Online Electronic Thesis Support System at Maritime University: A Teaching Case for Systems Analysis and Design Course

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Abstract

A business case in information system analysis and design is presented. The case describes an on-going system development project for graduate student’s thesis electronic submission and thesis defence online support system at a Canadian university. The case can be used in an undergraduate IS analysis and design course to explain key concepts, methodologies, and techniques in system’s analysis and design.

Keywords

Systems analysis, systems design, implementation, requirement gathering, IS teaching case.

The Project

It’s a typical snowy and cold winter day in mid-February 2012, Mary Smith, Manager of Enterprise Architecture and Associate Chief Information Officer (CIO) at the Department of Computing and Communication (CCS), Maritime University, Canada, had just completed reviewing a project progress report of an Information Systems, the Electronic Repository for Thesis and Research Project, one of many IS projects under her watch. She is pleased to learn that the project team has been making progress according to the plan. She is particularly happy to see that the project team has completed the “business process review and process mapping”, an important and critical step for the project “analysis” phase. Although the project is on track, she is concerned about meeting the project deadline, given and scope of the project and the mandatory deadline. She wants to have a good understanding what are the major tasks involved, the project scope, and how the project can be delivered on time and within budget.

Mandated by Theses Canada (see http://www.collectionscanada.gc.ca/thesescanada/index-e.html), all theses must be submitted in electronic format starting on January 1, 2014. As a publicly funded university, Maritime University is required to implement a system that will enable its students (mainly graduate students, i.e., master’s and PhD students) to submit their theses online. Internally, the University had decided to have a system fully functional by fall 2013 term (September 2013).

The Electronic Repository for Thesis and Research (ERTR) Project was initiated by the CCS in fall 2011. A project office and a project team were formed in September 2011. A senior manager at the CCS was appointed as the project manager. A senior system analyst at CCS was staffed on a full time basis for the project. In addition, the project team also includes representatives of major stakeholders at the university,
including 3 senior staff members of the Faculty of Graduate and Post-Doctoral Affairs (FGPA), and Associate Librarian of the university's library.

Maritime University is one of top comprehensive universities in Canada serving over 23,000 students (including approximately 20,000 undergraduate and over 3000 graduate students enrolled in various degree programs)

**The University and Graduate Programs**

Similar to many other universities in Canada, Maritime University is organized by academic faculties including science, engineering, business, arts and humanities, public affairs and administration, and graduate and post-doctoral affairs. The administration of graduate students, such as student admission, registration, and graduation, is the primary responsibility of the FGPA, although each individual academic department within each faculty is also closely involved with the program design, program delivery, and student administration. Each academic department and faculty typically is staffed with a “graduate program supervisor” who is responsible for either master’s or PhD program and a “graduate program administrator” who handles the administrative affairs of graduate programs and provide administrative supports to graduate supervisor and coordinate with the FGPA on graduate program matters. The position of graduate program supervisor is typically assumed by a faculty member on term basis, i.e., 3 to 6 years. The graduate program supervisor is typically responsible for overall program management such as program design, curricular review and change, graduate student admission, student progress monitoring, student advising, thesis committee organization, and thesis defense administration. The graduate program administrator is a full time staff position. The administrator provides all administrative supports for the office of graduate programs within the department/faculty and works closely with the graduate program supervisor as well as with staff at the FGPA. Some of the primarily responsibility of the graduate program administrator includes 1) preparing and processing graduate applications; 2) providing administration support for in program students such as course selection and course scheduling; 3) providing thesis committee and thesis defence administrative supports such as coordinating with the FGPA for thesis defence committee (from the formation of the committee to assisting thesis committee members on administrative matters), and for thesis revision and submission.

