

Chapter 4

Systems Analysis

Objectives

- Define systems analysis and relate it to the scope definition, problem analysis, requirements analysis, logical design, and decision analysis phases.
- Describe a number of systems analysis approaches for solving business system problems.
- Describe scope definition, problem analysis, requirements analysis, logical design, and decision analysis phases in terms of information system building blocks.
- Describe scope definition, problem analysis, requirements analysis, logical design, and decision analysis phases in terms of purpose, participants, inputs, outputs, techniques, and steps.
- Identify those chapters in this textbook that can help you learn specific systems analysis tools and techniques.

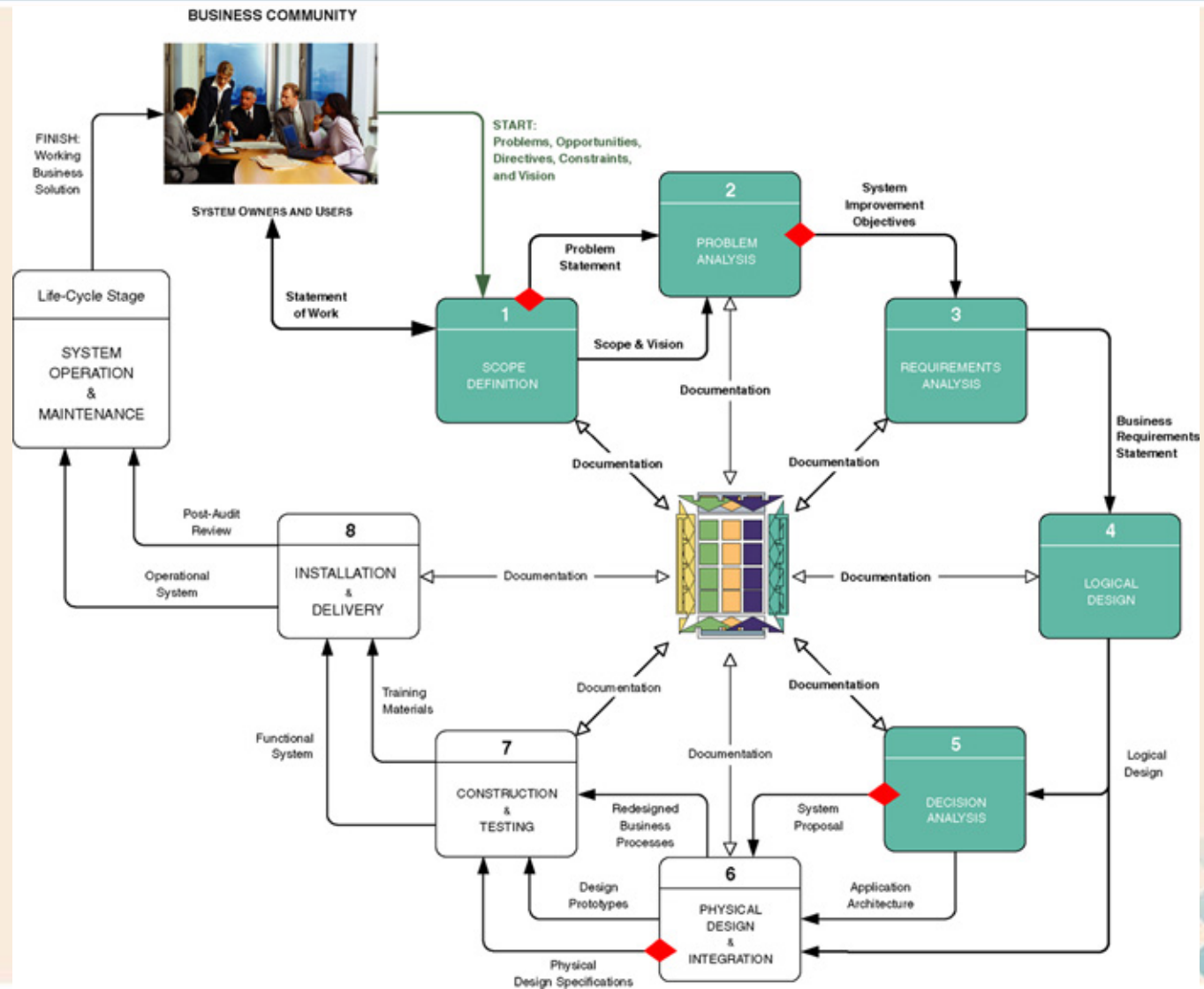
What is Systems Analysis ?

Systems analysis – a problem-solving technique that decomposes a system into its component pieces for the purpose of studying how well those component parts work and interact to accomplish their purpose.

Systems design – a complementary problem-solving technique (to systems analysis) that reassembles a system's component pieces back into a complete system—hopefully, an improved system. This may involve adding, deleting, and changing pieces relative to the original system.

Information systems analysis – those development phases in an information systems development project that primarily focus on the business problem and requirements, independent of any technology that can or will be used to implement a solution to that problem.

Context of Systems Analysis



Repository

Repository – a location (or set of locations) where systems analysts, systems designers, and system builders keep all of the documentation associated with one or more systems or projects.

- Network directory of computer-generated files that contain project correspondence, reports, and data
- CASE tool dictionary or encyclopedia (Chapter 2)
- Printed documentation (binders and system libraries)
- Intranet website interface to the above components

