Managing Information Technology 6th Edition

CHAPTER 5

THE DATA RESOURCE

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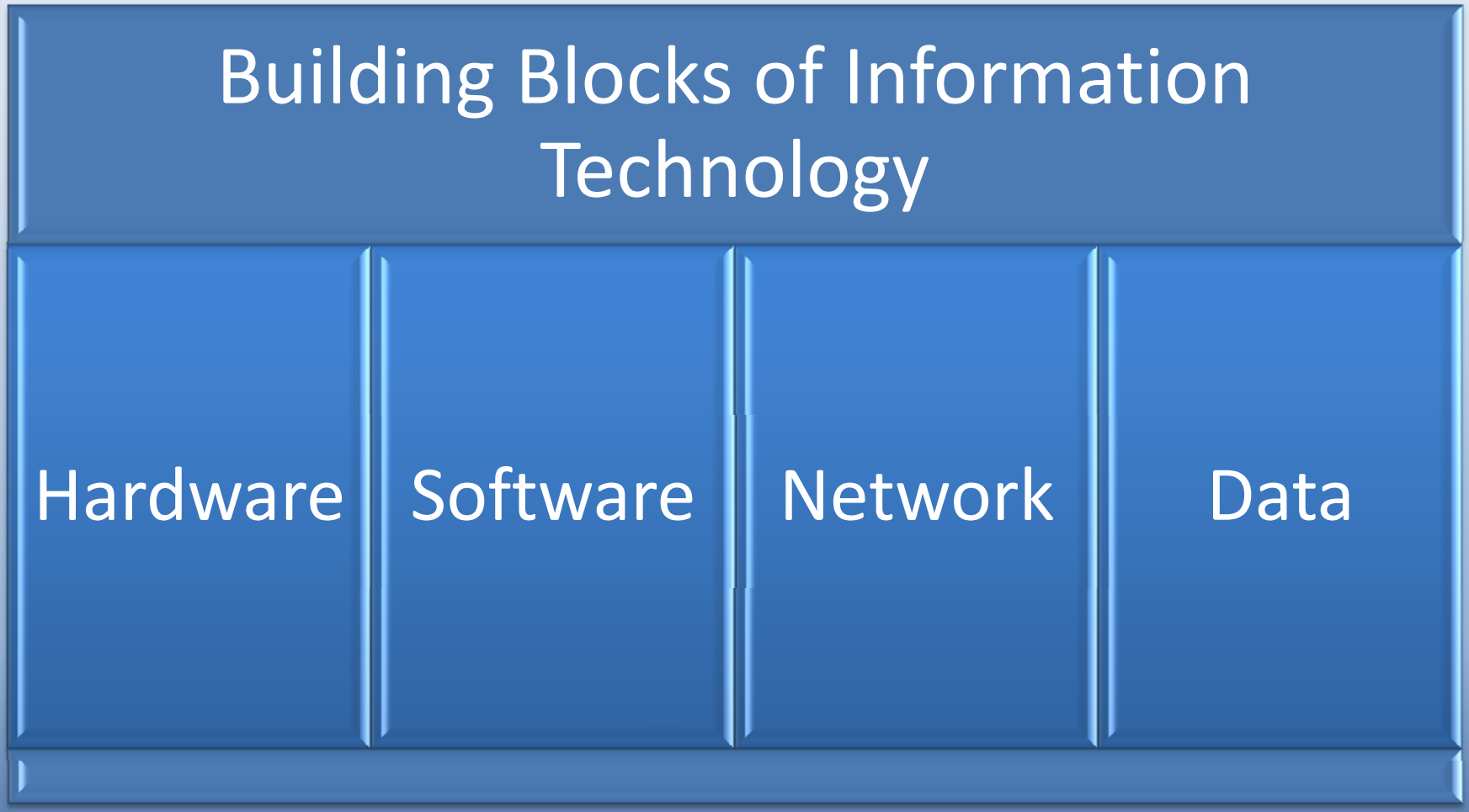

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WHY MANAGE DATA?

- Organizations could not function long without critical business data
- Cost to replace data would be very high
- Time to reconcile inconsistent data may be too long
- Data often needs to be accessed quickly

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WHY MANAGE DATA?

