Knowledge-Based Decision Support: Artificial Intelligence and Expert Systems

Managerial Decision Makers are *Knowledge Workers*

Use Knowledge in Decision Making

Accessibility to Knowledge Issue

Knowledge-Based Decision Support: Applied Artificial Intelligence

AI Concepts and Definitions

Encompasses Many Definitions

AI Involves Studying Human Thought Processes

Representing Thought Processes on Machines

Artificial Intelligence

Behavior by a machine that, if performed by a human being, would be considered intelligent

---

"…study of how to make computers do things at which, at the moment, people are better" (Rich and Knight [1991])

Theory of how the human mind works (Mark Fox)

AI Objectives

Make machines *smarter* (primary goal)

Understand what *intelligence* is (Nobel Laureate purpose)

Make machines more *useful* (entrepreneurial purpose)

Signs of Intelligence

***Learn* or *understand* from experience**

Make sense out of unclear or contradictory messages

Respond quickly and successfully to new situations

Use *reasoning* to solve problems

More Signs of Intelligence

Deal with perplexing situations

- ***Understand*** **and** ***infer*** **in ordinary, rational ways**
- **Apply** ***knowledge*** **to manipulate the environment**
- ***Think*** **and** ***reason***
- **Recognize the relative importance of different elements in a situation**

Turing Test for Intelligence

A computer can be considered to be *smart* only when a human interviewer, "conversing" with both an unseen human being and an unseen computer, can not determine which is which

Symbolic Processing

Use *Symbols* to Represent Problem Concepts

Apply Various Strategies and Rules to Manipulate these Concepts

AI Represents Knowledge as Sets of Symbols

A *symbol* is a string of characters that stands for some real-world concept

Examples

Product

Defendant

0.8

Chocolate

Symbol Structures (Relationships)

(DEFECTIVE product)

(LEASED-BY product defendant)

(EQUAL (LIABILITY defendant) 0.8)

tastes_good (chocolate).

AI Programs Manipulate Symbols to Solve Problems

Symbols and Symbol Structures Form Knowledge Representation

Artificial Intelligence Dealings Primarily with *Symbolic*, N*onalgorithmic* Problem- Solving Methods

Characteristics of Artificial Intelligence

Numeric **versus** ***Symbolic***

Algorithmic **versus** ***Nonalgorithmic***

Heuristic Methods for Processing Information

Search

Inferencing

Reasoning **- Inferencing from facts and rules using heuristics or other search approaches**

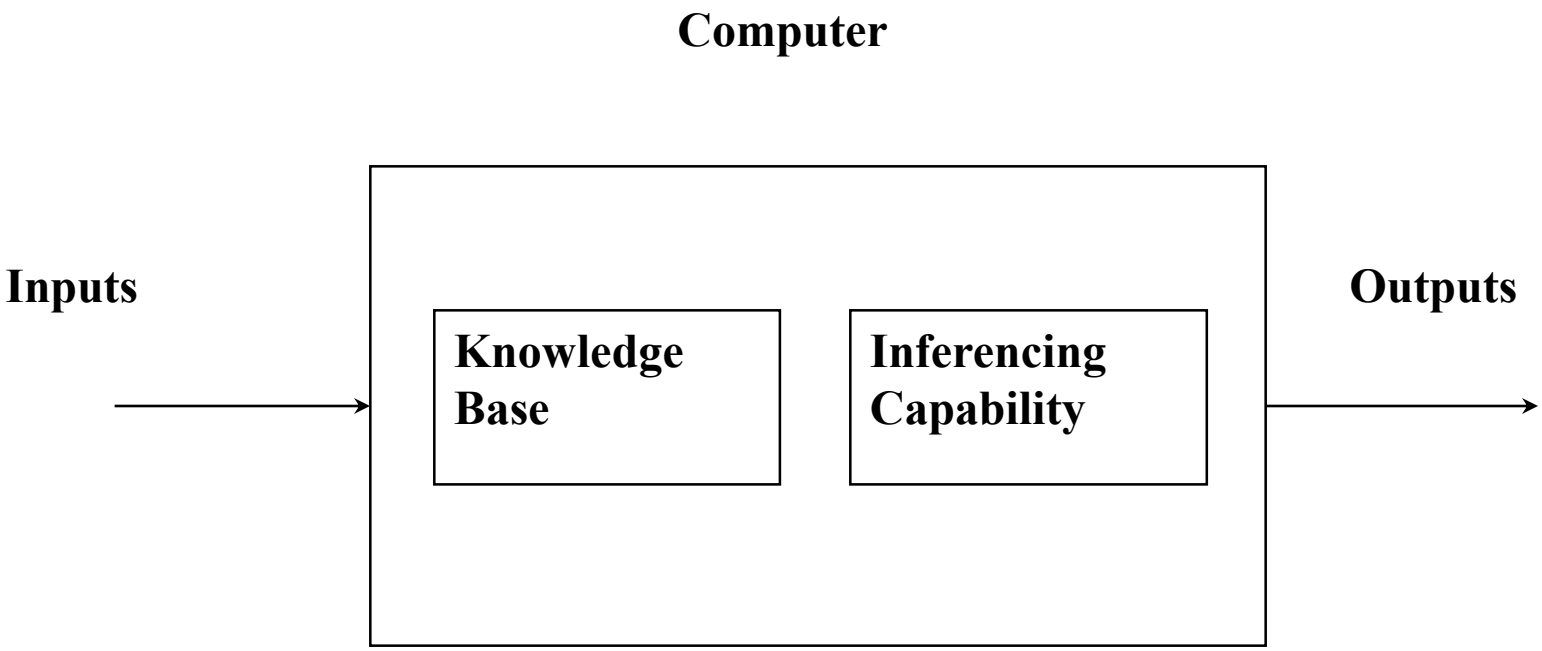
Pattern Matching **- Attempt to describe objects, events, or processes in terms of their qualitative features and logical and computational relationships**

Knowledge Processing **- Given facts or other representations**

Knowledge Bases **- Where knowledge is stored**

Using the Knowledge Base in AI Programs **- Inferencing**

Using the Knowledge Base



Artificial Intelligence versus Natural Intelligence

AI Advantages Over Natural Intelligence

More *permanent*

Ease of duplication and dissemination

Less expensive

Consistent and thorough

Can be *documented*

Can execute certain tasks much *faster* than a human

Can perform certain tasks *better* than many or even most people

Natural Intelligence Advantages over AI

Natural intelligence is *creative*

People *use sensory experience* directly

Can use a *wide context of experience* in different situations

AI - Very *Narrow Focus*

Information Processing

Computers can collect and process information efficiently

People instinctively:

- **Recognize relationships between things**
- **Sense qualities**
- **Spot patterns indicating relationships**

***BUT*, AI technologies can provide significant improvement in productivity and quality!**

AI Computing

Based on *symbolic representation* and manipulation

A *symbol* is a letter, word, or number representing objects, processes, and their relationships

***Objects* can be people, things, ideas, concepts, events, or statements of fact**

Creates a *symbolic knowledge base*

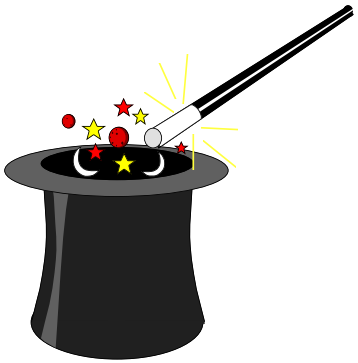
AI Computing (cont'd)

- Manipulates symbols to generate advice
- AI reasons or infers with the knowledge base by search and pattern matching
- Hunts for answers (via algorithms)

AI Computing (cont'd)

***Caution*: AI is NOT magic**

AI is a <u>unique</u> approach to programming computers



The AI Field

Many Different Sciences & Technologies

- **Linguistics**
- **Psychology**
- **Philosophy**
- **Computer Science**
- **Electrical Engineering**
- **Hardware and Software**

(More)

- Mechanics
- Hydraulics
- Physics
- Optics
- Others

Commercial, Government and Military Organizations

Plus

- Management and Organization Theory
- Chemistry
- Physics
- Statistics
- Mathematics
- Management Science
- Management Information Systems

Artificial Intelligence

A Science and a Technology

Growing Commercial Technologies

Major AI Areas

- Expert Systems
- Natural Language Processing
- Speech Understanding
- Robotics and Sensory Systems
- Computer Vision and Scene Recognition
- Intelligent Computer-Aided Instruction
- Neural Computing

Additional AI Areas

News Summarization

Language Translation

Fuzzy Logic

Genetic Algorithms

Intelligent Software Agents

AI Transparent in Commercial Products

- Anti-lock Braking Systems
- Video CAMcorders
- Appliances
  - Washers
  - Toasters
  - Stoves
- Data Mining Software
- Help Desk Software
- Subway Control

Expert Systems

Attempt to Imitate Expert Reasoning Processes and Knowledge in Solving Specific Problems

Most Popular Applied AI Technology

- **Enhance Productivity**
- **Augment Work Forces**

***Narrow* Problem-Solving Areas or Tasks**

Expert Systems

Provide Direct Application of Expertise

Expert Systems Do Not Replace Experts, But They

- **Make their Knowledge and Experience More Widely Available**
- **Permit Nonexperts to Work Better**

Expert Systems

Expertise

Transferring Experts

Inferencing

Rules

Explanation Capability

Expertise

The extensive, task-specific knowledge acquired from training, reading and experience

- Theories about the problem area
- Hard-and-fast rules and procedures
- Rules (heuristics)
- Global strategies
- Meta-knowledge (knowledge about knowledge)
- Facts

Enables experts to be better and faster than nonexperts

Some Facts about Expertise

- Expertise is usually associated with a high degree of intelligence, but not always with the smartest person
- Expertise is usually associated with a vast quantity of knowledge
- Experts learn from past successes and mistakes
- Expert knowledge is well-stored, organized and retrievable quickly from an expert
- Experts have excellent recall

Experts

Degrees or levels of expertise

Nonexperts outnumber experts often by 100 to 1

Human Expert Behaviors

Recognize and formulate the problem

Solve problems quickly and properly

Explain the solution

Learn from experience

Restructure knowledge

Break rules

Determine relevance

Degrade gracefully

Transferring Expertise

Objective of an expert system

- **To transfer expertise from an expert to a computer system and**
- **Then on to other humans (nonexperts)**

Activities

- **Knowledge acquisition**
- **Knowledge representation**
- **Knowledge inferencing**
- **Knowledge transfer to the user**

Knowledge is stored in a *knowledge base*

Two Knowledge Types

Facts

Procedures (usually rules)

Regarding the Problem Domain

Inferencing

Reasoning (Thinking)

The computer is programmed so that it can make inferences

Performed by the *Inference Engine*

Rules

IF-THEN-ELSE

Explanation Capability

- **By the justifier, or explanation subsystem**

ES versus Conventional Systems

Structure of Expert Systems

Development Environment

Consultation (Runtime) Environment

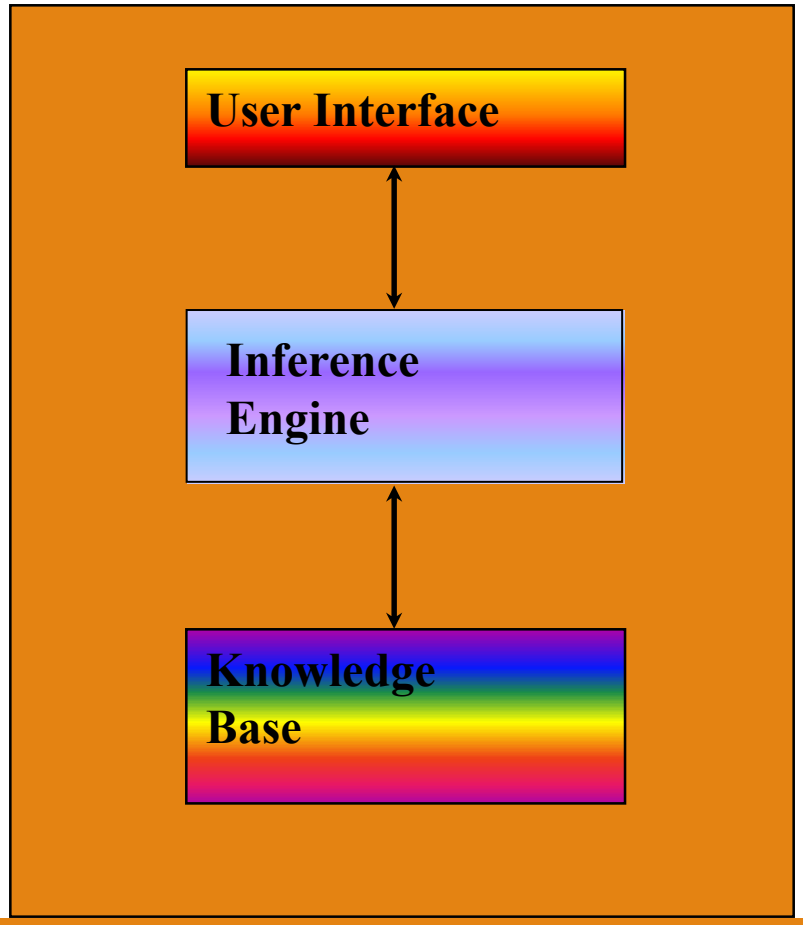
Three Major ES Components

Knowledge Base

Inference Engine

User Interface

Three Major ES Components



All ES Components

Knowledge Acquisition Subsystem

Knowledge Base

Inference Engine

User Interface

Blackboard (Workplace)

Explanation Subsystem (Justifier)

Knowledge Refining System

User

Most ES *do not have* a Knowledge Refinement Component

Knowledge Acquisition Subsystem

Knowledge acquisition is the accumulation, transfer and transformation of problem-solving expertise from experts and/or documented knowledge sources to a computer program for constructing or expanding the knowledge base

Requires a knowledge engineer

Knowledge Base

The knowledge base contains the knowledge necessary for understanding, formulating, and solving problems

Two Basic Knowledge Base Elements

- **Facts**
- **Special heuristics, or rules that direct the use of knowledge**

- **Knowledge is the primary raw material of ES**
- **Incorporated knowledge representation**

Inference Engine Major Elements

Interpreter

Scheduler

Consistency Enforcer

Blackboard (Workplace)

Area of working memory to

- Describe the current problem
- Record Intermediate results

Records Intermediate Hypotheses and Decisions

1. Plan
2. Agenda
3. Solution

The Human Element in Expert Systems

Expert

Knowledge Engineer

User

Others

The Expert

Has the special knowledge, judgment, experience and methods to give advice and solve problems

Provides knowledge about task performance

The Knowledge Engineer

Helps the expert(s) structure the problem area by interpreting and integrating human answers to questions, drawing analogies, posing counterexamples, and bringing to light conceptual difficulties

Usually also the System Builder

The User

Possible Classes of Users

- **A non-expert client seeking direct advice (ES acts as a *Consultant* or *Advisor*)**
- **A student who wants to learn (*Instructor*)**
- **An ES builder improving or increasing the knowledge base (*Partner*)**
- **An expert (*Colleague* or *Assistant*)**

The Expert and the Knowledge Engineer Should Anticipate Users' Needs and Limitations When Designing ES

Other Participants

System Builder

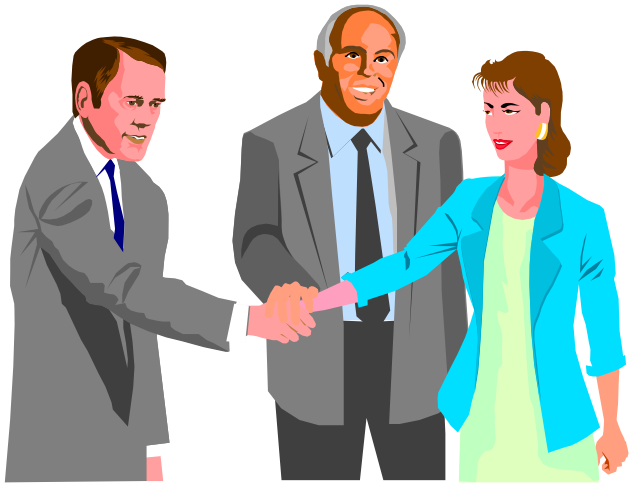
Systems Analyst

Tool Builder

Vendors

Support Staff

Network Expert



How Expert Systems Work

Major Activities of

ES Construction and Use

Development

Consultation

Improvement

ES Development

Knowledge base development

Knowledge separated into

- ***Declarative*** **(factual) knowledge and**
- ***Procedural*** **knowledge**

Development (or Acquisition) of an inference engine, blackboard, explanation facility, or any other software

Determine knowledge representations

Participants

Domain Expert

Knowledge Engineer and

(Possibly) Information System Analysts and Programmers

Expert Systems Shells
Software Development Packages

Exsys

InstantTea

K-Vision

KnowledgePro

Expert Systems Benefits

- Increased Output and Productivity
- Decreased Decision Making Time
- Increased Process(es) and Product Quality
- Reduced Downtime
- Capture Scarce Expertise
- Flexibility
- Easier Equipment Operation
- Elimination of Expensive Equipment

Operation in Hazardous Environments

Accessibility to Knowledge and Help Desks

Integration of Several Experts' Opinions

Can Work with Incomplete or Uncertain Information

Provide Training

Enhancement of Problem Solving and Decision Making

Improved Decision Making Processes

Improved Decision Quality

Ability to Solve Complex Problems

Knowledge Transfer to Remote Locations

Enhancement of Other MIS

Lead to

Improved decision making

Improved products and customer service

Sustainable strategic advantage

May enhance organization's image

Problems and Limitations of Expert Systems

Knowledge is not always readily available

Expertise can be hard to extract from humans

Each expert's approach may be different, yet correct

Hard, even for a highly skilled expert, to work under time pressure

Expert system users have natural cognitive limits

ES work well only in a *narrow domain* of knowledge

Most experts have no independent means to validate their conclusions

Experts' vocabulary often limited and highly technical

Knowledge engineers are rare and expensive

Lack of trust by end-users

Knowledge transfer subject to a host of perceptual and judgmental biases

ES may not be able to arrive at valid conclusions

ES sometimes produce incorrect recommendations

Expert System Success Factors

Most Critical Factors

- **Champion in Management**
- **User Involvement and Training**
- **The level of knowledge must be sufficiently high**
- **There must be (at least) one cooperative expert**
- **The problem to be solved must be qualitative (fuzzy), not quantitative**
- **The problem must be sufficiently narrow in scope**
- **The ES shell must be high quality, and naturally store and manipulate the knowledge**

- A friendly user interface
- The problem must be important and difficult enough
- Need knowledgeable and high quality system developers with good people skills
- The impact of ES as a source of end-users' job improvement must be favorable. End user attitudes and expectations must be considered
- Management support must be cultivated.

