# Chapter 1
# Industrial Information Systems (IIS)
# Introduction (Part I)
# مقدمة لأنظمة المعلومات الصناعية (جزء أول)

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# Introduction: Fundamentals concepts of information

مقدمة : مفاهيم أساسية
عن أنظمة المعلومات

# What is information?
# ماهي المعلومة؟

- Information is data put within a meaningful context

  المعلومة هي بيان وضع في سياق (موضوع) ذو معني (مثل ..درجة حرارة الغرفة)

- It is also a processed data (data are raw material that is proceed to provide information)

  و تعتبر المعلومة بيانات مشغلة أو تم معالجتها

- Knowledge is relationship or connection between several pieces of Information

  أكثر من معلومة المعرفة هي علاقة بين ....

- Information and knowledge are necessary for <u>decision making</u>

# What are Information technologies (IT)?

- IT includes:
  - Hardware (المعدات أو الأجهزة)(e.g., Computer systems equipments and devices)
  - Software (البرمجيات)
  - Communication technologies (تقنيات الإتصال)

# IT role in industry /Manufacturing

- It is necessary to manage both
  - Material flow (material processing) تدفق المواد الخام و الأجزاء
  - Information flow (manufacturing information processing).

تدفق المعلومات المصاحبة لتدفق المواد و المعدات و الأفراد و مراحل التصنيع و مخرجاتها. و تستخدم المعلومات في إتخاذ القرارات في مراحل المختلفة.

- Information technology (IT) is one of the major factor of productivity improvement

إن الإستثمار في إستخدام تقنية المعلومات يعتبر أحد أهم عوامل تحسين الإنتاجية، من خلال زيادة سرعة المعالجة و التخزين وإستدعاء المعلومات وتقليل تكلفة المعالجة و التخزين

- IT enables firms to integrate the decision functions in subsystems required to manufacture and distribute a product (sales, purchasing, production planning, quality control, process control, and supply chain logistics).

تسمح تقنيات المعلومات بتكامل (ربط وتنسيق) عملية إتخاذ القرار في وظائف التصنيع المختلفة اللازمة لتصنيع و توزيع المنتج (المبيعات، المشتريات ، تخطيط الإنتاج ، مراقبة الجودة ، التحكم في العملية التصنيعية و لوازم سلاسل التوريد )

# Computer Software

- IS is a computer software

نظام المعلومات هو برنامج حاسوبي

- A broad term given to the instructions that direct the operations of the hardware

البرمجيات هي مجموعة التعليمات و الأوامر التي توجه عمل جهاز الحاسب ومكوناته

- Basic types of software (أنواع البرمجيات):
  - Application software
  - End-user software
  - System development software
  - Systems software

# Types of software (أنواع البرمجيات)

1. **Application software** (برامج التطبيقات): process data for business activities, scientific applications, etc. like Accounting, inventory, sales forecasting application programs, CAD, CAM

2. **End-user software** (برامج المستفيد النهائي): multi-purpose software like spreadsheet (MS. Excel), word processor (MS. Word), Graphics package (Photoshop). This software directly used by the user, without programming.

# Types of software (أنواع البرمجيات)

3. **System Development Software** (برامج تطوير النظام): used by programmers and systems analysts in developing and constructing specific programs, and information systems. Such like JAVA, PHP, ORACLE, Computer-aided Software Engineering

4. **System Software /Operating systems** (أنظمة التشغيل): used to control internal operations of the computer systems, like operating systems, and data communication programs (Windows, Linux, MAC)

# Why IIS in industry?

لماذا نحتاج لنظام المعلومات الصناعي؟

- An industrial firm is a web of activities, or processes, that interact with each other (creating and exchanging information)

