MemRE: Collaborative development of an integrated research environment

Shane Cox[2], Maude Frances[1], Joanne, Croucher[1] Harry Sidhunata[1], Greg Leslie[2]

[1]University Library, University of New South Wales, Sydney, Australia
[2]UNESCO Centre for Membrane Science and Technology, University of New South Wales, Sydney, Australia

Introduction

The Membrane Research Environment (MemRE) is a component research infrastructure project of the Advanced Membrane Technologies for Water Treatment Research Cluster, a research project funded by the CSIRO flagship *Water for a Healthy Country*. The research cluster, a nationally distributed and multidisciplinary group of researchers including computational and physical chemists, physicists, material scientists, and chemical and mechanical engineers, aims to develop novel membrane materials in order to reduce the energy associated with desalination by 40%.

Common hurdles in multidisciplinary research projects include: a lack of consolidation of existing information relevant to the research from all the participating fields; an absence of information infrastructure to promote comparison of results; and the need for a common language to better enable project participants to communicate. MemRE has been designed and implemented as a solution to these hurdles, to provide an integrated research development tool and learning environment.

Development of MemRE

MemRE combines a digital repository with wiki database technology. The repository comprises a web-based search and discovery interface built on a Fedora repository, with a submission form based on VALET. The wiki was built using mediaWiki. The digital repository is designed to capture each stage of the membrane material research process, which comprises of the following step:

Characterisation: determination of specific physical properties, given specific protocols, to provide quantitative comparison across a variety of materials.

Visualisation: collection of images for additional characterisation of the material, providing a more qualitative comparison of materials.

Application: description of various uses and applications where the material has been used, indicating actual performance of the material in real world situations.

Fabrication: description of the apparatus, physical properties and other pertinent data required for replication of the material.
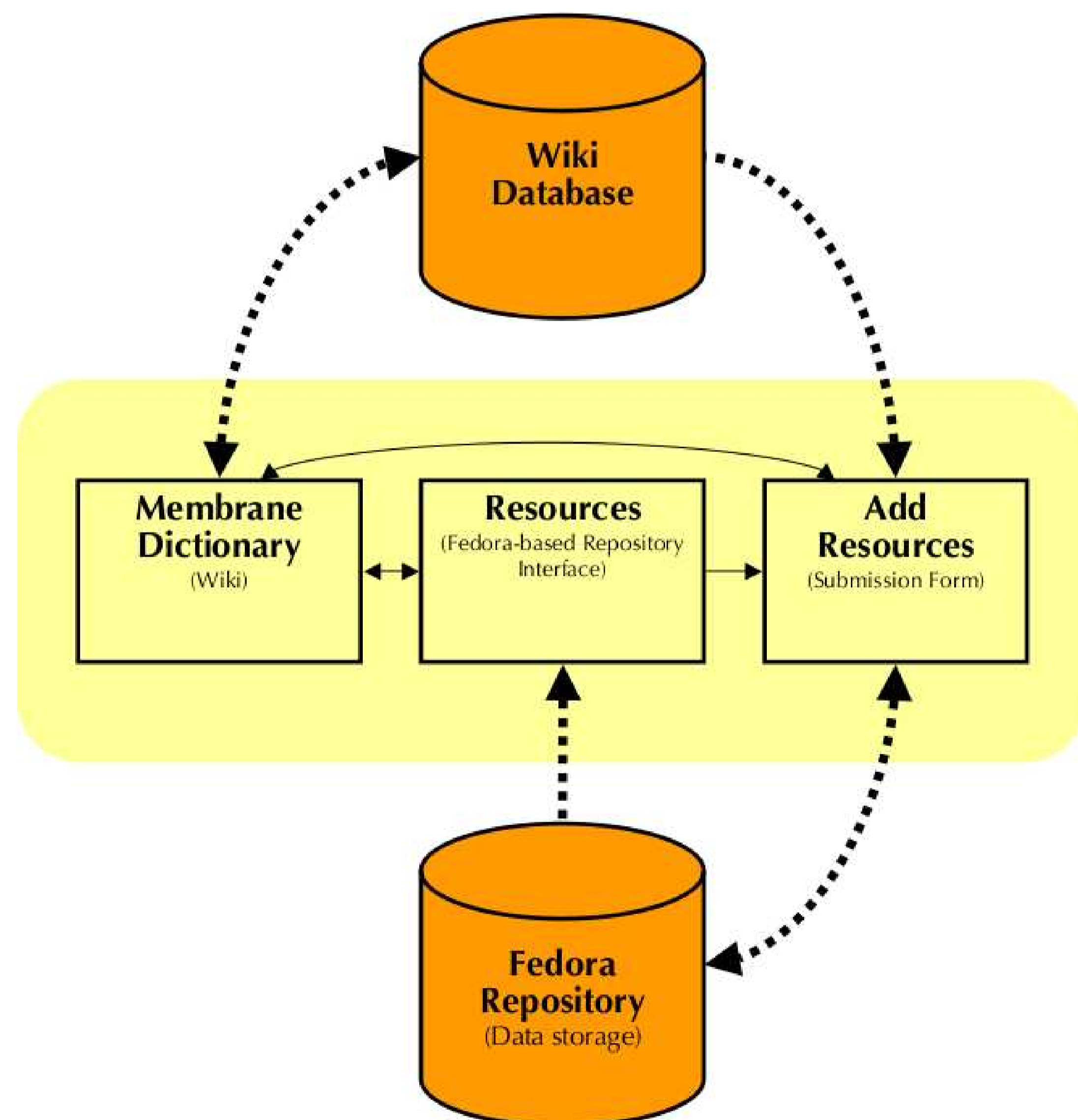

