Information System for a Volunteer Center:

System Design for Not-For-Profit Organizations with Limited Resources

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EXECUTIVE SUMMARY

This case focuses on the development of information systems for not-for-profit volunteer-based organizations. Specifically, we discuss an information system project for the Volunteer Center of Racine (VCR). This case targets the analysis and design phase of the project using the Unified Modeling Language (UML) methodology, database modeling, and aspects of project management including scope and risk management. Students must decide how to proceed, including recommending an IT solution, managing risk, managing scope, projecting a schedule, and managing personnel. The rewards and special issues involved with systems for not-for-profit organizations will be revealed. This case can be used in a variety of courses, including systems analysis and design, database management systems, and project management.

Keywords: *case study; data dictionary; data modeling; IS project risk management; IS teams; non-profit organization; not-for-profit organization; relationship building; risk assessment; scope management; software design; system life cycle; unified modeling language; university/community partnership*

ORGANIZATIONAL BACKGROUND

Jeff McCoy, project lead of a four-person project team, was finishing requirements and project status documentation related to an information system for the Volunteer Center of Racine (VCR). Jeff, the information systems team, and the client needed to make some important decisions concerning the future of the project. Jeff needed to formulate his own opinion, but it was getting late. He promised his fiancé that they would see a movie at the new cinema tonight. Recently, his promises have gone unfulfilled.

To this point, the VCR project had progressed smoothly. The focus of the project was the development of an application that helped the VCR place and track volunteers at various volunteer opportunities. The development team used the Unified Modeling Language (UML) to document the requirements of the system (Booch et al., 1999). A

Gantt chart and a standardized project status report were used to record progress. The project status report contained fields to record the time, budget, people, process, and technology status of the project (Appendix B). A color code was used in each field: Green meant that the item was on task, yellow indicated concerns, and red signaled a danger. In addition to these fields, the team had an opportunity to specify their confidence in the project. A high score signaled that the project was moving along well and was within budget. The previously filed status reports were all very positive.

Jeff and the other development team members, themselves, were volunteers at the Information Technology Practice Center (ITPC). The ITPC is a consortium of IT professionals from the local university and industry. The ITPC provided consulting services for not-for-profit agencies and small businesses. Some of the consulting engagements, including the VCR engagement, were performed on a pro bono basis. Many of the engagements involved students so that the students could obtain experience with live IT projects. The project status reports were sent to the ITPC executive committee.

Jeff was concerned that the next status report would not be as positive. At the most recent team meeting, several issues emerged. First, the project team disagreed about the quality and adequacy of the UML documentation. Jeff made changes to the documentation produced by some members of the team, and these members took offense. Jeff wondered whether they had captured all of the key requirements and had accounted for these requirements in the project plan. Second, volunteer placement and tracking was not the only need of the VCR. Marilynn, the primary contact at the VCR, also needed a system to track donors and expenses. These additional features were part of the original project scope, but it was not clear whether the IS team could deliver a system with this functionality by the target delivery date in August. Third, other options emerged besides a custom-developed solution, including purchasing an off-the-shelf package. Jeff and the project team needed to recommend a particular approach. Finally, a recent problem emerged regarding the computer network. This problem must be solved before any solution is implemented. Could the team deliver the system within the target timeline?

Client Mission & Organization

The Volunteer Center of Racine (VCR) is a not-for-profit organization located in Racine, WI, a city with a population of 85,000. While it primarily serves the county of Racine, it also services occasional requests from nearby counties. Volunteer organizations have existed in Racine County for a long time, but were not formally managed. That is, it existed as a volunteer organization managed by volunteers, and with no full-time employees on its staff. Since there was no full-time management staff, it was difficult to coordinate activities of the volunteers and obtain the much-needed funds for volunteer activities. VCR emerged as a formal organization only three years ago. Within three years it grew rapidly to list and coordinate thousands of volunteers. It currently has 7,000 active volunteers. An active volunteer is one who has volunteered with VCR in the past 12 months. VCR finds volunteers and places these volunteers at various com-

munity events. The community events range from blood donation drives at hospitals to fund raising ceremonies for causes such as leukemia.

The mission of the VCR is stated on their Web site.

> **Mission:** The Volunteer Center is a:
>
> - ***Leader*** in our community that mobilizes people of all ages and backgrounds to volunteer by investing their resources of time & talent to make a difference in their own lives as well as the lives of those served.
> - ***Catalyst*** for responding to community needs by creating, developing, implementing & supporting volunteer opportunities.
> - ***Connector*** of people & resources with the needs & services in our community.
> - ***Advocate*** for promoting the value of volunteerism.

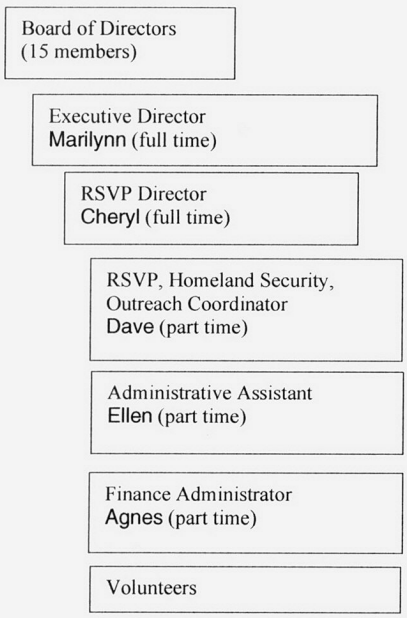
Programs and services offered by VCR include:

1. **Retired & Senior Volunteer Program (RSVP).** This program involves adults, 55 and over. Volunteers use their life experiences and skills to help make the community stronger. These volunteers commonly work with children, adults, or help homeland security activities.
2. **Youth with a Mission.** This program serves several local organizations such as community centers, medical facilities, faith-based organizations, and schools. Volunteers who work in such programs are primarily from the youth population. The program strives to show how the power of community service can make a profound difference in their lives.
3. **Special Projects.** This program provides onetime volunteer opportunities for individuals, co-workers, families, or youth. Example special projects include Earth Day and Make a Difference Day, and walks to raise food to feed the poor and the hungry.
4. **Volunteer Recruitment.** VCR recruits volunteers and matches their interests, skills, and availability to a list of volunteer opportunities from local not-for-profit agencies, organizations, and schools in need of their support.
5. **Volunteer Training.** VCR provides quarterly training meetings for volunteer coordinators of not-for-profit groups and organizations.

Being a small not-for-profit organization funded completely by grants and donations, VCR has a very simple organization structure. It has a board of directors and an executive director. There are other coordinators and support staff as listed below. Marilynn, the Executive Director, believes that it is important that the organizational structure not be seen as a hierarchy. Rather, she pictures the full-time and part-time workers as a team working together to achieve the organization's goals (Figure 1).

VCR receives its funding primarily from federal/state grants, private companies, and individual donors. Its annual budget is approximately $278,000. Federal and state grants account for 65% of the budget. Corporate and private donations account for 27% and 8% respectively. The $278,000 annual budget is allocated to current employ-

Figure 1



ees, facilities, and programs. Additional expenditures, including funding for IT, can only be funded through new grants and donations.

