

Technology Strategy Board

Driving Innovation



Our strategy for 'Digital Britain'

JUNE 2009



Executive summary

The internet and the mobile phone are revolutionising the way we live our lives and run our businesses, and this digital revolution is gathering pace. People, business and government must be ready to move with the disruptive shifts in economic and social structures, and we will need continual innovation to create an inclusive, fair and competitive future.

In its 'Digital Britain' report, the Government has assigned us the role of championing and leading the technology and innovation efforts required to make the policy's vision a reality. The Technology Strategy Board was set up to encourage innovation for sustainable wealth creation and quality of life, and we are endowed with a cross-governmental leadership role. This means investing with businesses, and co-ordinating activities with the Research Councils, the National Endowment for Science, Technology and the Arts (NESTA), regional agencies and others, as well as engaging with the various departments of government that have an influence on the digital agenda or that want to deliver services through digital means.

In partnership with UK business, the Government already invests in selected innovation programmes relating to software, digital communications, creative industries and information security. In addition, the Technology Strategy Board will commit up to £30m this year to business-led innovation programmes, supporting the aims of Digital Britain on a medium-term horizon.

Our underpinning vision is that all participants in Digital Britain should benefit fairly from the creation, distribution and consumption of digital content and services.

We have identified three broad challenge areas that we need to address to help achieve Digital Britain:

- The economics of the network – 'pipes'
- The economics of content and services – 'poems'
- Protection and enablement – 'people'.

The specific challenges in these areas include:

- How to deploy new infrastructure cost-effectively
- How to enable a sustainable marketplace for intellectual property
- How to protect the privacy and security of consumers whilst making the UK a safe place to do business
- How to increase the effectiveness of public services
- How to create economic and social benefit from increasing volumes of information.

We are taking an integrated, holistic approach across these areas to realize the vision. The initiatives that we invest in will explicitly stimulate cross-fertilization, bringing together diverse partners such as businesses, academics, content owners, technologists and public bodies – to meet the business, economic, technological and cultural challenges.

For example, we are proposing to set up a controlled test bed environment – where organisations can experiment with business and commercialisation models, or new services and technologies – in a realistic setting but without the usual risks and restrictions of network and content use.

How we will help achieve Digital Britain

The Technology Strategy Board has allocated £30m in 2009 to initiate programmes that will stimulate innovation in the Pipes, Poems and People challenge areas, and will work with Research Councils, regional agencies, NESTA and other government bodies to make them happen.

We will establish the priorities by talking to business and user communities, and activities are likely to begin with the following.

We will: encourage technology development for ultra-fast broadband, and for maximising the efficiency with which existing infrastructure is used.

We will: look for more cost-effective ways to deploy new and robust wireline and wireless access infrastructure, including encouraging regional and community schemes, and will co-ordinate activity across the country to ensure cross-compatibility of initiatives.

We will: work with the British National Space Centre and the European Space Agency to assess the feasibility of further satellite broadband provision.

We will: encourage industry to exploit technologies that will make digital infrastructure more reliable, secure, and content- and context-aware.

We will: develop the test bed(s) where businesses and users can explore the effects of alternative operating models, business and monetisation models at a representative scale. Anonymised studies of user behaviour will allow investigations such as:

- Services and technologies enabled by next generation access
- New business relationships between network owners and operators and digital content owners

- Content- and context-aware network operation
- Controlled suspension of copyright protection to investigate other commercialisation routes
- New advertising and charging models, eg virtual currency for digital content and micropayments
- Pilots of new services and new technologies by commercial and public businesses.

We have published details of this initiative on our website at www.innovateuk.org

We will: encourage the development of technology, services and tools that can support both the creation of digital content and the extraction of value from it, including intelligent systems for management of data and services, personalisation, and more responsive interfaces. We will assess user satisfaction with the results.

We will: work to remove barriers to the emergence of new business models, specifically around cost (eg overhead on micropayments), trust (suspicion of new costs incurred at or after consumption) and literacy (lack of familiarity with or understanding of model).

