CHAPTER 8
INFORMATION IN ACTION

Management Information Systems, 10th edition,
By Raymond McLeod, Jr. and George P. Schell

PEARSON Prentice Hall

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Learning Objectives

- Recognize that the transaction processing system processes data that describes the firm's basic daily operations.
- Become familiar with the processes performed by a transaction processing system for a distribution firm.
- Recognize that organizational information systems have been developed for business areas and organizational levels.
- Understand the processes performed by a marketing information system.
- Understand the processes performed by a human resources information system.
- Know the basic architecture of an executive information system.

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Learning Objectives (cont.)

- Know what customer relationship management is and why it requires a large computer storage capability.
- Know how a data warehouse differs from a database.
- Know the basic architecture of a data warehouse system.
- Know how data is stored in a data warehouse.
- Know how a user navigates through a warehouse data repository.
- Know what on-line application processing is.
- Know the two basic ways to engage in data mining.

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Introduction

- This chapter gives examples of how information is used in today's firms
- Transaction Processing Systems process data that describe the firm's daily operations and produce a database used by other firm systems
- A related application is Customer Relationship Management (CRM)
- CRM uses data warehousing, meaning data accumulates over time and can retrieved for use in decision making

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THE TRANSACTION PROCESSING SYSTEM

- This term TPS is used to describe the IS that gathers data describing the firm's activities, transforms the data into information, and makes the information available to users both inside and outside the firm
- Figure 8.1 is a model of a TPS where data is gathered from the firm's physical system and environment, and entered into a database
- Data processing software transforms the data into information for the firm's management and for individuals and organizations in the firm's environment

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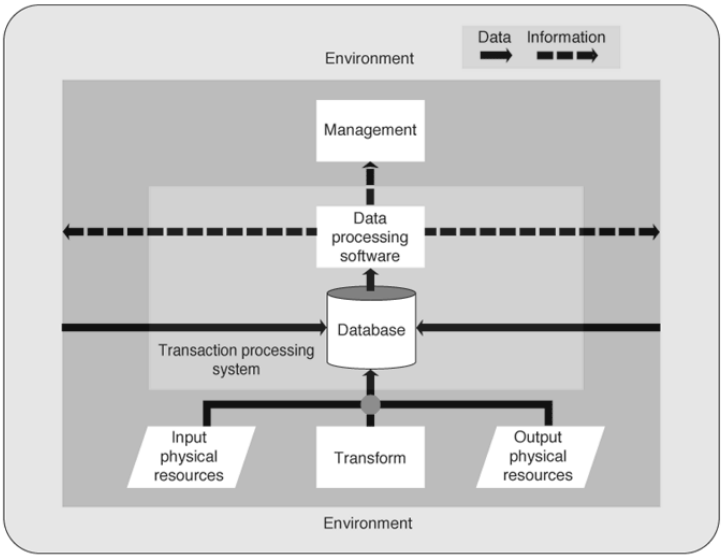
Figure 8.1 A Model of a Transaction Processing System



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System Overview

- Data flow diagrams (DFDs) are used to document the system in a hierarchical manner
- The diagram in Figure 8.2 represents the highest level, called a **context diagram** because it presents the system in the context of its environment
- The data flowing from the distribution system to management consists of the standard accounting reports

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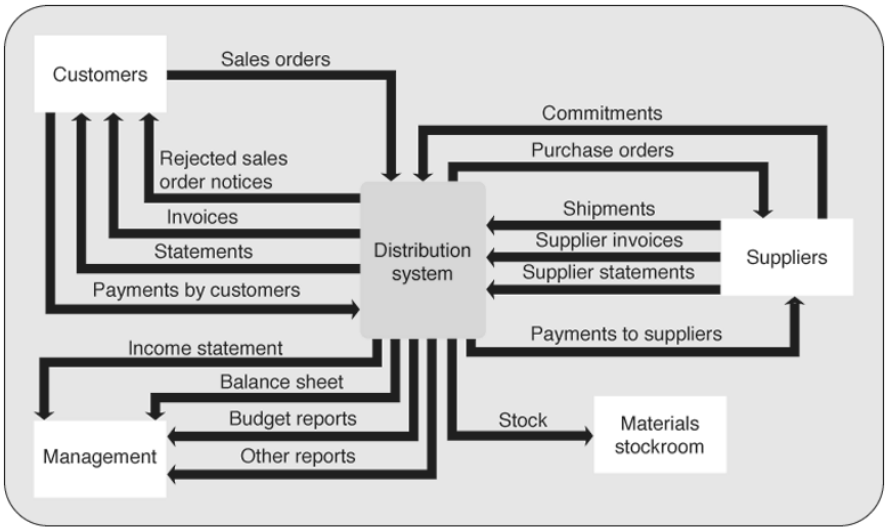
Figure 8.2 A Context Diagram of the Distribution System



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The Major Subsystems of the Distribution System

