



西安电子科技大学
XIDIAN UNIVERSITY

10

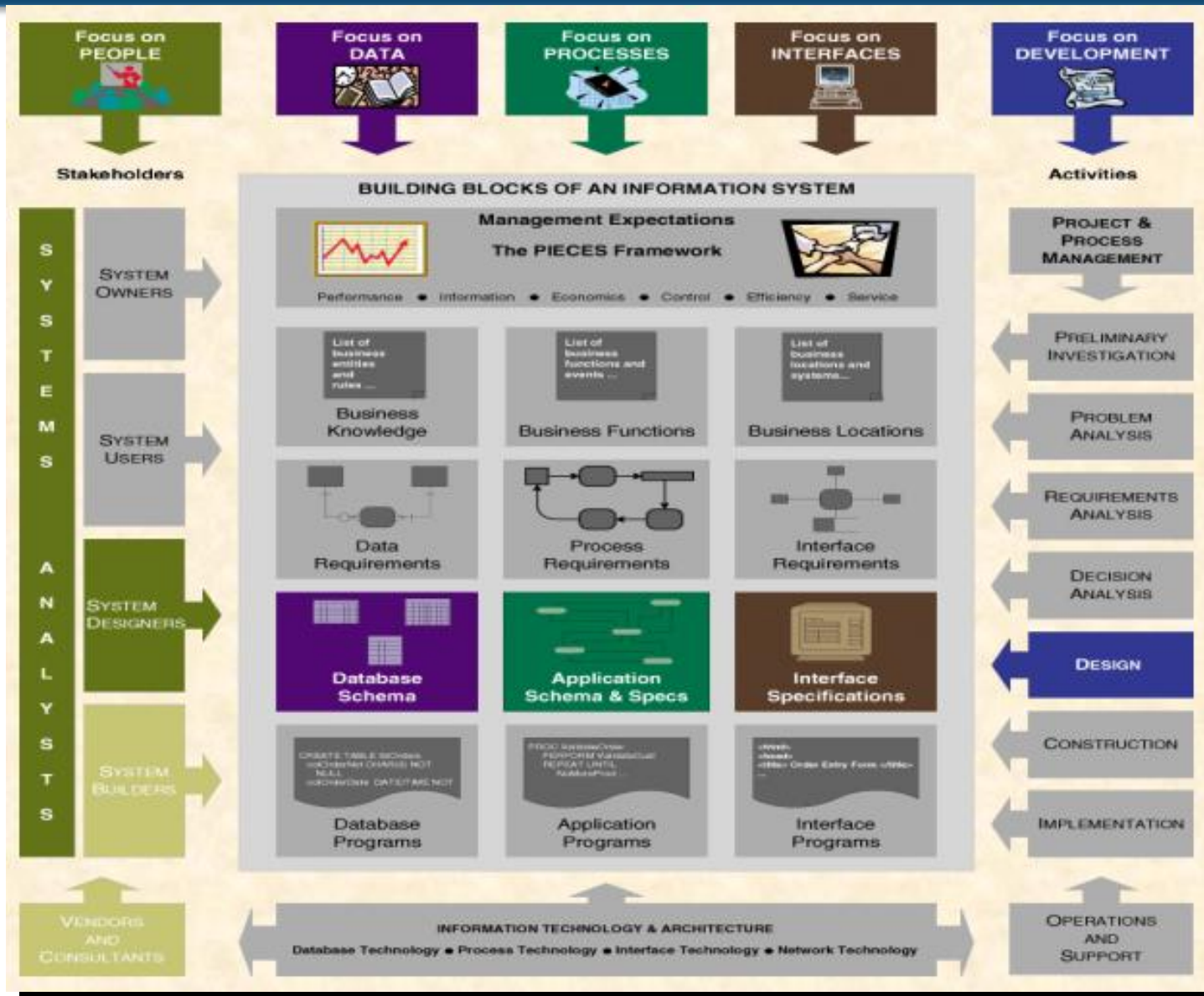
系统分析与设计 (SYSTEM ANALYSIS AND DESIGN)

Systems Design

Content Structure

- ✿ What is Systems Design?
- ✿ Systems Design Approaches
- ✿ Systems Design for In-house Development – The “Build” Solution
 - 体系结构设计；数据库设计；接口 / 界面设计；设计说明的打包；修改项目计划。
- ✿ Systems Design for Integrating Commercial Software – The “Buy” Solution
 - 研究技术准则和选择；向供货商询货；确认供货商的产品要求和产品性能；评估供货商的建议的等级；确定与供货商谈判的要点。

Chapter Map





What is Systems Design?



Systems Design

- ❁ Information **systems design** is defined as those tasks that focus on the specification of a detailed computer-based solution. It is also called **physical design**.
- ❁ Thus, whereas systems analysis placed emphasis on the business problem, systems design places emphasis on the technical or implementation concerns of the system.

Recall Chapter 5 ...

Systems Analysis vs. Systems Design

- ❁ **Systems Analysis** is 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** (also called systems synthesis (系统综合)) is 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 involves adding, deleting, and changing pieces relative to the original system.

System Models

- ❁ **Logical System Models** depict what a system is or what a system must do — not how the system will be implemented. Because logical models depict the essential requirements of a system, they are sometimes called essential system models. (The opposite of logical system models are **physical system models** that are used to depict how a system will implement the logical system requirements.)
- ❁ Logical models express business requirements — sometimes referred to as the **logical design** — as opposed to the technical solution, which is called the **physical design**.



Systems Design Approaches

Systems Design Approaches

- ✿ Model-Driven
 - Modern structured design
 - Information engineering
 - Prototyping
 - Object-oriented design
- ✿ JAD (Joint Application Development)
- ✿ RAD (Rapid application development)

Recall Chapter 5 ...

Systems Analysis Approaches

☼ Model-driven Analysis Approaches:

- Structured Analysis
- Information Engineering
- Object-oriented Analysis

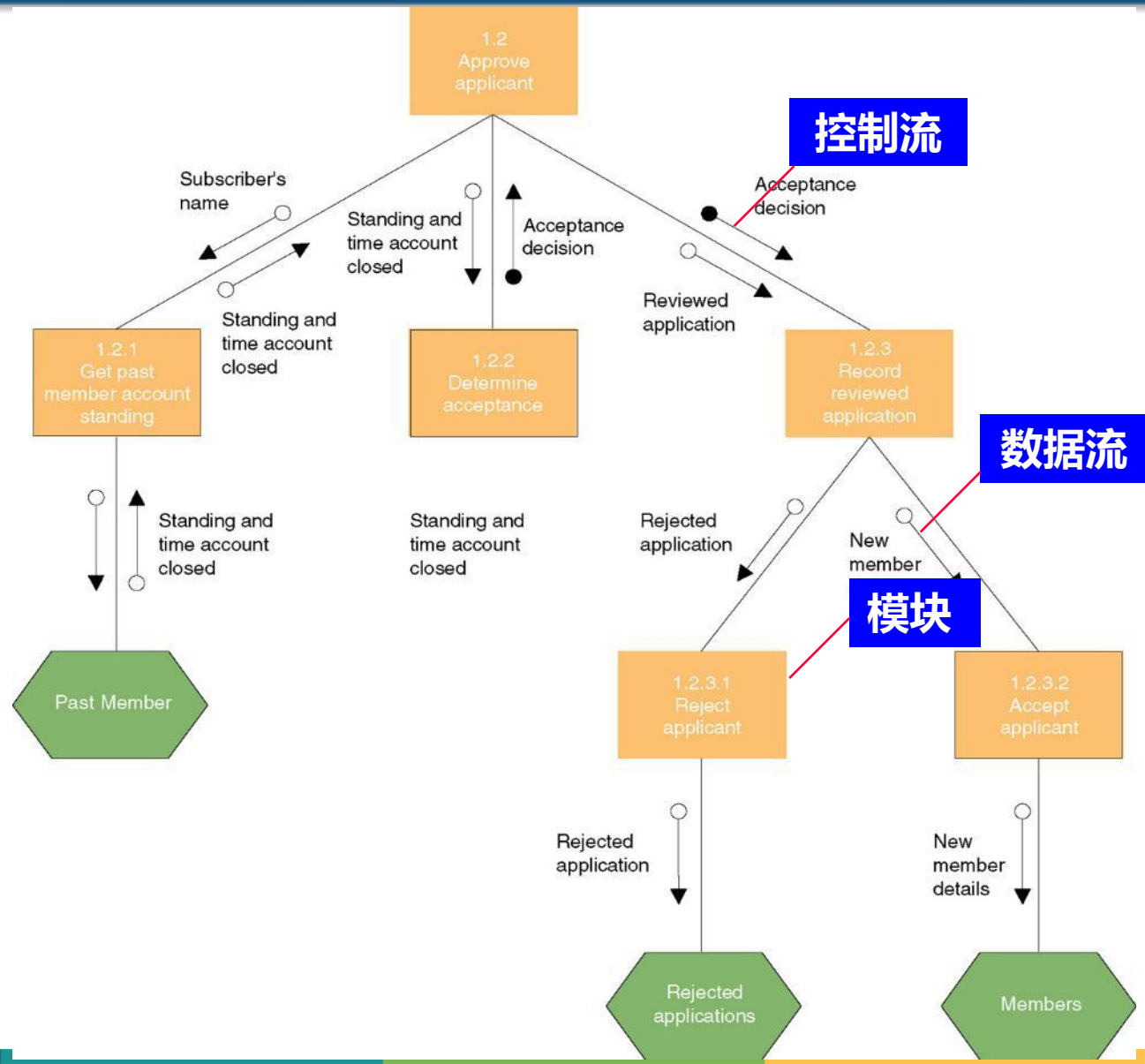
☼ Accelerated Analysis Approaches:

- Discovery Prototyping
- Rapid Architecture Analysis

Modern Structured Design

- ❁ Modern **Structured Design** is a process-oriented technique for breaking up a large program into a hierarchy of modules that result in a computer program that is easier to implement and maintain (change). Synonyms (although technically inaccurate) are top-down program design and structured programming.
- ❁ A module is a group of instructions-a paragraph, block, subprograms, or subroutine.
 - Modules should be highly **cohesive**
 - Modules should be loosely **coupled**
- ❁ The software model derived from structured design is called a **structure chart**.

Structure Chart





Recall Chapter 5 ... Structure Analysis



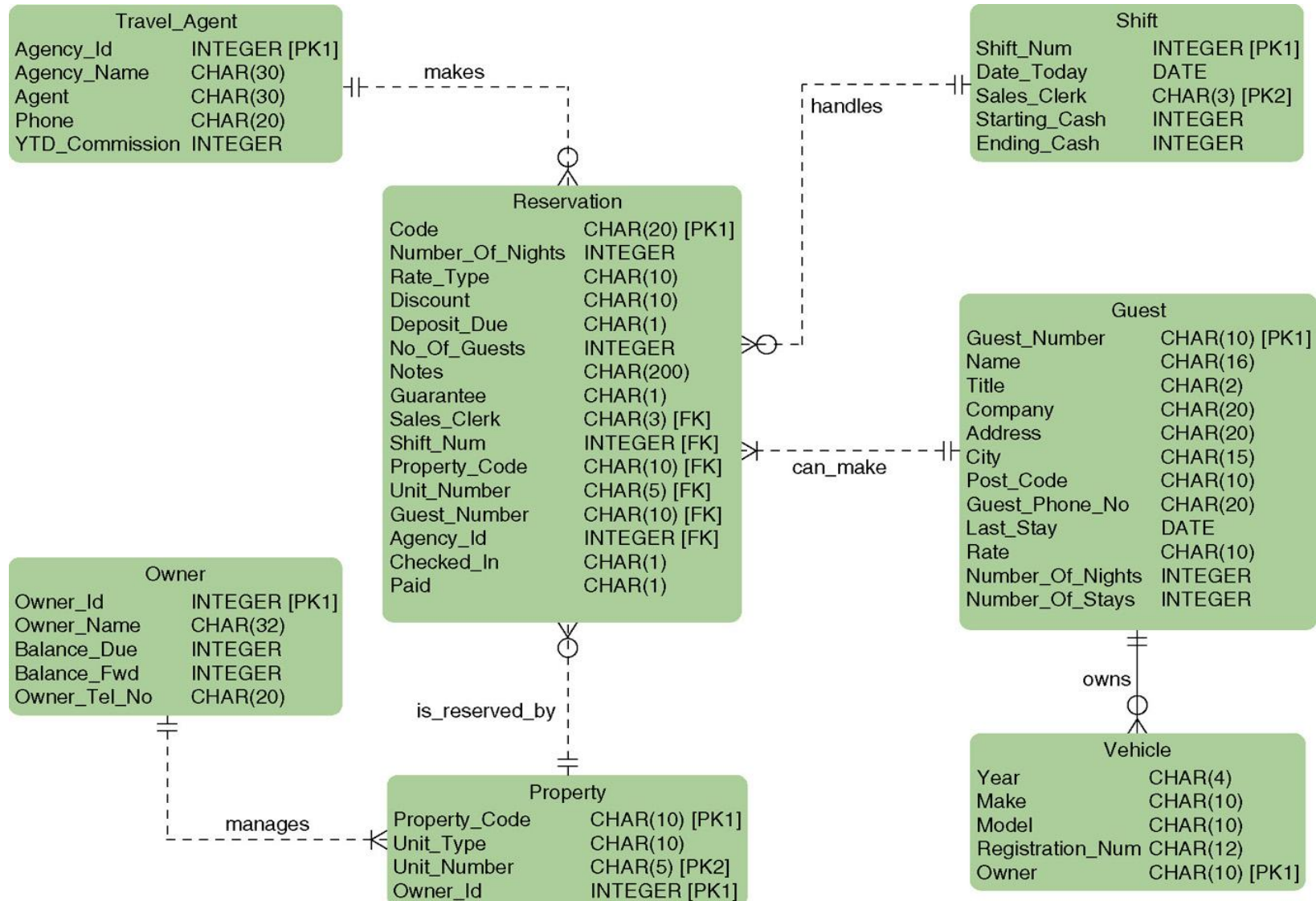
Structured Analysis

- ❁ **Structured Analysis** is a model-driven, process-centered technique used to either analyze an existing system, define business requirements for a new system, or both. The models are pictures that illustrate the system's component pieces: processes and their associated inputs, outputs, and files.
- ❁ The emphasis in this technique is on the Process building blocks. The technique has evolved to also model the Data and Interface building blocks as a secondary emphasis.
- ❁ Systems analysts draw a series of process models called **data flow diagrams** (DFD).

