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Teaching Case

A Database Design and Development Case: Smile Land Academy

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Abstract

This case describes the situation of Smile Land Academy (SLA), a real-world based childcare center. SLA has grown from a very small company to a fairly large-sized organization (30 employees with 150 children). Unfortunately, its system for record-keeping, summarization of data, and reporting has not kept pace. The hard copies and spreadsheet software programs that have been used to manage the data are no longer effective or efficient. This case presents the situation SLA is in as well as the desired system features and outputs that the organization would like in a new system.

Keywords: Case, Project, Database design, Systems Analysis and Design, Project-based learning, Team project

INTRODUCTION

While attending classes at a local college, Victoria Middleton had been working part-time as a child caretaker at a daycare center run by the university. After four years of experience and a bachelors degree in early childhood education, she obtained a State license and started Smile Land Academy (SLA), a daycare center, in her hometown. Her business has steadily grown over the years. What began with only one class of five children and a single caretaker, SLA has grown to where it currently provides services to more than 150 children and employs over 30 part-time and full-time caretakers.

Growing a business has required Victoria to be more efficient with her resources. However, much of her time is currently spent on paperwork. She needs a better way to organize her data and would like a computerized database system to help manage her day-to-day operational activities and provide summary reports.

1. THE CURRENT SYSTEM AND SITUATION

Presently, most data is first recorded on paper and later transferred to a computer file. Victoria keeps a paper copy of all the information in case there are problems with the computer files. Parents and caretakers can check in and out

using paper sign-in sheets or one of the three computers located at the building entrance. Victoria also utilizes a spreadsheet software program to keep track of employee work hours and payroll information. This practice has worked well until recently, when she felt she needed a better way to organize data for easy retrieval. In addition, she would like to be able to see the overall day-to-day operations without having to spend too much time going through her files and papers to create reports.

2. CURRENT DATA PROCESSING DESCRIPTION

This section describes activities performed at SLA.

2.1 Creating a Waiting list. SLA accepts child enrollment applications from parents or guardians all year round. If there is an opening in a class for the child in his or her age range, the child will be immediately accepted and may start attending class as early as the next day. However, SLA rarely has an unfilled seat. As a result, most applications will be placed on a waiting list. Applications on the waiting list are dated and kept in a file folder for the age group (Nursery (i.e., 3-12 months), 1, 2, 3, 4 and 5 years old). An application may be placed on the waiting list for as little as 1 week all the way up to one year. Any application older than one year old will be shredded.

2.2 Processing Initial child registration and enrollment. As soon as there is an open seat in a classroom, Victoria will contact the parents of a child who were next in line on the waiting list for that age group. The parents will be asked to update information on the application as well as complete additional forms including parent/guardian address and phone numbers, family physician information, hospital name and phone number, and health insurance provider information. Victoria will take a picture of the child and the parents and attach them to the records. A \$50 non-refundable registration fee is also due with the completed application.

2.3 Daily checking in and out of children. SLA is open Monday through Friday from 6:30am to 5:30pm. Parents, guardians, or other authorized persons may check in and out a child using the sign-in sheet located in

each classroom. At the end of the day, Victoria collects the sign-in sheets and places them in a binder in her office. See Figure 1 for an example of the sign-in sheet.

2.4 Caretaker scheduling. Another significant part of Victoria's job is to make sure that she hires the best possible caretakers for SLA. She also works with scheduling the caretakers so SLA has sufficient coverage throughout the operating hours each day.

2.5 Daily checking in and out of caretakers. Caretakers at SLA must check in at one of the three computer kiosks located at the building entrance. After choosing the option to check in as an employee, the computer will print out a sticker name tag for the day. Each caretaker must wear the name tag while they are at work. Caretakers must also check out at the kiosk at the end of the day. The check in and out process also serves as a timesheet for payroll purposes, with this information being copied to the spreadsheet software program.

2.6 Maintaining and updating the children's information

2.6.1 Basic information. Conforming to the State law, SLA maintains up-to-date information about each child. Victoria and full-time employees have access to children's basic information including phone numbers of parents/guardians and emergency contact information.

2.6.2 Once a year, SLA will ask parents/guardians to verify that the children's information is up-to-date. Parents/guardians of each child will receive a formal letter with a form containing the child's information. Parents/guardians are asked to make changes to the information on the form or confirm that the information is accurate before submitting it back to the office within ten days. In addition, SLA requests an annual updated immunization records for each child. The information may be faxed directly from a child's pediatrician to the SLA office.

- 2.6.3 Every three months, SLA evaluates each child to see if he/she is ready, both physically and intellectually, to move to the next room. If so and if there is a space in the next room (i.e., moving from the 12-15 month room to the 15-18 month room), Victoria will write a letter to inform the child's parents/guardians about the move. The letter contains the date when the child will move to the new class, information about the new teacher, changes in curriculum (if any), and the new weekly tuition rate if any). The class roster will also be updated accordingly.
- 2.6.4 List of people authorized for pickup. In addition to parents and guardians, SLA maintains a list, with pictures, of people authorized to pick up each child. A person can be added to a child's authorized pick up list only when he/she is initially presented with parents/guardians. Pictures of the authorized pick up person must also be taken and kept on file in the office for verification purposes.
- 2.6.5 Processing tuition and fee payment. Table 1 summarizes a fee structure at SLA. Detailed information for the fee is provided below.

Tuition and Fee description	Amount
One time Non-refundable registration fee	\$50
Weekly Tuition for Infant Rooms	\$160
Weekly Tuition for 1-year old Rooms	\$143
Weekly Tuition for 2-year old Rooms	\$130
Weekly Tuition for 3-year old Rooms	\$117
Weekly Tuition for 4-5 year old Rooms	\$115
Weekly Tuition for K-5th Grade	\$100

Table 1 SLA fee structure

- 2.6.6 Initial registration fee. Once a child has been accepted at SLA, a one-time \$50 non-refundable registration fee is due along with a complete application. Parents can pay the

registration fee by cash, check, or credit card.

- 2.6.7 Weekly fee. The primary source of revenue for SLA is from weekly tuition. Currently, tuition payments are accepted only by either cash or check. Victoria is interested in adding an option to allow parents to pay online with a credit card. However, she is not sure how to get started with this process.
- 2.6.8 Late pickup fee. Children must be picked up by their parents, guardians, or previously authorized persons before 5:30pm. If the children are not picked up by 5:30pm, a late pickup fee of \$20 per child per hour (fraction of an hour is considered one full hour) will be charged to the account. More than three late pick up in one month will result in a warning to parents.
- 2.7 **Recording child incident.** Conforming to the State law, SLA is required to maintain records of each child's illnesses, accidents, injuries, signs of abuse, etc. The detailed incident information must include the child's name, date of birth, date and time of the incident, type of the incident (accident, illness, etc.), description of the incident, injuries (if any), description of medical services or treatment provided (if any), date and time the parent/guardian was notified about the incident, witnesses of the incident, and name of the caretaker. Currently, Victoria uses a paper form to record each incident. The original copy of the form is kept in a binder in the office, one copy is placed in the child's personal folder, and another copy is given to the parents. An example of the incident report is provided in Figure 2. (also see Section 4.10)

3. DESIRED SYSTEM FEATURES AND OUTCOMES

Victoria would like to spend less time processing paperwork and more time managing her business. Currently, she had to obtain data from the paper forms and reentered it into a spreadsheet software in order to generate a report, even if it is a simple report such as a list of children attending class each day.

Victoria has set aside a budget for these purposes. She would like to be able to electronically record child attendance and easily retrieve information for planning and scheduling caretakers. She would also like the new system to be able to generate the following reports:

- 3.1 **Waiting list report.** Victoria would like to keep an electronic record of children in the SLA waiting list organized by age and when the child was placed on the list.
- 3.2 **Child information.** Per State Law, SLA must maintain accurate information of each child. Victoria would like the tasks of keeping accurate records to be as easy as possible. The system should allow Victoria to view and update information and pictures for each child. She would also like to be able to view the overall records for all active children enrolling at SLA. This feature would be very useful in such situations as looking up which children do not have an immunization record on file. Victoria would like to keep records of every child enrolled at SLA, whether the enrollment is active or not.
- 3.3 **Guardian Information.** Similar to the child's information, Victoria would like to maintain accurate information for the parents/guardians of each child. She wants to be able to view information about all children under each guardian as well as all guardians for each child. Again, Victoria would like to keep records of all the parents/guardians whether they have a child currently enrolled at SLA.
- 3.4 **Child reference report.** This feature would be useful for caretakers to quickly locate basic information about each child. The reference report for each child should include such information as parent/guardian names and phone numbers, emergency contacts, medical information, and name and pictures of authorized pick up persons.
- 3.5 **Birthday report.** This report lists birthdays of children currently enrolled at SLA as well as birthdays by classroom.
- 3.6 **Class roster.** Victoria would like to be able to view the SLA roster overall (i.e., a list of children currently enrolled at SLA) as well as individual class rosters (i.e., a list of child assigned to each classroom). Ideally, the printed individual class roster should include

the classroom number, teacher name(s), child names and the total number of children scheduled to be in a class. In addition, the reports should include checkboxes for attendance, a place to record the number of breakfast, lunch, and afternoon snacks requested for each class.

- 3.7 **Attendance reports.** Based on the check-in and check-out data, Victoria would like to be able to view the list of children currently attending SLA at any particular moment as well as the current attendance for each classroom. In addition, the system should be able to create a comprehensive report summarizing attendance hours for each child every week.
- 3.8 **Receipt for fee payments.** The system should be able to generate receipts for each of the payments SLA receives.
- 3.9 **Event reminders.** Victoria would like to receive an automatic reminder report at the beginning of each day. Examples of reminders include upcoming children's birthdays, upcoming activities (field trips, emergency drills, etc.), upcoming child progress evaluations (see Section 3.6.3), upcoming due dates for child immunizations, account information needed to be updated, and accounts that are currently past due.
- 3.10 **Child incident reports.** An incident report currently in use is provided in Figure 2. Victoria would like the new system to be able to generate a similar report that can be accessed from each child's record. She also would like to be able to create a monthly report summarizing all incidents by classroom, age group, and SLA overall.
- 3.11 **Caretaker Information.** Victoria would like to keep records of all employees at SLA although they are no longer actively working at SLA.

4. CONCLUSION

Victoria needs your help. Her business at Smile Land Academy has been successful. However, as her business (and profits) has grown, so have the demands on her time due to a number of different issues related to record-keeping and reporting. Not surprisingly, her spreadsheet software program and hard copies of other documents is no longer an efficient or effective

SMILE LAND ACADEMY INCIDENT REPORT	
*This form may be used to maintain a record of each child's illnesses, accidents, injuries, signs of abuse, etc. *Provide a completed copy to parents.	
Name of Child _____ DOB: _____	
Details of Incident	
Date / /	Type _____ <small>(Accident, illness, etc.)</small>
Time _____ <input type="checkbox"/> Am <input type="checkbox"/> Pm	Place _____ <small>(Kitchen, Playground, etc.)</small>
Describe Incident: _____ _____ _____	
Injuries: _____ _____ _____	
Describe Medical Services or Treatment Provided _____ _____ _____	
Parent/Guardian/Other Notified	
Name _____	Date / / Time _____ <input type="checkbox"/> Am <input type="checkbox"/> Pm
Name _____	Date / / Time _____ <input type="checkbox"/> Am <input type="checkbox"/> Pm
Witnesses	
Name _____	
Name _____	
Staff _____ Date / /	
<small>(Print Name)</small>	
Staff Signature: _____ Date / /	

Figure 2 Incident Report

Teaching Case

A Case for Calculating Innovation Score: Comparison between Apple, Inc. and Microsoft, Corp.

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Abstract

This case study is about measuring the innovation score of a firm and comparing it against a competitor within a particular industry nationally. It is meant to motivate students who are interested in how business intelligence dashboards can be used to measure innovation of firms. The case study is for students who are taking a class in business innovation, measuring business productivity, and business intelligence. Students should have studied the importance of innovation in business performance, as well as the strategies, tools, and roles of business intelligence before reading this case.

Keywords: business intelligence, innovation, innovation scorecard, Microsoft Corp., Apple Inc.

1. CASE SUMMARY

John has successfully presented a paper which he co-authored with his academic adviser, Dr. Zuba, as the main author at the Americas Conference on Information Systems (AMCIS). He is determined to turn the paper into a refereed journal publication by the end of the fall semester. John has completed the paper and is ready to submit it, but Dr. Zuba feels that despite the fact that he co-authored the initial paper for AMCIS, he will not co-author this upgraded paper. This is because Dr. Zuba does not agree with the innovation scores between Apple Inc. and Microsoft Corp. Dr. Zuba feels the more innovative company got the lower innovation score, which will be unacceptable to most professionals. Should John go ahead and submit this paper to a journal since his calculations are based on the exact measurements of innovation outlined in the AMCIS paper?

2. CASE

John got a standing ovation at the AMCIS conference because of the enthusiasm in which he presented his paper. Unlike many presentations at the conference, where members of the audience move in and out, John's audience sat down attentively throughout his 20-minute presentation. During the presentation, not a soul walked out. They asked questions with interest, and even the presentation coordinator suggested that his work should be submitted to a refereed journal. The initial work had a model, factors of innovation, and how the factors should be measured with Business Intelligence dashboards. It also explained the need to derive an innovation score for a firm within a country, but innovation scores for the firms mentioned were not calculated. John was determined to use the measures of the innovation factors in his AMCIS paper to calculate the innovation score for Apple Inc. and

Microsoft Corp., as well as compare which of them was more innovative in 2010.

The Student

John Brown is a Ph.D. candidate in a mid-sized university in Arizona. He was determined to have at least one journal publication annually. He just began his second year as an Information Systems student in the School of Business and is determined to turn his AMCIS paper on innovation scores into a refereed journal publication. John believes that publications are more important than getting all "As" before graduation and that conference presentations are not as highly rated by (university) employers as publications in refereed Information System journals. Also, he is on a fellowship that requires that he works with a faculty member for 20 hours weekly as a research assistant and he must submit annual progress reports to the School of Graduate Studies, which must be approved by the faculty to which he is assigned. John is in his mid-30s, is married, has a child, has written lots of articles in many newspapers, and has five years experience working as a business analyst in a communications company in Arizona.

The Professor

Dr. Zuba is a tenured faculty member in the university and has been a professor for 15 years. He taught at a different university before moving to Arizona seven years ago to help shape the new Information Systems department in the School of Business. His focus is business intelligence, information analysis and modeling, e-commerce, as well as data retrieval and analytics. Some of his publications have appeared in Decision Sciences, Decision Support Systems, and many others information systems journals. Dr. Zuba is also the graduate coordinator for the Ph.D. students in Information Systems. He is 52, married, has three children, and admires Steve Jobs and Apple, Inc.

The AMCIS Research Paper

The AMCIS paper that John presented was based on a model explained in Table 1 (all tables in appendix), which he designed to derive an innovation score for each firm within a country. The four factors and their various sub-factors were used to generate an innovation score. The multiple factors that help to determine how innovative a firm are listed in Table 1, along with

the research done to show how they influence innovation. The measurement in Table 2 is utilized to calculate the innovation score for each firm within a country.

According to John, "Based on research, there are four factors that could be used to measure the innovation score of a firm within a particular country. These include: intrinsic motivation, resources, organizational characteristics, and the firm industrial code. The intrinsic motivation of employees can be assessed on the basis of challenge, freedom, supervisory encouragement, and organizational support. The resources are financial and human capital. The sub-factors of organizational characteristics are organizational size, market power, as well as organizational structure and networks. The firm industry code is the numerical value for the largest possible innovative difference between a large and small firm within a particular industry."

Updated Paper for Submission

John then decided to make the **Innovation Score (IS) = 2(A + B + C + D) + E + 2(F) + 2(G) + 2(H) + 2(I) + J**, based on the disaster preparedness score formula from Simpson (2008), explained in Table 3. Before comparing innovation scores of Apple Inc. and Microsoft Corp., John assumed that the two firms would score above 80% (a B grade by U.S. standards) in their employees' surveys, as seen in Table 3.

According to the (2010) Apple report, Apple Inc. had revenues of \$65.23 billion and profits of \$14.01 billion, an outstanding issued stock share of \$899.8 million, and total assets amounting to \$75.18 billion. The operating cost for Apple Inc should be \$51.22 billion, which is the difference between revenue and profits. According to ifoApplestore.com, a site dedicated to news and information about Apple Inc's retail stores, the retail segment contributed the most to Apple Inc's revenue at \$9.08 billion in the fiscal year ending September 2010. Also, the (2010) Apple report shows that total revenue in 2009 for Apple Inc. was \$42.91 billion, the profit was \$8.24 billion, and Apple Inc's 2010 fiscal year ended on September 25, 2010. This means that the total cost to Apple Inc. for 2009 was \$34.67 billion. So the cost margin for Apple Inc. from 2009 to 2010 will be the difference between the two annual costs.

Microsoft Corporation's (2010) Annual Report shows that its fiscal year ended on June 30, 2010 with a revenue of \$62.4 billion, operating

expense of \$38.4 billion (\$38.1 for 2009), profit of \$24.1 billion, total assets of \$86.1 billion, and an outstanding issued stock share of \$8.9 billion. The business division made the most revenue - \$18.9 billion.

John observes, "In this innovation calculation, I made price-cost margin of market power a revenue-cost margin, which is equivalent to (revenue - (new year cost - last year cost)) / revenue). For human capital, I made (capital / sales) equivalent to (total assets / revenue). The financial capital is (stock value / total assets). I used Yahoo Finance to calculate the stock value by multiplying the outstanding issued stock share by the average stock price for the entire fiscal year."

In Yahoo Finance (YF), John used the monthly option for both companies and queried from July 1, 2009 to June 30, 2010 for Microsoft Corp. and from September 27, 2009 to September 25, 2010 for Apple Inc. because its last fiscal year ended in September 26, 2009. Since Apple Inc's fiscal year was not a perfect month-ending date, YF gave 13 monthly readings of the closing stock price for the year instead of 12. Apple Inc. had an average closing stock price of \$229.10, Microsoft Corp. had \$26.18, and John multiplied their average stock price with the average value of their diluted and outstanding stock shares shown in their respective financial reports.

In utilizing the Standard industrial Classification Code in Acs & Audretsch (1987), John had to depend on the large-to-small firm innovation rates created by the United States Small Business Administration in 1982. They decided to come up with a balanced innovative measure for large and small firms in the same industry. The purpose was to define a numerical value for the largest possible innovative difference between a large and small firm in a particular industry. The four measures include: the large firm innovation rate (LIE) and small firm innovation rate (SIE), which are both based on employee numbers, as well as innovation standardized by sales (DIS) and innovation standardized by employee number (DIE), which are both based on number of innovations. LIE is for firms with employees over 500, SIE is for firms below 500 employees, DIS is for sales that were made regardless of employee size, and DIE is for industries where employee size does not affect innovation.

