

CGS 2545: Database Concepts Fall 2010

Chapter 2 – The Database Development Process

Instructor : Dr. Mark Llewellyn
markl@cs.ucf.edu
HEC 236, 407-823-2790
<http://www.cs.ucf.edu/courses/cgs2545/fall2010>

Department of Electrical Engineering and Computer Science
University of Central Florida

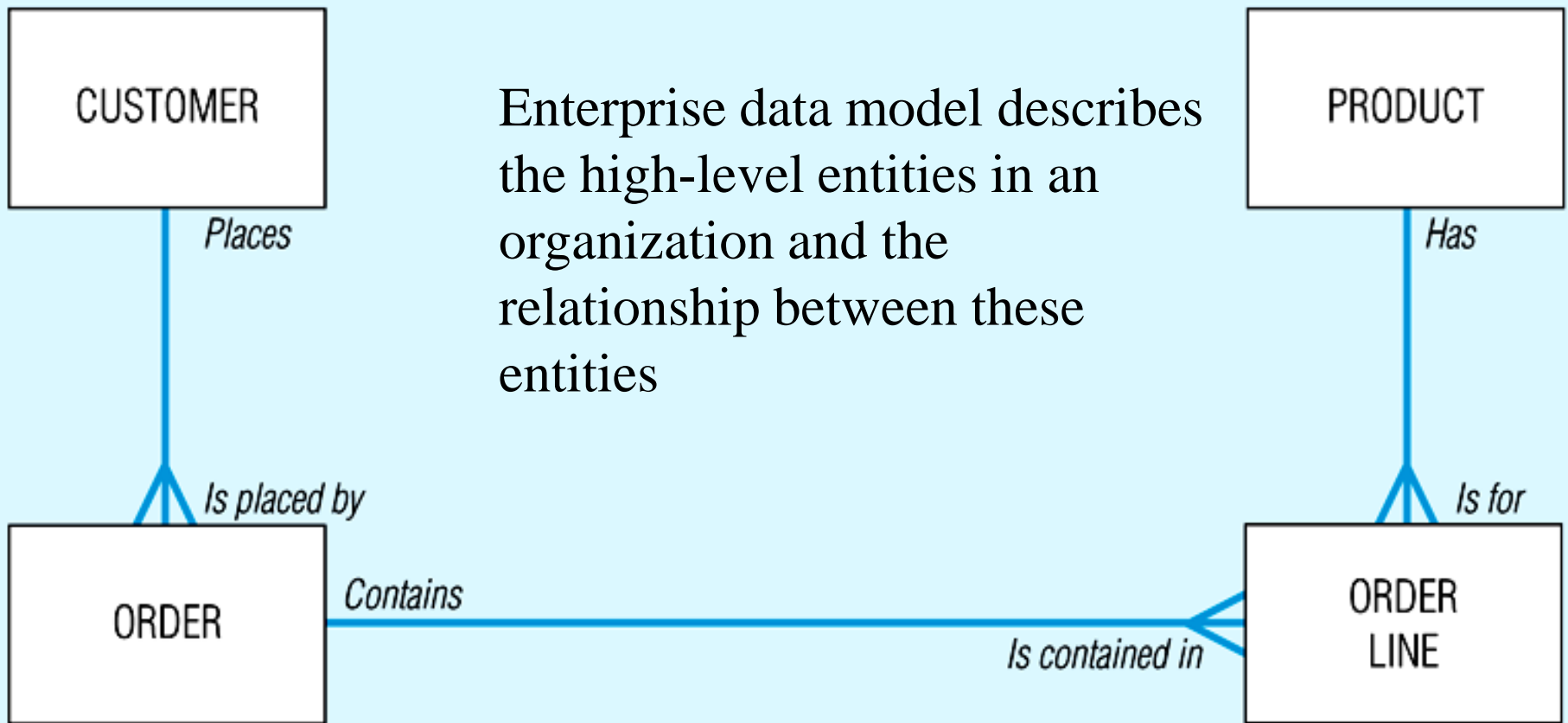


Enterprise Data Model

- First step in database development
- Specifies scope and general content
- Overall picture of organizational data at high level of abstraction
- Entity-relationship diagram
- Descriptions of entity types
- Relationships between entities
- Business rules



Segment from enterprise data model (Pine Valley Furniture Company) [simplified E-R diagram]



Information Systems Architecture (ISA)

- Conceptual blueprint for organization's desired information systems structure
- Consists of:
 - Data (e.g. Enterprise Data Model – simplified ER Diagram)
 - Processes – data flow diagrams, process decomposition, etc.
 - Data Network – topology diagram
 - People – people management using project management tools (Gantt charts, etc.)
 - Events and points in time (when processes are performed)
 - Reasons for events and rules (e.g. decision tables)



