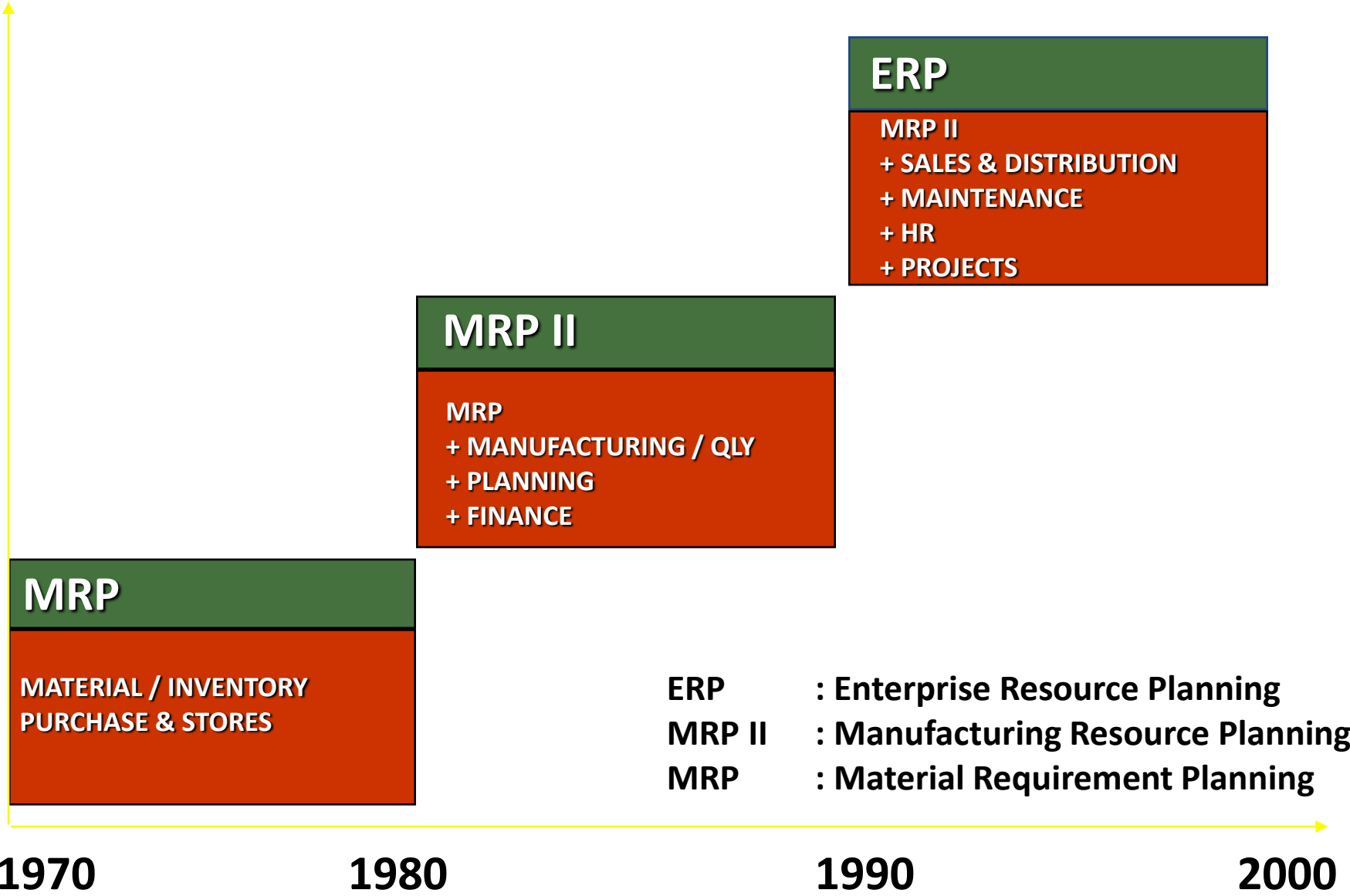# UNIT-II
# Enterprise Resource Planning

# Syllabus

- Evolution of ERP- MRP and MRP II,
- Structure Of ERP- Two Tier Architecture,
- Three Tier Architecture,
- Electronic Data Processing,
- Management Information System,
- Executive Information System,
- ERP As an Integrator of Information Needs At Various Levels.

# Evolution of ERP

- When companies were small, all the different managerial functions managed by a single person.

- But as companies grew, managing the entire operations became impossible for a single person.

- More people were employed and different business functions were given to different individuals.

- After that the concepts of departments evolved.

- As department became large, they became closed. Each had their own set of procedures and hierarchy.

- IT has just automated existing applications and not the business functions.

- And then comes the necessity of ERP.

# Evolution of ERP

**ERP**

MRP II
+ SALES & DISTRIBUTION
+ MAINTENANCE
+ HR
+ PROJECTS

**MRP II**

MRP
+ MANUFACTURING / QLY
+ PLANNING
+ FINANCE

**MRP**

MATERIAL / INVENTORY
PURCHASE & STORES

| | |
|---|---|
| ERP | : Enterprise Resource Planning |
| MRP II | : Manufacturing Resource Planning |
| MRP | : Material Requirement Planning |

**1970**          **1980**                    **1990**                    **2000**

| Timeline | System |
|----------|--------|
| 1960 | Inventory management and control |
| 1970 | Material Requirement Planning (MRP) |
| 1980 | Manufacturing Resource Planning (MRP II) |
| 1990 | Enterprise resource Planning (ERP) |

# Inventory Management and Control

- It is the combination of information technology and business processes of maintaining the appropriate level of stock in a warehouse.

- The activities of inventory management include:
  - Identifying inventory requirements
  - Setting targets
  - Providing replenishment techniques and options
  - Monitoring item usage
  - Reconciling the inventory balances
  - Reporting inventory status

# Material Requirement Planning (MRP)

- Material requirements planning utilizes software applications for scheduling production processes.

- MRP generates schedules for the operations and raw material purchases based on the production requirements of finished goods, the structure of the production system, the current inventories levels and the lot sizing procedure for each operation.

