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MemRE: An Introduction to the Membranes Research Environment

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Introduction and research context

The Membrane Research Environment (MemRE), is a 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%.

The problem of energy efficient desalination is a common research theme that has been addressed by multiple research groups at different periods over the last fifty years. However, the findings from this research have not been consolidated. The absence of any sophisticated data base or library that promotes synergistic comparison of other membrane separation systems (such as biological models) or operating strategies (such as fouling control) is not conducive to the development of innovative solutions.

Research infrastructure requirements

Requirement to capture the membrane material research comprising:

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.

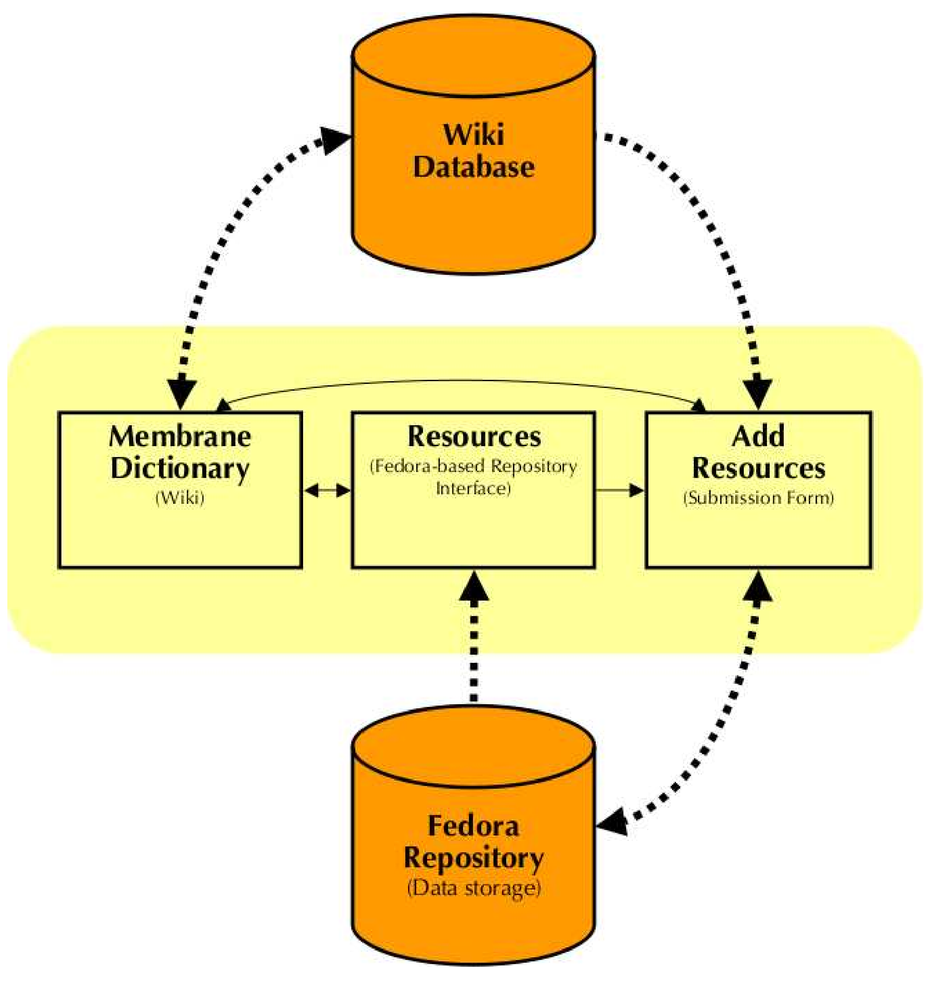
Application: description of various uses and applications where the material has been used, indicating actual performance of the material in real world situations.

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

Requirement for integrated research infrastructure to:

- **accelerate dissemination** of information on the mechanics of desalination by membrane process.
- **identify, refine, aggregate and catalogue** information on techniques for fabrication, characterisation, operation and evaluation of membrane systems in a way that is readily accessible by cluster members during the flagship project and the broader community at the end of the project.

Development of MemRE



MemRE was developed to address infrastructure requirements of the research cluster. It combines a digital repository with wiki database technology. The repository comprises a web-based search and discovery interface based on a Fedora repository, with a submission form based on VALET. The wiki was built using mediaWiki. While access to MemRE is restricted to cluster members during the three years of the project, content will be made freely and publicly available online at the conclusion of the project.

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, where 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. MemRE also enables new techniques to be peer reviewed, and benefits and limitations of the techniques to be discussed amongst researchers.

Participation and collaborations

The multidisciplinary Advanced Membrane Technologies for Water Treatment Research Cluster includes partners from nine universities and the CSIRO. MemRE is a model for research infrastructure development based on collaboration between researchers, systems developers and librarians. MemRE was developed through close collaboration between the Digital Library Innovation and Development Unit of the UNSW Library and UNSW members of the research cluster, throughout the planning, design and implementation phases of the project.

Acknowledgements

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