Information Engineering for Design

- ✿ **Information Engineering** is a model-driven and *data-centered*, but process-sensitive technique to plan, analyze, and design information systems.
- ✿ The primary tool of IE is a **data model diagram**.

Physical Entity Relationship Diagram





Recall Chapter 5 ... Information Engineering

Information Engineering for Analysis

- ✿ **Information Engineering** (IE) is a model-driven and data-centered, but process-sensitive technique to plan, analyze, and design information systems. IE models are pictures that illustrate and synchronize the system's data and processes.
- ✿ This technique emphasizes the study and requirements analysis of Data requirements before those of the Process and Interface requirements.
- ✿ Systems analysts draw **entity relationship diagrams** (ERDs) to model the system's raw data before they draw DFDs that illustrate how the data will be captured, stored, used, and maintained.

Prototyping

- ✿ The **prototyping** approach is an *iterative process* involving a close working relationship between the designer and the users.
- ✿ Key Benefits:
 - Prototyping encourages and requires **active end-user participation**.
 - It accommodates **end-users** whom tend **to change their minds**.
 - Prototyping endorses (認可) the philosophy that **end-users don't know what they want until they see it**.
 - Prototypes are an **active**, not passive, model that end-users can see, touch, feel, and experience.
 - An approved prototype is a working equivalent to a paper design specification, with one exception -- **errors can be detected** much earlier.
 - Prototyping can **increase creativity** because it allows for quicker user feedback, which can lead to better solutions.
 - Prototyping **accelerates several phases** of the life cycle, possibly bypassing the programmer.

Prototyping

❁ Disadvantages and Pitfalls:

- Encourages “code, implement, and repair” life cycle that cause maintenance nightmares.
- Still need systems analysis phases, but so easy to skip.
- Cannot completely substitute a prototype for a paper specification (like architect without a blueprint).
- Numerous design issues are not addressed by prototyping.
- Often leads to premature commitment to a design (usually the first).
- Scope and complexity of the system can expand out of control.
- Can reduce creativity in designs.
- Often suffer from slower performance because of language considerations (rapidly becoming a non-issue).

Prototype Screen

Members

Status

☐ Dropped
☒ Frozen
☐ Good Standing
☐ Inactive
☐ Probation

Member Number:

100003

New


Delete

Edit

Exit

Memberships

Orders



Address Information

Name:

Jeff Whitten

Street Address:

129 Rural Route 6

City:

Fowler

Area Code:

319

Phone:

789-3333

Extension:

P.O. Box:

12999

State:

IN

Zip Code:

47756-3333

Credit Card Type

☐ American Express
☐ Discover
☒ Mastercard
☐ Visa

Card Number:

5424-9981-2919-2912

Expiration Date:

2/2/96

Balance:

\$495.22

Bonus Balance:

1

Navigation

Previous

Back

Next

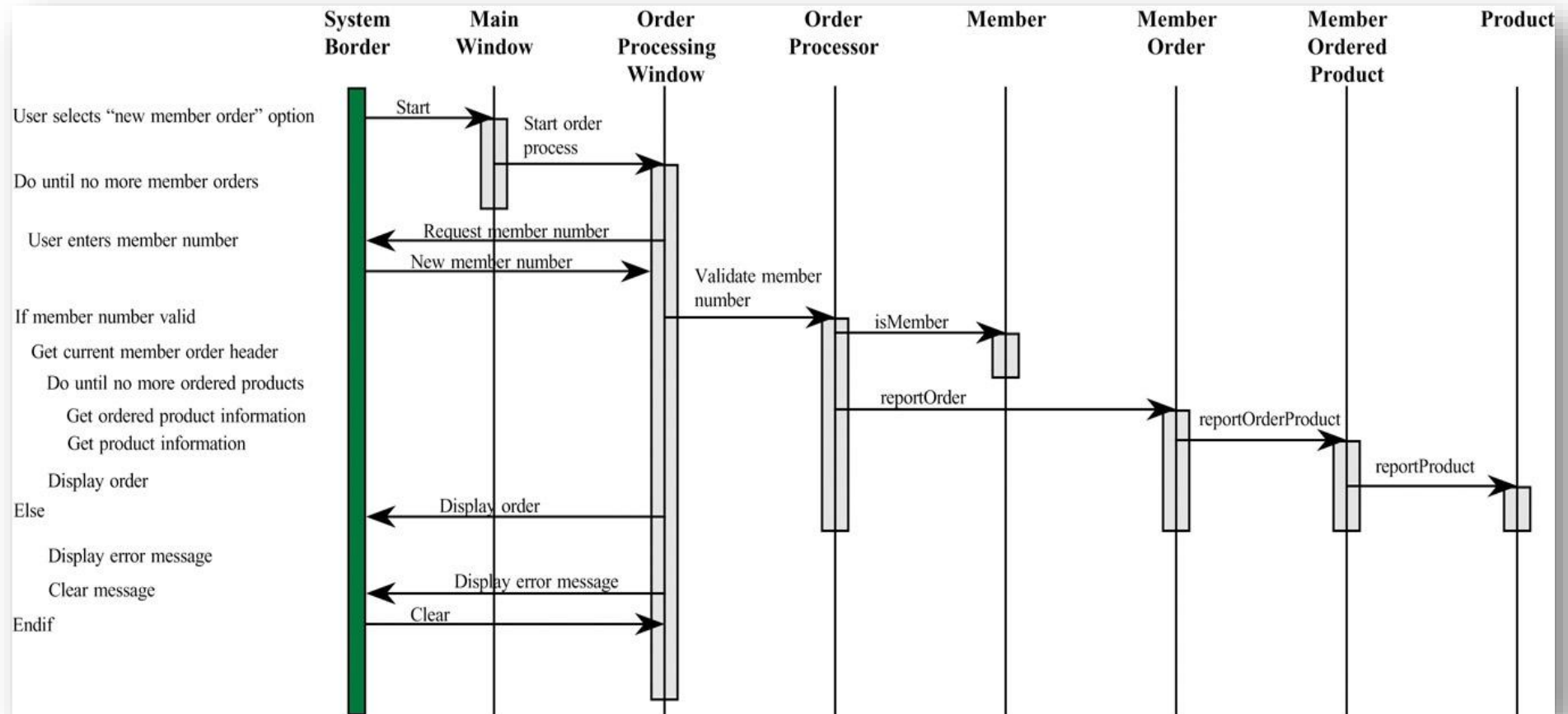
First

Refresh

Object-Oriented Design (OOD)

- ✿ Object-oriented design is the newest design strategy and is an extension of object-oriented analysis.
- ✿ **Object-Oriented Design (OOD)** techniques are used to refine the object requirements definitions identified earlier during analysis, and to define design specific objects.