- While context diagrams define the system boundary, other DFDs are used to describe the major subsystems in the firms data processes
- When a series of DFDs are used in a hierarchy, they are called **leveled DFDs**
- Figure 8.3 which is a **Figure 0 diagram** showing three major subsystems
- These subsystems are identified by the numbered upright rectangles in Figure 8.3

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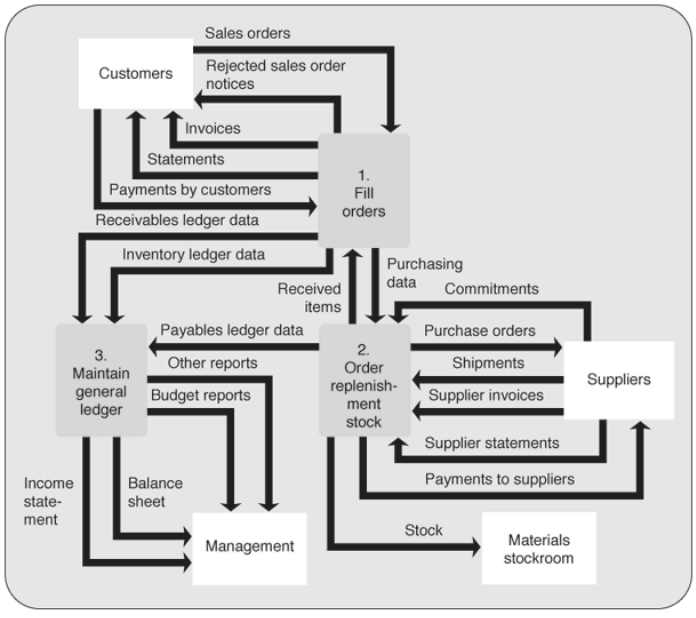
Figure 8.3 A Figure 0 Diagram of the Distribution System



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Systems That Fill Customer Orders

- Figure 8.4 shows the four main systems involved in filling customer orders:
  - The **order entry system** enters customer orders into the system
  - The **inventory system** maintains the inventory records
  - The **billing system** prepares the customer invoices, and
  - The **accounts receivable system** collects the money from the customers
- Figure 8.4 expands Process 1 shown in the Figure 0 diagram, and is called a **Figure 1 diagram**

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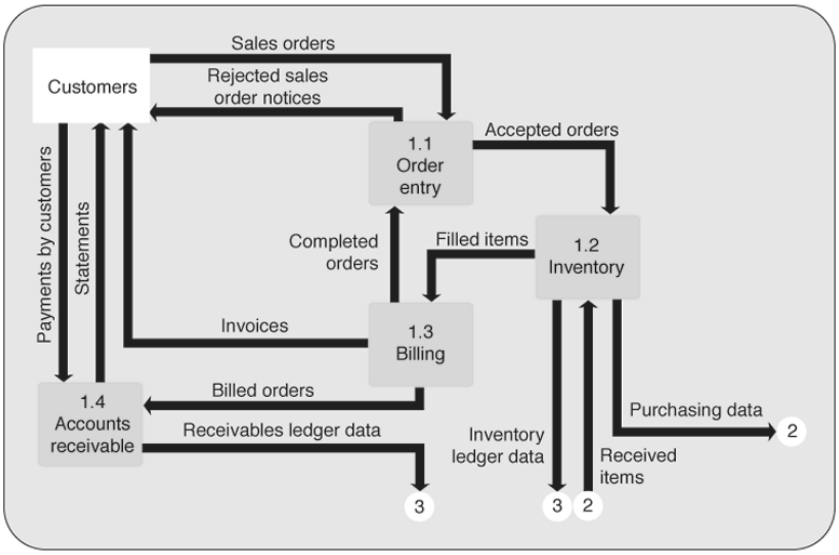
Figure 8.4 A Figure 1 Diagram of the System That Fills Customer Orders



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Systems That Order Replenishment Stock

- The subsystems concerned with ordering replenishment stock from suppliers are shown in Figure 8.5, which is called a **Figure 2 diagram** since it explodes Process 2 of the Figure 0 diagram
  - The **purchasing system** issues purchase orders to suppliers for the needed stock
  - The **receiving system** receives the stock, and
  - The **accounts payable system** makes payment

