Commerce 436: Information Systems Analysis & Design - Final Report

BMS Project

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April 11, 2007

RE: Integration of the information systems of BMS and Classroom Services.

Dear Brenda Sawada, Mark Scott, Kelly Simmons:

Enclosed is a summary of our analysis on the possibility of integration between the information systems of the BMS and Classroom Services department. We have examined the current interaction between the BMS department and the Classroom Services department and identified areas that may be of concern to the two departments. We have also proposed alternative solutions addressing these areas of concern.

Our report includes the following information:

a. Table of Contents
b. Executive Summary
c. Description of the Business and System Under Study
d. Problems and Requirements that Have Been Identified
e. A Description of Alternatives
f. Our Recommendation
g. Appendices

Thank you for the time you have spent with us on this project. Your cooperation was very much appreciated. We hope our recommendations will address your needs.

Yours truly,

_____   _____
Zahra Mottaghi-Far   Lucy Lin

_____   _____
Linna Yi Nan Li   Kam Chun Stanley Tung

Table of Contents

Executive Summary

This report is a summary of our findings on the possibility of integration between the information systems of the Classroom Services department and the Building Management Systems department at the UBC Vancouver campus. It includes a description of the responsibilities two departments and a summary of three problems and requirements that have been identified. It also proposes four solutions, as alternatives to a full scale integration of the information systems of the Classroom Services department and the Building Management Systems department, to improve the efficiency of the current communication between the two departments. We recommend Classroom Services to add a new property to the classroom object in their database system so that air handling units can be identified to each classroom.

A. Introduction

Our project is part of the UBC SEEDS (UBC Social, Ecological, Economic Development Studies) program, which was first launched in 2001 to bring students, staff, and faculty to work together in helping achieve the university's sustainability goals. In this project, we looked at the possibility of integration between the information systems of the UBC Classroom Services department and the UBC Building Management Systems (BMS) department. The integration of the information systems of these two departments will help produce more timely and up-to-date information so that each department can make better managerial choices. Most importantly, Building Management Systems will be able to plan energy usage more efficiently to help the university meet its sustainability objectives. Our group's goal was to not only look at the possibility of integration of the information systems but also to make an analysis of the current business processes involving the Classroom Services department and the Building Management Systems department, and to make a recommendation for improvement to their current system.

B. A description of the business and system under study

Classroom Services Department

The Classroom Services department is responsible for coordinating the scheduling of room bookings for the use of course instruction, exams, or for other special events.

Aside from coordinating the scheduling of rooms across the UBC Vancouver Campus, Classroom Services also provides other services such as promoting student development success by investigating the possibility of improvement to UBC's learning spaces. An example is looking at whether more study spaces are needed in certain building or areas across campus and at how these study spaces could be designed so that students can benefit the most out of these study spaces.

Bookings of the rooms across campus consist of two natures. One is the normal academic course scheduling that usually occurs at the beginning of each school term. The other is the ad-hoc or "out of typical" event bookings that may occur throughout the term. "Out of typical" events consist of events such as departmental meetings, AMS club functions, workshops, conferences, or events held by an external party of the university. Bookings are made by faculty and staff, student representatives of AMS clubs, and by off-campus groups. Faculty and staff wishing to make bookings for unofficial functions must obtain written consent from the dean or department head. Student representatives of AMS clubs must be listed with Classroom Services so that they can access Classroom Services booking system and make a booking on the club's behalf. Off-campus groups and those that are not pre-authorized to have access to the Classroom Services booking system make bookings by submitting an application called

the Off-Campus Request for Classroom Space application to Classroom Services by

fax, in person, or through email.

Booking information submitted to Classroom Services includes the following items:

Name
Faculty, department, or AMS club name
Telephone number
Date of event
Reason for function
Start time
End time
Room capacity required
Building and/or room preference
Specific room features required (e.g., moveable seating)
Whether you will charge a fee to attend
Whether you will have off-campus attendees

Classroom Services assesses booking requests through a prioritization schedule. It will

also accommodate the request by selecting a classroom that best meets the applicants

needs based on room availability and the information that was submitted to them (See

Appendix A for a depiction of the current booking process).

However, rooms on campus are divided into two types:

1) restricted rooms

2) non-restricted rooms

Classroom Services is not responsible for the scheduling of restricted rooms. Restricted

rooms are specifically designated for use by the department or administration in each

building. Restricted rooms may include laboratories, meeting rooms, and studio space.

For example, Room 412, the computer lab in the Henry Angus building is controlled by

the Commerce faculty, the department in the Henry Angus building. The restricted

rooms are scheduled within the department it belongs to. The department may

coordinate the scheduling of their restricted rooms through the use of software programs

such as MS Outlook and Excel. The bookings of restricted rooms do not go through

Classroom Services.

Classroom Services is responsible for the scheduling of non-restricted rooms. Non-

restricted rooms are available for use by all departments and exclude laboratories,

meeting rooms, and studio space. Non-restricted rooms are booked through a web-

based application managed by Classroom Services.

The web-based system that Classroom Services uses allows them to update room

schedule information into the database system. The database that Classroom Services

has includes information regarding the regular academic and out of typical events

scheduled for each non-restricted room. Classroom Services passes the schedule of

each non-restricted room to the Building Management Systems department.

