Chapter 2:

The Database Development Process

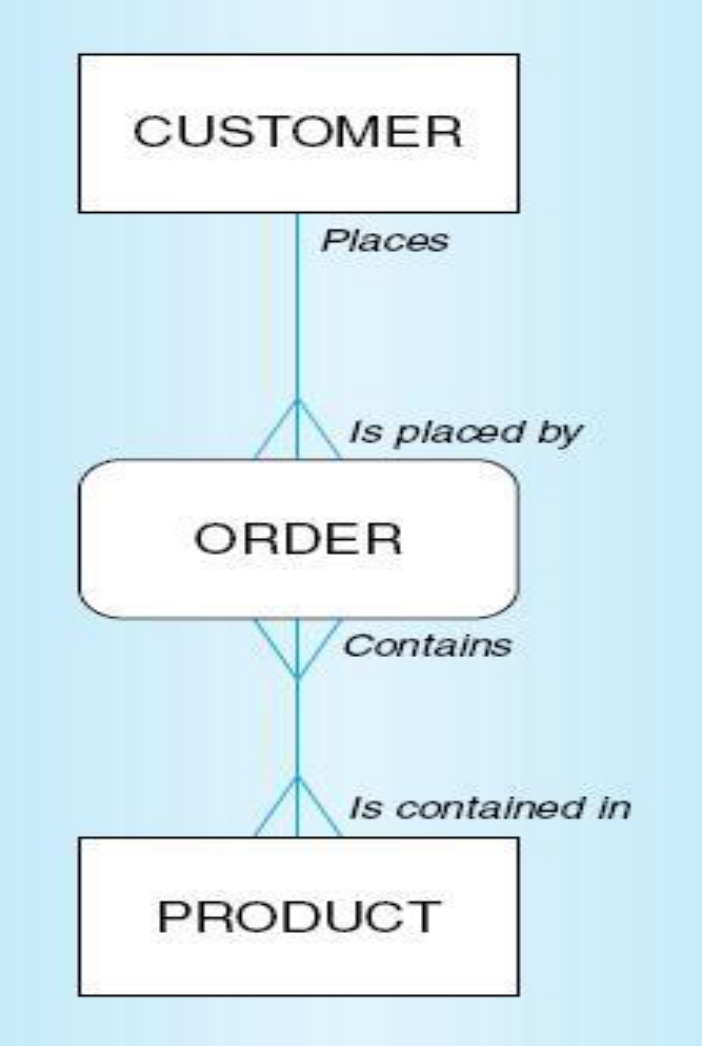
Objectives

- Definition of terms
- Describe system development life cycle
- Explain prototyping approach
- Explain agile software development approach
- Explain roles of individuals
- Explain three-schema approach
- Explain role of packaged data models
- Explain three-tiered architectures
- Explain scope of database design projects
- Draw simple data models

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

Figure 2-1 Segment from enterprise data model



Enterprise data model describes the high-level entities in an organization and the relationship between these entities

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.
  - 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***

Table 2-1
Information Engineering Planning Phase

STEP	EXPLANATION
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 an enterprise model
	a. Functional decomposition
	b. Entity-relationship diagram
	c. Planning matrixes

Identify Strategic Planning Factors (Table 2-2)

- 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 (Table 2-3)

- 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
  - Iterative process breaking system description into finer and finer detail
- Enterprise data model
- Planning matrixes
  - Describe interrelationships between planning objects

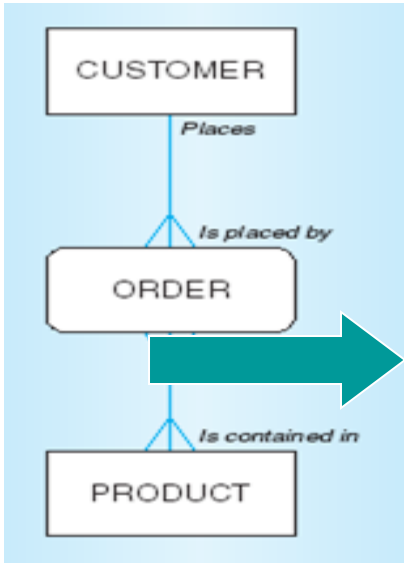
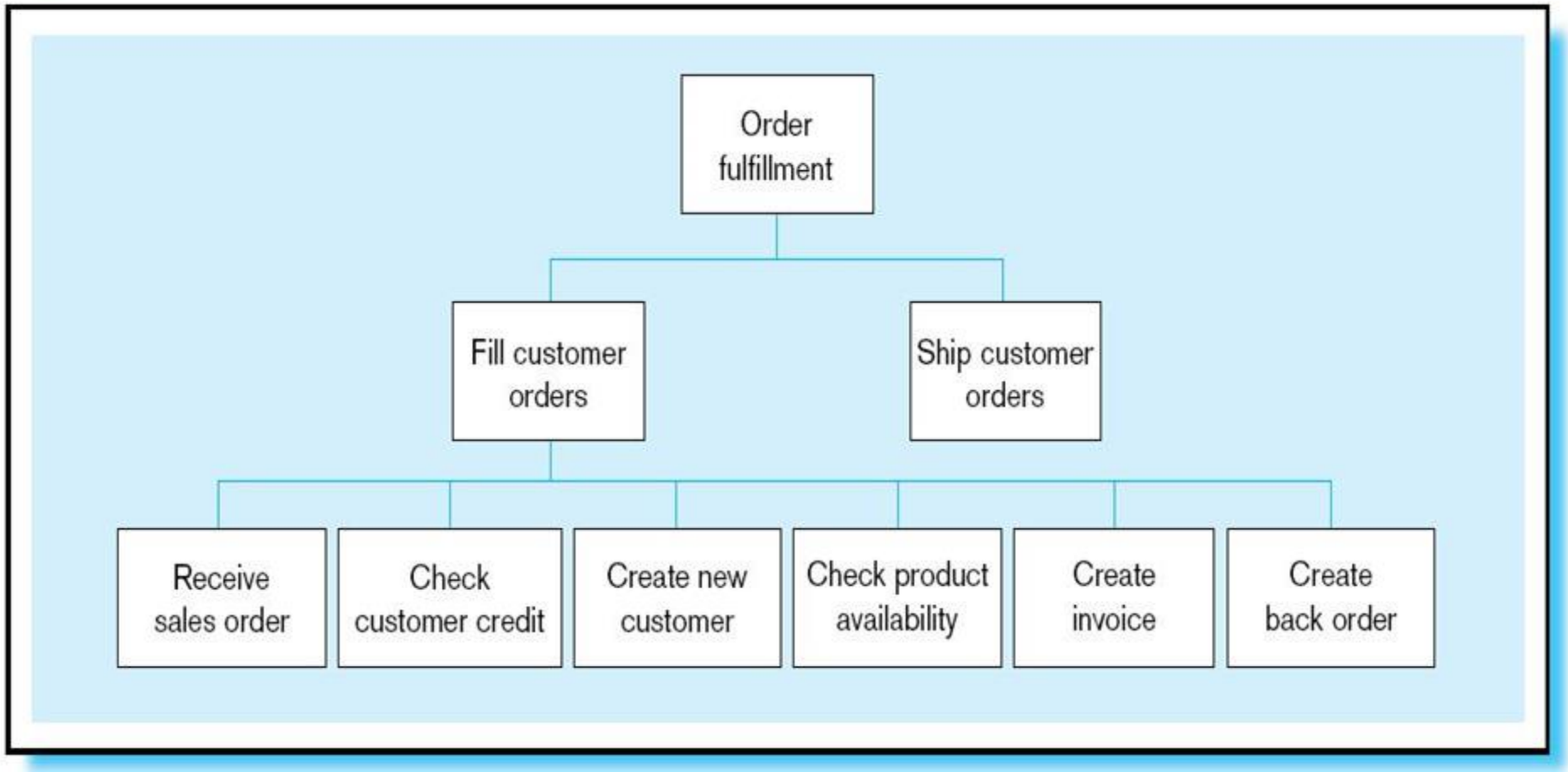


Figure 2-2 Example process decomposition of an order fulfillment function (Pine Valley Furniture Company)



Planning Matrixes

- Describe relationships between planning objects in the organization
- Types of matrixes:
  - Location-to-function
  - Unit-to-function
  - IS-to-data entity
  - Supporting function-to-data entity
  - IS-to-business objective

Example Business Function-to-Data Entity Matrix (Fig. 2-3)