**The Graduate Thesis and Thesis Defence**

Thesis submission and thesis defence are two important and closely related business processes. All graduate students, except those who are enrolled in course and / or project based master’s programs, are required to submit a written thesis. The submission of the written thesis is typically done in two steps: the initial submission before the oral defence and the final submission after the successful oral defence. The initial submission of written thesis is followed by thesis oral defence if the thesis defence examination board approves the oral defence. If the oral defence is successful and the written thesis is accepted by the thesis examination board, the FGPA will be notified to accept the thesis. At present time, students are asked to produce and submit a minimum of 4 (bound) hard copies of the written thesis to the academic department, one for the academic department, one for the FGPA, and one for the university’s library, and one for Library and Archive Canada, i.e., Theses Canada. Before forwarding the completed thesis to the FGPA and subsequently to the University’s Library and Archive Canada, the academic unit’s graduate program administrator will work with the students to make sure the required forms are completed. For example, the following forms must be completed and signed by the students and the graduate program administrator before the thesis is accepted by the department and submitted to the FGPA: 1) the “Academic Integrity Statement Declaration Form”; 2) the “ProQuest Subject Codes Form”; 3) the “Consent for Use of Personal Information (Publications)” (Freedom of Information and
Protection of Privacy Act Consent Form (FIPPA); 4) the Departmental Chair / Thesis Supervisor(s) Thesis Defence Authorization Forms; and 5) the Theses Non-Exclusive License.

Thesis oral defence can only take place after the initial submission and the completion of required forms. Following the approval of oral defence by the supervisor(s) and the graduate program supervisor, members of the thesis examination committee are recommended and decided. If all members are approved, a “Thesis examination committee” and a “Thesis examination board” are formed. Thesis examination board differs from the thesis examination committee in way that, in addition to members of the examination committee, it also includes examination board chair (which is appointed by the Dean of the FGPA), as well as ex-officio members such as the Dean of the Faculty (the student’s program of study) and the Dean of the FGPA. There are two types of thesis examination committee, master’s and doctoral. For master’s thesis examination committee, it consists a chair of the examination board, a supervisor (or supervisors in case there are more than one supervisor), two faculty members within the same academic faculty, and a faculty member from other faculty within the university (a.k.a., internal-external examiner). In case of doctoral thesis examination committee, an external examiner (typically a distinguished faculty member from outside of the university) must be identified and recommended by the graduate program supervisor and thesis supervisor(s). The external examiner must be approved by the Office of the Dean of the FGPA at least one month from the scheduled date of oral examination.

Once the members of the thesis examination committee are chosen and approved by the Dean of the FGPA and the date for the oral examination is determined, a “Notice of Thesis Defence” is prepared and distributed to all members of the examination committee and the examination board. One week from the actual oral examination (i.e., thesis defence) date, the “Committee Member Thesis Defence Authorization Form” must be signed by all members of the examination committee. If any member of the examination committee determines, after reviewing the written thesis, that the oral examination cannot proceed as scheduled due to significant deficiencies of the thesis or other reasons, the oral examination will be rescheduled or suspended.

The thesis defence (i.e., oral examination) usually takes about 2-3 hours with the student and all members of the thesis examination committee present. There are generally four (4) different outcomes for the thesis examination: thesis is “Accepted”; thesis is “Acceptable after Minor Revisions”; thesis is “Acceptable after Major Revisions”; thesis is “Rejected”. At the end of the examination, a “Thesis Examination Report” must be completed and signed by all members of the examination board. In addition to capturing the results of the thesis defence, the following information will also be included in the “Thesis Examination Report”: grades for oral examination and thesis (satisfactory or unsatisfactory), if the committee is recommending for student to receive special acknowledgement (i.e., a medal), examination chair’s remarks, and signatures of members of the examination committee.