We will: work with public information and online service providers such as DirectGov, and with specific Government policy owners, and mobilise industry solutions to help meet their public sector software and services challenges.

We will: support skills and knowledge transfer to assist in the development of new technologies and service models.

We will: help the Government reach a wider audience with the Digital Britain report and help parties from different sectors understand its implications in their language, for example by working with knowledge transfer networks to organise cross-sectoral workshops and conferences.

To get involved in our work on Digital Britain businesses should first join their industry knowledge transfer network. See ktnetworks.co.uk for more information.

You can also sign up for alerts on Technology Strategy Board initiatives, such as the digital test beds and upcoming collaborative research & development competitions at www.innovateuk.org

For the Government's new Digital Britain report see www.culture.gov.uk



The innovation imperative for Digital Britain

Sustainable paths to wealth creation are vital for the UK. One of the most lucrative, both economically and socially, is the generation, sharing and exploitation of digital content, where it is essential that everyone in the value chain gains an appropriate return from their investment.

In 'old world' business models, the link between the effort put into producing goods and services and the return from the point of consumption may have been indirect, but revenue flowed reliably.

In the 'new world' of the digital economy, content can be readily copied and shared, and this link is no longer clear. The ensuing difficulties in value creation and extraction undermine business models ranging from the generation and augmentation of content to the provision and maintenance of the communications networks used to carry it.

The infrastructure that will underpin Digital Britain encompasses both the networks transmitting the data and the services and tools that operate on that data. By understanding current and future user requirements, and acknowledging that we overestimate what can be achieved in one year but underestimate what we can do in 10 years', we can develop strategies to make the most of existing infrastructure, alongside innovation to meet the demands of the future.

This requires leadership and the co-ordination of cross-disciplinary approaches and inputs from everyone involved, including business and consumer users of services and digital content, network owners, internet service providers and mobile network operators, content and service vendors, government service providers, regulators and legislators.

Tensions and opportunities can be identified amongst these different perspectives and we have grouped these into three interdependent challenge areas:

- **Pipes: Economics of the network:** to ensure that physical infrastructure can be installed and maintained in a cost-effective and sustainable way and that its capacity and services are at the right scale for anticipated future needs
- **Poems: Economics of content and services:** to enable efficient flow of revenue from content and service consumers to producers and providers
- **People: Protection and enablement:** to ensure that the entire infrastructure, and the interfaces onto it, meet user expectations of quality of service, security, usability and flexibility.

Who will deliver Digital Britain's innovation needs?

The Technology Strategy Board was set up in 2007 to promote and support research into, and development and exploitation of, technology and innovation for the benefit of UK business - working with technology-intensive industries in the space between concept and commercialisation.

Our mission is to connect and catalyse (www.innovateuk.org/ourstrategy.ashx), linking businesses and academics through networking and knowledge transfer activities, and following through with targeted investments and interventions.

The Technology Strategy Board is already working with the Research Councils and others, to invest in an active portfolio of projects that underpin Digital Britain, and we have now allocated a further £30m to address the innovation challenges identified in the Government's Digital Britain report.

Pipes – Economics of the network

Modern businesses, public services and consumer applications increasingly rely on data, so broadband access is now essential for our knowledge-based economy. In Digital Britain, commercial home services will continue to drive network revenues, as high-end users' bandwidth demand doubles every 21 monthsⁱⁱ. To future-proof Digital Britain and enable the services that will be required 10 years from now, we not only require universal access to the network at 2Mbps, but must also plan core and access infrastructure scalable to 1Gbpsⁱⁱⁱ to 10Gbps^{iv}. Currently, there is not enough incentive to invest in this infrastructure, as the return on investment and revenue models across the end-to-end value chain are not clear.

Challenges

- How to deploy infrastructure cost-effectively, and ensure that the civil works required for roll-out represent a strategic investment against anticipated future requirements for network bandwidth, architecture, resilience and service quality
- How to provide a return on infrastructure investment
- How to connect the 'patchwork quilt' of regionally-based next generation access roll-out
- How to finance operation of the service platform and provide a return for network operators that reflects traffic volumes and quality

Examples

Historically, we have consistently underestimated bandwidth requirements, and today's core and access infrastructure already struggles to deliver the traffic demanded by home and business users.