Information Engineering

- A data-oriented methodology to create and maintain information systems
- Top-down planning: a generic IS planning methodology for obtaining a broad understanding of the IS needed by the entire organization
- Four steps to Top-Down planning:
 - *Planning*
 - *Analysis*
 - *Design*
 - *Implementation*



Information Systems Planning

- Purpose: align information technology with organization's business strategies
- Three steps:
 1. Identify strategic planning factors
 - a. Goals
 - b. Critical success factors
 - c. Problem areas
 2. Identify corporate planning objects
 - a. Organizational units
 - b. Locations
 - c. Business functions
 - d. Entity types
 3. Develop enterprise model
 - a. Functional decomposition
 - b. Entity-relationship diagram
 - c. Planning matrices



Identify Strategic Planning Factors

- Organization goals – what we hope to accomplish
- Critical success factors – what MUST work in order for us to survive
- Problem areas – weaknesses we now have



Identify Corporate Planning Objects

- Organizational units – departments
- Organizational locations
- Business functions – groups of business processes
- Entity types – the things we are trying to model for the database
- Information systems – application programs

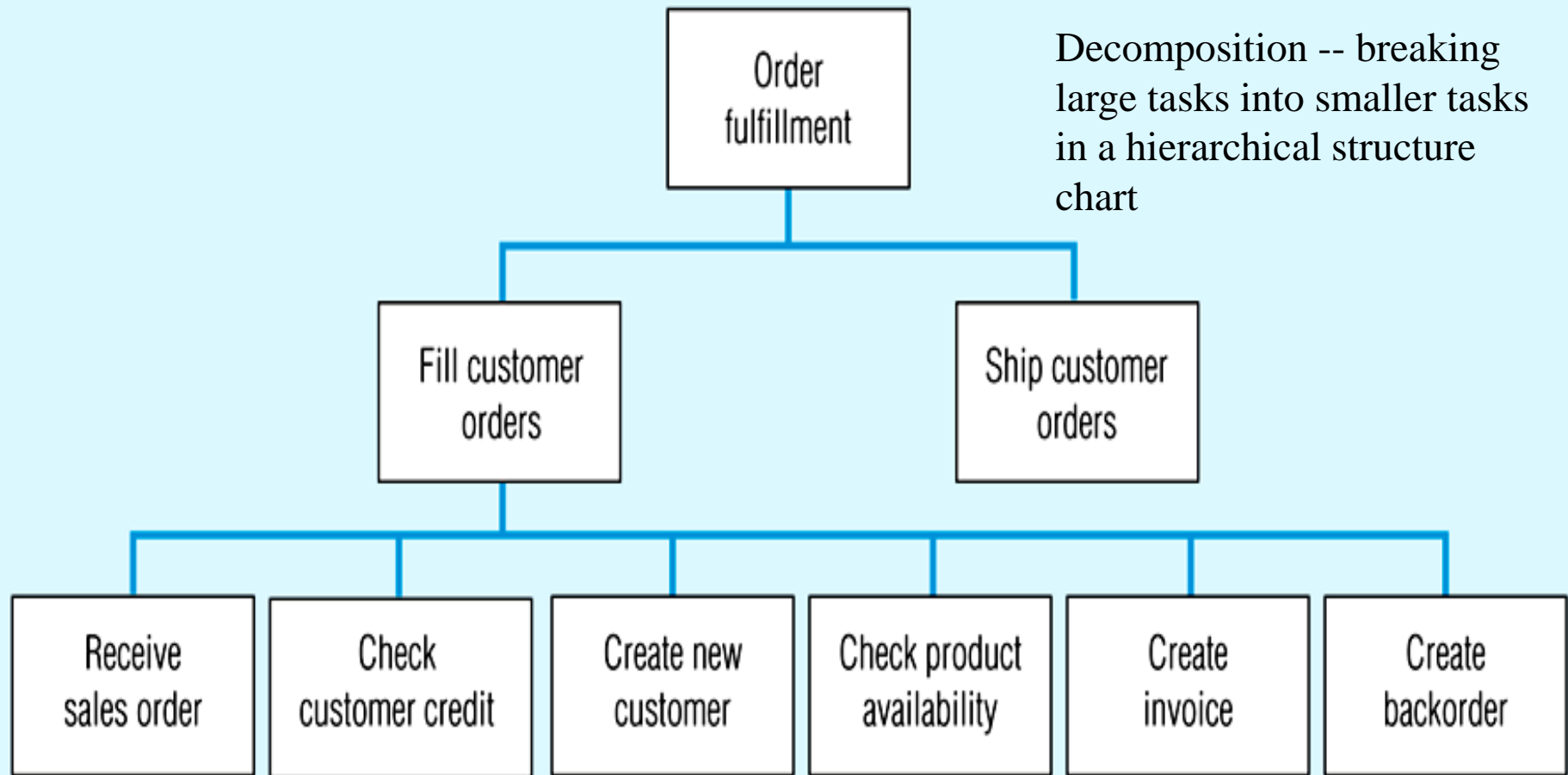


Develop Enterprise Model

- Functional decomposition
 - The process of breaking down the functions of an organization into progressively greater levels of detail.
- Enterprise data model
 - See page 3 (Figure 2-1, text page 38).
- Planning matrixes
 - See page 12 (Figure 2-3, text page 42).



Example of process decomposition of an order fulfillment function (Pine Valley Furniture)



Planning Matrixes

- Describe relationships between planning objects in the organization
- Types of matrixes:
 - Function-to-data entity: which data are useful to each function.
 - Location-to-function: which function is performed where.
 - Unit-to-function: which function is performed by which unit.
 - IS-to-data entity: how each IS interacts with each data entity.
 - IS-to-business objective: which IS supports each business objective.



Example business function-to-data entity matrix

<div> <div>Business Function (users)</div> <div>Data Entity Types</div> </div>	Customer	Product	Raw Material	Order	Work Center	Work Order	Invoice	Equipment	Employee
Business Planning	X	X						X	X
Product Development		X	X		X			X	
Materials Management		X	X	X	X	X		X	
Order Fulfillment	X	X	X	X	X	X	X	X	X
Order Shipment	X	X		X	X		X		X
Sales Summarization	X	X		X			X		X
Production Operations		X	X	X	X	X		X	X
Finance and Accounting	X	X	X	X	X		X	X	X