- Data should be:
  - Cataloged
  - Named in standard ways
  - Protected
  - Accessible to those with a need to know
  - Maintained with high quality
- There are technical and managerial issues to managing data

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TECHNICAL ASPECTS OF DM

The Data Model

- Data model is an overall map for business data
- Data modeling involves:
  - Methodology, or steps followed to identify and describe data entities
  - Notation, or a way to illustrate data entities graphically

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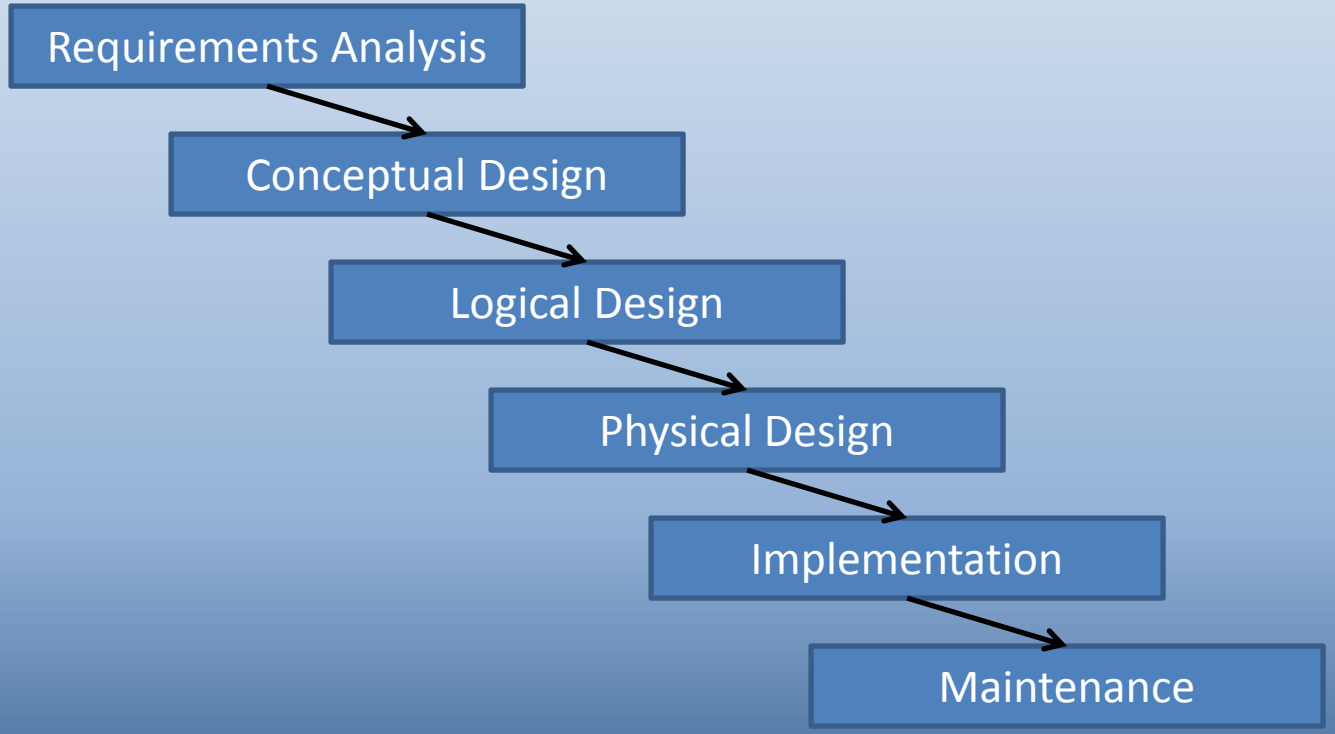
TECHNICAL ASPECTS OF DM

The Data Model: Methodology

- Development process for data management system involves six basic steps



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TECHNICAL ASPECTS OF DM

The Data Model: Methodology

- User requirements usually gathered in text format through personal interviews with users
- Data modeled in conceptual design phase as ***entity-relationship diagram (ERD)***
- Data modeled in logical design phase as a set of ***relations (tables)***

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TECHNICAL ASPECTS OF DM

The Data Model: Notation

- Entity-relationship diagram (ERD)
  - Most common method for representing a data model and organizational data needs
  - **Entities:** things about which data are collected
  - **Attributes:** actual elements of data that are to be collected
  - **Relationships:** relevant associations between organizational entities

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TECHNICAL ASPECTS OF DM

The Data Model: Notation

- ERD example:
  - Entities are Customer, Order, and Product
  - Relationships are Submits and Includes

