



GÉANT and DECIDE: Improving quality of life for sufferers from Alzheimer's Disease

Using advanced networks and grid computing technology to enable earlier diagnosis and faster treatment for patients

Dementia – the growing challenge for healthcare

Over 35 million people around the world suffer from a form of dementia, with 7.3 million in Europe alone. This number is predicted to double over the next 20 years to 65.7 million sufferers by 2030.

With no current cure for dementia conditions such as Alzheimer's Disease and schizophrenia, the medical focus is on earlier diagnosis, which dramatically improves the quality of life for both patients and their carers, as well as research into the causes and prevention of these crippling diseases.

However early diagnosis is often difficult, as many of the symptoms of Alzheimer's can be confused with common signs of aging. A user-friendly way to help make an informed diagnosis is therefore vital.

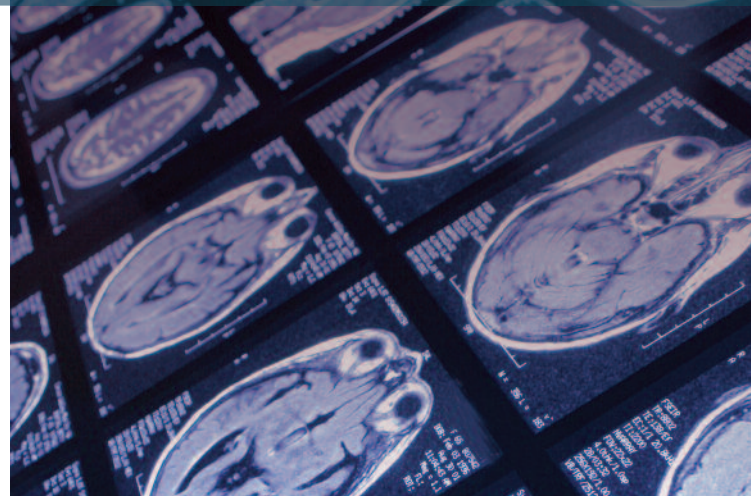
To achieve this clinicians need to analyse the rapidly increasing amount of patient data, such as medical images from Positron Emission Tomography (PET), Magnetic Resonance Imaging (MRI), Computerised Tomography (CT) and Electroencephalography (EEG) scans, and compare it with large reference databases. This will allow doctors to spot diagnostic markers for the disease, providing them with the tools to help make informed, early diagnoses.

DECIDE – making early diagnosis a reality

These increasingly detailed medical scans help provide better information on patient conditions, but consequently create ever growing volumes of data. Every PET scan is at least 1 gigabyte of data, and has many different parameters to analyse in order to complete a diagnosis.

This means that the computing power needed to compare scans to help diagnosis has traditionally been costly and complex. The ground breaking Diagnostic Enhancement of Confidence by an International Distributed Environment (DECIDE) project aims to solve this issue and make early Alzheimer's diagnosis straightforward, secure and available to doctors irrespective of location. DECIDE brings together the power of research networks, distributed databases, powerful diagnostic algorithms and grid computing to provide a secure, user-friendly service to clinicians across Europe.

At the heart of DECIDE is a grid-based e-infrastructure which links powerful computing resources across Europe through high speed,



The Challenge

Worldwide, dementia is one of the fastest growing medical conditions, with 65.7 million global sufferers predicted by 2030. With no current cure for conditions such as Alzheimer's Disease earlier diagnosis is critical to improving patient care. However spotting diagnostic markers for the disease requires high speed access to medical databases and intense processing power in order to compare patient imaging data, which are often beyond the computing resources of individual hospitals.

The Solution

A unique infrastructure of powerful computing resources, high speed networks and international databases that enables clinicians to quickly upload, analyse and compare medical imaging data, enabling informed diagnoses.

Key Benefits

By making advanced, simple to use diagnostic tools available to clinicians across Europe, DECIDE enables faster diagnosis of Alzheimer's and consequently improved patient care.

reliable research networks. By using the capabilities of the pan-European GÉANT network and National Research and Education Networks (NRENs), alongside their own networks, the whole process will be straightforward for clinicians. They will simply turn on their PC, access the DECIDE portal through their web browser, upload the biomedical images of the patient and, by a simple click, let DECIDE handle the processing, extracting any markers from the data that demonstrate the onset of Alzheimer's. If specific markers match, faster, more confident and crucially earlier diagnoses can be made, helping deliver major improvements in patients' lives. Prior to DECIDE doctors would not have had the tools or resources to quickly carry out this level of analysis themselves as it required a level of infrastructure that was too complex or costly for individual hospitals to provide.

