands and Islands Enterprise. It is a venture based upon a supply-led and universalist concept of infrastructure development, a concept at odds with the demand-led nature of mainstream UK telecommunications policy since the early 1980's, and not directly inspired by commercial considerations, therefore.

A number of points germane to the debates discussed above emerge from research projects around this plural provision of telecommunications infrastructure in Scotland and elsewhere in the UK:

1. Both BT and MCL, the UK's main telecommunications operators, have built optic fibre networks linking their main switches in Scotland thereby giving each company the basis for effective competition with the other in the main business centres of the country, in particular the main cities of Glasgow, Edinburgh, Dundee and Aberdeen. There is little fibre elsewhere in the Scottish telecommunications networks.
2. Elsewhere in Scotland [leaving aside the ISDN infrastructure in the north and the islands] telecommunications infrastructure provision is uneven. MCL has scarcely developed its network in Scotland beyond the main centres and BT's network enhancement programme is based largely upon forecast demand rather than universalist principles. Whilst BT's network in Scotland will be 'modernised' by about the turn of the millenium, that modernisation programme is at present of a quality which will leave much of the country with relatively low-grade 'pseudo-digital' switches which will permit some but not all network telephone services - a point made clear in Figure 3 below.

Additionally, that programme will retain in Scotland a predominantly copper wire transmission system whose bandwidth capabilities remain uncertain but which, in the absence of any huge leaps forward in data compression techniques, will not carry the multi-media, interactive applications which the heady visions of the information age are offering up.

3. Successive reorganisations of BT during the 1980's and since 1990 in particular has largely stripped away its public administration legacy of being organised around the geographical principle. Whereas prior to this the presence of powerful local 'barons', in the form of District Chief Executives and, before that, Regional Directors, assured the search for geographically defined service equality, the removal of this 'topocratic' element in the BT organisational structure leaves the way open for the company to skew investment to places and markets which are deemed of most strategic importance.
4. Fourteen cable franchises have been awarded in Scotland to date, eleven of which are active, though not all of these latter are offering telephony as well as entertainment services. Indeed only seven are offering telephony. Each of the franchise areas is in a heavily populated area, the first six active ones, for example, being in central areas in Glasgow, Edinburgh, Motherwell, Glenrothes, Dundee, and Falkirk. However the technical structure of the cable TV networks, with its reliance on co-axial cable for the 'last drop', bias the network towards capabilities for the distribution of pictures rather than simple telephony on the one hand or fully interactive multimedia services on the other. At present therefore there are significant reasons to raise doubts about the likely contribution of cable infrastructures to the provision of universal high quality infrastructures in Scotland.
5. The electricity companies - Scottish Hydro and Scottish Power - are linked to the UK wide electricity industry telecommunications arm, Energis and boast high quality fibre optic networks running between their main operating centres. As yet these companies have scarcely begun their telecommunications activ-

FIGURE 3

TELEPHONE FACILITIES BY TYPE OF EXCHANGE

Digital Exchanges	Electronic Exchanges	Pseudo Digital Exchanges	
		UXD5A	*UXD5B*
Itemised Billing	Yes	Yes	Yes
Call Barring	Yes	Q Yes	Yes
Call Waiting	No	No	Q Yes
3 Way Calling	No	No	Q Yes
Call Diversion	No	Q No	Q No
Call return	No	No	No
ISDN	No	No	No

Q = Qualified

Source: Taylor, 1994

ities and it is too early to assess their contribution to Scottish provision. The activities in Scotland of other licensed network operators such as British Rail [Telecommunications] and British Waterways remain restricted to the laying down of 'dark fibre'.

6. Telecommunications competition in Scotland is occurring only in relatively few places, as yet. These are the main centres for business and residential customers. For the rest of the country BT remains *de facto* the only viable supplier of services. The purported advantages of telecommunications competition are scarcely in evidence in much of Scotland therefore.
7. Telecommunications awareness amongst potential customers is strongest both where there is competition or where there has been a significant public investment in infrastructure development such as in the Highlands and Islands. In consequence for much of Scotland there are relatively low levels of telecommunications awareness.
8. Public service innovations appear to be occurring most strongly in these areas of the country marked by competitive presence or by public service infrastructure enhancements. Where neither of these conditions exists, then innovation in electronic public services is at its weakest. In consequence for much of Scotland there is a dearth of public sector innovation in electronic services.
9. Telecommunications infrastructure enhancement is further exacerbated through the installation by large companies and other large organisations of their own private networks. By developing their own private networks and meeting their own telecommunications needs largely outwith the public network, organisations are in effect by-passing local public infrastructures and thereby slowing their 'exhaustion rate'. This in turn allows the main telecommunications providers, particularly BT, to defer aspects of their modernisation upgrades.

Universal Service and Electronic Innovations in the Public Sector.

In this final substantive part of this paper we turn to a discussion of the nature and meaning of the concept of universal service and to a preliminary discussion of the relevance of that concept for innovations in the public sector which seek to exploit ICTs. A series of arguments has been taken forward above, which, when taken together, clearly indicate the contemporary relevance and importance of a debate about this core concept in public utility provision, specifically in a telecommunications context.

In summary the main arguments to this point have been:

- two important debates - that on the provision of superhighways, and that on the reinvention of government, - must be interpreted as ineluctably intertwined.
- Some governments, with the UK government as a good example, appear to be comparatively unconcerned that present approaches to infrastructure development might present significant barriers to the exploitation of the potentialities for 'information age government' which visions of the information society, taken together with the reinvention of government debates, suggest.
- our research evidence suggests that telecommunications infrastructure developments in Scotland [and by implication in the UK and elesewhere in liberalised policy regimes] will not produce universal service beyond basic telephony, at least to the medium term. Consequently public service development, and developments in democratic processes which draw upon ICT applications, and which require bandwidth beyond basic telephony, will inevitably be largely frustrated, especially where there is a desire to apply those developments comprehensively around a specific geographical area.