Since this paper is dealing with innovation in firms where employee size matters and both are large firms, John felt that the LIE would be more applicable in deriving the innovation scores for Microsoft Corp. and Apple Inc. For the electronic computing equipment industry, which includes the two companies under focus, the LIE innovation difference was 0.9570, SIE was 8.2246, DIS was - 7.2676, and the DIE was - 8.3290.

So John utilized 0.9570 for the firm's industry. Companies in different industries can be compared and you can use any of the SIC classification differences to get the firm industry score depending on the availability of information provided by each company. You may want to use DIS if you are working with sales. John concluded in Table 5:

Innovation Score (IS) for Apple Inc. =
2(1 + 1 + 1 + 1) + 1(0.5) + 2(0.13) +
2(1.5) + 2(2.3) + 2(5.42) + 0.96 = 18.81

Innovation Score (IS) for Microsoft Corp. =
2(1 + 1 + 1 + 1) + 1(0.5) + 2(0.3) + 2(1)
+ 2(1.38) + 2(5.42) + 0.96 = 19.94

The Disagreement

After reviewing the updated paper for submission, the day after Steve Jobs, co-founder of Apple Inc., died, Dr. Zuba felt that the paper was unsuitable for publication. This was because of how the results might affect Steve Jobs' sympathizers, how many in the technology field, including himself, believed that Apple Inc. is more innovative than Microsoft Corp., and because he disagreed with the use of a calculation used in a disaster preparedness paper (i.e., to calculate innovation score for firms).

Dr. Zuba insisted, "I do not know why you will use a formula for calculating disaster preparedness score for innovation, which is based on a linear combination of separate variables with various assigned values. When it comes to innovation factors, many executives would be concerned with issues such as pipeline of new products in development, number of innovative products being created, and comparing the current sales of new products to old ones. Many in the business community would even laugh at the fact that Microsoft Corp. is more innovative than Apple Inc. because the latter created innovations that shook up many industries."

John replied jokingly, "Sir, please do not allow your love for Apple Inc, the death of Steve Jobs, and your worship of Macintosh computers to prevent you from working with me to make this AMCIS paper become a refereed journal publication. I also know that you believe that IBM stands for "I Buy Mac". It was Dr. Moon, who teaches the PhD seminar in Internet Securities that suggested that any published formula from any field could be utilized to calculate any score as long as the adopted formula was replicated with adequate explanations. I believe that researched documentation always beats conversation, beliefs, or what we think. Numbers do not lie, and from my calculations based on financial data of the two firms, as well as researches from other notable scholars on the facts of innovation, Microsoft Corp. as of the end of 2010 was more innovative than Apple Inc."

Dr. Zuba inquired further, "Are you sure Microsoft did not promise you a paid internship position to come up with this conclusion? How on earth can Microsoft, Corp. be more innovative than Apples Inc.? What products have Microsoft got to show lately that even brings it close to Apple in terms of being innovative? Can you even compare Apples Inc.'s sales to that of Microsoft Corp.'s? How then can these bunches of numbers here justify to business professionals and researchers that Microsoft is more innovative? Even customers on the street know that Apple is more innovative by the quality of gadgets they bought from Apples Inc. or see in the news?"

John concludes, "Focusing on the definition of innovation make Apple Inc. appear to be more innovative because it has re-engineered and re-structured our lives through its invention more than Microsoft Corp. Also, Apple Inc. did create more revenue, but it failed to be more profitable than Microsoft in 2010 as well as in other financial data. The effects of new products or its sales are all covered in the financial data. The purpose of an innovation score is to provide numerical value for innovation based on reliable annual financial data from firms and their employee evaluations on motivation to innovate, rather than relying on mere numbers of inventions, patents, revenue, or profits. Sir, let us try to put sentiments aside because Microsoft Corp. beats Apple Inc. in every financial data aside from revenue, assuming they both have maximum employee evaluation points for motivation to innovate. Ultimately, Business

Intelligence scoreboards can be utilized to calculate a firm's innovation score annually in each industry within a country based on this research."

Dr. Zuba refused to put his name on the paper yet permitted John to submit it if he wanted to. John is worried that Dr. Zuba may be offended if he goes ahead and submit the paper and the paper gets accepted without his name. He feels maybe it is better to just let it go because the journal reviewers may see the paper the way Dr. Zuba sees it. Therefore, an innovative score will be insignificant to professionals, the public, and the media. John then wonders about the relevance and appropriateness of his innovation score and model.

3. EPILOGUE

John went ahead and submitted the paper to a refereed Information Systems journal as the only author and is still awaiting a decision on the acceptance or rejection of his paper.

4. CONCLUSION AND LIMITATIONS

Many believe that Apple Inc. is more innovative than Microsoft Corp. This assumption is based on the fact that Apples Inc. introduced a lot of innovative and dynamic products that really changed and affected the lives of many positively, but this does not mean that it was more innovative as a firm. The most innovative firm in an industry within a country should not be judged solely on the basis of the number of products, innovations, patents, or revenue. Rather, it should be judged by its employee surveys to determine how motivated its employees are to innovate, and its financial data to compute its firm structure, market power, human capital, as well as its financial capital. The firm industry score is usually constant within that industry, except the firms being measured are in separate industries. There may be other factors that need to be included in calculating innovation scores for firms. Perhaps in the future, Apple Inc. will become more innovative or have a higher innovation score than Microsoft, Corp. based on this innovation formula. In order for this to become a reality, Apple Inc. will really need to work on its financial data aside from its revenue, which is higher than that of Microsoft Corp.

The major limitation in this case study is that no survey was given to the employees of the firms

to actually measure the four sub-factors of motivation scores. In order to get accurate intrinsic motivation score for each sub-factor, each survey given and received from each employee must be graded on a scale of 10 for each survey question. After all the survey responses have been added up and averaged, only firms with a score of 80% and above should be given one point for each subgroup of motivation that the survey was meant for. A point of 0.5 (half) should be given if they score between 50% to 79%, or a zero if they score below 50%. Since the innovation score difference between the two firms was 1.13, Microsoft Corp.'s not getting maximum points in two of the motivation surveys would have reduced its score by 2 to 4 points. This would have made Apple Inc. have a higher innovation score, but in this case, maximum points were awarded to both firms on employee motivation surveys.

*All names of individuals have been changed.

5. ENDNOTES

1) Stahl (2004) defines innovation as creating ways to do things simpler and better.

2) Kuczarski (1996) defines innovation as "the appreciation of risk as well as a radical attitude and mindset that enables businesses to create a future vision."

3) Scherer (1965) sees innovation as measurement of input, such as Research and Development, while Mansfield (1968) states that innovation is a measurement of output, such as patents.

4) According to Tellis, Prabhu, & Chandy (2009), the analysis on patents reveals that patents are not a driver of radical innovation. Other studies have indicated that the number of patents is correlated with the size of the firm (Wallsten, 2000).

5) Kuczarski (1996) insists that "innovation is not cutting cost, but rather, the engineering, structuring, organizing, and examining of ourselves to beat industry competitors, increase our profit margin, and enhance future earnings from various streams."

6) Business intelligence as a concept is new compared to other strategic software approaches (Negash & Gray, 2008).

7) Business Intelligence creates forecasts based on past data, old and current performance, and predicts future directions (Negash, 2004).

8) As a part of Business Intelligence, balance scorecards are used for motivating and measuring business unit performance, which consists of four perspectives – financial, customer, internal business processes, and learning and growth (Kaplan & Norton, 1996).

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Teaching Case

IT System Integration: Global Medical Acquisition of Health Tech Case Study

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Abstract

Mergers and Acquisitions are just part of life in business. For example, in the health care technology field in 2012, Veritas Capital Partners acquired Thomson Reuters' Healthcare. Other major active acquisition companies included: Medical Transcription Billing, T-System Technologies and Sharecare.. In this case study, a larger health technology company (Global Medical) acquires a smaller health technology company (Health Tech). But, as the case unfolds, there are major problems with getting the smaller company integrated into the larger company – including decreased in production and falling behind on deliveries

Keywords: Merger, Acquisition, Health Technology, IT

1. THE PHONE CALL

"Hello, this is Steve Winters," Steve said as he answered the phone in his office. "Good evening, this is Stephanie calling from Mr. Thompson's office." Steve was somewhat expecting the call, but he still found himself unprepared for it. "Yes, how can I help you, Stephanie?" "I wanted to call and let you know that Mr. Thompson and some of the executive board will be traveling to the Health Tech campus tomorrow and he'd like to set up some time for you to update him on the latest developments of the Health Tech acquisition. They'll be arriving tomorrow at 9am, are you available?" Steve knew this wasn't really a question and he couldn't say 'no.' "Of course," Steve replied, "I'm looking forward to seeing Mr. Thompson again and bring him up to speed. I'd love to give the team an update. I'll see them at nine." However, that wasn't true – Steve was not looking forward to seeing the CEO or the

rest of the team. Nor would he love to give them an update on the terrible progress being made on his latest assignment: the smooth integration of the Health Tech business into a part of the Global Medical conglomerate. It was one of the company's most significant acquisitions in years and it was facing some trouble.

Steve grabbed his coat and headed for his car. It was yet another late night at the office trying to fix the problem. "But what was the problem," Steve thought to himself on his drive home. "The acquisition of Health Tech was a perfect fit for us. The customers love their product if we could only build without all these manufacturing problems. Maybe these guys from Health Tech aren't exactly what we thought they were...or maybe we aren't." Steve's mind kept racing through these thoughts as he drove home down the virtually empty highway. It would only be a few more hours before he had to turn his car

around and head back to the office to prepare to explain the problem and a solution to Mr. Thompson and the rest of the board. But what would he say?

2. BACKGROUND

Global Medical is one of the largest healthcare companies in the United States. They sell a variety of medical devices and pharmaceuticals and have been one of the great American success stories in business. Global Medical developed a strong brand name that became synonymous with innovation and healthcare. Global Medical used technology not only in their products, but also in the way they managed their business. They established a network of distribution centers and sales reps across the country and the world to efficiently move products to customers in short notice. Their company has been recognized for their effective use of IT to manage parts of their business such as their raw material, document control, and distribution management.

Health Tech, on the other hand, is a different story compared to Global Medical. Through the years Global Medical was an industry giant, Health Tech was struggling to exist as a business. Sam Knox started the company out of his home and built it from the ground up. Sam had previously worked at a metal machining shop where he worked for years making screws, bolts and other fasteners. Unfortunately, Sam was in a bad car accident that required several orthopedic screws to repair broken bones in his leg and back. When the bill came and he saw the price tag listed next to those pieces of hardware, it caught his eye. Sam wasn't able to go back to work, so in 1998, he enlisted the help of his two sons who had experience in the medical device field to start their own business in Atlanta. They worked mostly with the standard hardware at first to generate a cash flow, but ultimately intended on transitioning the business into the medical arena. They sought the advice of local doctors and displayed the ability to make specialized screws to fit the exact needs of the local surgeons. Essentially, they had the ability to make customized products for the surgeons' needs. The surgeons loved the idea and the product. They were looking for this type of service for a while and couldn't wait for Knox to start producing their product. But the Knox family didn't have the expertise or capital required to comply with the regulations of the FDA.

At that point in early 2008, Sam sought and garnished the financial backing of some venture capitalists. The business was still partially run by Sam and the family participated heavily in the manufacturing operations. However, it was re-named Health Tech to signify the "rebirth" as a new company with some additional financial power. The Knox family had created a solid company with potential to grow further, but they lacked an expertise in areas outside of manufacturing. They managed to gain traction in the local southeastern United States orthopedic surgical suites but there was room for growth throughout the remainder of the United States and perhaps internationally. As part of the agreement to provide financial investment, the venture capitalists insisted that they were allowed to create an executive board to serve with Sam to plan and execute a growth strategy for company. They hired experts with leadership experience that included Marketing, IT, Manufacturing, Sales, and Supply Chain to serve on the board.

3. THE GREAT RECESSION

In late 2009, the venture capitalists were hit hard as financial institutions were collapsing. Even the largest investment banks on Wall Street were going out of business, so it wasn't long before the other investments made by the venture capitalists that funded Health Tech were all dried up. Health Tech could have made it on their own had the investors left at a different time and for a different reason. But since the United States employment was hit hard – especially in the southeast – there were fewer people with health insurance coverage. Hospitals were also being hit by the reduced amount of patients and the economy. They were opting for cheaper products of the competition rather than the high-quality, customized products made by Health Tech. Even if other areas of the country were economically better, Health Tech didn't have sales, distribution and support in areas beyond Mississippi to the west, and Tennessee and South Carolina to the North. Health Tech was in trouble of maintaining their survival. Unemployment rates really slipped in the United States during late 2009 with the outeastern United States being hit harder than most other regions.

4. THE BOARD MEETING

The executive board of Global Medical is having their monthly meeting – their org chart is shown in the appendix as figure 1. Sharon Walters, VP

of Marketing was presenting to the board. "We've been waiting for an opportunity like this for years. Now is the time – it is here. The unfortunate realities of the challenging economy are that many businesses are falling on hard times. Health Tech is one of them. They have a strategic position in orthopedics in the southeastern United States. We've looked into them before, but the investors felt like they could grow their own business and were asking for too much money. I believe we can and should buy them now. They are struggling due to the economy and a lack of cash flow, so they have to be more willing to sell at a lower price. The bottom line is that their product is still good and we have the resources to grow the business elsewhere while times are tough in the region. When the economy comes back, we'll have a wonderful strategic advantage with their products in our portfolio. Thanks for your time and attentiveness." The board thanked Sharon for her presentation. In addition to the CEO, Phil Thompson, the VPs of R&D, Marketing, Sales, Operations, Finance and Legal began discussing the proposal of acquiring the Health Tech. It is a topic they have discussed before and had concluded that it would be a good fit for the right price. With their recent loss in financial cash flow, Health Tech might just be willing to sell at a price that Global Medial would be willing to pay.

After some lengthy discussions, Phil Thomson summarized the meeting: "Ok, I'd like to recap our conclusions. I'm hearing that marketing likes the idea of completing this acquisition. They like that the customized screw products would supplement our orthopedic division. Also, the southeastern United States has been a market where we've struggled to get a foothold with our other businesses for years. However, we will be able to use the relationships and reputations developed by the Health Tech brand to get into the southeastern market (as shown in figure 3 of the appendix). Karla, from sales said that they will be able to have their current sales reps in the region support the sales of the acquired product lines with minimal additional headcount. Furthermore, Karla believes that once they offer the Health Tech products, they will be able to generate additional pull-through sales of our other healthcare products and pharmaceuticals. Betty, from operations, believes that we can make the acquisition happen rapidly if we move several key operations managers into the Health Care manufacturing plant at first. They should be able to integrate our manufacturing expertise and computer systems into their facility quickly. The long term plan will be to bring their

manufacturing in-house and shed the assets and real estate that make up Health Tech's current operations. Betty says Operations will have our systems up and running in Health Tech's facility in less than 60 days and we'll have their products fully integrated into one of our manufacturing facilities within 18 months. Walter from legal has requested that we all make a trip to the Health Tech plant in Atlanta to get an on-site evaluation/audit of what we're acquiring before any final decisions are made. I think this might be one of the big opportunities we've been waiting for years. I'll expect marketing and sales to get with their people and get forecast estimates for new sales figures related to this potential acquisition over to Harry's team in finance. The same for everyone: if Finance needs some information from you for this evaluation, let's get that completed in the next two weeks. That will give Harry Wellman two weeks to crunch the numbers and see what offer price makes sense. We'll reconvene next month where you will all present and defend your estimates and Finance will discuss their projected price proposal. Thank you everyone, good work, let's get this done."

5. ACQUISITION ANNOUNCED

After the Finance Department of Global Medical crunched the numbers, they came up with a price that was appropriate for Global Medical to offer and Health Tech. Phil Thompson contacted Sam Knox to see if he'd interested in selling his company and offered a price. Sam Knox didn't have much of a choice – he lost his financial support and sales were hit too hard for Health Tech to survive on its own. The experts hired by the venture capitalist had invested much of Health Tech's money in upgrades to the company's IT and Marketing. These investments appeared to improve efficiency and started to grow the customer base. However, these investments were made during an unfortunate time. Just as the large investments in hardware, software, and implementation were made, the effects of the recession starting hitting Health Tech hard. If Health Tech hadn't extended themselves so far or the venture capitalist hadn't gone under, they may have had the resources to ride out the storm. But that wasn't the case. Knox wasn't willing to take the chance. He had become very close to most of the people that worked for him at his small company. They weren't wealthy but they made a decent wage working for Knox. The company was a tight-knit group and he worried how his decision, whatever it was, would affect them.

Sam struggled with the decision. He had made a decent amount of money through the sale of a portion of his company to the venture capitalists. His concern was more about his family and friends that worked for him than his own financial situation. If he didn't sell the company, they could lose everything as Health Tech went bankrupt. On the other hand, if he sold to Global Medical, his employees may feel alienated, let down, and they may lose their jobs anyway in addition to their friendship with Sam. After much debate, Sam decided to take the chance in selling his business to Global Medical. It would keep his people employed for at least a few more months and most likely for the foreseeable future with the new company. With a heavy heart and a tear in his eye, Sam Knox announced to his employees that he was selling the company to Global Medical effective April 1, 2010 and teams would be present soon to start the transition process.

6. GLOBAL MEDICAL VISITS HEALTH TECH

The Global Medical executive board was just about to depart for a trip to Health Tech to make a final assessment before the acquisition was official. Before he left his office for the trip that would take the better part of a week, Phil Thompson made sure all his loose ends were tied up. As he walked out, he stopped by the office of Mike Randolph, the VP of Information Systems at Global Medical. "Mike, I know this is late notice, but I need you to skip this trip and stay behind at the office to make sure your team completes that upgrade to the data center," Phil said. "Are you sure, Phil? I don't mind traveling for a day or two and then flying back early. While I'm gone, I can check in with the team via email and then come back to make sure the job gets finished here," Mike replied. Phil said, "No, that's OK, we can handle this one. It is straightforward and should be nice and easy. All of that traveling would be a headache and unnecessary. We'll give you a call if something comes up. They recently upgraded their IT systems anyway, so I'm sure there won't be any major weakness there. We'll see you next week."