Building Management Systems (BMS) Department

The Building Management Systems (BMS) department is responsible for providing heat and ventilation to the rooms across campus. In order to do so, they need to know when each classroom will be in use. The Building Management Systems department obtains the schedule for non-restricted rooms from Classroom Services. A schedule of the regular academic activities will usually be received by the BMS department from Classroom Services at the beginning of each term so that they can roughly plan out the times that heat and energy should be provided for each school term. In addition, each week, Classroom Services will provide the BMS department with a current report of the daily schedule of each non-restricted rooms to reflect the ad-hoc or "out of typical" events and booking changes that occur throughout the school term. Currently, ventilation and heat are provided to most classrooms from 7 AM to 7 PM to accommodate for the normal hours of operation during which regular classes are being held.

The Building Management Systems department uses a building management system called the Siemens System 600 Apogee System. This system monitors the temperature in each classroom and automatically makes adjustments to the amount of heat and air ventilation pumped to each classroom according to a preset target energy use level. The

building management system is able to monitor this through computerized sensors located in each classroom.

C. Problems and requirements that have been identified

From our interviews and discussions, we identified three major areas of concern:

1) Restricted Rooms

2) Inadequate Information Provided to BMS by Classroom Services

3) Meeting UBC's Sustainability Goals

1) Restricted Rooms

Because restricted room bookings do not go through Classroom Services' online booking system or through a formal booking process that will allow the BMS department to know the schedule of each restricted rooms, the BMS department will get on an occasional basis special requests by phone call/email from a department representative requesting that the BMS department provide their restricted rooms with heat and ventilation for certain times. This is an inefficient process of communication. In addition, there may be cancellations or a schedule change that the BMS department may not know about if the representative does not incur another call to inform the BMS department of any recent changes. There is hence a chance that the BMS department will provide heat and ventilation to rooms that may not be in use. These issues are of

concern mainly for bookings that reserve the restricted rooms to be used outside of the ordinary school hours of 7AM to 7PM during which most buildings and rooms across campus will be supplied with heat and ventilation.

2) Inadequate Information Provided to BMS by Classroom Services

Currently, the information systems of Classroom Services and Building Management Systems (BMS) are not connected, resulting in inefficient communication between the two departments. The BMS department is not always up-to-date with the most current classroom schedules. The BMS department does not know exactly when to supply heating and ventilation to classrooms. In the current system, Classroom Services prints off a current report of the daily schedule of each non-restricted rooms every Thursday at 4PM and sends this report to the BMS department. The purpose of the report is to inform the BMS department of the most current schedule (status) of each non-restricted room so that their ventilation system's schedule can be adjusted accordingly to accommodate for recent changes. However, to be up to date with the schedule in Classroom Services database, Building Management Systems only needs to see a report reflecting the most recent changes. The current report does not address the Building Management Systems department's needs as it is a report on the current schedule (status) of each non-restricted room and not on the most recent changes. In addition, the report is paper-based. Due to the fact that there are a great number of rooms across

campus, the report can become very difficult to go through. The report that the BMS

department currently receives from Classroom Services is approximately 600 pages. It

is almost impossible to actually go through the report and be able to make a decision as

to whether or not an adjustment to the schedule of the air handling units should be

made.

Since, the Building Management Systems department is unable to go through the whole

report, they become unaware of recent changes to the schedules of the non-restricted

rooms. As a consequence, UBC will sometimes receive complaints from customers that

heat and ventilation was not provided to them during the times that they have booked

their rooms for. On the other side, UBC may also provide heat and ventilation to

classrooms that do not need it since they may have been unaware of a cancellation.

This results in a waste of resources.

3) Meeting UBC's Sustainability Goals

This last area of concern ties in with the two previous problems. Because the BMS

department does not accurately know when rooms need heat and ventilation, they can

not accurately assess the amount of energy that the university really requires. Hence,

they may be unable to accurately set a target level of energy use that the university may

work towards.

D. A description of alternatives

One might suggest that we just integrate the information systems of the two departments. However, integration of Classroom Services database and the BMS database brings up many complex issues. First, it is a difficult process that would be difficult to implement at the moment given the limited resources that the two departments currently has. Second, there is information in the two databases that do not need to be shared. The BMS's aim is to manage heating and ventilation systems so it does not need to know which courses are held in which rooms. On the other hand, Classroom Service's aim is to schedule classes so it does not need to know information such as the amount of air being provided to each classroom. There may also be security issues where employees from each department should not be allowed access to certain data in each other's databases.

The alternative solutions that we propose are as follows:

1) Create a macro that will configure the start and stop times of air handling units.

2) Add a new property to the classroom object in the Classroom Services information system.

3) Implement a middleware.

4) Require restricted room bookers to book through Classroom Services online booking system.

In the following sections, we will discuss the proposed solutions in more detail:

1) Create a macro that will configure the start and stop times of air handling units.

In this solution, a macro, that will configure the start and stop times that the BMS department should adjust the current air handling units to, can be created using the existing testing report given to them in August 2006. Based on our knowledge, Classroom Services created a testing Crystal Report that was sent to the BMS department in August 2006 to see if the new report would better meet the BMS department's information needs. This report was generated by Classroom Services using the Crystal Reports 10 application. The BMS department does not have Crystal Reports and so the .rpt (Crystal Reports file format) file was converted by Classroom Services into a CSV format.

