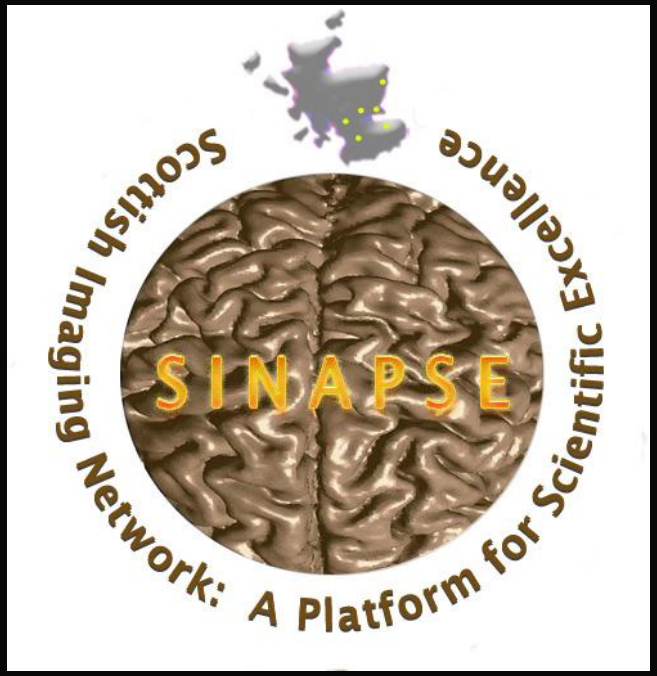
SINAPSE



Scottish Imaging Network: A Platform for Scientific Excellence

*NHS and Universities: **IT**'s better together*

Dr Trevor Carpenter - SFC Brain Imaging Research Centre

SINAPSE

UNIVERSITY OF ABERDEEN

UNIVERSITY OF DUNDEE

St Andrews

UNIVERSITY of STIRLING
INNOVATION and EXCELLENCE

THE UNIVERSITY OF EDINBURGH

VIA VERITAS VITA

SINAPSE

The Hardware:

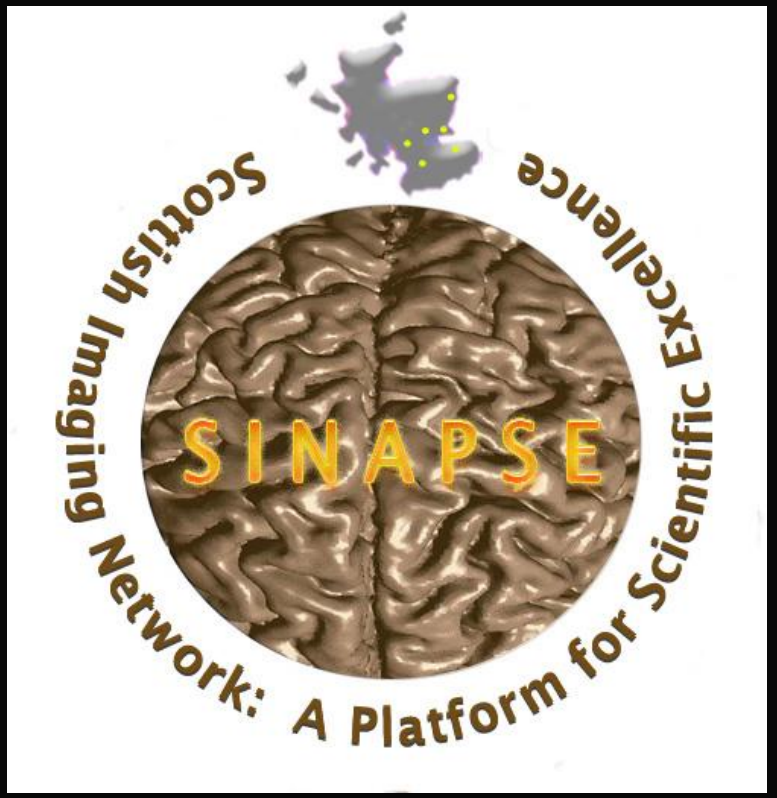
MRI
PET/SPECT
EEG/EMG/MEG

The Firmware:

Massively Parallel Computing
Distributed Storage (~100's TB)

The Software:

Staff
Shared Expertise
Training
Patient Benefit
Increased Research Capability



SINAPSE – Developments

Clinical Research Networks :

