

INFORMATION SYSTEMS EDUCATION JOURNAL

Special Issue – Teaching Cases

- 4. SAPCO: From Good to Great**
Saleh Alsaif, Middle Tennessee State University
Brandon Edinger, Middle Tennessee State University
Teja Kodathala, Middle Tennessee State University
Melinda Korzaan, Middle Tennessee State University
- 13. Teaching an Old Dog New Tricks: Disaster Recovery in a Small Business Context**
Zach Rossmiller, The University of Montana
Cameron Lawrence, The University of Montana
Shawn Clouse, The University of Montana
Clayton Looney, The University of Montana
- 20. Ding Dong, You've Got Mail! A Lab Activity for Teaching the Internet of Things**
Mark Frydenberg, Bentley University
- 32. Taking the High Road: Privacy in the Age of Drones**
Lucas Hamilton, The University of Montana
Michael Harrington, The University of Montana
Cameron Lawrence, The University of Montana
Remy Perrot, The University of Montana
Severin Studer, The University of Montana
- 40. Tourism through Travel Club: A Database Project**
Renee M. E. Pratt, University of Massachusetts Amherst
Cindi T. Smatt, University of North Georgia
Donald E. Wynn, University of Dayton
- 48. The Piranha Solution: Monitoring and Protection of Proprietary System Intangible Assets**
Christine Ladwig, Southeast Missouri State University
Dana Schwieger, Southeast Missouri State University
Donald Clayton, Southeast Missouri State University
- 52. American Guild of Musical Artists: A Case for System Development, Data Modeling, and Analytics**
Ranida Harris, Indiana University Southeast
Thomas Wedel, California State University, Northridge
- 60. Accentra Pharmaceuticals: Thrashing Through ERP Systems**
Nathan Bradds, Miami University
Emily Hills, Miami University
Kelly Masters, Miami University
Kevin Weiss, Miami University
Douglas Havelka, Miami University

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Teaching Case

SAPCO: From Good to Great

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Abstract

Saudi Arabian Petrochemical Company (SAPCO), a petrochemicals manufacturer, has decided to make some major internal changes to gain increased market share and continue its success. It has been easy going for some time now, and business has been very good, but in order to take that next step, SAPCO needs to attain the Responsible Care certification. Responsible Care is an environmental focus safety and health initiative focused on reducing negative impacts of all facets of hazardous material manufacturing. Environmental awareness has taken a front seat in the petrochemicals industry, and many of SAPCO's clients are looking to only do business with certified manufacturers. To get certified, SAPCO will need to convince some of its vendors to meet the certification requirements as well. Saudi National Transportation (SNT), a hazardous material transportation company who has a long standing business relationship with SAPCO, is apprehensive to meet the requirements for certification. Let's see what can be done.

Keywords: Responsible Care certification (RC), Enterprise Resource Planning (ERP), Vendor Partnering, Project Management, Petrochemical Industry

1. SAPCO BACKGROUND

Launched in December of 1999, within the fast growing and highly competitive petrochemicals industry, a new company was born to compete with the giants. Saudi Arabian Petrochemical Company (SAPCO) focused mainly on methanol, vinyl, and various other acetic acids as its primary product offering. These products are considered important mediation products, heavily used in the

manufacturing industry, especially high in demand in Germany and China. The company's top selling product, methanol, is one of the main components used in the production of plastics. Methanol's hazard level and reaction with other chemicals can vary in strength and texture depending on the amount used. Almost everything we see around us is the result of a reaction involving methanol or vinyl.

"SAPCO continues to grow as a petrochemical manufacturer, advancing its reputation in turning out high quality products and innovation in both products and processes." - Mr. Al-Mansour (Chairman of SAPCO)

SAPCO began its journey with an equally ambitious and optimistic goal of capturing the largest portion of the methanol production market within 10 years, and to become one of the world's leading methanol producers. The top managers all were in agreement that one of the keys to success was to implement an ERP system, heavily involved at the technical production level, which would nearly automate the daily production and significantly reduce inventory costs. The second, and equally important key, is a strong contracting and purchasing department. This would be integral in maintaining profit margins as one of SAPCO's largest expenses is raw materials. The first new hire of this initiative was an elite contracting specialist. Industry chatter led them to Mr. Sharif, an expert in contracting management, who had built great vendor relations over time. Nationally and internationally, Mr. Sharif was known as a matchmaker that led small companies down the path to become industry giants. His rule of thumb is clear communication; to which he credits a great deal of his success.

The company also began to diversify their clients and differentiate their products in an effort to reach their market share goal. Business was good. The production numbers kept growing and the company's sales kept inflating with the majority of growth centered in China and Turkey. The number of current and future projects started to increase and they began to capture a higher and higher percentage of the industry's market share. SAPCO's competitors began to take this success as a challenge.

Mr. Sharif felt he needed to enhance SAPCO's project and contract bidding process. In an effort to do so, he split the contract evaluation process into two classifications. Technical evaluation, which is handled by engineers and technicians in the related departments and business evaluation, to follow the completion of the technical evaluation process. The business evaluation focuses on pricing, timing, and contract scope. The contracting process of SAPCO became dynamic, weighing multiple factors such as risk assessment, technicality, commerciality, quality and safety.

2. THE RESPONSIBLE CARE CERTIFICATION PROJECT

In an effort to maintain their industry leading position, SAPCO began to research ways in which they could differentiate themselves from other organizations in the market. They were approached by the Responsible Care Association (RC), a United States based safety organization overseen by the American Chemistry Council (ACC). The goals of the Responsible Care Association can be seen in Figure 1.



Figure 1: Goals of Responsible Care Association (<https://slideshare.net/kaushalsutaria/rcms-rc-14001>)

Some of Responsible Care's main focuses are integration of management systems, community awareness, higher emergency response rates, improved safety and emergency handling, pollution prevention, safety staff, and more efficient and safe processes in general. The Responsible Care philosophy is "Plan, Do, Check, & Act". Around 220 companies in the U.S undergo tests and audits every three years to meet and maintain these qualifications. Being certified as a Responsible Care Organization, can also lead to an ISO 14001 certification, officially labeling the company as a cost effective performer. The Responsible Care implementation process is detailed in Figure 2.



Figure 2: Responsible Care Implementation Process(<https://responsiblecare.americanchemistry.com/Responsible-Care-Program-Elements/Management-System-and-Certification>)

The Responsible Care Organization audits and trains petrochemical companies on how to handle their products in a way that reduces the number of safety incidences, while simultaneously increasing efficiency. Prior to training, all segments of the company go through a vigorous safety and quality audit and all issues uncovered during the audit must be remedied. RC requirements were extended to cover contracts handled by third party vendors, and now require comprehensive audits of their facilities. The method for handling contracts under RC differs greatly from SAPCO's current practices.

The RC requirements are much stricter than normal practice in the region, and complying with these requirements means higher costs and delayed projects. Mr. Sharif's main concern is not that SAPCO will be able to comply, but that

projects that are held by third parties will cause issues. Very few of the third party vendors used by SAPCO have heard of RC nor are they willing to change their current practices for this certification, which will result in higher costs and lower profit margins in the short-term. One of the main issues faced by Mr. Sharif is convincing the main vendors to act more as business partners, and not simply vendors. SAPCO is expecting them to share in the concerns when it comes to risks, and work together to resolve any strategic or tactical problem related to the projects. They are expected to engage in RC examinations of their safety regulations, lead time tests and to be a bit more transparent when it comes to employee's emergency response rates.

3. THE ROLE OF IT SOLUTIONS

Mr. Sharif was concerned that the RC auditing procedures would require reliable, accurate and easily accessible data sources. At the time, SAPCO was lacking software to align and integrate their data where it could be readily retrieved. He believed this could be an opportunity, though, for a new IT solution to enhance their business value rather than just an upgrade of the technology to satisfy certifiers. Fundamentally, IT solutions could allow SAPCO's information to become an open source to encourage transparency "To Whom It May Concern" from employers to employees and from investors to RC auditors. Unfortunately, SAPCO, like many other industrial companies, was lacking many IT elements like storage, network administration, and data analysis; which are key factors proving the accuracy of SAPCO's practices and an important milestone in RC's auditing process. Overall, a new implementation of these IT solutions could result not only in satisfying RC, but also increase employee involvement and improve prospects for problem solving.

Another aspect that needed to be evaluated for change was SAPCO's implementation process. SAPCO mainly used the traditional waterfall model. The company worked linearly with its tasks and stages delivering goals sequentially. However, the problem in this type of approach as described by Mr. Sharif: "once objectives are delivered and tasks are made it is very hard to retackle issues or return to the accomplished tasks, it's exactly like a flowing waterfall." This is especially problematic when dealing with unclear expectations and constant changes of scope, which does not work well with this type of model.

Mr. Sharif discussed these issues with the CEO of SAPCO Mr. Ahmad Al-Ali and they both realized

they will need to find an alternative to achieve their deliverables using an iterative basis that supports the ever-changing environment that exists in most of their projects. They reviewed their problems through a set of questions to determine what defines a successful project, the level of commitment to this transformation, the degree of tolerance toward new changes in their working environment, and whether they will need an outside expert to help them overcome their problems and transform. The common belief was to have a model that would allow them to engage more with their teams through regular cooperative work with RC certifiers. Furthermore, they both agreed that the goal was not only to become certified but also to increase their client satisfaction, improve cost predictability, and reduce the expense of future developments. The only obstacle that they were facing was getting everyone on board and identifying the possible challenges that might appear during the transitioning stage, moving away from the current waterfall model to an appropriate iterative effective model.

The true challenges come from misconceptions and the lack of understanding about what an alternative model, an Agile approach for instance, would do if implemented at SAPCO. For that, SAPCO will have to take the differences between models in consideration and train employees and members of the boards to educate them on the importance of replacing a rigid, ineffective model to an agile approach. This is going to require a teamwork effort to accomplish an extreme cultural makeover after years of implementing with a waterfall model. This will be difficult for Mr. Sharif to get all of his leaders and employees fully on board.

Another need was for business analysts to use an integration of finance, logistics, sales, and marketing data for analysis. Unfortunately, SAPCO's database was 90 percent unstructured, which also resulted in a tremendous amount of noise in their processes; this was yet another area that will likely be flagged as an issue by RC certifiers.

There was a need within the company for an expert who could deliver the value of understanding how their partners and customers think. The desired improvements would also require high technical security specialists who could interpret any data into a business risk. With the importance of data and the range of data types that SAPCO is pursuing to take advantage of, there is an increased need for developers who could extract data from multiple sources within

departments, and transfer it to fit SAPCO's needs. Loading the data into a warehouse and making it presentable is another important aspect that was heavily needed, permitting easy access to information for internal users within SAPCO and external RC auditors. This would also require an open source framework that could support the processing of big datasets. Thus, SAPCO needed a massive data landscaping with a visualization tool development that would guarantee good intuitive data analysis. Although this transformation process tends to be challenging, IT leaders at SAPCO were viewing it as an opportunity to innovate and become involved in the art of transitioning their IT function.

Mr. Sharif knew the IT issues were not only a factor in providing RC the information they needed for the certification inspection, but were also a key element in the overall efficiency and strategic positioning of the company. They were already aware of the need for their development model to become more flexible and their systems to be more integrated and secure while being more accessible to those who needed to know the data. The timing of this RC audit may work well as the catalyst needed to really get the ball rolling on addressing the technology changes that have been needed for some time. Mr. Sharif recognized that the changes would be extensive, impacting every functional unit of their business, so he braced for the internal management of the upgrades. Internally, it would be a challenge, but should he consider a potential impact on relationships with external partners? How would the RC inspection and technology changes affect their business partners, especially in the key area of logistics and transportation? Would there be resistance? Mr. Sharif speculated there may be issues to address with suppliers as well.

4. THE CASE OF LOGISTICS AND TRANSPORTATION

The shipping and handling function of SAPCO is outsourced to Saudi National Transportation (SNT), their primary transportation vendor. SNT's job is the delivery of products directly to customers or to port stations, depending on whether the destination is national or international. In order to acquire RC certification, Mr. Sharif needs to convince SNT to get on board and adjust their practices to meet the RC requirements. After meeting the board and consulting his industry contacts, he decides his best course of action would be to speak to SNT about the benefits of implementing an RC certified management system. The board seems

to think that this will be a no-brainer, but he expects a great deal of push back.

He puts in a call to Mr. Pico, CEO of SNT, and informs him that a representative from the RC association would be stopping by to perform a general audit. Mr. Pico was upset that he was not first consulted and is not all at interested in becoming an RC certified organization, let alone what he calls "an invasive audit". Mr. Pico is worried that the audit might lead to schedule interruptions and disrupt their already very tight schedule. However, SAPCO is a very valuable client, so he eventually agrees to the audit.

The day of the audit Mr. Sharif arrives at SNT headquarters with a group of U.S experts and engineers. SNT flat out fails the audit. The report recommends that SAPCO either educate their current transportation services provider about enhancements to safety, or to terminate the contract and move to another transport company. If one of these two recommendations are not met, SAPCO themselves would fail the audit. Mr. Sharif again meets with Mr. Pico to further explain the benefits of the RC certification and how important it is to SAPCO. His suggestion is that they improve their qualifications gradually, and emphasis that participation in the certification would cause them to have a better management system in the long run. For instance, SNT needed to better streamline their contract handling process in order to better control costs in relation to fixed price or cost plus contracts. In addition, they were struggling with the reduction procurement risk, and their contract evaluation style was a waterfall approach in most scenarios. Mr. Sharif suggests that they test their market and consider building a system of RFI, RFQ and RFP. His efforts prove a failure when despite the benefits, Mr. Pico is still not interested in participating. He said: "the changes needed to meet the requirements for certification were simply too large and too costly." He believed that participation would not affect his bottom line because there were too few competitors in the transportation market to necessitate the change. Things were going fine the way they are, so if it isn't broken, don't fix it.

Mr. Sharif knew that Mr. Pico had the upper hand in this situation. He found himself in a difficult situation knowing that no other transporter would have his back on multiple occasions like SNT had. He decided to consult his contact at the RC for advice. "SNT makes their tanks available to us, even during peak times. No one else but SNT is able to meet our current demand", Mr. Sharif said to the RC expert. "They have largest fleet in the region with over 150 tanks". The RC expert stated

that they understand his predicament, and that their main concern, and largest reason for failing SNT during the audit, was that they require hazardous materials transporters to change the tires of all eighteen wheelers every 6 to 9 months, depending on usage and number of trips, but Mr. Pico was unwilling to meet this requirement. Other important issues are adding tracking devices to the trucks, intensive driver training, adding safety data for each product on each tank, installing pressure gages for each tank, and the most expensive of the requirements; installing an ERP system that can help them monitor vehicles and environmental impacts. Mr. Sharif told the RC representative that Mr. Pico refused to accommodate these alterations due to the associated costs.

With approval from SAPCO's board of directors, Mr. Sharif reluctantly offers to share some of the implementation cost. SNT's main argument is that none of the other petrochemical manufacturers in the region are requiring such extremely detailed and intense regulation requirements, and that the return on complying with such regulations is simply not beneficial on a large scale, since other companies only care about the availability of tanks. Mr. Pico offers his own solution of adding a new fleet that meets the RC requirements devoted only to SAPCO. He would do this only if they would be willing to sign a long-term contract. Mr. Sharif knew that the cost of having a devoted fleet would be extremely expensive and that upper management would never approve. Not putting all his eggs in the SNT basket, Mr. Sharif began searching for another transporter, and the best he is able to find is 90% compliant with RC requirements. Unfortunately, they have a much smaller fleet of only 30 tanks. This means that each tank will have to be reloaded multiple times to cover daily shipments, and this will lead to delays and various other inefficiencies. This is not an optimal solution and Mr. Sharif feels that the small number of available tanks will interrupt workflow increase transportation costs.

5. IBM SOLUTION TO THE RESCUE

SAPCO, at that time was using SAP ERP system but they were facing a lack of professional users able to build and upgrade their modules based on departmental needs. This was problematic to Mr. Sharif and his staff at the contracting department. Moreover, the company's main implementation of ERP is only seen in direct operations and technical departments. SAP was used in the business departments solely to process orders for the purchasing department and to aid in the technical

needs of the processing engineers at the factory. The head of the IT department, Mr. Smith, saw a need for increased connectivity and integration, especially when it comes to data managing and resource planning. Ahmad Al-Ali the CEO of SAPCO stated:

"Working with IBM international business specialists can equip us to successfully complete our optimization initiative and see positive results across multiple units of our organization including the plant, logistics, and marketing. Our sales team will be able to tap into growing markets while continuing to improve brand image and value."

He believed in virtualization and in the capabilities of ERP management. He shared this vision with the CEO and Mr. Sharif alike. Mr. Sharif saw the ERP management as an opportunity, and the funding was made available for this approach to solving the transportation issues.

IBM decided to educate SNT first, and then revise the policy and the procedures that are outside the RC requirements in order for SAPCO to be accredited the certificate. Consultants hired by Mr. Pico suggest that if SAPCO is dedicated enough, it should engage in a long term contract in the name of community awareness. Mr. Sharif gave Mr. Pico a call and explained that this is only the beginning, and an industry-wide shift towards environmental awareness has begun; he is better off reaching compliance early in the movement rather than being left behind. However, the agreement is contingent on SNT's willingness to participate in operations planning and optimization.

IBM solution experts arrive from Dubai and the audit of the contracting department was postponed due to various issues. IBM experts conduct an estimation of timeline, consisting of roughly 18 weeks to review the affiliates, 13 weeks to review the headquarters and 6 weeks to review the transporter. A meeting was held between SNT and SAPCO to lay out a plan for enhancing operational efficiency by imposing some ERP related planning strategies in real time. They focus on cargo management and human capital investments. They also identify the importance of quality management within the new distribution standards involving safety management systems, as recommended by the RC auditor. Also discussed handling and management of distribution service providers with the clear distinction that SAPCO provided delivery management and SNT provided transportation. IBM looks inside the fence line and

revises the standards of distribution, public relations/communication, and marketing functions. They implemented a predictive transport network and mobile enablement of operations. SNT hires staff dedicated to this project, and begin to realize how they could grow even more with the use of IT solutions. The consultants improved the quality of policy statement by developing new management system documents within SAPCO and SNT. In addition, they implemented a gap analysis. IBM involves 100 employees at SAPCO to address these gaps and assist in the redesigning process.

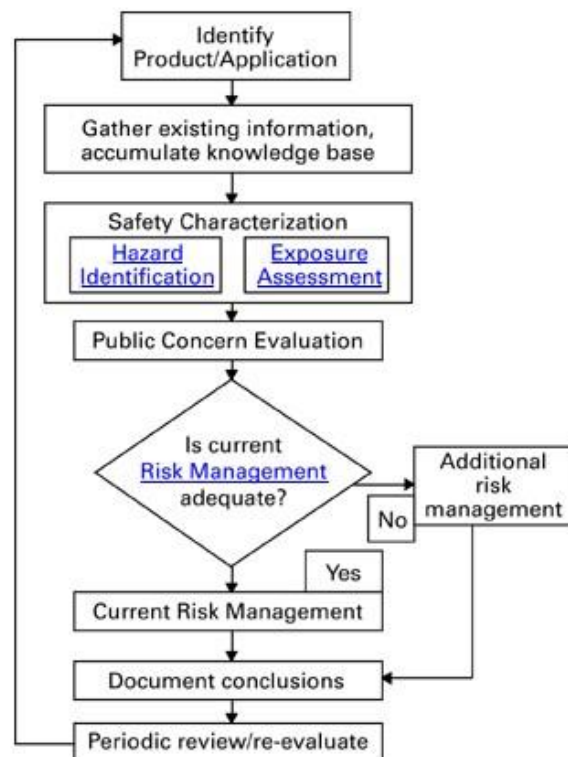


Figure 3: Product Safety Assessment and Management Framework (<http://www.dow.com/en-us/markets-and-solutions/product-safety/product-safety-assessment>)

Every petrochemical company goes through what they call the shutdown period, which is a scheduled plant shutdown. These shutdowns occur for maintenance, and each one can cost up to \$4.8 million and last up to 30 days, depending on the maintenance needs. The experts at IBM take these shutdowns as an opportunity to perform multiple tests to distinguish between the technical and commercial gaps within the gap analysis. Prior to plant recovery, they conduct multiple tasks and select subject matter experts as consultants from within to assist in closing the

commercial gaps. Figure 3 illustrates the recommended procedure that SNT needed to follow. It is simply an iteration through a loop of identified steps to understand the need of applying risk management during the process of every level of hazardous material that leaves the plant and is handled by SNT.

Mr. Al-Ali was very committed to becoming a responsible care company and the suggested approach is to have a full time manager appointed at the company and an RC coordinator appointed at SNT. They can then coordinate the movement of each individual tank and also improve the utilization of physical and human resources. SAPCO gained an advantage through increased operational capacity of SNT, and by the reduction of the number of accidents and empty tank trips. SNT implemented a data warehouse and analytics engine to make it easier to track financial performance. They redesigned the new values and beliefs of SAPCO.

