Strategic Information Systems

Systems Development Life Cycle

From Turban et al. (2004), Information Technology for Management.

Strategic Information System

Any information system that changes the goals, processes, products, or environmental relationships to help an organization gain a competitive advantage or reduce a competitive disadvantage.

- Competitive Advantage
  - An advantage over competitors in some measure such as cost, quality, or speed
- Improving Core Competency
  - Employee productivity
  - Operational efficiency

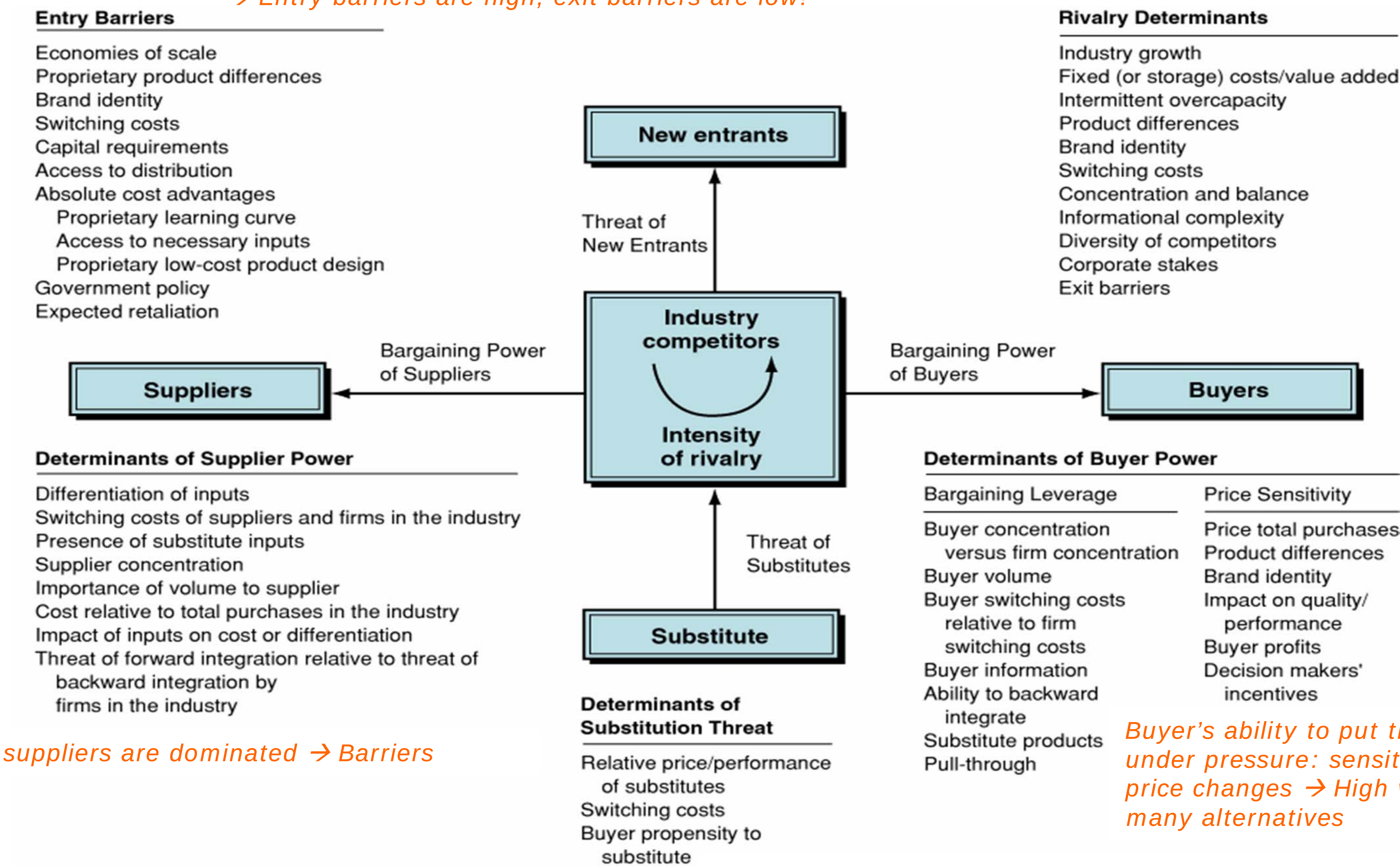
* Major components: hardware, software, data, network, people (user)

From Turban et al. (2004), Information Technology for Management.

Porter's Competitive Forces Model

- Framework to analyze the level of competition within an industry -

When is threat of new entry high? (들어가면 안됨)
→ Entry barriers are high, exit barriers are low!



If suppliers are dominated → Barriers

Buyer's ability to put the firms under pressure: sensitivity to price changes → High with many alternatives

Tap water might be a substitute for Coke, whereas Pepsi is a competitor → Pepsi advertising grows the pie

From Turban et al. (2004), Information Technology for M

Strategies for Competitive Advantage

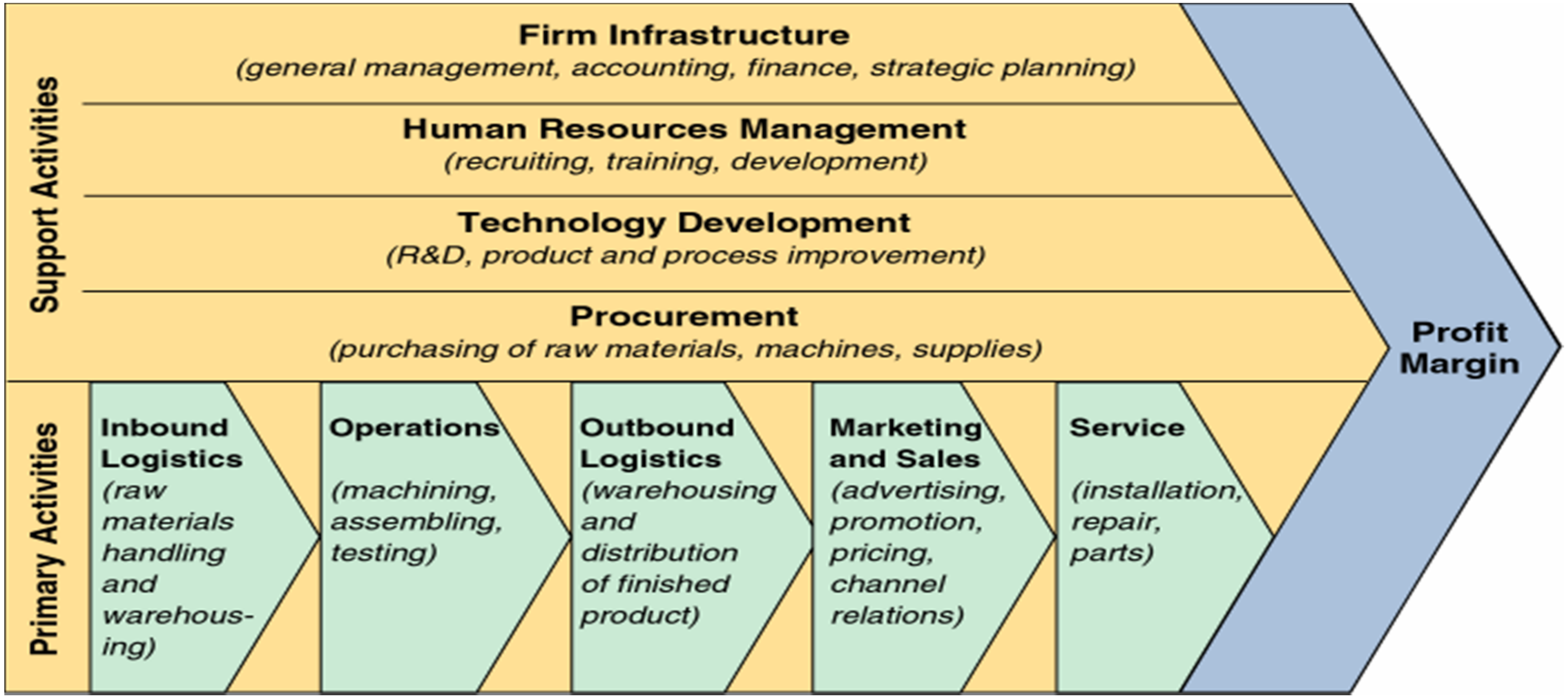
- Cost leadership strategy
- Differentiation strategy
- Niche strategy (틈새시장)
- Growth strategy
- Alliance strategy
- Innovation strategy
- Operational effectiveness strategy
- Customer-orientation strategy
- Time strategy
- Entry-barriers strategy
- Lock in customers or suppliers strategy
- Increase switching costs strategy

From Turban et al. (2004), Information Technology for Management.