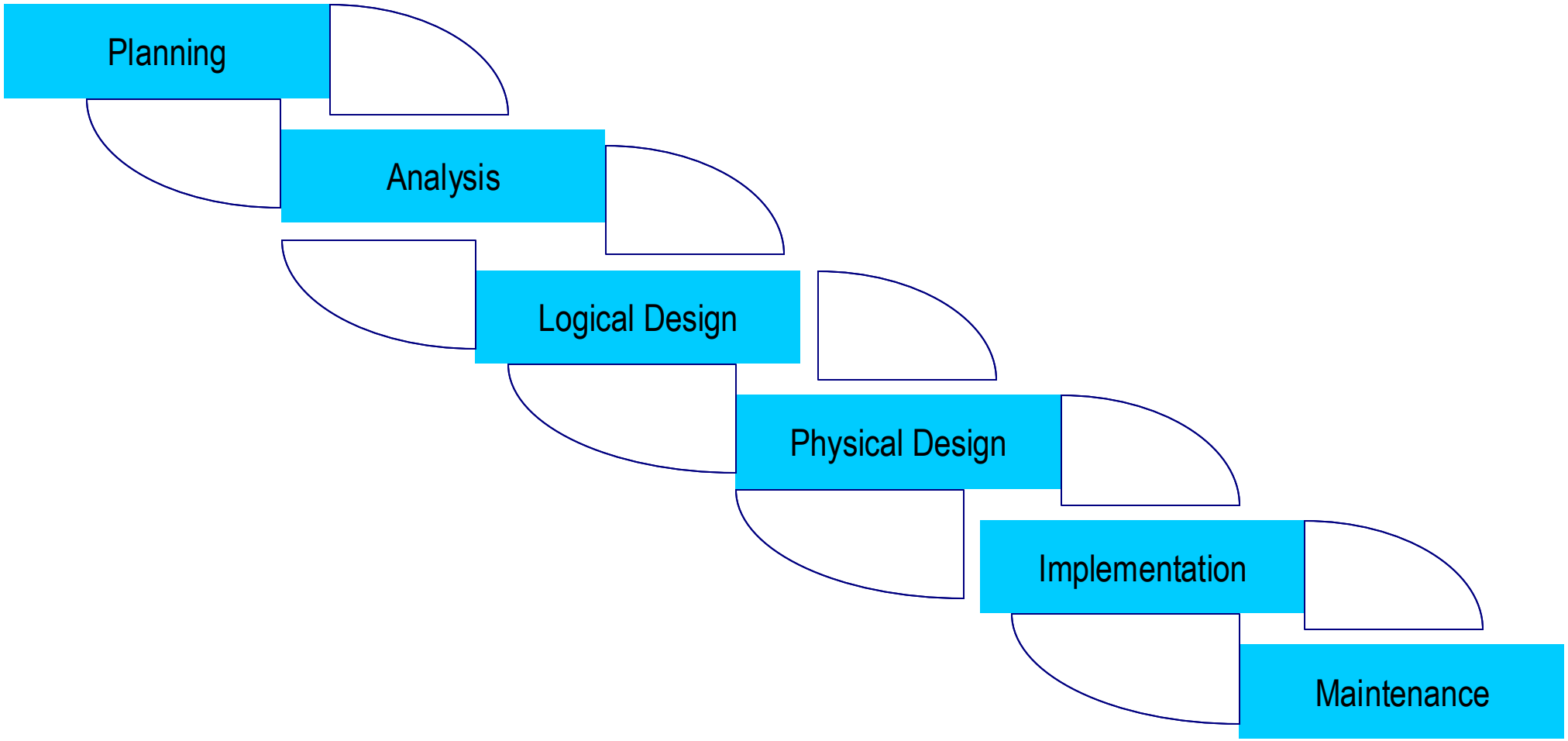
Business Functions \ Data Entity Types	Customer	Product	Raw Material	Order	Work Center	Work Order	Invoice	Equipment	Employee
Business Planning	X	X						X	X
Product Development		X	X		X			X	
Materials Management		X	X	X	X	X		X	
Order Fulfillment	X	X	X	X	X	X	X	X	X
Order Shipment	X	X		X	X		X		X
Sales Summarization	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

X = data entity (column) is used within business function (row)

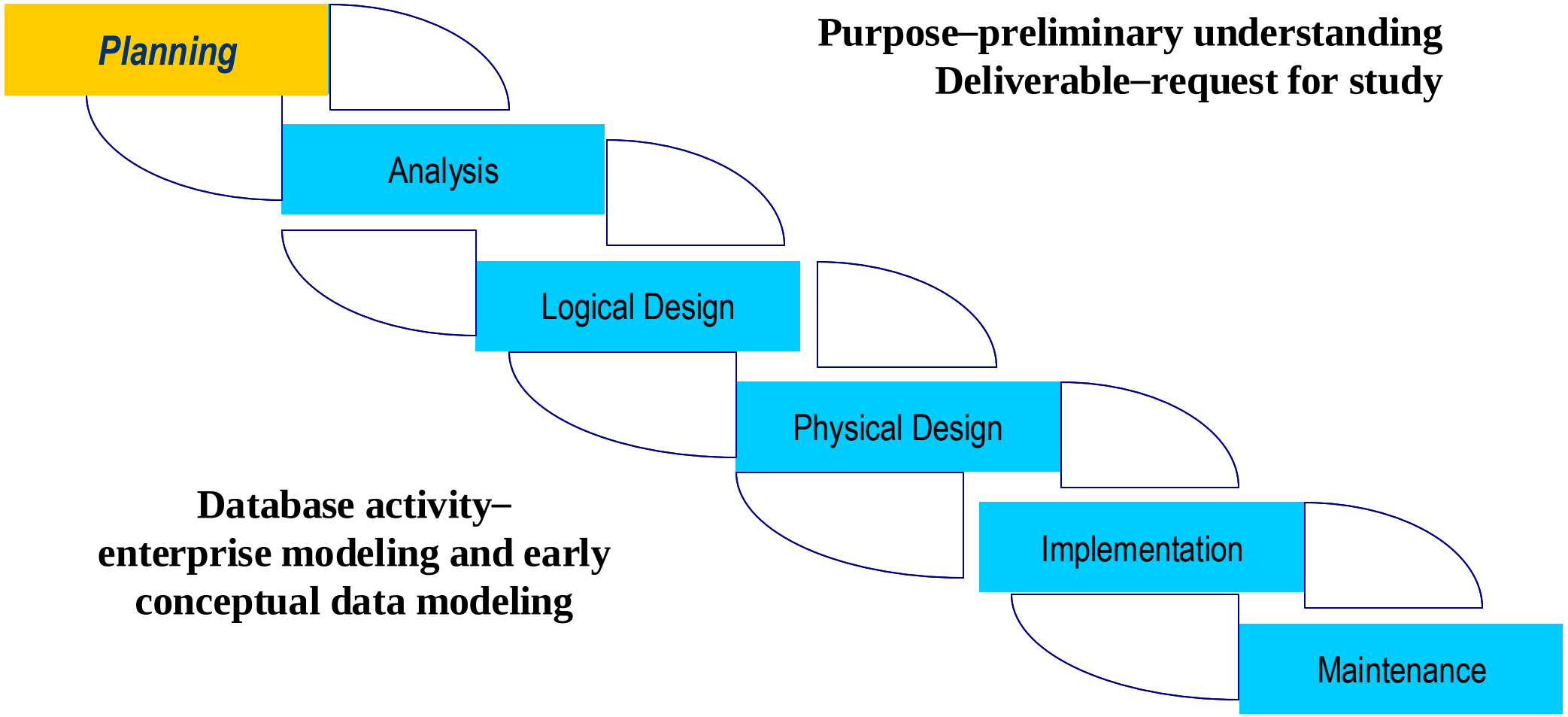
Two Approaches to Database and IS Development

- SDLC
  - System Development Life Cycle
  - Detailed, well-planned development process
  - Time-consuming, but comprehensive
  - Long development cycle
- 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

