Session 06

Introduction to Information Systems

Learning Objective

☐ Knowing the potential impact of information systems and having the ability to put this knowledge to work can result in a successful personal career and in organizations that reach their goals

  ☐ Describe the components of computer-based information systems.
  ☐ Describe the various types of information systems by breadth of support.
  ☐ Identify the major information systems that support each organizational level.
  ☐ Describe strategic information systems (SISs) and explain their advantages.
  ☐ Describe the fundamental of database technology
  ☐ Describe how information resources are managed and discuss the roles of the information systems department and the end users.

☐ Knowing the training program of Information Systems Major

Content

- ☐ Why learn about Information Systems
- ☐ What is an Information System
- ☐ Computer Based Information Systems
- ☐ Business Information Systems
- ☐ Database Fundamentals
- ☐ Careers in Information Systems
- ☐ Information Systems Major

Why Learn About Information System?

Why Learn About IS?

☐ There are many examples of the ways in which information systems and technologies are embedded in your lives:

- ☐ Register for classes
- ☐ Take classes, and not just classes from your university
- ☐ Access class syllabi, information, PowerPoints, and lectures
- ☐ Research class papers and presentations
- ☐ Conduct banking
- ☐ Pay your bills
- ☐ Research, shop, and buy products from companies or other people
- ☐ Sell your "stuff "
- ☐ Search for, and apply for, jobs
- ☐ Make your travel reservations (hotel, airline, rental car)

Why Learn About IS?

☐ Information systems are used in almost every profession, including:

- – Entrepreneurs
- – Small companies to large multinationals
- – Accounting, marketing, management

☐ Information systems are indispensable tools to help you to achieve your career goals

Why Learn About IS?

| Position	Job Description
Chief Information Officer	Highest-ranking IS manager; is responsible for all strategic planning in the organization
IS Director	Manages all systems throughout the organization and the day-to-day operations of the entire IS organization
Information Center Manager	Manages IS services such as help desks, hot lines, training, and consulting
Applications Development Manager	Coordinates and manages new systems development projects
Project Manager	Manages a particular new systems development project
Systems Manager	Manages a particular existing system
Operations Manager	Supervises the day-to-day operations of the data and/or computer center
Programming Manager	Coordinates all applications programming efforts
Systems Analyst	Interfaces between users and programmers; determines information requirements and technical specifications for new applications
Business Analyst	Focuses on designing solutions for business problems; interfaces closely with users to demonstrate how IT can be used innovatively
Systems Programmer	Creates the computer code for developing new systems software or maintaining existing systems software
Applications Programmer	Creates the computer code for developing new applications or maintaining existing applications
Emerging Technologies Manager	Forecasts technology trends; evaluates and experiments with new technologies
Network Manager	Coordinates and manages the organization's voice and data networks
Database Administrator	Manages the organization's databases and oversees the use of database-management software
Auditing or Computer Security Manager	Oversees the ethical and legal use of information systems
Webmaster	Manages the organization's World Wide Web site
Web Designer	Creates World Wide Web sites and pages

What is an Information System?

What is an information system?

A set of interrelated *components* that

collect/retrieve, process, store and distribute **information**

to *support decision making and control* in an organization
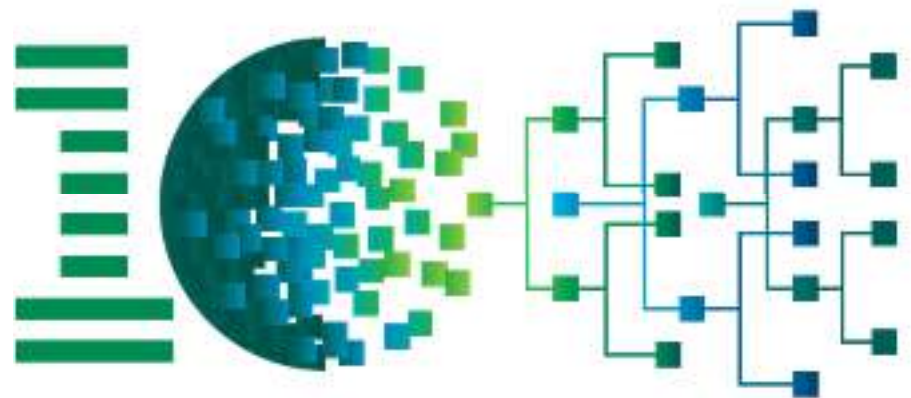
From ibmims

What is an information system?

☐ Information system feedback can help organizations:

  ☐ Achieve their goals

  ☐ Increase revenues and reduce costs

☐ Information concept:

  ☐ One of an organization's most valuable resources
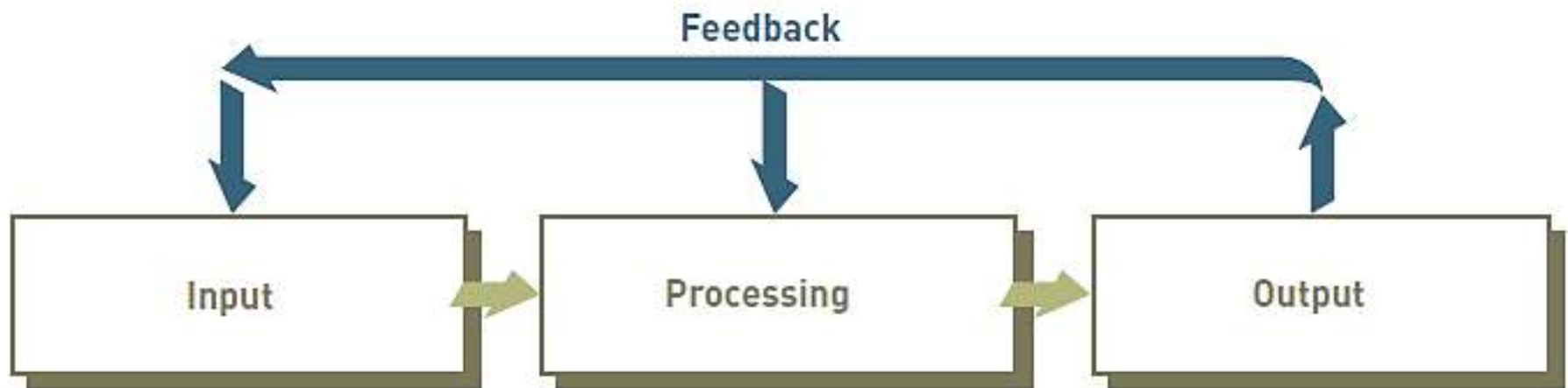
  ☐ Often confused with the term data

What is an Information System?

☐ An information system (IS) is a set of interrelated elements that:

- ☐ Collect (input)
- ☐ Manipulate (process)
- ☐ Store
- ☐ Disseminate (output) data and information
- ☐ Provide a corrective reaction (feedback mechanism) to meet an objective

Components of an IS

Input, Processing, Output, Feedback

- Input: activity of gathering and capturing raw data

- Processing: converting data into useful outputs

- Output: production of useful information
  - Usually in the form of documents and reports

- Feedback: information from the system
  - Used to make changes to input or processing activities
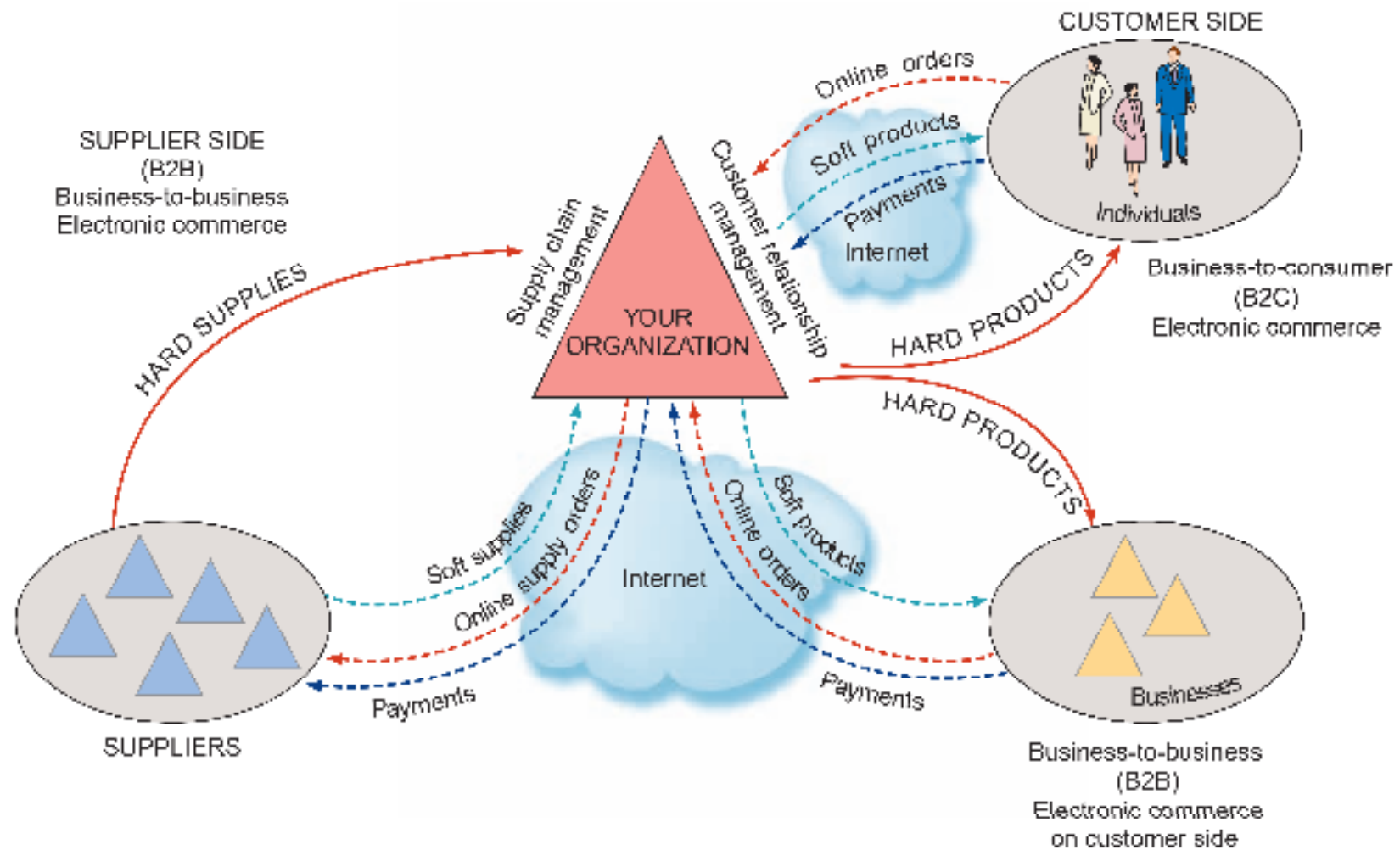
Type of Information Systems
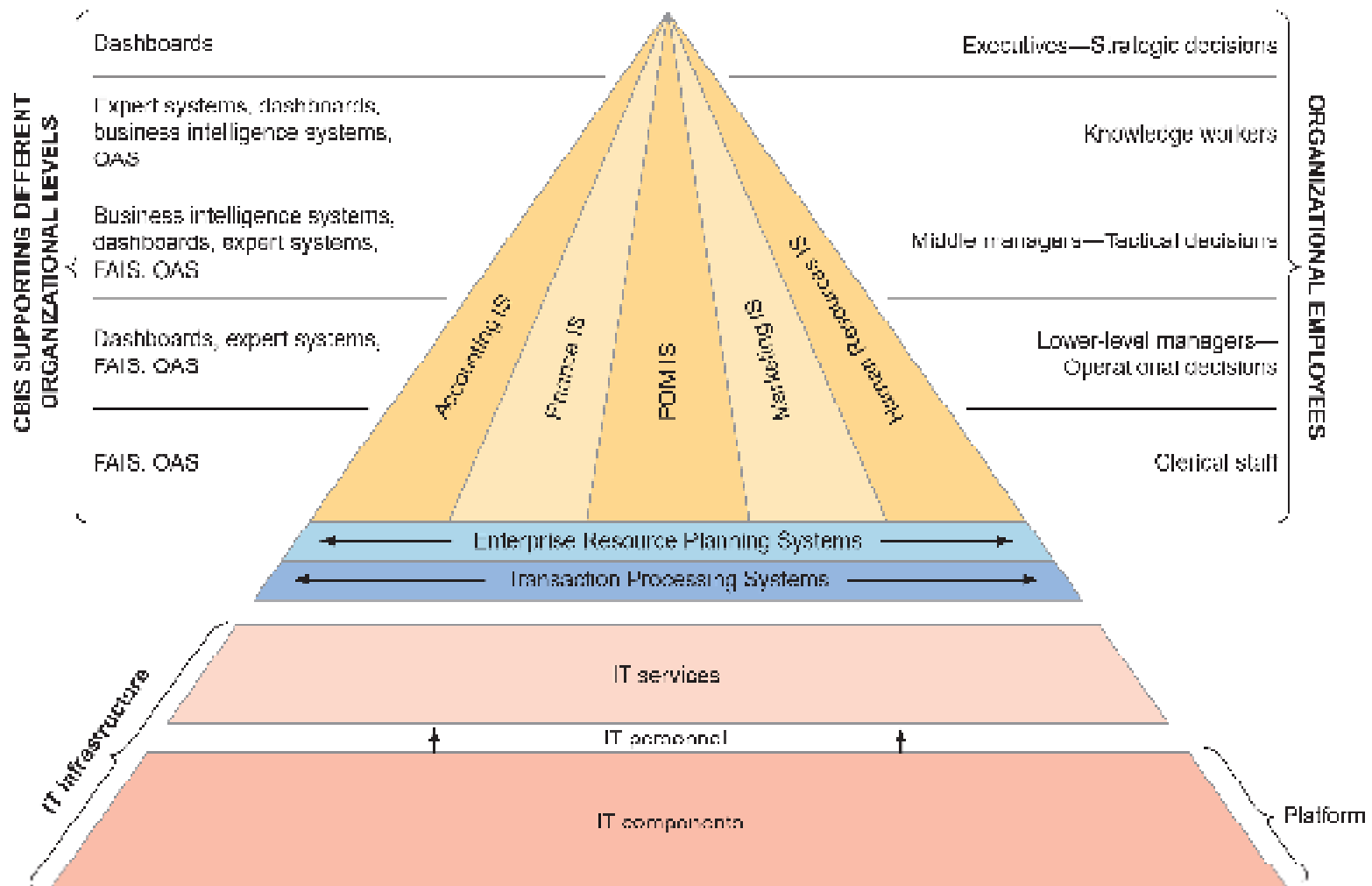
Type of Information Systems

Type of System	Function	Example
Functional area IS	Supports the activities within specific functional area.	System for processing payroll
Transaction processing system	Processes transaction data from business events.	Walmart checkout point-of-sale terminal
Enterprise resource planning	Integrates all functional areas of the organization.	Oracle, SAP system
Office automation system	Supports daily work activities of individuals and groups.	Microsoft Office
Management information system	Produces reports summarized from transaction data, usually in one functional area.	Report on total sales for each customer
Decision support system	Provides access to data and analysis tools.	"What-if" analysis of changes in budget
Expert system	Mimics human expert in a particular area and makes decisions.	Credit card approval analysis
Executive dashboard	Presents structured, summarized information about aspects of business important to executives.	Status of sales by product
Supply chain management system	Manages flows of products, services, and information among organizations.	Walmart Retail Link system connecting suppliers to Walmart
Electronic commerce system	Enables transactions among organizations and between organizations and customers.	www.dell.com