Examples of the pressure that innovation in media and the creative industries exerts on current broadband infrastructure include the BBC iPlayer (launched December 2007), which already accounts for up to 10% of peak internet traffic in the UK^v, and YouTube (founded in 2005), which now accounts for the same level of traffic as the entire internet did in 2000^{vi}. The fact that these valuable services also generate insufficient revenue to finance their operation links us to the Poems challenge area opposite.

Innovation requirements

- Motivation and technology to encourage the deployment of the access infrastructure that will enable universal service at 2Mbps
- Lower cost technology and installation methods, and support for the business case to deploy ultra-fast broadband to the premises (upgradable to 1Gbps and beyond), including the seamless connection and integration of wireline and wireless access
- Business models and technology to manage data within the home and workplace, handling building management, utilities metering and healthcare information as well as mainstream internet traffic
- Technology to deliver appropriate service quality at current and future connection speeds, to stop network saturation affecting usability

What is the benefit of technology innovation?

Broadband infrastructure will be the roads of the 21st century. Universal access will enable public services to be delivered to the entire population, whilst commercial ultra-fast broadband will fundamentally change the way that homes and businesses operate, and will define our future lifestyles and worldwide competitiveness. New infrastructure will also enable entirely new services, such as the use of serious games technology for immersive education and healthcare, or the monitoring and management of traffic, buildings and power. New solutions for teleworking and telepresence will encourage flexible and remote working, reducing traffic congestion and carbon footprint. Direct fibreoptic connections to homes and businesses will also allow existing and future infrastructure to use less energy, and so offset the environmental costs of deployment in as little as six years^{vii}.

Poems – Economics of content and services

Traditional content delivery mechanisms, such as broadcast analogue television and celluloid film, protected the content transferred across them. Restricting access to the source material ensured that duplicates were of poor quality or difficult to make. In the digital world, copies may be indistinguishable from source, can be made instantaneously at nearly no cost, and can be disseminated instantly and without limit. This undermining of intellectual property threatens the future benefits to be derived from the UK's global strength in creative industries.

Meanwhile, a general move is in progress, across all digital industries, away from client-server and broadcast models towards more distributed connections such as peer-to-peer communications. The resulting proliferation of piracy and loss of central control have damaged revenue flows from users to content and service providers, making many business models unsustainable and many businesses unviable.

Challenges

- How to price content and services
- How to identify opportunities for content producers to generate revenue from consumption of their content
- How to more effectively manage licensing of content
- How to create a sustainable marketplace for digital property, and how to protect this new idea of property that can be easily copied
- How to deliver public and government services over the internet, alongside or in concert with commercial services

Examples

Emerging business models can disrupt, or even undermine existing models: tension has developed between the BBC and Tiscali^{viii} as demand for the iPlayer service places greater demands on the network, whilst Guardian Media Group has complained to the Department for Culture, Media and Sport of the 'negative effects of [search engines] on the ability of UK commercial players to invest in quality content'^{ix}.

Potentially illegal services based on BitTorrent and eDonkey are responsible for over a third of all internet traffic^x.

Innovation requirements

- Solutions to reduce risk in the exploration and implementation of new business models and processes
- Technology to create value in coupling content with ownership and usage, and/or to enable revenue generation alongside traditional service provision, eg with advertising
- Cost-effective, comprehensive and persistent information infrastructures to better manage digital assets
- A new concept and legal framework for 'digital property'
- Ways to relate service quality to the nature and content of the service, within privacy bounds

What is the benefit of innovation?

Innovation in the relationship between users, content and the networks, and in the way consumers transact, can allow for safer and more effective exploitation of intellectual property. More sustainable content and service business models will enable new services that are currently not economically viable or technically supportable. Creating a legal and efficient market in digital content and services, which draws on the distributed nature of the content and audience, and is both dynamic and remunerative, will ensure that content continues to be produced in the UK for audiences here and all over the world.