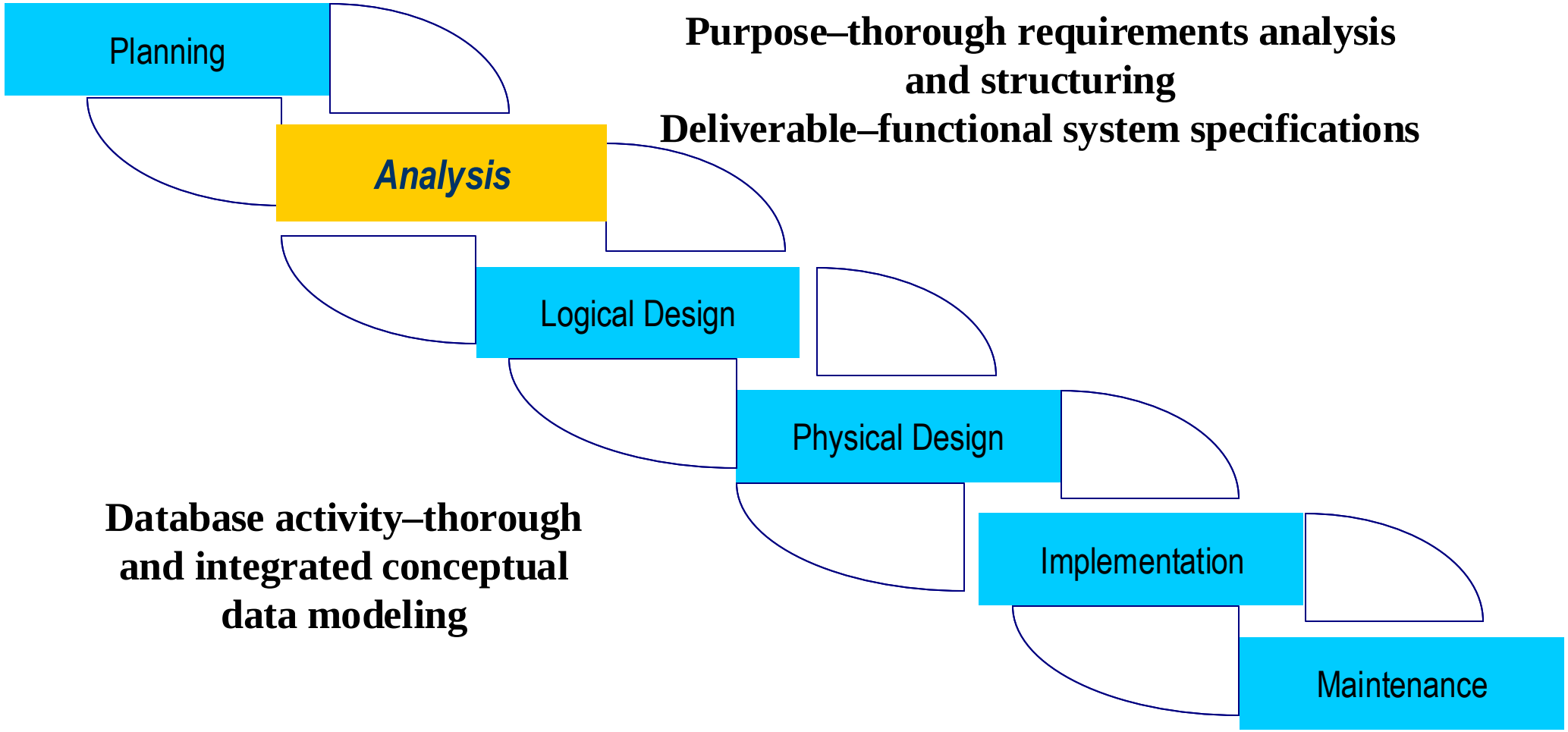
Systems Development Life Cycle(see also Figures 2.4, 2.5)



Systems Development Life Cycle (see also Figures 2.4, 2.5) (cont.)



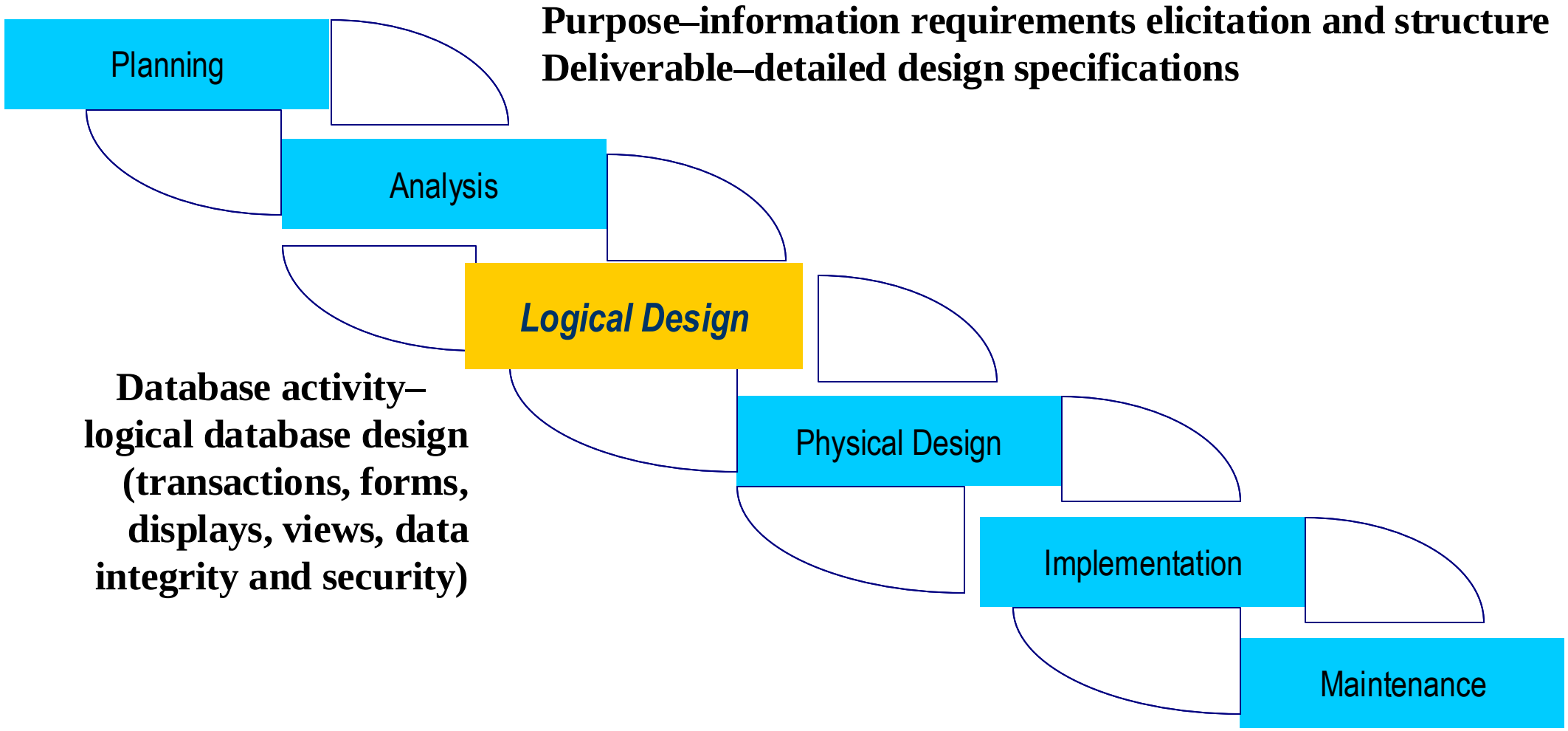
Systems Development Life Cycle(see also Figures 2.4, 2.5) (cont.)



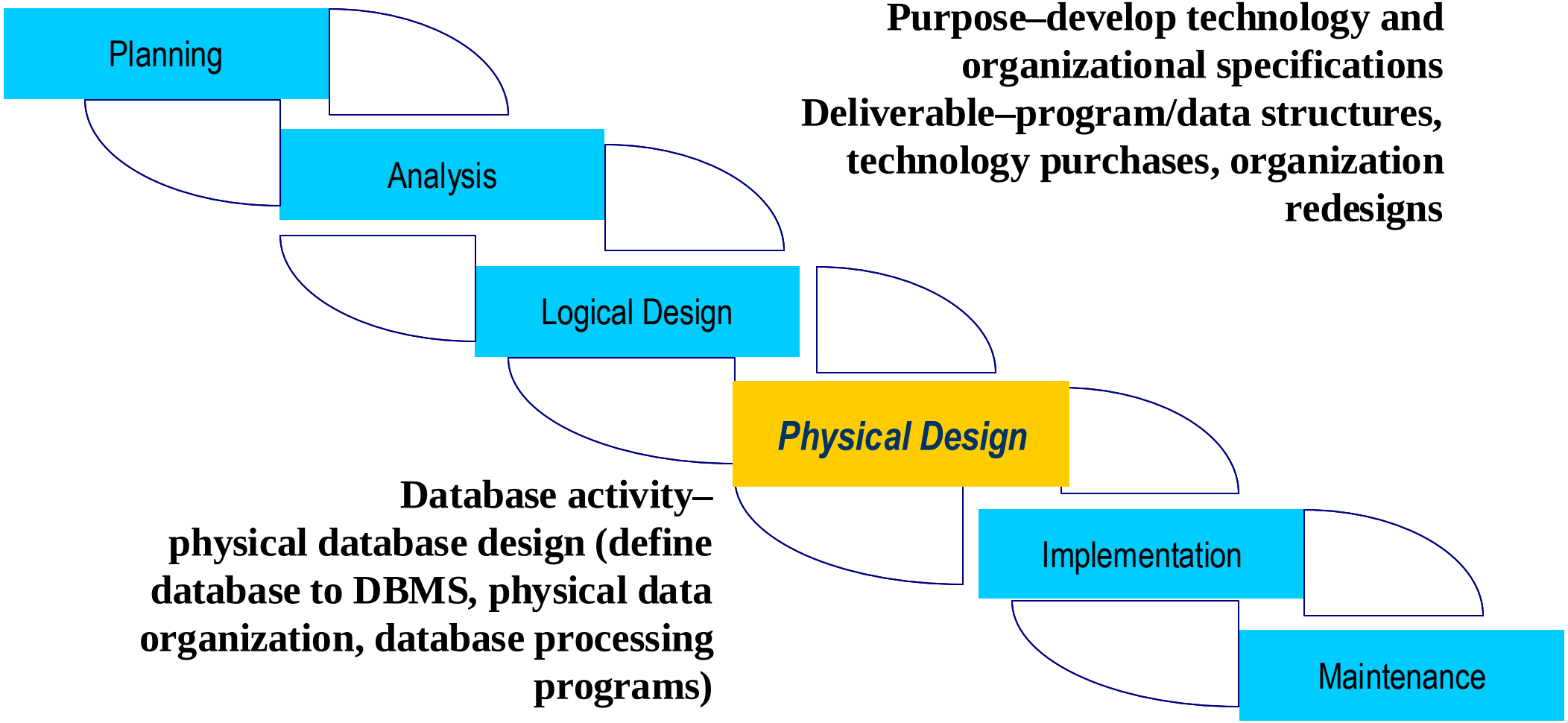
Purpose–thorough requirements analysis and structuring
Deliverable–functional system specifications

Database activity–thorough and integrated conceptual data modeling

Systems Development Life Cycle (see also Figures 2.4, 2.5) (cont.)