Model-Driven Analysis Methods

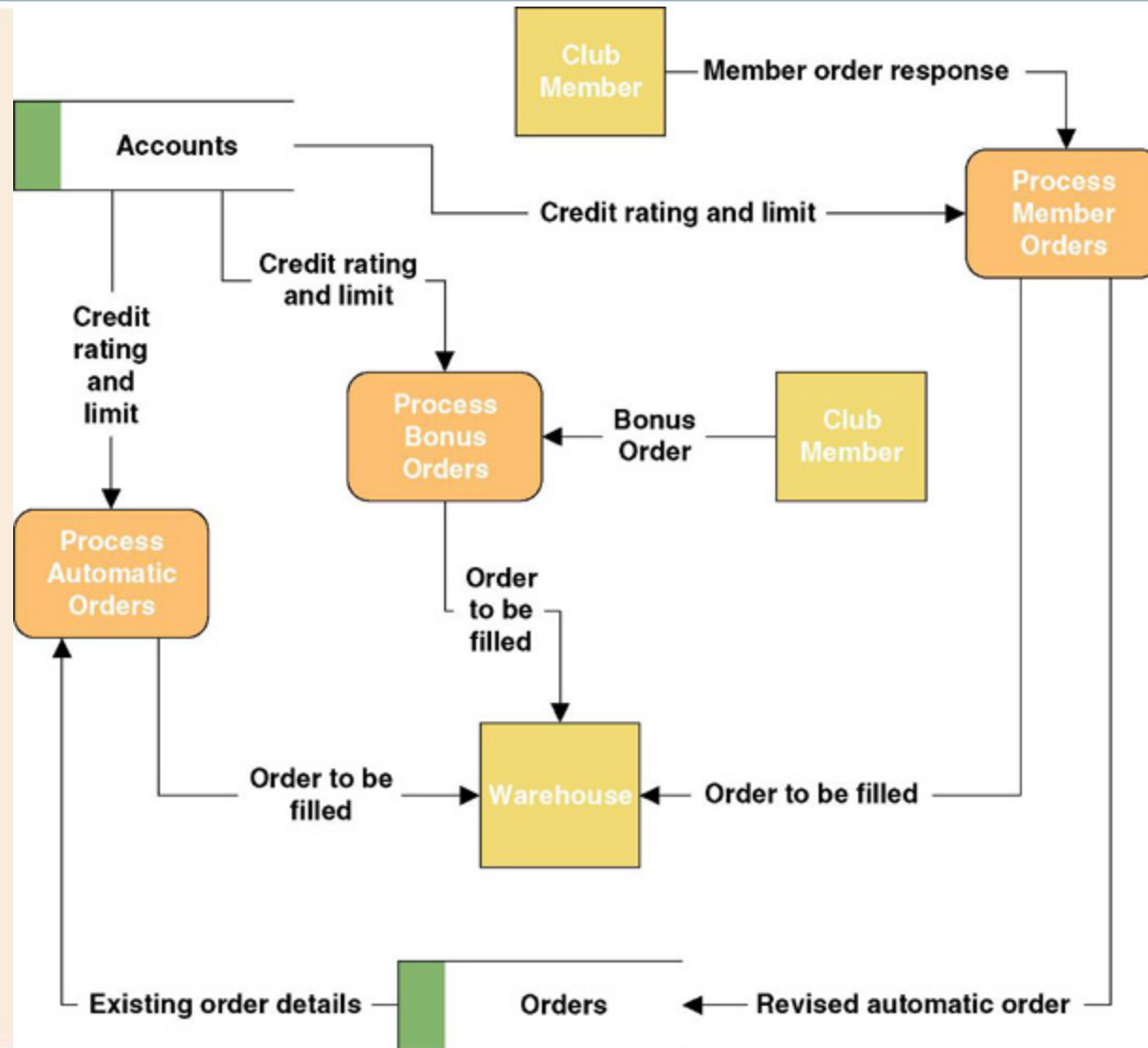
Model-driven analysis – a problem-solving approach that emphasizes the drawing of pictorial system models to document and validate both existing and/or proposed systems. Ultimately, the system model becomes the blueprint for designing and constructing an improved system.

Model – a representation of either reality or vision. Since “a picture is worth a thousand words,” most models use pictures to represent the reality or vision.

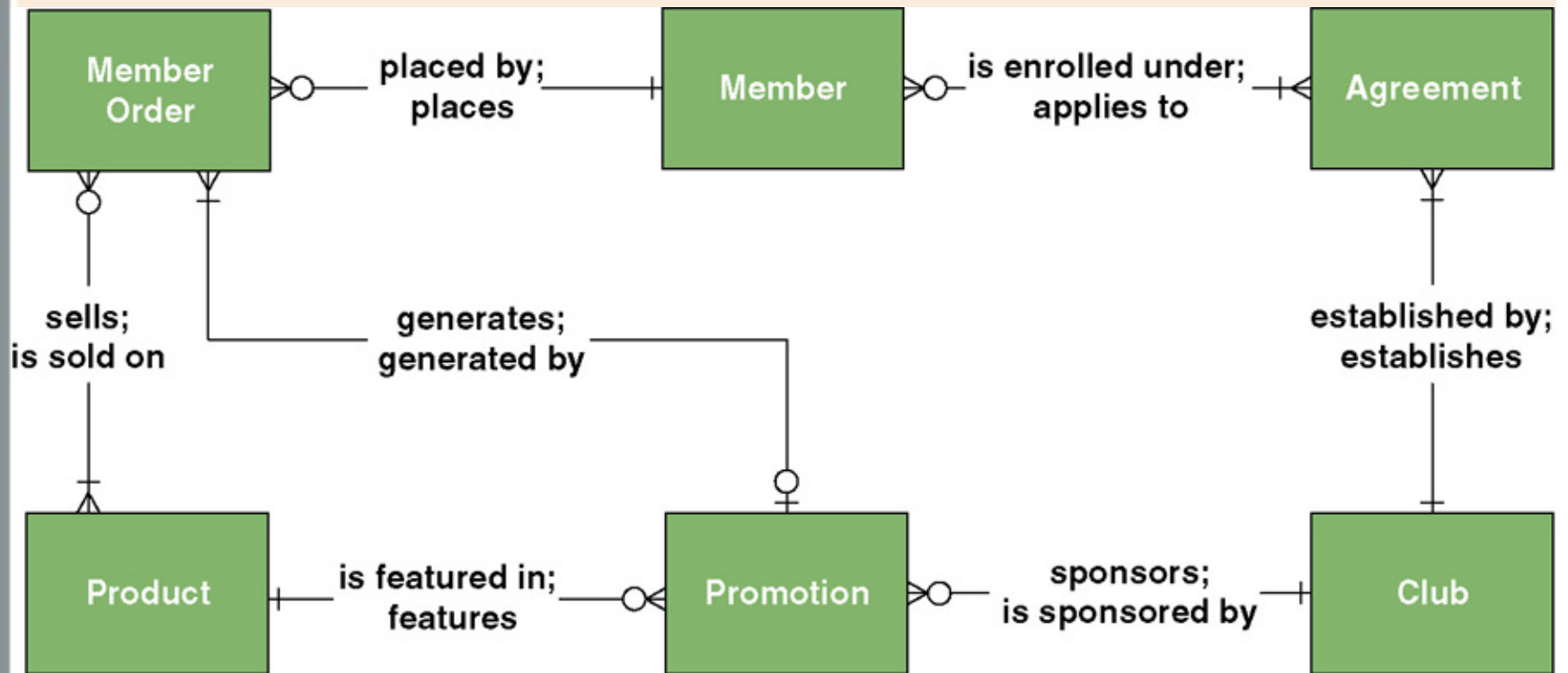
Model-Driven Approaches

- **Traditional Approaches**
 - Structured Analysis
 - Focuses on the flow of data through processes
 - Key model: data flow diagram
 - **Information Engineering**
 - Focuses on structure of stored data
 - Key model: entity relationship diagram
- **Object-Oriented Approach**
 - integrates data and process concerns into objects
 - Object – the encapsulation of the data (called properties) that describes a discrete person, object, place, event, or thing, with all the processes (called methods) that are allowed to use or update the data and properties. The only way to access or update the object's data is to use the object's predefined processes.
 - **Unified Modeling Language (UML)**

