DATABASE MANAGEMENT SYSTEMS

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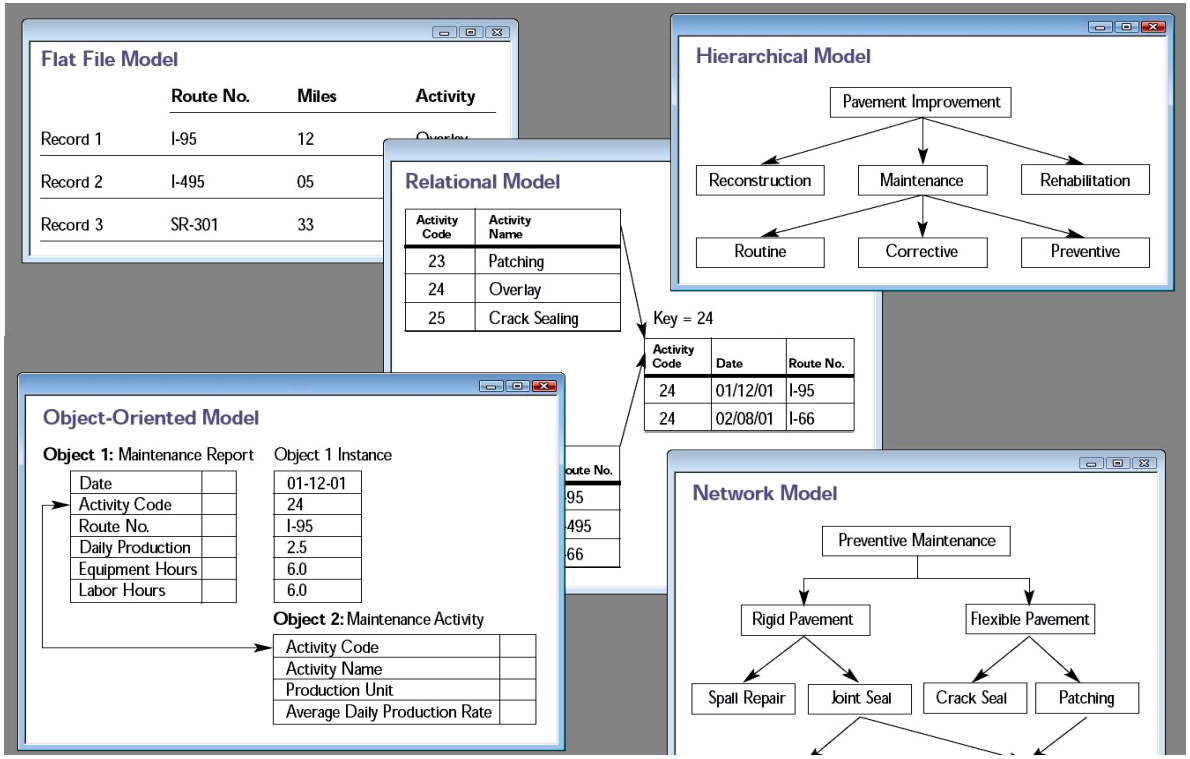
Points to Cover

- Basic Concepts
- Database model
- Hierarchical Model
- Network Model
- Hierarchical Model - Data Structures
- Hierarchical occurrence
- Virtual Parent-child Relationships
- Hierarchical data model
- Data-Structure Diagrams

Database model

A **database model** is a type of data model that determines the logical structure of a database and fundamentally determines in which manner data can be stored, organized, and manipulated.



Database Model Overview

- Hierarchical Model
- Network Model

Basic Concepts

- A **hierarchical database** consists of a collection of *records* which are connected to one another through *links.*
- Developed in the 1960s to manage large amounts of data for complex manufacturing projects.
- A **link** is an association between precisely two records.
- The **hierarchical model** differs from the **network model** in that the records are organized as collections of trees rather than as arbitrary graphs.

