THE UK NATIONAL INFORMATION INFRASTRUCTURE

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This is a summary of a 130-page report available from the PARLIAMENTARY OFFICE OF SCIENCE AND TECHNOLOGY (extension 2840).

Over the last 2 years, the debate on an 'information superhighway' has spread from the USA to most industrial nations, the EU, and the global G7 agenda. In the UK, all parties have policy reviews under way, and there is much parliamentary interest on the form a UK National Information Infrastructure should take.

POST has carried out a detailed analysis of the technical and policy issues related to the UK NII. The full report is available from POST[1]. This note summarises the main findings.

BACKGROUND AND SCOPE OF REPORT

Information and Communication Technologies (ICTs) are advancing at a bewildering rate and already account for a market of £48B in the UK with an adverse balance of trade of £5B. They are already leading to a globalisation of the economy but the power of communications networks, computers, 'intelligent' televisions, all using digital technology, also promises to affect many other aspects of our lives. Multimedia entertainment, information services, interactive services (e.g. videophones, teleshopping, telebanking) and video-on-demand (VOD) are but some of the applications already advanced. The growth of the Internet as a 'prototype' global information infrastructure (GII) shows how rapidly (and unpredictably) such developments can proceed. Whole new companies and 'industries' can emerge, but so too can threats to privacy or culture. In view of the mix of opportunity and threat, governments across the world are addressing how these developments should be applied, encouraged or controlled.

The USA led the debate with its proposed National Information Infrastructure (NII). This "*seamless web of communication networks, computers, databases and consumer electronics*" is seen as putting vast amounts of information at users' fingertips and unleashing an "*information revolution*" changing forever the way people live, work and interact with each other. The NII will be a key technology driver to enhance competitiveness in IT, telecommunications, software, entertainment and other industries, as well as to improve education, health care delivery and public involvement with government. There are many other social and cultural issues.

1. The report (130 pages) "Information 'Superhighways': the UK National Information Infrastructure", and is available from POST, House of Commons, 7, Millbank, London SW1P 3JA; (ext 2840). External price £16.

The 'Information Superhighway' has also caught on within the European Union, is on the agenda of the G7, and is the subject of UK Government initiatives. The UK NII was also considered last year by the Commons Trade and Industry Select Committee (TISC). Even so, there are still uncertainties over what exactly is a national information infrastructure, how it would be assembled, what uses are critical, desirable and undesirable, and what barriers are in the way. The POST report looks at these questions and the policy options for encouraging or controlling NII development.

WHAT IS THE PURPOSE OF THE NII?

It is one thing to coin a popular phrase such as information superhighway, but a government's policy needs a practical objective. The full report describes various national visions which see the NII generally contributing to national economic and technological competitiveness, and providing a tool to improve healthcare, education, training and the like. Some visions however see the NII catalysing much broader changes to the social and political structures of society. For instance:

'The dawn of the information age' vision talks of a transformation from the industrial to the information age, causing as substantial a change in society as the move from an agricultural to an industrial society - transport replaced by virtual presence; shopping centres replaced by teleshopping; tele-(or dispersed) working leaving office and high street property vacant; remote courses at universities the norm; production workers replaced by 'knowledge workers'.

Re-inventing government through new ways of delivering services, increasing public access to government information, enabling the public to express its views by electronic(E)-mail; allowing public participation in decisions on specific issues (via electronic 'referenda'); shifts of power from national to local/regional level.

Wide and unintended social and political impacts, include the growth of single-issue politics enabled via ICTs, replacement of human physical contact by electronic means, threats to cultural identities and the erosion of the nation state, undermining of national 'contents' laws (e.g. on pornography), threats to the integrity and status of public service broadcasting and an increase in inequality between those able to benefit from the NII and those excluded on the basis of knowledge, education or income.