Final thesis submission takes place after the successful completion of thesis defence. If the recommendation is “Accepted”, student can proceed and complete the “final thesis submission” step. If the recommendation is “Acceptable after Minor Revisions”, student must make the revisions first and then complete the “final thesis submission” after the thesis supervisor(s)’s review and approval of the revisions. If the recommendation is “Acceptable after Major Revisions”, student must make the revisions first and then, subject to the specific recommendation, may submit then complete the “final thesis submission” after the examination committee’s review and approval of the revisions or may be asked to complete a second oral examination. If the second examination is satisfactory, student can then complete the “final thesis submission”. If the recommendation is “Rejected”, student will not complete the “final thesis submission”. In case of minor and major revisions, a “Thesis Revision Approval Form” must be completed and signed by members of the examination committee. Before the final thesis submission, a “Thesis Acceptance Form” must be completed and signed by the thesis supervisor(s), the graduate
program supervisor, and the external examiner (in case of doctoral thesis). After completing the thesis acceptance form, a “Thesis Deposit Form” must be completed and signed by the graduate program administrator. Appendix A and B provide a list and samples of various forms with key data identified. Appendix C shows the workflow (flowchart) of the thesis submission process.

**The Proposed System**

The primary objective of the proposed system, the Electronic Repository for Thesis and Research, is to replace current paper based manual process with one that allows students to submit their theses electronically to their academic departments, to the thesis defence committees, to the FGPA, and to be deposited into the university’s library repository system (an automated online system), and to be transferred and deposited in to the Library and Archive Canada’s system. In addition to processing thesis documents (i.e., transmit and deposit files electronically), the proposed system should provide automated and online support for thesis defence as well since the thesis submission and thesis defence are closely related and intertwined business processes. Finally, the proposed system must be an integral part of the overall university’s computing environment. It should be integrated with other systems such as student administration and registration, faculty administration, the university’s library repository system, and the Library and Archive Canada.

**The Challenges and Opportunities**

Moving forward, Mary Smith is aware of the major challenges for acquiring and implementing such a system. Technically speaking, the project is not the most challenging and difficult one if it is intended to handle “documents” and “files” only. However, adding thesis defence and defence committee support function presents some significant challenges, both technically and organizationally. She knows that several other universities in Canada have already developed and implemented similar systems. The option to purchase a “packaged solution” seems to be rather limited since almost all of these universities have developed the system in-house. If Maritime University is to develop the system in-house, project scope and time are of an essence. With less than 20 months left before the intended date of system delivery and production, the project team has to complete the system analysis, design, development, test, implementation, and user training phases before September 2013. Can the project be delivered on time and on budget if both thesis submission and thesis defence functions are included? Should the project be divided into two distinctive phases with phase 1 for developing a system that supports thesis submission only and phase 2 for thesis defence? What are the major tasks involved in analysis, design, development, test, implementation and training? More specifically, what are the system’s requirements? How should the requirements be gathered and structured? How should the system be designed (e.g., architectural, data, and user interface) to provide the necessary functionalities?

Although the project presents some challenges in terms of the major tasks at hand, Mary Smith is confident that the system can be developed in time given that the university has already committed adequate resources to the project, and more importantly, the university has an excellent computing infrastructure and a centralized ERP system (i.e., Banner) already in place.
Appendix A – List of Form

1. Academic Integrity Statement Declaration Form
2. ProQuest Subject Code Form (http://www.collectionscanada.gc.ca/obj/s4/f2/s4-300.1-e.pdf)
3. Consent for Use of Personal Information (Publications) – (Freedom of Information and Protection of Privacy Act Consent Form) (FIPPA)
4. Departmental Chair / Thesis Supervisor(s) Thesis Defence Authorization Forms
6. Notice of Thesis Defence
7. Committee Member Thesis Defence Authorization Form
8. Thesis Examination Report
9. Thesis Revision Approval Form
10. Thesis Acceptance Form
11. Thesis Deposit Form
Appendix B – Form Sample

1. Academic Integrity Statement – Thesis Submission
(To be completed upon submission of Master and Ph.D. theses for examination)

**Introduction**
The university is committed to ensuring that all students conduct themselves in a manner consistent with the University Academic Integrity Policy. Recognizing that regulations and practices relating to academic integrity and intellectual property, as well as the culture related to their enforcement, vary substantially from place to place, all graduate students are required to review, comprehend and adhere to the University Academic Integrity Policy upon commencing graduate studies and upon submitting Masters and Ph.D. theses.

