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# **Business Software Systems**

## **Course Slides**

Prof. Dr. Andreas Lux

# Course Content

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- Introduction to Business Informatics, Classification of Business Information Systems within the area of Business Informatics
- Enterprise Resource Planning (ERP): Definition, History, Architecture
- Business Process Management and its Relation to Business Information Systems
  - Modeling Methodologies: ARIS & BPMN
- Industry-independent Business Information Systems
  - Modules: Accounting, Sales & Distribution, HR
- Industry-specific Business Information Systems
  - Modules: Production Planning and Retail
- Business Intelligence
- Supply Chain Management (SCM)
- Customer Relationship Management (CRM)
- Knowledge Management (KM)

# Learning Outcome

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The students should be able to ...

- distinguish the main differences between the area of business informatics and the area of computer science
- understand the purpose of business software systems, especially enterprise resource planning (ERP) systems
- know the potential use and benefits of the different kind of business software systems
- explain standard architectures of ERP systems
- know the core business processes supported by business software systems
- explain the relationship between business process management and business software systems (BPM cycle)
- model business processes with graphical standard notations
- understand graphical models of business processes as a starting point for the introduction and customizing of an ERP system

# Learning Outcome (continued)

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The students should be able to ...

- understand the term Business Intelligence (BI) and know the components of a business intelligence system
- understand the concepts of an enterprise content management systems (ECMS)
- describe the terms SCM and CRM and understand their respective goals and processes
- know the important meaning of knowledge management

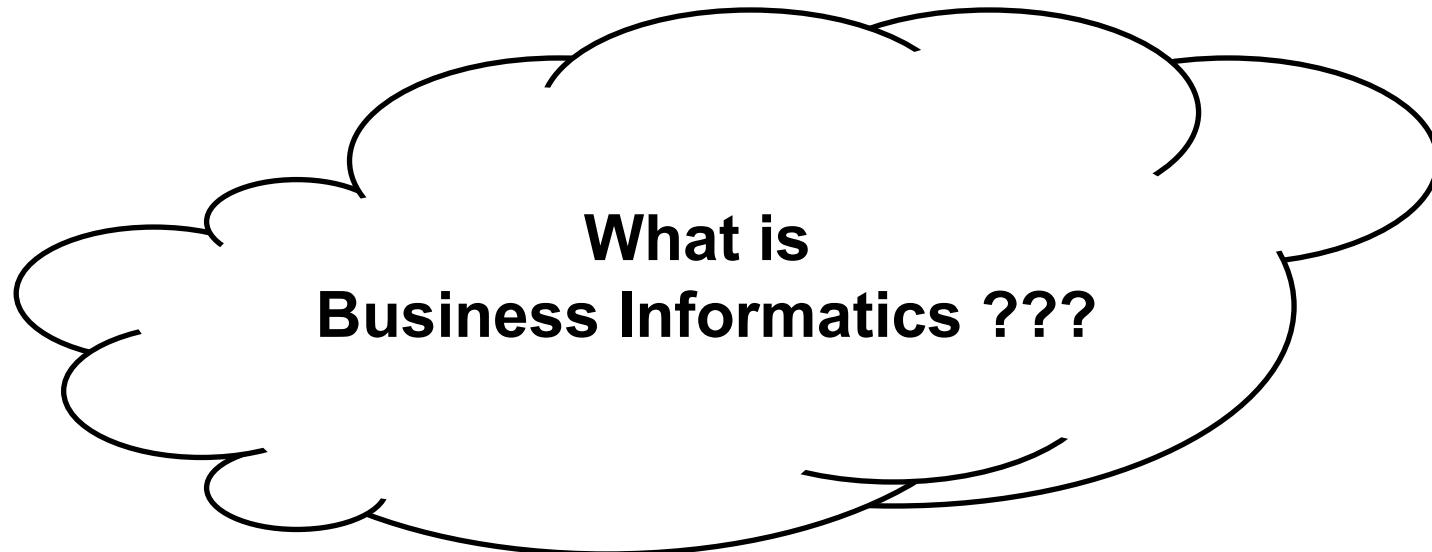
# Literature

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- Kenneth Laudon, Jane P. Laudon: Management Information Systems: Global Edition, 13<sup>th</sup> ed., Pearson Education, 2014.
- K. Ganesh et. al.: Enterprise Resource Planning - Fundamentals of Design and Implementation, Springer International Publishing, 2014.
- M. Dumas, M. La Rosa, J. Mendling, H. A. Reijers: Fundamentals of Business Process Management, 2nd ed., Springer. 2018.
- B. Silver: BPMN Quick and Easy Using Method and Style: Process Mapping Guidelines and Examples Using the Business Process Modeling Standard, Cody-Cassidy Press. 2017.
- Scheer: ARIS - Business Process Modeling, Springer Berlin Heidelberg, 3rd ed. 2000.

# Business Informatics

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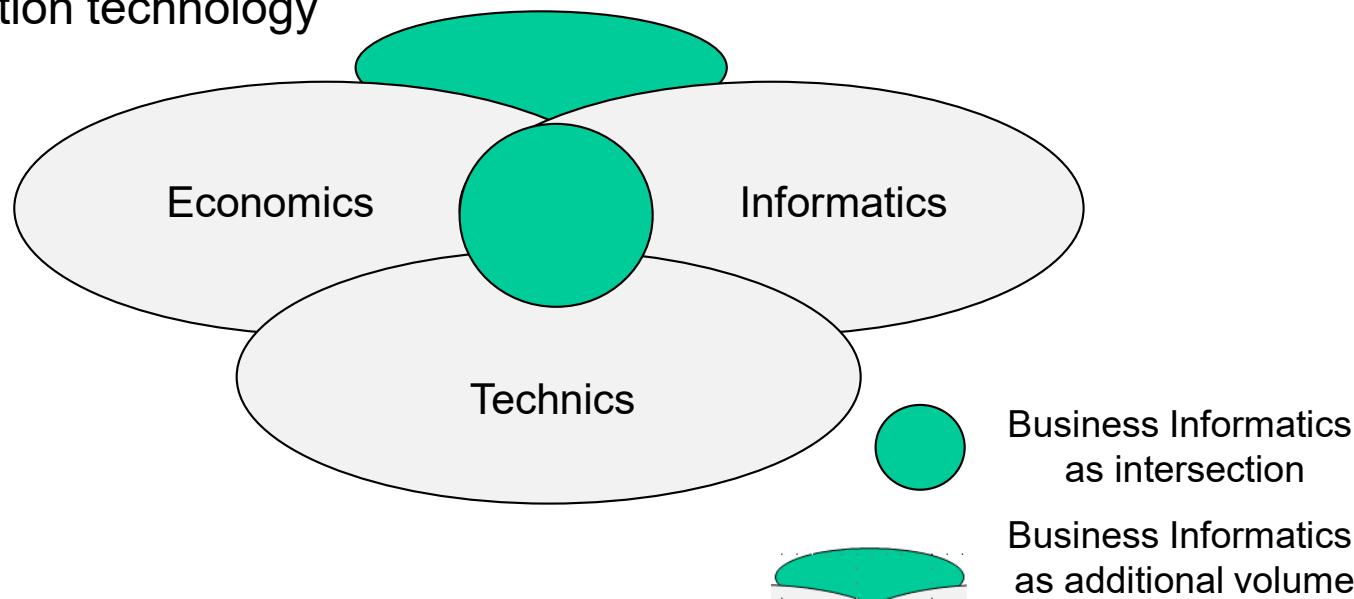
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# Business Informatics – General Characteristics

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- ... is an ***interdisciplinary area*** with strong practical relevance to economy
- ... is concerned with ***socio-technical systems***, i.e. systems that comprise **human and technical components** which are dependent and co-operate
- ... distinguishes itself from the more scientific „core“ informatics (in Germany so called „***hyphen-informatics***“)
- ... is **more than the intersection of economy, informatics and technics**, e.g. special methods for the coordination of enterprise strategies with information technology



# Fields of Activity

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## Basic knowledge of a business data processing specialist:

- phase-oriented, process-driven **development or introduction of business information systems**
  - therefore necessary: **business process management**, i.e. modeling, analysis, implementation and improvement of business processes with information technology (IT) means
- **IT management**

## Further fields of activity:

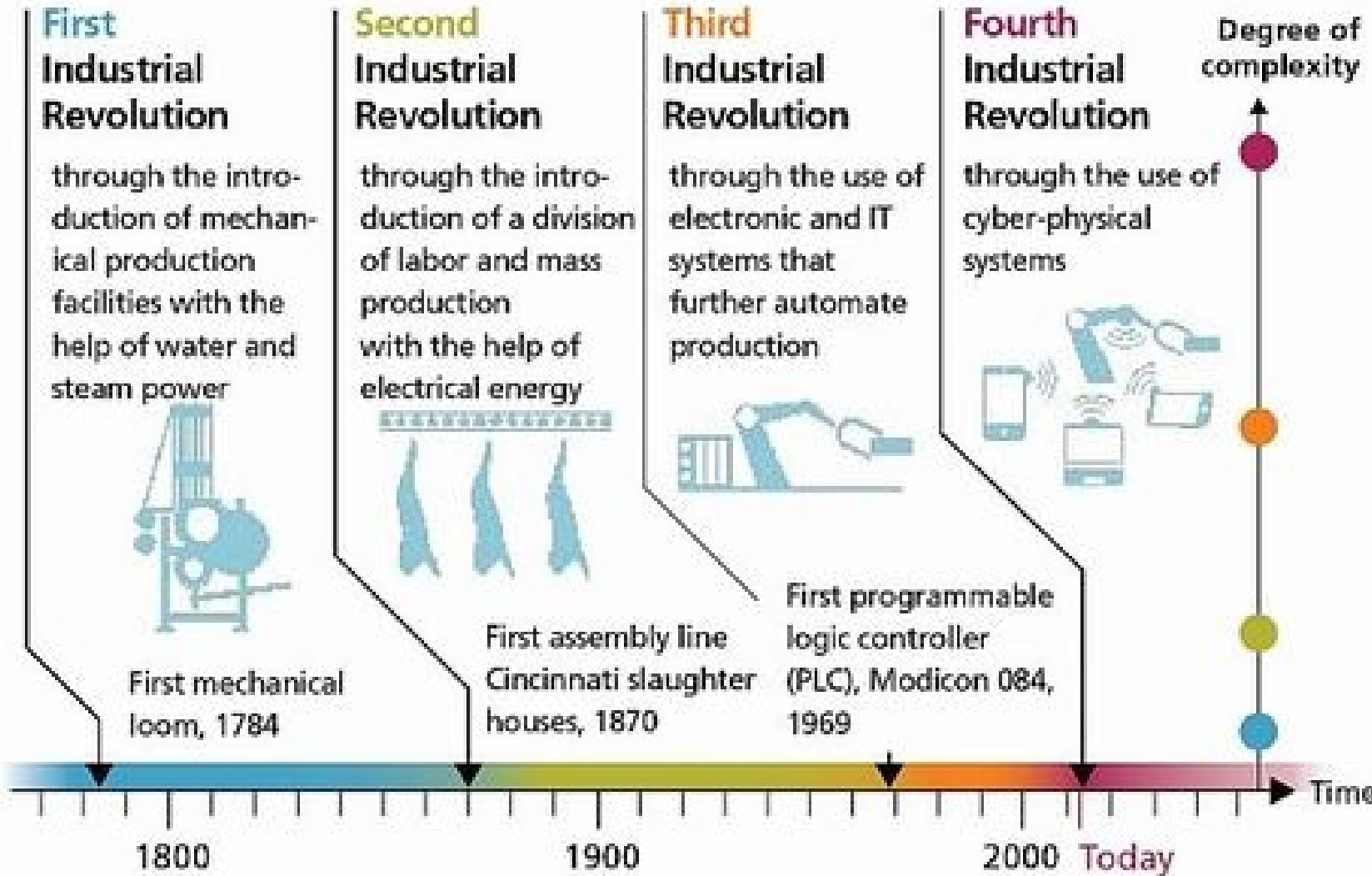
- definition of criteria for the **selection of hardware** and **standard software** for business applications within the whole enterprise
- examination of usage and profitability of information technology

# Necessary Know-how

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- hardware
- software
- data modeling and data management
- business process modeling and business process management
- **architecture / design of information systems**
- communication: networks, protocols, distribution aspects
- ...
- → **mediator function:** balance of interests between the desires of the specialized department coworkers and/or IT- users on the one hand and the requirements of the system designers and - operators on the other hand
- must be able to communicate appropriately with the management, the department coworkers and the IT specialists in their respective technical terminology

# Historical Review: Industrial Revolutions



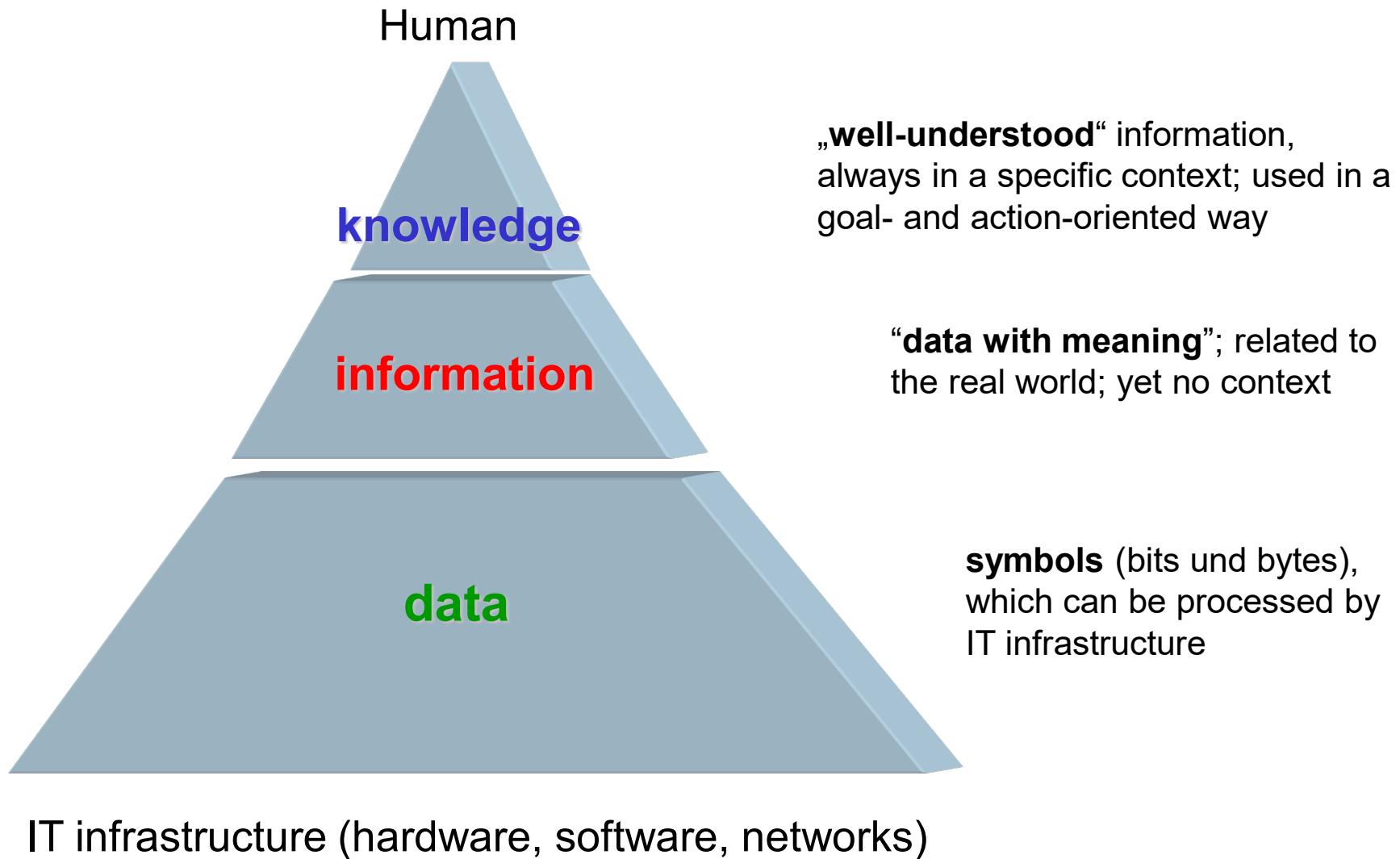
# Information as Key Production Factor

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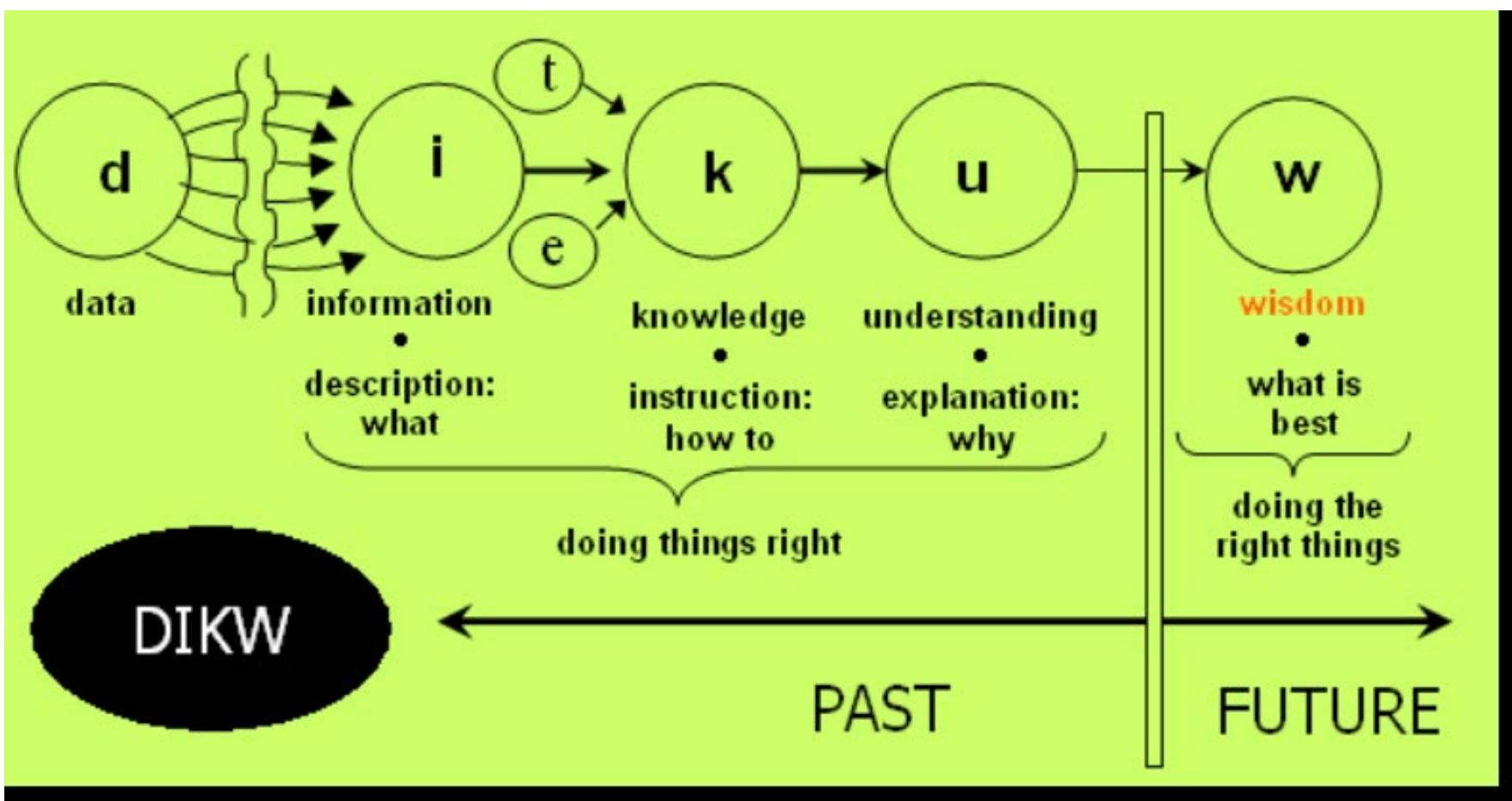
- **Information society** is the follow-up of the traditionally, machine- and material-oriented production
- the portion of the so-called **transaction costs** (information and communication costs) by inside and inter-company coordination lies in modern national economies already over 65% (information as key factor of production)
- → **strategic meaning of the information technology**: new forms of co-ordination and division of labor

# Data - Information - Knowledge

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# DIKW Flow Diagram



[https://en.wikipedia.org/wiki/DIKW\\_pyramid](https://en.wikipedia.org/wiki/DIKW_pyramid)

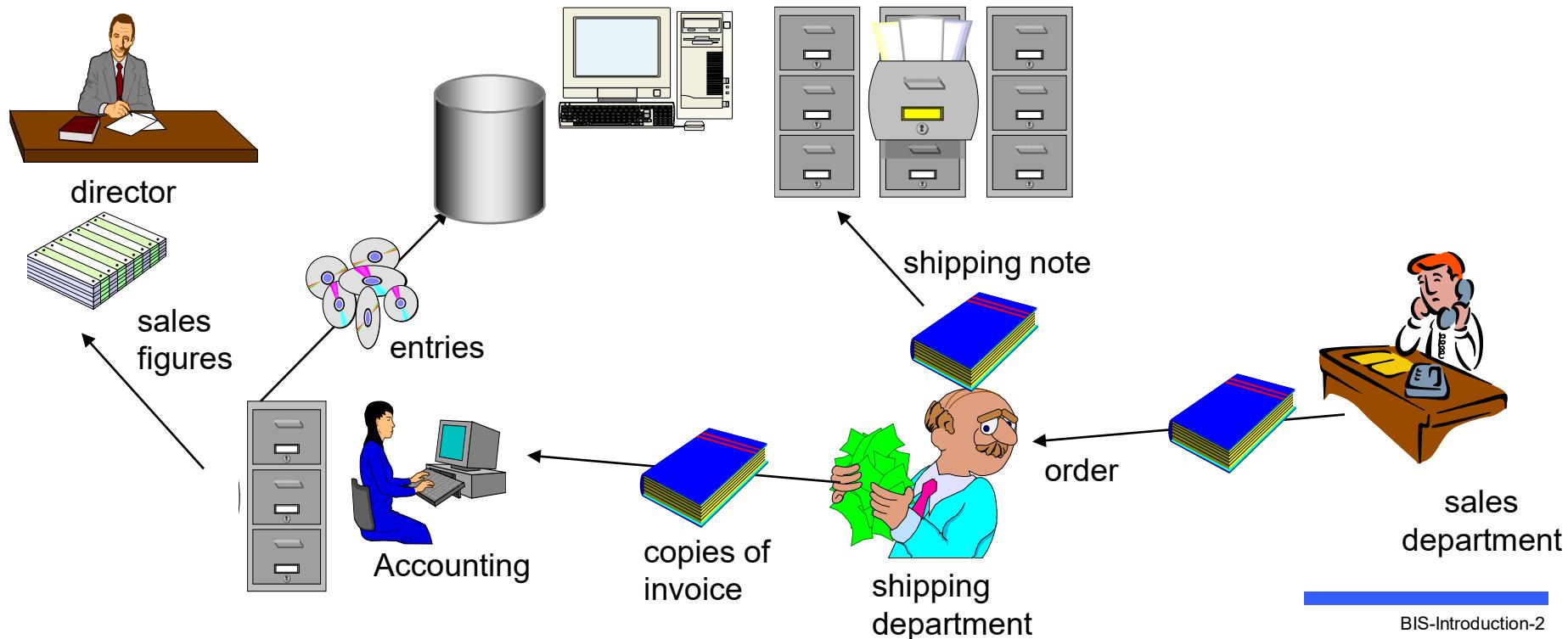
# Business Software Systems

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- ... are - from a business informatics perspective - the **central components** of the computer-assisted data processing in an enterprise
- **main goals:**
  - automation everywhere in the enterprise, where the machine system can do a task at least as well as humans can (quality, costs, time,...)  
→ “**reasonable full automation**“
  - where automation is not attainable, the IT-system is **to support** technical and high-level personnel **as effectively as possible**

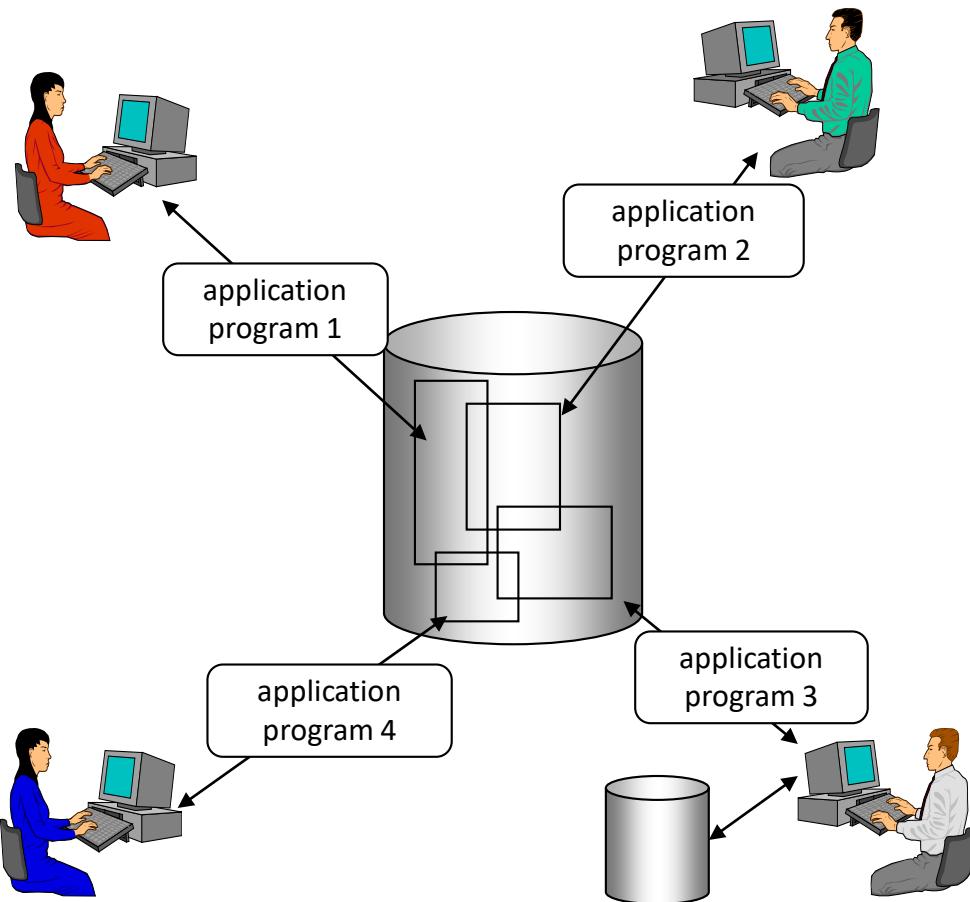
# Business Software System - Definition

- An **software system** consists of humans and machines which create and / or use information and which are related by communication relationships
- A **business software system** is used to support the **core business processes** within an enterprise and between an enterprise and its environment