IBM conducted a thirty-minute refresher overview for the executive leading teams, with new reading material for every milestone accomplished and to be accomplished. They also had a general orientation which was handled by an RC manager trained by the RC expert to cover safety meeting objectives which are mandatory for all employees at SAPCO. An identical process was handled by the coordinator at SNT. The involvement of IBM helped to enhance the monitoring process and educate third parties on how to update their reporting processes.

At SNT, the transformation was underway. The implementation of the ERP system and full training was given to selected employees. These employees started to produce clear reports and have clear communication with stakeholders, represented by the head of the IT department. The selection of the lead team at SNT was based on an employee's potential to become a professional ERP user. The logistics department began using target action planning and categorizing tasks by functional areas which they called "cascading of objectives". IBM recommended the use of the process of iteration through corrective action planning. The technical side of the improvement included following the monitor and measure procedure, which requires inspection at the critical phases, and testing of compliance by the RC manager during the transitioning period. IBM focused on the importance of executive management involvement equal to the involvement of everyone else at the company. IBM's help was leading both companies to fast track their

shipments and shorten their scheduled delivery times, which in return led to a major reduction in costs for both firms. One of the major improvements resulting from the SAPCO/SNT partnership was reduction of overlapping tasks. Most delays that occurred after enhancements were due to change risk that occurred during the work so to minimize this risk, they began with the project that had the least amount of risks. With the approaches that were offered by IBM and the implementation of ERP in both companies, they were able to determine their courses and the duration of each course.

It had been quite a journey, but benefits were now being realized by both SAPCO and SNT. Mr. Sharif felt it was time to reflect on what had been accomplished and document lessons learned. He considered the things that could have been done differently and what was done well. Mr. Sharif hoped SAPCO would now be granted the RC certification and wondered what should be carried forward from the lessons learned as they aspired to continue this mutually beneficial relationship with SNT and with future business partners.

6. DISCUSSION QUESTIONS

1. Do you think SAPCO made a wise choice deciding to stay in business with SNT despite their resistance to change?
2. What other routes could they have taken to meet the requirements for Responsible Care Certification?
3. Should SAPCO have offered to share the costs of the ERP implementation?
4. Could SAPCO have handled the ERP implementation without the added costs of IBM Solutions?

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Appendix

Key Characters and Acronyms in the Case

SAPCO	Saudi Arabian Petrochemical Company
Mr. Al-Mansour	Chairman of SAPCO
Ahmad Al-Ali	CEO of SAPCO
Mr. Smith	Head of IT department at SAPCO
Mr. Sharif	Manger of contracting and purchasing department
Mr. Pico	CEO of SNT transportation company
RC	Responsible Care certifying association
SNT	Saudi National Transportation company
ERP	Enterprise Resource Planning

Responsible Care Code of Management Practices

(<https://responsiblecare.americanchemistry.com/Responsible-Care-Program-Elements/Management-System-and-Certification>)

Code of management practices	Purpose
Distribution code	To reduce the potential for harm posed by the distribution of chemicals to the general public, employees and the environment.
Community awareness and emergency response code	To work with nearby communities to understand their concerns and to plan and practice for emergencies.
Pollution prevention code	To achieve ongoing reductions in the amount of all pollutants released into the environment
Process safety code	To prevent fires, explosions and accidental chemical releases.
Employee health and safety code	To protect and promote the health and safety of people working at or visiting company sites.
Product stewardship code	To make health, safety and environmental protection a priority in all stages of a product's life, from design to disposal.

Teaching Case

Teaching an Old Dog New Tricks: Disaster Recovery in a Small Business Context

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Abstract

Many entrepreneurs and small business owners lack disaster recovery plans, which minimize business disruptions caused by failures of critical technical systems. Typically, technology is not the main focus for a small business owner, as most of their time is spent focused on business operations. This case study demonstrates that when a business fails to plan for technological disasters, it can have severe consequences for the business.

In this case, an ambitious and experienced entrepreneur opens a large self-storage facility. The technical systems, which support mission critical elements of the business, were compromised by a power surge and subsequent outage as the result of a major electrical storm.

Part 1 of the case establishes the context as well as the events that led to the failure of critical business systems. Part 2 details how the business recovers from the disaster and the steps necessary to prevent something similar from happening in the future. At the end of the case, the reader will find discussion questions and suggested lab activities that will help students understand the importance of a disaster recovery plan. In addition, students are encouraged to consider implementing a plan to protect their personal data. This case complements the model curriculum objectives in IS 2010.1 and IS 2010.7.

Keywords: Disaster recovery, business continuity, backups, cloud storage, battery backup, case study.

1. INTRODUCTION

Jeff Wolf was a blue-collar entrepreneur who enjoyed building businesses from the ground up.

Jeff considered himself a lone wolf with his business ventures because he could never find a partner who matched his energy and dedication to building the enterprise. Once he built a new

venture into a profitable and self-sustaining business, he would often sell the business and move on to a new challenge. Typically, he would sell to a group of employees and maintain a small equity position in the company.

Wolf Storage Solutions, founded in 2008, is a self-storage facility that has a diverse array of storage units ranging from 5 feet by 5 feet all the way to 12 feet by 30 feet. The company differentiates itself from competitors by employing state-of-the-art security systems, which include 16 digital video cameras and a computer-controlled gate access to the facility. The cameras are strategically placed throughout the facility for each customer's security and safety. Of greater importance, Jeff obsesses over customer service. Each of the businesses he founded through the years provided exceptional service to customers.

When Wolf Storage Solutions leases storage space to a new customer a standard process is followed. First, the customer fills out paperwork that captures important information, including the customer's name, billing address and credit card number for recurring monthly billing. Once the paperwork is completed, the information is then transferred into an application management system called Winsen Property Manager, which is a powerful application used to manage every aspect of the business, including site access.

From there, the program generates a unique seven-digit numeric code that is then assigned to each customer. When a customer wants to enter the facility, she is required to enter this unique code into a keypad immediately adjacent to the computer-controlled gate. This also allows the system to monitor the dates and times each customer is in the facility. This information can then be matched up to the digital camera system that is programmed to turn on when motion is detected within the facility.

Finally, the unique code is recorded on the paperwork and a copy is given to the customer. The paperwork is then scanned into a folder located on the computer's desktop. The hardcopy of the completed paperwork is placed in a filing cabinet located in the office.

Although Jeff considered himself a successful businessman and a savvy entrepreneur, he knew that technology was not his strong suit. In fact, he would be the first to admit that he did not understand technology and that he wanted to focus on running the business and not dealing with technical issues.

When he founded Wolf Storage Solutions he hired a "small herd of tech geeks" to install the new system and train he along with his staff on its use. When the system was installed in 2008 it was a state-of-the-art system, but it hasn't been updated since. Unfortunately, the company responsible for the installation has been out of business for several years. To compound the problem, whenever technology-related issues emerged, he usually relied on his part-time employees. Through the years Jeff had a lot of success hiring students from the local university. These employees were all far more comfortable with the technology than Jeff so he often left the technical tasks to them. Unfortunately, the students would often move on after graduation and take along their understanding of the system.

2. THE CALM BEFORE THE STORM

Jeff sipped his coffee and looked out the window. The morning's bright sky had faded into a cold gray by late afternoon. He turned around in his chair and stared blearily at the stack of paperwork on his desk that he would have to tackle tomorrow. When he heard the sound of a car door closing, Jeff stood up and rubbed his eyes. One of his customers walked in just before closing time.

"Hello. How can I help you?" Jeff asked.

"I just need to pay my bill," replied the customer.

Jeff shoved the computer mouse around in a circle to wake the computer from sleep mode and took the customer's credit card.

"It'll take a few minutes. This old thing is taking forever to load," said Jeff as he continued vigorously swirling the mouse on the counter.

"No worries. The weather is starting to get ugly out there," said the customer.

"I heard there was an advisory for high winds and lightning. Hopefully the weather doesn't turn that ugly," chuckled Jeff as he swiped the credit card. "All right, you are good to go unless there is anything else I can help you with today."

At 5 p.m. Jeff locked the front door and exited the office through a door that led directly into the storage facility. A gust of wind nearly blew his hat off as he climbed into his golf cart. He drove around the facility for a general inspection, which involved checking for unlocked storage units or to note when a storage unit appeared to be vacated or damaged. Once he finished the inspection, Jeff

headed back to the office right as it started to rain.

Back inside the office, Jeff opened a closet that housed the system for the facility's security cameras. The system was running with no issues. He was happy with this system. Customers were impressed that the facility was so secure, and the company that installed it also took care of all maintenance and configuration issues.

Jeff ambled back over to the main office computer and shook the mouse to wake the computer again. Jeff opened the Property Manager software and clicked a button called "Business Close" that opened a wizard that took him through the daily closing process. Jeff really liked this aspect of the software because it required everyone to follow the same closing procedures.

The first step confirmed that the auto bill payments will be automatically processed at midnight. The next step confirmed the gate was scheduled to be locked at 10 p.m. Once Jeff received confirmation that the gate has been locked, the last part of the wizard ran a backup of the customer database. The backup of the database was then placed in a folder on the local system labeled "Wolf Storage Backups." When the wizard finished, a green checkmark appeared and then the software switched into "Off-Hours Mode."

3. THE STORM

Sitting in the comfort of his lounge chair at home, Jeff pulled out a remote to turn on his television. He watched the local news report: "Severe thunderstorms and wind in the area. Please be advised." Jeff snorted derisively then took a bite of his dinner. It doesn't take a scientist to tell me that the weather is ugly outside, Jeff thought as the wind howled.

Suddenly, the lights in his house flickered and dimmed, and cracks of lightning lit up the sky and thunder continuously echoed through the valley for the next several hours.

Shortly after midnight, the storm passed. Unbeknownst to Jeff, the damage from the storm crippled his business.

4. THE AFTERMATH

"Most of the power has been restored throughout the city..." announced the radio weatherman. Jeff turned down the volume as he pulled up to Wolf Storage Solutions. He knew the storm had

caused some damage in the neighborhood and was anxious to see how his business had fared.

Jeff walked up to the keypad that controlled the main gate and punched in his code. Access denied. *That's odd*, Jeff thought to himself. He tried again, but several beeps and a red flashing light indicated his credentials had been denied. Jeff clenched his teeth as he pulled out his keys and walked up to the office and unlocked the front door. He flipped on the light switch, and the florescent office lights slowly flickered on. *Well, I have power so that's good*, he thought.

He continued to the back door that opened up into the storage facility, got into his golf cart and drove through the facility. He was relieved to find that there hadn't been any physical damage, and all of the rain water drained properly.

Jeff drove back up to the office and went over to the front counter, which housed the main computer, and attempted to wake it from sleep mode by shaking the mouse. No response. Jeff moved the mouse around and hit a few keys on the keyboard. He figured it was just being slow, so he waited a few minutes. Still no response.

Finally, Jeff got down on his knees and opened the cabinet door where the computer tower was located. Because there was no light indication on the front of the tower he pushed the power button to turn on the computer.

"Power must have gone out last night," muttered Jeff to himself as he unplugged the computer and plugged it back in. The computer still would not power on. He decided to check the breaker box to see if the storm tripped a breaker. Jeff stood up and walked into the next room where his breaker box was located on the wall. Jeff opened the panel but did not see any breakers flipped. Jeff tried several more times to turn on the computer, but it still would not power on.

Jeff then picked up his phone to call the only person he knew who could help with a serious technical problem such as this. He called his niece, Stephanie, who graduated from the local university with an MIS degree. Following graduation, she worked for a local consulting firm that specialized in implementing Salesforce CRM systems for clients throughout the country. She was currently working part-time for the local firm while completing her MBA degree. She answered his call immediately, and Jeff explained the situation. Stephanie assured him that it should be an easy fix and that she would be right over.

"How is my favorite niece doing?" Jeff asked her by way of greeting.

"Your *only* niece!" she laughed. "I'm pretty good, but that storm last night caused havoc all over town!"

"I can't believe that it took out my computer system. I had no idea that was possible." Jeff said.

"The other day I read an article about the high percentage of small business owners who do not have any kind of disaster recovery plan or even a basic checklist of steps to take if their technology fails," she said.

"I guess you can say I am one of those business owners. Technology is a foreign language to me," he said.

Smiling wryly at her uncle, Stephanie walked around the counter and opened the cabinet. She pushed the button on the front of the computer and nothing happened.

"Last night, everything was working fine. I went through the closing procedures like I always do at the end of business, then I went home. The wizard in the property management software, was supposed to put the system in "Off-Hours" mode at 10 p.m.," he said.

Stephanie pulled out the computer and placed it on the counter. She tried several different power outlets but the computer still would not turn on. "So this computer plugs directly into the outlet under the counter, right?"

"Yup, that's how the contractors installed it," Jeff replied.

"Because you don't have this plugged into a surge protector or even a battery backup, my guess is that you have a bad power supply."
"Was that something I did?" he asked.

"My guess is the storm last night created some kind of surge and that fried your power supply. It may have fried your motherboard and hard drive, too."

"Is there any way of preventing this?" he asked.
"I always recommend to my clients that they plug their computers directly into a surge protector. This way, it can prevent those voltage spikes," she said.

"I recommend a battery backup to clients who have to have their systems up and running 24 hours a day. Because this computer controls that gate, you should absolutely have this computer plugged into a battery backup. That way, if you have a power outage, your computer can still communicate with the gate for a short amount of time. Power outages usually don't last very long," she said.

"So, what do we need to get my business up and running the right way?" he asked.

"I will run into town and buy a power supply, a surge protector and battery backup. We will start from there and cross our fingers that it is just the power supply. If it is, your computer should be back on in about an hour."

Stephanie returned with the computer parts, opened the computer case and quickly started to untangle the cables. Stephanie wiped away layers of dust. "How old is this computer?" she asked as she replaced the old power supply with the new one.

"I don't know, probably eight years old?" Jeff replied. His niece cringed.

Stephanie finished installing the power supply and turned on the computer. Unfortunately, the computer still would not power on.

Jeff asked her what they should do next.

"Honestly, I think the best idea is to replace this computer with a new one, and I can transfer the data. It will be several hours, but I should have it running this afternoon." Jeff agreed and told her to buy whatever she thought would work best for the business.

Several hours passed and eventually Stephanie walked through the door with a brand new computer.

"So how are you going to get the stuff off of the old computer onto this new one? ... Magic?" Jeff asked as she plugged the new computer into the surge protector and battery backup.

"I brought some tools that will allow me to use the old hard drive on your new computer," Stephanie replied as the new computer powered on.

Stephanie clicked through the installation wizard that configured the computer. Once that finished, she pulled out a simple SATA to USB adapter and

plugged the old hard drive into the adapter. She then plugged the USB cable into the new computer thereby connecting the hard drive from the old system to the new computer. Stephanie patiently waited as the new computer installed the correct drivers. The drivers successfully installed but the old hard drive did not appear. Stephanie placed her hand on the hard drive and realized that the old hard drive was not spinning. It was completely dead. Stephanie turned to her uncle and broke the bad news. "It is not looking good. That storm not only fried the power supply, but it also corrupted your hard drive," she said.

"All of my client information was on that computer— the property management software, the database, everything," Jeff replied.

"What are the chances you have a backup of that database that isn't on the computer?" she asked.

Jeff sighed as he pointed to the filing cabinet labeled "Customer Paperwork." Both Stephanie and Jeff let out a huge sigh as they realized they will have to recreate the database from scratch by manually inputting the original customer paperwork.

"This is going to take weeks of sorting and re-adding the customer data," Jeff groaned.

"It'll be okay. This is exactly the sort of project the company I work for can handle. Let me talk with my boss and see if we can get a small group in here that can get you up and running in the next 24 hours. Be prepared this will cost a few thousand dollars, but it is money well spent," she assured him.

Stephanie called her boss to explain the situation. Her boss was sympathetic and agreed to let her spend the next day or two on this project. In addition, she agreed to send over three MIS student interns from the local university to help.

"Well, Uncle Jeff, help is on the way. It will be about thirty minutes, which will give me plenty of time to install some of the necessary software."

"Excellent! You are definitely a candidate for niece of the year!" he exclaimed.

Stephanie laughed, rolled her eyes and went through the process of setting up the new property management software on the new system.

"I'm going to set this up, and it will look identical to the old interface to you, but I am going to configure a few things differently to prevent this from happening again," Stephanie explained to Jeff.

"First things first, I am going to subscribe you to a service called CrashPlan that will back up your entire computer every night. This will not only back up the computer to an external hard drive, but it will also back up a snapshot of your computer to the cloud. This way, you will have two backups in two separate locations at all times. The daily backup won't interfere with your day to day operations as it will be scheduled to run in the middle of the night," she explained.

"Next, I have subscribed you to another service called Dropbox, which is a cloud service that syncs files between different computers. Each evening when you back up the database as part of the closing procedures it will sync a copy of the database to another computer and provide a backup in the cloud. Basically, you will have two different types of backups in several different locations. If we had this configuration originally, we would be up and running again." Stephanie finished as the fresh-faced interns walked in the door.

After two days of hard work Stephanie and the interns were able to successfully recreate critical parts of the database from the original customer paperwork. Throughout this process, Jeff was busy dealing with upset and concerned customers. If it was not for the original paperwork stored on site and a savvy team of MIS students, Jeff's business would have had major problems.

5. CONCLUSION

For the first time in Jeff Wolf's career he experienced a computer systems failure that brought his business to a standstill. This event compelled Jeff to put more time and attention into the technical aspects of his business ventures. Prior to this event, he didn't put much thought into the technology that was a central component of his business.

In the self-storage business, Jeff had always focused his attention on the physical part of the business as well as providing exceptional customer service. Unfortunately, he neglected a part of his business that many small business owners often neglect – disaster recovery. He realized that almost everything he knew about his customers was mediated and captured via

technology. This critical business asset needed more of his attention.

With Stephanie's help, Jeff implemented a more robust backup system and she helped him develop a written disaster recovery plan that detailed the steps required to help recover the business systems in the event of another major systems failure. Furthermore, she developed a set of simple procedures that could be executed at the end of the week to test the veracity of the backups in the system.

Perhaps of greatest importance, he committed to gain an in-depth understanding of the systems that are critical to his business. He did this by hiring the interns that helped with the data recovery project. He scheduled them for two hours a week for the next three months to teach him about this important part of almost every small business. About halfway through the scheduled sessions he started to see new business opportunities brought about by using more and different types of technology.

Maybe you can teach an old dog new tricks...

6. QUESTIONS AND STUDENT LAB

1. List and describe your "mission-critical" devices that are essential for your school work and daily life.

a) What important data reside on these devices?

b) To what threats are these data vulnerable?

c) Would you be able to recover these data in the event of a catastrophic failure?

d) What steps could you take to protect these data?

2. Identify different types threats that could affect mission-critical systems within businesses. How would you recommend minimizing the impact of each threat?

3. Research CrashPlan and Dropbox. Why do you think Stephanie recommended these solutions? Are both necessary? How does one complement the other? What other technologies are available to achieve the same objectives?

6. Explain how cloud storage services, such as Dropbox, can be beneficial to a small business?

What are some potential business vulnerabilities of utilizing cloud storage as the sole means for backing up data?

7. Why is it important to maintain multiple copies of mission-critical data? Why is it important to store copies at geographically separated locations?

8. How often should mission-critical data be backed up? What factors should be considered in timing backups?

Bonus Activities

1. Work with a local small business and perform a risk assessment. If a similar disaster were to befall the business, how would they fare? Help them design a disaster recovery plan. The plan should identify those responsible for recovery of the affected systems. In addition, the plan should provide a detailed overview of the procedures to follow in the event the business was affected by a disaster that compromised the computer systems.

2. Research companies that have experienced a systems failure. What consequences did the system failure have on business operations? What losses were incurred (e.g., data, money, customer loyalty)? In hindsight, what could the companies have done to minimize the severity of system failures?

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Teaching Case

Ding Dong, You've Got Mail! A Lab Activity for Teaching the Internet of Things

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Abstract

Connecting ordinary devices to the Internet is a defining characteristic of the Internet of Things. In this hands-on lab activity, students will connect a wireless doorbell to the Internet using a Raspberry Pi computer. By modifying and running a program on the Raspberry Pi to send an email or text message notifying a recipient that someone is at the door, students will gain an appreciation for how the Internet of Things enables devices to work together to produce new products or solutions. The activity also serves as a brief introduction to interacting with the Linux operating system on a Raspberry Pi computer. Working in groups of 3 or 4, students will demonstrate their understanding by completing a collaborative lab report that summarizes the key takeaways of each step. Little or no programming skills are required. The experience of physically connecting an everyday object to a device online gives an appreciation of the potential for automating tasks using the Internet of Things.

Keywords: Internet of Things, Raspberry Pi, Python, programming, automation.

1. INTRODUCTION

The Internet of Things continues to become apparent in daily life as the number of everyday items connected to the Internet constantly increases. Sensors, wearable and mobile devices, and apps capable of transmitting, receiving, and modifying data over the Internet allow for new possibilities and business opportunities.