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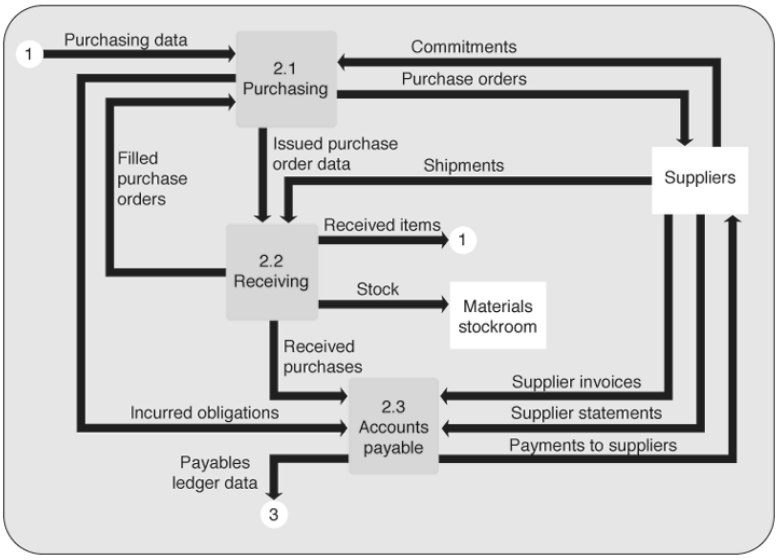
Figure 8.5 A Figure 2 Diagram of the Systems That Order Replenishment Stock



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Systems That Perform General Ledger Processes

- Figure 8.6 shows the detail for the last of the three processes in the Figure 0 diagram
- The **general ledger system** is the part of the accounting system that combines data from other accounting systems to present a composite financial picture of the firm. Two subsystems are involved:
  - The **update general ledger system** posts records that describe the various actions and transactions to the general ledger
  - The **prepare management reports system** uses the contents of the general ledger to prepare the balance sheet and income statement

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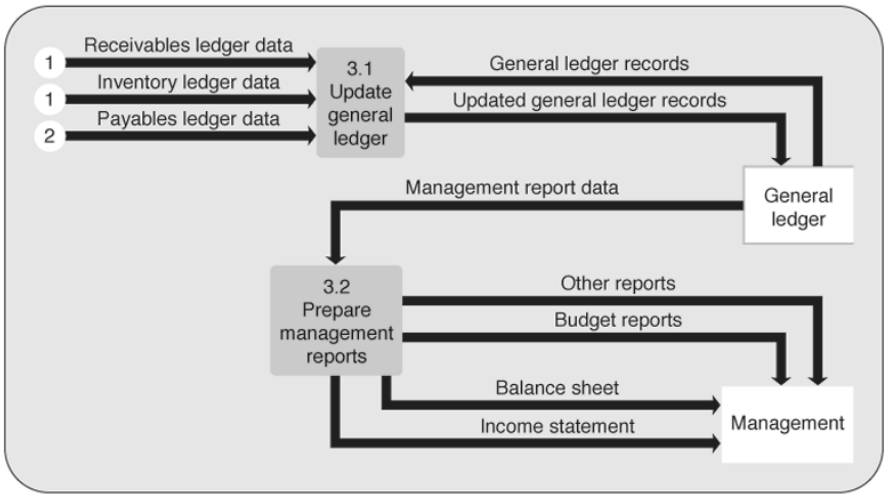
Figure 8.6 A Figure 3 Diagram of the Systems That Perform General Ledger Processes



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ORGANIZATIONAL INFORMATION SYSTEMS

- Other specialized information systems used in a firm include the marketing information system (MKIS) and the human resources information system (HRIS)
- Another IS that is implemented at the organizational level is the executive information systems (EIS), used by upper level managers in an organization
- The MKIS, HRIS, and EIS are described below.

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The Marketing Information System

- An MKIS is made up of input and output subsystems connected by a database (Figure 8.7)
- The Input Subsystems are:
  - **Transaction processing system**
  - The **marketing research subsystem**
  - The **marketing intelligence subsystem**
- Each output subsystem provides information about four critical elements in the **marketing mix**:
  - The **product subsystem**
  - The **place subsystem**
  - The **promotion subsystem**
  - The **price subsystem**

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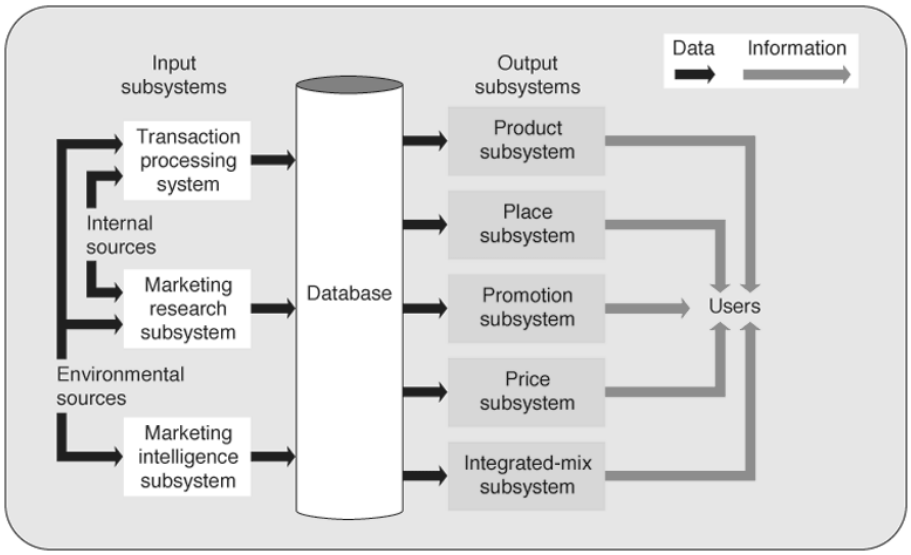
Figure 8.7 A Model of a Marketing Information System