# Business Software System

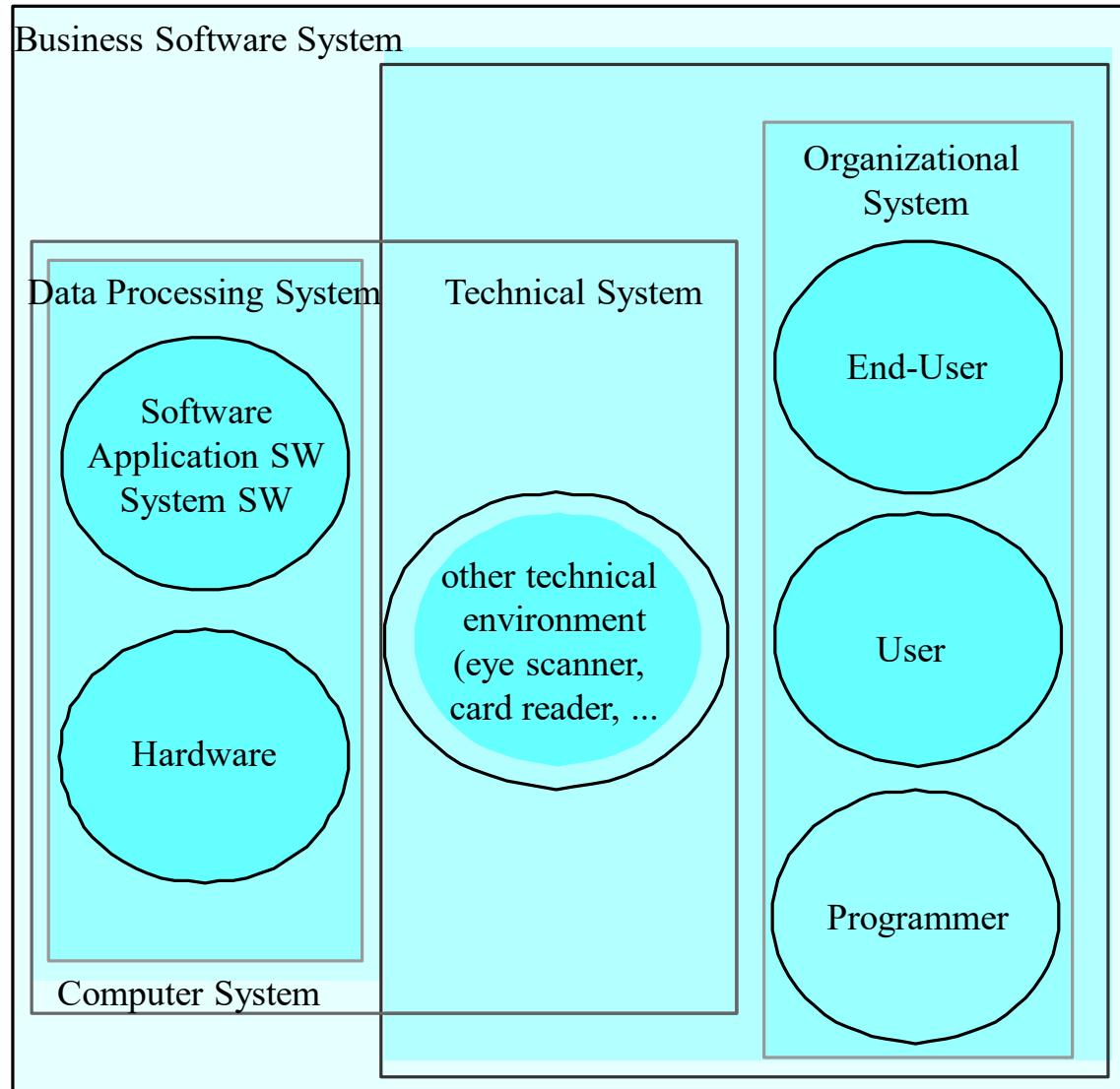
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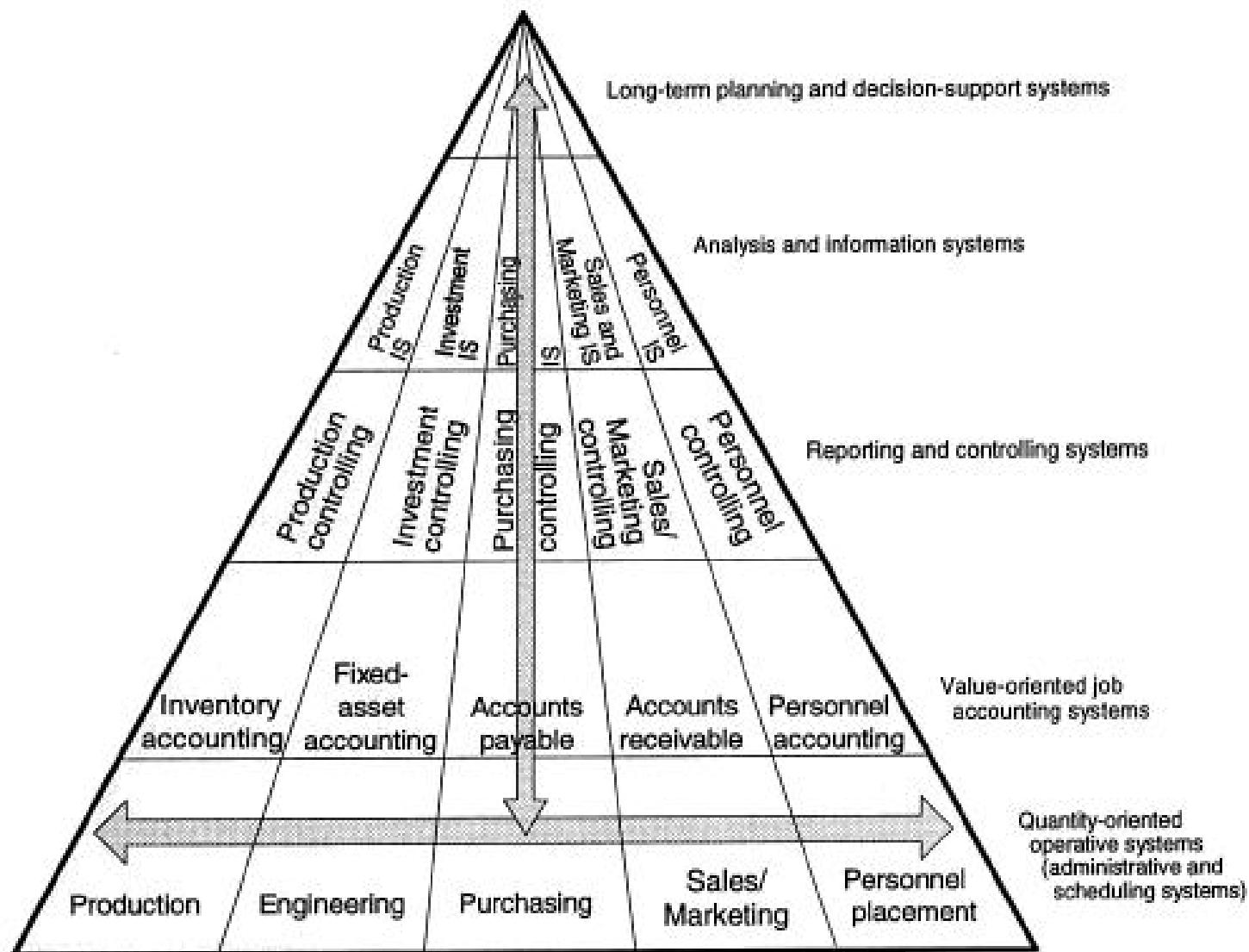
- „.... in a **closer sense** the whole of all programs, i.e. the **application software**, and the associated data for a concrete operational area of business application“
- „.... in a **broader sense** additionally the **hardware** and **system software** needed for the use of the application software, the necessary **communication devices** and **networks** and - depending upon viewpoint - also the different kind of **users**... “

according to: Stahlknecht, Hasenkamp, 1999

# Business Software System



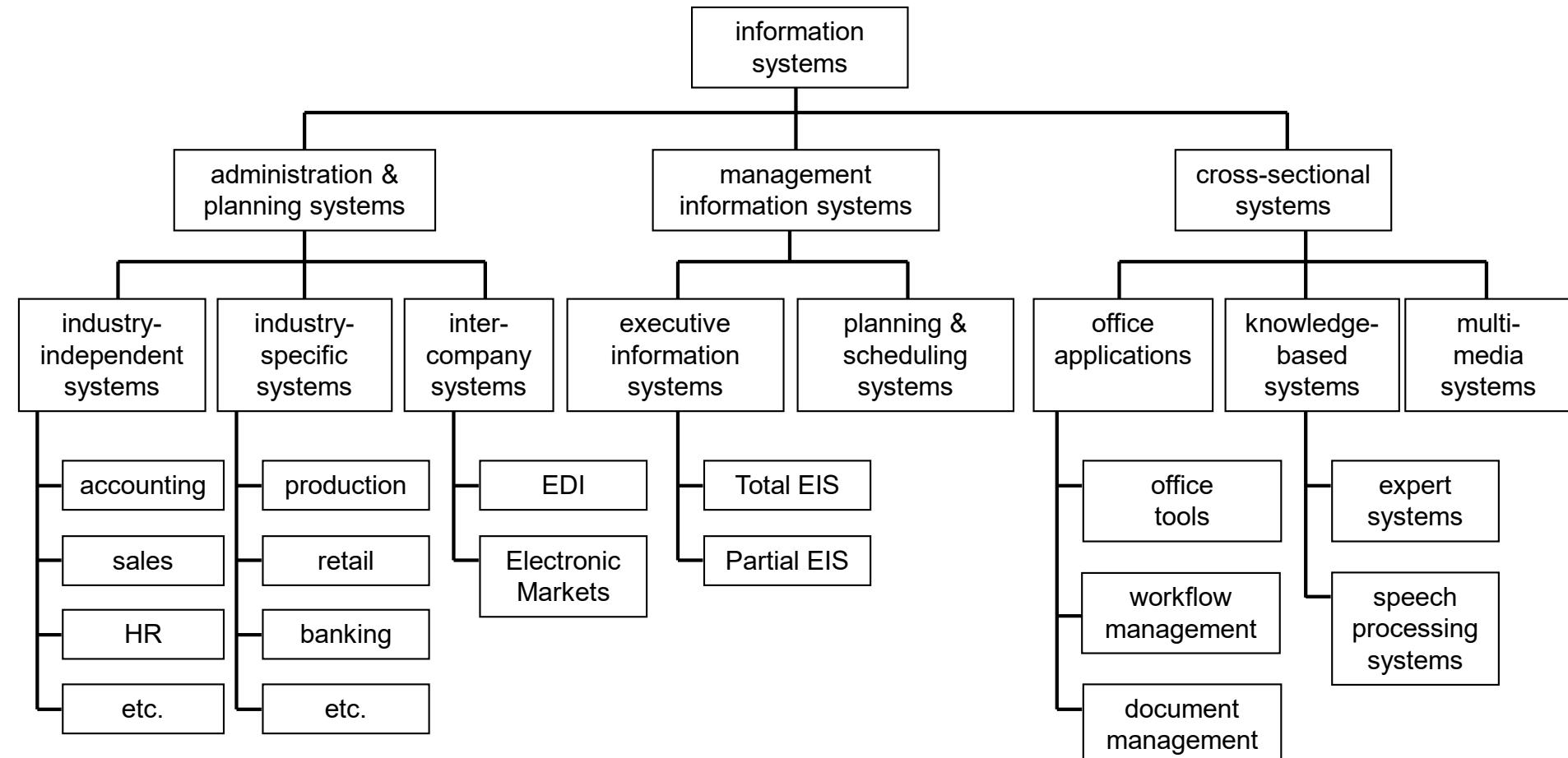
# Classification of Business Software Systems (I)



[according to:  
Scheer, 1994]

# Classification of Business Software Systems (II)

according to intended use (functional view)



[according to:  
Stahlknecht, Hasenkamp, 2004]

# Different Categories of Business Software Systems

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- **standard software (COTS = Commercial off-the-shelf) or individual software (custom software, bespoke software or tailor-made software)**
- **industry-independent** or **industry-specific** software
  - **industry-independent** software is universally applicable in all companies
    - Cross-sectional systems (e.g. office packages)
    - ERP systems (Enterprise Resource Planning)
  - **industry-specific** software is tailored to the special requirements and conditions of the companies in an industry, e.g. mechanical engineering, banks, insurance companies etc.

# Different Categories of Business Software Systems

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- other distinguishing features:
  - **open source** or **closed-source (proprietary)** software
  - architectural design (monolithic, client-server, browser-based, ...)
  - embedded or non-embedded
  - right of use (free, open source, GPL, SaaS, ...)

# Different Views to Business Software Systems

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- Which data are stored and processed within the System (**data view**)?  
→ quantity-oriented or value-oriented, control- or report-oriented
- **Who** and **how many** use the system (**organizational view**)?  
→ departments, middle management, executive board
- **What is the main functionality** (**functional view**)?  
→ administration system / planning system, executive information system, cross-section system

# Administration Systems

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- **Function view:** Classical operational account of "bulk data"
  - record keeping in the financial accounting department including month and end-of-year procedures
  - monthly wage and salary statements
- **Data view:** Administration of stocks, e.g.
  - article in the trade or in the manufacturing industry
  - accounts with banks
  - contracts at insurance or leasing companies
- **Organizational view:** operating departments

# Planning Systems

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- **Function view:** preparation of short term decisions, e.g.
  - Reminders in the financial accounting
  - Outer service control and route planning in the selling area
  - material procurement and workshop control in the manufacturing area
  - Ordering in the trade
- **Data view:** Transaction data such as orders, incoming goods etc.
- **Organization view:** Lower and middle leadership level in operating departments

# Executive Information Systems

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- **Function view:**
  - **Planning** of all activities necessary for the reaching of the company goals (e.g. sales planning, product planning)
  - IT use for the computation of plan alternatives: model computations, optimization and simulation methods
- **Data view:**
  - internal data from administration and planning systems
  - external data, e.g. market studies, on-line data bases
- **Organization view:**
  - support decision preparation for the upper leadership levels (middle and upper management)

# Cross-sectional Systems

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- Function view:
  - **support of general office activities**, e.g. by office automation and communication systems (text processing, spread-sheet analysis)
  - **support of group work** with groupware, workflow or document management systems
  - Methodical support for different areas of application, e.g. **knowledge-based or decision-support systems** for the support of decisions
- **Data view:** different kinds of information and data
  - structured data from data bases
  - text documents
  - multimedia documents
- **Organization view:** applicable on all operational jobs

# Standard Software vs. Individual Software

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„make“

- **custom software**

- unique development for an enterprise
- fits exactly the needs of a single customer

or

„buy“

- **standard software** \*)

- multiply used software product for an anonymous market
- customizable up to certain limits to the users' needs  
("Customizing")

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\*) Note: The English word „standard“ means among other things „norm“. Standard software is not however, by any means standardized software, since it was not created by a neutral standardization organization. Standard in this sense means only „non-individually“

# Standard Software vs. Individual Software

Internal solution

External solution

Make

Buy

	<p><b>In-house development:</b></p> <ul style="list-style-type: none"><li>- software development with own employees</li></ul>	<p><b>Purchase of standard software:</b></p> <ul style="list-style-type: none"><li>- implementation with own employees and the help of external consultants</li></ul>
	<p><b>External development of software:</b></p> <ul style="list-style-type: none"><li>- External software house carries out the development of individual software on behalf of the company (if necessary supported by employees of the company)</li></ul>	<p><b>Standard software rental:</b></p> <ul style="list-style-type: none"><li>- Standard software is procured and operated by an external company (provider); needs-based use (rental) of the software as a client</li></ul>

# Pros and Cons of Standard Software and Individual Software

## Pros and cons of custom software



- tailor-made solution
- no adaptation of the organization required
- independence from the software supplier
- possibly strategic benefits



- High **development** costs
- maintenance is expensive, often no longer possible
- partly insufficient documentation
- dependence on developers

## Pros and cons of standard software



- low **purchase** price
- know-how transfer by software manufacturer
- permanent further development in line with market standards
- high functionality
- industry neutrality and individuality by customizing



- Manufacturer dependency
- Expensive special personnel
- little influence on the development of functionality
- High implementation effort (training, consulting)
- Adjustment time-consuming or even not possible

# Standard Software vs. Individual Software

high

**Availability  
of Standard  
Solutions**

low

**Buy and Customize**

- Purchase and customizing of standard software
  - complete adaptation of the organization to the software
- (Organisation follows IT)**

**Buy and Customize  
and Integrate**

- Purchase and customizing of standard software
- Supplement with add-ons where the organization cannot or should not be adapted **(IT meets Organisation)**

- Development of simple and inexpensive individual software
- Additional use of standard software (if available on the market)

- Development of complex and functionally customized individual software **(IT follows Organisation)**

**Make or  
Buy and Customize**

**Make!**

low

**Strategic  
Meaning**

high

# ERP Definition

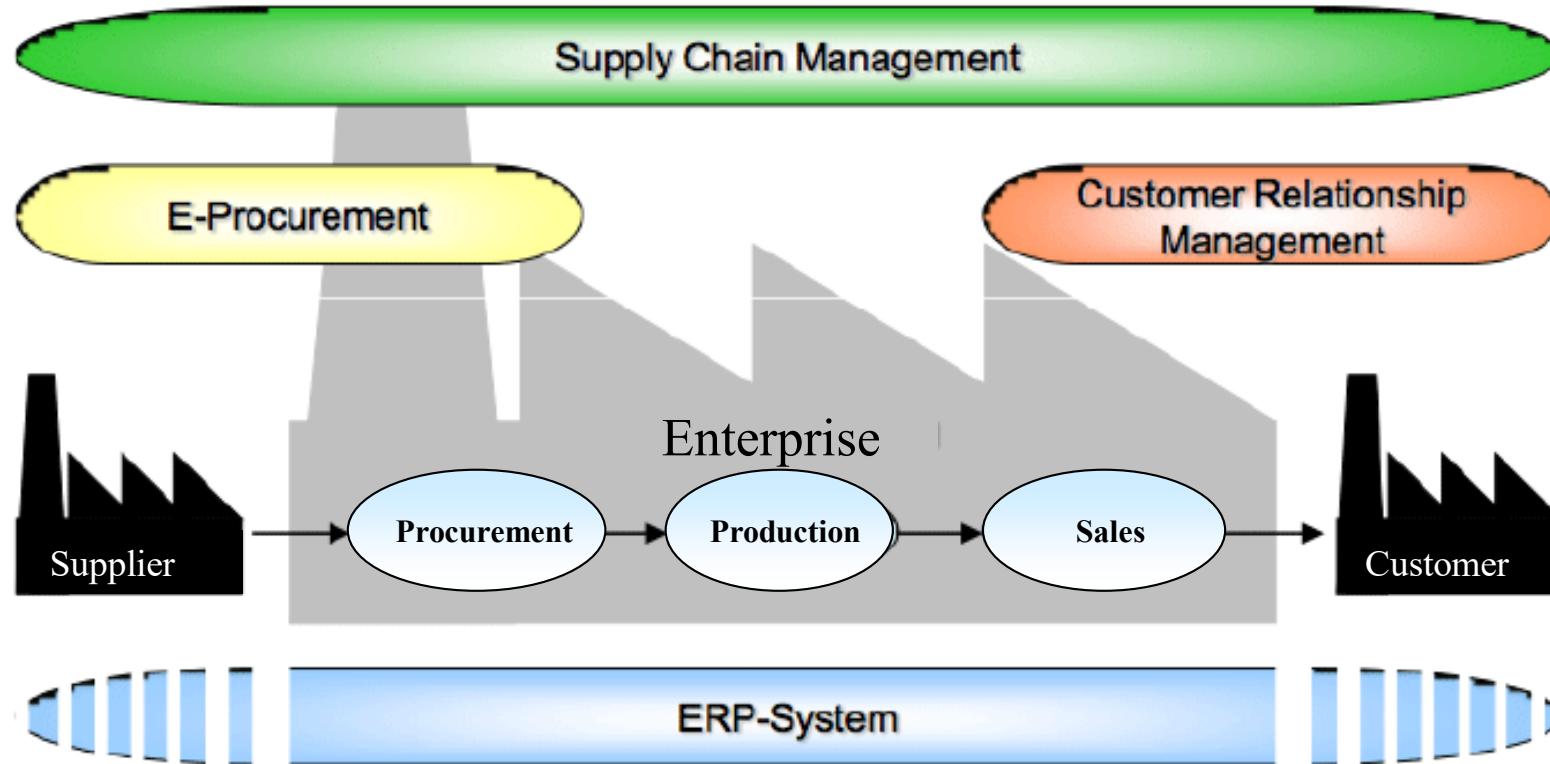
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- Enterprise Resource Planning (ERP) is the overall term for all planning and controlling processes within an enterprise
- term coined by Gartner Group in 1990
- **main goal** of ERP systems:
  - continuous support (automation) of all standard business processes
    - in a structured and highly integrated platform
    - applicable in many industries
    - usable in many countries
- evolved from manufacturing resource planning systems (MRP II) and production planning and scheduling systems (PPS)

- also called: **Extended ERP** (Gartner, 2000)
- company-wide integrated collaboration, i.e. integration of customers, suppliers respectively partners in the enterprise' business processes
- integrated cooperation with help of the internet
  - Supply Chain Management
  - Customer Relationship Management
  - Product Data Management (PDM)
  - E-Business
- integration of new technical components (mobile end-devices → “**mobile ERP**”)
- “**Social ERP**”, esp. Social CRM (usage of social networks)

# ERP System and Extensions

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# Development of ERP Market

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- **in the 1990s:**
  - **extreme growing phase** ( up to 40 %)
- **in the 2000s:**
  - **focus on SME** (small medium enterprises, i.e. enterprises with < 250 employees and < 50 Mio. € volume)
  - growing rate 3 - 8 %
  - **consolidation phase**
  - number of vendors is shrinking constantly (from about 200 in the 90s to about 70 today)
  - a lot of acquisitions by the “**BIG-3 players**” SAP, Oracle and Microsoft

# ERP Market

- **SAP** (→ mySAP, Business One, All-In-One)



- **Oracle**

- Peoplesoft (2005)
  - J. D. Edwards
- Siebel



- **Microsoft** (→ Microsoft Dynamics)

- Navision(Damgaard)
- Great Plains
- AXAPTA
- Solomon



- **Sage** (KHK): X3, ERP b7 (formerly Bäurer)



- **Infor Global Solutions**

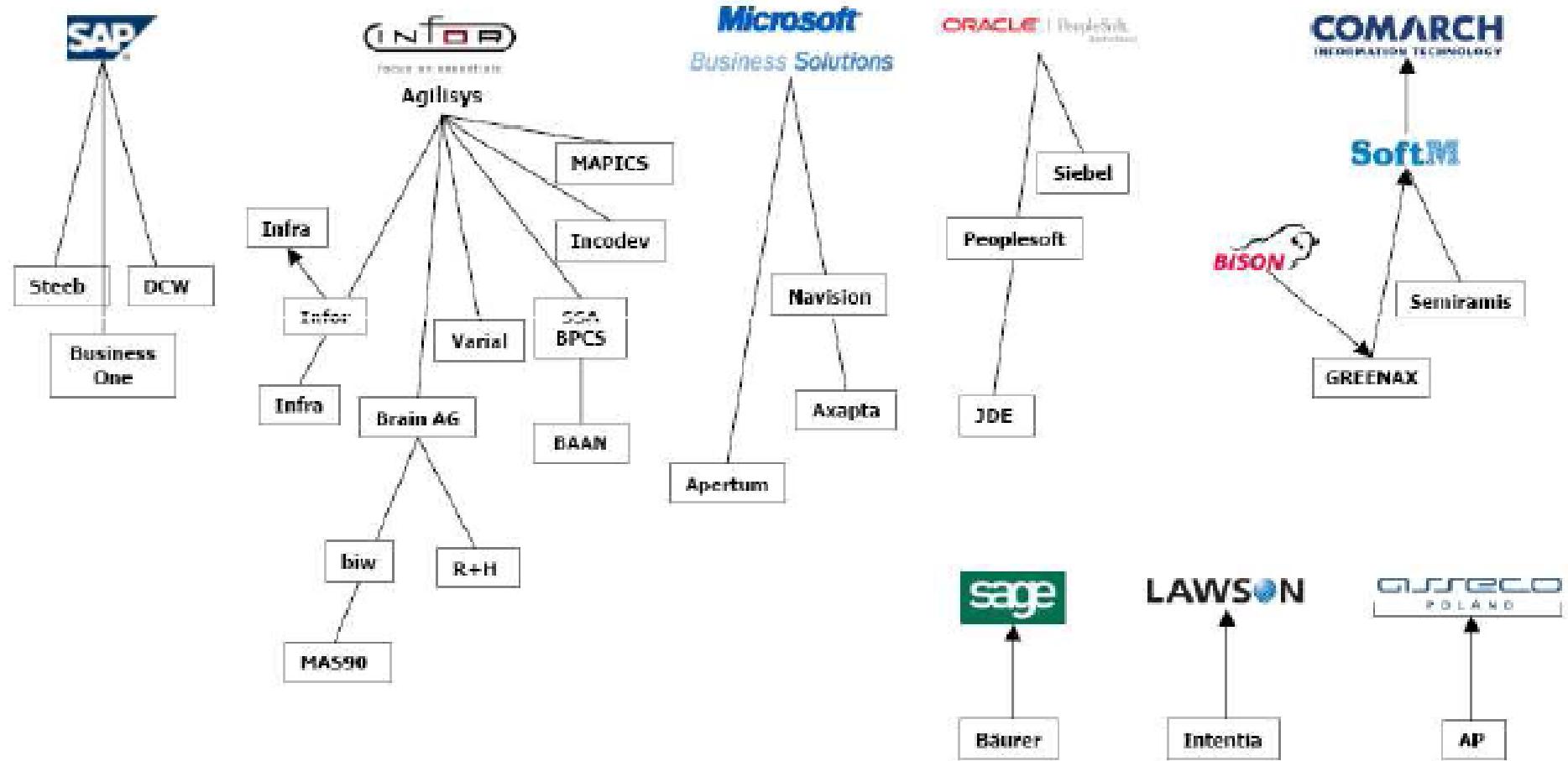
- SSA Global (formerly Baan) (2006)



- **Open Source Systems**



# Consolidation Process of ERP Market



+ about 90 further vendors on the German market

# German Market Shares of ERP Vendors in the Industrial Sector

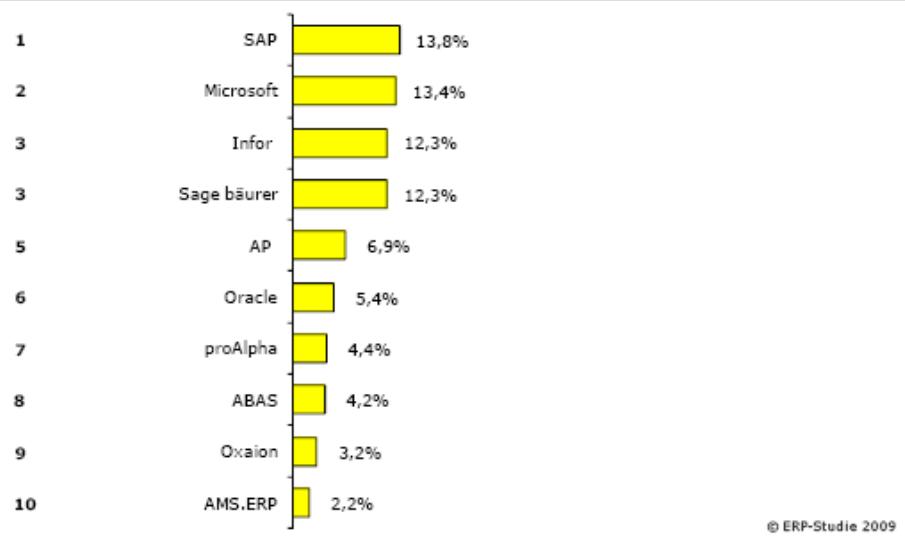


Abbildung 64: Marktanteile von ERP-Herstellern in Industriebetrieben mit 50 bis 99 Mitarbeitern, Rang 1 bis 10

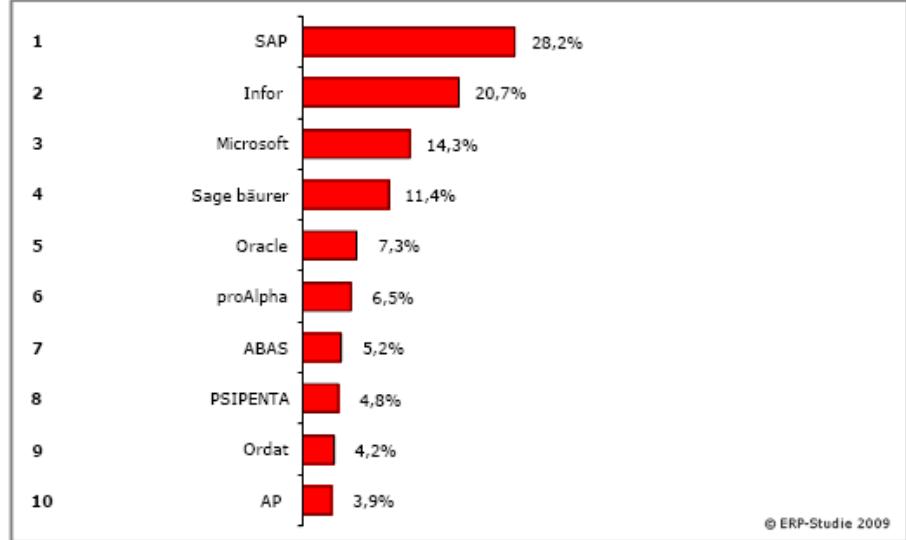


Abbildung 65: Marktanteile von ERP-Herstellern in Industriebetrieben mit 99 bis 499 Mitarbeitern, Rang 1 bis 10

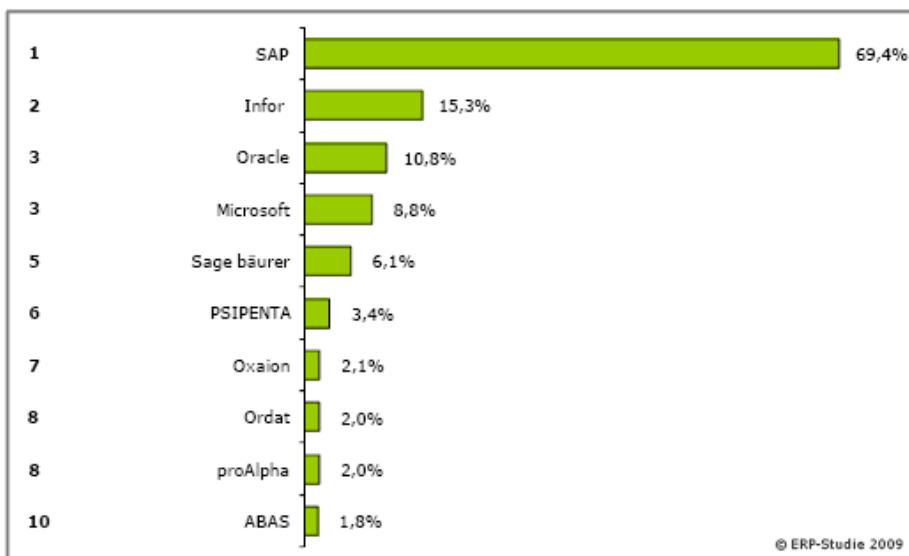


Abbildung 66: Marktanteile von ERP-Herstellern in Industriebetrieben mit 500 und mehr Mitarbeitern, Rang 1 bis 10

- process industry
- metal industry
- mechanical engineering
- vehicle manufacturing
- supplier

# Characteristics of ERP Systems

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- **integrated database** (→ data consistency, data actuality)
- **integration of business processes** across different organizational units
- **modularity** → extensibility for different industries
- **flexibility** (customizing)
- **comprehensive tool support**: reference models, implementation guides, project management support
- **different language versions** for different countries
  - tax regulations
  - reporting standards
  - payments
- **independence from system infrastructure**
  - available for different OS, DBS, network protocols
  - scalability
  - support of standards (e.g. data formats)
  - connection of legacy systems with defined interfaces