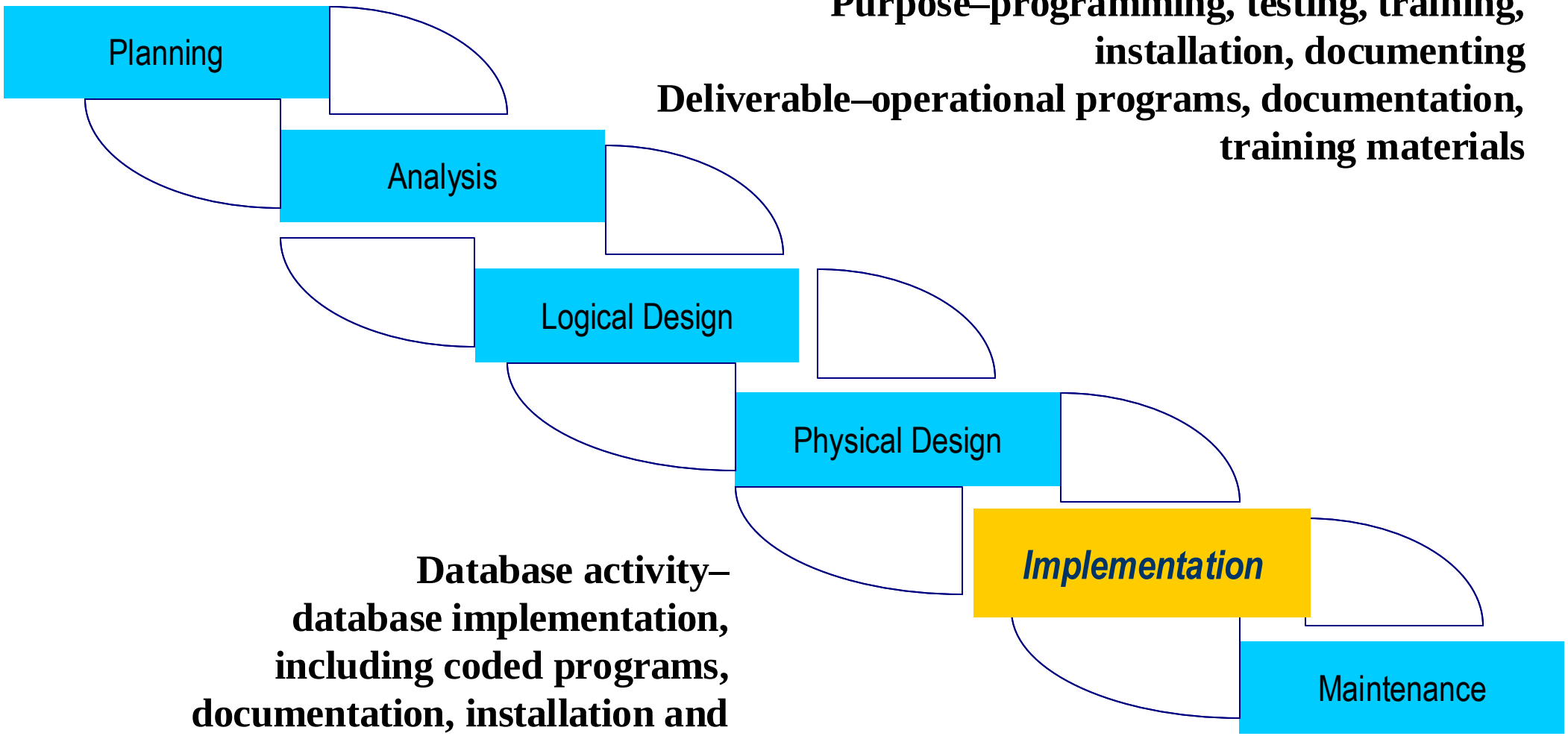
Systems Development Life Cycle (see also Figures 2.4, 2.5) (cont.)



Purpose–develop technology and organizational specifications Deliverable–program/data structures, technology purchases, organization redesigns

Database activity–physical database design (define database to DBMS, physical data organization, database processing programs)

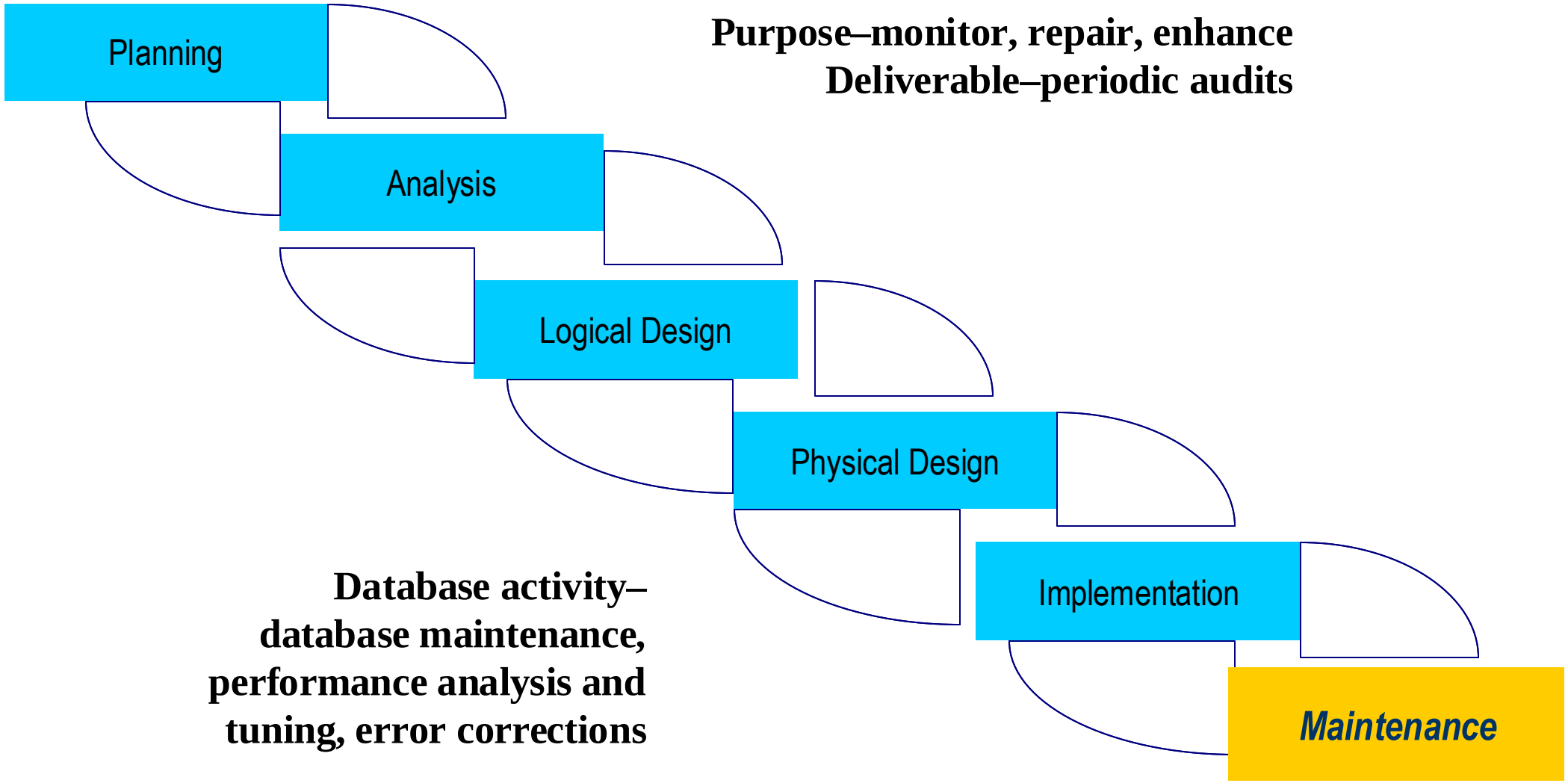
Systems Development Life Cycle (see also Figures 2.4, 2.5) (cont.)