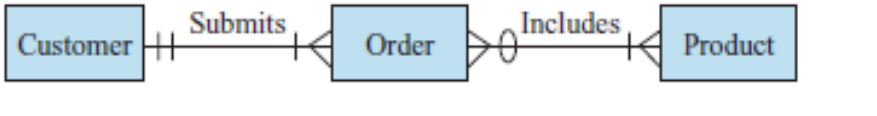

Figure 5.1 Entity-Relationship Diagram

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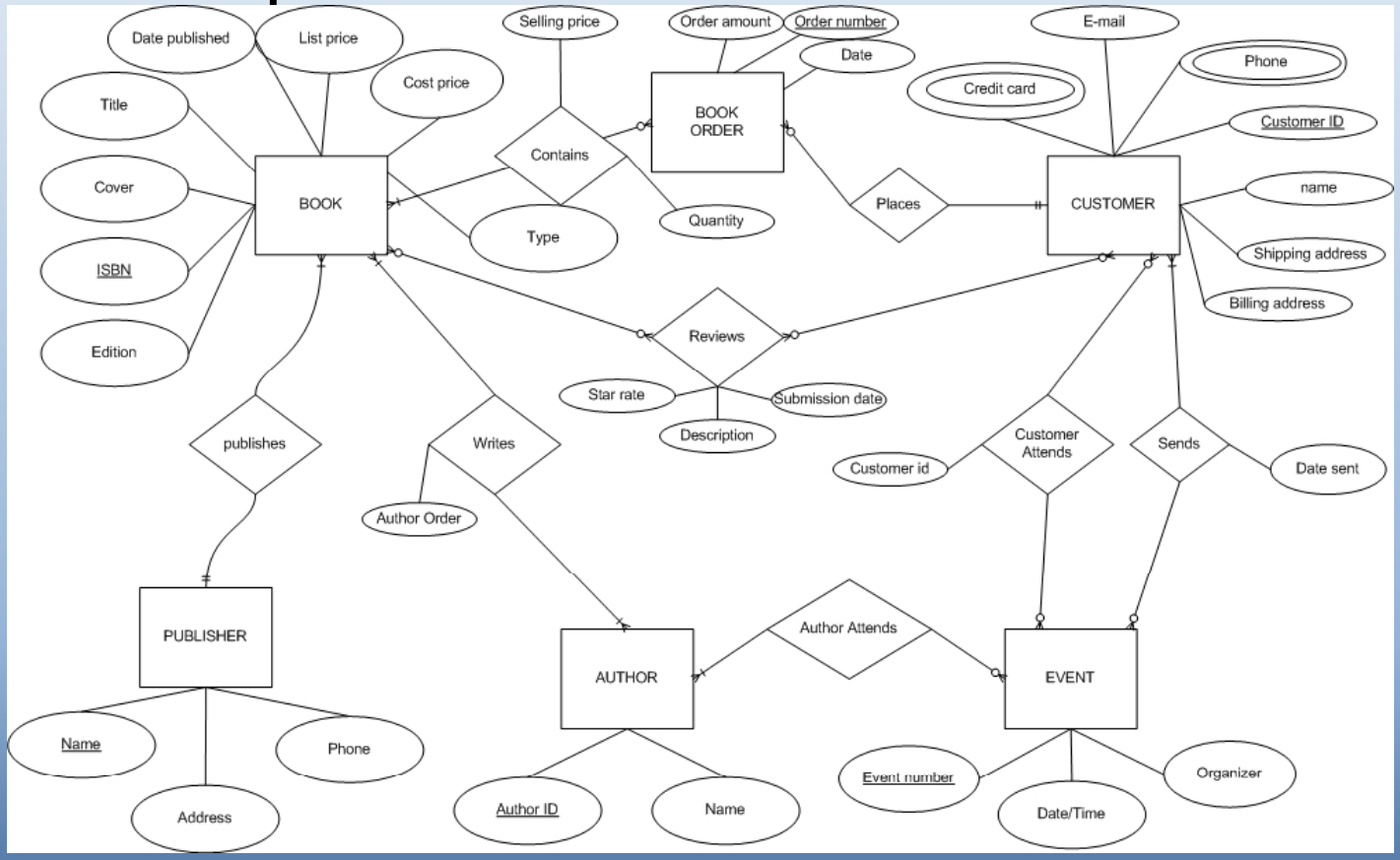
TECHNICAL ASPECTS OF DM

The Data Model: Notation

- ERD example:



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TECHNICAL ASPECTS OF DM

The Data Model: Notation

- Relations (tables)
  - Structure consisting of rows and columns
  - Each row represents a single entity
  - Each column represents an attribute
- ERDs are converted into sets of relations

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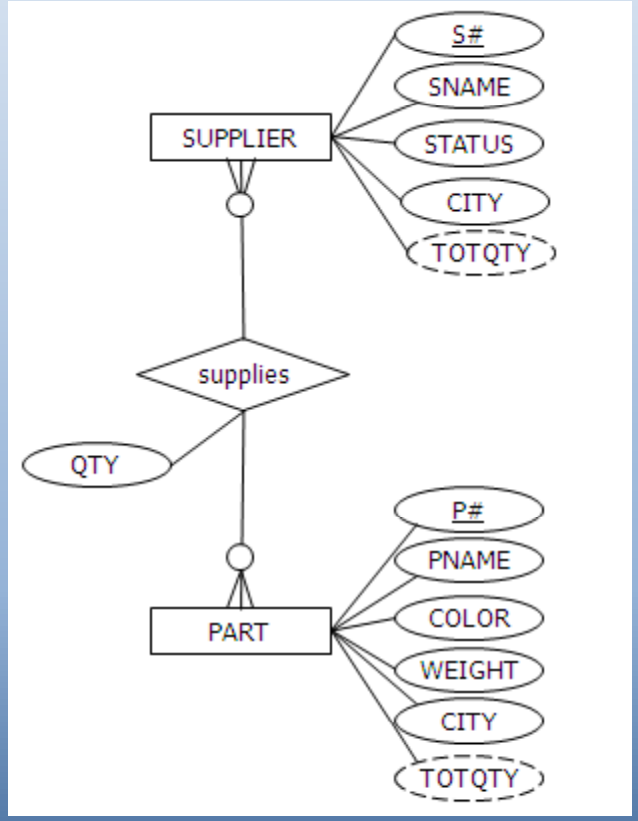
TECHNICAL ASPECTS OF DM