IoT has become common in home automation through thermostats such as Nest that can be adjusted via a mobile app, washing machines in college dormitories whose availability is published online through a service such as laundryview.com, and wearable devices such as FitBit whose sensors monitor heart rate and share that data with a smartphone or computer connected over the Internet.

This lab activity is based on a project by technology blogger Martin Harizanov. (Harizanov, 2013). Harizonov's blog at <http://harizonov.com> shares several do-it-yourself home automation projects using simple tools and equipment. This lab guide describes how connect a wireless doorbell to the Internet using a Raspberry Pi computer. Upon pressing the doorbell's buzzer, a program running on the Raspberry Pi will send an email or text message to the recipient's computer or mobile device notifying that someone is at the door.

A Raspberry Pi (Raspberry Pi Foundation, n.d.) is a very inexpensive, single-board computer with ports for connecting a keyboard, mouse, and display device. It runs a version of the Linux operating system such as Raspbian, connects to the Internet, and supports developing applications using programming languages including Python, C, C++, Java, Scratch, and

Ruby. A Raspberry Pi has pins which enable it to obtain input from a variety of external sensors and devices, such as weather stations and motion detectors. A Raspberry Pi computer is about the size of a deck of playing cards. (See Appendix 1, Figure 2.) Raspberry Pi computers are popular among hobbyists, students, and educators who want to build solutions as they learn about computing.

You will complete this project in several steps:

- Create a lab report as a Google Doc and share it with your group and instructor
- Identify all of the equipment needed
- Wire the doorbell to the Raspberry Pi
- Connect the keyboard, mouse, camera, Ethernet cable, and display to the Raspberry Pi, and power it on
- Test the camera to make sure it takes pictures and identify the location where they are stored
- Create a folder to store, and examine the source code for the programs that wait for the doorbell to be pressed, and then send the notifications
- Run a program to test the connection between the doorbell and the Raspberry Pi
- Modify and test the program to take a picture and send an email message
- Modify the program to send a text message

You will work in groups of 3 or 4 to complete this assignment. Discuss the **For Your Lab Report** questions with your group as you complete each step, and take turns recording your answers in a lab report document that you create as a Google Doc. As you proceed through the exercise, one group member may serve as the "recorder", typing your group's answers to the lab report questions directly in the Google Doc, or on paper to enter into the Google Doc at a later time. Except for the last two questions, which ask you to reflect on your own personal experience with this activity, your group will receive the same grade for your lab report. Each group member is responsible to ensure that the lab report shows your group's answers to all of the questions, so remember to review and edit the entire lab report document after completing the activity.

Learning Objectives

After completing this activity, you will be able to:

- Explain ideas related to the Internet of Things

- Identify the components and ports of a Raspberry Pi Computer
- Describe how a Raspberry Pi computer can receive data from an external object
- Recognize and modify simple code statements in Python
- Navigate to files and folders, and run programs in the Linux operating system using both graphical and command line interfaces
- Describe how a program can automate common tasks

Prerequisites

While no programming knowledge is required to complete this activity, some basic digital literacy skills are required:

- Read and follow written instructions
- Identify ports on a Raspberry Pi computer and connect computing devices to them
- Create, edit, and share a Google Document
- Capture and save a screenshot using the Snipping Tool or Print Screen on a Windows PC, or Command-Shift-4 on a Mac computer
- Modify and save files using a text editor
- Navigate and interact with files and folders using an operating system's File Explorer or Finder app
- Examine incoming and sent mail using a Gmail account
- Examine text messages sent to a mobile phone

Preparing for the Lab Activity

Complete these steps before working on this activity:

- Read this description before coming to class on the day that this lab activity is scheduled, so that you will be familiar with the steps. Doing so will save you a lot of time.
- Identify the three other people who are in your group.
- Create a new Google Doc for your group's lab report. Share it with your group members and with your instructor at the email provided.
- Copy and paste the lab report template document into your blank Google Doc. You can find the lab report template at <http://bit.ly/doorbellreport>

2. GETTING STARTED

Examine the kit containing the equipment for this lab activity. Make sure it contains all of these items, shown in Appendix 1, Figure 1:

- Raspberry Pi with camera installed (or USB webcam)
- Power supply with micro-USB cable
- Ethernet cable
- Wireless doorbell and buzzer with batteries installed
- 1 220-ohm resistor
- 3 clip lead wires (two of the same color for positive, and one of a different color for ground)
- 2 jumper wires already connected to Raspberry Pi pins

In addition, you will need:

- An HDMI display and cable
- A USB keyboard and mouse
- A Gmail address and password so your Raspberry Pi can send email (provided by your instructor)
- A personal Gmail account for receiving email
- A mobile phone at which you can receive a text message (fees from your carrier may apply)

Know Your Pi

A Raspberry Pi is a small, inexpensive single-board computing device that runs a variation of the Linux operating system built specifically for the Pi platform. Many programs that run on a Raspberry Pi are written in the Python programming language.

Raspberry Pi computers have on-board memory and a CPU and graphics processing unit on the circuit board. Processing speed and amount of memory vary depending on the Raspberry Pi model used. SD (Secure Digital) cards store the operating system and other files. Most models have wired Internet, Wi-Fi, and Bluetooth connectivity. For simplicity, this activity uses a wired Internet connection, although it is possible to access the Internet on a Raspberry Pi using Wi-Fi via a USB dongle or on-board Wi-Fi, depending upon the model. (Sims, 2014)

A Raspberry Pi contains several ports and plugs to connect a variety of cables and devices, as shown in Appendix 1, Figure 2. The Raspberry Pi connects to other devices through its general purpose input/output (GPIO) pins which may send or receive signals from connected devices.

You can program the pins to interact with devices, sensors, and other signals. Some pins are "ground" pins that do not receive current.

Appendix 1, Figure 3 shows the pins and their names. To orient the Raspberry Pi correctly, hold it so that the GPIO pins are at the right edge.

For Your Lab Report: Know Your Pi What type of cables or devices might you connect or attach to each of the ports or pins, numbered 1 – 8 of Appendix 1, Figure 2?

For Your Lab Report: GPIO Pins Your Raspberry Pi has two pre-connected wires. What are the pin numbers and GPIO names of the pins to which they are connected?

3. CONNECT THE DOORBELL TO THE RASPBERRY PI

Appendix 1, Figure 4 shows the inside of the wireless doorbell receiver. To simplify the process of connecting the doorbell to the Raspberry Pi, and avoid damaging the wiring inside the receiver box, a red (positive) and black (ground) wire have been soldered to the corresponding wires inside the doorbell receiver.

You will connect the doorbell chime to the Raspberry Pi via the soldered red (positive) and black (negative) wires soldered to the doorbell's speaker so that you can easily connect them to the Raspberry Pi without concern about damaging the fragile wiring inside. When the speaker chimes after pressing the doorbell buzzer, wires attached to the speaker will carry the current to the Raspberry Pi through the clip wires that you attach to connect both devices.

Your kit contains three clip lead wires: two of one color, and one of another. The two clips of the same color will serve as the positive wires transferring the electrical current, the one clip of the other color will serve as a "ground" wire completing the circuit.

Clip one end of each positive wire (for which you have two clips of the same color) to the ends of a 220 ohm resistor. A resistor reduces current flow, and, acts to lower voltage levels within circuits. Use the clip of the same color connected to the other end of the resistor, to the wire coming from the Pi that is connected to the GPIO pin closest to the end of the Raspberry Pi that has USB ports.

Clip the other (Ground) wire to connect the speaker with the wire attached to a Ground pin (the pin closest to the end of the Raspberry Pi that does not have USB ports) on your Raspberry Pi. The completed setup is shown in the diagram in Appendix 1, Figure 5.

4. SET UP THE RASPBERRY PI

Follow these steps to set up your Raspberry Pi.

1. Connect the keyboard, mouse, Ethernet, and HDMI cables to the appropriate ports (Connect an external USB webcam if you are not using the built in Pi camera).
2. Verify that the MicroSD card is inserted.
3. Turn on the monitor, and make sure input is set to come from the attached HDMI cable.
4. Connect the power cable to the Raspberry Pi and watch it boot.
5. Sign in to the Raspberry Pi using username *pi* and password *raspberrypi*.
6. Type the command *startx* to load a graphical user interface.
7. Open a file manager app and navigate to Desktop. You should see a folder named StarterFiles. Copy those files to a new folder on the desktop named Doorbell. Be careful that you name the Doorbell folder with a capital D.
8. Open the Doorbell folder and verify that it contains three files: *webcam.jpg*, *sendnotify.py*, *wait_doorbell.py*.

For Your Lab Report: Path A path describes the location of a file in a computer's storage. What is the path to the Doorbell folder that you created, stored on your Raspberry Pi?

For Your Lab Report: User Interface How does the user interface for the version of Linux on the Raspberry Pi resemble that of other operating systems with which you are familiar? How is it different?

5. TEST THE CAMERA

Locate the LXTerminal application's icon on the Raspberry Pi desktop. Click on the icon to open a window running LXTerminal. You can type commands into the LXTerminal app to run programs on the Raspberry Pi.

Type one of these commands to instruct the Raspberry Pi to use its camera to take a picture. Be careful to include spaces after the command

name and the letter after each option specified by a minus sign (-). Be sure to smile!

- If you are using the built-in Raspberry Pi camera, type this command all on one line in the terminal window to take a picture: *raspistill -h 300 -w 400 -n -o /home/pi/Desktop/Doorbell/webcam.jpg*
- If you are using a USB webcam, type this command all on one line in the terminal window to take a picture: *fswebcam -r 960x720 -d /dev/video0 /home/pi/Desktop/Doorbell/webcam.jpg*

Look in the Doorbell folder and click the *webcam.jpg* file to view the picture. Make sure it has the photo you just captured.

If you receive a permission denied error when running either *webcam* command, try typing it again, and preceded with the keyword *sudo*. In Linux, *sudo* ("super user do") is a program that gives you permission to run the command that follows with "super user" (often higher) privileges.

For Your Lab Report: Camera Where is the picture stored? What happens to the picture that was stored previously after you take a new one?

6. CODE CHECK: *wait_doorbell.py*

In this step you will examine the source code from *wait_doorbell.py*, shown in Appendix 1, Figure 5, to get a sense of how it works. You can open this file in a text editor app installed on the Raspberry Pi.

The *wait_doorbell.py* file is a program written in the Python programming language. Its job is to wait until someone presses the buzzer on the doorbell, and when that happens, take a photo and send it in an email message. The program runs forever. The only way to stop it is to press the Control key and the C key (written as Control-C) at the same time.

The code statements to take the photo (19 or 22) are *commented out* – that means, they have a *#* symbol at the beginning which tells the computer to ignore those lines. As part of the exercise you will remove the *#* symbols from one of these lines so that the program runs them. Be careful not to change the indentation of any of the lines of program code.

For Your Lab Report: *wait_doorbell.py* Which line of the *wait_doorbell.py* program causes it to run forever until you press Control C? Which

line's statement checks to see if somebody pressed the buzzer? What does the program do when that happens?

7. CODE CHECK: `sendnotify.py`

In this step you will examine the source code from `sendnotify.py` shown in Appendix 1, Figure 7 to get a sense of how it works. You can open this file in a text editor app on the Raspberry Pi.

The `sendnotify.py` program contains steps to set up the contents of an email message, and then send that message. The program calls `sendMail` (in line 51) to send an email message with an attachment to a recipient. Lines 14-46 specify the steps for the Raspberry Pi to send an email message from a sender's email address. Lines 55-59 specify the content of that email message.

For Your Lab Report: `sendnotify.py` In addition to a sender's email address, what four pieces of information are necessary for the `sendnotify.py` program to send an email message to a recipient? Where does the program get this information?

8. TEST THE CONNECTION BETWEEN THE DOORBELL AND THE RASPBERRY PI

In this step you will test the connection between the doorbell receiver and the Raspberry Pi.

1. Open the `wait_doorbell.py` file in a text editor. (The text editor app has an icon on the desktop.)
2. Change line 6 to replace 999 with the GPIO number of the pin receiving the positive charge. Look at Figure 1 to find the GPIO number. (This is not the pin number!)
3. Save this change in the text editor.
4. In an LXTerminal window, type `cd` (for change directory) and a space, followed by the path to the Doorbell folder that you created. Press the ENTER key to complete the command. This will change directory in the command window so you can directly run the programs in the Doorbell folder.
5. Type the command `sudo python wait_doorbell.py` and press the ENTER key to run the program. This command instructs the Raspberry Pi to run the Python program whose code is in the file `wait_doorbell.py`.

6. What do you see on the screen in the terminal window when the program runs?
7. Press the button on the doorbell buzzer. (It is possible and likely that your buzzer may cause several receivers in the room to chime if they operate on the same frequency. If this happens, press the sound button on the back of the receiver unit.) What information displayed in the terminal window changes when you sound the doorbell?
8. The program will run forever. Press the Control key and the C key at the same time (Control C) to end the program and return to the terminal prompt.

For Your Lab Report: `wait_doorbell.py` Terminal Window When running the `wait_doorbell.py` program, what does the terminal window show when you are not pressing the buzzer? How does the contents of the terminal window change when you press the buzzer?

9. TEST SENDING AN EMAIL MESSAGE WITH A PHOTO ATTACHED

If the values in the terminal window change when you press the doorbell's buzzer, this should convince you that the Raspberry Pi is receiving input from the doorbell's receiver through the wires you connected to it. Now you will configure the `sendnotify.py` program to send an email message containing the photo as an attachment.

1. Open the file `sendnotify.py` in another text editor window.
2. Replace the values for USERNAME and PASSWORD in lines 11 and 12 to show the sender's username and password. This will be your doorbell email sender address and password provided by your instructor.
3. Select one member of your group as the person to receive an email notification. Replace the recipient's email address at the bottom of the program the recipient's personal Gmail address.
4. Save the changes to `send_notify.py`.
5. The `#` symbol starting a line of code in a Python program indicates a comment. The program will skip that line when it runs. In the `wait_doorbell.py` program, remove the `#` symbols at lines 19 or 22 (depending on which type of camera you are using).

6. Remove the # symbol starting line 26 to instruct wait_doorbell.py to run the sendnotify.py program. Also remove the # symbol starting the line that prints "Photo captured." This will instruct the program to print a notification message when the camera takes a photo.
7. Save these changes to the wait_doorbell.py file.

These steps will verify that the program sends, and the user receives email messages.

For Your Lab Report: Commented Out What does the statement at line 19 or 22 that is not commented out, do?

On another computer or mobile device, one person in your group should sign into Gmail using the doorbell email sender address and password, provided by your instructor. *Please note: If you already signed into Google with your own account because you are working on the lab report, then you will need to sign in using a different browser or using private browsing, so you can access your account and the doorbell email account in its own browser window.*

Delete all sent mail from the doorbell sender account, so you can determine easily if the program is sending mail when you run the program. Navigate to the SENT folder and monitor it when you run the program.

The program on the Raspberry Pi should be able to send email messages from the doorbell sender Gmail address because security settings for that address are set to allow apps to send email messages. *Please note: If it is not working, you may need to check the settings on that account. From the doorbell sender Gmail account, visit <https://www.google.com/settings/security/lesssecureapps> and turn on access for less secure apps.*

On the recipient's own computer or mobile device, the recipient should sign into his or her personal Gmail at the address specified to check if the email messages from the doorbell email account have arrived.

Navigate to the recipient's INBOX folder in Gmail and monitor any new messages that may appear when you run the program.

Click in the LXTerminal window, press the UP ARROW key to reissue the `python`

`wait_doorbell.py` command (or retype it) to run the program and press ENTER.

10. TEST THE DOORBELL CONNECTION

With the wait_doorbell.py program running, press the buzzer on the doorbell.

Check the sender's sent mail and the recipient's received email. How many messages were sent when you ring the bell? If you received several messages, try adjusting value specified in the time delay of line 6 of wait_doorbell.py. Check the sent mail and received mail accounts to see if the program sent an email message. Take a look at the picture.

For Your Lab Report: What values do you see in the LXTerminal window when the wait_doorbell.py program runs? What information does the program display in the terminal window before and after you press the buzzer? When does a message appear? Why?

11. SEND A TEXT MESSAGE

To send a text message via email, you must use a SMS (simple messaging service) to email gateway. By sending an email message to an address containing the mobile number of the recipient, the gateway will forward the email-message as a text message. Substitute a 10-digit cell number for 'number' for each carrier's name. Table 1 shows email gateways for popular cellular carriers. If you have a different carrier, use a search engine to find the gateway email address for your carrier.

Table 1. Carriers and Email Gateway Addresses

Carrier	Email Gateway Address
AT&T	number@txt.att.net
T-Mobile	number@tmomail.net
Verizon	number@vtext.com
Sprint	number@messaging.sprintpcs.com

Copy the code at lines 55 to 58 of sendnotify.py that sends an email message to a recipient. Paste it at the bottom of the file, after the existing code. Replace the recipient's email address with an email address containing your ten-digit phone number (with no dashes, spaces, or parentheses) and the correct email gateway for your mobile provider.

Run send_notify again, press the doorbell buzzer, and see if you receive both an email message and a text message on your phone. *Please note: Some carriers may not forward the attached photo, but will send the text message.*

For Your Lab Report: Add these screenshots to your lab report:

- The email message sent from the sender's Gmail account
- The email message and attached photo received in the recipient's personal Gmail account
- The text message received on the recipient's mobile device

12. CLEAN UP

Complete these steps to remove the files you created, then disconnect and power off the Raspberry Pi.

1. Delete the Doorbell folder on the Raspberry pi desktop containing the files you modified and the webcam photo.
2. Power off the Raspberry Pi.
3. Disconnect the wires, power supply, and connected devices from the Raspberry Pi. Disconnect the clip wires from the doorbell. Place all of the parts back in the plastic bag as you received it.

For Your Lab Report: (To be answered individually) What was the most difficult part of this lab activity for you? How did this activity help you learn about the Internet of Things? What did you learn?

For Your Lab Report: (To be answered individually) What everyday items have you seen or would you like to see connected to the

Internet? What does or would connecting those items to the Internet enable you to do?

Review and discuss the answers with your group, and share the Google Doc with the instructor at the Gmail address provided.

13 ACKNOWLEDGEMENTS

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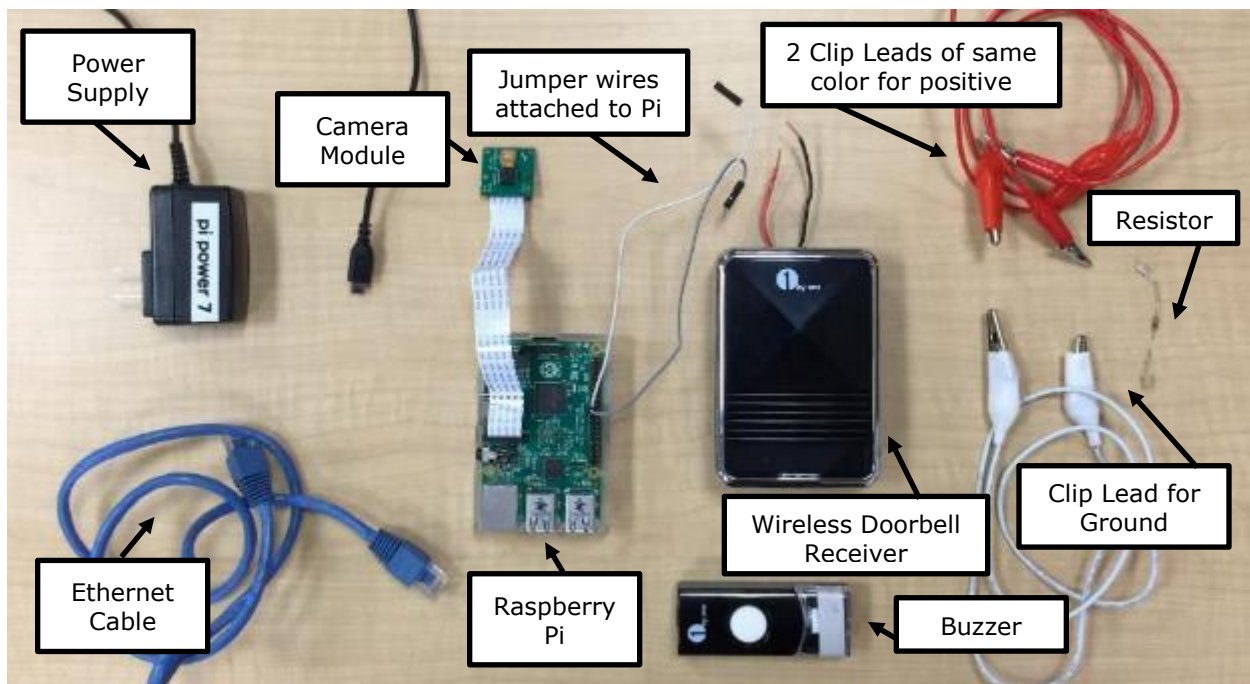
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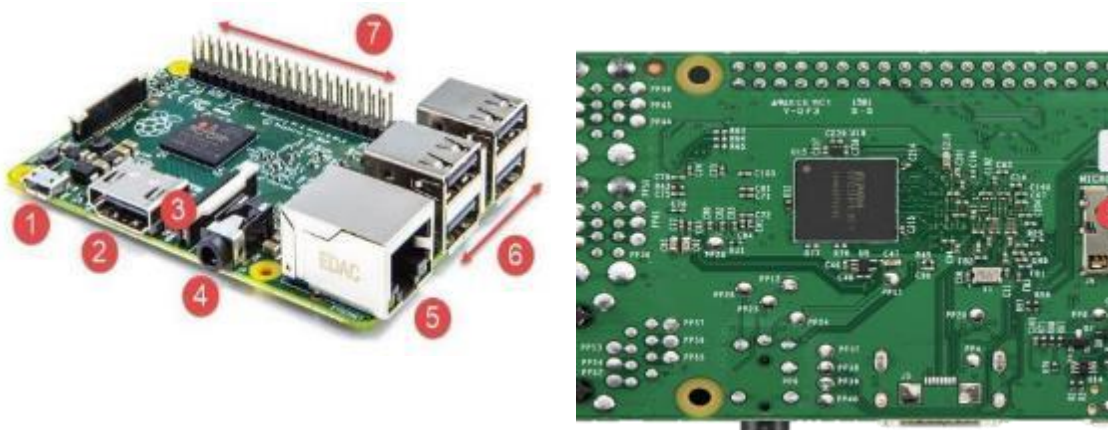
Editor's Note:

This paper was selected for inclusion in the journal as the EDSIGCON 2016 Best Teaching Case. The acceptance rate is typically 2% for this category of paper based on blind reviews from six or more peers including three or more former best papers authors who did not submit a case in 2016.

