Accelerating the digital researcher on the information superhighway

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– PROFESSOR LEON STERLING

THE INTERNET has grown over the past 50 years from a network connecting computer science researchers funded by the US military, to a network connecting two billion people worldwide.

Internet users span all ages, abilities and interests, and the web has equally transformed the world for scientists and researchers. Wikipedia's 3.5 million articles were assembled in less than 10 years. In contrast, the hundred thousand entries for the Oxford English Dictionary were assembled over 100 years. We can tackle problems with a scale and speed previously impossible. The famous Australian mathematician Terry Tao described in a 2009 lecture tour how, over a few days, considerable progress was made on a challenging problem by mathematicians across the world sharing thoughts on a website.

Universities and government are ensuring that the internet's possibilities for transforming the way we work are made available for large-scale research of a global, collaborative nature. The current focus on supporting the use of the internet to facilitate big science started 10 years ago in the UK with advocacy for eScience – the 'e' standing for 'enabling' rather than 'electronic'. In Australia, the term was generalised to 'eResearch' five years ago to cover the complete spectrum of research, including humanities, social sciences, medicine and all branches of science.

The Australian Government supports eResearch. Its Super Science Initiative, announced in 2009, is providing $1.1 billion from the Education Infrastructure Fund. The initiative encompasses critical areas of science including space science and astronomy, climate change, marine and life sciences, biotechnology and nanotechnology. Government investments depend on collaboration between universities, government research agencies, independent research institutes and business.

Capabilities of eResearch include the following: high bandwidth network access to research instruments, data repositories, sensor networks and advanced computational facilities, and to research collaborators worldwide; software applications and services that enable secure connectivity and interoperability between research infrastructure at differing institutions; and tools for developing applications in specific disciplines such as genetics and astronomy.

Perhaps the largest driver for the prominence of eResearch is the emergence of extremely large datasets in areas including computational biology, astronomy and high energy physics. Some researchers go so far as to say that we now need to think about scientific discovery differently, the case made in a recent book, *The Fourth Paradigm: Data-Intensive Scientific Discovery*, edited by Tony Hey and colleagues from Microsoft Research.

There are many global problems that render essential the ability to absorb, process and analyse large amounts of data – climate change, water quality and accessibility, sustainable agriculture, and even searches for life on other planets. The ability to make genetic sequences available holds open the prospect of personalised medicine. The publication of data for worldwide scrutiny can potentially remove heat from some political issues. For example, there are divergent views on global warming, and ensuring researchers can access data is the best way of advancing understanding. While high-definition videoconferencing makes it possible for researchers from across the world to discuss the datasets in real time.

An interesting aspect of making the datasets available is the possibility of 'citizen science'. There is now a complete map of the night sky available for all to ponder. People are conscripted to classify galaxies. In a way, it updates the history of science by enthusiastic amateurs once described by Bill Bryson in *A Short History of Almost Everything*.

Swinburne University of Technology is developing a strategy for eResearch. We are formulating policies and procedures to share data generated from our research across the world (in a way that still means the research is acknowledged and intellectual property protected). While we lead eResearch in astronomy – and to a lesser extent in brain sciences – other areas of our research will benefit from the strategy. It will lead to investment in eResearch infrastructure such as mass data storage and high-speed networks. Improvements in access to data and knowledge will assist our researchers to conduct and disseminate their research more creatively, efficiently and collaboratively.