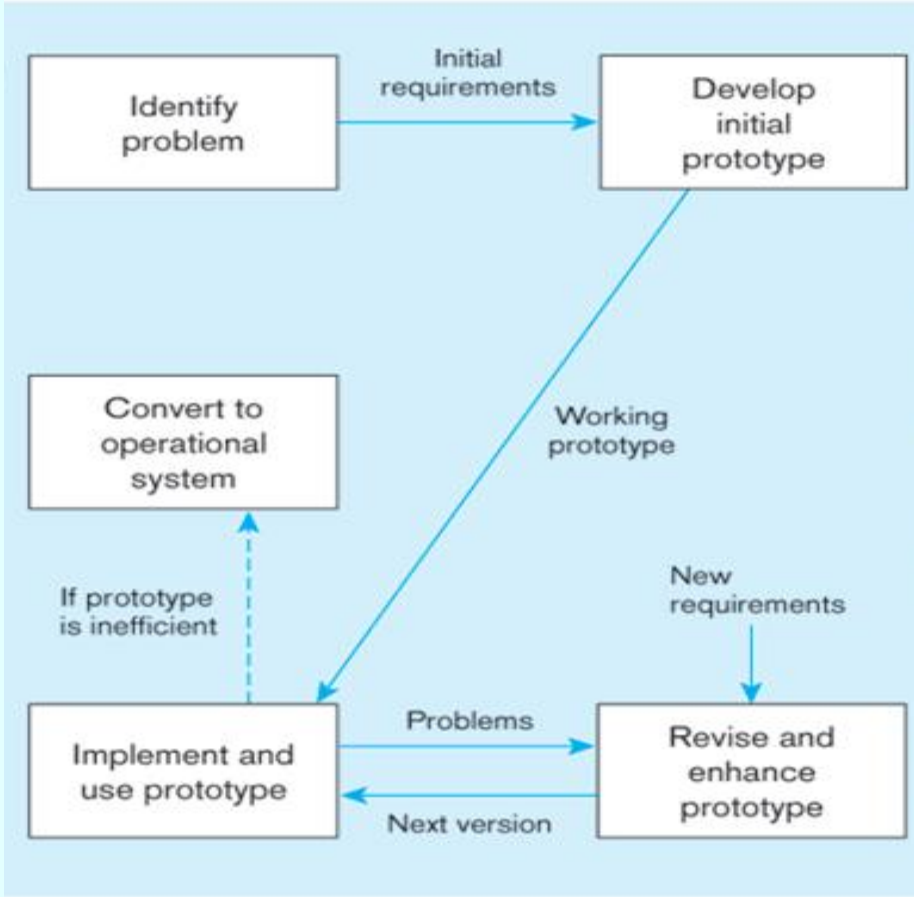
Purpose–programming, testing, training, installation, documenting
Deliverable–operational programs, documentation, training materials

Database activity–database implementation, including coded programs, documentation, installation and conversion

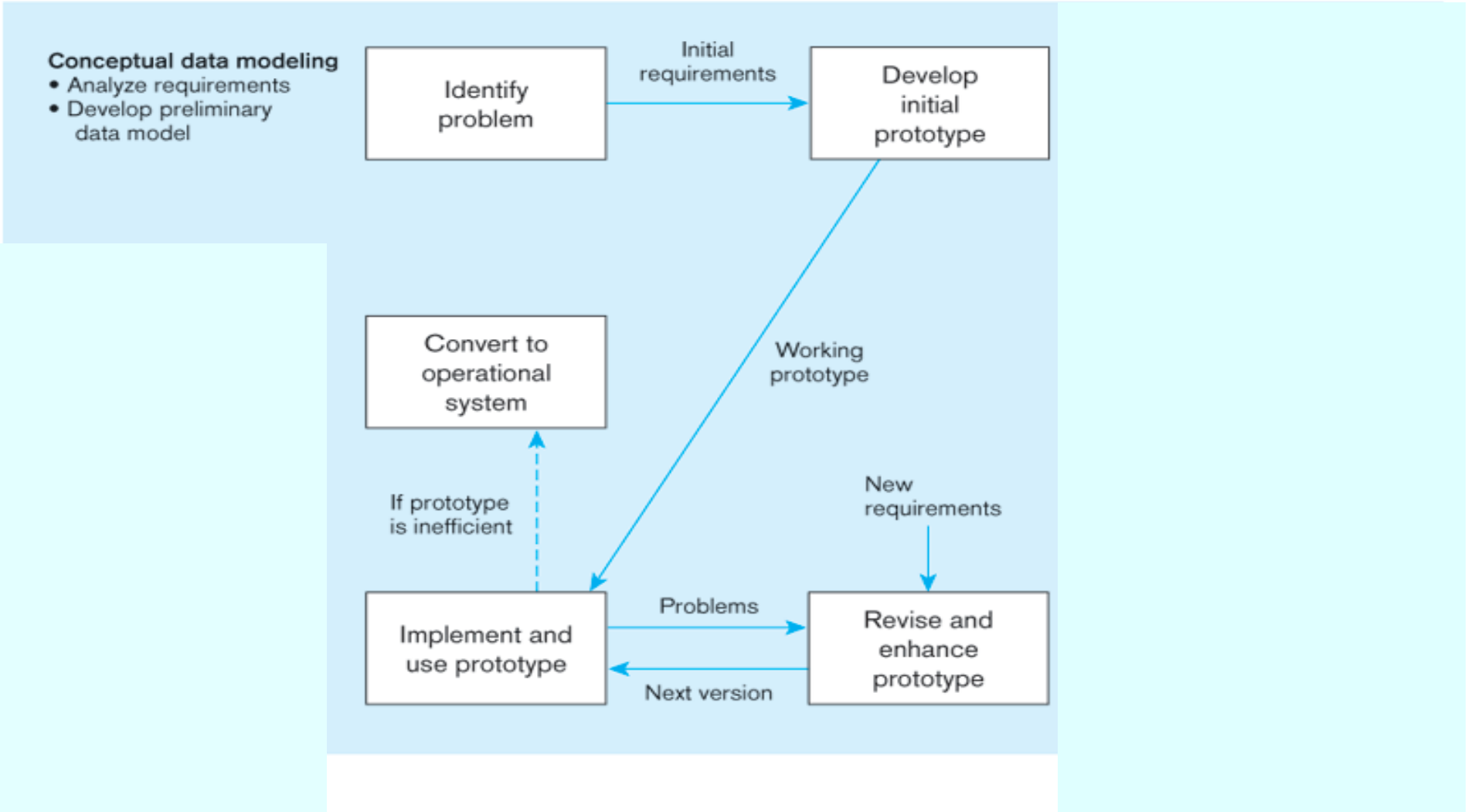
Systems Development Life Cycle (see also Figures 2.4, 2.5)(cont.)



Prototyping Database Methodology(Figure 2.6)

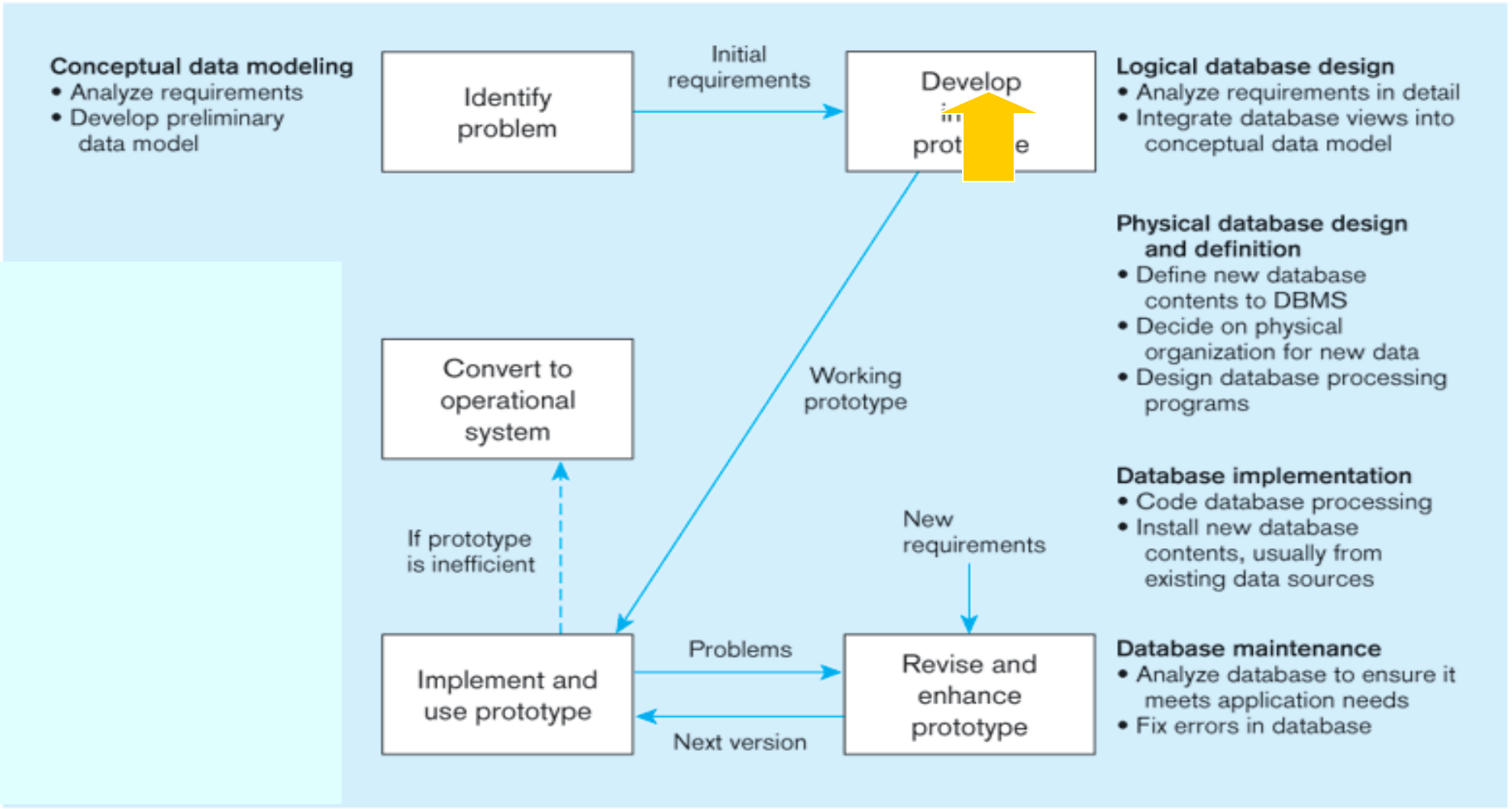


Prototyping Database Methodology (Figure 2.6) (cont.)