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The Human Resources Information System

- Figure 8.8 illustrates the **human resources information system (HRIS)**
- The figure shows three main HRIS input subsystems:
  - The transaction processing system provides input data
  - The human resources research subsystem used for gathering specialized research information
  - The human resources intelligence subsystem that gathers environmental data that bears on HR issues

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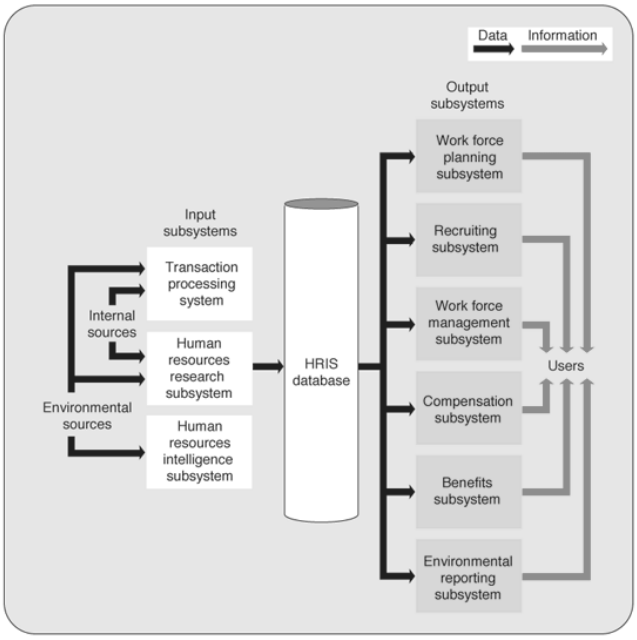
Figure 8.8 A Model of a Human Resources Information System



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The Executive Information System

- The **executive information system (EIS)** provides information to top-level managers on overall firm performance.
- A firm's EIS usually includes executive workstations networked to a central server (shown in Figure 8.9)
- Some executives prefer more detail, so EIS designers build in flexibility so their systems fit the preferences of all executives, whatever they are
- One approach is to provide a **drill-down** capability, giving executives the ability to bring up a summary display and then display successively greater levels of detail (Figure 8.10)

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Figure 8.9 An EIS Model

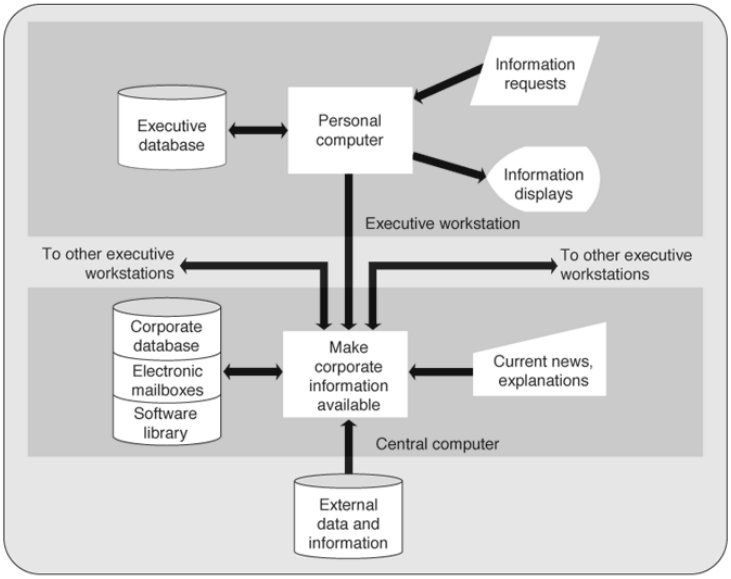

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Figure 8.10 The Drill-Down Technique

AMERICAN ELECTRONICS
STANDARD FINANCIAL REPORTS

Consumer

Current Month	Actual	% Total	Budget	% Total	Variance	% Var.
Profit Before Tax						
Radio	1,771	24.83%	2,084	28.71%	– 313	– 15.0%
Stereo	2,256	31.63%	2,193	30.21%	63	2.9%
Tape Recorder	569	7.98%	504	6.94%	65	12.9%
Television	2,537	35.57%	2,478	34.14%	59	2.4%
Total	7,133	100.00%	7,259	100.00%	– 126	– 1.7%