Figure 1 shows what the report looks like:

B	C	D	E	F	G	H	I	J	K	L	M	N
20060523-I	Information	Career Ser	Katherine I	########	5:00 PM	8:00 PM	WESB		100	Scheduled	05/23/2006	05/23/2006	UBC
20060523-I	Lecture	Classroom	May Chow	########	9:30 AM	11:00 AM	SWNG		306	Scheduled	05/23/2006	05/23/2006	UBC
20060523-I	Lecture	Classroom	May Chow	########	9:30 AM	11:00 AM	ANGU		312	Scheduled	05/23/2006	05/23/2006	UBC
20060523-I	Lecture	Classroom	May Chow	########	9:30 AM	11:00 AM	SWNG		105	Canceled	05/23/2006	05/23/2006	UBC
20060523-I	Lecture	Classroom	May Chow	########	11:00 AM	12:30 PM	BUCH	D324		Scheduled	05/23/2006	05/23/2006	UBC
20060523-I	Lecture	Classroom	May Chow	########	11:00 AM	12:30 PM	BUCH	D304		Scheduled	05/23/2006	05/23/2006	UBC
20060523-I	Lecture	Classroom	May Chow	########	11:00 AM	12:30 PM	BUCH	A104		Scheduled	05/23/2006	05/23/2006	UBC
20060526-I	AMS Club	AMS-Deba	Ashish Sir	########	5:00 PM	6:30 PM	BUCH	A204		Scheduled	05/26/2006	05/26/2006	UBC
20060530-I	Course	Continuing	Judith Ples	########	7:00 PM	10:00 PM	BUCH	D307		Scheduled	05/30/2006	05/30/2006	UBC

Figure 1: Testing Sample Created by Classroom Services in August 2006 Using Crystal Reports

As is boxed in Figure 1, the only data that BMS needs to know is the date, time and

room number field of each booked room. For example, the third record shows that room

312 in ANGU building has been booked for 05/23/2006 from 9:30 AM to 11:00 AM.

The BMS department can attempt to implement the use of this testing report. However,

the problem is that the BMS department has to first identify the air handling unit

associated with each room, then identify the start and stop times of each air handling

unit. It is a very time consuming process if done manually.

We can overcome this process through the following steps:

1. Create a spreadsheet in Excel with two columns, one indicating the room
   numbers and one indicating the building air system number.

2. Create a macro in Excel that goes over the report and replaces each room
   number by the corresponding building air handling unit number using the
   spreadsheet created in step 1. The look up function in the Excel is able to
   perform this task as well.

3. Create another macro in Excel so that whenever BMS receives a report from
   Classroom services, the macro written in step 2 automatically runs on the
   received report.

4. Sort the spreadsheet based on the building air handling unit number by time so that they can compute the start and end times for each building air handling unit.

5. The BMS department manually adjusts the scheduling of air handling units.

Economical feasibility:

This solution will not cost a lot if BMS can find a computer science student volunteer to write the Excel macro. We estimate that the macro can be written in one hour depending on the individual's familiarity with Excel and experience with writing macros. If the macro is successfully implemented, the BMS department would only need to click the "execute macro" button each time they receive the report generated with Crystal Reports from Classroom Services. This would require much less time as compared to the time that a BMS staff would have to spend to figure out the start and stop times manually.

Technical feasibility:

No new purchase of software is necessary. BMS already has the required Microsoft Excel software.

Advantages and disadvantages of this solution:

	Advantage	Disadvantage
Using Excel Macro	1) This solution has no extra cost for BMS if a volunteer is able to write the macro. 2) No extra software needs to be purchased. 3) A person with Excel and Visual Basics knowledge can write this macro. There is no need to hire a very technical person. 4) It could be an effective short-term solution.	1) The process is still not %100 automated. BMS still has to update the database manually.

2) Add a new property to the classroom object in the Classroom Services information system.

At the moment, upon receipt of the room schedules from Classroom Services, the BMS department has to look up their cross-reference table (see appendix C) to identify the air handling units associated with each room.

Since there is currently no connection established between the rooms and their corresponding air handling units in either the Classroom Services or the BMS departments' databases, we can implement a process that does establish the connection in the Classroom Services system in the following steps:

1) IT administrators in Classroom Services would need to add two tables to their

   existing database: a "System" table and a "Room_System" table (see Figure 2).

   The "System" table stores the properties of each air handling unit and is used to

   show which rooms are tied to which air handling unit, while the

   "Room_System" table is a linking table between the "Room" table and the

   "System" table, due to a many-to-many relationship (i.e. one room can be tied to

   more than one system, and one system can be associated with more than one

   room).