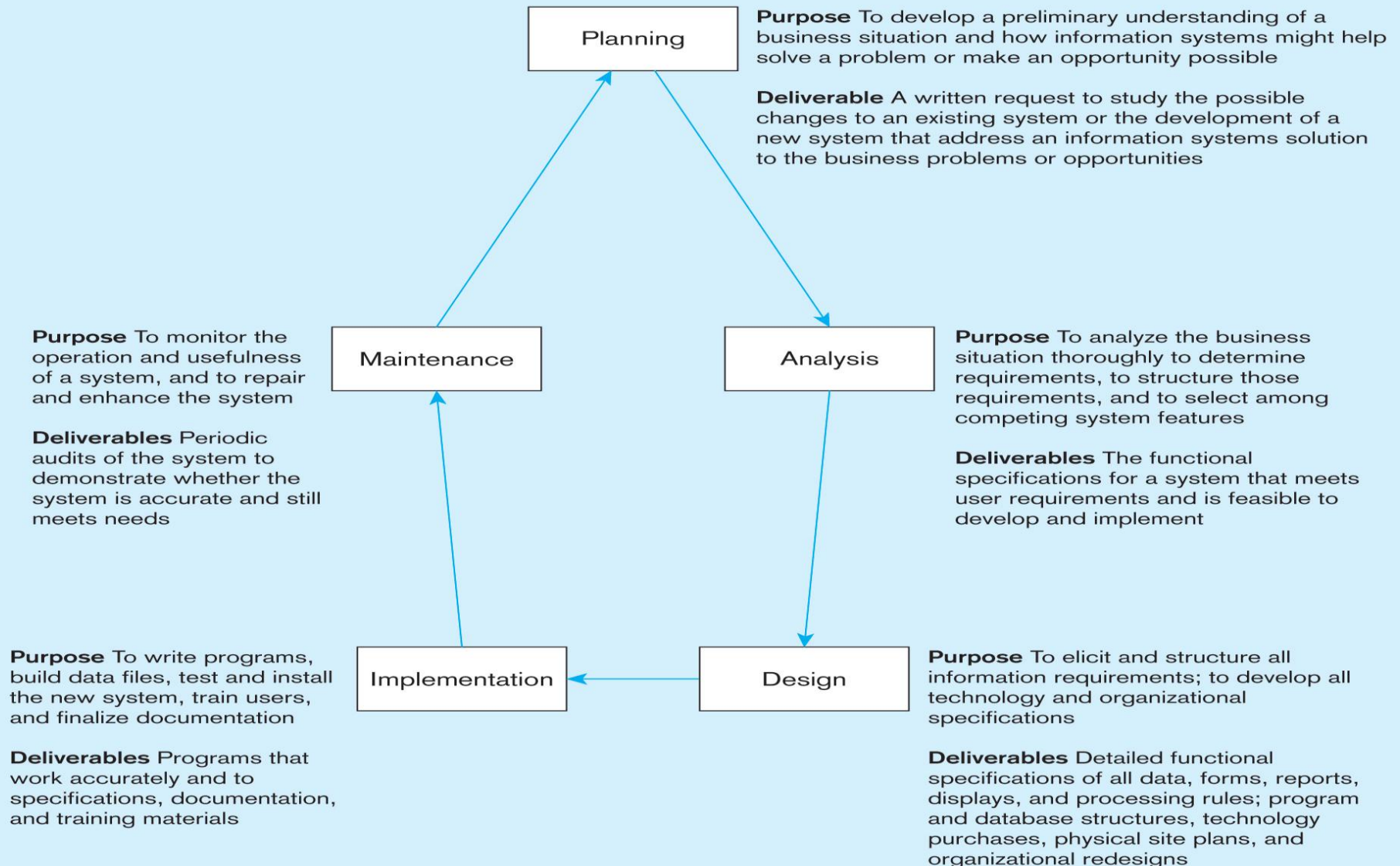


Two Approaches to Database and IS Development

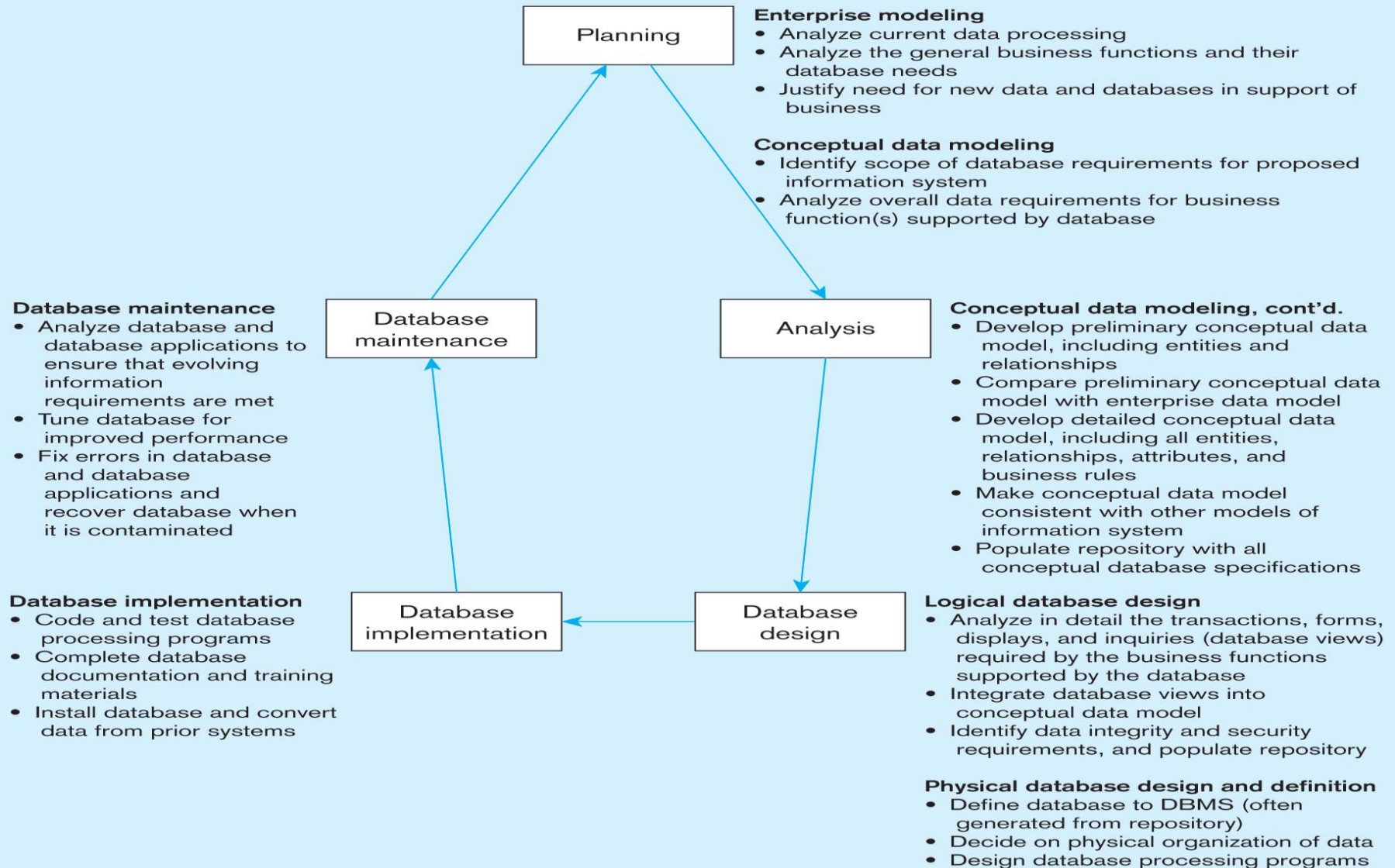
- SDLC
 - System Development Life Cycle
 - Detailed, well-planned development process
 - Time-consuming, but comprehensive
 - Long development cycle
- Rapid Prototyping
 - Rapid application development (RAD)
 - cursory attempt at conceptual data modeling.
 - Define database during development of initial prototype
 - Repeat implementation and maintenance activities with new prototype versions