- Stroke
- Dementia - DeNDRoN
- Mental Health
- Diabetes
- Paediatrics
- Oncology

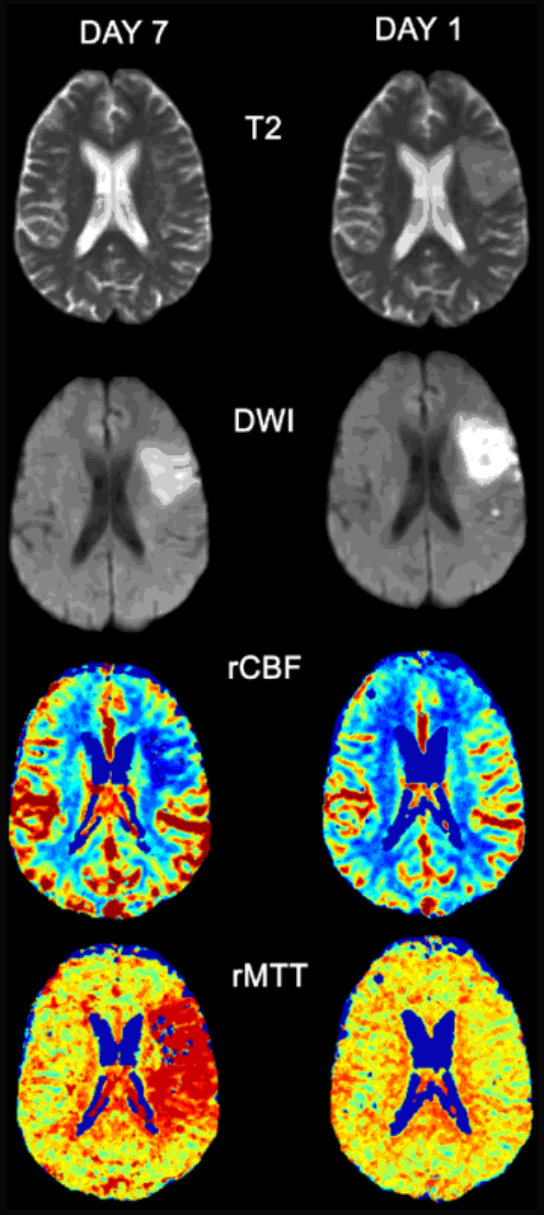
SINAPSE will provide a “backbone” of imaging expertise to the Clinical Research Networks

SINAPSE – Multi-Centre Imaging

Acute Stroke

- Wyeth Funded multi-centre trial
- Define imaging markers of ‘Salvageable’ tissue
- Aberdeen, Edinburgh, Glasgow
- Imaging on University and NHS modalities
- MRI and CT data sets.
- Net based subject and image submission
- Image transfer to Edinburgh for analysis
- Remote reporting via distributed application

Improved Diagnosis & Patient Care



SINAPSE - Widest range of benefits

Procurement of:

- four PET CT scanners
- several MR scanners
- EEG and MEG equipment

Considerable opportunities for research collaboration with NHS and Industry

SINAPSE – Subject Groups

Who do we acquire imaging from:

- NHS Patients
  - Service provision to NHS
- NHS Patients in Research study
  - Relevant data transferred to NHS
  - Informed consent obtained
- Volunteers
  - Assumed ‘normal’
  - Informed consent obtained