The digital repository comprises two sub-repositories: a publications collection and a materials collection. The publications collection includes journal articles, conference and workshop proceedings, working papers, technical reports and theses. This component of MemRE meets infrastructure requirements relating to **fabrication** and **application.** Information contained in the publications collection is, were possible, directly associated with content in the materials collection.

The materials collection is used to describe specific characteristics of a material, based on various **characterisation** and **visualisation methods.** The aim of this component of MemRE is to provide a standard framework for reporting material properties, which may be compared across various material types.

To provide consistency across material properties entered by various researchers and institutes within the research cluster, a **characterisation** and **visualisation** wiki has been developed as an integrated component of MemRE. The wiki is used to define the properties that are reported and stored in the repository, as well as the various characterisation techniques that may be applied for each method. When a new material is entered into the repository, only those properties and methods that have been described in the wiki are able to be included. Researchers who wish to include a new property must first create an entry for the property in the wiki. By dynamically linking the properties and methods available in the repository with the collaborative environment created by the wiki, the materials collection is able to remain up to date with newly developed techniques.
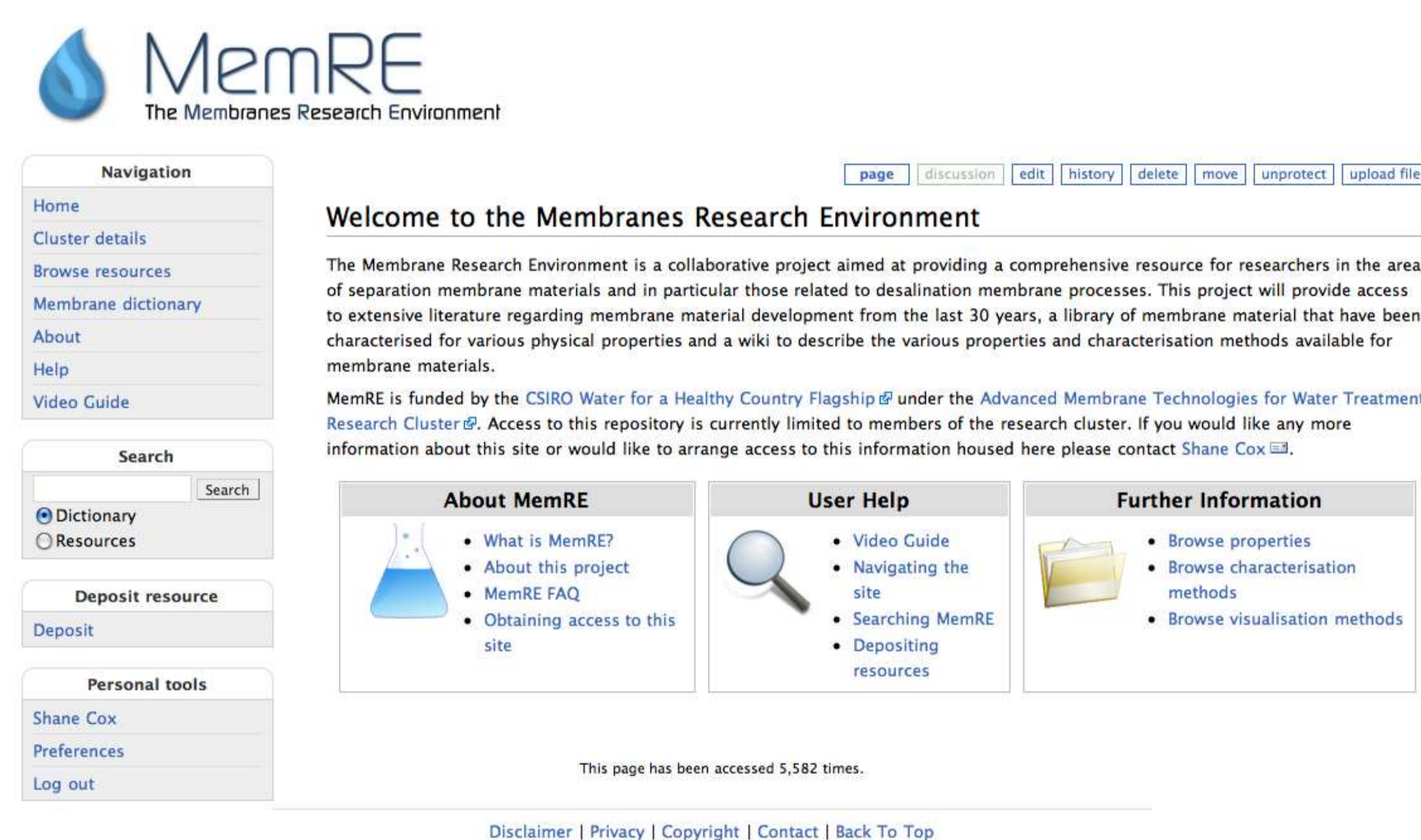
Collaboration and participation