# An MRP System
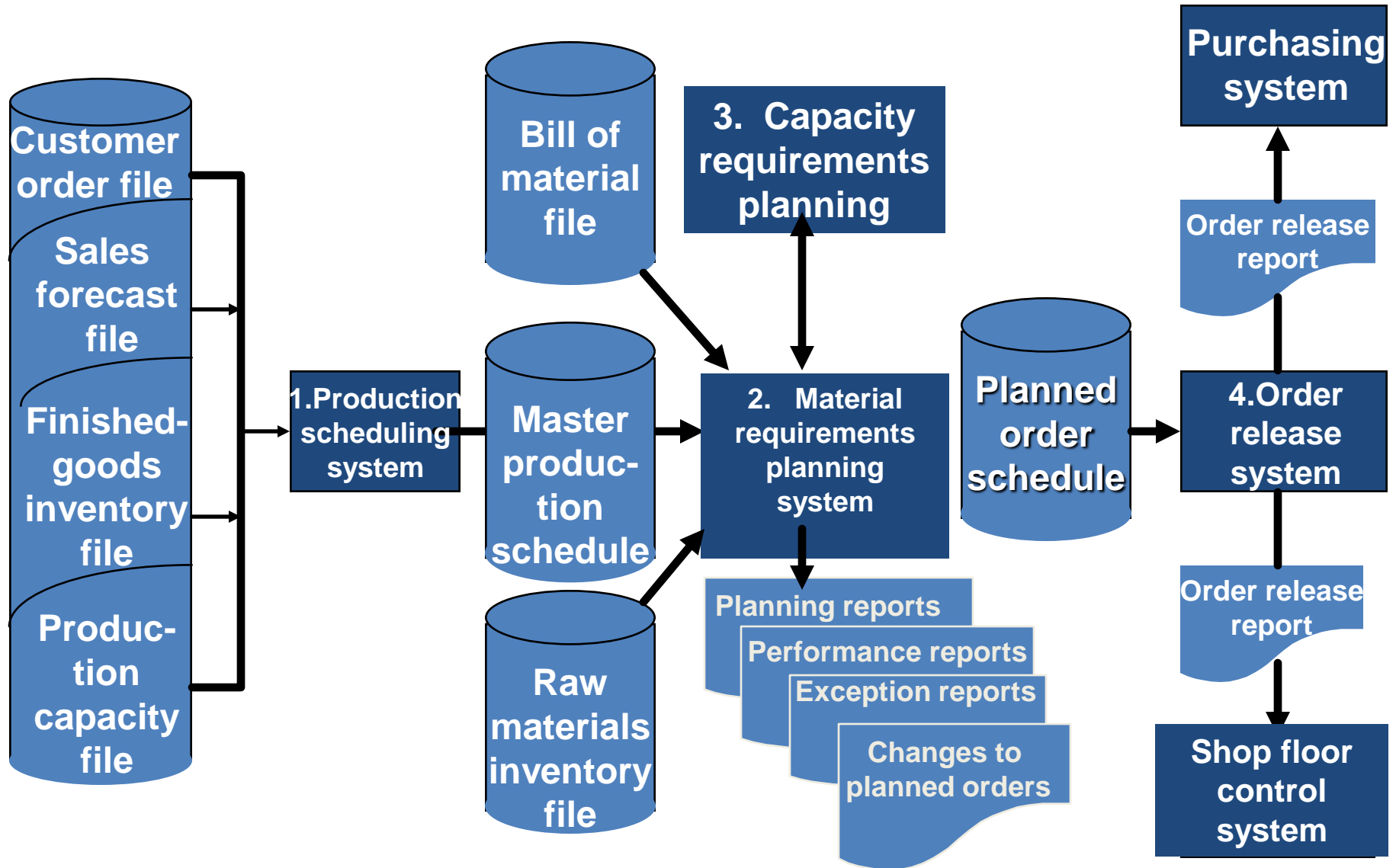
# Material Requirements Planning (MRP)

Components:

1. Production scheduling system -- produces a master production schedule that encompasses the longest lead time plus the longest production time.

2. MRP system -- explodes the bill of materials. Converts the gross requirements into the net requirements.
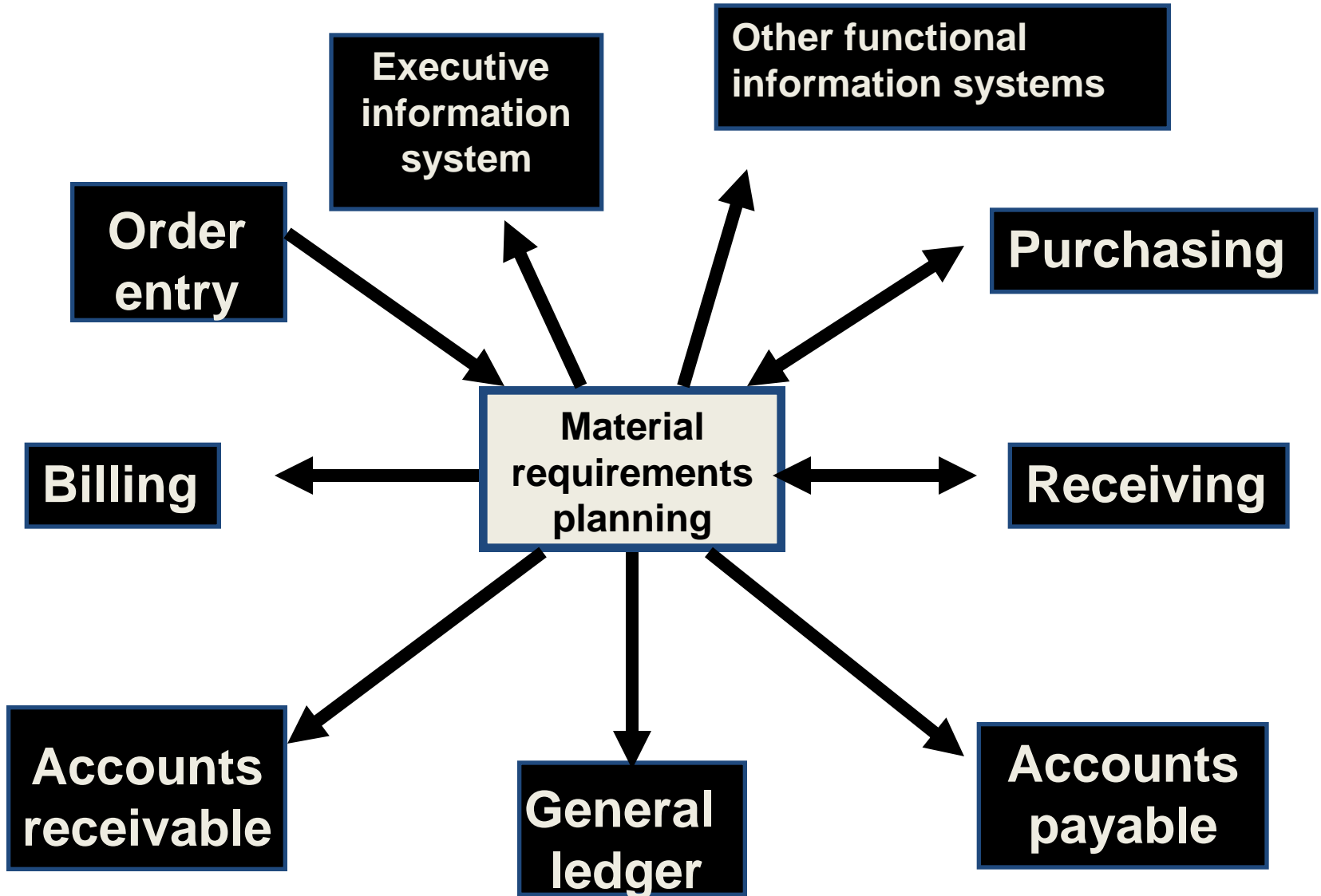
# MRP Components (continued)

3.  Capacity requirements planning system works with MRP system to keep production within plant capacity.  Produces outputs:  reports and planned order schedule.

4. Order release system produces reports for shop floor and purchasing.

# Manufacturing Resource Planning (MRP II)

- MRP II utilizes software applications for coordinating manufacturing processes, from product planning, parts purchasing inventory control to product distribution.

# An MRP II System

Executive information system

Other functional information systems

Order entry

Purchasing

Material requirements planning

Billing

Receiving

Accounts receivable

General ledger

Accounts payable

# An MRP II System

- Order entry

- Billing

- Accounts receivable

- General ledger

- Accounts payable

- Executive information system

- Other functional information system

# Order entry

- Process of entering order information to a fulfillment system.

- The most important objectives of order entry are speed and accuracy so that customers can receive what they have ordered as quickly as possible.

# Billing

- determine the appropriate chargeable amounts,
- apply applicable discounts,
- format the bill,
- and send the bill to the customer.

# Accounts receivable

- **Accounts receivable** (A/R) is one of a series of accounting transactions dealing with the billing of a customers for goods and services received by the customers.