The board traveled down to the Health Tech facility in an industrial part of Atlanta. Shortly after their arrival, Phil Thompson spoke to the employees at Health Tech and tried to reassure them as many naturally feared for their future. He was sincerely concerned. He recognized they had created a great product and although they had fallen on hard times, Global Medical would be a partner in their revival as a successful

business and help push it through the hard times toward a bright future. He also introduced Steve Winters to them. Steve was given the special assignment in charge of ensuring that the merging of the two companies went smoothly. He would be located on site at Health Tech for the couple months it was going to take to complete the integration. After his CEO was through, Steve introduced himself to the employees of Health Tech and briefly laid out his plan for a successful transition. After Steve spoke with the employees, he and the two leadership teams met in the conference room to make sure there were no surprises in the acquisition and transition plan. As they sat down, the leadership teams reviewed a previously agreed upon agenda of items to cover. That agenda appears below in figure 2.

They spent days digging through the details of Health Tech often working late in to the night. It was a long week for both teams. By the time Friday rolled around things had run as smoothly as possible with only a few minor details that made anyone pause with concern, but they were resolved very simply. By the time the teams started in on the Friday agenda, Phil noticed a slight problem. "Pardon me ladies and gentlemen, but as I look closer at today's agenda, I see that we plan to cover 'IT'," Phil started. "I have to acknowledge that I asked Mike Randolph, our VP of IS, to stay behind and take care of other business." "That's okay, Phil," Linda Kowolski responded. She was the IT expert hired by the venture capitalists to serve on Health Tech's board. She continued, "I'm sure everything is fine with our IT. We recently upgraded all the IT here in the last year or so. I'll just email a summary of the hardware and software we currently use to Mike and he can follow up with me if he has any concerns." The rest of the leadership teams agreed and they went on reviewing the remaining items and creating integration plans for each of them. At the end of the long week, they felt like they successfully completed all the necessary items to satisfy their due diligence investigation and were comfortable proceeding with the final steps of the acquisition. As everyone started to gather up their belongings, Steve Winters came forward and said, "Before you all leave, I just want to thank you all for your participation in this week's meetings. Thanks for putting together a great set of transition plans. I look forward to working with all of you and ensuring this integration of our two great companies goes as well as this week of teamwork has. Thanks again"

7. "LET'S DO LUNCH"

A couple weeks after the acquisition took place, Global Medical and Health Tech were working on integrating the two businesses into one. The integration, among many other details, required eliminating overlap in IT systems where they existed and training the employees on the new systems as needed. Brian and Heather are friends and worked for Health Tech before the acquisition. Brian worked as a documentation analyst where he is responsible for document revision control for every document in the company from Standard Operating Procedures (SOP) and Company Policies to employee training records and Engineering Blueprints used to control the design of the products they make. Heather worked as a purchasing agent where she is responsible for processing purchase orders for anything needed to conduct business as well as making sure that there is always enough raw materials on hand to keep manufacturing up and running.

Each just finished up a week of training on the Global Medical IT systems they are being asked to migrate to as part of their jobs. They met up for lunch and discuss their experiences. Brian said, "How'd training go?" Heather just gave him a disgusted look and sighs. "That well?" he says and chuckles. "How was yours?" Heather responded. "Actually, it went pretty well. Global Medical has this great PLM (Product Lifecycle Management) system. It should make my life a lot easier. Rather than having to carry around documents for signatures and approvals, this system allows us to process any document changes electronically," Brian explained. "How does that work? How do they approve a change then?" Heather inquired. Brian elaborated, "It is easy. Any employee can start a change to document on their computer, then they use this system to select the necessary approvers, and it routes a change notice to those approvers with the proposed change attached to it in an email. The approvers can sign off by entering a password if they agree with the proposed changes. If not, they can conference with each other within the system and discuss some amendments to make the document appropriate for approval. Once signed off by the managers, I get a notice in my email. I then review the format, implement the change and close out the change request. The system even stores the documents when they are changed and all users can search for any document they need to reference. It is going to make my life a lot easier. I won't have to spend half my day walking around trying to find a manager to sign

off on document changes. Our department should be able to process much more of these in a given day. Not only is the system great, but Paul from Global Medical is doing the training. I don't know if you've worked with him yet, but he's great. He did a great job of making the training interactive, he answered all the questions thoroughly, and just did an outstanding job explaining the details to us. By the second day, we were able to walk through the system on our own. By the end of the week, we were pros." Heather shot Brian another one of those disgusted looks. "I wish I could say the same," she said. Heather continued, "I swear they're trying to make things more complicated for us. Global Medical is having us shift over to their ERP (Enterprise Resource Planning) system. I don't get it. Our system was much better and less confusing. I know we both had ERPs and it makes sense to consolidate to one system, but they definitely chose the wrong one. I could barely get through the entire training. The instructor, Bill, was so boring. He didn't even know how to use the system in the way we need it to work for us. My colleagues, Jim and Sandy skipped the last two days of the training. They said they'll try to figure it out on their own. Maybe I should have joined them. I just don't think this is helping -- I don't know what I'm going to do when I have to use this on my own. I just knew this acquisition was going to be bad news." "Wow, that sounds painful, Brian responded, "I'm sorry to hear that it isn't working out better. At least they included you in training. Did you hear about what happened in R&D? They have to use the ERP from time to time as well, but no one ever told them we were transitioning to a new system. I guess the R&D staff at Global Medical never had to use theirs and they didn't expect R&D would need it here." "But it goes live in two days," Heather replied. "Yeah, I know. They were furious." Brian said, "Sam Knox demanded that they train our R&D staff immediately. So they're going to try to give them a crash-course tomorrow. A week of training crammed in to one day!" "Ouch. Maybe I don't have it so bad after all," Heather said.

The two friends continued their lunch while continuing to catch up on their experiences with the acquisition. When they finished their meal, they said goodbye and returned to their desks to continue working. On their way back, that each wondered how smoothly the acquisition was going. Were more people having the experience that Brian had? Were more people having the experience that Heather had -- or worse, what R&D was having?

8. MANUFACTURING FIASCO

Sal Valentino, a director in operations at Global Medical, was in his temporary office he had set up in the Health Tech facility. He was on-site to keep a closer eye on the integration process of manufacturing to the Global Medical standard. He was reviewing the latest data from the production line. When he looked it over, he was concerned. "Hmm," he said to himself, "they are still not performing as well as I thought they would by now." Sal was reviewing the efficiency data from the production line. Efficiency was measured by the amount of good units built per hour of labor. Then that value is divided by the target number of good units built per hour of labor. The values were much lower than he expected for the newly acquired line. He looked up the historical data to see where they were running before the acquisition. He was right. Something was not right. What was going on? Sal sent the data (shown in figure 4 below) to his boss, Betty Reynolds, the VP of operations at Global Medical. It showed that the efficiency dropped dramatically shortly after the Global Medical acquisition of Health Tech.

Betty saw the data and immediately called Sal on the phone. She agreed there were major problems they needed to address. If this acquisition was to be viewed as a success by the shareholders of Global Medical, production inefficiencies would not be tolerated in addition to the weak revenue stream resulting of the struggling economy. Investors would wonder why Global Medical made the acquisition if they didn't significantly grow revenue or profit soon. They'd demand a return on the investment or lose faith in the management of Global Medical. Betty was not happy. She practically yelled at Sal, "Why haven't they got it together? We should be up and running at full capacity by now. We're not even close to operating where they were when we took over. Do you think the Health Tech employees are just too incompetent to work with more advanced manufacturing and technology or are they just trying to sabotage the acquisition?" Sal didn't have an answer, but he agreed to go find out what the problem was immediately and fix it. "Good," Betty agreed, "please find out what's going on and do what you need to do to fix it immediately. Meanwhile, I'm going to have a chat with Sam Knox and see what's wrong with his people. This is just not acceptable."

Sal hung up the phone and went straight to the production line to investigate the problem in

person. When he arrived, he saw many of the manufacturing employees sitting around doing nothing. "Betty was right, they are trying to sabotage the acquisition," he thought to himself as he approached the line supervisor. "What on earth is going on?" he asked in an angry, stern tone, "how can you be sitting around doing nothing?" "We're shut down again, we ran out of material," replied Dave the line supervisor. "I don't know what you guys do at Health Tech, but this isn't the type of performance that is acceptable as part of Global Medical. You guys need to get on board now. Purchasing didn't order enough material to run the line?" "No, I misspoke," Dave explained, "the material is in the building, it is just in the warehouse and hasn't been moved to the manufacturing floor." The problem was, and has been, getting the material from the warehouse to the manufacturing line. The line has been shut down for a couple hours most days waiting for material to arrive from the warehouse. When it gets to Dave on the line, they have been working as hard as they can to hit their production targets. They have even worked overtime here and there to try to produce their quotas. Sal could see the expensive overtime wages and time spent not producing product is what was causing the line efficiency to drop significantly. The fact that the metrics didn't drop further was probably a testament to the hard work being done on the manufacturing line to complete as much as they have over the past few months. Sal could see that the problem was a little different than he thought.

Sal moved on to the warehouse to continue his investigation. There he found Tom Larson frantically trying to put together orders of raw material going to the manufacturing floor. As Sal spoke with Tom, he found that Tom was struggling with the new ERP system. He wasn't able to keep up with the orders fast enough to keep the process going. He learned how to handle a standard order in the new system, but he struggled with anything that wasn't a standard order and needed to seek help from others in order to move the material through the system. Sal asked Tom if he had been trained. Tom admitted that he missed a few days of the week long training. Tom explained that at first, he missed the notice of training that was emailed to him. He explained that with the acquisition in process, all Health Tech employees were receiving many useless emails from the leadership regarding information on salaries, benefits, changes in policies, responsibilities, press releases, etc. That's not to say the information was useless, but the same

announcements were posted everywhere in the building and mailed to the employees at home. Each notice was sent on a separate email and for Tom, the training notice was lost in the mix during the storm of emails he was receiving from "Global Medical Leadership." However, Tom also said that he wasn't the only having trouble. Sometimes even when he knew how to process the order, the material wasn't available to move through the ERP system even though Tom could physically see the shipment of raw material in the warehouse. Figure 5 in the appendix shows the flow of material through Health Tech at a high level and how the ERP system works with staff to control material movement from receipt to manufacturing.

Sal's investigation continued further. When he went to the receiving department he saw the staff there also struggling with the new ERP. Sal was just hoping that didn't miss training too. The supervisor assured Sal that his people did in fact attend the training. However, some of them were just having a hard time handling the new system and they were finding it complex. As a result of their trouble, sometimes the raw material wasn't able to get through the system fast enough to allow the warehouse staff to move raw material to the manufacturing line. Sal was seeing the bigger picture come together. He returned to Dave on the manufacturing line. Sal told him that he had gotten to the root of the problem and realized that there wasn't a manufacturing problem after all, but a challenge with IT. Sal apologized for being short with Dave earlier. Dave said, "I understand. It has been frustrating down here too, trying to do our job but running out of material every day. I'm sure you guys aren't thrilled about this either. I just wish I could have corrected the problem, you know? Before, this would happen once in a while. Back then, I was able to go to the warehouse, fill out a material requisition form, sign it, leave it with the warehouse staff, go get the material myself and keep the line running while leaving them a record of the material movement through our facility to enter into their records when they caught up. But we can't do that anymore with this system." Sal thanked him for his work and returned to his desk to call Betty and give her an update on the situation.

9. INVESTOR MEETING

Steve Winters had heard the problems that they were having in manufacturing by now. He was aware efficiency was down, but he expected that for a month or so and then for it to improve better than it was before the acquisition.

However, that wasn't the case. Thus far, the merger wasn't exactly impressive. The challenging economy was not helping sales of the Health Tech products and therefore the Global Medical sales force was not generating the incremental gains they anticipated from pull-through sales piggy-backed off of Health Tech's products. While the acquisition was made with longer term strategic goals in mind, there would certainly be negative repercussions from the shareholders if the profit margins of Health Tech were hurt too. The inefficiency in production was translating into higher costs with little revenue gains for Global Medical. There was no return on the investment made for the acquisition and the share price of Global Medical would suffer for that. The CEO Phil Thompson, VP of Ops Betty Reynolds, the rest of the executive board and the shareholders were fully expecting a week or two of Health Tech losing a bit of efficiency as they learned the new IT systems. Phil had stated that when they announced the acquisition. However, he also said the efficiency numbers would improve back to normal by now, if not better. He also promised increased sales and profits hitting Global Medical's books early next year. It would be hard to keep investors believing that if they were already heading backwards. Phil had contacted Steve Winters several times over the past few weeks asking for answers to why the efficiencies in manufacturing failed to return to their pre-acquisition levels. Steve said he'd get him some answers and solutions. But Steve didn't have them.

When he saw the latest numbers published, Steve ran into Sal's office. Sal was on the phone with Betty. Steve quietly asked, "Is that Betty? Can you put her on speaker phone? I need to talk to you two now." Sal put Betty on speaker phone and let her know Steve stopped in to talk. Steve said to both of them, "We have to solve this problem with your manufacturing group now or we're in trouble. In fact, I'm sure it's even too late for that. Phil has to present to the shareholders on the latest updates regarding this acquisition of Health Tech and I need to give him answers. If Phil's demands for answers haven't been bad enough, what do you think the investors will say? So I ask you two: is it time we let some people go and get some better people in place that can get the job done? I can't stand around not taking serious action anymore." Betty responded, "I have IS in my office on the call too." "Who cares?" Steve thought to himself. Then he heard, "Hi Steve, it is Mike Randolph."

Now Steve understood. It was the VP of IS who was in Betty's office. Then a sinking feeling came over him and his mind tuned out of the call. All this time Steve was thinking manufacturing was the problem. But was it? If so, why was Mike involved and why hadn't Steve figured that out sooner? While on-site as he had been since day 1 of the acquisition, Steve had heard the complaints around the office of complaints about training and the occasional person not being included. Steve thought these were not the norm, but "things that happened" during a major acquisition like this. He discussed these findings with Phil on an occasional update. Phil told Steve that these are the challenges to be expected in any acquisition or merger. It isn't easy; many people are on edge and are asked to do different and sometimes more difficult things. Phil told Steve to keep pushing through, show leadership and make the successful transition happen. Phil even told Steve to give the company a Friday afternoon to have a company barbeque when the weather was nice to try to boost morale. He did, and they all seemed to enjoy it. However, Steve didn't think it had a lasting effect. The very next week, he heard more complaining about the systems that Global Medical was using. Some Health Tech employees were even saying that the Global Medical systems were worse than what they used to use. Steve could see that the Health Tech employees weren't positive about making this whole acquisition work. Steve thought to himself, "Phil was right - people don't like change period. That even holds true when they go from the low-tech systems to the high-tech systems with much more advanced features. We're not looking very successful right now. We'll have to get there though. Just have to keep pushing through the resistance to change."

Steve's focus returned back to the conference call. Mike, Betty and Sal had been talking about Sal's recent findings. Steve explained the negative attitudes and insubordination he had been hearing about while walking about the facility - something that Betty and Mike couldn't see from Global Medical's corporate offices. Mike said, "You're right Steve, you're there on the ground handling the day-to-day transition, so only you know best about that topic. Personally, my opinion is that these things take time - it may take more than a couple months for new users to successfully use a new IT system. But maybe you're right. Maybe the culture needs to be changed there. In fact, I just received an email from Linda Kowolski this week providing me the information on Health

Tech's IT software, hardware and other general assets. Everything looks ok, but I probably should have had this information months ago. She said 'she forgot.' If that's their leadership, you have to wonder. Anyway, Steve, let me know if you need anything from my team to get this sorted out. I don't know when they'll be able to get back to you, they're all tied up in integrating the two IT systems, but we'll do our best. Good luck." Betty offered her assistance as well. Then they hung up. Steve strolled back to his office. On the way, he was thinking of how he missed this. He was scheduled to have a call with Phil tomorrow morning to give a regular update. What was he going to explain? At least he more answers for him.

It looked like it was going to be another late night for Steve as he tried to make sense of all the challenges they were facing. Just a few months ago, this seemed like it couldn't be any easier and the acquisition was going to be a walk in the park. How long ago that all seemed now. "Should I have seen this earlier? Does Health Tech need to get on board faster? Did Global Medical mess this up? Did I mess this up?" Steve thought to himself. As he glanced out his window, the sun was setting over a nearly empty parking lot. Just as the sun set behind the trees, his office phone rang. Steve didn't move for a moment, then he slowly rose in his chair and looked over toward the phone's caller ID. There was that sinking feeling again. It was the call he'd been dreading: it was Stephanie, Phil Thompson's assistant. "Hello, this is Steve Winters."

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Student Questions

- 1) Give an synopsis of the case
- 2) What went wrong?
- 3) Mike Randolph (VP of Information Systems) did not make the first trip to Health Tech. Was that a good move? Discuss.
- 4) What went wrong with the training? Was the lack of training a major contributor to the project’s situation?
- 5) There is an adage ‘if it isn’t broke, don’t fix it’ – should Global Medical left Health Tech’s ERP system in place? Why or why not?
- 6) At this point, with the manufacturing efficiency (see figure 4) sliding, what should be done to quickly solve the situation?
- 7) What is the value of communication in an acquisition? What communication channels should have been established?