Need end-user training programs

Organizational environment should favor new technology adoption (freedom to fail)

Global E-Business: How Businesses Use Information Systems

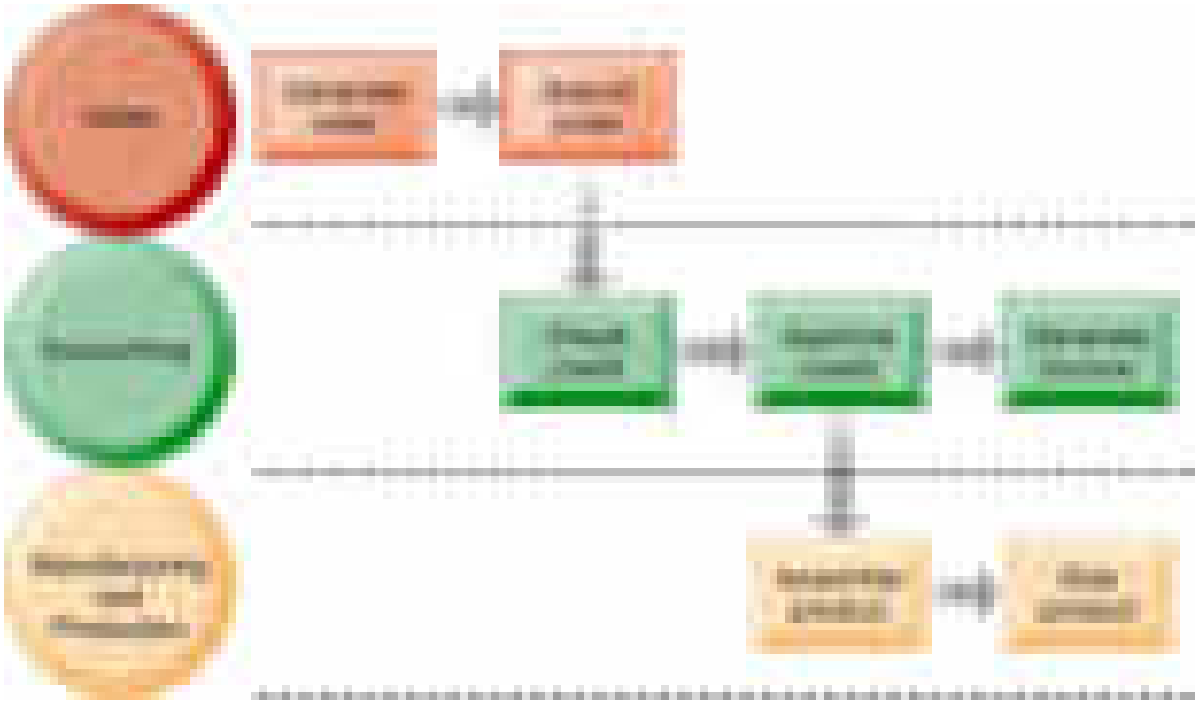
Business Processes and Information Systems

- **Business processes**

- **How information technology enhances business processes: efficiency and transformation**

Business Processes and Information Systems

The Order Fulfillment Process



Fulfilling a customer order involves a complex set of steps that requires the close coordination of the sales, accounting, and manufacturing functions.

Figure 2-1

Types of Business Information Systems

Systems from a functional perspective

- Sales and marketing systems
- Manufacturing and production systems
- Finance and accounting systems
- Human resources systems

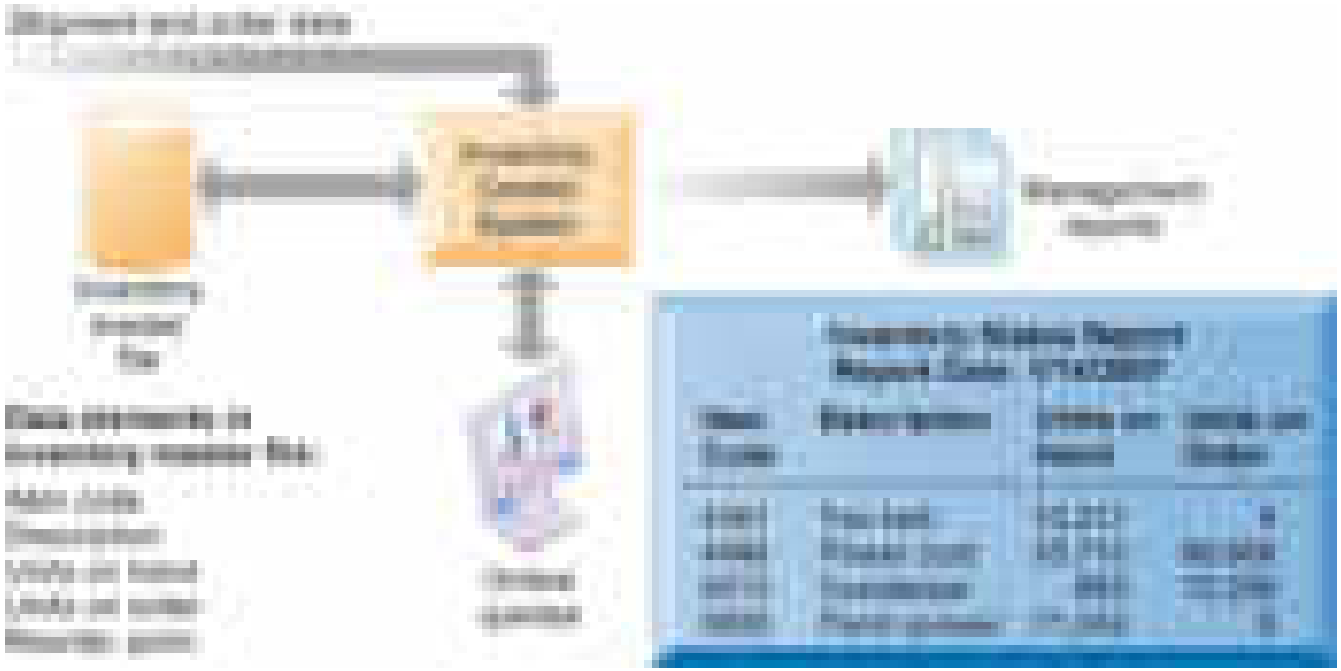
Systems from a constituency perspective

- Transaction processing systems
- Management information systems and decision-support systems
- Executive support systems

Relationship of systems to one another

Types of Business Information Systems

Overview of an Inventory System



This system provides information about the number of items available in inventory to support manufacturing and production activities.

Figure 2-3

Information Systems Help Kia Solve Its Quality Problems

- **Read the Interactive Session: Organizations, and then discuss the following questions:**
  - **Why was it so difficult for Kia to identify sources of defects in the cars it produced?**
  - **What was the business impact of Kia not having an information system to track defects? What other business processes besides manufacturing and production were affected?**
  - **How did Kia's new defect-reporting system improve the way it ran its business?**
  - **What management, organization, and technology issues did Kia have to address when it adopted its new quality control system?**
  - **What new business processes were enabled by Kia's new quality control system?**

Types of Business Information Systems

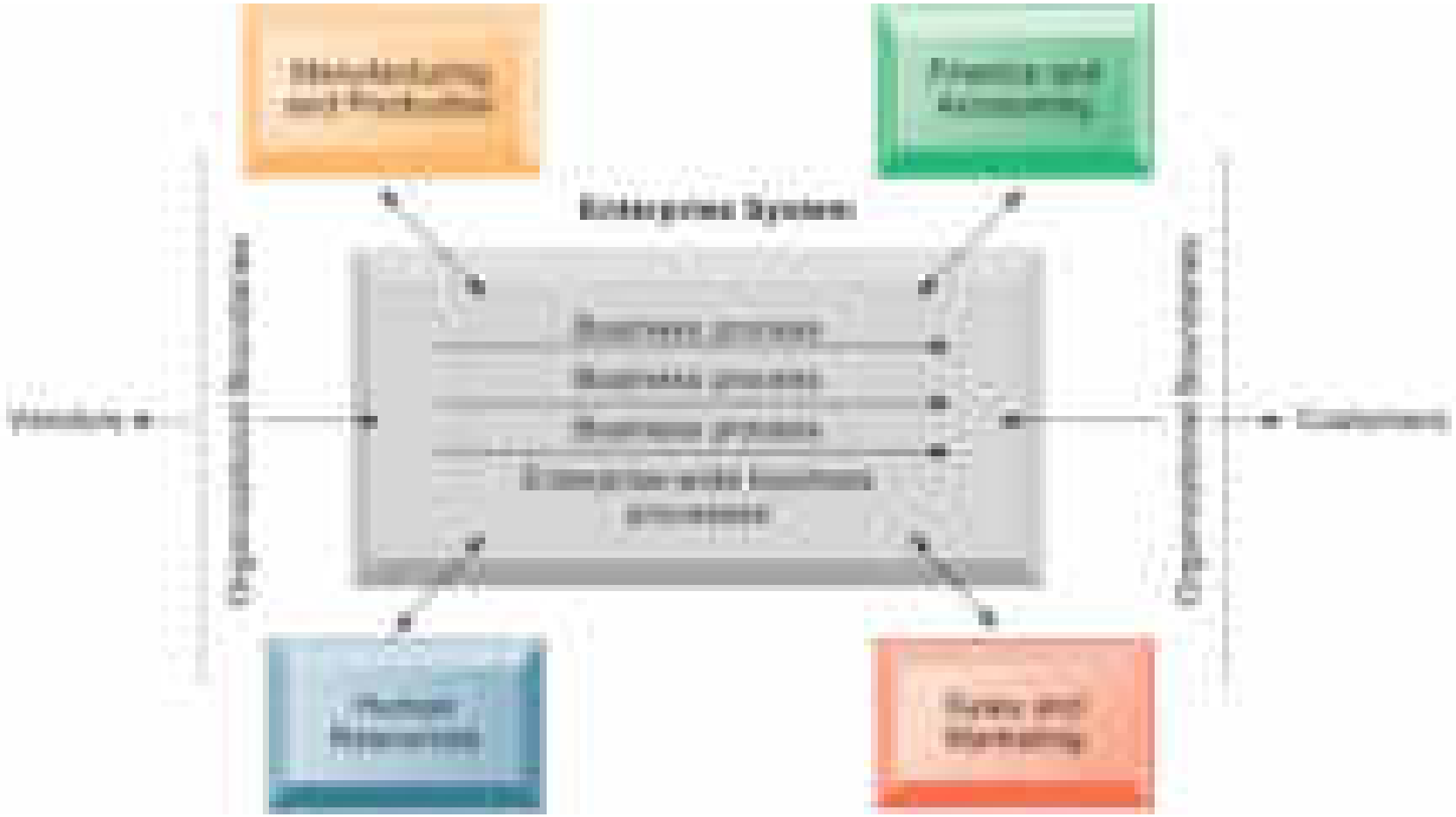
Interrelationships Among Systems

The various types of systems in the organization have interdependencies. TPS are major producers of information that is required by many other systems in the firm, which, in turn, produce information for other systems. These different types of systems are loosely coupled in most business firms, but increasingly firms are using new technologies to integrate information that resides in many different systems.

Figure 2-10

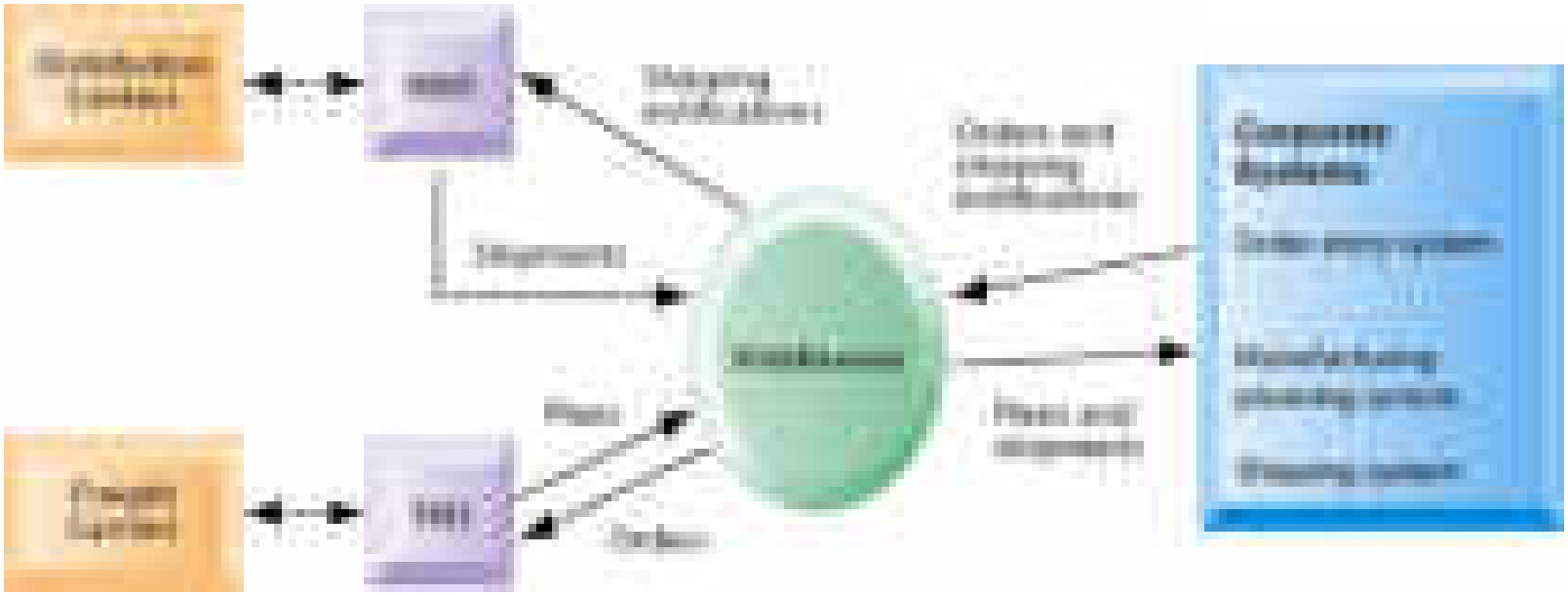
Systems That Span the Enterprise

- **Enterprise applications**
  - Enterprise systems
  - Supply chain management systems
  - Customer relationship management systems
  - Knowledge management systems
- **Intranets and extranets**
- **E-business, e-commerce, and e-government**



Systems That Span the Enterprise

Example of Supply Chain Management System



Customer orders, shipping notifications, optimized shipping plans, and other supply chain information flow among Haworth's Warehouse Management System (WMS), Transportation Management System (TMS), and its back-end corporate systems.