Marilynn, Executive Director, and Cheryl, RSVP Director, are responsible for developing the strategic plan. This plan, as well as progress toward the plan's goals, is discussed with the Board of Directors. Consistent with VCR's mission, the strategic plan identifies activities that will support VCR's mission of finding, encouraging, and placing volunteers. Practically, the plan must also identify grant and other funding opportunities. Successful grant writing is critical to VCR's survival. Over the last year, VCR has focused on operational efficiency. As the size of VCR's volunteer base and opportunities have grown, the task of assigning and tracking volunteers has become more arduous. Success at grants has also resulted in significant administrative work. Grant writing, reports to funding agencies, and submitting reports to the state increasingly occupy Marilynn and Cheryl's time. VCR believed that these tasks could be improved through the use of information technology.

Economic & Organizational Climate

The Wisconsin state budget and the budgets of local businesses, which are primarily manufacturing in nature, were adversely affected by the economy in 2003. These budgets are not expected to improve in the near future. The VCR and other not-for-profit agencies were increasingly under stress to find sources of revenue. Although the VCR has been successful in obtaining grants, the smaller pool of available funds is an ongoing concern.

As a result of the shrinking pool of money and their growth, Marilynn and Cheryl were eager to improve the operations of VCR. They met regularly with the ITPC group and were very appreciative of their efforts to date. Marilynn and Cheryl's support helped to motivate the other staff. In October, seven of VCR's employees and volunteers met with the ITPC group to discuss the features of the new information system.

SETTING THE STAGE

Project Team

The IS project team is composed of Jeff McCoy, Lyndsay Nash, Rick Harrington, Judy Taft, Bob Ferguson, and Zoya Alvi. Zoya Alvi is a graduate student in Computer

Information Systems, while the remaining team members are senior students of Management Information Systems. In addition, both Jeff McCoy and Lyndsay Nash work full time for a major pharmaceutical company. Jeff has been with this corporation for more than 11 years, and is currently a senior computer software validation analyst. Lyndsay has been working for the pharmaceutical company for more than six years, and is currently a director's assistant. Just as in any project team, different members of the IS team have different abilities and personalities (Whitten, 2004). Jeff and Lyndsay both handled large-scale, complex projects in the past. Jeff is undoubtedly the most experienced person on the team and Lyndsay's experience is next. Jeff, based on his experience, was designated as the project manager. Jeff, by nature, is a very motivated person and seeks perfection from himself and others around him. Lyndsay is a dynamic, outgoing person who works hard to achieve the tasks at hand; however, she at times is not confident of her abilities, and some times has difficulty presenting even nice deliverables in a positive manner. Rick accomplishes tasks that are assigned to him, but lacks the skills to research an open problem and find solutions for it. Judy has no prior IS project experience, and requires an extensive amount of coaching on how to accomplish tasks in an IS project. Bob and Zoya are very well organized, responsible team members who follow any given task until it is satisfactorily completed. Bob and Zoya are recent additions to the project team.

In terms of capabilities, Jeff is skilled in project management, system analysis, system design, database development, and client-server programming. Lyndsay is skilled in project management, system analysis, and systems documentation. Rick is very comfortable with database development and client-server programming. Bob has expertise in implementation, troubleshooting, and network design. Zoya has expertise in project documentation, database design, client-server, as well as Web programming. Judy is skilled at system analysis and design.

The project team from VCR is primarily composed of Marilynn and Cheryl. Marilynn understands the high-level overview of the VCR operations, while Cheryl knows in detail the inner workings of the current systems and paper-based processes at VCR.

Project Initiation

Early in the project cycle, Jeff and his project team met with Marilynn and others from VCR to initiate the project. The VCR team was not familiar with the System Development Life Cycle (SDLC) for constructing information systems (Dennis, 2002). Jeff and the project team explained the concepts behind SDLC and helped Marilynn create a system request (see Figure 2). Jeff forwarded a blank template of the system request to Marilynn, who then created a first draft. Jeff and Marilynn then sat together and refined the first draft into the system request document shown in Figure 2.

After the system request was developed, Lyndsay and Jeff conducted a feasibility study. The feasibility study focused on economic, technical, and organizational feasibility. Lyndsay and Jeff created extensive documentation to support the summary conclusions indicated.

Figure 2

Date: September 18, 2003

SYSTEM REQUEST

Project Name: Information Systems for the Volunteer Center of Racine

Project Sponsor:
Name: Marilynn Pelky, Executive Director, Volunteer Center of Racine
Department:
Phone: 262-996-9612 Email: volunteer@bizwi.rr.com

Business Need:

VCR currently uses tools such as Excel to maintain information on the volunteers, organizations and the positions that the volunteers fill at different organizations. VCR also uses an older system to keep track of volunteers 55 and older. However, these tools have several limitations and are unable to meet the growing requirements as the number of volunteers, organizations, and the funding agencies grow.

This project is aimed at obtaining a system that keeps track of the myriad pieces of information that VCR needs in a structured and organized database and provides the VCR employees a user-friendly interface to access the information and generate appropriate reports.

Functionality:

The VCR information system will:

- Maintain information on all volunteers in one integrated system.
- Maintain information on stations at which volunteers volunteer their time and the activities of the volunteers
- Maintain information on the donors to the VCR and the donations
- Generate reports for volunteer center management, and donors, which may include government agencies and private foundations
- Maintain and track expenses and budget

In addition, it is expected that all the above functions are integrated in one system with a user-friendly interface so that users with limited exposure to technology can use the system.

Expected Value:
Tangible:

- Because the quality of data on volunteers will improve with the new system, costs such as mailing costs can be reduced. An approximate estimate of this reduction is between $1,000 to $1,500.
- Since the new system will generate reports automatically, it is expected that the time to prepare reports for funding agencies will be reduced by 50%.

Intangible:

- Improved operations which will result in faster matching of volunteers with stations looking for volunteers.
- Improved satisfaction for the volunteers and for the stations.

Special Issues or Constraints:

- The VCR is new to project management methodologies. Hence, there may be a learning curve involved with different phases of the project.
- Since the project is to be carried out by students, ensuring the continuity of the student team is critical for the success of the project.

- **Economic Feasibility:** Based on the current available financial resources from the Volunteer Center, it has been determined that the proposed solution must be relatively inexpensive. Exact numbers were not available from the center; however, indications are that the Center can spend between $500 and $1,000 on this

project. The Volunteer Center is in agreement that the value of this project greatly exceeds the allotted budget, but cannot support a larger budget at this time. Even with this budgetary constraint, the project team believed a solution can be obtained.

- **Technical Feasibility:** With the young technical skills of the project team consisting of senior MIS students, a certain degree of risk appears to be evident. This risk is born out of the uncertainty in the skill-sets of the team (Ward & Chapman, 2003). The project team, however, is working closely with the ITPC members who have significant experience in building large-scale information systems. The faculty resources will guide the student project team in all aspects of the project.
- **Organizational Feasibility:** An analysis of VCR staff indicates all end users are proficient with PCs. In addition, the VCR staff appears to be very open to accepting a new completely electronic system, as the current processes are highly inefficient.

Based on the above analysis, the project team concluded that the project meets the criteria for economic, technical, and organizational feasibility.