"A new case of dementia develops every 24 seconds in Europe, showing its steady increase and in 2008 alone, the total cost of caring for dementia patients was estimated to be €160 billion," said Jean Georges, executive director of Alzheimer Europe. "Because of Europe's ageing population and increasing pressures on public finances, dementia will be one of the major challenges for national health systems moving forward. Projects such as DECIDE that improve and facilitate early diagnosis are therefore welcome in improving the lives of sufferers and carers."

neuGRID – the Google for brain imaging

DECIDE, which is funded by the European Union under the FP7 programme, is an international project that brings together partners from across Europe. It builds on the pioneering neuGRID e-infrastructure, which was designed specifically for scientific research into Alzheimer's and other neurodegenerative brain diseases. In neuGRID, the collection/archiving of large amounts of imaging data is paired with facilities and services to provide a virtual imaging laboratory that can be accessed by any scientist with a PC and a web browser. For example, by comparing over 6,000 medical imaging scans from 715 patients, neuGRID successfully found and extracted a promising biomarker that tracks Alzheimer's disease progression in a record time of two weeks.

Making diagnosis simple for all

Essentially DECIDE extends neuGRID, enabling doctors and researchers to access its databases and computing power through an easy to use, secure service tailored to their needs. As it is a grid-based infrastructure they do not need to invest in additional computing resources – it can be used through any PC with a network connection within a hospital or surgery.

Grid computing relies on high speed networks that can link large amounts of processing power together, seamlessly and reliably – currently DECIDE has over 1,000 CPU computing processors with 70 terabytes of storage. Consequently DECIDE has worked in partnership with the pan-European GÉANT network, as well as Italian national network GARR to design a network that matches its needs.

"The neurological data that researchers and clinicians collect is dramatically increasing, meaning that managing and analysing this information is becoming more and more difficult and expensive," said Laura Leone, DECIDE project co-ordinator. "DECIDE will ensure that the diagnostic process is much more straightforward and simple, using distributed computing resources and the power of the GÉANT network to create an advanced e-infrastructure that spans the entire European medical community. Once it is rolled out it will help clinicians make better informed decisions, delivering a positive impact on patient care when it comes to conditions such as Alzheimer's Disease."

There are a wide variety of local networks involved in healthcare – including commercial providers that provide connectivity to hospitals and national research networks that link universities and research centres. GÉANT works with all of these and provides support that is customised to their particular needs, meaning they are all able to use the resources they have to best advantage. To make it seamless and transparent to the end user, GÉANT's perfSONAR MDM monitoring tool is currently being used to monitor service across the multiple network domains that make up the DECIDE infrastructure.

Rolling out the service

While the project only began in November 2010, progress has been swift. The first version of the service, based on Statistical Parametric Modelling (SPM) techniques, was validated and tested in the first half of 2011 prior to wider release. The researchers are also developing other diagnostic algorithms to search for new markers within the DECIDE infrastructure, such as the GriSPM algorithm evaluating brain metabolism and perfusion as well as co-operating with projects outside Europe. Looking longer term the infrastructure could be extended to cover algorithms relating to other diseases of the brain and other organs, involving the whole life science research community.

connect • communicate • collaborate

GÉANT is the pan-European data network dedicated to the research and education community, built and operated by DANTE. Together with Europe's national research networks (NRENs), GÉANT connects 40 million users in over 8,000 institutions across 40 countries and supports research types as diverse as medicine, climate change and performing arts.

GÉANT and national research networks provide DECIDE with the high quality, reliable and high speed connections to allow easy access to distributed computing resources and information databases. This helps clinicians across Europe make more informed diagnostic decisions, improving patient's lives.

For more information:

DECIDE: <http://www.eu-decide.eu/>

neuGRID: <http://www.neugrid.eu>

GARR: <http://www.garr.it>

GÉANT: www.geant.net