These points then provide a backcloth to a discussion of the concept of universal service provision in this field of telecommunications, and to how such a concept might be advanced in the provision of public services and democracy.

If we take the main elements in the USO to be those adduced by OFTEL, which we brought forward above, then the concern will be to provide *access* to telecommunications where the users' location and income are broadly irrelevant to that access and where the quality and reliability of the network are guaranteed uniformly across the providers territory. Similarly the costs of *use* should be uniform and at a level appropriate to delivering a level of uptake deemed commensurate with universality.

A strong view of these elements of the USO would suggest that access to, and use of, telecommunications is accepted as a basic right deriving from citizenship. In some senses the organisational delivery mechanisms of the PTT monopolies may appear as better designed to fulfill this view of telecommunications as a basic right than contemporary policy paradigm based upon competition and choice. Here was an organisational form based on the geographical principle, with powerful units of administration at regional level headed by senior officials likely to take on a topocratic approach to their role, protecting and promoting the interests of customers on their own patch. This was an organisational form which appeared to offer much in the delivery of this strong view of the USO as did a set of arrangements for the implementation of telecommunications based upon equitable provision through subscriber waiting lists to which would-be users were assigned for them to be removed in strict turn. However, the

waiting lists for access to this particular superhighway were long [particularly in the 1960s and 1970s], as more and more households and businesses became would-be subscribers. In the UK the surge of subscribers during the 1970s is testament to the pent up demand for domestic telephony as the numbers moved up from 42 % in 1972 to 72 % in 1980. Thus whilst in principle this public service provision offered much in terms of geographical equality, in practice it kept levels of telephone penetration low through a combination of 'demand compression' techniques [notably the waiting list] and through tariff structures which consistently favoured business rather than residential subscribers.

In the UK the gradual separation of the Telecommunications and Posts accounts in the post-war period, culminating in full-blown organisational separation in 1981, the development of liberalisation, and then privatisation and competition, marked a process of commercialisation and with it a shift from the public service tradition. It was only at this point, as the system moved from one of public service to one of regulated competition, that the concept of USO was made explicit.

> *"..in the UK it is only with liberalization that the provision of universal service has been made both an explicit aim of government regulatory policy in the Telecommunications Act and a specific obligation laid upon BT and Mercury in their licenses".*
>
> *[Garnham, 1988].*

At the same time technical change was shifting telecommunications provision from the POTS [Plain Old Telephone Services] era to one of 'pretty amazing new services' [PANS], and the admission of additional trading on the public switched network in the form of Value Added Network Services. Moreover, and as we have seen, the possiblities for the commoditisation of public information; for a move towards more electronic transactions in the public sector; for the electronic delivery of public service; for the value-added potential of informatisation of public services; and for the delivery of electronic citizenship, all equally suggest the case for profound reconsideration of the USO. In combination, all of these changes have brought about a newfound explicit concern with the nature of USO.

What then are the key questions about USO in an era when public authorities appear to have much to gain from ICT applications?

Some of these questions are:

- what are the likely bandwidth requirements for various forms of commoditised information, electronic transactions, electronically enhanced services, and from developments in electronic citizenship? Figures 5, 6 & 7 below cast some light on this question. Figure 5 shows the bandwidth required for different services and clearly shows the rising bandwidth requirement which accompanies video and multimedia kinds of applications. Figure 6 adds further to the data in Figure 5 by looking at the different transmission times of two examples - colour fax and video-conferencing - on networks of differing bandwidth capability. Figure 7 adds further again to both of these Figures by showing the bandwidth capabilities of different sorts of cable. A critical question therefore for public authorities is to what extent the telecommunications infrastructure in their geographical area of jurisdiction will allow them to develop and exploit the full range of electronic services.
- what are the likely *reach* requirements in each of these service areas? ie what is the necessary point of delivery, the kerbside, the shopping mall, the Town Hall, the police station, the branch library, the school, or the home?
- how should bandwidth and telecommunications reach be regulated into existence?

Figure 4

Bandwidth Requirements of Different Services

Information Source	Bandwidth Required
Digital Telephone/fax	64kbps
Videotex	15kbps
Videophone	64 or 128 kbps
Videoconference	128 - 960 kbps
Video on Demand	2 mbps
High definition TV	140.8 to 560 mbps

Source: Adapted from House of Commons Trade & Industry Select Committee, 1994

FIGURE 5

TRANSMISSION TIMES FOR TELEMATICS APPLICATIONS OF TYPICAL SIZE ON NETWORKS OF DIFFERENT BANDWIDTHS

	9.6 Kbps	64kbps	2mbps	20mbps
Colour Fax	9 min	1 min	3 sec	0.3 sec
Video Conference	3 min	23 sec	0.8 sec	00

FIGURE 6

Bandwidth of Different Sorts of Cable

Cable	Over 1 km	Over 3 km	Over 10 km
Copper	6 mbps	2 mbps	0.5 mbps
Cable TV [Coaxial]	1000 mbps	150 mbps	25 mbps
Optical Fibre	10,000 mbps+	10,000 mbps+	10,000 mbps+

- who should pay for the changes in infrastructure provision which will derive from the answers to some of these questions? In particular, how should the costs of providing bandwidth be apportioned between end

users, telecommunications and other service providers, and public service providers [ie in cases where the latter are not the end user]?

- in an environment of competitive and interconnected infrastructures should the regulatory process include the management of competing telecommunications businesses so as to maintain higher order USO rather than having the USO in effect defined by the lowest common technical denominator?

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