The Current System

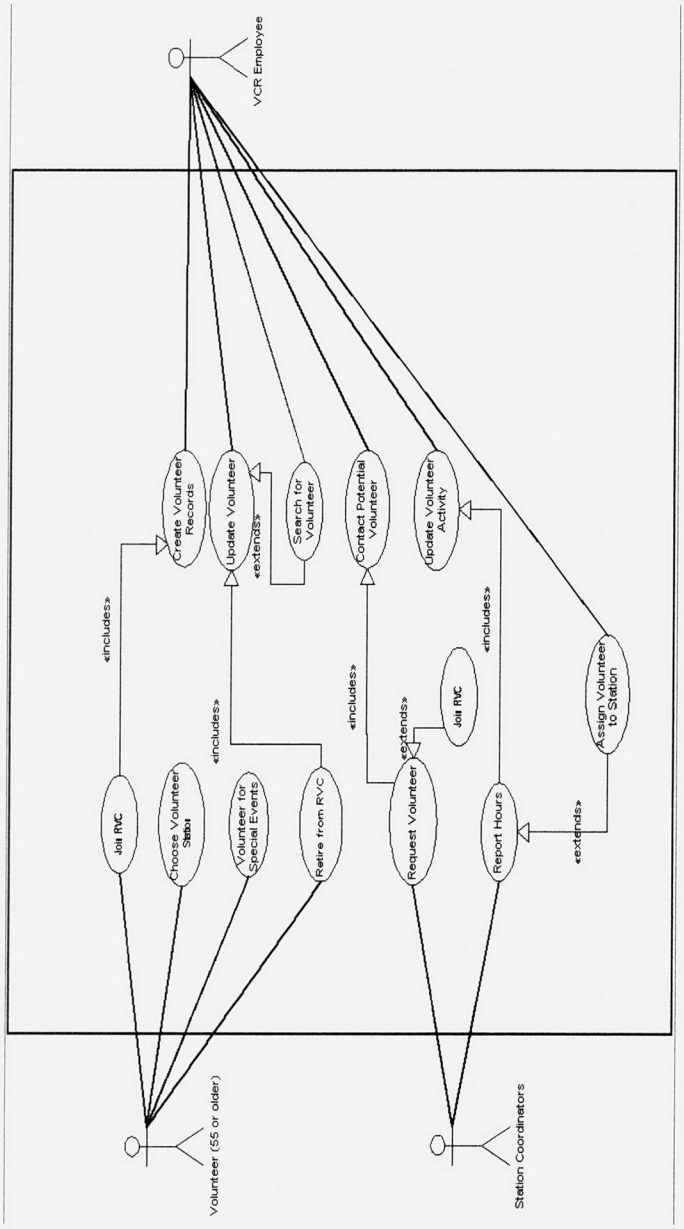
Early in the system development process, the project team reviewed the current information systems at VCR. The VCR maintained and processed four general types of information: payroll, expenses, donors, and volunteer information. Agnes, the Finance Administrator, used a PC-based accounting application to process payroll and record expenses. Donors were recorded in a spreadsheet. Jeff and his team focused most of their time on the volunteer system. Information was manually gathered from each system to produce a variety of reports in preparation of grants and in fulfillment of state and national reporting requirements.

The VCR used terminology that was initially unfamiliar to the team. A **station** is a place where volunteers work by devoting their time and effort. Stations include local hospitals and schools where the volunteers work. A **job** refers to a specific activity that a volunteer performs at a specific station. Example jobs include driving seniors between a nursing home and a hospital or working at the reception desk at a blood-donation center. **Placement** is the process of matching volunteers, depending on their skills and interests, with specific jobs at stations.

Currently, VCR uses an electronic system for maintaining senior volunteers, 55 and older, and their activities under the Retired & Senior Volunteer Program (discussed below). Activities of all other volunteers (younger than 55 years) are maintained using paper processes. Jeff and his team documented the current business processes using UML documentation such as the use case diagram. For a discussion of UML, the reader is referred to Arrington (2001). In addition, Appendix A provides an introduction to UML.

Jeff McCoy, leader of the project team, created the following use-case diagram to illustrate the different activities performed by the current electronic system.

Figure 3. Use Case Diagram for the Current Electronic System



The actors in the above use-case diagram include the following: 55-or-older volunteers, VCR-employees, station-coordinators. The current electronic system maintains information only on volunteers who are 55 or older. These volunteers fill out a paper application form to join VCR, indicate preferences on which station they would like to work, and respond to special-event mailings from VCR via phone or e-mail. In addition,

volunteers can retire from VCR, and this activity is accomplished by phone or e-mail. VCR employees create volunteer records in the current electronic system for new volunteers who are 55 years or older. VCR employees may also update information on existing volunteers, and search for volunteers who might be interested in a specific job at a specific station. In addition, VCR employees may update volunteer activities including the number of hours spent by each volunteer in a job. Station coordinators communicate with VCR employees most often by phone, and they request volunteers for specific jobs at their stations. Station coordinators also communicate the number of hours spent by each volunteer at their stations in specific jobs by filling out a paper form. Most of these activities do not have any predetermined frequency and take place on-demand.

Note that the tasks performed by the volunteer and the station coordinator do not directly involve the current electronic system. However, the information obtained by performing these tasks is entered into the electronic system by the VCR employee.

The use case diagram on the next page was also created by Jeff. This diagram includes all processes not integrated with the current electronic system. Some of the processes indicated in this use-case diagram do not necessarily involve "paper." However, they use manual processes such as using the typewriter or maintaining documents and spreadsheets that are not integrated with the electronic system described in the previous section (Figure 4).

The actors in the above use-case diagram include the following: VCR-employee and the donor.

As part of the "Generate Mailings" use-case, VCR employees prepare word documents announcing opportunities to volunteers and mailing labels in Microsoft Word; they then mail them to volunteers. To accomplish the "Create Reports for Funding Agencies" use-case, VCR employees obtain information on the number of hours spent by volunteers on the electronic system, and type these hours on a report form that the funding agency provides. VCR employees track expenses in a PC-based financial system, while the donations to VCR and the donor information are maintained in a spreadsheet. Information on volunteers younger than 55 is also maintained in a spreadsheet.