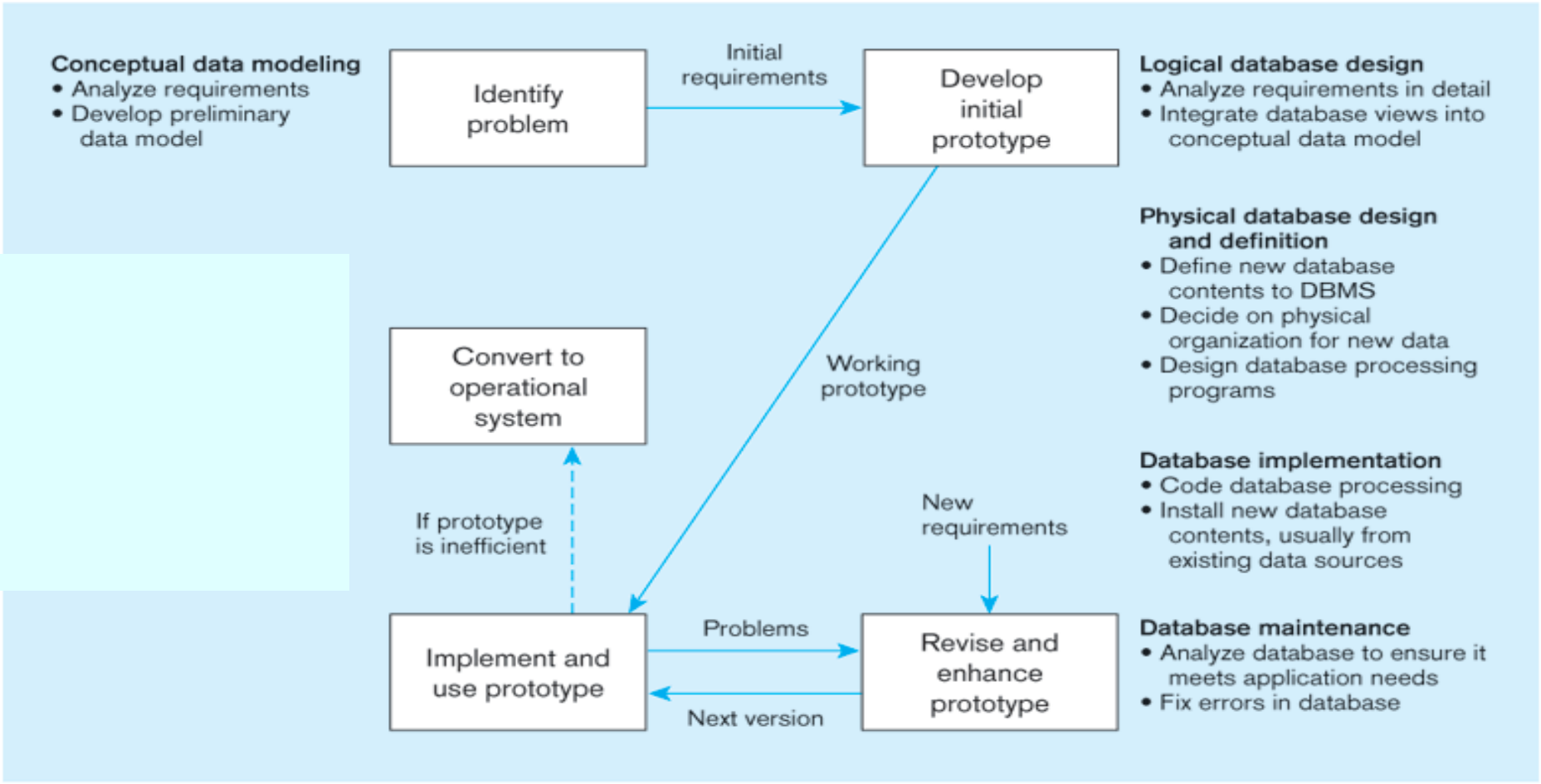


Prototyping Database Methodology (Figure 2.6) (cont.)

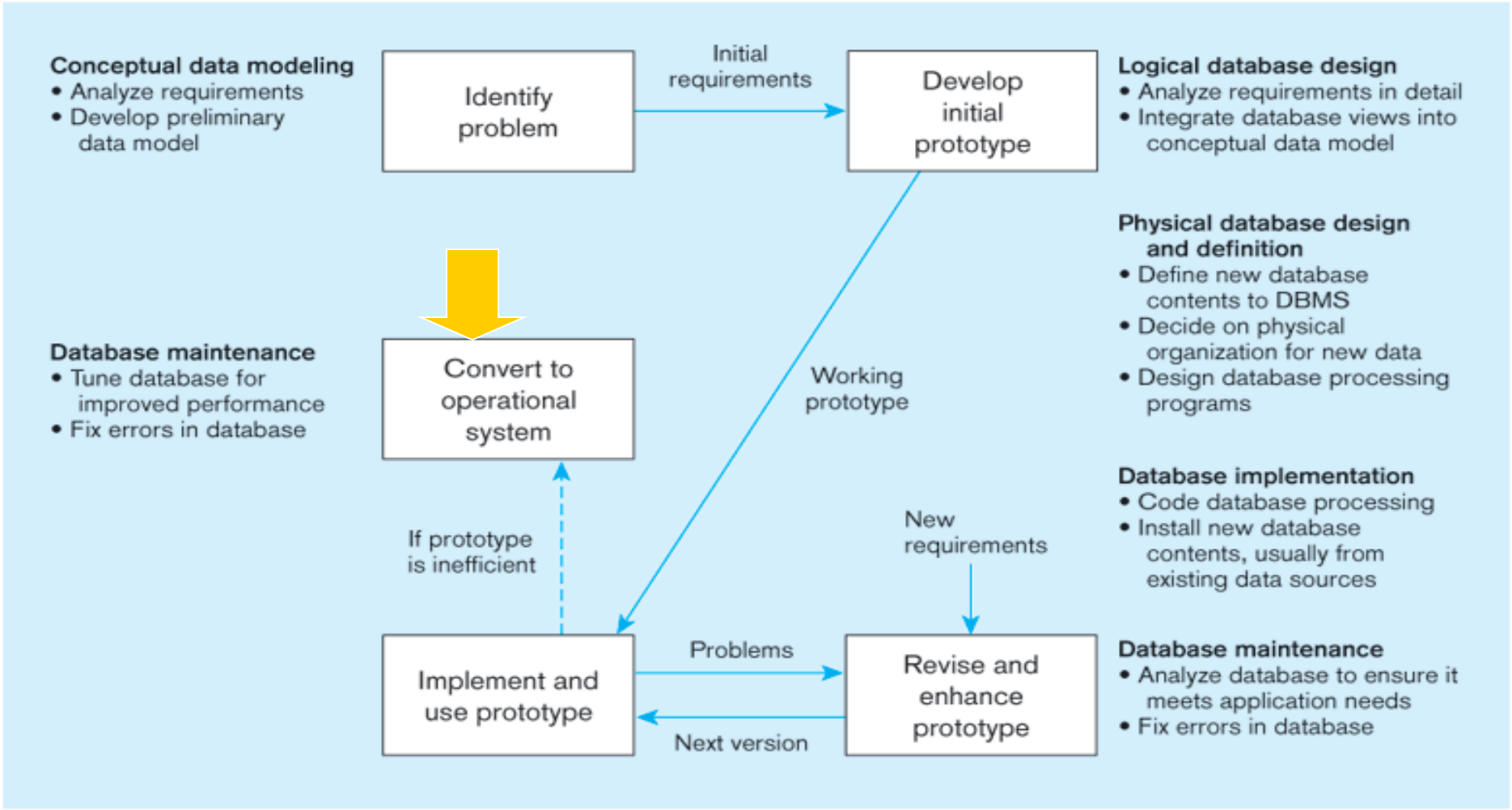
Figure 2-6 The prototyping methodology and database development process



Prototyping Database Methodology (Figure 2.6) (cont.)