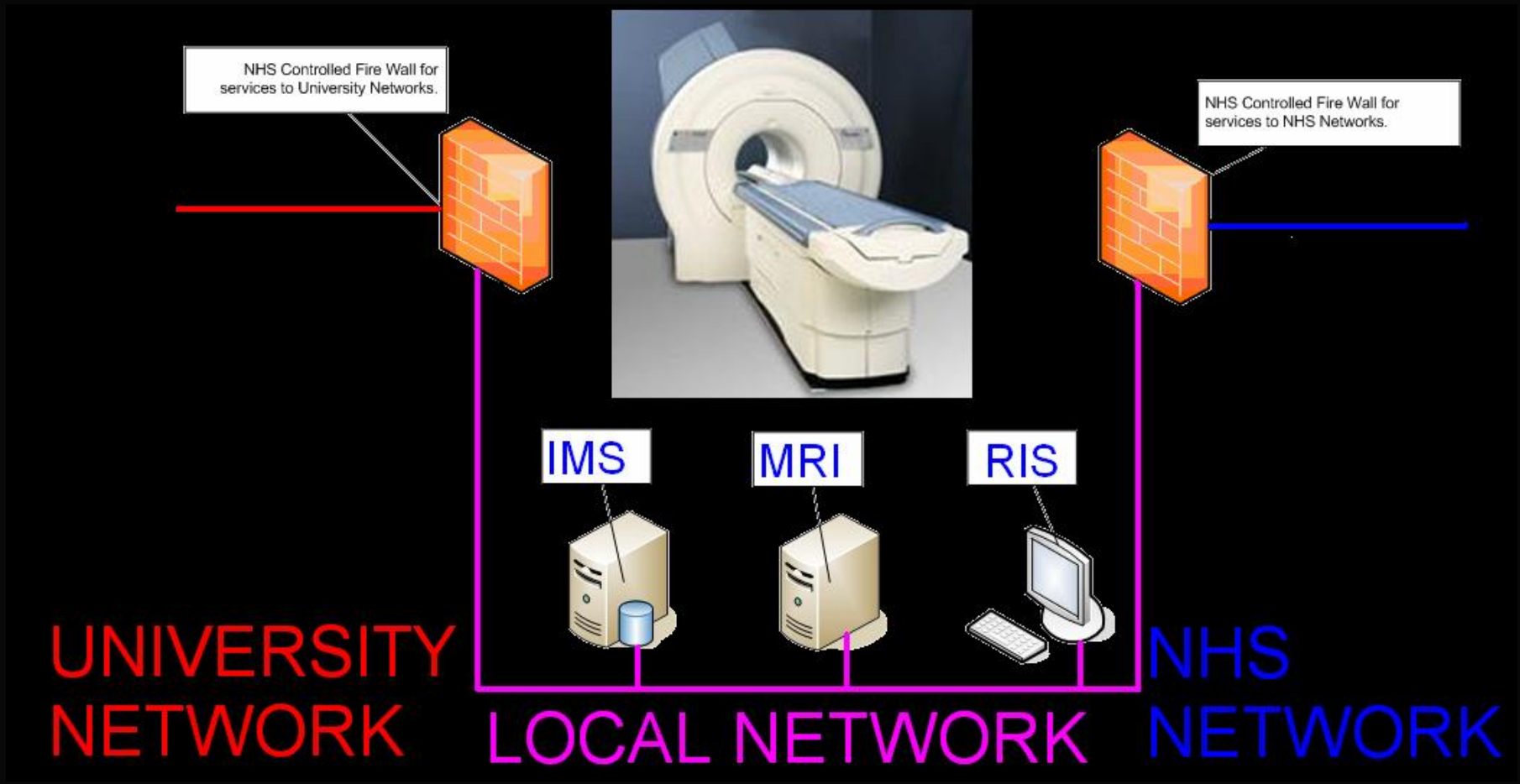
SINAPSE – Data Protection

- NHS Patients
  - Imaging acquired under ‘contract’
  - Key Staff have honorary NHS contract
  - NHS is Data Controller
  - imaging data and patient details not retained
- NHS Patients in Research study
  - Study covered by research ethics approval
  - Who is Data Controller?
  - Imaging data retained by University
- Volunteers
  - Study covered by research ethics approval
  - University is Data Controller
  - Imaging data retained by University

SINAPSE – Reporting

- All Participants
  - A radiological report is issued for **ALL** research scans
  - It is part of the duty of care
  - Associated Imaging is transferred to NHS
- Patients
  - Report sent to relevant clinically competent PI
  - Imaging and Report Inform Clinical management
- Volunteers
  - Incidental findings occur in between 3 and 6% in NHV
  - Report sent to GP or Nominated Clinician

SINAPSE – Local Networking



SINAPSE – Local Networking

Local Network:

Provides to NHS –

- Connection to Radiology Information System of NHS
- DICOM send to NHS PACS
- DICOM Work List and DICOM Modality Step Complete

Provides to Imaging Management System –

- DICOM send & File System Access

Provides to Manufacturer

- Access to Modality Monitoring (ADSL)

DOES NOT PROVIDE –

Passing Messages from University Network to NHS

Sending Data from NHS to University Computers

SINAPSE – Local Networking

Research Imaging Management System:

Provides –

- Restricted Access to Data Based Upon Roles/Identity
- Cataloguing of Data (requirement for freedom of information)
- Logging of Data Access
- Method for inter-site data exchange/reception
- Local data back up