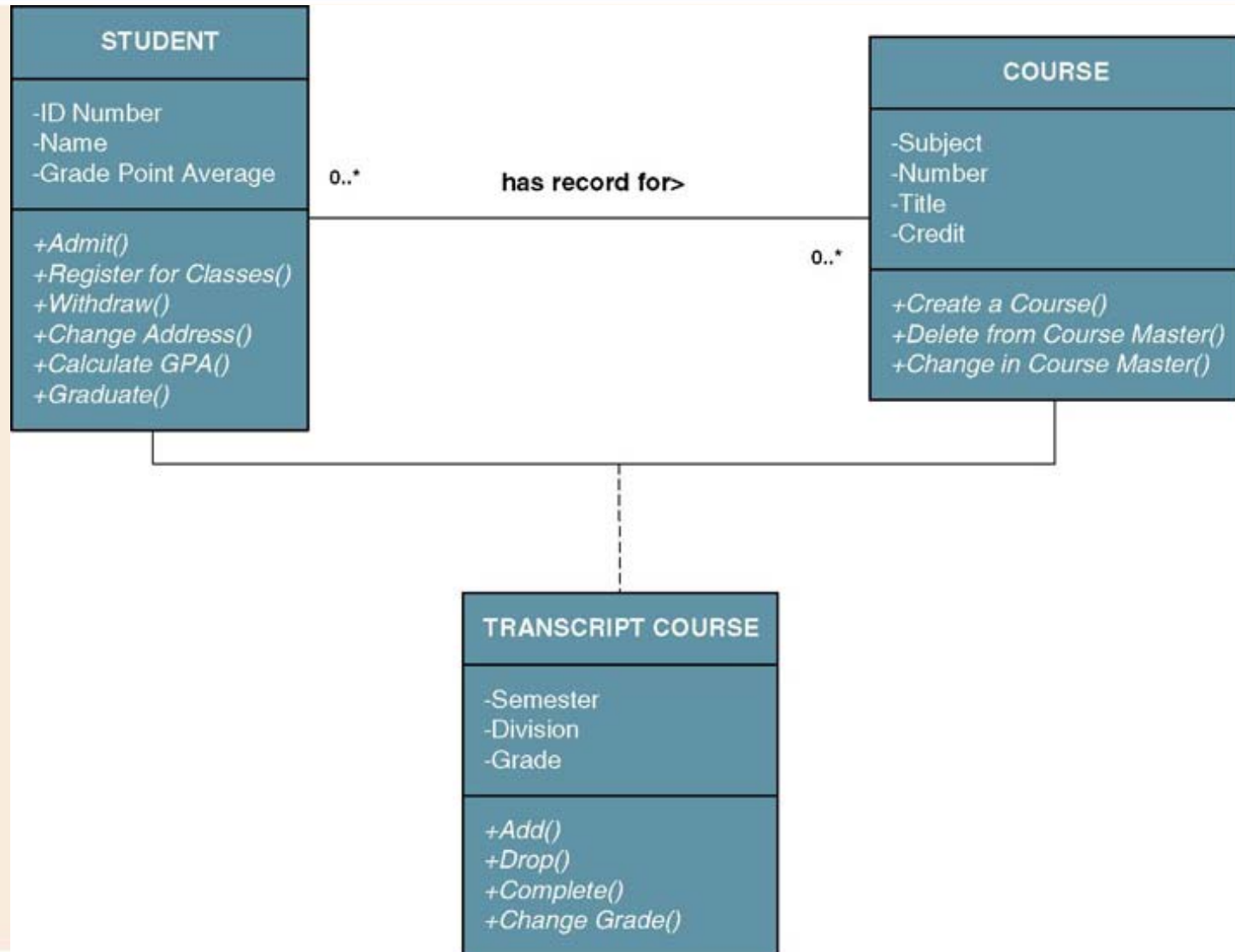
A Simple Process Model



A Simple Data Model



A Simple Object Model



Accelerated Systems Analysis

Accelerated systems analysis

approaches emphasize the construction of prototypes to more rapidly identify business and user requirements for a new system.

Prototype – a small-scale, incomplete, but working sample of a desired system.

- Accelerated systems analysis approaches
 - Discovery Prototyping
 - Rapid Architected Analysis

Discovery Prototyping

Discovery prototyping – a technique used to identify the users' business requirements by having them react to a quick-and-dirty implementation of those requirements.

– Advantages

- Prototypes cater to the “I’ll know what I want when I see it” way of thinking that is characteristic of many users and managers.

– Disadvantages

- Can become preoccupied with final “look and feel” prematurely
- Can encourage a premature focus on, and commitment to, design
- Users can be misled to believe that the completed system can be built rapidly using prototyping tools

Rapid Architected Analysis

Rapid architected analysis – an approach that attempts to derive system models (as described earlier in this section) from existing systems or discovery prototypes.

- **Reverse engineering** – the use of technology that reads the program code for an existing database, application program, and/or user interface and automatically generates the equivalent system model.

Requirements Discovery

Requirements discovery – the process, used by systems analysts of identifying or extracting system problems and solution requirements from the user community.

Requirements Discovery Methods

- **Fact-finding** – the process of collecting information about system problems, opportunities, solution requirements, and priorities.
 - Sampling existing documentation, reports, forms, databases, etc
 - Research of relevant literature
 - Observation of the current system
 - Questionnaires and surveys
 - Interviews
- **Joint requirements planning (JRP)** –use of facilitated workshops to bring together all of the system owners, users, and analysts, and some systems designer and builders to jointly perform systems analysis.
 - Considered a part of a larger method called joint application development (JAD), a more comprehensive application of the JRP techniques to the entire systems development process.

Business Process Redesign

Business process redesign (BPR) – the application of systems analysis methods to the goal of dramatically changing and improving the fundamental business processes of an organization, independent of information technology.

Agile Methods

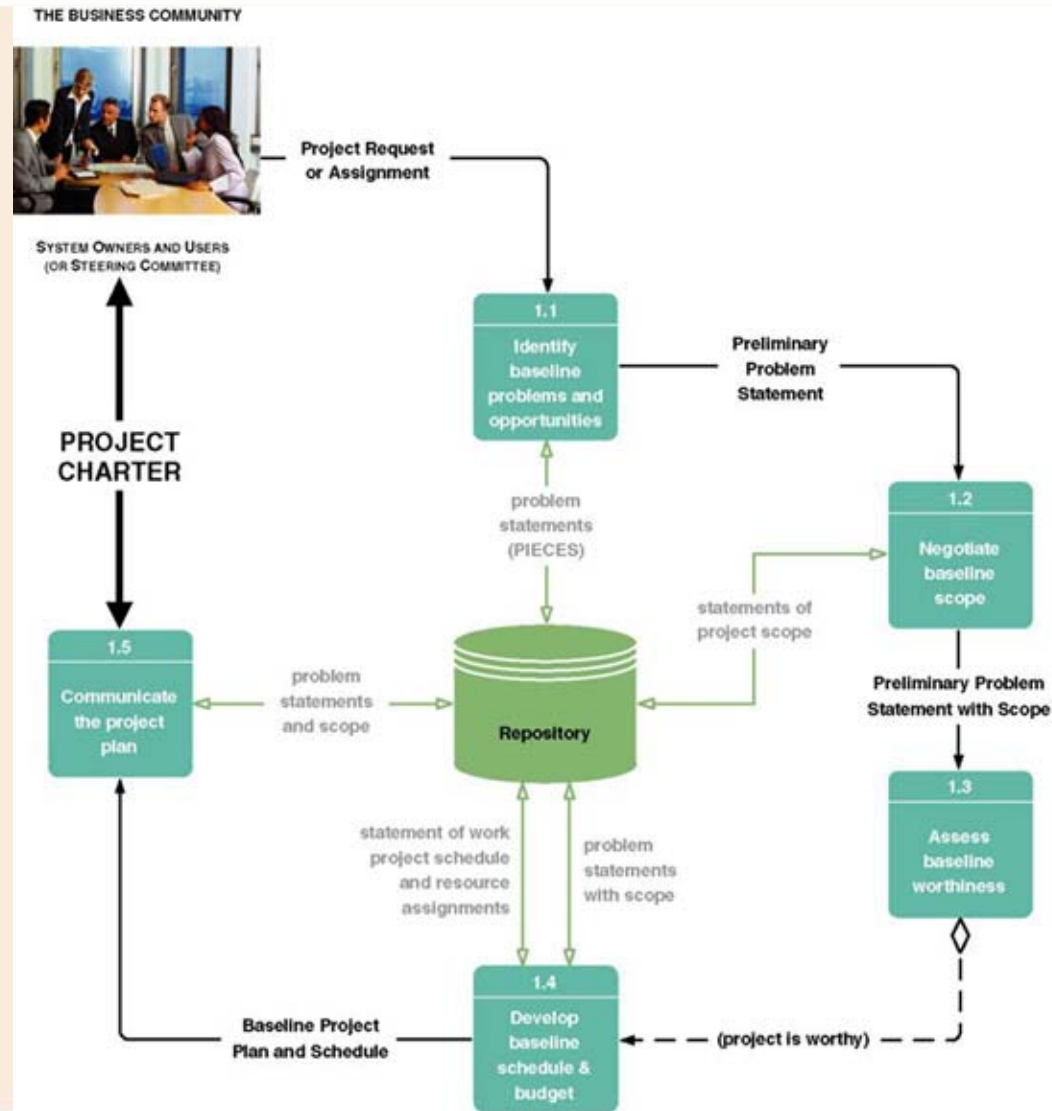
Agile method – integration of various approaches of systems analysis and design for applications as deemed appropriate to problem being solved and the system being developed.