The Value Chain

Secondary Activities

Value

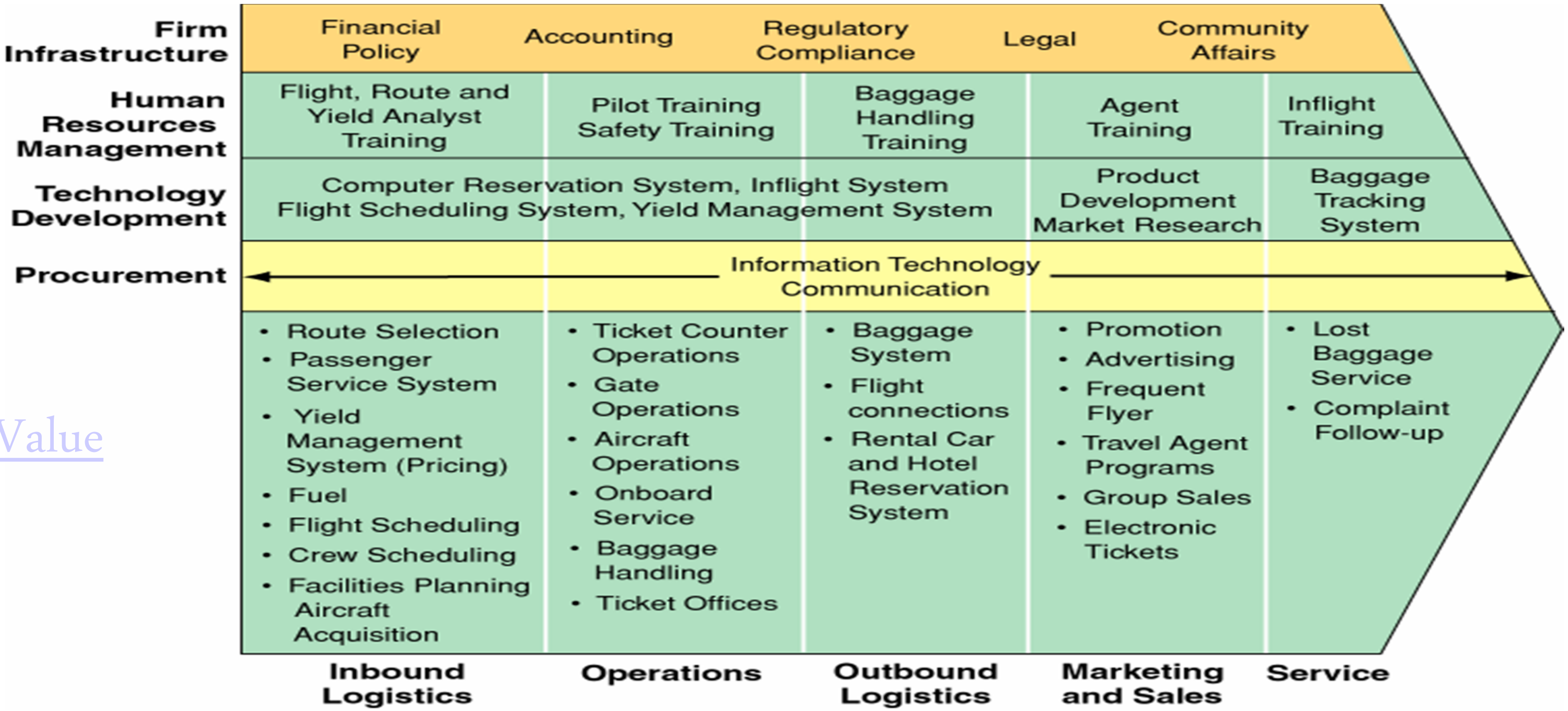


Primary Activities

From Turban et al. (2004), Information Technology for Management.

The Value Chain *(example)*

Secondary Activities



Value

Primary Activities

Managerial Issues

Risk in implementing strategic IS Planning

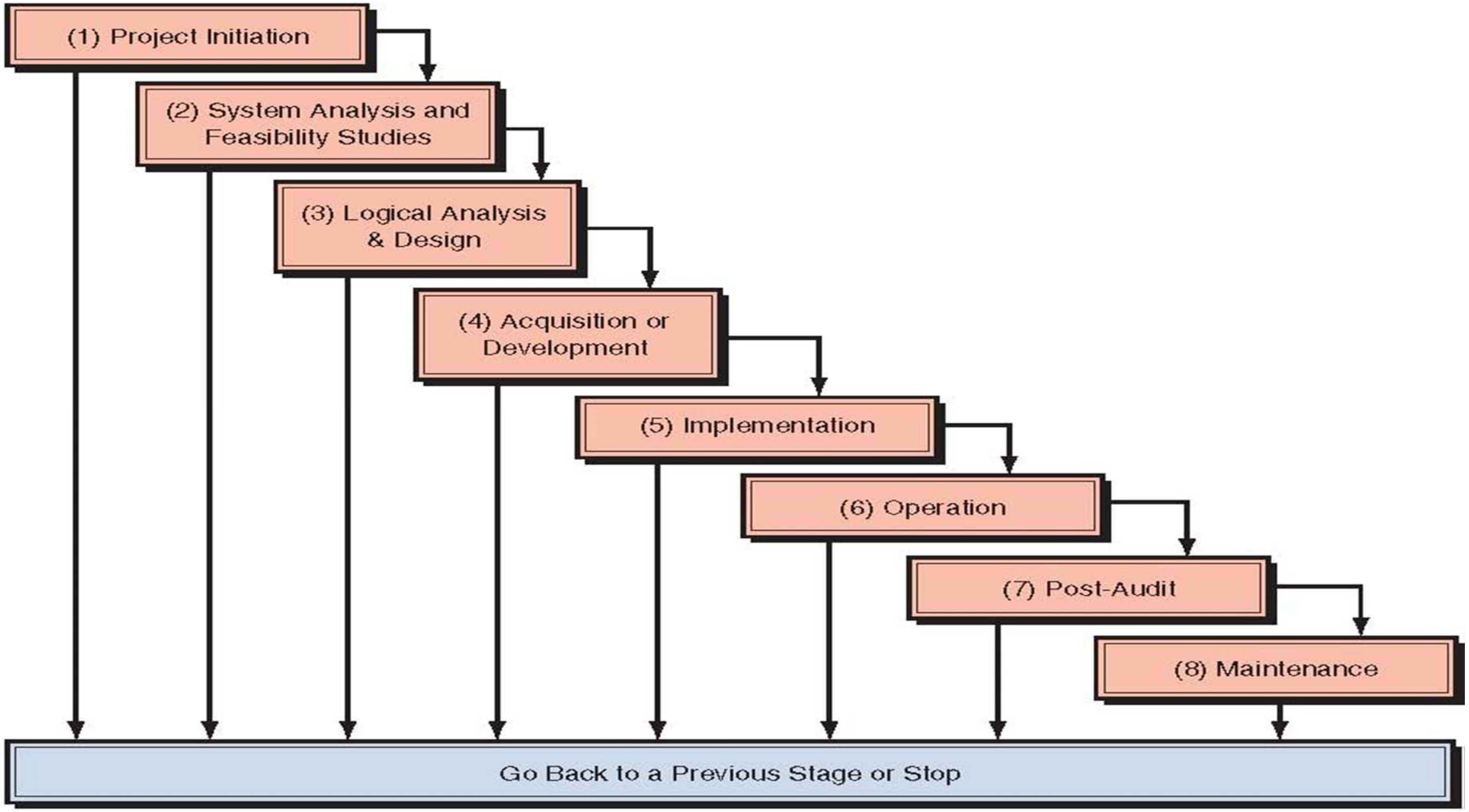
Sustaining competitive advantage

Ethical issues

From Turban et al. (2004), Information Technology for Management.

Systems Development Life Cycle

Formal framework for designing and developing systems for the effective and efficient processing of information. There is no universal, standardized version of the SDLC however a typical eight stage model is shown below.



From Turban et al. (2004), Information Technology for Management.

SDLC - Stages

1. Stage 1: Project Initiation: Projects often start when a manager has a problem or sees an opportunity.

2. Stage 2: Systems Analysis and Feasibility Studies
   - Systems analysis is the phase that develops a thorough understanding of the existing organization, its operation, and the situation that is causing a problem. Systems analysis methods include:
     - observation
     - review of documents
     - interviews
     - performance measurement

From Turban et al. (2004), Information Technology for Management.

SDLC - Stages

- *Feasibility studies* calculate the probability of success of the proposed solution and include:
  - Technology
  - Economics
  - Organizational factors
  - Legal, ethical, and other constraints

3. Stage 3: Logical Analysis and Design emphasizes the design of system from the user's point of view. It identifies information requirements and specifies operations such as input, output, processing and storage.
   - To represent logical processes and data relationships, modeling tools such as *data flow diagrams* and *entity-relationship diagrams* can be used. The logical design is followed by a *physical design*.

From Turban et al. (2004), Information Technology for Management.

SDLC - Stages

4. Stage 4: Development or Acquisition
   - IS personnel use the specifications to purchase the hardware and software required for the system.
   - Programmers write code for parts of the system.
   - Technical writers develop documentation and training materials.
   - IS personnel test the system
   - Users test prior to the actual implementation.

5. Stage 5: Implementation is an important stage; the system can fail here even if it has all the specified functionality.
   - Users need training
   - Forms need to be ordered
   - Help desk needs to be created
   - Sometimes requires a conversion from a previous system.

From Turban et al. (2004), Information Technology for Management.

SDLC - Stages

6. Stage 6: Operation Post production environment
7. Stage 7: Post-Audit Evaluation reviews the stages and processes to determine best practice methods.
8. Stage 8: Maintenance Every system needs two regular types of maintenance:
   – Fixing of bugs
   – Regular system updating

From Turban et al. (2004), Information Technology for Management.

Database Management Systems

From Turban et al. (2004), Information Technology for Management.

Introduction

- Database: shared, integrated computer structure that houses:
  - End user data (raw facts)
  - Metadata (data about data): description of each data

- DBMS (database management system):
  - Collection of programs that manages database structure and controls access to data
  - Possible to share data among multiple applications or users
  - Makes data management more efficient and effective
  - Oracle, MS SQL Server, etc.