Type of Information Systems

Concepts of Information System

☐ Information vs. Data

☐ Business process (quy trình nghiệp vụ)

☐ Information system development process

☐ Information system development tools

Data, Information, and Knowledge

☐ Data: raw facts

☐ Information: collection of facts organized in such a way that they have value beyond the facts themselves

☐ Process: set of logically related tasks performed to achieve a defined outcome

☐ Knowledge: awareness and understanding of someone or something which is acquired through experience or education by perceiving, discovering, or learning
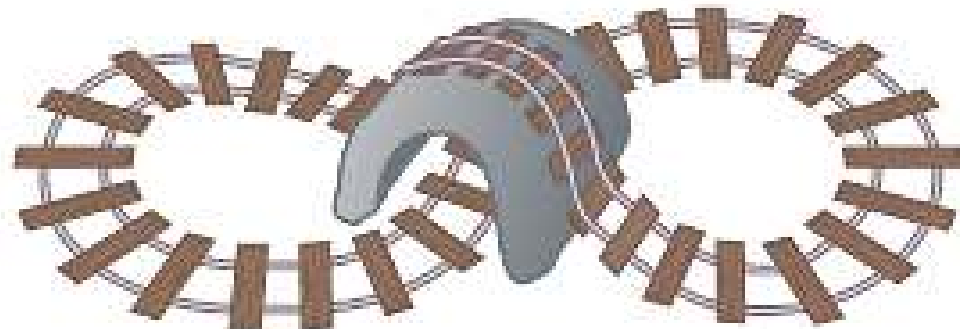
Data and Information

Types of Data

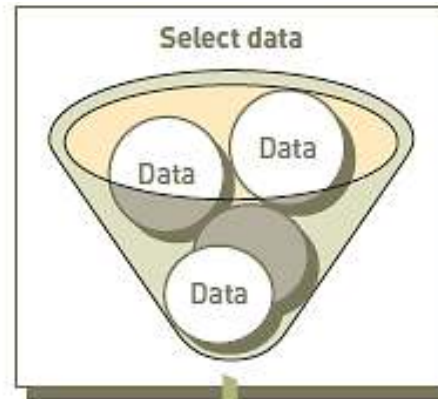| Data	Represented By
Alphanumeric data	Numbers, letters, and other characters
Audio data	Sounds, noises, or tones
Image data	Graphic images and pictures
Video data	Moving images or pictures
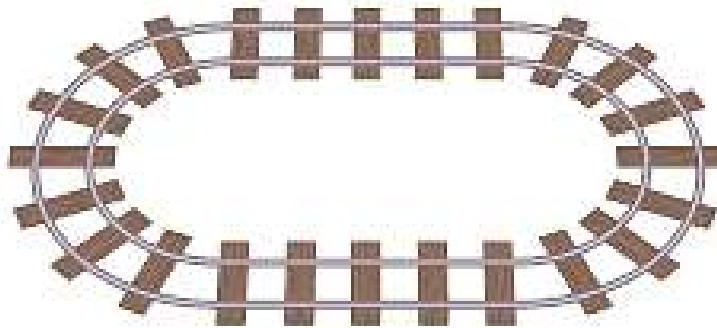
Data

Information

Process of Transforming Data into Information

Information vs. data

☐ Data are streams of raw facts

☐ Information is data shaped into meaningful form

Data

331 Brite Dish Soap 1.29
863 BL Hill Coffee 4.69
173 Meow Cat .79
331 Brite Dish Soap 1.29
663 Country Ham 3.29
524 Fiery Mustard 1.49
113 Ginger Root .85
331 Brite Dish Soap 1.29

Information System

Information

Sales Region: Northwest
Store: Superstore #122

ITEM NO. DESCRIPTION UNITS SOLD
331   Brite Dish Soap   7,156

YTD SALES
$9,231.24

From Laudon, 2016
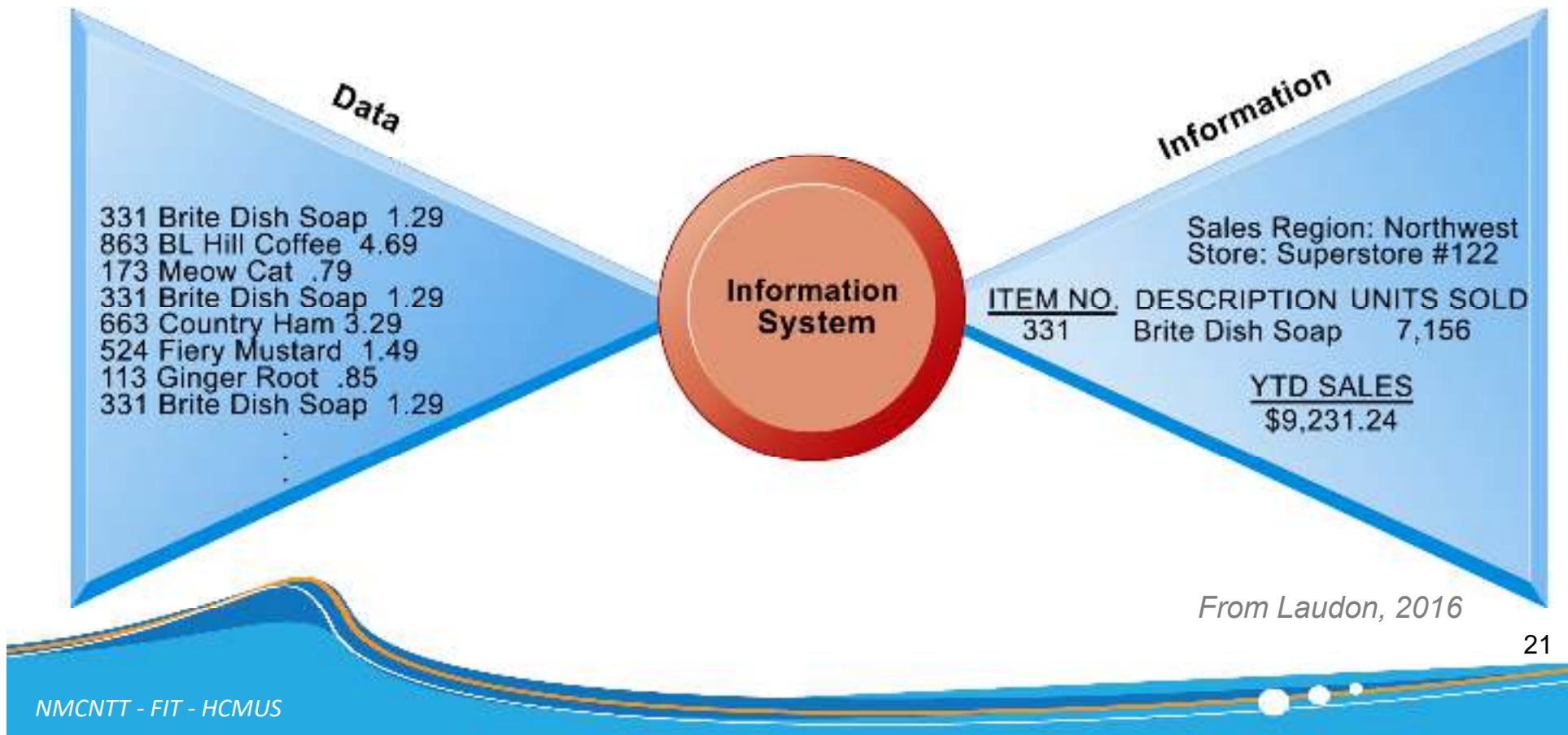
Characteristics of Valuable Information

☐ The value of information is directly linked to how it helps decision makers achieve their organization's goals

☐ Accuracy and completeness are critical for data used in accounting for the management of company assets, e.g., cash, inventory, and equipment

Characteristics of Valuable Information

Characteristics	Definitions
Accessible	Information should be easily accessible by authorized users so they can obtain it in the right format and at the right time to meet their needs.
Accurate	Accurate information is error free. In some cases, inaccurate information is generated because inaccurate data is fed into the transformation process. This is commonly called garbage in, garbage out (GIGO).
Complete	Complete information contains all the important facts. For example, an investment report that does not include all important costs is not complete.
Economical	Information should also be relatively economical to produce. Decision makers must always balance the value of information with the cost of producing it.
Flexible	Flexible information can be used for a variety of purposes. For example, information on how much inventory is on hand for a particular part can be used by a sales representative in closing a sale, by a production manager to determine whether more inventory is needed, and by a financial executive to determine the total value the company has invested in inventory.
Relevant	Relevant information is important to the decision maker. Information showing that lumber prices might drop might not be relevant to a computer chip manufacturer.

Characteristics of Valuable Information (cont'd.)

Characteristics	Definitions
Reliable	Reliable information can be trusted by users. In many cases, the reliability of the information depends on the reliability of the data-collection method. In other instances, reliability depends on the source of the information. A rumor from an unknown source that oil prices might go up might not be reliable.
Secure	Information should be secure from access by unauthorized users.
Simple	Information should be simple, not complex. Sophisticated and detailed information might not be needed. In fact, too much information can cause information overload, whereby a decision maker has too much information and is unable to determine what is really important.
Timely	Timely information is delivered when it is needed. Knowing last week's weather conditions will not help when trying to decide what coat to wear today.
Verifiable	Information should be verifiable. This means that you can check it to make sure it is correct, perhaps by checking many sources for the same information.

Data, Information, Knowledge

©Chad Reischl/iStockphoto
Data

Exactostock/SuperStock
Information

©Tatiana Popova/iStockphoto
Knowledge

Data, Information, Knowledge

Data	Information	Knowledge
[No context]	**[University context]**	
3.16	3.16 + John Jones = GPA	* Job prospects
2.92	2.92 + Sue Smith = GPA	* Graduate school prospects
1.39	1.39 + Kyle Owens – GPA	* Scholarship prospects
3.95	3.95 + Tom Elias = GPA	
[No context]	**[Professional baseball pitcher context]**	
3.16	3.16 + Ken Rice = ERA	
2.92	2.92 + Ed Dyas = ERA	* Keep pitcher, trade pitcher, or send pitcher to minor leagues
1.39	1.39 + Hugh Carr = ERA	
3.95	3.95 + Nick Ford = ERA	* Salary/contract negotiations

GPA = grade point average (higher is better).

ERA = earned run average (lower is better); ERA is the number of runs per nine innings that a pitcher surrenders.
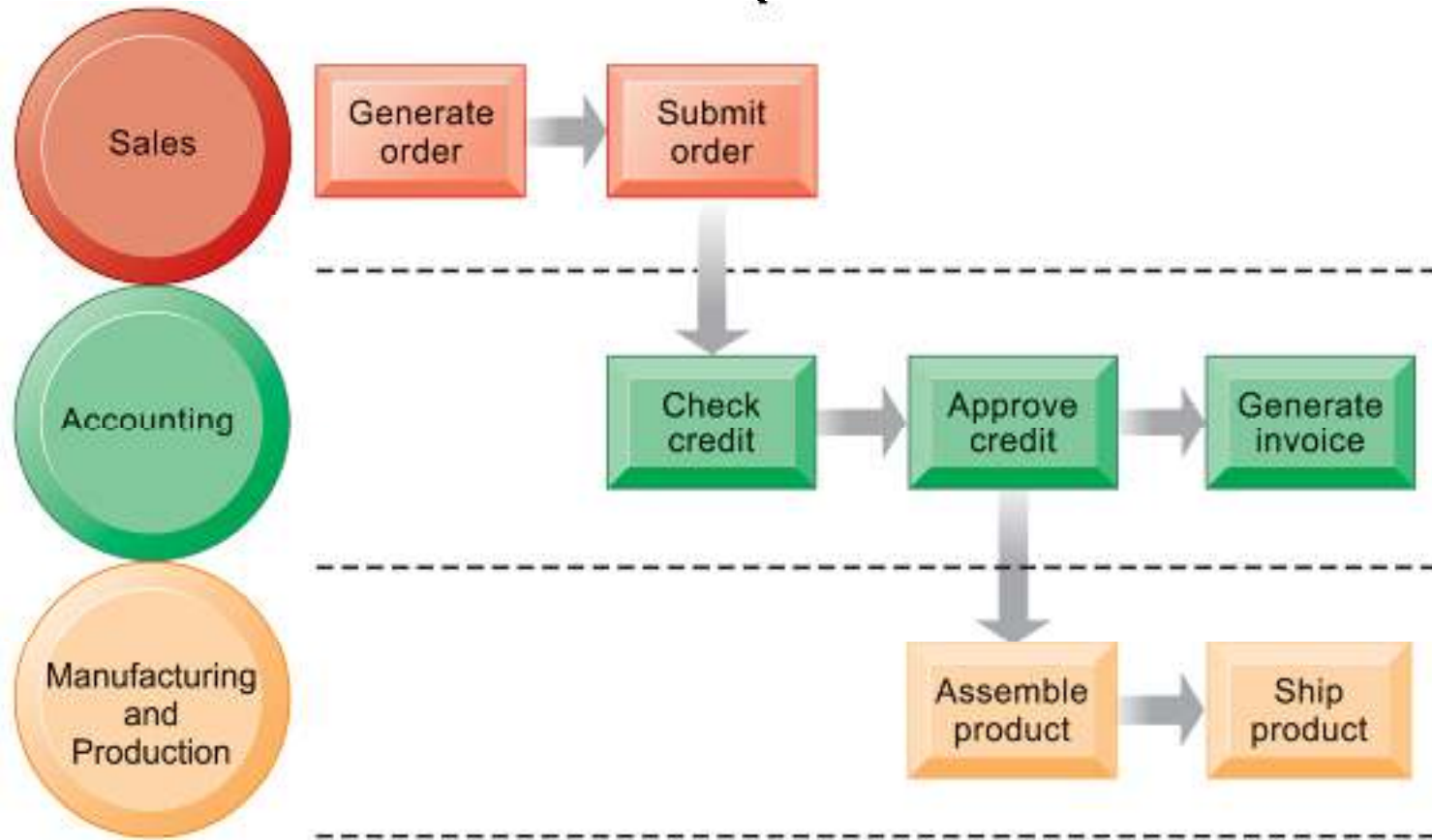
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What is a business process?

☐ The *manner* in which work is organized, coordinated, and focused to produce a valuable product/service

☐ The *collection of activities* required to produce a product/service

  ☐ Supported by flows of material, information, and knowledge among the participants

Example of a business process

□ The order fulfillment process

Information system development process

☐ Similar to software development process

☐ Information systems are expressed through application software

☐ Specially focus to the end-user factor

☐ End-user: a person who performs tasks of a business process

Information system development tools

☐ **Tools support following stages**

- ☐ Requirement collection and analysis
- ☐ Business process analysis
- ☐ Data analysis
- ☐ Information system analysis and design
- ☐ Testing
- ☐ Deployment
- ☐ Operations/Maintenance

Computer-Based Information System (CBIS)

Computer-Based Information Systems (CBIS)

☐ Definition: is an information system that uses computer technology to perform some or all of its intended tasks.

☐ Companies are incorporating CBIS into their products and services

 ☐ Example: investment tools for clients of Fidelity Investments

Computer-Based Information Systems (CBIS)

Perform high-speed, high-volume numerical computations.
Provide fast, accurate communication and collaboration within and among organizations.
Store huge amounts of information in an easy-to-access, yet small space.
Allow quick and inexpensive access to vast amounts of information, worldwide.
Interpret vast amounts of data quickly and efficiently.
Automate both semiautomatic business processes and manual tasks.