APPENDICES

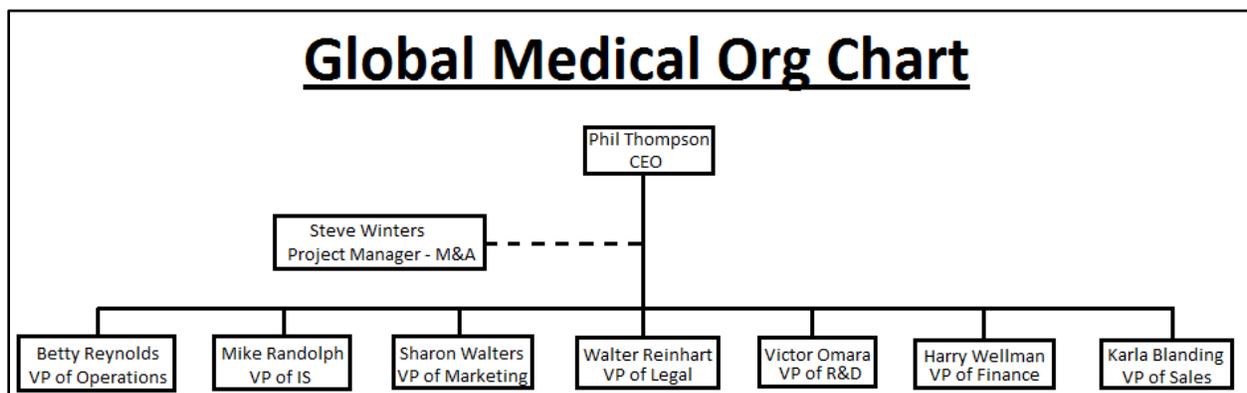


Figure 1 – the Executive Board for Global Medical

Monday	Tuesday	Wednesday	Thursday	Friday
<ul style="list-style-type: none"> • Tour of Offices • Tour Manufacturing Plant • Process Flow 	<ul style="list-style-type: none"> • Operations • Assets • Liabilities • Equity • Real Estate 	<ul style="list-style-type: none"> • Financials • Cash Flow • Sales • R&D • IP 	<ul style="list-style-type: none"> • Quality • Regulatory • HR • Personnel • Management 	<ul style="list-style-type: none"> • Policies and Procedures • Benefits • Salaries • Current Legal Issues • IT

Figure 2—the agenda for the Due Diligence Meeting. Source: (The Acquisition Due Diligence Checklist, 2012)

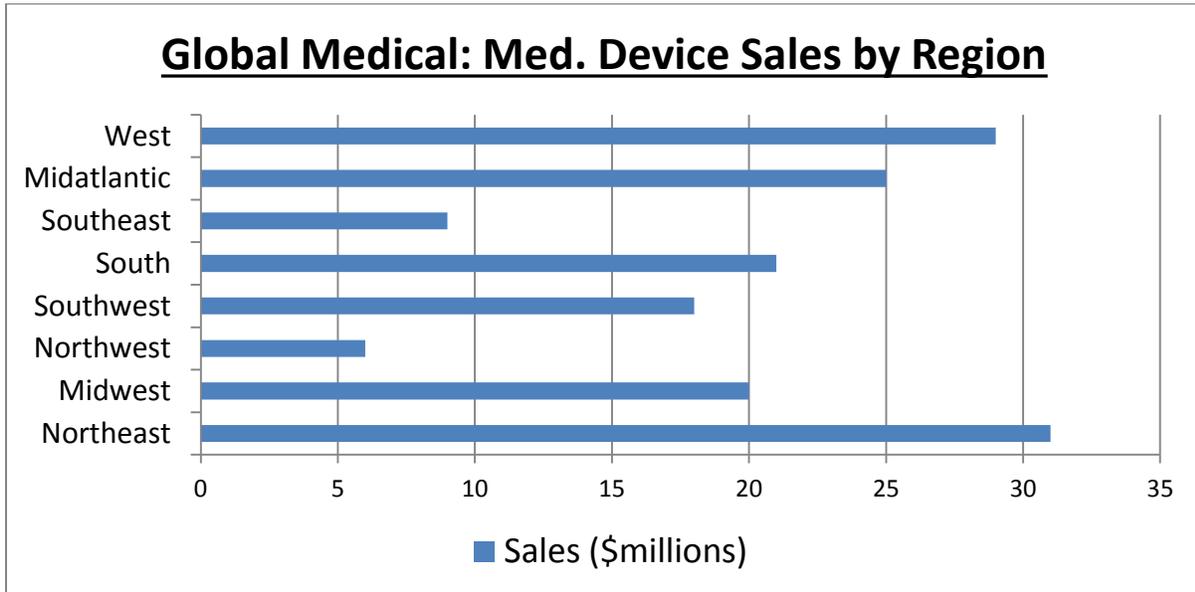


Figure 3—this is the sales figures (in millions) for Global Medical’s medical device business division prior to the acquisition of Health Tech.

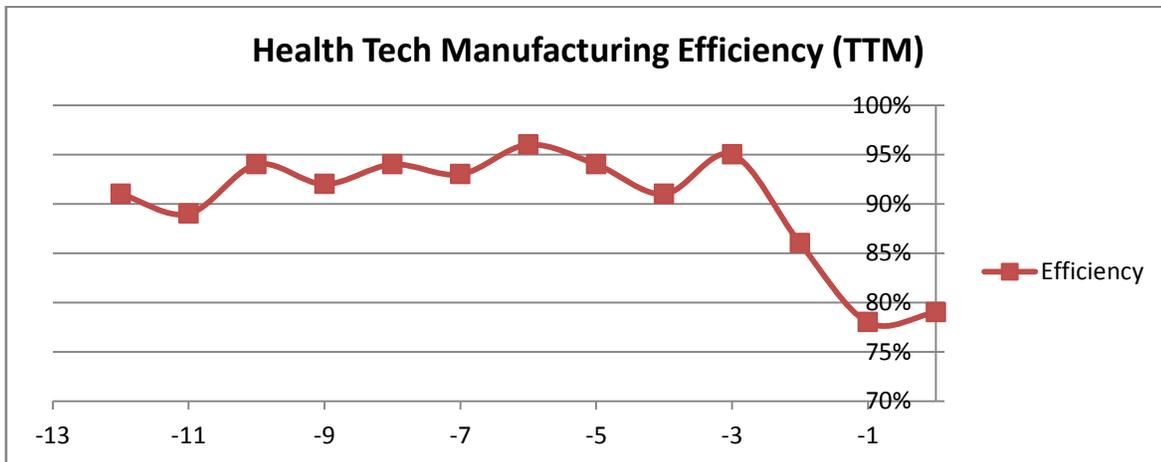


Figure 4—this is the trailing 12 months of Manufacturing Efficiency for Health Tech. On the x-axis T=0 is the current month.

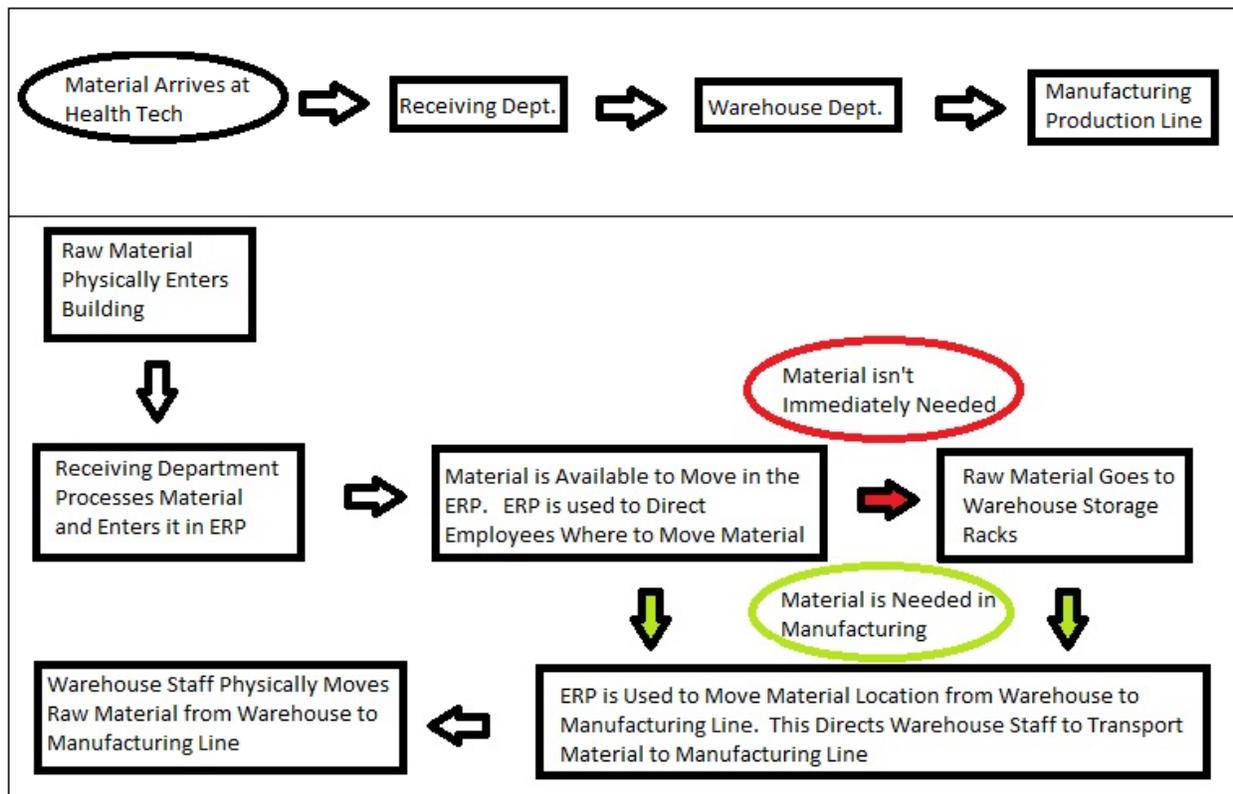


Figure 5—this is a flow chart of the high-level material movement of raw material from receipt to manufacturing (top portion) and a flow chart of how the ERP system works with the staff to control the movement of raw material from receipt to manufacturing line (bottom portion).

Teaching Case

Privacy and ethics in the age of the smartphone: A Case Study

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Abstract

Smartphones are fundamentally transforming almost all aspects of modern life. This case study examines moral and ethical issues surrounding the use of powerful smartphones that can be used to discreetly capture the activities of unsuspecting people. This case shows how a standard iPhone, coupled with widely available apps, can be used in a malicious manner to capture sensitive information. Furthermore, this case encourages students to consider issues surrounding privacy, ethics, ambition as well as corporate governance. This case is intended to be used at both the undergraduate and graduate levels. This case complements the model curriculum objectives in IS 2010.1, IS 2010.7

Case Summary:

InBin, Inc., which was founded by an entrepreneurial-minded MIS major, evolved out of a business school project and into a successful technology company built around the iOS operating environment. The founder is a charismatic and visionary young man who built a company that was admired by many in the tech industry, including the leadership at Apple. However, the operating environment that gave rise to his company's success also introduced risks that shook the company to its core.

Keywords: Security, Ethics, Privacy, Smartphones, mobile technology trends

1. INTRODUCTION

Alisha Brown sat quietly in the boardroom, stunned at the events that had transpired over the past few days. Looking across the empty room she knew that after today's meeting everything was going to be different. In short, lives were going to be changed in profound ways in the very near future.

A short while later, Jack Gray burst into the boardroom, startling Alisha. "What has our boy done this time?" he chided with a smirk. Jack had been on the board since the early days and often played the father figure to the youthful management team.

Alisha was glad Jack arrived first. Jack knew there were serious problems when he saw the expression on Alisha's face. "Jack, this is bigger than any of us could have imagined. It is going to take everything we have as a company to get through this." The other directors entered the room; Alisha and Jack's somber expressions spoke volumes.

2. COMPANY HISTORY

InBin, Inc. started as a far-fetched business school project. In the fall of 2000, while in his senior year of business school, John Smith began work on the framework for an online technical service. John's gregarious personality and leadership skills attracted interest in his idea and several students with strong technical skills volunteered to work on the project.

John poured all of his effort and energy into advancing his vision. While many thought his idea wasn't feasible, he ignored all critics and pushed ahead. In the spring of 2000, Dr. Alisha Brown encouraged him to participate in the annual business plan competition and offered to serve as his faculty sponsor. She knew there was something special about this young man's singular focus and she wanted to help push him to the next level. After a series of passionate presentations to the business plan judges, he was awarded 2nd place, which came with a \$10,000 dollar prize to help get the company going.

The judges and audience members commented on his personal charisma and enthusiasm. In addition, many believed that if he was able to build his service beyond the prototype, the profit

potential could be extraordinary. However, some expressed concern that "his product is too out there to be truly realistic" and that he lacked the technical sophistication to take this to the next step. Following his strong showing in the business plan competition, his focus on getting his company off the ground turned into a night and day obsession and he was frequently seen working in the college's computer lab with other students late into the night.

In spite of the fact that he was focused on this project, he graduated on schedule in the spring of 2001. Early that summer he married his college sweetheart, Lacie, and they welcomed their first child just before Christmas.

Also in the summer of 2001, John incorporated InBin. The same year, with much help from fellow students, the new company released InBin v.1.0 software for Macs, which provided online synchronization and backup with offline accessible computer folders.

The next several years were a struggle for InBin, but John had never been happier. Eventually revenue began to trickle in, and through the company's fanatical attention to customer service, they developed a strong user base. Of greater importance, he managed to develop a small team that believed in the product and the company. Part of the deep commitment of the company's employees was a by-product of John's complete focus on the Macintosh platform, which was counter to conventional wisdom. He would passionately argue that Apple makes computers for people and that technological platforms designed for people will always win!

John slowly hired some of the people who worked with him in business school, but he also began to attract talented developers who were drawn in by the excitement and energy that could be felt as soon as one walked into the company's shabby offices. Even during the lean times he never missed payroll and they almost always had the resources they required. As revenue began to arrive he kept operating expenses low and plowed the money back into development. While wages were low, morale was kept high with stock options for all employees. The remarkable part of John's approach was that he was able to start the company and grow it without ever taking a dime from investors. His "boot strap" approach enabled the company to be 100% owned by the

employees, which many considered to be remarkable.

The stars aligned in 2008 and the company exploded. Apple opened mobile app development on the iOS operating system and provided distribution through the ubiquitous iTunes store interface. John knew this was big and put almost all of the company's resources into developing in the iOS environment. John was elated because the vision he had in 1999, of which many were critical, had finally come true and his company had a solution that would allow a person to sync seamlessly throughout the Mac AND the iOS ecosystem.

Downloads of the InBin app were slow at first, but in October of 2008, Walt Mossberg, a noted technology columnist in the *Wall Street Journal*, wrote that InBin was the "clear leader in the synchronization and backup category and offered an elegant solution to a growing problem." The explosion of interest that followed almost overwhelmed the InBin infrastructure. By May of 2009, three million users were using the iOS app and it became one of the most popular productivity apps on the iTunes store. InBin witnessed another explosion in demand when in the spring of 2010 Apple introduced the iPad. In fact, when InBin released the iPad app, it broke all of the company's previous revenue records. As revenues poured in, John continued to invest back in the company. Everyone, previous detractors included, began to celebrate him as a visionary and extraordinary entrepreneur.

As the company's revenues exploded, the venture capital investing community began to show up in droves. John understood that he would need additional capital as well as the expertise within the VC firms to take InBin to the next level. During the first round of VC investment, John had a stake in the company somewhere in excess of \$100 million. In the spring of 2011, riding high on InBin stardom, John Smith became one of the youngest and most successful technology millionaires since the dot com era. In the remaining months of 2010, John thoroughly enjoyed the attention and the satisfaction in knowing he was right.

What started as a crazy idea in a business school classroom evolved into one of the star companies in the mobile app arena. In fact, its success was splashed across the front page of the *Wall Street Journal* when it was announced that Apple wanted to buy the company and

include InBin's technology in the next generation of its Mac and iOS operating systems.

3. FRIEND OR FOE

Having supported his vision starting from his undergrad studies, Dr. Alisha Brown remained in close contact with John and his young family through the years. She was enjoying her retirement when in the winter of 2007 her husband died unexpectedly.

Lonely for family, Alisha was delighted to become increasingly involved with John's young kids. To them she was "Grandma Leesh." In fact, when things began to look up for InBin in 2008, the Smith family purchased a home just two doors down from Alisha. Many mornings John's young family could be found at Alisha's house. John's wife Lacie would enjoy a cup of coffee while kids Nelli (5) and Jake (6) played.

In early 2010, when an InBin director resigned due to health issues, John asked Alisha to join the board. "Alisha, your expertise in marketing would be a welcome addition to our board. In addition, it was your encouragement and support when I was a student that really got this company going and, besides, you are someone I trust completely." Alisha replied, "I'd be happy to work on any board where you serve as the chairman, John. Of all my years as a professor, watching you grow as a young man and entrepreneur has been one of my great joys. I look forward to serving you and the company."

Professionally, John was on top of the world, but his personal life was far from good. John's singular focus on building InBin strained his marriage as well as other important relationships. Their marital problems were widely discussed within the company as John wasn't shy about discussing sensitive issues. It became widely known that John's wife Lacie had had an affair and John occasionally hinted that he had evidence to prove it.

By the summer of 2011, Lacie had moved out and John and Lacie had joint custody of the kids. Increasingly, Alisha spent a lot of time with the children and became a trusted intermediary between the battling parents. Sometimes Lacie would drop the kids off at Alisha's and John would pick them up when he was done with work. On some of these occasions John would share his fears surrounding his failed marriage

and the future of the kids, as well as concerns about InBin.

The emotional strain weighing on John became crippling and it was clear he needed a break. The pending divorce, coupled with his hectic professional life, had simply become too much and he, as well as almost everyone else, knew something had to give. In order to lighten up on some of his duties he asked Alisha to take over as chairman of the board while the Apple acquisition was negotiated. The board unanimously supported John's request. Privately, several directors expressed relief because they had become increasingly troubled by some of John's actions, including discussing sensitive issues surrounding his wife's affair.

The acquisition talks were progressing smoothly and the board, as well as knowledgeable outsiders, was happy to have Alisha in the chairman's role during the negotiations. Alisha was growing increasingly comfortable in her role as chairman of the board, but she wasn't ready for what happened next. Late on the evening of Wednesday, November 9th, 2011, Alisha received a call from John. In hushed tones, he asked her to come over right away. Alisha, fearing something had happened to one of the kids, rushed over. When she arrived, he asked her, "Can you take my iPhone and keep it safe for a few days?" Knowing something wasn't right, she reluctantly took it and dropped it into her purse.

4. IPHONE DISCOVERIES

Alisha tossed and turned all night. John's behavior over the last few months had been troubling, but she attributed it to the pain of losing his family. The next morning she sat alone in her kitchen wondering what to do. It was at times like these when she missed her late husband most because they could always help each other think through the difficult issues. She was torn between trying to look at what he might have on the phone, and going straight to the police. However, she knew that doing nothing was not an option. She was also aware that as chairman of the board she had a strict fiduciary responsibility to the company and its shareholders. Furthermore, with the Apple acquisition in its final stages she knew that whatever was on that phone might affect that acquisition.

She decided that she should attempt to view the contents of his phone and based upon her findings determine the next step. As recently as the previous week she had used John's phone to take pictures of him and the children, and she wondered if he still used the same four-digit passcode. Hesitantly she reached for his phone and entered the four-digit code, and it revealed a home screen with a picture she had taken of John and the kids.

The first thing she did was go to the Photos App and started scrolling through the pictures. As expected there were a lot of pictures of the kids and seemingly innocuous random images. However, there was a tremendous number of photos that seemed to repeat . . . or at least mostly repeat.

Priding herself on her smartphone abilities, Alisha swiped the home screen to the right to do a global search. "How about a search on the word Lacie," she thought aloud. The first result was a note. She opened it to find a list organized by date, the title of which was "Lacie."