# Basic Modules of ERP Systems

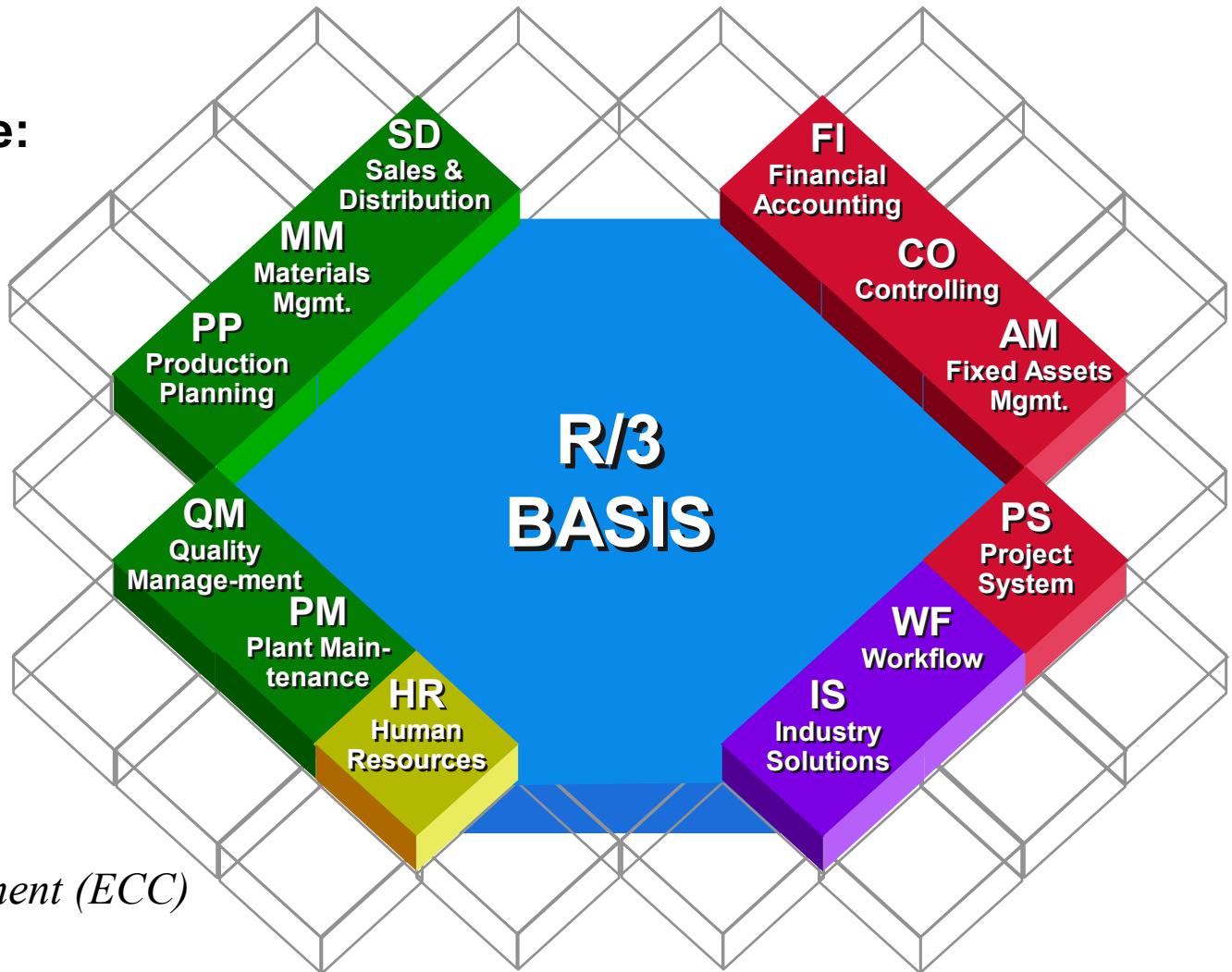
**prominent example:**  
**SAP R/3**

**Versions:**

*SAP R/3 (until 2003)*

*SAP ERP Central Component (ECC)*

*SAP S/4 Business Suite for HANA  
(since 2015)*



# SAP Industry Solutions

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## Financial and Public Services

- Banking
- Defense & Security
- Healthcare
- Higher Education & Research
- Insurance
- Public Sector

## Service

- Media
- Professional Services
- Retail
- Telecommunications
- Transportation & Logistics
- Utilities
- Wholesale Distribution

## Manufacturing

- Aerospace & Defense
- Automotive
- Chemicals
- Consumer Products
- Engineering, Construction & Operations
- High Tech
- Industrial Machinery & Components
- Life Sciences
  - Pharmaceuticals
  - Biotechnology/Biopharmaceuticals
  - Medical Device/Scientific Instruments
- Mill Products
- Mining
- Oil & Gas

Source: <http://www.sap.com/industries/index.epx>

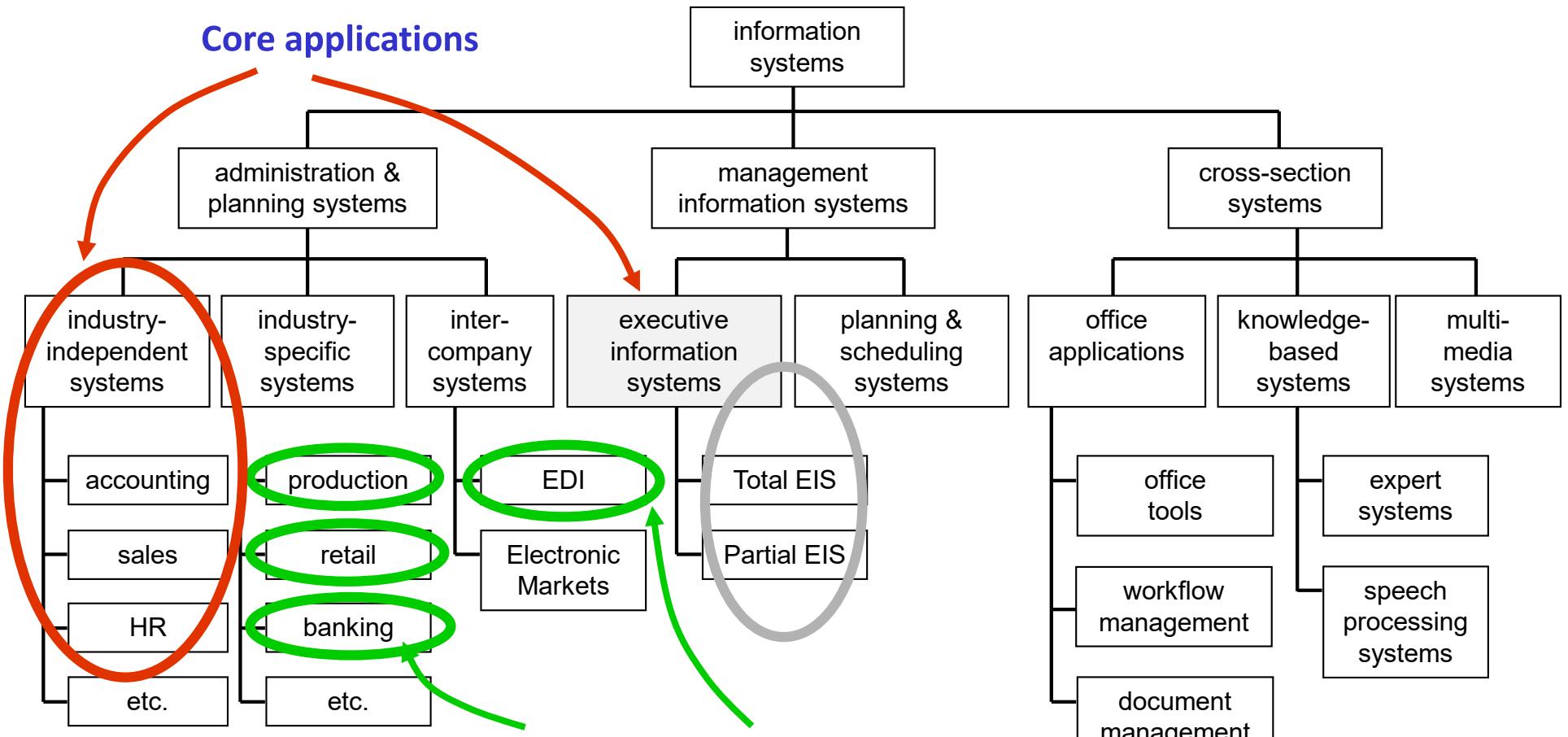
# ERP Systems for Small-Medium Enterprises (SME)

**example:**  
**Sage ERP X3**



# Classification of Business Information Systems (II)

according to intended use (functional view)



**Additional modules (industry-specific, specific business appl.)**

[according to:  
Stahlknecht, Hasenkamp, 2004]

# Advantages/Disadvantages of ERP Systems

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## Advantages:

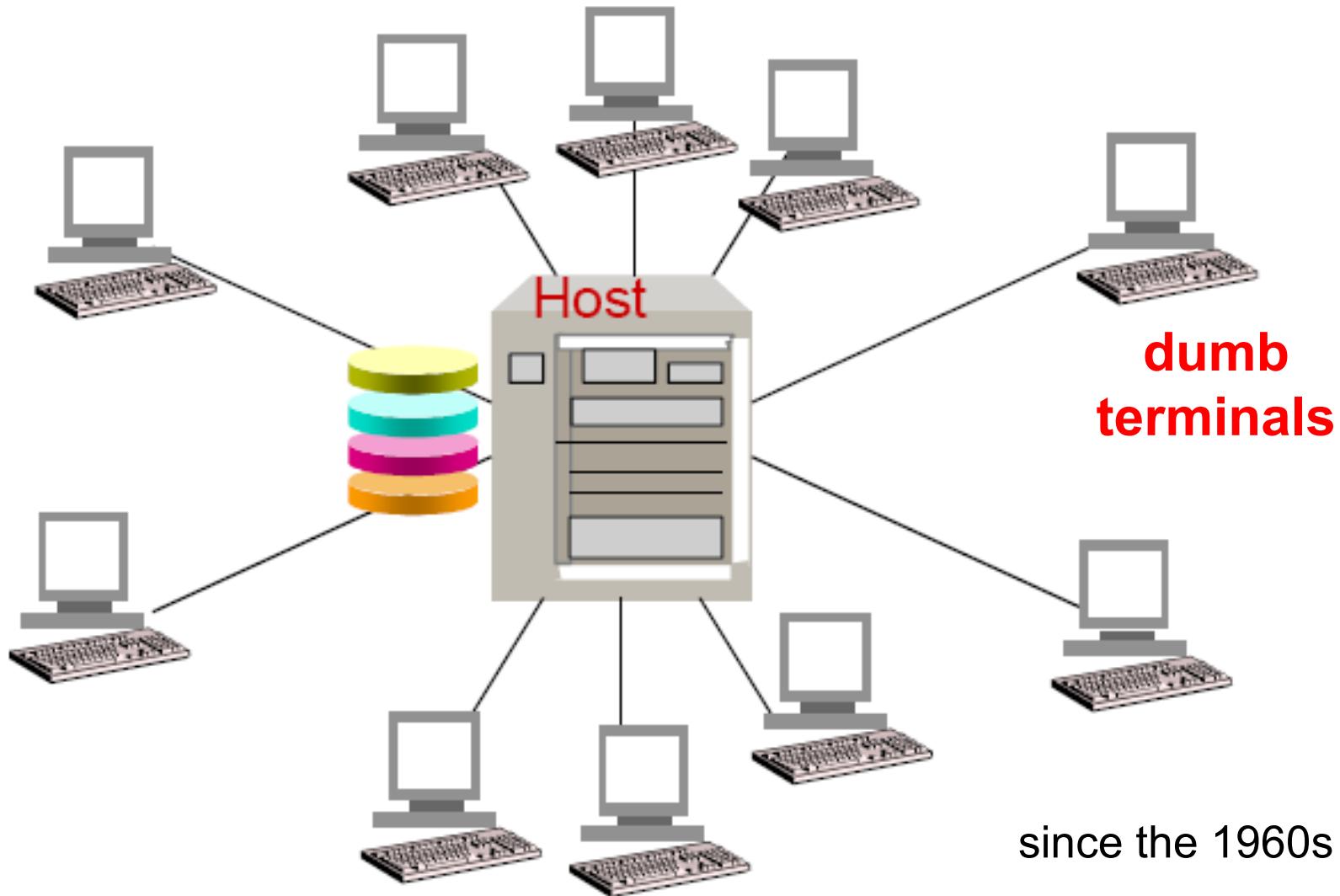
- “**best business practices**” are mapped in the software
- **high degree of integration** (e.g. master data only available once)
- **lower maintenance effort**: is provided by system manufacturers (e.g. changes in tax legislation)
- adaptability to special customer requirements (**customizing**)
- available **for different platforms** (hardware, operating system, databases)

## Disadvantages:

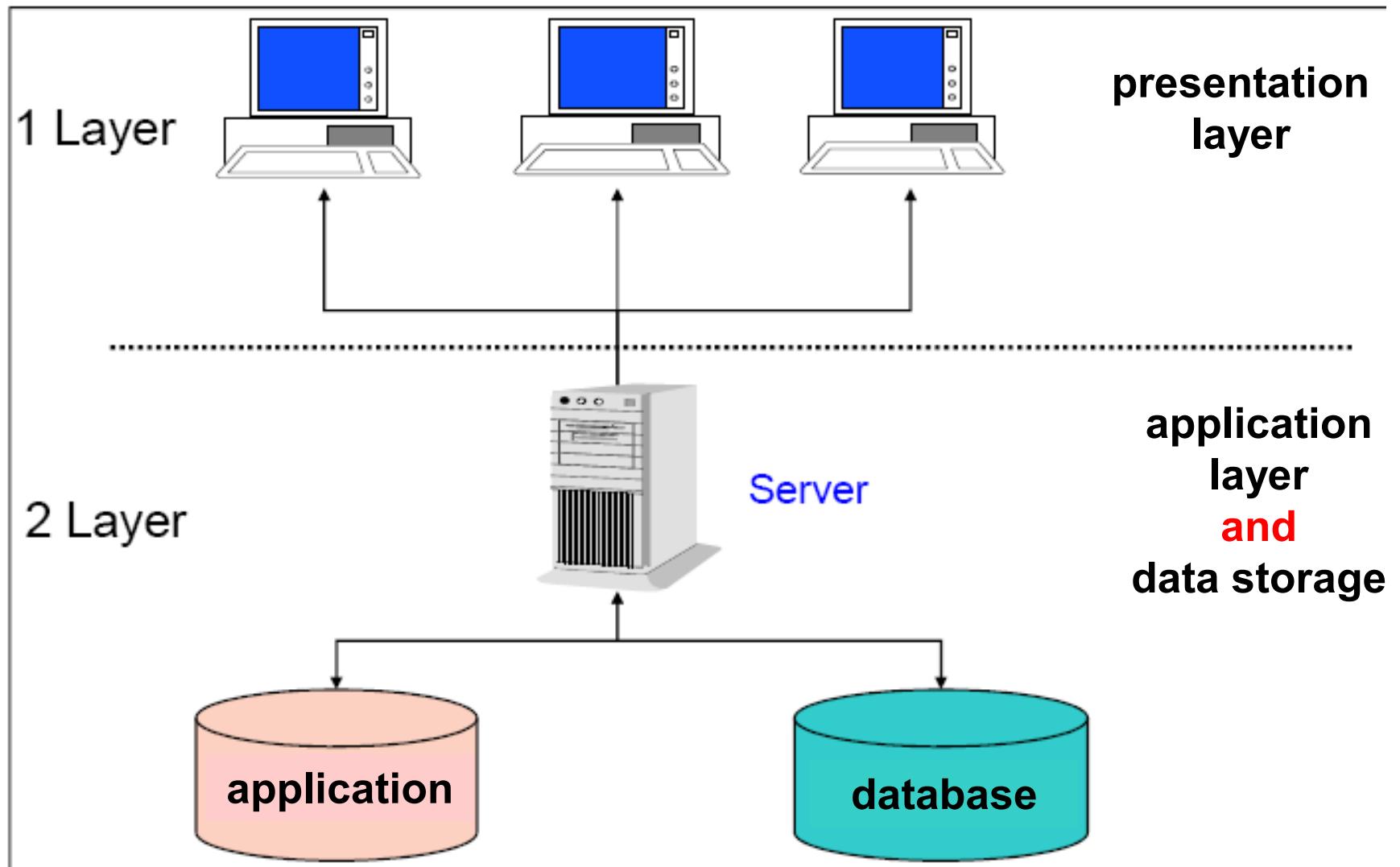
- adapting the software to the operation is often very **time-consuming**
- **high level of complexity** due to the interdependency of the components requires a **lot of training** for application and system administrators
- company often has to **adapt its processes to the software** (but also offers the opportunity to optimize the organizational structure and processes)

# ERP Technology – Mainframes

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# ERP Technology – 2-tier Client/Server Architecture

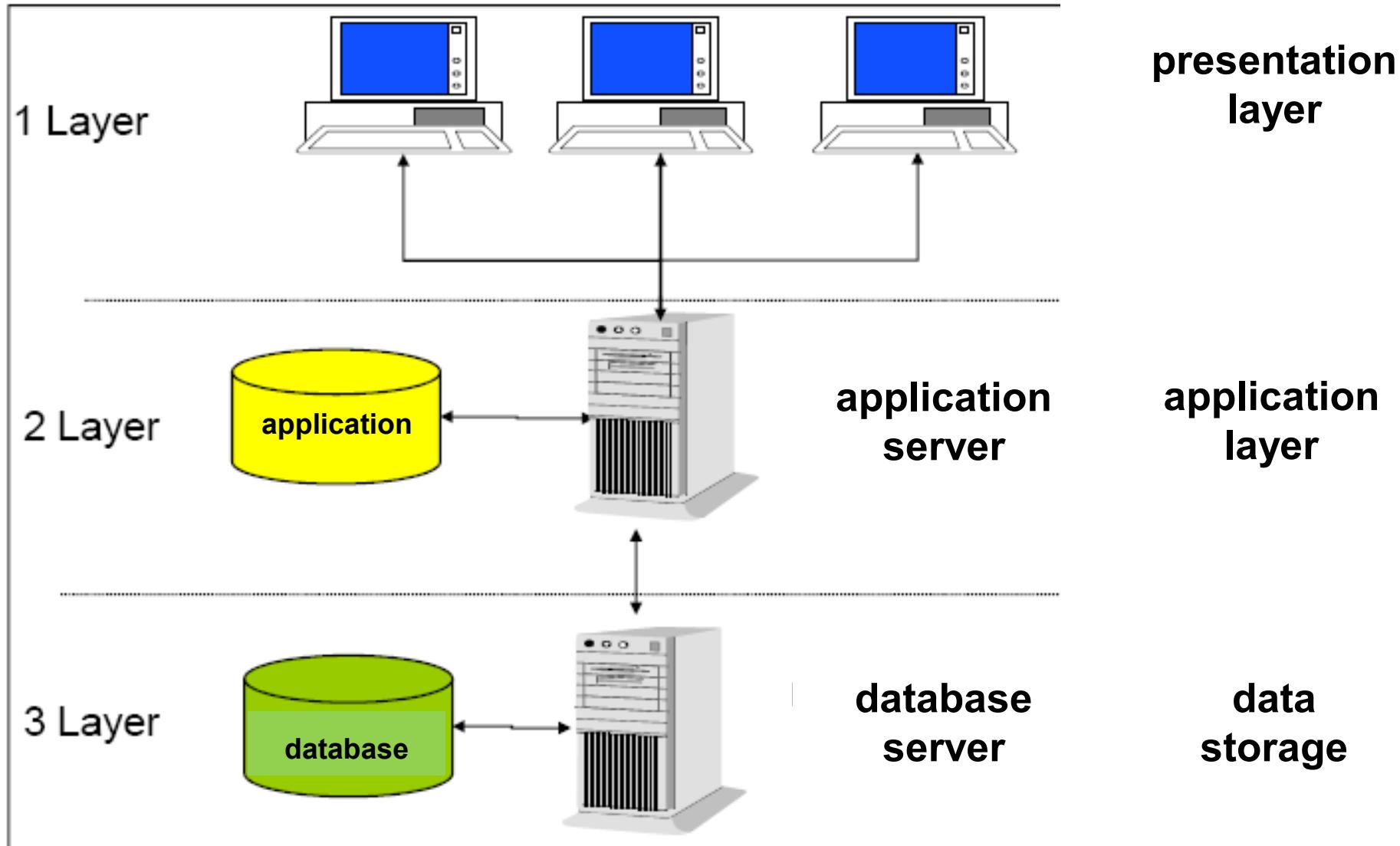


# General Characteristics of Client/Server (C/S)

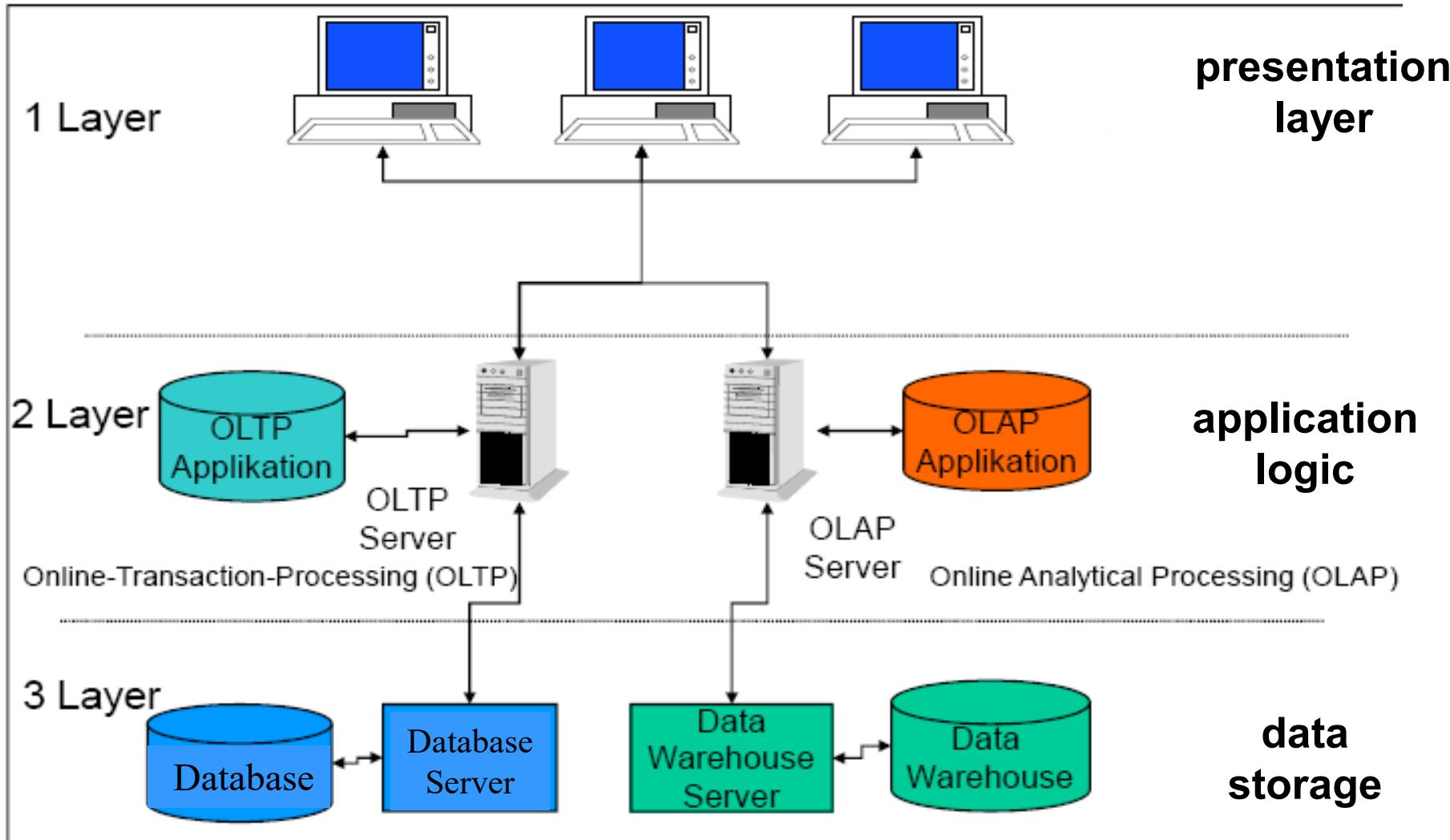
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- **advantages:**
  - scalability
  - flexibility
  - distribution of tasks
  - load balancing
  - fast data access
- **disadvantages:**
  - rapidly growing complexity
  - installation, maintenance and security is more complex compared to a central system

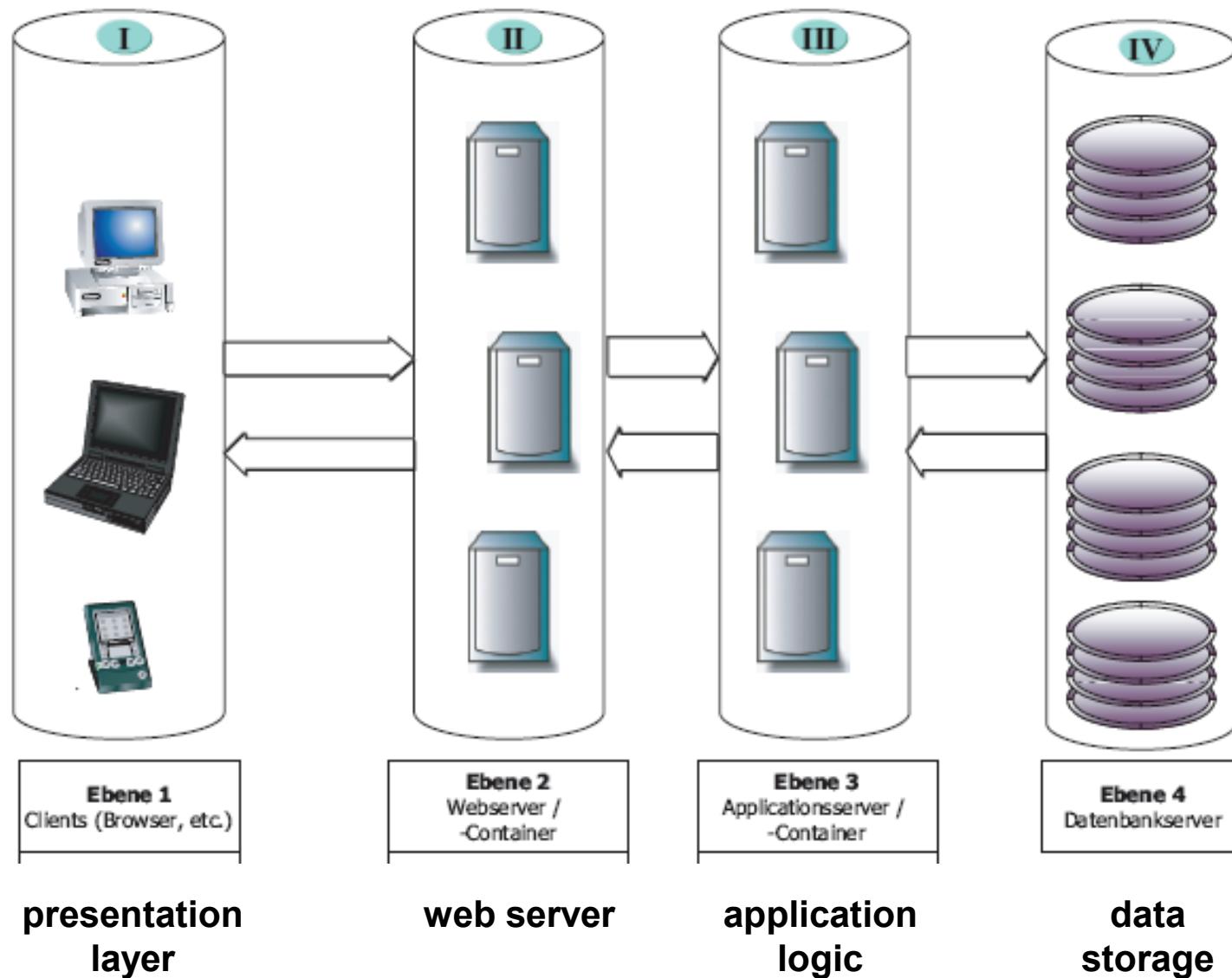
# ERP Technology – 3-tier C/S Architecture