People – Protection and enablement

The UK needs to enable and encourage economic growth of digital services, for business and the individual. The security, protection and exploitation of information are key to realising this. To make sure the user's experience of digital services meets their expectations, appropriate management of the risks associated with confidentiality, integrity and availability must be applied.

Challenges

- How to create, establish and utilise new models of trust between users and service providers
- How to guarantee connection and availability, on demand, to everyone that requires a service
- How to both maintain privacy and consent whilst personalising services and content and at the same time maintaining a satisfying user experience
- How to obtain quality and timely information from increasing data volumes
- How to make infrastructure both resilient and intelligent for the benefit of all
- How to build the confidence of investors that Britain is a secure place to grow businesses

Examples

Traditional e-commerce models have developed to create adequate trust between transacting parties without prior knowledge of each other. However, market penetration is still relatively low and dependent, due to lack of confidence in the general population.

The Serious Organised Crime Agency's recent threat assessment reported that 'the rapid growth of the internet has resulted in the evolution of a criminal market for the compromise, trade and exploitation of personal data. Those compromising large quantities of data either: sell it directly to others who can realise its value through fraud by committing wider identity theft, enabling other crimes to be committed; or sell it to data brokers who collate data from different sources and sell it on.'^{xi}

Innovation requirements

- Design of flexible and intelligent systems that enable trustworthy services, usability, accessibility and ubiquity of services
- Usable commercial tools, techniques and business models to enable trusted services
- Creation of flexible and personalised services and human interfaces
- Development of tools, techniques and services to manage increasing data volumes to provide valuable information
- Reliable, robust and secure design of ICT systems from the outset, for the benefit of all UK organisations, society and business
- An effective education programme to instil awareness and appropriate trust in users of services

What is the benefit of technology innovation?

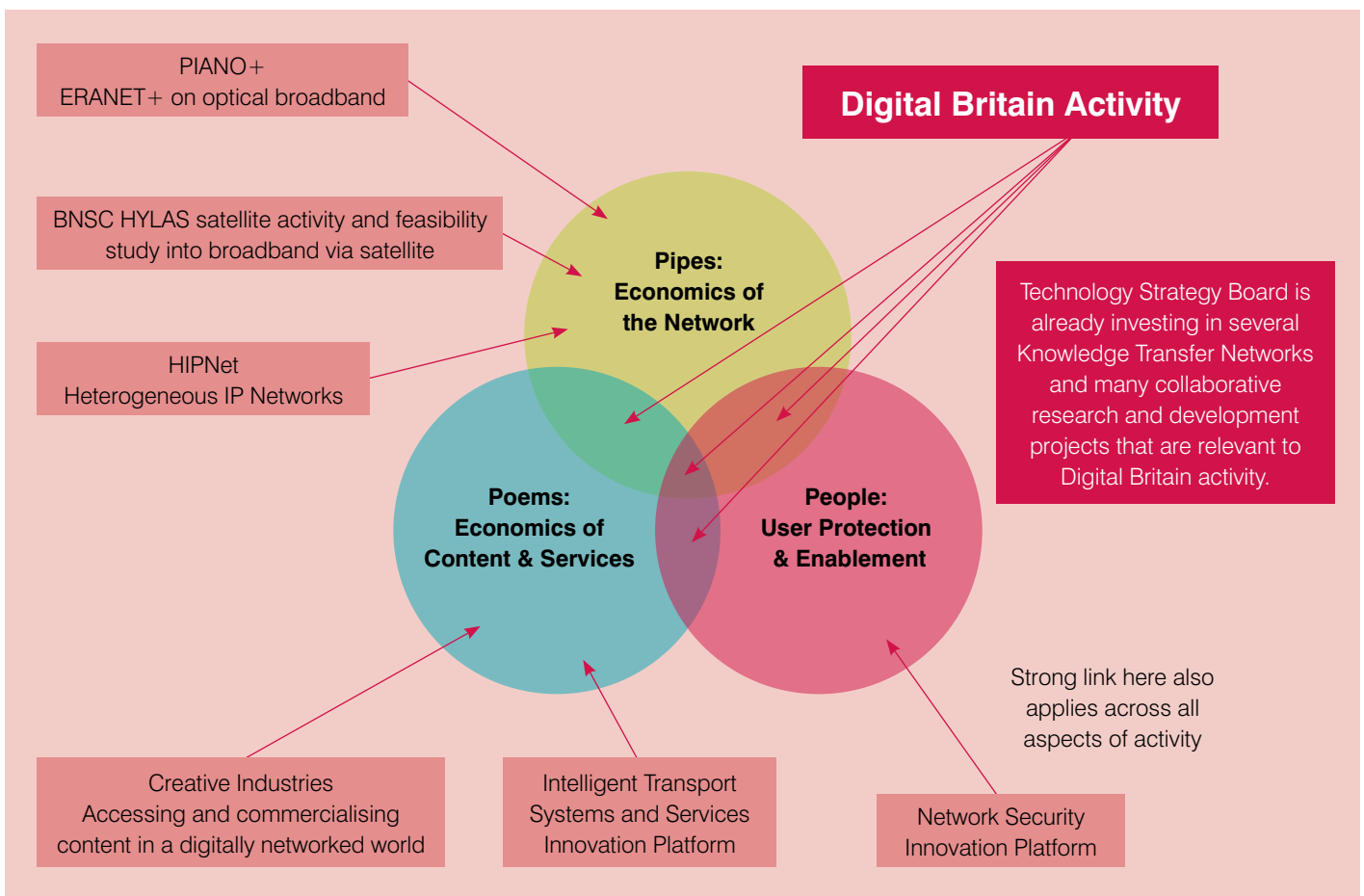
Investment in digital protection and enablement allows UK business and society to contribute to and benefit from the digital economy. The protection and security of services are a fundamental requirement for the Pipes and Poems challenge areas to realise their potential.