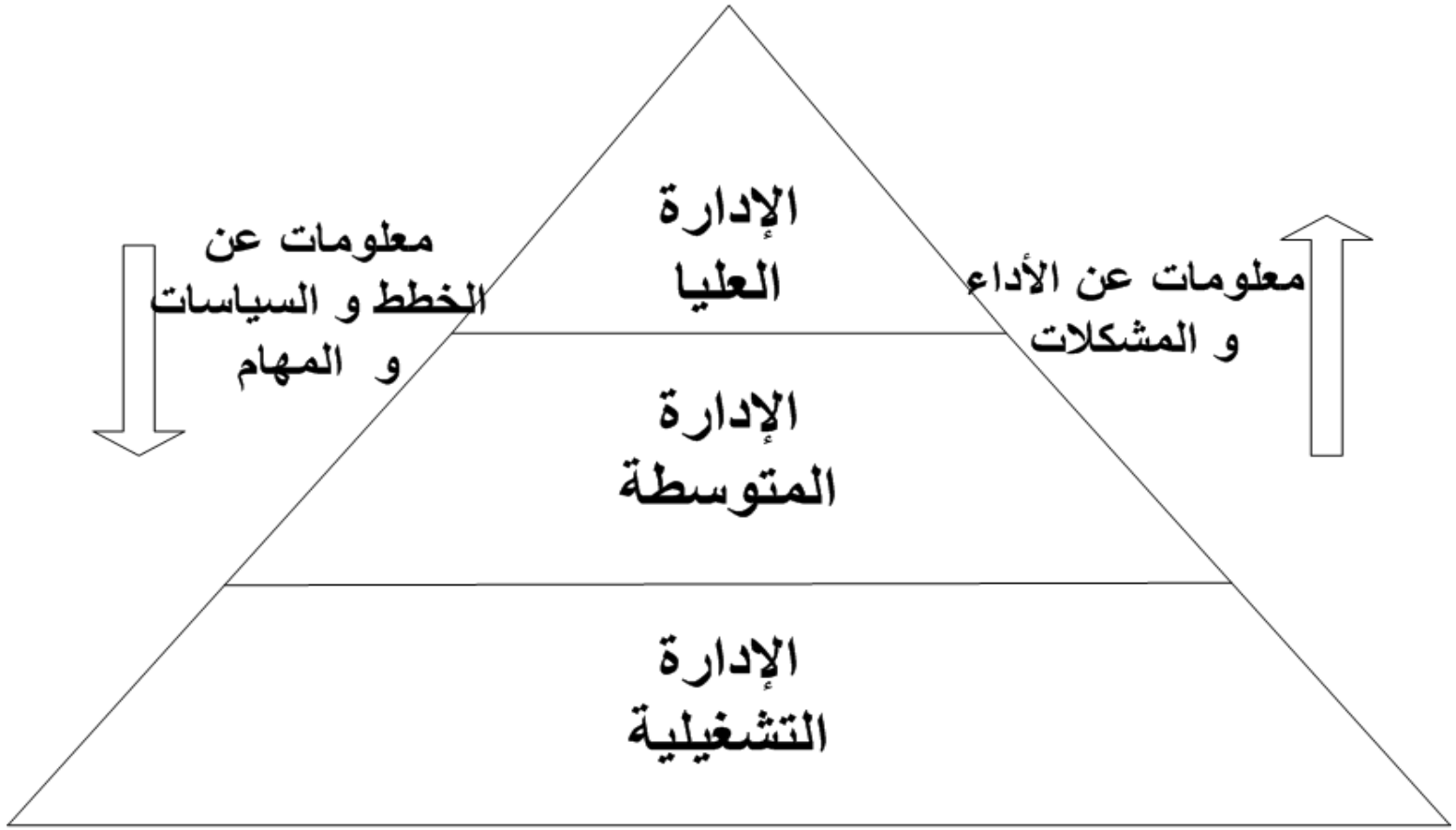
  تعتبر الشركة الصناعية شبكة من الأنشطة و العمليات التي تتفاعل فيما بينها (أي أن التفاعل يكون في صورة خلق و تبادل المعلومات)

- Example: The fact that quality control has given final approval to use the material is "information" passed on to production before production personnel can process the material.