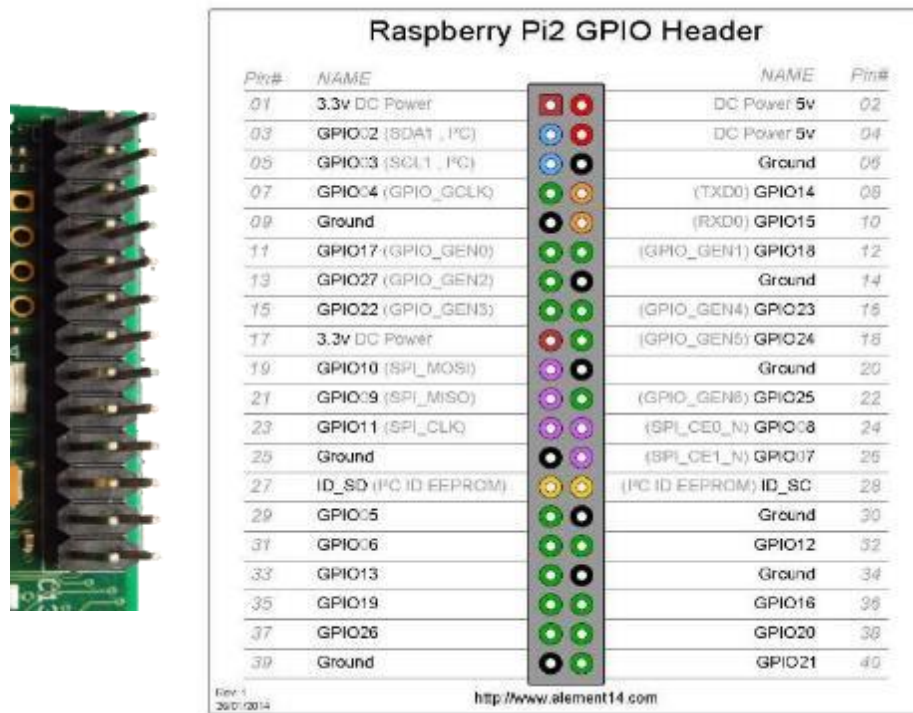
Appendix 1. Additional Figures



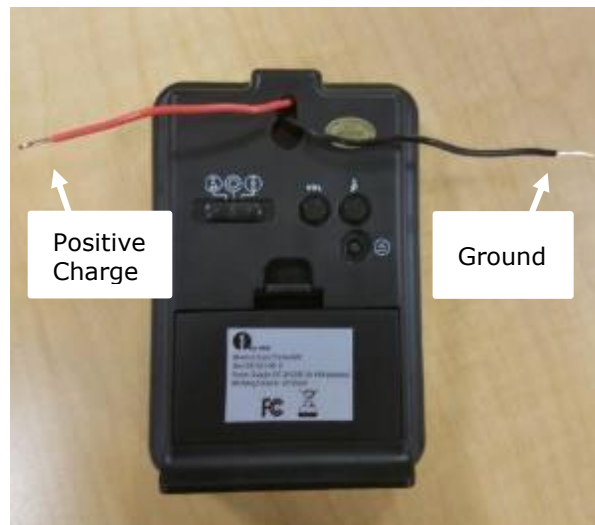
Appendix 1, Figure 1. Doorbell Lab Kit



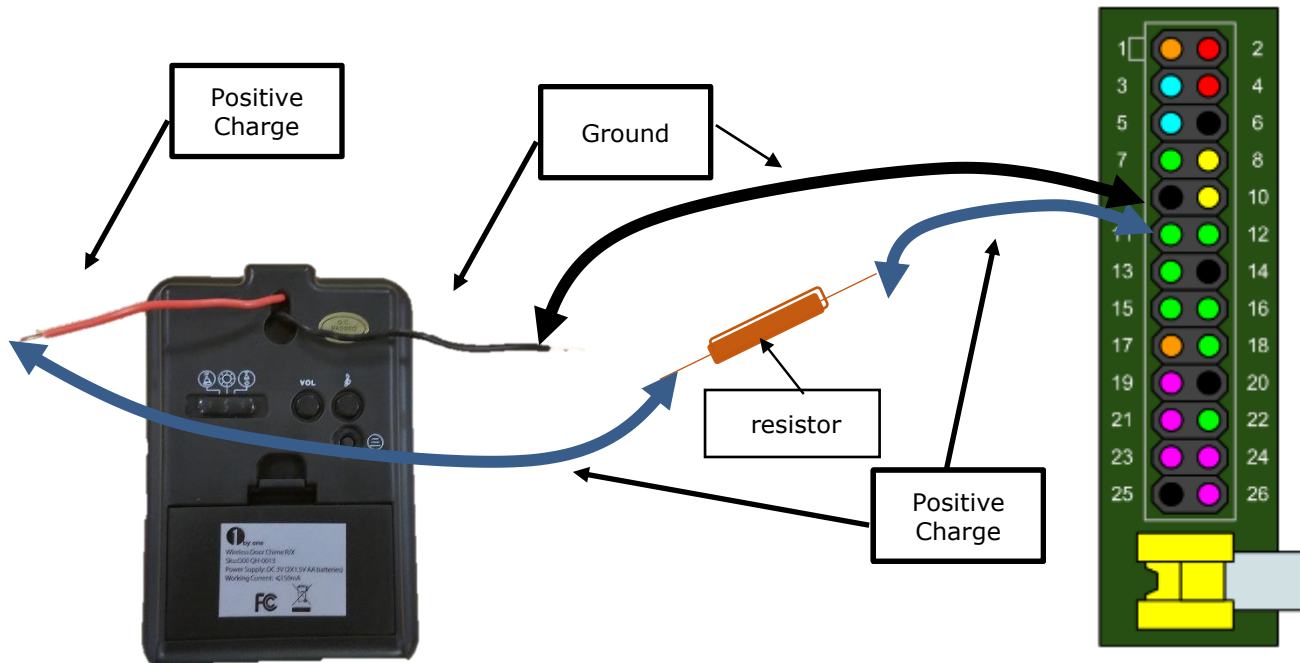
Appendix 1, Figure 2. Raspberry Pi Ports and Pins.



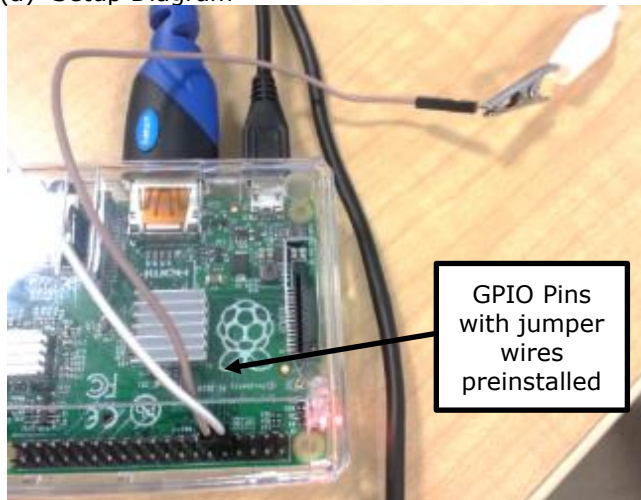
Appendix 1, Figure 3. Raspberry Pi GPIO Pins. (Diagram reference: <http://element14.com>)



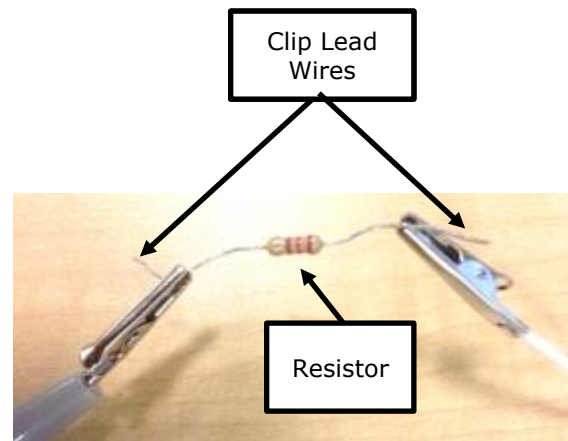
Appendix 1, Figure 4. Inside a wireless doorbell receiver. Soldered wires connect to ground (black) and positive charge (red).



(a) Setup Diagram



(b) Wires connected to GPIO pins of Raspberry Pi



(c) Clip leads connected to a resistor


```
1 import RPi.GPIO as GPIO
2 import time
3 import os
4
5 #adjust for where your switch is connected
6 buttonPin = 999 # change 999 to the GPIO pin number of the positive charge
7
8 while True:
9     GPIO.setmode(GPIO.BCM)
10    GPIO.setup(buttonPin,GPIO.IN)
11    #assuming the script to call is long enough we can ignore bouncing
12    #
13    time.sleep(2)
14    print GPIO.input(buttonPin)
15    if (GPIO.input(buttonPin)):
16        print GPIO.input(buttonPin)
17        #this is the script that will be called (as root)
18        #when using a USB webcam
19        #os.system("fswebcam -r 960x720 -d /dev/video0 /home/pi/Desktop/Doorbell/webcam.jpg")
20
21        #when using the Raspberry Pi webcam
22        #os.system("raspistill -h 300 -w 400 -n -o /home/pi/Desktop/Doorbell/webcam.jpg")
23        #print "Photo captured."
24
25        #call send the email message with the photo attached
26        #os.system("python /home/pi/Desktop/Doorbell/sendnotify.py")
```

Which GPIO pin with a positive charge has a connected jumper wire?

Appendix 1 Figure 6. Code for wait_doorbell.py

```
1  #!/usr/bin/env python
2  import smtplib
3  from email.MIMEBase import MIMEBase
4  from email.MIMEText import MIMEText
5  from email.Utils import COMMASPACE, formatdate
6  from email import Encoders
7  import os
8  import time
9
10
11  USERNAME = "doorbellemailXX@gmail.com"
12  PASSWORD = "password"
13
14  def sendMail(to, subject, text, files=[]):
15      assert type(to)==list
16      assert type(files)==list
17
18      msg = MIMEBase('application', 'octet-stream')
19      msg['From'] = USERNAME
20      msg['To'] = COMMASPACE.join(to)
21      msg['Date'] = formatdate(localtime=True)
22      msg['Subject'] = subject
23
24      msg.attach( MIMEText(text) )
25
26      for file in files:
27          part = MIMEBase('application', 'octet-stream')
28          part.set_payload( open(file,"rb").read() )
29          Encoders.encode_base64(part)
30          part.add_header('Content-Disposition', 'attachment; filename="%s"'
31                        % os.path.basename(file))
32          msg.attach(part)
33
34      server = smtplib.SMTP('smtp.gmail.com:587')
35      server.ehlo_or_helo_if_needed()
36      server.starttls()
37      server.ehlo_or_helo_if_needed()
38      server.login(USERNAME,PASSWORD)
39      server.sendmail(USERNAME, to, msg.as_string())
40
41      print "Mail sent."
42
43      server.quit()
44
45
46  # end sendMail
47
48
49
50  localtime = time.asctime(time.localtime(time.time()))
51
52
53  # change to recipient's email address
54
55  sendMail( ["recipient@gmail.com"],
56           "Doorbell notification",
57           localtime + ": " + "Someone is ringing the doorbell, picture attached",
58           ["/home/pi/Desktop/Doorbell/webcam.jpg"] )
59
```

Type doorbell email sender
address and password here

Type recipient email
address here

Appendix 1 Figure 7. Code for sendnotify.py

Teaching Case

Taking the High Road: Privacy in the Age of Drones

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Abstract

This case examines the technological, ethical and legal issues surrounding the use of drones in business. Mary McKay, a recent Management Information Systems (MIS) graduate sets up a professional photography and videography business. She gains a leg up on the competition with drone-mounted cameras and live video streaming through the free streaming app, Periscope. While Mary's star rises, Carl Davis, Mary's friend from college, gets fired from the local television station for invading the privacy of one of his stories' subjects. Struggling to make it as a news blogger, Carl hires Mary and her drones to help him report on a scandal in local government. Before Mary knows it, she's watching an illicit affair unfold through the lens of her drone. Mary must ultimately decide if she's willing to broadcast the private scene to Carl's followers.

Keywords: drones, live streaming applications, conflict of interest, privacy invasion

1. MARY MCKAY, SHUTTERBUG

Ever since her 12th birthday, Mary McKay dreamed of becoming a professional photographer. On that day, Mary's father gave her a simple Polaroid camera, and Mary proceeded to burn through two packages of

instant film before her party was over. Few of the photos she took that day were ideal—shots were routinely blurred by her exuberant clicking or obscured by an errant finger jutting into the frame—but the seed of the dream was planted nonetheless. She particularly loved capturing

candid moments in which her subjects were smiling or laughing honestly and naturally. In high school, Mary volunteered as a photographer for her school's newspaper and worked after school retouching photos for a local photography studio. When it came time to apply for college, Mary looked for schools with strong fine arts and business programs. She set her sights on dual degrees, majoring in MIS and fine art. It was an ambitious combination that reflected both her love for the artistry of photography and her dream of opening her own studio.

2. CARL DAVIS, NEWSHOUND

Mary was a sophomore when she met Carl Davis in an introductory management information systems class. Carl took the class as an elective, hoping to one day put the skills toward a career in journalism. When Mary and Carl partnered for a class project, they instantly bonded over their mutual love of photography. Although they never took another class together, Mary and Carl remained close friends over the remainder of their college years. After graduation, Mary and Carl lost touch. While Carl focused on landing a job in the competitive world of broadcast journalism, Mary pursued her dream of opening her own photography studio.

3. BIRD'S EYE PHOTO & VIDEO

In her final year of college, one of her professors encouraged Mary to put together a project for a business plan competition. Mary seized the opportunity. Even if she didn't win, she would have the opportunity to work on the plan for her dream business.

She wrote a plan for a photo studio that would cater to weddings, parties, and other special events. She put her heart and soul into the project, and it paid off. Her photographic talent, combined with her technical savvy, won over the judges. The judges were particularly impressed with her plan to incorporate low-cost drones into the business, allowing her to capture photos and videos from previously impossible angles. When the final votes were tallied, Mary won by a landslide and walked away with the \$10,000 grand prize.

Mary used the money she won at the Business Plan competition to start her company: Bird's Eye Photo & Video. Eager to get started, Mary set up a website and started advertising her business through social media. Due to her haste, Mary

failed to consider the risks of running a business or the benefits of various forms of business organizations. By default, Mary operated the company as a sole proprietor. Occasionally, Mary would contract with a friend to help with equipment setup or fly drones at her bigger events. She handled all of the editing and retouching herself as well as all the scheduling, marketing, and bookkeeping. Before she knew it, Bird's Eye Photo & Video consumed her life, but she loved every minute of it.

Mary's MIS background gave her a leg up on other professional photographers in the area. Whereas other studios were notoriously slow at producing photos and albums for their clients, Mary capitalized on cloud storage and a customer relationship management platform that let her clients see their photos upload in real time from her camera. Clients raved about the stunning footage Mary could capture from her drone-mounted cameras.

Building off of her work in the business plan competition, Mary knew that the high-end drones used by cinematographers and bigger studios were beyond her modest budget. Still, she believed drones would play a major role in the future of photography and be essential to Bird's Eye's competitive advantage. She set out to find an affordable drone that could still capture professional-quality photos and video. She scoured the internet and photo industry magazines for information before picking the Y6-Rotor drone.

The Y6-Rotor drone had three arms attached to the body and two motor-propellers mounted at the end of each of the arms. The drone's Y shaped body maximized its weight-to-lift ratio, which allowed Mary to attach a small Go-Pro camera to capture wide-angle aerial images. Still, the drone was far from perfect. With its six propellers positioned in pairs of two, the drone was less stable than high-end, eight-armed drones used by most other professionals. After a couple weeks of testing and struggling, Mary finally felt comfortable enough with the drone to try it out at a friend's birthday party.

She left the party with some usable footage, but it was far from a success. Although she had nearly mastered maneuvering the drone, she still couldn't see through the lens of the camera. As a result, she never knew if her subject was in focus, let alone in the frame. If she was going to use the drone in her business, she needed to know that it would produce high-quality shots.

She couldn't afford to waste her time, or that of a contracted assistant, flying a drone that may not capture worthwhile photos and video.

Mary wasn't able to use the drone as she intended, but she nonetheless found a way to capitalize on it. For a modest fee, a small safety deposit, and a lease agreement, she would let her clients or their guests fly the drone and capture their own photos and video. Mary wasn't responsible for the quality of the shots, but she would still edit together the pieces that were valuable into the final product for the client.

As Bird's Eye Photo & Video grew, Mary kept her eye on the market for drones, hoping to find an affordable option that would better suit her needs. Eventually, the evolution of technology and her business's growth aligned and she invested in an Eagle Vision 4K. The Eagle Vision was a photographic powerhouse capable of capturing video up to 4K resolution at 30 frames per second. It could even capture slow-motion video in high resolution 1080p. The Eagle Vision's ActiveTrack technology allowed the drone to follow a subject in motion, a type of autopilot for photographers. Best of all, Mary could control the drone from her tablet with a live feed from the drone's camera.

For the first time, Mary was no longer flying blind. Word spread quickly throughout the community that Bird's Eye truly lived up to its name. Soon, Mary started getting calls from local businesses asking her to help with their multimedia advertising. Before she knew it, Mary's time was booked months in advance. Her larger competitors took note of Mary's success, and one even offered to buy her business, and more importantly, her talent. Mary felt like her dream was coming true.

4. CARL'S TROUBLES

While Mary was hard at work building up her photography studio, Carl was having a rocky start to his career in broadcast journalism. Right after Carl graduated with his degree in journalism, he started working for the local CBS affiliate, Channel 3 News. At first, his supervisor, Sarah Moore, was happy with his work. He could be overly aggressive at times, but Sarah appreciated Carl's tenacity. After just two years, however, Carl's dogged pursuit of exclusive stories started to raise ethical concerns around the station.

The last story Carl prepared for Channel 3 News was about Amanda Overtree, an up-and-coming

country music starlet who passed through town on a national tour. Instead of waiting in front of the hotel to catch some fleeting footage of Amanda boarding her tour bus like every other "lousy paparazzi," Carl had a better plan.

Five days before Amanda was scheduled to arrive, Carl got a tip about where she would be staying. Carl scouted out her hotel and took notes on the dress code and routines of the hotel's staff. He ordered a uniform online that would help him blend in with the hotel staff, then booked a night at the hotel at the same time Amanda was scheduled to be in town.

Carl checked into his room just before Amanda arrived, taking his camera, a tripod, a bottle of champagne, and his hotel outfit in an inconspicuous duffle bag. While she got settled in her room, he changed into the hotel uniform, put the champagne on ice, and waited in his room. He cracked the door open and listened for the sound of Amanda leaving. The moment she opened her door, he popped into the hallway with the iced champagne in hand and a towel draped over his arm.

"Ms. Overtree, a gift from the hotel," he told her, nodding toward the champagne in his hand.

"Oh, how very nice," she replied. "Be a doll and leave it in my room, won't you?" She held the door to her room for Carl, who slipped in as she walked away. When the coast was clear, Carl propped the door open, ran back to his room, and grabbed his camera. Carl proceeded to rummage through her luggage and film everything he saw.