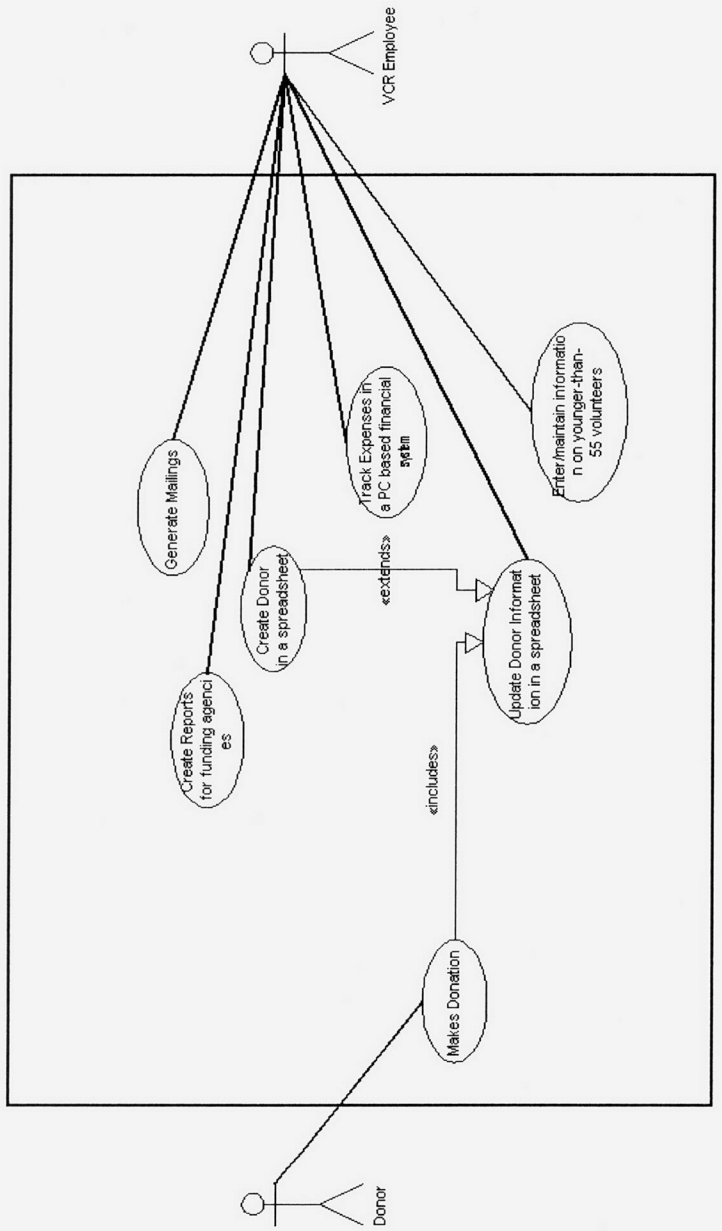
Funding agencies are one source from which VCR gets its support, apart from donations by individual donors. Some of the funding agencies require reports on a regular basis. These reports should include the following pieces of information.

- Volunteer Name
- Station Name
- Station and Job Description
- Hours Worked for the Period

Some of the reports are indicated below.

- United Way Quarterly Report
- RSVP Homeland Security Report
- Wisconsin State Funding Report

Figure 4: Use-Case Diagram for the Current Manual/Paper Processes (not integrated with the current electronic system)



From the above use-case diagram, it is clear that there is no comprehensive system at VCR that keeps track of the expenses, donations, and donors. In addition, volunteers who are younger than 55 are maintained in a spreadsheet.

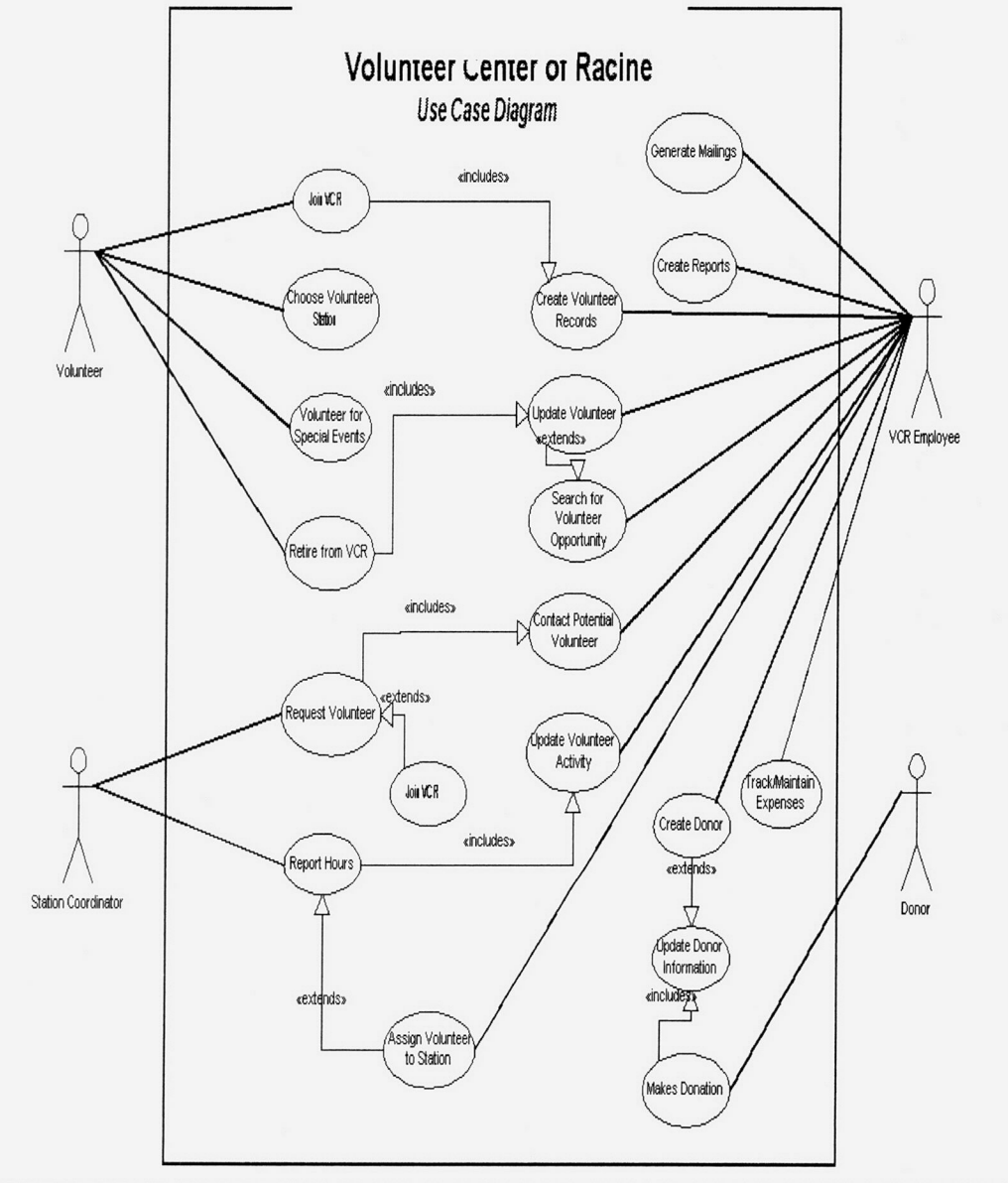
Analysis of the Current System: Problems & Opportunities

Based on their analysis of the current system, Jeff and Lindsay developed a list of the following problems and opportunities for improvement.

- **Problem:** The Volunteer Center is using a hybrid paper and electronic system.
  Opportunity: Combine into one unified electronic system.
- **Problem:** The current electronic system is on one personal computer that holds data only on retired and senior volunteers (those who are 55 and over). Any remaining volunteer categories, such as youth and adult (under 55), are handwritten and entered on an Excel spreadsheet on a separate personal computer.
  Opportunity: Bring all volunteer data into one integrated system.
- **Problem:** The data is entered manually which can lead to input errors and data-integrity issues. For example, the same station names are entered differently at different times.
  Opportunity: Maintain consistent names and categories in the system, and minimize the user-input in the form of free text in the system.
- **Problem:** There is no support offered on the current electronic system. Questions about the operation of the RSVP system go unanswered.
  Opportunity: For the new system, provide support by creating user manuals.
- **Problem:** Reports are manually compiled.
  Opportunity: Improve the productivity of the VCR employees by generating reports required by different funding agencies electronically from the system.
- **Problem:** There are many fields of data required for reports that are currently not included in the system. Some of the fields that are not currently available in the existing system include person's ethnicity, driver's license number, actual number of hours for each volunteer, etc. A discussion with Marilynn revealed that there are at least 50 pieces of data not currently maintained by the system.
  Opportunity: Deliver a system so that it includes all the data needed by VCR.
- **Problem:** Security on the system seems to be non-existent.
  Opportunity: In the new system, provide security at the user level.
- **Problem:** The information cannot be shared with other users.
  Opportunity: Design the new system so that it is at least a client-server system so that users get their data from a centralized location (see Allamraju, 2001; Chalasani & Baldwin, 2003).
- **Problem:** There is no automatic backing-up of data in the current system. In addition, data could be typed over or errors made without proper verification at the time of entry.
  Opportunity: In the new system, arrive at procedures for backing up of data, and minimize the entry of free text by the users.