Although the range of dates was expansive, they were carefully ordered using a standardized naming convention built around date and then topic. Because of this she was able to easily get to the dates near the time when John had learned of Lacie's affair.

One note in particular caught her eye. It was labeled 2011/10/09 - Find out where Lacie is going - set up IGPS. "IGPS?" thought Alisha, "what does that stand for?" Once again, she did a global search and simply typed in the letter "I" and then scanned through the search results looking for a result that might be associated with IGPS. She didn't have to scan down too far before she came to an app called "Instamapper GPS" (see appendix A). At first, Instamapper GPS did not appear to do anything, but then she clicked the information pane and followed a link which then took her to a site showing a detailed map of a route through the community with a destination and the address. "Aha, this iPhone was hidden in Lacie's vehicle to track her location and her route, and all with a time-stamp," Alisha thought.

She returned to her previous search and began scrolling through the notes surrounding the previous date range. Scrolling through the note list she was startled to find notes titled, "2011/05/09 - Capture Managers - SK"

"2011/09/21 - Capture Board - SK", and "2011/11/09 - Capture Lacie - SK." Once again, based on the previous pattern Alisha did a global search around the letter "S" and then scanned through the search results. It didn't take her long to find an application named SpyKit. After opening the application, Alisha was presented with sub applications with names like Voice Disguise, Stealth Cam and Covert Cam. It took her less than 20 minutes of playing around with the sub apps to determine things had gotten way out of hand. Essentially she found countless instances where conversations and corresponding photos were taken without the knowledge of those present. What was even more startling to her was that John was able to accomplish most of this with an app that is available for free through the iTunes store. Most of the entries related to Capture Managers included reference to photos and audio.

Even more alarming was what Alisha discovered in the board of directors capture instances. Sensitive meetings where John was present had been recorded and logged. Executive board sessions, where John was not allowed to be present, were also recorded. During the executive sessions sensitive issues often related to John's performance as CEO were discussed.

By now, all questions regarding Alisha's next steps were answered. She called InBin's legal counsel for advice on how to proceed. After reviewing some of the evidence the company's legal counsel suggested the police should be notified immediately. Since John was maintaining detailed notes and logs concerning Lacie's travels, coupled with his current strained mental state, they couldn't dismiss the possibility that John may harm Lacie. Furthermore, it was obvious that John crossed a line by spying on the board of directors, which was a clear violation of the law. She called the police and submitted the phone to them as evidence of possible crimes. Immediately following this an emergency board meeting was convened.

5. CONCLUSION

It had been 12 hours since Alisha handed over the phone to the police and called the emergency board meeting. The police analyzed John's iPhone and the District Attorney assigned to the case agreed there was ample evidence to prosecute him.

The police coordinated with InBin's legal counsel to initiate the arrest at the same time the board was scheduled to meet. During the meeting Alisha, along with InBin's legal counsel, methodically discussed what they believe happened and the impact it might have on the company. It was clear that John would be charged with several criminal acts and the company might be liable. What was unclear was the extent to which John employed these tactics with InBin's business partners and with Apple execs leading up to the pending acquisition. As Alisha relayed and displayed information found on John's iPhone to the board of directors, looks of confusion and a desire for answers overcame each director's face. Jack Gray could be heard occasionally grunting, "unbelievable."

Once Alisha completed her discourse and what she believed to be the possible implications, she said, "You now know all we know. In terms of next steps we have hired a PR firm to help us manage what is sure to be an avalanche of media issues. Finally, I wanted to inform all of you about the situation before calling Apple's legal counsel. My suggestion is that we try to keep the merger on track, but it won't be easy. Now, with that said, I am open to any and all suggestions!"

6. DISCUSSION QUESTIONS

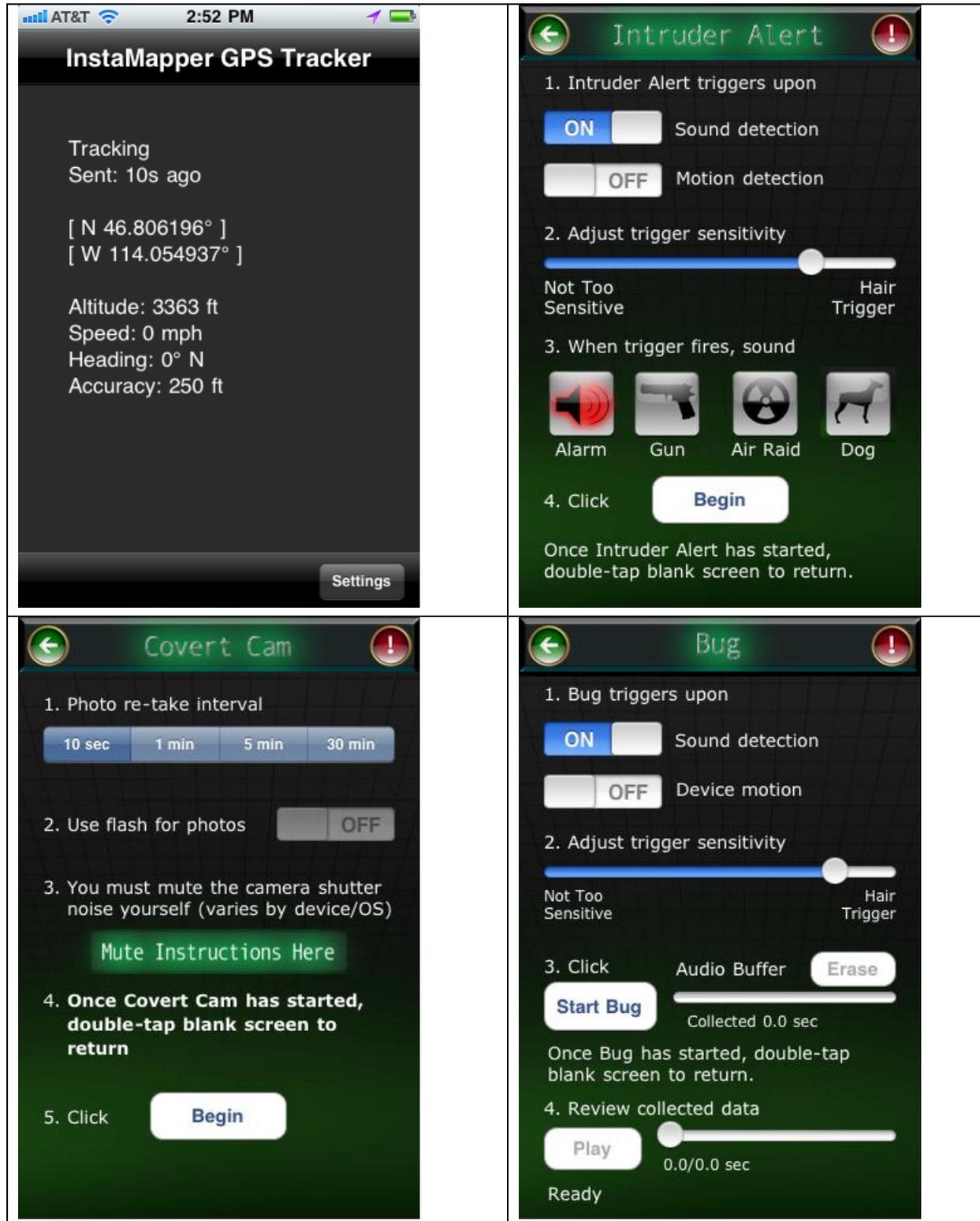
- 1) One way to think about mobile technologies is to view them as powerful sensing devices that are constantly monitoring the environment. What sensing mechanisms do current smart phones have?
- 2) What will the capabilities of smart phones be in five years?
- 3) What are your state's laws concerning digitally recording private conversations without all of the participants' consent?
- 4) How do the states surrounding your state handle the issue addressed in Question 3? Do they differ significantly?
- 5) How diverse are the state laws for capture of images and audio? Is the public, or even a fraction of the public, aware of such laws? How many people with smartphones capable of violating such laws do so inadvertently?

- 6) Increasingly local police departments are being asked to investigate crimes where digital technology provides a significant part of the evidence. What resources does your local police department have to analyze this type of evidence? How about your District Attorney's office?
- 7) Pay-as-you-go phones, which don't require a contract and are difficult to track, are growing in popularity. What are the possible implications of someone utilizing multiple inexpensive phones with the capabilities discussed in this case?
- 8) The apps discussed in this case are all available on Apple's iTunes store, which means it is approved for distribution by Apple. However, are there other apps that aren't available on the store, but that can still be installed on an iPhone?
- 9) Can anything be done to avert the use of smartphone capabilities by those willing to work independent of the public app marketplaces?
- 10) What are the long-range regulation possibilities? How will the government(s) enforce these regulations?

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Appendix A



Teaching Case

Enhancing the IT Infrastructure at Saint Philip's Hospital: Point-Of-Care Solutions

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Abstract

Healthcare has become a rapidly changing field. With the introduction of value-based purchasing to determine reimbursement of Medicare providers based on the quality of care in addition to outcomes in treatment, the environment is becoming ever more competitive. Saint Philip's Hospital is among the largest non-profit hospitals in the nation offering a wide variety of specialist services. It has an outstanding reputation among its competitors, but like everyone, it needs to find additional ways to remain competitive in this field. The most recent patient satisfaction reports reflect a drop in quality measure results from the previous quarter and Saint Philip's needs to find a way to retain its reputation as being among the leaders in providing excellence in treatment and patient-focused care. With the recent increase in patient flow, this has been challenging. Saint Philip's IT infrastructure is strong, but increasing efficiency is pivotal for the future performance of the hospital in the increasingly changing and digitally-enhancing healthcare environment. (Note – some of the data is based upon a real New York metropolitan hospital, but the case is fictitious)

Keywords: value-based purchasing, point-of-care, quality improvement, patient satisfaction

1. INTRODUCTION

James Kirby walked into his office early in the morning at the end of the fiscal year, on June 30, 2010 and sat behind his desk. He brought in the extra-large coffee that he bought from the Cafeteria on the way back from the quarterly executive meeting with the Quality Improvement and Patient Safety Committee that he attended much earlier this morning. James was the CEO of the largest hospital in the New York metropolitan area. Saint Philip's Hospital has a 21-year history of serving patients from the North-East area. It offers top notch inpatient,

ambulatory, and preventive care in all areas of medicine at each of its five major centers.

James had been the CEO only for the past 2 years, but during this time he saw a dramatic change in the way hospital administration was developing all around the country. And with President Barack Obama signing the health care reform legislation on March 23, 2010, James knew that the healthcare system would never be the same.

He put his cup of coffee on the desk and started going through the handouts from this morning

again. The quarterly executive quality improvement meetings were held with the purpose of improving operations within the hospital to continuously enhance the quality of healthcare provision and the efficiency in treatment for the patients.

The mission statement of Saint Philip's Hospital includes its commitment to "excellence in patient care, research, education and community service." The hospital is dedicated to providing exceptional services and to stand up to its ranking of a first-rate medical institution.

Quarterly meetings with the Quality Improvement and Patient Safety Committee were officially administered and required the participation and contribution of the hospital's leaders who were members of the Committee. Senior members included James Kirby, Jonathan Wiseczcki (Chief Financial Officer), Bruce Goodwill (Chief Information Officer), and Lisa O'Connor, RN (Director of Patient Care & Employee Relations). Other members were leaders from the main units of the hospital, including Surgery, Cardiothoracic, Intensive Care Unit (CTICU), the Emergency Department, and the Cardiovascular Unit (CVU), which had the most intensive patient flow and therefore the quality of care in these units was among the most critical for the reputation of the hospital.

James started going through the bar charts with the results of their latest Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) report. The hospital used Press Ganey to track patient satisfaction and these reports gave measured evidence for the quality of care provided across the different units.

Generally, Saint Philip's enjoyed high scores on overall ratings of the hospital by patients and their willingness to recommend the hospital to friends and family. Lower ratings generally included evaluation on quietness of the environment (noise had been a huge problem for many healthcare providers, especially large hospitals), and cleanliness. However, this time Saint Philip's saw an unexpected decline in patients' scores on physician and nurse communication with the patients and this was surprising to James. Saint Philip's had always had a reputation of providing exceptional services to its patients. Effective physician and nurse communication made patients feel that they were being treated with exceptional care,

catering to their needs. The three areas determining proper physician and nurse communication with patients included treating patients with courtesy and respect, listening carefully to the patients, and explaining things in a way that the patients could understand.

It was true that in the 2009 Annual Report, Saint Philip's admitted experiencing a consistent growth of patient flow, especially in inpatient care. The beds were filled almost up to capacity (for more information on the distribution of beds, please see [Figure 1](#) in the "Appendices" section). James was wondering whether this could be the reason for the drop in patient satisfaction regarding communication with physicians and nurses. He remembered the presentation of Enrico Gomez (Director of Emergency Department) this morning on efforts in patient safety and quality of treatment that had been implemented by the Emergency Department and the Intensive Care Units. Enrico presented data for the past quarter on readmission levels and sentinel events. Unfortunately these numbers also saw an increase in comparison to past performance.

James could see Lisa's face at the meeting becoming increasingly red with embarrassment. She was nervously moving her leg under the table and this could also be noticed. She interrupted Enrico right in the middle of his presentation: "I don't understand why those numbers are so different from last quarter, Enrico. I have been having monthly meetings with the head nurses of the departments, and considering all the efforts that we had put in to ensure providing exceptional patient-centered care, we expected to see a decrease in sentinel events, reduced readmission rates, and an improvement of patient satisfaction scores. I just don't understand why this would happen. Perhaps the efforts are not being equally implemented by the different departments? I have to see how I should present this at the next Nurse Leadership meeting!"

James remembered this occurrence from this morning and immediately felt a headache from looking at the numbers again. He knew that the new healthcare reform by the Obama Administration would bring new challenges in hospital administration and new standards to live up to. Although the changes would not be actually seen until 2012, he knew that actions had to be taken in advance. Thinking about the future need of implementation of electronic

medical records systems (EMRs) and future reimbursement based on a value-based purchasing plan by the Center for Medicare and Medicaid Services (CMS), which were all parts of the healthcare reform, only increased his headache. He trusted that Bruce Goodwill as a CIO would do a good job in enhancing the IT infrastructure of the hospital and the efficient implementation of the electronic medical records system. However, he also knew that the hospital had to be pro-active and engage in other initiatives that would increase the quality of care provision even with the increased inpatient admissions.

James heard the tone of an incoming email. It was from Bruce:

"James,

I am confirming that I will come to the emergency senior executive meeting next week! I will have a rough draft of an IT infrastructure plan that I would want to implement in order to increase staff productivity while also increasing patient satisfaction and quality of healthcare delivery.

I hope that you, John and Lisa will find it valuable as well. I think it will be a great opportunity for us to be pioneers in this area as we establish one of the most sophisticated integrated IT solution systems that would combine efficient and effective health information exchange along with practical treatment management tools for our staff.

This can be huge and improve our scores significantly. Remember the Point-of-Care solutions that I mentioned to you? I will explain more at the meeting. See you next week!

Best,
Bruce"

James had sent an urgent email to both Bruce and Jonathan regarding an emergency senior executive meeting to be held in a week through his cell phone right after he left the quarterly meeting this morning. He did not want to invite Lisa this time as he felt that with every meeting all she did was express disapproval and initiate arguments. James never heard her make any

suggestions on her own and this morning he saw her frustration which made him decide to give her some time to cool off.

James remembered a brief conversation in the Cafeteria with Bruce about Point-Of-Care solutions – technological systems that enable physicians and nurses to provide effective treatment through any point of patient care. There were several possible devices and system management tools that ranged in services and functions which could help medical staff provide excellent treatment to patients. James was curious to hear more about the preliminary plan that Bruce would develop. Ten minutes after Bruce's email, James received a confirmation from Jonathan as well. He took another sip of his coffee. Things can get better as long as the right people are part of a team. And James knew he had the best team in the area!

2. ABOUT THE HOSPITAL

New York-based Saint Philip's Hospital is one of the largest not-for-profit hospitals in the nation. Having 2,409 beds, and about 2 million inpatient and outpatient visits a year, the institution strives for excellence in healthcare delivery through the hard work of its 6,144 affiliated physicians and 19,376 staff members. It has five major centers and has enjoyed high reputation and ranking across its competitors.

The Saint Philip's Healthcare System provides healthcare services to residents of Brooklyn, Bronx, Manhattan, Queens, and also Connecticut, Long Island, New Jersey, Westchester, and several upstate New York counties. The system is affiliated with the medical colleges of Weill Cornell Medical College and Columbia University College of Physicians and Surgeons. It has been praised to employ leading specialists from every field of medicine.

Saint Philip's Healthcare System includes both acute-care and community hospitals, ambulatory sites, continuum-of-care facilities and specialty institutes. All members of the system are committed to providing high-quality and easily accessible care to residents, while also maintaining a cost-effective structure.

In 2009, according to the hospital's annual report, Saint Philip's experienced high increase in volume of patients. Mostly very sick patients with complex problems sought care from Saint Philip's. From inpatient statistics, the total

number of patients discharged increased from 111,726 in 2008 to 114,628 in 2009 (more details can be found in [Figure 1](#)). The total distribution of beds was about 2,389 in 2009.

In 2010 the hospital continued to enjoy prestigious rankings, being recognized in the beginning of the year as the Number 1 Hospital in the NYC metropolitan area and Number 6 in the nation, according to U.S. News Media Group's 2009-2010 report on "America's Best Hospitals" survey. The hospital was also included in the "America's Best Children's Hospitals" Honor Roll of the 2010 U.S. News & World Report. It was the only tri-state area hospital to get such recognition.

The hospital's financial report from 2009 shows increase in total revenue and even higher increase in expenses. However, the excess of revenue over expenses has also improved significantly. More information on Saint Philip's financial performance is presented in [Figure 2](#).

Saint Philip's has also gained reputation as being among the leaders investing in healthcare information technology to improve quality and efficiency of healthcare provision. The hospital adopted a decision support system (DSS) to assist physicians when they needed consultation in making treatment decisions. The initial release of the system in 2008 gained so much popularity among physicians that they would often line up at the available workstations to use it. Bruce Goodwill decided that it was time to expand the system even further. Ideally Bruce wanted to adopt a system where the hospital staff could have mobile access to the DSS. An integrated system which would also offer access to patient health records and other clinical data would ideally improve quality of care while lowering costs.