After he was finished, he set his camera on the tripod and recorded a short stand-up teaser for the nightly news. "Tonight, an exclusive, behind-the-scenes look at Amanda Overtree's life on the road."

Later, as he edited his segment for the evening news, Carl patted himself on the back. *This will finally get me to the big leagues*, he thought. With a self-assured smile on his face, he sauntered into his boss's office and presented his work. But instead of praising him, as he expected, Sarah seemed stunned.

"There's no way we can run this footage!" she roared. "Have you no decency? You could face criminal charges for invading a person's privacy like that. This is the final straw! Pack up your things. You're fired!"

Carl was recalcitrant. "I'm not wasting my time with you any longer. I can sell this to any other station and make good money." Carl yelled as he stormed out of Sarah's office, slamming the door behind him. It was the end of Carl's tenure with Channel 3 News but the start of his freelance career.

At first, Carl felt energized by the seemingly limitless possibilities of freelancing. Carl quickly realized, however, that selling stories to local news outlets was more difficult than he had anticipated. He would spend days on a story only to have it rejected by television stations and newspapers. On more than one occasion, he saw a story of his run just days after pitching it to a news editor, but it had been written and produced by one of the outlet's own reporters.

After a month of struggling, Carl decided to change his business plan. Rather than selling stories to other outlets, he would be his own publisher. Dusting off the skills he learned in his MIS classes, Carl registered a domain and subscribed to a web hosting service. Within hours, he had his own news blog up and running. He planned to generate revenue through Google's DoubleClick advertising services as well as the occasional sponsored story purchased by local businesses. All he needed now was some eye-catching original content.

5. MARY AND CARL UNITE

Only a couple of years had passed since Mary and Carl graduated from college, but Mary was so engrossed in her business that she didn't notice Carl's absence from the Channel 3 Evening News. It had been several months after Carl's falling out with the Channel 3 News brass before Mary ran into Carl at a Fourth of July Parade. The local chamber of commerce had hired Mary to film the parade and produce a short promotional video about the community to attract new businesses. Carl, meanwhile, had attended in the hopes of cornering the mayor for an exclusive interview to post on his struggling freelance news blog.

After the parade, Mary met Carl at a nearby coffee shop to catch up. "It's hard right now, but I'm finally starting to build a following," Carl told Mary.

"I know what you mean," Mary commiserated. "I've been working on Bird's Eye for two years, and I'm only now starting to earn a profit."

"Really? The chamber must have deep pockets, right? Maybe you're not charging enough," Carl joked.

"I wish it was that simple. The fact is, most of what I've made over the last couple of years, I've reinvested in the business. It's hard work, but I love it. Just look at this footage I took today with my newest drone." Mary pulled out her phone, and after a few taps on the screen, handed it to Carl.

"Wow," was all Carl said as he watched the screen. The footage panned over the parade from above the treetops before dropping down and passing through a row of the high school marching band. "How high can you fly this thing?"

"Basically as high as I want," Mary replied. "It's rated to go a kilometer in any direction, but it's illegal to fly it beyond your line of sight. Besides, most of my clients wouldn't get much out of a kilometer-high aerial shot. But they really go gaga over a live stream."

"You can stream this footage live?"

"Through a live-streaming app like Periscope. You download the app to your phone or tablet. See?" Mary said as she pulled out her tablet. "I've set up my tablet to feed from the drone's camera instead of the built-in camera. While Periscope runs in the background, I can fly the drone with the separate drone app." Mary deftly tapped and swiped the tablet screen, switching effortlessly between the applications until the drone's controls were stacked alongside the Periscope "broadcast" button. "Anyone with a smartphone or tablet can see the live feed from the drone, and they can even provide live feedback. Once a broadcast is over, I can post and share the recording with anyone or everyone."

Carl was suddenly struck with an idea. "Hey, I know you were filming for some promotional video today, but do you have any extra footage I could post?"

Mary thought about it for a moment. Technically, everything she shot at the parade was for the chamber, but what could be the harm in helping out Carl with some B-roll footage? "Sure," she said. "I'll send you some spare footage this afternoon, as long as you post a link back to my Bird's Eye website."

Carl agreed, and Mary headed back to her studio, unsure of what she could give up without using

the footage she would need for the chamber's promotional video. As she combed through the footage, she started to play with shots of the high school marching band. After she had a few minutes of video stitched together, she decided to overlay the audio she had captured of the band playing the high school's fight song. Satisfied with the result, she posted the video to her studio's Vimeo channel and shared the link with Carl.

Within hours of posting Mary's footage on Carl's blog, the footage went viral. The video was wildly popular among the high school community, with parents and students alike sharing it across social media. In short order, the video became the most viewed post in this history of his blog. It also generated a lot of traffic back to the Bird's Eye page, and Mary started getting calls from brand new clients who were blown away by the footage.

6. CARL'S BIG STORY

Weeks passed before Carl stumbled across a news tip that, if true, would generate substantial traffic to his blog. Ron Johnson, the CEO of Johnson Development Inc. recently won a bid to build a new, \$120-million public housing project. Many of his competitors who submitted bids on the project accused him of greasing palms around city hall to win the bid.

Rumors surrounding Ron's close relationship with city leaders were common in the construction industry. Although his firm was occasionally outbid, it seemed like the city always chose Johnson Development for the most lucrative projects. The local media had looked into these rumors in the past but were unable to uncover any real evidence to corroborate the claims of corruption, so no accusations were reported.

Carl, however, was desperate for a good story and decided to investigate the accusations for himself. After talking with a handful of sources in the industry, he learned Johnson Development's bid was actually slightly higher than other bids submitted. Through a meeting with one of Ron Johnson's main competitors, Carl learned of a rumor about Ron having an affair with Olivia Brown, the city planner who oversees the city's construction projects.

"If this is true, I could scoop every news outlet in the state," Carl told himself. He decided to have a closer look into Ron's private affairs. While staking out Ron one morning, he happened to hear Ron on a phone call while leaving his office. Carl heard Ron talking about a meeting in the

penthouse of the Ritz-Carlton Hotel, just a few blocks from the Johnson Development offices.

Why would Ron meet someone in a hotel if his office is just 10 minutes away? Carl thought. He decided to find out more about that mysterious meeting at the Ritz.

Carl followed Ron to the Ritz-Carlton and watched as he breezed past the check-in desk headed straight to an elevator. As the elevator doors closed behind Ron, Carl watched the floor indicator as the elevator climbed. When it stopped on the 22nd floor, Carl realized that this must be the meeting. Unfortunately, Carl was too late to attempt his fake room service routine. Carl walked outside and gazed up the side of the building. The 22nd floor was at the top, and the penthouse provided an unobstructed 360-degree view of the city through its large plate-glass windows.

Carl was frustrated. The Ritz was the tallest building in this part of city, and there was no way he could get high enough to see through the penthouse windows. Just as he was about to give up, he noticed a small flock of pigeons land on an awning just above the penthouse. Struck with an idea, Carl pulled out his phone and dialed Mary's number.

7. CAUGHT IN THE ACT

"Mary? It's Carl. What are you doing right now?" he asked, still peering up at the pigeons atop the Ritz.

"Oh, hi, Carl. I'm just editing together some video for a client. What's up?"

"Actually, I'm hoping you could tell me," Carl joked. "I'm working on a big story right now, but I need your help. Specifically, I need a bird's-eye view, and I instantly thought of you. Can you meet me at the Ritz with that drone you told me about--the one that can live stream video?"

"Yeah, I think I can pencil you in. What day and time do you need me?" Mary asked as she pulled up her appointment schedule.

"Today, and right now," Carl answered. "Trust me, it will be worth it. This could be the biggest story this city's seen in years. I'll pay you double your hourly rate."

Mary looked at the clock and considered Carl's offer. She had been editing all morning, and the

time had gotten away from her. She decided it would be good to get outside, and the premium rate wouldn't hurt. "Sure, let me grab my things. I'll meet you there in 15 minutes."

As Mary arrived at the hotel, she saw Carl standing in an open parking spot just off the sidewalk. He waved her into the spot and met her at the back of her equipment van. "I'm glad you could make it," Carl told her. "Let's get that drone flying."

Mary pulled the drone out of the van and set it on the sidewalk. "So what exactly is this story?" Mary asked Carl as she turned on her tablet and started the drone. Within seconds, it was hovering just overhead. Carl gave her in the login information for his Periscope account. With one tap, the feed from the drone would start live streaming on Carl's blog.

"The story is all the way up there," Carl said as he pointed to the top floor. "You know that new housing project on the east side? I have reason to believe Ron Johnson cheated the bidding process, and the proof is in the penthouse as we speak."

Mary recognized the name from her work with the chamber of commerce. Ron served on the chamber's board of directors, and Mary had taped an interview with him for the promotional piece she put together. She began to wonder if helping Carl was still a good idea, but Carl's enthusiasm and her own curiosity led her to start flying the drone up to the penthouse. She wasn't recording anything yet, so what could be the harm in simply looking through the windows to see what Carl was so excited about?

Carl huddled next to Mary as the drone reached the penthouse, both of them carefully watching the tablet screen. Carl pointed to what looked like two people standing in a far corner of the room. "See if you can get closer," he said.

Mary guided the drone around to the opposite side of the building, near the corner where the two figures were standing. She glanced away from the screen to watch the drone glide around a corner, beyond her field of view. She knew she shouldn't lose sight of the drone, and anxiety started to build in the pit of her stomach. *This is only temporary, she thought to herself. Besides, I've flown the drone farther away before. I can bring it back in a jiffy.*

Back on the tablet screen, Mary recognized one of the figures was, in fact, Ron Johnson. He appeared be talking to a woman that Mary had never seen before. The woman reached out and touched Ron's arm, and the two met in a sultry embrace. Just as Mary realized what she was watching, Carl snapped his fingers. "That's it!" he exclaimed. "Start the feed now!"

Mary began to panic. "Wait, what are we doing here, Carl? Who is this woman?"

"Just trust me," Carl reassured her. "This is going to be big news. People will want to know what's happening in that room right now."

Mary remained frozen, unsure of what to do. "Listen, if you're not willing to do it, just give me the controls and I'll take over," Carl said, reaching for the tablet. Mary recoiled for a moment, then looked up at Carl.

"I..." she began.

8. CONCLUSIONS

With its focus on the intersection of technology, ethics, and law, this case aims to demonstrate some of the dilemmas faced by the deployment of cutting-edge technology within an ethical and legal decision-making context.

One of the reasons for the increasingly successful results of Bird's Eye Photo & Video is the competitive advantage attributed to Mary's technological acumen. By using drones, complete with live streaming capabilities through the Periscope application, Mary has helped to create an increase in demand for her products and services.

Mary's reunion with a college friend, Carl, who had a brief journalism career before being fired for ethical violations, tests Mary's mettle. Mary is forced to decide whether or not she should comply with instructions from Carl, who hires her to do some filming for his blog. Specifically, Carl wants Mary to use her drones to privately film a meeting in a hotel suite between a city official, Olivia, and a local businessman, Ron. Olivia oversees the city's construction projects, and Ron routinely submits and is awarded bids for development projects for the city.

The case probes the separate technological, ethical, and legal issues involved and also examines the intersecting areas. It illustrates

that technological advances can raise a host of challenging and complex issues when viewed from the framework of making ethically responsible, and even legally compliant, decisions.

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Appendices and Annexures

DISCUSSION QUESTIONS

MIS and Business Questions

1. What are some of the challenges that will need to be overcome before drones are more broadly used and what kinds of needs and niches might drones fill in the future?
2. How could drones potentially change Mary's business?
3. What kinds of businesses could most benefit from drones?
4. How have drones evolved in the last couple of years? What other technologies were first used by the military and then by the public (i.e., went from proprietary technology to infrastructural technology)?
5. In addition to technological issues, what other issues are customarily faced by entrepreneurs as they launch their business idea to market?

Ethics Questions

1. Should Mary push the button and stream the scene live?
2. What are some potential disadvantages/downsides and some potential advantages/upsides of the ubiquitous availability of drones?
3. Does Mary owe any duty to the chamber of commerce? What ethical issues are presented by the apparent personal relationship between Ron Johnson and Olivia Brown?
4. Should law enforcement agents be allowed to use drones for security reasons?
5. What are some of the implications of using live streaming applications such as Periscope?

Legal Questions

1. If Mary starts the live video stream, is she committing a crime? What kind of penalties could she face?
2. If Mary starts the live video stream, could she face civil liability? Is her business liable?
3. Should Mary continue running Bird's Eye Photo & Video as a sole proprietor? What are her options? How could she benefit from forming a business organization that could provide her with liability protection?
4. How do laws regarding recording of private conversations vary among states?
5. What legal issues are presented by Mary entering into a lease agreement for the use of her drones? What legal issues are raised by Mary hiring a contracted assistant for occasional help with her business? What legal issues are posed by Carl being fired by Sarah?

Teaching Case

Tourism through Travel Club: A Database Project

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Abstract

This applied database exercise utilizes a scenario-based case study to teach the basics of Microsoft Access and database management in introduction to information systems and introduction to database course. The case includes background information on a start-up business (i.e., Carol's Travel Club), description of functional business requirements, and sample data. Carol is a young entrepreneur who wishes to start her own business. Starting a new business has required Carol to be more efficient with her resources. She desires a way to organize her data and would like a computerized database management system. Students are asked to design and develop a database to help her manage the new company's customers, products, and purchases by emphasizing effective business rules and professional database development. In addition, this case will explore the benefits of working with MS Access, data population, creation and development of forms, queries, reports and a switchboard to complete the requirements expressed by Carol's Travel. This case can be used in a course where the students have little or no prior relational database experience, as well as a more intermediate/advance level of experience. Teaching notes containing suggested guidelines, deliverables, and the resulting database containing data, forms, queries, reports, and switchboard are provided upon request.

Keywords: Database Development, MS Access, SQL

1. CASE OPENING

Carol loves to travel! Each time she is ready to visit a new city, she has always wished there was a database that logged many of the great attractions, sites, and events of the cities. In college she majored in Marketing and remembered seeing so many clunky and misinformed websites. Many people, including friends and family, consistently mentioned the difficulty in searching for city information when traveling. To solve this issue, Carol came up with the idea of creating a list of all the sights in the

major cities that she and her friends typically visited or wanted to visit. Her lists became so popular that she decided to make a business out of her idea. Now as an entrepreneur, she is challenged to build a system that will allow tourists (friends or not) that have registered as members to view the information that she has collected about cities. Thus, Carol's Travel Club was born.

Carol wants to be more efficient with her resources. She has been using spreadsheet software to keep track of the different sight-

seeing activities. She needs a better way to organize her data and would like a computerized database management system to help manage the attraction information and provide summary reports for each city. She wants to start small and then eventually grow into a complete travel business.

You are challenged to help Carol make her dreams come true. She has provided a series of questions and business rules that will help you develop a database that will store tourism and event information and allow others to search and prepare for their upcoming travels. You will develop a database with 5 cities and some of their attractions and sights.

2. FUNCTIONAL REQUIREMENTS

Carol wants a database that allows her to track member and employee information. Members are either free or paid (premium). She also needs to manage the numerous attractions and sights around the world. In addition, she needs simple, effective forms for entering the data about each attraction and location information.

Carol would like to organize and track:

- Member Information
- Employee Information
- Attraction and Location of Trips
- Club Membership and Payment

She would also like to address a number of concerns and requests provided by her employees and members:

- To provide our members with the opportunity to review and reserve different attractions in cities all around the world.
- There are multiple locations (city, state, country) and each location has multiple sights.
- There are approximately 9 categories (museums, theaters, food, etc). Each category may have multiple attractions but each attraction has only one category.
- As a paid member (premium) you can request reservations for major attractions. As a viewing member (free) you can only see information and cannot have reservations made on your behalf.

Carol has already been collecting the data in Excel and Word documents. These documents can be found in the Appendix (or attached). The next several sections explain further details on the database development (e.g., ER-diagram, data dictionary), the forms, queries, and reports and the navigational page.

Member Scenario

When you initially approach Carol's Travel Club, there are two member choices – free or premium. As a free member, access to city information and sights are available for viewing. With a premium membership, a member can access city and sight information, build an itinerary and use our club employees to set reservations for different attractions on your itinerary. Currently the premium membership is an annual \$60 fee starting from the day you purchase it. During your membership you may create itineraries and reservations for during the membership time period. At the current time, Carol collects member name, address, phone, email preferred vacation location and their membership. (See Appendix Fig 1)

Employee Scenario

Each employee accesses the database for a number of reasons. Their primary task is to make reservations for the attraction requests on each premium member's itinerary. They are to check for open reservations and complete any that are not closed. At the end of each day, the manager will print a report of all closed itineraries/reservations. In order to know who our employees are we request their name, email, phone and location (ex: Miami, FL, USA). Since this company is a pure-play business, there is no reason to know exact addresses at this time for employees. They are paid direct-deposit through a secured online banking system. (See Appendix Fig 2)

Attractions/Sights Information

Attractions and sights around the world have been broken down into categories (see Table 1). Each category may have multiple attractions/sights but each attraction/sight has only one category.

Table 1. Attraction categories	
Code	Category
C1	Art
C2	Fashion
C3	Food
C4	Museum
C5	Music
C6	Performance/Entertainment
C7	Sporting Events
C8	Statues and Monuments
C9	Tours

Each of the categories have specific opening months. Art, Food, Museum, Music, Performance/Entertainment, and Tours are open year round.

Fashion, Sporting Events, and Statues and Monuments are open from March to November.

Each category has multiple attractions. These attractions each belong to only one city location. In order to create reservations, itineraries, and reviews for the different attractions, you will need to collect some basic information about each. See Figure 3 for some sample data.

4. FORM REQUIREMENTS

Carol and her employees need several user-friendly forms to enter data into the database. Two types of forms are needed – input forms and application forms. The input forms are data entry forms or forms that replicate the information in the database. The application forms combine information from multiple tables to produce related table information. The functional requirements for the input and application forms are provided below.

Input Forms

Input forms are to allow the employees to enter, edit, or query data in given table. These forms are to be columnar type forms that display data or allow for input of one record at a time. The forms are to be user friendly with all the field labels consisting of user-friendly descriptive names.

Input/Query forms are to be developed for the following tables:

- Employee information Form
- Attraction/Sight Page Form
- Location Information Form
- Attraction Category Form

Application Forms

1.Membership/Payment Form: This form is an entry form for the members and includes any payment information for premier members. This form should include all of the Member table information. If the member is a premier member then there should be payment information. The subform includes payment ID, amount, payment type, and payment date.

2.Reviews by Member: This form is an entry form for the member reviews of the attractions and sights that members have visited. This form should include review ID, member first name, member last name, attraction name (drop-down list), comment, and rating.

3.Reservations (open only – intermediate): This form is an entry form for member reservations. This form should have three parts: member type check, itinerary information, and reservation information. The upper portion should include premier member checkbox, member first name, and member last name. The middle portion should include itinerary ID and start and end dates of vacation. The bottom portion should include reservation ID, employee ID, attraction name (drop-down), day of reservation, estimated time, number of visitors, and name to place reservation under.

4.Switchboard: The database is to have a menu system designed for our everyday users. The menu is to be user-friendly and contain selections for all the forms and reports. The management team is open to design and look, so any template or design choices are feasible. Your switchboard at minimum should meet the following requirements:

- a. Contain menus for Input Forms, Application Forms, and Reports
- b. The main menu is to contain an exit selection that will exit the database application. Each smaller menu should contain a return link to the main menu
- c. The menu is to be executed automatically when the database is opened and the database window is to be displayed in the background.
- d. All forms and reports created in the earlier sections should be included in their appropriate sections.

Note: Each part of the switchboard should be user friendly. Therefore, there should be an easy way to move in and out of menu selections. Don't forget you should have exit buttons on your forms/reports to close them properly! (*Don't just use the x in the upper corner*)

Double check that your forms are usable and enter data to verify.

5. QUERIES

A variety of queries are required to extract meaningful and accurate data. In order for Carol's Travel Club's employees to be more efficient and effective with their members, reservations, and locations, data must be extracted and filtered to answer fundamental and essential questions.

We have determined that the initial queries to be included in the database are below.

All query column headings are to be clear, concise and accurately describe the contents of the column to the average user. Only universally accepted abbreviations are to be used. All queries, when printed out, should fit on standard paper when printed in landscape mode (11" by 8½"). The queries are to be named as they are listed below.

Basic Queries

1. **Current Member List:** List all members in the database. Order by member last name and then first name.
2. **Things to Do:** Display all activities and their corresponding categories. Sort in ascending by category.
3. **Cities and their Activities:** List all attractions and their addresses, include their cities, states, and countries. Sort by Country and City.
4. **Closed Reservations:** How many reservations has an employee completed? Show all completed reservations include reservation ID, reservation name, attraction name, day, employee name associated with reservation. Sort by reservation ID.
5. **Reservation Summary:** List all reservations in the database. Display reservation ID, employee ID, attraction name, day, estimated time, number of visitors, and name the reservation is placed under. Order by day.
6. **Premium Members:** List all premium members in the database, include all member information.
7. **Museum Listing:** Show all museums in their given cities, states, and countries. Order by City.
8. **City Information:** Display information about Berlin, Germany, include city information, all attractions/sights and the associated categories.
9. **3 Stars or Higher:** Display members and their reviewer comments with a rating of 3 or higher.