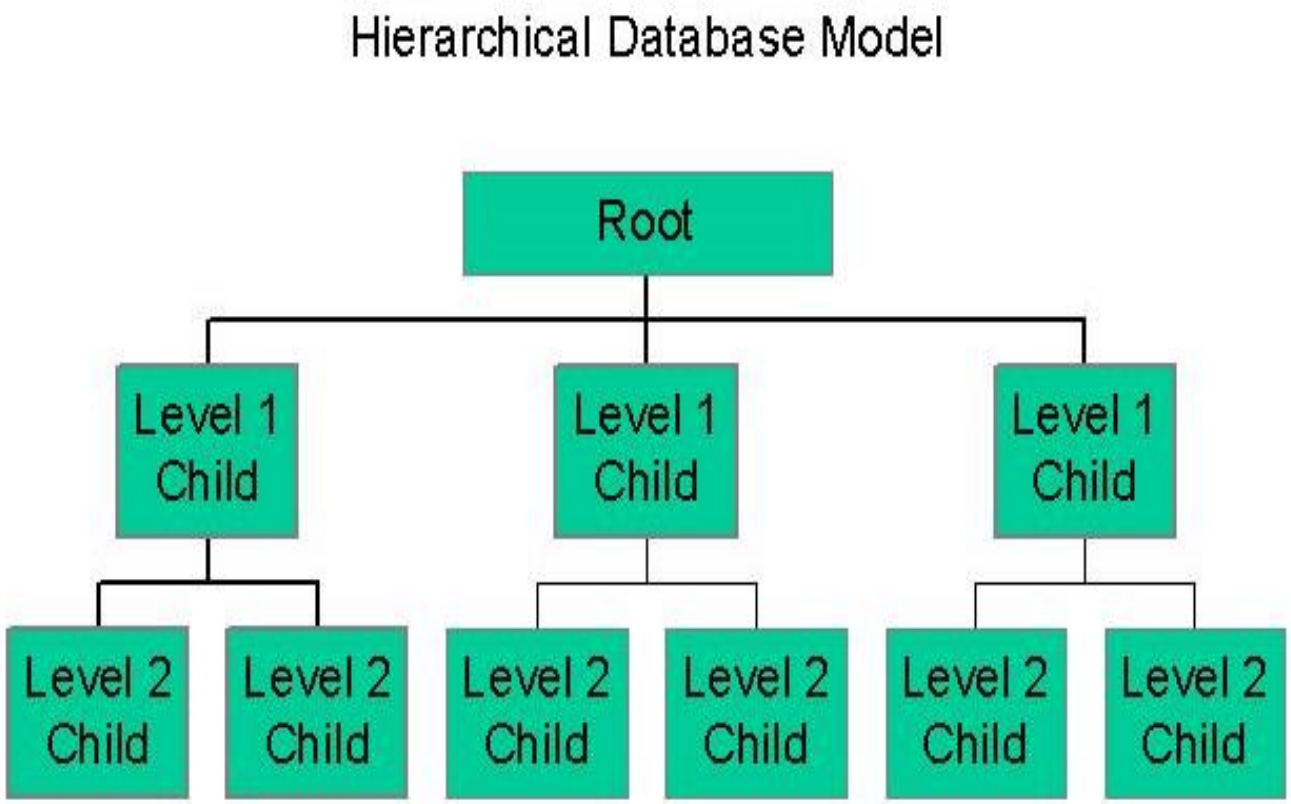
Hierarchical Terms

- **Field** “smallest unit of data”
- **Segment** “groups of fields; nodes of the tree structure”
- **Data base record** “a collection of related segments; a particular tree structure”
- **Data base** “composed of database records”

Tree-Structure Diagrams

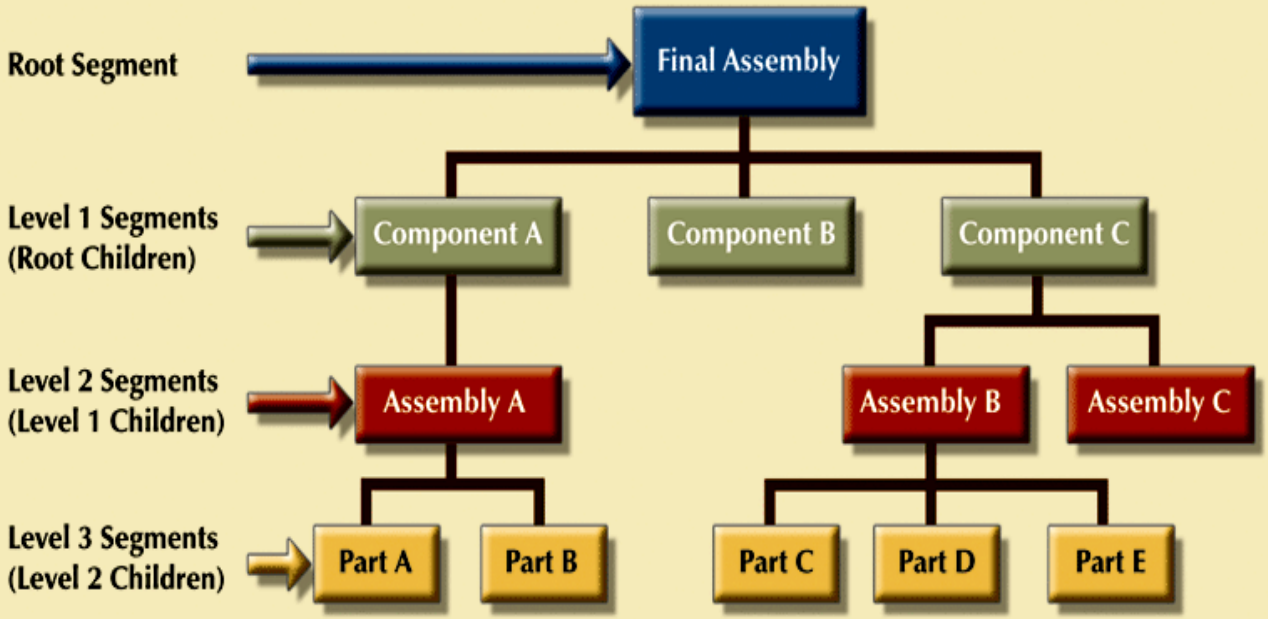
- The schema for a **hierarchical database** consists of
  - *boxes,* which correspond to record types
  - *lines,* which correspond to links
- **Record** types are organized in the form of a **root** *tree.*
  - No cycles in the underlying graph.
  - Relationships formed in the graph must be such that only one-to-many or one-to-one relationships exist between a parent and a child.