To gain most benefit from this, the design of future services and online business models must consider security and protection from the start. Once future business models are established and accepted, consumer confidence in them will grow. Digital services from both public and private sectors will then be able to realise their full potential.

How our existing programmes relate to Digital Britain

The Technology Strategy Board is the UK Government's innovation agency, set up in 2007 under the sponsorship of the Department for Innovation, Universities and Skills (now the Department for Business, Innovation and Skills). Our remit spans technology-intensive business sectors, from nanotechnology to high value services, and with an economy increasingly underpinned by communications we already have a broad sweep of activities across the digital agenda.

Figure 1 – How our current work fits with the Digital Britain strategy



BNSC= British National Space Centre. PIANO+ and ERANET+ are European programmes

We have multiple programmes that address specific aspects of the challenges faced by Digital Britain. This strategy supplements these with activities that are explicitly cross-disciplinary, linking end-to-end the needs of network owners and operators with users, service providers and government, and engaging hardware and ICT technologies as well as social and behavioural studies.

Innovation platforms

Amongst the Technology Strategy Board's delivery tools, and of particular relevance to the delivery of government policy, are innovation platforms. We have formed an innovation platform where a specific challenge from government becomes the driver for business innovation and new technology, and some of these are already working in the digital economy.

Network Security Innovation Platform

The Network Security Innovation Platform (working with the Home Office, DirectGov and Cabinet Office) aims to make the UK a more prosperous and secure environment for both business and the individual, in the face of the risks of information being compromised by disclosure (confidentiality), unreliability (integrity) or being unreachable (availability).

Its recent work relevant to Digital Britain includes:

- £4m investment in projects for 'Trust Economics'
- £5.5m investment (with the Economic and Social Research Council and the Engineering & Physical Sciences Research Council) in projects for 'Ensuring Privacy and Consent'
- £6m investment (with the Engineering & Physical Sciences Research Council and the Centre for the Protection of National Infrastructure) in projects for 'Information Infrastructure Protection: managing complexity, risk and resilience'.

Assisted Living Innovation Platform

We set up the Assisted Living Innovation Platform (working with the Department of Health) to aid people who suffer from chronic long-term conditions to live independently and to address the societal challenges raised by health conditions that require a preventative approach.