The Data Model: Notation

- ERD example:



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TECHNICAL ASPECTS OF DM

The Data Model: Notation

- Convert ERD to relations:

SUPPLIER

S#	SNAME	STATUS	CITY
S1	Smith	20	London
S2	Jones	10	Paris
S3	Blake	30	Paris
S4	Clark	20	London
S5	Adams	30	Athens

PART

P#	PNAME	COLOR	WEIGHT	CITY
P1	Nut	Red	12	London
P2	Bolt	Green	17	Paris
P3	Screw	Blue	17	Rome
P4	Screw	Red	14	London
P5	Cam	Blue	12	Paris
P6	Cog	Red	19	London

supplies

S#	P#	QTY
S1	P1	300
S1	P2	200
S1	P3	400
S1	P4	200
S1	P5	100
S1	P6	100
S2	P1	300
S2	P2	400
S3	P2	200
S4	P2	200
S4	P4	300
S4	P5	400

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TECHNICAL ASPECTS OF DM

Metadata

- Data about data
- Needed to unambiguously describe data for the enterprise
- Documents the meaning of all the business rules that govern data
- Cannot have quality data without high-quality metadata

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TECHNICAL ASPECTS OF DM

Data Modeling

- Enterprise modeling
  - Top-down approach
  - Describes organization and data requirements at high level, independent of reports, screens, or detailed specifications
  - Not biased by how business operates today

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TECHNICAL ASPECTS OF DM

Data Modeling

- Enterprise modeling steps:
  - Divide work into major functions
  - Divide each function into processes
  - Divide processes into activities
  - List data entities assigned to each activity
  - Identify relationships between entities

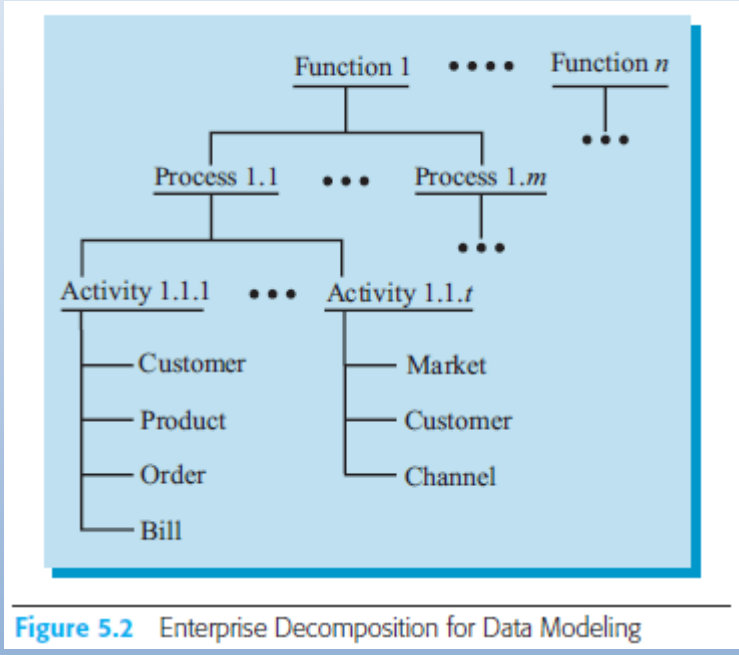

Figure 5.2 Enterprise Decomposition for Data Modeling

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TECHNICAL ASPECTS OF DM

Data Modeling

- View integration
  - Bottom-up approach
  - Each report, screen, form, and document produced from databases (called user views) identified first

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TECHNICAL ASPECTS OF DM

Data Modeling

- View integration steps:
  - Create user views
  - Identify data elements in each user view and put into a structure called a normal form
  - Normalize user views
  - Integrate set of entities from normalization into one description
- **Normalization:** process of creating simple data structures from more complex ones