Figure 2-13

Client/Server Computing
(the wave of the future)

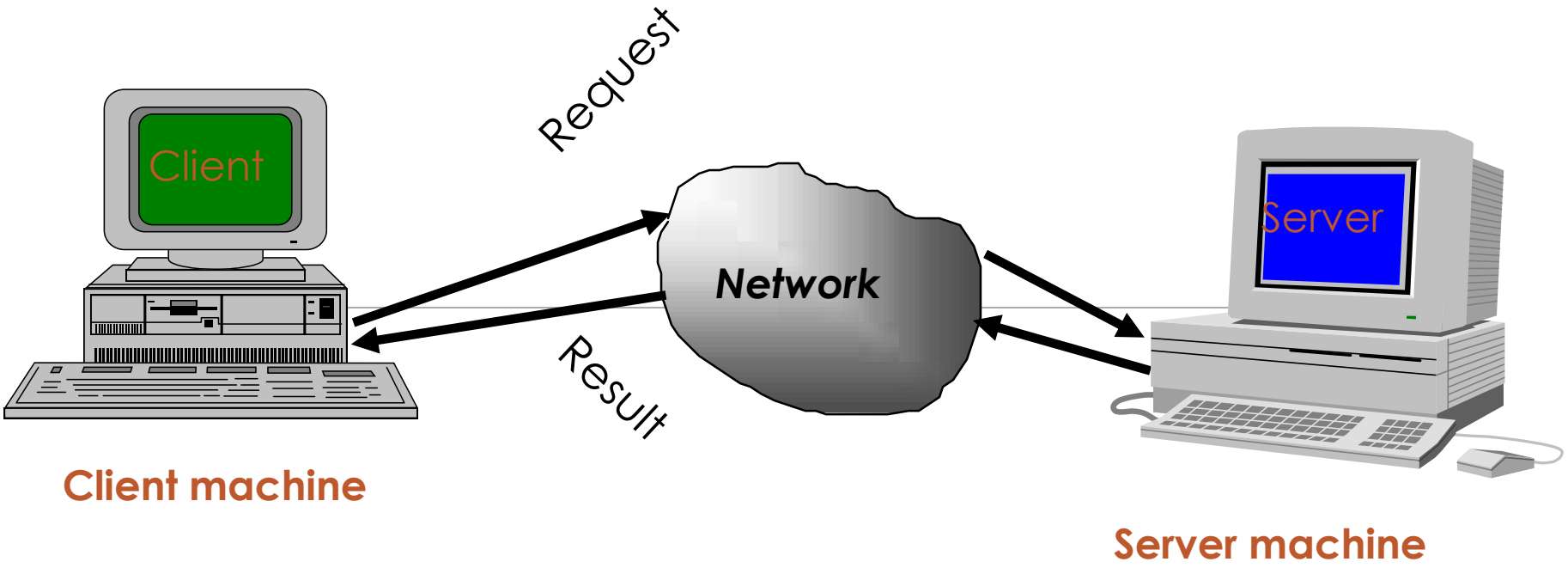
A simple definition

A SIMPLE DEFINITION OF CS IS

" SERVER SOFTWARE ACCEPTS REQUESTS FOR DATA FROM CLIENT SOFTWARE AND RETURNS THE RESULTS TO THE CLIENT"

Elements of C-S Computing

a client, a server, and network



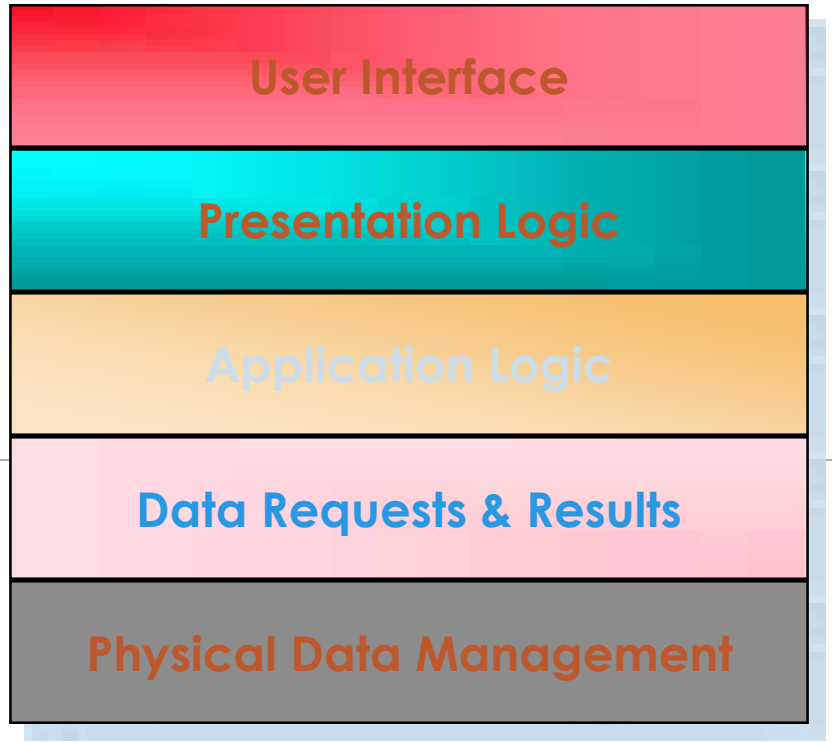
Where Operations are Done

In CS Relationship “most of the application processing is done on a computer (client side), which obtains application services (such as database services) from another computer (server side) in a master slave configuration

CS-Focus is on

IN CLIENT-SERVER COMPUTING MAJOR FOCUS IS ON SOFTWARE

Application Tasks



Categories of Servers

File Server

Data Server

Compute Server

Database Server

Communication Server

Video Server

File Server

File Servers manage a work group's application and data files, so that they may be shared by the group.

Very I/O oriented

Pull large amount of data off the storage subsystem and pass the data over the network

Requires many slots for network connections and a large-capacity, fast hard disk subsystem.

Compute Server

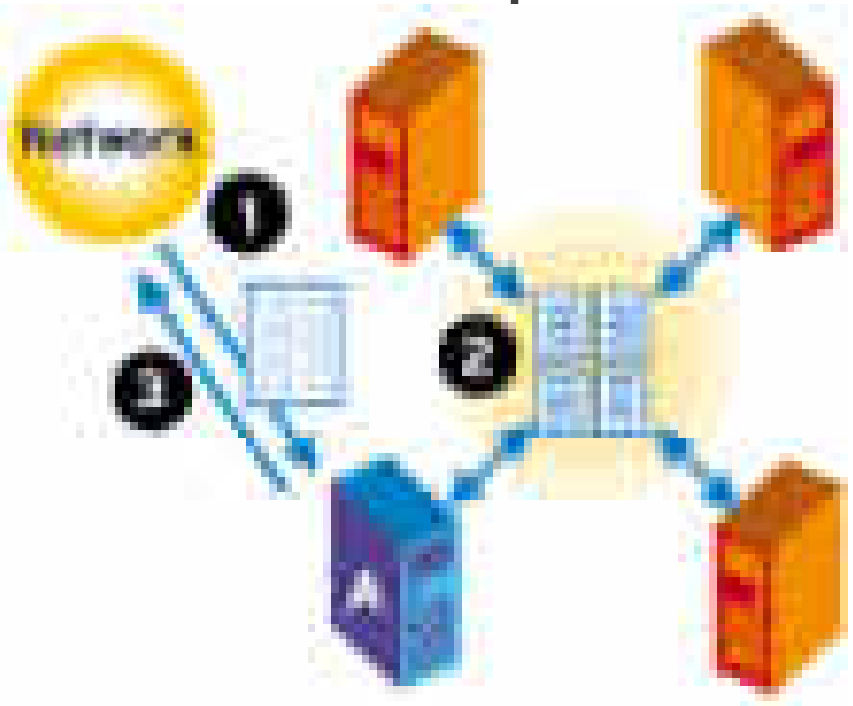
Performs Application logic processing

Compute Servers requires

- **processors with high performance capabilities**
- **large amounts of memory**
- **relatively low disk subsystems**

By separating data from the computation processing, the compute server's processing capabilities can be optimized

Cluster as Compute Server



Data Server

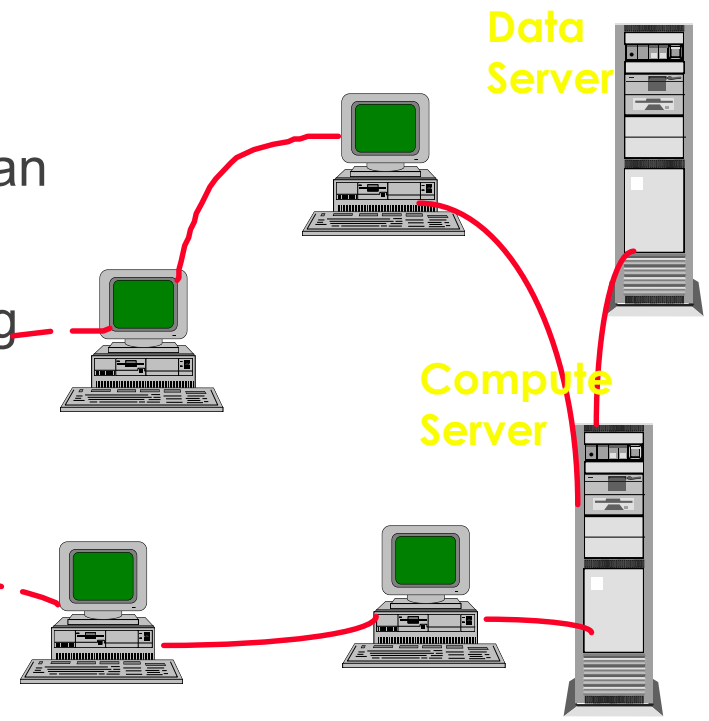
Data-oriented; used only for data storage and management

Since a data server can serve more than one compute server, compute-intensive applications can be spread among multiple severs

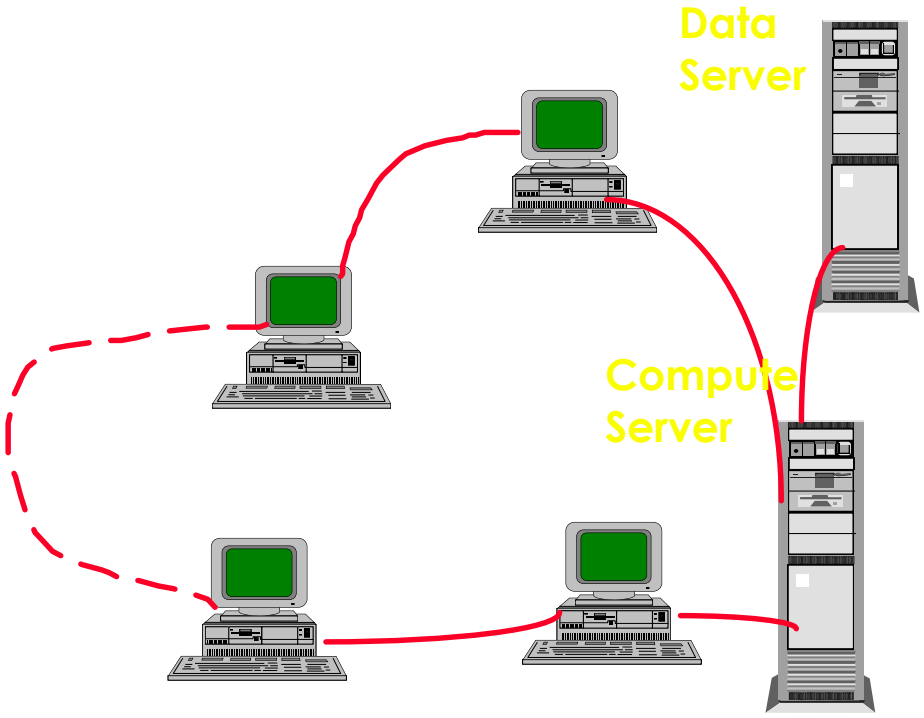
Does not prefer any application logic processing

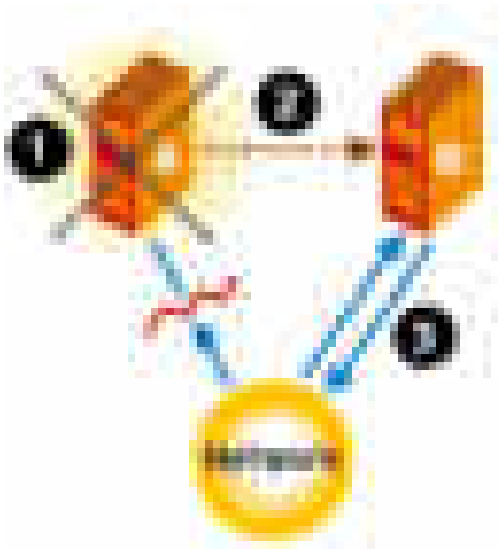
Performs processes such as data validation, required as part of the data management function.

Requires fast processor, large amount of memory and substantial Hard disk capacity.



Cluster as High Availablity Data Server





Database Server

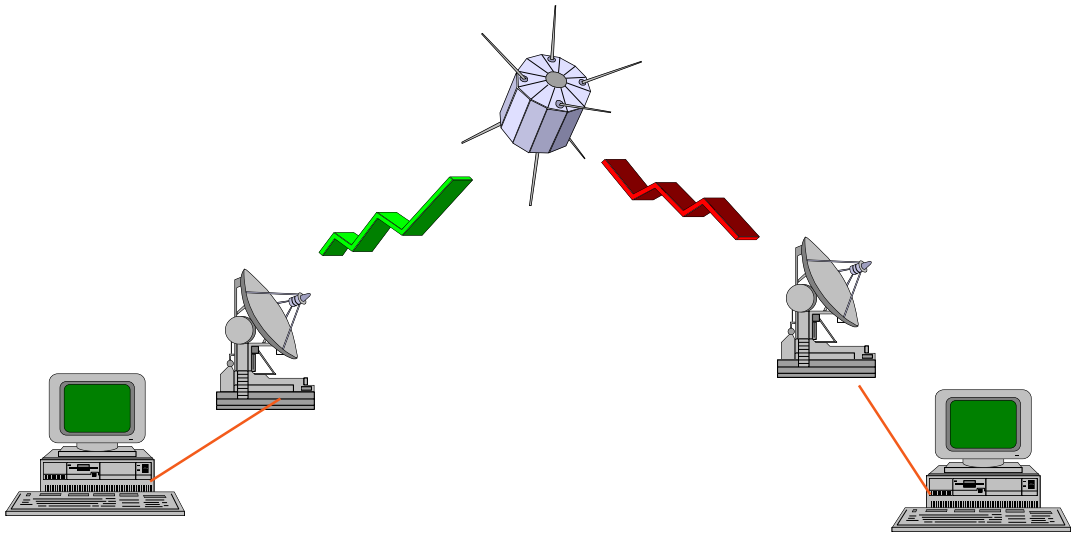
Most typical use of technology in client-server

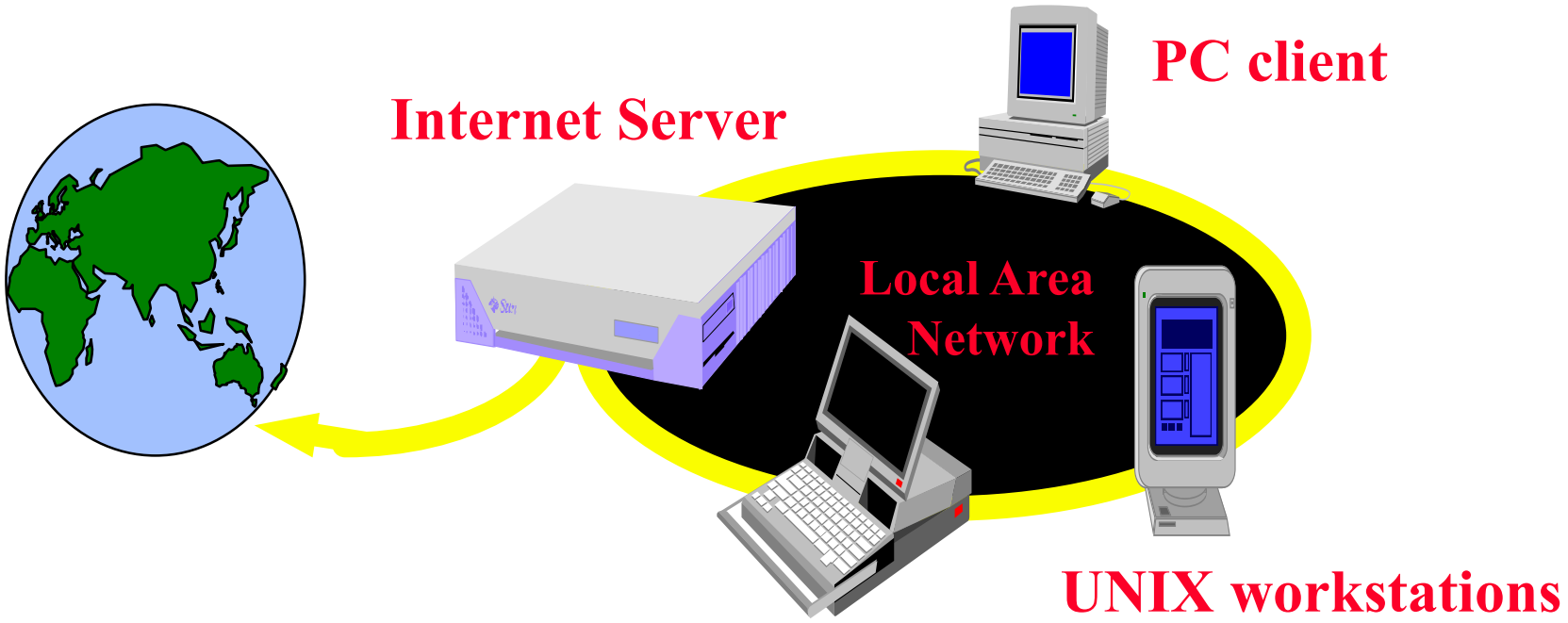
Accepts requests for data, retrieves the data from its database(or requests data from another node)and passes the results back.

Compute server with data server provides the same functionality.

The server requirement depends on the size of database, speed with which the database must be updated, number of users and type of network used.

- Provides communication between LANs, networks & Computers
- E-mail Server & internet server
- Modest system requirements
  - multiple slots
  - fast processor to translate networking protocols





Internet Server

Managing Data Resources

Virgin Mobile Australia Case

Challenge: Fragmented and isolated corporate systems creating a single integrated view of customers and operations

Solution: single integrated corporate data warehouse, using a single data model.