Its recent work relevant to Digital Britain includes:

- £5m investment in projects for 'A Smart Care Distributed Environment', looking at the issues around digital communications (fixed and mobile telecommunications and broadcast) technologies and their implications for new assisted living devices and services.

Intelligent Transport Systems and Services Innovation Platform

The Intelligent Transport Systems and Services Innovation Platform's societal challenge is to relieve traffic congestion (working with the Department for Transport), using information and communication systems to provide real-time information services that help people to plan journeys and move goods more intelligently, thus leading to more sustainable and efficient transport mobility.

Its recent work relevant to Digital Britain includes:

- £7m investment in projects for 'Time-Distance-Place Road Pricing'
- £11m investment in projects for 'Informed Personal Travel'.

Low Impact Buildings Innovation Platform

The UK Government has set the challenging target of a 80% reduction in carbon emissions by 2050, including a timetable to reduce net carbon emissions to zero for new houses from 2016 and for new non-domestic buildings from 2019.

The Low Impact Buildings Innovation Platform (working with the Department for Communities & Local Government and Department for Children, Schools & Families) aims to increase innovation in the buildings industry to meet these challenges and harness the growing market for environmentally sustainable buildings.

It is planning a project relevant to Digital Britain on:

- Management and operation of buildings – ensuring that low-impact buildings deliver the design performance in use.

For further information about the innovation platforms see www.innovateuk.org

Application areas

Alongside the innovation platforms are the Technology Strategy Board's market-led programmes directed at strategic sectors where there are further demands for new communications services enabled by digital infrastructure.

Creative Industries

The creative industries sector accounts for over 6% of the UK economy. Globally, the UK enjoys a leading position across many of the sub sectors and creative industries contribute a greater percentage to our national GDP than in any other country. The sector spans arts and antiques, architecture, advertising, computer games, crafts, performing arts, TV & radio, film and video, designer fashion, software, music, design and publishing.

Its recent work relevant to Digital Britain includes:

- £5m investment in projects for 'Accessing and Commercialising Content in a Digitally Networked World'.

Healthcare

The emergence of e-health, the use of electronic resources for storing and remotely accessing medical records, coupled with the development of telemedicine for remote diagnosis of patients offers new opportunities for companies working in this sector. The potential to develop 'integrated solutions' with devices and diagnostics connected into data networks to provide healthcare professionals with information on-line and in real time, has the potential to provide major step-changes in the provision of healthcare.



Energy Generation and Supply

The recent Department of Energy and Climate Change announcement of a national roll-out of smart electricity and gas meters by 2020 requires a targeted programme of strategic investment in innovation, and presents an opportunity for technology convergence between smart meters and other forms of home-generated data such as healthcare information. A proposal to build such developments upon the Technology Strategy Board's HIPNet technology demonstrator is already under development within the Assisted Living Innovation Platform.

Coupling smart metering to intelligent electricity grid management opens opportunities for active control of supply and demand, which would in turn enable a higher proportion of renewables generation to be connected to the grid with less need for rapid-response back-up from nuclear and coal-fired stations.

For further information on the work of our application areas see www.innovateuk.org

Case study: HIPNet

The £20m Heterogeneous IP Networks (HIPNet) project, launched in March 2006, brought together four UK universities and some of the world's leading multinationals to better understand complex next-generation ICT networks.

The project has built a world-class next generation all-internet protocol network test bed that has researched many of the problems of carrying video at the same time as other traffic over the complexities of modern networks. In particular it has demonstrated that simple concepts such as 'bandwidth' that were valid in the old switched network do not come close to adequately addressing the issues of quality of service in all-internet protocol systems. The project has shown what is required and this know-how is now ready to be deployed.



Technology areas

The policy- and market-driven challenge areas are supported in the Technology Strategy Board by programmes to build technology capabilities.

Electronics, Photonics and Electrical Systems

The physical infrastructure of Digital Britain requires innovation to encourage national deployment of a next generation access network, and innovation to develop local high frequency wireless networks. We have pledged to:

- Champion the benefits of high bandwidth next generation access (1Gbps and beyond), to position the UK as a world leader, and act to ensure that UK technology is available to support its low-cost deployment
- Encourage development of systems and services based on wireless communications technologies to enable smart environments.