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TECHNICAL ASPECTS OF DM

Data Modeling

- Prepackaged data models – an alternative to enterprise data modeling
- Advantages:
  - Developed using proven, up-to-date components
  - Require less time and money
  - Easier to evolve data model
  - Greater application compatibility
  - Easier to share data across organizations

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TECHNICAL ASPECTS OF DM

Data Modeling

Data Modeling Guidelines	
Objective	Modeling effort must be justified by some overriding need
Scope	Coverage for a data model must be carefully considered
Outcome	The more uncertain the outcome, the lower the chances for success
Timing	Start with high-level model and fill in details as major systems projects undertaken

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TECHNICAL ASPECTS OF DM

Data Programming

1. Database processing activity can be specified with a procedural language (3GL) or
2. Special-purpose language
   - Structured query language (e.g., SQL)
   - Data exchange language (e.g., XML)

Example SQL Query

```
SELECT ORDER_ID, CUSTOMER_ID, CUST-NAME, ORDER_DATE
FROM CUSTOMER, ORDER
WHERE ORDER_DATE > '04/12/08' AND
CUSTOMER.CUSTOMER_ID = ORDER.CUSTOMERID;
```

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MANAGERIAL ISSUES OF DM

Principles in Managing Data

The need to manage data is permanent

- Data values may change, but a company will always have customers, products, employees, etc. about which it needs to keep current data
- Business processes will change, but only the programs will need to be rewritten

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MANAGERIAL ISSUES OF DM

Principles in Managing Data

Data can exist at several levels

- Most new data are captured in operational databases
- Managerial and strategic databases typically subsets, summaries, or aggregates of operational databases
- If managerial databases are constructed from external sources, there may be problems with data consistency

