Questions and Answers

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1. *Are you able to elaborate on the evidence upon which the Government was able to develop the current NBN proposal?*

Answer: No.

2. *There was no specific mention of the Tasmanian Government's proposal in the published extract of the Expert Panel. However it is obvious that the Tasmanian proposal was comprehensive enough for the Government to enter into negotiations and commence the Tasmanian rollout prior to the results of the Implementation Study being known.*
    a. *What are your views on whether the Tasmanian model could be used as a template for the rest of Australia without the delay of the Implementation Report?*

Answer: The Tasmanian rollout has already commenced. The geography of Tasmania is unique, so it will not be possible to simply duplicate the Tasmanian network elsewhere. However, the experience gained in the Tasmanian rollout will no doubt be useful elsewhere.

    b. *What value is there is considering the Tasmanian implementation as a test-bed for the national implementation?*

Answer: The Tasmanian network will provide opportunities for initial testing of a number of technologies and applications.

3. *Could you provide an overview of the objectives of the Institute for a Broadband Enabled Society (IBES)?*

Answer: A full statement of the objectives of IBES is available on the Institute website (www.broadband.unimelb.edu.au). In summary, IBES aims to

- act as an umbrella for all research at the University of Melbourne related to broadband technologies and applications of broadband for the benefit of society;
- assist in the establishment of new research projects at the University of Melbourne and to provide seed funding to assist researchers to find external funding;
- seek out and develop opportunities for collaborations between University of Melbourne researchers and researchers in other universities, other research organizations, and industry;
- promote the societal benefits of broadband;
- establish a test-bed laboratory to enable researchers to test new applications and innovations;
- provide broadband service providers and equipment vendors with test-bed opportunities to trial new equipment, test cross-vendor interoperability, and to showcase new innovations;
- establish an Industry Partner Program that provides partners with a range of benefits, and provides a neutral ground where companies and researchers can discuss and debate issues relating to the national Broadband network.

a. *Can you elaborate on any achievements made to date?*

Answer: The Institute was launched on July 24, 2009. The Institute is currently in its establishment phase, and activities to date have primarily been associated with hiring staff, planning and building the test-bed laboratory, establishing relationships with members of the Industry Partner Program, forming an Advisory Board, and building research programs through internal planning workshops. There are currently approximately University of Melbourne100 researchers who have indicated a desire to be participate in the IBES research program. IBES is currently managed by an executive team of 11 senior academics form fields as diverse as Media and Communications, Economics, Education, and Medicine. In an ongoing activity in the University of Melbourne's Centre for Ultra-Broadband Information Networks (CUBIN), which is now a part of IBES, researchers have developed an engineering cost model for the rollout of the NBN. The model uses Geomatic Information System (GIS) data and is currently being applied to a number of regions of Australia. Details of this work are subject to commercial confidentiality.

b. *In a recent article in Computerworld (28 Sept) you stated that: "Researchers and vendors will be able to test their applications and equipment on a fully operational model of the NBN within two months." Can you detail the operational model being used by IBES and why that model was chosen?*

Answer: We hope to launch the IBES test-bed laboratory in about two months (although ongoing building delays are likely to shift the timeframe somewhat). The test-bed laboratory will initially be restricted to passive optical network (PON) equipment and will focus on the performance of PON equipment under load. We will also be investigating the performance of long-reach PON technologies under development in CUBIN. Over a period of about one or two years, the test-bed will be expanded to include a model of a metro and core network that will provide end-to-end interconnection between two or more PON's. This approach to development of the test-bed laboratory will ensure that the hardware and software used in the test-bed is in alignment with the hardware and software to be used in the NBN, so that it becomes an effective tool for development and demonstration of new service initiatives.

c. *Can you detail planned research and initiatives for the next few years?*

Answer: As pointed out earlier, IBES researchers are currently putting together a detailed research strategy. A series of internal workshops and other planning activities, together with inputs from members of the Industry Partner Program has led to the establishment of five main research themes as follows:

- Education and Learning
- Health and Wellbeing
- Social Infrastructure and Communities
- Service and Business Transformation
- Network Deployment and Economics

Additional information about these themes is on the IBES website (www.broadband.unimelb.edu.au). Research plans for each of these themes are being developed. The general intent of all projects will be to encourage and support the development of applications and to exploit the capabilities of the NBN for the benefit of the community.