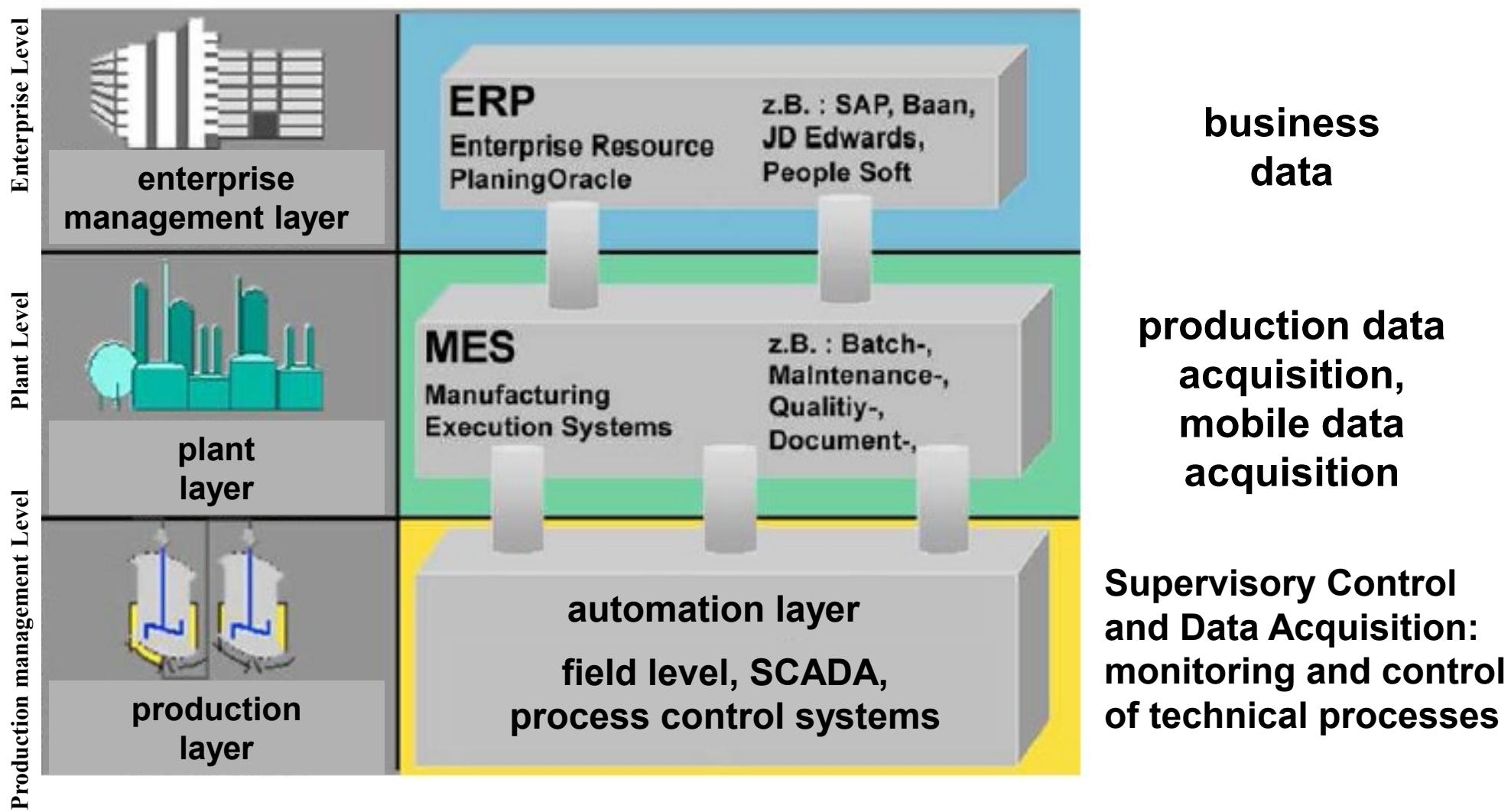
# ERP Technology: 3-tier C/S Architecture with OLTP, OLAP & DW



# ERP Technology: 4-tier C/S Architecture



# ERP Technology: Enterprise Integration Layers

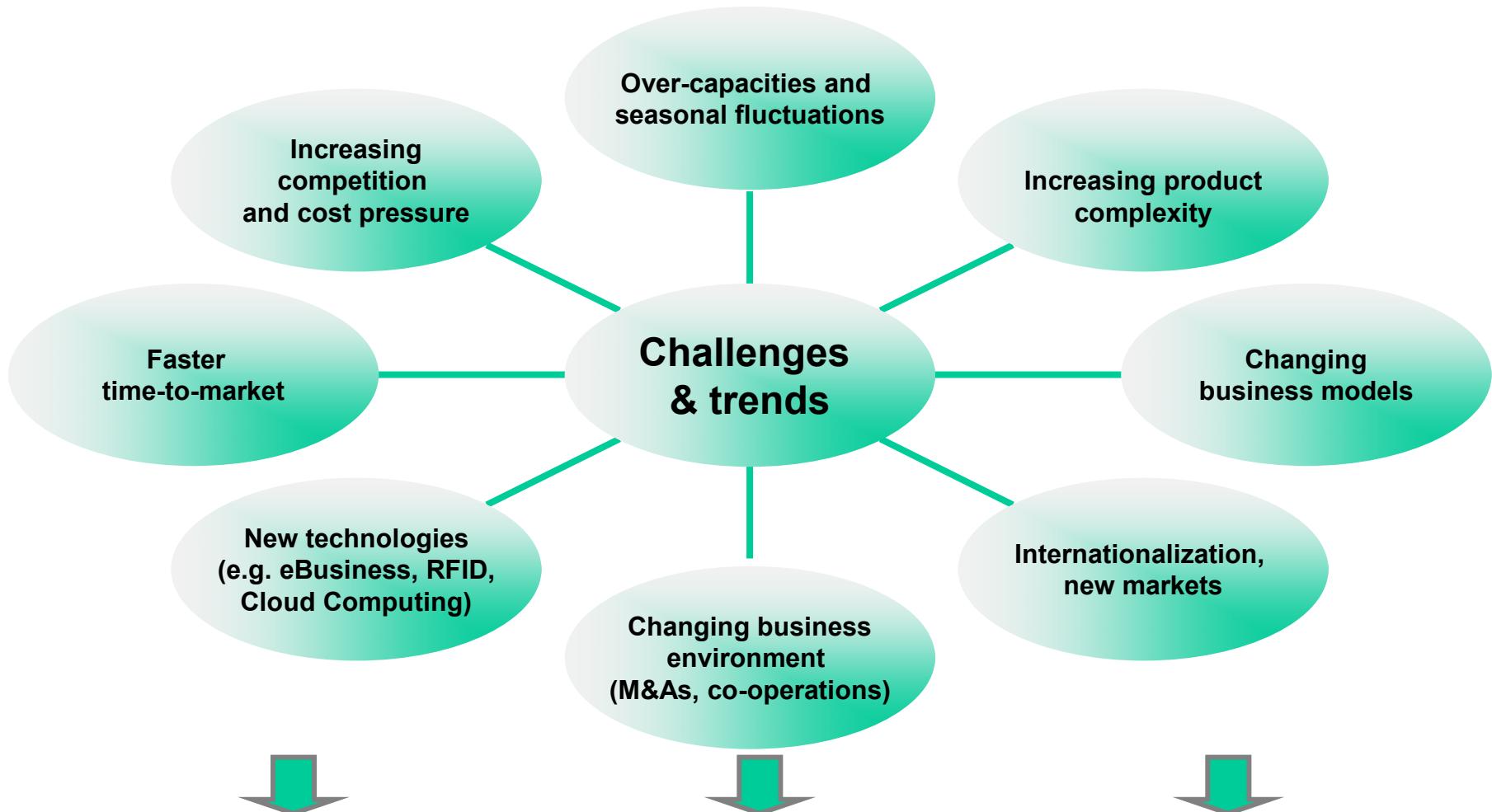


# Today's Enterprise Situation

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- highly dynamical environment
  - constant evaluation compared to the positioning of competitors
  - constant search for innovations and competitive advantages
- **external and internal view** of an enterprise
- **external view** focused on
  - direct relations with business partners
  - global *market environment*
  - focus on market, product program, quality of services, customer satisfaction
- **internal view**
  - efficient and innovative execution of activities within the enterprise

# Business Process Management - Challenges & Trends



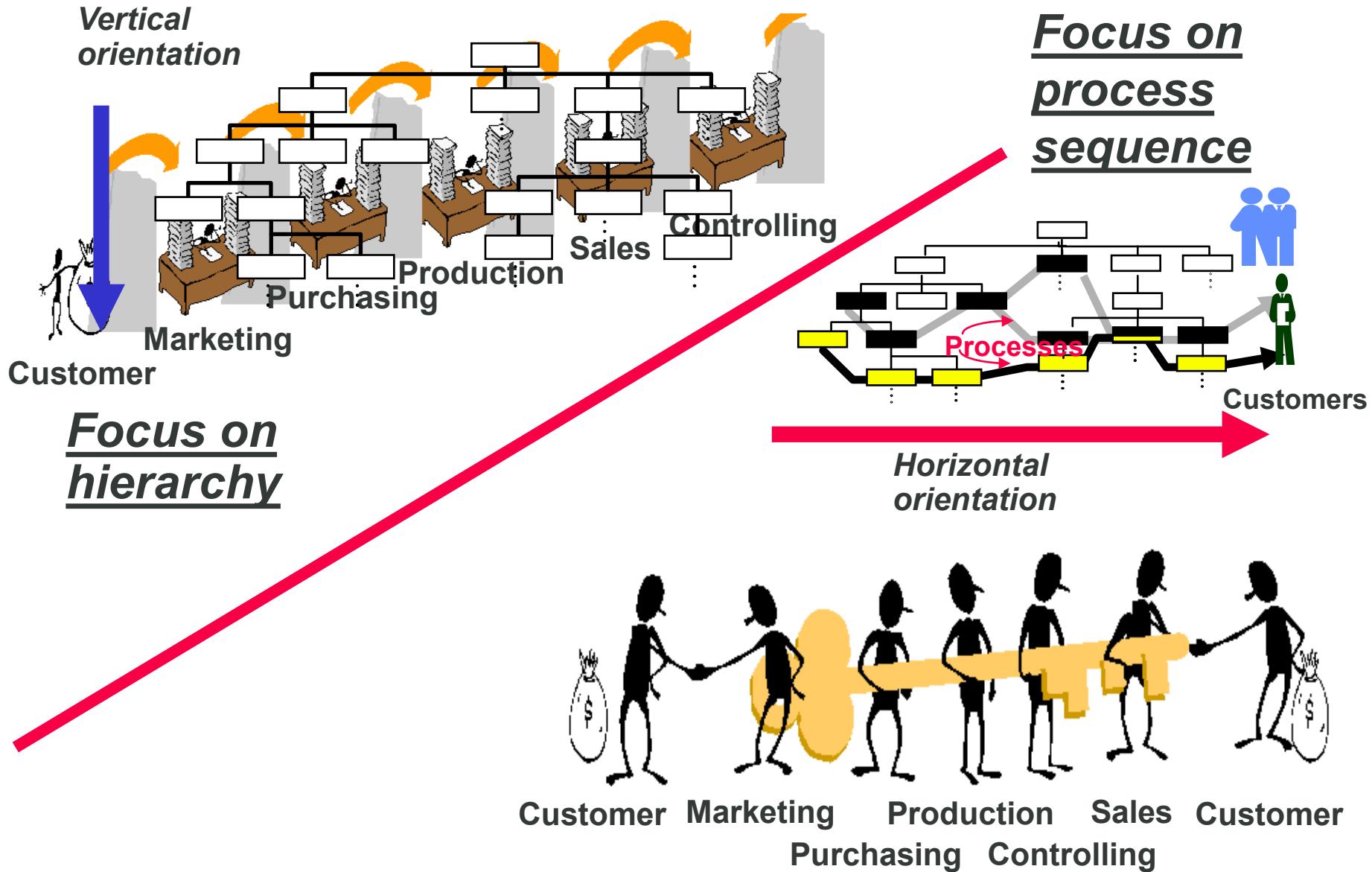
- Need for agile, efficient and effective business processes
- Business Process Management (BPM) is a competitive advantage and a critical success factor in an ever-changing environment

# From Function Orientation to Process Orientation

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- within the last century:
  - orientation towards an efficient execution of simple stand-alone functions
    - **local optimization** of separate functional working divisions (Taylor → Ford)
  - **but:** loss of knowledge about the overall process
    - with increasing autonomy also increasing costs for coordination of different departments
- ⇒ **process oriented organizational management** to reduce barriers between working units and to strengthen the status of the overall enterprise

# Function Orientation vs. Business Process Orientation



# Business Process Management

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## Business Process Modeling:

- goal: organizational changes
- support of the early phases of IT system design

## Business Software Systems:

- goal: introduction of process-oriented business software systems
- automated support of business processes with flexible adaptation possibilities



- Combination of both approaches:
- **modeling, analysis, execution and control of business processes**

# What is a Business Process?

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**"We define a business process as a set of activities with one or more "inputs" producing one or more outcomes that have an added value for the customer."**

Source: Hammer and Champy, Reengineering the Corporation, 1993, p.35



**"In general, a business process is a coherent sequence of company operations for performing a service. The output and result of a business process is a service that is required and accepted by internal or external "customers"."**

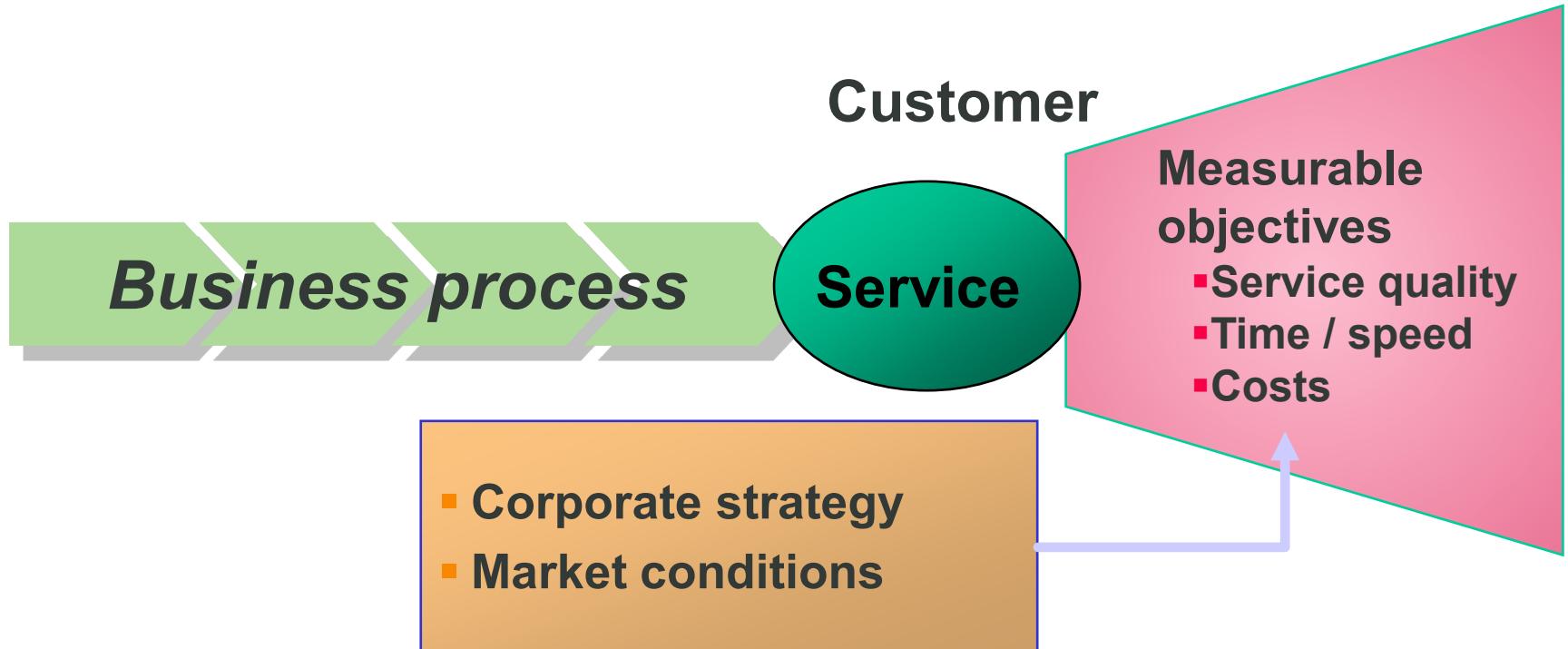
Source: Scheer, August-Wilhelm: ARIS - From the business process to the application system. 3rd Edition, Berlin et al. 1998.



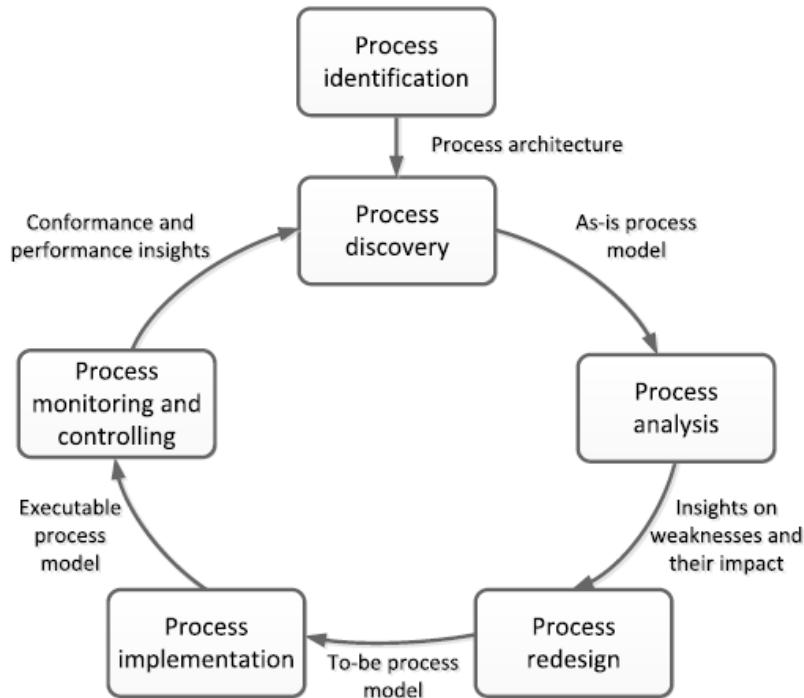
# Business Process: Features

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- Customers can mean both internal and external customers

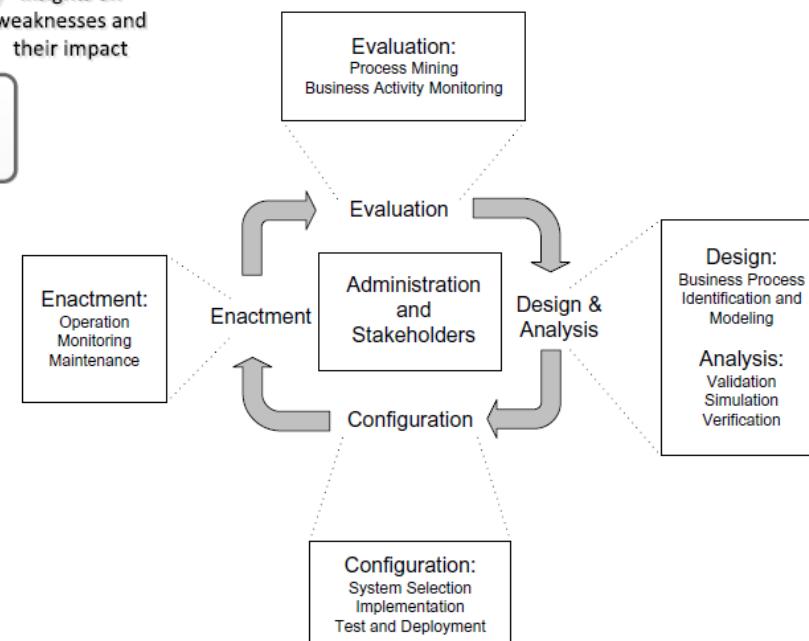
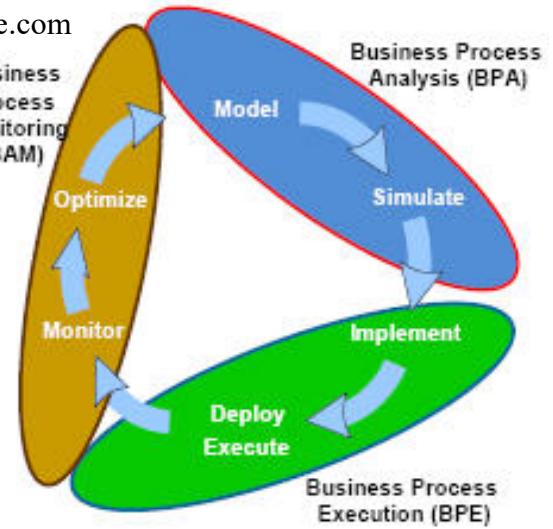


# BPM Cycle



Dumas, La Rosa, 2013

Source: www.oracle.com



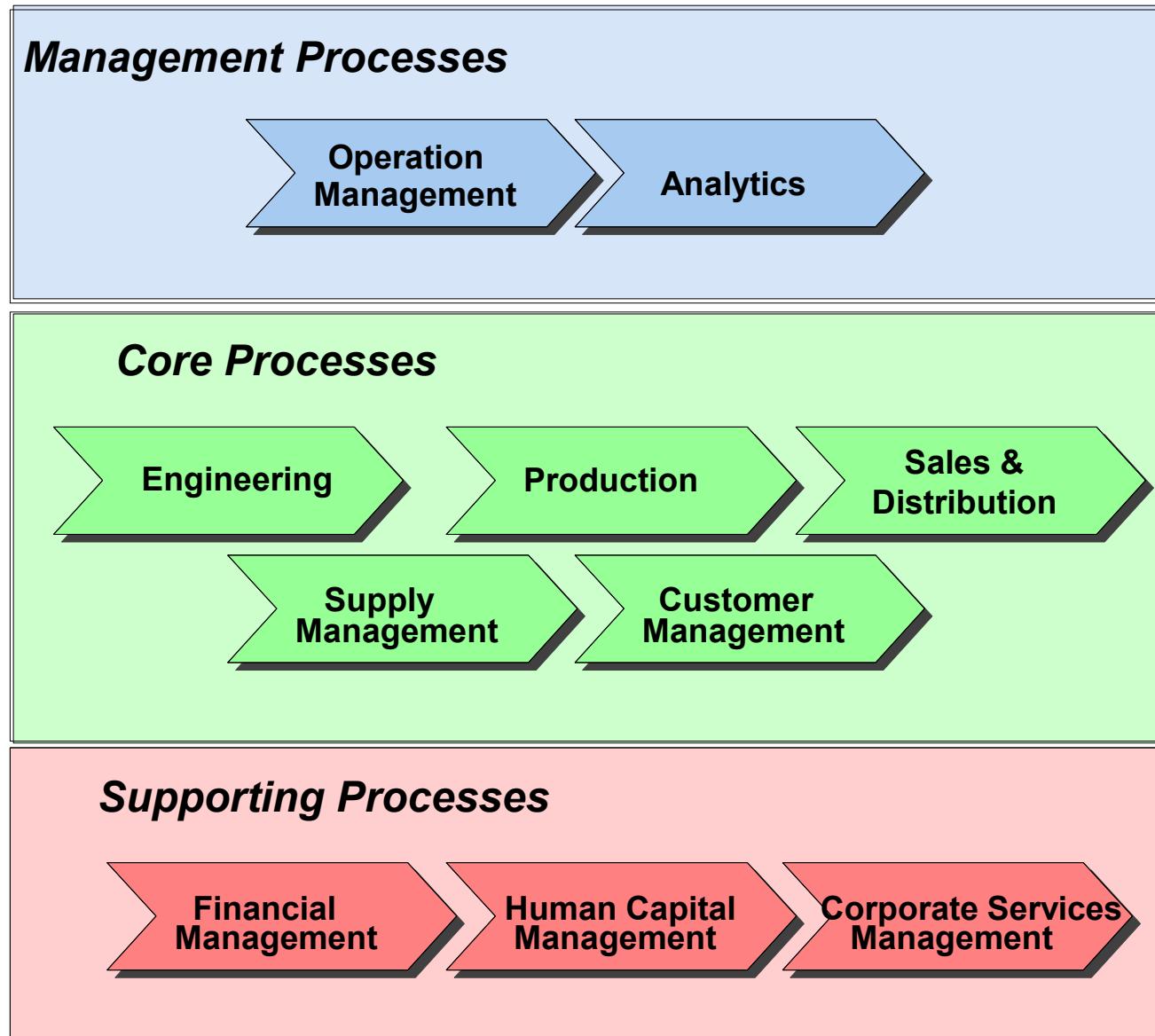
Weske, 2014

# Process Categories

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- **Core Process:**
  - process which has a **direct** relationship to a product/service
  - contributes directly to the overall added value of an enterprise
  - examples:
    - sales, order processing, service, product development, production planning
- **Support Process:**
  - process whose activities are not directly adding a value from a customer's perspective, but which are necessary to execute the tasks within the core processes
  - examples:
    - personal, IT, controlling
- **Management Process:**
  - process with strategic meaning for the enterprise
  - examples:
    - Innovation process, strategy planning, TQM

# Process Map Example



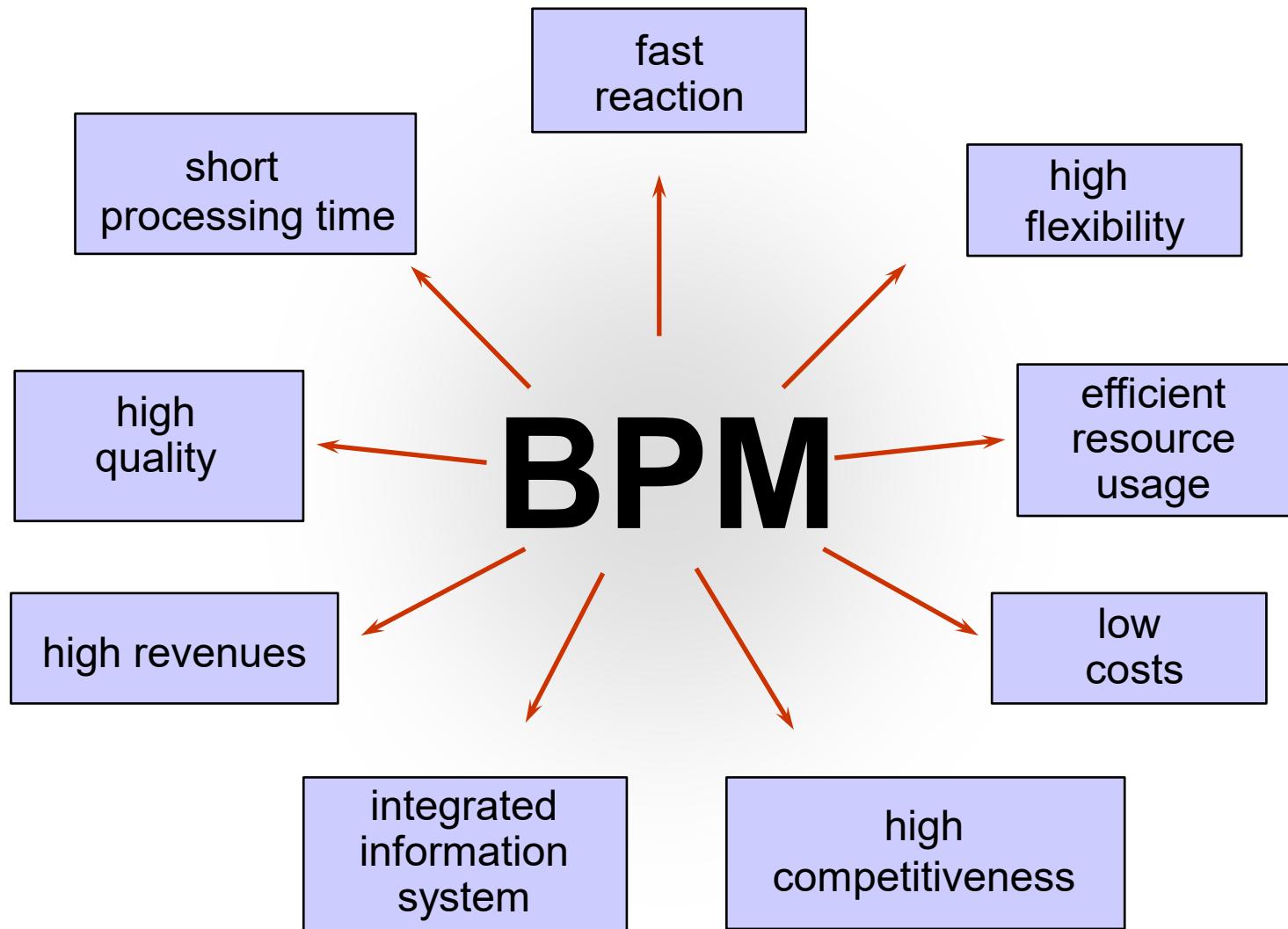
# Three Different Approaches to BPM

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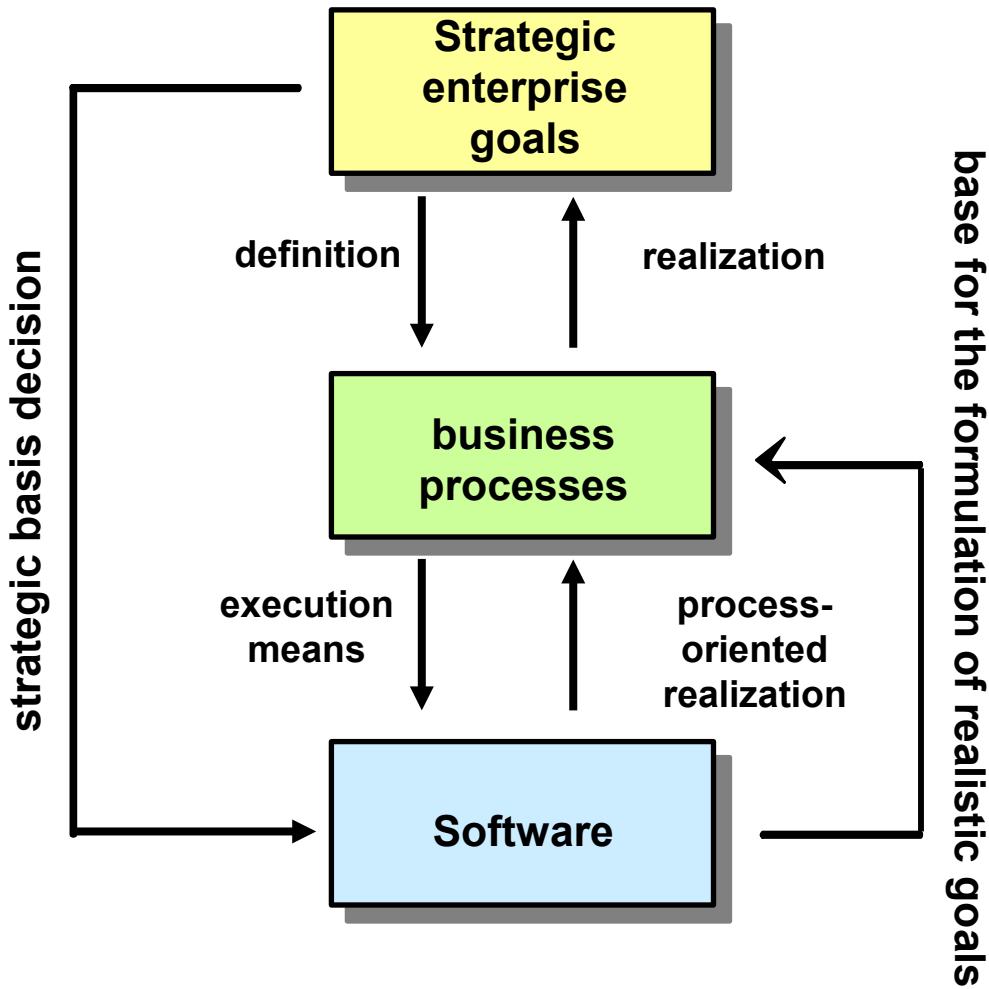
- **Business Engineering (BE):**
  - is the fundamental considering of the business purpose and the radical re-design of enterprise processes
  - main goal of BE is the re-orientation of the whole enterprise and its processes to achieve **drastic improvements** with respect to costs, quality, service and time
- **Business Process Engineering (BPE):**
  - is the re-thinking and the revised design of the business processes
  - a goal of the BPE is to improve profitability, efficiency and flexibility by the redesign of the organizational structure and the underlying business processes
- **Continuous Process Improvement (CPI):**
  - starting with optimized business processes these always must be adjusted to the strategic enterprise goals and the permanently changing markets
  - Japanese management approach: **Kaizen**