**Thesis Submission**
I am familiar with the University Academic Integrity Policy and I understand the potential consequences should my thesis be found to contain plagiarized content or violate this policy in any other way.

Name: Student Number:
Signature: Date:

2. ProQuest Subject Code Form
(http://www.collectionscanada.gc.ca/obj/s4/f2/s4-300.1-e.pdf)

**ProQuest Subject Code Form**
The ProQuest Dissertations and Theses (PQDT) database and the PQ/UMI citation indices are arranged by subject categories. Please select the one category below that best describes the overall subject of your dissertation or thesis. You may add one or two additional categories on this form that will also be associated with your work as secondary subjects.

Name:

Primary Subject Code Secondary Subject Codes

**THE HUMANITIES AND SOCIAL SCIENCES**

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| 0358 Folklore                |
| 0366 Geography               |
| 0351 Gerontology             |
| 0733 Gender Studies          |
| 0737 Hispanic American Studies|
| History                      |
3. **Consent for Use of Personal Information (Publications)**

(Freedom of Information and Protection of Privacy Act Consent Form) (FIPPA)

I, __________________________ give my consent to the <Insert Department/School/Office/Program> to publish my <Image/Article/Project> further described as follows:

________________________________________________________________________

This consent is given non-exclusively and copyright to my work and/or image is retained by me. Further, I give specific consent to publish the following:

I hereby grant a non-exclusive license to the <Insert Department/School/Office/Program> for the use of this information for an indefinite term for the use specified as follows:

The license is restricted to the usage described in this consent document.

I do hereby release and forever discharge the University, ..., the use of my photograph or photographic image in the manner and for the purposes contemplated herein.

This agreement does not include or supersedes other personal information agreements signed by me at the University and concerning my personal information.

Signature of Person Giving Their Consent  Date:

4. **Departmental Chair/Thesis Supervisor(s) Thesis Defence Authorization Form**

Student’s Name:  Student No:

☐ I am not aware of any potential conflict of interest that the examiners have with the candidate and or...

☐ In my opinion, the thesis defence can take place subject to the approval of the thesis examination board

☐ The thesis defence should not take place

Signature (Department Chair):  Date:

☐ I/We have read the thesis and in my/our opinion, the thesis defence can take place subject to the approval of the thesis examination board

☐ The thesis defence should not take place

Signature (Supervisor):  Date:

If the thesis defence should not take place then indicate why:
5. Theses Non-Exclusive Licence
(http://www.collectionscanada.gc.ca/obj/s4/f2 frm-nl59-2-e.pdf)

THESIS NON-EXCLUSIVE LICENSE

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<td>Thesis Title:</td>
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Signature: Date:

6. Notice of Thesis Defence

Candidate: (Name in Full)
Previous Degrees, University, Year
Date:
Thesis title:

Examination board:

External Examiner: Name, Department, University (or company when applicable)
Internal Examiner: Name, Department
Committee Member(s): Name, Department
Co-Supervisor: Name, Department
(If Applicable)
Thesis Supervisor: Name, Department
Chair of Department: Name, Department (Ex-officio)
Dean of Faculty Name: Faculty (Ex-officio)
Dean, Faculty of Graduate & Postdoctoral Affairs: Name (Ex-officio)

Signature: Date:
Dean, Faculty of Graduate and Postdoctoral Affairs
7. Committee Member Thesis Defence Authorization Form

Student’s Name: 
Student No: 

☐ In my opinion, the thesis defence can take place
☐ In my opinion, the thesis defence can take place with the expectation that revisions may be required
☐ In my opinion, the thesis defence should not take place