MemRE was developed through close collaboration between the Digital Library Innovation and Development Unit of the UNSW Library and the UNESCO Centre for Membrane Science and Technology. It is a model for research infrastructure development based on collaboration between researchers, systems developers and librarians, throughout the planning, design and implementation phases of the project.

The multidisciplinary Advanced Membrane Technologies for Water Treatment Research Cluster includes partners from nine universities and the CSIRO, all of whom are now contributing to MemRE through the addition of further content i.e. theses, reports and journal articles, and through collaborative authoring of definitions of membrane properties and characterisation methods.

Further Development

Integrate the experimental framework with data storage

Develop protocols to transfer data from laboratory apparatus and equipment to the MemRE materials collection. The new functionality will allow raw source data, exported from equipment such as an atomic force microscope, to be directly ingested into the relevant MemRE collection, to be stored and compared with output values, such as surface roughness or pore diameter. This will enable integration of research data from all stages of the research process. This will also include further application of the existing MatML schema to relate information generated by analytical instruments to characterisation methods in the MemRE materials collection.

Develop an end-user tool to aggregate data and resources

Using the OAI-ORE data model, develop a tool to enable researchers to aggregate specific sets of data and resources, from within MemRE as well as external sources, for re-use in their experiments and other research tasks. This will help the research community with data management throughout the various stages of the research process.

Acknowledgements