Object-Oriented Design (OOD)





Recall Chapter 5 ... Object-Oriented Analysis

Object-Oriented Analysis

- ❁ **Object-Oriented Analysis** (OOA) is a model-driven technique that integrates data and process concerns into constructs called objects. OOA models are pictures that illustrate the system's objects from various perspectives such as structure and behavior.
- ❁ Object technologies have emerged to eliminate the artificial separation of concerns about data and processes, i.e., to integrate them into constructs called Objects.
- ❁ The **Unified Modeling Language** (UML) provides a graphical syntax for an entire series of **object models**.

Rapid Application Development (RAD)

- ✿ **Rapid Application Development (RAD)** is the merger of various structured techniques (especially the data-driven information engineering) with prototyping techniques and joint application development techniques to accelerate systems development.
- ✿ RAD calls for the interactive use of structured techniques and prototyping to define the users' requirements and design the final system.
- ✿ The expedition (考查) of the design effort is enhanced through the emphasis on user participation in Joint application development (JAD) sessions.

Joint Application Development (JAD)

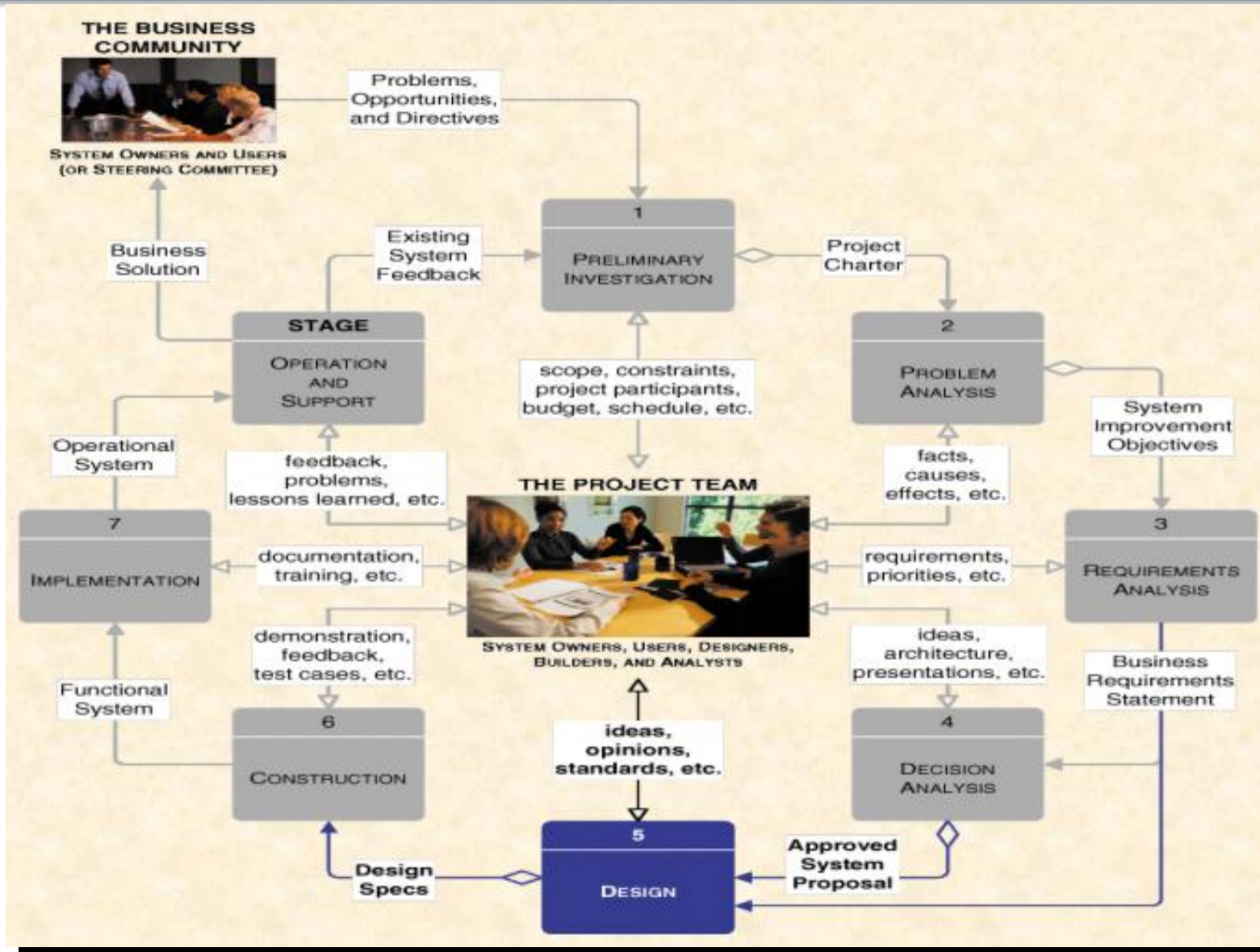
- ✿ **Joint Application Development (JAD)** is a technique that complements other systems analysis and design techniques by emphasizing participative development among system owners, users, designers, and builders.
- ✿ During the JAD sessions for systems design, the systems designer will take on the role of facilitator for possibly several full-day workshops intended to address different design issues and deliverables.