From Turban et al. (2004), Information Technology for Management.

Historical Roots: File Systems

FIGURE 1.3 CONTENTS OF THE CUSTOMER FILE

Any problems here?

Data or Metadata?

	C_NAME	C_PHONE	C_ADDRESS	C_ZIP	A_NAME	A_PHONE	TP	AMT	REN
▶	Alfred A. Ramas	615-844-2573	218 Fork Rd., Babs, TN	36123	Leah F. Hahn	615-882-1244	T1	$100.00	05-Apr-2004
	Leona K. Dunne	713-894-1238	Box 12A, Fox, KY	25246	Alex B. Alby	713-228-1249	T1	$250.00	16-Jun-2004
	Kathy W. Smith	615-894-2285	125 Oak Ln, Babs, TN	36123	Leah F. Hahn	615-882-2144	S2	$150.00	29-Jan-2005
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	Myron Orlando	615-222-1672	Box 111, New, TN	36155	Alex B. Alby	713-228-1249	T1	$100.00	28-Dec-2004
	Amy B. O'Brian	713-442-3381	387 Troll Dr., Fox, KY	25246	John T. Okon	615-123-5589	T2	$850.00	22-Sep-2004
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C_NAME = Customer name
C_PHONE = Customer phone
C_ADDRESS = Customer address
C_ZIP = Customer ZIP code
A_NAME = Agent name
A_PHONE = Agent phone
TP = Insurance type
AMT = Insurance policy amount, in thousands of $
REN = Insurance renewal date

From Turban et al. (2004), Information Technology for Management.

Basic File Terminology

TABLE 1.1 BASIC FILE TERMINOLOGY

TERM	DEFINITION
Data *Each Piece*	"Raw" facts, such as a telephone number, a birth date, a customer name, and a year-to-date (YTD) sales value. Data have little meaning unless they have been organized in some logical manner. The smallest piece of data that can be "recognized" by the computer is a single character, such as the letter A, the number 5, or a symbol such as /. A single character requires one byte of computer storage.
Field *Column*	A character or group of characters (alphabetic or numeric) that has a specific meaning. A field is used to define and store data.
Record *Row*	A logically connected set of one or more fields that describes a person, place, or thing. For example, the fields that constitute a record for a customer named J.D. Rudd might consist of J.D. Rudd's name, address, phone number, date of birth, credit limit, and unpaid balance.
File *All*	A collection of related records. For example, a file might contain data about vendors of ROBCOR Company; or a file might contain the records for the students currently enrolled at Gigantic University.

From Turban et al. (2004), Information Technology for Management.

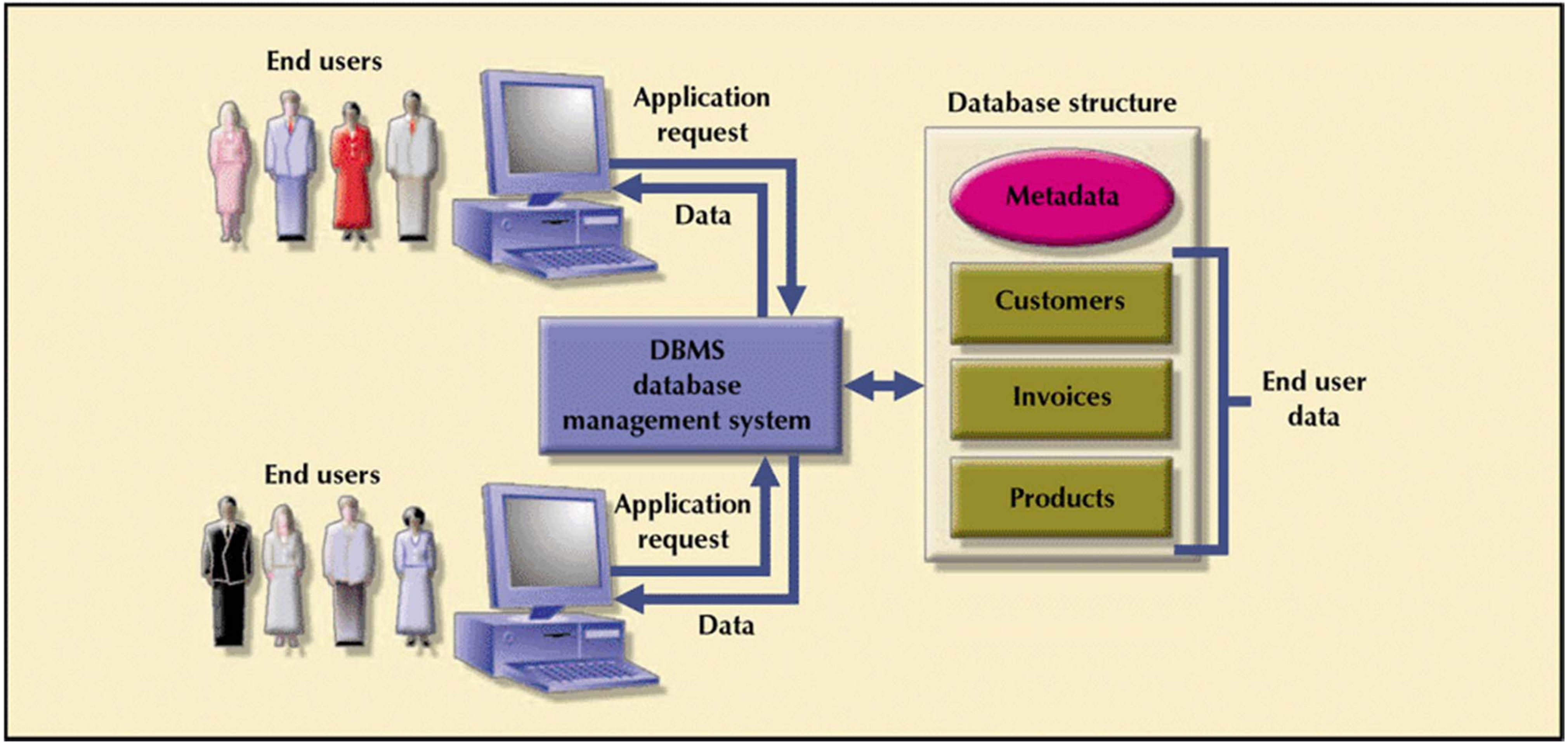
DBMS Makes Data Management More Efficient and Effective

- End users have better access to more and better-managed data
  - Improve data sharing
  - Promotes integrated view of organization's operations: represent the work
  - Probability of data inconsistency is greatly reduced **Data inconsistency exists when same data appears in different places (e.g., Bill Brown & William Brown)*
  - Possible to produce quick answers to ad hoc queries **Query: specific request for data manipulation (e.g., How many of our customers have credit balances of $3,000 or more?)*

From Turban et al. (2004), Information Technology for Management.

The DBMS Manages the Interaction Between the End User and the Database

FIGURE 1.2 THE DBMS MANAGES THE INTERACTION BETWEEN THE END USER AND THE DATABASE



From Turban et al. (2004), Information Technology for Management.

Types of Databases

**If A uses, B & C should wait*

- Single-user: Supports only one user at a time
  - Desktop: Single-user database running on a personal computer

- Multi-user: Supports multiple users at the same time
  - Workgroup: Multi-user database that supports a small group of users or a single department **usually fewer than 50*

- Enterprise: Multi-user database that supports a large group of users or an entire organization

From Turban et al. (2004), Information Technology for Management.

Location of Databases

- Centralized:
  - Supports data located at a single site
- Distributed:
  - Supports data distributed across several sites

From Turban et al. (2004), Information Technology for Management.

Uses of Databases

- Transactional (or operational, production)
  - Supports a company's day-to-day operations
  - e.g. product or service sales, payments, supply purchases, etc.
- Data warehouse:
  - Stores data used to generate information required to make tactical or strategic decisions
  - Require extensive data massaging (manipulation)
  - e.g. pricing decision, sales forecasts, etc.
  - Store historical data from transactional databases
  - Store data derived from many sources

From Turban et al. (2004), Information Technology for Management.

Why Database Design is Important?