Components of a CBIS

Hardware

Software

Telecommunications

People

Procedures

Components of a CBIS
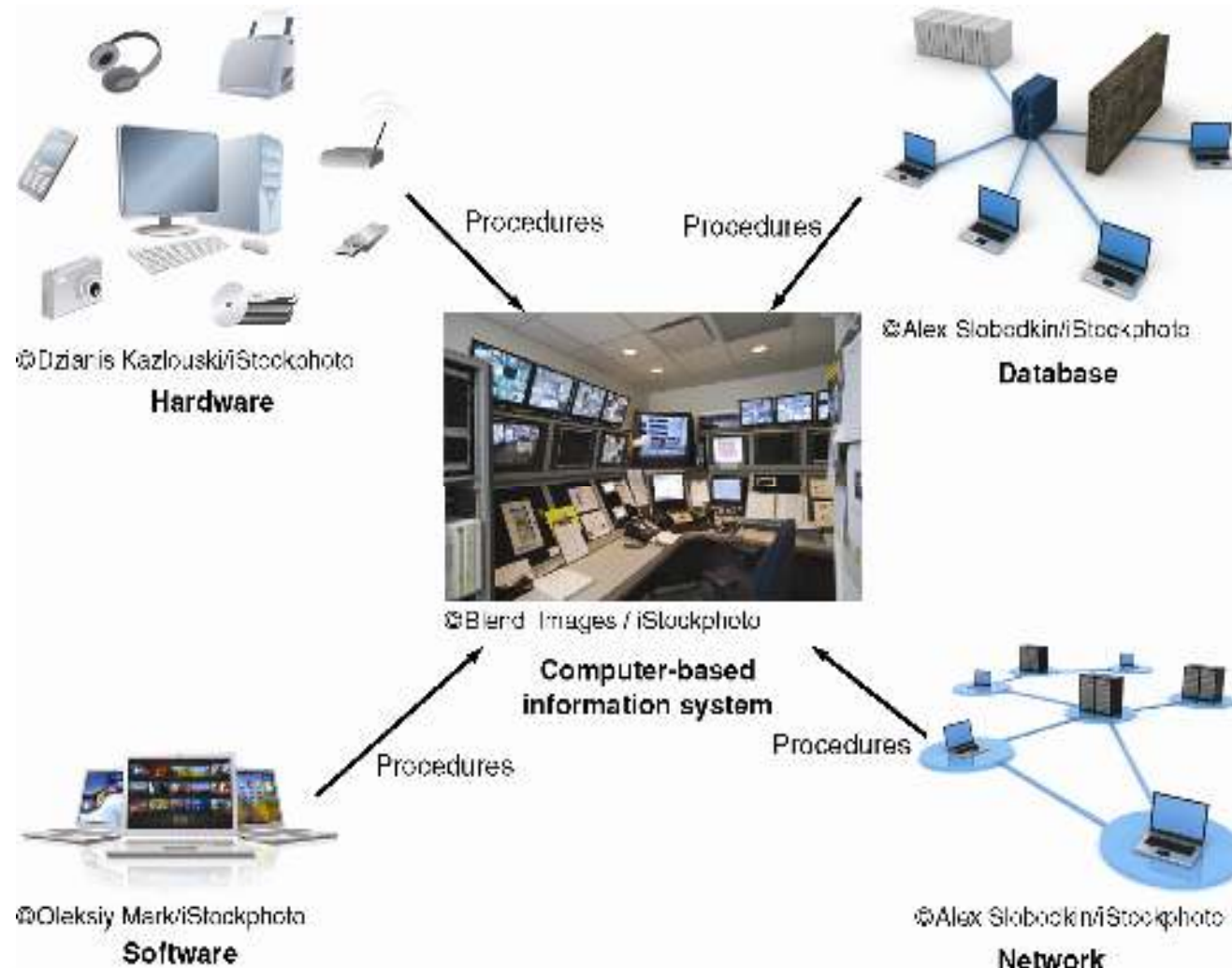
CBIS: Hardware, Software, and Databases

☐ Hardware: computer equipment used to perform input, processing, storage, and output activities

☐ Software: computer programs that govern the operation of the computer

☐ Database: organized collection of facts and information

  ☐ Typically consists of two or more related data files

CBIS: Telecommunications, Networks, and the Internet

☐ Telecommunications: electronic transmission of signals for communications

☐ Networks connect computers and equipment enabling electronic communication

☐ Internet: world's largest computer network

   ☐ Thousands of interconnected networks

CBIS: Cloud-Computing and the Web

☐ Cloud-computing environment:

  ☐ Provides software and data storage via the Internet in order to:

  ▪ Run services on another organization's computer hardware

  ▪ Easily access software and data

☐ World Wide Web (WWW or Web)

  ☐ Network of links on the Internet to documents containing text, graphics, video, and sound

CBIS: Intranets and Extranets

☐ Intranet: internal network that allows people within an organization to exchange information and work on projects

☐ Extranet: network based on Web technologies

  ☐ Allows selected outsiders, e.g., business partners and customers, to access authorized resources of a company's intranet

CBIS: People and Procedures

☐ People are the most important element in most computer-based information systems

☐ Procedures: strategies, policies, methods, and rules for using a CBIS

Business Information System (BIS)

Definition

□ Most common types of information systems:

    ■ Systems for electronic and mobile commerce, transaction processing, management information, and decision support

□ Special-purpose systems are utilized by some companies

    ■ Example: virtual reality

Why BIS important?

- Operational Excellence
  - Improve the efficiency of operations in order to achieve higher profitability. E.g. having the correct amount of stock in store so consumers can always get want they want

- New product services and business models
  - IS systems play a major role for businesses in creating new products and services. New business models can be created and these can describe how a company produce, create and sell there products.

- Customer and Supplier intimacy
  - The better services a company provides its consumers with more likely they are too come back to them and as result the more they will buy off the supplier therefore creating a good relationship with both parties.

Why BIS important?

☐ Improved decision making

  ❑ Managers can use real time data to make better decisions and not have to waste time looking for information.

☐ Competitive advantage

  ❑ IS systems will generally create a competitive advantage over their rivals

☐ Day to Day survival

  ❑ Business invest in these systems to make their jobs as easy as possibly.

  ❑ Example: is Citibank introduced the first ATM machine to make it easier for customers to access their money and to cut down queues in their banks.

Trends

Enterprise Resource Planning and Business Intelligence: 2000s–2010s

Enterprisewide common-interface applications data mining and data visualization, customer relationship management, supply-chain management

Electronic Business and Commerce: 1990s–2000s

Internet-based e-business and e-commerce systems

Web-enabled enterprise and global e-business operations and electronic commerce on the Internet, intranets, extranets, and other networks

Strategic and End-User Support: 1980s–1990s

End-user computing systems

Direct computing support for end-user productivity and workgroup collaboration

Executive information systems

Critical information for top management

Expert systems

Knowledge-based expert advice for end users

Strategic information systems

Strategic products and services for competitive advantage

Decision Support: 1970s–1980s

Decison support systems

Interactive ad hoc support of the managerial decision-making process

Management Reporting: 1960s–1970s

Management information systems

Management reports of prespecified information to support decision making

Data Processing: 1950s–1960s

Electronic data processing systems

Transaction processing, record-keeping, and traditional accounting applications

The Expanding Roles of IS in Business and Management

Major branches of BIS

Major branches of BIS

Executives — Execute information systems

Senior managers — Decision Support Systems

Middle managers — Management Information Systems

Staff — Operations Support Systems (Transaction Processing Systems, Process Control Systems, Enterprise collaboration systems)

Expert Systems

Business Intelligent & Data warehouse

Artificial Intelligence

Knowledge Management

E-Commerce, e-business, mobile commerce

Enterprise Systems - ERP

Data Management (Database, Advanced DB, DBMS, etc.)

Security in Information Systems

Electronic and Mobile Commerce

☐ E-commerce: business transactions executed electronically

- ☐ Business-to-business (B2B)
- ☐ Business-to-consumer (B2C)
- ☐ Consumer-to-consumer (C2C)
- ☐ Between business and the public sector
- ☐ Between consumers and the public sector

Mobile Commerce, E-commerce, and Electronic Business

☐ Mobile commerce (m-commerce): the use of mobile, wireless devices to place orders and conduct business

☐ E-commerce offers many advantages for streamlining work activities

☐ Electronic business (e-business) uses information systems and the Internet to perform all business-related tasks and functions

Electronic Commerce

Traditional process for placing a purchase order

E-commerce process for placing a purchase order

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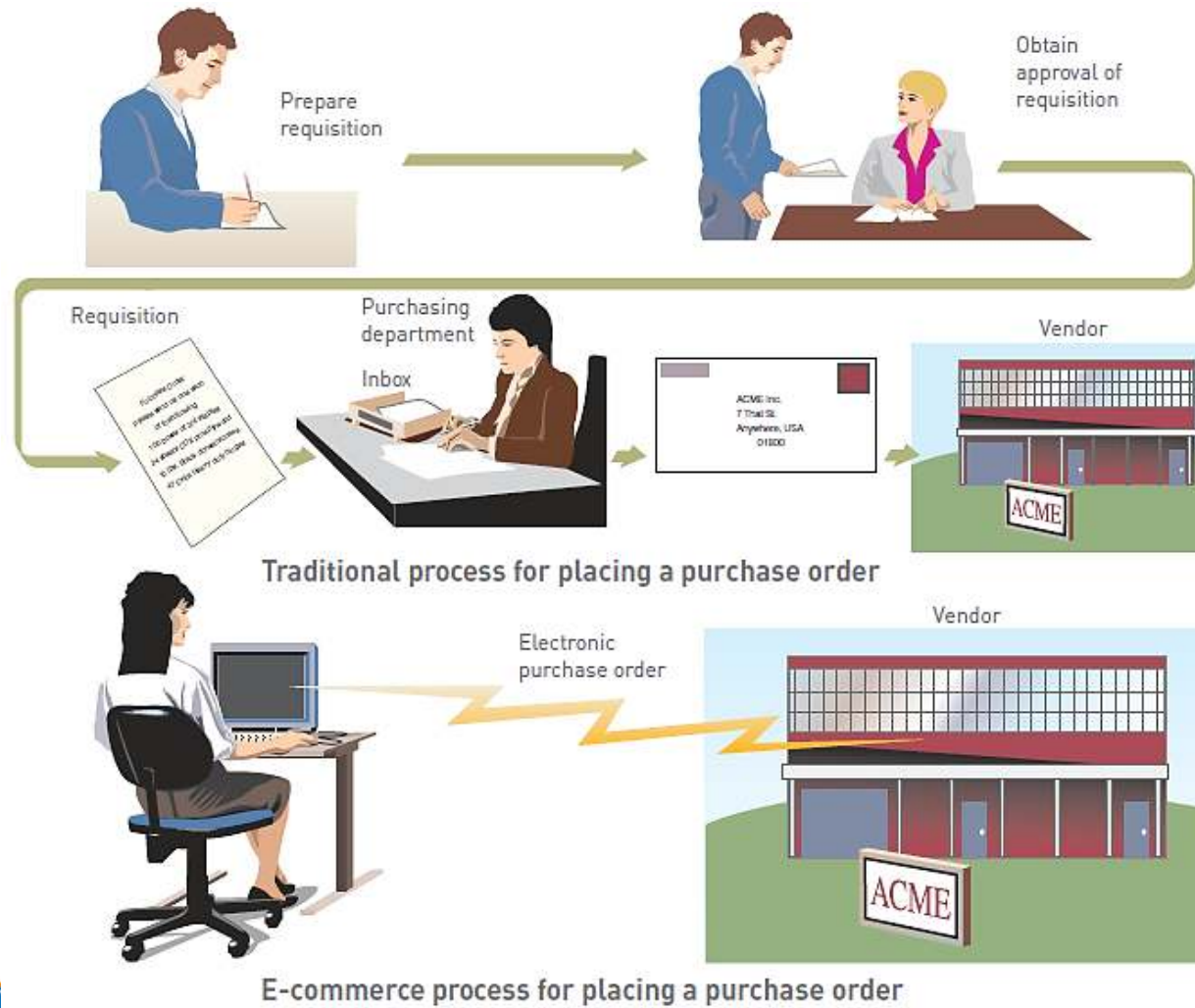
Electronic Business (E-business)
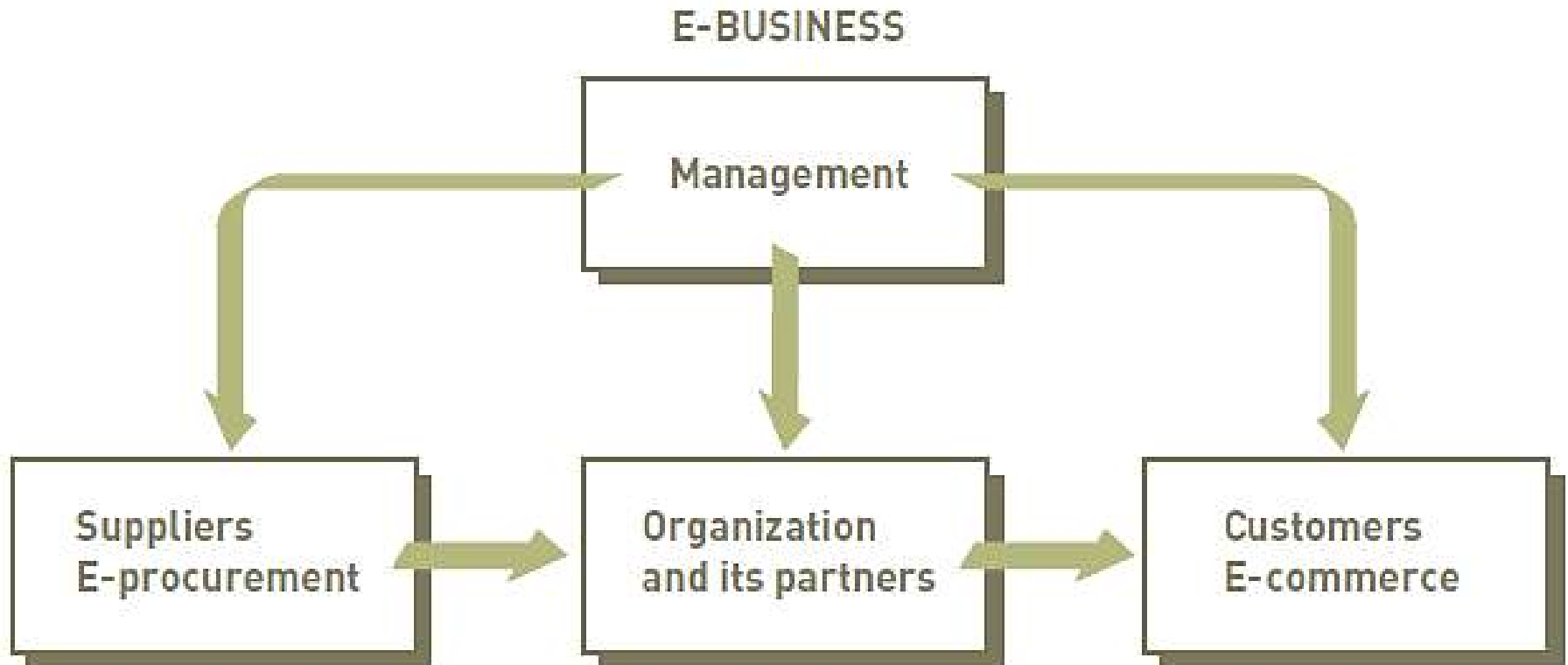
Enterprise Systems- Transaction Processing Systems

☐ Transaction

- ❑ Any business-related exchange, such as payments to employees and sales to customers