A. Summary display

AMERICAN ELECTRONICS
STANDARD FINANCIAL REPORTS

Consumer Radio

Current Month	Actual	% Total	Budget	% Total	Variance	% Var.
Net Sales	12,986	100.00%	12,741	100.00%	245	1.9%
Cost of Sales	– 7,488	– 57.66%	– 7,213	– 56.61%	– 275	3.8%
Gross Margin	5,498	42.34%	5,528	43.39%	– 30	– .5%
Research & Devel.	1,694	13.04%	1,412	11.08%	282	20.0%
Selling & Mktg.	1,505	11.59%	1,498	11.76%	7	.5%
General & Admin.	511	3.94%	522	4.10%	– 11	– 2.1%
Interest Income	60	.46%	62	.49%	– 2	– 3.2%
Interest Expense	– 77	– .59%	– 74	– .58%	– 3	4.1%
Before Tax Profit	1,771	13.64%	2,084	16.36%	– 313	– 15.0%

B. Display one level down

AMERICAN ELECTRONICS
STANDARD FINANCIAL REPORTS

Consumer Radio Research & Devel.

Current Month	Actual	% Total	Budget	% Total	Variance	% Var.
Project RA100	517	30.52%	303	21.46%	214	70.6%
Project RA200	179	10.57%	176	12.46%	3	1.7%
Project RA300	115	6.79%	80	5.67%	35	43.8%
Project RA400	315	18.60%	288	20.40%	27	9.4%
Project RA500	231	13.64%	225	15.93%	6	2.7%
Project RA600	337	19.89%	340	24.08%	– 3	– .9%
Total R&D Expense	1,694	100.00%	1,412	100.00%	282	20.0%

C. Display two levels down

Source:Courtesy of Pilot Executive Software

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CUSTOMER RELATIONSHIP MANAGEMENT (CRM)

- CRM systems are used to manage relationships between a firm and its customers so both can receive maximum value from the relationship
- Using more effort to cultivate long-term client relationships makes good marketing sense since its usually cheaper to keep existing customers than to obtain new ones
- The **CRM system** accumulates customer data over a long period and uses the data to produce information for users. A CRM system's central element is the **data warehouse**

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DATA WAREHOUSING

- Until recently, computer technology could not support a system with such large-scale data demands
- The term **data warehouse** was coined to describe a data store with the following characteristics:
  - Very large scale storage capacity
  - The data is accumulated into new records instead of updating existing records with new information
  - The data is easily retrievable.
  - The data is used for decision making, not for the firm's daily operations

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The Data Warehousing System

- A **data warehousing system** (Figure 8.11) enters data into the warehouse, transforms the data into information, and makes the information available to users
- Data is gathered from data sources and goes through a staging area before being entered in the warehouse data repository
- An information delivery system obtains data from the warehouse data repository and transforms it into information for the users
- The data warehousing system also includes a management and control components

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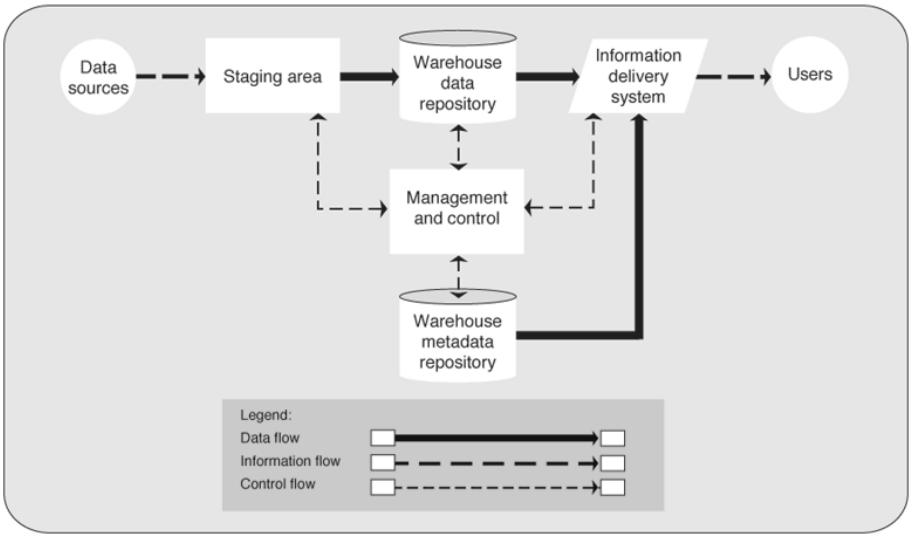
Figure 8.11 A Model of a Data Warehousing System



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How Data Is Stored in the Warehouse Data Repository

- The warehouse data repository stores two types of data in separate tables, which are combined to produce an information package
- Identifying and descriptive data are stored in **dimension tables** (Figure 8.12)
- **Fact tables** contain the quantitative measures of an entity, object, or activity (Fig. 8.13)
- An **information package** identifies all of the dimensions that will be used in analyzing a particular activity. Figure 8.14 shows the format and Figure 8.15 includes some sample data