Oracle 9i database provides near real-time access to customer activity, customer profitability, and customer reactions

Illustrates the importance of managing data resources for achieving profitability

File Organization Terms and Concepts

- **Bit:** Smallest unit of data; binary digit (0,1)
- **Byte:** Group of bits that represents a single character
- **Field:** Group of words or a complete number
- **Record:** Group of related fields
- **File:** Group of records of same type

File Organization Terms and Concepts (Continued)

- **Database:** **Group of related files**
- **Entity:** **Person, place, thing, event about which information is maintained**
- **Attribute:** **Description of a particular entity**
- **Key field:** **Identifier field used to retrieve, update, sort a record**

ORGANIZING DATA IN A TRADITIONAL FILE ENVIRONMENT

The Data Hierarchy

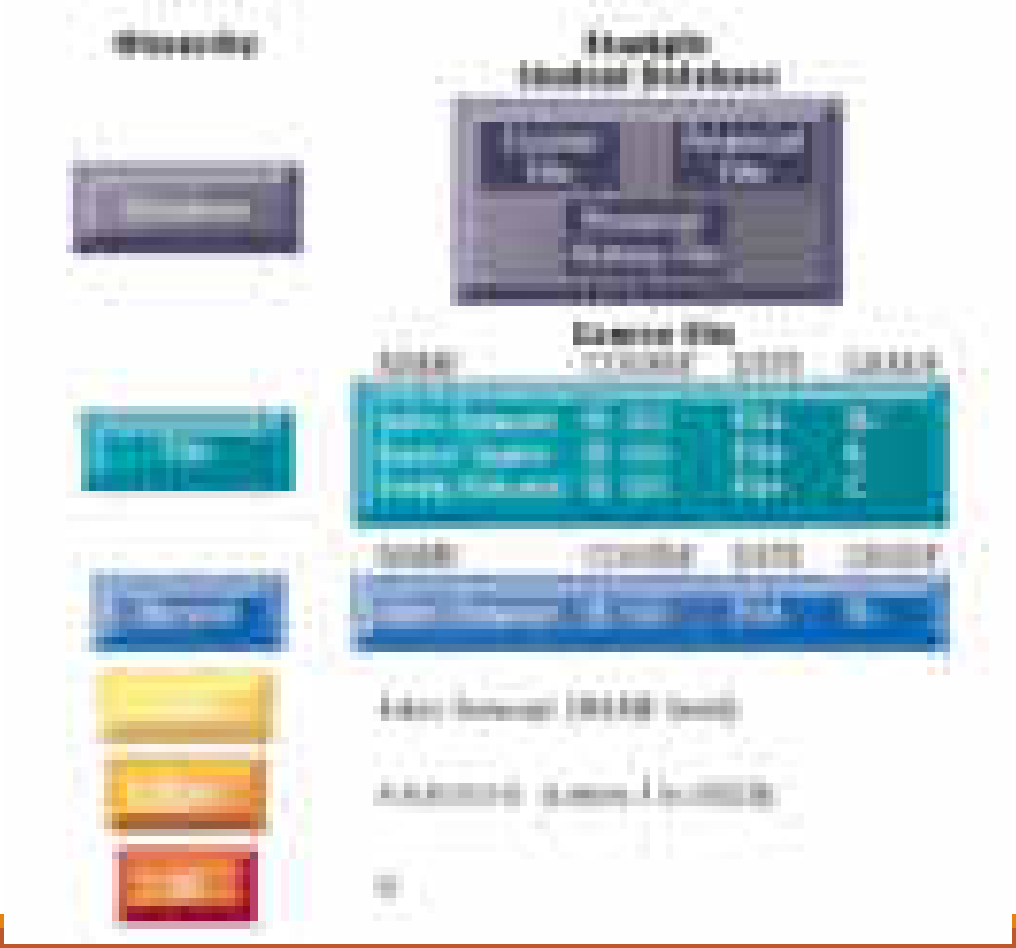


Figure 7-1

ORGANIZING DATA IN A TRADITIONAL FILE ENVIRONMENT

Entities and Attributes

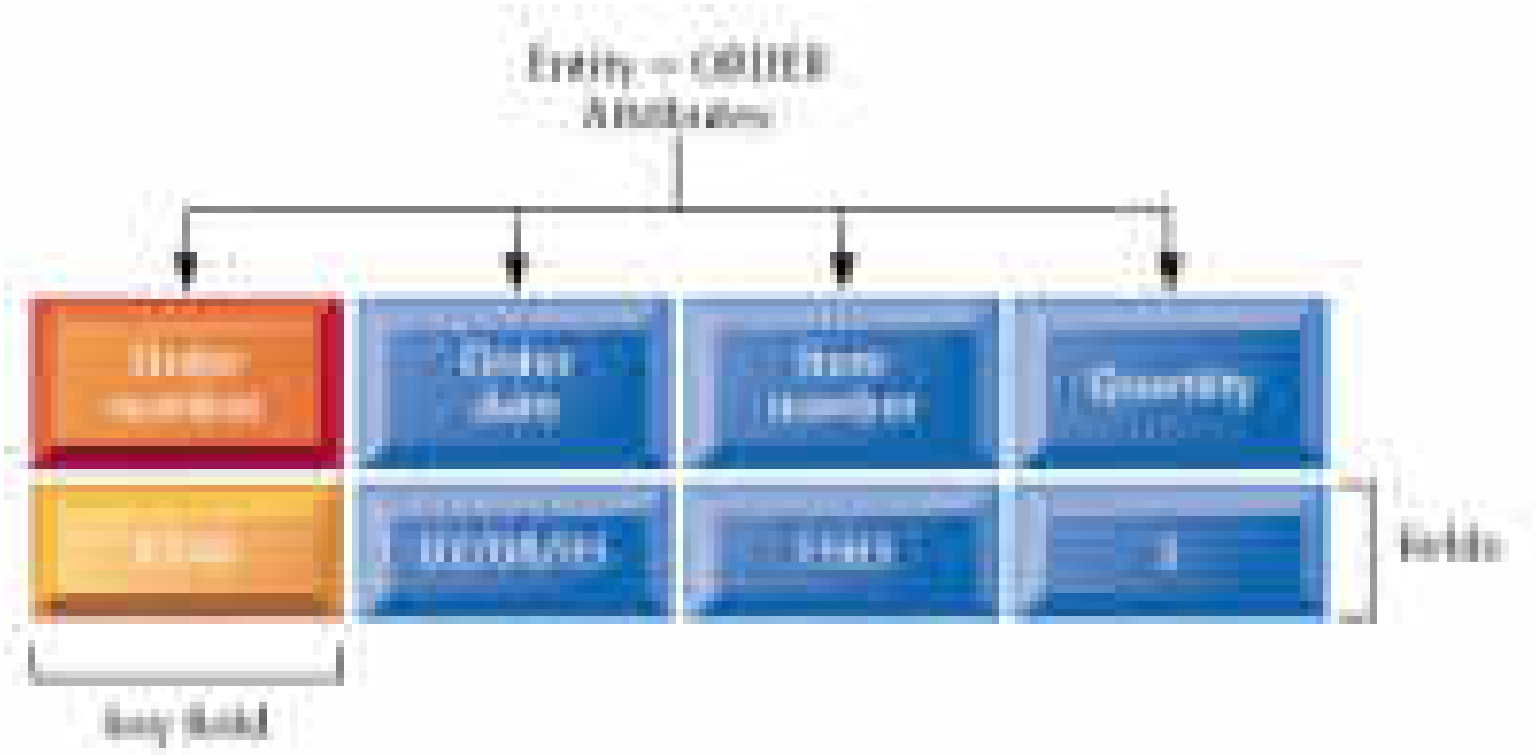


Figure 7-2

Problems with the Traditional File Environment

Data Redundancy and Inconsistency:

- **Data redundancy: The presence of duplicate data in multiple data files so that the same data are stored in more than one place or location**

- **Data inconsistency: The same attribute may have different values.**

Problems with the Traditional File Environment (Continued)

Program-data dependence:

- The coupling of data stored in files and the specific programs required to update and maintain those files such that changes in programs require changes to the data

Lack of flexibility:

- A traditional file system can deliver routine scheduled reports after extensive programming efforts, but it cannot deliver ad-hoc reports or respond to unanticipated information requirements in a timely fashion.

Problems with the Traditional File Environment (Continued)

Poor security:

- Because there is little control or management of data, management will have no knowledge of who is accessing or even making changes to the organization's data.

Lack of data sharing and availability:

- Information cannot flow freely across different functional areas or different parts of the organization. Users find different values of the same piece of information in two different systems, and hence they may not use these systems because they cannot trust the accuracy of the data.

ORGANIZING DATA IN A TRADITIONAL FILE ENVIRONMENT

Traditional File Processing

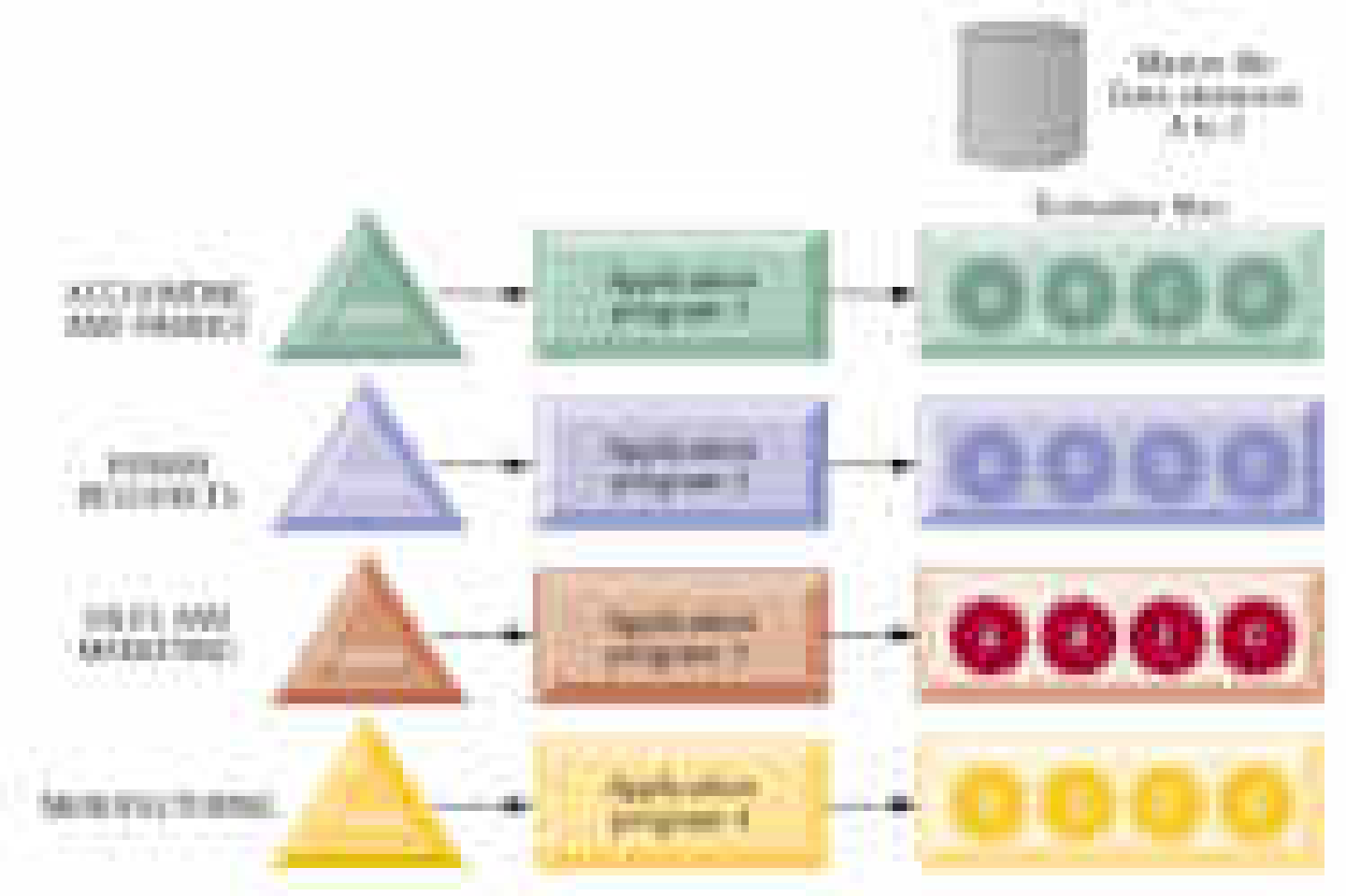


Figure 7-3

Database Management System (DBMS)

- Software for creating and maintaining databases
- Permits firms to rationally manage data for the entire firm
- Acts as interface between application programs and physical data files
- Separates logical and design views of data
- Solves many problems of the traditional data file approach

The Contemporary Database Environment

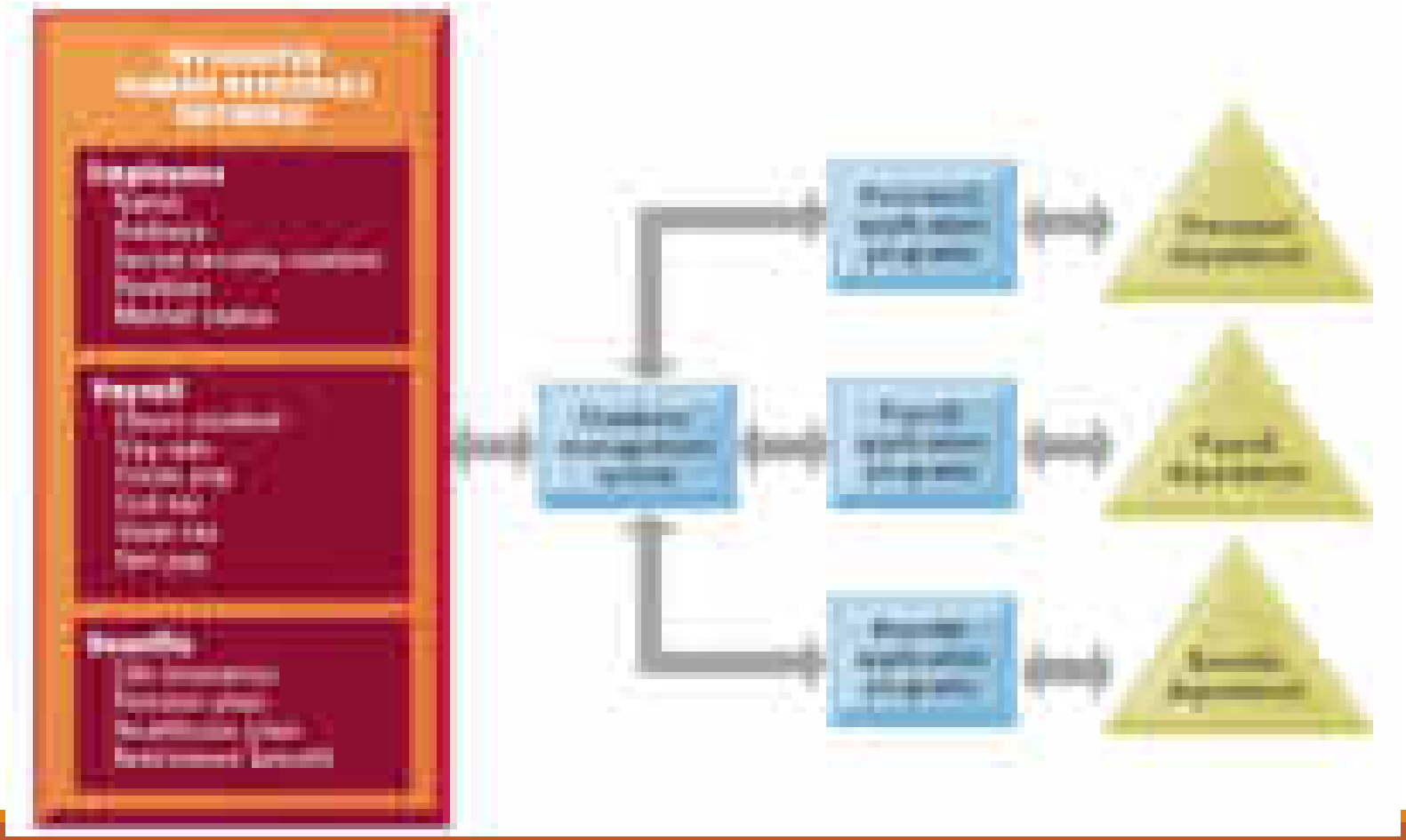


Figure 7-4

Components of DBMS:

- **Data definition language:** Specifies content and structure of database and defines each data element
- **Data manipulation language:** Used to process data in a database
- **Data dictionary:** Stores definitions of data elements and data characteristics

Sample Data Dictionary Report

Figure 7-5

Types of Databases:

- **Relational DBMS**
- **Hierarchical and network DBMS**
- **Object-oriented databases**

Relational DBMS:

- Represents data as two-dimensional tables called relations
- Relates data across tables based on common data element
- Examples: DB2, Oracle, MS SQL Server