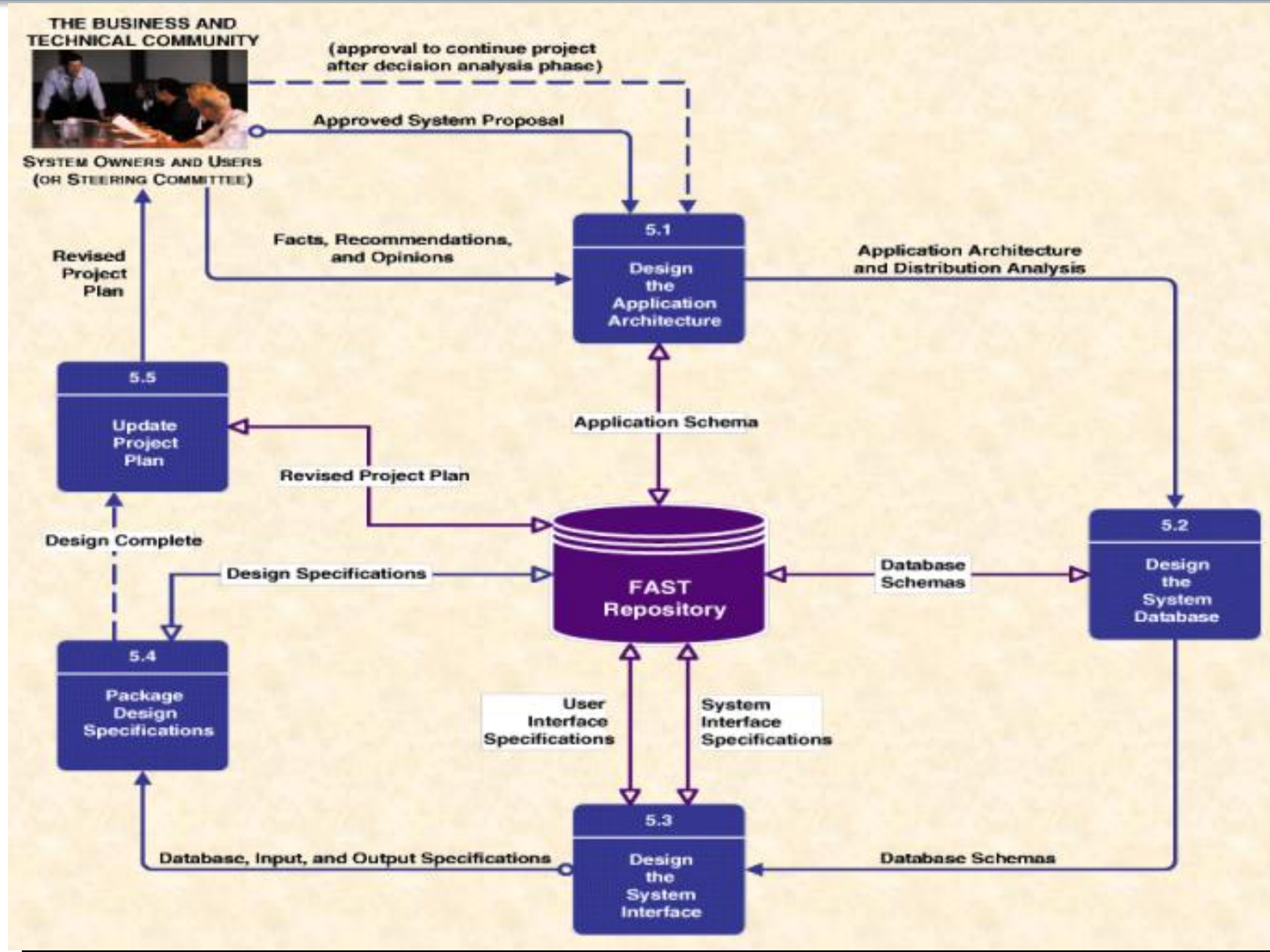
Systems Design for In-house Development

– The “Build” Solution

Context Of In-House Development Projects



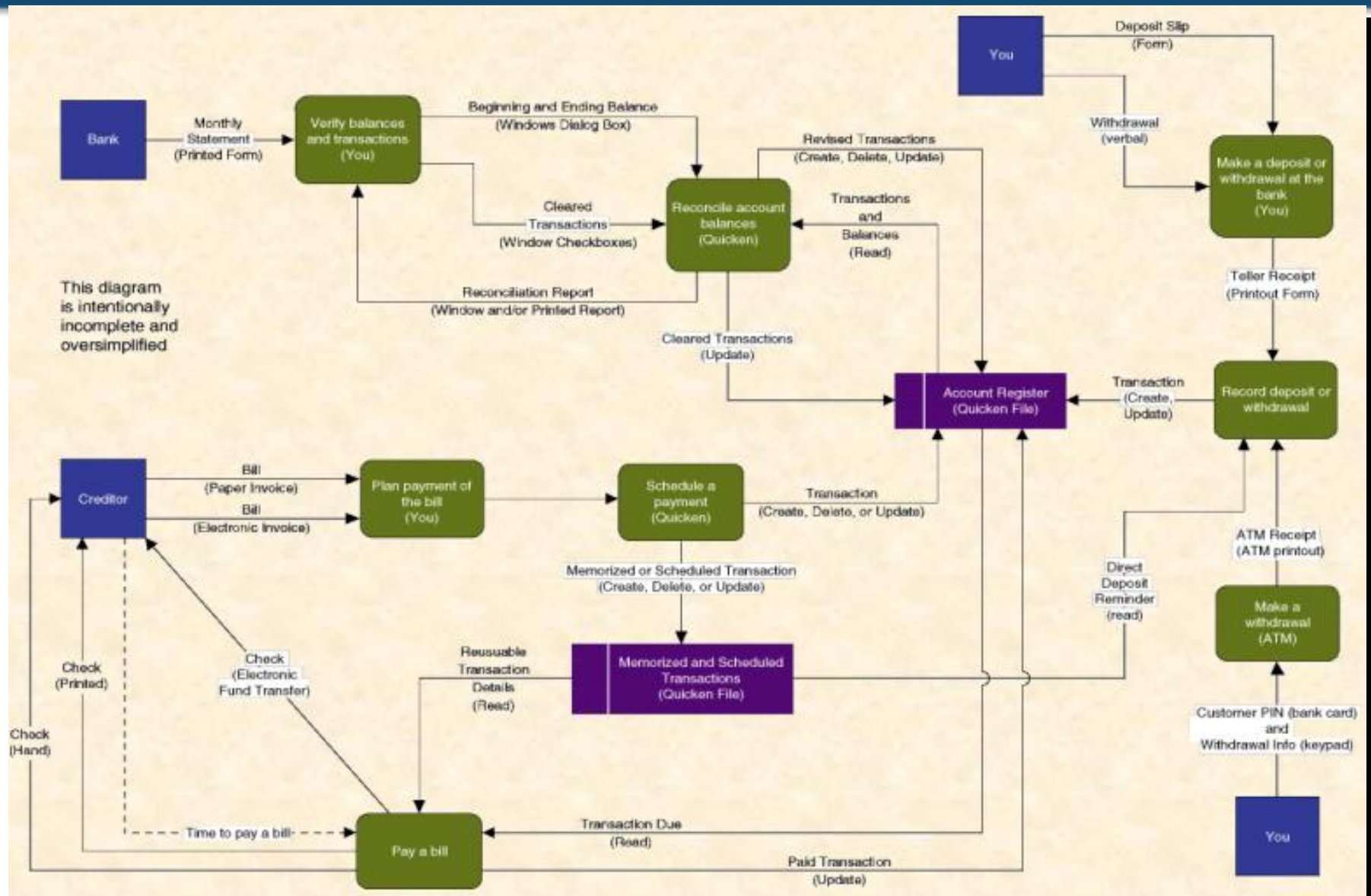
Design Phase Tasks For In-House Development



Task 5.1 Design the Application Architecture

- ✿ An **Application Architecture** defines the technologies to be used by (and used to build) one, more, or all information systems in terms of its data, processes, interfaces, and network components.
- ✿ This task is accomplished by analyzing the data models and process models that were initially created during requirements analysis.
- ✿ The **Physical Data Flow Diagram (PDFD)** is used to establish physical processes and data stores (databases) across a network.