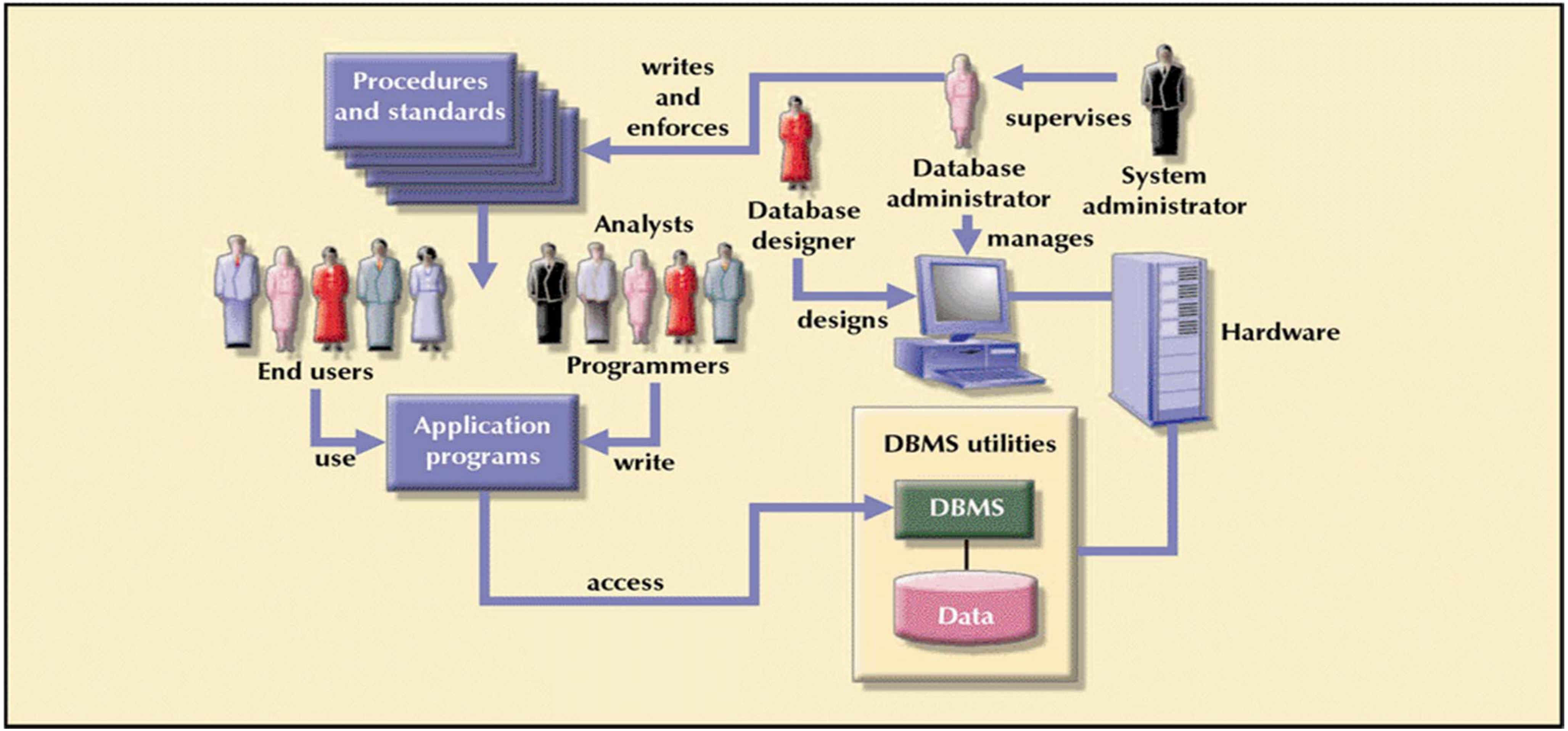
**Meet all user requirements: accurate, consistent, fast!*

- Defines the database's expected use
- Different approach needed for different types of databases
- Avoid redundant data (unnecessarily duplicated)
- Poorly designed database generates errors → can lead to bad decisions

From Turban et al. (2004), Information Technology for Management.

The Database System Environment

FIGURE 1.7 THE DATABASE SYSTEM ENVIRONMENT



**Programmers: Policies into interfaces, reports, etc.*

From Turban et al. (2004), Information Technology for Management.

DBMS Functions

- Performs functions that guarantee integrity and consistency of data
  - Data dictionary management
    - defines data elements(metadata) and their relationships
  - Data storage management
    - stores data and related data entry forms, report definitions, etc. (single or multiple)
  - Data transformation and presentation
    - translates logical requests into commands to physically locate and retrieve the requested data

**U.K.: 11/07/2015 VS U.S.:07/11/2015*

***Data integrity: Minimizing data redundancy and maximizing data consistency!**

하나의 자료가 변경되면 그와 관련된 모든 ***data*** *역시 변해야 한다. 그리고* ***data****마다 형식(날짜 등)이 따로 있고 그에 맞는* ***data****가 입력되어야 한다.*

DBMS Functions (continued)

- Security management
  - enforces user security and data privacy within database
- Multi-user access control
  - creates structures that allow multiple users to access the data
- Backup and recovery management
  - provides backup and data recovery procedures

From Turban et al. (2004), Information Technology for Management.

DBMS Functions (continued)

- Data integrity management
  - promotes and enforces integrity rules to eliminate data integrity problems
- Database access languages and application programming interfaces
  - provides data access through a query language
- Database communication interfaces
  - allows database to accept end-user requests within a computer network environment

From Turban et al. (2004), Information Technology for Management.

Data Models

Data Model

- Relatively simple representation, usually graphical, of complex real-world data structures

  Model: abstraction of a more complex real-world object or event

- Within the database environment, it represents data structures and their characteristics, relations, constraints, and transformations

- Why? **Blind people and the elephant → Need ability to see the whole!*

  – Need to organize data for various users

  – End-users have different views and needs for data (e.g., inventory manager vs purchasing manager vs applications programmer)

  – Need a communication tool to facilitate interaction among the designer, the applications programmer, and the end user (big picture)

  – Create a foundation for information systems design

From Turban et al. (2004), Information Technology for Management.

Building Blocks

- Entity: anything, such as a person, place, or event, about which data are to be collected and stored (particular type of an object: customer)
- Attribute: characteristic of an entity (last name, first name, address, ...)
- Relationship: describes an association among (two or more) entities (customer-agent)
  - One-to-many (1:M) (e.g.: PROFESSOR/LECTURE)
  - Many-to-many (M:N or M:M) (e.g.: STUDENT/COURSE)
  - One-to-one (1:1) (e.g.: MANAGER/STORE)

**Bi-directional! How many classes can one student enroll in? Many classes*
How many students can enroll in one class? Many students

- Constraints: restriction placed on the data (GPA: 0.00 – 4.30)

From Turban et al. (2004), Information Technology for Management.

Business Rules

- Brief, precise, and unambiguous description of a policy, procedure, or principle within a specific organization's environment

(1)"An agency can serve many customers, and each customer may be served by one agent."
(2)"A training can't be scheduled for fewer than 10 people."
→ Should easy to understand, widely disseminated

- Why?
  - Help to define entities, attributes, relationships, and constraints
  - Allow designer to understand business processes
  - Standardize company's view of data
  - Allow designer to understand the nature, role, and scope of data, business processes

**Noun: entity (e.g. customer, invoice)*
Verb: relationship (e.g. generate)

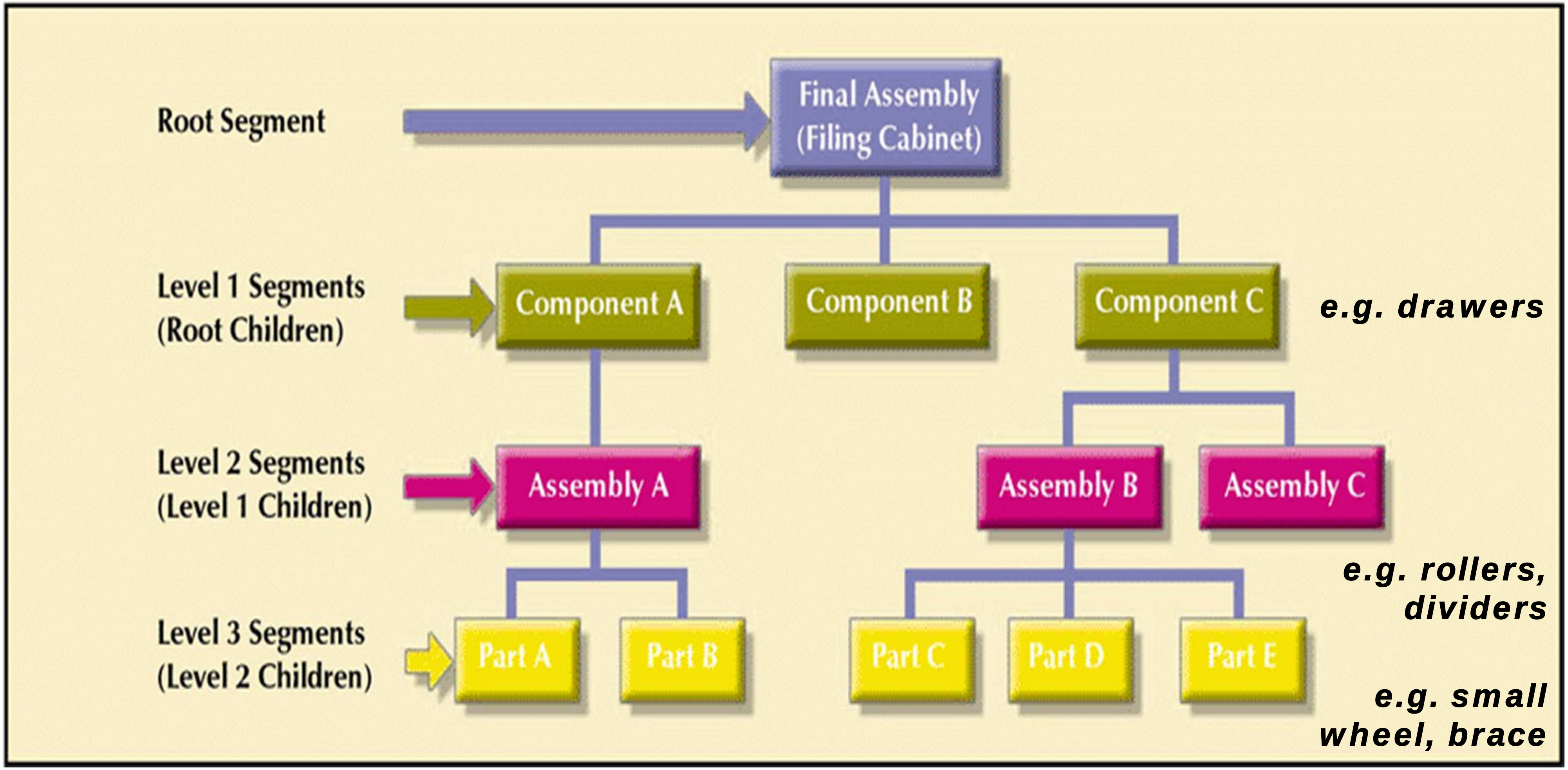
From Turban et al. (2004), Information Technology for Management.