# Goals of BPM

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# Three Layers of BPM



enterprise structure,  
business fields, markets,  
products, success factors

(sub-)processes, functions,  
organizational units,  
technical terms, documents

forms, transaction codes,  
user and access rights,  
data objects and attributes

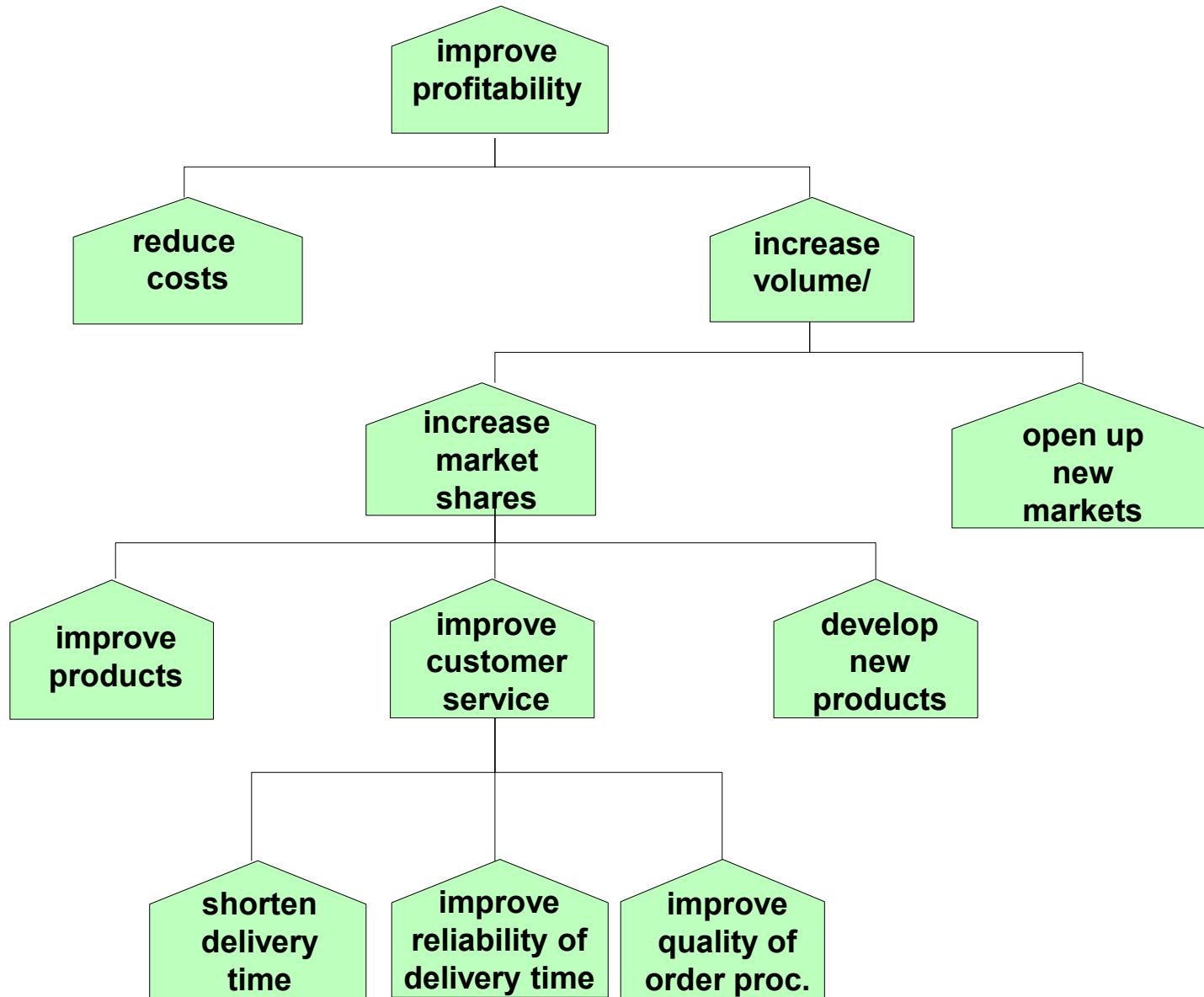
# Enterprise Goals and Business Processes

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- carry out goal definition
- define parameters for measurement
- associate goals with business processes
- define actions for process improvement
- measure process **key performance indicators (KPIs)**

# Hierarchy of Enterprise Goals

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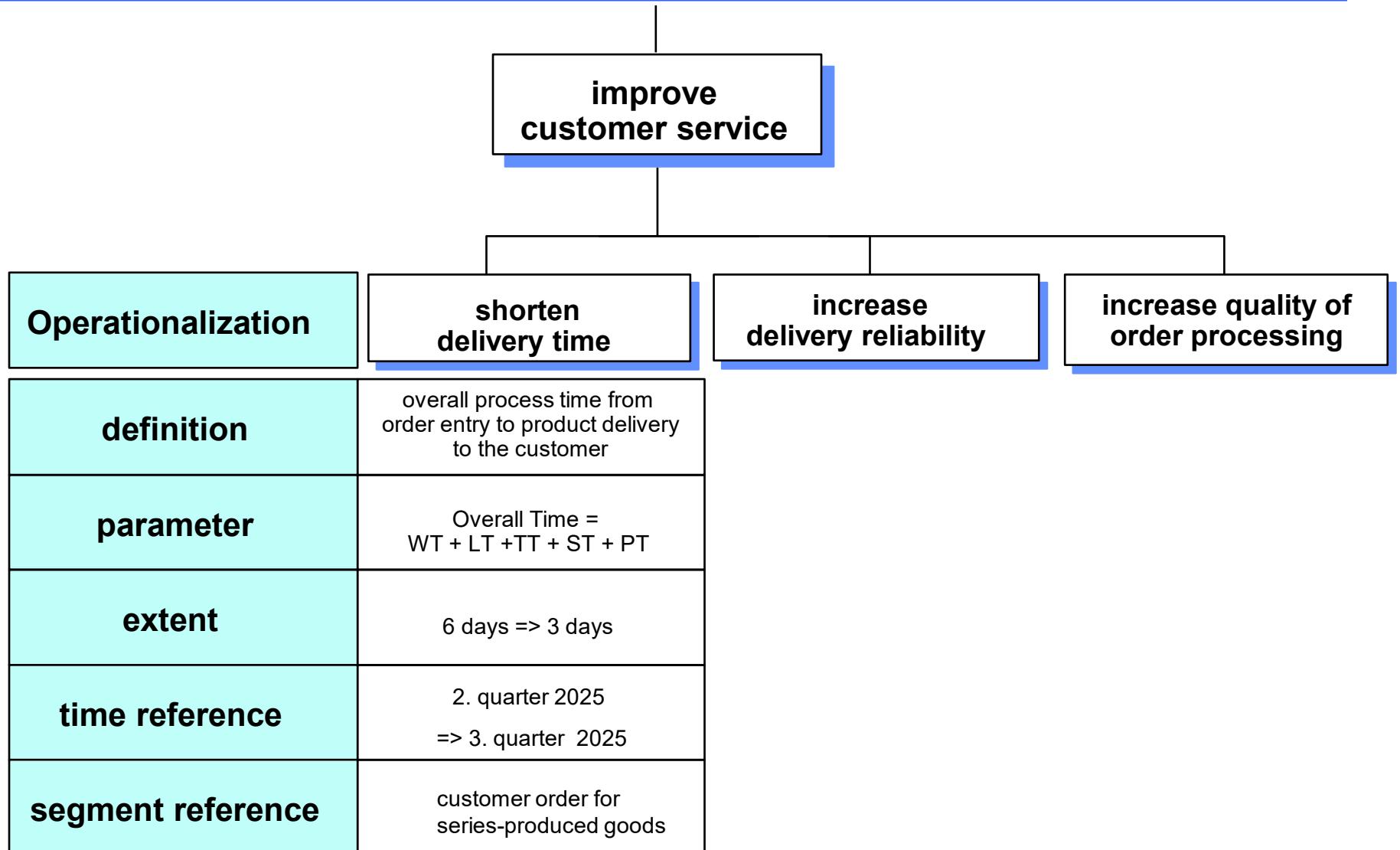


# Key Performance Indicators (KPIs) for Process Evaluation

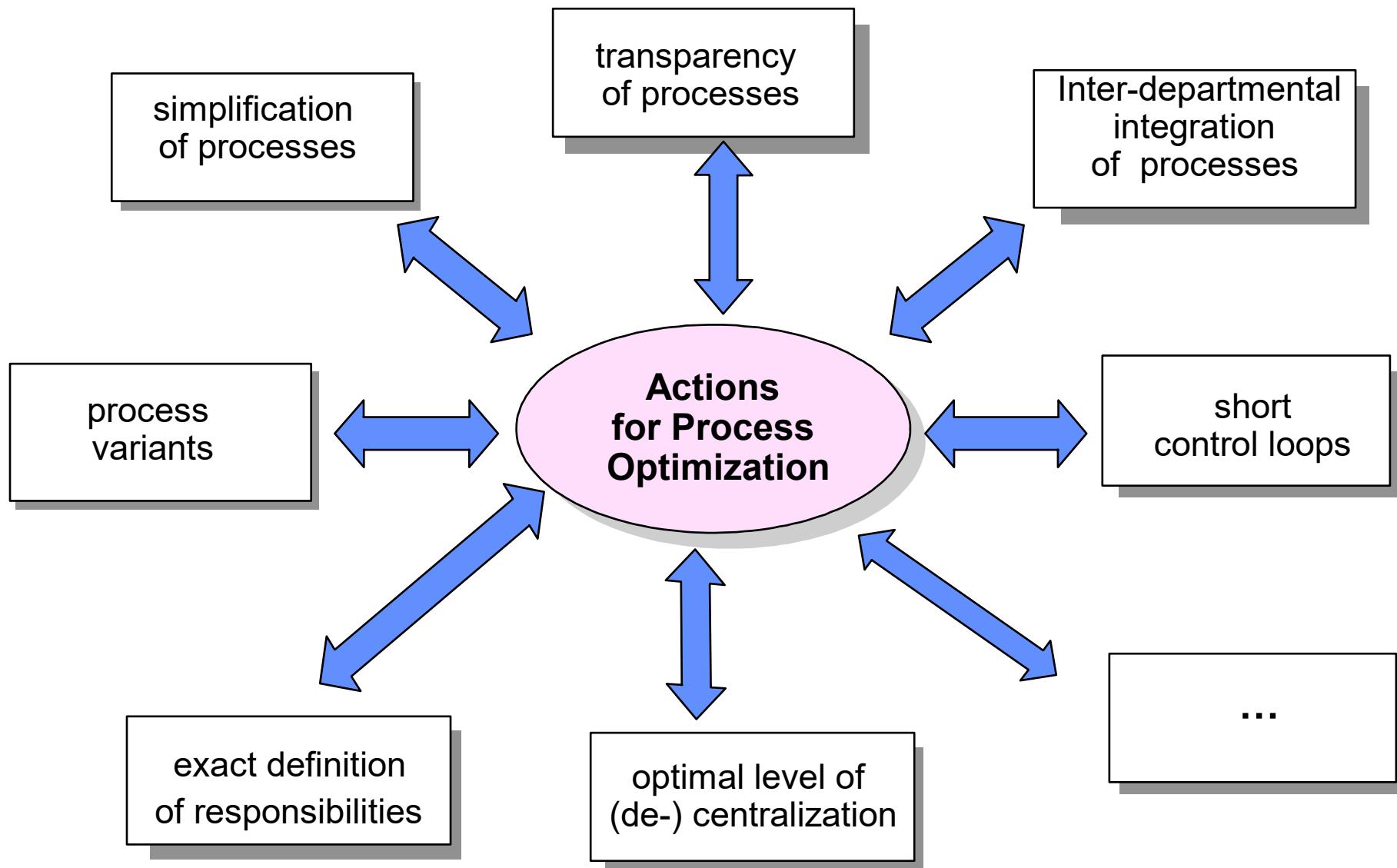
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- costs
- processing time
- percentage of „unproductive“ time (waiting time, settling time, transmission time, lay time) with respect to the overall processing time
  
- number of organizational breaks
- number of IT system breaks
- number of media breaks (→ data redundancy)
- (human) resource capacity utilization
- ...

# Operationalization of Goals



# Actions for Process Optimization



# Prerequisites for Successful BPM

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- knowledge of the specialties and future trends of a certain industry
- transparency of re-organization
- integration of all involved persons (management, working divisions, IT division, employees' committee)
- support by top- and middle-management
- knowledge of methodologies / tool support
  - ARIS
  - **BPMN 2.0 (Business Process Model and Notation)**

# What is ARIS?

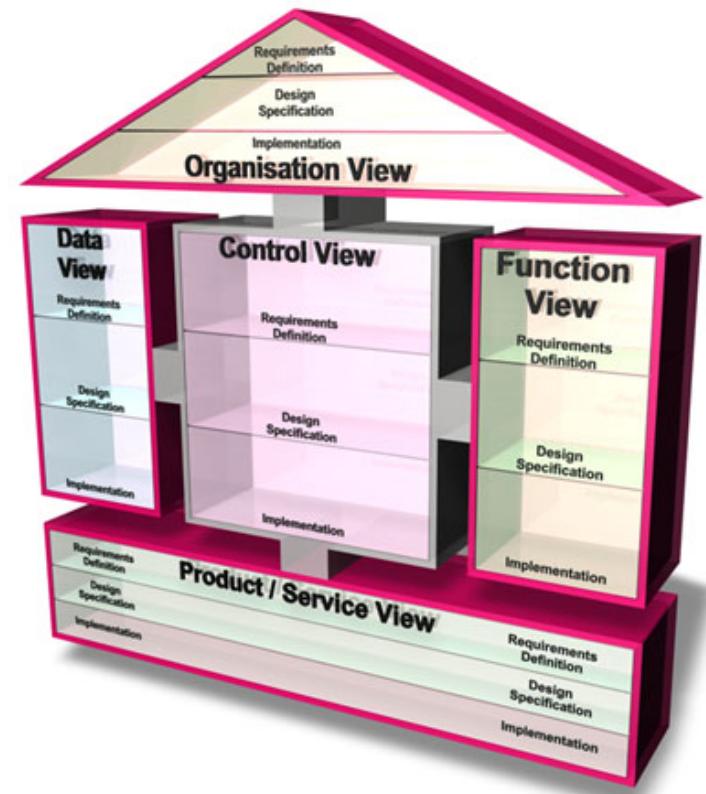
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## ARIS = Architecture of Integrated Information Systems

- **framework concept** to describe companies and application software
- developed by Prof. August-Wilhelm Scheer, founder of former IDS Scheer AG (now Software AG)
- uses standard modeling methods
- concentrates on the business process
- effective in all areas:
  - independent of the number of departments
  - the size of the company
  - or the available software

## Main goal:

- **mapping of business structures of an enterprise or an application software to a model**



# ARIS Methodology

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Which objects can be used to describe enterprises?

- **Functions**  
check customer creditworthiness, book goods receipt, ...
- **Data**  
article, customers, material, suppliers, ...
- **Organizational units**  
sales, purchasing, accounting, production, ...
- **Events**  
goods have arrived, invoice is cancelled, ...
- **Resources**  
PC, paper, drill machine, ...
- **Products/Services**  
BPM consulting, chip, board, PC, ...



These objects are **not isolated**, but have a **tight relationship**.

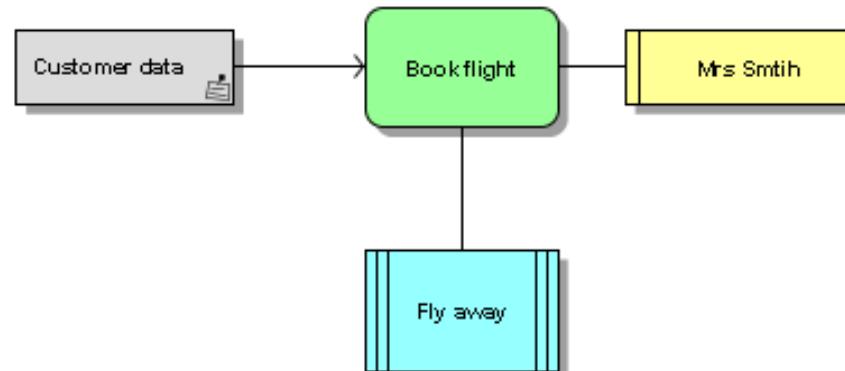
# Model Creation – Presenting Business Issues

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- Presentation as text
  - Flights are booked by Ms. Klein in the *Fly away* system. She needs the customer data as an input.
- Presentation in tables

A	B	C	D
Activity (function)	Organizational unit	IT system	Input data
Book flight	Mrs Smith	Fly away	customer data

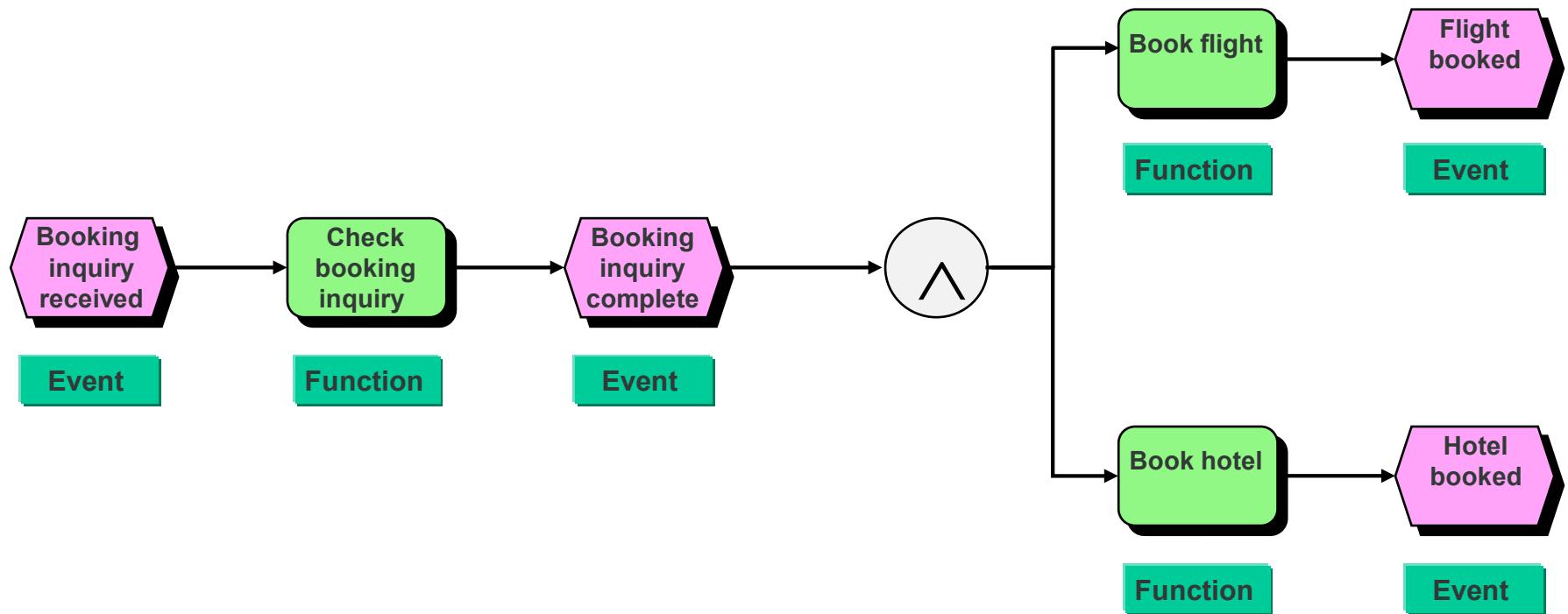
- Presentation in charts



# Derivation of ARIS Architecture (1)

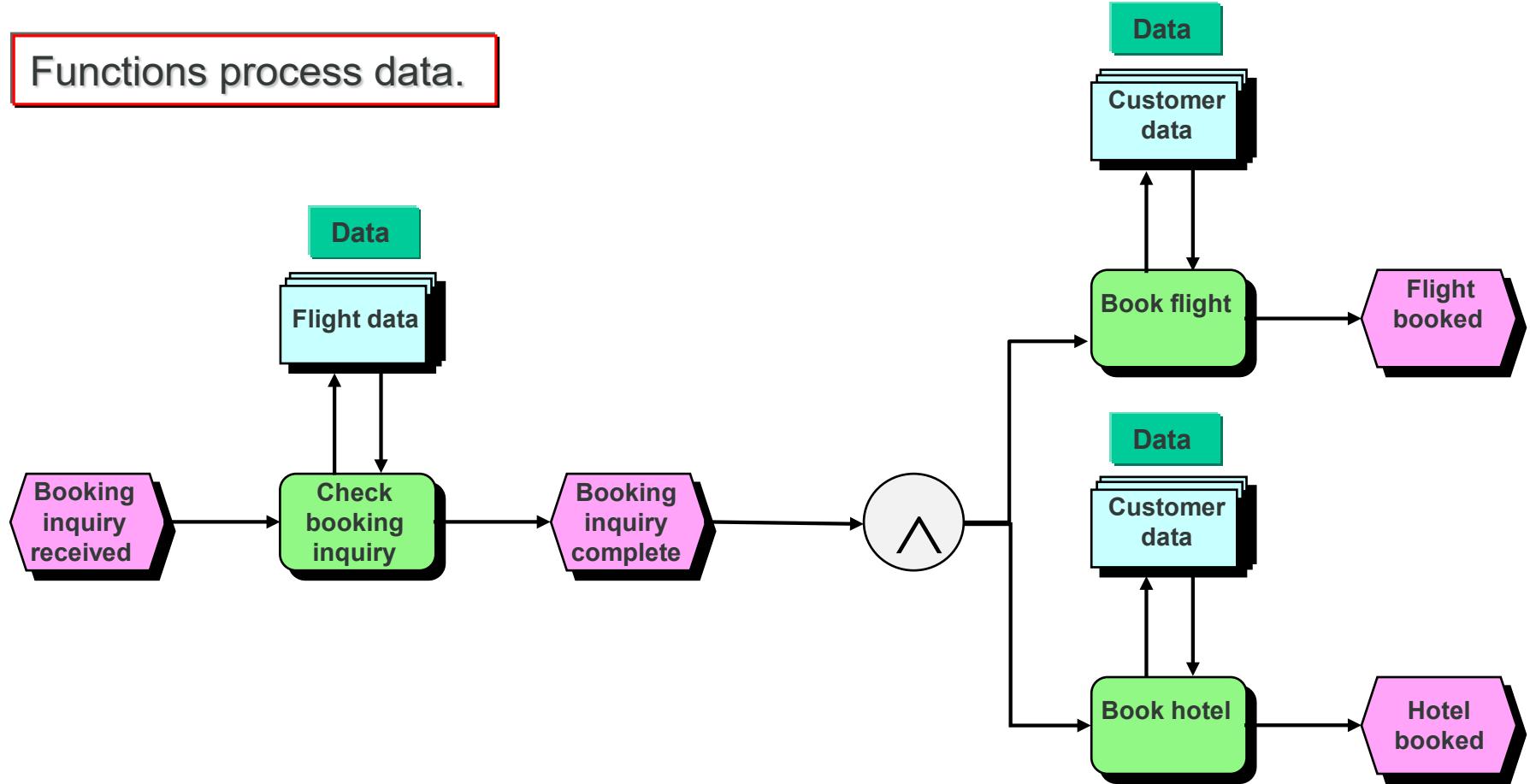
Events trigger functions.

Functions create events.



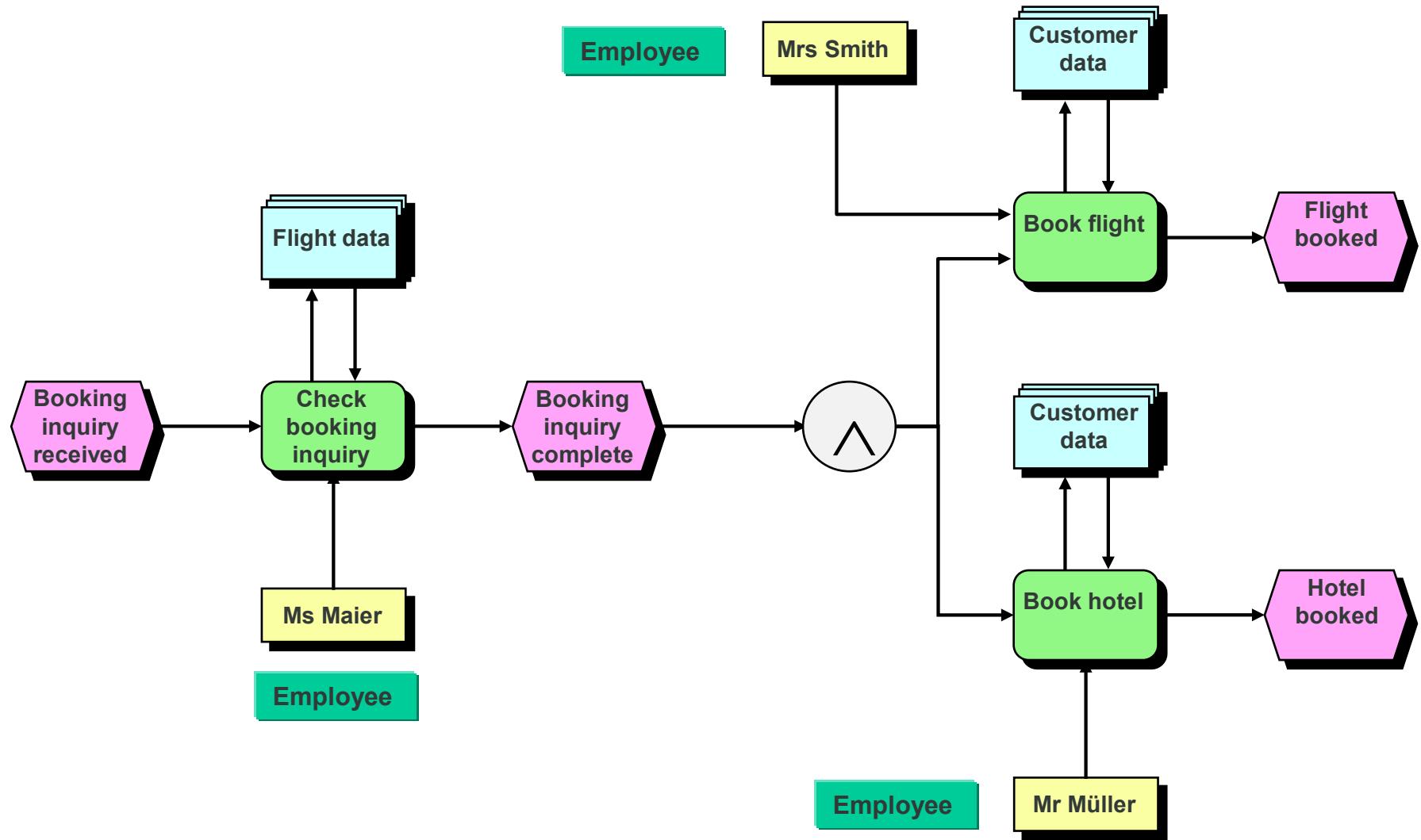
# Derivation of ARIS Architecture (2)

Functions process data.



