An Example of eResearch: The Australian Schizophrenia Research Bank - ASRB

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Schizophrenia

- A mental illness characterised by
  - Complex clinical symptoms
  - Cognitive deficits
  - Subtle structural brain changes
- Prevalence of 4 per 1,000 sufferers
  - But by its nature the illness it also affects family, friends & acquaintances
- Monetary cost to the community is ~$40,000 per patient per year
- E.g. the Russell Crowe movie *A Beautiful Mind* (Nash), recent tragic publicity

Research Into Schizophrenia

- Investigation of life history, environment, etc
- Examination of brain morphology
  - Until recently only possible after subject had died
  - Now possible using MRI and fMRI technology
- Study of genetic characteristics
  - Typically involves analysis of blood samples
- Until recently involved disparate teams individually collecting and studying samples and data
Support for ASRB

- Initial support for unified study provided by ARC Special Research Initiatives Grant: "A software grid for data-sharing associated with the NISAD/LONI Virtual Brain Bank", 2005/06
- Major support provided by NHMRC Enabling Grant: "Australian Schizophrenia Research Bank", 2006-2010
- Several smaller NHMRC grants 2007, 2008, 2009
- Other financial support from The Pratt Foundation, Ramsay Healthcare, and Perpetual Trustees
- Administered and financially supported by Schizophrenia Research Institute (SRI)
- In-kind support INTERSECT: “ASRB – Web Interface and Tools”, 2009-2010
- Many other supporters (including John Singleton & Russell Crowe)

Purpose of ASRB

- Shortage of patients and case-matched controls, characterised in terms of
  - Clinical
  - Cognitive
  - Neuro-anatomical evaluations
- Will provide a bank of data (initially 2,000 subjects & 2,000 controls):
  - Clinical & cognitive assessments
  - Genetic data
  - MRI brain scans
  for use by national and international researchers
**Who Is ASRB?**

- Administered by SRI
- Led by scientists based at the University of Newcastle
- Collaboration with scientists at University of Melbourne, University of NSW, University of Queensland, University of Western Australia, Schizophrenia Research Institute

**What Is ASRB Doing?**

- Clinical Assessment Officers (CAOs)
  - Conduct a comprehensive clinical assessment of each participant to collect
    - Socio-demographic & clinical history schedule
    - Neurological, personality & cognitive function evaluations
    - Psychosis screening tool representing a combination of the instruments currently used by prominent researchers in the field
- Technicians conduct MRI scan
- Qualified personnel extract blood samples
- *Compliance with multi-level Ethics conditions is essential*
How is ASRB Data Collected?

- CAOs conduct the (previously paper-based) assessments using purpose-built software on tablet computers
- A web portal allows upload of the data to a central database located in Newcastle
  - The data is then removed from the tablet
  - The ASRB web-site facilitates subsequent access to the data
- MRI data is transported to Newcastle on CD
  - Processed to de-identify and normalise, then stored on the central server
- Blood samples are stored under refrigeration
- Complex rules govern right to access

Initial Technology

- PostgreSQL RDBMS on server and PCs
- Data described in XML
- CA software written in Java
  - So can execute on Windows-based PCs and Unix-based server
- JSP aligns software screens with database fields
- Transport Layer Security and Secure Socket Layer certificate ensures security of data transfer
- Server access is controlled by Globus 4 grid
- Portal framework is Gridsphere with GridPortlets used to access the grid
- PURSe portlets abstract over certificate management for users
New INTERSECT-Implemented Application Software & Frameworks

- Java and PostgreSQL (v 8.3) as before
- Apache Tomcat servlet engine (http://tomcat.apache.org)
- Liferay enterprise open source portal (http://www.liferay.com) - ASRB Server
- Apache Pluto portal (http://portals.apache.org/pluto) - CAS Laptop
- Spring JEE application framework (http://www.springsource.org)
- Spring Security authentication and security framework (http://www.springsource.org)
- Hibernate ORM persistence framework (http://www.hibernate.org)
- jQuery JavaScript and Ajax library (http://jquery.com)
- Several other Apache and other open source libraries and frameworks

New INTERSECT-Implemented Technologies & Techniques

- Dependency Injection (Inversion of Control) for run-time deployment
- MVI (Model-View-Controller) pattern for the UI
- Java Persistence API (JPA) for data persistence
- Java Architecture for XML Binding (JAXB) for XML processing
New INTERSECT-Implemented Products & Technologies for System Construction

- Eclipse IDE (http://www.eclipse.org)
- Subversion code revision control system (http://subversion.tigris.org/)
- Apache Ant build tool (http://ant.apache.org)
- JUnit test framework (http://www.junit.org)
- EasyMock mock object library (http://easymock.org)
- Hudson continuous build and integration server (http://hudson-ci.org)
- Atlassian Jira issue tracking system (http://www.atlassian.com/software/jira/)
- Atlassian Confluence enterprise wiki (http://www.atlassian.com/software/confluence/)

Current State of Development

- New INTERSECT system:
  - Testing with (copy of) real data will commence shortly
  - Deployment planned before end of year

- ASRB Data collected as of 6 weeks ago:
  - 434 Cases: 288 male (66.4%); 146 female (33.6%)
  - 248 Controls: 118 male (47.6%); 130 female (52.4%)
  - Average age: 39.8 for cases; 37.7 for controls
  - > 12 years education: 12.9% for cases; 15.4% for controls
  - Average age at onset: 23.0 for males; 25.2 for females

- INTERSECT demonstration follows this session
Use of ASRB for Research

• Integration of previous SRI Register and ASRB recruits to form ASRB Register
  – Several approved studies currently recruiting using the Register

• From June 2009 CIs started accessing subsets of the data for conduct of studies
• Access will shortly open to other researchers
  – Australian in July 2010
  – International in July 2011