Hierarchical Model

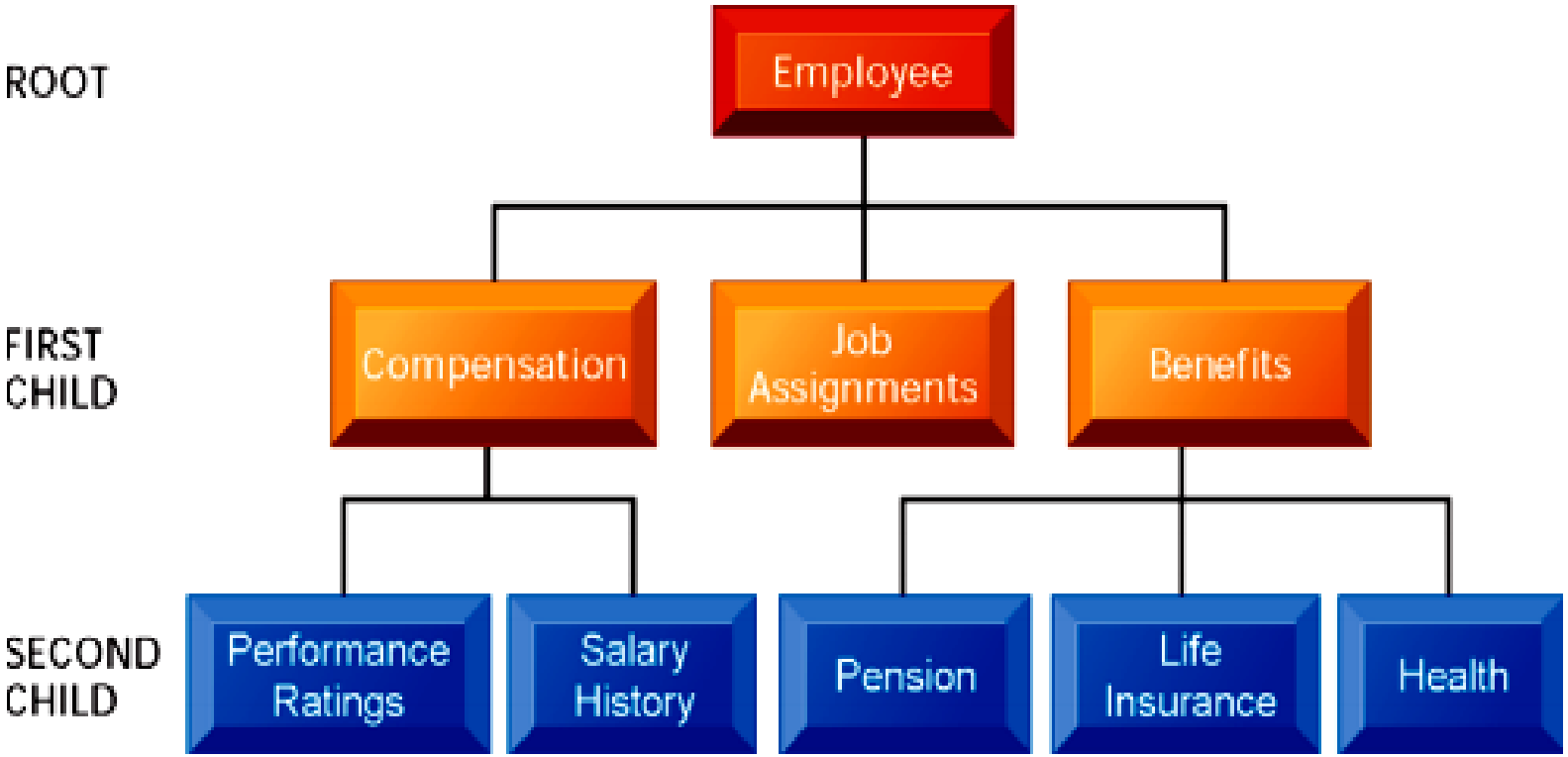


The Hierarchical Model

FIGURE 2.1 A hierarchical structure



A hierarchical database for a human resources system.



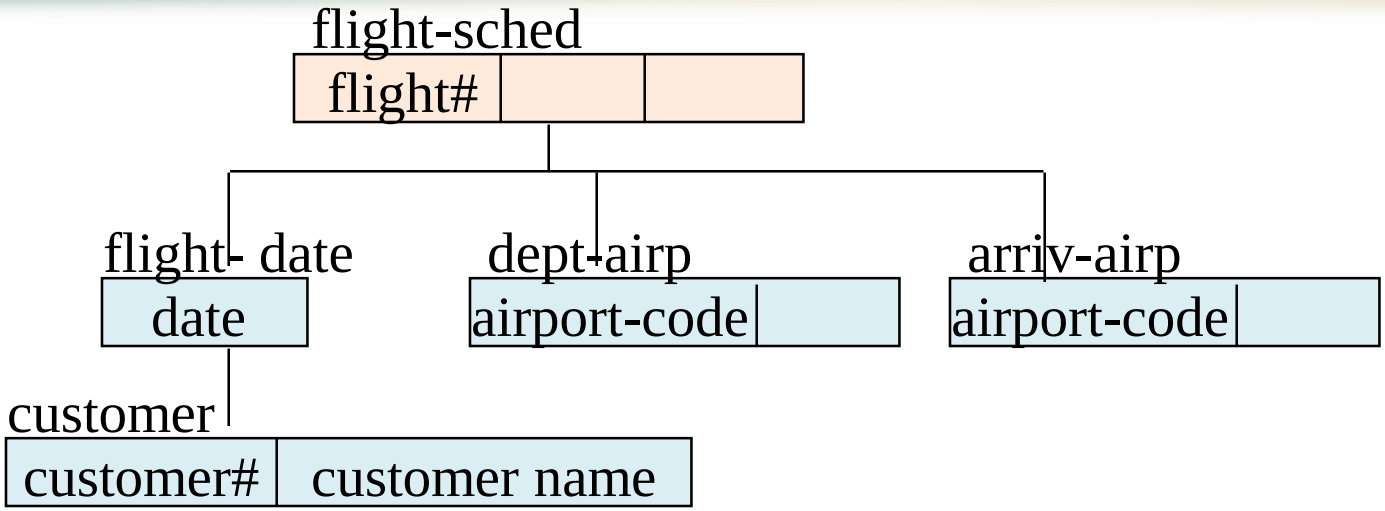
The Hierarchical Model (continued)

- The hierarchical structure contains levels, or segments
- Depicts a set of one-to-many (1:M) relationships between a parent and its children segments
  - Each parent can have many children
  - each child has only one parent