With these current processes in place, the Volunteer Center has struggled to perform two of its critical business functions. First, the Center has experienced difficulty in finding "best fit" volunteer candidates for stations requesting volunteer resources. As a result, a station requesting a volunteer may encounter situations where a volunteer's skills do not fully meet their needs. Secondly, the Center has encountered difficulty in accurately managing, tracking, and reporting volunteer resources using multiple sys-

Figure 5: Volunteer Center of Racine — Use Case Diagram



tems. Because the Center relies on the volunteer resource reports to procure government funds, a consequence of inaccurate reporting is insufficient funding to the Center.

CASE DESCRIPTION

Jeff and the project team spent a considerable amount of time in the analysis and early design phases of the System Development Life Cycle (SDLC). During this process several standard documents were produced, including use cases, a data model, and a project schedule. In addition, the project team noted other requirements, such as budget requirements, that would impact the choice of alternatives and the ultimate success of the project (Barki, Rivard, & Talbot, 2001). The various tasks required to complete the analysis and early design phases were divided among group members. Once an initial draft of a document was created, Jeff and Lindsay reviewed and integrated the work.

System Requirements

Early on, all parties agreed that the standard way to document the requirements was via use-case diagrams, and by providing details of each use-case (Hoffer, 2002; Prowell & Poore, 2003). After numerous meetings with the VCR team, led by Marilynn, Jeff McCoy, with the help of the IS team, arrived at the following use-case diagram.

All processes, regardless of how they will be implemented, were documented as part of the use-case diagram (McConnell, 1998). There are four primary actors in this use-case diagram: Volunteer, VCR Employee, Station Coordinator, and the Donor. This use-case diagram shows the <<includes>> and <<extends>> relationships. For example, when a station coordinator reports hours, it triggers the "Update Volunteer Activity," and hence there is an <<includes>> relationship between the two activities. Similarly, updating information on a volunteer may cause a VCR employee to search for volunteer opportunities. Hence, there is an <<extends>> relationship between the "Update Volunteer" and "Search for Volunteer Opportunity" use-cases.

Different members of the IS team documented the details of each use-case (Booch, 1999; Krushten, 1999). For example, the "Join VCR" use-case, developed by Lindsay, is detailed in Table 1. It includes key aspects such as the stakeholders, relationships to other use-cases, normal flow of events, and alternate flows. This use-case has three different alternate flows which model three different business scenarios in which a volunteer may join VCR (including enrolling by telephone, finding an enrollment form on the Web, and enrolling at an external recruiting event).

Table 2 indicates the details of the use-case "Create Volunteer Records."

In addition to the use-cases, the project team documented the following high-level requirements for the VCR information system.

(R1) Need to maintain volunteers and their information
(R2) Need to maintain stations at which volunteers volunteer their time and the activities of the volunteers

Table 1

Use-case name: Join VCR	**ID:** 1	**Importance level:** High
Primary actor: Volunteer	**Use case type:** Detailed, Essential	
Stakeholders and interests: Volunteer - Want to volunteer to provide a community service. VCR - Want many volunteers to join VCR.		
Brief description: Volunteer joins VCR and has the ability to volunteer.		
Trigger: Volunteer decides to volunteer at VCR. **Type:** External (event driven)		
Relationships: **Association:** Volunteer, VCR, Enrollment Form **Include:** Use Case: Create Volunteer Records **Extend:** **Generalization:**		
Prerequisites: Volunteer desire to perform volunteer services in the community through the VCR.		
Normal flow of events: 1. Volunteer arrives at VCR. 2. Volunteer inquires about volunteer work. 3. VCR provides enrollment form. 4. Volunteer completes enrollment form. 5. VCR employee accepts enrollment from. 6. Execute: Create Volunteer Records.		
Subflows: (Groups of Subflows should start with a caption that describes the subflow group. The caption should be identified with a label in the following format: S-# (e.g., S-1, S-2))		
Alternate/exceptional flows: 1a-1. Volunteer contacts VCR by telephone. 1a-2. VCR employee invites volunteer to VCR. 1a-3. Proceed to Step 3. 1b-1. Volunteer connects to VCR Web site. 1b-2. Volunteer complete online enrollment form. 1b-3. Volunteer prints copy of enrollment form. 1b-4. Volunteer delivers enrollment form to VCR. 1b-5. Proceed to Step 5. 1c-1. Volunteer completes enrollment form through an external recruiting event. 1c-2. VCR employee delivers enrollment form to VCR. 1c-2. Proceed to Step 5.		

(R3) Need to maintain information on the donors to the RVC and the donations
(R4) Need to generate reports for volunteer center management, and donors, which may include government agencies, private foundations
(R5) Need to maintain and track expenses and budget
(R6) Need to convert/transform current data into the new system, once the new system is built

In addition to the use-cases, the IS team developed a data model to highlight the data requirements of the system. The initial data model was developed by Judy. Part of the ER model (Baldwin & Paradice, 2000) is shown on the next page. The main entity in

Table 2

Use-case name: Create Volunteer Records	**ID:** 2	**Importance level:** High
Primary actor: VCR	**Use-case type:** Detailed, Essential	
Stakeholders and interests: VCR - Wants to have a record of all volunteers.		
Brief description: VCR employee enters the new volunteer information into the system.		
Trigger: New volunteer completes enrollment form. **Type:** External (event driven)		
Relationships: **Association:** VCR **Include:** **Extend:** **Generalization:**		
Prerequisites: Must complete Use-Case: Join Volunteer Center.		
Normal flow of events: 1. VCR employee obtains enrollment form. 2. VCR employee gives enrollment form to Program Manager. 3. VCR Program Manager reviews enrollment from. 4. VCR Program Manager gives enrollment form to VCR employee for entry. 5. VCR employee enters information in the system. 6. VCR employee files hard copy into file cabinet.		
Subflows: (Groups of Subflows should start with a caption that describes the subflow group. The caption should be identified with a label in the following format: S-# (e.g., S-1, S-2))		
Alternate/exceptional flows: 3a-1. Program Manager finds error or incomplete form. 3a-2. Program Manager or VCR employee contact volunteer for accurate information. 3a-3. Proceed to Step 4.		