Data is Stored Anonymised

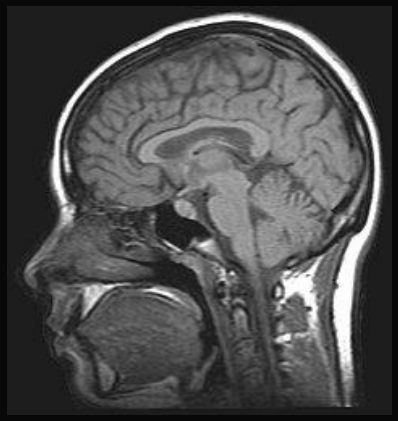
File system is ‘unintelligible’ to Intruder

SINAPSE – Anonymisation

DICOM Medical Images

- Store Patient Identifying Information
- Restrict Access
  - for researcher blinding
  - for data protection reasons
- Two Types of Anonymisation
  - Pseudo (reversible)
  - Total (irreversible)

SINAPSE – Anonymisation



Patient Identifiable

Pseudo Anonymised

Identifiers Unrecoverable

Radiographers

Radiologists

Clinical Scientists

Data Managers

Study PI's

Image Analysts

Administration

Training Data Sets

Case Libraries

SINAPSE – Pseudo Anonymisation

Table Based Approach

- **Overwrites** DICOM entries in files
- Secure (restrict access to table)
- Very risky?
  - lost lookup table
  - ‘crossed wires’ (worse!)

Encryption

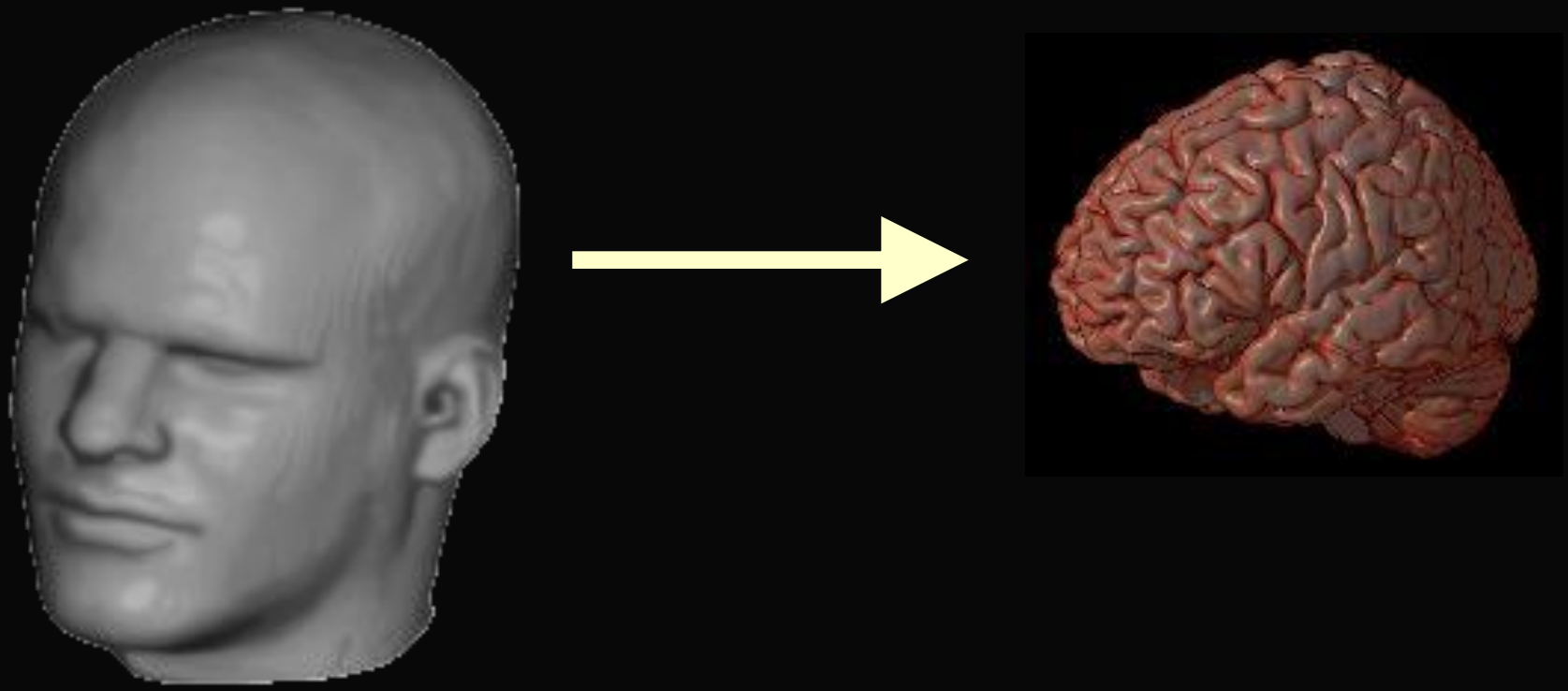
- **Encodes** DICOM entries in files
- secure
- ‘Easy’ to implement
- Uses keys
  - very flexible (different keys for different roles)
    - eg:

Name/Address/CHI	level 0 key
Age/Weight	level 1 key

- Reversible
  - Easier to back up keys than table
  - ‘someone’ can check ID

SINAPSE – Anonymisation

Not as simple as encrypting DICOM tags:



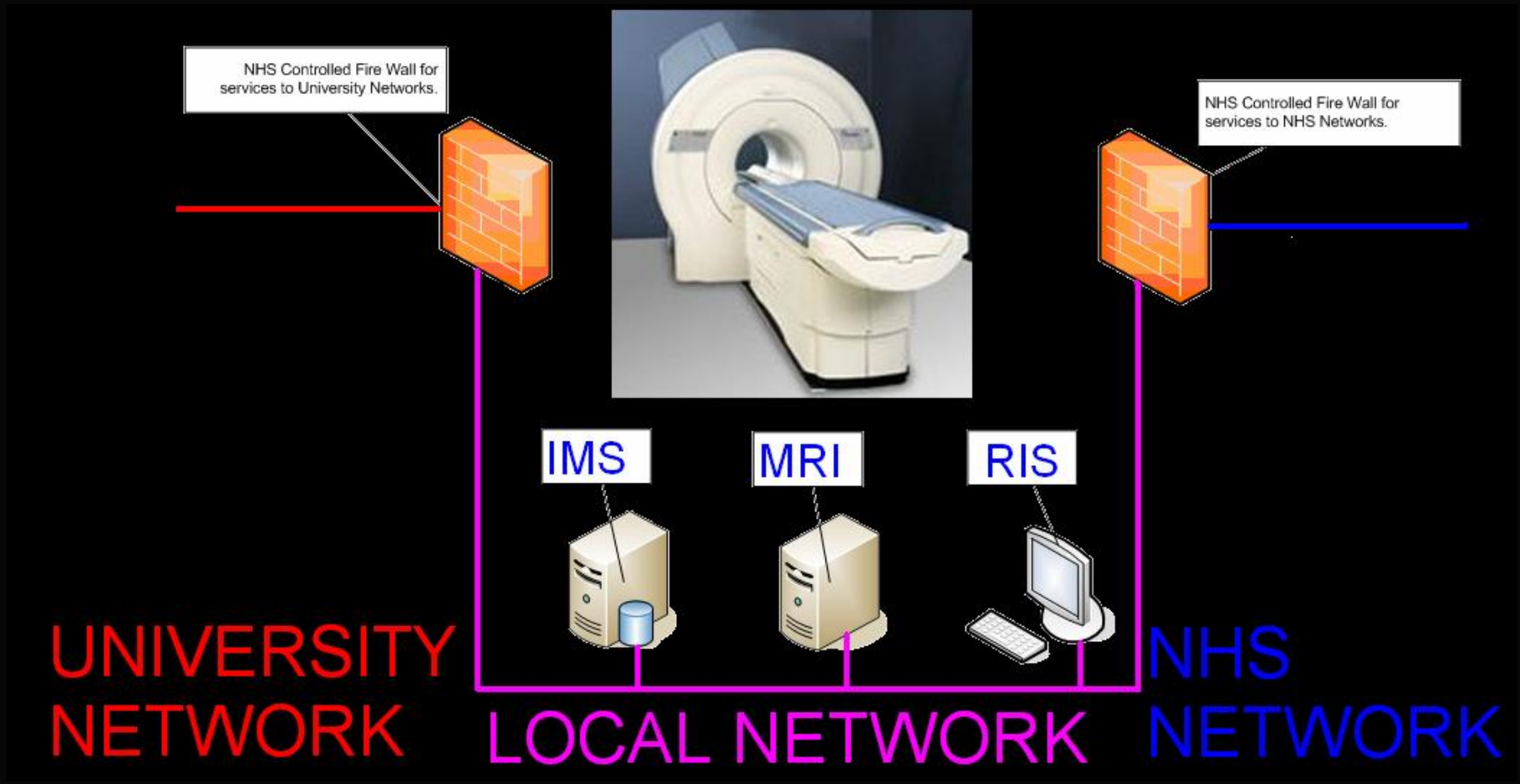
SINAPSE – National Networking

- Connection Between Centres for data exchange
  - Sites Already Connected by UKERNA-JANET
  - All transfers mediated by local/central IMS
- Centralised Storage for Backup and Archiving
  - Provides ‘offsite’ backup with secure transfer/access mechanism
  - Offsite archiving of completed studies
- Access to Compute Clusters (EPCC - NESC)
  - For task farming of large datasets (multi-centre clinical trial)
  - For complex modelling
- Data Libraries
  - For developing image processing
  - Standard Brains (registration targets / tissue class extraction)
  - For e-learning resources / teaching

SINAPSE – National Networking

- Networking issues
  - "Perhaps involving UKERNA would be a good idea?"
    - What is acceptable use in terms of Data Volumes?
    - Where is the 'best' location for the Central services?
- Security issues
  - IMS to IMS transfer
  - Data Access based on roles
  - Data within SINAPSE reversibly Anonymised
  - Data sent to external service fully Anonymised

SINAPSE – Local Networking



SINAPSE – NHS Connection

Local Connections to the NHS:

For RIS

For DICOM Transfer

For Reporting

Not achievable using an N3-JANET gateway or shared applications

The Modalities physically close to NHS network:

- For example:

  SBIRC IN DCN @ WGH

  CRIC NEXT to ERI (~200 m to access point)

  JMS PET Centre IN NM @ ARI

- Use point to point connection into Local NHS networks

  fast

  secure

SINAPSE – National PACS

The National PACS System for Scotland

- Paucity of detailed Technical Information for Planning

BUT (*from what I understand*)

- Uses Work Lists

    Can other imaging be included in the same DICOM study?

- Uses snowMED CT codes

    But no subset for research?