The Hospital was using the "Five Rights" from a Health Information and Management Systems Society (HiMSS) report as founding principles for any Clinical Decision Support system (CDS). Those rights were:

- Right information (evidence based, guide, action...)
- Right people (clinicians, and patients)
- Right intervention formats (alert, order set...)
- Right channel (Computer Information Systems, internet, mobile)

- Right points in workflow (decision/action) (HiMSS, 2010)

In addition, there were several types of CDS systems that the hospital could implement. Among the ones that Bruce was interested in were:

- Medication dosing support;
- Order facilitators; and
- Point-of-care alerts/reminders (drug-drug interaction to critical lab alerts)

3. NEW POLICIES, REGULATORY BODIES, AND STANDARDS

Value-Based Purchasing:

Value-Based Purchasing is one of the elements stemming out of the Affordable Care Act introduced by the Obama Administration and signed on March 23, 2010. It basically combines outcomes with quality of care measures to determine reimbursement for healthcare providers. The Centers for Medicare and Medicaid Services (CMS) released a decision plan based on value-based purchasing which reveals that clinical quality process of care and patient satisfaction measures will provide for 1% of a provider's base DRG payment for the federal fiscal year of 2013. Fiscal year 2014 will also incorporate performance on outcome measures for the payments. Patient satisfaction scores are reflected on HCAHPS reports. Saint Philip's and many other hospitals use Press Ganey to gather and analyze data from patient satisfaction surveys through HCAHPS reports.

According to the U.S. Department of Health and Human Services, "In FY 2013, an estimated \$850 million will be allocated to hospitals based on their overall performance on a set of quality measures that have been shown to improve clinical processes of care and patient satisfaction" (U.S. DHHS, 2011). The idea is to take the funds of what Medicare would have spent initially and to shift funding from reimbursement based on volume to reimbursement based on performance. The funding is expected to be increasing over time.

Health Information Technology Exchange (HITE):

The goals of Health Information Technology Exchange (HITE) include providing standards and principles of health information storage,

sharing, and general management of patient data to ensure a secure exchange of this data between healthcare providers, consumers, private payers and government organizations in accordance with the standards from the Health Information Portability and Accountability Act (HIPAA).

HIPAA policies require efficient data exchange through standards-based enforcements and protection of the confidentiality and security of health data. The overall mission is to seek ways to improve quality, safety and efficiency of health delivery system (Chaudhry et al., 2006).

Measurements of achieved goals, as published by the CMS include:

- Improved health care quality;
- Prevented medical errors;
- Reduced health care costs;
- Increased administrative efficiencies
- Decreased paperwork; and
- Expanded access to affordable care.

4. SAINT PHILIP'S SITUATION

The spectrum of care delivery at Saint Philip's often required data to be mobile and to be able to be accessed from different locations to improve workflow of operations by staff members.

Bruce knew all about Point-of-Care systems and had a stack of marketing materials from different companies on his desk regarding latest technology in the field.

Bruce was a very creative IT specialist. He had worked at the hospital for 10 years and knew all about the operations and staff members' needs from the different departments. He could also implement an effective IT system, modified to cater to the needs of the hospital. All he needed to do was browse through the marketing materials and find ways in which to integrate different solutions in the most efficient and cost-effective manner so that patient care was handled with the exceptional service expected from Saint Philip's Hospital. Some of the materials that Bruce had on his desk are included in the "Appendices" section for review.

Bruce picked up one of the marketing reports sent from Intel. He read that the company was now offering mobile enabled electronic medical

record (EMR) applications that would allow instant access to patient records through a wireless network. Bruce was reading Intel's promises on the system:

"Errors are reduced, decisions are made more quickly, and quality of care is increased. At El Camino Hospital in California, the number of errors per 1000 patient days dropped from six to four following the implementation of electronic medical records and a WLAN. In the United Kingdom, staff at the George Eliot Hospital admitted to saving up to four hours per week after they were given wireless access to hospital and patient information" (Intel, 2007).

Bruce wrote something down on his pad. His pad had a bunch of random notes that Bruce would take whenever a new IT idea came into his mind. He liked using the ideas as if they were pieces of a puzzle that could be combined and work together to effectively create a beautifully integrated picture of well-functioning IT systems. On the first page he had a centralized phrase - "Point of Care" - and all around it floated different ideas and solutions that could mold the future of the hospital.

Bruce remembered that SpyGlass Consulting Group released in February 2010 their survey findings regarding Point-of-Care Computing. The study explored the perceptions of physicians and the current adoption of computing solutions at the point of care. The company had done more than 100 in-depth interviews with physicians working in acute care and ambulatory environments from a broad range of competencies. This was a national study. Some of the findings included the physicians' embrace of mobile computing devices, physicians' primary use of desktop computers to access patient data, and the trend that Hospital IT was resistant to supporting personal devices on corporate network.

Bruce read a highlighted statement from the Spyglass report: "Mobile device adoption is being driven by technology innovation including easy-to-use, low-cost, lightweight mobile devices, widespread cellular broadband availability (3G/4G), a cloud-based ecosystem to support internet-connected applications, and the emergence of location-based services" (Spyglass, 2010).

Bruce wrote some additional thoughts on his pad after reading this statement.

The report also included that 83% of interviewed physicians used desktop computers to access needed data. On the other hand, 75% of physicians also reported that their institution's IT infrastructure did not support personal mobile devices on the network.

Intel's report on the other hand shared that "the rapid growth and adoption of mobile devices and applications in other industries had spurred a large number of healthcare software vendors to enable their applications for mobile platforms such as notebook computers, tablet computers, or personal digital assistants (PDAs)."

At any point of care, having access to critical patient data and decision support information system enhances healthcare quality, reduces medical errors, and improves patient satisfaction. Healthcare staff can access pertinent information through a wide variety of devices from tablets, to laptops, and mobile devices.

Bruce knew that the future of healthcare IT relied on the proper adoption of wireless mobile applications to support context based computing. The goal would be to provide instant access to vital patient information, treatment consultation and additional support throughout the provision of care.

5. POINT-OF-CARE SOLUTIONS

With the consistent growth in technology, healthcare record keeping and data management is becoming more and more digitized. Paper medical records are being replaced by Electronic Medical Records (EMR) systems. Hospitals already enjoy the benefits of having a reliable IT infrastructure that would allow fast and efficient access to patient data in order to ensure quality and efficiency in healthcare delivery with improved patient outcomes.

Point-of-Care solutions are the next phase in enhancing healthcare provision. Systems in the category of Point-of-Care Solutions include barcode scanners, clinical decision support systems, mobile health solutions and others.

The idea behind the concept "point-of-care" is to have reliable technology for any point of care in the patient's treatment. From the access to

medical record of the patient to follow-up communication after discharge or physical exam, the link between patients and physicians and the efficient access to pertinent information improve patient satisfaction and healthcare quality of care.

According to statistics, 88% of health systems have already implemented or plan to implement point-of-care data management systems. (Modern Healthcare, 2012)

Additional Solutions:

Bruce also reviewed Motorola's health systems report again. Motorola offered various technological solutions to healthcare providers, including mobile computers and barcode scanners for better medication administration. A sample list of some of the solutions is provided in [Figure 5](#).

Bruce wondered whether he could suggest combining any of Motorola's Point of Care systems with the current IT infrastructure.

In addition, Bruce had also heard about cloud computing and his inner sense immediately recognized an opportunity to integrate the whole IT infrastructure on a cloud space and provide an easy access to all components of the system from this space.

Bruce knew that cloud computing was the future of IT. He also knew that healthcare technology solutions will see rapid development with the implementation of electronic medical records and point-of-care solutions. He just did not know how much of this information he should present at the emergency executive meeting that was the following week. He did not want to overwhelm the other leaders and at the same time he wanted to provide a solid recommendation for an effective, properly integrated IT infrastructure solution in correspondence to the pace of healthcare technology development.

His recommendation had to satisfy three goals:

- Consistent with the hospital's mission of providing excellence in patient care;
- Increasing efficiency in healthcare delivery while reducing medical errors, costs and reflecting top notch IT trends in healthcare;

- Protecting privacy and enhancing security of patient information, following all HIPAA standards and regulations.

6. SECURITY ISSUES

Bruce knew that among the main questions that James and Jonathan would have included taking proper security measures with the new system.

Security issues remain the main concern for healthcare providers utilizing digital healthcare systems. However, Bruce was aware of the latest trends in security measures. Enhanced practices ensured that proper security standards would be implemented in the adopted systems.

Intel also touched upon this area in their report, stating that "Wireless security has made great advances over the past few years thanks to the efforts of the IEEE (Institute of Electrical and Electronic Engineers) and the Wi-Fi Alliance. New security standards like IEEE 802.11i and the Wi-Fi Alliance Wi-Fi Protected Access 2 (WPA2) have emerged to match the robust protection previously found only on wired networks."

7. CONCLUSION

Bruce came into the meeting 10 minutes late holding a bunch of copies containing his major recommendations, mainly consisting of charts and bullet-points listing the advantages and disadvantages of each recommendation. "Sorry I'm late. I had to print these from Jill's printer because mine was out of toner, can you believe this?" Bruce started laughing, "Where is Lisa?"

"Lisa is not coming," said James. "I wanted us to have a limited senior executive meeting this time, including only us."

Bruce was surprised. He was not sure whether he liked James' management style. Lisa had worked for the hospital for 5 years and although she often came across as being critical and skeptical about most things, she had been a part of the senior leadership team since before James joined the hospital as the new CEO two years ago. Bruce knew that Lisa would not like it if she heard of this meeting being held without her. He wanted to say something to James but did not want to do it in front of Jonathan. He just decided to start on his presentation:

"Well, gentlemen, I would like to talk to you about three main recommendations that I have designed with the goal of the future improvement of our system. Each of these has its own advantages and disadvantages, which I will expand on more later on. I have several vendors who would bid for us, but overall I am using our own customized solution that will combine several ideas. Please take a look at the first graph of this report..."

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Appendices

Student Questions

1. What is point-of-care?
2. What were Bruce's three main recommendations in your opinion? Imagine that you are Bruce - what would you recommend for Saint Philip's Hospital for point-of-care solutions?
3. How might James react to the proposal? What other alternatives can the hospital consider in order to improve patient care and patient satisfaction?
4. How might cloud-computing help in the integration of all the healthcare IT solutions listed in the case?
5. How would you handle potential conflicts with Lisa? What might happen after the emergency executive meeting and what would you recommend James to do?
6. Considering all the changes in healthcare regulations, what actions should James take as a CEO to keep up with these changes along with the changes in technology? How can the hospital fund such technology changes?
7. What are some benefits and drawbacks in the change of the IT infrastructure within the hospital? Would that affect patient care? How would you deal with the changes in order to ensure smooth transition without affecting patient treatment?
8. Devise a plan of action that any hospital could use when implementing a new system. List all the important steps and include possible risks/complications along with relevant recommendations.

Figure 1: Summary on Saint Philip's Inpatient Statistics

Statistical Summary

Inpatient Statistics	2008	2009
Patients Discharged	107,283	110,466
Westchester Division	4,443	4,162
Total	111,726	114,628
Surgeries	29,641	29,211
Deliveries	12,369	12,662
Average Length of Stay (including Westchester Division)	6.65 days	6.41 days

Distribution of Beds

Medical/Surgical	1,591	1,627
Pediatrics	127	127
Maternity	146	146
Newborn Bassinets	111	111
Psychiatric	378	378
Total	2,353	2,389

Outpatient Statistics

Ambulatory and Outpatient Surgeries	66,453	67,196
Cardiac Catheterizations	8,830	8,763
Dialysis	4,813	5,004
Visits to Outpatient Clinics	688,524	705,874
Visits to Emergency Facilities (excluding admissions)	186,688	200,245

Services to Patients

Laboratory	9,673,687	10,012,179
Blood Bank	450,487	433,284
Radioisotopes Services	16,239	17,936
X-ray Procedures	530,281	567,333
Electrocardiograms	217,923	223,525
Electroencephalograms	33,246	35,630
Therapy Treatments (Physical, Occupational)	324,017	297,720
Transfusions	84,555	81,726

Average Number of Full-Time Equivalent Employees (including House Staff)	18,029	18,322
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Figure 2: Summary on Saint Philip’s Financial Performance:

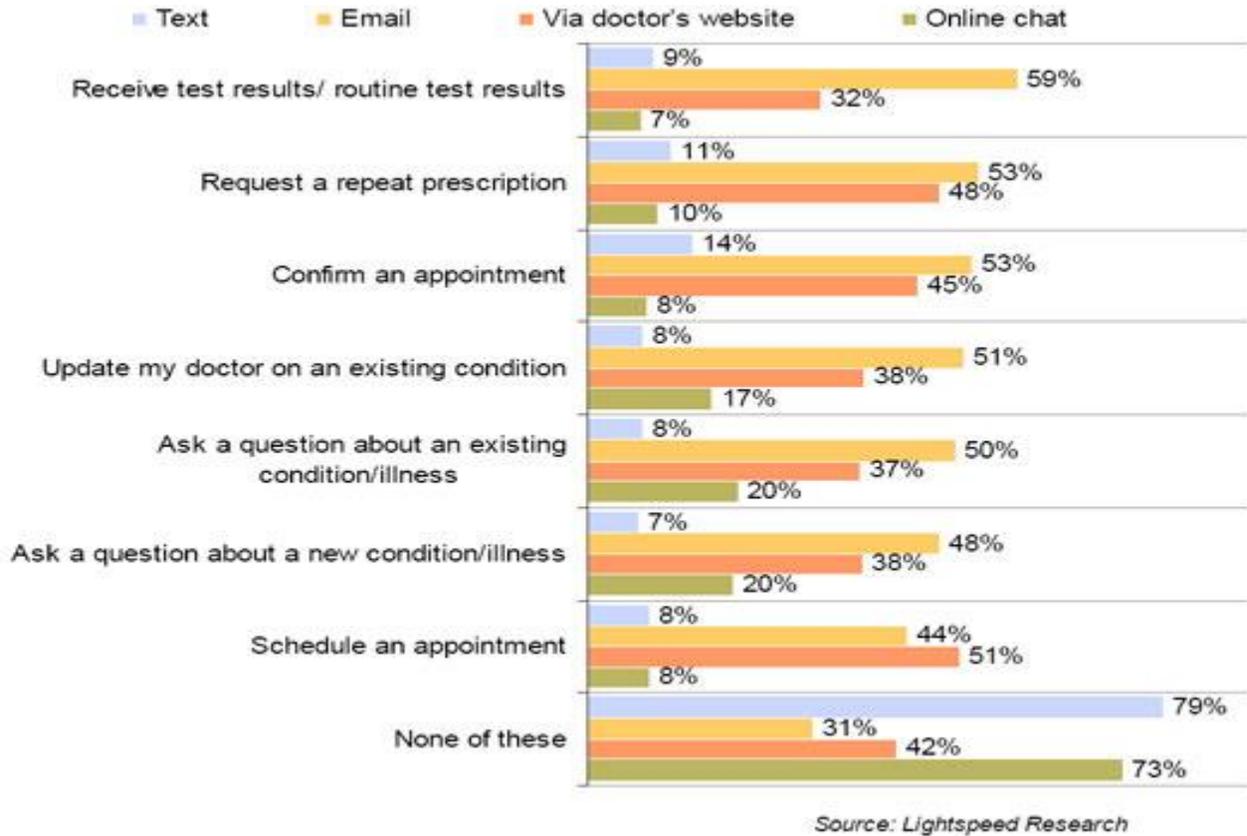
**Saint Philip’s Hospital
Financial Summary**

	January 1 - December 31 2008	January 1 - December 31 2009
Revenues	\$ Millions	\$ Millions
Net Patient Revenues	2,927.0	3,049.6
Other Revenues	159.1	171.6
Total Revenues	\$ 3,086.1	\$ 3,221.2
Expenses	\$ Millions	\$ Millions
Salaries and Benefits	1,737.7	1,863.1
Supplies and Other Expenses	962.1	987.6
Depreciation and Amortization	181.7	192.0
Leases and Rentals	61.7	60.5
Interest	40.1	35.9
Total Expenses	\$ 2,983.3	\$ 3,139.1
Operating Income	\$ 102.8	\$ 82.1
Investment Income (loss)	\$(90.8)	\$92.8
Excess of Revenues over Expenses	\$ 12.0	\$ 174.9

Figure 3: Saint Philip's Environment



Figure 4: Lightspeed Research on Patient's Preferences



(Statistical graph is based on a survey study conducted by Lightspeed Research. Retrieved from: <http://www.lightspeedresearch.com/press-releases/consumers-would-embrace-email-communication-with-their-doctor/>)

Figure 5: Motorola's Solutions

Mobility at work in healthcare

Healthcare facilities around the world utilize our comprehensive portfolio of wireless solutions to improve the accuracy and efficiency of every day tasks, track medical information and equipment and increase the quality of patient care. our healthcare mobility portfolio includes:



mobile Computers

Whether you need rugged enterprise class PDA style mobile computers, single and dual-mode Voice-over-WiFi phones or other data capture devices, our portfolio offers the features required for use in federal government healthcare applications — from FIPS 140-2 certification (certain models) to the ability to withstand the frequent device wipe downs necessary to protect the health and safety of both patients and healthcare providers.



Radio Frequency Identification (RFID)

RFID infrastructure enables complete automation of asset tracking. Fixed RFID readers at entry and other key points enable the automatic capture of information on RFID tags. As a result, assets such as monitors, IV pumps or a specialized piece of equipment for an upcoming operation can be tracked in real time.



Bar Code Scanners

Motorola's bar code scanners provide the ability to capture 1D/2D bar codes and direct part marks as well as images that can be attached to a medical record, all with a single device. The need to purchase, manage and maintain multiple devices to accommodate multiple bar code symbologies is eliminated. Since one device does it all, capital and operational costs are reduced — and productivity is increased.



Wireless Network Solutions

Motorola offers the industry's most comprehensive wireless portfolio, capable of delivering the real indoor and outdoor coverage required to reliably and securely extend wireless communications to and from every employee in every inch of your facility. FIPS 140-2 certified, common criteria EAL4, PCI and HIPAA compliance combine with our best-in-class AirDefense wireless intrusion prevention system, providing the advanced security required when and where you need it.



Centralized mobility management

one of the biggest costs associated with a mobility solution is the ongoing daily management of the wireless infrastructure. our family of powerful management solutions provide the tight integration required to create a single command center for end-to-end control over virtually every aspect of your mobility solution — from wireless LAN infrastructure to mobile devices and the applications and data resident on those devices. This easy to use comprehensive toolset drives management costs to a new low, delivering the peak performance and maximum uptime required to maximize the total cost of ownership (TCO) for your end-to-end mobility solution.



mobile applications

our award-winning channel partners offer deep vertical industry expertise and best-in-class applications that have been tested and validated on Motorola technology. And since our devices are built on a common technology platform, the applications you invest in today can be easily migrated to the Motorola devices of tomorrow. You can easily support changing business needs without the substantial costs associated with new application development — future proofing your solution and providing superior investment protection.