- Most commercial methodologies do not impose a single approach (structured analysis, IE, OOA) on systems analysts.
- Instead, they integrate all popular approaches into a collection of agile methods.
- System developers are given the flexibility to select from a variety of tools and techniques to best accomplish the tasks at hand,
- Hypothetical methodology operates this way.

Systems Analysis Phases

- Scope Definition Phase
 - *Is the project worth looking at?*
- Problem Analysis Phase
 - *Is a new system worth building?*
- Requirements Analysis Phase
 - *What do the users need and want from the new system?*
- Logical Design Phase
 - *What must the new system do?*
- Decision Analysis Phase
 - *What is the best solution?*

Tasks for the Scope Definition Phase



Key Terms for Scope Definition Phase

Steering body – a committee of executive business and system managers that studies and prioritizes competing project proposals to determine which projects will return the most value to the organization and thus should be approved for continues systems development.

- Also called a *steering committee*.

Project charter – the final deliverable for the preliminary investigation phase. A project charter defines the project scope, plan, methodology, standards, and so on.

- Preliminary master plan includes preliminary schedule and resource assignments (also called a *baseline plan*).
- Detailed plan and schedule for completing the next phase of the project.

Sample Request for System Services

 SoundStage Entertainment Club <i>Information System Services</i> Phone: 494-0666 Fax: 494-0999 Internet: http://www.soundstage.com Intranet: http://www.soundstage.com/iss		REQUEST FOR INFORMATION SYSTEM SERVICES	
DATE OF REQUEST January 9, 2003		SERVICE REQUESTED FOR DEPARTMENT(S) Member Services, Warehouse, Shipping	
SUBMITTED BY (key user contact) Name Sarah Hartman Title Business Analyst, Member Services Office B035 Phone 494-0867		EXECUTIVE SPONSOR (funding authority) Name Galen Kirkhoff Title Vice President, Member Services Office G242 Phone 494-1242	
TYPE OF SERVICE REQUESTED: <input type="checkbox"/> Information Strategy Planning <input checked="" type="checkbox"/> Business Process Analysis and Redesign <input checked="" type="checkbox"/> New Application Development <input type="checkbox"/> Other (please specify) _____ <input type="checkbox"/> Existing Application Enhancement <input type="checkbox"/> Existing Application Maintenance (problem fix) <input type="checkbox"/> Not Sure			
BRIEF STATEMENT OF PROBLEM, OPPORTUNITY, OR DIRECTIVE (attach additional documentation as necessary) The information strategy planning group has targeted member services, marketing, and order fulfillment (inclusive of shipping) for business process redesign and integrated application development. Currently serviced by separate information systems, these areas are not well integrated to maximize efficient order services to our members. The current systems are not adaptable to our rapidly changing products and services. In some cases, separate systems exist for similar products and services. Some of these systems were inherited through mergers that expanded our products and services. There also exist several marketing opportunities to increase our presence to our members. One example includes Internet commerce services. Finally, the automatic identification system being developed for the warehouse must fully interoperate with member services.			
BRIEF STATEMENT OF EXPECTED SOLUTION We envision completely new and streamlined business processes that minimize the response time to member orders for products and services. An order shall not be considered fulfilled until it has been received by the member. The new system should provide for expanded club and member flexibility and adaptability of basic business products and services. We envision a system that extends to the desktop computers of both employees and members, with appropriate shared services provided across the network, consistent with the ISS distributed architecture. This is consistent with strategic plans to retire the AS/400 central computer and replace it with servers.			
ACTION (ISS Office Use Only) <input type="checkbox"/> Feasibility assessment approved <input checked="" type="checkbox"/> Feasibility assessment waived <input type="checkbox"/> Request delayed <input type="checkbox"/> Request rejected			
		Assigned to <u>Sandra Shepherd</u> Approved Budget \$ <u>450,000</u> Start Date <u>ASAP</u> Deadline <u>ASAP</u> Backlogged until date: _____ Reason: _____	
Authorized Signatures: <u>Rebecca J. Todd</u> <u>Galen Kirkhoff</u> Chair, ISS Executive Steering Body Project Executive Sponsor			