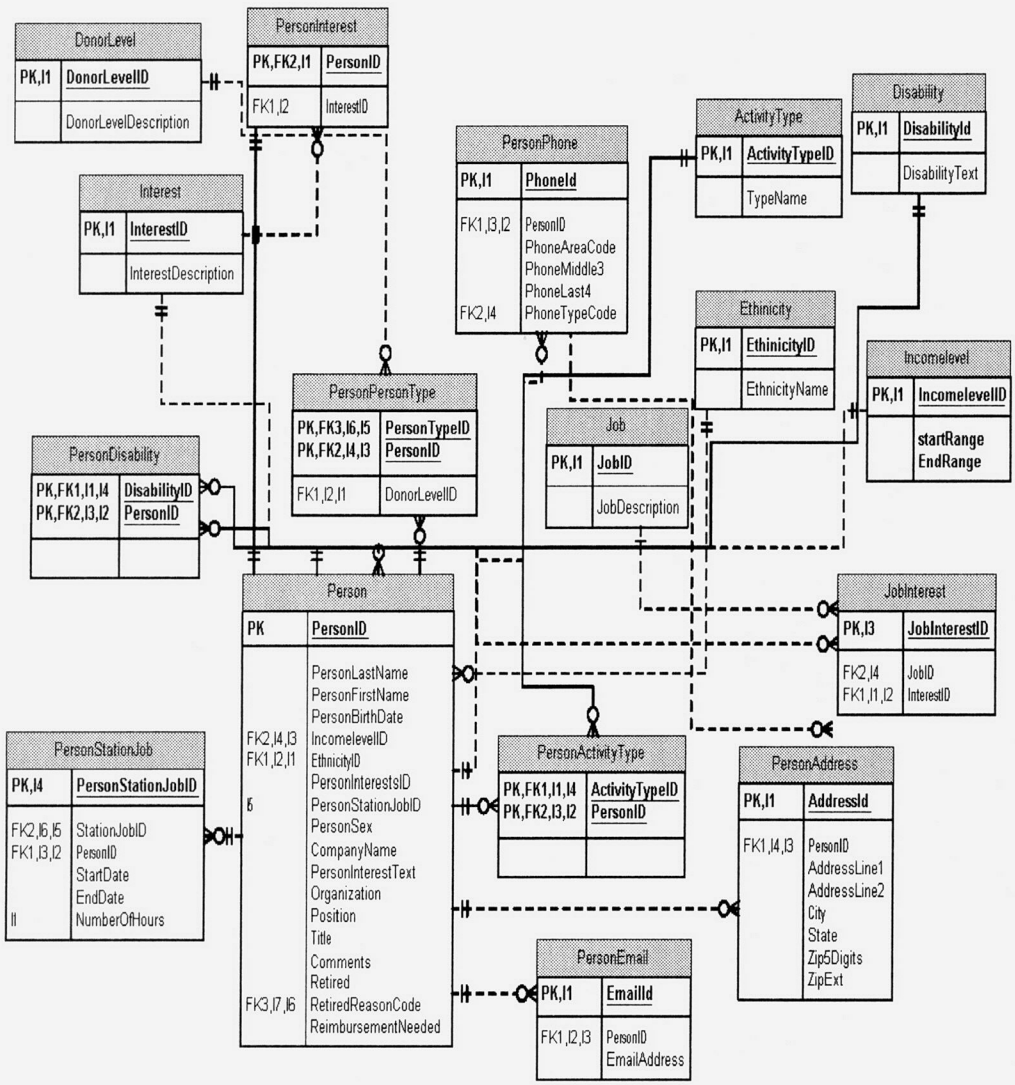
the ER model is the Person entity. Person has many attributes such as name and ethnicity. A person can be of multiple types — "Volunteer," "Donor," "Station Coordinator," and so forth. The type of a person is captured using the PersonType lookup table and PersonPersonType cross-reference table. This model is capable of maintaining multiple addresses, e-mail addresses, and phone numbers for a person. PersonPhone, PersonEmail, PersonAddress are separate entities that capture this data. Since most volunteers are retired and senior volunteers, it is possible that volunteers have some disability that restricts them from certain types of volunteer activities. PersonDisability captures this data, while PersonInterest captures the activities that a volunteer may be interested in (Figure 6).

The entities and the data fields contained in a few example entities are described in Table 3. Judy developed the initial version of the data dictionary (Hoffer, 2002). Jeff modified various entries to correspond to his view of the data requirements.

Special Requirements

Not-for-profit organizations frequently face challenges that may not be faced by for-profit organizations. These challenges most often stem from budgetary and time

Figure 6: A Partial ER Model for the VCR Database System



constraints. For the Volunteer Center of Racine, even though Marilynn and Cheryl were completely committed to the project, they are unable to secure even limited funding to implement the project. For example, purchasing high-end PCs that implement new software is not an option; instead, they depend on local companies to donate equipment such as PCs. In addition, due to budgetary constraints, their current server and PCs are connected by a wireless network. The wireless network itself is supported by Mike Daniels, another volunteer. However, the wireless network is very unreliable with the client PCs losing their connections to the server very often during the day. Thus far,

Table 3

I	Name:	Person
	Type:	Structure
	Alias:	
	Description:	Person is used to model a Volunteer, a Donor, a VCR employee or a Station coordinator
	Fields:	PersonID, PersonLastName, PersonFirstName, PersonBirthDate, IncomeLevelID, EthnicityID, PersonInterestID, PersonStationJobID, PersonSex, CompanyName, PersonInterestText, Organization, Position, Title, Comments, Retired, RetiredReasonCode, ReimbursementNeeded

II	Name:	PersonType
	Type:	Structure
	Alias:	
	Description:	Lookup table containing values for person types (volunteer, donor etc.)
	Fields:	PersonTypeID, TypeName

III	Name:	DonorLevel
	Type:	Structure
	Alias:	
	Description:	Lookup table containing different donor levels depending on their contribution (Gold/Silver/Bronze).
	Fields:	DonorLevelID, DonorLevelDescription

IV	Name:	StationContacts
	Type:	Structure
	Alias:	
	Description:	Information on contact persons for each station is maintained in this entity
	Fields:	StationID, PersonID, PersonTypeID

V	Name:	StationJob
	Type:	Structure
	Alias:	
	Description:	Jobs at any station are maintained here
	Fields:	StationJobID, StationID, JobID, StatoinJobStartDate, StationEndDate, Impact

VI	Name:	Station
	Type:	Structure
	Alias:	
	Description:	Maintains information on a station
	Fields:	StationID, StationName, StationTypeID, GroupAffiliationID, Contract Date

Mike has not been able to spend enough time to come up with a solution to the network problem. Jeff and the project team are confident that they can implement a wired network for the VCR under a budget of $500. However, funding for this has not yet been secured. Such problems are routine in a non-profit organization, and cause dependencies that may affect the project schedules and project timelines significantly.

Another requirement for the project is that it should be completed by August so that Cheryl and others at the volunteer center can start using the system for numerous fall volunteer activities. In addition, implementing the new system in August will also facilitate creation of the year-end reports needed by the funding agencies using this new system.

Proposed Designs

Jeff and Rick arrived at four alternative solutions for the Volunteer Center Project. They presented these alternatives to the IS team, which conducted an analysis of the alternatives. Alternatives range from complete off-the-shelf packages to total custom developed system approaches. The identified alternatives and their analyses are presented below.

Alternative #1. Purchase Off-the-Shelf

This alternative would entail the purchase of commercially available off-the-shelf software that meets all the documented requirements. The product would then be used "as-is" with no additional configuring or modifications to meet the special needs of the business.