Sample Physical Data Flow Diagram



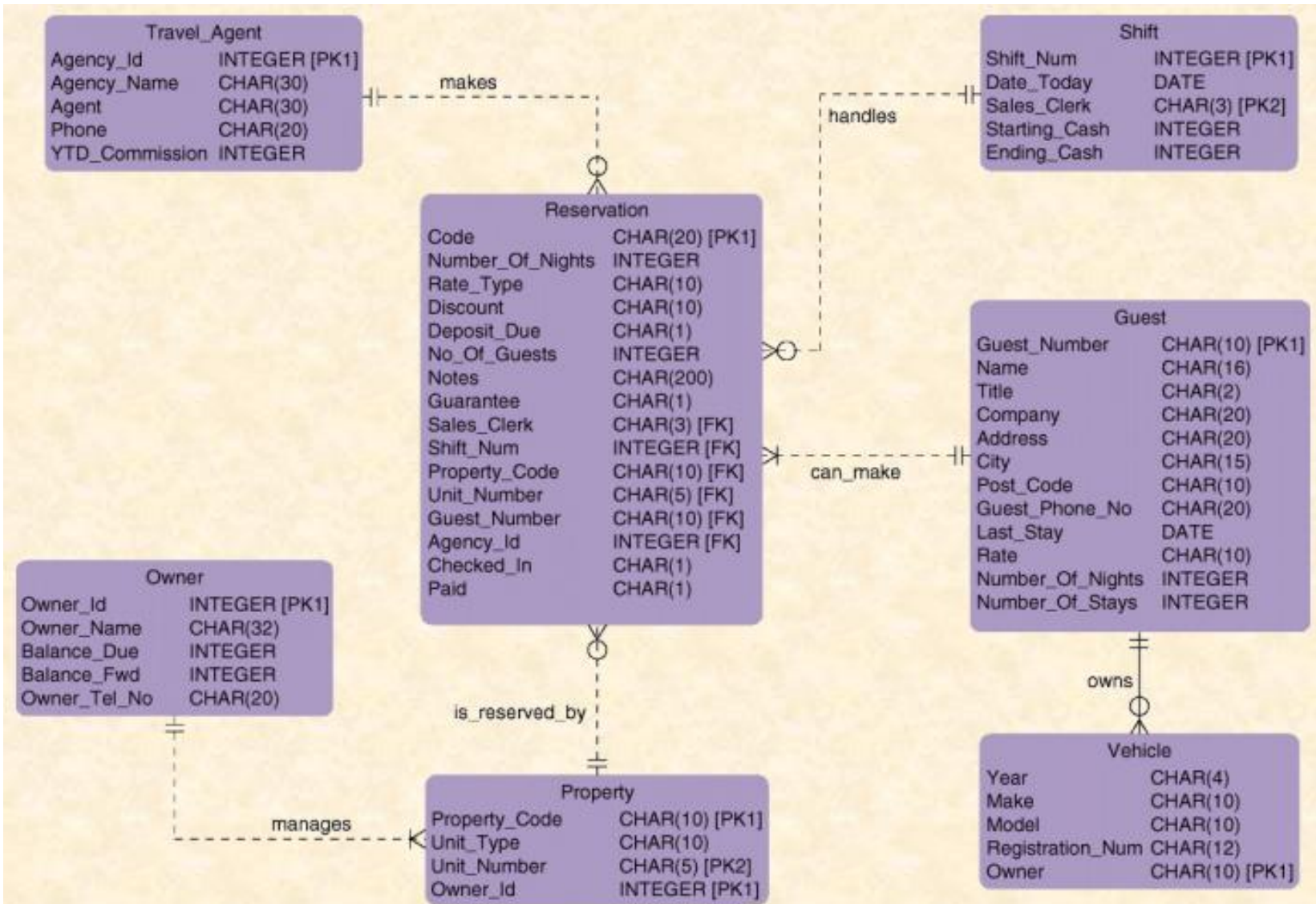
Task 5.1 Design the Application Architecture

- ✿ The key inputs to this task are the facts, recommendations, and opinions that are solicited(恳请) from various sources and the approved system proposal from the decision analysis phase.
- ✿ The principal deliverable of the task is the application architecture and distribution analysis that serves as a blueprint for subsequent detailed design phase activities.

Task 5.2 Design the System Database(s)

- ✿ This task is to develop the corresponding database design specifications.
 - Adaptable to future requirements and expansion.
 - How programs will access the data in order to improve performance.
 - Record size and storage volume requirements.
 - Internal controls to ensure proper security and disaster recovery techniques.

Sample Database Schema



Task 5.3 Design the System Interface

- ✿ The system designers work closely with system users to develop input, output, and dialogue specifications.
 - Transaction outputs: preprinted forms
 - Reports and other outputs: printed directly onto paper or displayed on a terminal screen
 - Inputs: the data capture methods to be used
 - Interface: terminal familiarity, possible errors and misunderstandings


Sample Output Screen Design

QuickReport version 1.0

Page 1 of 1

Exit

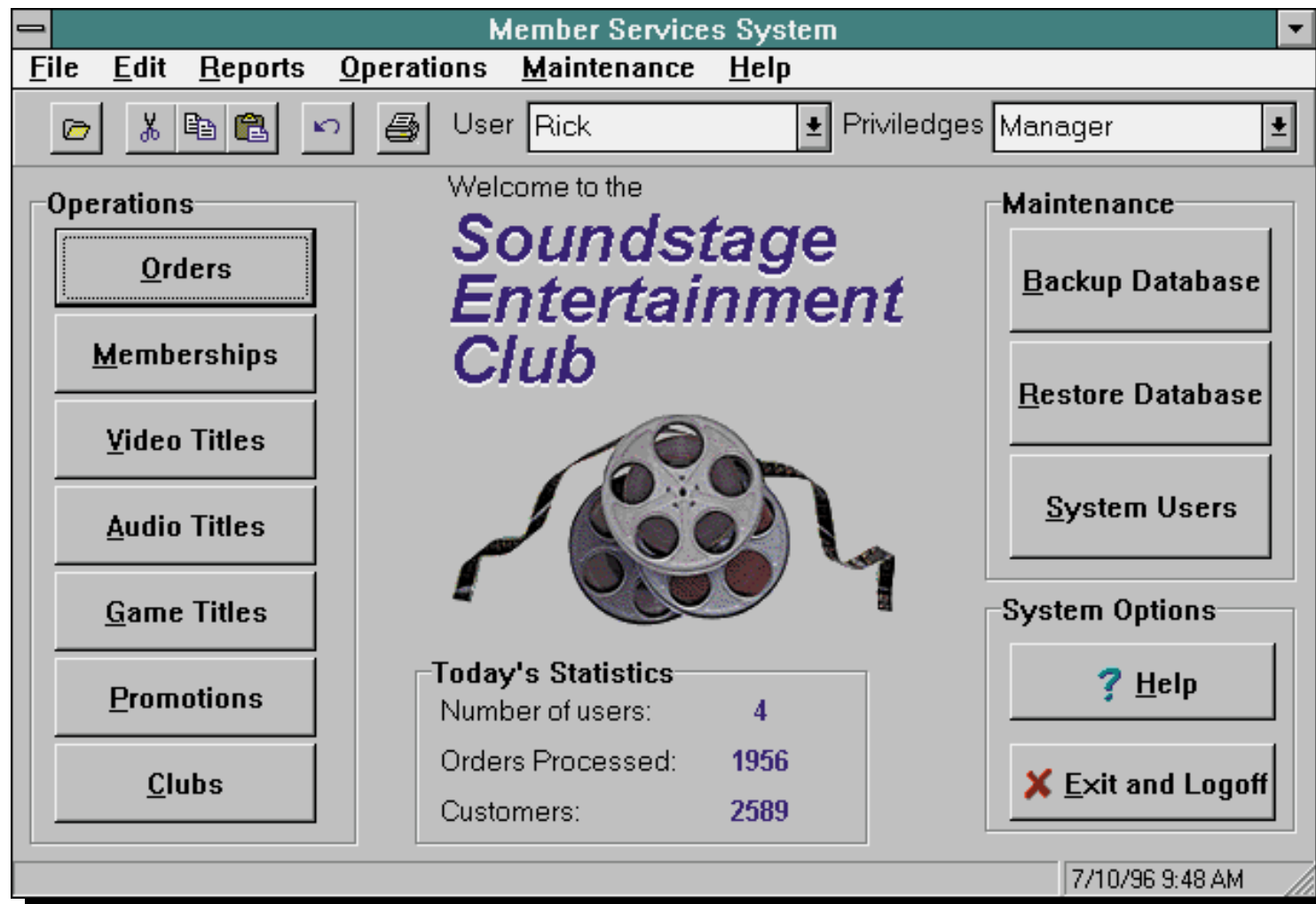
Member Response to Video Title Selection of the Month