# General ledger

- A company's accounting records.
- This formal ledger contains all the financial accounts and statements of a business.

| Account | Title | Debit_ | Credit_ |
|---|---|---|---|
| 1**** | *** ASSETS *** | $0.00 | |
| 10100 | Cash | $16,910.75 | |
| 10150 | Petty Cash | $500.00 | |
| 10200 | Accounts Receivable | $45,000.00 | |
| 10209 | Allowance for Bad Accounts | | $250.00 |
| 10300 | Inventories | $170,000.00 | |
| 10410 | Supplies | $3,085.30 | |
| 10420 | Prepaid Rent | $1,000.00 | |
| 10430 | Prepaid Insurance | $4,250.00 | |
| 10440 | Miscellaneous Prepaid Expense | $500.00 | |
| 10500 | Fixed Assets | $220,000.00 | |
| 10509 | Accumulated Depreciation | | $15,000.00 |
| 2**** | *** LIABILITY *** | | $0.00 |
| 20000 | Accounts Payable | | $47,000.00 |
| 20020 | Dividends Payable | | $0.00 |
| 20050 | Notes Payable | | $36,000.00 |
| 20110 | Accrued Payroll | | $0.00 |
| 20120 | Accrued Payroll-Taxes | | $0.00 |
| 20130 | Accrued Payroll-Other | | $0.00 |
| 20200 | Miscellaneous Accrued Expense | | $10,085.30 |
| 20300 | Taxes Payable | | $125.00 |
| 25000 | Long Term Debt | | $117,000.00 |
| 3**** | *** OWNERS' EQUITY *** | | $0.00 |

General Ledger is edited with journal entries.

# Accounts payable

- **Accounts payable** is a file or account that contains money that a person or company owes to suppliers, but has not paid yet.

# Executive information system

- An integrated set of components for collecting, storing, processing, and communicating information is **information system**.

- Executive information systems make a variety of critical information readily available in a highly summarized and convenient form.

# Other functional information system

- Marketing information system
- Manufacturing information system
- Financial information system
- Human resource information system

# MRP-II Benefits

- More efficient use of resources
  - Reduced inventories
  - Less idle time
  - Fewer bottlenecks
- Better priority planning
  - Quicker production starts
  - Schedule flexibility

# MRP-II Benefits (continued)

- Improved customer service
  - Meet delivery dates
  - Improved quality
  - Lower price possibility
- Improved employee moral
- Better management information

# Enterprise resource Planning (ERP)

- ERP uses multi-module application software for improving the performance of the internal business processes.

## Table 62.1 The Evolution ERP to ERP II

| ERP (1990-1999) | Extended ERP (2000-2005) | ERP II (2005 Onwards) |
|---|---|---|
| ▪ Materials Planning | ▪ Scheduling | ▪ Project Management |
| ▪ Order Entry | ▪ Forecasting | ▪ Knowledge Management |
| ▪ Distribution | ▪ Capacity Planning | ▪ Workflow Management |
| ▪ General Ledger | ▪ e-Commerce | ▪ Customer Relationship Management |
| ▪ Accounting | ▪ Warehousing | ▪ Human Resource Management |
| ▪ Shop Floor Control | ▪ Logistics | ▪ Portal Capability |
| | | ▪ Integrated Financials |
| | | ▪ Internet and WWW Integration |

# ERP(1990-1999)

- Materials planning
- Order entry
- Distribution
- General ledger
- Accounting
- shop floor control

# Materials planning

- Material planning utilizes software applications for scheduling production processes.

# Distribution

- A distribution module distributes products or services to their customers.

# General ledger

- A company's accounting records.

- This formal ledger contains all the financial accounts and statements of a business.

- The ledger uses two columns: one records debits, the other has offsetting credits.

# Accounting

- The systematic recording, reporting, and analysis of financial transactions of a business.

# shop floor control

- The actual implementation starts with shop floor control (SFC, also called production activity control-PAC).

- The SFC or PAC module monitors all shop floor activities and communicates status information on manufacturing orders and work centers back to respective managers.

# Extended ERP (2000-2005)

- Scheduling

- **Forecasting**

- **Logistics**

- **Capacity planning**

- E-commerce

# SCHEDULING

- Scheduling is committing resources to a plan.

# Forecasting

- **Forecasting** is the process of estimation in unknown situations.

- It is a method for translating past experience into estimates of the future.

# Logistics

- Logistics is the management of the flow of goods, information and other resources, including energy and people, between the point of origin and the point of consumption.

# Capacity planning

- **Capacity planning** is the process of determining the production capacity needed by an organization to meet changing demands for its products.

- In the context of capacity planning, "capacity" is the maximum amount of work that an organization is capable of completing in a given period of time.

# E-commerce

- A type of business model that enables a firm or individual to conduct business over an electronic network, typically the internet.

# ERP II(2005 onwards)

- [Project management](#)
- [Knowledge management](#)
- [Workflow management](#)
- [Customer relationship management](#)
- [Human resource management](#)

# Project management

- **Project management** is the discipline of planning, organizing, and managing resources to bring about the successful completion of specific project goals and objectives.

# Knowledge management

- Knowledge management is the name of a concept in which an enterprise consciously and comprehensively gathers, organizes, shares, and analyzes its knowledge in terms of resources, documents, and people skills.

# Workflow management

- Workflow management is a system of overseeing the process of passing information, documents, and tasks from one employee or machine within a business to another.

# Customer relationship management

- It is a process or methodology used to learn more about customers' needs and behaviors in order to develop stronger relationships with them.

# Human resource management

- HRM means employing people, developing their resources, utilizing, maintaining and compensating their services in tune with the job and organizational requirement.
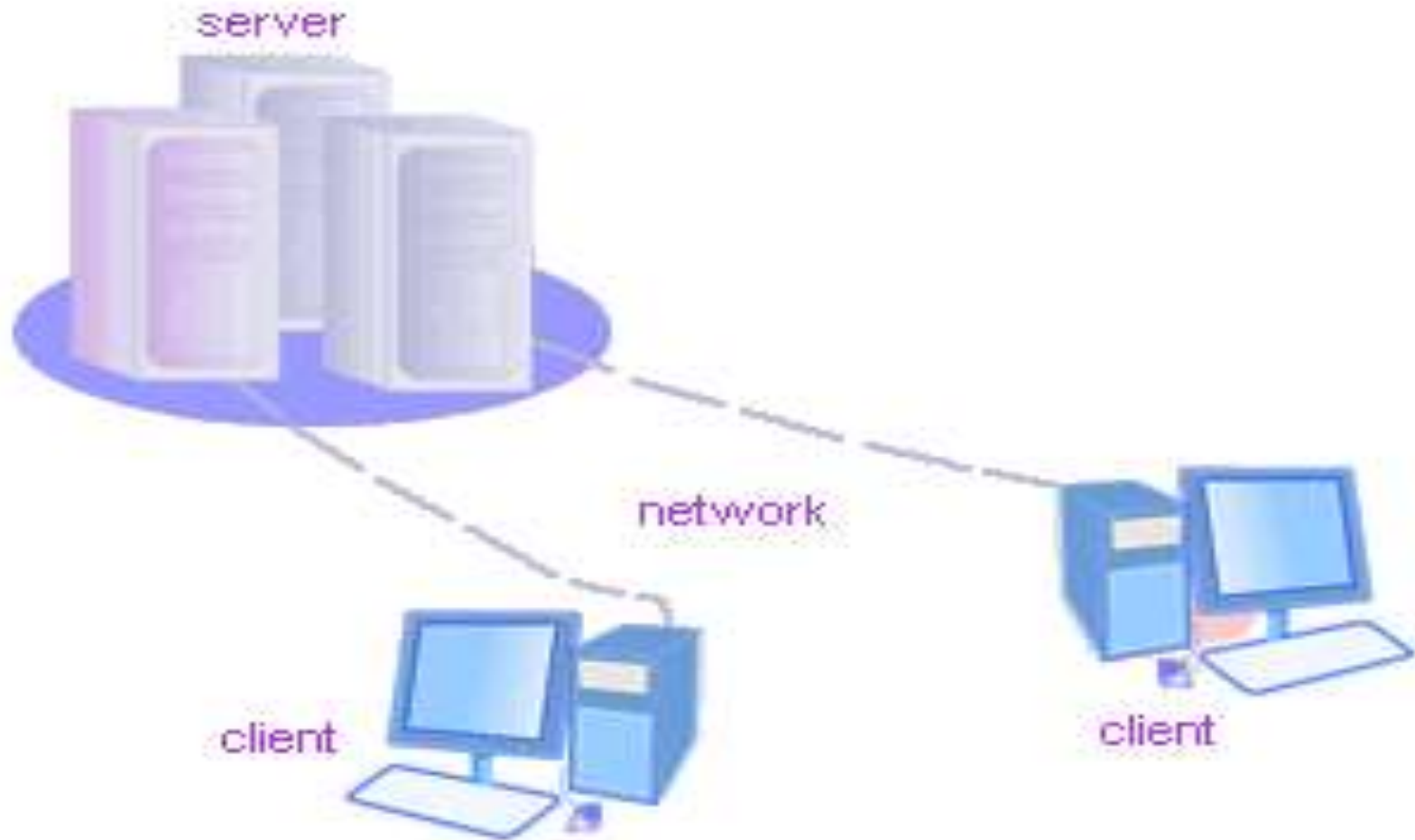
# Structure Of ERP