  على سبيل المثال :تعتبر من أهم المعلومات المتبادلة في نظام التصنيع ، أنه عندما تأذن قسم مراقبة الجودة بصلاحية المواد الخام لعملية التصنيع أو المعالجة ، قبل إستخدامها

# Why IIS in industry?

# لماذا نحتاج لنظام المعلومات الصناعي؟




المعلومات تدعم القرار بالمؤسسة في كل
مستوى إداري

# Material Requirements Planning (MRP ) as an IIS

## نظام تخطيط الإحتياجات من المواد كنظام معلومات صناعي

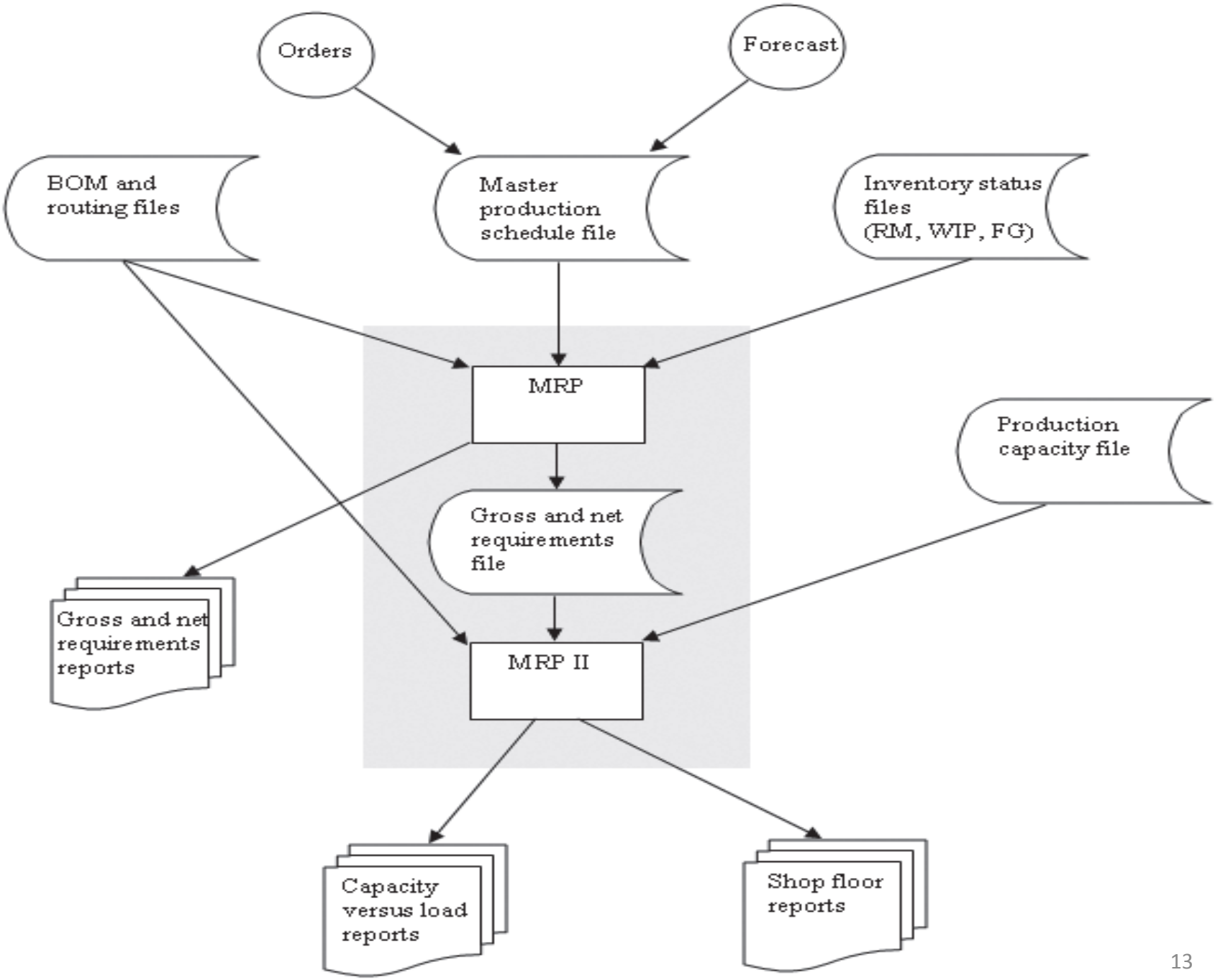
- MRP represents a typical instance of IIS for inventory/production management
- Input to the MRP is the Master Production Schedule (MPS) through (sales order or warehouse stock replenishment request)
- MPS contains how much and when (gross requirements) of finished product units
- The demands for subassemblies and components are determined through Bill of Materials (BOM) explosion.
- The demand of raw materials are determined from subassemblies and components demands
- The demand for raw materials are fulfilled either from stock or through purchase requisitions