(Source: Retrieved from:
http://www.motorola.com/web/Business/Solutions/Federal%20Government/Documents/Static%20files/Fed_Healthcare_AB_FINAL.pdf)

Teaching Case

Real time locations systems or outsourcing: A case study

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Abstract

Information Technology has transformed almost all aspects of modern healthcare and is playing a vital role in the administration of hospitals around the world. This case study examines one hospital's struggle to solve crucial operational problems related to the efficient management of medical equipment inventory. This case study is the result of studying the issues facing a regional medical center in the western United States and is based on an actual set of events. This case focuses on one hospital's decision between deploying a sophisticated information system in the form of a Real Time Location System, or outsourcing these activities to a specialist company. All identifying information has been changed to protect the privacy of all parties involved.

Case Summary:

A large regional medical center in the western United States is struggling. A consulting firm hired to examine the hospital's operating procedures revealed that the hospital was suffering from terrible inefficiencies costing the hospital millions. In addition to the financial costs, the hospital was also exposed to legal liabilities because important medical equipment maintenance activities were not being conducted. The new CEO took immediate action to understand the full extent of the problem and, based upon advice from his leadership team, to identify a solution. The CEO and his team had a difficult choice between investing in more technology or outsourcing important hospital activities.

Keywords: Information Technology, Real Time Location System, Process Improvement, Outsourcing, Health Informatics

1. INTRODUCTION

Six months ago Mike Smith assumed the CEO position at St. Francis Hospital, the region's largest health care center. Mike is a seasoned healthcare executive, with 24 years of hospital administration experience. In the healthcare industry he has developed a national reputation as a turnaround specialist focusing on hospital systems in financial difficulty. Accordingly, Mike was recruited to run St. Francis in the hope that he might improve the struggling hospital's performance and profitability.

This particular morning Mike looked tense and troubled. None on the hospital's staff could know what was troubling him as he had just received the confidential report from the consulting firm Premier, Inc. Premier is a leading consulting firm in the healthcare industry. Mike has worked with Premier over the years and has found the firm's work to be first rate. Premier's approach focuses on using statistical process control techniques to analyze and improve organizational processes. Their techniques and methods are considered to be the highest standard in the field. While Mike knew the hospital had issues he was stunned to learn about the terrible operational inefficiencies unearthed by the consulting team.

Based on the report it was clear to Mike that the operational problems were not isolated to financial issues, but also extended into liabilities associated with not following important compliance procedures that are critical to patients' care. If the hospital failed to correct these issues it could result in the loss of its accreditation. As Mike set the confidential report back on his desk his cellphone rang. It was Kim Huntington, the CEO of Providence Healthcare Services, which owns St. Francis and other hospitals. Mike knew that Kim must have just finished reading the same document he had and he knew she would want to know what he planned on doing to fix the problems.

2. ORGANIZATION'S HISTORY

St. Francis Hospital was founded in 1873 by the sponsorship of the Catholic Healthcare Missionary Group. As a non-profit healthcare provider, the hospital is committed to providing for the needs of the community it serves, especially the poor and vulnerable. St. Francis's primary facility consists of a seven-story building with over 400 beds to accommodate inpatient

care. In 2007 the hospital completed a major reconstruction effort that substantially upgraded the facilities. The hospital is able to provide a wide array of surgical services and, because of the quality of the community in which the hospital is located coupled with the new facility, is able to attract high quality nurses and physicians onto its staff.

In fact, in 2009 the hospital received a national award recognizing excellence in its trauma facility. The facility is supported by two helicopters that deliver trauma patients from across the region. Because of the diverse services St. Francis provides, the trauma facility is a critical component of the region's healthcare system.

However, the hospital's "crown jewel" is its Heart Institute, which is regularly recognized as one of the top 100 in the world. This is an unusual distinction for a hospital like St. Francis, as most of the other top cardiac facilities are associated with research hospitals across the globe. The Heart Institute was founded in 1994 when a team of leading cardiac surgeons elected to leave a major research hospital in the northeast and move to St. Francis to try to build a world renowned institute in a location that could provide the physicians and their families a better quality of life.

In 2010, St. Francis' board of directors made a major decision: for the first time since 1873 the hospital would not be an independent medical facility. The board decided to join a large health care system called Providence Healthcare Services (Providence). This decision was made in response to changing industry dynamics that favor larger integrated organizations (Harris, 2000). This change represented a significant departure from the hospital's history, and many of the staff struggled with the idea that the hospital is but one entity in a much larger healthcare organization.

Providence Health includes 27 hospitals, 214 smaller clinics and 42 geriatric assisted living facilities. In addition, Providence contracts with 7 universities to provide on-campus health services to their student populations. Providence's assets span six states: Alaska, California, Idaho, Montana, Oregon and Washington; the organization's headquarters are located in Seattle, Washington. The board was motivated to merge with Providence because of the significant efficiency benefits the

organization would accrue. In addition to the efficiency benefits associated with greater scale, the board also hoped that Providence would help St. Francis modernize its technology.

The modernization of St. Francis's technical infrastructure began almost immediately following the merger with Providence through the implementation of a cloud-based Electronic Health Record System (EHRS). Because of Providence's size and scale, they were able to implement the cutting edge cloud-based EHRS and deploy it to all of its affiliates. This provided significant benefits as Providence staff could centrally manage the EHRS and the IT staff in the member hospitals could focus on providing better service and working on local initiatives. Almost everyone in the hospital agreed that it represented a significant improvement. The physicians were the most vocal in their support because the cloud-based system allowed them to securely access patient records from almost any approved device.

During the implementation of the cloud-based EMRS, it became clear that the project management skills of the St. Francis staff were not at the level they should be. For example, Mark Nesbit, the previous CIO and a long-time St. Francis employee (it was the only job he had had since college), was lacking the skills to keep up with the more advanced systems employed by Providence and was accordingly encouraged to retire. He was replaced by Sarah Thompson, the assistant CIO in one of Providence's Oregon hospitals. Sarah brought a thorough understanding of Providence's cloud-based EMRS and first-rate credentials. In addition to holding an MIS degree, she is certified by the Project Management Institute (PMI) as a Certified Project Management Professional (PMP).

3. THE MEETING

Upon finishing the call with Kim Huntington, the CEO of Providence Health Care Systems, Mike sent out an email to his executive team calling for an emergency meeting the next morning and instructing them to clear their schedules for the first half of the day. He attached the report critical of St. Francis's operations to the message and asked the executive team to thoroughly read the report and to show up with solutions.

The next morning all of the members of the executive team were present. The atmosphere

was tense, as everyone in the room knew that solving the problems would inevitably require them to bring to the surface some of the tensions between the long-time St. Francis's employees and the new guard brought in after the merger of St. Francis's and Providence.

Mike called the meeting to order and summarized the findings of the report. Based upon Premier's analysis, St. Francis received a 'D' grade in the area of staff efficiency. Furthermore, the report stated that the inefficient use of medical staff time was costing the hospital millions and exposing it to malpractice risk. The report highlighted in devastating detail how nurses throughout most of St. Francis were spending 23 percent more time per patient than was the average hospital. In addition, the time the nurses were spending was not a result of providing quality care, but instead was consumed by incredible logistical inefficiencies. Due to poor inventory control and tracking procedures, important medical equipment was either not in the stock rooms or was restocked slowly. In short, the report revealed the nursing staff was spending a startling amount of time looking for the required equipment instead of treating patients. As a response to such inefficient inventory management practices, nursing staff would hoard important equipment, further complicating matters.

Required maintenance on critical medical equipment was also poorly documented and, in some cases, being skipped entirely because of substandard medical equipment management practices. If the hospital were sued for malpractice, the deficient maintenance processes would not only be embarrassing to St. Francis's reputation, they could also serve as the basis for a successful judgment against the hospital.

Following the summary, Mike asked the team what they thought of the findings. The first reaction was to dismiss the report as the work of people who come in for a few days and leave without really understanding the organization or its processes. Mike quickly dismissed this critique, as he had worked with Premier over the years and found them to be an outstanding firm. He stated, "We aren't going to sit around here and kill the messenger. This report has pointed out that we have real problems and we are here to fix them."

"Many of you are still getting to know me, but you should know me well enough to know that I value your candid assessment. I encourage all of you to speak your mind, but please be respectful and operate in a spirit of positive problem solving and not one of blame. I understand that much has changed around here over the last few years, but we must come together so that we can continue to enable one of the noblest goals in our society and that is helping sick people get better. Remember, our goal is to not defend our turf, but to help sick people. Now, who wants to speak?"

The first person to speak was Kelly Andrews, the Director of Nursing Services for St. Francis. Kelly is considered to be a quiet professional and has spent her entire career with the hospital. She attended the local university and was the first person in her family to earn a college degree. With tears welling up in her eyes she stated that she thought that the problems identified in the report were actually worse than the report revealed. While the report focused on the economic effects of the failings in the existing system, she stated that from her perspective the morale issues were much worse. She said that the nursing staff were demoralized by the existing system and that the issue had been pointed out for several years. In fact, Kelly had spoken with the previous CEO on several occasions about her concern. Mike's predecessor simply stated that steps would be taken to fix the problems, but she and the nursing staff needed to be patient. After hearing this, Mike stated, "this mistake will not happen again and you can rest assured that this issue is going to be resolved. Please convey to the nursing staff that this is our top priority and we will need their help in solving the problem."

By this time everyone on the staff recognized the significance and legitimacy of the problem and Mike continued to push for solutions. After a few hours of discussion the members of the executive team were evenly split between one of two solutions. The first, an idea championed by Sarah Thomson the CIO, was a technical solution that focused on using Real Time Location Services (RTLS) to monitor the location of equipment. The second solution was supported by George Hill, the Central Stores and Distribution Manager. He strongly advocated for outsourcing the equipment maintenance and management to a company the hospital has been working with through the years.

Solution 1: RTLS

The solution supported by the CIO was the result of her previous experience at another hospital that used RTLS to improve operational efficiencies. RTLS, "which combine radio frequency ID (RFID) and Wi-Fi, will allow for real-time data gathering and live asset tracking. RTLS can calculate distances, range, time or direction in order to determine the location of objects, and is capable of providing stored data that can be used for analysis and reporting" (Okoniewska, 2012). When RTLS are employed in an organization, each piece of equipment is embedded with an RFID chip. When the piece of equipment is moved its location is known at all times. The information can then be linked to medical records systems such as those used by St. Francis. Furthermore, it is widely recognized in the hospital administration community that the data derived from RTLS can be used to rationalize and "transform hospital processes" (Carrasco, 2010).

Solution 2: Outsourcing

George Hill, who has over twenty years of experience at St. Francis and is considered to be the leader of the old guard, favored outsourcing all inventory control and maintenance to a third party. Five years ago, George was instrumental in working with a local company, Drothall Hospital Services, to outsource all of St. Francis's janitorial services; this had largely been viewed as a success. He suggested that with its proven track record with the hospital, Drothall is well positioned to assume procurement, inventory management and all medical equipment maintenance for St. Francis. In addition, Drothall would hire most of the St. Francis staff currently working in this area of the hospital, thereby reducing payroll considerably. George concluded by saying that outsourcing, coupled with process improvement, could effectively solve the problems currently faced by the hospital. Furthermore, while the transferring of some St. Francis staff to Drothall would be controversial, the savings would be an added benefit to the efficiency and profitability of St. Francis.

After several hours of discussion, Mike challenged both Sarah and George to investigate the advantages and disadvantages of employing RTLS and outsourcing. He concluded the meeting by giving Sarah and George one week to research and develop the business case

around their respective ideas. He set the next meeting for exactly one week later and asked them both to prepare presentations to be given to the entire executive committee.

4. MAKING THE CASE: RTLS OR OUTSOURCING?

The presentation day quickly came and all members of the executive team were assembled. Both Sarah and George came prepared with presentations to represent their respective solutions.

REAL TIME LOCATION SYSTEM

Sarah began the meeting by emphasizing how healthcare organizations are investing significant resources into IT infrastructure for the purpose of improving medical service delivery, operational efficiency and to ensure regulatory compliance (Medpac, 2004). In addition, Sarah recognized that "IT continues to hold more potential for providing competitive advantage for health care providers" (Carr, 2004). Additionally, St. Francis could leverage the hospital's existing Cisco Systems WiFi infrastructure by using WiFi based RTLS technology. WiFi based RTLS delivers room level accuracy of medical equipment and other operational resources.

Benefits of RTLS

The main reasons for investing and implementing the WiFi RTLS were:

1. RTLS would significantly reduce the time required to search for and identify equipment that is due for regular maintenance. St Francis's has already invested in a maintenance tracking system that is a cloud-based system that tracks the maintenance requirements for critical medical equipment. Sarah's research revealed that the RTLS system being considered was interoperable with the maintenance scheduling system. This is a critical activity in that it is important for hospitals to demonstrate to accrediting bodies that they are compliant with the processes and procedures identified by the *Healthcare Compliance Accreditation Group*, an important governing body.
2. RTLS will reduce total expenditures by reducing costs associated with renting additional equipment due to shrinkage or

hoarding by clinical staff. The WiFi based RTLS technology is able to penetrate through barriers like walls and lockers to identify hidden equipment.

3. RTLS would reduce inventory count and relocating time. The system displays the exact location of all equipment, which can be displayed from several different views such as the entire hospital, all the way down to an individual room. By knowing the exact location of a required piece of equipment, hospital staff are far more efficient. This would have the effect of lowering costs and improving the effectiveness of hospital staff as they will no longer have to wander through the hospital looking for a piece of equipment. This would have the added benefit of improving staff morale.
4. RTLS would improve nurse and patient tracking capabilities as well as St. Francis's Business Intelligence initiatives. Because the RTLS interfaces seamlessly with the hospital's EMR, the hospital's employees would be able to view patients' and clinicians' movements on the wall monitors displayed throughout the hospital. Thus, results stored in the databases could be used to monitor trends and could be analyzed to identify operational activities that can be improved. Sarah related an incident where a hospital at which she previously worked used RTLS to avoid a legal judgment from a patient who alleged that a nurse had assaulted her. By using the employee tracking aspect of RTLS, the hospital was able to prove that the employee was inside the patient's room for a total of three minutes and that other members of staff were in close proximity, thereby proving the assault did not happen.

Disadvantages of RTLS

In spite of the promises from various RTLS vendors, the implementation and full use of the system had sometimes fallen short of expectations.

1. The costs associated with implementing an RTLS can be high and hospital administrators have observed that in some instances other components of the infrastructure including hardware and software had to be updated for proper implementation.

2. A few hospitals reported issues during the implementation of RTLS that compromised operations. Hospital staff in the affected hospitals blamed the company hired to implement the system and it was believed the vendor did not have sufficient project management expertise.
3. In order to properly use the system, the hospital would have to develop and deploy a new training program for hospital staff so that the powerful feature set within the RTLS could be used. It was noted that these types of training programs are both expensive and require the time of an already overworked staff.
4. In order to effectively deploy RTLS, issues affecting signal strength throughout the proposed environment must be considered. One concern involved the areas of the hospital that provide magnetic resonance imaging (MRI) services. These areas are known to be "a major source of electromagnetic interference at the hospital" (Cheng, 2011). Some evidence suggests that there can be blurred images in areas where RFID is used. However, the WiFi-based RTLS technology being considered had not been linked to such interferences.
5. It is estimated that the IT department would need to hire an additional person, thereby increasing the number of full time IT staff.

OUTSOURCING

George also came prepared with a full presentation outlining the argument for outsourcing. He stated that he is in favor of outsourcing as it could complement the broader strategy at St. Francis. He opened his presentation by stating, "Strategic outsourcing is the decision to allow one or more of a company's value chain activities or functions to be performed by independent specialist companies that focus all their skills and knowledge on just one kind of activity" (Hill, 2010). Strategically, he supported outsourcing all the medical equipment services to a specialist firm with experience in providing healthcare support services.

Benefits of Outsourcing

George said that the primary reasons for outsourcing are:

1. Outsourcing would significantly reduce the costs of doing business because specialist firms are far more efficient than internal departments. George noted that Gartner Inc. estimates that "health care organizations save an average of about 23 percent on outsourcing contracts, including IT and non-IT outsourcing, with some organizations seeing savings up to 45 percent on some outsourcing contracts" (Gross, 2004).
2. Outsourcing would improve service quality delivery. By outsourcing noncore activities, the hospital can focus its energies on core activities and deliver better quality healthcare services to patients.
3. Outsourcing would improve the speed of adopting new technology geared toward integrated health IT infrastructure. George noted that research has shown that "IT outsourcing is a harbinger of the transformation of traditional IT departments and provides a glimpse at the emerging organizational structures of the information economy" (Lacity, 1998). In addition, specialist firms are better suited to stay on top of emerging trends and technologies.
4. George concluded with an emotional appeal for St. Francis to focus on what it does best, which is providing invaluable health services to the community. By "outsourcing materials supply, the hospital benefits by lowering its cost structure, which allows it to focus on its distinctive competencies. This is vital to its long-term competitive advantage and profitability as well as increasing product differentiation" (Hill, 2010).

Disadvantages of outsourcing

However, it is important to recognize the downside of outsourcing healthcare services, namely, "risks such as holdup and possible loss of important information when an activity is outsourced" (Hill, 2010).

1. One downside of outsourcing, observed across industries, relates to a loss of quality control in the outsourced

function. When control is shifted to a third party it can sometimes be difficult to quickly remedy quality problems.

2. In the healthcare environment losing patients' personal information may result in penalties as a consequence of violating the Health Insurance Portability and Accountability Act (HIPAA). HIPAA requirements mandate healthcare organizations to follow strict procedures in order to protect the privacy and security of the patient records within the hospital's care (HHS, 1996a and 1996b).
3. Another problem with outsourcing is that sometimes when "companies sign long-term [outsourcing] contracts they lose control of their IT assets and capabilities" (Lacity, 1998). Therefore companies that outsource functions lose autonomy to the outsourcing specialist.
4. It has been observed by critics of outsourcing that there are often hidden costs associated with outsourcing and that scope creep can severely affect total costs.

5. CONCLUSION

Two weeks later Mike called a meeting with Sarah, George, and the executive team to announce his decision. After consulting with Providence staff and other hospital CEOs he has decided to go with the RTLS solution. He asked Sarah and George to co-chair a subcommittee that would develop an implementation plan. George questioned whether or not he was the right person to co-chair an initiative he didn't support. Mike stated that George's expertise and institutional memory would be a valuable contribution toward the project's success.