A clear national vision would help determine which of these views is realised. A '**UK Vision**' could be **primarily economic** in attempting to maximise wealth creation - in which case the main focus needs to be on strengthening UK-based manufacturers and providers of equipment, software, network services, multimedia products, etc., and on maintaining a favourable climate for inward investment. Or **the vision could be more concerned with societal and cultural impacts** and in harnessing the powers of ICTs to improve the efficiency and effectiveness of education and training, increase the capacity/ manage the demand for transport, improve health service efficiency and help public participation in the democratic system. Without a national vision, NII development may be slow and fragmented, and the UK's influence at the EU/G7 reduced.

The NII debate impinges on **all** government departments. Currently, OPSS has something of a *de facto* lead role through its ownership of the Government's Centre for Information Systems (CCTA). The Secretary of State for Education has launched an initiative, and DTI has activities under both the Industry and Energy Minister and the Trade and Technology Minister. A follow-up to last year's CCTA consultation paper is expected by the summer, but it is not yet clear how far this will lead to a government-wide policy on the NII. **One option would be to assign a clear cross-departmental leadership role** (in an analogous way to Vice-President Gore's role on the US NII initiative), and **develop a national vision** taking into account social and public interest needs, in parallel with measures to encourage enterprise and wealth creation. This could also include **clarifying or rationalising the roles of the different advisory groups** of which several have been set up in the last year.

CHARACTERISTICS OF THE NII

Not everyone would recognise a NII at first glance! In general, most envisage it offering **two-way operation, broadband capacity** (in technical terms - 2 Mbits/s or more) and **near-universal provision** across the nation. It used to be thought that 2-way broadband links had to be optical fibre and therefore achieving the NII was the conceptually simple (if expensive) matter of connecting fibre to every home. But the full report finds that the situation is now much more complicated due to advances in technology, which threaten to turn on their heads some of the previously-accepted technological paradigms. The capacity of the traditional 'copper pair' telephone connection is being radically increased, the abilities of coaxial cable TV connections to support interactivity is changing rapidly, mobile communications are expanding at the same time as the requirements for many 'broadband' services are shrinking through digital compression etc.

There is thus a strong argument that a fully functional NII can be achieved with relatively modest enhancements to existing infrastructures, or even that **the NII already exists** because current networks can provide any informational service for which there is a **known** demand. Despite this, some continue to argue that the only meaningful target is to wire up all households, work-places, leisure and education facilities to a universal broadband fibre network.

Reaching a consensus on the **necessary performance characteristics of the NII is vital**. The investment costs envisaged for a truly high-performance NII are huge, and there will be severe penalties if investment in the NII is wrongly judged. Providing infrastructure too far ahead of consumer demand for the increased 'bandwidth' would be a poor investment; failure to provide infrastructure in phase with developing services and demand would create a critical stumbling block, passing the advantage to companies in countries where the infrastructure supports such services.

THE REGULATORY ENVIRONMENT

UK regulatory policy has been the subject of much controversy as illustrated in the Trade and Industry Committee report and Government response[2]. The POST report explores the interaction between technological trends and the regulatory environment and finds that, because of the complex and unpredictable ways in which NII infrastructure and services interact, there is a danger that **regulatory regimes which favour competition in physical infrastructure over competition in innovative services may have disadvantages** in the future. One option is to shift the regulatory emphasis from competition in the physical infrastructure to **competition on services**, leaving the market players to decide whether to construct duplicate infrastructure, share the investment or reach some form of common carrier agreement.

The convergence of telecommunications and entertainment may also have implications for a regulatory regime which evolved when there was a clear separation between the two, and some see a case for an **'Office of Communications (OfCOM)'** to absorb the relevant regulatory responsibilities of ITC and OFTEL.

DEVELOPING THE NII

The NII comprises both the **physical infrastructure of networks and the interactive services** carried over them, each of which clearly depend on the other.