The Relational Data Model

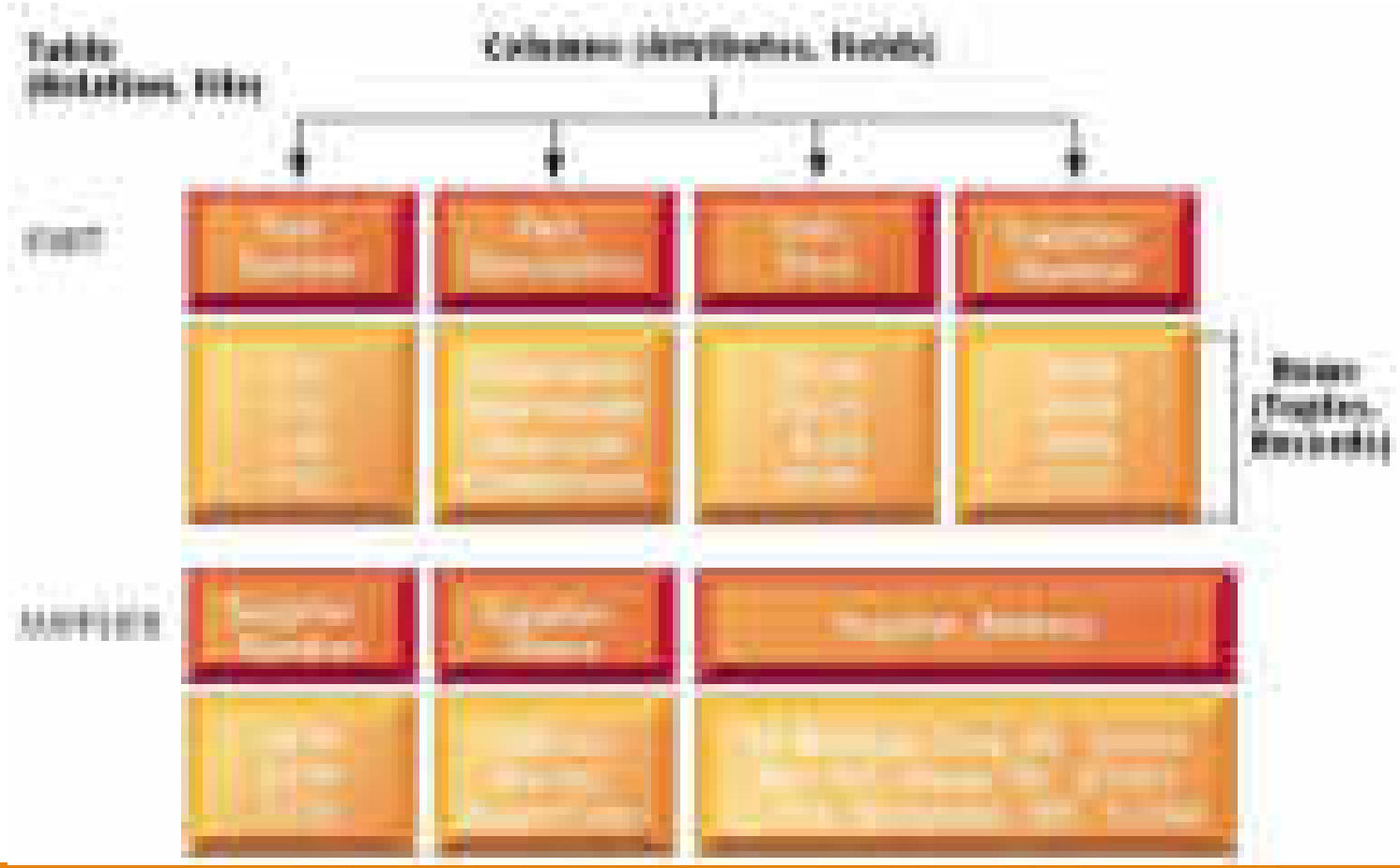


Figure 7-6

Three Basic Operations in a Relational Database:

- **Select:** **Creates subset of rows that meet specific criteria**
- **Join:** **Combines relational tables to provide users with information**
- **Project:** **Enables users to create new tables containing only relevant information**

The Three Basic Operations of a Relational DBMS

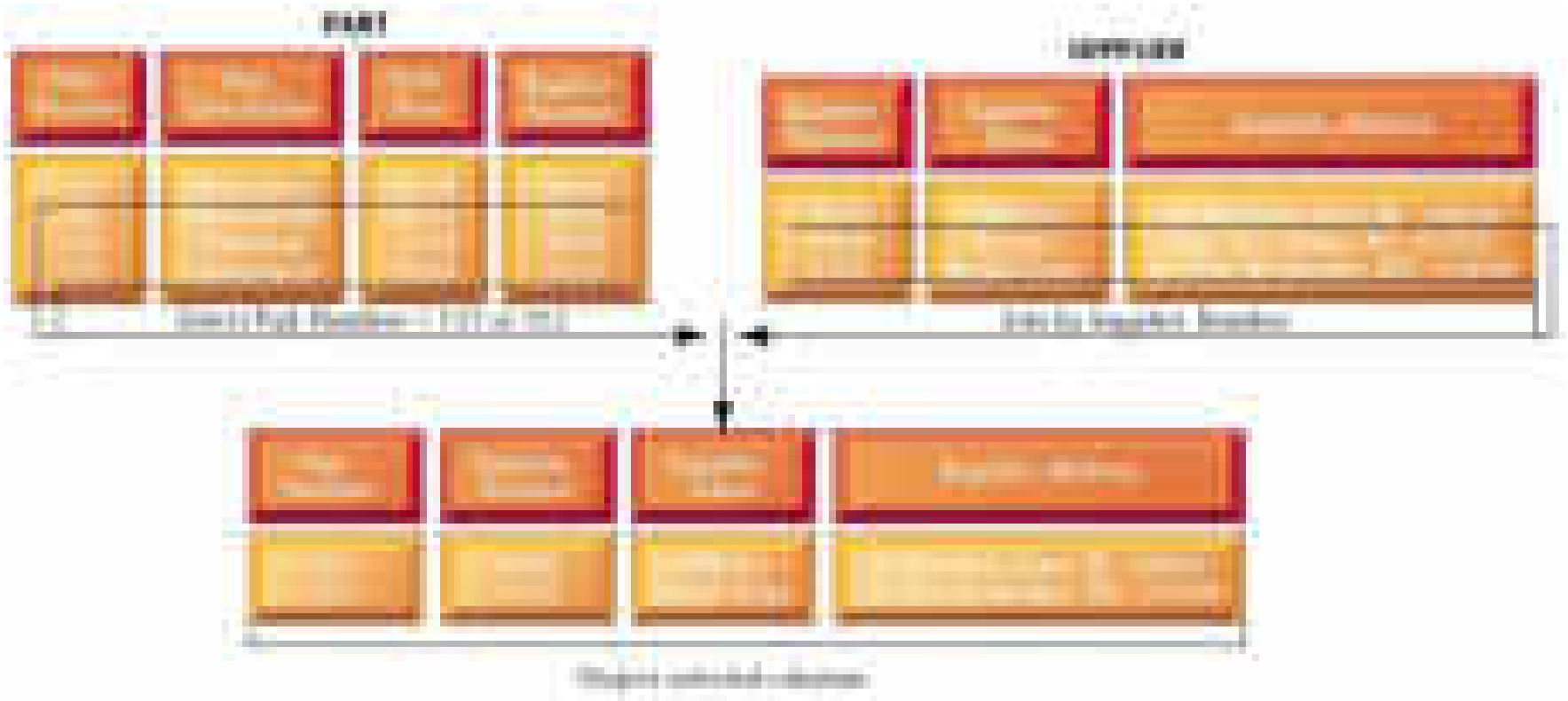


Figure 7-7

Hierarchical and Network DBMS

Hierarchical DBMS:

- **Organizes data in a tree-like structure**
- **Supports one-to-many parent-child relationships**
- **Prevalent in large legacy systems**

A Hierarchical Database for a Human Resources System

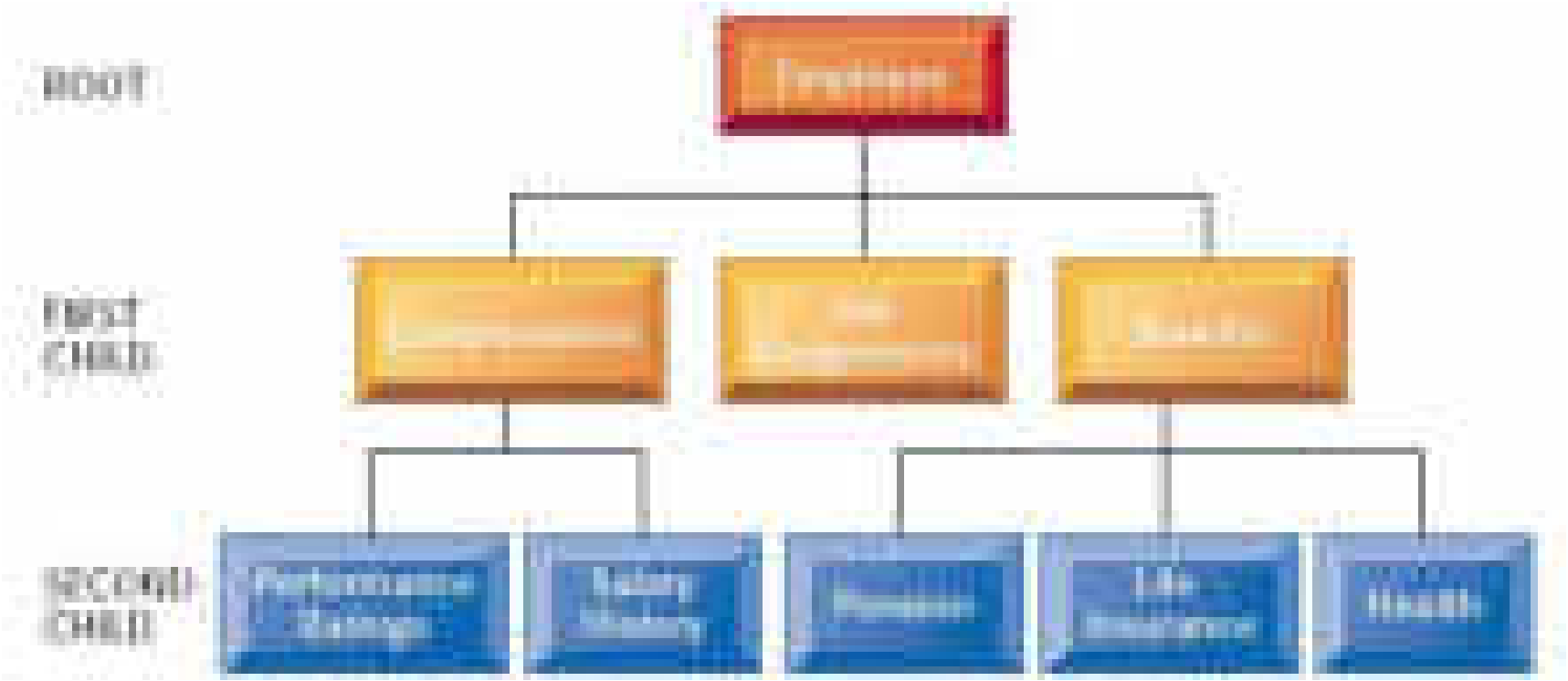


Figure 7-8

Hierarchical and Network DBMS

Network DBMS:

- **Depicts data logically as many-to-many relationships**

The Network Data Model

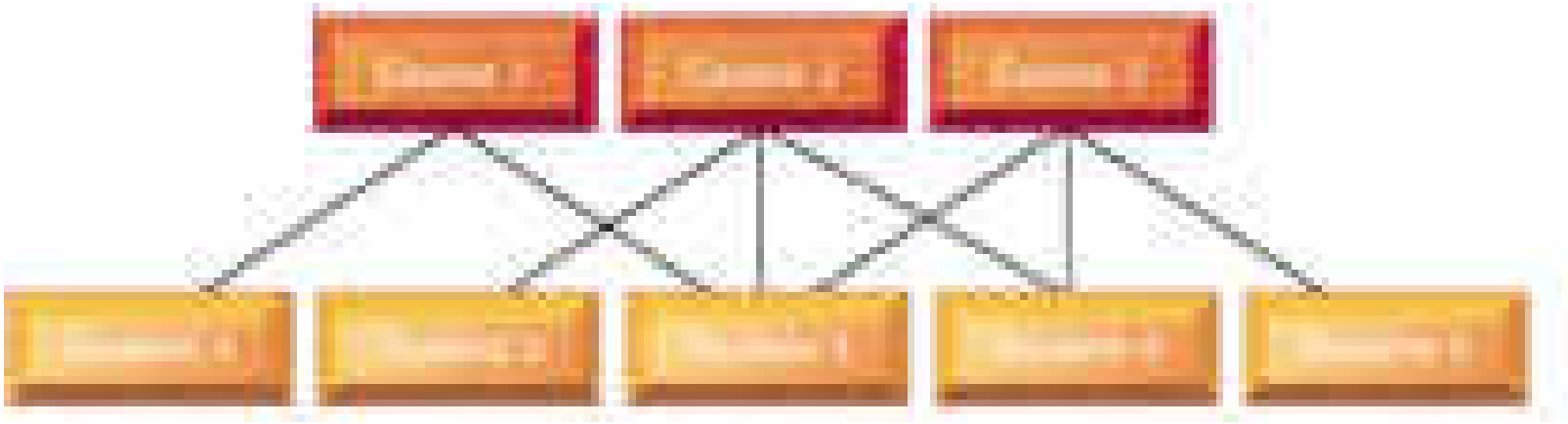


Figure 7-9

Hierarchical and Network DBMS

Disadvantages:

- **Outdated**
- **Less flexible compared to RDBMS**
- **Lack support for ad-hoc and English language-like queries**

Object-Oriented Databases:

- **Object-oriented DBMS:** Stores data and procedures as objects that can be retrieved and shared automatically

- **Object-relational DBMS:** Provides capabilities of both object-oriented and relational DBMS

Designing Databases:

- **Conceptual design:** Abstract model of database from a business perspective
- **Physical design:** Detailed description of business information needs

Designing Databases: (Continued)

- **Entity-relationship diagram:** Methodology for documenting databases illustrating relationships between database entities

- **Normalization:** Process of creating small stable data structures from complex groups of data

An Unnormalized Relation for ORDER

Figure 7-10

Normalized Tables Created from ORDER

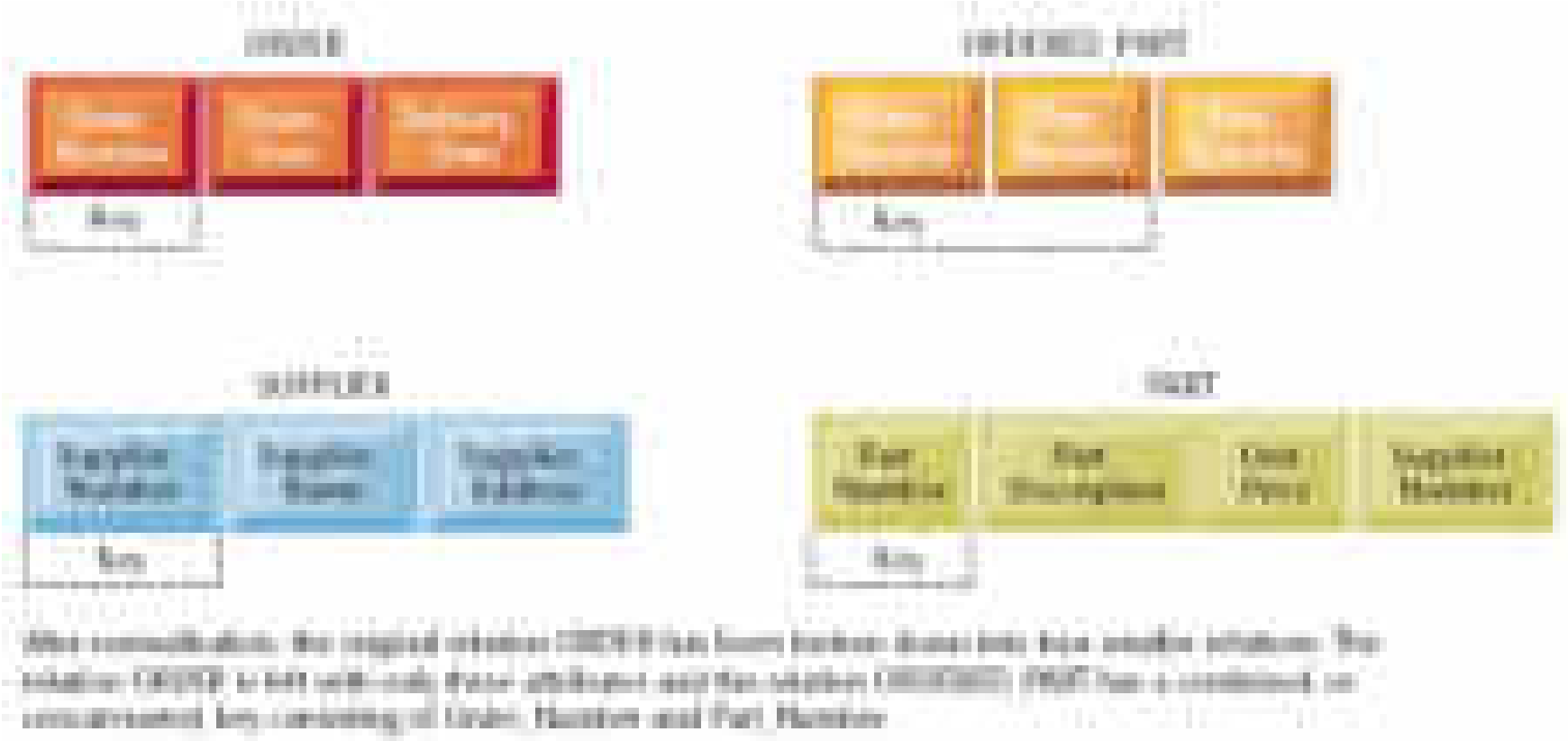


Figure 7-11

An Entity-Relationship Diagram

Figure 7-12

Distributing Databases

Centralized database:

- **Used by single central processor or multiple processors in client/server network**
- **There are advantages and disadvantages to having all corporate data in one location.**
- **Security is higher in central environments, risks lower.**
- **If data demands are highly decentralized, then a decentralized design is less costly, and more flexible.**

Distributed database:

- Databases can be decentralized either by partitioning or by replicating

- **Partitioned database:** Database is divided into segments or regions. For example, a customer database can be divided into Eastern customers and Western customers, and two separate databases maintained in the two regions.

