

**Building Decision Support through Dynamic Workflow Systems for Health Care –  
Ontology Focus**

By

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## **Acknowledgement and Endorsement**

This report was written by Tanay Sharma in partial fulfillment of the requirements for the Masters of Health Informatics Program at Dalhousie University. This report has not received any previous academic credit at Dalhousie University or any other institution.

I would like to thank Dr. Wendy MacCaull and Ms. Janet Norgrove for allowing me the opportunity to work on project team. I would also like to thank Ms. Heather Jewers for her constant support, collaboration, discussion and help with numerous tasks during internship.

Tanay Sharma

## Executive Summary

Internship was completed at ACOA funded AIF project, Building Decision-support through Dynamic Workflow Systems for Health Care under Dr. Wendy MacCaull in the Department of Math, Statistics and Computer Science at StFX University. This was a 13 week position , located in Antigonish, Nova Scotia, starting on May 7<sup>th</sup> 2008 and ending August 1<sup>st</sup> 2008.

Reporting directly to Dr. Wendy MacCaull, this position offered the opportunity to work on ontology development for a palliative care workflow project. The work term was intended to guide the following activities:

- (1)Contributing to the development of a workflow model
  - >Refining user cases as defined by requirements team
  - >Identifying exception cases
    - Early discharge
    - Stabilization within service
    - Invalid referrals
  - >Development of palliative care workflow
  - >Develop parallel workflow for HITH and VON palliative care processes
- (2)Model testing
- (3)Designing workflow components (horizontal process)
  - >Links to existing data sources (if any)
  - >Links to Meditech/CDHA (Cerner)
- (4)Designing workflow for vertical processes
  - >Reporting paths
  - >Policy influence
- (5)Knowledge of Protégé software required

Publishing opportunities and/or presentations at workshops or conferences were encouraged and delivered as and when needed. The specific activities and deliverables will be highlighted in this summary report. Following privacy and security issues some sections may be deleted to ensure integrity of overall project.

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**Organizational Profile** - <http://www.logic.stfx.ca/index.html>

StFX Centre for Logic and Information, established in 2007, which supports research in modeling and reasoning about complex and distributed processes. The applications of this research are directed to the development of innovative software for verifiable, dynamic, adaptive software for process management, information exchange and data integration.

The project **Building Decision-support through Dynamic Workflow Systems for Health Care** is funded by Atlantic Canada Opportunities Agency (ACOA) through the Atlantic Innovation Fund (AIF), an undertaking of StFX Center for Logic and Information.

Through research, innovative software science and information systems engineering, carried out at the StFX Centre for Logic and Information, in close collaboration with local health authorities, we will offer improved software functionality over existing products, thereby addressing critical problems currently faced in the health informatics market and other economic sectors and expand the knowledge-based economy.

The team, led by Dr. Wendy MacCaull, is researching the conceptual, scientific and technological problems underlying the design and development of dynamic workflow systems for complex and distributed processes. Seeking to apply the knowledge gained to development of innovative market-ready workflow software products for web-based case management to support decision-making in the health domain.

## **Intern Background**

Tanay Sharma is a Master of Health Informatics student (2009) in his last semester at Dalhousie University. Tanay Sharma has a prior Medical Doctorate and has extensive knowledge in the medical domain. He has also has a Bachelors degree in biology and a partial degree in Occupational Therapy. His activities for this 13 week internship focused on ontology and development of ontology highlighting the domain of palliative care.

## **Project Background** – From AIF Project Proposal Executive Summary

St. Francis Xavier University, in Antigonish, NS is pleased to be the proponent of the project **Building Decision-support through Dynamic Workflow Systems for Health Care**. The project goal is to research the conceptual, scientific and technological problems for the design and development of dynamic workflow software systems for complex and distributed processes. The end product is a verifiable and easily customizable software platform for dynamic workflow to guide and inform clinical care, public health systems and biomedical research, facilitating knowledge based decision-making and improving both the processes and the outcomes of health care.

Health care entails numerous requirements, services and interactions among a complex web of service settings and providers. The need for software tools that support the delivery of health care at all levels is an issue of fundamental importance to Atlantic Canadians. In this project, we will develop prototypes for two workflow software systems for case management: (1) one targeting clinical care, specifically hospice palliative care and (2) the other targeting program activities for public health, specifically for the early childhood Healthy Beginnings program. A by-product of the project is a self-sustaining mechanism combining scientific research and development processes with commercial development and revenue generation, focusing on the health informatics market.

It is intended that our software platform will offer the following innovative functionality; it will:

- **be dynamic** – that is, incorporate temporal features which facilitate changes “on the fly” (that is, in real time, not before patient care starts or drug trial begins);
- **be interactive** with all stakeholders and in a manner appropriate to the user (different users require different outputs);
- **incorporate a richer language** (so its rule base can express the more complex concepts that are needed to represent health sector issues);
- **incorporate methodology** to deal with incomplete and inconsistent information;
- **include a verification engine** (which is intended to be used to guarantee that specific workflows, even after dynamic changes, are “safe” and “effective”);
- **be easily customizable** (through the use of model driven architecture, a new paradigm in software development);
- **have built-in evaluation mechanisms** for assessment and long-term policy making.

These features are critical for the delivery of health services, for the deployment of public health programs, for improved biomedical research, and for enhanced health policy and services research.