   (The exact process may be different depending on how room properties are

   currently been stored in the Classroom Services database but the idea behind it

   is to add a new property to the room object showing which air handling units

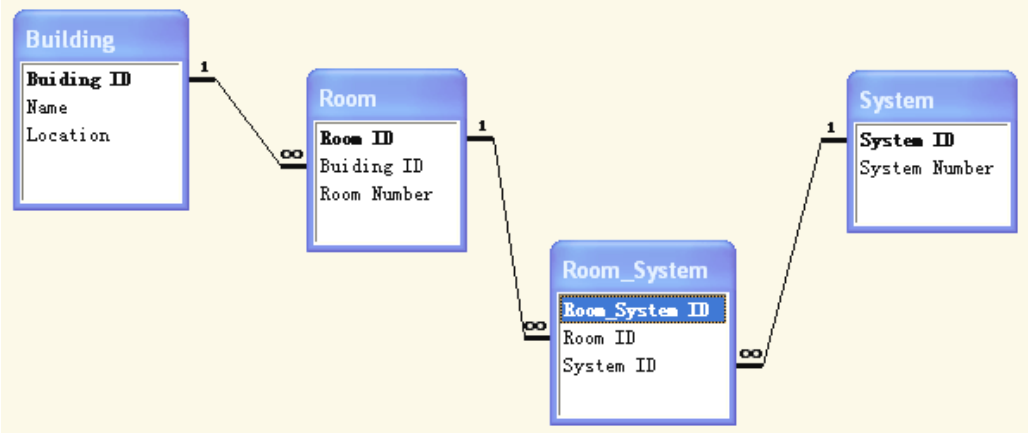   each room is associated with.)

Figure 2: Relationship between the System table, the Room_system table, and existing tables in
Classroom Services database. (We assume the Building and Room tables are already in Classroom
Services' Oracle database).

2) IT administrators in Classroom Services need to adjust the layout of the existing cross-reference table (see Appendix C) so that they are able to "import" the information in the existing cross-reference table into the Classroom Services database as opposed to entering the data manually into the two new tables.

3) Before sending out room schedules to the BMS department, Classroom services needs to sort the System Number field in descending order, with a secondary sort by Date field in ascending order and a tertiary sort by Time field (we assume Date and Time fields exist in their Room Booking table). The result is that Classroom Services sends a modified room schedules report to BMS with the air handling unit information on it sorted in good order. The BMS department can then manually adjust the scheduling of the air handling units in their system.

4) Classroom Services must update their database whenever there is a change in the air systems architecture whereby the air handling unit associated with a room is affected.

The other advantage of imputing this new property into the Classroom Services database is that Classroom Services can create a query that will be able limit room bookers to a choice of rooms whose air handling systems will already be open for the specified time. This would help meet the university's sustainability objectives.

The booking process becomes as follows:

1. A room booker specifies the time that he/she would like to book a room for.

2. The room booker specifies whether to search for rooms by building or type of room (i.e. lecture hall, laboratory, etc.).

3. The Classroom Services system turns up a list of rooms, meeting the above requirement, whose air handling units will already be open during the specified time.

4. If the search turns up no rooms, the room booker can specify the room that he/she wants. The room booker books the room. This would open up a set of rooms that share the same air handling unit as the room that the room booker has just booked.

The advantages and disadvantages of this solution are:

	Advantage	Disadvantage
Input air handling unit information into the database of Classroom Services.	1) No extra software is needed 2) Eliminates the time for cross-reference table checking. 3) Helps meet UBC's sustainability objectives.	1) Labour is required to add the new air handling unit information into Classroom Services database. 2) The BMS database still has to be updated manually.

3) Implement a middleware

A middleware can be implemented without making changes to the current databases of Classroom Services and the BMS department. A common application of a middleware is to allow programs written for access to a particular database to access another database. Typically, middleware programs provide messaging services so that different applications can communicate…."[1]

With a middleware, a report whose values can be directly plugged into the BMS department's information system (without human interaction) can be created. Whenever there is a change in the Classroom Services database, the BMS database can be automatically be updated. Therefore, at any given time all users can make sure that any information on the databases is up-to-date and accurate.

We recommend using the Crystal Report 10 Professional Edition as it is currently one of the best middleware applications on the market. With this software, a report can be automatically created whenever a booking is done on the Classroom Services system. The values from the report can then be collected by the BMS department's system and plugged into their scheduler application, the application that is currently adjusted manually whenever there is a booking. Crystal Reports has flexible formatting and is user friendly.

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[1] http://searchwebservices.techtarget.com/sDefinition/0,290660,sid26_gci212571,0 0.html

(Appendix B shows a depiction of what the current booking process would become.)

Processes for implementation:

1. With the use of Crystal Reports 10 Professional Edition, Classroom Services would need to decide whether to have the report generated with Crystal Reports 10 to be scheduled for emailing to BMS, or to publish the report over the web. The advantages of publishing the report over the web is that the report can be distributed to a number of users over the web and that the BMS can go on the web and be able to acquire the most up-to-date information instead of waiting for a scheduled email.

2. An IT person is necessary to write the code for grabbing data from the report and plugging it into the BMS database. (Based on our phone conversation with three Business Objects consultants, we were able to conclude that that it is possible to automatically update a database using a Crystal Reports file. However, Business Objects was unwilling to provide more detailed and technical information to us as we were unable to discuss with them in more details the exact functions that we would like the middleware to serve for us. Classroom Services might achieve a better result considering that they are already registered users of Crystal Reports)

Economic feasibility:

The Crystal Reports 10 Professional Edition software costs $495 US Dollars. In return,

a registered user can also take advantage of Crystal Reports' technical support services.