- Two Tier Architecture
- Three Tier Architecture

# Client Server Architecture

- A network architecture in which each computer on the network is either a *client* or a *server*.

- A client may initiate a communication session, while the server waits for requests from any client.
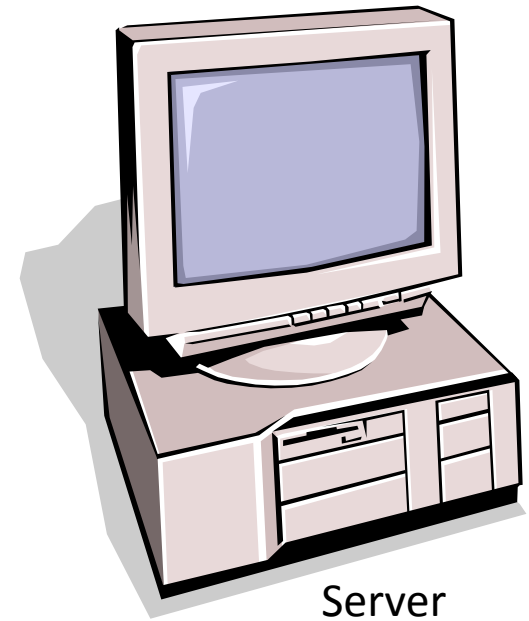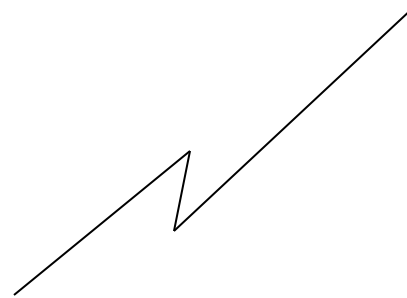
# Client server architecture

# Components

- Clients
- Servers
- Communication Networks



Client

Server

# Clients

- Applications that run on computers
- Rely on servers for
  - Files
  - Devices
  - Processing power
- Example: E-mail client
  - An application that enables you to send and receive e-mail
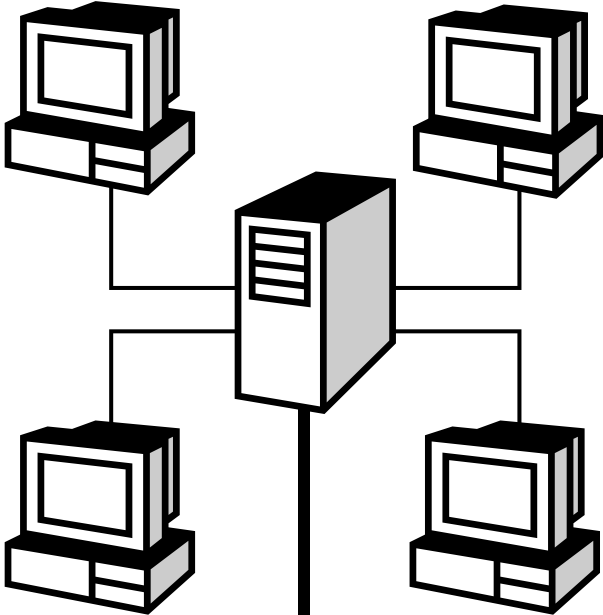
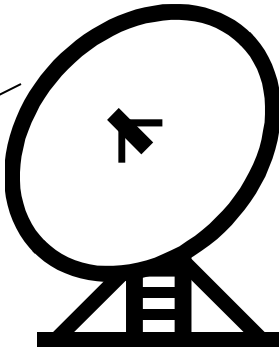**Clients are Applications**

# Servers

- Computers or processes that manage network resources
  - Disk drives (file servers)
  - Printers (print servers)
  - Network traffic (network servers)

- Example: Database Server
  - A computer system that processes database queries

**Servers Manage Resources**

# Communication Networks

**Networks Connect Clients and Servers**

# Characteristics of a client

- Initiates requests
- Waits for replies
- Receives replies
- Usually connects to a small number of servers at one time

# Characteristics of a server

- Never initiates requests or activities
- Waits for and replies to requests from connected clients
- A server can remotely install/uninstall applications and transfer data to the intended clients

# Advantages

- Greater ease of maintenance

- All the data is stored on the servers, which generally have far greater security controls than most clients.

- Since data storage is centralized, updates to that data are far easier to administer.

- It functions with multiple different clients of different capabilities.

# Two-Tier Client-Server Architecture

- 2-tier architecture is used to describe client/server systems where the client requests resources and the server responds directly to the request, using its own resources.

- This means that the server does not call on another application in order to provide part of the service.

# Two-tier Architecture

LEVEL 1

LEVEL 2

Http
request,
files,
SQL,...