Recent work relevant to Digital Britain includes:

- £1m investment in feasibility studies for optical broadband access technology, to prepare for an expected €5m investment in the Photonics21 ERANET+ programme in 2010.

Information and Communication Technology

There are opportunities for innovation in software-based technologies to address increasing volumes of digital data, convergence and complexity of ICT systems, advances in hardware capacity and the push for environmental sustainability. The software and service platforms that support the delivery of Digital Britain are the hidden, but vital, core of its infrastructure. Innovations in systems that are data-driven, intelligent, user-centric and truly fit-for-purpose will lead to the new technologies that will enable future business models.

British National Space Centre

From 2009, we have taken responsibility for some of the business-facing aspects of the British National Space Centre, including satellite communications and navigation.

Its recent and upcoming work relevant to Digital Britain includes:

- £30m support for development of the HYLAS satellite broadband platform
- €0.25m investment to support a feasibility study of further satellite broadband expansion^{xii}.

For further information on the work of our technology areas see www.innovateuk.org

Investment tools and knowledge transfer networks

The Technology Strategy Board has a wide and increasing range of investment tools, including:

- funding support for collaborative research and development projects, feasibility studies and demonstrators – all awarded through open competition
- acting as a portal for government-sponsored research contracts through the SBRI scheme – all awarded through open competition
- skills placements and knowledge transfer through the Knowledge Transfer Partnership scheme – see www.ktponline.org.uk
- investment in centres of excellence and research centres.

In addition, a portfolio of knowledge transfer networks link together over 50,000 members with events, information services, academic-industrial and business-to-business brokering and a two-way conversation with government – see www.ktnetworks.co.uk.

How to get involved

In the areas relevant to Digital Britain, we will be working closely with these networks, to engage with businesses and academics and develop and deliver the necessary interventions to realise the Digital Britain vision.

We want to encourage those interested to participate, and the first move would be to join one of these networks, for example:

- Digital Communications Knowledge Transfer Network
- Creative Industries Knowledge Transfer Network
- Photonics Knowledge Transfer Network
- Cyber Security Knowledge Transfer Network
- Grid Computing Now!

By engaging through the knowledge transfer networks, businesses can then become involved in the initiatives and interventions that the Technology Strategy Board will be announcing as a result of this programme of activity.



References

- i Joseph Licklider as quoted in the Caio report, www.berr.gov.uk/files/file47788.pdf
- ii 'Nielson's law' for bandwidth expansion, which is enabled by Butters' Law that the cost per bit transmitted halves every nine months.
- iii Gbps = Gigabits per second
- iv Given that current technology (ADSL2+) can support a maximum speed of 24Mbps, applying Nielson's Law means that by 2020 we will need speeds in excess of 1Gbps.
- v Source: The Guardian, 11 December 2008, www.guardian.co.uk/media/2008/dec/11/interview-anthony-rose-iplayer
- vi Source: The Guardian, 20 October 2008, www.guardian.co.uk/business/2008/oct/20/internet-europe
- vii PriceWaterhouseCoopers Report for the Fiber-to-the-home Council, September 2008 – www.ftthcouncil.org/UserFiles/File/PWC_FTTH_Sustainability%20Report%20FINAL.pdf
- viii Source: Computing, 9 April 2008, www.computing.co.uk/computing/news/2213832/tiscali-bbc-quarrel-iplayer
- ix Source: Guardian Media Group letter to Department for Culture, Media and Sport, www.culture.gov.uk/images/publications/GMG_DBIRResponse.pdf
- x University of Toronto Law School (www.ipsogoode.ac/2009/03/the-pirate-bay-an-ocean-away-from-google),
- xi www.soca.gov.uk/assessPublications/downloads/UKTA2008-9NPM.pdf
- xii Provisional: subject to coordination between British National Space Agency, Technology Strategy Board and European Space Agency



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