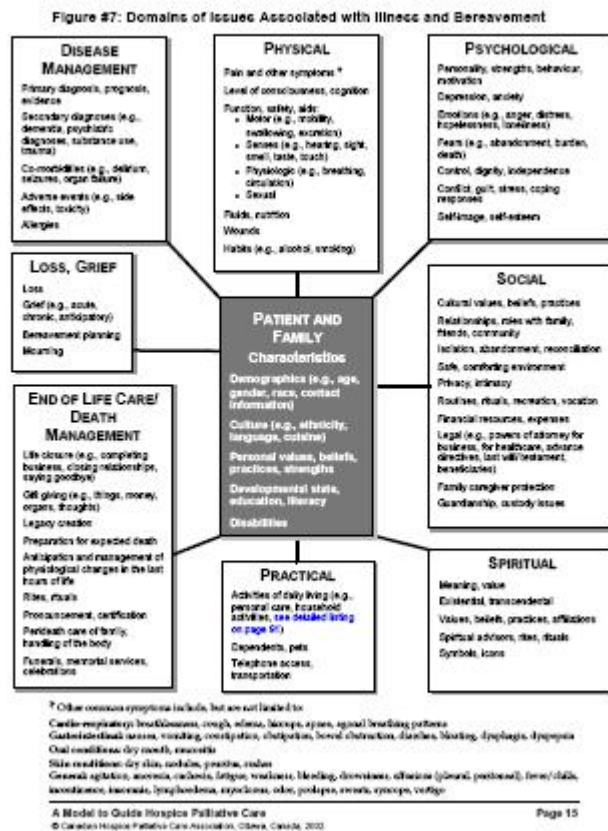
The research and development underlying this software is an ambitious project that presents a number of scientific and technical challenges. These include research into reasoning mechanisms that are robust in situations of under- or over-specified data sets, protocols for dynamic adaptation within a framework that is computationally tractable for real time applications, methods to reduce the computational complexities of verification

mechanisms and the integration of health programs, national guidelines, and research processes into workflow representations and operational software prototypes. Time lines include (Years 1-5) resolving conceptual issues for reasoning, and processing restraints (Years 1-4) establishing a health domain knowledge base; (Years 3-5) ensuring interoperability among users; and (Years 3-5) facilitating the integration of research processes into health policy and decision making.



## Summary of Activities Completed

- Gained insight into the vision of AIF project, “**Building Decision-support through Dynamic Workflow Systems for Health Care**” under direction of Dr. Wendy MacCaul.
- Broken down of 10 palliative care case studies within the fields of Disease Management, Physical, Psychological, Spiritual, Loss and Grief, practical, End of Life Care/Death Management and Social according to “**A Model to Guide Hospice Palliative Care**” model of “**Domains of Issues Associated with Illness and Bereavement**”. These cases can be instantiated using the developed palliative care ontology. When completed these cases will become part of “model testing” component of palliative care ontology development. These case studies cover all exception cases and encompass links in palliative care with VON, HITH, social work, medication regime etc.



- Written an introductory paper on ontology and health care – “**Ontology & Health**”. The paper provides novice researchers in the field of ontologies a stepping stone to begin quest.

>Topics Covered in Paper:

- INTRODUCTION
- DISCUSSION

*-Ontology Building Tools*  
*-Recent Ontology Application Developments*  
*-Ontology and Interoperability*  
*-Weaknesses of Ontology*  
*-Major Institutions of Ontology Research*  
*-Future Ontology*

■ **CONCLUSION**

- Put together user manual for any individual beginning to learn ontology building tool - Protégé. This manual allows individual to have all available resources Protégé - compiled and simplified in one paper. It addresses the issue of multiple versions of Protégé and compensates the manual user to understand how to work through versions, gaining appreciation of tool functioning.

## Recommendations

- Suggest all new participants on project team to read “Ontology & Health”. Paper will provide easy reading, familiarization of terms and potential uses of ontologies, for individuals with no prior ontology experience.
- Suggest running through Protégé user manual - to disseminate functional knowledge on using Protégé software tool. Manual allows individuals becoming comfortable working with Protégé.
- Complete “A Model to Guide Hospice Palliative Care” model of “Domains of Issues Associated with Illness and Bereavement” in all domains. Using the explicit information captured formalizing it into implicit knowledge.
- Continuous check for inconsistencies in palliative care ontology development by domain experts. Make sure the hierarchy falls as intuitively expected.
- Goal is to streamline complex health care workflow by guiding an intelligent care flow process

## **Conclusion**

- Enabled contribution of my prior educational knowledge to further AIF project goal
- Provided valuable opportunity to expand learning in the field of technology and health care
- Allowed the opportunity to gain insight into ontology and ontology development through software tool - Protégé
- Modeled a progressive professional research work environment - superior for developing practical skills (paper writing, researching topics, steering/evoking discussions etc.)

**References**

[1] <http://www.logic.stfx.ca/index.html>

[2] AIF Project Proposal Executive Summary

[3] [http://www.chpca.net/marketplace/national\\_norms/national\\_norms\\_of\\_practice.htm](http://www.chpca.net/marketplace/national_norms/national_norms_of_practice.htm)

## **Appendix A - Weekly Intern Reports (Weeks 1-6, 8-12), Midterm Report**

## **Appendix B - Miscellaneous Work/Proposals**

## **Appendix C - Protégé Manual**



## **Appendix D - Ontology and Health Paper**

## Appendix E - Case Study Breakdowns

## **Appendix F: Final Internship Presentation Slides**