Their technical support services include complimentary interactive technical support,

complimentary 24/7 online support resources, an extensive knowledge base,

downloadable files and updates, and access to user discussion forums found at:

http://www.businessobjects.com/products/dev_zone/net/gettingstarted.asp

Crystal Reports 10 Professional Edition would only need to be purchased by the BMS

department as Classroom Services already has this program.

In addition to the cost of purchasing the middleware software, a labour cost would also

need to be incurred for an IT administrator to install and configure the application in the

BMS department's system and to write a code that would automatically plug the value

from the report into the BMS database.

Technical feasibility:

The system requirement for Crystal Reports 10 Professional Edition is as follow:

OS Requirement: Microsoft Windows XP, Microsoft Windows 2000 or a later version

If the BMS department decides to purchase Crystal Reports 10 Professional Edition,

they then are able to fully automate current processes. A report created by Classroom

services can be sent to BMS or be published on the web. New, updated and deleted

booking records in Classroom Services can be flagged so that the BMS database knows

what to update rather than go through a whole report containing information that they do not necessary need. The other option with Crystal Repots is that the BMS department can open a Crystal Reports file and use a SQL query to compare the data in the report to the data in their current database and compute whether adjustments may be required to the air handling units' schedule.

The advantages and disadvantages of using Crystal Report 10 Professional Edition are shown in the following table:

Middleware	Advantage	Disadvantage
Crystal Reports 10 – Professional Edition	1) It will eliminate the extra communication that is currently needed whenever there is an ad-hoc booking or change in the Classroom Services system. 2) Crystal Reports only needs to be purchased for the BMS department as Classroom Services already has it. 3) Since Classroom Services already has Crystal Reports 10, it is better for BMS to purchase the same product rather than buy another middleware and be worried about compatibility issues. 4) BMS can use Crystal Reports for creating any other reports to meet other purposes that would improve their management and decision making. 5) It may be possible to automate the adjustment that BMS has to make given the room schedule information passed to them from Classroom Services.	1) An IT specialist has to install the Crystal reports software and configure it for use by the BMS department. 2) More communication with Business Objects consultants may be necessary to carry out the actual implementation. 3) There may be limitations to Crystal Reports that we may be unaware of.

<u>4) Require restricted room bookers to book through Classroom Services online booking system.</u>

If the communication problem between Classroom Services and the BMS department can be made more efficient with the solutions that we have proposed above, the BMS department may want to require that restricted room bookers also book through the Classroom Services online booking system. This solution would probably be of most benefit only if the middleware solution, where the BMS system may be updated automatically, can be successfully implemented.

(Appendix B shows a depiction of what the current booking process would become.)

The advantages and disadvantages of this solution are:

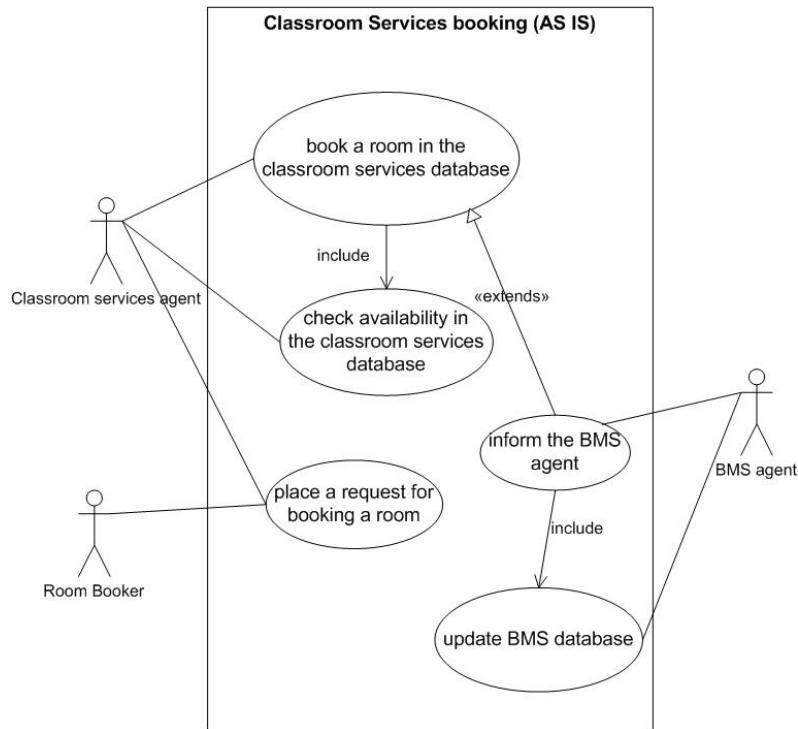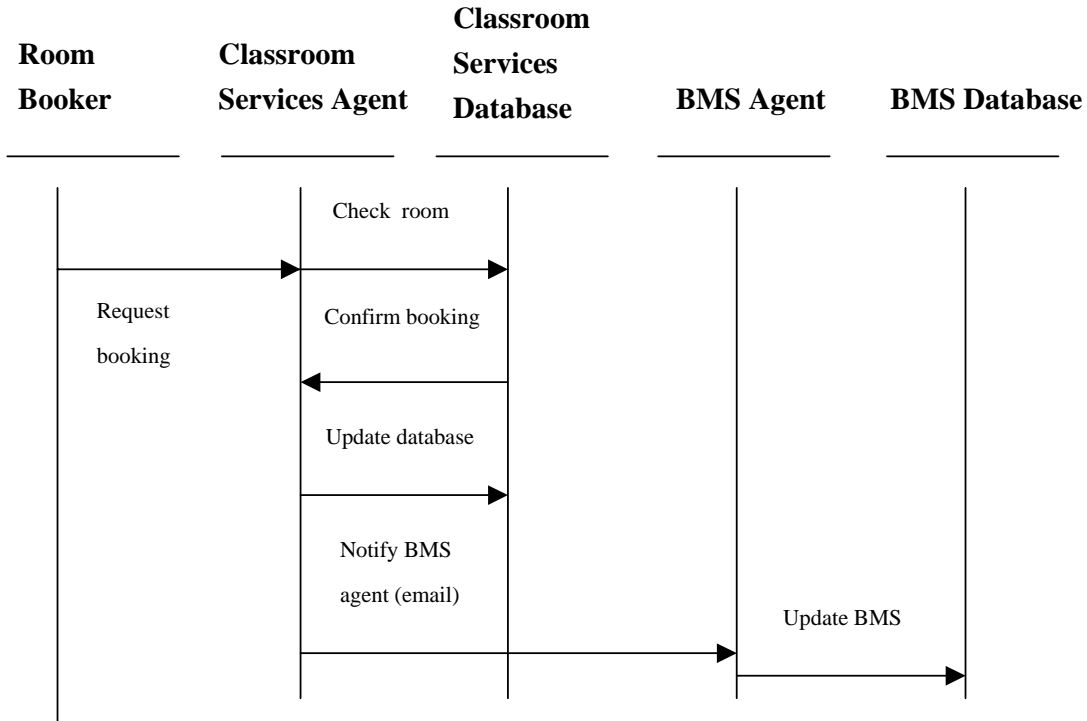|	**Advantage**	**Disadvantage**
Formalizing the room booking process of restricted rooms.	1) Eliminates out of ordinary phone calls to the BMS department. 2) Eliminates the same problems that we have attempted to solve above for the non-restricted rooms (on the basis that an efficient communication process is able to be successfully implemented) 3) The process for booking restricted rooms should not be too difficult to implement as the process should be essentially the same in nature as for the booking of non-restricted rooms.	1) Reluctance from restricted room bookers to follow a stricter and formalized process. 2) Classroom Services would have to input data for the restricted rooms into their database. The booking system would have to be configured to accommodate the restricted room bookers.

