

## Case study: Understanding global market dynamics requires global network reach



### INWA Grid: Analysing local socio-economic behaviour in the context of global markets

In an ever more competitive and volatile global economy, access to information is key to innovation and competitiveness. Insights into market behaviour enable new opportunities to be identified and competitive advantage to be created and maintained.

Social and economic sciences play a vital role in improving knowledge management and decision-making in business strategy and government policy. From the collection and analysis of data on society's behavioural patterns, they can provide invaluable insights into population dynamics and market trends. Viewing these conditions from a regional as well as a global market perspective, allows the same underlying data to inform decisions made by a local councillor as well as a business executive.

The INWA (Innovation Node: Western Australia) Grid project demonstrates how a high-capacity intercontinental data network infrastructure can meet the needs of collaborative socio-economic science in an increasingly interconnected world. It joins China, the United Kingdom and Australia in a grid of data, processing power and human expertise. Using grid technologies deployed over the pan-European GÉANT2 network, the Asia-Pacific TEIN2 backbone and the Sino-European ORIENT link, the project helps researchers understand regional socio-economic behaviour in the context of global markets.

### Meeting the needs of global collaborative socio-economic science

Today's globalisation of consumer markets has had a profound effect on the global economy and consumer spending patterns have changed dramatically. Economists therefore recognise the need for international collaboration in analysing socio-economic activity in order to capture consumer behaviour on a global scale. The INWA project was initiated to use the Grid for secure aggregation of dispersed commercial data, to collaborate with local experts on understanding the underlying behaviour, and to distribute the computing power required to model and hence predict that consumer behaviour into the future.

The project's full title is 'Informing Business and Regional Policy: Grid-enabled Fusion of Global Data and Local Knowledge'. It brings together interdisciplinary researchers at the University of Edinburgh (EPCC and University of Edinburgh Business School), United Kingdom, Curtin University of Technology (CBS) in Perth, Western Australia, and the Chinese Academy of Sciences (CNIC) in Beijing, China. The aim for the consumer behaviour data, derived from the customer databases of large telecommunications and financial services organisations, is to help understand the demand in highly volatile services-based markets, in turn helping participating companies to better meet customer needs and identify latent demand. This will contribute to the maintenance of consumer spending cycles and help foster a healthy economy with positive effects on employment and competitiveness.

Until recently, accessing large datasets for data mining and subsequent analysis from either of the INWA nodes in Australia and China would require data transport back to Europe via the USA. However the distance in which this data had to travel across long-haul TCP/IP networks reduced the efficiency with which the data and computational resources could be used together, and hence the responsiveness of the overall INWA Grid. The effectiveness of the collaboration was limited by network characteristics such as bandwidth and in particular latency, directly reducing the all-important 'time to observation' that is the objective of such eSocial Science collaborations.

It soon became clear to the teams involved that greater capacity or bandwidth alone was not the limiting factor, as computations may sometimes be waiting for very small sets of data queried from a distant database. The objective is to get that piece of data across the global network as rapidly and reliably as possible between the research centres spread across three continents. The TEIN2, GÉANT2 and ORIENT networks were available to facilitate this. TEIN2 is the first large-scale research and education network across the Asia-Pacific region, which provides direct connectivity to the pan-European, multi-gigabit GÉANT2 network. ORIENT creates a high speed, direct network connection linking Europe and China.

With the migration of INWA to TEIN2 and ORIENT, data traffic to and from Europe is no longer routed via the USA, but passes through the shortest possible network routes. Using this high-capacity network infrastructure, the INWA Australian and European research groups can now connect directly to China and to each other across Eurasia. This has reduced fragmentation and latency and significantly increased the performance of this e-social science collaboration. "Networks that travel over long distances often have a negative impact on the throughput performance of data sent over the network. The longer the distance, the greater the negative impact. Taking a path with TEIN2, which is around half of the distance of the original path, not only reduces the distance related element of the time taken to transfer data, but reduces the impact of packets of data being lost on the way," said George McLaughlin, coordinator and developer of the TEIN2 applications and collaborations framework.

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Using the GÉANT2 and TEIN2 links enables each node to receive vital data queries and the results of intermediate computations at a fraction of the speed it previously took. The TEIN2 topology gives the shortest possible transport route from the Asia-Pacific region and so it made sense to utilise these networks to enhance INWA's performance