Page number 1
Printed at 6/14/96 7:32:11 AM

Category	Potential Orders	Selection of the Month	Alternate Selection	Selection of Month + Alternatives	Number of Orders
Action Adventure	6342	2410	824	241	2867
Animated	3577	1538	644	154	1241
Comedy	954	181	38	18	716
Documentary	1486	877	45	88	477
Drama	540	389	54	39	58
Western	104	9	54	1	40
Horror	920	99	23	409	2501
Musical	209	40	78	289	103
Science Fiction	4590	2011	899	2200	5329
Sports	288	288	277	121	387
Sum of Potential Orders		19010			
Sum of Selection of the Month		7842			
Sum of Alternate Selections		2936			
Sum of Selection of the Month + Alternatives		3560			
Total Number of Orders		13719			

Sample Interface Design



Task 5.4 Package Design Specifications

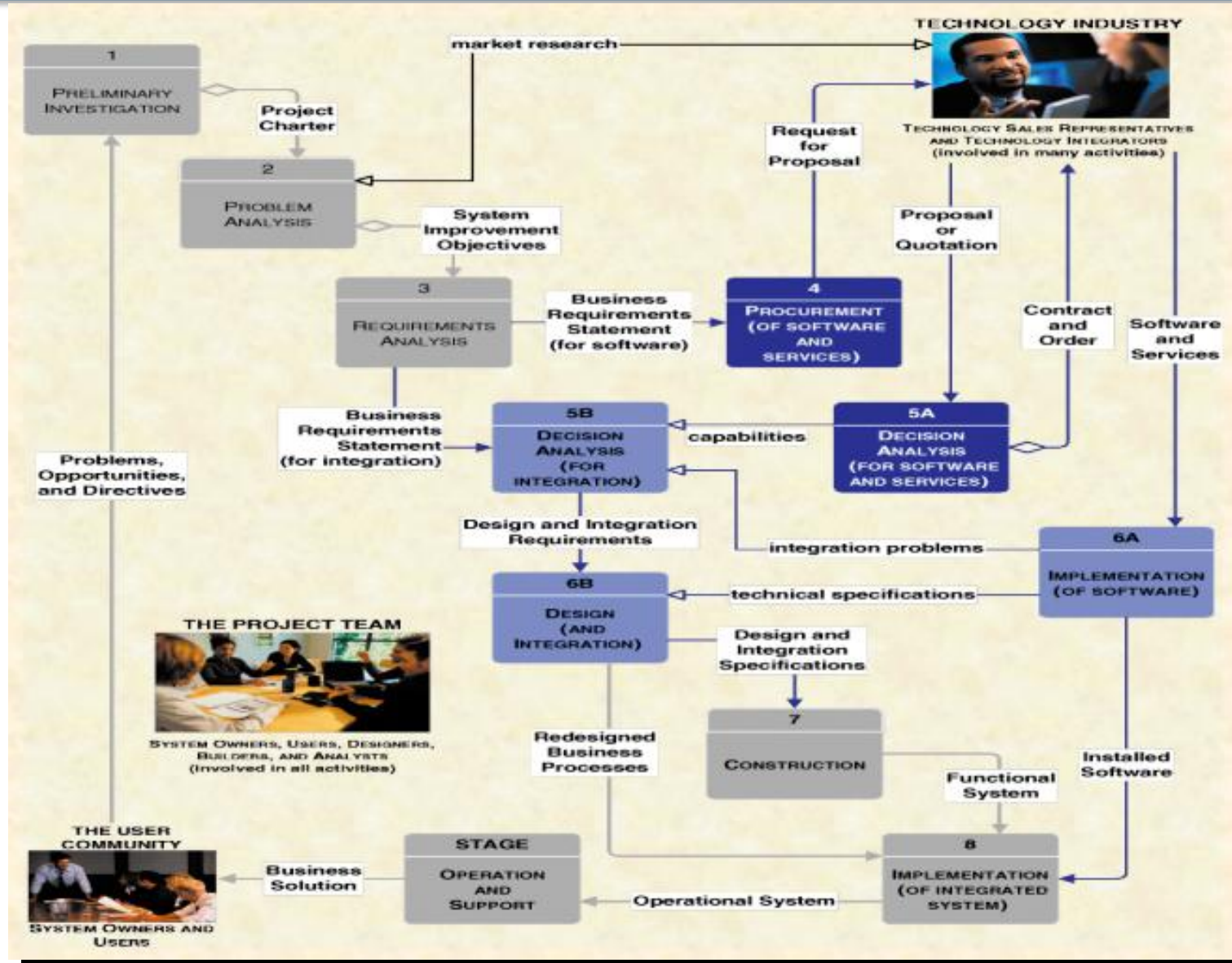
- ✿ This task involves packaging all the specifications from the previous design tasks into a set of specifications that will guide the computer programmer's activities during the construction phase.
 - There is more to this task than packaging. How much more depends on
 - where you draw the line between the system designer's and programmer's responsibilities, and
 - whether the methodology and solution calls for the design of the overall program structure.