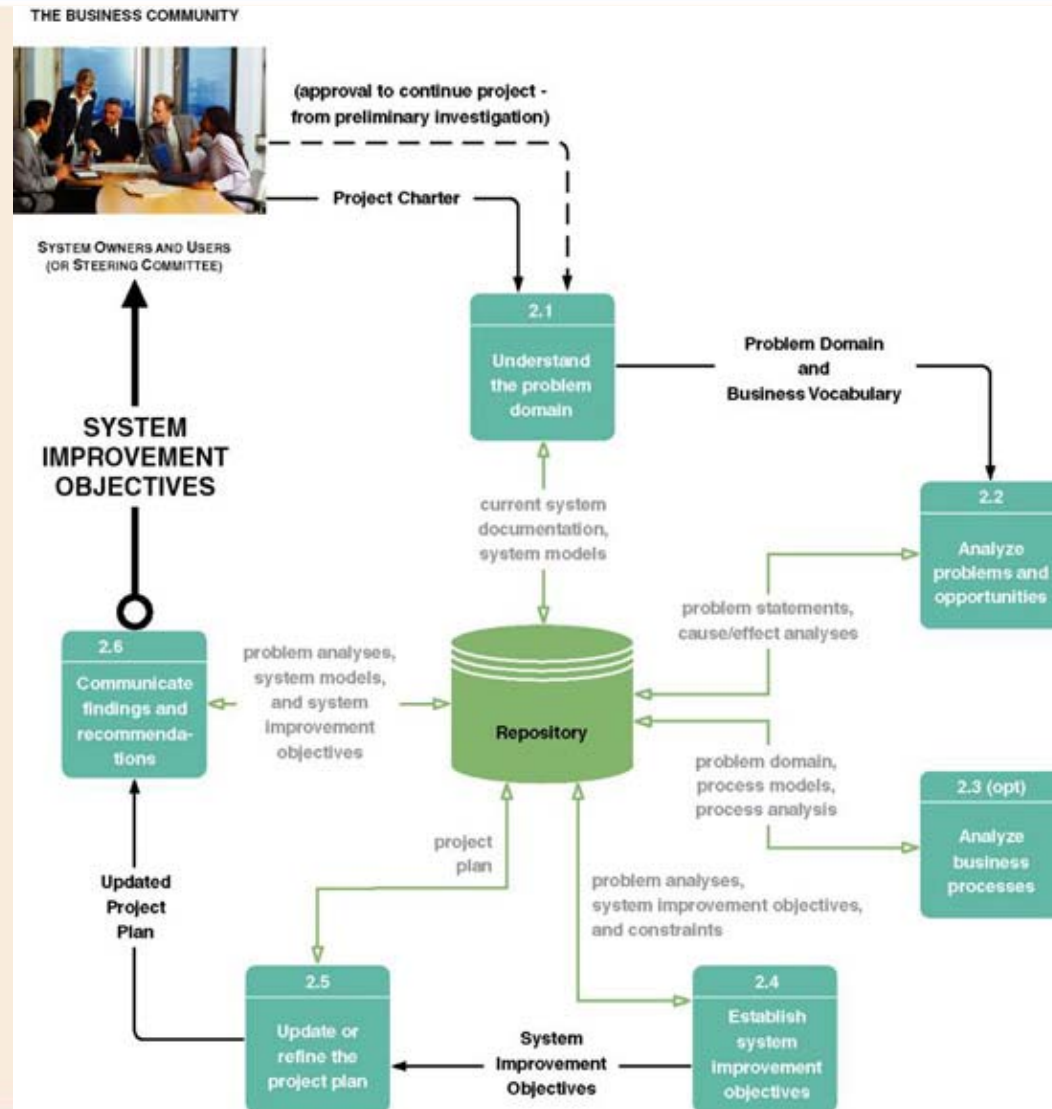
Sample Problem Statements

Problem Statements

Project: Member services information system	Project manager: Sandra Shepherd
Created by: Sandra Shepherd	Last updated by: Robert Martinez
Date created: January 9, 2003	Date last updated: January 15, 2003

Brief Statements of Problem, Opportunity, or Directive	Urgency	Visibility	Annual Benefits	Priority or Rank	Proposed Solution
1. Order response time as measured from time of order receipt to time of customer delivery has increased to an average of 15 days.	ASAP	High	\$175,000	2	New development
2. The recent acquisitions of Private Screenings Video Club and Game-Screen will further stress the throughput requirements for the current system.	6 months	Med	75,000	2	New development
3. Currently, three different order entry systems service the audio, video, and game divisions. Each system is designed to interface with a different warehousing system; therefore, the intent to merge inventory into a single warehouse has been delayed.	6 months	Med	515,000	2	New development
4. There is a general lack of access to management and decision-making information. This will become exasperated by the acquisition of two additional order processing systems (from Private Screenings and Game-Screen)	12 months	Low	15,000	3	After new system is developed, provide users with easy-to-learn and -use reporting tools.

Tasks of the Problem Analysis Phase



Key Terms of the Problem Analysis Phase

Cause-and-effect analysis – a technique in which problems are studied to determine their causes and effects.

In practice, effects can be symptomatic of more deeply rooted problems which, in turn, must be analyzed for causes and effects until the causes and effects do not yield symptoms of other problems.

Context Diagram – a pictorial model that shows how the system interacts with the world around it and specifies in general terms the system inputs and outputs.

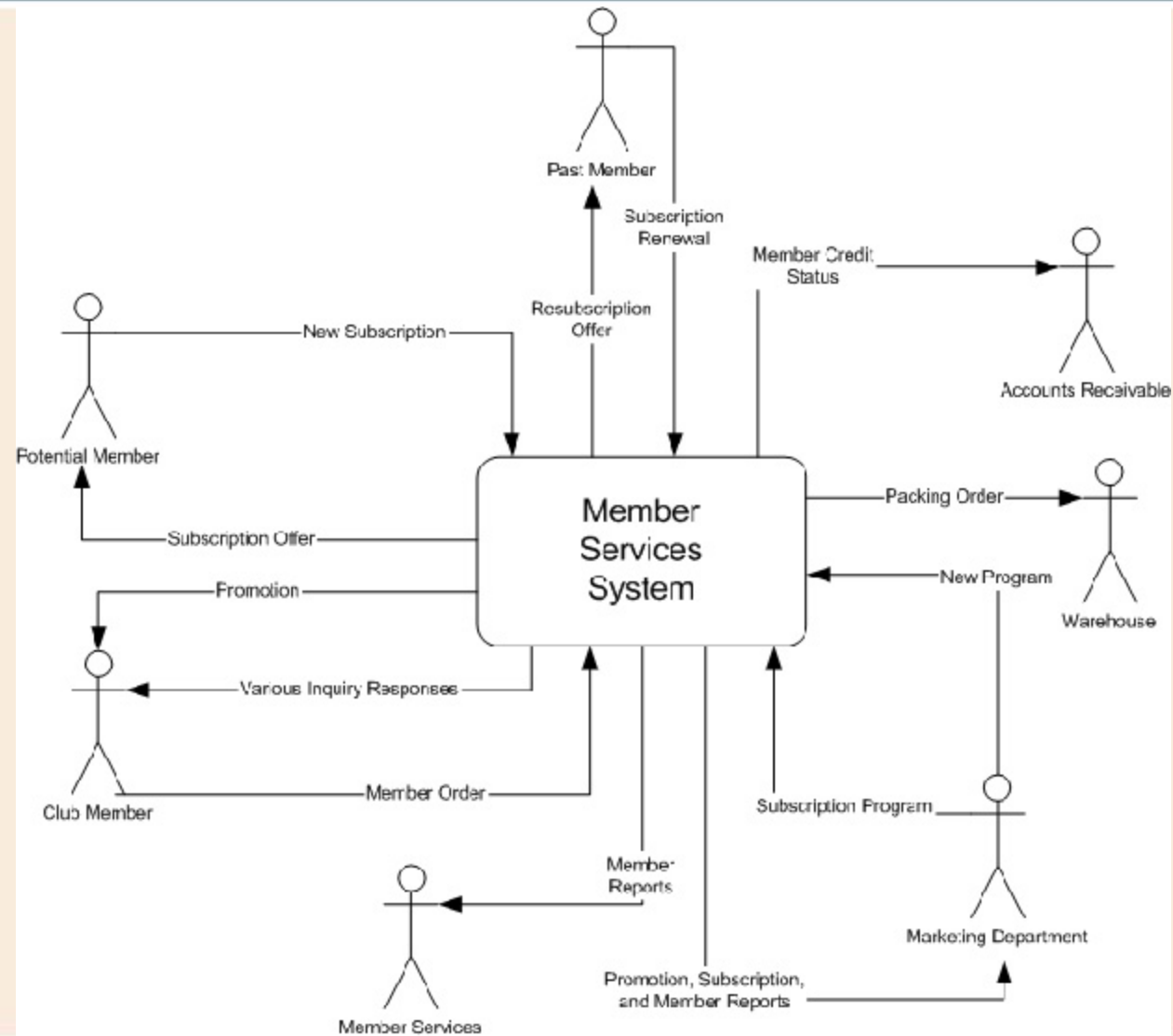
Sample Cause-and-Effect Analysis

PROBLEMS, OPPORTUNITIES, OBJECTIVES, AND CONSTRAINTS MATRIX

Project:	Member Services Information System	Project Manager:	Sandra Shepherd
Created by:	Robert Martinez	Last Updated by:	Robert Martinez
Date Created:	January 21, 2003	Date Last Updated:	January 31, 2003