Hierarchical Database

Airlines may use a hierarchical database

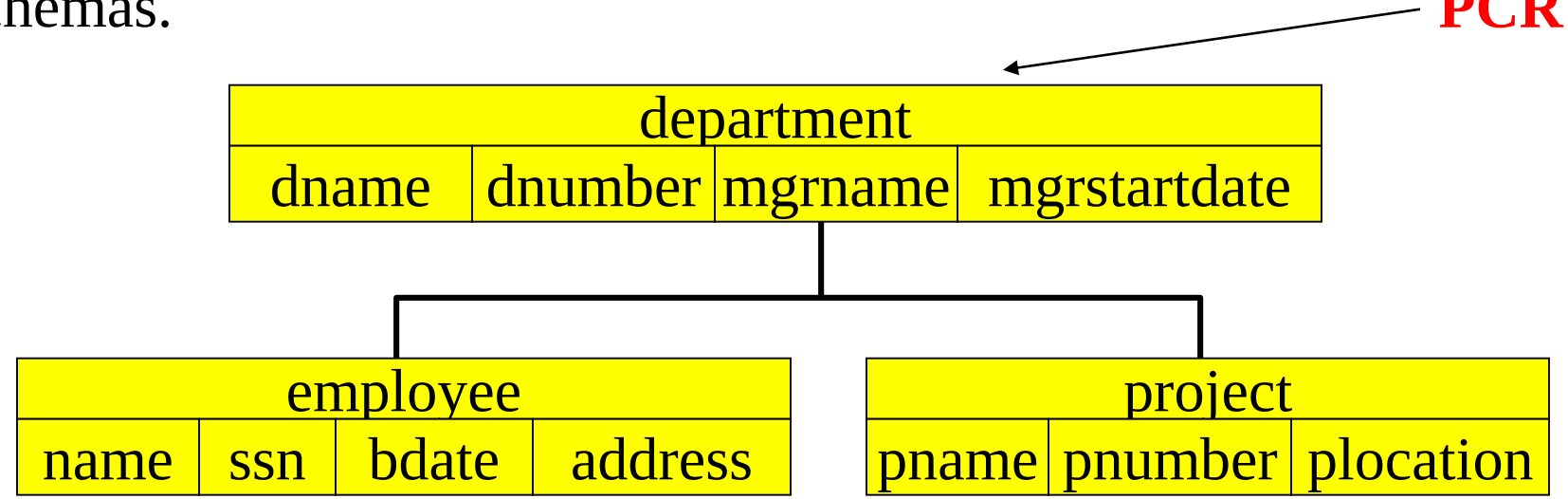
Hierarchical Model - Data Structures



- record types: flight-schedule, flight-instance, etc.
- field types: flight#, date, customer#, etc.
- parent-child relationship types (**1:n only).**
- **one** record type is the **root,** all other record types is a **child** of **one parent** record type **only**

Hierarchical Model - Data Structures

- A hierarchical schema consists of record types and PCR types.
  - A record is a collection of field values.
  - Records of the same type are grouped into record types.
  - A PCR type (**parent-child relationship type**) is a 1:N relationship between two record types.
- A hierarchical database schema consists of a number of hierarchical schemas.

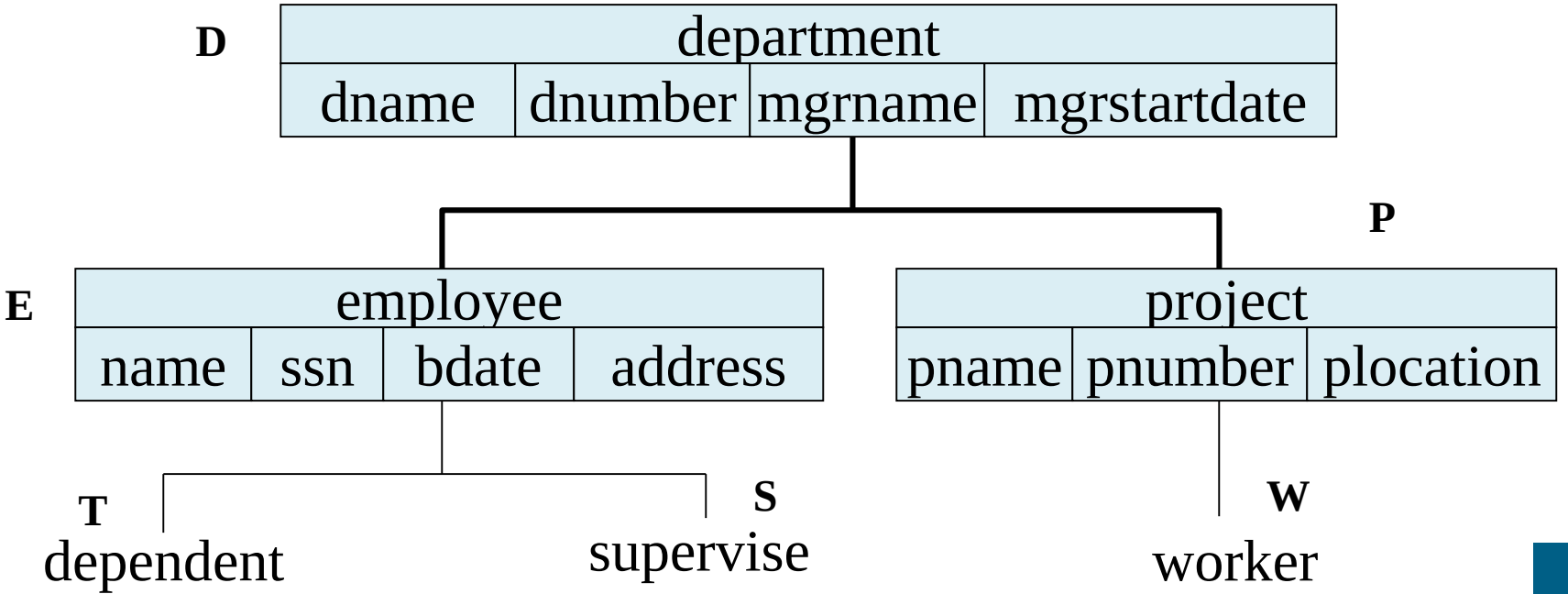


Hierarchical occurrence

Hierarchical occurrence

Each hierarchical occurrence, called an occurrence tree, is a tree structure whose root is a single record from some record type. Each subtree of the root is again a hierarchical occurrence.