Sending
requests

Sending
replies

Client
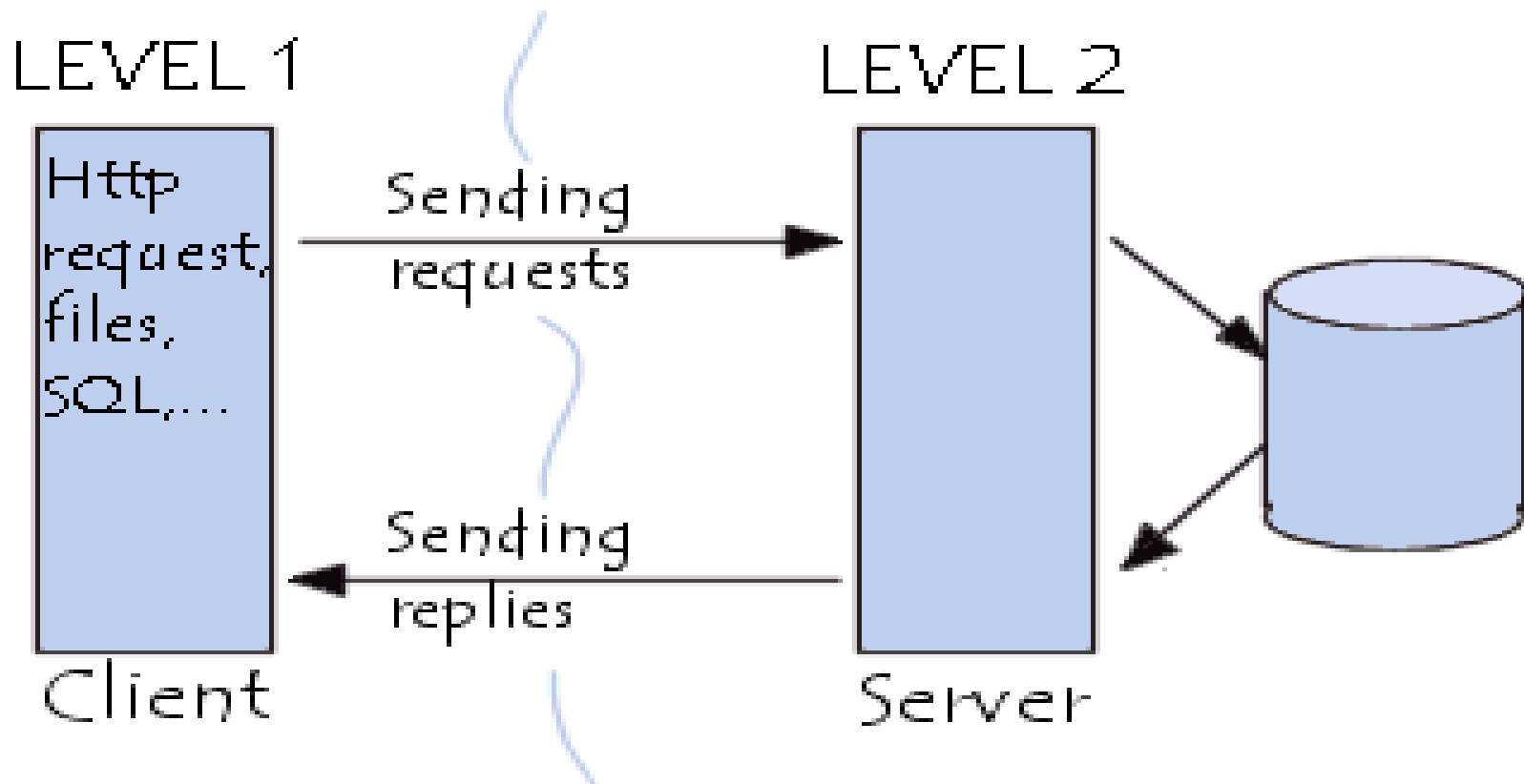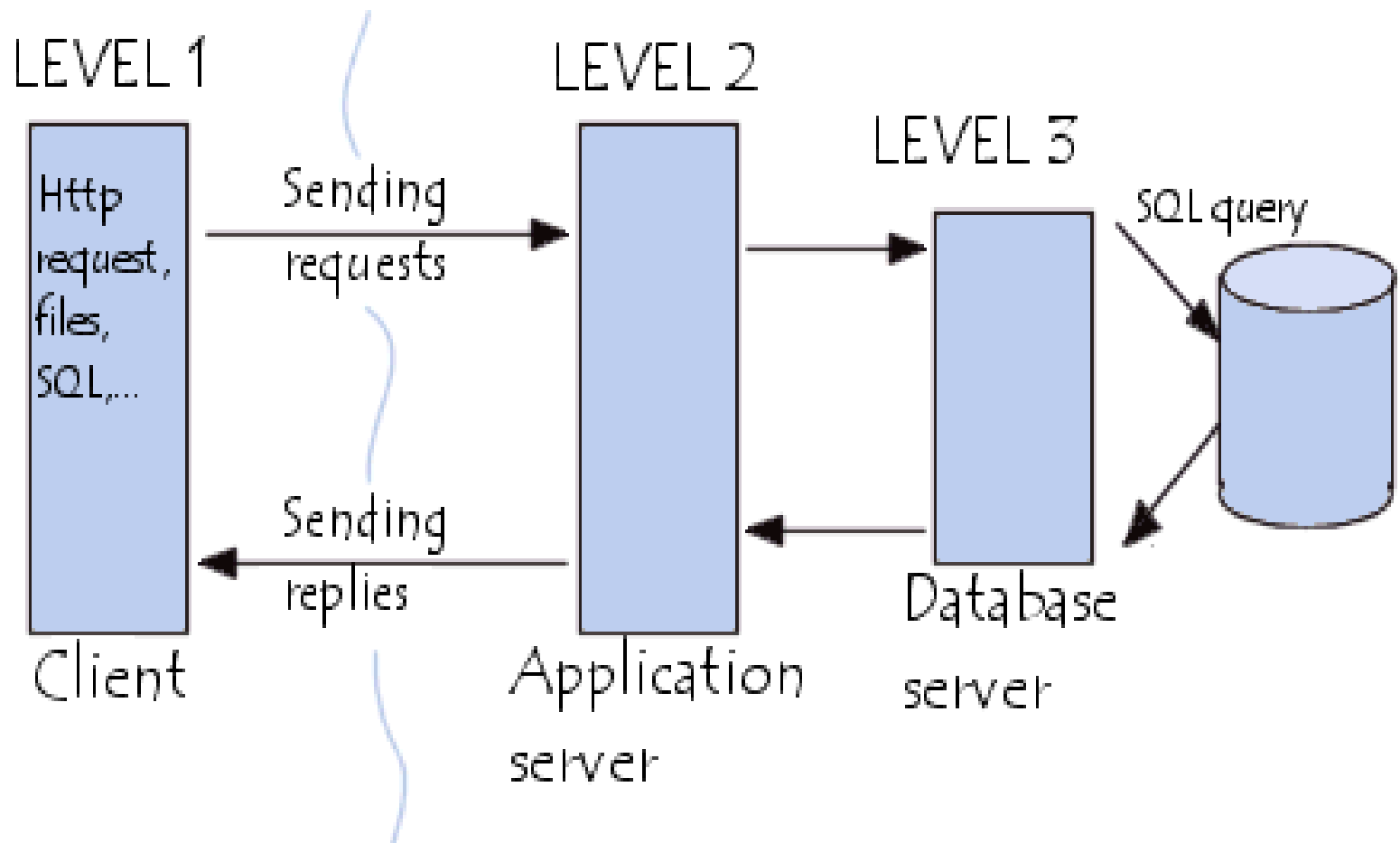
Server

# Problems in 2-tier architecture

- A common error in this architecture is that it works properly in small applications.

- But as we add more users, the system become ineffective as the server becomes overwhelmed.

- To properly scale to hundreds or thousands of users, it is usually necessary to move to 3-tier architecture.

# Three-tier Architecture

In 3-tier architecture, there is an intermediary level, meaning the architecture is generally split up between:

- A client, i.e. the computer, which requests the resources, equipped with a user interface (usually a web browser) for presentation purposes
- The application server (also called **middleware**), whose task it is to provide the requested resources, but by calling on another server
- The data server, which provides the application server with the data it requires

# Three-tier Architecture



LEVEL 1

Http
request,
files,
SQL,...

Client

Sending
requests

Sending
replies

LEVEL 2

Application
server

LEVEL 3

Database
server

SQL query

# Advantages

- Lower network traffic
- Easier migration to Internet/intranet solution
- Greater fault tolerance
- Load balancing

# Presentation tier

The top-most level of the application is the user interface. The main function of the interface is to translate tasks and results to something the user can understand.

> GET SALES
TOTAL

> GET SALES
TOTAL

4 TOTAL SALES

# Logic tier

This layer coordinates the application, processes commands, makes logical decisions and evaluations, and performs calculations. It also moves and processes data between the two surrounding layers.

GET LIST OF ALL
SALES MADE
LAST YEAR

ADD ALL SALES
TOGETHER

# Data tier

Here information is stored and retrieved from a database or file system. The information is then passed back to the logic tier for processing, and then eventually back to the user.