The Evolution of Data Models

- File system
- Hierarchical
- Network
- Relational
- Entity relationship
- Object oriented

From Turban et al. (2004), Information Technology for Management.

A Hierarchical Structure



From Turban et al. (2004), Information Technology for Management.

Hierarchical Structure—Characteristics

Segment → file system's record type

- 1960s: Apollo rocket in 1969 (upside-down tree)
- Each parent can have many children
- Each child has only one parent

Set of 1:M relationships

- Tree is defined by path that traces parent segments to child segments, beginning from the top, left

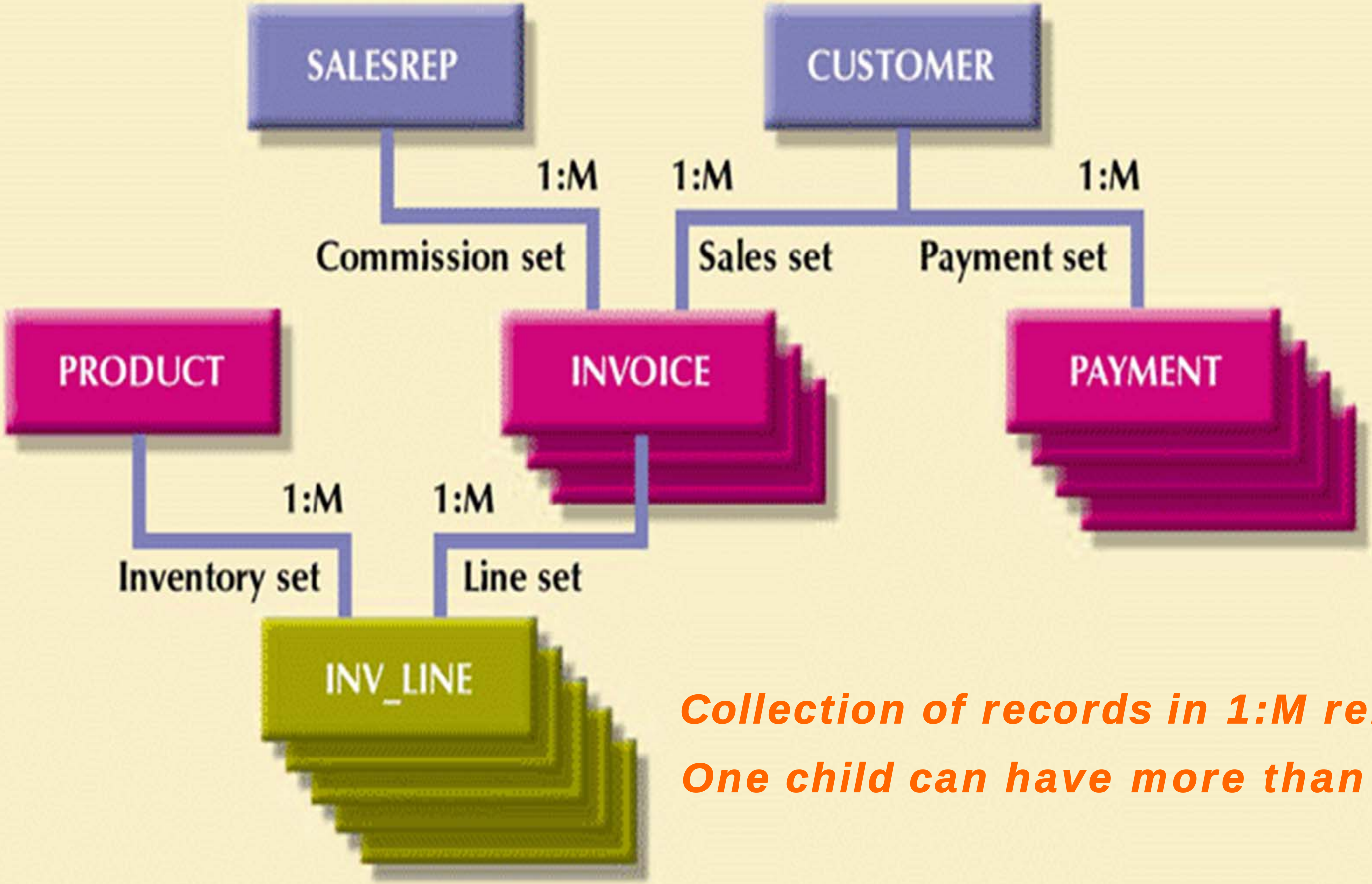
From Turban et al. (2004), Information Technology for Management.

The Hierarchical Model—Characteristics

- Good: Basic concepts form the basis for subsequent database development
- Bad: Complex to implement, Difficult to manage, Lacked structural independence (1:M)
- Limitations lead to a different way of looking at database design

From Turban et al. (2004), Information Technology for Management.

A Network Data Model



Collection of records in 1:M relationships

One child can have more than one parent

From Turban et al. (2004), Information Technology for Management.

The Network Model

- Created to
  - Represent complex data relationships more effectively
  - Improve database performance
  - Impose a database standard

    Lack of database standards → difficulties in designing and programming

From Turban et al. (2004), Information Technology for Management.

Network Model—Basic Structure

- Resembles hierarchical model
- Collection of records in 1:M relationships
- Set
  - Relationship in network database terminology
  - Composed of at least two record types
    - Owner
      - Equivalent to the hierarchical model's parent
    - Member
      - Equivalent to the hierarchical model's child
- Difference between hierarchical and network models: a member may have several owners

From Turban et al. (2004), Information Technology for Management.

Network Model—Basic Structure

- Still too cumbersome
- Lack of ad hoc query capability
- Limited data independence, but difficult structural changes → interminable information delays

From Turban et al. (2004), Information Technology for Management.

Linking Relational Tables

Database name: Ch02_InsureCo **Table name: AGENT (first six attributes)**

AGENT_CODE	AGENT_LNAME	AGENT_FNAME	AGENT_INITIAL	AGENT_AREACODE	AGENT_PHONE
501	Alby	Alex	B	713	228-1249
502	Hahn	Leah	F	615	882-1244
503	Okon	John	T	615	123-5589

Link through AGENT_CODE

Table name: CUSTOMER

CUS_CODE	CUS_LNAME	CUS_FNAME	CUS_INITIAL	CUS_AREACODE	CUS_PHONE	CUS_RENEW_DATE	AGENT_CODE
10010	Ramas	Alfred	A	615	844-2573	05-Apr-2004	502
10011	Dunne	Leona	K	713	894-1238	16-Jun-2004	501
10012	Smith	Kathy	W	615	894-2285	29-Jan-2005	502
10013	Olowski	Paul	F	615	894-2180	14-Oct-2004	502
10014	Orlando	Myron		615	222-1672	28-Dec-2004	501
10015	O'Brian	Amy	B	713	442-3381	22-Sep-2004	503
10016	Brown	James	G	615	297-1228	25-Mar-2004	502
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From Turban et al. (2004), Information Technology for Management.