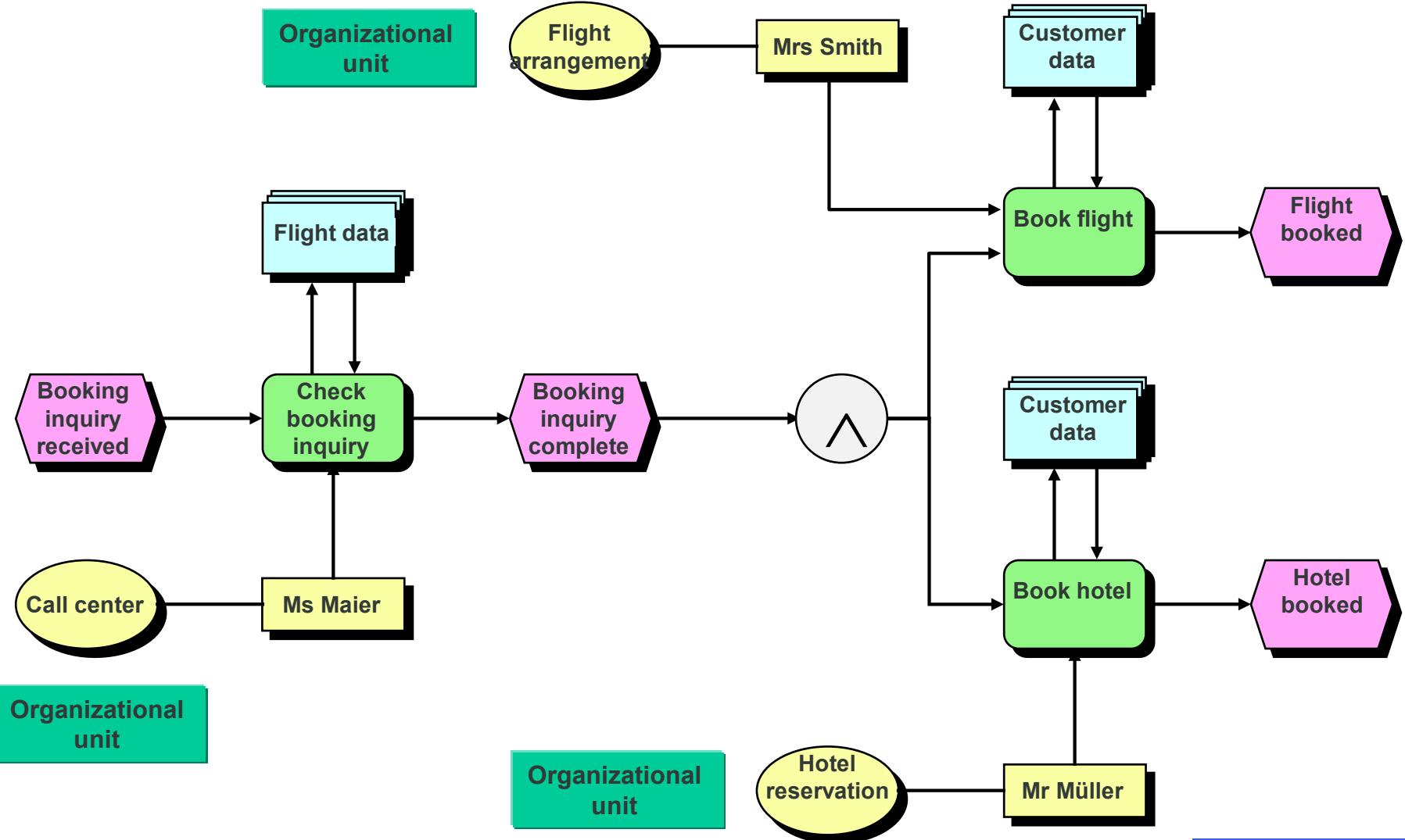
# Derivation of ARIS Architecture (3)

Employees execute functions.



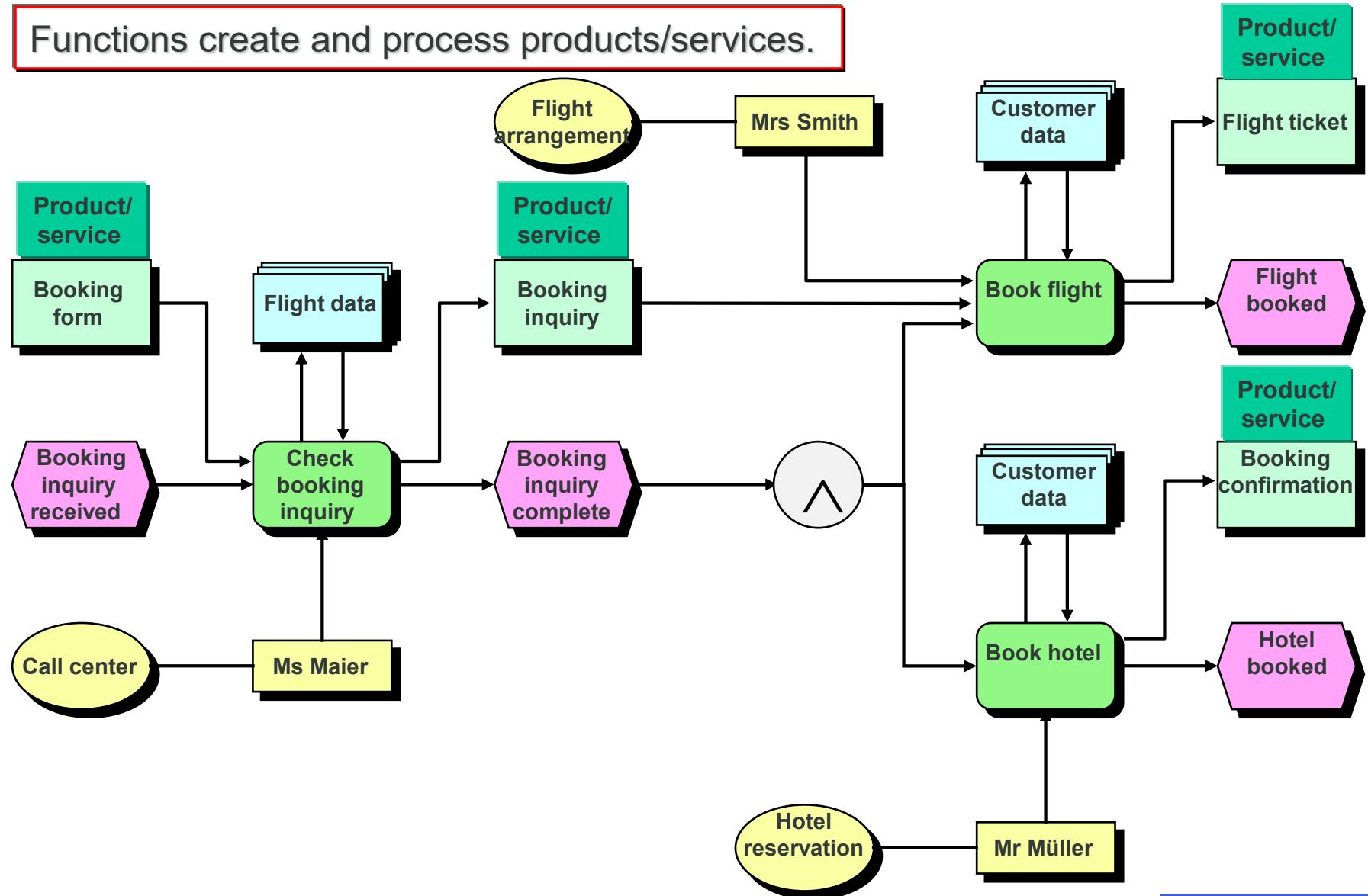
# Derivation of ARIS Architecture (4)

Employees belong to organizational units.

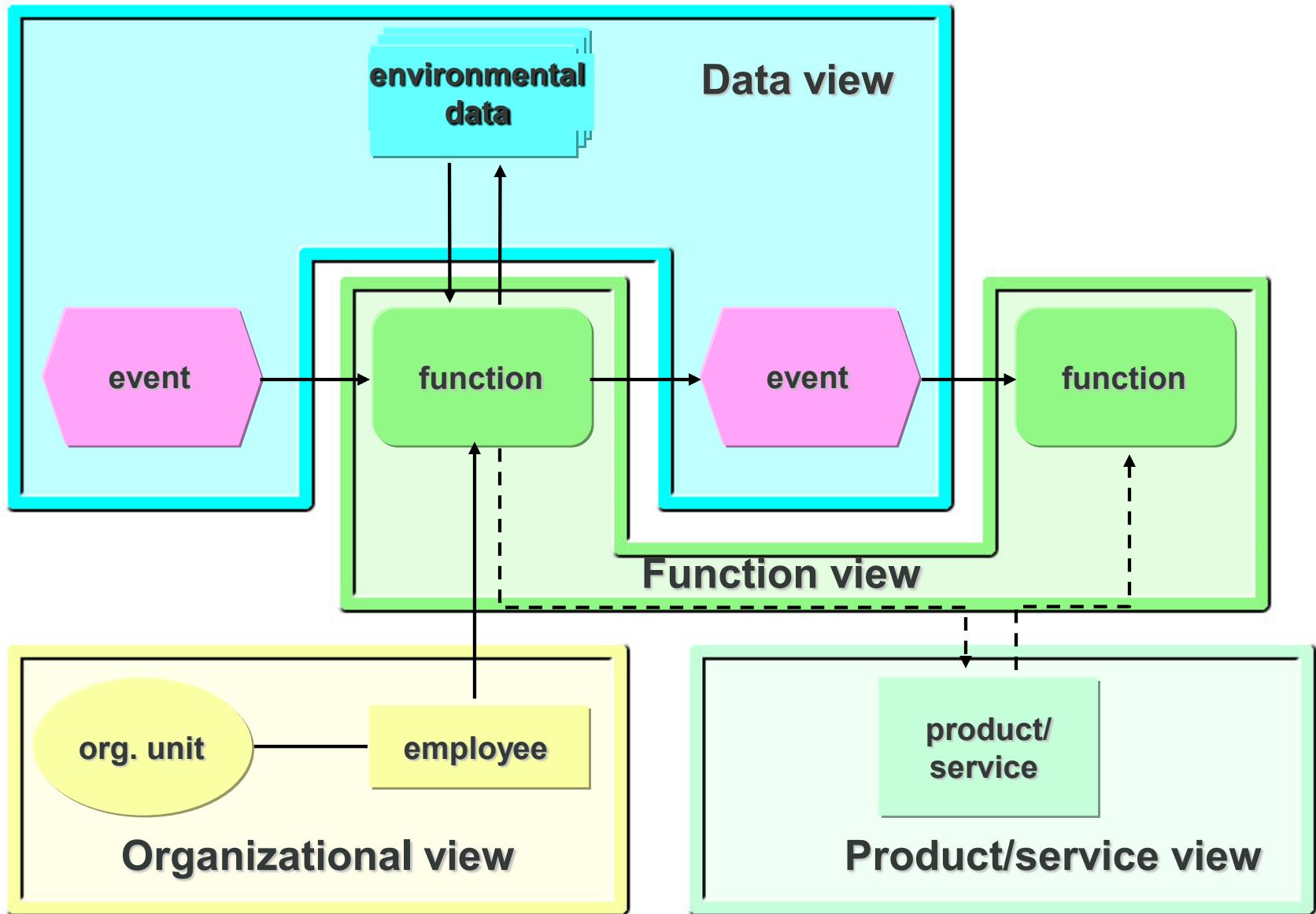


# Derivation of ARIS Architecture (5)

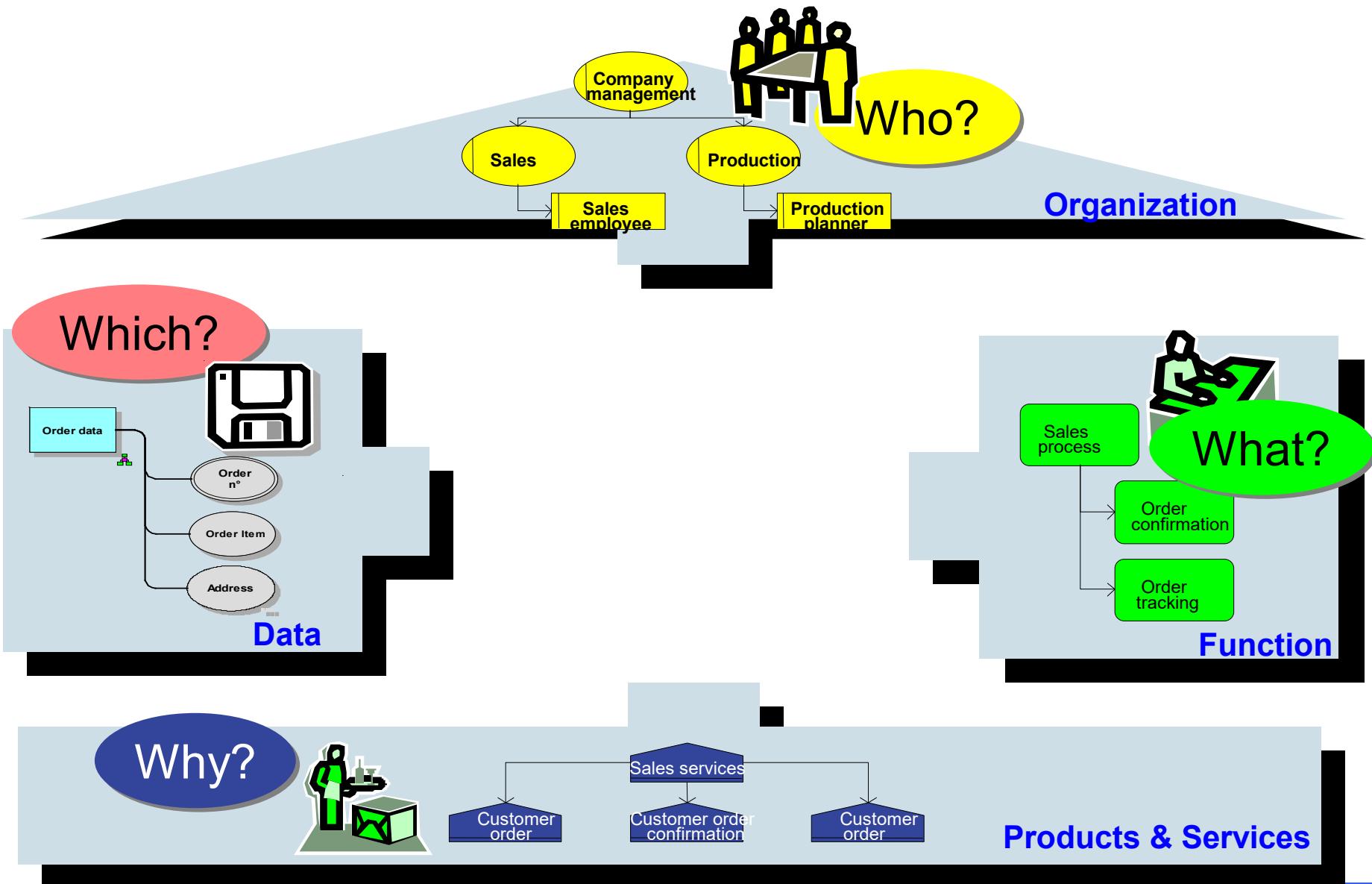
Functions create and process products/services.



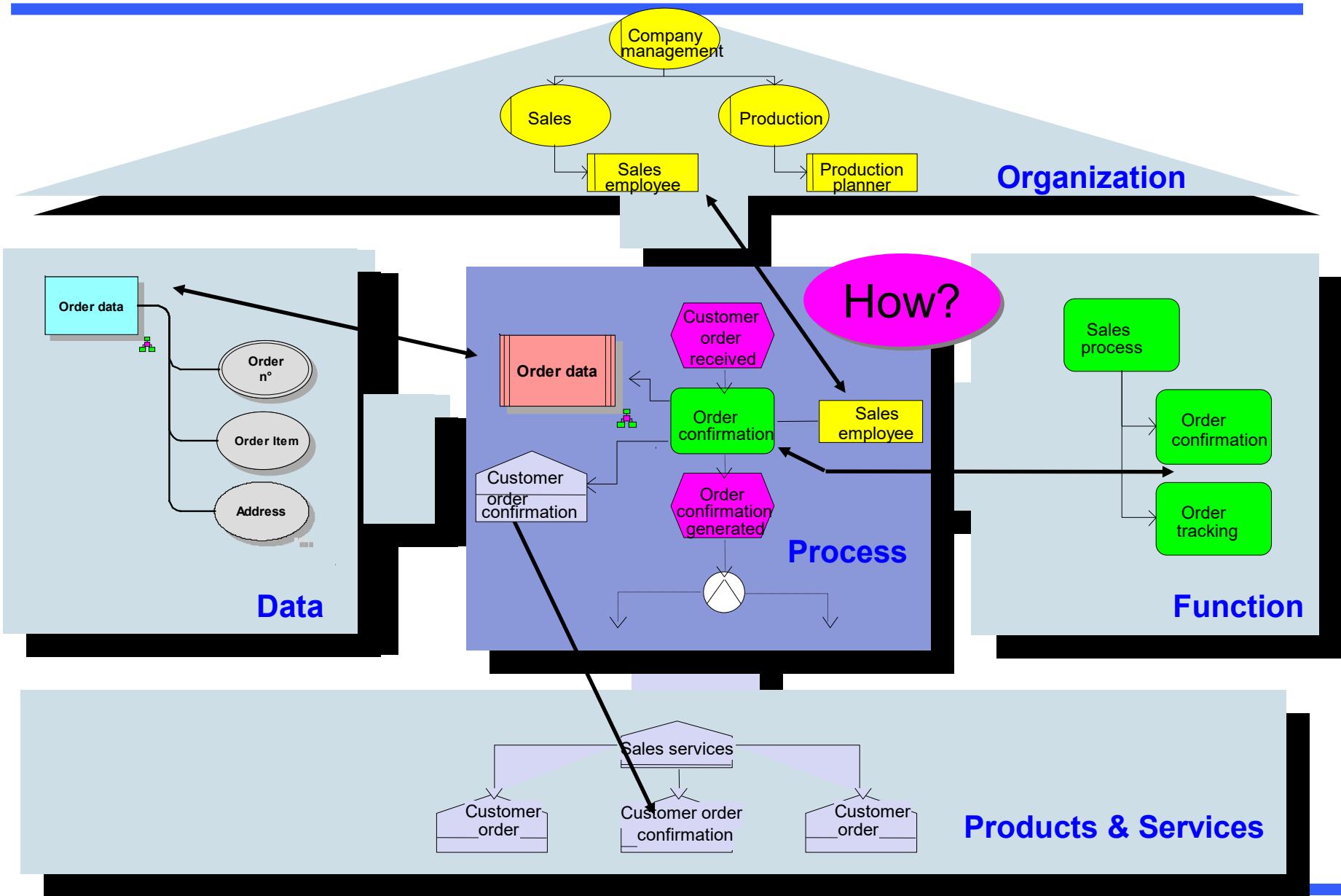
# Reducing Complexity by Creating Views



# Process Modeling Considerations

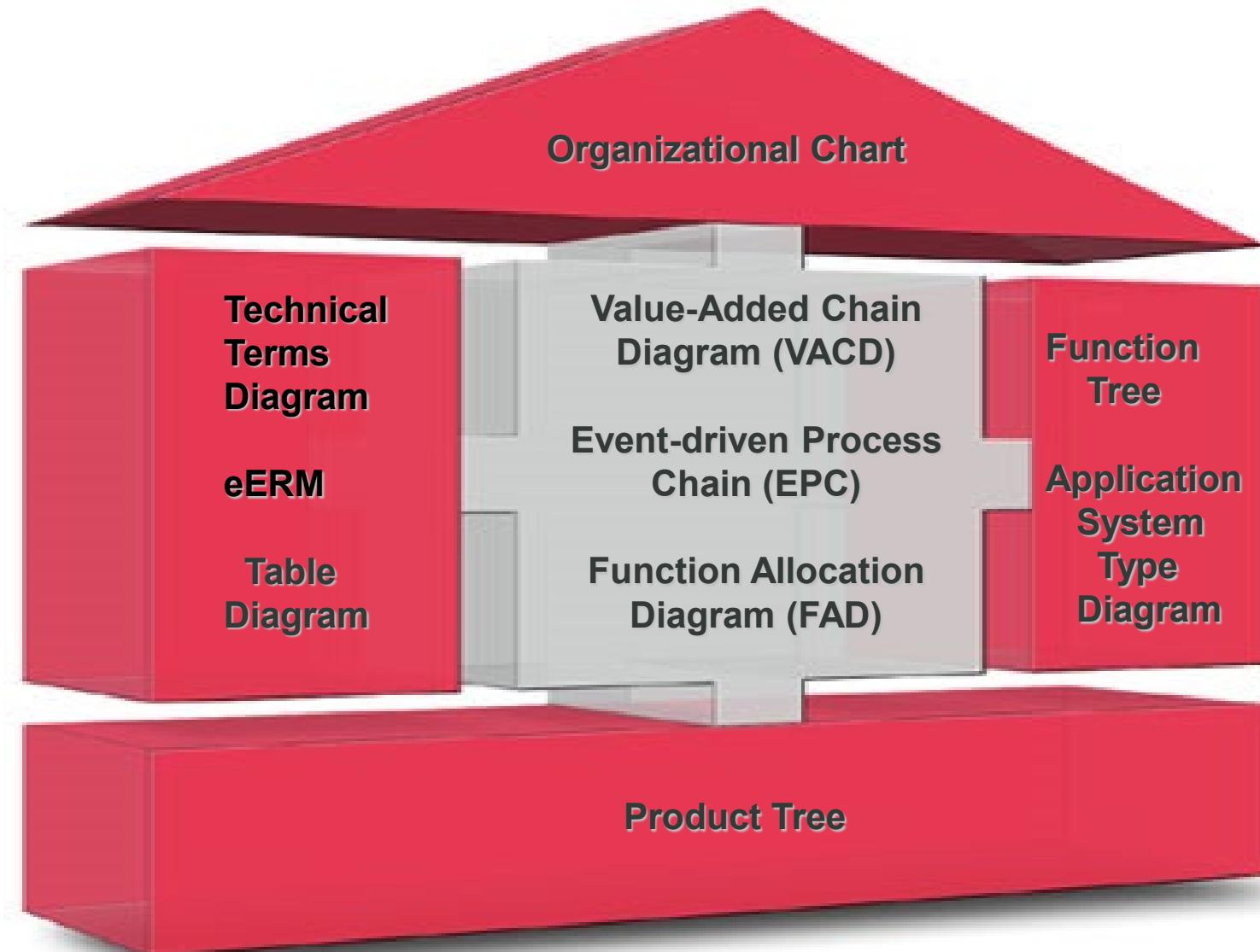


# ARIS Concept – Process Centric Approach



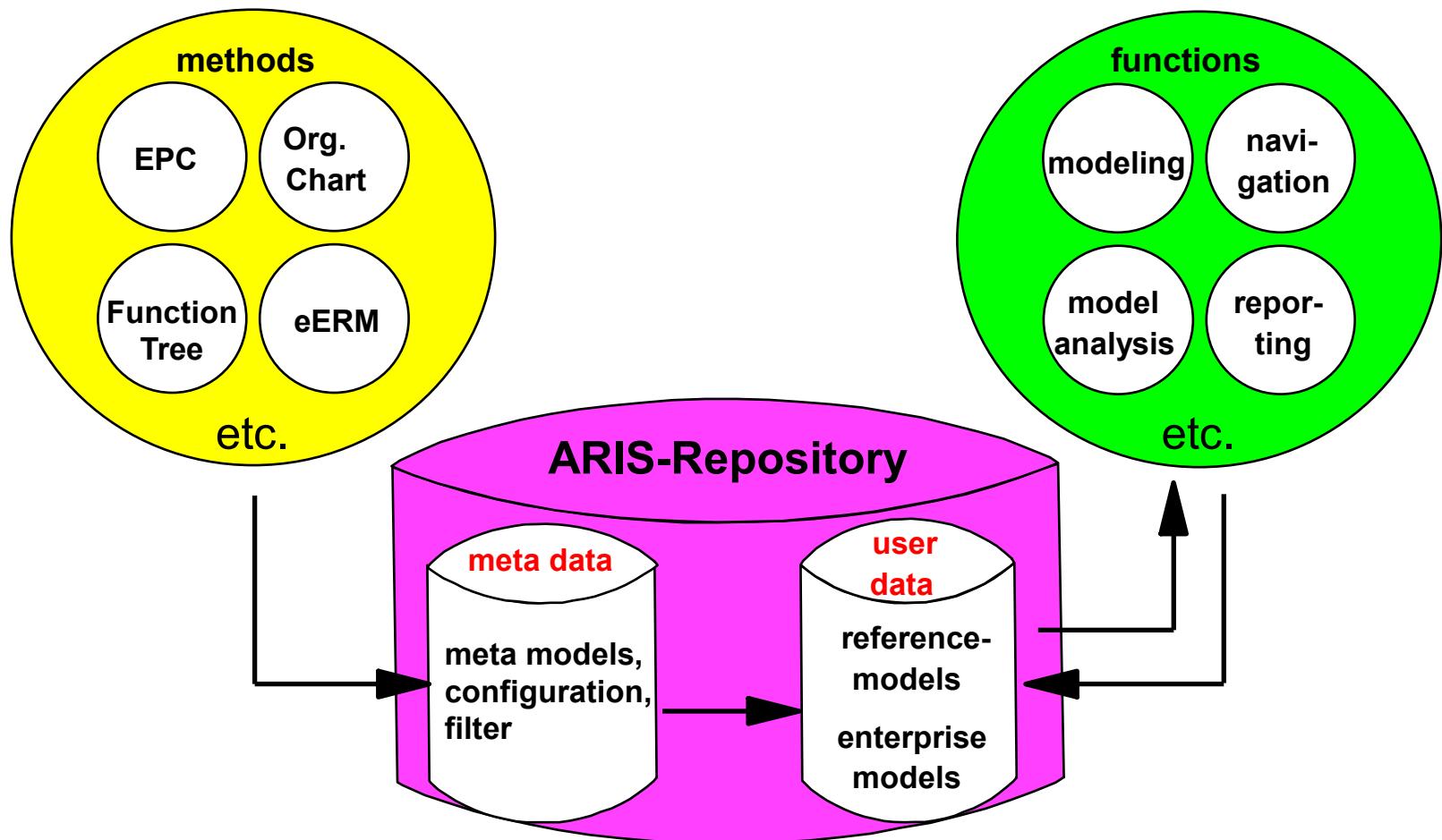
# ARIS House – Model Types (examples)

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# ARIS Software Architecture

- object-oriented design
- database (ARIS repository)



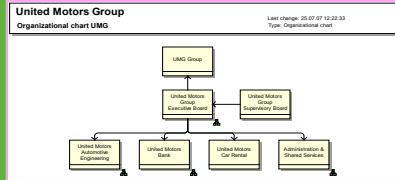
# Organizational Chart – Purpose

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- The **Organizational Chart** is primarily used to represent the following information:
- The **organizational structure** of a company
  - e.g. departments, positions, employees
- The **structure of a project** (project organization)
  - e.g. project team, project manager, project employees
- **positions and roles**
- **different connection types** between organizational objects

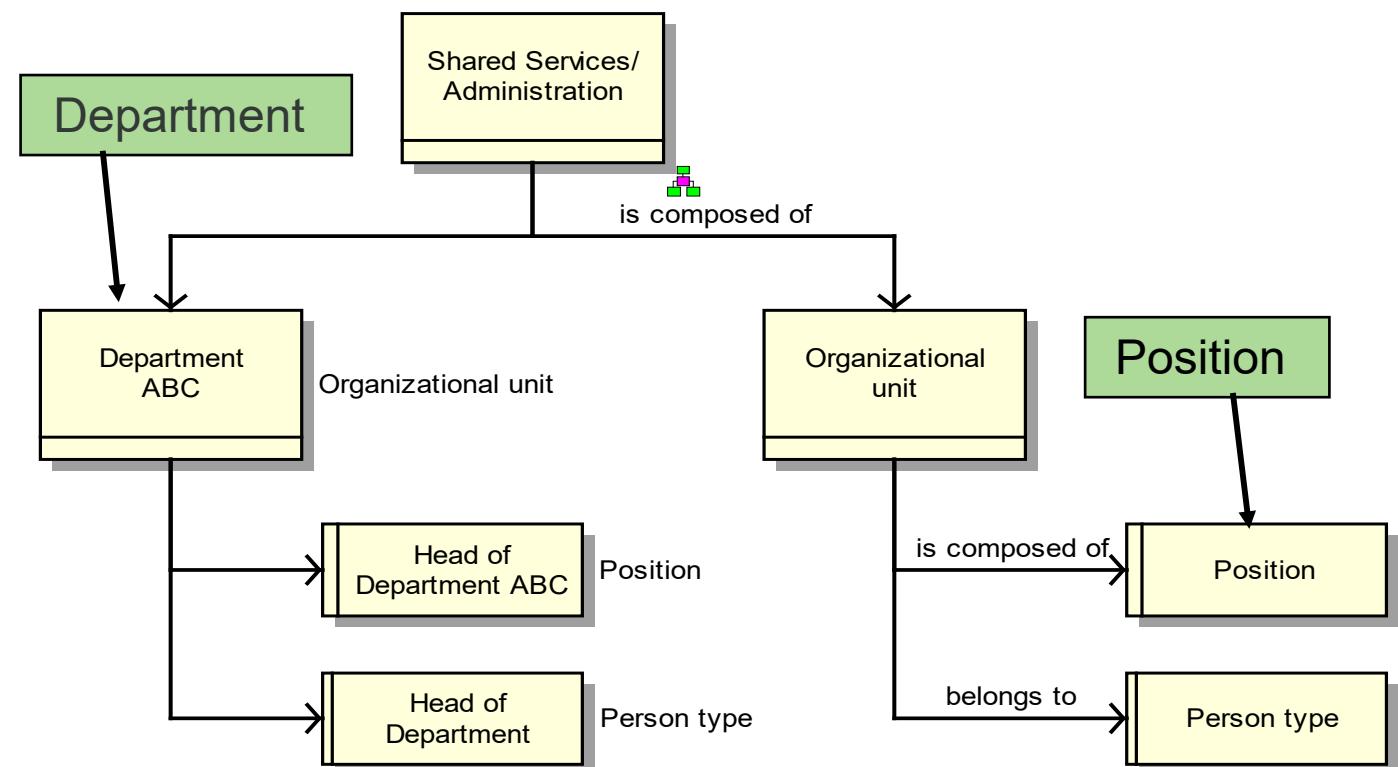
# Organizational Chart – Organization Structure – Example