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APPENDIX A: STUDENT ASSIGNMENT

You have been hired by a hospital that is considering solutions to the same problems encountered at St. Francis. Please consider the following questions and prepare a 15 minute presentation. Your presentation should address the following questions.

1. What are additional strengths and weaknesses of either RTLS or Outsourcing?
2. What important components (sponsors, stakeholders, project management, roles and responsibilities) of RTLS and Outsourcing implementation project would you suggest? Who should be involved in the project from these various stakeholders, and why?
3. Identify tangible business benefits for all relevant departments of either RTLS or outsourcing.
4. What processes and methodologies would you employ to select the appropriate system? What sort of information would you require to make accurate projections for the costs and benefits associated with this system?
5. Early in the case it was revealed Sarah holds the PMP designation. What is this designation? What type of skills are required to earn this certification?

Teaching Case

LINUX, Virtualization, and the Cloud: a hands-on student introductory lab

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ABSTRACT

Many students are entering Computer Science education with limited exposure to operating systems and applications other than those produced by Apple or Microsoft. This gap in familiarity with the Open Source community can quickly be bridged with a simple exercise that can also be used to strengthen two other important current computing concepts, virtualization and cloud computing. Students can gain firsthand experience through the creation of virtual machines utilizing free LINUX distributions with pre-installed productivity software. This enables the students to have a greater understanding of these concepts and how they may be applied to meet their own needs, or the requirements of a corporate scenario.

Keywords: LINUX, Virtualization, Cloud Computing, Operating Systems, Open Source Software, Open Document Format

1. INTRODUCTION

Computer Science / Information Systems / Information Technology (CS/IS/IT) education is constantly striving to keep pace with the developments and evolutions of industry implemented Information Technology. For graduates with Computer Science degrees to be able to hit the ground running and garner jobs post-graduation that are above entry level positions requires the education they receive in the collegiate school to be as near as possible to the hard knocks school of the work world.

While it is understandable that it is impossible for the school curriculum to respond to every change and new fad of the computing industry, especially in smaller schools with tighter budgets and fewer resources, it is incumbent upon every school to incorporate concepts and practices that form the fundamental foundation of computing in the business world.

Three of the most prevalent topics in the IT industry since the turn of the millennium have been Cloud Computing, Open Source software, and Virtualization. Each can be taken individually, but often they are seen working together as part of a greater system. These three areas have grown and matured to where companies of any size must address the questions that each poses.

The following lab centralizes an activity that can present to CS/IT/IS students on any level a valuable experience with Virtualization, Open Source software, and Cloud Computing. With proper setup and resources, the core exercise can be accomplished in under an hour, and easily expanded as needed for longer time windows. The exercise can also be augmented by a multitude of additional assignments and tasks to expand upon the experience, or to further apply the concepts in different environmental scenarios.

In this lab, students will create virtual machines (VMs) utilizing readily available, often free,

virtualization software. These VMs will have as their operating system (OS) one of many open sourced LINUX distributions which are also free of charge. It is most beneficial to include multiple 'flavors' of LINUX to include a variety of pre-installed options for Web browsers, office productivity software, as well as look and feel of file management and desktop environments. Students will also utilize Cloud Computing concepts in managing files for ultimate delivery of the artifacts related to the assignment.

After experiencing these areas of current computing trends hands-on, students will be prepared to address further questions and scenarios projecting the concepts and applications of the technologies into various situational based assignments catered to their educational level and course of study.

2. BACKGROUND

For several years I have straddled the line between academia and the business world as a full time Managed Service Provider (MSP) consultant to Small/Mid-Sized business (SMB) and an adjunct professor of Computer Science and Information Systems. Having a foot in both worlds allowed me to continue to develop at a very rapid rate with the new technologies entering production in the business world, as well as relate those techniques and tools to students not yet exposed to the vagaries of that environment.

Through anecdotal evidence I became aware that many of my students were coming into Computer Science classes with a base recognition of many words associated with computers and computing, but with a very wide range of definitions of what these words meant or what actually accomplished the tasks. In an interview with Newsweek, Inventor Dean Kamen stated, "If you are not on the front edge of the wave (of innovation), it's harder to understand it, much less be involved. You used to be able to open the hood of a car and understand, that's the engine. Most people today look at technology and see magic (Kenny, 2004)." The students that I found in my class room were walking in knowing that magic was occurring, and not knowing how. They were on the tangential edge of consumption of computer devices and computing tasks, certainly not on the leading edge of implementation - let alone innovation.

This lab was initially developed as part of a class in operating systems being delivered to students working towards a Master's degree in Information Systems. To my surprise, an informal poll on the first day of class showed that not a single student of the twenty-four had ever used LINUX directly to their knowledge. In response to this, I devised a series of progressive labs utilizing VMWare Workstation to introduce the students to LINUX as a desktop OS and progressing to their installation of a server system including several separate user accounts and an FTP service for 'drop box' scenarios. This initial trial worked very successfully with many comments from the students expressing gratitude for the inclusion of hands on practical tasks.

Subsequently, I have adjusted the level of instructions and tasks to accommodate undergraduate introductory classes. In the graduate classes little instruction was provided, mandating that the students find their own resources to support and direct their tasks. In the undergraduate classes a more detailed set of step by step instructions was necessary to hand hold the students through the initial setup process. However, once at the desktop of the LINUX OS, students were expected to 'find their own way' by looking for familiar words, menus, and icons. The tasks were also adjusted to the undergraduate level as more of an introduction to the possibilities of replacing costly licensed software with free open sourced equivalents.

In the past year, I have included a more formalized survey to begin the exercise. This survey has been administered to three classes, a non-major introductory course, a freshman level introductory course for majors, and a senior level special projects course for majors. As expected, results varied greatly for the senior level course and the two introductory courses. A full ten of ten had experience in using LINUX on some level in the senior level course. However, there was little difference between the two introductory level courses. In the non-major course, 24 of 24 did not have any experience with LINUX, and 23 of 24 did not have any LINUX experience in the intro course for CS majors. One-hundred percent of the students in all three classes responded that they had had some experience with both Apple OS's and Microsoft OS's. Between the two intro courses, 8% (4/48) responded that they believed that LINUX to be a command line only operating

system with no point and click graphical user interface.

The survey also included questions regarding how students access their e-mail. Answers to these questions have highlighted the need to address core concepts of client server systems to the students. Not a single student utilized a standalone/installed client (such as Microsoft Outlook or Opera for MAC) application in the traditional sense to access their e-mail. All students responded that they exclusively utilize the web interface for either school e-mail or other public services such as Gmail, Hotmail, Yahoo, AOL, etc. In a subsequent question, 56% (27/48) incorrectly believed that in utilizing the web interface to view an e-mail message, that message was automatically saved to the local device on which it was viewed. For file sharing, 62.5% (30/48) had utilized some form of Internet based file sharing with Google Docs, Windows Live, Picassa, or Dropbox. Every respondent (48/48) believed that uploading a picture to a social networking sites such as Facebook or Twitter was the equivalent of file sharing.

Prior to the lab, two of the students in the upper level class had experience with running a virtual machine (VM). Both had MAC books and were currently running Windows 7 as a VM. No other students responded affirmatively that they had previous experience with a virtual machine.

3. LAB EXERCISE

Environment:

The environment for the lab can be very flexible. The most essential piece needed is a virtualization application. For this lab I have been utilizing VMWare Workstation; however I have also performed the lab with VMWare Player and Oracle's Virtual Box. VMWare Player and Virtual Box are free; VMWare workstation is not, although a trial version is available.

I have been lucky to be in a lab that I have administrative control over. I can ensure software is pre-installed and ready. I have also performed this lab in settings that utilized Deep Freeze for protection of the machines. In these cases, the installations worked perfectly fine, as long as students did not re-boot after completing the install of the virtualization software.

LINUX distributions are many. Distrowatch (<http://www.distrowatch.com>) is a terrific

resource for tracking the most current and most popular distributions. Each version offers their own take on what they think is best, and customized to fit various environments. There are many that are for general use and provide multiple applications pre-installed for convenience. I have utilized Fedora, Knoppix, Ubuntu, LINUX Mint, Puppy LINUX, and Pear OS. All of these distributions are available for free and downloadable. Most are in the 700MB range in size, though some will grow to over 1GB. These Operating Systems (OS's) are available as disk image (ISO) files that can be loaded directly by the VM software or burned onto and then booted off of DVD's and also flash drives. It may be beneficial to have these available on a flash drive or DVD for ease of copying from computer to computer to avoid a larger class all pulling the same larger file down from the Internet at the same time. This is a good opportunity to stress familiarity with the file system of the computer they are working on. Placing these files on a network share can work, but will also create a terrific amount of network traffic that will slow everyone down. Keeping the disk image for the OS local will avoid this.

Tasks:

Most often I have included the installation of the virtualization software as the initial task for the students to perform. I believe that we often take it for granted that all students are familiar and comfortable with simple installation procedures. I have often found this is not the case and many do benefit from the process.

Once the installation of the VM software has been completed, students are tasked with creating three different virtual machines one at a time. This is accomplished by first creating the shell for the VM in the software. This requires designating how much of the resources of the physical host machine can be dedicated for use by the VM and includes CPU, RAM, and Hard Drive space. A point of emphasis can be made here as to what exactly does make up the basics of any computer system. Once these resources are designated, it should be stressed to students that they have essentially created a new machine, just like the one physically in front of them, and that at this point is has all the 'physical' parts necessary but no operating system. In all of the VM software packages, they then point the virtual optical drive to the ISO file for the LINUX OS they wish to run. Upon "powering up" the new VM, the new LINUX OS will automatically begin to load. This process is

repeated for the subsequent VM's as well. It is important to note to students to make sure to power down their previous VM's before powering up a new one. More than one on at a time will begin to tax the resources of the host and noticeably slow their progress.

Within each OS a separate basic assignment is given to highlight the similarities of the OS with what they are already accustomed to. Each of the LINUX distributions will have a version of an open source office suite for word processing, spreadsheet, presentation, and possible personal database work. Each will also have a web browser program. Simple assignment can be centered around searching for current standing for the college's sports teams that are in season, importing into a spreadsheet, and including a picture that was saved from a website on the spreadsheet. Once completed, the student must e-mail the saved spreadsheet to the professor. This type of assignment will force the student to explore the OS to find the programs necessary to create the artifact, as well as to send it off for completion. The inclusion of the image file will force the student to save a file from the Internet onto the file system of the VM and find it to include into the spreadsheet enforcing the existence of a different and separate file structure from the host machine. I recommend including different assignments for different OS's with multiple variations of open source office applications and browsers for variety. Screen shots from within the VM can be included into documents. Scavenger hunt questions can be asked and answered to provide content for documents. Games can also be included.

E-mail is a preferred method of delivery for the artifacts of the assignments. This enforces the ease of access of mail systems and the use of various browsers to access them. It also reinforces the idea that even within the VM, there are still multiple connections to the outside to direct output from the system.

4. CONCEPTS

The following is a list of concepts that can and should be stressed throughout the lab. These can be enforced through the specific assignments given within each VM instance, or simply highlighted with running dialog between the instructor and the class during the session.

- Components of a computer
- File system navigation

- Operating systems
- Open source software
- Output channels from a computer
- Variety of software for common tasks
- Utilization of computer resources
- Virtualization
- Cloud computing, personal
- Cloud computing, corporate
- File type in saving documents
- Compatibility of software, file types
- Commonality of menus and icons

5. ASSIGNMENTS

The purpose of the preceding lab exercise is to ensure that all students have been exposed to the essential elements of virtualization, open sourced OS and application options, and virtualization. It is not meant as exhaustive training in any of these areas. By introducing and allowing the students to experience these applications personally, it will remove barriers of ignorance and allow them to move forward to greater conceptual assignments. These assignments can be centered on specific applications or scenarios as would most benefit the course in general. The following are examples of possible longer form assignments that build upon the concepts introduced in this lab:

Assignment 1:

You have been hired as a consultant to a Small/Mid-sized business that is less than two years old. Currently the office has 11 employees. The company has 8 PC's that are mixed between Windows XP and Windows 7. Five employees are utilizing personal laptops for work as well, three of these are MACs. The owner would like to standardize and make sure everyone is on the same page and can work together seamlessly. Provide a proposal to him that would utilize open sourced software and a LINUX based operating system.

Assignment 2:

What is the current market share breakout of operating systems? Find four measures of this statistic. Explain how each of the measurements is derived. Pick four operating systems and provide an overview of their history, their strengths, weaknesses, and their public perception.

Assignment 3:

Your new client is a food marketing company that produces pre-made appetizers for several restaurant chains. There are five regional offices across four states. Multiple sales people and managers are in the field supplying and selling products to restaurants. You need to develop a system of portable file sharing that can work across multiple OS platforms including MAC Air Books, Windows based laptops, iPads, and Android based tablets. Identify four leading cloud file sharing services. Compare their features and costs. Make a recommendation as to which you think will work best for this company. Make sure to include in your recommendation the following: cost, collaboration features, security, multiple OS integration, multiple file type compatibility, reliability, offline options, and backup/recovery options.

Assignment 4:

You have just been hired as a quality assurance specialist at a small software development company. The company develops an installable application for Windows based PCs. With each revision of the software, the application need to be tested in various environments, including multiple versions of Windows and multiple versions of Windows with multiple other common software applications installed on Windows. Scenarios also include fresh installs, as well as upgrades from existing installations. The previous person in charge of this task had

14 PCs that they would need to re-install every time a new revision of the company software came out. Your boss wants you to re-think this system and make it more efficient.

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Appendix A: Lab Instructions

Ingredients:

- Virtualization Software (Oracle Virtual Box) - <https://www.virtualbox.org/wiki/Downloads> (Download the Windows version.)
- "LIVE OS" versions of LINUX distributions: LINUX Mint, Puppy LINUX (<http://distrowatch.com/>)
- A workstation, either a Windows or Apple PC, to host your virtual machines

Installation of Virtualization Software:

- Acquire install package for Oracle Virtual Box (95MB install file)
- Run the installer (Each instruction line is a new window in the installer)
 - o Click next past the welcome screen
 - o Take the default location for installation (C:\Program Files\Oracle\VirtualBox)
 - o Choose whether you would like shortcuts placed on desktop or quick launch bar
 - o Reply "Yes" to the warning about the networking interface install
 - o Reply "INSTALL" to the ready to install prompt
 - o The installation will proceed – there will be several prompts to OK component installations from Windows. Choose either OK or Install to proceed.
 - o Leave the check in the box to start the program after installation. Click "Finish" when the installer is complete

Creation of first virtual machine:

- Open Oracle VM VirtualBox Manager
- From the Machine menu, choose "New"
- In the new window that appears, provide a name form your machine
 - o Choose "Linux" as Type
 - o Choose "Debian (64 bit)" for Version
- In the next window, set the amount of memory to 1024MB
- In the next window, take the default, which creates a virtual hard drive at the recommended 8GB size
- In the next window, choose the VMDK option for Hard drive file type
- In the next window, take the default to Dynamically allocate the hard drive
- In the next window, take the default that confirms the 8GB drive size

Choose OS and start machine:

- Before powering on the machine, set direct the machine to the proper boot image
 - o In the Oracle VM VirtualBox Manager, select he machine listing you just created
 - o Click on the "Settings" gear icon
 - o In the new window, select "Storage" from the left side menu
 - o In the middle pane, select the listing for "Controller: IDE"
 - o To the right of the "Controller: IDE" listing are two disk icons, choose the first wich shows only 1 platter
 - o In the window that comes up announcing that you are about to add a new CD/DVD drive, select "Choose Disk"
 - o Browse to the location you have the ISO file for LINUX MINT and select the ISO file
 - o Place a check in the box or "Live CD/DVD"

- Start the new virtual machine
 - o Press the "ICON" icon to start the machine
 - o Through the boot process, several advisory screens will appear with information about pointer capture and color settings. "OK" past these.
 - o As a "live OS" you will find yourself at a desktop in just a few short moments without the need to login.

Exercise 1: From MINT

- Once at the desktop
- Open a word processing program (look around – you'll find it!)
- Insert a picture related to Girl Scout Cookie Thin Mints with an appropriately witty remark.
 - o To accomplish this, you must also find an internet browser, find the image, save the image to the virtual hard drive of the virtual machine, and retrieve the image from that location to insert into your document...)
- Save as an "Open Document" format (.odt) file name "yourname_Mints.odt"
- From the internet browser open your school e-mail. Send the document to me as an attachment.
- Exit from the applications and power off the virtual machine.

Exercise 2: From Puppy

- Create a virtual machine for Puppy just as the first
- Upon power on, you will need to make several selections during the initial boot sequence. Puppy is not a "LIVE OS" and is in fact installing itself to the new virtual disk.
 - o Select USA
 - o Select en_US
 - o GMT-5 for time zone
 - o Local clock type
 - o Xorg for video type
 - o Probe for video type
 - o 800x600 screen size
 - o Verify 800x600
 - o Finish
- Once at the desktop, Open a spreadsheet program (Gnumeric Spreadsheet Editor)
- Create a quick spreadsheet. Copy the schedule for the school's baseball team
- Include a picture of a baseball on the spreadsheet
- Save the spreadsheet as "yourname_Puppy".
- Open a web browser, log into your school E-mail
- Mail the spreadsheet to me.

Appendix B: Student Survey

1 – Have you ever used LINUX? Yes No

(For the following – use a scale of 1 to 10, 1 low to 10 high)

2 – How comfortable would you be creating a document in a program other than Microsoft Word _____

3 – How hard would it be for you to adjust to a new Operating System? _____

4 - Have you ever used a computer with the following Operating System?

Windows _____ MAC OSX _____ MAC IOS _____ Android _____ LINUX _____

5 – Rank the following common tasks with how important they are in your everyday computer usage:

1 - Web Browsing _____

2 - Word Processing _____

3 - E-Mail _____

4 – Printing _____

5 – Spreadsheets _____

6 - File Sharing _____

7 – Music _____

8 – Video _____

6 – Which Operating System do you have on your personal computer? _____

7 – What is your most commonly used web browser?

1 – Internet Explorer

2 – FireFox

3 – Google Chrome

4 – Safari

5 – Other: _____

8 – In what program do you work with your e-mail?

Stand Alone Client (Outlook, Opera)? _____ Web Browser _____ Phone _____

9 – If you utilize a web browser for e-mail, where do you believe are these messages saved? _____

10 – Do you use any online file storage systems/services? If yes, which?

11 – Do you believe that uploading a picture to a social networking sites such as Facebook or Twitter was the equivalent of file sharing? _____