File Systems

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TP = Insurance type
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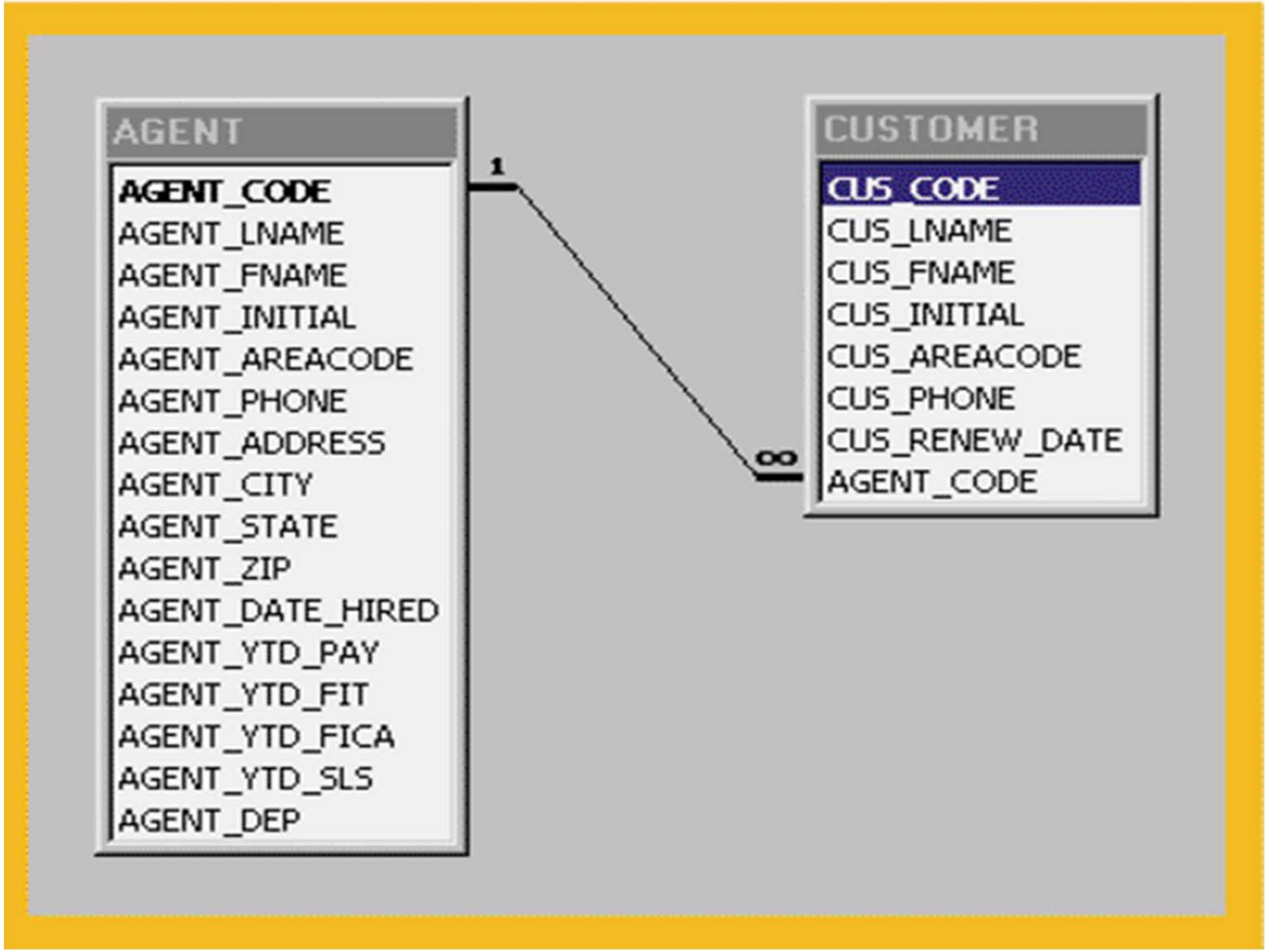
From Turban et al. (2004), Information Technology for Management.

Relational Schema



From Turban et al. (2004), Information Technology for Management.

The Relational Model

- Developed by Codd (IBM) in 1970
- Considered ingenious but impractical in 1970
- Conceptually simple
- Computers lacked power to implement the relational model
- Today, microcomputers can run sophisticated relational database software

From Turban et al. (2004), Information Technology for Management.

The Relational Model—Basic Structure

- Relational Database Management System (RDBMS)
- Performs same basic functions provided by hierarchical and network DBMS systems, plus other functions
- RDBMS manages all of the physical details, user wees the relational database as a table collection
- Most important advantage: its ability to let the user/designer operate in a human logical environment

From Turban et al. (2004), Information Technology for Management.

The Relational Model—Basic Structure

- Relational Table
  - Matrix consisting of a series of row/column intersections
  - Related to each other by sharing a common entity characteristic (attribute)

Customer Table → Agent Number → Agent Table (Tables are independent!)

- Relational Schema
  - Visual representation of relational database's entities, attributes within those entities, and relationships between those entities

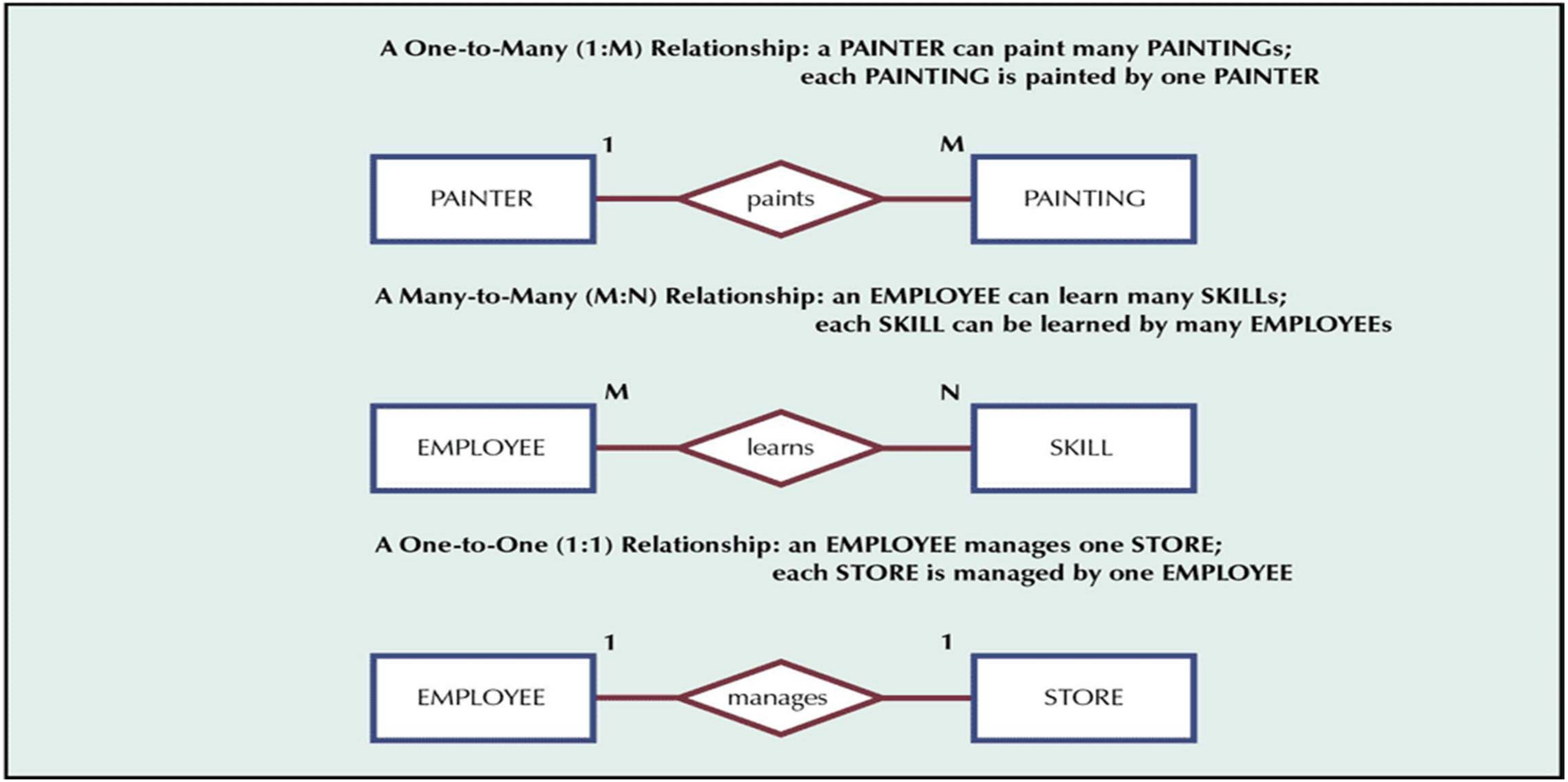
From Turban et al. (2004), Information Technology for Management.

Relational Table

- Stores a collection of related entities
  - The relational database table resembles a file
- Relational table is purely logical structure
  - How data are physically stored in the database is of no concern to the user or the designer: only perception
  - This property became the source of a real database revolution
- Powerful and flexible query language (SQL)

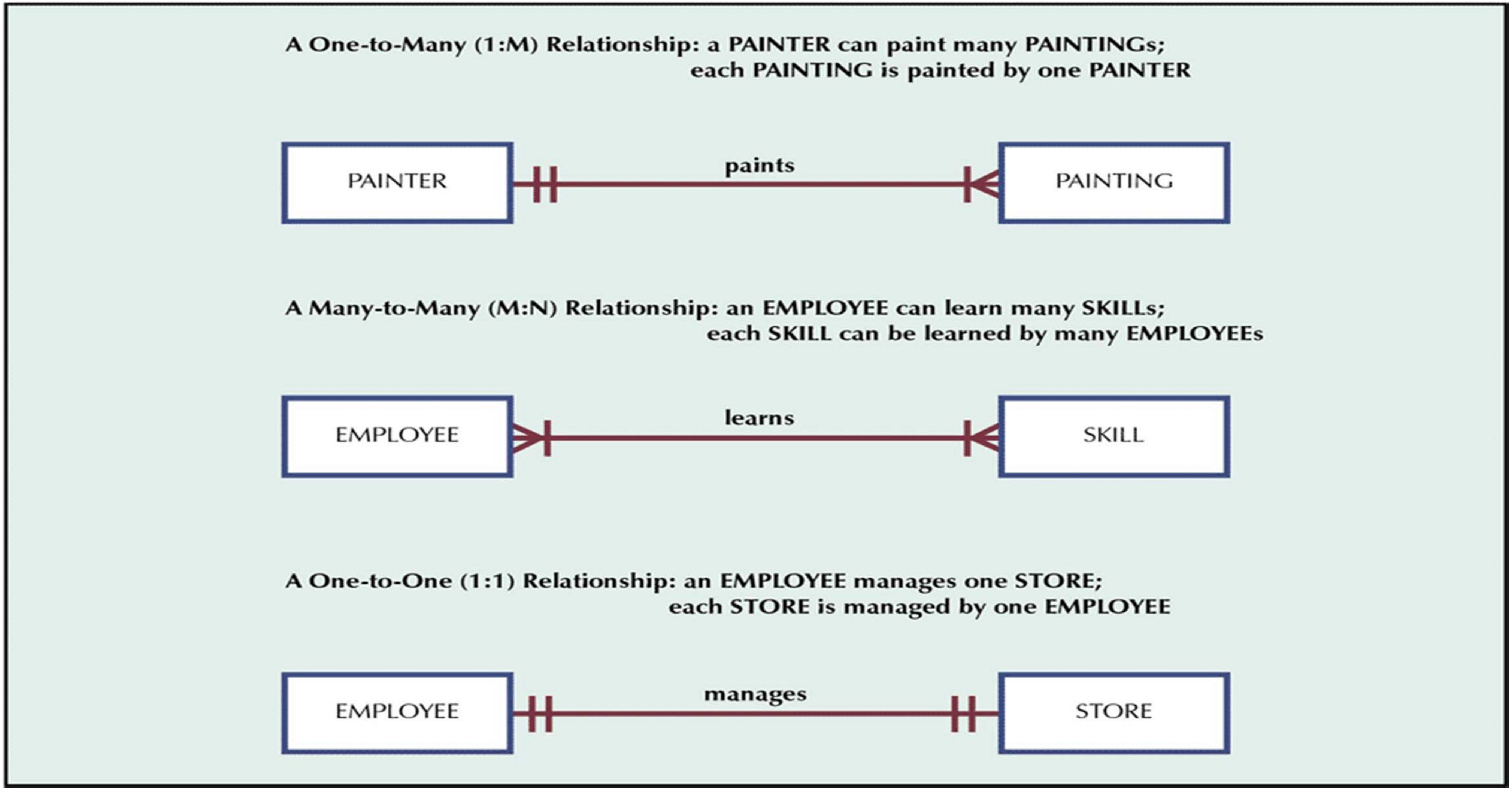
From Turban et al. (2004), Information Technology for Management.