10. **Member City Attraction Search:** a) Display a city (member's choice) and country with the activities and sights in that city, include the categories of each of the attractions. Sort by category. b) Run the same query but give the member choice by country. Sort by city
11. **Top Attractions Reserved:** Display the top 5% attractions that have been reserved. List the attraction name, city, and entry fee.
12. **Membership Expiration:** Calculate the expiration date of memberships.
13. **Total Reservation Cost:** Calculate the total cost of entry to the attraction reserved. Display member name, attraction name, date, number of visitors, city, and entry fee. Sort by date.

Intermediate Queries

14. **February Activities and Sights:** Show all activities available in February. Display attraction name. Sort in ascending order (Hint: use Month function).
15. **September Reservations:** Show all reservations in the month of September. Display the date of reservation, attraction, reservation ID, reservation name, number of visitors, member first name and member last name.
16. **June Payments:** Show all membership payments for the month of June.
17. **December Expirations:** Show all members expiring before December 2016. Display member ID, member name, payment date, and expiration date. Sort by member ID.

6. REPORT REQUIREMENTS

Carol requires a number of reports both for her employees and her members. Below are the required reports. Label all sub-totals and grand totals appropriately with user-friendly descriptions to the left of the totals. Finally, to provide a more detailed and accurate appearance, all sub-totals should have a line above and the grand total should have a double line above the total.

1. **Things To Do Report:** Categories and activities within each category. List in ascending by category.

2. **Number of Visitors per Sight:** Visited sights and their member counts. List in ascending by sight.
3. **Total entry fees for complete itinerary:** Calculate the total amount due for the itinerary for all sights a member is visiting. Make sure to include the itinerary id, reservation id, start date, end date, number of visitors and entry fee. [Hint: this may be done best with creating a query first]
4. **Premium Members Report:** Premium membership. List all premium members, order by last name.
5. **Member Receipt:** Premium membership payment receipt. This is an opportunity to see each member and their payment information (payment date, payment amount, and payment type)
6. **Monthly Reservations Report:** Current Reservations by 'month'. Grouped by month and day, we are able to see each member, their attraction and city, and the employee who handled the reservation.
7. **Completed Payments Report:** Total payments for 'month'. This report includes member information and payment information grouped date.

7. CONCLUSIONS

Once you have completed all the functional requirements, Carol's Travel Club is now prepared to manage reservations and itineraries for their paid members and general travel information for all members.

Appendices

ID	Member Name	Address	Phone	MbrEmail	Preferred Vacation Location	Are you a Premiere Member?
1	Mary Hart	255 Amherst Lane Amherst, MA 01003 USA	413-897-6543	mhart@ amherstlane.com	London	Yes
2	Charles Montgomery	10 Charlotte Road Austin, TX 78610 USA	521-555-6666	gotexas@ test.com	Dublin	No
3	Jorge Calhoun	5068 Orlando Court Orlando, FL 32801 USA	786-321-8912	jcalhoun@ monstermail.com	Milan	Yes
4	Emily Sharp	424 Stanbeck Place Bradenton, FL 34204 USA	941-234-0152	sharpland@ csharp.com	Dublin	No
5	Thomas Smith	21 Thompson Lane Cleveland, OH 44107 USA	424-852-9525	tsmitt@ smithfamilyrocks. com	Fort Lauderdale	No
6	Mark Lewis	2502 Seaworthy Drive Atlanta, GA 30345 USA	770-982-1314	marlew@ lakta.net	London	No
7	Julie Jacobs	425 Madison Park Drive Nashville, TN 37218 USA	615-952-2532	queenj@ soundstuff.com	Dublin	No
8	Terry Stewart	5226 University Drive Plano, TX 75023 USA	252-232-1157	stewbaby@ planethane.net	Paris	No
9	Donald Parker	6811 Calista Road Carlsbad, CA 92008 USA	442-957-5322	parkhere@ cccaltat.com	Cincinnati	No
10	Samuel Dear	6262 Lakeland Drive Techny, IL 60082 USA	606-522-6690	sdear@ aolmailx.com	Berlin	No
11	Alise Jankovic	375 10th St NE Washington, DC 20004 USA	202-851-2522	alisej@ uwad.edu	Milan	No
12	Sebastien Toms	2525 North Main Street San Jose, CA 95115 USA	902-559-9115	sebtom@ sebserver.com	Berlin	No

Figure 1. Member Table Data

Employee ID	Employee Name	EmpEmail	EmpPhone	EmpCity	EmpState	EmpCountry
1	David Convoy	dconvoy@carolstravel.com	888-543-8932	Miami	FL	USA
2	John Davidson	jdavidson@carolstravel.com	888-702-5912	Miami	FL	USA
3	Emily Sharp	esharp@carolstravel.com	020775095022	London		England
4	Jerry Hallowell	jhallowell@carolstravel.com	888-702-5912	Miami	FL	USA
5	Teresa Wright-Maven	twright@caroltravel.com	888-702-5912	Miami	FL	USA
6	Edward Hirsch	ehirsch@carolstravel.com	020782321540	London		England

Figure 2. Employee Table Data

Attraction	Address	Phone	Type	Website	Cost
Louvre Museum	4 Place du Louvre, Paris 75001	+33 1 40 20 50 50	Art	http://www.louvre.fr/en	16.71
Eiffel Tower	5 Avenue Anatole France, Paris 75007	+33 892 70 12 39	Monument	http://www.toureiffel.paris/	17.00
Arc De Triomphe	Place Charles de Gaulle, Paris 75008		Monument		0.00
Musee d'Orsay	1 Rue de la Legion d'Honneur, Paris 75007	33140494814	Art		0.00
Jules Verne Restaurant	5 Avenue Anatole France, Paris 75007	+33 892 70 12 39	Food		0.00
Eiffel Tower	5 Avenue Anatole France, Paris 75007	33892701239	Monument	http://www.toureiffel.paris/	26.00
Seine River Cruise	Seine River, Paris 75007	33180421	Entertainment	http://viator.com	36.00
Tour de France	Around France, Paris 75007		Sporting Event	http://en.parisinfo.com	0.00
Le Marais	Aristocratic District, Paris 75001		Fashion	http://www.aparisguide.com	0.00
London Eye	South Bank of the River Thames, London SE1 7PB		Monument	http://www.visitlondon.com/	29.99
British Museum	Great Russell St, London WC1B 3DG		Museum		0.00
National Gallery	Trafalgar Square, London WC2N 5DN		Art		0.00
Tower of London	Tower Hill, London EC3N 4AB		Monument	http://www.hrp.org.uk/tower-of-london/	30.55
Statue of Liberty	Liberty Island, New York 10004	(212) 363-3200	Monument	http://www.nsp.gov	26.00
The Metropolitan Art Museum	1000 5th Ave, New York 10028	(212) 5357710	Art	http://www.metmuseum.org	12.00
Yankee Stadium	1 E 161st St., New York 10451	(718) 293-4300	Sporting Event	http://www.yankees.com	0.00
Best Clubs in New York	245 8th Ave #192, New York 10011	(917) 300-8187	Entertainment	http://www.bestclubsinnewyork.net	25.00
Keens Steakhouse	72 W 36th St., New York 10018	(212) 347-3636	Food	http://www.keens.com	0.00

Figure 3. Attractions Sample Data

Teaching Case

The Piranha Solution: Monitoring and Protection of Proprietary System Intangible Assets

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Abstract

The *Piranha Solution*® is a complex and valuable integrated chemical supply inventory management system protected as a trade secret by its asset holder, the Confluence Corporation. The *Piranha* program is the lifeblood of the corporation's growth and success in the chemical supply industry. A common definition of *trade secret* is "any information you don't want your competitors to have," and this statement couldn't be truer for the much sought after *Piranha Solution*®. The advantage of a trade secret is the potential to keep unique details of an invention a secret forever, as opposed to alternative protections such as a patent, which require public disclosure. But in order to retain assets as trade secrets, the holding company must take "reasonable steps" to insure the security and secrecy of undisclosed, unique details. These steps for Intellectual property security inevitably include a computer and information system component, especially when the asset is digital, as is the case with the *Piranha Solution*®. In this case, while Confluence Corporation appropriately focuses on, and continuously monitors for, external threats to the *Piranha Solution*®, internal threats that may compromise the system are largely ignored. Failure to take proper precautions to protect their assets, a not uncommon business scenario, will ultimately be disastrous for the company. How to identify and avoid missing these important issues, and what reasonable steps may be taken to protect corporate intangible assets, is the focus of this case study based on actual events known to the authors.

Keywords: IS Strategy and Management, IS Security, Intangible Assets, Trade Secrets, IS Policy & Protections.

1. GOOD EVENING CONFLUENCE CORPORATION

The late-night summer celebration at Confluence Corporation headquarters in Saint Louis, Missouri, was a spectacular affair. Tables set up in the 14th floor conference hall were covered

with linens in the company's trademark indigo blue, and laden with heaping plates of gourmet cheeses, smoked salmon, and bite-sized filet mignon. There were cobalt crystal glasses to dip into the champagne fountain, and even some appetizers with a Trinidadian influence to honor the company's co-founders: curried shrimp, aloo

pies, and raw oysters bathed in a sweet-hot cilantro sauce. The party marked the opening of the newest corporate branch of Confluence (in Hawaii) and concurrently the hiring of the corporation's 100th sales staff employee. Business was booming, and the Confluence family was growing and celebrating amid the glow of what seemed to be unstoppable success.

Although adding a new office is an important milestone, the summer evening had an even stronger basis for celebration; Confluence Corporation was quickly rising to become a national leader in the chemical supply industry. Growing at a rate of over 15% per year, the burgeoning company was divided among two dozen U.S. branch sales offices and distribution sites, each with its own sales staff of a manager and an average of 4-6 trained personnel. Confluence employees all knew the key to the corporation's exponential success was a complex and highly coveted trade secret inventory system known as the *Piranha Solution*®. The program, dubbed after the strongly oxidizing chemical mixture of Hydrogen peroxide and Sulfuric acid used to clean organic residues (as well as the tiny Amazonian razor-toothed fish), was a marvel of ingenuity. Its multi-layered secure design tracked hundreds of thousands of compounds, hazard classifications, and compliance data. The system also had the capacity to interface with the over 60,000 chemical classifications in the OSHA/EPA (Occupational Safety and Health Administration / Environmental Protection Agency) Toxic Substances Control Act inventory, as well as track signature verification for regulatory compliance. Competitors of Confluence begged for licensing of the system, but co-founder and CEO Dr. Devlin Khan knew his valuable inventory program was the best in the country, maybe even the world. Dr. Khan had considered the potentially lucrative licensing route at one time in the early stage launch of *Piranha*, even providing access in the form of a "sneak peek" to a staunch competitor. He quickly retracted his flirtation with licensing, however, upon the realization that the *Piranha* system possessed a once-in-a-lifetime uniqueness that was unlikely to ever be duplicated. Born in Trinidad, Dr. Khan had cut his teeth on the chemical exports of ammonia and methanol for which his home country was well known. The company's *Piranha Solution*® was the "confluence" of CEO Devlin's chemical knowledge and the computer programming expertise of his wife Dr. Tamika Sunil-Khan, also a Trinidad native. Together the Drs. Khan built a powerful chemical supply domain around the tremendously intricate *Piranha*—no system came even remotely

close to mimicking its efficiency, safety and pure elegance.

2. ONE BIG CONFLUENT FAMILY

As Confluence Corporation continued to accelerate its expansion, employees were added to the sales force at a phenomenal rate. Other chemical supply companies were hemorrhaging from the loss of their best salesmen and women to the Khan Empire. Because the company was growing so quickly, it was imperative to have the sales force "hit the ground running" with a clear understanding of both the inventory and its management via *Piranha*. All members of the Confluence sales force were therefore trained on *Piranha Solution*® and each had open access to the system. Although Tamika and her team had established elaborate security from external threats for the inventory program (spurred by the intense interest of previously mentioned competitors, both honest and not-so-much-so), the Confluence in-house family of employees and founders didn't see a need for internal security. Insider activity against the company was viewed as unthinkable.

As a result of this culture of confidence, Confluence didn't require its sales personnel to sign non-competition agreements, which could potentially limit employees from leaving the company for a direct competitor (and possibly taking *Piranha* secrets with them). The Khans knew that there was nothing like the *Piranha Solution*® at any other chemical supply company, and it was this precise asset that was driving unprecedented sales and profits. Salespersons were "beating down the door" to secure a position at Confluence, and knew they would be foolish to go anywhere else once they were on board.

The corporation also didn't see a need to have employees sign agreements to keep details of the *Piranha Solution*® a secret. It was an unspoken rule that everyone protected the system that the Khans had so carefully constructed; it would have been offensive to require Confluence "family" members to sign a document that, by its nature, called into question their loyalty and dedication to the company.

Therefore because of this unprecedented culture of trust, the usual safeguards for a trade secret like the *Piranha* software, such as restricted access and confidentiality agreements, were completely absent. Yet the Khans were confident that their prized system was impervious to any threat, either internal or external.

3. THE PARTY'S OVER

It was on a sultry, warm Tuesday night in June that a breach of the Confluence comfort zone would first materialize. Tamika Khan was working late that evening at company headquarters in St. Louis. Devlin had already left the office for their brownstone townhouse in Soulard, and was expecting his wife to follow him home shortly. As Tamika was preparing to shut down systems at around 2AM, out of curiosity she checked the branch access logs to see if anyone else was working late. It was midnight at the company shop farthest continental west in Happy Valley, Oregon, and all was quiet. The same was true of branches in Montana and Iowa. In Confluence sub-headquarters Austin, Texas, not a creature was stirring either. All was also tucked away in Florida, West Virginia and Illinois. Feeling tired, Tamika had just decided to head home when something in the Indiana branch logs caught her eye. Multiple logons beginning just after midnight central time were scrolling on the screen—12:21AM, 12:24AM, 12:31AM—and on and on well past 1AM. Tamika smiled to herself when she saw the access times. *"Our employees are so dedicated," she thought.* She put the system to bed and headed home.

Just before 8AM the next day, Devlin Khan's mobile phone rang. On the line was Confluence's Midwest regional branch manager Evelyn Connors, who was just leaving the Iowa office. Evelyn checked in with each branch on a weekly basis, sometimes even flying to a location to look in on operations, the sales manager, and staff. "Dr. Khan I haven't been able to raise the Indiana shop yesterday or today," she said, sounding a bit concerned. "I was going to fly out there Monday, but Kevin said they were in training this week. No one is answering the office phone, and I'm not receiving a response on anyone's cell phone either." Kevin Roth was the Evansville, Indiana branch manager who had come on board about six months earlier. He had a stellar record in chemical sales and more than 10 years of management experience. Kevin's last position was working for the mid-sized chemical supplier Cold River Chemicals, located in northern Indiana. Aside from a good bit of complaining about his lack of bonus this past quarter (During his short tenure with the company, Kevin had driven the Evansville office to its highest sales numbers to date. However, he had missed the six-month corporate residency requirement to receive a much anticipated \$25,000 quarterly bonus by two weeks. Kevin felt that he had more than made up for those missing ten days through late night shifts and weekend hours.) Kevin was

overall an excellent manager, and well-liked by his administrative and sales staff. He had a natural charm and ways of motivating his Indiana group to aspire to greatness. And, in keeping with the Confluence culture of loyalty, the Evansville employees would follow Kevin's every command without question.

Devlin hung up with Evelyn and tried himself to contact the Evansville office, then Kevin, and finally the assistant sales manager, Matthew Langenstein. He, like Evelyn, did not receive a single response. After speaking to Tamika, who was down the hallway in her office, Devlin called Evelyn back. "Instead of returning to Missouri today, please head to Indiana. We just need to be sure everything is okay over there."

Tamika asked her administrative assistant Renee to keep trying to contact the Indiana branch. Tamika then quickly remembered the logon access from the previous evening. Turning to her system, she looked back over access logs from the prior few days for the Evansville branch. The record there also showed multiple odd hours logons—times such as 2:32AM or 3:40AM—highly unusual even for a motivated and diligent workforce. Tamika called Devlin—"We may have a problem in Indiana." She then consulted with her top technical programmer Martin Salaam. Martin had designed the impenetrable external protections for the *Piranha Solution*® and had extensive experience with computer forensics. Tamika charged Martin with finding out what was going on in Indiana. "Please tell me it is nothing," she pleaded silently.

4. SAINT LOUIS, WE HAVE A PROBLEM

Evelyn was able to book a 9AM flight from Cedar Rapids to Evansville, but the flight would take 3 hours. "I can drive there faster," Devlin thought aloud. Tamika was now in his office, pacing the room and looking out the east windows at the arch and city skyline. "We should wait for Evelyn, it is likely nothing important," she said nervously. As the minutes ticked away, Martin was discovering more and more alarming signs indicating that there was far from "nothing" going on in Indiana. But, because the company periodically deleted its system back-ups, he could only investigate so far. He did see, however, that the odd hours access was coming from two specific locations—one inside the Evansville branch, and the other in northern Indiana. At half past noon, Devlin, Tamika and Martin were all eyes glued to Martin's computer screen when the call from Evelyn came. "The outer door was locked when I arrived. I'm inside the office now,

and it is empty—no people, all the desks cleared out, nothing.” She stumbled over a moving box while she talked and roamed around the silent space. “Everyone, and everything associated with them, is gone.” Tamika and Devlin looked at each other incredulously. *How could this happen? Why? What do we do now?*

A few days after the police incident report was filed, branch surveillance video showed Confluence employees loading a U-Haul truck with boxes and materials from the Evansville office. While the furniture, computers and desks remained in the building, a few files and written materials—including a proprietary print *Piranha Solution*® training manual—were missing. Even though a copyright instantly attaches to written materials when they are created, the Khans didn’t have time to register the copyright for *Piranha Solution*® support materials, a requirement to bringing legal action for violations. With open access to the inventory program, many employees also had *Piranha* materials, including the training manual, on their mobile phones and laptops; none of these personal devices belonged to Confluence. Martin and Tamika surmised—from the little activity data they could recover—that in the days before the move, Evansville employees were downloading files pertaining to *Piranha*. Additionally, there was increased email traffic between Evansville employees in the two weeks before their departure, which was also unusual for their independent, highly trained sales force. An issue slowing the investigation was the fact that, for simplification of access, all employees at a branch used the same user name and password. Therefore due to the lack of unique identifiers, it was impossible to tell from the logs which employee was in the system at any given time.

The Khans were devastated; all indications suggested that the highly prized and sought after *Piranha Solution*® trade secret had been compromised in the most egregious fashion—by members of the Confluence family. Further investigation revealed that sales manager Kevin Roth was more than nominally upset about his lack of bonus, especially as he knew that the Illinois branch manager had received a \$10k award for the first quarter for sales numbers inferior to those his office had attained. Without an employment contract, internal system safeguards, or a non-competition agreement from Confluence to modulate his behavior, Kevin had taken his sales skills, sales staff, and sales system to greener pastures in northern Indiana. Mr. Roth and his group were found a few months later to be operating a chemical supply company

under the name “Roth Chemical” just north of Indianapolis. As a final insult, the hallmark of the new company was an incredible inventory system called the *Caiman Solution*™, named for a voracious Amazonian predator of the piranha fish.

5. QUESTIONS

1. What are some internal threats to the *Piranha Solution*®?
 - b. List some protective measures that can be taken to address those threats.
 - c. Was Confluence Corporation doing enough to protect against these potential threats?
2. What are some external threats to the *Piranha Solution*®?
 - b. List some protective measures that can be taken to address those threats.
 - c. Was Confluence Corporation doing enough to protect against these potential threats?
3. What network monitoring and security tools could have been used to protect the system? What are some open source options?
4. Imagine you are a co-founder of Confluence Corporation when it was just a start-up. What policies would you establish to protect the company and *Piranha Solution*®?
 - a. A “trade secret” like the *Piranha Solution*® may be defined as “a formula, practice, process, design, instrument, pattern, or compilation of information that has independent economic value in being not generally known or reasonably ascertainable (that is, the secret gives the owner some actual or potential competitive advantage).” In order to maintain trade secret protection, a company must take reasonable steps to keep undisclosed details a secret. Research and list five reasonable steps that a corporation can take to protect a trade secret (Lin, 2012).
 - b. Did Confluence Corporation take any of the steps you’ve listed?
 - c. What could the corporation have done to better protect *Piranha Solution*®?