# MRP as an IIS

نظام تخطيط الإحتياجات من المواد كنظام معلومات صناعي

- MRP II (Manufacturing Resources planning (تخطيط موارد التصنيع) is an extension of MRP for the inclusion of capacity planning (resources planning: workers , machines, etc.) required to meet the manufacturing activities

- MRP II answers the question of whether or not the a sufficient week-by-week plant capacity exists to meet the planned production schedule


Orders
Forecast
BOM and routing files
Master production schedule file
Inventory status files (RM, WIP, FG)
MRP
Production capacity file
Gross and net requirements file
Gross and net requirements reports
MRP II
Capacity versus load reports
Shop floor reports

# Enterprise resource planning (ERP)
# تخطيط موارد المؤسسة التصنيعية

- The standard MRP system has been expanded to include much more functionality within a concept known as ***enterprise resource planning (ERP).***

- In addition to the traditional MRP, ERP has added support for some of the following functions:
  - Quality management
  - Sales and distribution
  - Human resource management
  - Project management

# Enterprise resource planning (ERP)
# تخطيط موارد المؤسسة التصنيعية

- More recently, ERP was extended beyond the factory and the firm to include functions that link the company to its customers and suppliers, such as the following:

- Logistics supply chain management
- Inter-company communications
- Electronic commerce

# Manufacturing execution system
# نظام متابعة و تنفيذ الإنتاج (التصنيع)

- MRP/MRP II/ERP are generally thought of as “planning” systems. They are not very well integrated into the execution of production

- The absence of available software solutions for production execution the shop floor has led to the development of the ***manufacturing execution system (MES)***

- The MES manage resources (materials, machines, and personnel, etc) on a daily or hourly basis.

# MES functions

Typical MES functions include the following:

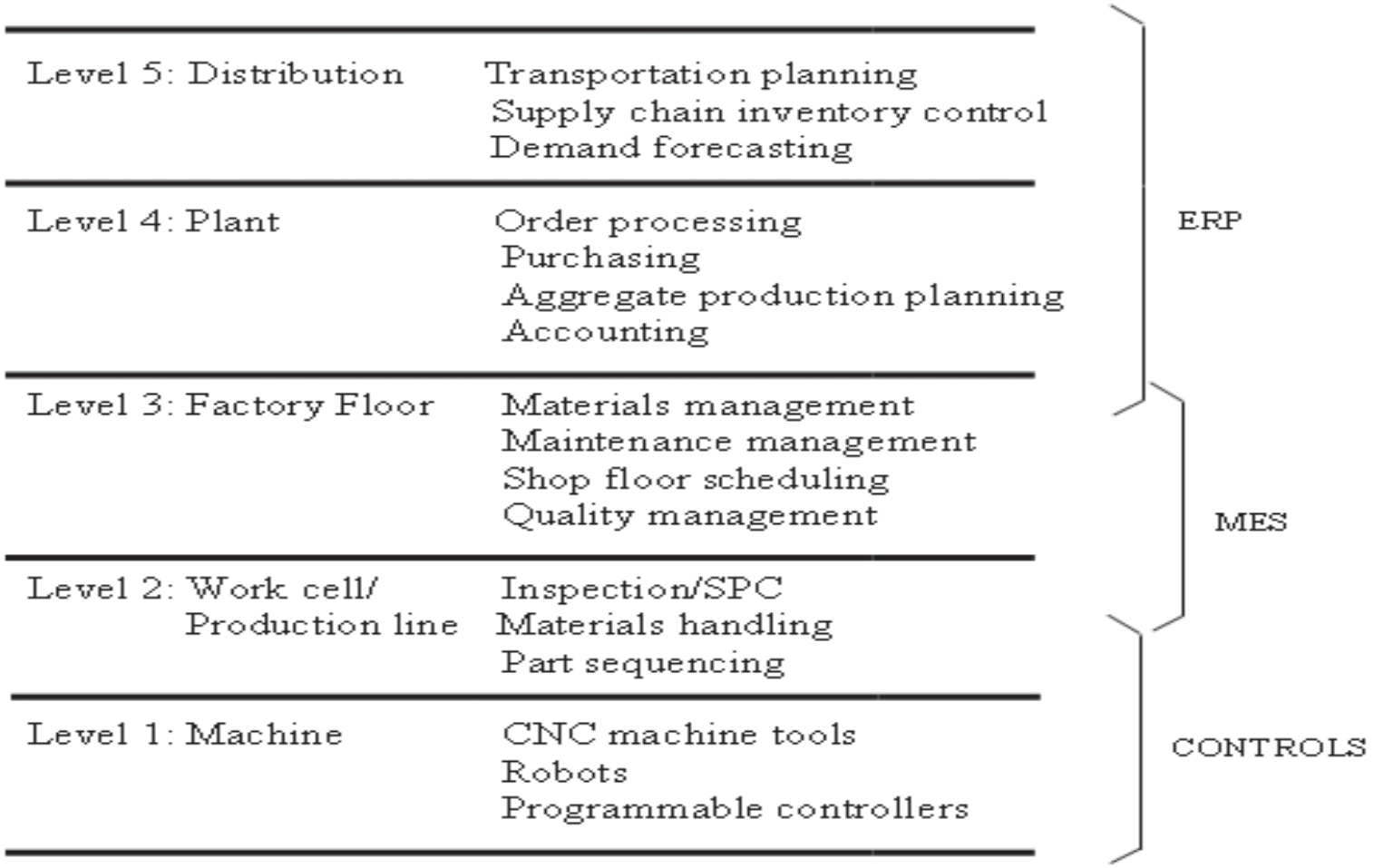
- **Dispatching and monitoring production** تشهيل ومتابعة الإنتاج (controlling the release of work orders to the shop floor and tracking work-in-process inventory.
- **Detailed scheduling** الجدولة التفصيلية للإنتاج
- **Data collection** from factory floor operation to provide a history of factory events (تجميع بيانات العمليات و الأحداث بالمصنع)
- **Quality data analysis** تحليل بيانات الجودة(real-time analysis of manufacturing, notifying of out-of-tolerance, and sometimes recommend corrective action.

## ERP/MES/Control: A hierarchy of information
## تسلسل تدفق المعلومات و القرارات داخل نظام التصنيع

- A hierarchy of decisions must be made in manufacturing, from the machine, or unit operation control level, up through the overall planning of plant operations.

# Decision hierarchy of industrial information system

تسلسل إتخاذ القرار بنظام المعلومات الصناعي



# Production line or work cell level

## القرارات على مستوى خط الإنتاج أو الخلية التصنيعية

- **Control the interactions between** a group of related machines or processes.