- **Benefits:** Complete system, reliable/proven system, customer support available
- **Weaknesses:** High cost, proprietary code that cannot be modified easily for future customization or modifications, inability to configure to meet users' needs

Alternative #2. Purchase Configurable

This alternative would entail the purchase of commercially available off-the-shelf software that could be further configured by the user/developer. The product would be modified to meet the special needs of the business.

- **Benefits:** Ability to configure as per requirements, large selection of vendors, availability of customer support
- **Weaknesses:** High cost, special skills needed to configure, limited customer support once configured

Alternative #3. Custom Develop

This alternative would entail the purchasing of no software by the Volunteer Center. All software will be built by the project team to meet the special needs of the business.

- **Benefits:** Low cost, ability to build to meet users' exact needs, standard programming languages can be used (Visual Basic, Java, etc.)
- **Weaknesses:** Special skills needed to build, special skills needed to support, undefined maintenance responsibilities

Alternative #4. Reengineer Existing System

This alternative would entail the reengineering of the existing system in place at the Volunteer Center. This alternative *cannot* be considered, as the existing system is a hybrid comprised of electronic and paper business processes. In addition, the existing electronic system uses proprietary code that is not accessible to the project team. A best

attempt at reengineering would be to contact the software supplier and review current off-the-shelf offerings (the use of Alternative #1). This alternative was not considered further.

As the project team managed by Jeff pondered on the above alternatives, they needed to choose one of the above alternatives in a logical way (Goseva-Popstojanova, 2003). It appeared to Jeff that purchasing an off-the-shelf component (Alternative #1) will require at least $5,000, and may be as high as $15,000. Alternative #2 has similar costs for purchasing the software. In addition, some of these products require customers to sign a multi-year maintenance deal that can run into hundreds of dollars per year. On the other hand, a custom-developed solution (Alternative #3) will require a significant amount of time to be spent in system design and development. The VCR will not have to pay for this alternative, since this will be done by the IS project team on a pro bono basis.

Project Schedule & Remaining Tasks

In order to help determine the viability of the custom-development approach, Jeff and Lindsay decided to sketch a schedule for this alternative. Their high-level schedule is indicated in Table 4.

Even though the Waterfall method has been followed until the design phase, Jeff and the project team decided to use a phased approach that will implement the system in three different phases at the VCR site. The reason to use such a phased approach is to reduce the risk of implementation facing too many implementation problems, and also to incorporate user feedback into the system before the end of the project (Jorgensen 2004).

Approximately 50 screens need to be developed for the VCR information system. In addition, Microsoft SQL server software will be installed and used to maintain the data. The approximate division of effort among team members to accomplish these tasks is shown in Table 5.

Table 4

Phase	Start Date	End Date	Completed?
Planning	09/16/03	10/31/03	Yes
Analysis	11/01/03	03/31/04	Yes
Design	04/01/04	05/15/04	In progress
Implementation (including Development)	05/15/04	07/31/04 Phase #1 - 05/31/04 Phase #2 - 06/30/04 Phase #3 - 07/31/04	Yet to begin
Post Implementation Support		08/2004	Yet to begin

Table 5

Item	Task	Approximate Hours	Person Assigned	Start Date	End Date
1	Development, testing, and implementation of 10 screens	100	Bob Ferguson	5/15/2004	6/30/2004
2	Development, testing, and implementation of 20 screens	200	Zoya Alvi	5/15/2004	7/15/2004
4	Development, testing, and implementation of 20 screens	200	Rick Harrington	5/15/2004	7/15/2004
5	Development of Database in MS SQL Server and Installation of MS SQL Server and Troubleshooting	100	Lyndsay Nahf	4/1/2004	5/15/2004
6	Data Conversion from the current System to the New System	50	Lyndsay Nash	5/1/2004	6/30/2004
7	Creation of Test Plans	75	Lyndsay Nash	4/1/2004	5/15/2004
8	Project Coordination and Management	250	Jeff McCoy	1/10/2004	7/31/2004
9	Post-Implementation Support	75	Yet to be determined	8/1/2004	9/30/2004
	TOTAL	1,050			

CURRENT CHALLENGES/PROBLEMS FACING THE ORGANIZATION

The ITPC offices were quiet by the time Jeff began to fill in the project status report. The tone of the most recent meeting interfered with his ability to think. Jeff's drive for perfection created friction between him and some of his team members who felt belittled by his criticism of their work (Barki & Harwick, 2001). As an instance, when the data model and the data dictionary completed by Judy were substandard, Jeff spent a large amount of time modifying the models. Jeff felt that he needed to provide feedback and, if necessary, complete the task himself in order to obtain satisfactory results. He could not figure out why members of his team had problems with this approach (Radosevich, 1998).

In addition to the personnel issues, several other issues needed to be considered. Should the team recommend purchasing software or custom developing a solution? What risks face the project and how can the risks be mitigated (Ward & Chapman, 2003; Goseva-Popstojanova, 2003)? How might the risks affect the project schedule? Will the project be completed on time? Are there any omissions in the requirements specification? How should the team manage the project scope?

Jeff glanced at this watch, which now read 6:55. "Late movies are always good, fewer people in the theater," he thought.

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APPENDIX A

A Brief Introduction to UML

This section is written by the authors from the information gathered from the references indicated in the references section. Unified Modeling Language (UML) is a language for specifying, visualizing, constructing, and documenting the artifacts of a software system. UML provides a precise notation needed to model software systems. It enables the creation and communication of ideas.

Abstraction. Abstraction means simplification or model of a real-world object or a process or a complex concept. A good abstraction highlights the relevant characteristics and behavior of something that is too complex to understand in its entirety. Abstraction helps us understand how different parts of a larger model interact together. Different interacting parts of a model are referred to as *objects*.

Encapsulation. Encapsulation means that data and behavioral logic are hidden within the object. Abstraction highlights the important aspects of an object, while encapsulation hides the cumbersome internal details of the object. A well-encapsulated object allows other objects to use it without depending on any internal details.

Object. A particular and finite element of a larger model. Examples of an object are indicated below.

- A specific car in a car dealer's inventory system (very concrete object)
- Individual's savings account in a banking system (invisible object)
- A transaction in a banking system (object with a short life)

Objects have *state*, which describes their current condition and characteristics. For example, the car object has some characteristics such as make/model that never change, and other characteristics such as mileage that change over time. Objects have *behavior*, which describes the actions other objects may perform on an object.

For example, the customer object may withdraw/deposit money from/into the bank account object. Logic corresponding to this behavior resides within the object. Similarly, this behavior depends on the state. Each object in the system must be *uniquely identifiable*. There must be one or more characteristics that set each object apart from the other objects. For example, the Vehicle ID Number uniquely distinguishes one car object from another.

Class. A class is a group of objects that have something in common. A class provides an abstraction for the object and a *template* for object creation. It specifies the type of data that the object can hold. It also specifies the type and number of objects that it knows about. For example, a car object may maintain information on one or more previous owners.

An object may have an association with a single object, with a certain number of objects, or with an unlimited number of objects. *Multiplicity* indicates the number of other objects to which a given object is related. There are several different types of relationships between objects. Some of these relationship types are described below.