## Organizational Chart & Role Models



## Organizational Chart

Model Type



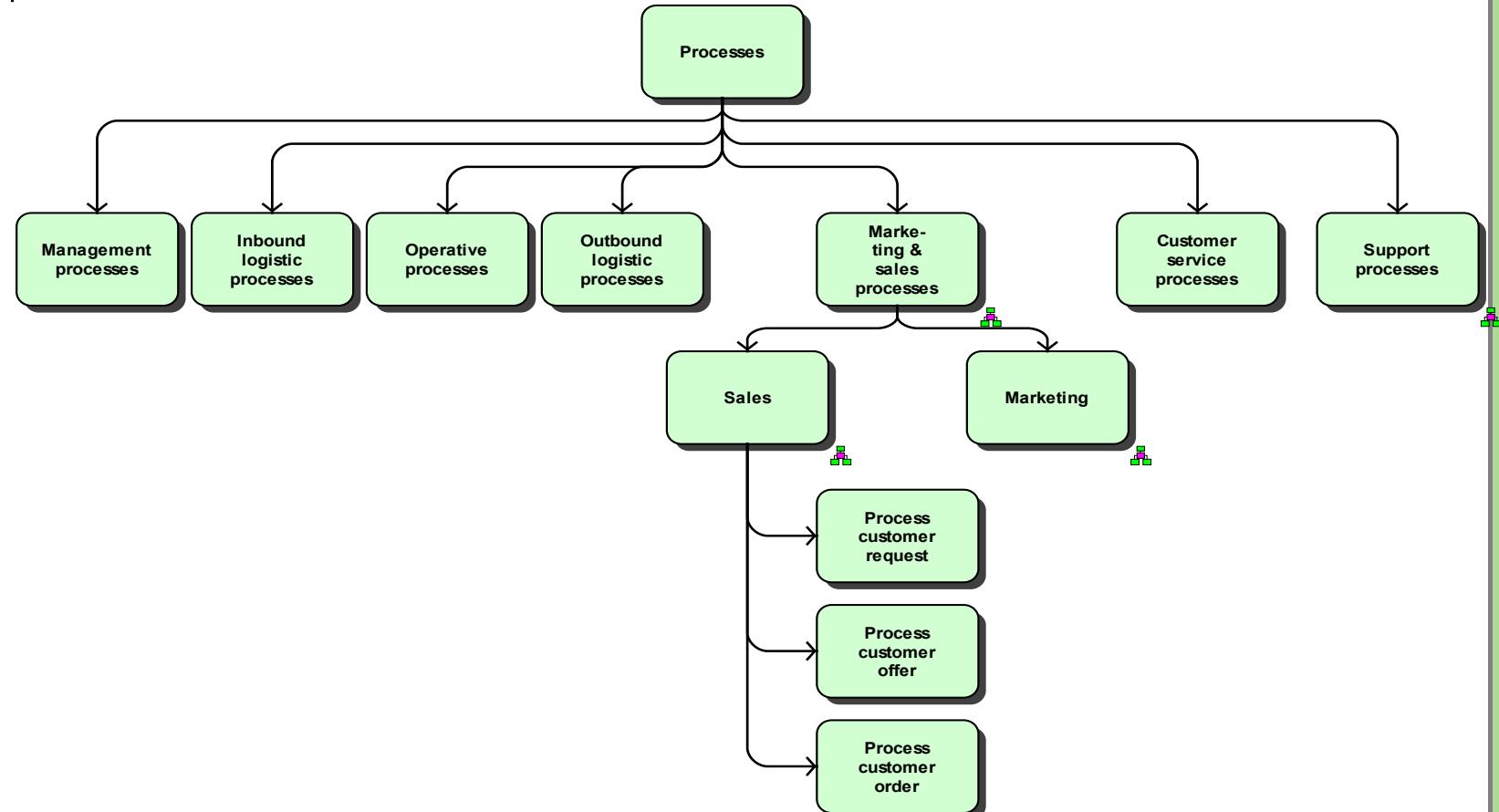
Represents:

- **Departments** (object type: **Organizational Unit**)
- **Positions** (object type: **Position**)
- **Employees** (object type: **Person**)

# Function Tree

Entry Model  
To Processes

- complex functions can be split into sub-functions
- graphic representation via model type function tree
  - shows multiple levels on the one diagram (**hierarchy diagram, static**)



## Important Models of Process View

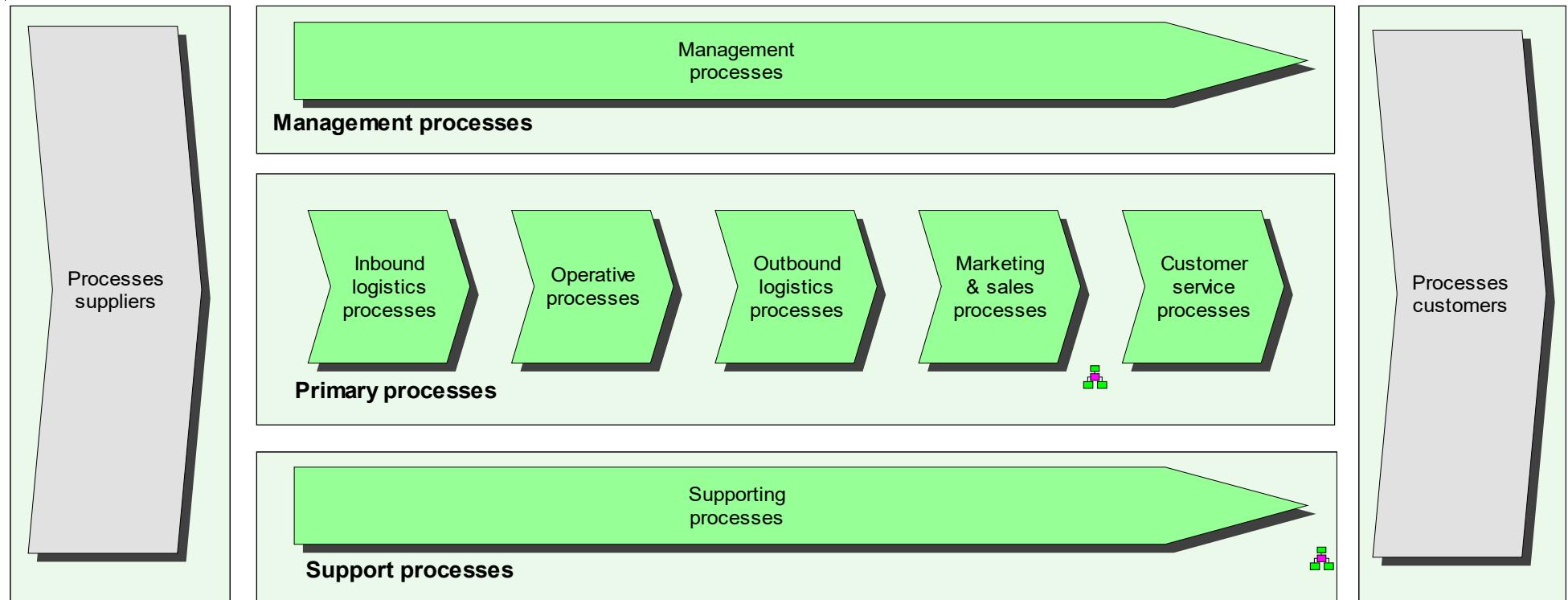
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- Value-added Chain Diagram (VACD)
- Event-driven Process Chain (EPC) (→ ARIS)
- Business Process Diagrams (→ BPMN)

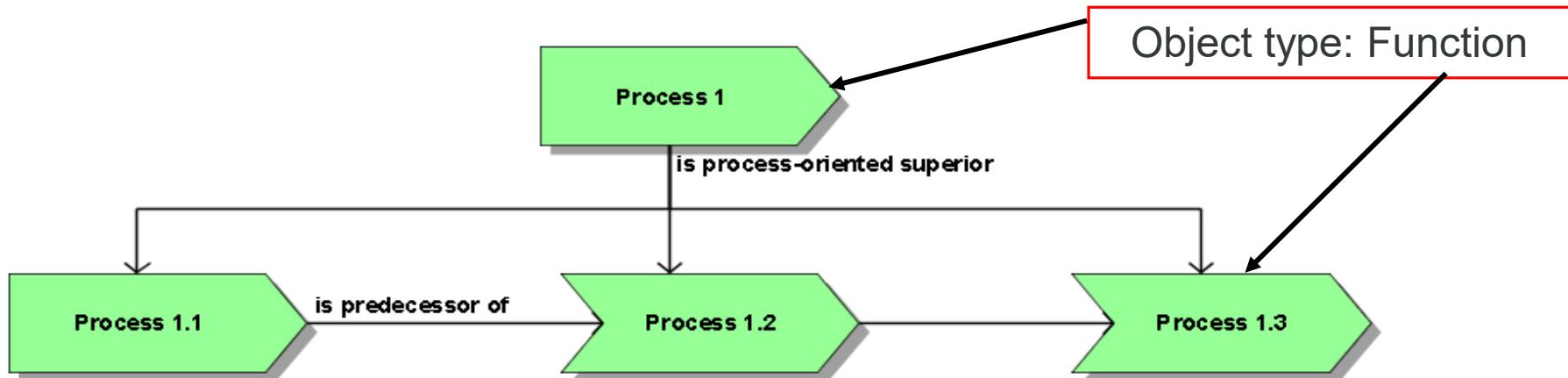
- The Value-Added Chain Diagram (VACD) model type is primarily used to represent a company's process map
  
- The process map
  - provides an overview of the processes in a company
  - represents an ideal starting point for looking at business processes

# VACD – Example Process Map

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# VACD – Object Type and Connection Types



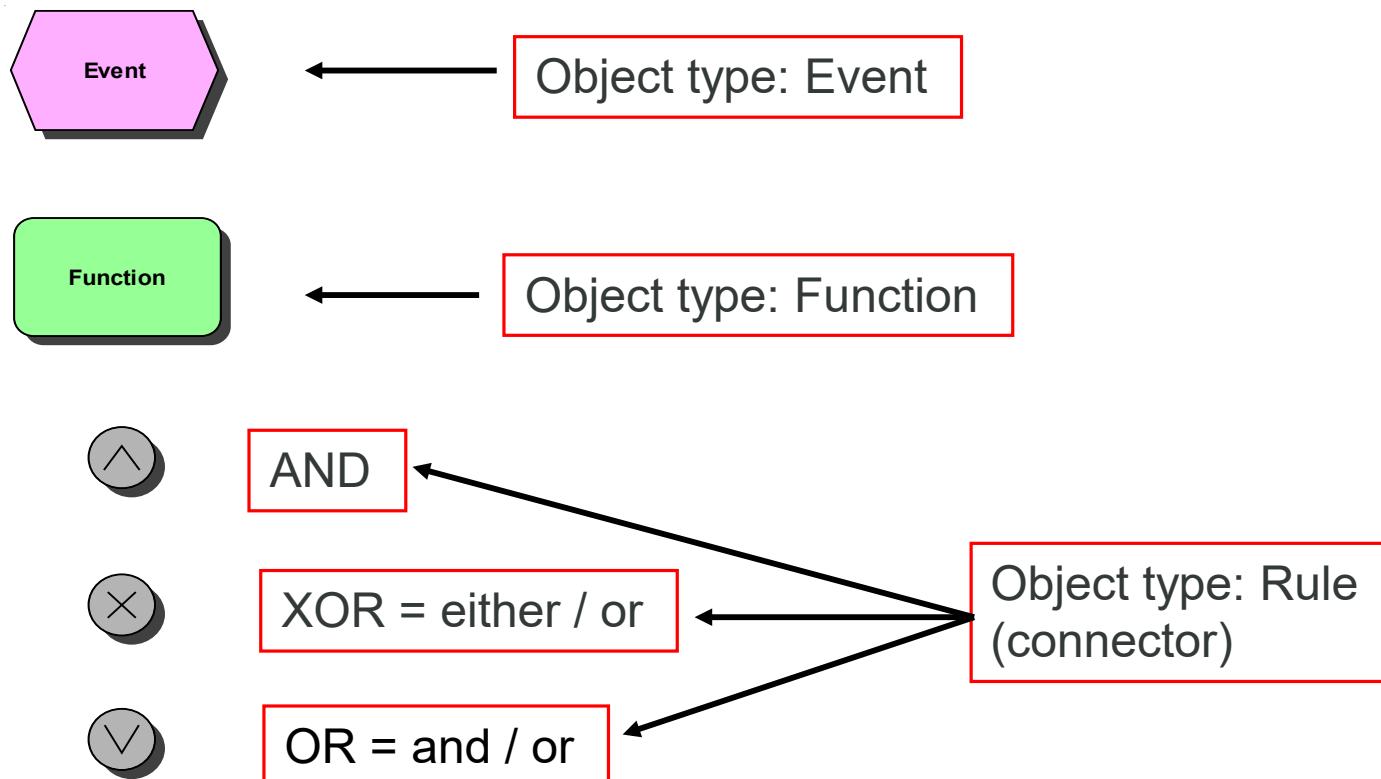
- In a Value-added Chain Diagram, there are **2 fundamental connection types** between functions:
  - Is process-oriented superior ( $\rightarrow$  process hierarchy)
  - Is predecessor of ( $\rightarrow$  process sequence, but no control flow)

From name (Type)	Relationship type	To name (Type)
Process 1 (Function)	is process-oriented superior	Process 1 (Function)
Process 1 (Function)	is predecessor of	Process 1 (Function)

# EPC – Purpose

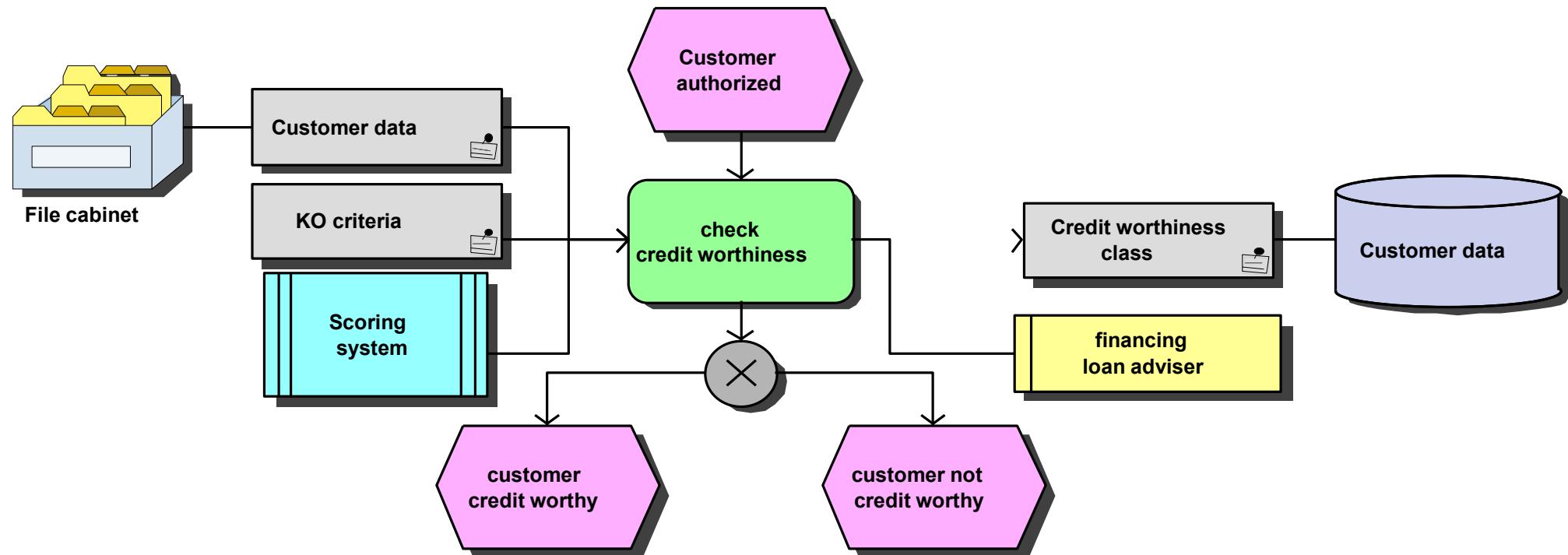
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- Representation of the ***control flow***, i.e. the chronological and logical sequence of individual functions in a process
- Constructs for modeling the control flow:



# EPC – Additional Information

- As well as the control flow, an EPC can also be used to represent additional information relevant to the process.



- **Business Process Model and Notation (BPMN)** is a **standardized graphical notation** for drawing business processes in a workflow
- specification of Object Management Group (**OMG**), actual version 2.0, see URL:  
<http://www.omg.org/spec/BPMN/>
- The **primary goal** of BPMN:
  - to provide a standard **notation that is readily understandable by all business stakeholders**. These business stakeholders include the **business analysts** who create and refine the processes, the **technical developers** responsible for implementing the processes, **and the business managers** who monitor and manage the processes.
  - Consequently BPMN is intended to serve as **common language to bridge the communication gap** that frequently occurs between business process design and implementation.
- graphical representation with so-called **Business Process Diagrams (BPD)**

# Business Process Model and Notation (BPMN)

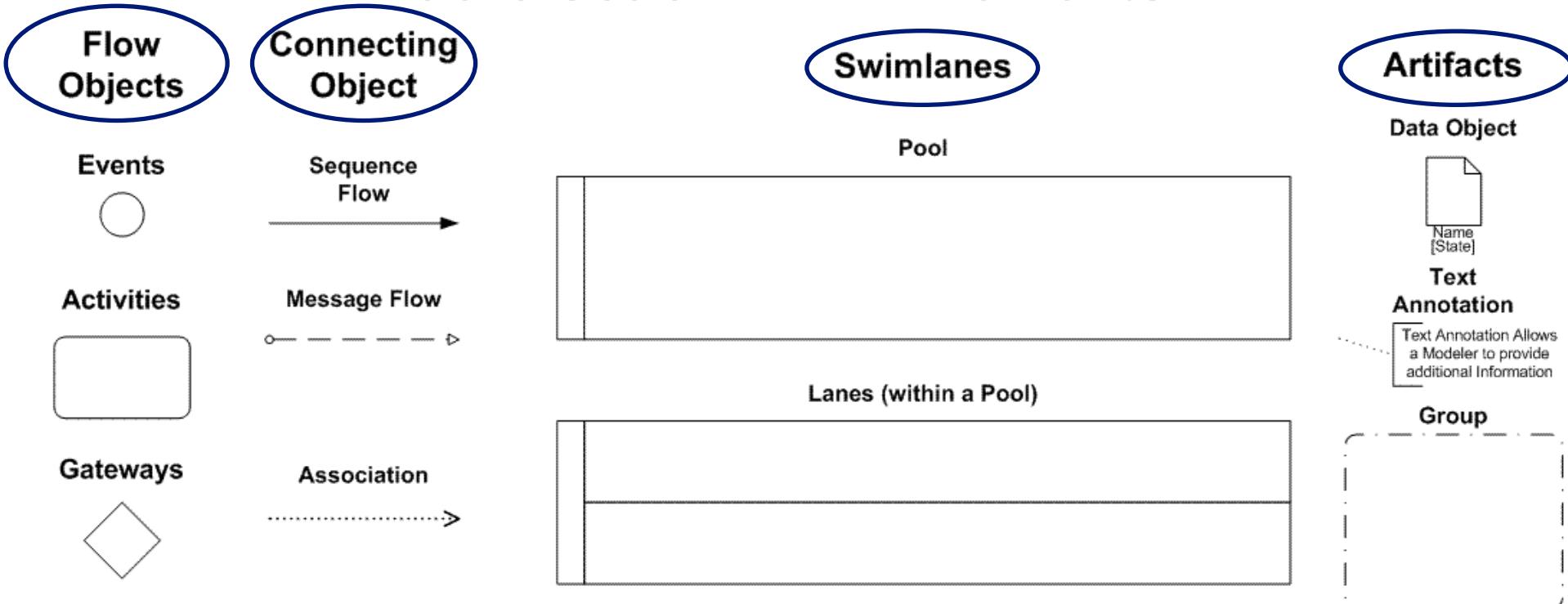
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- Usage of the „best ideas“ of existing notations like UML Activity Diagrams, IDEF, RosettaNet, LOVeM, Event-Process Chains (EPCs), ...
  - graphical elements with additional attributes (→ necessary for automation of processes)
- 
- **4 different diagram types**
    - Process Diagram
    - Collaboration Diagram
    - (Choreography Diagram) → High Level Diagram
    - (Conversation Diagram) → High Level Diagram

# Core Element Set

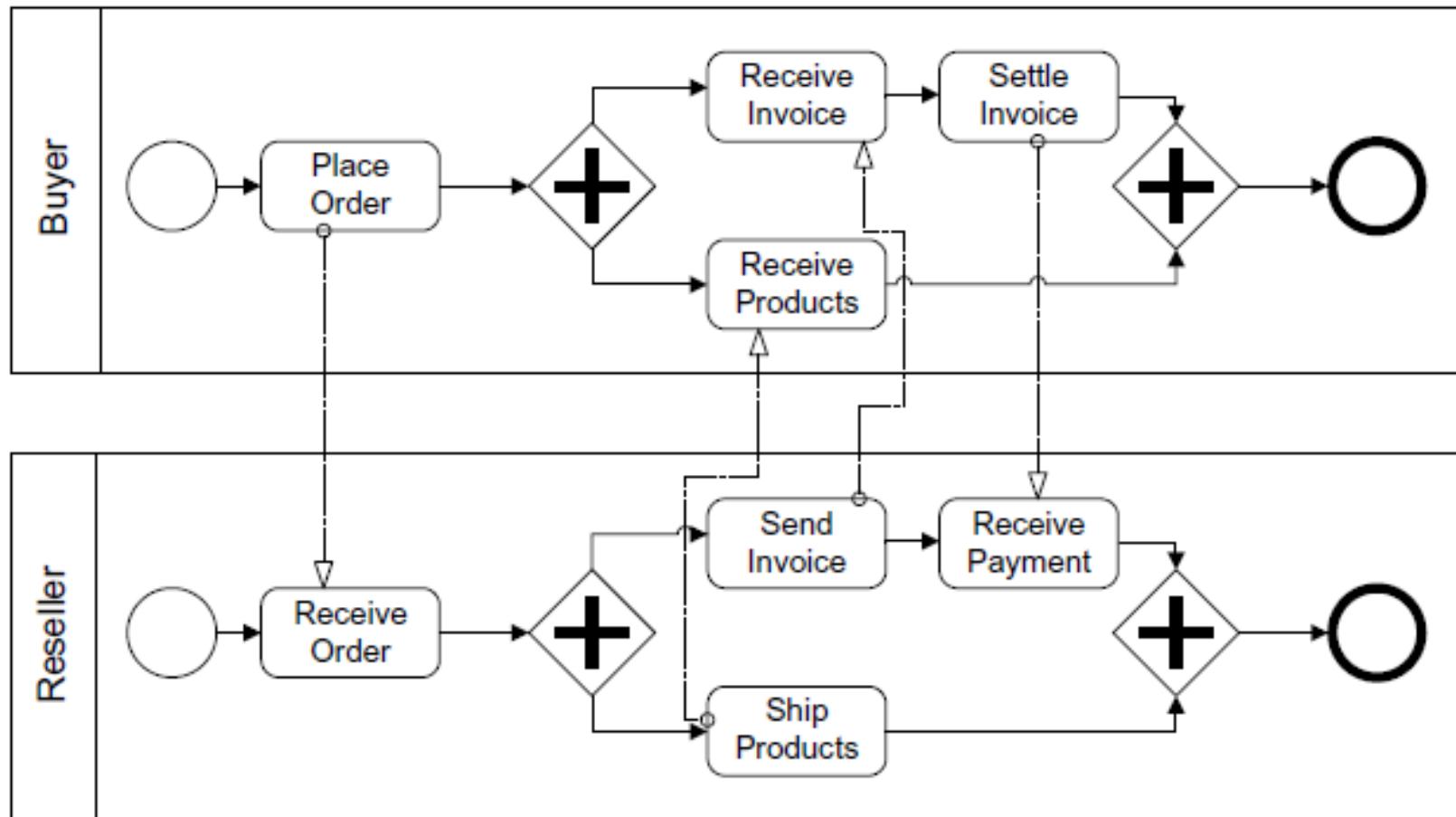
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## Core Set of BPMN Elements

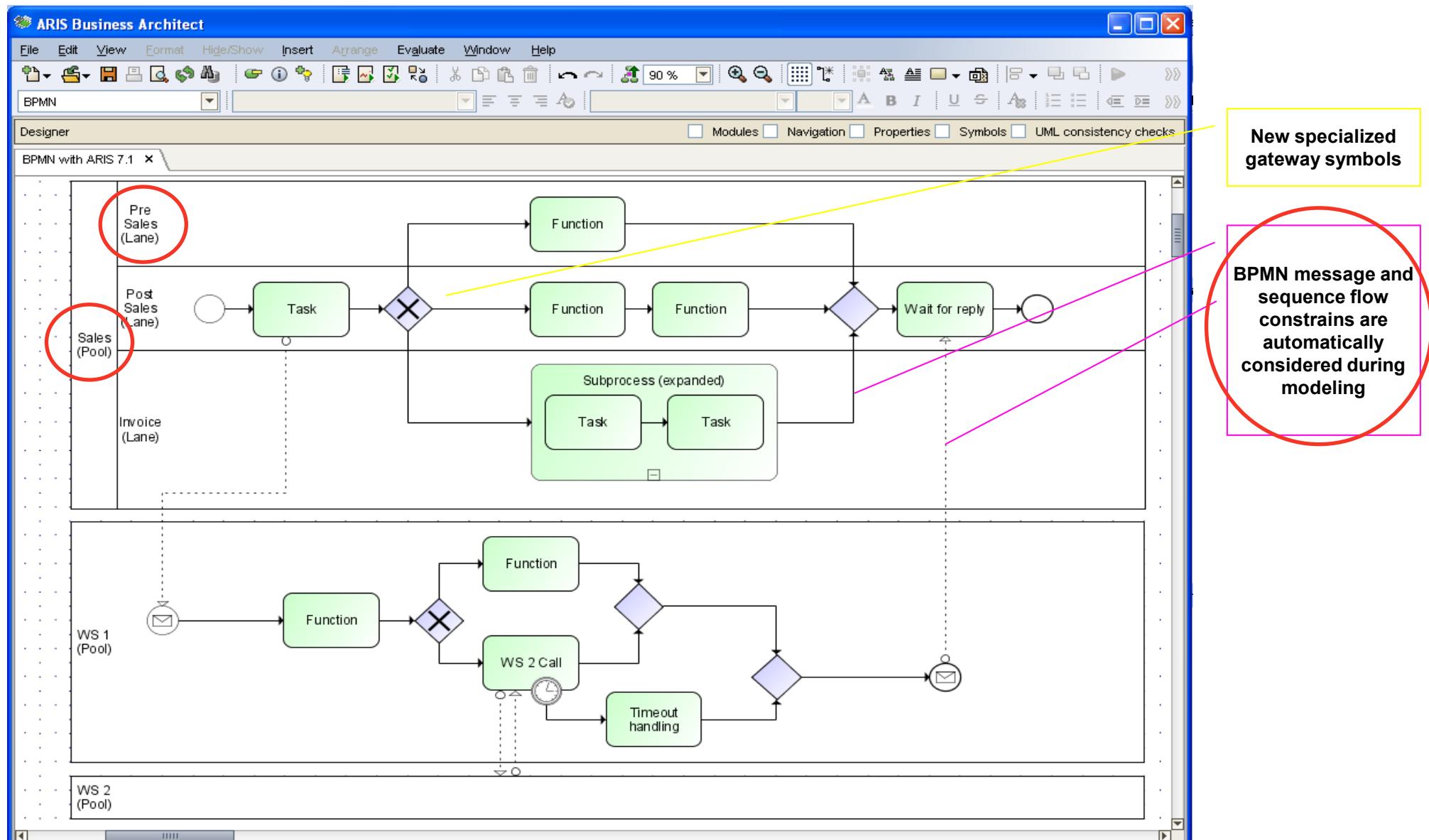


## A simple Example

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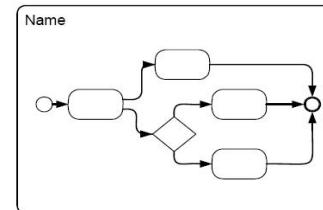
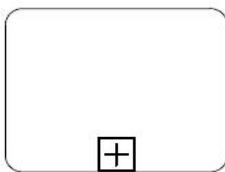
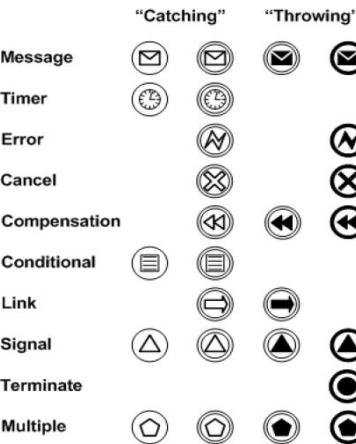
# BPMN – Another Collaboration Diagram Example



# BPD Extended Set

## Events

→ catching/throwing events:  
timer, synchronisation  
events, ...