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MANAGERIAL ISSUES OF DM

Principles in Managing Data

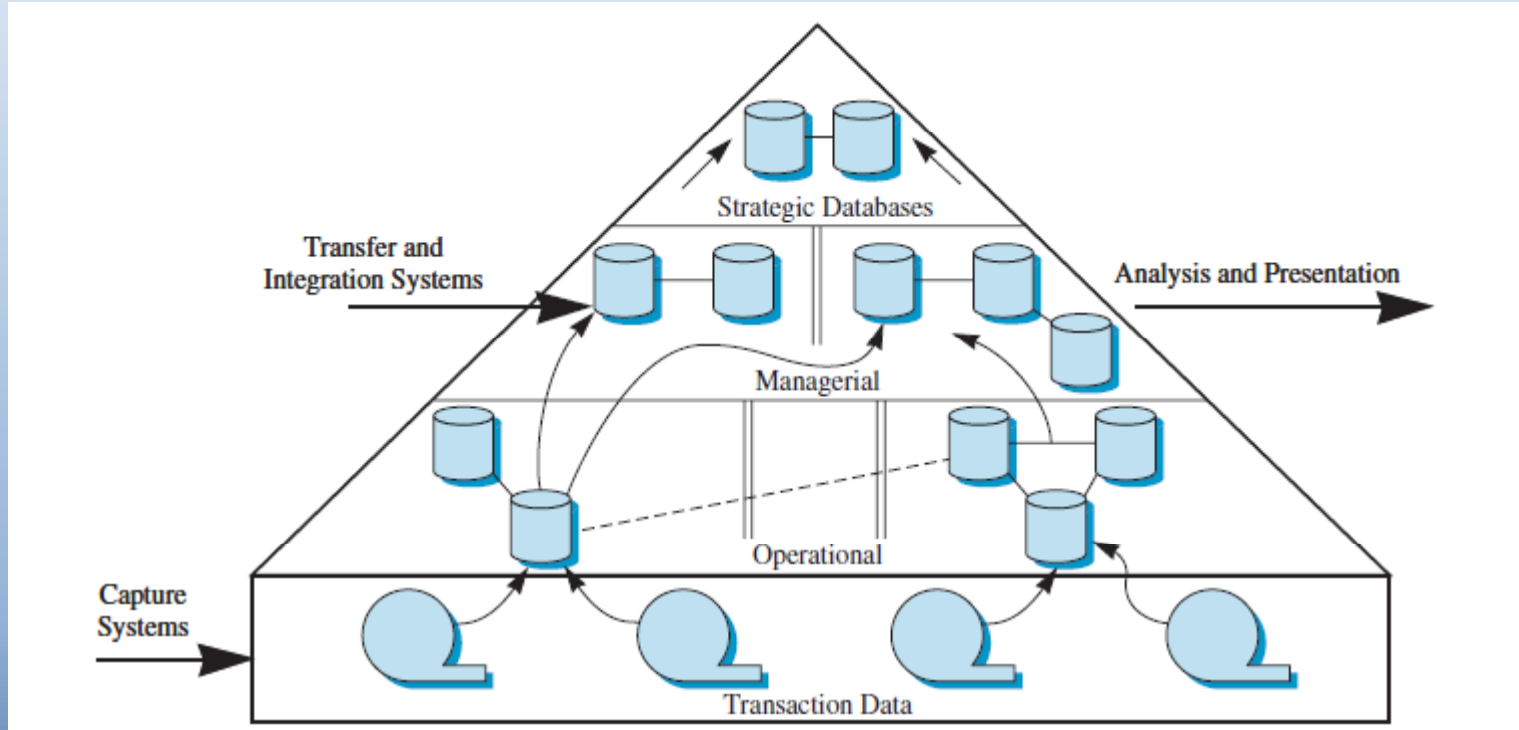

Figure 5.3 The Data Pyramid

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MANAGERIAL ISSUES OF DM

Principles in Managing Data

Application software should be separate from the database

- **Application independence:** separation or decoupling of data from application systems
  - Raw data captured and stored
  - When needed, data are retrieved but not consumed
  - Data are transferred to other parts of the organization when authorized
- Meaning and structure of data not hidden from other applications

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Principles in Managing Data

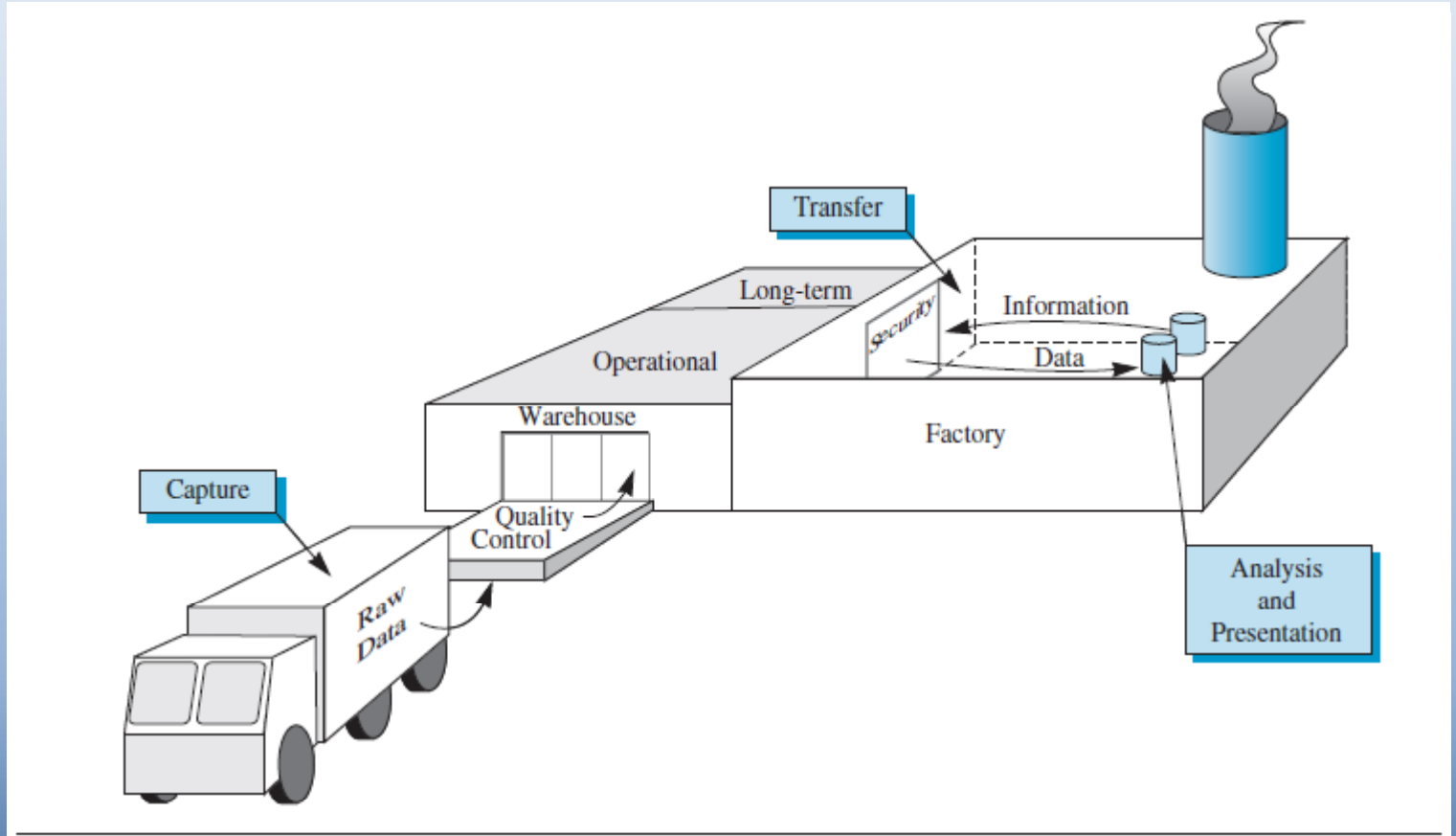

Figure 5.4 Categories of Information Processing with Application Independence

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MANAGERIAL ISSUES OF DM

Principles in Managing Data

Application software can be classified by how it treats data

- ***Data capture:*** gather data and populate the database
- ***Data transfer:*** move data from one database to another or otherwise bring data together
- ***Data analysis and presentation:*** provide data and information to authorized persons