☐ Transaction processing system (TPS)

- ❑ An organized collection of people, procedures, software, databases, and devices
- ❑ Used to perform and record completed business transactions

Integrated Transaction Processing System
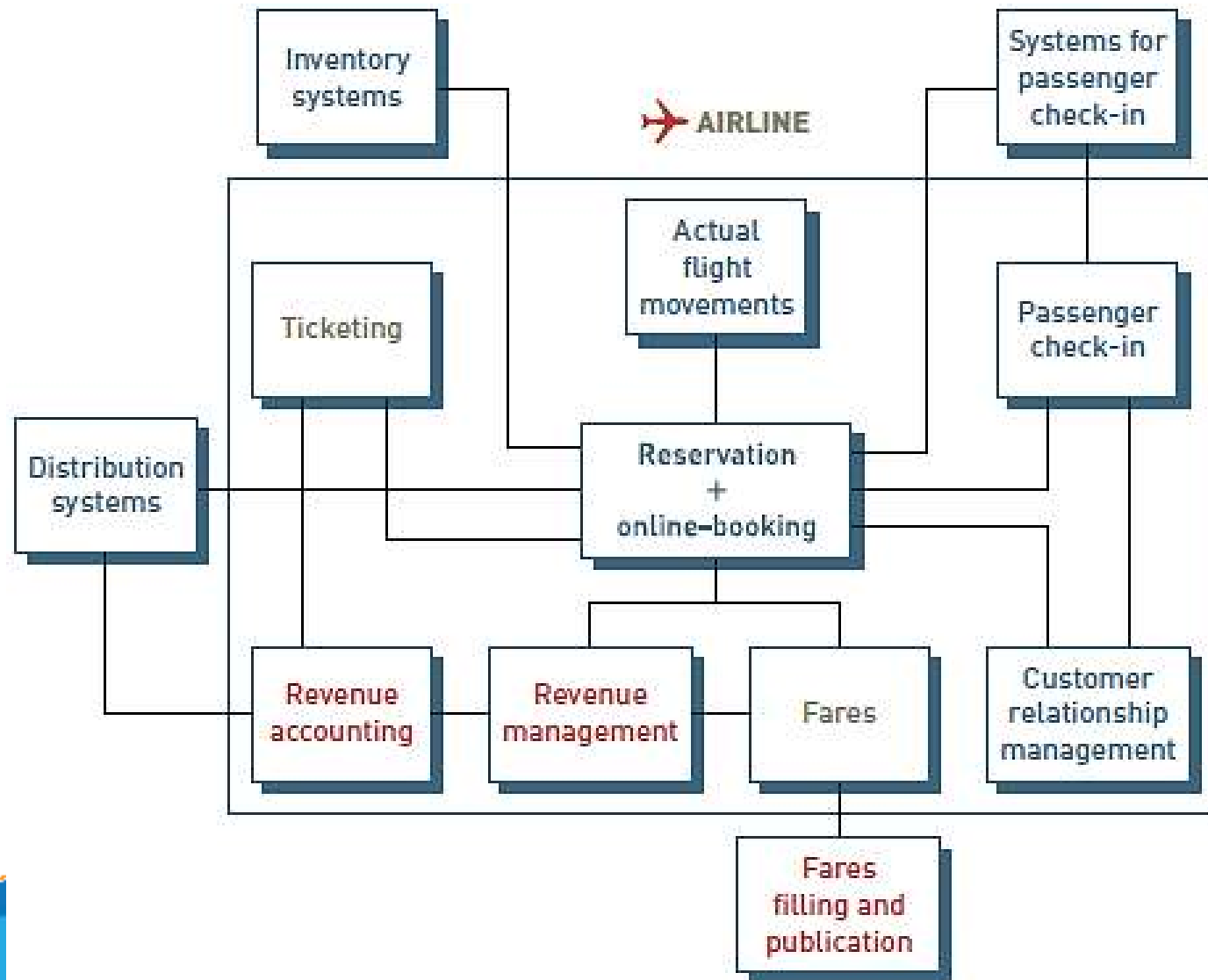
Enterprise Systems- Enterprise Resource Planning

☐ Enterprise resource planning (ERP) system

- ☐ A set of integrated programs
- ☐ Manages the vital business operations for an entire multisite, global organization

☐ Most ERP systems provide integrated software to support manufacturing and finance

ERP II System
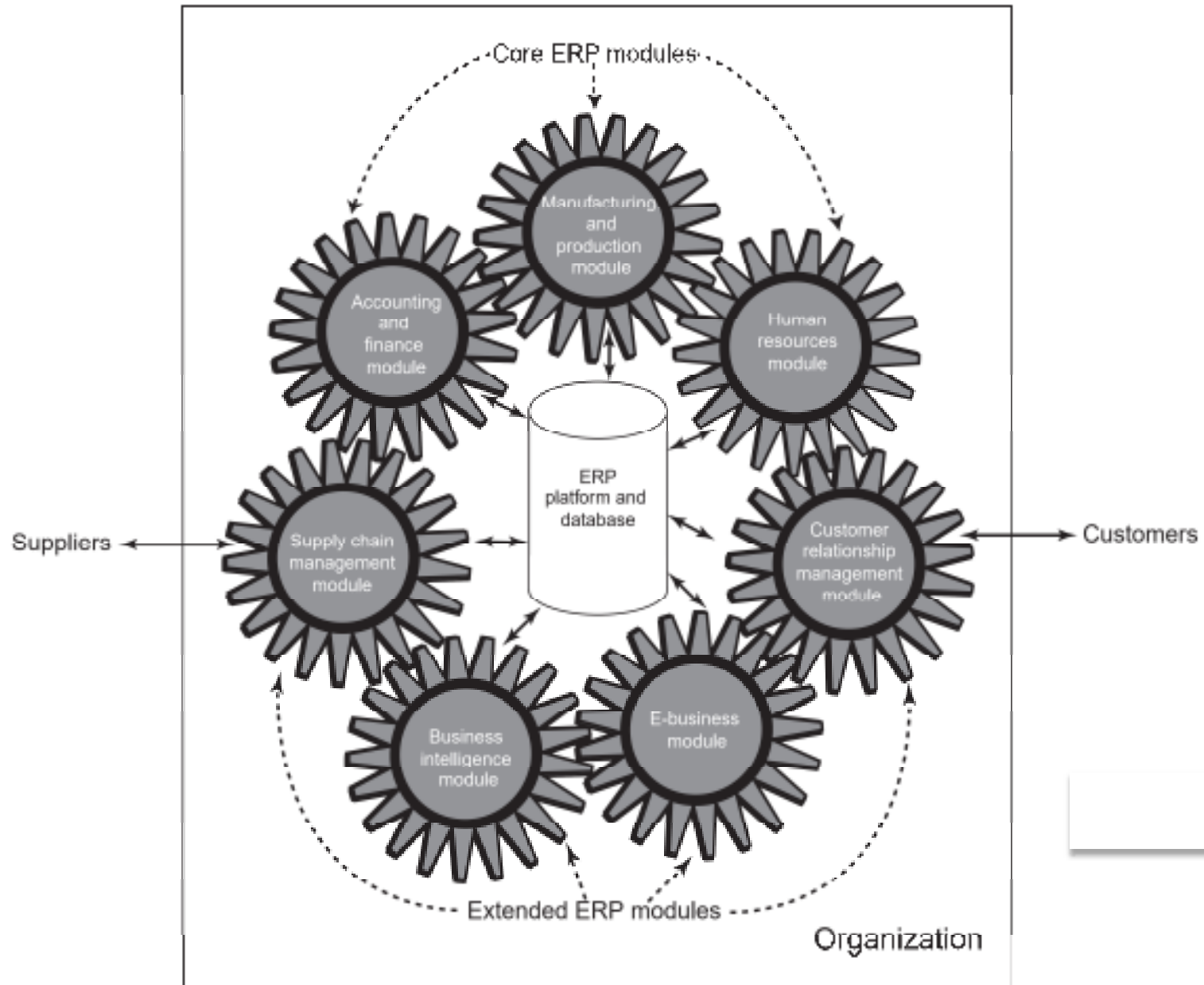
Information and Decision Support Systems

☐ Management information system (MIS)

- ❑ Organized collection of people, procedures, software, databases, and devices

- ❑ Provides routine information to managers and decision makers

- ❑ Focuses on operational efficiency

- ❑ Provides standard reports generated with data and information from the TPS or ERP

Management Information System

Marketing management information system

Manufacturing management information system

Common database

Financial management information system

TPS

Other management information systems

ACCOUNTING · FINANCE · HUMAN RESOURCES · PRODUCTION/OPERATIONS · MARKETING

Profitability Planning

Employment Planning, Outsourcing

Financial Planning

Product Life Cycle Management

Sales Forecasting, Advertising Planning

Auditing, Budgeting

Investment Management

Benefits Administration, Performance Evaluation

Quality Control, Inventory Management

Customer Relations, Sales Force Automation

Payroll, Accounts Payable, Accounts Receivable

Manage Cash, Manage Financial Transactions

Maintain Employee Records

Order Fulfillment, Order Processing

Set Pricing, Profile Customers

Decision Support System (DSS)

☐ An organized collection of people, procedures, software, databases, and devices that support problem-specific decision making

  ☐ Focus is on making effective decisions

☐ A DSS can include the following:

  ☐ Model base

  ☐ Database

  ☐ User interface or dialogue manager
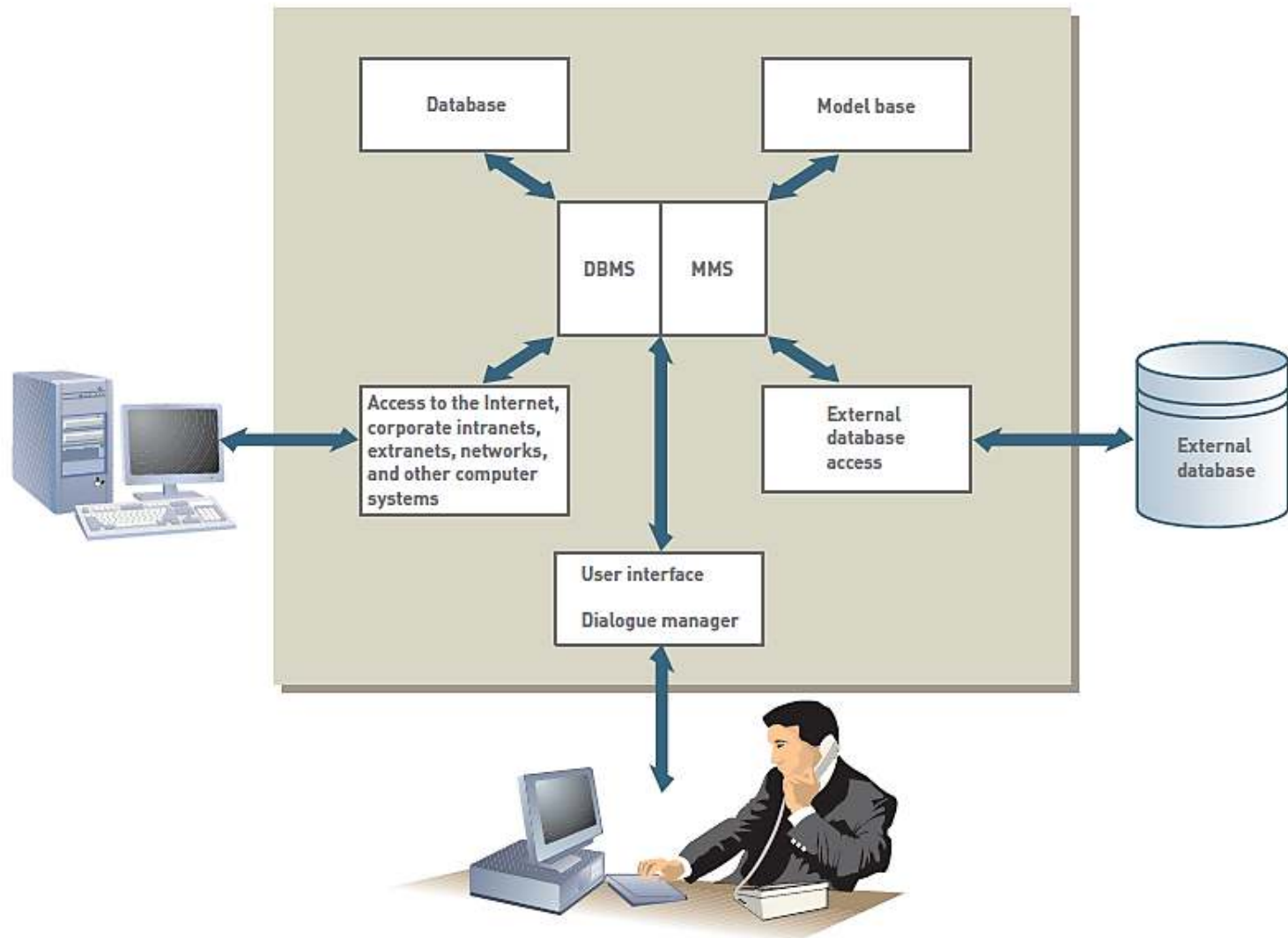
Knowledge Management

☐ Knowledge management systems (KMSs)

  ❑ An organized collection of people, procedures, software, databases, and devices

  ❑ Create, store, share, and use the organization's knowledge and experience

Knowledge Management Process
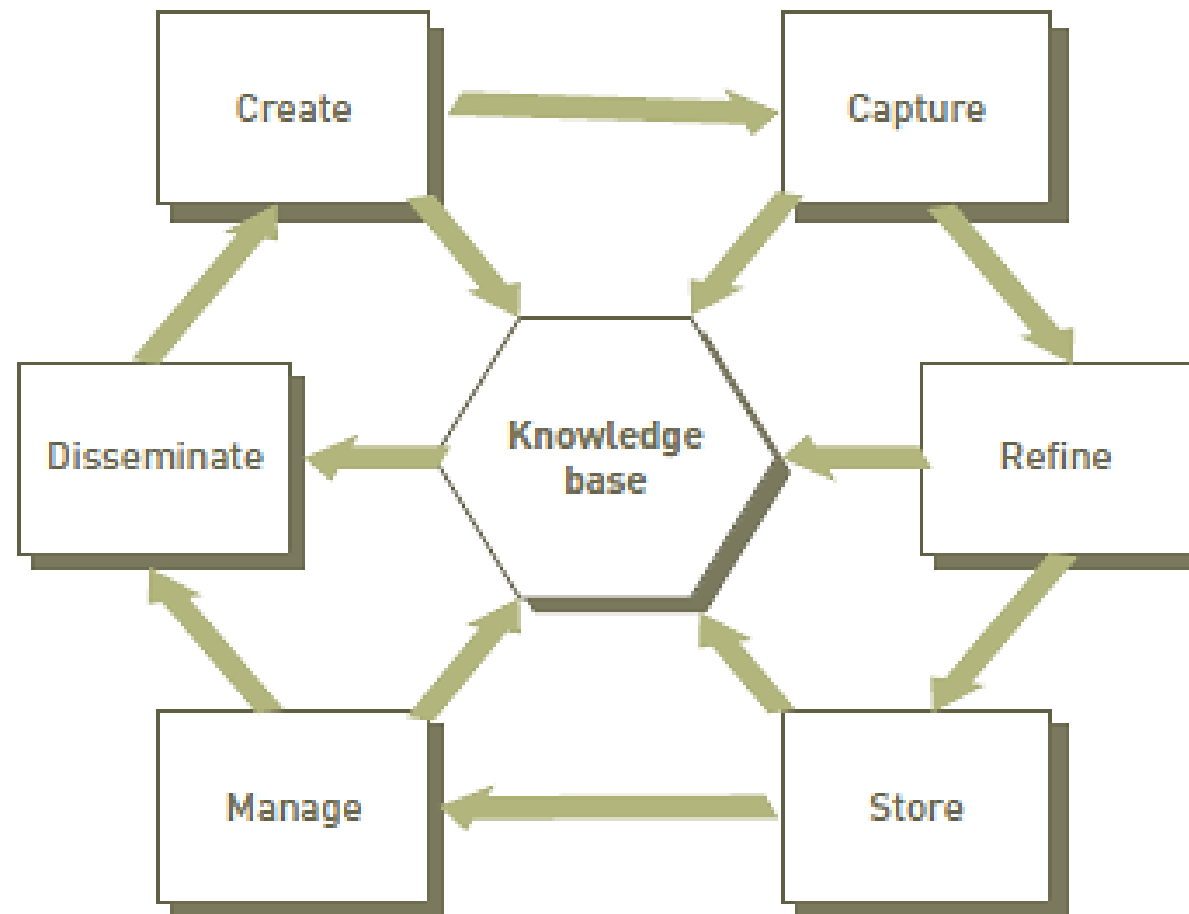
Artificial Intelligence (AI)