The Physical Networks

The UK has seen large investments in infrastructure in recent years - by the PTOs, the cable companies and

2. The TISC report on 'Optical Fibre Networks' (HC 285-I, 1994)and the Government response (Cm2734) in November 1994.

other players (£6B will be invested in 1995). As a result, many key components of a NII's infrastructure already exist. The optical fibre network used by the main PTOs forms the 'backbone' of a NII, although the local telephony loop remains largely based on 'narrowband' copper wiring (irrespective of whether it is from BT or a Cable TV company). Local entertainment networks are growing based on a mix of fibre and coaxial cable - these provide predominantly a one-way broadband connection, but 2-way interactivity is set to grow rapidly and will lead to at least some 'regional IIs'. The use of radio is extending from mobile phones to possible local distribution in rural cable franchises or competition in the local loop for telephony. Some homes thus have 3 fixed links - two sets of copper pairs from the BT and cable TV telephony, and one coaxial copper - in addition to any mobile telephones.

The full report examines whether the current fragmentation and heterogeneity in the capability and coverage of current networks matters. Some argue not on the grounds that no significant applications are impeded by the current situation and that competition may well speed developments. Businesses can obtain the bandwidths they need from BT or their local cable companies. Domestic interactive services are still at an early stage and are proceeding at different speeds in different franchises, and even if developed and tested locally, could be offered nationally. However, too fragmented a market could have dangers. The greater costs of duplicate local facilities relative to a single national service could delay uptake. Another uncertainty is over the outcome of the parallel efforts to develop services over narrowband and broadband networks, resulting partly from the current regulatory restrictions on BT. Thus much effort is going into 'squeezing' the most out of the existing national narrowband copper infrastructure (e.g. to offer videophone and VOD). If this succeeds, then a basis for national interactive services such as VOD will exist; if not, the investment will be wasted and they will be more likely to develop on the back of local/regional cable TV services, accessible to only some of the population.

In view of the plurality of networks and providers, if there is to be any **national** element to broadband infrastructure, interconnection and interoperability between the different networks are essential. The full report examines these questions in depth and explores arguments that **OFTEL, ITC and DTI should consider interconnectivity performance standards more formally** in future. The ultimate extension of interoperability is the **open network** - where **any service can be offered by any provider over any network to any customer**. Some governments are adopting this target, but the UK Government is more ambivalent, seeing the current situation where the network and the service often go together as advantageous. Even so, **one option would be to pursue more vigorously international discussions (e.g. in the EU) towards development of an appropriate architecture for open networks** and **to encourage test beds of open systems**. Progress on this front could keep all options open for future competition policy - including the possibility that PTOs and cable companies would be able to work together to share broadband infrastructure, competing on the services provided across it.

In this context, OFTEL will shortly issue a discussion document on what regulation is needed to govern the four broad sectors of the market:

- content/information providers,
- service providers,
- distribution networks,
- users/customers and their equipment,

with the long-term aim of allowing **open access for all service providers to all customers over all networks**.

NII Services

The full report explores in some detail the roles foreseen for the NII in business, education, healthcare, the home, publishing and in the public sector. Although there are policy options related to specific public sector targets for infrastructure and R&D, the greatest **limiting factor to NII deployment** is widely viewed as the demand for the **services** carried over it. There are already interactive services (particularly the Internet) which can be accessed by the existing infrastructure and where the physical linkages are not the limiting factor.

Commercial uncertainty over the level of potential demand for interactive services leads many to conclude that relying purely on a growing consumer market to 'pull through' improvements in the infrastructure will be an uncertain and slow process. A role for Government exists in 'pathfinder' applications and in adapting regulatory systems to facilitate uses requiring higher bandwidths. In the latter respect, the UK (and EU) pricing regime discourages the use of the Internet and other 'on-line' services and would be an early candidate for review under a policy to encourage use of a NII.

The full report explores several other potential options for delivering public services over the NII **to help public familiarity with the technology, provide a model for universal access and increase levels of confidence and investment by information service providers** (similar pilot projects are being funded by the EU):

1. **Government procurement**, where the role of Government as a major purchaser of goods and services offers the potential to use electronic data interchange, E-mail and other applications.
2. **Electronic delivery of Government services** - this can include information on services (e.g. electronic delivery of forms), electronic submission of data (e.g. for tax returns), even amending details electronically

(e.g. changing vehicle licence details). Government use of external E-mail is limited to only a few examples and could, if expanded, encourage wider use.