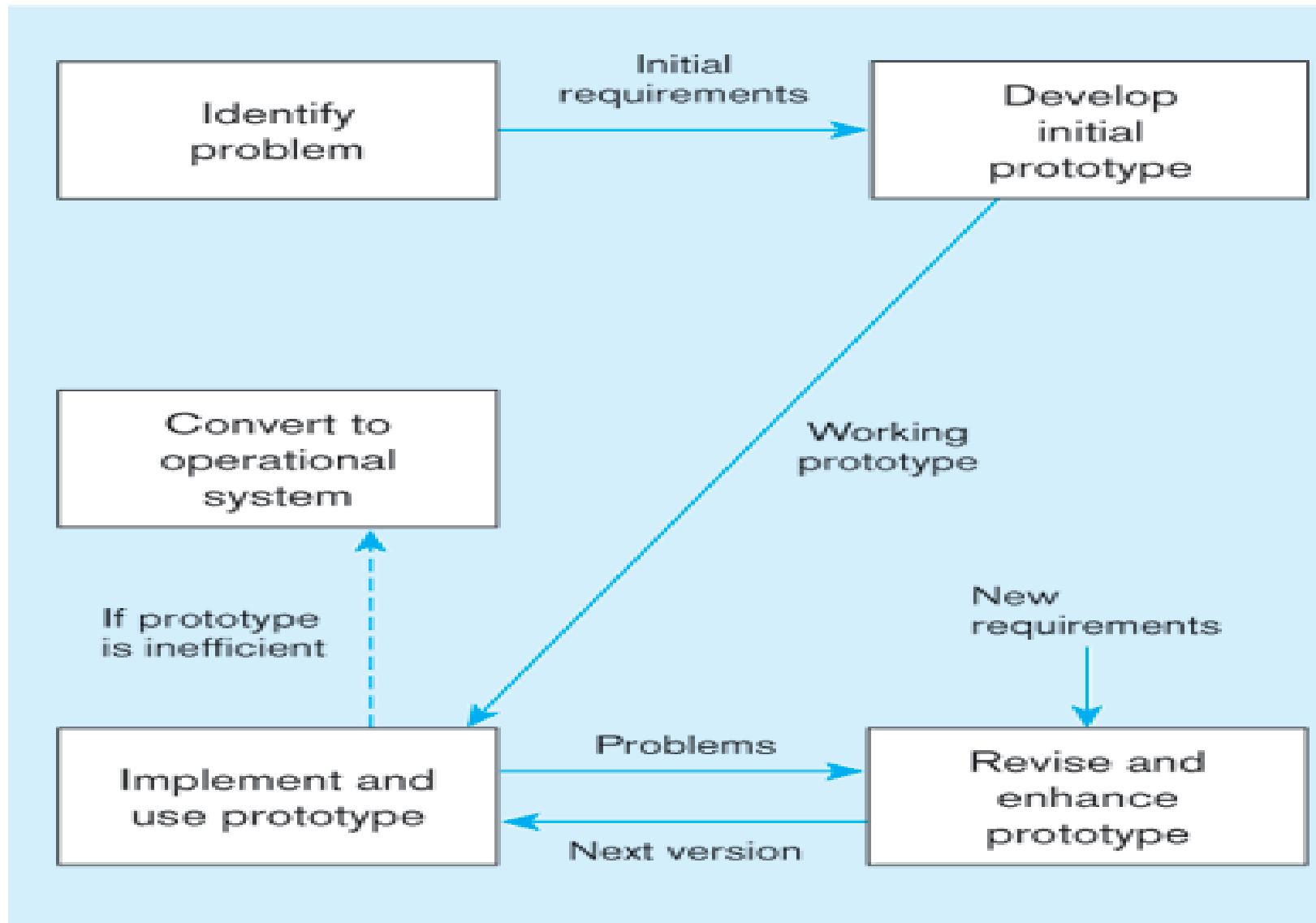


Systems Development Life Cycle



Database Development Activities During The Systems Development Life Cycle





Packaged Data Models

- Model components that can be purchased, customized, and assembled into full-scale data models
- Advantages
 - Reduced development time
 - Higher model quality and reliability
- Two types:
 - Universal data models
 - Industry-specific data models



Database Design

- The database design process can be divided into six basic steps. Semantic data models are most relevant to only the first three of these steps.
1. *Requirements Analysis*: The first step in designing a database application is to understand what data is to be stored in the database, what applications must be built on top of it, and what operations are most frequent and subject to performance requirements. Often this is an informal process involving discussions with user groups and studying the current environment. Examining existing applications expected to be replaced or complemented by the database system.