QUERY

SALE 1
SALE 2
SALE 3
SALE 4

Storage
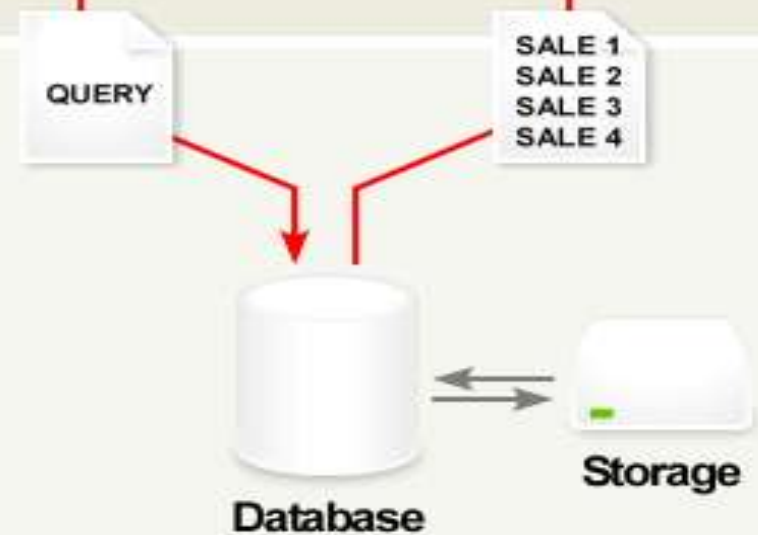
Database

| 2-Tier Paradigm | 3-Tier Paradigm |
|---|---|
| Great number of concurrent connections to databases | Multiplexing -- lesser number of concurrent connections to databases |
| No access to mainframe | Can possibly utilize OpenOLTP and Gateways and other mainframe access software |
| **Security Risk** -- anyone can physically connect to database using ODBC and a useris ID | All database access must go through the middleware. No client can connect to database directly.<br>Increased auditing capabilities. |
| Non-Transactional (conversational instead) | Transaction-oriented system.<br>High throughput. |
| Supports synchronous communication only. | Supports both synchronous and asynchronous communication. |
| Homogenous data management (Generally, 1 database vendor) | Heterogeneous data management (Many database solutions/vendors) |
| Great for small scale applications. | Necessary for large, mission critical Enterprise systems. |

# ERP with other technologies

- ERP systems serves an important function by integrating separate business functions-material management, product planning, sales, distribution, finance and many others into a single application. But it has some limitations:

    – Managers cannot generate custom reports or queries without help from a programmer and this inhibits managers from obtaining information quickly so that they can act on it for competitive advantage.

    – ERP systems provide current status only, such as open orders. Managers often need to look past the current status to find trends and patterns that aid better decision-making.

    – The data in the ERP application is not integrated with other enterprises or division systems and does not include external intelligence.

There are many technologies that help ERP systems to overcome the limitations.

- These technologies used are:
    - Business Process Reengineering (BPR)
    - Data warehousing & data marts
    - Data mining
    - On-line analytical processing (OLAP)
    - Product life cycle management (PLM)
    - Supply chain management (SCM)
    - Customer relationship management (CRM)
    - Geographical information systems (GIS)
    - Intranets and extranets
    - Electronic data interchange (EDI)
    - Electronic Funds Transfer (EFT)
    - Cryptography
    - Electronic data processing(EDP)
    - Management information system(MIS)
    - Executive information system(EIS)

# Electronic Data Processing (EDP)

- "Data processing is handling raw data in a systematic manner to confirm the data quality standards as determined by the designers of the information system."

- Data is the smallest atomic entity in the information system which is basic to build the information system.

- The character of data decides the quality of information it provides to the user.

- If the data is taken care of properly, its usage will ensure quality output.

- Therefore, in any information system significant care is taken in building the data as a first level input to the system.

# Continued…….

- A firm's data processing tasks are performed by **Accounting information system** (AIS) that gathers data describing the firm's activities transforms the data into information, and makes the information available to users both inside and outside the firm.

- **Data processing software** transforms the data into information for the firm's management and for individuals and organization in the firm's environment.

# Data processing tasks

- Data gathering

- Data manipulation

- Data storage

- Document preparation

Environment

Management

Data processing software

Database

Accounting information system

Input physical resources

Transform

Output physical resources

Environment

67
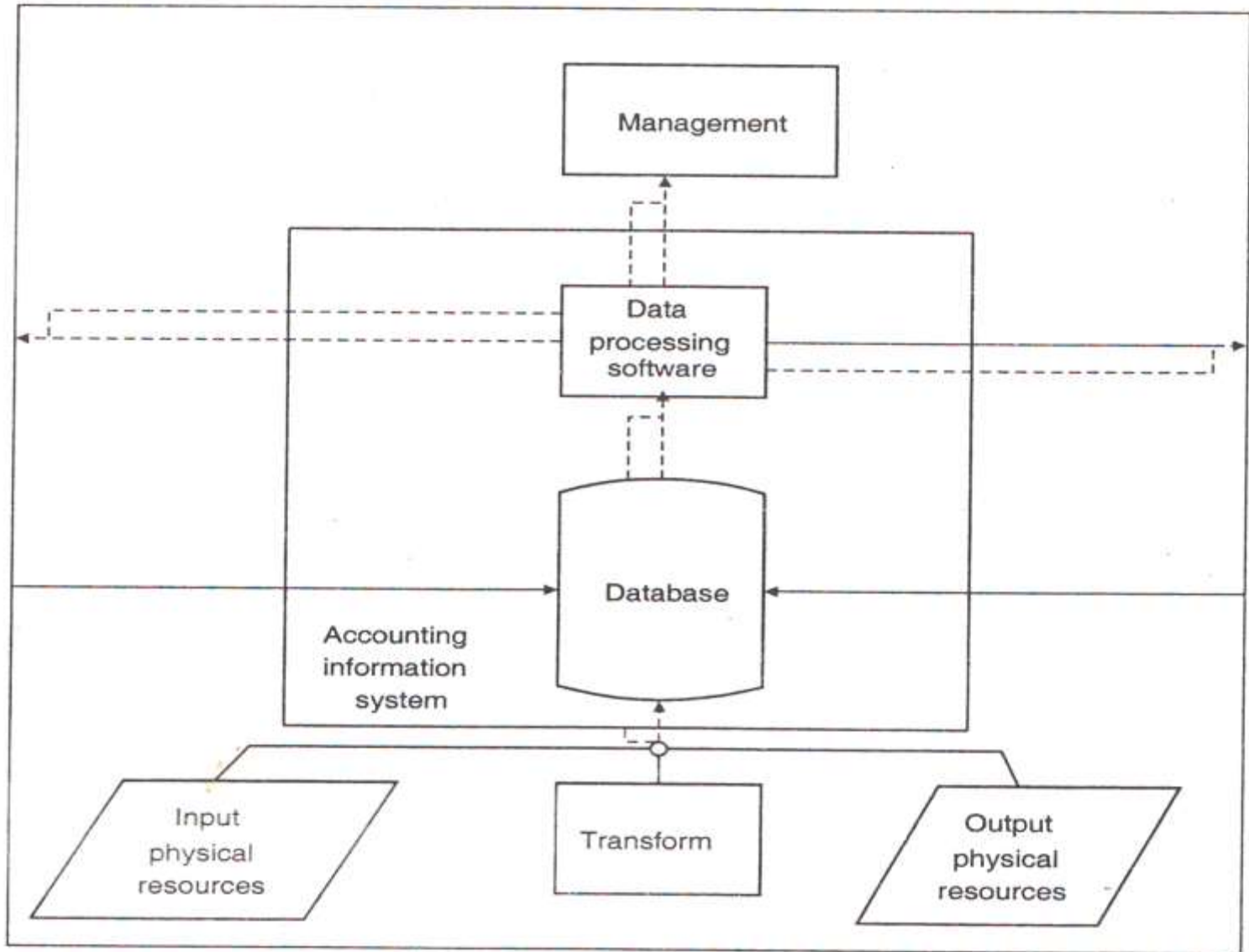
# Environmental elements



Society

- Government
- Financial community
- Global community
- Suppliers
- The firm
- Customers
- Labor unions
- Stockholders or owners
- Competitors

# Management Information System (MIS)

- MIS refers to a computer-based system that provides managers with the tools for organizing, evaluating and efficiently running their departments.