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MANAGERIAL ISSUES OF DM

Principles in Managing Data

Application software should be considered disposable

- Significant result of application independence
  - Company can replace the capture, transfer, and presentation software modules separately if necessary
  - Applications and data are not intertwined
- Obsolete systems do not need to be kept alive only to access data

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Principles in Managing Data

Data should be captured once

- Too costly to capture data multiple times and reconcile across applications
- Instead, data should be captured once and synchronized across different databases
- Data architecture should include inventory of data and plan to distribute data

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Principles in Managing Data

There should be strict data standards

- Data must be clearly identified and defined so that all users know exactly what they are manipulating
- Only business managers have the knowledge necessary to set data standards
- **Data steward**: a business manager responsible for the quality of data in a particular subject or process area

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MANAGERIAL ISSUES OF DM

Principles in Managing Data

There should be strict data standards (cont'd)

- Five types of data standards
  - ***Identifier:*** Unique value for each business entity
  - ***Naming:*** Unique name or label for each type of data
  - ***Definition:*** Unambiguous description for each type of data
  - ***Integrity rule:*** Specification of legitimate values for a type of data
  - ***Usage rights:*** Security clearances for a type of data

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Principles in Managing Data

There should be strict data standards (cont'd)

- Data standards should be stored in standards database called a **metadata repository** or **data dictionary/directory (DD/D)**
- **Master data management (MDM):** disciplines, technologies, and methods to ensure the currency, meaning, and quality of reference data within and across subject areas

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The Data Management Process

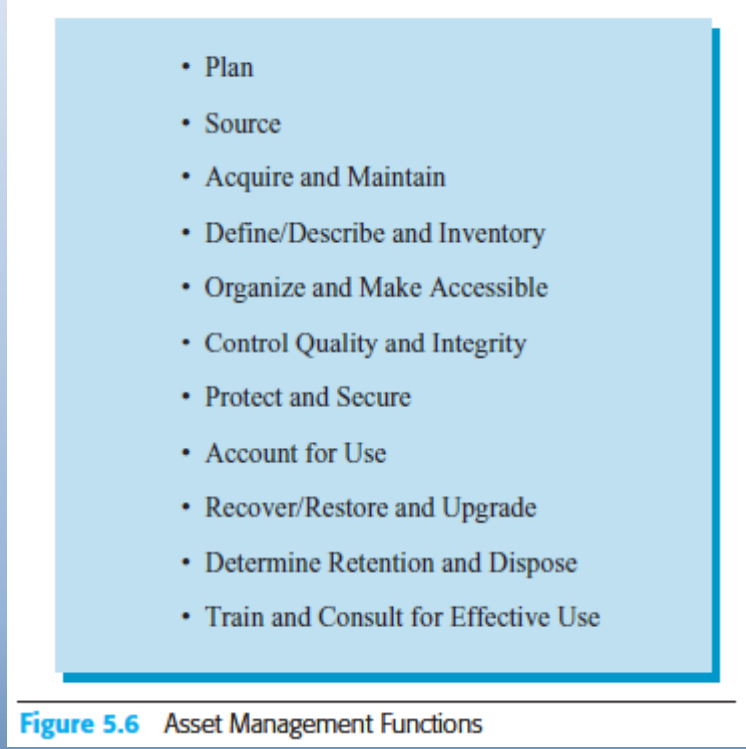

Figure 5.6 Asset Management Functions

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The Data Management Process

- *Plan:* develop a blueprint for data and the relationships among data across business units and functions
- *Source:* identify the timeliest and highest-quality source for each data element
- *Acquire and maintain:* build data capture systems to acquire and maintain data

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The Data Management Process

- *Define/describe and inventory:* define each data entity, element, and relationship that is being managed
- *Organize and make accessible:* design the database so that data can be retrieved and reported efficiently in the format that business managers require
  - One popular method for making data accessible is by creating a data warehouse
  - A data warehouse is a large data storage facility containing data on all (or at least many) aspects of the enterprise