Database Design (cont.)

2. *Conceptual Database Design:* The information gathered in the requirements analysis step is used to develop a high-level description of the data to be stored in the database, along with the constraints that are known to hold on this data.
3. *Logical Database Design:* A DBMS must be selected to implement the database and to convert the conceptual database design into a database schema within the data model of the chosen DBMS.



Database Design (cont.)

4. *Schema Refinement*: In this step the schemas developed in step 3 above are analyzed for potential problems. It is in this step that the database is *normalized*. Normalization of a database is based upon some elegant and powerful mathematical theory. We will discuss normalization later in the term.
5. *Physical Database Design*: At this stage in the design of a database, potential workloads and access patterns are simulated to identify potential weaknesses in the conceptual database. This will often cause the creation of additional indices and/or clustering relations. In critical situations, the entire conceptual model will need restructuring.

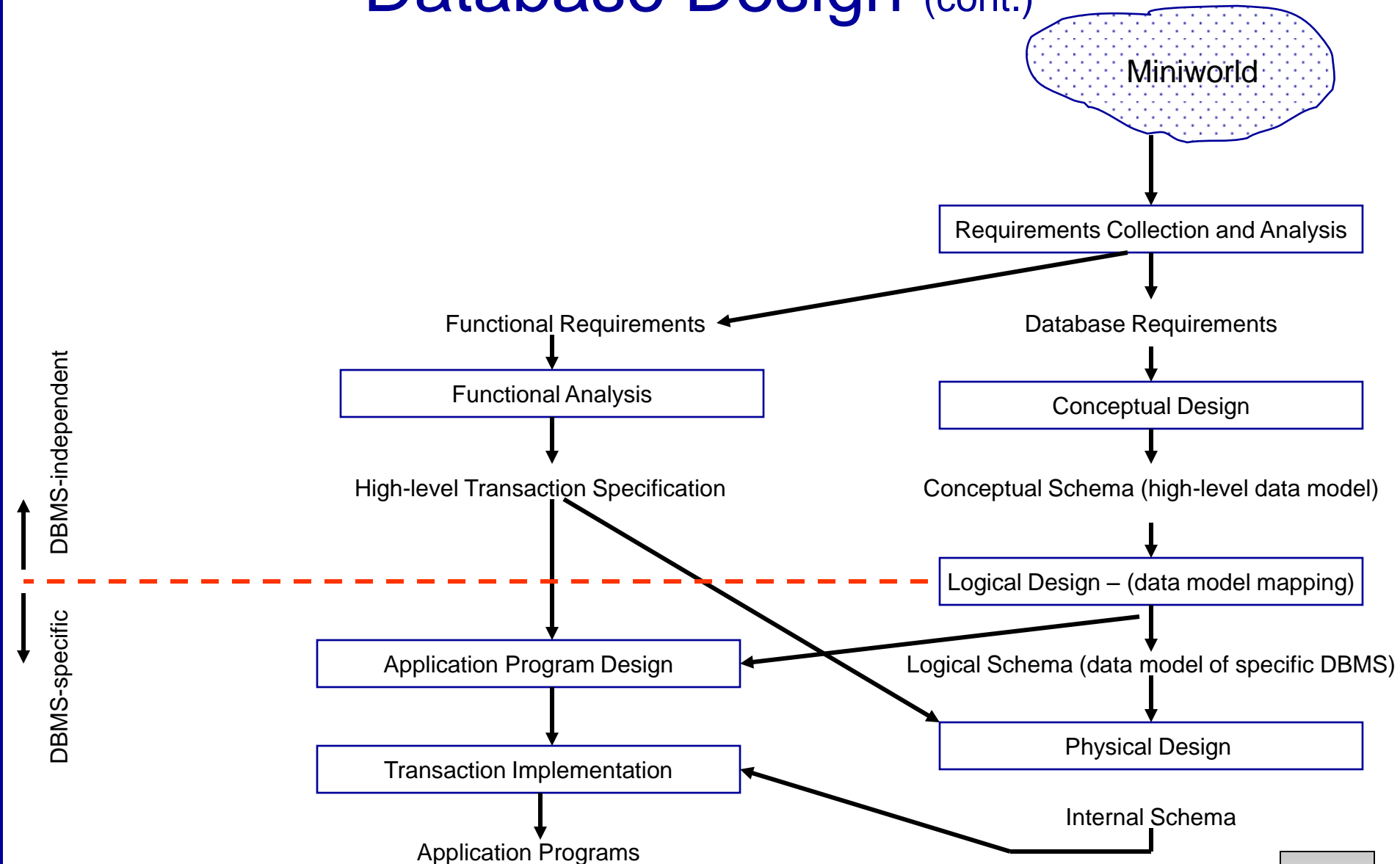


Database Design (cont.)