- ☐ A computer system takes on characteristics of human intelligence

- ☐ Examples of AI applications: games, medical diagnoses, and automobile operation

Major Branches of Artificial Intelligence

Artificial intelligence

Robotics

Vision systems

Learning systems

Natural language processing

Neural networks

Expert systems
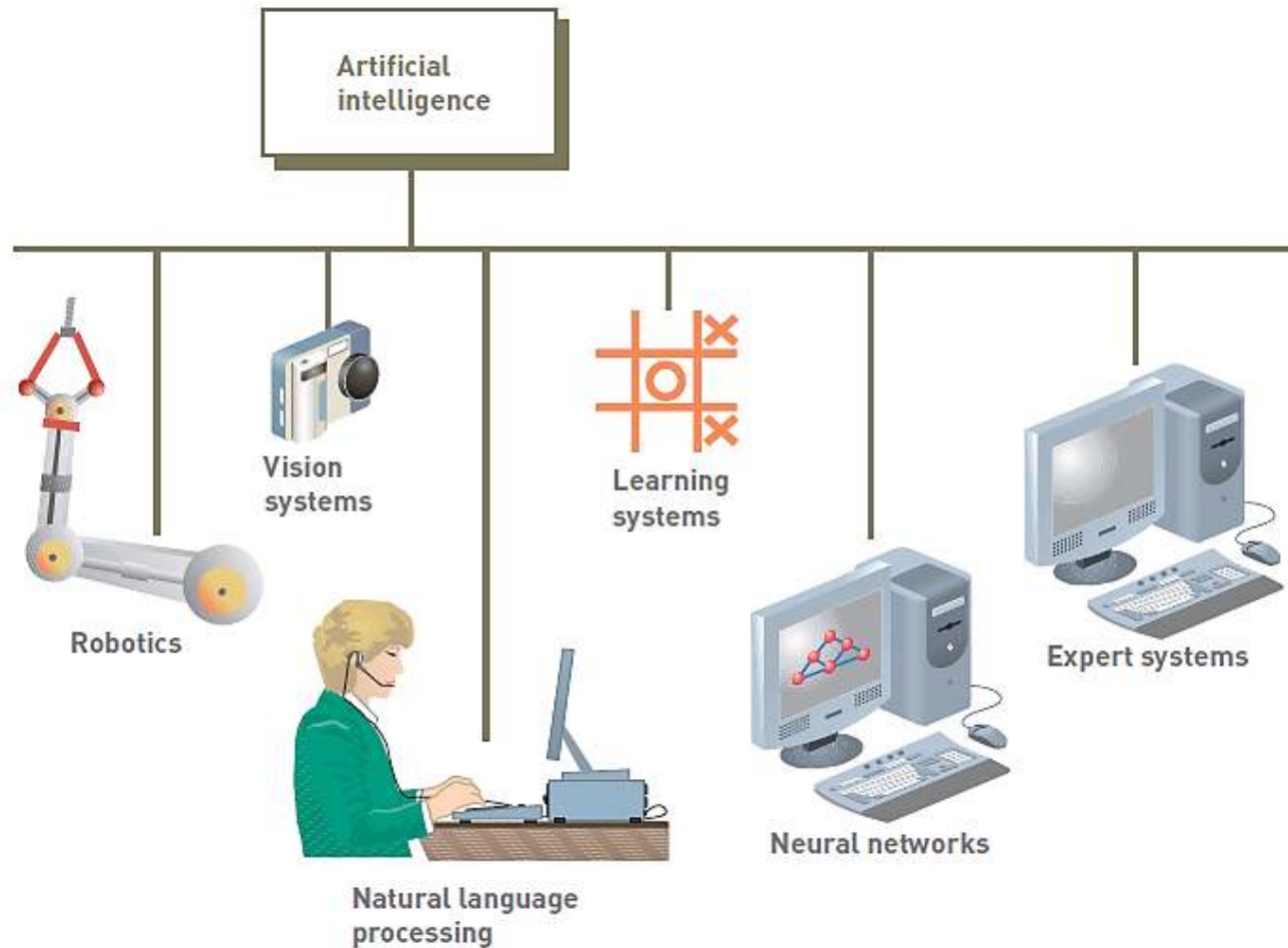
Artificial Intelligence Subfields

☐ Robotics: machines take over complex, dangerous, routine or boring tasks

☐ Vision systems allow devices to see, store and process images

☐ Natural language processing involves computers understanding and acting on verbal or written commands

☐ Learning systems allow computers to learn from past mistakes or experiences

☐ Neural networks allow computers to recognize and act on patterns or trends

Expert Systems and Virtual Reality

☐ Expert systems give computers the ability to make suggestions and function like an expert in a particular field

  ☐ Knowledge base contains data, rules, procedures, and relationships used by expert system

☐ Virtual reality: simulation of a real or imagined environment that can be experienced visually in three dimensions

Database Fundamentals

Data Life Cycle
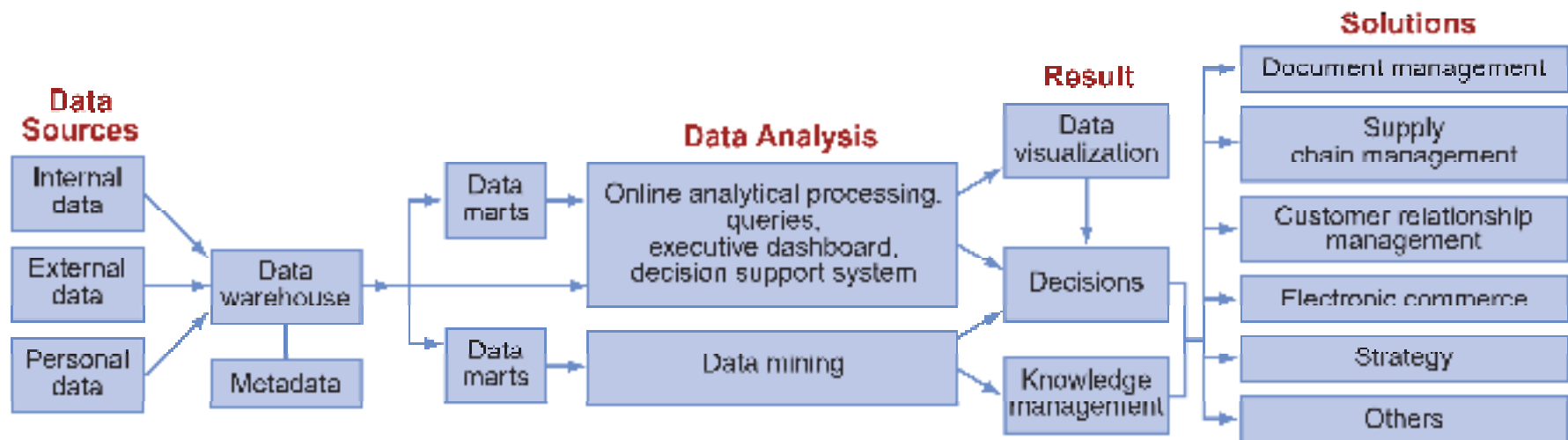
Database Approach
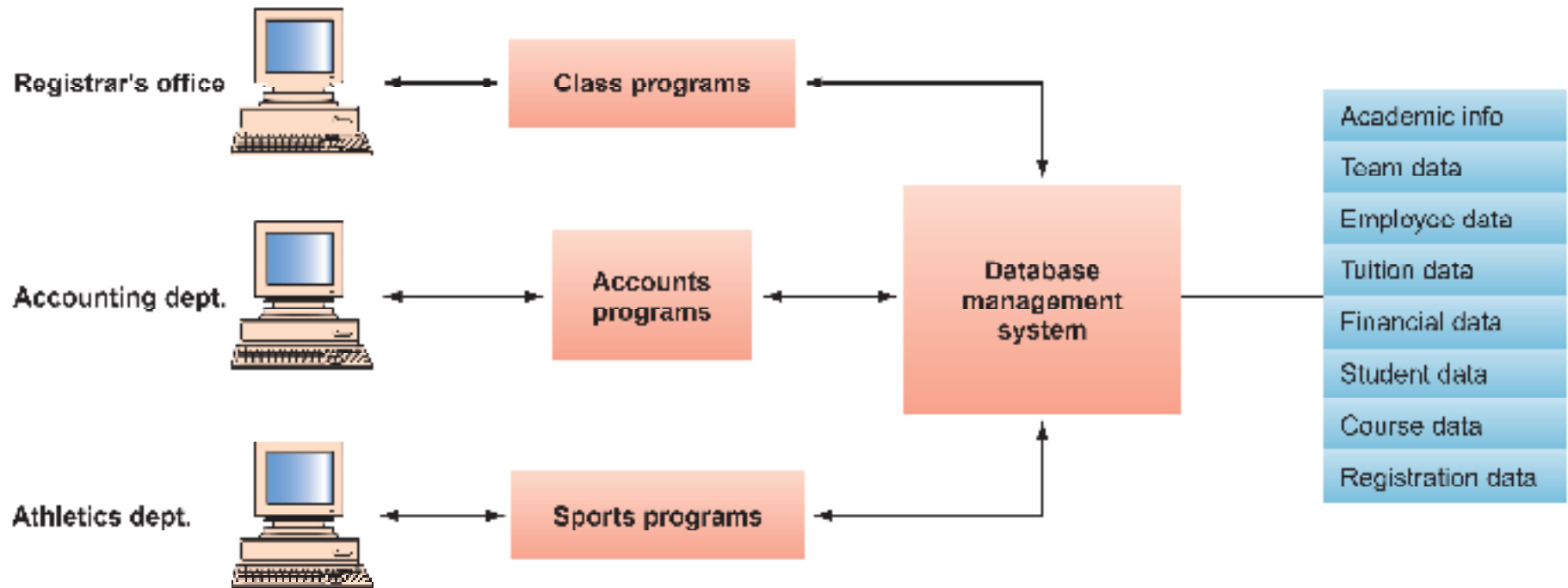
A database management system (DBMS) provides access to all data in the database.

Data Hierarchy
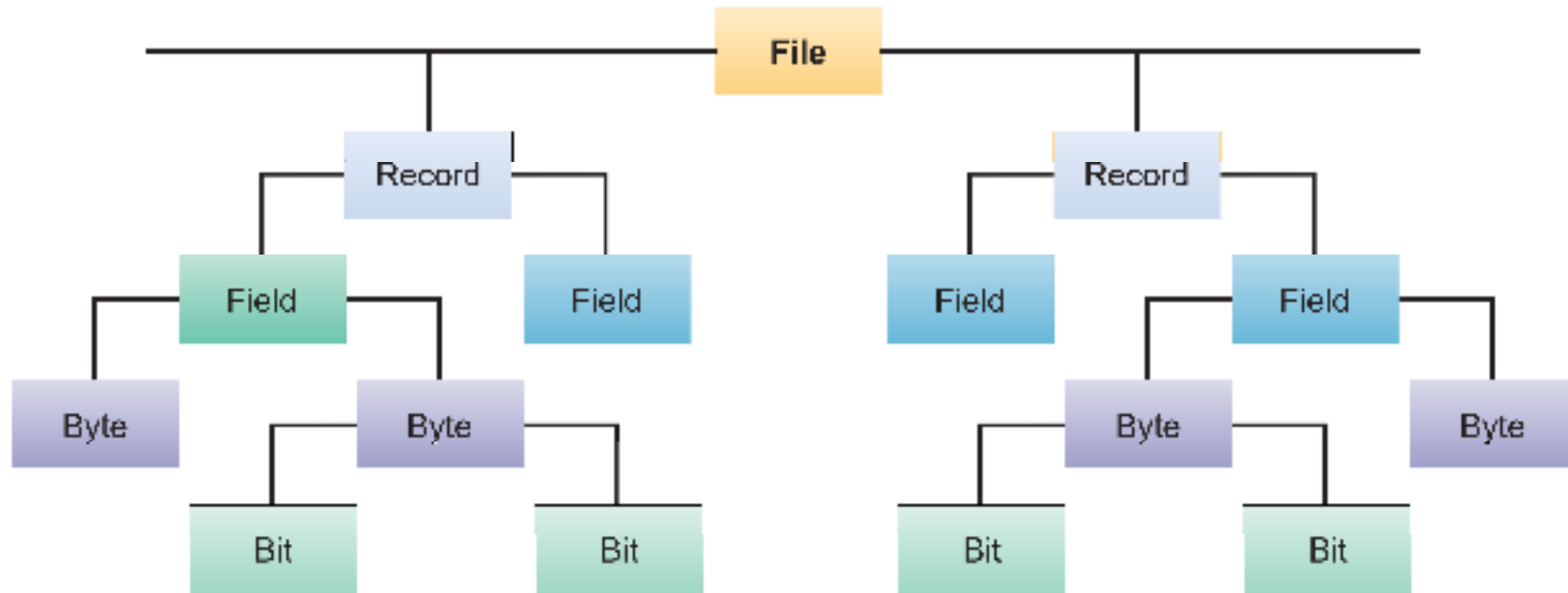
Hierarchy of data for a computer-based file.