CAUSE-AND-EFFECT ANALYSIS		SYSTEM IMPROVEMENT OBJECTIVES	
Problem or Opportunity	Causes and Effects	System Objective	System Constraint
1. Order response time is unacceptable.	<ol style="list-style-type: none"> Throughput has increased while number of order clerks was downsized. Time to process a single order has remained relatively constant. System is too keyboard-dependent. Many of the same values are keyed for most orders. Net result is (with the current system) each order takes longer to process than is ideal. Data editing is performed by the AS/400. As that computer has approached its capacity, order edit responses have slowed. Because order clerks are trying to work faster to keep up with the volume, the number of errors has increased. Warehouse picking tickets for orders were never designed to maximize the efficiency of order fillers. As warehouse operations grew, order filling delays were inevitable. 	<ol style="list-style-type: none"> Decrease the time required to process a single order by 30%. Eliminate keyboard data entry for as much as 50% of all orders. For remaining orders, reduce as many key-strokes as possible by replacing keystrokes with point-and-click objects on the computer display screen. Move data editing from a shared computer to the desktop. Replace existing picking tickets with a paperless communication system between member services and the warehouse. 	<ol style="list-style-type: none"> There will be no increase in the order processing workforce. Any system developed must be compatible with the existing Windows 95 desktop standard. New system must be compatible with the already approved automatic identification system (for bar coding).

Sample Context Diagram



Key Terms of the Problem Analysis Phase (cont.)

Objective – a measure of success. It is something that you expect to achieve, if given sufficient resources.

Constraint – something that will limit your flexibility in defining a solution to your objectives. Essentially, constraints cannot be changed.

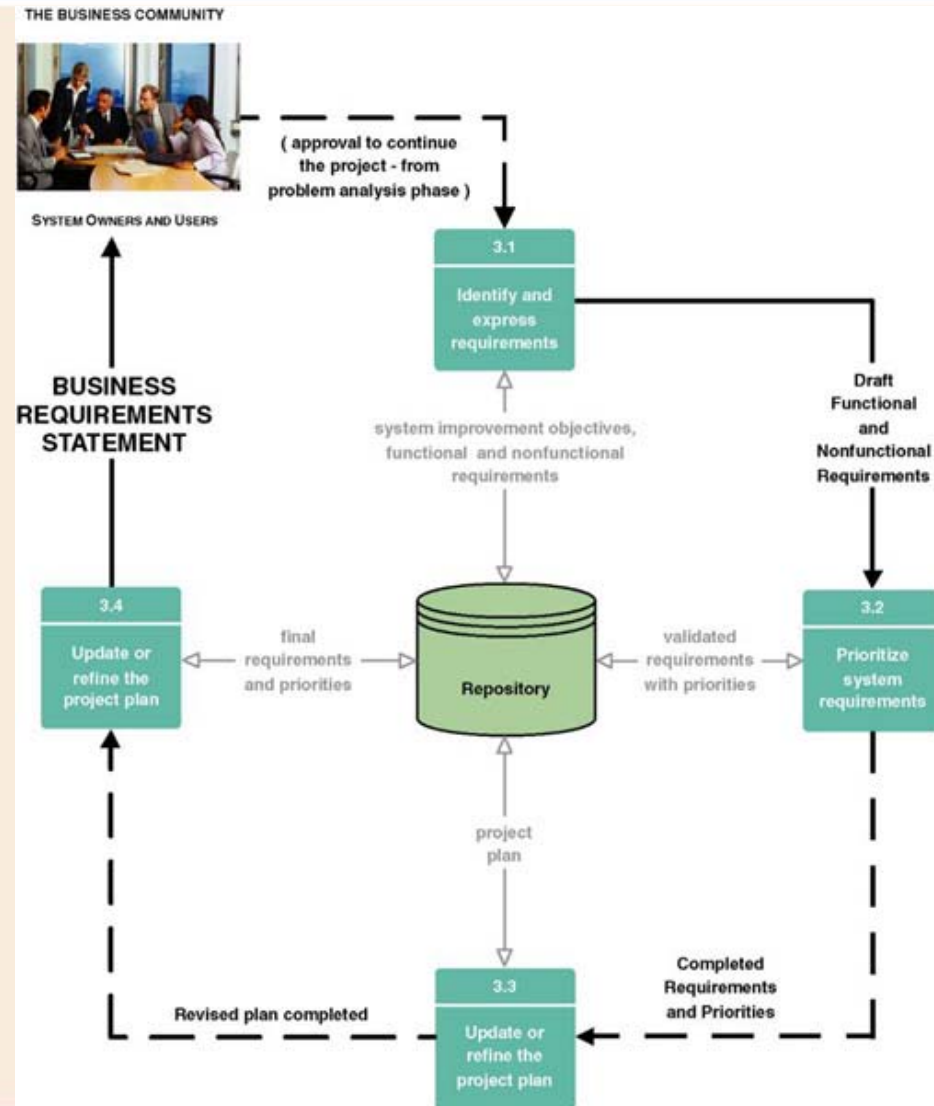
System Improvement Report Outline

- I. Executive summary (approximately 2 pages)
 - A. Summary of recommendation
 - B. Summary of problems, opportunities, and directives
 - C. Brief statement of system improvement objectives
 - D. Brief explanation of report contents
- II. Background information (approximately 2 pages)
 - A. List of interviews and facilitated group meetings conducted
 - B. List of other sources of information that were exploited
 - C. Description of analytical techniques used
- III. Overview of current system (approximately 5 pages)
 - A. Strategic implications (if project is part of or impacts existing IS strategic plan)
 - B. Models of the current system
 - 1. Interface model (showing project scope)
 - 2. Data model (showing project scope)
 - 3. Geographical models (showing project scope)
 - 4. Process model (showing functional decomposition only)

System Improvement Report Outline (cont.)

- IV. Analysis of the current system (approx. 5-10 pages)
 - A. Performance problems, opportunities, cause-effect analysis
 - B. Information problems, opportunities, cause-effect analysis
 - C. Economic problems, opportunities, cause-effect analysis
 - D. Control problems, opportunities, cause-effect analysis
 - E. Efficiency problems, opportunities, cause-effect analysis
 - F. Service problems, opportunities, and cause-effect analysis
- V. Detailed recommendations (approx. 5-10 pages)
 - A. System improvement objectives and priorities
 - B. Constraints
 - C. Project Plan
 - 1. Scope reassessment and refinement
 - 2. Revised master plan
 - 3. Detailed plan for the definition phase
- VI. Appendixes
 - A. Any detailed system models
 - B. Other documents as appropriate

Requirements Analysis Phase Tasks



Key Terms of Requirements Analysis Phase

Functional requirement – a description of activities and services a system must provide.

- inputs, outputs, processes, stored data

Nonfunctional requirement – a description of other features, characteristics, and constraints that define a satisfactory system.

- Performance, ease of learning and use, budgets, deadlines, documentation, security, internal auditing controls

Key Terms of Requirements Analysis Phase (cont.)