Entity Relationship Models: Chen ERD



From Turban et al. (2004), Information Technology for Management.

Relationships: Crow's Foot ERD



From Turban et al. (2004), Information Technology for Management.

The Entity Relationship Model

- Widely accepted and adapted graphical tool for data modeling
- Introduced by Chen in 1976
- Graphical representation of entities and their relationships in a database structure

RDBMS: conceptual simplicity → ER: more complex database implementation

Complemented the relational data model concepts

From Turban et al. (2004), Information Technology for Management.

The ER Model—Basic Structure

- Entity Relationship Diagram (ERD) **Entity + Relationship**
  - Uses graphic representations to model database components
  - Entity is mapped to a relational table (combined)
- Entity instance (or occurrence) is row in table
- Entity set is collection of like entities
- Connectivity labels types of relationships

From Turban et al. (2004), Information Technology for Management.

Object Oriented Data Model (OODM)

- Semantic data model (SDM) developed by Hammer and McLeod in 1981
- Modeled both data and their relationships/operations in a single structure known as an object
- OODM becomes the basis for the object oriented database management system (OODBMS) and several other software systems

"Object" has greater meaning than a factual content → Semantic data model (Semantic indicates meaning)

Operations: changing data values, finding specific data values, printing data values, etc.

Object → Self-contained, thus making the object is a basic building block

From Turban et al. (2004), Information Technology for Management.

OODM—Basic Structure

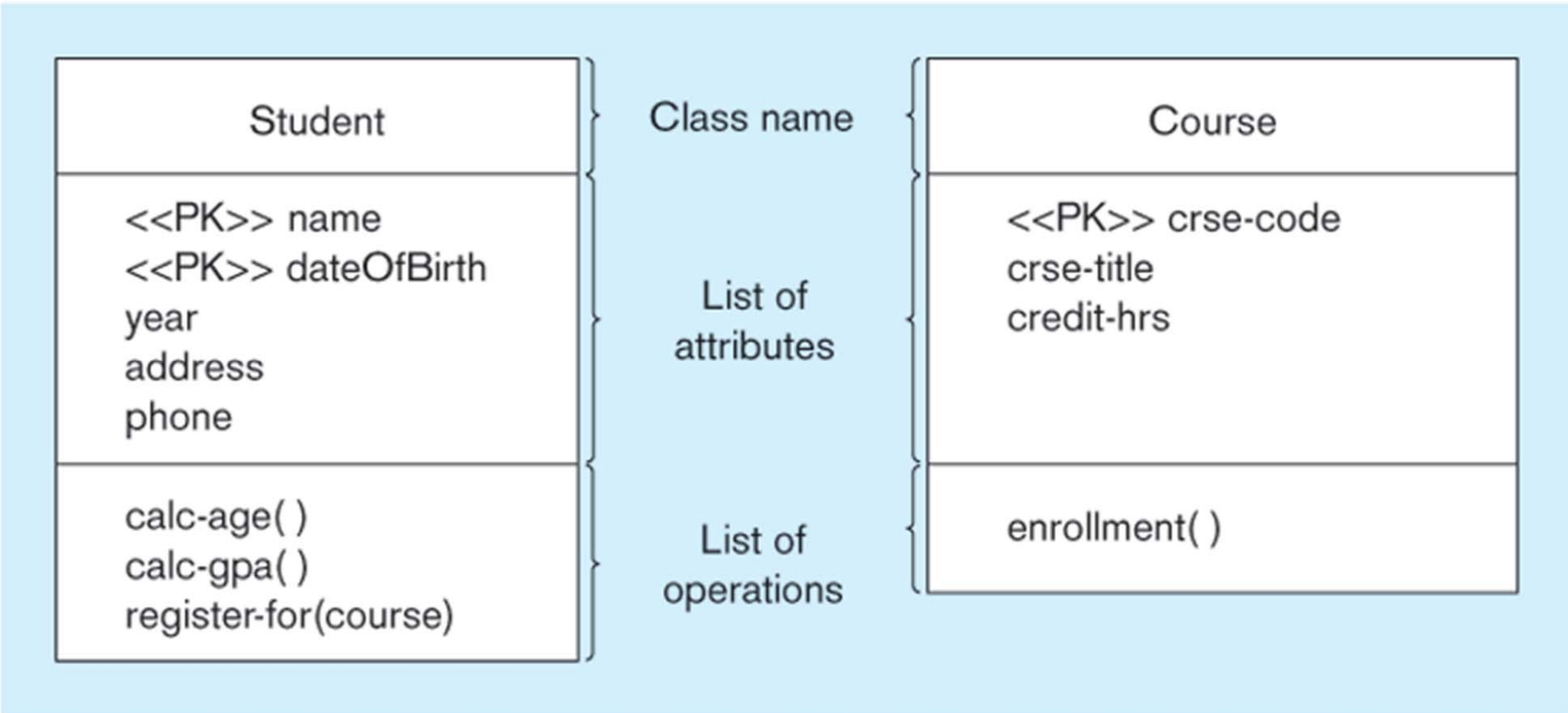
- Object: abstraction of a real-world entity
- Attribute: describe the properties of an object
- Class: objects that share similar characteristics are grouped in. Contain a set of procedures known as *methods*.

  Finding or changing data
- Class's method (*behavior*): represents a real world action
- Class hierarchy: upside-down tree ***Parent (PERSON) → Children (CUSTOMER, EMPLOYEE)***
- Inheritance: the ability of an object within the class hierarchy to inherit the attributes and methods of classes above it ***CUSTOMER, EMPLOYEE will inherit all attributes and methods from PERSON***

From Turban et al. (2004), Information Technology for Management.

Object-Oriented Models: Class Diagram

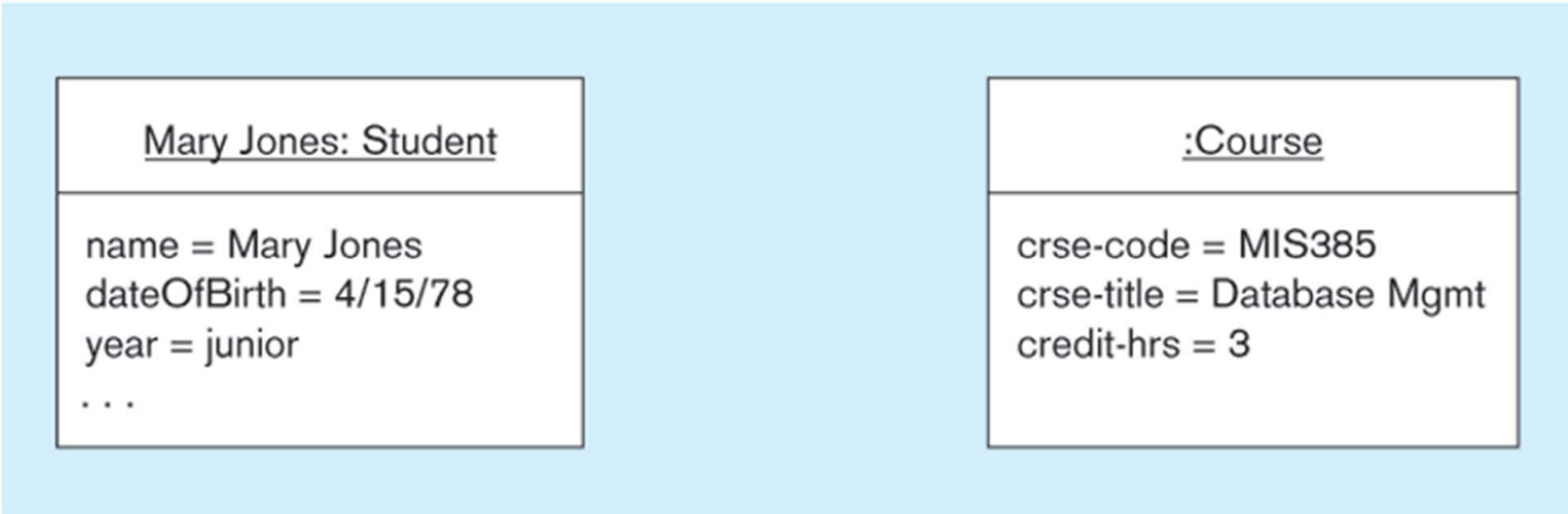
• Shows the static structure of an object-oriented model: object classes, internal structure, relationships.