6. *Security Design*: Different user groups are identified and their different roles are analyzed so that access patterns to the data can be defined.
- There is often a seventh step in this process with the last step being a *tuning phase*, during which the database is made operational (although it may be through a simulation) and further refinements are made as the system is “tweaked” to provide the expected environment.
- The illustration on the following page summarizes the main phases of database design.



Database Design (cont.)



CASE

- Computer-Aided Software Engineering (CASE) – software tools providing automated support for systems development
- Three database features:
 - Data modeling – entity-relationship diagrams
 - Code generation – SQL code for table creation
 - Repositories – knowledge base of enterprise information



Managing Projects

- Project – a planned undertaking of related activities to reach an objective that has a beginning and an end
- Involves use of review points for:
 - Validation of satisfactory progress
 - Step back from detail to overall view
 - Renew commitment of stakeholders
- Incremental commitment – review of systems development project after each development phase with re-justification after each phase

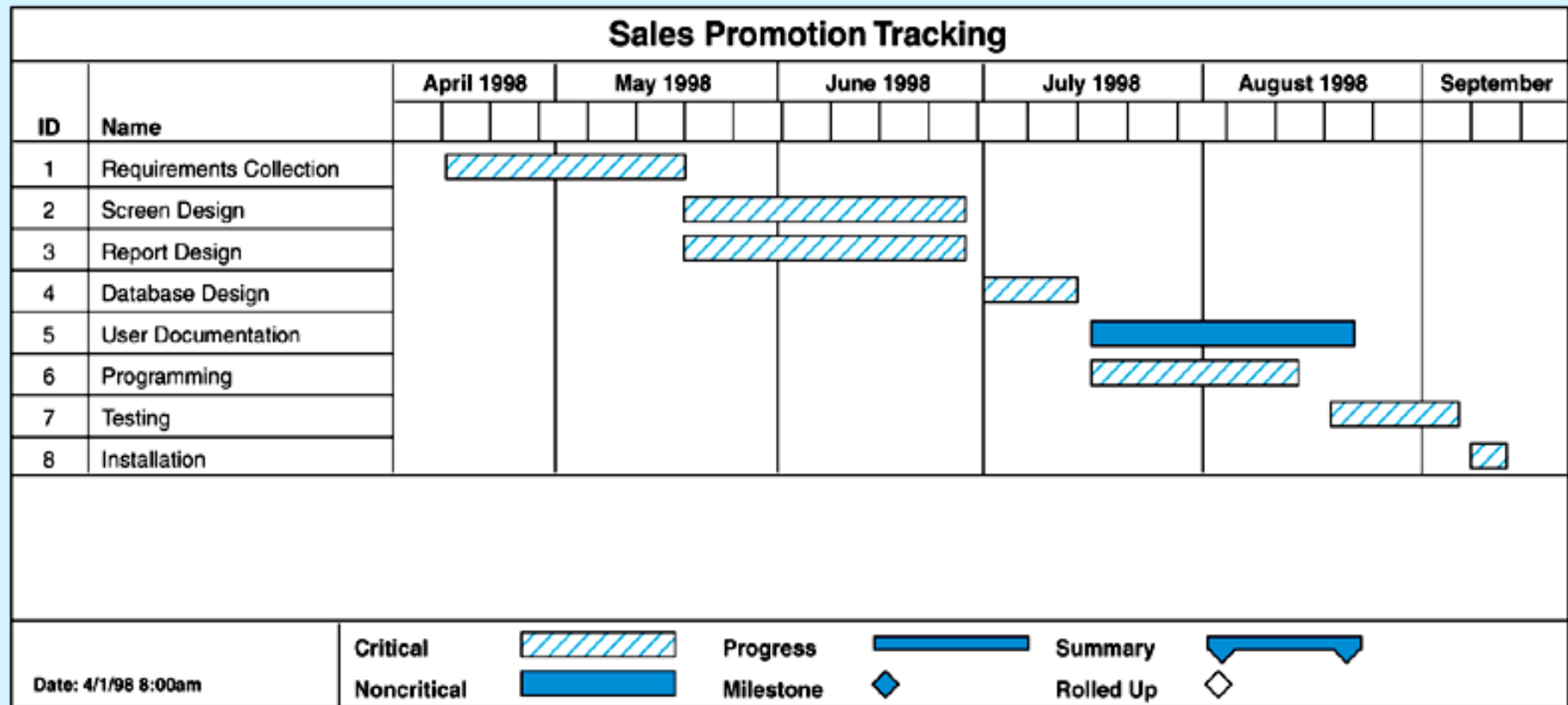


Managing Projects: People Involved

- Systems analysts
- Database analysts
- Users
- Programmers
- Database/data administrators
- Systems programmers, network administrators, testers, technical writers