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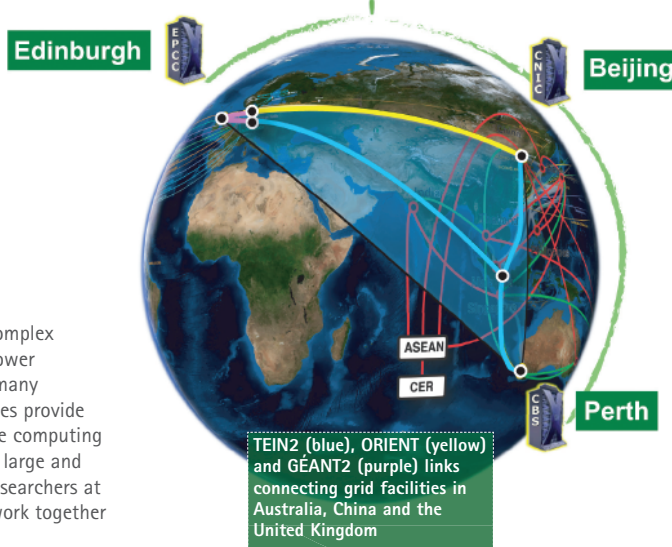
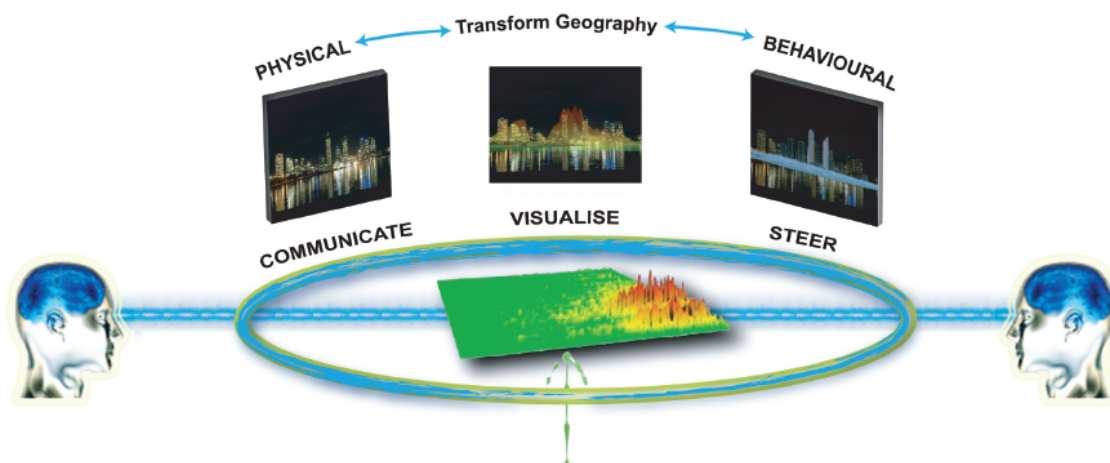
Professor Ashley Lloyd, Curtin University and Principal Investigator, University of Edinburgh Business School



Photo: Robert Frith / Acorn Photo Agency



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Visualisation by A.D. Lloyd. Earth texture provided by NASA. Network links include abstractions from GLIF graphics. Head provided by NIH.

### Embracing intercontinental grid technology

Data mining and generating complex models require a computing power which is beyond the reach of many organisations. Grid technologies provide access to the high performance computing facilities needed for modelling large and dispersed datasets, enabling researchers at spatially remote locations to work together interactively.

The INWA project went live in 2003 between the UK and Australia. It was extended to the Chinese Academy of Sciences in January 2005. Modelling and understanding market dynamics within the most rapidly developing economy in the world provides a number of valuable outputs but also allows a single, giant Grid infrastructure for collaborative eResearch across three continents to be tested and developed.

### Challenge and solution

Until June 2007, all INWA grid traffic between the participating European sites and those in China and Australia was routed the long way round the world via the United States. By this time, DANTE, operator of GÉANT2, was in the final stages of deploying TEIN2 and ORIENT with direct links to GÉANT2. This offered an alternative that is less than half the distance of the previous US routing and therefore significantly reduces latency and improves overall performance of this virtual collaboration.

Professor Depei Qian, Chief Scientist, China National Grid commented:

*"Without the combination of knowledge from researchers across the globe and the computational capacity to model and validate behaviour during our collaborative sessions we wouldn't be able to steer the modelling process as effectively and hence predict accurate behavioural trends. With the INWA Grid combining data, computation, and expertise across three continents, the advent of TEIN2 provides the most direct link for our collaboration between Australia, China and the UK and the capacity to send and receive vast amounts of crucial data across the world in seconds. This will help us create clearer global patterns with distinctive contrasts between regions, and is a significant milestone in INWA's development."*

Enabled by the global reach of the underlying network infrastructure, the INWA project is testament to how technology is shaping society today. It bridges the academic and commercial sectors and helps ignite innovation, enhance competitiveness and contributes to a healthy economy in an ever more globalised world.

*This document has been produced with the financial assistance of the European Union. The contents of this document are the sole responsibility of DANTE and can under no circumstances be regarded as reflecting the position and opinions of the European Union.*

### Find out more

To learn more about global research and education networking, visit:  
<http://global.dante.net>  
[www.tein2.net](http://www.tein2.net)  
[www.geant2.net](http://www.geant2.net)

To find out more about INWA please visit:  
[www.epcc.ed.ac.uk/inwa](http://www.epcc.ed.ac.uk/inwa).

DANTE is a non-profit organisation that operates the GÉANT2 network and manages the TEIN2 and ORIENT projects. Further information about DANTE and its activities can be found at [www.dante.net](http://www.dante.net)

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