Database

- Central repository of shared data

- Data is managed by a controlling agent

- Stored in a standardized, convenient form

Central Database

Contains employee, order, inventory, pricing, and customer data
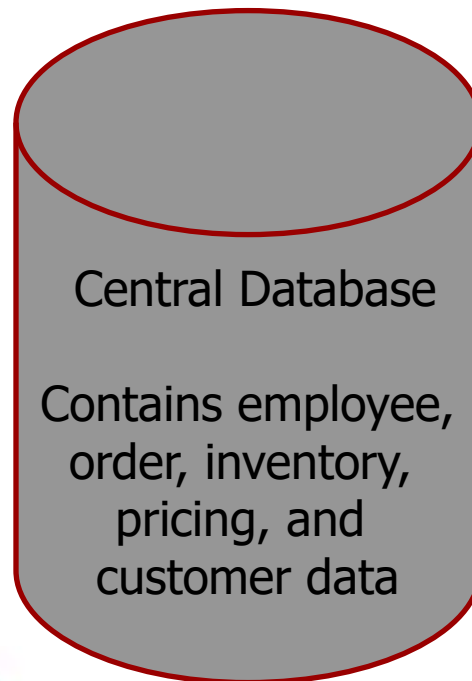
Requires a Database Management System (DBMS)

Database Management System

A software system that is used to create, maintain, and provide controlled access to user databases
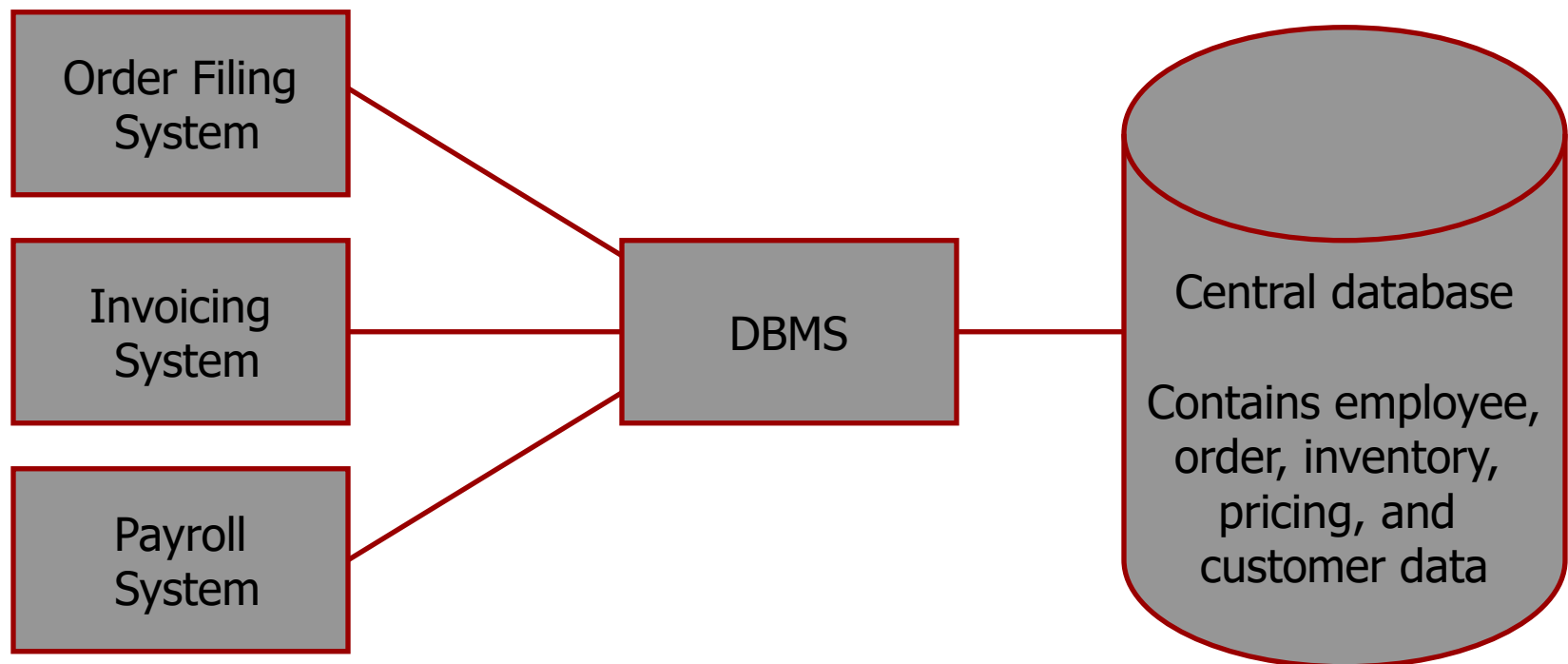
DBMS manages data resources like an operating system manages hardware resources

Conceptual layers of a database implementation

User → Application software → Database management system → Actual database

Database seen in terms of the application

Database seen in terms of a database model

Database seen in its actual organization
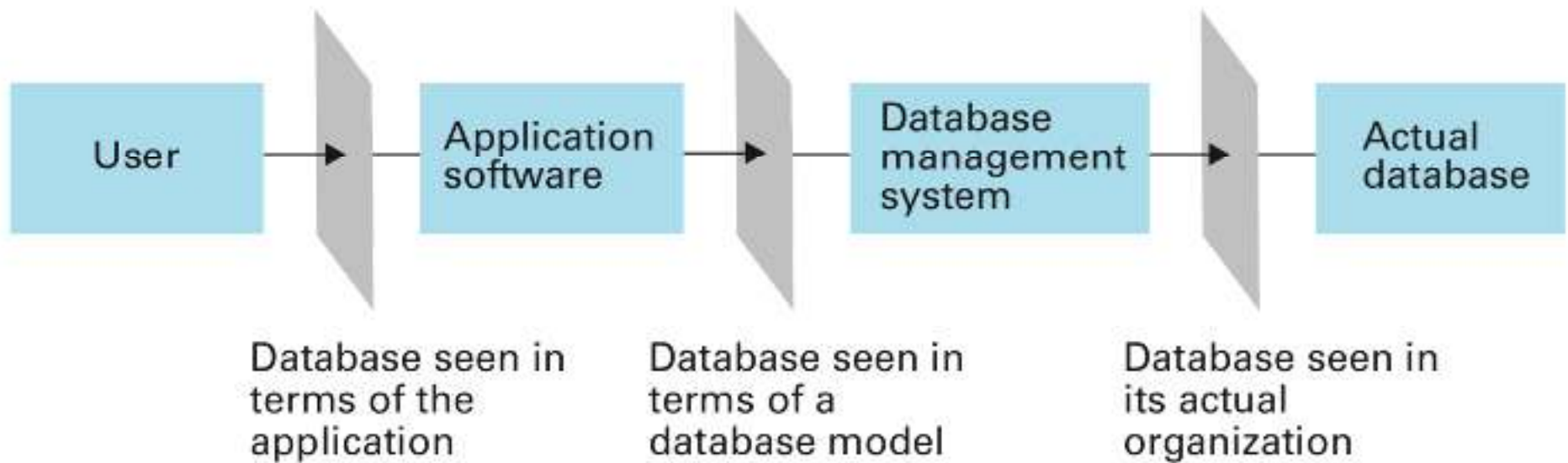
From Brookshear, 2015

Database models

- A conceptual view of a database
  - Entity Relationship Model (ERM)
  - Relational Model
  - Object-oriented Model
  - Hierarchical Model
  - NoSQL
  - …

- ERM, Relational model is the most popular model

Evolution of Data Models
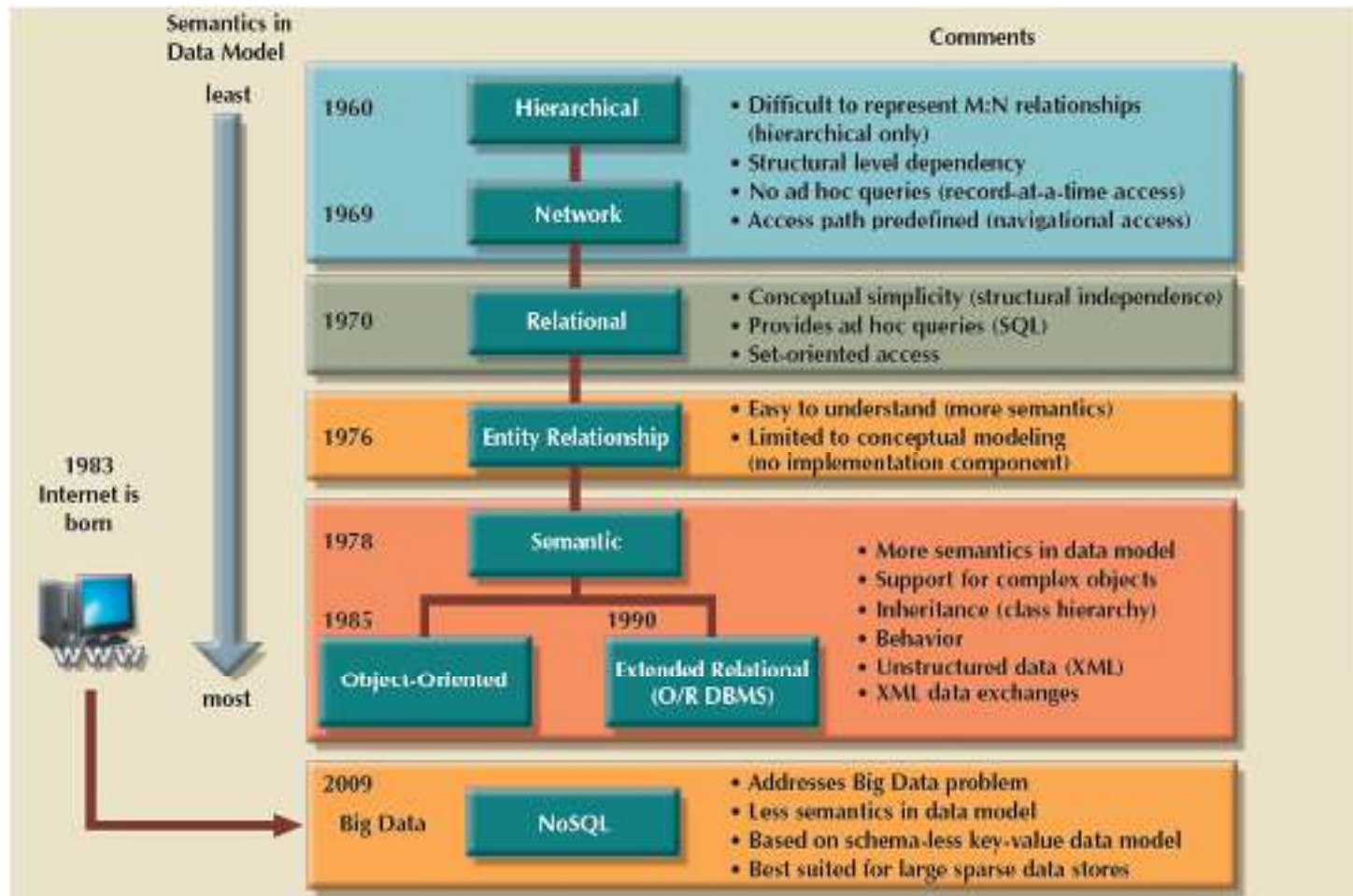
Entity Relationship Model
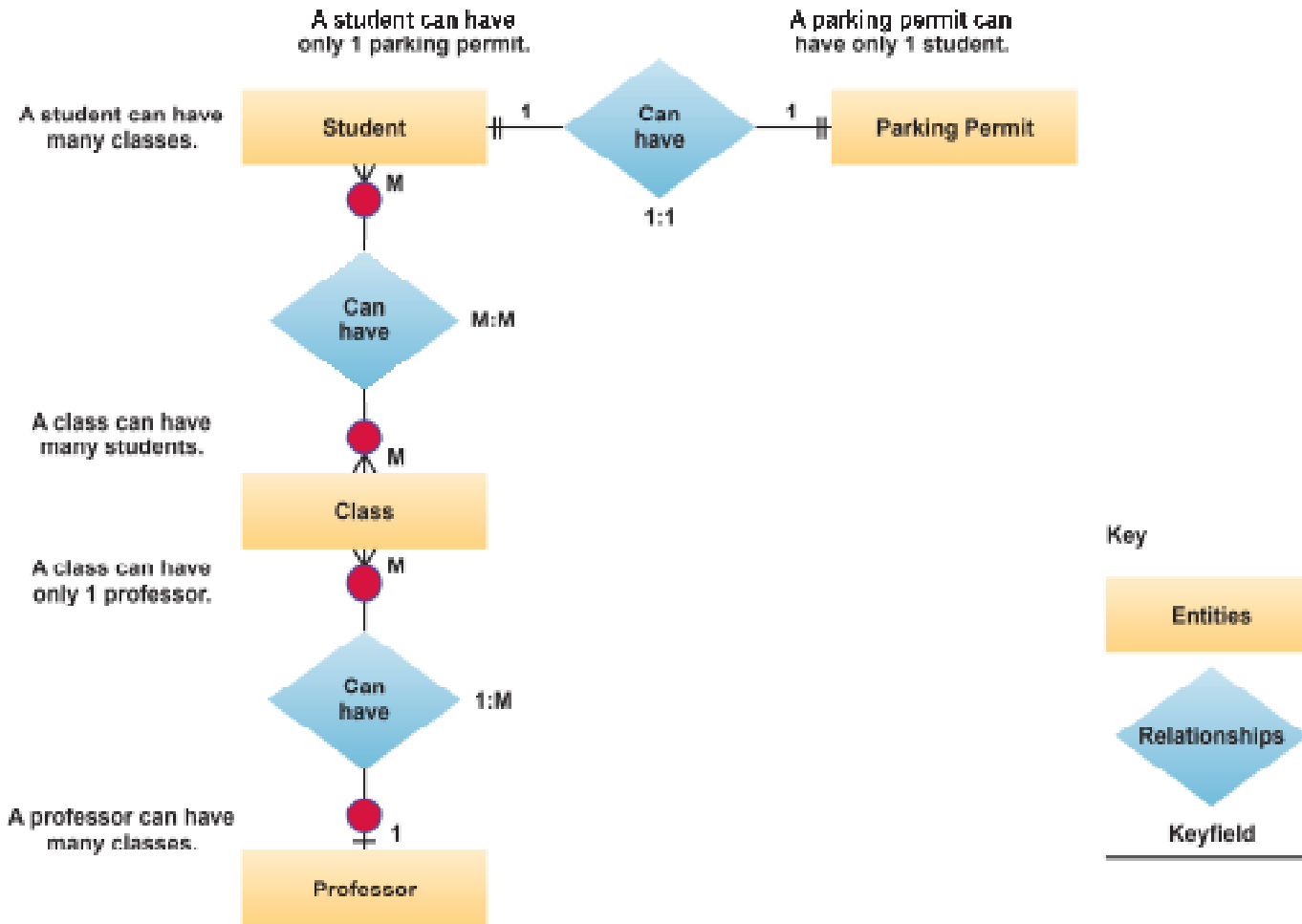
(a) ER diagram

Relational database model

Query Languages

Structured query language (SQL)

- Operations to manipulate tuples

  - ```sql
    SELECT EmplId, Dept
    FROM Assignment, Job
    WHERE Assignment.JobId = Job.JobId
        AND Assignment.TermData = '*';
    ```

  - ```sql
    INSERT INTO Employee
    VALUES ('43212', 'Sue A. Burt',
        '33 Fair St.', '444661111');
    ```

  - ```sql
    DELETE FROM Employee
    WHERE Name = 'G. Jerry Smith';
    ```

  - ```sql
    UPDATE Employee
    SET Address = '1812 Napoleon Ave.'
    WHERE Name = 'Joe E. Baker';
    ```