3. **Access to Government information.** Information available through the "open.gov.UK" site on the WorldWide Web is growing rapidly (CCTA report 46,600 enquiries each week). However, there is a tension between moves to make more information available over the Internet and the policy for Executive Agencies to maximise agency income from sale of information. There may be a need to develop **an updated policy which balances the interests of more open Government, widespread dissemination and freedom of information, against the case for maintaining charges.**

4. **Parliament.** There is scope for increasing electronic access to the UK Parliament (in the US Congress, information is provided on the current activities of Congress, text of debates and reports, as well as the E-mail addresses of Congressmen).

5. **Existing advanced networks such as SuperJANET** provide a testbed for NII applications, and their use could be encouraged by extending the networks (e.g. to schools), and by helping small companies to evaluate the potential of advanced information infrastructures. The **Internet** already offers a prototype global infrastructure which is starting to allow secure transactions and therefore offers scope for small companies to market their products and services globally; there could be **a role for Government to monitor and advise companies on the best way of harnessing the Internet's potential for their products.**

6. **Test-beds for service development in the Public Sector** - better infrastructure in the NHS will allow telemedicine to make better use of scarce or distant expertise, personal health information systems, or just rapid records exchange across Europe. The DfE is consulting on cost-effective ways in which **education** might benefit from broadband communications. Schemes such as BT's Campus 2000 (and other initiatives such as Project Connect) are to include Internet access. The cable companies have offered free connections to some schools, and the DTI 'Schools on-line' initiative will connect some 50 schools to the Internet, although such initiatives must address how teachers can best use the technology as well as controlling access to unsuitable material. **Coordination among the Government departments involved is important.**

7. **Libraries could provide sites for 'Information kiosks'** or computer terminals to raise public awareness and interest in the NII, and also ensure access for those lacking their own connection. This could also provide local information - e.g. job vacancies, local social services, as being explored in some local initiatives (e.g. Cambridge 'on-line' city plans).

3. These range from the 'hardware' of computers, TVs, networks etc., through the software which controls them, to the 'content' (TV programmes, films, educational materials etc.) where the UK's familiarity with English as the international language of business and entertainment creates a considerable advantage.

OTHER ISSUES

The full report also explores barriers to NII applications. On **electronic intellectual property rights**, problems arise from the ease of copying, the difficulty of detection, the possibility of masking authorship, and the 'anarchic' philosophy over the Internet. Attempts to adapt the copyright law to the new challenges of multimedia are still a matter of debate.

Closely linked with protection of IPR is the more general issue of **network security and privacy**. There are a number of issues, including how to balance protection of privacy (particularly in the movement of personal data across national boundaries) with the needs of legitimate international electronic business; security of personal data and implications under the Data Protection Act; controls on encryption and whether advanced encryption techniques should allow law enforcement agencies special access mechanisms; authentication and security of financial and other transactions.

Another issue is the availability over networks such as Internet of material which would contravene national laws on content. **Pornographic pictures and stories, racist material etc.** cause particular concern to those seeking to extend educational use of the Internet.

There are also issues related to encouraging NII development to lead to **wealth creation and competitiveness**. In this respect, there is a happy coincidence of purpose between the interests of US companies already in a leading position in components of the NII infrastructure and services, and the thrust of the US Government in placing this issue high on the international agenda. Some see a similar opportunity for the **UK Government to strengthen the position of UK companies in these emerging markets**[3], while maintaining the attractive environment for inward investment. Some options are discussed in the full report.

There is concern about the possible division of society into information 'haves' and 'have nots', and this raises challenges in re-defining the **universal service provision** of telephony to apply to new interactive services. Last but not least, several issues flow from the possible impact of the emerging NII on the UK (and European) tradition of **socially responsible broadcasting.**

In Conclusion. ICTs will advance dramatically for many years yet. The pace of change, its international scope, its technological complexity, the potential for economical and social impacts in so many fields, make the information superhighway debate of potential interest to Parliamentarians from many perspectives. It is hoped that the full report will help both Houses to anticipate and deal with the many issues arising.