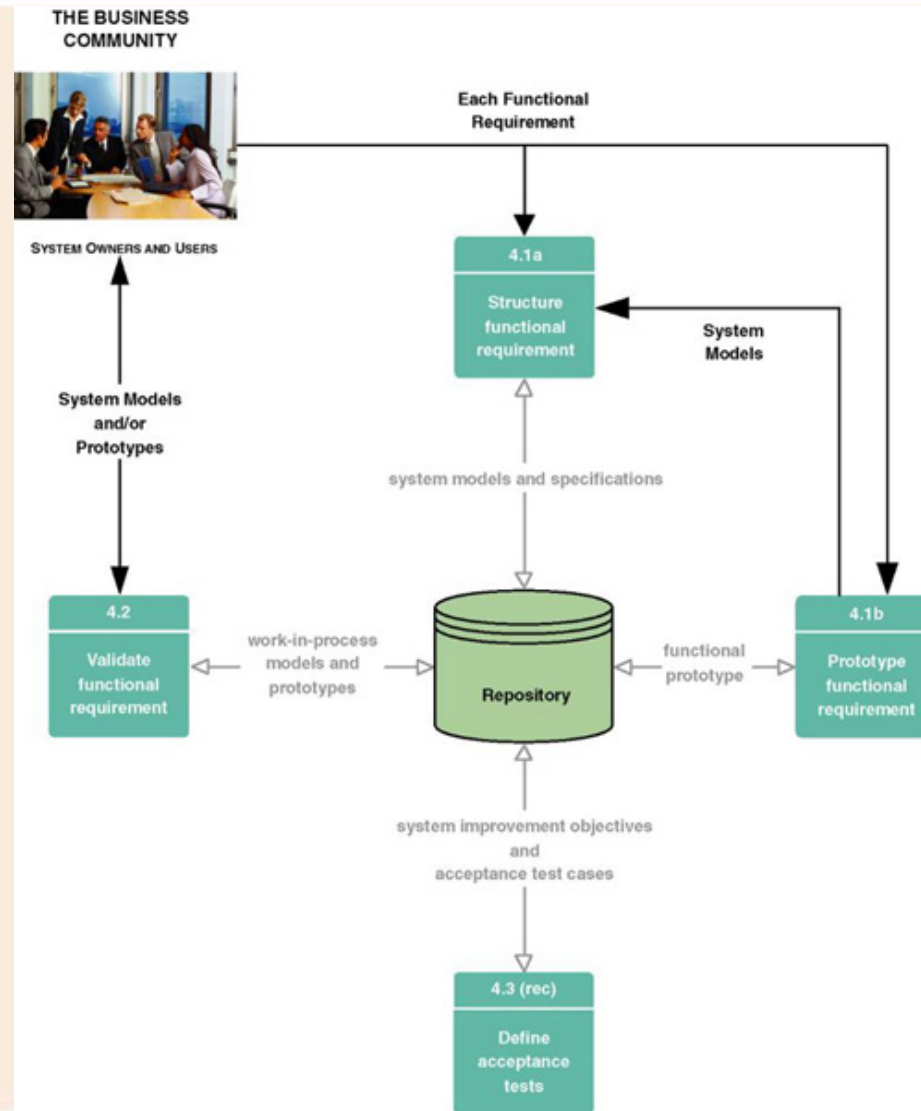
Use case – a business scenario or event for which the system must provide a defined response. Use cases evolved out of object-oriented analysis; however, their use has become common in many other methodologies for systems analysis and design.

Key Terms of Requirements Analysis Phase (cont.)

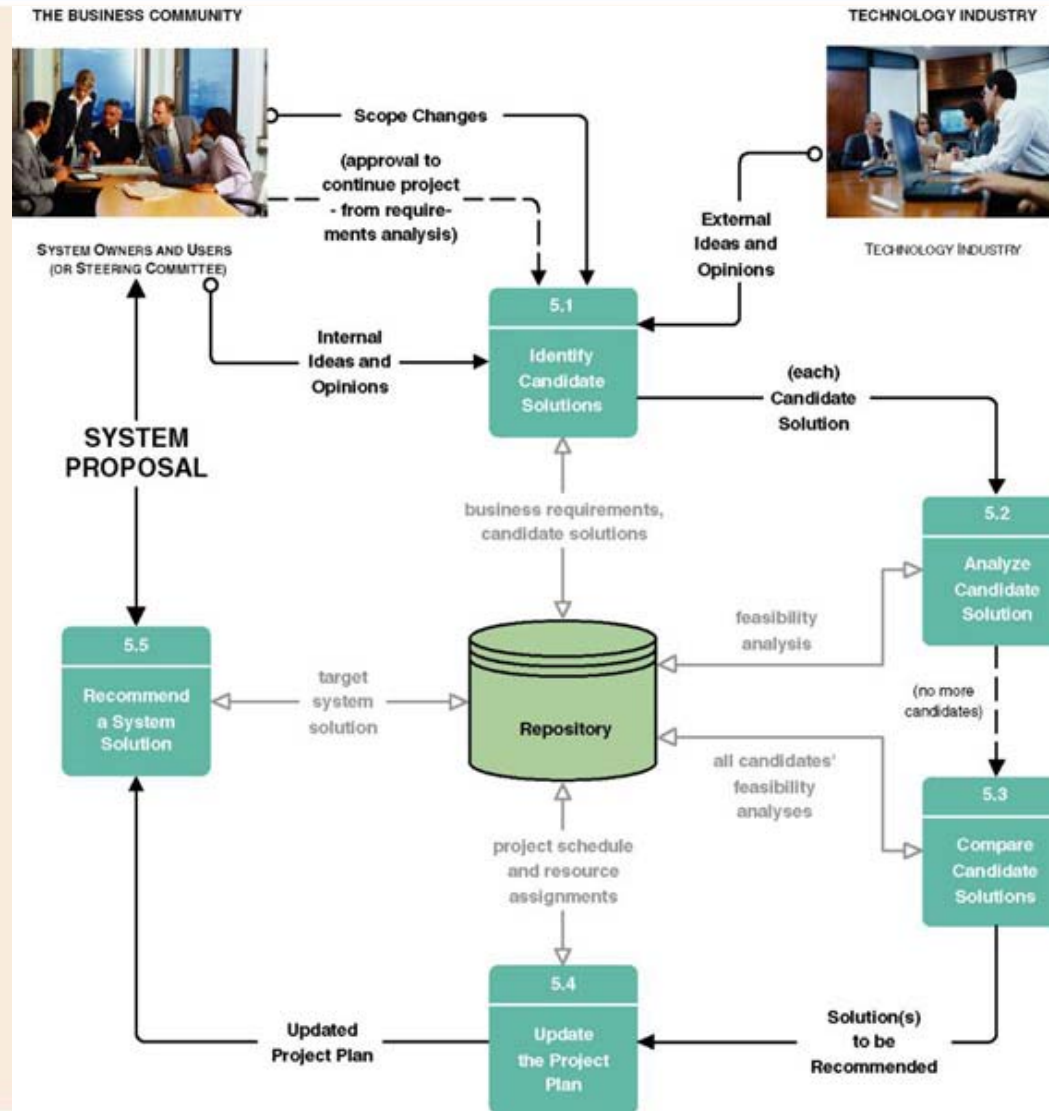
Timeboxing – a technique that delivers information systems functionality and requirements through versioning.