6. REFERENCES

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Teaching Case

American Guild of Musical Artists: A Case for System Development, Data Modeling, and Analytics

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Abstract

This article presents a case scenario that may be used in system analysis and design, database management, and business analytics classes. The case document includes realistic, detailed information on the operations at the American Guild of Musical Artists (AGMA). Examples of assignments for each class and suggested reading are presented. In each assignment, students should learn relevant concepts and skills before applying them to create the deliverables. The core application in the case is a membership accounting system (a variation of an accounts receivable system) with several custom features that require innovative reflection by the student analysts. Instructor's materials are available.

Keywords: Database design, Systems analysis and design, Entity-relationship diagram, Data flow diagram, Analytics, Business process, Teaching case.

1. ORGANIZATIONAL BACKGROUND

Founded in 1936, the American Guild of Musical Artists (AGMA) is an AFL-CIO affiliated labor union that represents about 8,000 active and retired opera and concert singers, production personnel and dancers at principal opera, concert, and dance companies throughout the United States (<http://www.musicalartists.org/>). It was established in an effort to prevent the exploitation of opera singers who were, at the time, being forced into oppressive contracts with few benefits or protections.

2. OPERATIONS AND DATA REQUIREMENTS

AGMA is organized into 11 regional jurisdictions across the country with field offices in several major cities. AGMA members enjoy the benefits, privileges and protections under various national collective bargaining agreements including guaranteed salaries, rehearsal and overtime pay, regulated work hours, vacation, and sick pay. Over the years, AGMA expanded its jurisdiction to include dancers (plus ice skaters) and production/backstage personnel. The union members are classified according to their primary pattern of employment with the categories being Soloist, Chorister, Dancer, Choreographer, Actor, Stage Manager and Stage Director. Leadership of

the union is provided by the Board of Governors and Local Area Committees consisting of members elected by other members. These groups create policies which are then, implemented by professional staffs employed at AGMA offices. AGMA maintains its headquarters and principal office in New York City and has satellite offices in Philadelphia, Washington DC, Miami, Chicago, Los Angeles, San Francisco, and Seattle.

AGMA operations regarding signatory agreement, membership, and accounting are described below:

2.1 Overview of Operations

Opera, dance and concert companies that have signed a collective bargaining agreement with AGMA are referred to as signatory companies. When an artist is hired by a signatory company to work in one of the covered categories, that individual must be a member of the AGMA. Artists wishing to join the Guild must pay an initiation fee and continue to pay both a basic dues fee on an annual basis plus a percentage of their salary earned while working in designated roles. Elections are held to elect the Board of Governors from the membership with the number of governors dependent upon the location and categories of the AGMA member population. AGMA also maintains a directory of auditions that have been scheduled by the signatory companies.

2.2 Signatory Companies and Agreements

There are approximately 100 companies that have signed a collective bargaining agreement with AGMA. They include most large opera and dance companies in most of the major cities in the United States, e.g. the New York City Ballet, the San Francisco Opera, the Joffrey Ballet, and the New York Grand Opera. Any opera, choral, or dance company wishing to establish such an agreement with the AGMA must complete an application form supplied by the AGMA Signatory Department. The information required in the application includes: company legal name, address, phone, email and a contact individual. If the company wishes to link its web site to AGMA's web site, then that web site address must be provided. There are separate types of contracts covering opera, dance, and concert and each contract is for a specific duration. These contracts detail the guaranteed salaries (e.g. rehearsal and overtime pay) for all categories of work (e.g. Leading, Feature, Supporting, Bit Solo, and Bit Mute for opera); regulated work hours; vacation and sick pay, working conditions, and dispute

resolution procedures. When a contract expires, a revised contract must be negotiated and signed by each company. AMGA wishes to maintain a record of all current and previous contracts that each company signed.

When the initial signed contract has been received and approved, AGMA assigns the company an identification number (SignatoryID). Additional information collected includes the company's legal name, address, phone, fax, email address, a primary contact person and his/her phone number. In addition, an agreement code (AgreementTypeID) indicating the specific agreement signed plus the sign date and the agreement effective date range (agreement start and termination dates) are recorded. A company may be signatory to multiple contracts at the same time.

2.3 Membership

Any artist who takes employment at a signatory company in a covered position must join the AGMA and must continue to be a member in good standing for the term of the engagement. The Membership Department receives the completed application form from the artist and validates the information provided. Please see Appendix A for the Application for Membership form, also available at http://www.musicalartists.org/membership_general.html

Upon receipt of the applicant's initial year's basic dues payment of \$78 and an arrangement for payment of the \$500 initiation fee, the artist's application information is entered into the system. The legal name, professional name, social security number, gender, primary employment category (Soloist, Chorister, Dancer, Choreographer, Actor, Stage Manager and Stage Director), date of birth, country of citizenship, and date joined are recorded. A unique membership number (MemberID) is automatically assigned to each artist by the system. The StatusID is set to "A" (Active) in the data base and a membership card is created and sent to the new member.

AGMA membership status may be Active, Inactive, Honorary, Life, and Deceased. A member's status may change over time and AGMA needs to track the history of each member's status. Persons who have rendered distinguished service to AGMA or the profession, or persons in sympathy with the objects and purposes of AGMA may be awarded Honorary

Membership with approval of the Board of Governors. Any active member who has served as an Officer and/or a Member of the Board of Governors for no fewer than twelve (12) years, or any member who in the opinion of the Board of Governors has performed a qualifying distinguished service to AGMA, is entitled to Life Member status. Former Active members who are no longer working in the field and who do not pay the annual basic dues are coded as Inactive. Only members having a status of Active or Life are permitted to vote in AGMA elections and contract ratifications.

Area Code	Area Name	States
01	New York	Connecticut, New Jersey (Northern), New York, and Outside the United States
02	Southern California	Arizona, California (Southern), Hawaii and New Mexico
03	Chicago/Midwest	Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota and Wisconsin
04	San Francisco	California (Northern), Colorado, Nevada and Utah
05	New Orleans	Alabama, Arkansas, Louisiana, Mississippi and Tennessee
06	Philadelphia	New Jersey (Southern) and Pennsylvania (Eastern)
07	Washington /Baltimore	Delaware, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, Washington D.C. and West Virginia
08	Pittsburgh	Pennsylvania (Western)
09	New England	Maine, Massachusetts, New Hampshire, Rhode Island and Vermont
10	Texas Area	Texas and Oklahoma
11	Northwest	Alaska, Idaho, Montana, Oregon, Washington and Wyoming

Table 1: AGMA Regional Areas

Artist members may have multiple addresses and AGMA must keep track of address changes, as

well as, the names and contact information for the artist's business manager, agent, or other personal representatives, if any.

AGMA is the smallest of the talent unions which also include American Federation of Television and Radio Artists (AFTRA), Screen Actors Guild (SAG), American Guild of Variety Artists (AGVA), Actors' Equity (AE), and American Federation of Musicians (AFM). AGMA needs to keep track of whether or not one of its members is also affiliated with another talent union. One thing that sets AGMA apart from the other unions is that it doesn't prohibit members from working non-union jobs. This gives a performer the freedom to work in other venues or capacities without limitation.

AGMA members are assigned to a regional Area Code. A member's regional area is determined by their principal residential address unless the member designates a different area based on their pattern of employment. The eleven areas are listed in Table 1.

2.4 Initiation Fee

After an Application for Membership is approved and the new member data is recorded, the Membership Department forwards a copy of the application form, the \$78 basic dues payment and the initiation fee arrangement/payment to the Accounting Department. The Accounting Department creates a Receivable entry for the \$500 initiation fee owed by all new members. Other receivable related information for the entry includes: a unique identification number (ReceivableID), MemberID, date, dollar amount and ReceivableTypeID (with the code "IF" identifying the entry as an initiation fee). The paid-to-date amount is set to zero when the receivable is entered and is updated when an initiation fee payment is received.

Most members include a payment for the initiation fee with their membership application while some defer the initiation fee payment. If the new member's initial contractual compensation is greater than \$2,000, the initiation fee of \$500 is due by the first performance date of the production. If the contractual fee is less than \$2,000, the Artist may pay the initiation fee in installments (partial payments equal to 12.5% of their gross compensation until the balance is paid off. Regardless of the level of compensation, the member must pay off the initiation fee balance within 36 months.

2.5 Basic Dues

The initial payment of \$78 accompanies the copy of the membership application that is sent to the Accounting Department. AGMA members are required to pay this fixed fee of \$78 every year. This is referred to as basic dues. The initial basic dues payment must be submitted before the membership application will be processed. A receivable entry is created by the Accounting Department in a similar fashion to that for the initiation fee but with a `ReceivableTypeID` of "BD" for basic dues. Thereafter, a \$78 invoice for basic dues will be sent to each member on December 1st each year and a receivable entry is created for each invoice. The annual basic fee is due within 31 days (i.e., January 1st). Reminder notices are sent to members who are late or delinquent in paying their basic dues. If an artist joins midyear, they still pay the full \$78 with no proration.

2.6 Percentage Dues

AGMA members must also pay a variable fee, referred to as percentage dues (sometimes also called working dues), amounting to 2% of the first \$100,000 of AGMA covered earnings in a calendar year. The percentage dues are collected through payroll deduction by the signatory companies. The payroll department at each signatory company produces a report or a file that is transmitted to AMGA's Accounting Department along with one check or funds transfer covering the percentage dues withheld from all AGMA members included in that payroll run. The report/file includes the name, social security number, payroll period, gross earnings, and percentage dues withheld for each AGMA member on that payroll run.

2.7 Account Balance

When the member entry is first created, a receivable entry is created with a `ReceivableTypeID` code of "AB" identifying it as an account balance entry. The sum of all monies owed to AGMA from each member is maintained in the amount field of this entry. Also, if a member makes an over payment on any receivable, the excess amount will be allocated to this account balance entry.

2.8 Payment Receipts

When a payment is received from the member for an initiation fee or basic dues is received, the Accounting Department assigns it a unique number (`ReceiptID`) and the following information is recorded in the data base: `MemberID`, receipt date, `PaymentTypeID` (e.g., check, money order, credit card, etc.), payment amount, and

reference number (e.g., fund transfer number, check number, money order number, or credit card confirmation number). The amount of the receipt is then applied/distributed to the open receivable items that are being paid off or having their balance due reduced. The entire payment amount must be distributed exactly in its entirety before the receipt transaction and its distribution are posted.

When processing percentage dues payments received from payroll deductions, the Accounting Department staff creates a receivable entry with `ReceivableTypeID` of "PD" (percentage dues) for each member on that signatory's report indicating the amount of their percentage dues withheld. When the receivable amounts of all reported members are all entered and their sum equals the paid amount of the signatory payroll deduction payment, the linked batch of entries are posted to the related `Receivable`, `Receipt`, and `Distribution` tables simultaneously.

2.9 Board of Governors and Local Area Committees

The Board of Governors, the governing body of AGMA, is responsible for final approval of all contracts, for the management of union funds, and for protecting all members from unfair or unsafe practices and conditions. Active and Life members are eligible to run for Board positions. The Board of Governors consists of 75 general members plus eight National Officers (President, First Vice-President, Second Vice-President, Third Vice-President, Fourth Vice-President, Fifth Vice-President, Recording Secretary and Treasurer). The Board members serve four year terms with half being elected on two year election cycles. Terms commence on June 1st and end four years later on May 31st. The 75 general board members are allocated on a pro rata basis by the percentage of active members in each category in each area. For example, New York dancers get to elect 7 board positions because they constitute approximately 9% of the active national membership. In case of death, resignation, or removal of a member of the Board, a successor shall be appointed by the remaining members of the Board to hold office until the next regularly scheduled election is held.

Area Committees in each geographical area are elected by the active members in that area. Each area committee must have an Area Chairperson and may have additional Area Officers. The election cycles and term lengths are determined by the membership in that area. Additional

standing and ad hoc committees exist at both the national and local levels.

AGMA needs to maintain the composition of current and past Boards, Area Committees, and other committees, as well as the positions/offices held by each person. The start and end date of each member's term, along with the selection method (election or appointment), and the termination date and reason (term expiration, death, resignation, or removal) must be recorded. AGMA uses the information in this table to facilitate communication with committee members, sending email announcing meeting dates, and providing other information pertinent to specific committee members.

3. ASSIGNMENTS

Students should assume the analyst role, working either for AGMA in the Information Technology department or for a consulting firm providing technical support for AGMA. The analyst's specific responsibilities, requirements, and outcomes vary depending on the class and assignments. Examples of assignments based on this case are provided below. Suggested answers for some assignments are provided in a separate document.

3.1 Process Modeling and System Development Assignments

Courses: Systems Analysis and Design, Database Management, Process Modeling and Analysis

Additional Case Information: Currently, AGMA uses an off-the-shelf accounting package for preparing their general ledger and performing accounts payable operations. The rest of the data are stored on paper, word processing files, and/or electronics spreadsheets. As AGMA continues to grow, the current system is not sufficient to keep up with the requirements.

Requirements: As a system analyst, you are assigned to assist AGMA with a task related to acquiring a new computer-based information system. Specifically, you will...

1. Develop a set of functional and technical requirements for the system.
2. Develop a set of system constraints including budget and time limits for system development. Please provide technical as well as organizational assumptions where appropriate.

3. Develop cross-functional flowcharts, i.e. Swimlane Diagrams, depicting the process flow of AGMA operations related to memberships.
4. Determine different alternatives to system development and software acquisition (e.g. off-the-shelf software package, Enterprise Solution software, in-house development, open source software, etc.). Evaluate pros and cons of each approach pertaining to the AGMA requirements and constraints previously discussed.
5. Justify the best approach to the new system development and/or acquisition. Where possible, please conduct research on potential software vendors and include the information as part of the rationale.
6. Develop an action plan for system development including a network diagram and/or Gantt Chart.

3.2 Data Modeling Assignments

Courses: Systems Analysis and Design, Database Management, and Accounting Information Systems

Additional Case Information: Currently, AGMA uses an off-the-shelf accounting package for preparing their general ledger and performing accounts payable operations. The rest of the data are stored on paper, word processing files, and/or electronics spreadsheets. As AGMA continues to grow, the current system is not sufficient to keep up with the requirements.

Requirements: As a system analyst, you are assigned to assist AGMA with a task related to developing a new computer-based information system to support its membership services. Specifically, you will develop...

1. A set of functional and technical requirements for the system.
2. Data Flow Diagrams
3. An Entity-Relationship Diagram
4. A data dictionary
5. A set of relational tables

3.3 Data Analytics Assignments

Courses: Business Analytics, Business Intelligence

Requirements: You are an intern for the Assistant Director of Operations at AGMA. You have attended Board of Directors meetings and become familiar with the values, missions, and strategies of the organization.

AGMA currently consists of 11 regional areas (See Table 1 above). The Board of Directors is interested in learning how the regional offices perform relative to each other with the possibility of reorganization of the regional areas. Using the information from the case regarding data collected from AGMA operations, create reports comparing the regional offices performances. Specifically, you will...

1. Identify key performance indicators that may be used to evaluate the operations of the regional offices.

2. List data fields required for each key performance indicator.
3. Develop templates for reports.

4. REFERENCES

American Guild of Musical Artists. (2016).
Retrieved from
<http://www.musicalartists.org/>

[Print Form](#)

Affiliated with the AFL-CIO, Branch of Associated Actors and Artistes of America

Page 58

SUMMARY OF CONSTITUTIONAL PROVISIONS GOVERNING MEMBERSHIP CLASSIFICATIONS

Classifications

All members shall be divided into nine (9) classes, to wit: Active Solo Members, Active Stage Directors, Active Stage Managers, Active Chorus Members, Active Choreographers, Active Dancers, Honorary Members, Charter Members, and Active Life Members for Distinguished Service to AGMA.

Active Members

All Solo artists, including stage directors, stage managers and all singers and dancers who have performed or who intend to perform for compensation within the jurisdiction of The American Guild of Musical Artists, and who are paid-up members.

INITIATION FEES AND DUES

Initiation Fee

The Initiation Fee is \$500.00.

Partial Initiation Fee: All new members are required to pay the first \$78 Basic Dues within one week of their first contracted rehearsal, or upon submission of their Membership application, whichever comes first. If the contractual fee is greater than \$2,000, the Initiation Fee is due by the contract's first performance date. If the contractual fee is less than \$2,000, the Artist may pay the Initiation Fee in installments (partial payments equal to 12 ½ % of AGMA contractual gross compensation) preferably within one year of application and definitely over a period not to exceed 36 months.

If the Artist is applying for membership without having received an AGMA contract, the Initiation Fee is due in full upon submission of the application.

Dues

Basic Dues in the amount of \$78 are billed annually and are due by January 1.

Working Dues (The Check-Off System): All members working under AGMA Collective Bargaining Agreements will have 2% of the first \$100,000 gross income deducted from their compensation ("Check-Off") and remitted by the employer to AGMA according to the terms of the Collective Bargaining Agreement.

I hereby apply for membership in the AMERICAN GUILD OF MUSICAL ARTISTS, INC., and agree to be bound by each and every provision contained in the constitution of the American Guild of Musical Artists, Inc., by such amendments to said Constitution as may hereafter be made, by any and all Bylaws to said Constitution whether now in force or hereafter enacted, and by any and all rules and regulations adopted by the Board of Governors of the American Guild of Musical Artists, Inc., whether now in force or hereafter amended, enacted, or adopted. I agree that the said amendments, Bylaws, rules and regulations are binding upon me as of the date of their lawfully taking effect, regardless of the rights, if any, vested in me prior to such date.

I hereby authorize the American Guild of Musical Artists, Inc., to be my exclusive agent for collective bargaining purposes in any matter dealing with Opera, Concert, Recital, and Ballet, or in any other matters within the jurisdiction of the American Guild of Musical Artists, Inc.

I affirm that I have truthfully answered the questions on the reverse side hereof.

Signature

Date

Revised 05/29/10

Teaching Case

Accentra Pharmaceuticals: Thrashing Through ERP Systems

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Abstract

Implementing and integrating an Enterprise Resource Planning (ERP) system into an organization is an enormous undertaking that requires substantial cash outlays, time commitments, and skilled IT and business personnel. It requires careful and detailed planning, thorough testing and training, and a change management process that creates a supporting culture. In rare circumstances is a company required to implement an ERP twice in two years. This teaching case documents the business process changes and ERP system related events that occurred to a pharmaceutical manufacturing facility when it was involved in an acquisition; and then, a second acquisition in less than a three year time period.

Keywords: Enterprise resource planning, implementation, change management, business processes, manufacturing

1. INTRODUCTION

As he awoke on a bright winter morning in January, Kyle was worried how the second launch of SAP would impact his line. Just six months prior, his line launched its first commercial batch.

Prior to that, he spent six years preparing the Dual Chambered Pen Packaging line for its debut. Through all the lessons learned and lobbying for more user participation, he wondered if he was about to experience the same result as a year ago.

"Clearly we, as an organization, have learned what not to do this time around, haven't we?" he thought to himself as he grabbed his car keys.

He was exhausted from the amount of time dedicated to this project and he was not sleeping well worrying that things would go awry again. He had little time to dwell on it now, since his drive to work was a short one, but he knew it would be a challenging day. His goal was simple, to get Packaging production up and running as quickly as possible.

2. BACKGROUND

Ten years earlier, Accentra Pharmaceuticals, based out of San Diego, California, committed to building a manufacturing facility in southwest Ohio, to produce a Once-Weekly GLP-1 diabetes therapy. The staff at headquarters numbered around 300 people, comprised mostly of scientists, and research and development personnel. The new manufacturing in Ohio was a mix of a pre-existing building that housed the drug manufacturing processes and a newly constructed building for offices, warehouse, and packaging operations. The underlying manufacturing process is presented in Appendices 2 and 3.

JD Edwards EnterpriseOne was chosen as the Enterprise Resource Planning (ERP) system to track inventory levels throughout the plant (raw bulk material, filling material, inspection, and packaging). Although EnterpriseOne provided additional capabilities, plant operations management decided to handle some processes manually, e.g. order scheduling across the lines. A separate warehouse execution system (WES) was integrated with the ERP to accommodate the fully automated operations. Automatic Guided Vehicles (AGV's) were staged throughout the first floor of the manufacturing building and transported pallets of materials and finished goods in and out of the warehouse racks.

EnterpriseOne was used by multiple departments: Supply Chain, Materials Management, Quality Assurance, Finance and Manufacturing (Bulk, Filling, Packaging). The plant contained hundreds of components, each one having its own dedicated item number in the EnterpriseOne system.

Approximately four years ago, Bio-Science Incorporated (BSI) purchased Accentra Pharmaceuticals. Immediately after, BSI sent a team to assess the current systems and formulate a plan for implementing BSI systems into the

Accentra plant. The following year, BSI announced that SAP would replace EnterpriseOne with a launch date in 16 months.

3. IMPLEMENTATION: TAKE ONE

Work began quickly to identify an Accentra Core Team that would work with BSI. BSI also hired consultants to assist in integrating SAP into the site. The Accentra team consisted of representatives from IT, Finance, Manufacturing, Supply Chain and Quality; these departments represented the bulk of the SAP implementation and where SAP would be used throughout the plant.