- **type indicator**



Hierarchical data model

- Advantages
  - easy to search
  - add new branches easily
- Disadvantages
  - Complex to implement
  - Difficult to manage

Network Model

- The **network model** is a database model conceived as a flexible way of representing objects and their relationships.
- Its distinguishing feature is that the schema, viewed as a graph in which object types are nodes and relationship types are arcs.
- **Created to**
  - Represent complex data relationships more effectively
  - Improve database performance

The Network Model (continued)

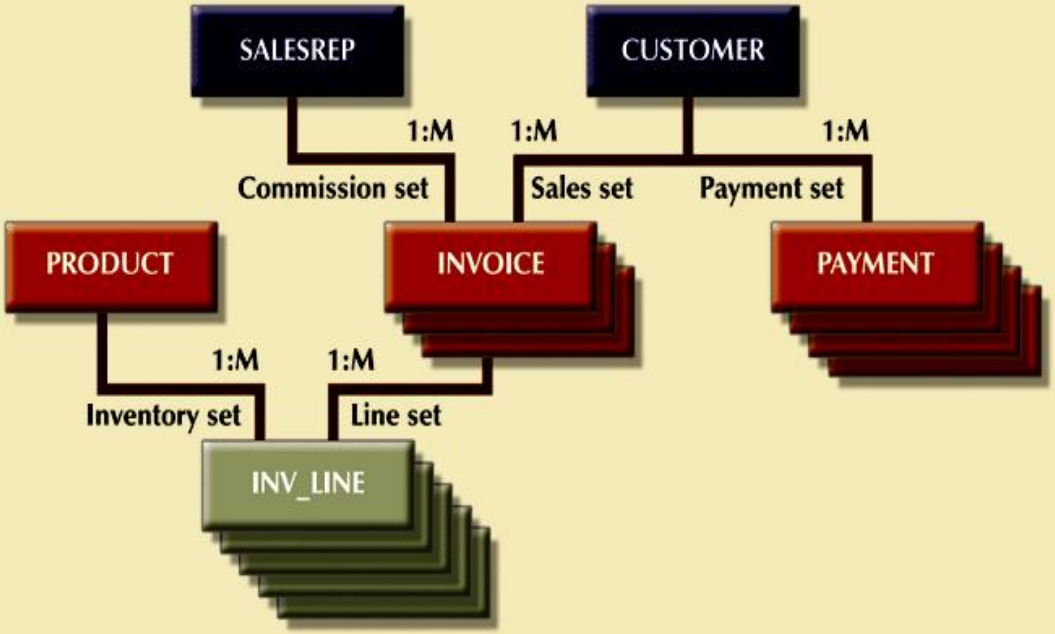
- **Schema**
  - Conceptual organization of entire database as viewed by the database administrator
- **Subschema**
  - Defines database portion "seen" by the application programs that actually produce the desired information from data contained within the database
- **Data Management Language (DML)**
  - Defines the environment in which data can be managed

The Network Model (continued)

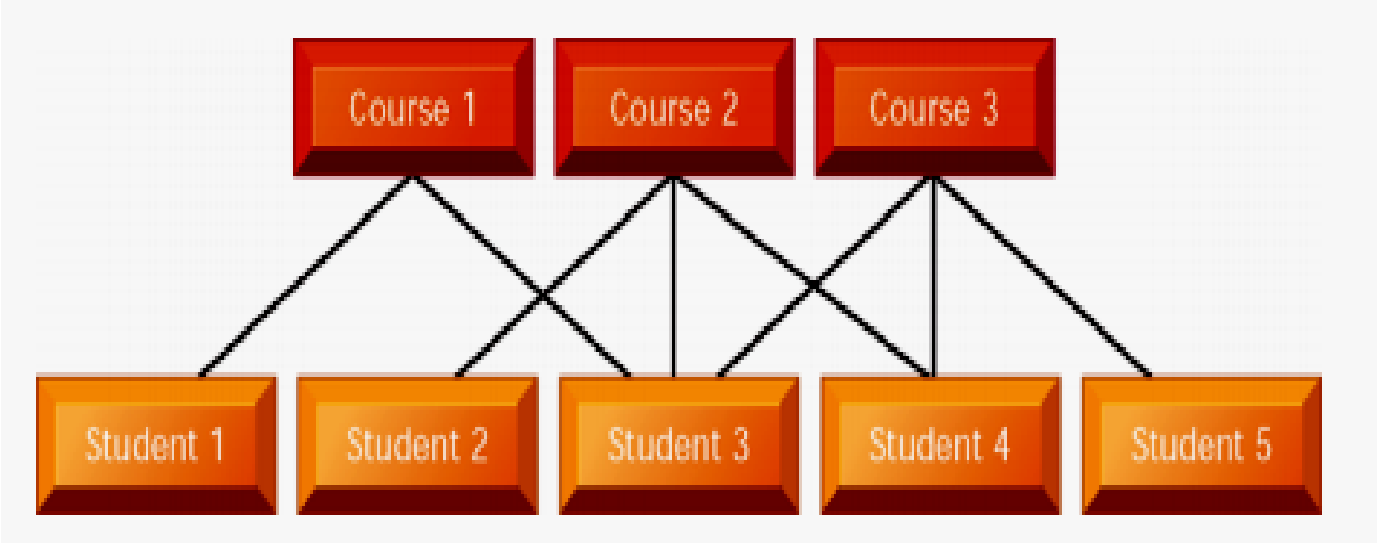
- Schema Data Definition Language (DDL)
  - Enables database administrator to define schema components
- Subschema DDL
  - Allows application programs to define database components that will be used
- DML
  - Works with the data in the database