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Figure 8.12 A Sample Dimension Table

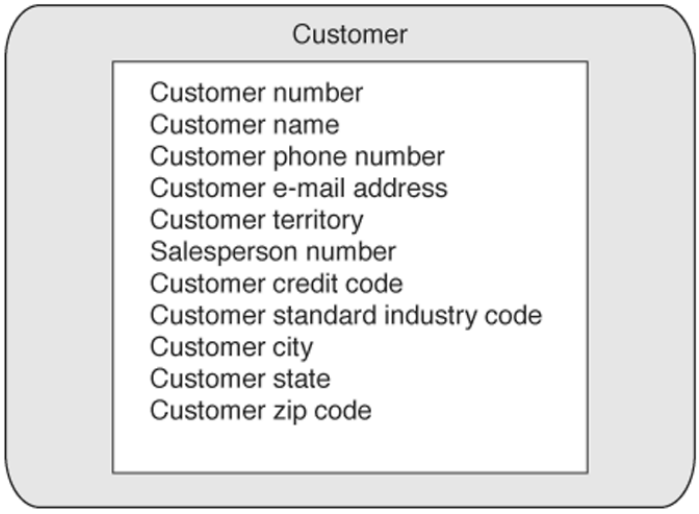

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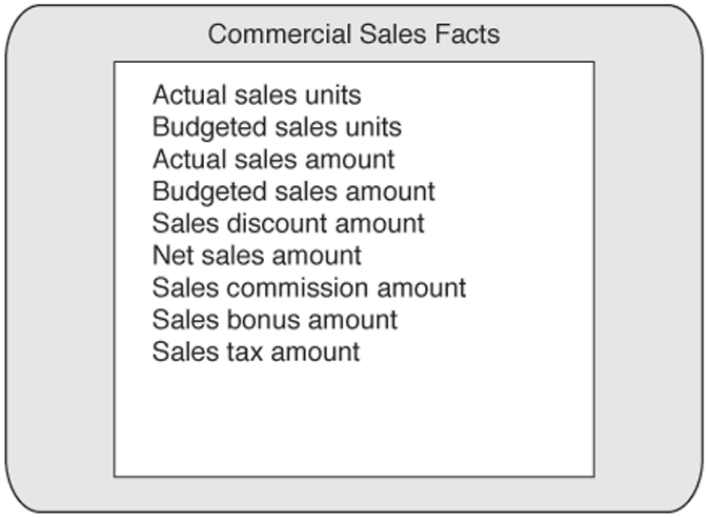
Figure 8.13 A Sample Fact Table



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Subject: Name of Business Activity Being Measured

Dimension name	Dimension name	Dimension name	Dimension name
Dimension key	Dimension key	Dimension key	Dimension key
Dimension 1	Dimension 1	Dimension 1	Dimension 1
Dimension 2	Dimension 2	Dimension 2	Dimension 2
Dimension 3	Dimension 3	Dimension n	Dimension 3
Dimension 4	Dimension n		Dimension 4
Dimension n			Dimension n
Facts: Numeric measures of the business activity.			

Figure 8.14
Information Package Format

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Subject: Commercial Sales

Time	Salesperson	Customer	Product
Time key	Salesperson key	Customer key	Product key
Hour	Salesperson name	Customer name	Product name
Day	Sales branch	Customer territory	Product model
Month	Sales region	Customer credit code	Product brand
Quarter	Subsidary		Product line
Year			
Facts: Actual sales units, budgeted sales units, actual sales amount, bugeted sales amount, sales discount amount, net sales amount, sales commission amount, sales bonus amount, sales tax amount			

Figure 8.15 **A Sample Information Package**

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The Star Schema

- The key that identifies the dimension and provides the link to connect the dimension tables to the fact table is called a star schema
- Figure 8.16 shows how the keys in four dimension tables are related to keys in the information package in the center
- Fig. 8.17 is an example using the four dimension tables: customer, time, salesperson, and product
- The warehouse data repository contains multiple star schemas – one for each activity type to be analyzed

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Figure 8.16 Star Schema Format