# MIS provides the following advantages

- It Facilitates planning
- It Minimizes information overload
- MIS Encourages Decentralization
- It brings Co ordination
- It makes control easier
- MIS assembles, process, stores, Retrieves, evaluates and disseminates the information

# An MIS Model
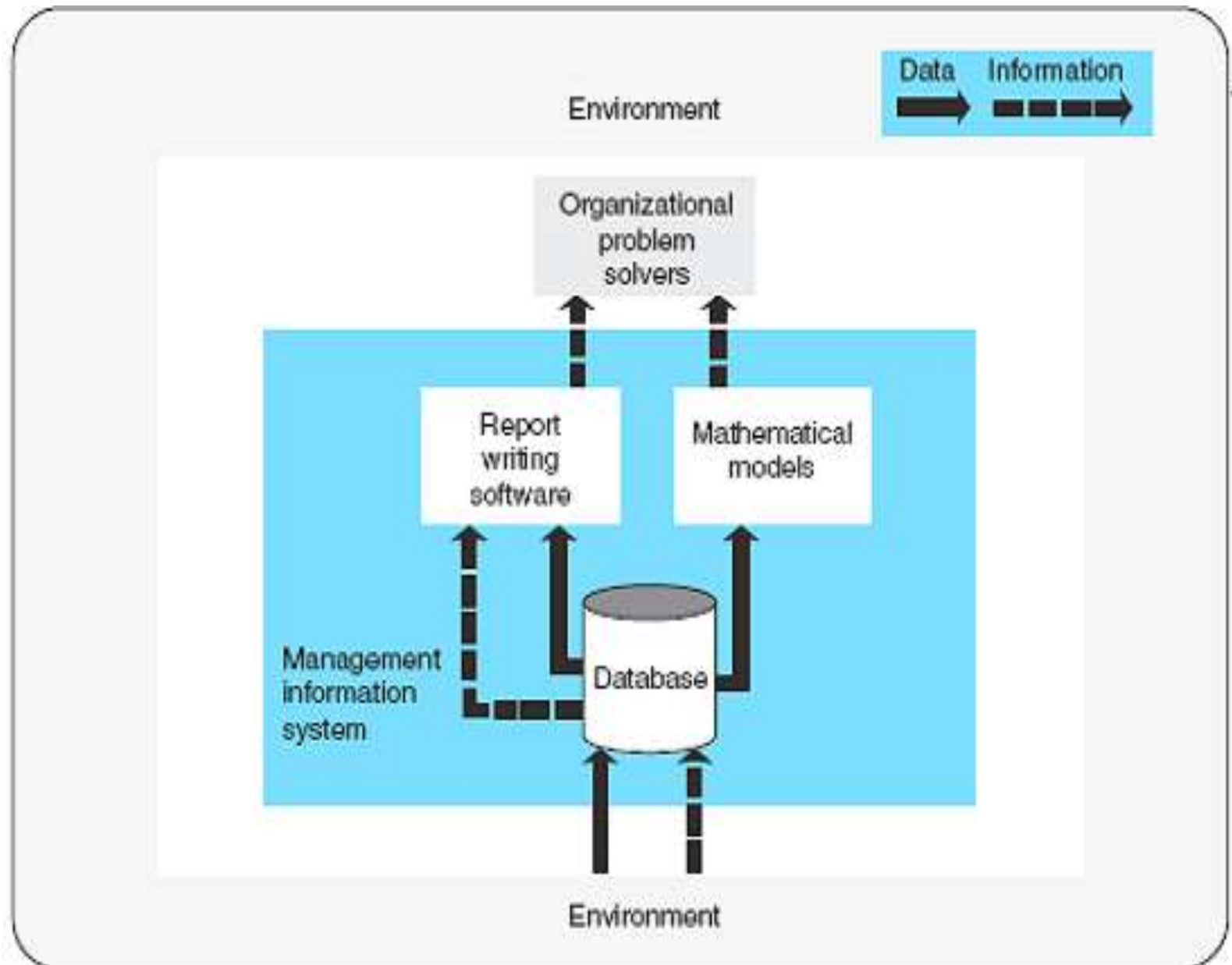
- **Management Information System (MIS)** is a computer-based system that makes information available to users with similar needs.
- **Data base** - The data base contains the data provided by the accounting information system. The data base contents are used by software that produces reports as well as mathematical models.
- **Report-writing software** – produces both periodic and special reports.
- **Mathematical models** – produces information as a simulation of the firm's operations
- **Organizational problem solver** -The software outputs are used by persons who are responsible for solving the firm's problem.

# Report Writing Software

- Periodic and special reports may look the same
- Difference is in what *triggers* the report
  - Periodic report
    - Produced on a schedule
  - Special report
    - Produced when something out of the ordinary occurs

# An Overtime Earnings Report

**OVERTIME EARNINGS REPORT**
**FOR WEEK ENDING AUGUST 19**

| | | OVERTIME EARNINGS | |
|---|---|---|---|
| Department No. | Department Name | Current Month | Year-to-Date |
| 16-10 | Receiving | $ 2,305.00 | $ 5,319.20 |
| 16-11 | Inspection | $ 1,025.60 | $ 4,386.12 |
| 16-12 | Materials Handling | $ 3,392.50 | $12,629.00 |
| 16-13 | Tooling | $ 78.00 | $ 1,049.00 |
| 16-14 | Assembly | $ 0.00 | $ 792.80 |
| 16-15 | Plating | $ 3,504.90 | $12,635.20 |
| 16-16 | Shipping | $ 5,219.16 | $18,294.16 |
| | TOTALS | $15,525.16 | $55,105.48 |

# SALES BY PRODUCT
# FOR THE MONTH OF JUNE

| PRODUCT NUMBER | PRODUCT NAME | CURRENT MONTH SALES | YEAR-TO-DATE SALES |
|---|---|---|---|
| 129875 | GASKET CENTER CASE | $ 5,090.23 | $ 31,764.00 |
| 087235 | MAINSHAFT | 4,760.01 | 29,329.45 |
| 118320 | 1ST MOTION SHAFT | 1,789.45 | 28,243.59 |
| 250067 | OIL SEAL REAR | 11,560.24 | 23,450.07 |
| 228203 | LAYGEAR | 8,369.34 | 14,709.03 |
| 576000 | HUB 5TH | .00 | 13,623.68 |
| 516012 | SHIFT FORK 1-2 | 450.95 | 12,634.44 |
| 090407 | SYNCHRO RING 2ND | 2,243.27 | 9,963.58 |
| 282130 | BUSH SHIFT LEVER | .00 | 490.00 |
| 576301 | OIL SLINGER | .00 | 11.50 |

# SALES BY SALESPERSON REPORT
# FOR THE MONTH ENDING MARCH 31

| SALESPERSON | | CURRENT-MONTH | | | YEAR-TO-DATE | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| NO. | NAME | QUOTA | ACTUAL | VARIANCE | QUOTA | ACTUAL | VARIANCE |
| 0120 | JOHN NELSON | 1200 | 1083 | -117 | 3600 | 3505 | -95 |
| 10469 | LYNN SHERRY | 1000 | 1162 | +162 | 3000 | 3320 | +320 |
| 19261 | DARVIN UPSHAW | 800 | 1090 | +290 | 2400 | 2510 | +110 |
| 20234 | JANIE EVANS | 1500 | 1305 | -195 | 4500 | 4110 | -390 |
| 61604 | TRAVIS BURKE | 2000 | 2333 | +333 | 6000 | 6712 | +712 |
| 62083 | CATHY HAGER | 1000 | 990 | -10 | 3000 | 2319 | -681 |
| 63049 | STEVE JENNER | 1100 | 1250 | +150 | 3300 | 2416 | -884 |
| 64040 | SAM MOSELY | 1050 | 985 | -65 | 3150 | 3020 | -130 |
| | TOTALS | 9650 | 10198 | 548 | 28950 | 27912 | -1028 |

# Modeling

- Model as the body of information gathered for the purpose of studying the system.
- Models may be:
  - Physical
  - Narrative
  - Graphic
  - Mathematical

# Mathematical Modeling

- Three dimensions
  - Influence of time
  - Degree of uncertainty
  - Ability to optimize

# Influence of time

- Static
  - Does not include time
  - Like a snapshot
- Dynamic
  - Includes time
  - Like a motion picture

# Degree of uncertainty

- Probabilistic
  - Includes probabilities of events occuring
  - 0.00 to 1.00

- Deterministic
  - Events are certain
  - Not random

# Ability to optimize

- Optimizing
  - Selects best solution
  - Requires structured problems
- Sub optimizing
  - Model identifies outcomes for manager to select among

# Executive Information System

- An **Executive Information System** (EIS) is a type of management information system intended to facilitate and support the information and decision making needs of senior executives by providing easy access to both internal and external information relevant to meeting the strategic goals of the organization.