Prototyping Database Methodology (Figure 2.6) (cont.)



CASE

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

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

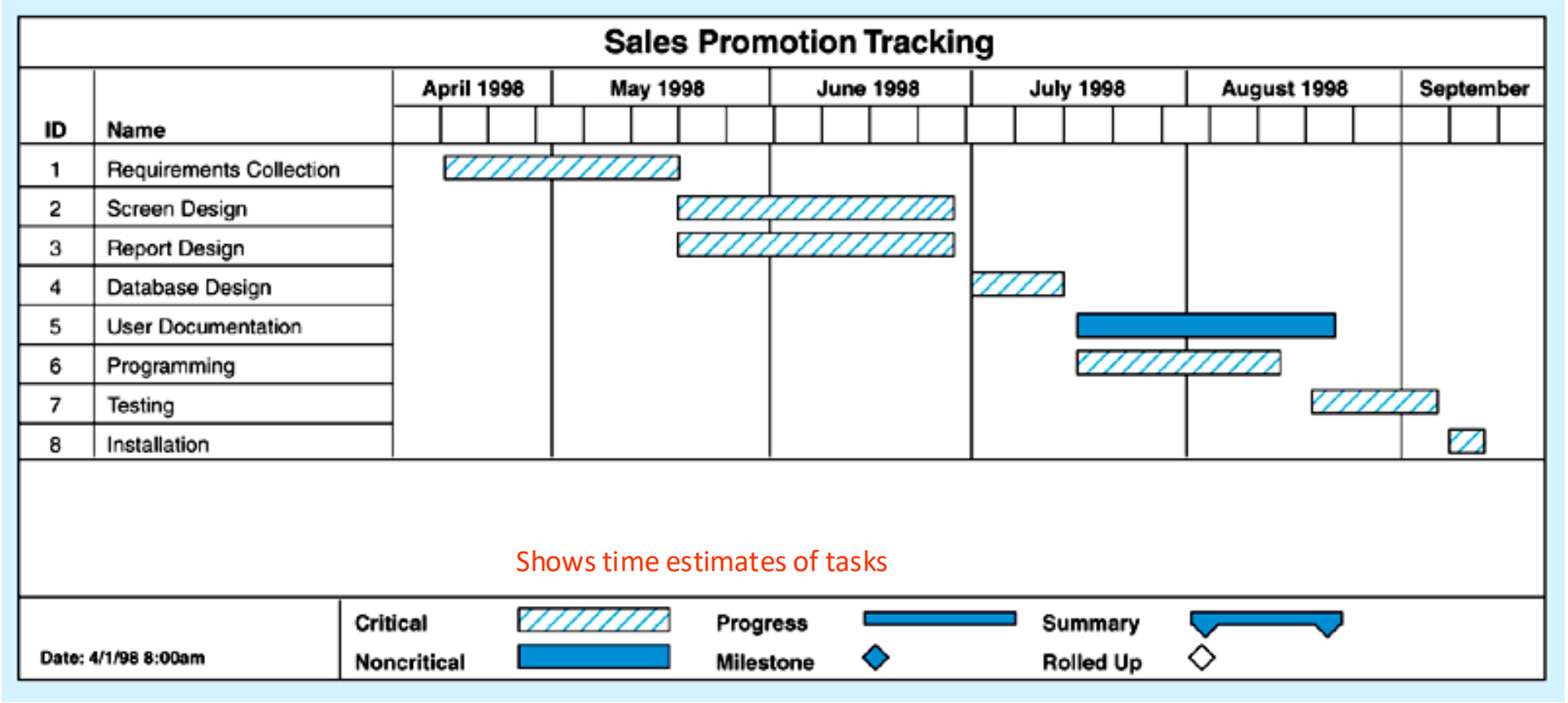
Managing Projects

- 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 rejustification after each phase

Managing Projects: People Involved

- Business analysts
- Systems analysts
- Database analysts and data modelers
- Users
- Programmers
- Database architects
- Data administrators
- Project managers
- Other technical experts

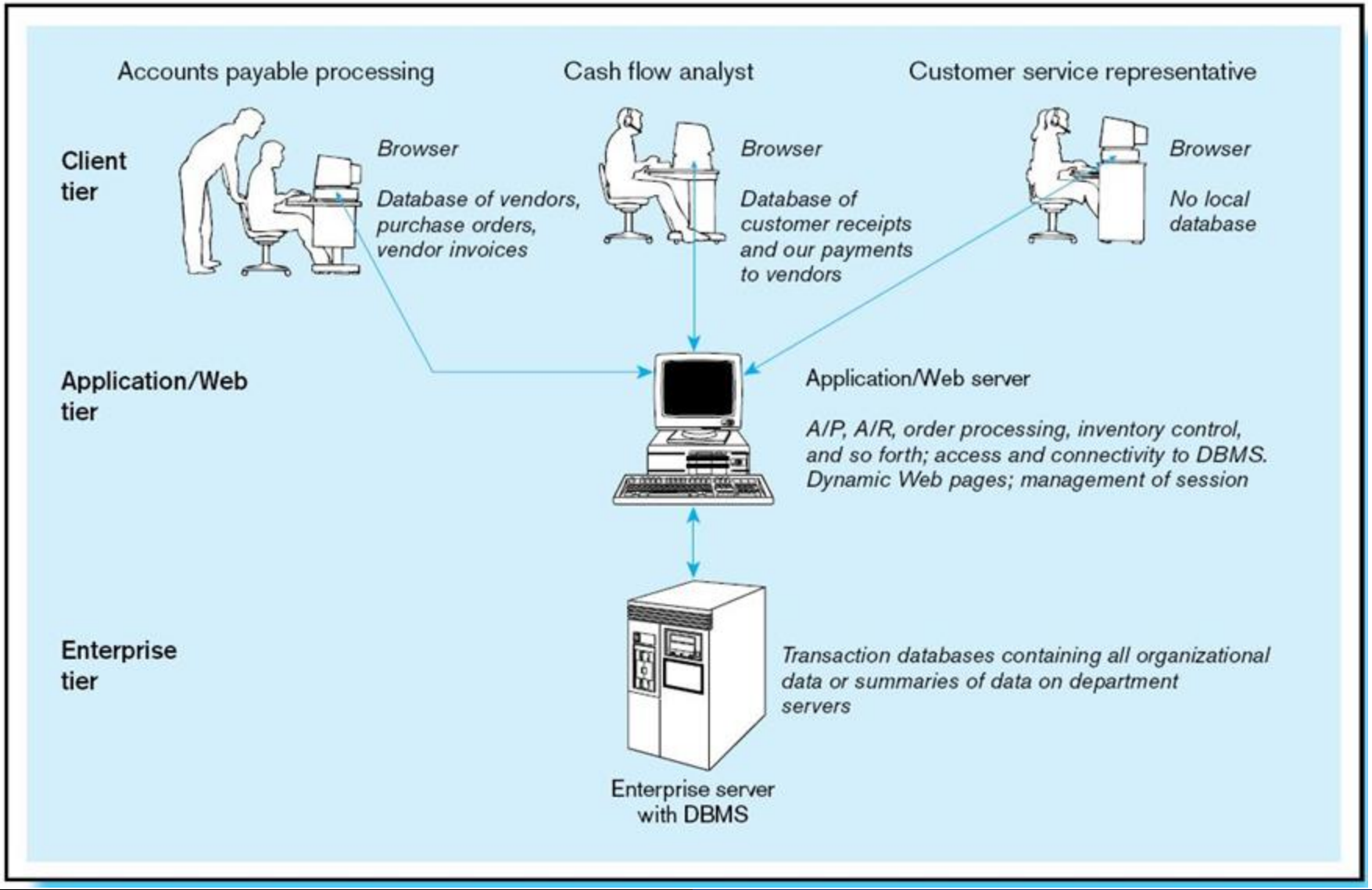
Gantt Chart


Sales Promotion Tracking
ID
Name
April 1998
May 1998
June 1998
July 1998
August 1998
September
1 Requirements Collection
2 Screen Design
3 Report Design
4 Database Design
5 User Documentation
6 Programming
7 Testing
8 Installation
Shows time estimates of tasks
Date: 4/1/98 8:00am
Critical
Noncritical
Progress
Milestone
Summary
Rolled Up