- This level of decision making is concerned with the release and delivery of materials at the correct time

- Examples of decisions at this level include routing of material among machines, and the decision to extract out-of-specification components while they are being processed

- The work cell or production line level is considered part of the MES level, but there is some overlap with the controls level.

# Factory floor level

القرارات على مستوى الورش

- At the factory floor level, decisions are made that affect groups of production lines or work cells.

- Decision examples include the scheduling of which production line or work cell will fabricate a part

- There is some overlap between MES and ERP responsibilities at this level of the hierarchy.

# Plant level

## القرارات على مستوى المنشأة

- At the plant level, more closely related to the business planning objectives of the firm.

- A typical plant-level production control decision is aggregate production planning التخطيط التجميعي (planning the production capacity to meet customer demands over a period of months or a year)

- Decisions and functions at this level of the hierarchy are considered part of MRP/ERP functions.

# Distribution system level

القرارات على مستوى التوزيع للعميل

- Finally, at the distribution system level decisions coordinate the supply of finished product to the end customer.

- Example decisions are maintaining appropriate and cost-effective inventory, as well as managing the transportation levels of product between warehouse locations in the supply chain.

# The nature and role of IIS
## طبيعة ودور نظام المعلومات الصناعي

- The industrial system is modeled as a hierarchy of decisions, where the upper levels of the hierarchy place constraints and control decisions on each succeeding lower level.

- The complete integration of all levels of decision processes, supported by computer information systems, is the domain of an industrial information system.

# Information flows within the industrial system

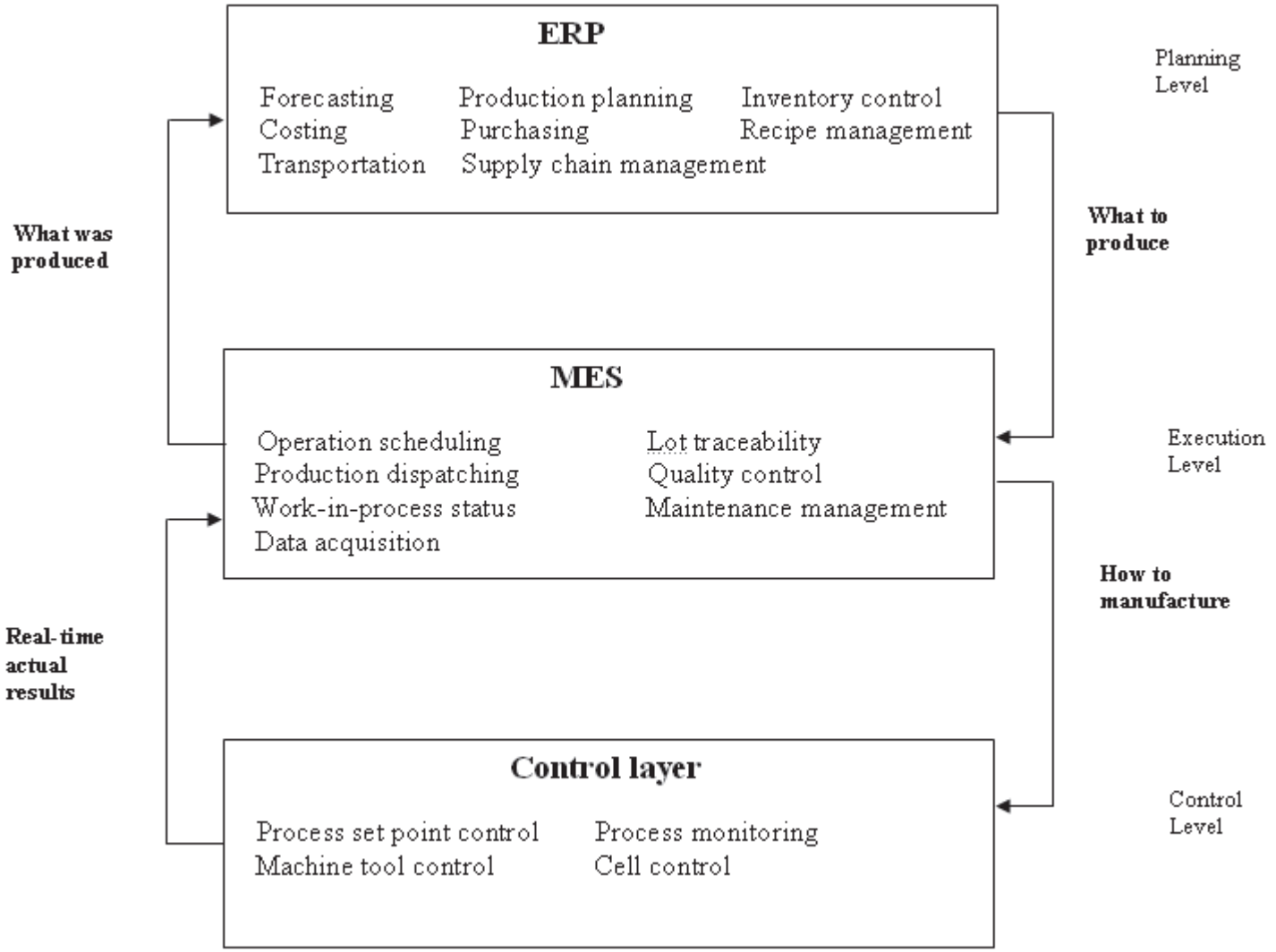
- ERP , MES & control are standard software solutions
-
- ERP provides the MES level with an overall plan of what is to be produced during the current planning horizon