The Network Model (continued)

FIGURE 2.2 A network data model

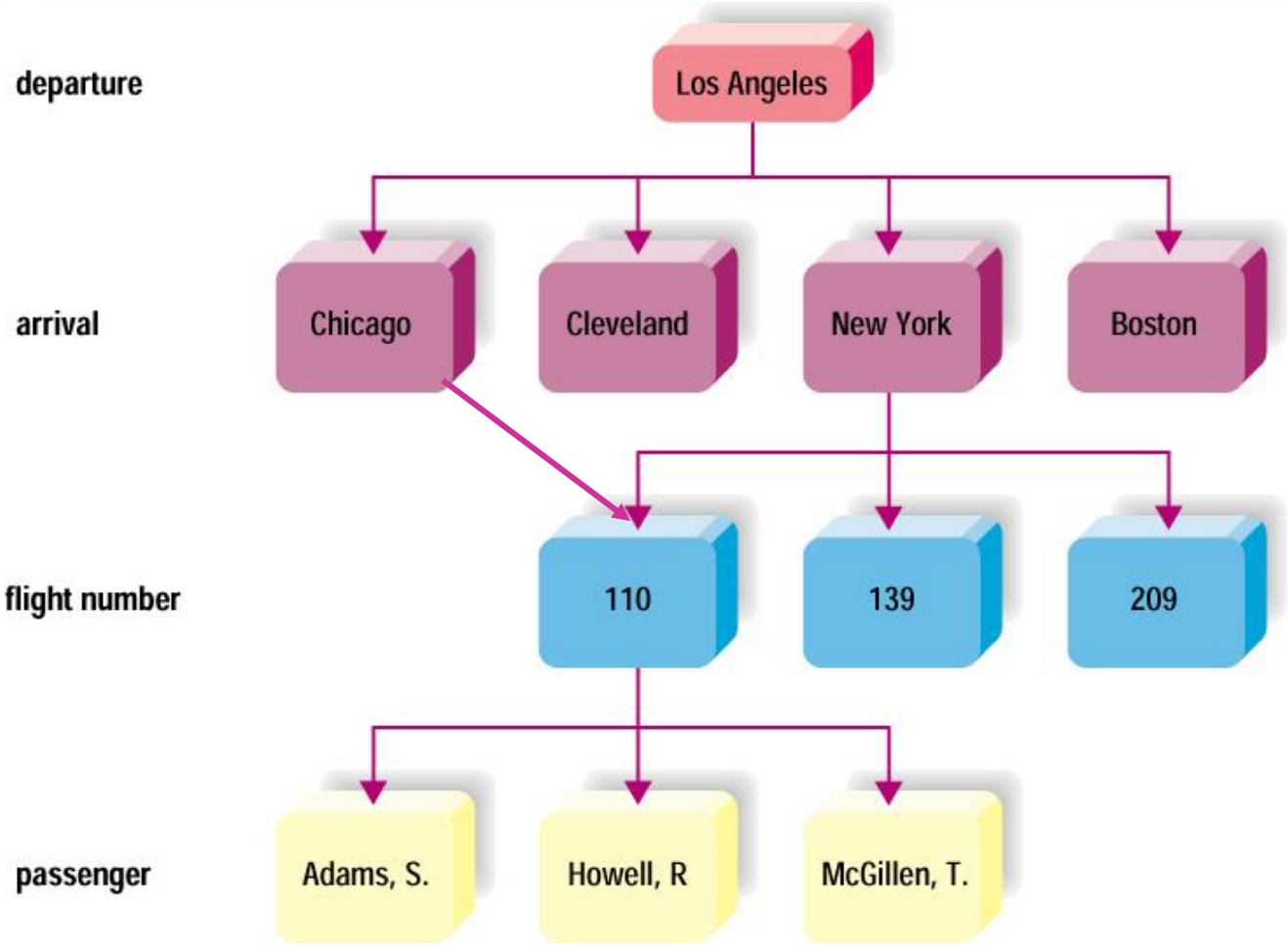


The network data model.



This illustration of a network data model showing the relationship the **students in a university** have to the courses they take represents an example of logical many-to-many relationships.