- **Duplicated database:** The database is completely duplicated at two or more locations. The separate databases are synchronized in off hours on a batch basis.

- Regardless of which method is chosen, data administrators and business managers need to understand how the data in different databases will be coordinated and how business processes might be effected by the decentralization.

Distributed Databases

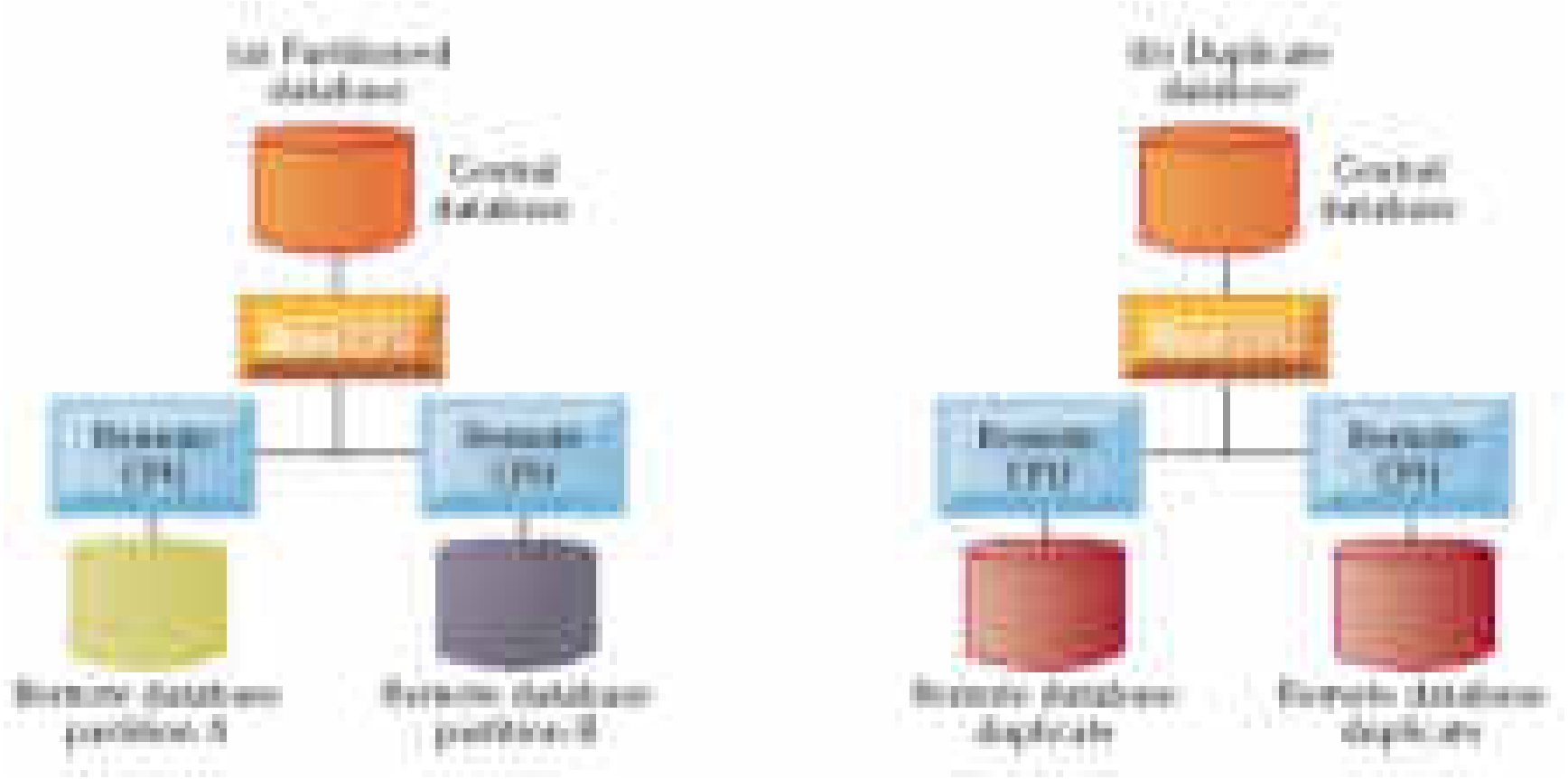


Figure 7-13

Ensuring Data Quality: (Continued)

- **The quality of decision making in a firm is directly related to the quality of data in its databases.**

- **Data Quality Audit: Structured survey of the accuracy and level of completeness of the data in an information system**

- **Data Cleansing: Consists of activities for detecting and correcting data in a database or file that are incorrect, incomplete, improperly formatted, or redundant**

Chapter 10

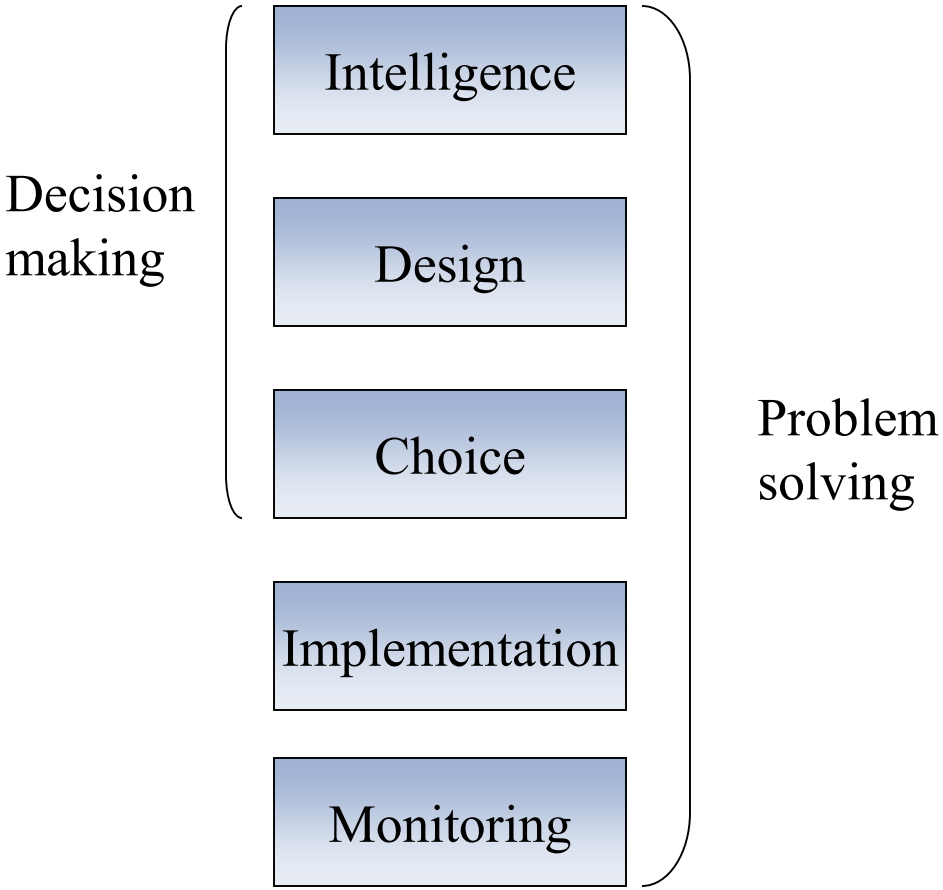
Decision Support Systems

Decision Support Systems

Decision support systems (DSS)

- Offer potential to assist in solving both semi-structured and unstructured problems

Decision Making as a Component of Problem Solving



Solution Types

Optimization model

- Finding the best solution

Satisficing model

- Finding a good -- but not necessarily the best -- solution to a problem

Heuristics

- Commonly accepted guidelines or procedures that usually find a good solution

Problem Solving Factors

Multiple decision objectives

Increased alternatives

Increased competition

The need for creativity

Social and political actions

International aspects

Technology

Time compression

Characteristics of a DSS (1)

Handles large amounts of data from different sources

Provides report and presentation flexibility

Offers both textual and graphical orientation

Characteristics of a DSS (2)

Supports drill down analysis

Performs complex, sophisticated analysis and comparisons using advanced software packages

Supports optimization, satisficing, and heuristic approaches

Characteristics of a DSS (3)

Performs different types of analyses

- "What-if" analysis
  - Makes hypothetical changes to problem and observes impact on the results
- Simulation
  - Duplicates features of a real system
- Goal-seeking analysis
  - Determines problem data required for a given result

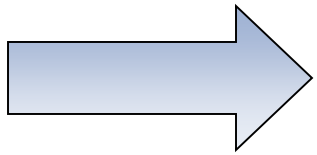
Goal Seeking Example

You know the desired result

You want to know the required input(s)

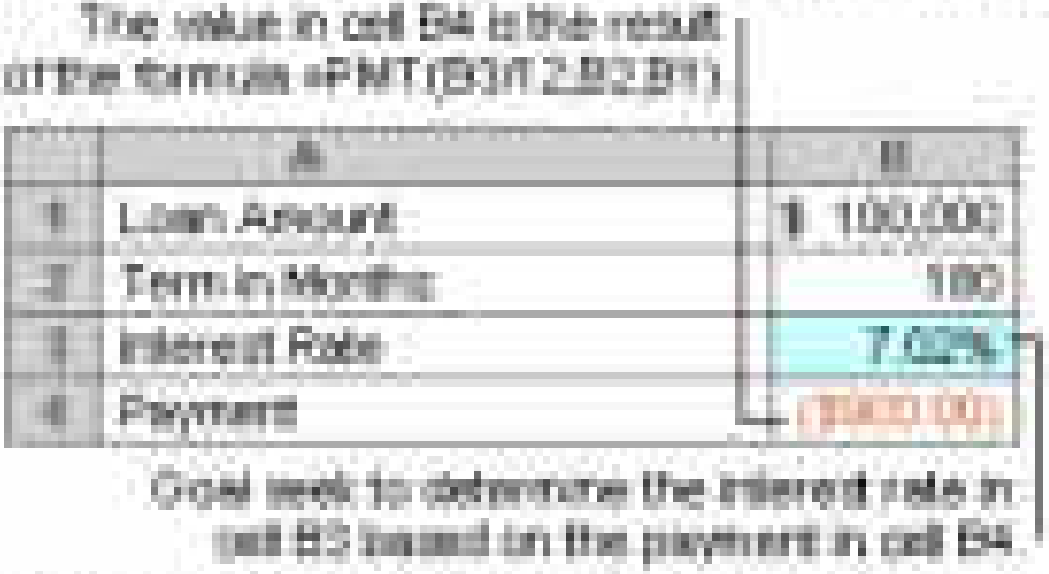
Example:

- Microsoft Excel's "Goal Seek" and "Solver" functions



Goal Seek

When you know the desired result of a single formula but not the input value the formula needs to determine the result, you can use the **Goal Seek** feature. When goal seeking, Microsoft Excel varies the value in one specific cell until a formula that's dependent on that cell returns the result you want.



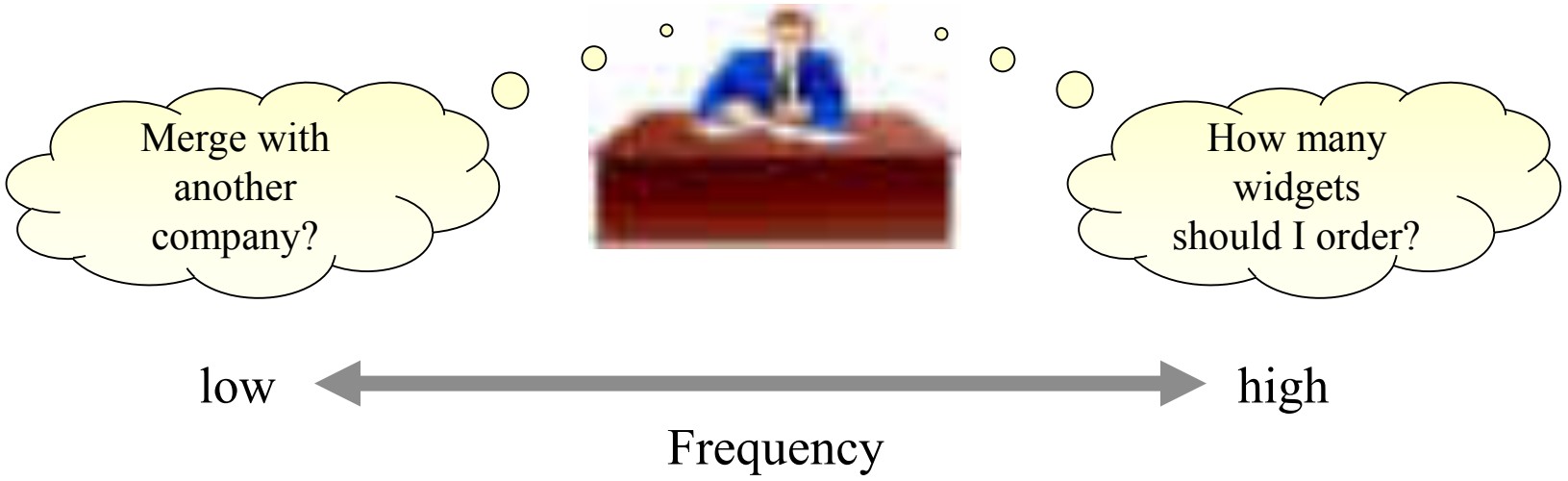
For example, use **Goal Seek** to change the interest rate in cell B3 incrementally until the payment value in B4 equals $900.00.

Excel demo

Capabilities of a DSS (1)

Supports

- Problem solving phases
- Different decision frequencies



Capabilities of a DSS (2)

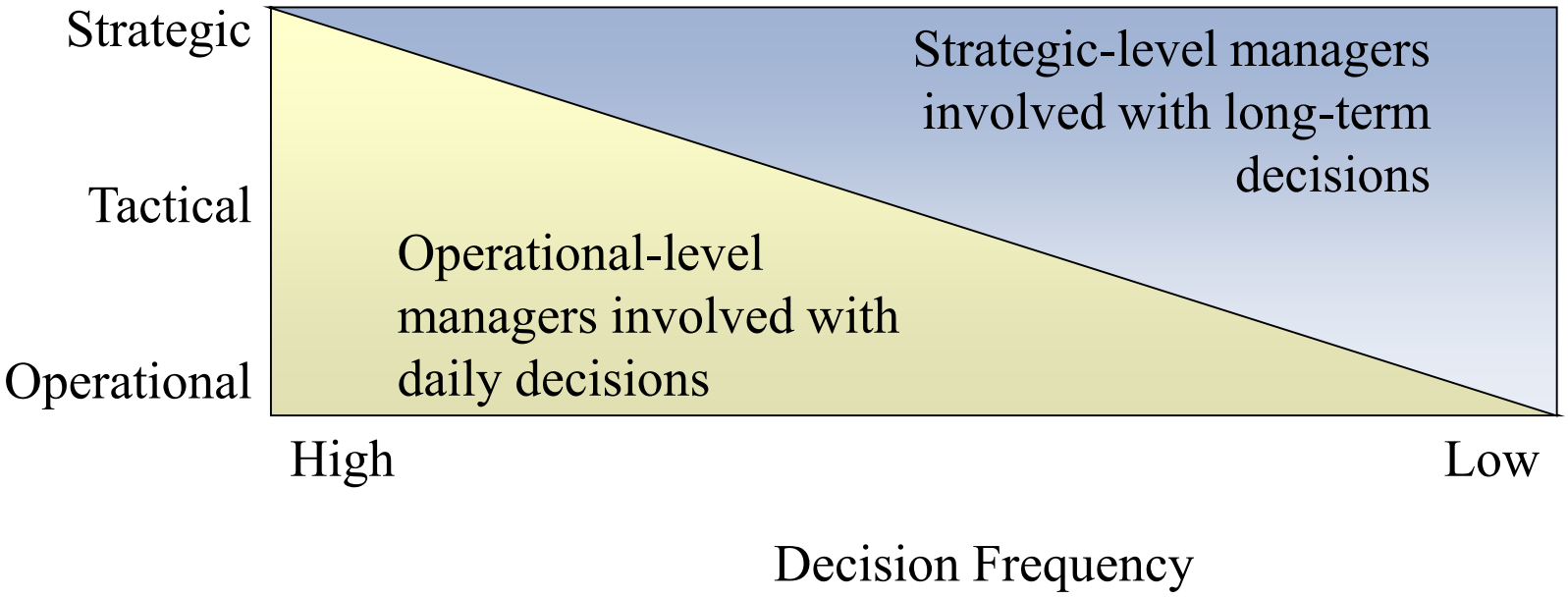
Highly structured problems

- Straightforward problems, requiring known facts and relationships.