If there are reservations about the thesis or concern that the thesis defence should not take place then indicate why:

Role on Examination Board: (Internal Examiner, Member of Department Member)

Name: 
Signature: 
Date: 

8. Thesis Examination Report

Name: 
Student No: 
Department: 
Course No: 

Date of Examination: 
Term of Completion: 

Thesis Title: 

Thesis: 
☐ Accepted
☐ Acceptable after minor revisions
☐ Acceptable after major revisions
☐ Rejected

Oral Defense: 
☐ Satisfactory
☐ Unsatisfactory

Thesis Grade: 
☐ Satisfactory
☐ Unsatisfactory

Medal Nomination: 
☐ Yes
☐ No

Examination Chair’s Remarks: (Thesis revisions list to be forwarded)

Signatures of the Examination Board: (please print names under signatures)

Chair of the Examination Board:
External Examiner:
Internal Examiner:
Supervisor (or Co-Supervisor):
Co-supervisor:
Other Members:
9. **Thesis Revision Approval Form (PhD)**

Student’s Name:      Student No:

This form indicates that all required thesis revisions as determined by the examination board have been completed satisfactorily and the thesis can now be deposited. Only those examination board members charged with overseeing the thesis revisions need to complete this form.

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<td>Member of Department</td>
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10. **Thesis Acceptance Form**

The undersigned recommend to the Faculty of Graduate and Postdoctoral Affairs acceptance of the thesis: (Thesis Title)

Submitted by (Candidate’s name and previous degree information)

In partial fulfillment of the requirements for the degree of (Degree name)

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<td>□ The title page follows the format prescribed by the FGPA</td>
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<td>□ The Acceptance Sheet is attached to the deposit form and follows the format prescribed by the FGPA</td>
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<td>□ The Abstract does not exceed 150 words (Masters) – Ph.D. not to exceed 350 words</td>
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<td>□ Preliminary Materials: preliminary materials (acknowledgements, foreword, table of contents, list of abbreviations, etc.) as required, are present and in the sequence specified by the department</td>
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<td>□ Illustrative Materials: all illustrative materials (tables, diagrams, illustrations, etc.) as required, are present and in their proper places. All maps destined for map-pockets are tied together by set and one set is included with each copy of the thesis</td>
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Total number submitted: 2 Library Copies: (Yes/No)
Thesis to be withheld for 3 months: (Yes/No)
Withdraw for refund: (Yes/No)
Funded: (Yes/No)

Forms attached:

□ Theses Non-Exclusive Licence
□ Proquest Subject Code Form
□ Licence to the University
□ Separate Copy of Title Page
□ Separate Copy of Abstract

Checked by Department:

Signature of Graduate Program Administrator:

Date:

1. Pre-Upload
   - Thesis Submitted
2. Thesis Package Received
3. Defence Authorized?
   - Yes: Notice of Defence Approved (Ph.D)
   - No: Defence Denied
4. Ready for Defence
   - Yes: Thesis Defence
   - No: Revision
5. Revisions?
   - Yes: Revisions Submitted
   - No: Revision
6. Revisions Submitted
   - Yes: Thesis Accepted
   - No: Thesis is sent to Library
7. Thesis Accepted
   - Yes: Thesis is sent to Library
8. Thesis is sent to Library

* FIPPA: Freedom of Information and Protection of Privacy Act

Appendix C – Thesis Submission Process
TEACHING NOTES

Teaching objectives

1. To introduce students the concept of System Development Life Cycle (SDLC, planning, analysis, design, implementation, maintenance) by using a real world example in an university environment that the students are familiar with;
2. To introduce students the concept of system's acquisition alternatives (in-house development, packaged solution, outsourcing);
3. To introduce students system's project management methodology and techniques (project feasibility studies, phased development approach);
4. To introduce students system's analysis methodology and techniques (requirement determination and requirement structuring – both structured and OO techniques, process and data modeling);
5. To introduce students system's design methodology and techniques (system’s architecture, function, data, and user interface design, both logical and physical design).