4. *How does IBES differ from CUBIN?*

Answer: CUBIN was established in 2000 as an Australian Research Council (ARC) Special Research Centre. The ARC funding came to an end in 2008, but CUBIN continues on a much-reduced budget. The objective of CUBIN is to develop wireless and fibre technologies for broadband. All staff members in CUBIN are members of the Melbourne School of Engineering and all students are students in the same School. IBES is one of the University of Melbourne's Interdisciplinary Research Institutes. Like other Research Institutes at the University of Melbourne, the objective of IBES is to promote and facilitate interdisciplinary research across schools and faculties in the University. IBES has the special objective to undertake research aimed at maximizing the benefits of broadband to society. In essence, IBES is an umbrella organization that covers all research in the university that is related to broadband and society. In the University of Melbourne structure, some institutes include a number of specialized centres. At present there are two centres within IBES – CUBIN, and a newly planned Centre for Health Informatics. Other centres may follow in the future.

5. *How will you ensure that the efforts of CUBIN and IBES are not duplicated, and in fact can leverage each others results to facilitate optimal outcomes for the NBN?*

Answer: As explained above, CUBIN fits under the broad umbrella of IBES. IBES is a broad interdisciplinary institute, and CUBIN represents a group of specialists within IBES. Duplication is not an issue. The beauty of this structure is that through IBES, the specialists in CUBIN will be brought closer to researchers from a diverse range of backgrounds. This will facilitate optimal outcomes.

6. *What are your views on the appropriateness of the proportion of 10 per cent of homes, schools and businesses being serviced by a combination of wireless and satellite technology?*

Answer: Our work on the engineering cost model referred to above shows us that there is a cost-benefit trade-off. The cost of fibre deployment per user rises rapidly as the population density decreases.

   a. *What degree of flexibility in this proportion should the Government contemplate when considering the needs of individual communities?*

Answer: Some flexibility is possible, but ultimately costs will drive the final decision.

7. *Your website has an interesting quote that raises a couple of new research issues:*

   a. *Can you expand on your comment that there are 'possible limitations on Internet growth due to power dissipation in high-capacity routers' and how this risk could be factored into the design and build of the NBN?*

Answer: My group has been researching the energy consumption of the Internet for a number of years. We carried out the world's first detailed study of energy consumption of the Internet and showed that power consumption in high-capacity routers is an issue. Fortunately, this has recently become a mainstream research topic and industry is paying a lot of attention to developing newer generations of energy-efficient router. Our recent work has shown that with appropriate design, the NBN will be able to grow without power consumption in routers becoming a major problem.

   b. *Can you also further explore your comment that: 'recent research has led us to question assumptions underlying the accepted evolution of the all-optical Internet.'*

Answer: The "all-optical Internet" is a term used in the optical fibre research community to refer to an imaginary future network that uses no electronic components for the transmission and switching of data. In the view of some researchers, electronic chips will be replaced by optical chips. For many years, this futuristic picture has been the "holy grail" of some sections of the optical fibre research community around the world. My research group has recently, through peer-reviewed papers, been showing that the all-optical Internet will probably never become a reality. In short, there are some things that electronics can do very well and optics cannot compete. Electronics is very good for switching, but optics is very good for transmission. This is why the fibre-to-the-premises (FTTP) technology to be used in the NBN provides the very best access technology.

c. What implications does this have for the 90% FTTP network the Government has planned?

Answer: The implication is that the structure to be used for the NBN is the very best choice of technology. By using FTTP in as much of the access network as is economically viable, the NBN will deliver a future-proof delivery platform that also consumes less energy than any other technology. And by using modern electronic switching technology in the core network, the network will provide maximum flexibility and upgradability.