Dependency Relationship. Dependency is the weakest relationship between objects. An object depends on an object if it has a short-term relationship with the object. A dependent object calls the methods of the other object to obtain services. In the object-oriented world, dependency means that an object may create an object as part of a method, configure it, and pass the object to the calling method as a return value. Or, an object may receive an object as a parameter to a method, use it or modify it, then forget about it when the method ends. For example the cashier object may interact with the customer object to ring up grocery items, a relationship that is inherently short term.

Association Relationship. Association is a long-term relationship between objects. Under association, an object can keep a reference to another object and call the other object's methods, as it needs them. An object may instantiate another object and keep it for future use. In addition, an object may receive an object as a parameter to a configuration method and keep a reference to the object.

Aggregation Relationship. An aggregation relationship indicates that an object is part of a greater whole. The contained object may participate in more than one aggregate relationship, and exists independently of the whole. For example, a developer object may exist on its own, but a project object may consist of multiple developer objects in addition to other objects.

Composition Relationship. An object is owned by a greater whole. The contained object may not participate in more than one composition relationship, and cannot exist independently of the whole. The part is created as part of the creation of the whole and is destroyed when the whole is destroyed. For example, a small gear object may not exist on its own, but should be completely contained as part of the engine object.

Interface. Each interface completely specifies the signature of one or more methods, complete with parameters and return type. An interface captures abstraction, without addressing any implementation details. A class realizes an interface by implementing each method in the interface. Interfaces provide flexibility.

Polymorphism. Polymorphism through inheritance means that more than one class inherits from a base class (extends). Polymorphism through realization means that more than one class can implement an interface (implements). An advantage of polymorphism is the unlimited flexibility it provides. That is, different implementations can be mixed and matched to achieve interesting effects. Another advantage is long-term extensibility. That is, new implementations can be introduced without affecting the code that depends on an interface.

UML enables developers to build a single coherent model that describes a software system from several perspectives. A variety of participants can use the

same model and speak the same language throughout the development process. Some of the diagrams that are developed as part of UML are indicated below.

Use-Case Diagrams. A use-case diagram models all interactions between the user and a system in a single high-level diagram. A use-case diagram allows developers and customers to understand/capture the intent and scope of the system. Use-case diagrams are constructed by finding actors, finding use-cases and the interactions between the actors and the use-cases. In addition to the use-case diagram, often detailed descriptions of each use are constructed.

Class Diagram. A class diagram defines and constrains a group of objects in detail. It shows the state, behavior, and relationships with other objects that are mandated for each object that is instantiated from the class.

Sequence Diagram. A sequence diagram depicts how objects interact with one another to provide functionality corresponding to a single use-case. A sequence diagram indicates the order of the interaction and the order of messages between objects. Sequence diagrams are often constructed based on the following steps:

1. Add the objects that participate in accomplishing the use-case to the sequence diagram.
2. Work forward from the actor, finding behavior and messages between the objects as the use-case functionality is developed.
3. Validate the sequence from the end.

For the purpose of object-oriented analysis, objects are classified into four categories: Entity, LifeCycle, Control, and Boundary objects. These four types of objects are described below. A sequence diagram often depicts the sequence of messages that flow between boundary, control, lifecycle, and entity objects.

Boundary Objects. Boundary objects are useful for presenting information to the actors (users). Boundary objects are identified by examining the relationship between the actors and the use cases. Each actor/use-case pair forms a boundary object.

Control Objects. Control objects provide workflow and session services to other objects.

A high-level message from the boundary object to the control object is converted into a series of messages from the control object to the lifecycle and entity objects. Each use case translates into one control object. Control objects do not encapsulate any business logic; most business logic is delegated to the lifecycle and entity objects.

Entity Objects. Entity objects encapsulate the business data and part of the business logic of the system. Entity objects often have the attributes and the get/set methods that read/modify these attributes. For example, an account is an entity object, and similarly customer is an entity object.

Lifecycle Objects. Often, there is only one lifecycle object for each entity class. The lifecycle object is useful for accumulating and finding different instances of an entity class. Common functions of a lifecycle object include Create, Destroy and

Locate entity objects. Sometimes, lifecycle objects are also referred to as *factory*, *home*, and *container* objects.

APPENDIX B

Sample Project Status Report

PROJECT STATUS REPORT
Reporting Period: 12/02/03
PROJECT: Volunteer Center of Racine
PROJECT SPONSORS: Marilynn Pelky (VCR), Suresh Chalasani, and Dirk Baldwin (UW-Parkside)
PROJECT MANAGER: Jeffery McCoy
PROJECT TEAM: Jeffery McCoy, Rick Harrington, Judy Taft, Lyndsay Nash
SUBJECT MATTER EXPERTS: Marilynn Pelky (VCR), Suresh Chalasani, and Dirk Baldwin (Project Advisors)
PROJECT OVERVIEW: The project is to create a new system for the Racine Volunteer Center. The system should allow for better overall management of past, present, and future volunteers, donors, and businesses/organizations with volunteer needs ("stations"). The system will allow for new volunteers to be entered into the system and their progress to be documented and monitored. The system will also allow for donor information to be stored and updated to be used for miscellaneous purposes, including the reporting of state taxes. Thirdly, the system will allow for a higher quality of management of the stations to better track the needs of the business/organization, providing a higher level of volunteer service. Finally, the system will provide several reports that encompass the above listed processes for better overall documentation and control.

Project Current Status Summary

On Time	On Budget	People	Process	Technology	Confidence
Yellow	Green	Green	Green	Green	10

FOR ANY YELLOW, RED, or CONFIDENCE less than a 5 status identify:

ISSUE	*ACTION PLAN*
Currently there is only one programmer assigned to complete this project. The project requires a project manager and one additional programmer, at minimum.	We have a commitment from one student to join the team as a programmer for next semester. We also have a second potential student looking into joining next semester as well.
We have had a few additional requirements given to us by VCR. We do not anticipate much set-back, however our diagrams, data dictionary, etc. will require updating.	Update the diagrams, use cases, data dictionary ASAP.

Project Summary KEY:

KEY:

On Task	Concerns	Danger
Green	Yellow	Red

Note: Include words Green, Yellow & Red in appropriate cells for B/W printers

Confidence Scale:
1= Project is beyond salvage, cannot to be completed with satisfactory deliverables
3= May be able to complete portions of the project with overruns likely
5= Project still has many unknowns but average risk for completion
7= Project moving well towards completion, adequate resources available
10= Project is virtually a certainty to complete on time, on budget, and to scope

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Dirk Baldwin is an associate professor of management information systems and department chair of business at the University of Wisconsin-Parkside. Professor Baldwin conducts research related to multiple view systems, decision support systems, and document management. He has published in journals such as the Journal of MIS *and* IEEE Transactions on System, Man, and Cybernetics. *He has coauthored books on MS Access. Professor Baldwin is chair of the Information Technology Practice Center and was named Wisconsin Idea Fellow by the University of Wisconsin Board of Regents.*

Jayavel Sounderpandian is professor of quantitative methods at the University of Wisconsin-Parkside. He teaches project management, operations management, business statistics, and a few elective subjects. He has published in Operations Research, Interfaces, Abacus, Journal of Risk and Uncertainty, International Journal of Production Economics, *and several others. He coauthored the book,* Complete Business Statistics *(McGraw-Hill/Irwin). He has won several awards for excellence in research and in teaching. He has 24 years of academic experience and seven years of industry experience. He is a consultant to many businesses in the region, and guides many students to do projects in those businesses.*