Datawarehouse
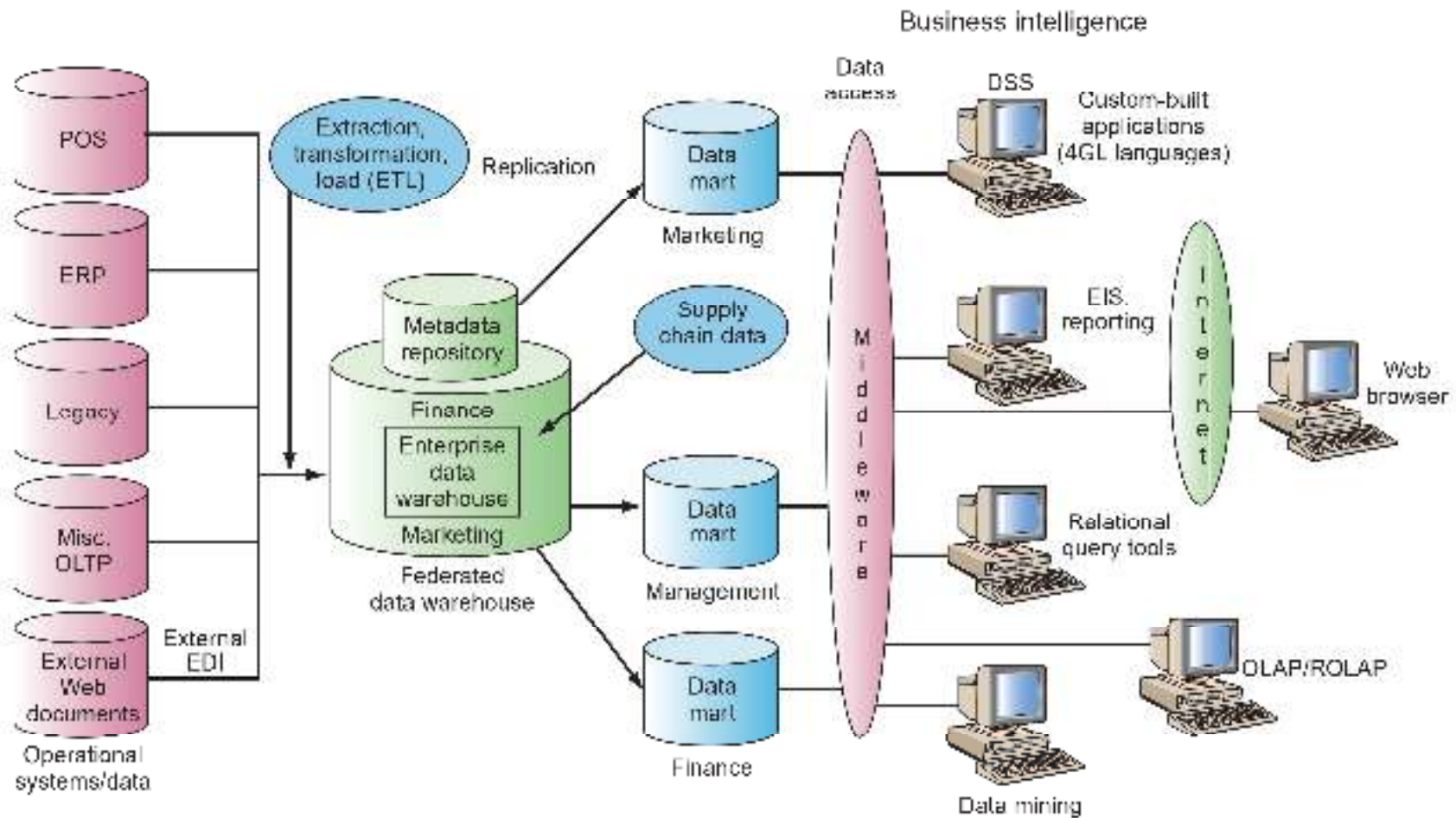
Data warehouse framework and views

Careers in Information Systems

Careers in Information Systems

☐ **Successful IS workers must:**

- ☐ Enjoy working in a fast-paced, dynamic environment
- ☐ Meet deadlines and solving unexpected challenges
- ☐ Possess good communication skills
- ☐ Have solid analytical and decision-making skills
- ☐ Develop effective team and leadership skills
- ☐ Be adept at implementing organization change
- ☐ Be prepared to engage in life-long learning

Important Skills for IS Workers

☐ Mobile applications for smartphones, tablet computers, and other mobile devices

☐ Programing and application development

☐ Help desk and technical support

☐ Project management

☐ Networking

☐ Business intelligence

☐ Security

☐ Web 2.0

☐ Data center

Occupational Outlook for Selected Information Systems Positions
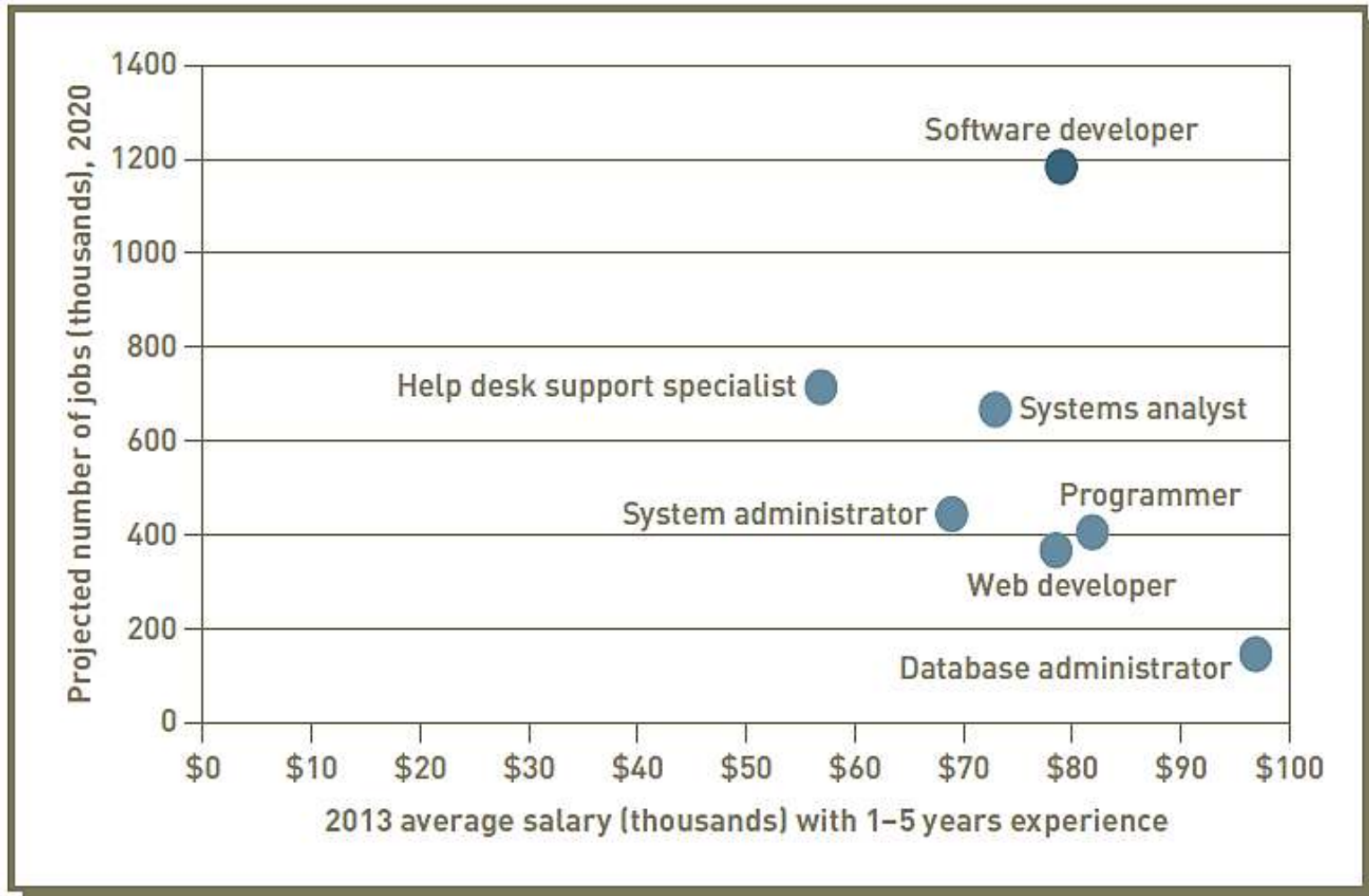
Roles, Functions, and Careers in IS
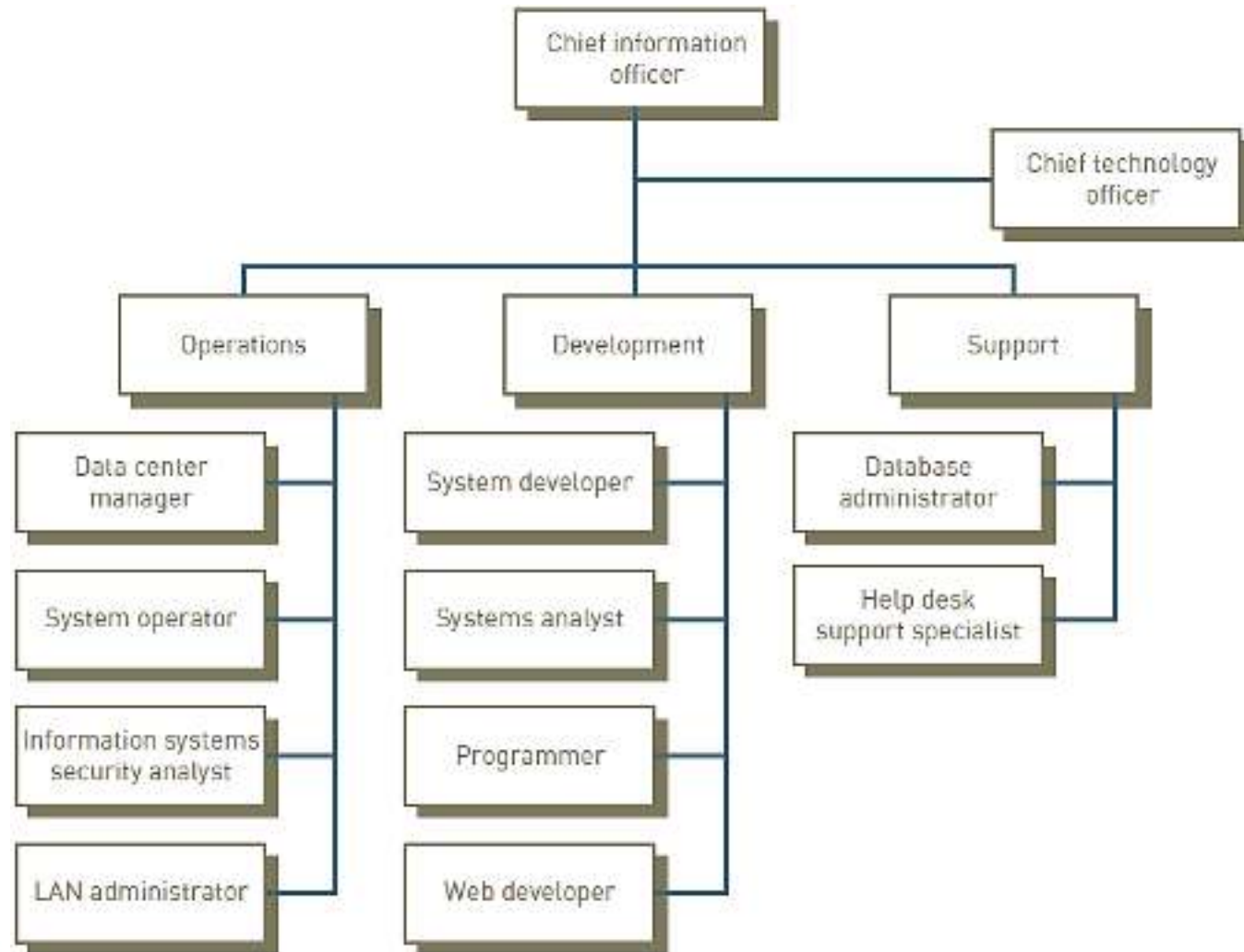
☐ In addition to technical skills, IS professionals need:

- ☐ Communication: skills in written and verbal communication
- ☐ Problem solving
- ☐ An understanding of organizations and the way they operate
- ☐ Team work: ability to work with people and in groups
- ☐ Etc.

Three Primary Functions of the Information Systems Organization

Typical IS Titles and Functions

☐ Chief Information Officer (CIO) employs the IS department's equipment and personnel to help the organization attain its goals

☐ Senior IS Managers

- ☐ IS Director
- ☐ Vice President of Information Systems
- ☐ Manager of Information Systems
- ☐ Chief Technology Officer (CTO)
- ☐ Information Management Manager

Typical IS Titles and Functions: Operations Roles

☐ Data center managers are responsible for the maintenance and operation of the organization's computing facilities

☐ Operations group includes:

- ☐ Operations Manager
- ☐ System Operators
- ☐ Information System Security Analysts

Typical IS Titles and Functions: Development Roles

☐ The development group implements the new information systems required to support the organization's existing and future business

☐ The development group includes:

- ☐ IS Project Manager
- ☐ Systems Analyst, Business Analyst (BA)
- ☐ Database designer, Web designer
- ☐ Programmers
- ☐ Web developers

Typical IS Titles and Functions: Support

☐ Provides customer service for the employees, customers, and business partners

☐ The support group includes:
  ☐ Database Administrators (DBAs)
  ☐ Help Desk Support Specialists

IS Careers in Technology Organizations

☐ Consulting opportunities

☐ Computer training

☐ Computer and computer-equipment sales

☐ Computer repair and maintenance

☐ Many other related careers
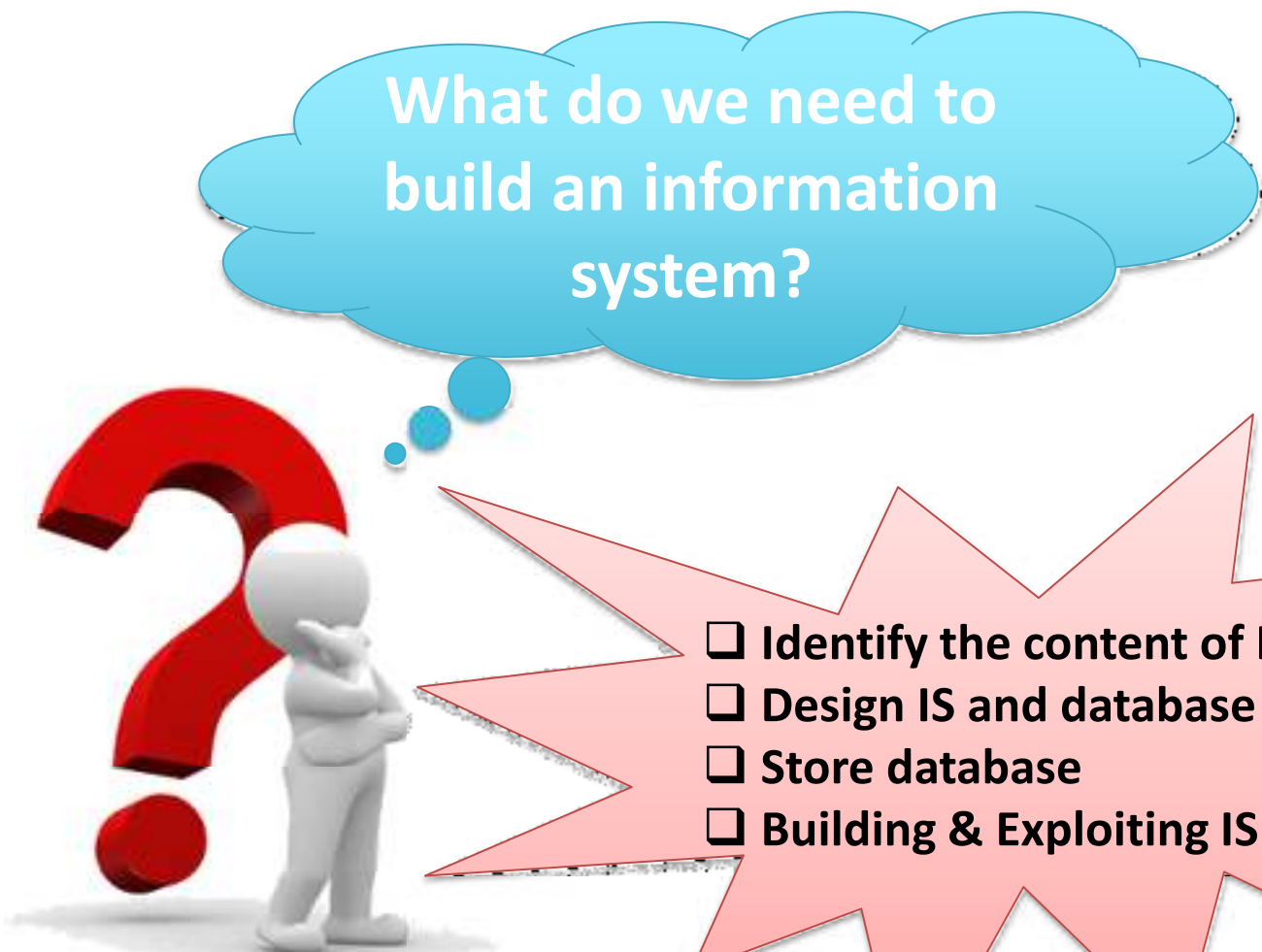
Information Systems Majors – IS Department