E. Recommendation:

Given the limited resources in time and labour at the moment, we would recommend the departments to attempt solution two where a new property to the classroom object is added into the Classroom Services database system. A query could also be created, whereby the university could impose some limitations on room bookers that could help the university reach its sustainability goals.

Implementing a middleware would achieve the most benefit in terms of time savings as it best improves the efficiency of communication between Classroom Services and the Building Management Systems department. It may also automate the adjustment that is necessary to the air handling units' schedule. However, this solution also appears to be the most time consuming alternative to implement as more communication with the Business Objects consultant would be required to confirm that Crystal Reports 10 Professional Edition will be able to serve the functions that we propose in the middleware solution.

APPENDICES:

Classroom Services Booking Process (AS IS)

Room Booker	Classroom Services Agent	Classroom Services Database	BMS Agent	BMS Database

Check room

Request booking

Confirm booking

Update database

Notify BMS agent (email)

Update BMS

Classroom Services booking (AS IS)

book a room in the classroom services database

Classroom services agent

include

«extends»

check availability in the classroom services database

inform the BMS agent

BMS agent

place a request for booking a room

Room Booker

include

update BMS database

Appendix B: A proposed booking process for both restricted and non-restricted rooms.

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Classroom Services Booking Process (TO BE)
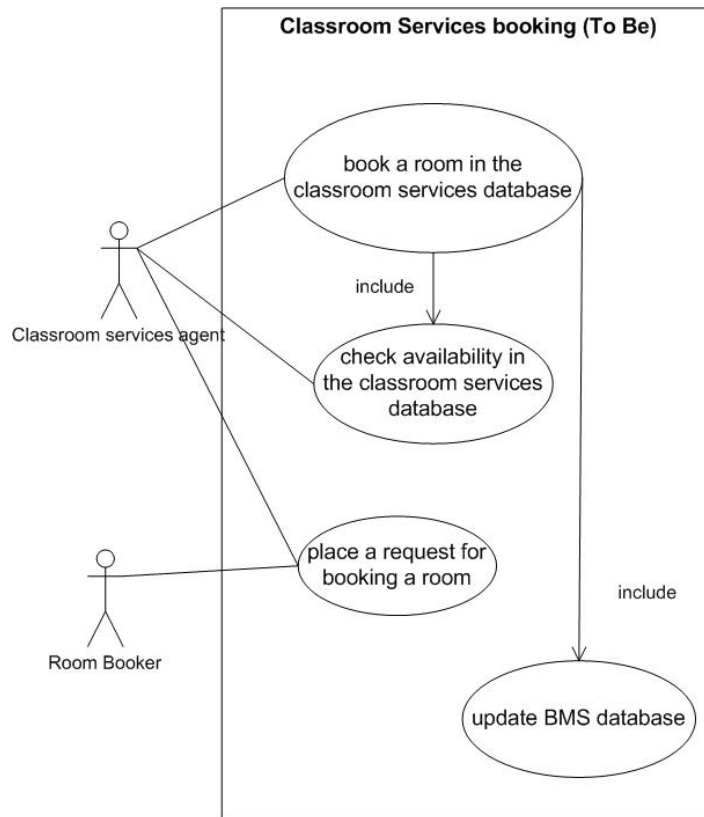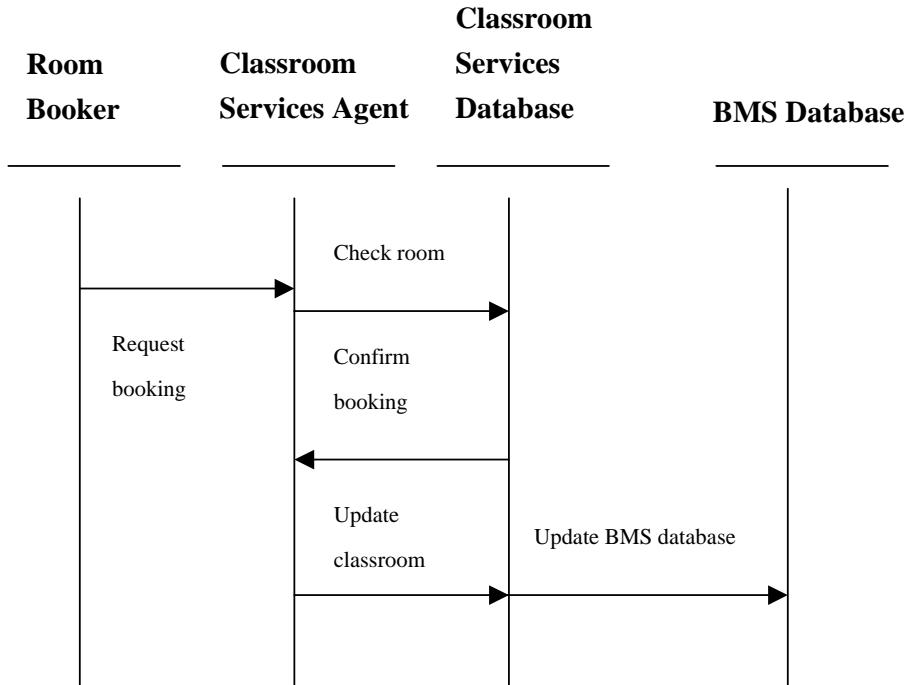