Task 5.5 Update the Project Plan

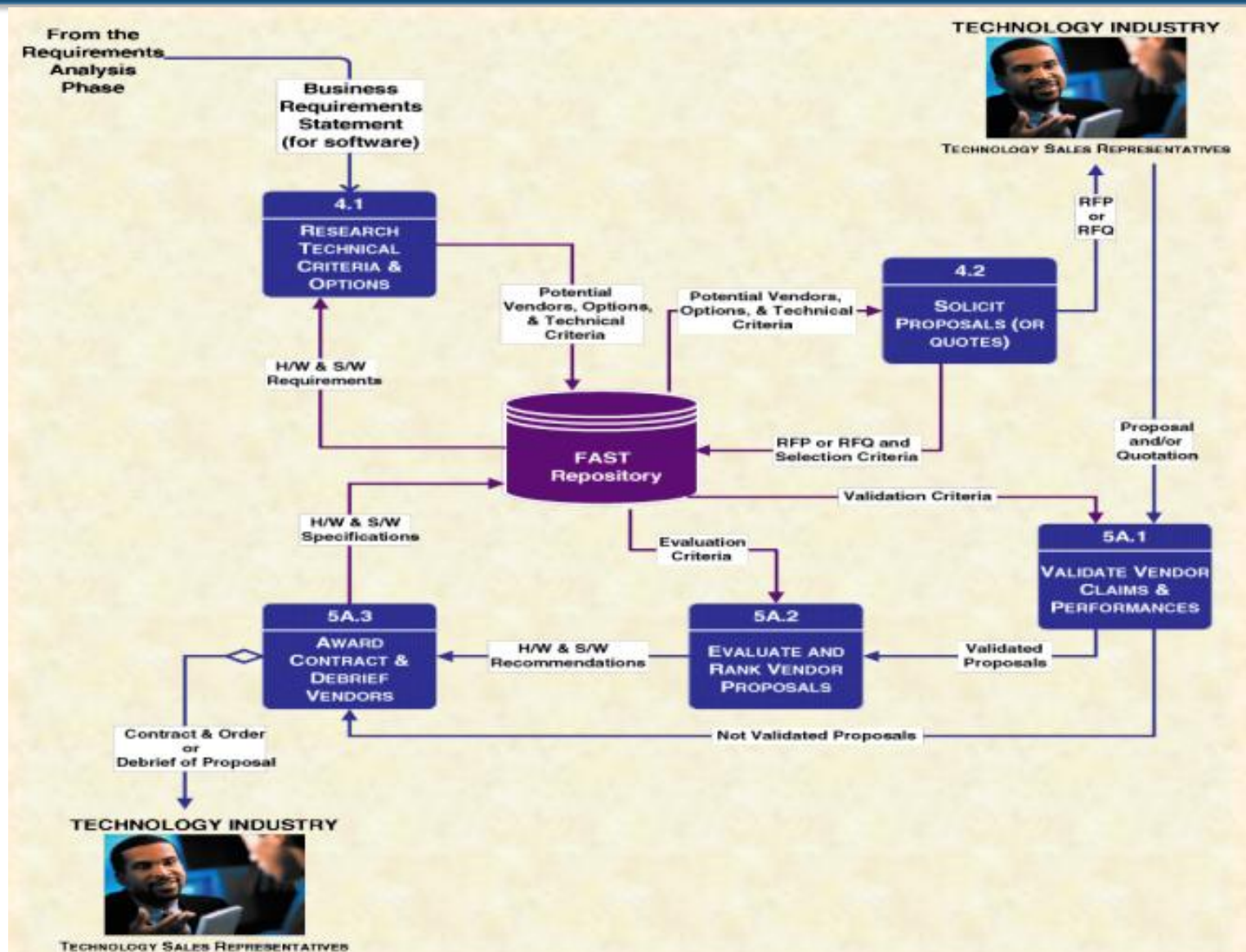


Systems Design for Integrating Commercial Software – The “Buy” Solution

Context Of System Design For “Buy” Solutions



Tasks For the Procurement Phase



Task 4.1 Research Technical Criteria and Options

- ✿ This task identifies specifications that are important to the software and/or hardware that is to be selected.
- ✿ Focus on the software and/or hardware requirements specifying the functionality, features, and critical performance parameters for our new software/hardware.

Technical and Business Research Sources

- ❁ Magazines and journals
- ❁ the Internet
- ❁ Internal standards may exist for hardware and software selection.
- ❁ Information services are primarily intended to constantly survey the marketplace for new products and advise prospective buyers on what specifications to consider.
- ❁ Trade newspapers and periodicals offer articles and experiences on various types of hardware and software that you may be considering.

Task 4.2 Solicit Proposals (or Quotes) from Vendors

- ✿ Require the preparation of one of two documents:
- ✿ a request for **quotations** (报价申报书 / 报价单) (RFQ)
- ✿ a request for **proposals** (建议申报书 / 竞标书) (RFP)
- ✿ The RFQ is used when you have already decided on the specific product but that product can be acquired from several distributors.
- ✿ The RFP is used when several different vendors and/or products are candidates and you want to solicit competitive proposals and quotes.
- ✿ The primary purpose of the RFP is to communicate requirements and desired features to prospective vendors.

Typical Outline for Request For Proposal (RFP)

Request for Proposals (RFP)

- I. Introduction
 - A. Background
 - B. Brief summary of needs
 - C. Explanation of RFP document
 - D. Call for action on part of vendor
- II. Standards and instructions
 - A. Schedule of events leading to contract
 - B. Ground rules that will govern selection decision
 - 1. Who may talk with whom and when
 - 2. Who pays for what
 - 3. Required format for a proposal
 - 4. Demonstration expectations
 - 5. Contractual expectations
 - 6. References expected
 - 7. Documentation expectations
- III. Requirements and features
 - A. Hardware
 - 1. Mandatory (必须遵循的) requirements, features, and criteria
 - 2. Essential requirements, features, and criteria
 - 3. Desirable requirements, features, and criteria
 - B. Software
 - 1. Mandatory requirements, features, and criteria
 - 2. Essential requirements, features, and criteria
 - 3. Desirable requirements, features, and criteria
 - C. Service
 - 1. Mandatory requirements
 - 2. Essential requirements
 - 3. Desirable requirements
- IV. Technical questionnaires
- V. Conclusion

Task 5A.1 Validate Vendor Claims and Performances

- ❁ The purpose is to validate requests for proposals and/or quotations received from vendors.
- ❁ Must collect and review all facts pertaining to (适合于) the product requirements and features.

Task 5A.2 Evaluate Rank Vendor Proposals

- ✿ The evaluation and ranking is, in reality, another cost-benefit analysis performed during systems development.
- ✿ To complete this task,
 - Must collect and review all details concerning the validated proposals
 - Establish an evaluation criteria and scoring system

Task 5A.3 Award Contract and Debrief Vendors

- ✿ Present a recommendation to management for final approval.
- ✿ The purpose of this activity is to negotiate a contract with the vendor who supplied the winning proposal, and to debrief (听取报告) those vendors that submitted losing proposals.

Impact of Buy Decision on Remaining Life Cycle Phases

- ✿ Must integrate or interface the new system to other existing systems.
- ✿ Decision Analysis
 - Make revisions in models to reflect purchased solution.
 - Implement purchased solution.
 - Integration problems lead to revised business requirements statements.
- ✿ Design
 - Technical specification for a subset of programs to integrate purchased and built solutions.

要点与引申

- ✿ 系统设计是在系统分析的基础上（在对问题空间进行了客观反映和表示的基础上）构造解空间的过程。
- ✿ 系统设计的途径有多种，但强调与用户保持及时的、协调的、友好的交互，则是各种途径得以达到其目的之共同的必要条件。
- ✿ 无论是自己构造，还是外购，可行性的评估和判断都是不可或缺的。