BỘ MÔN HỆ THỐNG THÔNG TIN

☐ Room I84 – Phone 38354266 (804)

☐ Head: Dr. Pham Nguyen Cuong

☐ Vice head: Dr. Nguyen Tran Minh Thu

Educational objectives

☐ Be able to **analyze, evaluate, design, implement and operate** projects of information system

☐ Be able to **utilize and self-study** Information System development tools *(analysis and design, software development via network / distributed / mobile environment)*

☐ Have **self-development skills, do research** of technologies, methodologies, new processes in Information System area
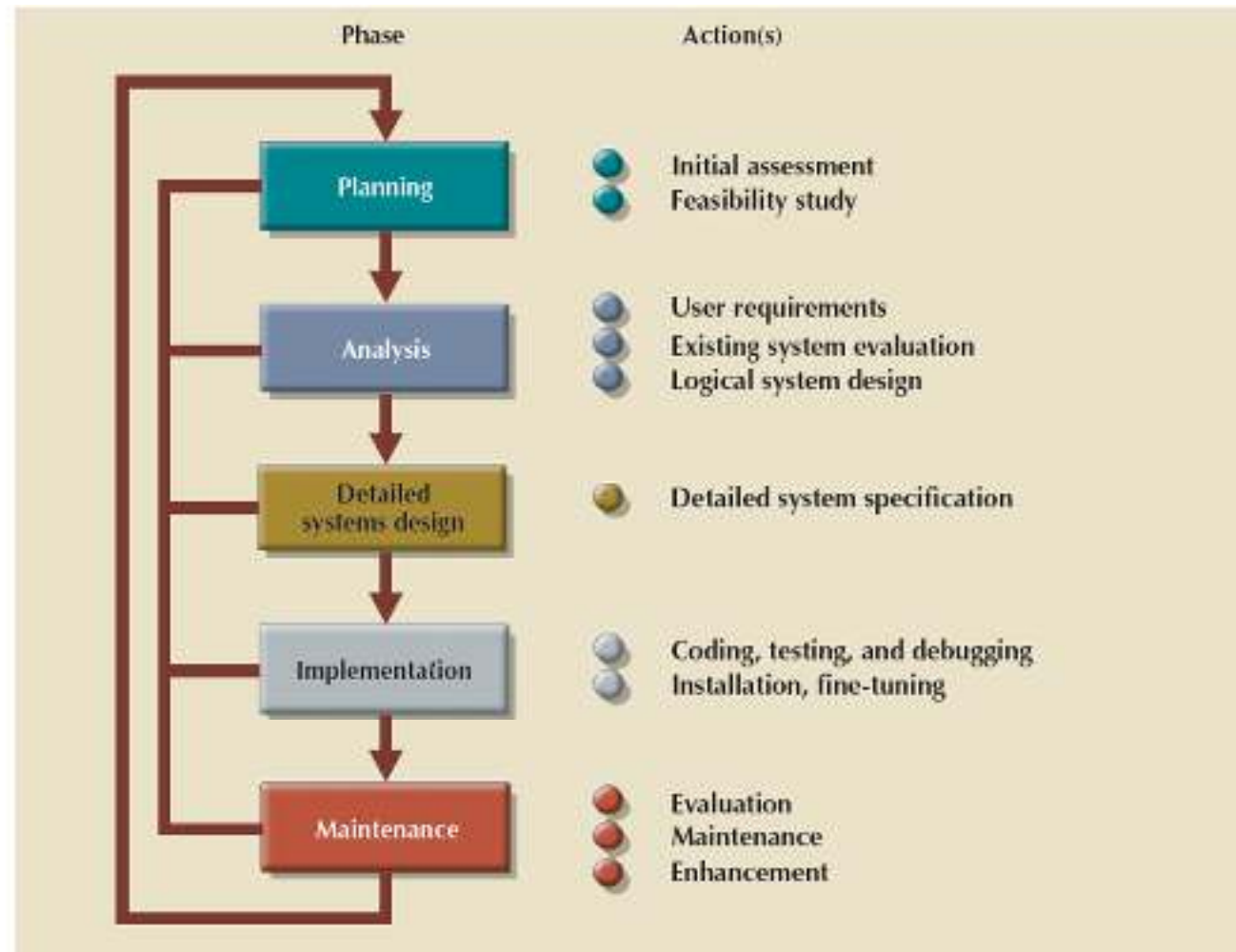
Building an Information System

What do we need to build an information system?

- ❑ **Identify the content of IS**
- ❑ **Design IS and database**
- ❑ **Store database**
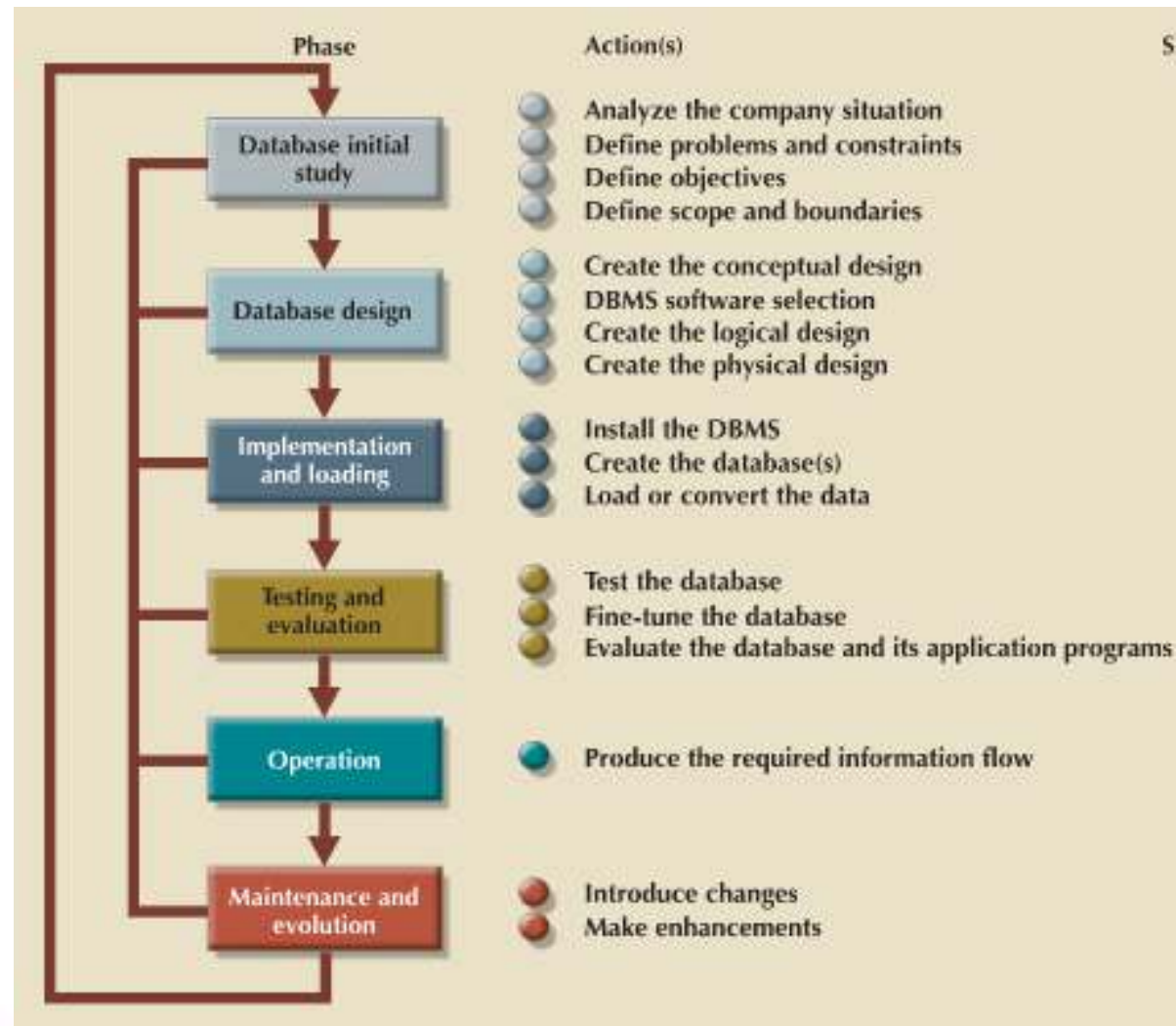- ❑ **Building & Exploiting IS**

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Systems Development Life Cycle (SDLC)

The Database Life Cycle (DBLC)

Courses

☐ Môn học cở sở và bắt buộc ngành

STT	Mã môn học	Tên môn học
1	CSC10006	Cơ sở dữ liệu
2	CSC12001	An toàn và bảo mật dữ liệu trong HTTT
3	CSC12002	Cơ sở dữ liệu nâng cao
4	CSC12003	Hệ quản trị cơ sở dữ liệu
5	CSC12004	Phân tích thiết kế HTTT
6	CSC12005	Phát triển ứng dụng HTTT hiện đại

Courses

☐ Nhóm môn học tự chọn ngành

STT	Mã môn học	Tên môn học
1	CSC12109	Hệ thống thông tin doanh nghiệp
2	CSC12107	HTTT phục vụ trí tuệ kinh doanh
3	CSC12102	Chuyên đề chọn lọc trong HTTT
4	CSC12105	Thương mại điện tử
5	CSC12106	Tương tác người máy
6	CSC12108	Ứng dụng phân tán
7	CSC10108	Trực quan hóa dữ liệu
8	CSC12103	Chuyên đề Hệ QTCSDL NC
9	CSC12110	Ứng dụng phân tích dữ liệu
10	CSC12111	Quản trị CSDL hiện đại

Courses

☐ Chuỗi phát triển kỹ năng

Phân tích hệ thống	Thiết kế hệ thống	Cài đặt và khai thác hệ thống

Database

🔴 Hệ QT CSDL
- MS SQL Server
- Oracle
- My SQL

🟡 Ngôn ngữ lập trình
- C++
- C#
- Java

🔵 Công nghệ Web
- PHP
- ASP.Net
- Apache

🟣 Công cụ khác
- PHP
- ASP.Net
- Apache
- Tool IR
- **Tool Machine Learning**

Courses

Database

Database Management System

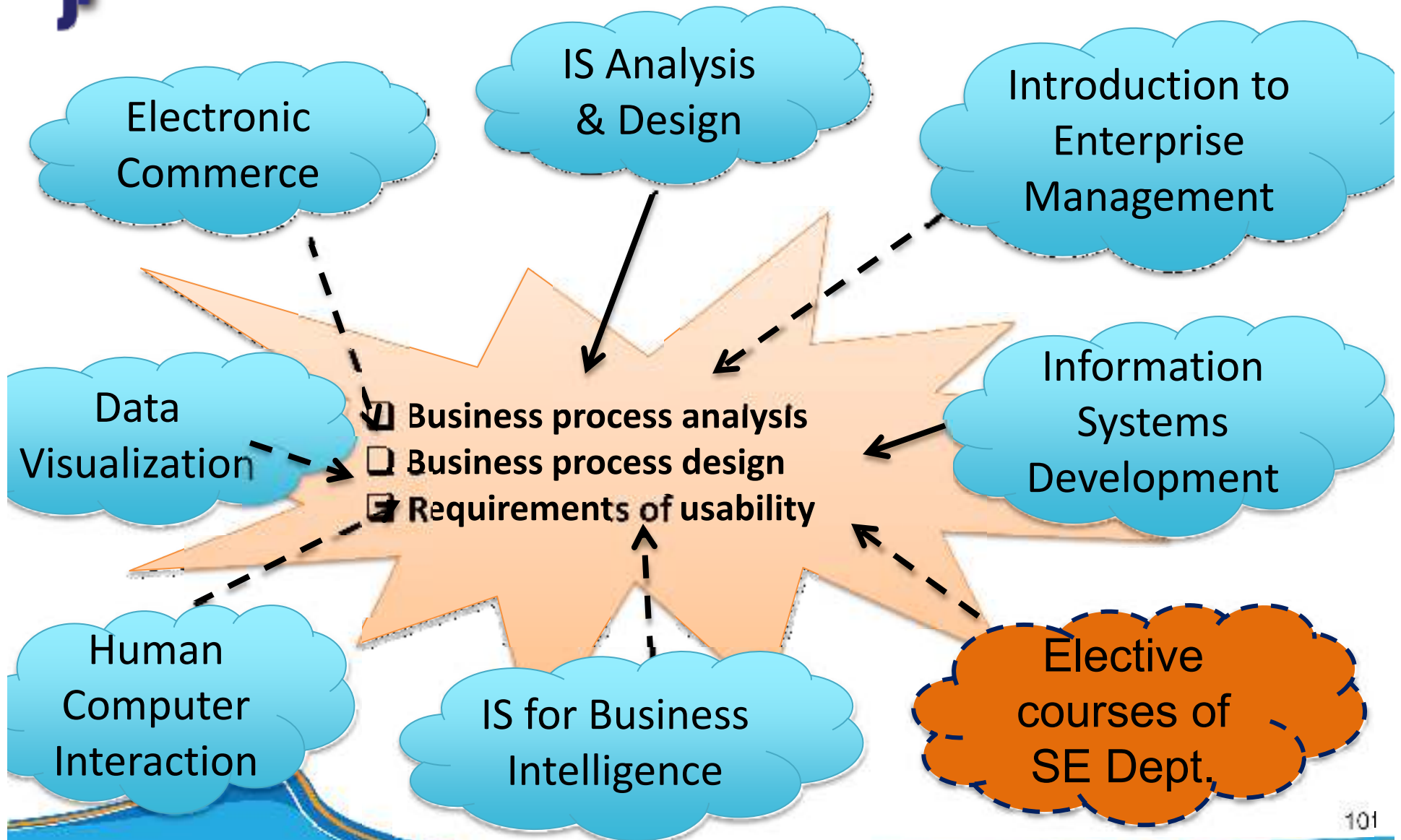Advanced Database

Security issues in information systems

- ☐ **Identify the content of IS**
- ☐ **Design IS and database**
- ☐ **Store database**
- ☐ **Exploit IS**

Selected topics on DBMS

Distributed Application

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Research Groups

1. Khai thác văn bản và tìm kiếm thông tin

2. Khoa học dịch vụ, Học theo ngữ cảnh , Semantic Web, Smart Services

3. Hệ thống thông tin di động, CSDL di động, Internet of Things

4. Tích hợp lược đồ, Phân tích dữ liệu, kinh doanh thông minh (BI), Hệ thống tư vấn, BigData

5. Bảo mật cho hệ thống thông tin

6. Hệ thống hỗ trợ, mạng xã hội học tập