Appendix C: A portion of the cross reference Excel file that associates each room with

an air handling unit(s).

Note: Rooms such as Room No. 229, 230, and 231 have no corresponding air handling

units whereas rooms such as Room No. 361 and 361A are associated with more than

one air handling unit.

 University of British Columbia

Building Name: Sedgewick Library/Walter C. Koerner
Library (#515,515-1)

Rm. No.	AHU Tag	Rm. No.	AHU Tag	Rm. No.	AHU Tag
1	AHU-3 (SF-3/RF-3)	201B	AHU-1 (SF-1/RF-1)	227	AHU-2 (SF-2/RF-2)
2	-	201C	AHU-1 (SF-1/RF-1)	229	-
101	AHU-1 (SF-1/RF-1), AHU-2 (SF-2/RF-2)	201D	AHU-1 (SF-1/RF-1)	230	-
102	AHU-3 (SF-3/RF-3)	201E	-	231	-
103	AHU-3 (SF-3/RF-3)	201F	AHU-2 (SF-2/RF-2)	232	-
104	AHU-1 (SF-1/RF-1)	202	AHU-3 (SF-3/RF-3)	240	AHU-3 (SF-3/RF-3)
105	AHU-1 (SF-1/RF-1)	202A	AHU-3 (SF-3/RF-3)	241	AHU-2 (SF-2/RF-2)
105A	AHU-1 (SF-1/RF-1)	202B	AHU-3 (SF-3/RF-3)	241A	AHU-2 (SF-2/RF-2)
106	AHU-1 (SF-1/RF-1)	203	AHU-1 (SF-1/RF-1)	241B	AHU-2 (SF-2/RF-2)
106A	AHU-1 (SF-1/RF-1)	204	AHU-1 (SF-1/RF-1)	242	AHU-2 (SF-2/RF-2)
107	AHU-1 (SF-1/RF-1)	205	AHU-1 (SF-1/RF-1)	244	AHU-2 (SF-2/RF-2)
108	AHU-1 (SF-1/RF-1)	205A	AHU-1 (SF-1/RF-1)	245	AHU-2 (SF-2/RF-2)
110	AHU-1 (SF-1/RF-1)	206	AHU-1 (SF-1/RF-1)	246	AHU-2 (SF-2/RF-2)
112	AHU-1 (SF-1/RF-1)	206A	AHU-1 (SF-1/RF-1)	247	AHU-3 (SF-3/RF-3)
118	AHU-2 (SF-2/RF-2)	206B	AHU-1 (SF-1/RF-1)	248	AHU-3 (SF-3/RF-3)
118A	AHU-2 (SF-2/RF-2)	207	AHU-1 (SF-1/RF-1)	260	AHU-3 (SF-3/RF-3)
118B	AHU-2 (SF-2/RF-2)	208	AHU-1 (SF-1/RF-1)	260A	AHU-1 (SF-1/RF-1), AHU-2 (SF-2/RF-2)
119	AHU-2 (SF-2/RF-2)	210	AHU-1 (SF-1/RF-1)	260B	AHU-3 (SF-3/RF-3)
119A	AHU-2 (SF-2/RF-2)	211	AHU-1 (SF-1/RF-1)	261	AHU-13
120	AHU-2 (SF-2/RF-2)	212	AHU-1 (SF-1/RF-1)	262	AHU-3 (SF-3/RF-3)
121	AHU-2 (SF-2/RF-2)	213	AHU-1 (SF-1/RF-1)	263	AHU-3 (SF-3/RF-3)
121A	AHU-2 (SF-2/RF-2)	213A	AHU-1 (SF-1/RF-1)	263A	AHU-3 (SF-3/RF-3)