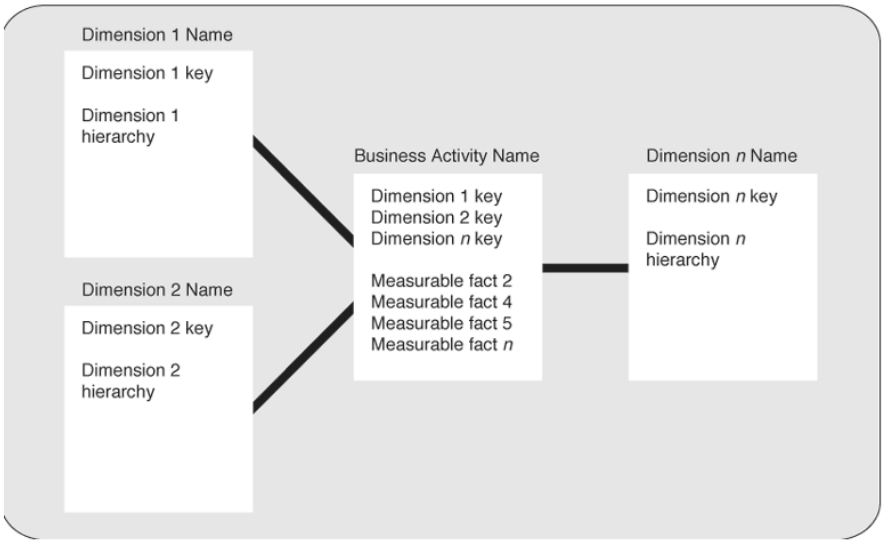

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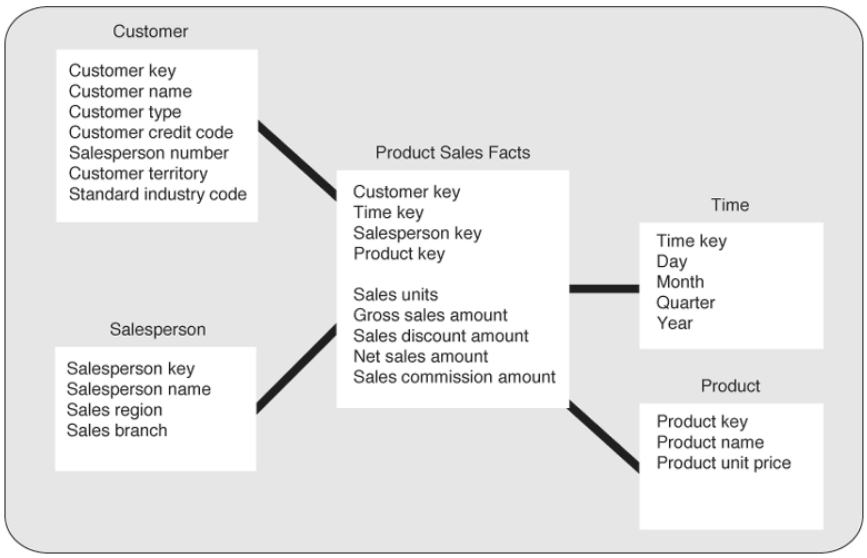
Figure 8.17 A Sample Star Schema



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INFORMATION DELIVERY

- The final element in the data warehousing system is the information delivery system
- Information is obtained from the data repository, transformed into information, and made available to users
- Figure 8.18 shows how the user can navigate the data repository to produce summary information, detailed information, and detailed data
- Figure 8.19 shows the results of a drill-across navigation, producing outputs in different hierarchies

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Figure 8.18 Navigating through the Warehouse Data Repository

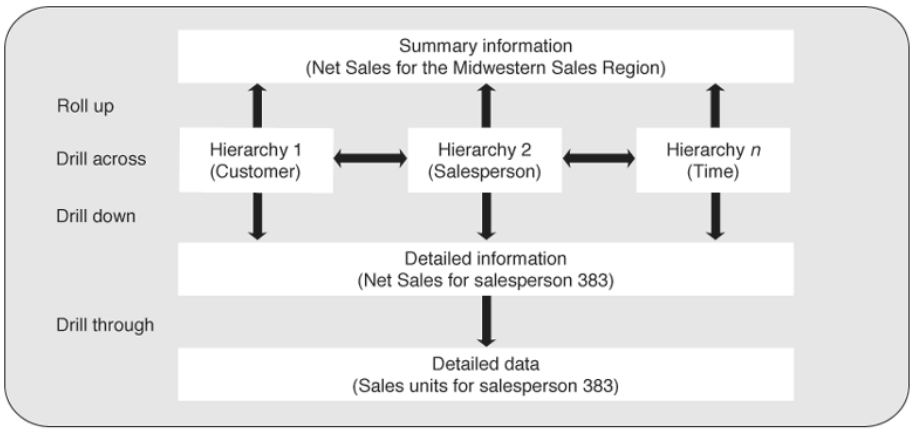

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Figure 8.19 Drilling Across Hierarchies Produces Multiple Views.