1. The development team selects the smallest subset of the system that, if fully implemented, will return immediate value to the systems owners and users.
 2. That subset is developed, ideally with a time frame of six to nine months or less.
 3. Subsequently, value-added versions of the system are developed in similar time frames.
- A *mandatory requirement* is one that must be fulfilled by the minimal system, version 1.0
 - A *desirable requirement* is one that is not absolutely essential to version 1.0. It may be essential to the vision of a future version.

Tasks for Logical Design Phase



Tasks for Decision Analysis Phase



Key Terms of Decision Analysis Phase

- **Technical feasibility** – Is the solution technically practical? Does our staff have the technical expertise to design and build this solution?
- **Operational feasibility** – Will the solution fulfill the users' requirements? To what degree? How will the solution change the users' work environment? How do users feel about such a solution?
- **Economic feasibility** – Is the solution cost-effective?
- **Schedule feasibility** – Can the solution be designed and implemented within an acceptable time period?

Candidate Systems Matrix

Characteristics	Candidate 1	Candidate 2	Candidate 3	Candidate ...
<p>Portion of System Computerized</p> <p>Brief description of that portion of the system that would be computerized in this candidate.</p>	COTS package Platinum Plus from Entertainment Software Solutions would be purchased and customized to satisfy Member Services required functionality.	Member Services and warehouse operations in relation to order fulfillment.	Same as candidate 2.	
<p>Benefits</p> <p>Brief description of the business benefits that would be realized for this candidate.</p>	This solution can be implemented quickly because it's a purchased solution.	Fully supports user required business processes for SoundStage Inc. Plus more efficient interaction with member accounts.	Same as candidate 2.	
<p>Servers and Workstations</p> <p>A description of the servers and workstations needed to support this candidate.</p>	Technically architecture dictates Pentium Pro, MS Windows NT class servers and Pentium, MS Windows NT 4.0 workstations (clients).	Same as candidate 1.	Same as candidate 1.	
<p>Software Tools Needed</p> <p>Software tools needed to design and build the candidate (e.g., database management system, emulators, operating systems, languages, etc.). Not generally applicable if applications software packages are to be purchased.</p>	MS Visual C++ and MS Access for customization of package to provide report writing and integration.	MS Visual Basic 5.0 System Architect 3.1 Internet Explorer	MS Visual Basic 5.0 System Architect 3.1 Internet Explorer	
<p>Application Software</p> <p>A description of the software to be purchased, built, accessed, or some combination of these techniques.</p>	Package Solution	Custom Solution	Same as candidate 2.	

Candidate Systems Matrix (cont.)

<p>Method of Data Processing</p> <p>Generally some combination of: on-line, batch, deferred batch, remote batch, and real-time.</p>	Client/Server	Same as candidate 1.	Same as candidate 1.	
<p>Output Devices and Implications</p> <p>A description of output devices that would be used, special output requirements (e.g., network, preprinted forms, etc.), and output considerations (e.g., timing constraints).</p>	(2) HP4MV department laser printers (2) HP5SI LAN laser printers	(2) HP4MV department laser printers (2) HP5SI LAN laser printers (1) PRINTRONIX bar-code printer (includes software & drivers) Web pages must be designed to VGA resolution. All internal screens will be designed for SVGA resolution.	Same as candidate 2.	
<p>Input Devices and Implications</p> <p>A description of input methods to be used, input devices (e.g., keyboard, mouse, etc.), special input requirements (e.g., new or revised forms from which data would be input), and input considerations (e.g., timing of actual inputs).</p>	Keyboard & mouse	Apple "Quick Take" digital camera and software (15) PSC Quickscan laser bar-code scanners (1) HP Scanjet 4C Flatbed Scanner Keyboard & mouse	Same as candidate 2.	
<p>Storage Devices and Implications</p> <p>Brief description of what data would be stored, what data would be accessed from existing stores, what storage media would be used, how much storage capacity would be needed, and how data would be organized.</p>	MS SQL Server DBMS with 100GB arrayed capability.	Same as candidate 1.	Same as candidate 1.	

Feasibility Matrix

Feasibility Criteria	Weight	Candidate 1	Candidate 2	Candidate 3	Candidate ...
<p>Operational Feasibility</p> <p>Functionality. A description of to what degree the candidate would benefit the organization and how well the system would work.</p> <p>Political. A description of how well received this solution would be from both user management, user, and organization perspective.</p>	30%	<p>Only supports Member Services requirements and current business processes would have to be modified to take advantage of software functionality</p> <p>Score: 60</p>	<p>Fully supports user required functionality.</p> <p>Score: 100</p>	<p>Same as candidate 2.</p> <p>Score: 100</p>	
<p>Technical Feasibility</p> <p>Technology. An assessment of the maturity, availability (or ability to acquire), and desirability of the computer technology needed to support this candidate.</p> <p>Expertise. An assessment of the technical expertise needed to develop, operate, and maintain the candidate system.</p>	30%	<p>Current production release of Platinum Plus package is version 1.0 and has only been on the market for 6 weeks. Maturity of product is a risk and company charges an additional monthly fee for technical support.</p> <p>Required to hire or train C++ expertise to perform modifications for integration requirements.</p> <p>Score: 50</p>	<p>Although current technical staff has only Powerbuilder experience, the senior analysts who saw the MS Visual Basic demonstration and presentation have agreed the transition will be simple and finding experienced VB programmers will be easier than finding Powerbuilder programmers and at a much cheaper cost.</p> <p>MS Visual Basic 5.0 is a mature technology based on version number.</p> <p>Score: 95</p>	<p>Although current technical staff is comfortable with Powerbuilder, management is concerned with recent acquisition of Powerbuilder by Sybase Inc. MS SQL Server is a current company standard and competes with SYBASE in the Client/Server DBMS market. Because of this we have no guarantee future versions of Powerbuilder will "play well" with our current version SQL Server.</p> <p>Score: 60</p>	
<p>Economic Feasibility</p> <p>Cost to develop:</p> <p>Payback period (discounted):</p> <p>Net present value:</p> <p>Detailed calculations:</p>	30%	<p>Approximately \$350,000.</p> <p>Approximately 4.5 years.</p> <p>Approximately \$210,000.</p> <p>See Attachment A.</p> <p>Score: 60</p>	<p>Approximately \$418,040.</p> <p>Approximately 3.5 years.</p> <p>Approximately \$306,748.</p> <p>See Attachment A.</p> <p>Score: 85</p>	<p>Approximately \$400,000.</p> <p>Approximately 3.3 years.</p> <p>Approximately \$325,500.</p> <p>See Attachment A.</p> <p>Score: 90</p>	
<p>Schedule Feasibility</p> <p>An assessment of how long the solution will take to design and implement.</p>	10%	<p>Less than 3 months.</p> <p>Score: 95</p>	<p>9-12 months</p> <p>Score: 80</p>	<p>9 months</p> <p>Score: 85</p>	
Ranking	100%	60.5	92	83.5	

Typical System Proposal Outline

- I. Introduction
 - A. Purpose of the report
 - B. Background of the project leading to this report
 - C. Scope of the report
 - D. Structure of the report
- II. Tools and techniques used
 - A. Solution generated
 - B. Feasibility analysis (cost-benefit)
- III. Information systems requirements
- IV. Alternative solutions and feasibility analysis
- V. Recommendations
- VI. Appendices