Semi-structured or unstructured problems

- Complex problems wherein relationships among data are not always clear, the data may be in a variety of formats, and are often difficult to manipulate or obtain

Decision Making Levels



Integration of TPS, MIS, and DSS

In many organizations they are integrated through a common database

Separation of DSS transactions in the database from TPS and MIS transactions may be important for performance reasons

Web-Based Decision Support Systems

Web-based decision support systems

- Decision support system software provides business intelligence through web browser clients that access databases either through the Internet or a corporate intranet

Components of a DSS

Model management software (MMS)

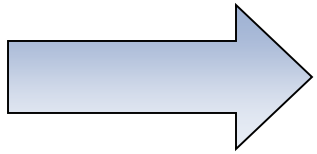
- Coordinates the use of models in the DSS

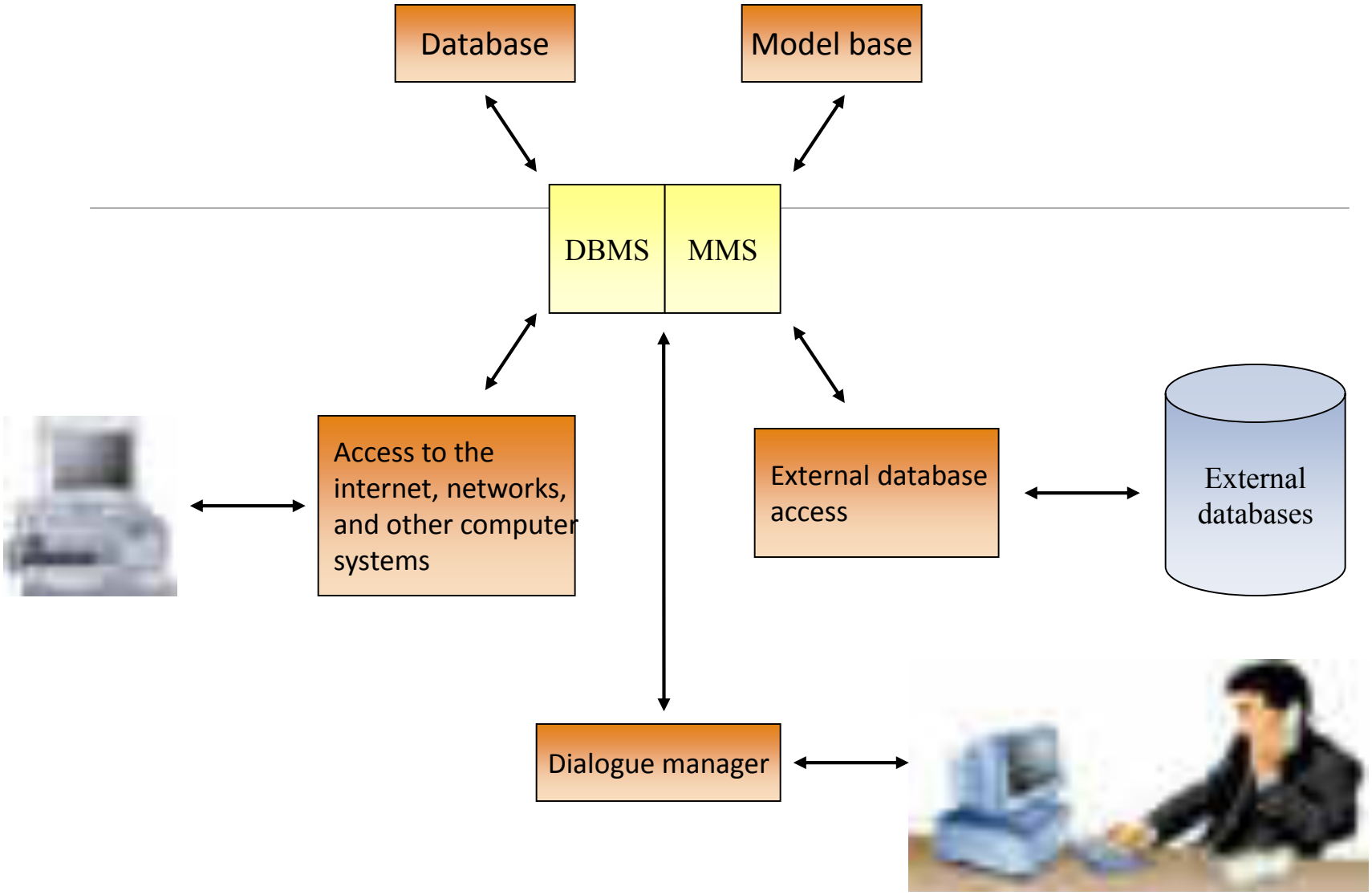
Model base

- Provides decision makers with access to a variety of models

Dialogue manager

- Allows decision makers to easily access and manipulate the DSS




Database
Model base
DBMS
MMS
Access to the internet, networks, and other computer systems
External database access
External databases
Dialogue manager

Model Base

Model Base

- Provides decision makers with access to a variety of models and assists them in decision making

Models

- Financial models
- Statistical analysis models
- Graphical models
- Project management models

Advantages and Disadvantages of Modeling

- Advantages
  - Less expensive than custom approaches or real systems.
  - Faster to construct than real systems
  - Less risky than real systems
  - Provides learning experience (trial and error)
  - Future projections are possible
  - Can test assumptions
- Disadvantages
  - Assumptions about reality may be incorrect
  - Accuracy of predications often unreliable
  - Requires abstract thinking

5-1: What Exactly is an EIS?

An EIS is a special type of DSS designed to support decision making at the top level of an organization.

An EIS may help a CEO to get an accurate picture of overall operations, and a summary of what competitors are doing.

These systems are generally easy to operate and present information in ways easy to quickly absorb (graphs, charts, etc.).

A Typical EIS Session

The session may start with a report of the firm's financial and business situation. Key performance indicators are clearly displayed.

The EIS will allow the executive to drill down from any figure to see its supporting data.

The executive can select a level of detail (for example, sales by state) if further investigation is needed.

This top down approach should lead to better decisions.

What an EIS is NOT

It is not a substitute for other computer-based systems. The EIS actually feeds off these systems.

It does not turn the executive suite into a haven for computer “techies”.

It should be viewed by senior management as a trusted assistant who can be called on when and where necessary.

5-2: Some EIS History

The term EIS was first coined at MIT in the 1970s.

The first EISs were developed by large firms willing to take risks to gain competitive advantage.

By the mid 1980s several vendors had developed broad customer bases and support for EIS technology continues today.

5-3: Why Are Top Executives So Different?

They are enterprise-oriented in thinking

The possess the broadest span of control

They are responsible for establishing policy

They represent the organization to the external environment

Their actions have considerable financial and human consequences

Executive Information Needs

Disturbance management may require around-the-clock attention.

Entrepreneurial activities require the executive to predict changes in the environment.

Resource allocation tasks require the manager to choose when and where the limited resources are deployed.

Negotiation requires up-to-the-minute info to help build consensus.

Types of Executive Information

Accounting systems that relate revenue to specific operational areas are more important than traditional accounting systems.

Information about markets, customers and suppliers is valuable in determining strategy.

The information required is often spread across several computer systems and located throughout the organization.

The information used is often short-term and volatile.

Methods for Determining Information Needs

Rockart identified five basic methods for determining information needs:

- By-Product Method
- Null Method
- Key Indicator Method
- Total Study Method
- Critical Success Factors Method

5-4: EIS Components

Early EIS products were developed for use on high-powered computers, but current products target the client/server platform.

These more-flexible platforms can adapt to changes in the organization and in technology.

Use of real-time data leads to faster, more informed decisions.

Hardware Components

An EIS requires no specific or unique hardware.

A key issue is to be sure that the EIS components optimize and conform to the organization's computing resources.

The system must be configured so that the resources are well-matched to the executives using them.

Software Components

In contrast to hardware, software is usually highly specialized to the problem domain.

This specialization is often achieved by using off-the-shelf components for the EIS backbone, and customized modules to meet specific needs.

Lotus Notes is a good example. It can be used alone, or can accommodate third-party plug-in modules.

Current EIS Technologies

Dobrzeniecki proposed a three-tiered functional categorization:

- Category 1 products include a full set of applications from one vendor
- Category 2 products are implemented on top of DSS products developed by the same vendor
- Category 3 products bind together any number of products owned by the firm.

5-5: Making the EIS Work

Building an EIS is much like building any other type of modern information system.

A structured development approach should be followed from design to implementation.

Yet, EIS projects tend to be unique and require working in the realm of executives.

Building an EIS may turn out to be the most formidable task a developer ever faces.

An EIS Development Framework

Watson, *et al* suggest a framework with three components:

1. Structural perspective: focus is on people and data as they relate to the EIS.
2. Development process: the dynamics and interactions are identified.
3. User-system dialog: contains an action language for processing the commands.

Some EIS Limitations and Pitfalls to Avoid

Cost: a 1991 survey showed an average development cost of $365,000 with annual operating costs of $200,000.

Technological limitations: the EIS needs to be seamlessly integrated into the company's current IT architecture, so it is a formidable challenge to the designer.

Organizational limitations: the organizational structure might not be right.

Organizational Limitations

Agendas and time biases: the EIS represents only part of executive's total agenda, and it may become easy to be overly reliant on it.

Managerial synchronization: heavy reliance on the timely, ad-hoc, EIS reports may disrupt stable, well-established reporting cycles.

Destabilization: fast EIS response may cause the executive to react too swiftly, leading to less stability in the organization.

Failure is not an Acceptable Alternative

Some factors that contribute to EIS failure:

- Lack of management support
- Political problems
- Developer failures
- Technology failures
- Costs
- Time

5-6: The Future of Executive Decision Making and the EIS

Several conditions will merge to transform the technology. Some are easy to predict, some not. Two that we can foresee are:

- Increased comfort with computing technology in the executive suite will make innovations more readily accepted.
- Broadening of executive responsibilities will broaden the demand for information.

Enterprise Resource Planning (ERP) Systems

What is ERP?

An ERP system is an attempt to integrate all functions across a company to a single computer system that can serve all those functions' specific needs.

"Integration" is the key word for ERP implementation.

What is ERP?

It may also integrate key customers and suppliers as part of the enterprise's operation.

It provides integrated database and custom-designed report systems.

It adopts a set of "best practices" for carrying out all business processes.

Major Reasons for Adopting ERP

Integrate financial information

Integrate customer order information

Standardize and speed up operations processes

Reduce inventory

Standardize Human Resources information

Potential Benefits of ERP

Internal Benefits

- Integration of a single source of data
- Common data definition
- A real-time system
- Increased productivity
- Reduced operating costs
- Improved internal communication
- Foundation for future improvement

Potential Benefits of ERP

External Benefits

- Improved customer service and order fulfillment
- Improved communication with suppliers and customers
- Enhanced competitive position
- Increased sales and profits

Major Phases of ERP Implementation (Kent Sandoe, Enterprise Integration)

Initiation – develop business case, project scope, and implementation strategy

Planning – establish implementation team, determine goals and objectives, establish metrics

Analysis and process design – analyze and improve existing processes, map new processes to be adopted by the system

Major Phases of ERP Implementation (Kent Sandoe, Enterprise Integration)

Realization – install a base system, customization, and test the system

Transition – replace the formal system with the new system, data conversion

Operation – monitor and improve system performance, provide continued training and technical support

Major Challenges to ERP Implementation

Limitations of ERP technical capabilities

Inconsistency with existing business processes

Costs - implementation (hardware, software, training, consulting) and maintenance

Impact on organizational structure (front office vs. back office, product lines, etc.)

Changes in employee responsibilities

Major Challenges to ERP Implementation

Flexibility of software system upgrades

Implementation timelines

Availability of internal technical knowledge and resources

Education and training

Implementation strategy and execution

Resistance to change

Benefits of ERP Implementation
(META Group Survey)

Benefits are mostly in terms of cost containment rather than revenue increase.

53 companies (out of 63) reported annual savings of over $5 millions with the median annual saving of $1.6 million. Nine companies account for 73.4% of the reported savings.

The study found that much of the ERP value is in indirect, non-quantifiable benefits.

A number of companies surveyed had a negative net present value.

ERP Implementation - Key Enablers (APQC Best-Practice Report)

The organization is prepared for the change.

The executive leaders are active and visible in their support.

The initiative is seen as a business imperative by the organization.

The resources are available to conduct the project completely.

A good packaged system is used and not customized.

The user group is trained to use the software before it is implemented.

New Developments In ERP

Availability of web-based and wireless ERP systems

Adoption of easy-to-install ERP systems

Linkage to other software systems, e.g., supply chain management system, e-commerce, customer relationship management system

Information systems & Business processes

IMPROVING BUSINESS PROCESSES WITH INFORMATION SYSTEMS

What Is a Business Process?

The method with which work is organized, coordinated and controlled is the Business Process.

Business Processes are also the flow of information – sets of activities through the organization.

Examples include: processing payroll, account payables, class registration, inventory management, sales, purchases etc.

Activities transform resources and information of one type into resources and information of another type. In a payroll process, the activity of paying an employee turns into an activity of salaries and benefits information report for the organization.

Business Process & Functional areas

Traditionally, business processes are often tied to specific functional area of the organization.

Examples include the following:

Function	Process
Sales & Marketing	Identify potential clients and Sell products
Finance & Accounting	Processing payroll, managing cash accounts, paying creditors , collecting receivables.
Human Resources	Hiring employees, managing employees' benefits

Business Process & information systems

How do information systems enhance business processes?

- Automation
- Change the flow of information replacing sequential steps with tasks that can be performed. The result is the elimination of delays in decision making.
- Transform the way an organization works and reduce costs for everyone – textbooks can now be ordered online at lower costs.

In some processes, several activities use one information system.

In other processes, each activity has its own information system, and in still other processes, some activities use several different information systems.

Business Process & Functional areas

Processes affect many functional areas.

Consider the steps involved in fulfilling a customer order.

- Customer enters request for order via website or makes a phone call to Sales (Sales function).
- Request would pass to Accounting to verify that the customer can pay. (Accounting function) and pass the verification back to Sales.
- The Warehouse department will then pull the item(s) from inventory and arrange for shipping perhaps through an independent shipper such as FedEx or UPS. (Production or Warehouse).
- This can and usually results in the fragmentation of information and data across the organization.
- How do we resolve this problem?

MAJOR ROLES OF OFFICES

- COORDINATE WORK OF LOCAL PROFESSIONALS AND INFORMATION WORKERS
- COORDINATE WORK ACROSS LEVELS AND FUNCTIONS
- COUPLE ORGANIZATION TO EXTERNAL ENVIRONMENT

*

OFFICE AUTOMATION SYSTEMS

MANAGING DOCUMENTS:

- CREATION
- STORAGE
- RETRIEVAL
- DISSEMINATION
- TECHNOLOGY: Word processing, desktop publishing, document imaging, Web publishing, work flow managers

*

OFFICE AUTOMATION SYSTEMS

SCHEDULING:

FOR INDIVIDUALS & GROUPS:

- ELECTRONIC CALENDARS
- GROUPWARE
- INTRANETS

*

OFFICE AUTOMATION SYSTEMS

COMMUNICATING:

INITIATING, RECEIVING, MANAGING:

- **VOICE**
- **DIGITAL**
- **DOCUMENTS**
- **TECHNOLOGY: E-mail, voice mail, digital answering systems, GroupWare, intranets**

*

OFFICE AUTOMATION SYSTEMS

MANAGING DATA:

EMPLOYEES, CUSTOMERS, VENDORS:

- DESKTOP DATABASES
- SPREADSHEETS
- USER-FRIENDLY INTERFACES TO MAINFRAME DATABASES

*

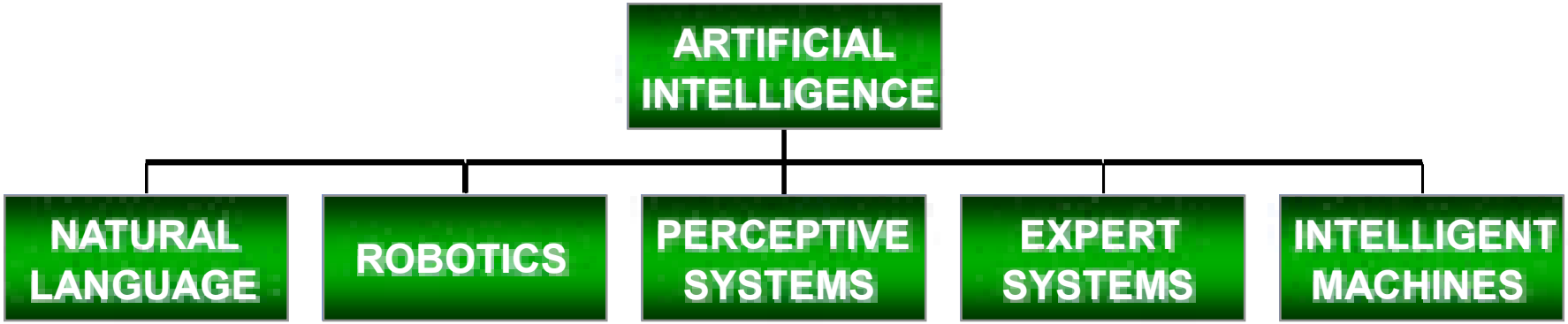
OFFICE AUTOMATION SYSTEMS

MANAGING DATA:

- **DOCUMENT IMAGING SYSTEMS:** Systems convert documents, images into digital form (e.g.: optical character recognition; microfiche)
- **JUKEBOX:** Storage & retrieving device for CD-ROMs & other optical disks
- **INDEX SERVER:** Imaging system to store / retrieve document

*

AI FAMILY


ARTIFICIAL INTELLIGENCE
NATURAL LANGUAGE
ROBOTICS
PERCEPTIVE SYSTEMS
EXPERT SYSTEMS
INTELLIGENT MACHINES

CHAPTERS

8–9

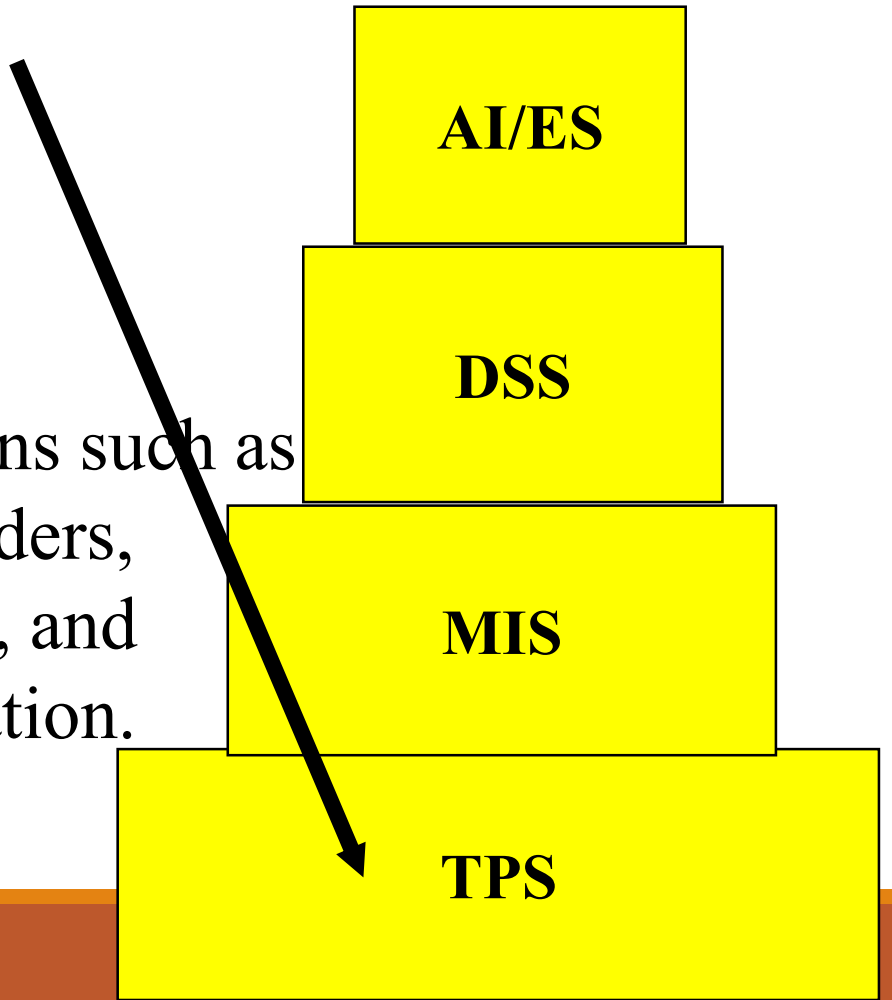
TRANSACTION PROCESSING, ELECTRONIC COMMERCE, AND ENTERPRISE RESOURCE PLANNING SYSTEMS

TRANSACTION PROCESSING

TPS, MIS, DSS, and AI/ES

Transaction Processing Systems (TPS)

• Performs routine operations and serve as a foundation for other systems.



Transactions

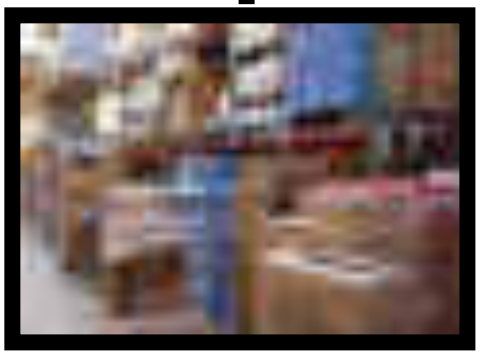
• The basic business operations such as customer orders, purchase orders, receipts, time cards, invoices, and payroll checks in an organization.

Sales/Inventory/Order Transactions

UPC from scanner

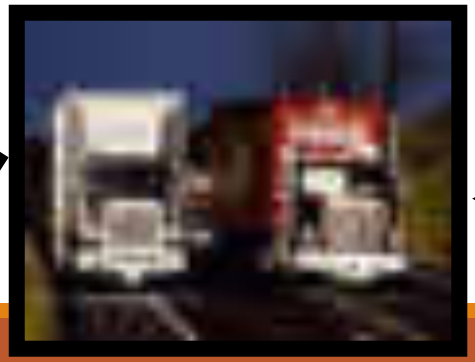
Record sale/date/time.
Update inventory.

Price/description of item



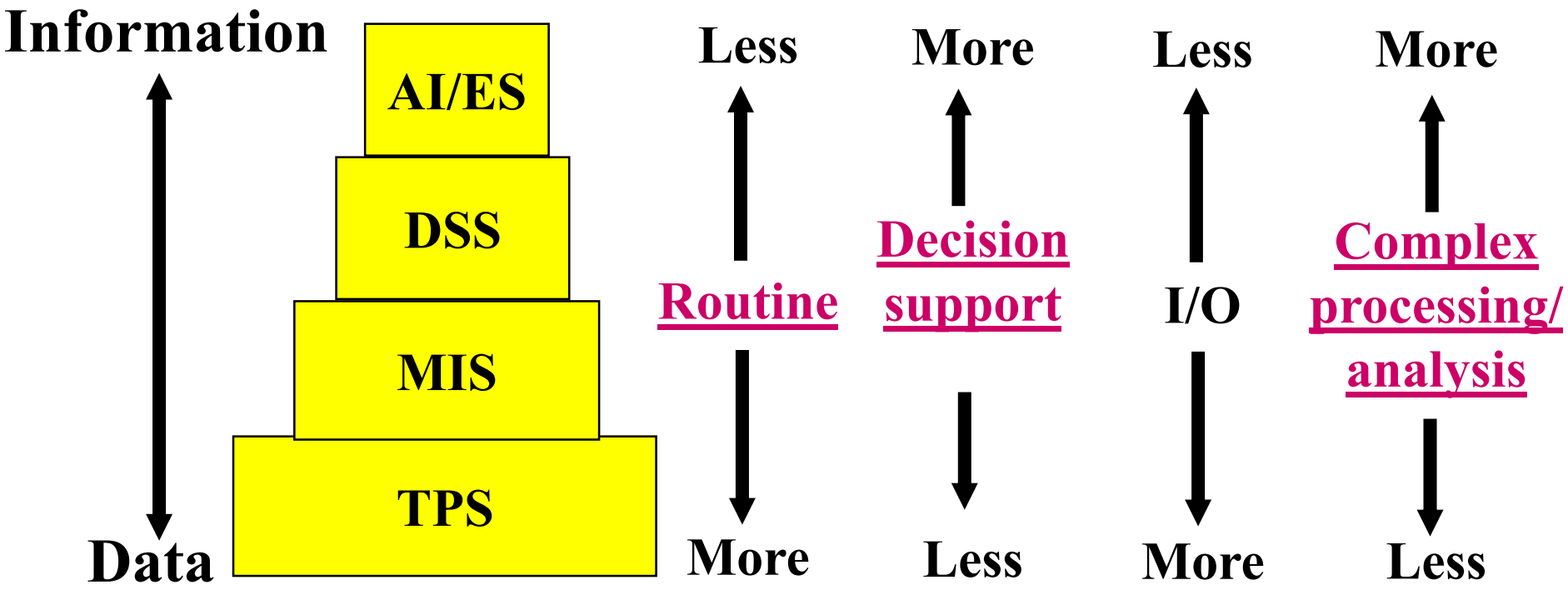
EDI Electronic Data Interchange **(Order)**

Re-stock inventory



Shipping

TPS, MIS, DSS, and AI/ES



Batch vs On-line Processing

Batch processing

- **All transactions are accumulated over a period of time and processed as a single unit.**
- **Typical periods: daily, weekly, biweekly, monthly, etc.**
- **Examples**
  - **Payroll**
  - **Billing**

Transactions

Batch vs On-line Processing

On-Line Transaction Processing (OLTP))

- **All transactions are processed immediately, without delay.**
- **Also called Real-time transaction processing.**

Airline Reservations

Hotel Reservations

Car Rentals

On-line Delayed Transaction Processing

On-Line Delayed Transaction Processing

- **All transactions are entered into the computer when they occur, but are processed at a later time.**

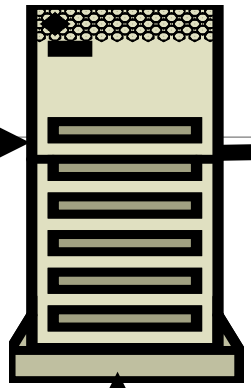
Catalog Orders

Deposits

Simplified View of a TPS

Data Input

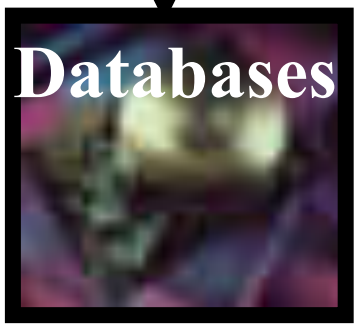
Processing



Document and Reports

Internal Transactions
- Shipped Orders
- Purchase Orders
- Employee Time Cards

External Transactions
- Customer Orders
- Vender Invoices
- Customer payments



Database Update
- Customer orders
- Inventory
- Purchase Orders
- Suppliers

Documents
- Pick list
- Checks to vendors
- Receiving notices
- Paychecks

Operational Reports
- Finished goods status
- Raw Materials
- Inventory status
- Packing materials
- Spare parts

Source Data Automation

Source Data Automation

- Capturing data at its **source** in a form that can be directly entered into the computer. It does NOT require keyboard input.

Mark Sense Reader

Time Clock

Barcode Reader

RFID

Magnetic Strip Reader

POS Register

POS Register

POS Register

Transaction Processing Cycle

Corrected Data

Original Data

Data Collection

Data Editing

Bad Data

Good Data

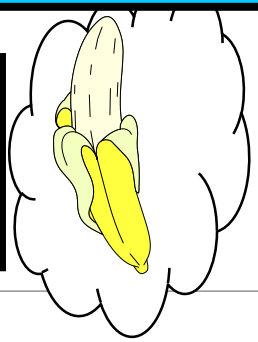
Data Correction

Data Manipulation

Data Storage

Document Production

Order Processing System



Invoice

Product

Mail

EDI

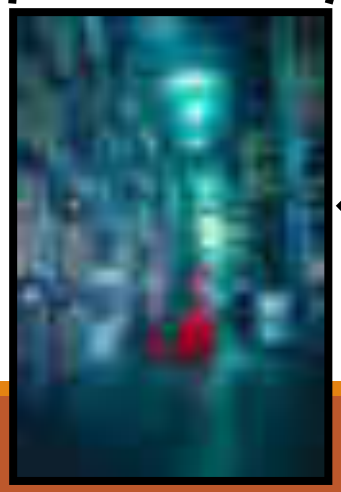
Phone

Internet

Order Entry

Scheduling

Shipment Execution

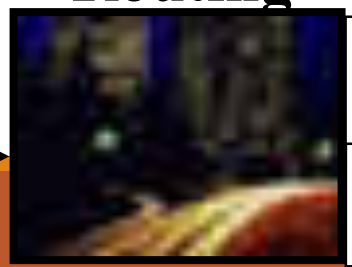


Inventory Status

Orders

Shipment Planning

Routing



Picking List

Planned Shipments

Order-Processing System

Order Entry System

- Captures data needed to process the customer's order.
- Sources of data:
  - Telephone
  - EDI
  - E-mail
  - Internet
  - Salesperson

Sales Configuration System

- Ensures that products/services ordered will accomplish customer's objectives and will work well together.
  - Customer orders a five-station network. Does the customer have all they need?

Continued

Order-Processing System

Shipment Planning System

- A system that determines which open orders will be filled and from which location they will be shipped.

Shipment Execution System

- A system that coordinates the outflow of all products and goods from the organization, with the objective of delivering quality products on time to customers.
- Uses a picking list from Shipment Planning.

Continued

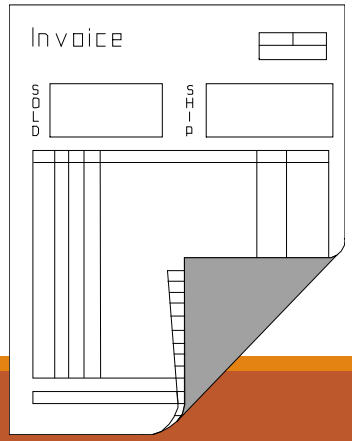
Order-Processing System

Inventory Control System

- For each item picked during Shipment Execution, inventory is updated.

Invoicing System

- Customer invoices are generated and sent based on records received from the Shipment Execution System.

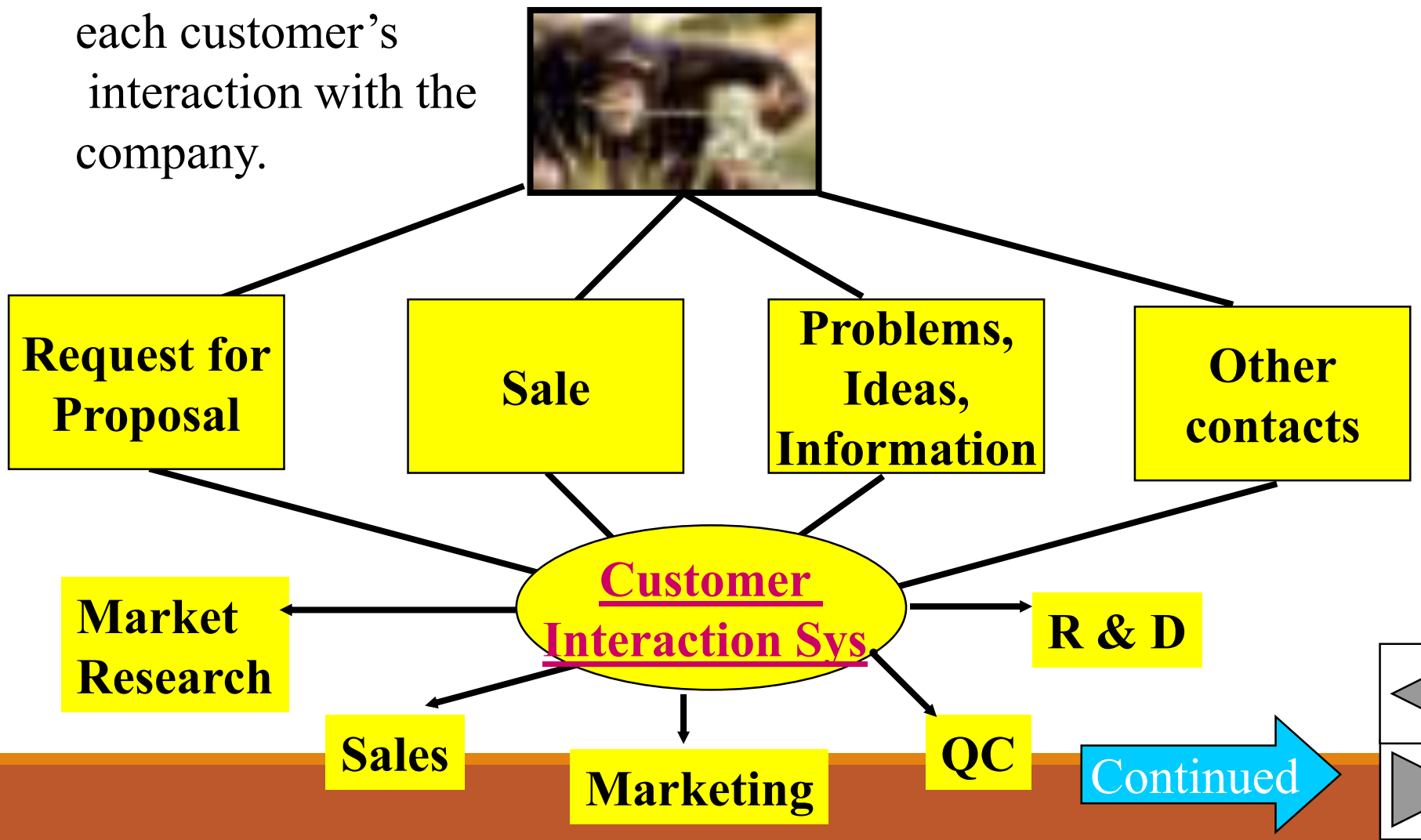


Continued

Order-Processing System

Customer Interaction System

- Monitors and tracks each customer's interaction with the company.



Continued

Order-Processing System

Routing System

- Determines the best way to get goods from one location to another.




Scheduling System

- Determines the best time to deliver goods and services.


TPS Summary

TPS SUMMARY

- A TPS records and processes detailed data necessary to update records about the business operations of an organization.
- Types of Systems:
  - Order entry
  - Inventory control
  - Payroll
  - Account payable and receivable
  - General ledger
  - Etc, etc