CUSTOMER: Bill Marlowe

Month	Shoes	Coats	Sweaters	Skirts/Slacks
January 2003	145.00	279.95	118.29	.00
February 2003	.00	.00	79.95	.00
March 2003	239.50	.00	.00	391.50
April 2003	49.95	.00	.00	129.95

A Sales by Customer by Product Class by Month

Month: January 2003

Product	Paul Murray	Bill Marlowe	Armondo No	Kelly Pope
Shoes	.00	145.00	89.95	234.68
Coats	234.68	279.95	.00	434.50
Sweaters	112.19	118.29	.00	.00
Skirts/Slacks	141.12	.00	217.92	.00

B Sales by Month by Product Class by Customer

Product Class: Shoes

Customer	January 2003	February 2003	March 2003	April 2003
Paul Murray	.00	.00	.00	238.92
Bill Marlowe	145.00	.00	239.50	49.95
Armondo No	89.95	122.34	89.95	119.35
Kelly Pope	234.68	.00	112.92	.00

C Sales by Product Class by Customer by Month

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ONLINE ANALYTCAL PROCESSING

- **OLAP** is a type of software especially developed for data warehouses
- Using OLAP, users can communicate with the data warehouse either through a GUI or Web interface, and quickly produce information in a variety of forms, including graphics
- There are two approaches to OLAP (Figure 8.20):
  1. **ROLAP** (for **relational online analytical processing**) that utilizes a standard relational DBMS
  2. **MOLAP** (for **multidimensional online analytical processing**) that utilizes a special multidimensional DBMS

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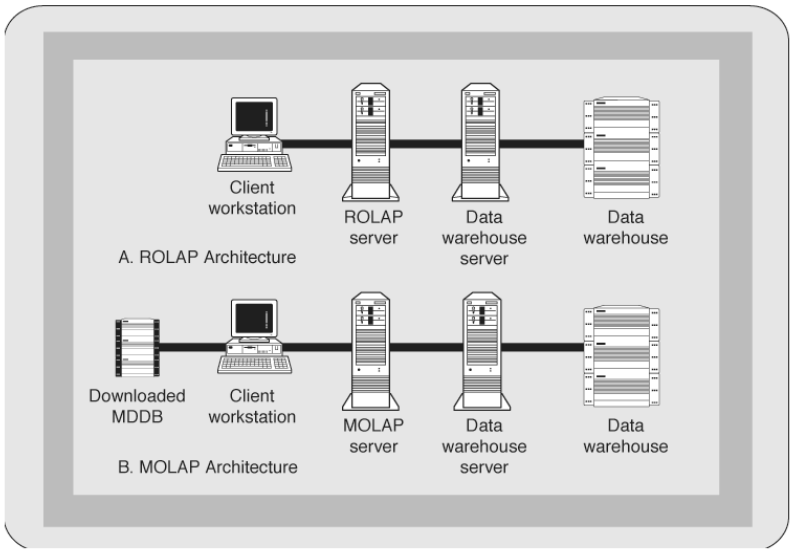
Figure 8.20 ROLAP and MOLAP Architectures



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ROLAP and MOLAP

- Both OLAP types include a data warehouse server and a second server that houses OLAP software
- A major difference is that the MOLAP workstation includes a downloaded multidimensional database
- The data in this database has already been formatted in various dimensions so that it may be made available quickly rather than go through time-consuming analyses
- Figure 8.21 illustrates a report that is the type that ROLAP can easily prepare
- MOLAP can produce information in many dimensions
- Figure 8.22 illustrates a summary report in four dimensions: store type, product, age, and gender

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Figure 8.21 An Example of a Report That Could Be Produced with ROLAP

ANALYSIS OF RETAIL PRICE DISCOUNTS
PRODUCT CLASS BY STORE REGION BY QUARTER
2001 THROUGH 2003
IN DOLLARS

STORE REGION: WEST

PRODUCT CLASS: DVD

QUARTER	RETAIL SALES	SALES DISCOUNTS	NET SALES
1/2001	7,525	610	6,915
2/2001	7,280	0	7,280
3/2001	11,310	1,108	10,202
4/2001	12,445	1,829	10,616
1/2002	16,418	2,314	14,104
2/2002	1,320	725	595
3/2002	6,694	890	5,804
4/2002	12,310	2,555	9,755
1/2003	11,927	3,719	8,208
2/2003	5,423	1,429	3,994
3/2003	2,764	960	1,804
4/2003	15,329	4,230	11,009
TOTAL	110,745	20,459	90,286

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Figure 8.22 An Example of a Report that Could Be Produced with MOLAP

PRODUCT SALES BY CUSTOMER GENDER
YEAR-TO-DATE 2003
IN UNITS

STORE TYPE: DEPARTMENT

PRODUCT NUMBER: 23184

PRODUCT NAME: ROLLING CARRY-ON LUGGAGE

GENDER	AGE= 15–20	AGE= 21–30	AGE= 31–40	AGE= 41–50	AGE= OVER 50	TOTAL
FEMALE	8	23	144	124	79	378
MALE	6	17	85	63	51	222
TOTAL	14	40	229	187	130	600

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DATA MINING

- Data mining is the process of finding relationships in data previously unknown to the user
- Data mining helps users discover relationships and present them in an understandable way so the relationships can be used in decision making
- The two basic data mining techniques are:
  - **Hypothesis Verification** where data is used to test theories
  - **Knowledge Discovery** in which users search for common characteristics within the data

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END OF CHAPTER 8

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