Network Database

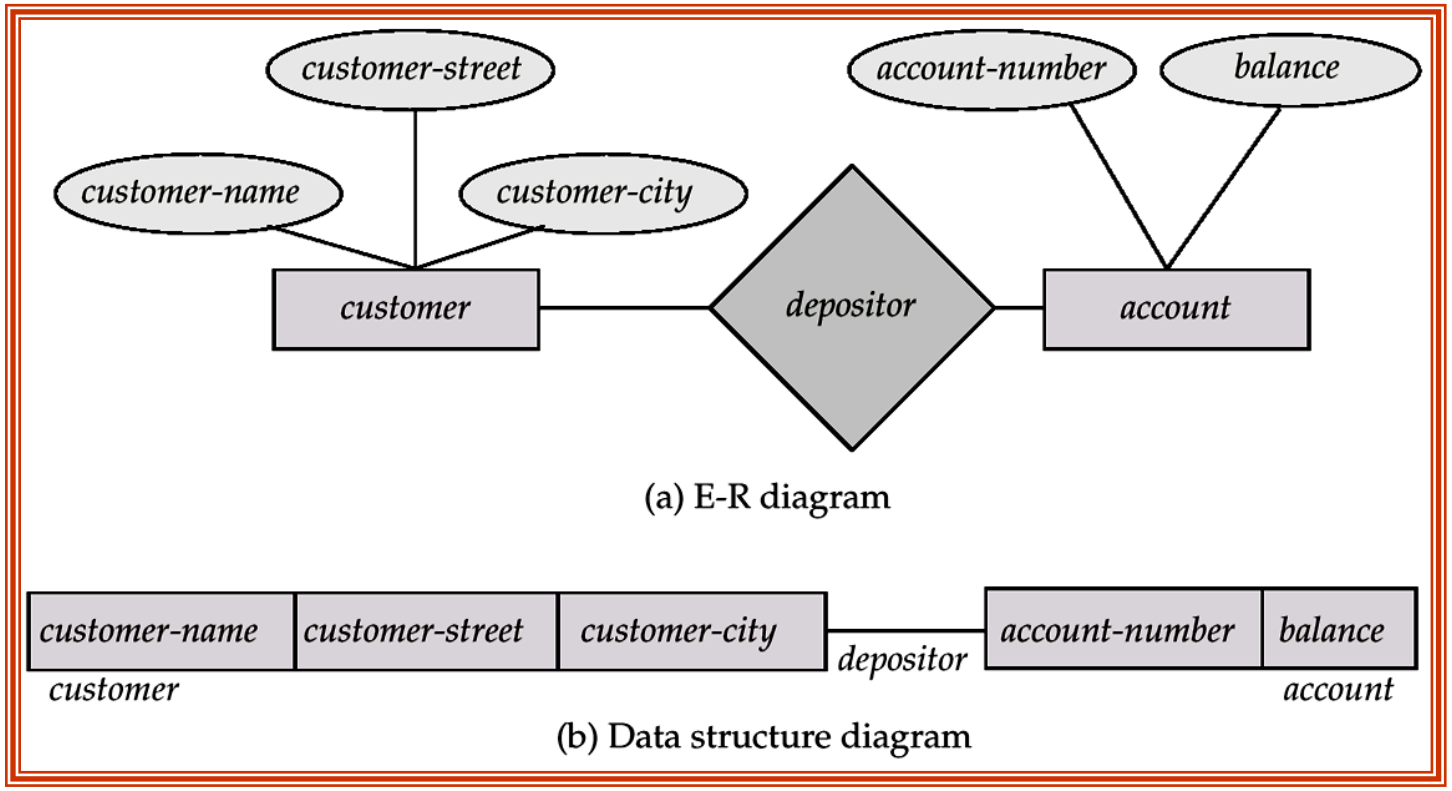


Data-Structure Diagrams

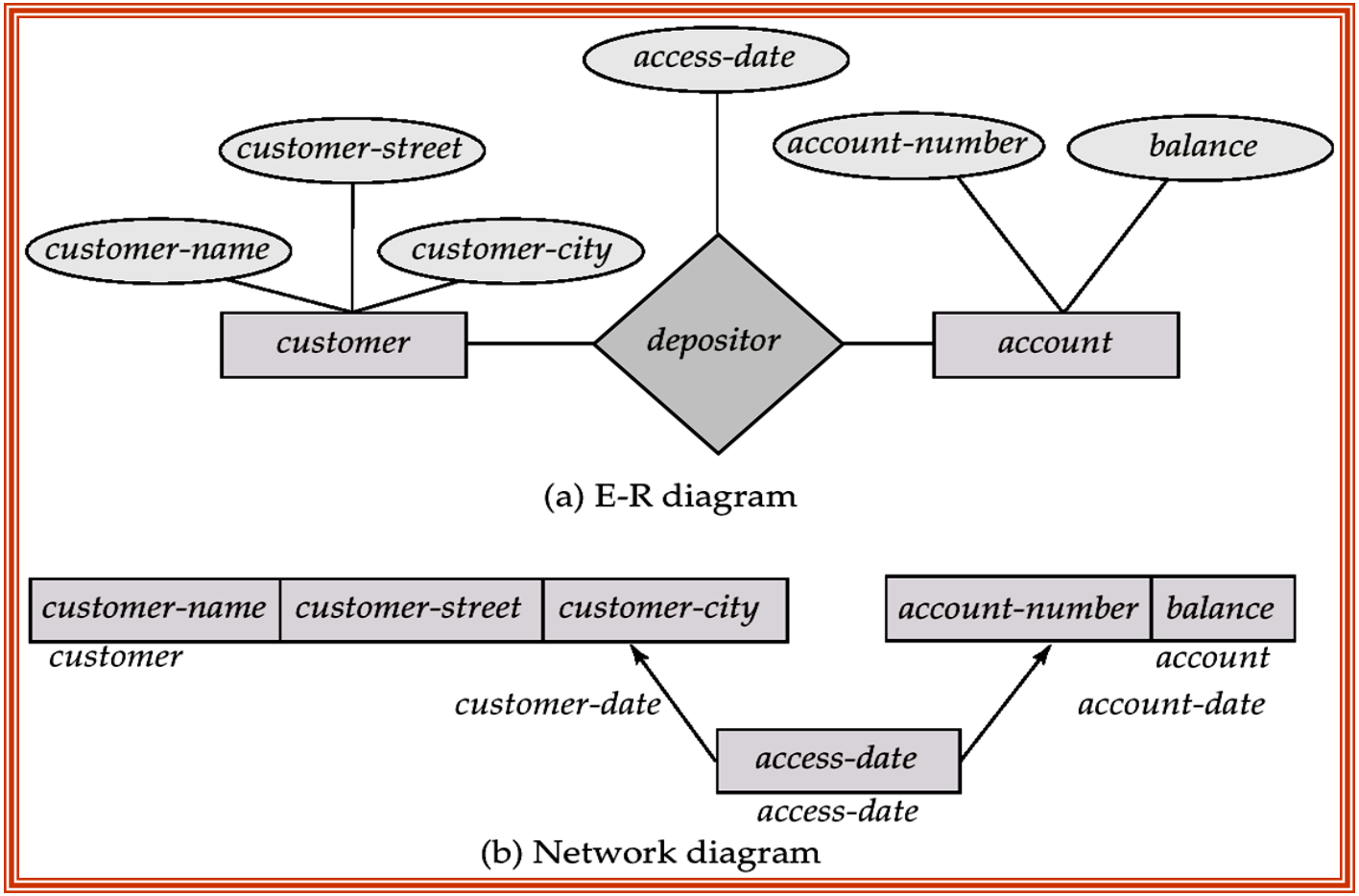
- Schema representing the design of a network database.
- A data-structure diagram consists of two basic components:
  - **Boxes**, which correspond to record types.
  - **Lines**, which correspond to links.
- Specifies the overall logical structure of the database.