    How will we flag research scans to exclude them audits?

- Data cannot be sent to clean store unless a ‘jacket’ is created on PACS

    Does the RIS create the episode?

- Connection of modality requires ‘provider’ cooperation

    after the initial implementation this is costly (~£2000)?

SINAPSE – Where does IT belong?

…In the past

Computer Scientists have concentrated on encryption

Systems Analysts have implemented databases

Telecommunications Engineers have designed networks

BUT

These are still solutions looking for a problem

…In the grand scheme of things

1. An agreement at national level that there can be a connection to the NHS if it meets all the Legal, Ethical and Security Requirements.
2. The Legal and other requirements are specified
3. These requirements are used to implement the management and working practices for the centres
4. Finally policies and procedures are implemented in IT systems.

SINAPSE

Martin Connell

Elizabeth McDowell

Prof. David Newby

Prof. Joanna Wardlaw

Dr. Andy Welch

Dr. Sam Wilson

Graham Ewing

Ted Boyle

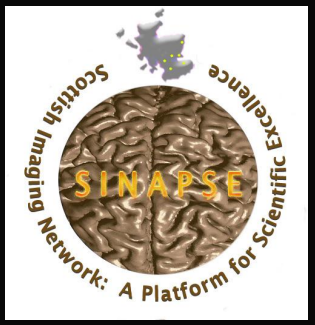
Mandy Creighton

Rod Gibson

Gavin Grieg

James Veitch

SINAPSE



Trevor Carpenter
Research Fellow

Email: trevor.carpenter@ed.ac.uk
Tel: 0131-537-3284

SFC Brain Imaging Research Centre
Clinical Neurosciences
Western General Hospital
Edinburgh
EH4 2XU

SINAPSE

Mission :

A single virtual national clinical imaging research laboratory for 5.5 million people which will be unique in the world

A virtual national training “college” for imaging researchers of the future

SINAPSE - Developments

Scottish Science Advisory Committee
December 2006

Research Excellence in Medical Imaging

1. Need for Scottish imaging strategy to improve links between academia and the NHS to foster fundamental clinical interactions, shared planning of resources (human and hardware) and data processing systems to bridge strategic gaps to catalyse more effective research but also with improved clinical care.