- The MES level is then responsible for detailed production operations on the factory floor.

# Information flows within the industrial system

- The MES level tells the machine controllers how to produce a particular part by controller programs
- As production is executed, actual results concerning what was produced are fed back to the planning level.
- The MES level monitors real-time actual results, and data summaries are logged for storage in factory databases.

# Coordinating the layers in the industrial System: Information flows



# Network architecture

# البناء الشبكي للإتصال بين مستويات القرار بنظام المعلومات الصناعي

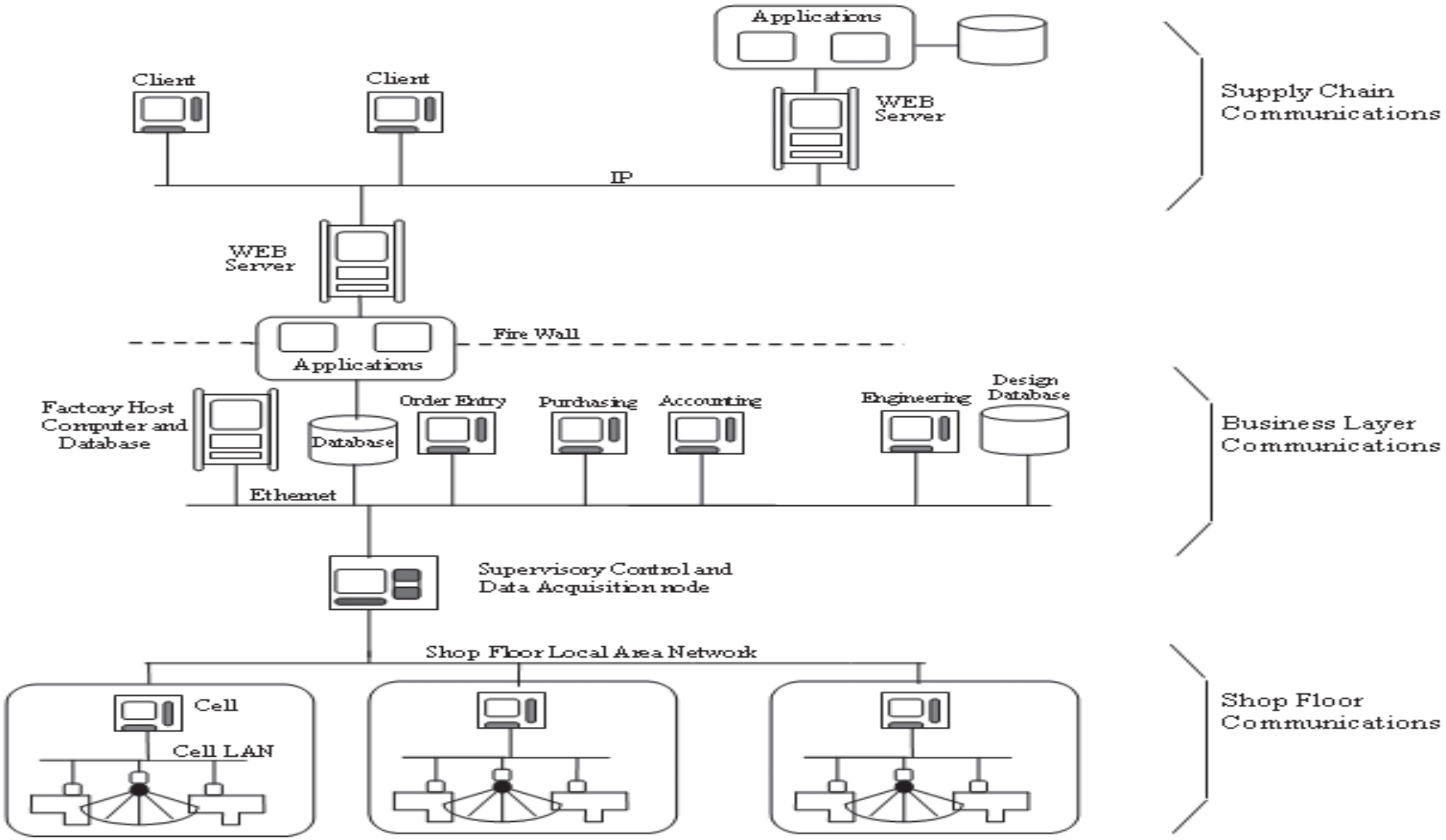
- Enterprise integration تكامل المؤسسة التصنيعية is about the integration of functional areas through information sharing تشارك المعلومات

- To realize efficient information sharing, it is desirable to network the levels of the hierarchy of the manufacturing enterprise

- The network architecture is a description of how the various layers of the decision hierarchy will communicate with one another

- The network architecture is typically implemented with the use of local area networks (LAN)

# Typical network architecture for modern industrial company شبكة نظام معلومات صناعي بشركة



# Components of computerized IIS

مكونات نظم المعلومات الصناعية المحوسبة

- **Computer Hardware**
- **OS and applications software**
- **Database**:
  - Contains all data utilized by applications software.
  - Individual set of data stored = file
  - Physical Storage media (second storage): tape, diskette …etc

# Components of computerized IS

- **Procedure:** manual or physical instructions booklet:
  - User instructions
  - Instructions for preparation of inputs
  - Operating instruction  for computer personnel
- **Operating personnel**:
  - Computer operators
  - Database administrators
  - Systems analysts
  - Programmers

# Functions of information systems

وظائف نظم المعلومات

- Data collection: captures data about events affecting the system and its environment, and loads data into computer means of input devices. Collected data are classified and indexed into order to make retrieval of desired information easy

- Data storage: storing past data and information into database for future retrieval.

- Information retrieval: database management system extract necessary processed data as information for decision making

# Functions of information systems

- Data processing: computation, includes all transformation process on input data into information

- Data / information transmission: communication of coded information between geographically separated points

- Data display: presentation of output information in a form for human perception, by means of printed form, or temporary display on CRT display, etc.