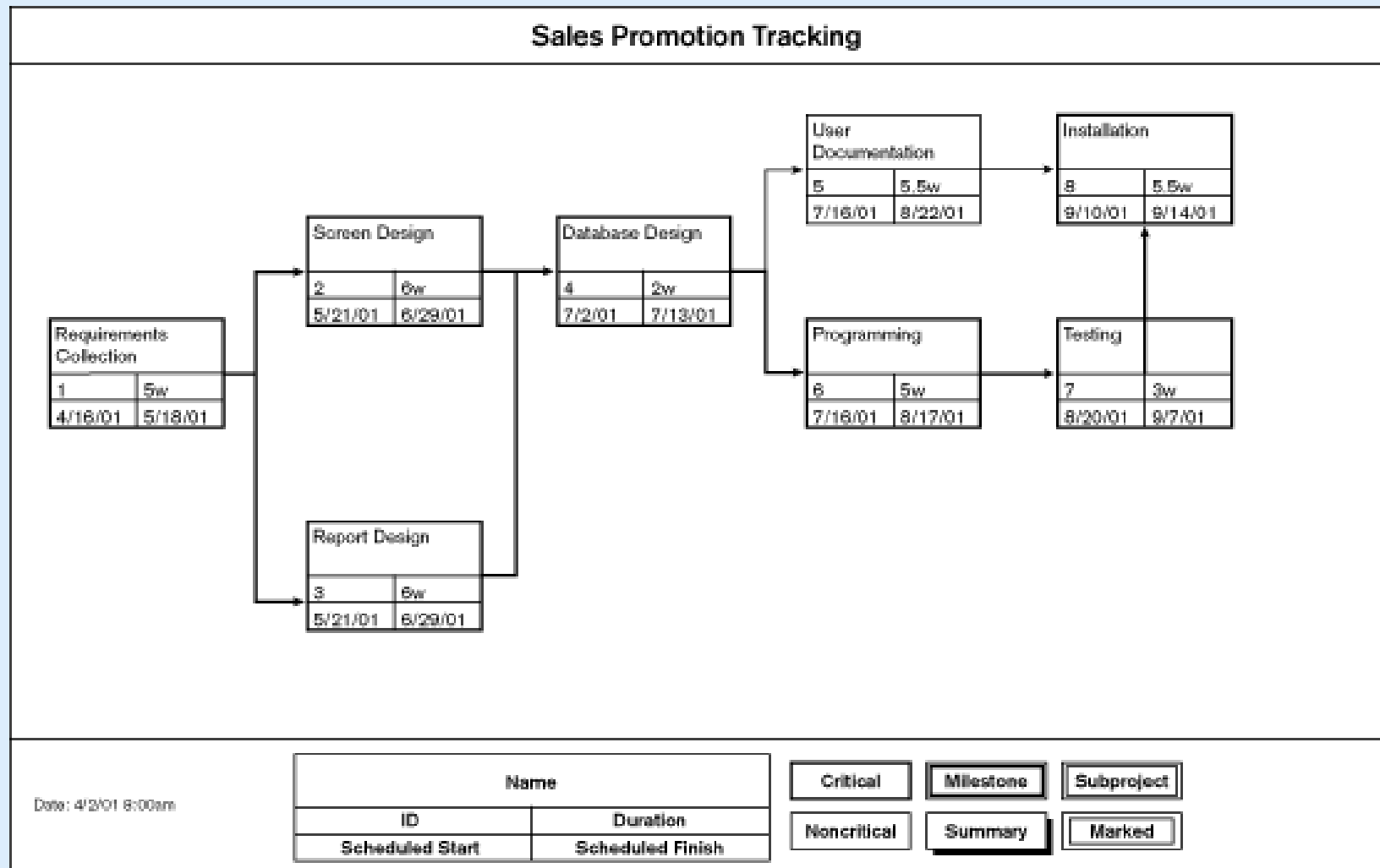
Gantt Chart



Shows time estimates of tasks



PERT chart (Program Evaluation and Review Technique)



Shows dependencies between tasks