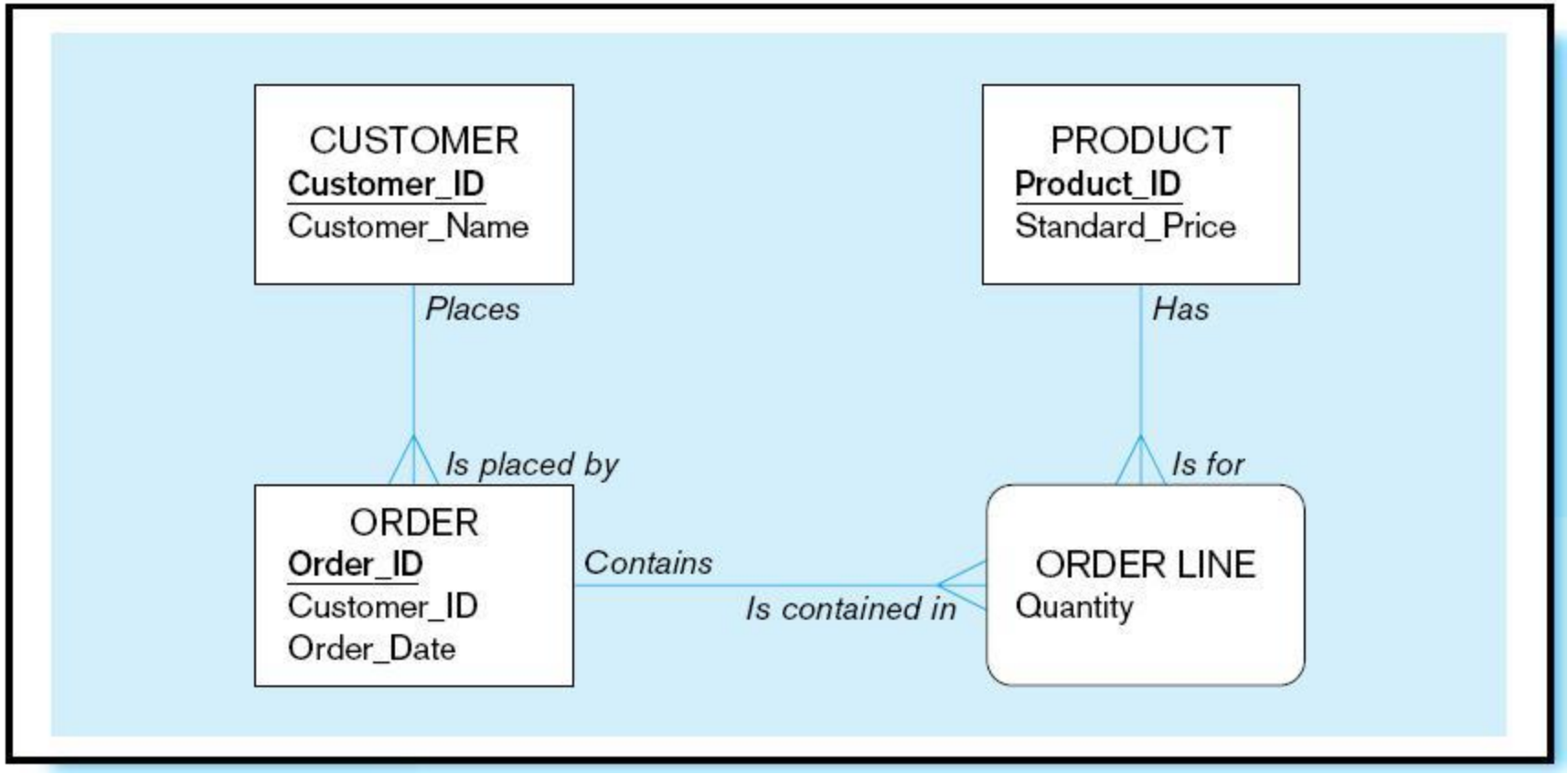
Database Schema

- External Schema
  - User Views
  - Subsets of Conceptual Schema
  - Can be determined from business-function/data entity matrices
  - DBA determines schema for different users
- Conceptual Schema
  - E-R models–covered in Chapters 3 and 4
- Internal Schema
  - Logical structures–covered in Chapter 5
  - Physical structures–covered in Chapter 6

Figure 2-9 Three-tiered client/server database architecture



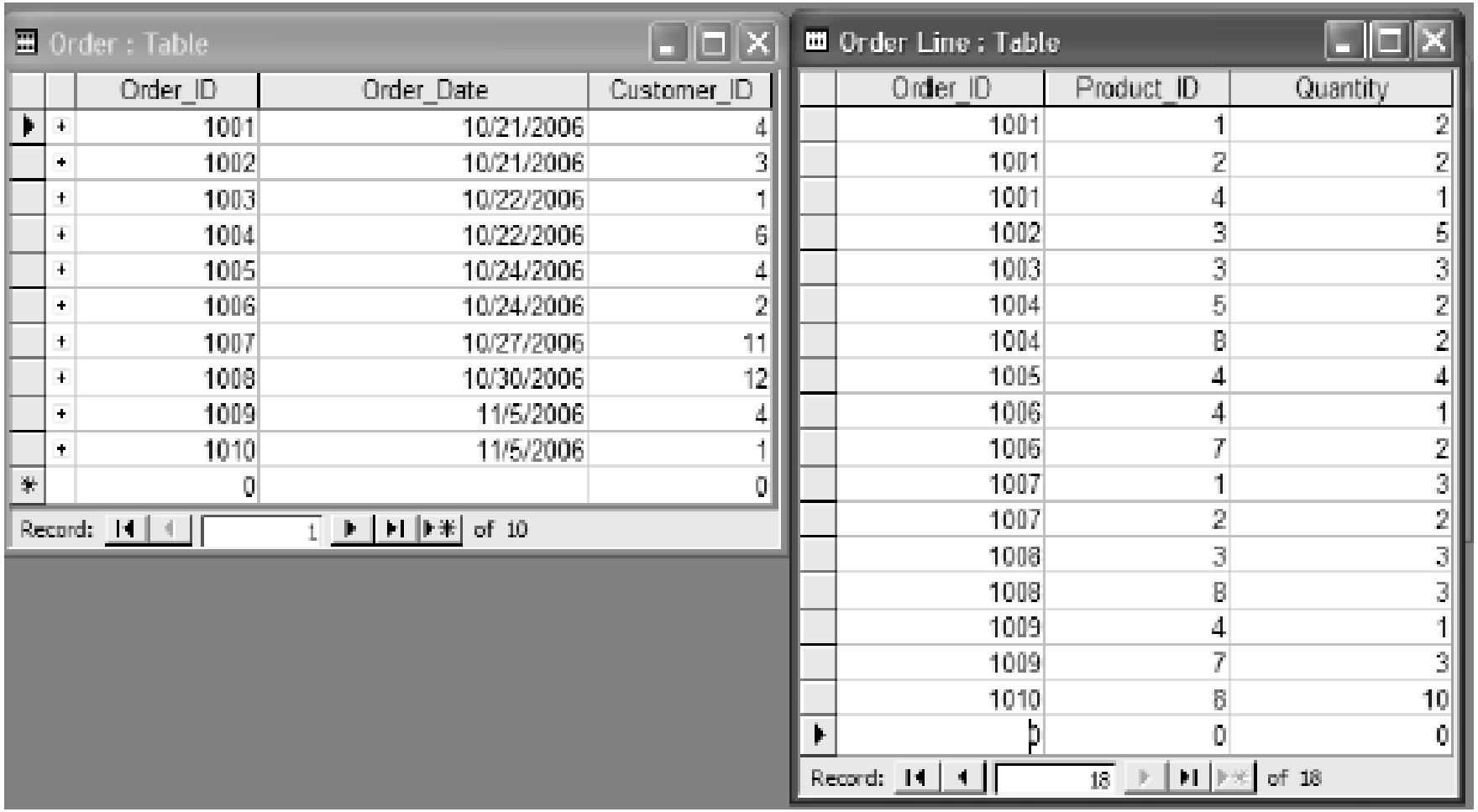
Pine Valley Furniture



Segment of project data model (Figure 2-11)

Figure 2-12 Four relations (Pine Valley Furniture)

(a) Order and Order Line tables



Order : Table

Order_ID	Order_Date	Customer_ID
1001	10/21/2006	4
1002	10/21/2006	3
1003	10/22/2006	1
1004	10/22/2006	6
1005	10/24/2006	4
1006	10/24/2006	2
1007	10/27/2006	11
1008	10/30/2006	12
1009	11/5/2006	4
1010	11/5/2006	1
0		0

Record: 1 of 10

Order Line : Table

Order_ID	Product_ID	Quantity
1001	1	2
1001	2	2
1001	4	1
1002	3	5
1003	3	3
1004	5	2
1004	8	2
1005	4	4
1006	4	1
1006	7	2
1007	1	3
1007	2	2
1008	3	3
1008	8	3
1009	4	1
1009	7	3
1010	8	10
0	0	0

Record: 18 of 18

Figure 2-12 Four relations (Pine Valley Furniture) (cont.)

(b) Customer table

Customer : Table

Customer_ID	Customer_Name
1	Contemporary Casuals
2	Value Furniture
3	Home Furnishings
4	Eastern Furniture
5	Impressions
6	Furniture Gallery
7	Period Furniture
8	California Classics
9	M and H Casual Furniture
10	Seminole Interiors
11	American Euro Lifestyles
12	Battle Creek Furniture
13	Heritage Furnishings
14	Kaneohe Homes
15	Mountain Scenes

Record: 16 of 16

(c) Product table

Product : Table

Product_ID	Standard_Price
1	$175.00
2	$200.00
3	$375.00
4	$650.00
5	$325.00
6	$750.00
7	$150.00
8	$250.00
0	$0.00

Record: 9