The case is developed to describe an information system project, Electronic Thesis Submission and Thesis Defence Online Support for Graduate Programs at a Canadian University. It can be used as a teaching case for Information Systems Analysis and Design (ISAD) course. Instructors can use the case either at the beginning of the course as a supplementary material to introduce students the content of the course or use the case throughout the entire course and use the background information included in the case to demonstrate and explain concepts, methodologies, and techniques in each of the SDLC phase.

For project planning, the case can be used as an in-class exercise for discussion of system’s acquisition strategy and options, and feasibility studies (i.e., economic, building the business case, technological, and operational). Students can be asked to work as a group to identify major tasks. Based on the tasks identified, students can do estimations of cost and time to complete with each task. Planning and scheduling tools, such as Gantt chart and PERT, will be used to create project plan.

For system analysis phase, the case can be used as an example to demonstrate requirement determinations and requirement structuring. For example, the use of storyboard and interview to determine thesis submission and thesis defence business processes. Instructors can ask students to apply relevant analysis techniques such use cases, sequence diagram, workflow diagram, context diagram, data flow diagram, decision tree/decision table, and data modeling (class diagram / ERD) to model the application processes, data, and user and system interfaces for both existing and proposed systems. The case includes detailed description of the current business processes and required input (various required forms) for each process. Based on the information, instructors can ask students to identify system's alternatives and recommend a system’s solution.

For system design phase, instructors can ask students to develop logical design based on the information gathered in the analysis phase. For example, applying IS architecture model (i.e., client, presentation, application logic, and resource management), instructors can ask students to work as a group to propose design solution(s) for each of the main components as well as overall system’s architecture. Specifically, for instance, the following main components might be proposed:

1. Client – designer must consider the way in which external entities (can be a system’s user and/or a web-browser, and/or a windows’ form) is connected with the e-thesis system. In case of e-thesis project, it’s likely that client will be implemented in the form of a webpage through existing client already available to the University's users (i.e., student, faculty, and staff).
2. Presentation layer – designer must consider the following two main issues: data input and data output (forms and reports); user interfaces and dialogues. Relating to e-thesis project, the presentation layer must provide the following main functionalities: allow students to submit and re-submit their theses and associated document online; track their thesis submission status; allow staff (academic unit and FGPA staff) to receive, review, approve and reject student’s thesis; allow staff/faculty/academic manager to select/change/reject/approve thesis defense committee; allow external members (i.e., external examiner) to access the system; allow e-thesis system to interface with other systems (i.e., library, students, course and course schedule, faculty, staff management systems)

3. Application logic – designer must consider the business processes and business rules pertaining to graduate student’s thesis requirements. Specifically, the following three aspects of business processes must be included in the design: 1) committee membership selection and approval; 2) thesis submission requirements (all business forms and business rules must be included); 3) thesis examination reports and thesis revisions and final submission.

4. Resource management layer – designer must consider how the system will handle the documents (DMS); database design, as well as data processing (input, process, and output), data transmission, and data storage.
Suggested solutions (sample)

Requirement structuring: process and data modeling

1. Flowchart (see Appendix C)
2. Context diagram (or use case diagram in case of OO)

![Diagram]

3. Decision table

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4. Data Modeling

Entity: the following entities are typically identified and be included in the data model: STUDENT, FACULTY (member), STAFF, THESIS, ACADEMIC UNIT (i.e., school/department), DEGREE PROGRAM. Others can include COURSE (i.e., thesis is related to a course) and REGISTRATION (i.e., a student must register in a course at a time of thesis submission).

Relationship: STUDENT and THESIS (typically one to one); STUDENT and FACULTY (optional one to many); FACULTY and ACADEMIC UNIT (optional one to many), STAFF and ACADEMIC UNIT (one to one)

5. Form/UI Design (sample)

Thesis Package Upload

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