Due to operational goals and financial impact, the team was given a deadline to launch SAP on January 1 of the following year (at this point a one year schedule). During the first meeting of the new year, the project manager displayed "The Kübler-Ross Change Curve" for the team to view and discussed the seven phases of change: shock, denial, frustration, depression, experiment, decision and integration (see APP 1). He explained the overall scope of the project and stated that he's observed project teams and key business partners go through these exact stages in the past. During the next break Charlie Berry, a Manufacturing representative on the SAP implementation team, was overheard saying:

"I've been a part of these types of implementations in my previous company, there is no way we'll meet this deadline by the beginning of next year. If we do, it won't be a complete implementation."

The first months were spent seeking information from each of the functional departments impacted by the change to SAP. Daily team meetings were established between the on-site project team and the governing team located at BSI headquarters. The overall schedule was displayed for everyone to see and consisted of high level project tasks. By the end of the first quarter it was expected that all process flow maps would be completed (see APP 2, 3, and 4) and traced between each functional department to know how each process impacted both the manufacturing and support units.

Blank sheets of paper covered the walls of the project room as the team worked to understand all the transactions that would need to be changed in order to provide a total solution come launch time. Slowly through the first three months, the blank sheets were transformed into detailed process flow maps.

In conjunction with the project team, the local IT group assisted the team by sending out monthly emails to the site that communicated project points of contact, key project dates and a high level status of the progress made by the team. As well as transitioning to SAP, the site was also in the midst of an IT architecture change. New hardware (laptops) and software (applications) were being distributed and installed to conform to BSI standards. Many of the applications were completely new to the Accentra group and required education and training for the end users. Needless to say it was a lofty goal for the site to achieve a total transition by the end of one calendar year.

It was expected that by the end of the second quarter that all test scripts would be developed and shared between the off-site SAP programming team and project team so that the scripts could be tested in the third quarter with training in the fourth quarter.

Unfortunately, progress was slow and test scripts were still being developed during the third quarter. Charlie Berry's statement at the beginning of the project was starting to look like reality. As the timeline and status updates were shared among the site personnel, it was apparent that training would be "accelerated," i.e. shortened, in order to meet the deadline. Key testers (end users) were identified in the second quarter, but as of the third quarter, no information had yet been shared between the programmers and end users. The end users did not yet know what the interface would look like or how they would be expected to execute normal batch transactions.

It wasn't until November (mid-fourth quarter) that training was scheduled for each of the departments. Additionally, each department would need to run test batches before the go-live date to flush out any bugs; the last week of December was set aside for each Manufacturing function to test their portion of the system. Staffing was already expected to be low Thanksgiving through Christmas and this would definitely add strain to any chance of success during the testing and cutover tasks.

The green light was given for testing at the start of December. Each department was allotted up to five days of training, but no more. For some departments, they were expected to maintain normal commercial operations during training. Kyle recalled during training that he had no idea what they were being asked to test, no understanding of the new nomenclature and no

link between how the new processes related to the old. The worst part of testing was that when something didn't work, a phone call was made to a group of coders "behind the scenes". They would fix the issue and ask the tester to pass the test script.

Two days into testing Kyle couldn't take it anymore. His boiling point had been exceeded when he was informed that testing was now considered training and that nothing more would be provided to the users. The launch date was not moved, go-live was happening the first week of the new year.

4. IMPLEMENTATION: TAKE TWO

After more than a year of implementing, training, and integrating a new IT architecture into their site; shortly before the SAP go-live date it was announced that the Accentra portfolio of products was being spun-off to another pharmaceutical company. This meant that, after completing implementation of the new SAP system, the site would immediately begin a new project to conform to the new company's software. The site personnel awoke to find a message in their email informing them that BSI was divesting its diabetes portfolio and that BETAPHARM would purchase the Accentra portion of BSI, effective in February of 2014.

The start of the year was absolute chaos. Due to missed requirements and limited functionality of the system at launch, the consulting firm (JOLF Consulting) hired for project management during the prior year was retained to help manage IT services.

Morale among the SAP Users was low and nothing seemed to work as expected. The more knowledgeable SAP users were overheard as saying:

"Even when we know what the problem is and we try to communicate the fix, no one is available to hear our issues."

There was no prioritization of the issues; it was first come, first served with the support staff.

Production was crippled across the plant. Production orders containing the bill of materials of products were incomplete. The user interface to request materials and update inventory, PI (production information) sheets, were not functioning correctly and users were still unsure of how to use the system due to lack of training.

Standard Operating Procedures (SOPs) were useless because the deliverable for identifying and documenting procedures was deemed optional during the implementation process, and so were not completed. Information contained in the documents that did exist was incomplete and had little specific guidance for the technicians to perform the required duties. The SAP process flow that was supposed to be implemented is presented in Appendix 4.

By March, a project manager was identified to lead the new (re-configuration) implementation of SAP. In addition, although the BSI implementation was considered a disaster by many, BETAPHARM retained the services of the JOLF Consulting team; hoping they could leverage their understanding of plant processes and use the lessons learned from the previous year to improve the second ERP project, which was given a target cutover date of January 1 of the following year. This would be a chance to correct mistakes made the prior year and improve some key elements necessary for success.

Geoff Fox was unanimously voted by the Plant Leadership Team to be the face of the SWO (southwest Ohio) site mainly because he had built solid relationships across all the functional departments and for the simple reason that people listened when he spoke.

"I was overjoyed to see that Geoff was put in charge of the second implementation. This will be a tough challenge for him but he has the right demeanor and sense of humor to deal with the ups and downs in a high profile project such as this. I expect better results this time around." – Agnus Manuellson (Coworker)

His first order of business was establishing recurring meetings with each department with a goal of talking to each at least once a month. Tracking document updates and organizing the SAP training program were his other top priorities.

Geoff spent the first quarter of the year rolling out the implementation plan in a series of "town hall" meetings highlighting the organizational structure of the project team, communicating key milestones and preparing each department for the changes they would be responsible for making. Informal discussions throughout the plant highlighted the fact that most departments were operating under incomplete work instructions as a result of the prior implementation. Some departments had no documentation to follow and were trying to follow

the processes in place prior to the implementation. While most found this humorous, the lack of accountability was alarming. Geoff had his work cut out for him.

The following months produced a flurry of high-level and detail oriented meetings. Town hall meetings continued in regular intervals while smaller meetings were established to allow the project team to meet with "super" users from each department. The goal of these meetings was to identify gaps from the previous roll-out and provide more straightforward solutions for executing transactions within each business process. Process flows were reviewed again in detail and unnecessary steps were removed. Within manufacturing there were four basic user interfaces called PI sheets. These PI sheets were built specifically for each department and were meant to capture transactions performed on a daily basis. Transactions such as material produced, pallets used, and tracking movements of component pallets to name a few. These functions were previously grossly over-designed and were too complicated for users to learn and execute.

While these revisions were meant to provide hope, cynical users like Greg Houghton weren't convinced. Greg was observed as a hopeful team player during the meetings, but outside in the hallway he was overheard stating "What faith should I have that they will actually implement what they say they will? We were promised the moon the last go around and we know how that turned out." It wasn't just the normal transactions that required an upgrade, but also the hearts and minds of those damaged by a poorly executed transition the year before.

One morale booster for the general population at the site was the plan to allow all technicians' access to SAP. Previously, access was limited to only a couple of individuals in each department. Because laptops were not provided to each employee, handheld Radio Frequency (RF) units would be purchased to handle the bandwidth of users. Handheld functionality was another sore spot; roll out of these units the prior year was a disaster. Connectivity was weak and users were immediately disconnected after logging in. The network was not able to support use of the handhelds out on the floor and they were eventually shelved in favor of using SAP via the laptop.

The fourth quarter brought the final preparations to the site. Emails and reminders were sent out each day informing everyone what the final

months would look like. The training plan was unveiled which included the courses each user was expected to take to learn how to use the system to do their job. Instructor names and course times were distributed to the departments. Billboards were placed around the plant announcing the location, times, and points of contact for the SAP help room. The experts that designed and coded the system were also going to be on-site two weeks before and after the new launch. On the surface it was a good show, but was it enough for a successful launch?

5. CONCLUSION

The milestones were completed. Kyle was antsy on his short drive to work knowing that they would flip the switch and go-live within the next hour. He arrived to work and booted up his computer. "Now for the first test" he thought. The SAP graphical user interface came to life on his screen. A few hits on the keyboard and....success! He logged in and stared at the numerous transactions. "One hurdle down!" he exclaimed.

The next big test would be the release of the production order. Without this there would be no production. The call came in from planning. "Hey Kyle, it's Tonya. I released the order in SAP, are you able to see it? A few hits on the keyboard and there it was. "Yes Tonya, I can see it. Let me check and see if it downloaded the parts list to our Warehouse Execution System." It was in fact downloaded to WES.

Kyle's crew went through a series of batch startup procedures. It would be another hour or so until they would know the real impact of going live with the new implementation. For the next few hours the glitches and issues reared their ugly head. Users were having issues logging on to their laptops. Connectivity with the laptops was poor. Some buttons in the PI sheet didn't work at all or were coded incorrectly and sent material to

incorrect locations. User instructions were lacking. The first two production batches each took three days longer to process due to the new SAP system.

The saving grace was the accessibility and reaction time of the SAP help room. User access issues were resolved in minutes. Coding issues were resolved within hours. Functionality of the PI sheets hit 100% in about a weeks' time. Other issues such as connectivity and documentation took time to fix and were finally resolved within the first quarter of the new year.

Kyle was pleased with his team's performance and their resolve to recognize and follow through on issue resolution. It wasn't until a week after the second Go-Live that he could sit back and reflect on all that the SWO site had been through in the past few years.

6. DISCUSSION QUESTIONS

What factors influence an IT system implementation?

How can these factors be managed?

How did business process management (re-design) impact this project?

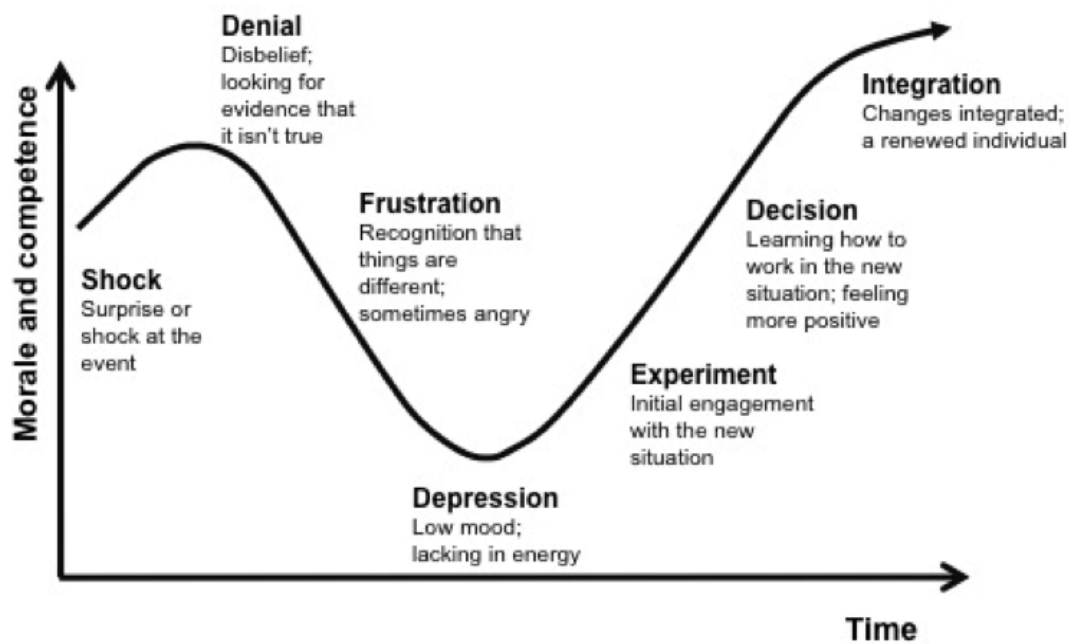
What project management best practices are present in this case? Which are missing?

Create an outline of the action plan you would recommend to ensure a successful IT systems implementation? What do you feel is most important?

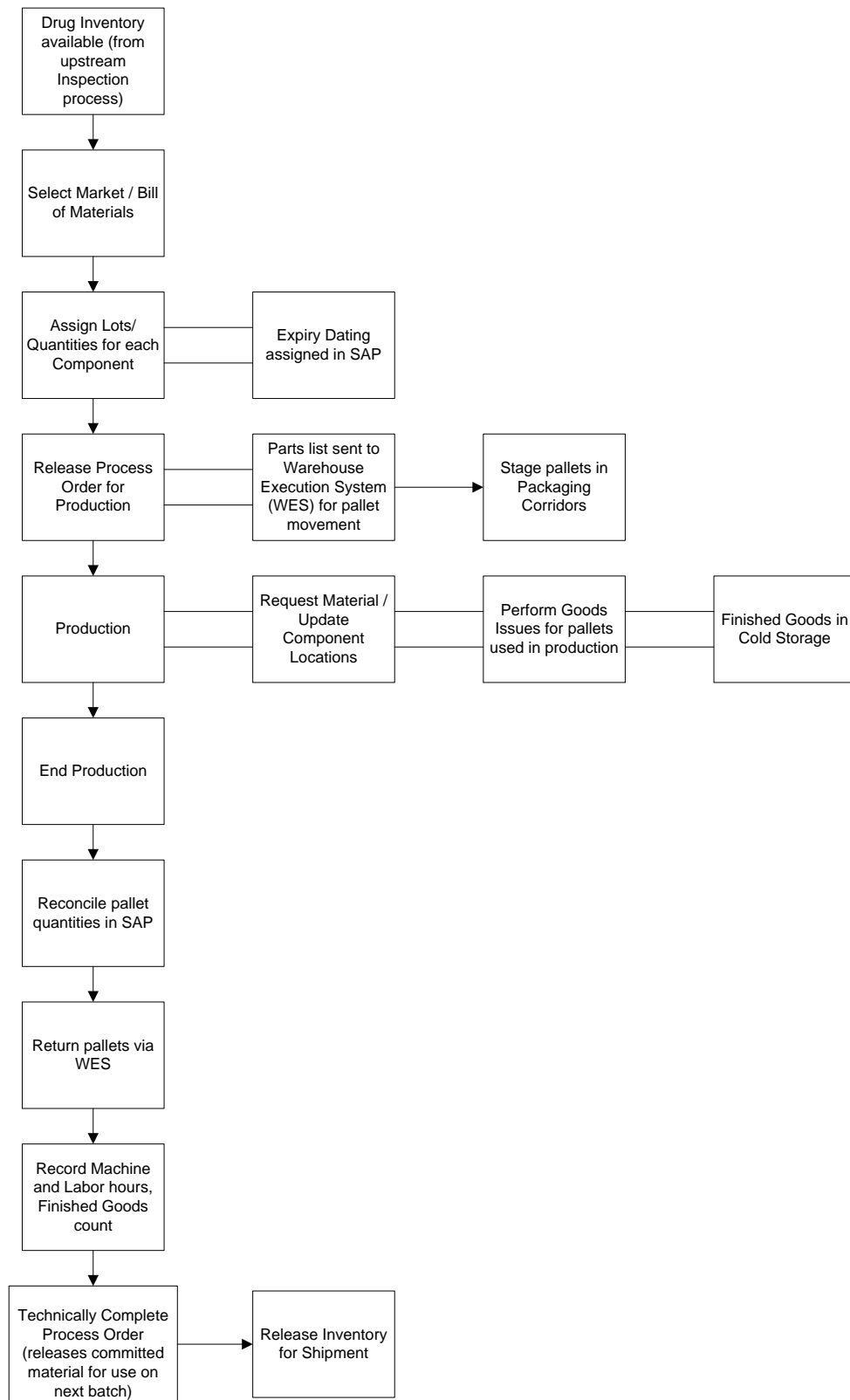
The Kubler-Ross model of changes is presented in Appendix 1. How could this model help explain the events in the case? How could it be used to help improve the chances of a successful system implementation?

APPENDIX 1: The Change Curve

The Kübler-Ross change curve

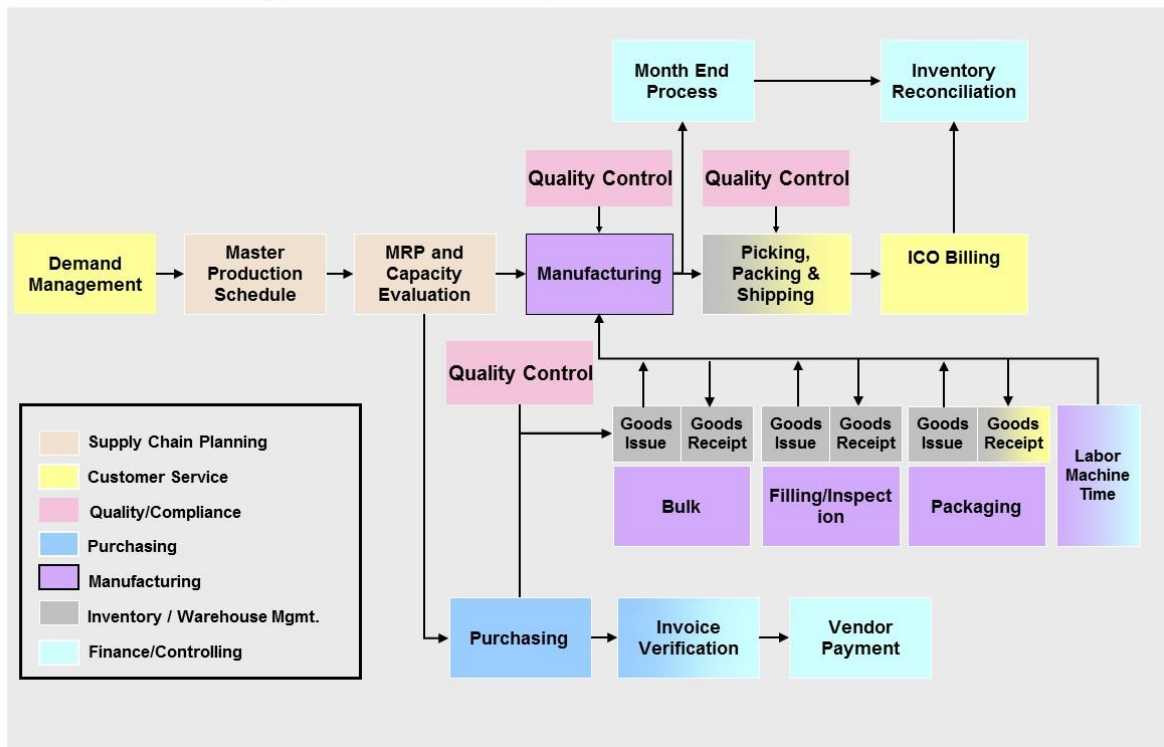


APPENDIX 2: Packaging Process Flow



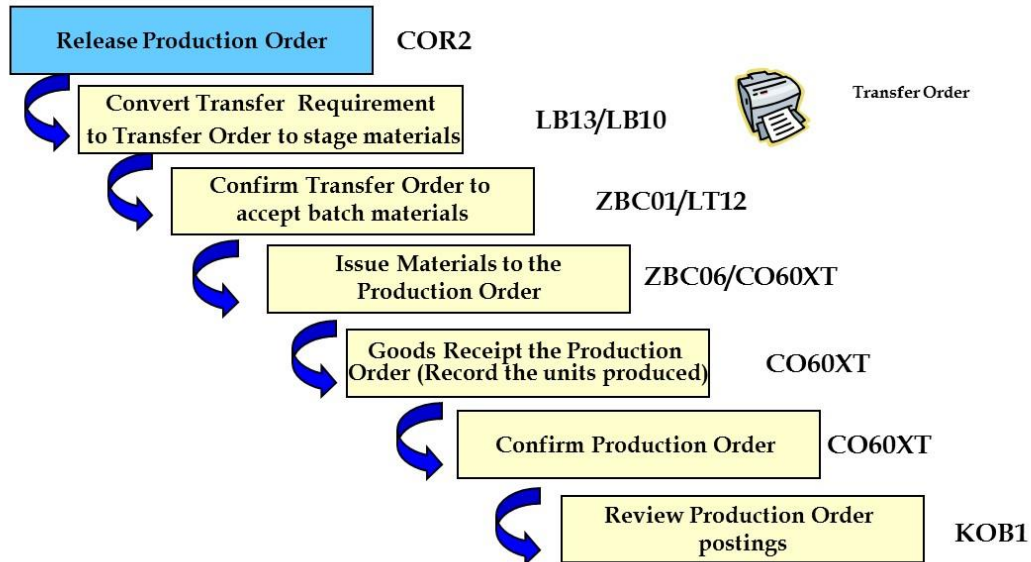
APPENDIX 3: Plant processes

Manufacturing in Overall Integrated Process



APPENDIX 4: SAP Transaction Flow

Material Staging, Manufacturing and Costing



7