From Turban et al. (2004), Information Technology for Management.

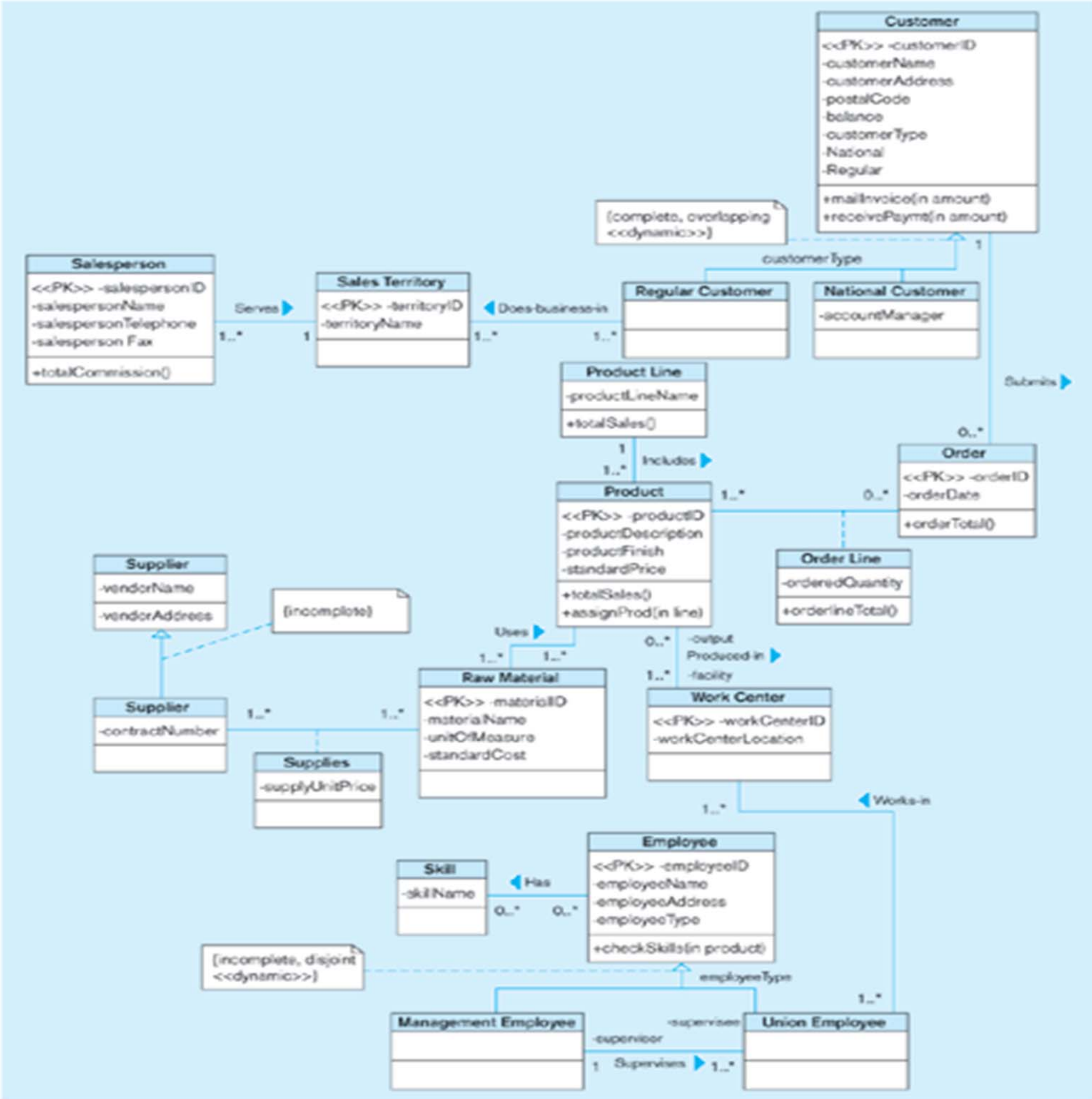
Object Diagram

- Shows instances that are compatible with a given class diagram.



From Turban et al. (2004), Information Technology for Management.

OO Diagram - Example



From Turban et al.

Developments that Boosted OODM's Popularity

- Growing costs put a premium on code reusability
- Complex data types and system requirements became difficult to manage with a traditional RDBMS
- Became possible to support increasingly sophisticated transaction & information requirements
- Ever-increasing computing power made it possible to support the large computing overhead required

From Turban et al. (2004), Information Technology for Management.

Other Models

- Extended Relational Data Model (ERDM)
  - Semantic data model developed in response to increasing complexity of applications
  - DBMS based on the ERDM often described as an object/relational database management system (O/RDBMS)

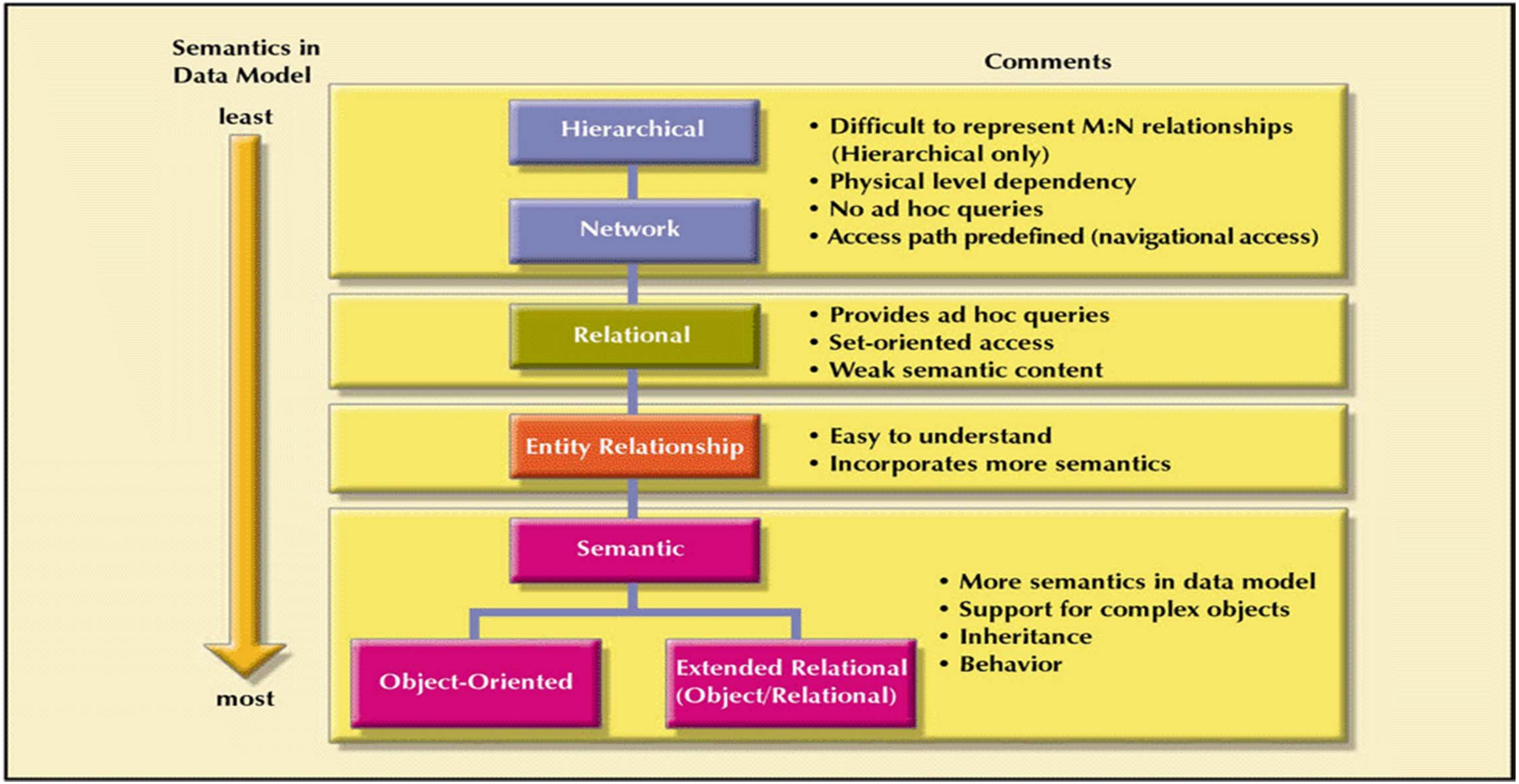
    OO model's best features + simpler relational database structural environment
  - Primarily based on the relational data model's concepts

    ERDM: primarily geared to business applications
    OODM: focus very specialized engineering and scientific applications

From Turban et al. (2004), Information Technology for Management.

The Development of Data Models

FIGURE 2.9 The Development of Data Models



From Turban et al. (2004), Information Technology for Management.