- It is commonly considered as a specialized form of a Decision Support System (DSS).

# Advantages

- Easy for upper-level executives to use
- Provides timely delivery of company summary information
- Information that is provided is better understood
- Filters data for management
- Improves the tracking of information
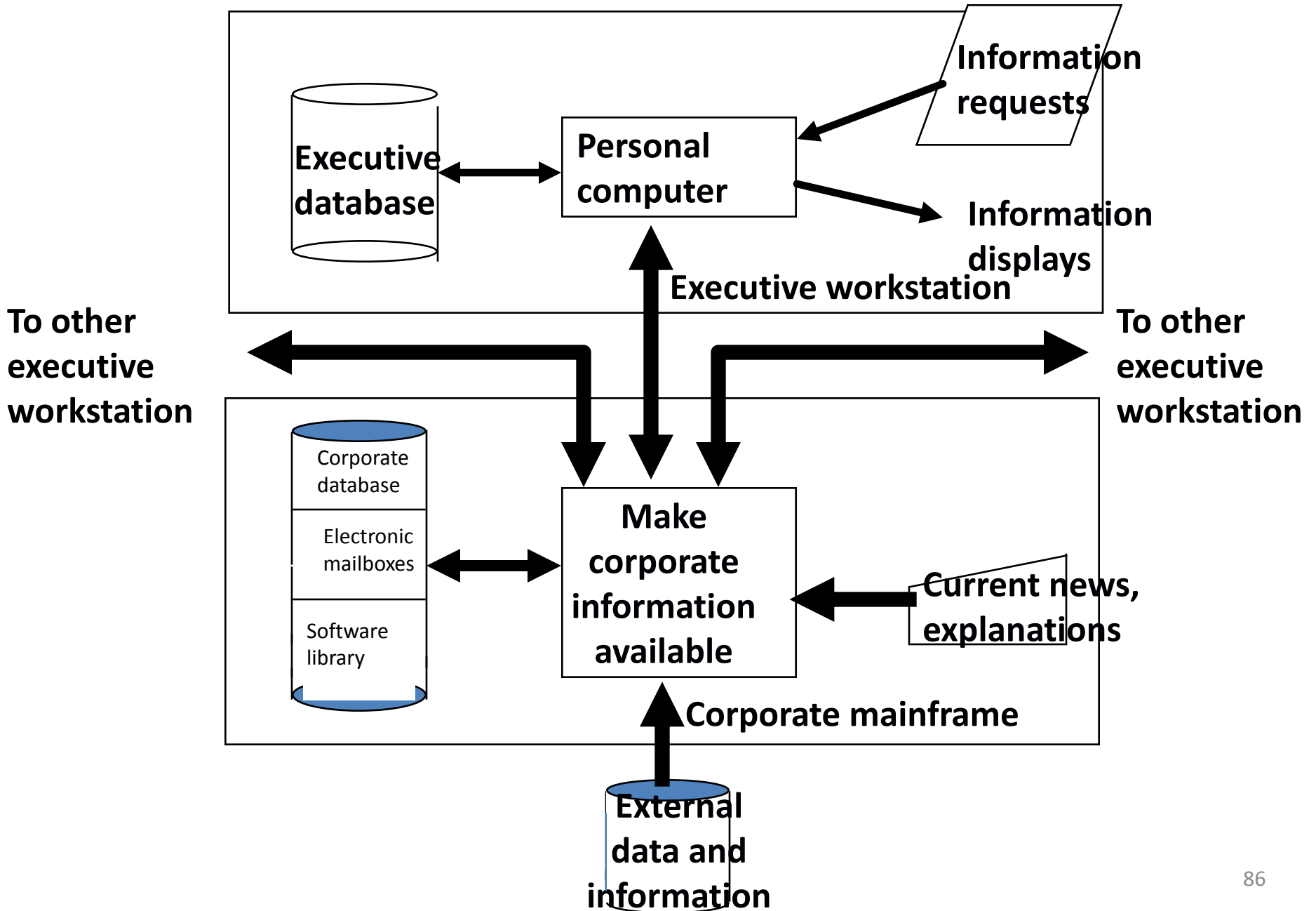- Offers efficiency to decision makers

# Disadvantages

- Functions are limited, cannot perform complex calculations
- Hard to quantify benefits and to justify implementation of an EIS
- Executives may encounter information overload
- System may become slow, large, and hard to manage
- May lead to less reliable and insecure data
- Small companies may encounter excessive costs for implementation

# EIS

- Executive information system or EIS are used by the firm's executives.

- It is a system that provides information to the executive on the overall performance of the firm.

- EIS model consists of
  - Executive workstation
  - Central computer

# An EIS Model



**Executive database**

**Personal computer**

**Information requests**

**Information displays**

**Executive workstation**

**To other executive workstation**

**To other executive workstation**

Corporate database

Electronic mailboxes

Software library

**Make corporate information available**

**Current news, explanations**

**Corporate mainframe**

**External data and information**

# Three Key Questions

- Do we develop an EIS? When the answer is no, the executives continue to rely on their present systems. When the answer is yes, the next question is

- "Is there prewritten personal productivity software available to meet the executive's needs?" If so, it is purchased.

- If not, the next question is "Should we purchase prewritten EIS software?" if so, it is purchased. If not, the firm's information services staff creates custom EIS software.

# Prewritten personal productivity software

- It is general purpose software that anyone can use to develop his or her own applications.

- Examples are DBMS, electronic spreadsheet packages.

# Prewritten EIS software

- Prewritten EIS software, which is specially designed to meet the information needs of executives.

# ERP as an Integrator of Information Needs At Various Levels

- In today's competitive business environment, the key resource of every organization is information.

- if the organization doesn't have an efficient and effective mechanism that enables it to give the decision makers the right information at the right time, then the chances of its success are very rare.

- Question comes how we can manage the information?

# Continued………..

- The three fundamental characteristics of information are
  - accuracy,
  - relevancy
  - timeliness
- The information should be accurate, it should be relevant for the decision-maker and it must be available to the decision-maker when he needs it.
- Today, the time available for an organization to react to the changing market trends is very short.
- To survive, the organization must always be on its toes, gathering and analyzing the data-both internal and external.
- Any mechanism that will automate this information gathering and analysis process will enhance the chances of the organization to beat the competition.

# Continued………..

- So what is needed is a system that treats the organization as a single entity and caters to the information needs of the whole organization.

- If this is possible, and if the information which is generated is accurate, timely and relevant, then these systems will go a long way in helping the organization to realize its goals.

- This is the strength of ERP systems- integration and automation- and that is why implementation of ERP systems will help in improving the accuracy of information and thus help in better decision-making.