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The Data Management Process

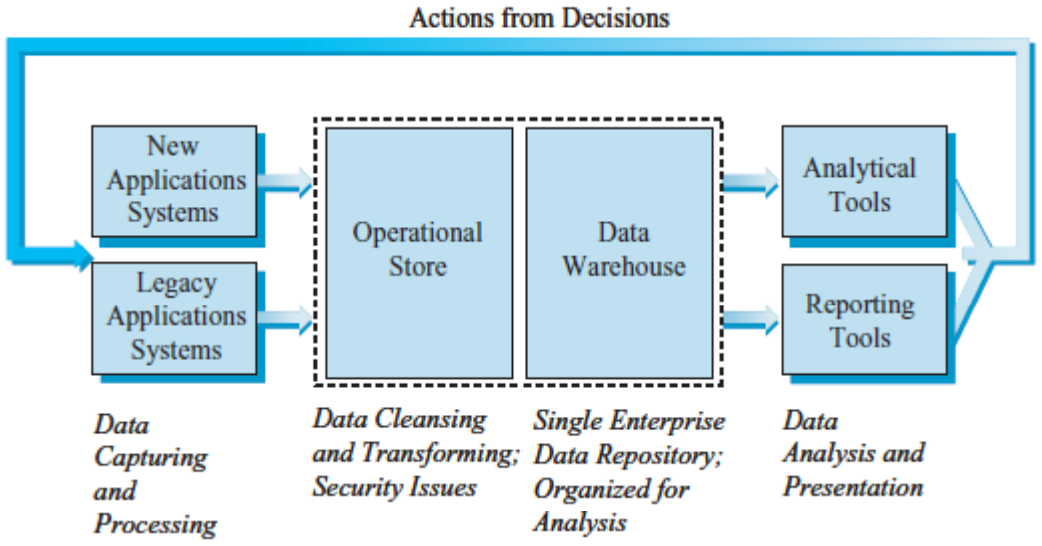

Figure 5.7 The Data Warehouse

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The Data Management Process

- *Control quality and integrity:* controls must be stored as part of data definitions and enforced during data capture and maintenance
- *Protect and secure:* define rights that each manager has to access each type of data
- *Account for use:* cost to capture, maintain, and report data must be identified and reported with an accounting system

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The Data Management Process

- *Recover/restore and upgrade:* establish procedures for recovering damaged and upgrading obsolete hardware and software
- *Determine retention and dispose:* decide, on legal and other grounds, how much data history needs to be kept
- *Train and consult for effective use:* train users to use data effectively

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Data Management Policies

- **Data governance:**
  - Organizational process for establishing strategy, objectives, and policies for organizational data
  - Data governance council sets standards about metadata, data ownership and access, and data infrastructure and architecture
- Two key policy areas for data governance:
  - Data ownership
  - Data administration

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Data Ownership

- Data sharing requires business management participation
  - Commitment to quality data is essential for obtaining the greatest benefits from a data resource
  - Data must also be made accessible to decrease data processing costs for the enterprise
- **Corporate information policy:** foundation for managing the ownership of data

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Data Ownership

Data is a corporate resource. Much of our corporate data is stored electronically. Excellence in data management is key to achieving many of our business goals.
The following statements constitute our electronic data access policy:

- Corporate data will be shared internally. Data are not owned by a particular individual or organization, but by the whole organization.
- Data will be managed as a corporate resource. Data organization and structure will be planned at the appropriate levels and in an integrated fashion.
- Data quality will be actively managed. Explicit criteria for data accuracy, availability, accessibility, and ease of use will be written by the IS department.
- Data will be safeguarded. As a corporate asset, data will be protected from deliberate or unintentional alteration, destruction, or inappropriate disclosure.
- Data will be defined explicitly. Standards will be developed for data representation.
- Databases will be logically designed to satisfy broad business functions.

Figure 5.8 Example Data Access Policy

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Data Ownership

- **Transborder data flows:** electronic flows of data that cross a country's national boundary
- Data are subject to laws of exporting country
- Laws justified by perceived need to:
  - Prevent economic and cultural imperialism
  - Protect domestic industry
  - Protect individual privacy
  - Foster international trade

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MANAGERIAL ISSUES OF DM

Data Ownership

- Example transborder issue
  - U.S. Company Fined by E.U. for Improper Cross-Border Data Transfer

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MANAGERIAL ISSUES OF DM

Data Administration

- **Data administration group:** leads data management efforts in an organization

Key Functions of the Data Administration Group
• Promote and control data sharing
• Analyze the impact of changes to application systems when data definitions change
• Maintain metadata
• Reduce redundant data and processing
• Reduce system maintenance costs and improve systems development productivity
• Improve quality and security of data
• Insure data integrity

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MANAGERIAL ISSUES OF DM

Data Administration

- **Database administrator (DBA):** IS role with the responsibility for managing computer databases

Key Functions of the Database Administrator
• Tuning database management systems
• Selection and evaluation of and training on database technology
• Physical database design
• Design of methods to recover from damage to databases
• Physical placement of databases on specific computers and storage devices
• The interface of databases with telecommunications and other technologies

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