Room	AHU	Room	AHU	Room	AHU
121B	AHU-2 (SF-2/RF-2)	214	AHU-1 (SF-1/RF-1)	264	AHU-3 (SF-3/RF-3)
121C	AHU-2 (SF-2/RF-2)	215	AHU-1 (SF-1/RF-1)	265	AHU-3 (SF-3/RF-3)
122	AHU-2 (SF-2/RF-2)	216	AHU-1 (SF-1/RF-1)	265A	AHU-3 (SF-3/RF-3)
129	-	217	AHU-1 (SF-1/RF-1)	266	AHU-3 (SF-3/RF-3)
130	-	218	AHU-1 (SF-1/RF-1)	267	AHU-3 (SF-3/RF-3)
131	-	218A	AHU-1 (SF-1/RF-1)	268	AHU-3 (SF-3/RF-3)
132	-	218B	AHU-1 (SF-1/RF-1)	270	AHU-3 (SF-3/RF-3)
133	AHU-2 (SF-2/RF-2)	218C	AHU-1 (SF-1/RF-1)	280	AHU-3 (SF-3/RF-3)
133A	AHU-2 (SF-2/RF-2)	218D	AHU-1 (SF-1/RF-1)	281	AHU-3 (SF-3/RF-3)
135	AHU-3 (SF-3/RF-3)	218E	AHU-1 (SF-1/RF-1)	282	AHU-3 (SF-3/RF-3)
136	AHU-3 (SF-3/RF-3)	218F	AHU-1 (SF-1/RF-1)	283	AHU-3 (SF-3/RF-3)
137	AHU-2 (SF-2/RF-2)	218G	AHU-1 (SF-1/RF-1)	283A	AHU-3 (SF-3/RF-3)
151	AHU-3 (SF-3/RF-3)	218H	AHU-1 (SF-1/RF-1)	283B	AHU-3 (SF-3/RF-3)
152	AHU-3 (SF-3/RF-3)	218J	AHU-1 (SF-1/RF-1)	283C	AHU-3 (SF-3/RF-3)
153	AHU-3 (SF-3/RF-3)	218K	AHU-1 (SF-1/RF-1)	290	-
154	AHU-3 (SF-3/RF-3)	218L	AHU-1 (SF-1/RF-1)	340	AHU-4
154A	AHU-3 (SF-3/RF-3)	218M	AHU-1 (SF-1/RF-1)	341	AHU-4
160	AHU-3 (SF-3/RF-3)	219	AHU-2 (SF-2/RF-2)	341A	AHU-4
161	AHU-3 (SF-3/RF-3)	219A	AHU-2 (SF-2/RF-2)	341B	AHU-4
162	AHU-3 (SF-3/RF-3)	219B	AHU-2 (SF-2/RF-2)	341C	AHU-4
163	AHU-3 (SF-3/RF-3)	219C	AHU-2 (SF-2/RF-2)	342	AHU-4
163A	AHU-3 (SF-3/RF-3)	219D	AHU-2 (SF-2/RF-2)	343	AHU-4
164	AHU-3 (SF-3/RF-3)	219E	AHU-2 (SF-2/RF-2)	344	AHU-4
165	AHU-3 (SF-3/RF-3)	219F	AHU-2 (SF-2/RF-2)	345	AHU-4
165A	AHU-3 (SF-3/RF-3)	219G	AHU-2 (SF-2/RF-2)	346	AHU-4
166	AHU-3 (SF-3/RF-3)	219H	AHU-2 (SF-2/RF-2)	347	AHU-4
167	AHU-3 (SF-3/RF-3)	219J	AHU-2 (SF-2/RF-2)	348	AHU-4
168	AHU-3 (SF-3/RF-3)	219K	AHU-2 (SF-2/RF-2)	349	AHU-4
169	AHU-3 (SF-3/RF-3)	219L	AHU-2 (SF-2/RF-2)	350	AHU-4
170	AHU-3 (SF-3/RF-3)	219M	AHU-2 (SF-2/RF-2)	360	-
180	AHU-3 (SF-3/RF-3)	219N	AHU-2 (SF-2/RF-2)	361	AHU-2 (SF-2/RF-2), AHU-3 (SF-3/RF-3)
181	AHU-3 (SF-3/RF-3)	220	AHU-2 (SF-2/RF-2)	361A	AHU-2 (SF-2/RF-2), AHU-3 (SF-3/RF-3)