Data-Structure Diagrams

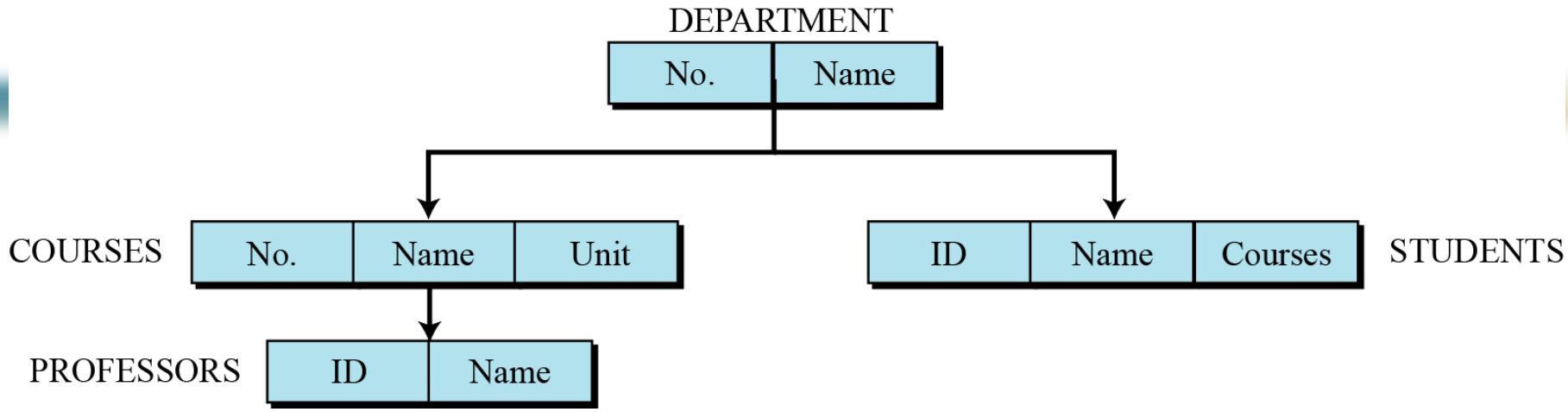
- For every E-R diagram, there is a corresponding data-structure diagram.



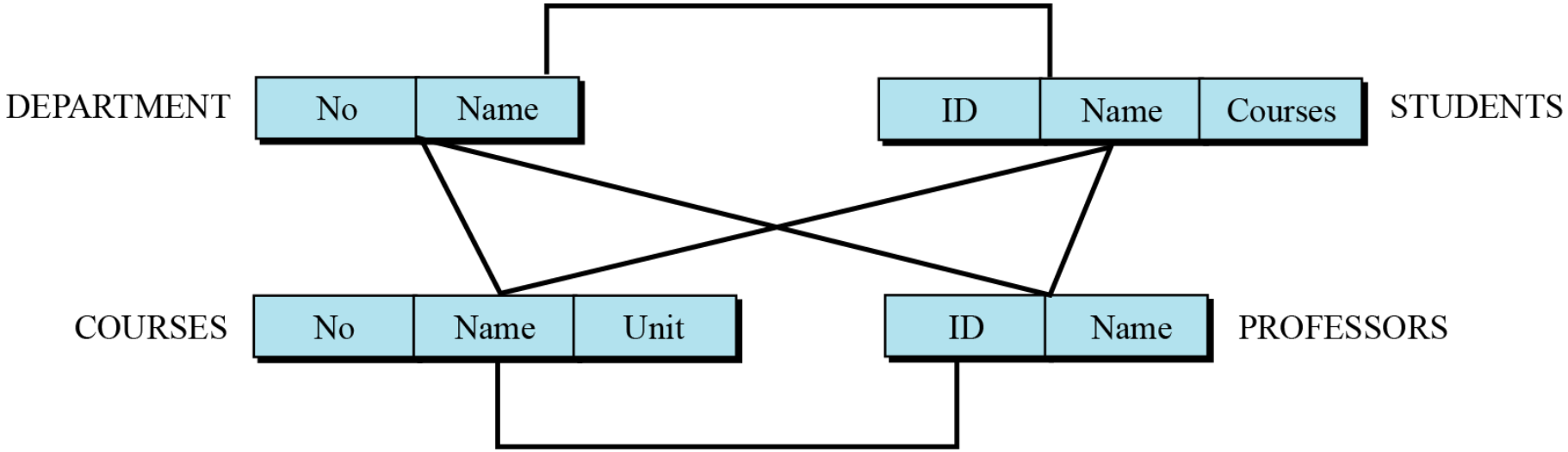
Data-Structure Diagrams



Hierarchical and Network database model



An example of the hierarchical model representing a university



An example of the network model representing a university

Network data model

- Advantages
  - flexible, fast, efficient
- Disadvantages
  - Complex
  - Restructuring can be difficult because of changing all the pointers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