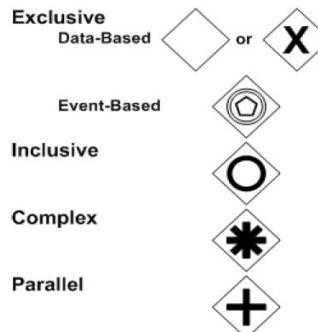


## Sub-Processes

→ Hierarchy of processes

## Gateway Control Types

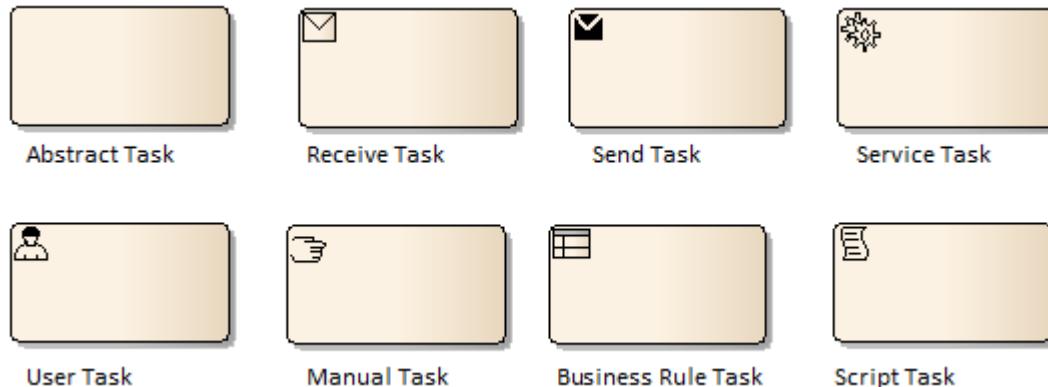
→ complex flow- and control logic)



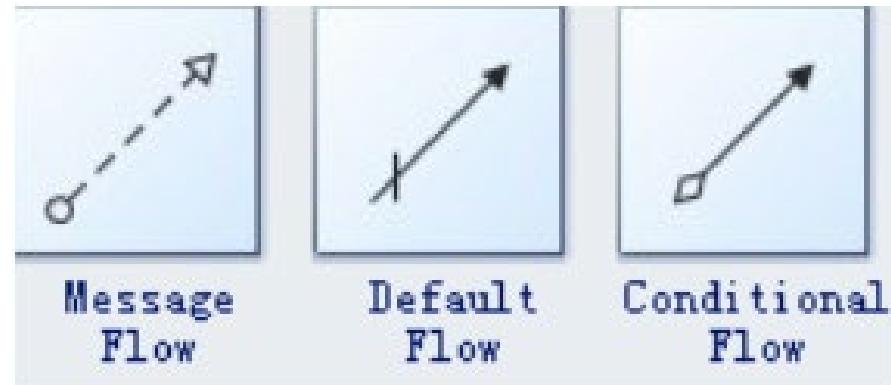
# Extension of basic BPMN elements (BPD Extended Set)

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## ■ Different types of tasks



## ■ Different types of flow



# Three Types of BPMN Models

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## 1. Private (internal) business processes

- Internal processes within an organizational unit

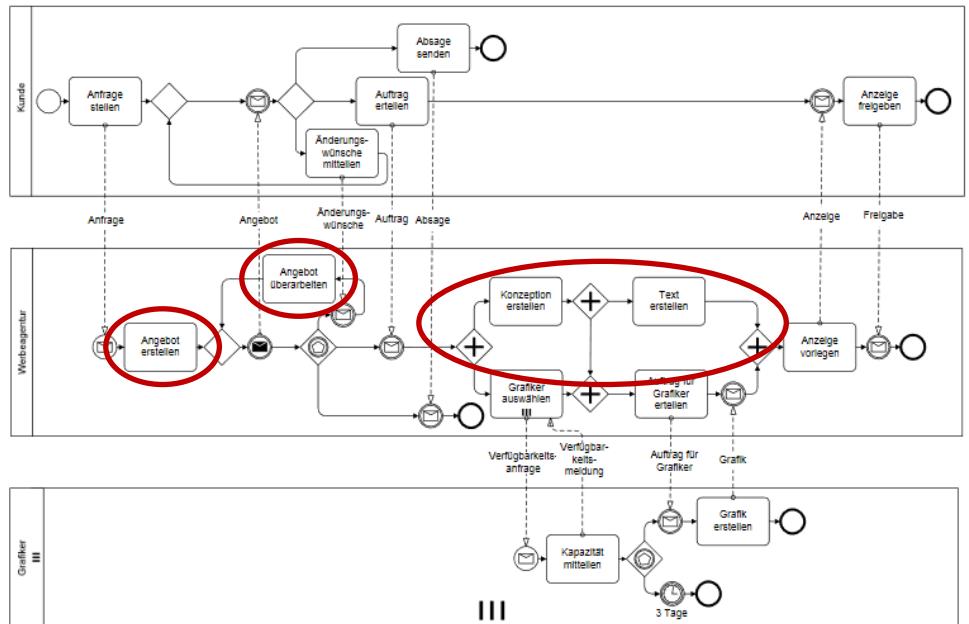
## 2. Abstract (public) processes

- Hiding of internal activities of a private process
- Only representation of events, activities which are used for the communication with other processes

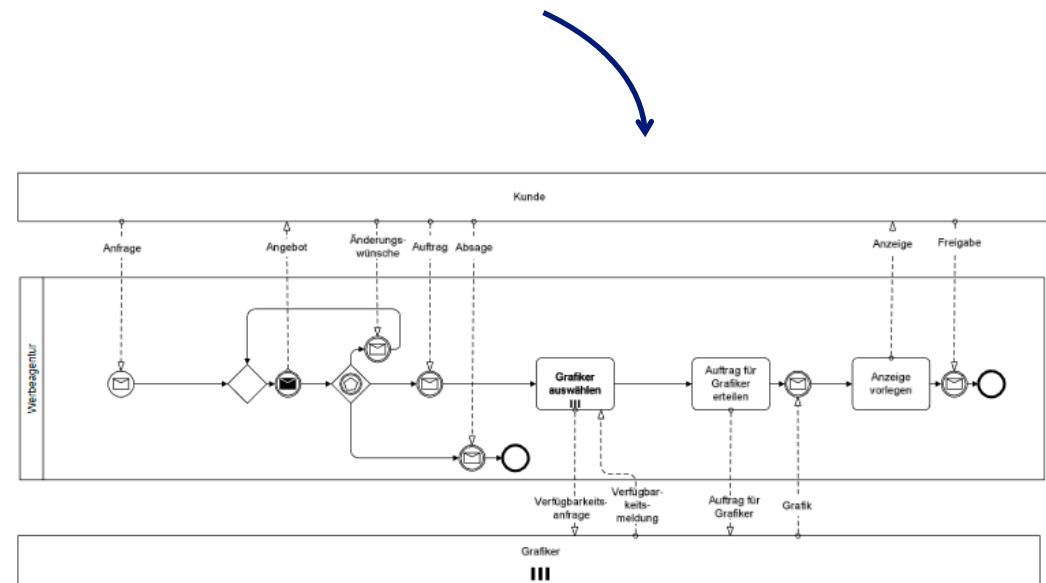
## 3. Collaboration (global) processes

- Interaction between different private and/or abstract processes  
(→message flow)
- Special case: collaboration by using so-called **Black Box Pools**

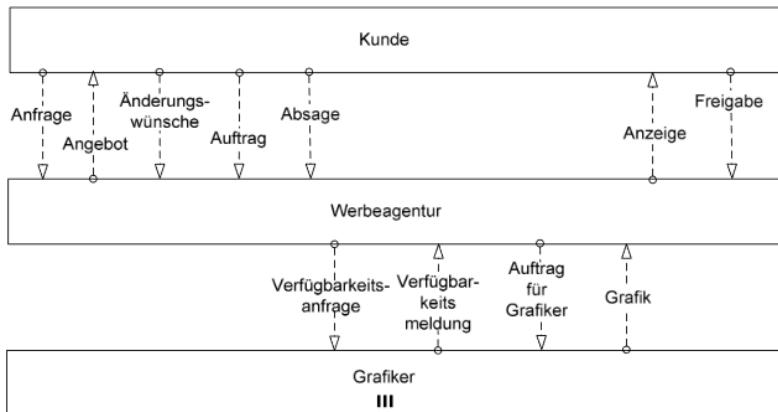
# Example for the different Diagram Types



collaboration to produce an advertisement (**three private processes** representing the client, the advertising agency and **different grafic designers** )



collaboration showing the public **process** of the advertising agency



collaboration with Black-Box Pools

## Modeling Rules

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- **Semantics of modeling elements** is partially very complex
  
- **Syntax rules and „Layout“ rules, e.g.:**
  - *Message Flow vs. Sequence Flow: 90° angle*
  - *Sequence Flow can not cross a Pool boundary.*
  - *If a sub-process has been expanded within a diagram, the objects within the sub-process cannot be connected to objects outside of the sub-process.*
  - ...

# Poster

## BPMN 2.0 - Business Process Model and Notation

<http://bpmb.de/poster>

### Activities

A Task is a unit of work, the job to be performed. When marked with a  $\oplus$  symbol, it indicates a Sub-Process, an activity that can be refined.

A Transaction is a set of activities that logically belong together. It might follow a specified transaction protocol.

An Event Sub-Process is placed into a Process or Super-Process. It is activated when its start event gets triggered and can interrupt the higher level process context or run in parallel (non-interrupting) depending on the start event.

A Call Activity is a wrapper for a globally defined Task or Process reused in the current Process. A call to a Process is marked with a  $\ominus$  symbol.

**Activity Markers**  
Markers indicate execution behavior of activities:

- Sub-Process Marker
- Loop Marker
- Parallel MI Marker
- Sequential MI Marker
- Ad Hoc Marker
- Compensation Marker

**Task Types**  
Types specify the nature of the action to be performed:

- Send Task
- Receive Task
- User Task
- Manual Task
- Business Rule Task
- Service Task
- Script Task

**Sequence Flow**, **Default Flow**, **Conditional Flow**

### Conversations

A Conversation defines a set of logically related message exchanges. When marked with a  $\ominus$  symbol, it indicates a Sub-Conversation, a compound conversation element.

A Conversation Link connects Conversations and Participants.

**Conversation Diagram**

Multiple Participants Marker denotes a set of Participants of the same kind.

**Choreographies**

A Call Choreography is a wrapper for a globally defined Choreography Task or Sub-Choreography. A call to a Sub-Choreography is marked with a  $\ominus$  symbol.

**Choreography Diagram**

**Collaboration Diagram**

**Data**

**Events**

	Start	Intermediate	End
Standard			
Event Sub-Process			
Event Non-Interrupting			
Catching			
Boundary			
Boundary Non-Interrupting			
Throwing			

**Definitions**

- None:** Untyped events, indicate start point, state changes or final states.
- Message:** Receiving and sending messages.
- Timer:** Cyclic timer events, points in time, time spans or timeouts.
- Escalation:** Escalating to an higher level of responsibility.
- Conditional:** Reacting to changed business conditions or integrating business rules.
- Link:** Off-page connectors, two corresponding link events equal a sequence flow.
- Error:** Catching or throwing named errors.
- Cancel:** Reacting to cancelled transitions or triggering cancellation.
- Compensation:** Handling or triggering compensation.
- Signal:** Signalling across different processes. A signal thrown can be caught multiple times.
- Multiplicities:** Catching one out of a set of events. Throwing all events defined.
- Parallel Multiples:** Catching all out of a set of parallel events.
- Terminate:** Triggering the immediate termination of a process.

### Gateways

**Exclusive Gateway**: When splitting, it routes the sequence flow to exactly one of the outgoing branches. When merging, it waits for all incoming branches to complete before triggering the outgoing flow.

**Event-based Gateway**: Is always followed by catching events or receive tasks. Sequence flow is routed to the subsequent event/task which happens first.

**Parallel Gateway**: When used to split the sequence flow, all outgoing branches are activated simultaneously. When merging parallel branches, it waits for all incoming branches to complete before triggering the outgoing flow.

**Inclusive Gateway**: When splitting, one or more branches are activated. All active incoming branches must complete before merging.

**Complex Gateway**: Complex merging and branching behavior that is not captured by other gateways.

**Exclusive Event-based Gateway (Instantaneous)**: Each occurrence of a subsequent event starts a new process instance.

**Parallel Event-based Gateway (Instantaneous)**: The occurrence of all subsequent events starts a new process instance.

**Swimlanes**

**BPM OFFENSIVE BERLIN**

**Hasso Plattner Institut**

**camunda**

**inubit**

**SIGNAVIO**

# Extensibility of Notation

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- with the help of so-called **artefacts**
- **shape of basic elements** (events, activities, gateways, flow elements) should not be modified for reasons of uniformity and readability
- **to clarify the diagrams, usage of**
  - text annotations,
  - (filling) colors,
  - different kinds of lines and so forth
- is possible
- **variety of tools** (proprietary, Freeware, Open Source)
  - Activiti, Adonis, Bizagi, Camunda Modeler, IBM Process Designer, iGrafx Process, Innovator, jBPM, Mega Process, Modelio, Signavio Process Editor, Tibco Business Studio, webMethods, yEd, and a lot more, **see also:** <https://bpmnmatrix.github.io/>

# Missing Parts of the Notation

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- no possibility to represent the „static“ views of an enterprise
- Not any diagram type for the representation of e.g.
  - Process landscapes
  - Organizational charts
  - Data models
  - Strategy models
  - Business rules (**→ DMN = Decision Model and Notation**)
  - IT-Landscapes

# Summary

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## ■ Pros

- OMG Standard (**international standard ISO/IEC 19510:2013**)
- set of basic core elements is manageable
- **easily understandable** by business units

## ■ Cons

- **missing parts** (organizational modeling, data modeling)
- **missing possibilities for analysis and simulation**
- **can lead to „technical“ modeling** (→ execution phase of the BPM cycle), then difficult to read by business unit staff

# Administration and Planning Systems

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- support of the **functional tasks** of the enterprise
- **Administration systems:**
  - **classical handling of “bulk data”**
    - book-keeping
    - payroll accounting
  - ***management of assets***
    - warehouse articles in retail or production
    - bank accounts
    - contracts (insurance and leasing companies)
- **Planning systems:**
  - **preparation of short-term decisions**, mainly for the lower and middle management
    - dunning process
    - calculation within cost accounting
    - sales force control
    - material procurement

# Industry-independent vs. Industry-specific Applications

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- **industry-independent applications** normally follow a predefined (often prescribed by law) procedure
- main areas:
  - *financial accounting*
  - *payroll accounting*
  - *invoice processing*
- **industry-specific applications** for different industries, e.g.
  - manufacturing
  - trade
  - service enterprises (especially banks, insurance companies)

# Different Kind of Data

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- **master data**
  - information about objects which never or only seldom changes, e.g. employee number, name, address, birth date, family status
- **inventory data**
  - represent assets, e.g. warehouse assets, bank accounts
- **transactional data**
  - update of master data and inventory data, e. g. stock requisitions, payments, withdrawals
- master and inventory data have a status while transactional data are triggered by events (sales, payments, ...)

# Accounting

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- **Financial Accounting** (main task: protection of solvency)
  - **solvency planning**: short- and middle-term acquisition or usage of capital
  - **cash management** (international operating enterprises): information of the current status of all bank accounts worldwide
- **Book-keeping** (classical core area)
  - **financial accounting**: accounts receivable, accounts payable and general ledger accounting
  - **cost and results accounting**: cost category, cost center, cost unit and operating statement

# Human Resources

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- **personnel accounting**, especially gross wages and net wages
  - “minor” applications for travel expense accounting, phone calls accounting, compensation, rewards, and benefits management
- **time management**
  - management of time accounts (e.g. attendance times)
- **human resources planning**
  - recruitment and selection
  - training and development (learning management)

# Sales (1)

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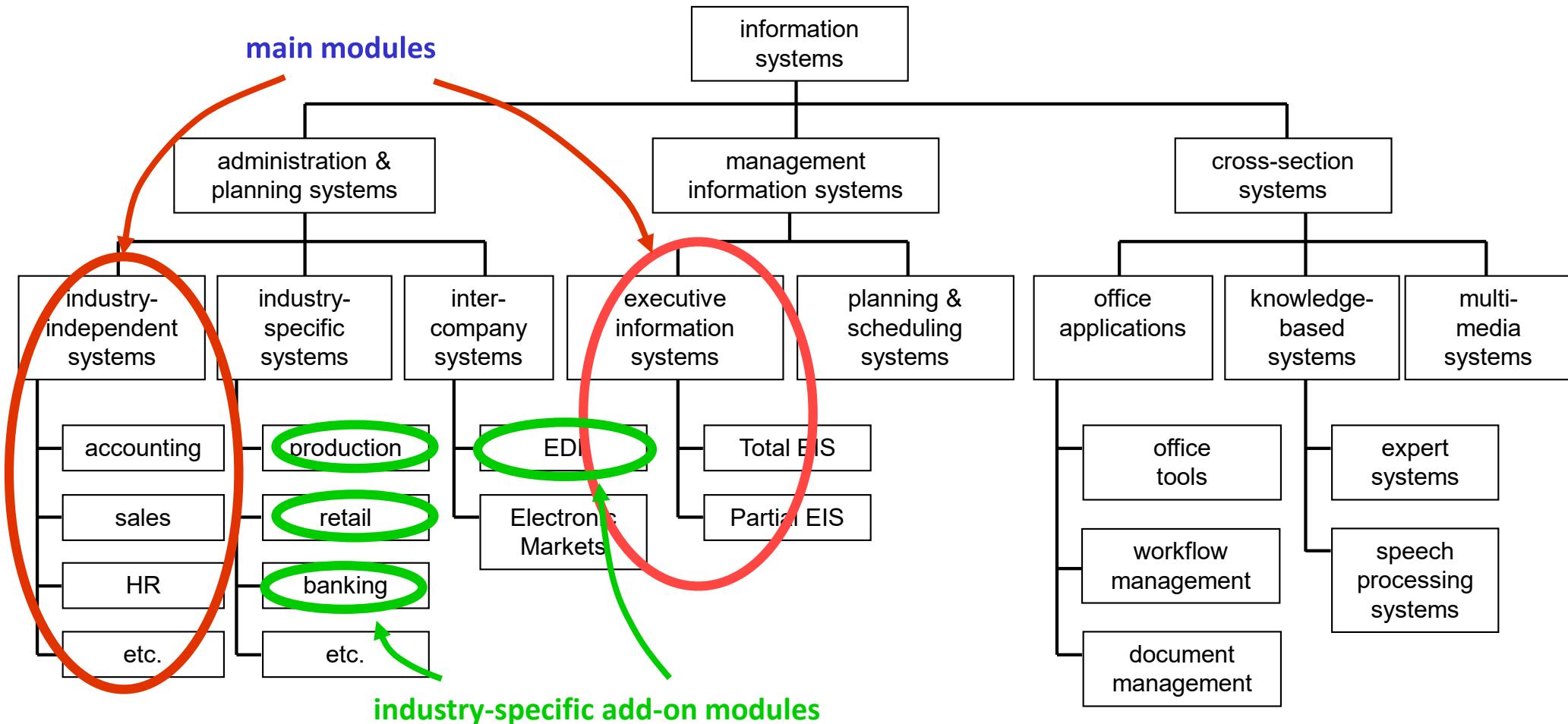
- **Administrative functions**
  - **quotation management and monitoring:** calculation, processing of potential buyer requests, submission of offers
  - **order processing:** entering, assessment and management of customer orders
  - **invoicing:** creation of invoices including shipping documents, with respect to article prices and special conditions (discounts, scaled prices)
    - also: processing of credit vouchers
    - analysis of invoice data for executive information

# Sales (2)

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- **planning functions**
  - **shipping management** : monitoring of order dates, goods allocation for delivery, picking of goods, goods issue, toll calculation for delivery of goods in foreign countries
  - **shipping logistics** (goods delivery): typical application area for operations research methods:
    - vehicle fleet management,
    - charging of transportation vehicles
    - route planning
  - **sales force support (Computer-Aided Selling - CAS)**: sales call scheduling and -preparation, order taking on customer site, management of call reports

# ERP Systems: Main Modules



[according to:  
Stahlknecht, Hasenkamp, 2004]

# Advantages and Disadvantages of ERP Systems

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## Advantages:

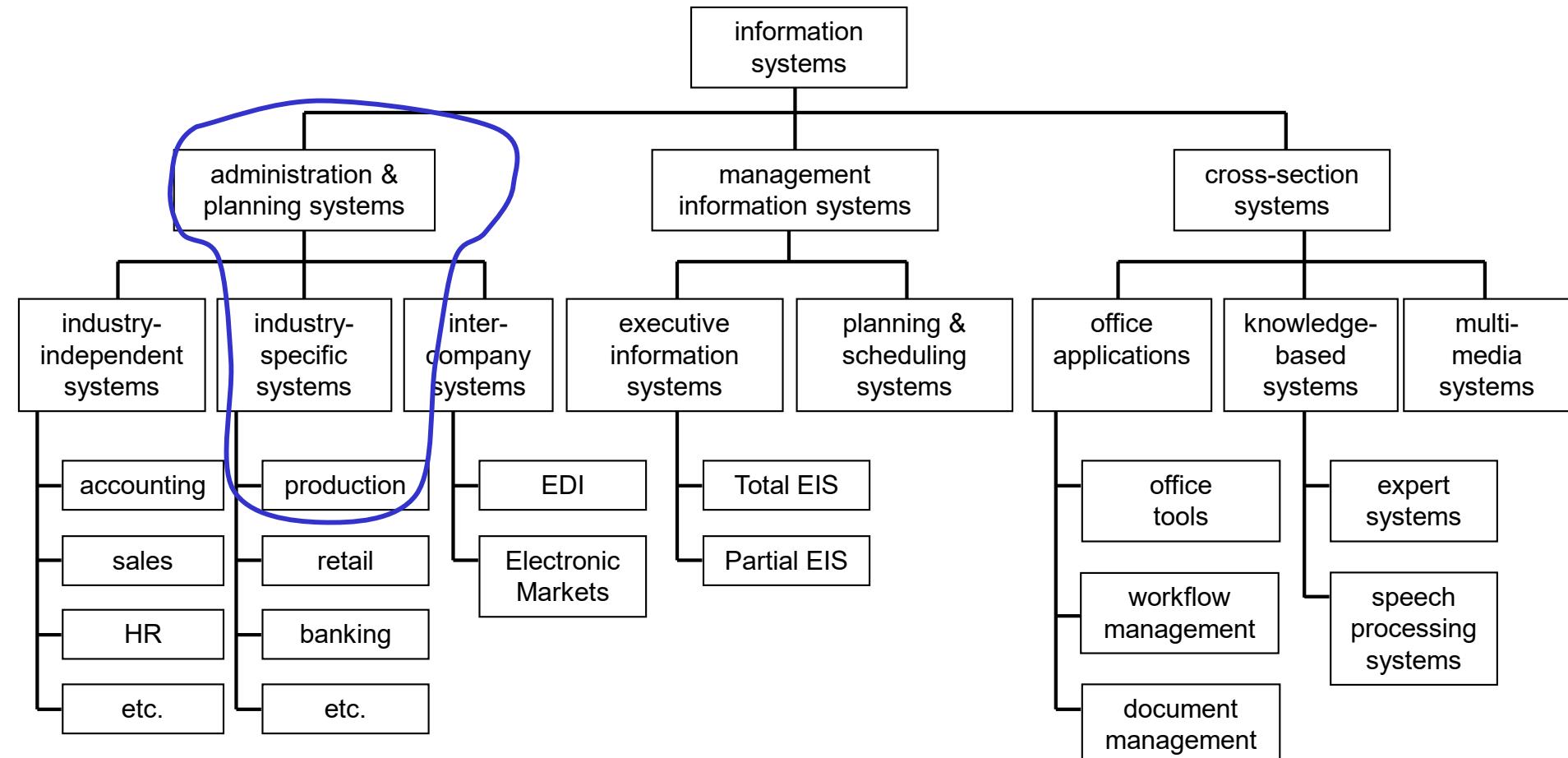
- "**Best business practices**" are represented within the software
- **high integration degree** (one database, e.g. master data exist only once)
- **less maintenance effort**, maintenance provided by software vendor (e.g. tax modifications)
- **Customizing**
- **availability for different platforms** (hardware, operating system, database)

## Disadvantages :

- **customizing is often very expensive**
- **high complexity** requires **high on-the-job training efforts** both for end-users and system administrators
- enterprise is often forced to **adapt its processes to the software**

# Classification of Business Information Systems

according to intended use (functional view)

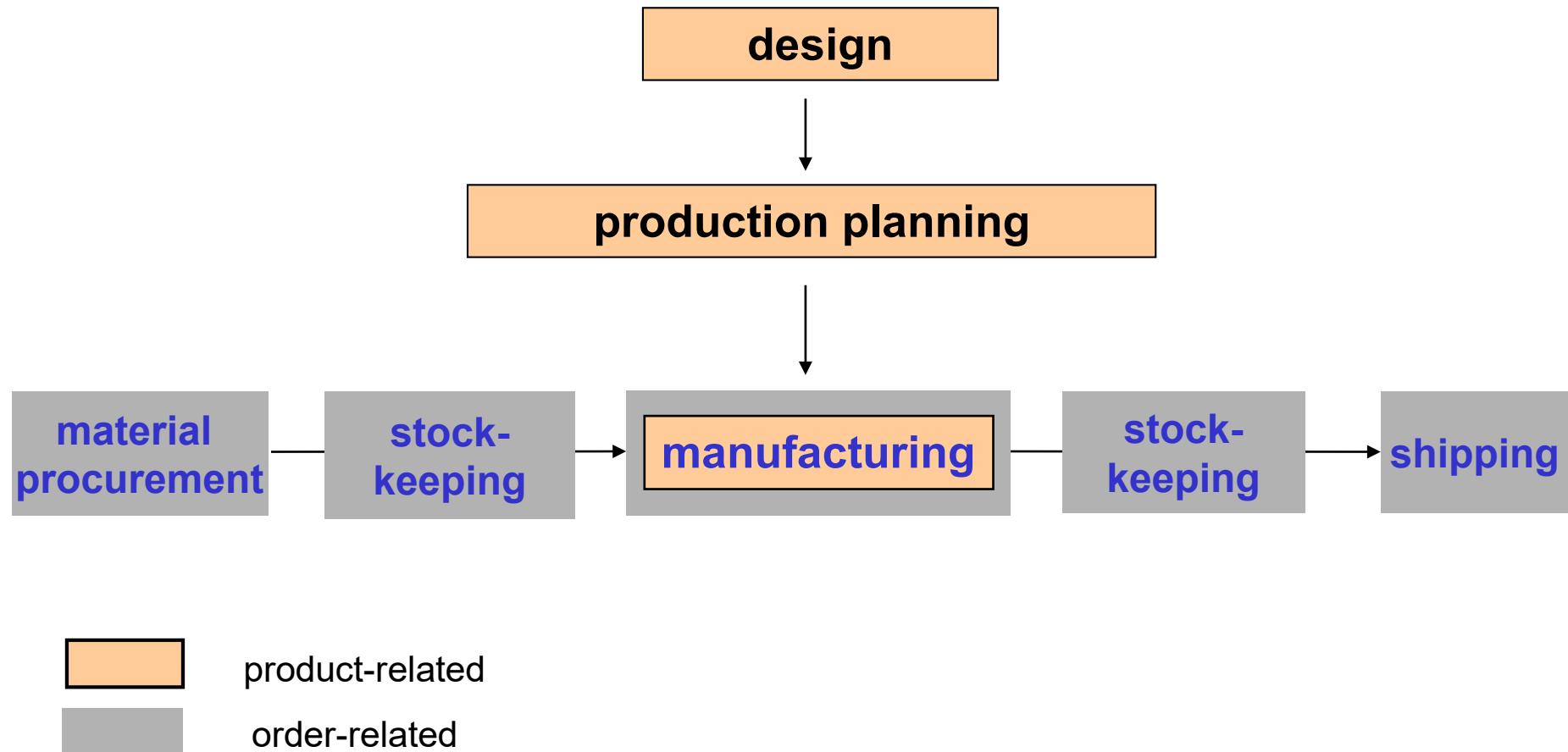


[according to:  
Stahlknecht, Hasenkamp, 2004]

# Manufacturing Industry

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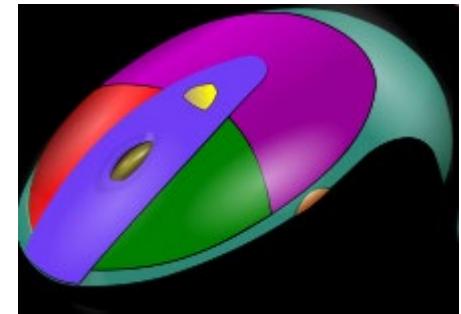
2 core processes in manufacturing:



# Product Life Cycle and corresponding IT Support

product-related

- **CAD - Computer-Aided Design**
  - design
  - material data (bill of material)
  - Tools: AutoCAD, Catia, VectorWorks
- **CAP - Computer-Aided Planning**
  - definition of production flow (working steps, machines, tools, material, intermediate products, processing and set-up times, ...)
- **CAM - Computer-Aided Manufacturing**
  - material machining (programs for turning, milling, cutting) resp. material assembly (robot control)
- **PPS – Production planning and scheduling**
  - production scheduling
  - material supply (logistics)
  - machine control



order-related

# CAP - Computer Aided Planning

---

- determines the **sequence of individual manufacturing operations** needed to produce a given part or product
- **results:**
  - **form** typically referred to as a **route sheet** containing a listing of the production operations and associated machine tools for a work part or assembly; routing becomes a major input to the manufacturing resource planning system
  - **process plans** which typically provide more detailed, step-by-step work instructions including dimensions related to individual operations, machine parameters, set-up instructions, and quality assurance checkpoints
  - fabrication and assembly drawings to support manufacture

# CAM - Computer Aided Manufacturing

---

- use of computer software to control machine tools and related machinery in the manufacturing of work pieces
- CAM has been considered as a **numerical control (NC)** programming tool, wherein two-dimensional (2-D) or three-dimensional (3-D) models of components generated in CAD software are used to generate **G-code** (common name for the most commonly used NC programming language) to drive **computer numerically controlled (CNC)** machine tools
- **Direct numerical control (DNC)**, also known as distributed numerical control, is a common manufacturing **term for networking CNC machine tools**

# CAM - Systems

---

## flow of material systems

- conveyors, vertical conveyor for high bay warehouse, (control by „dedicated“ computer)

## flexible manufacturing cells (FMC)

- work machines which are often automated CNC machines
- these machines are connected by a material handling system to optimize parts flow
- central control computer which controls material movements and machine flow



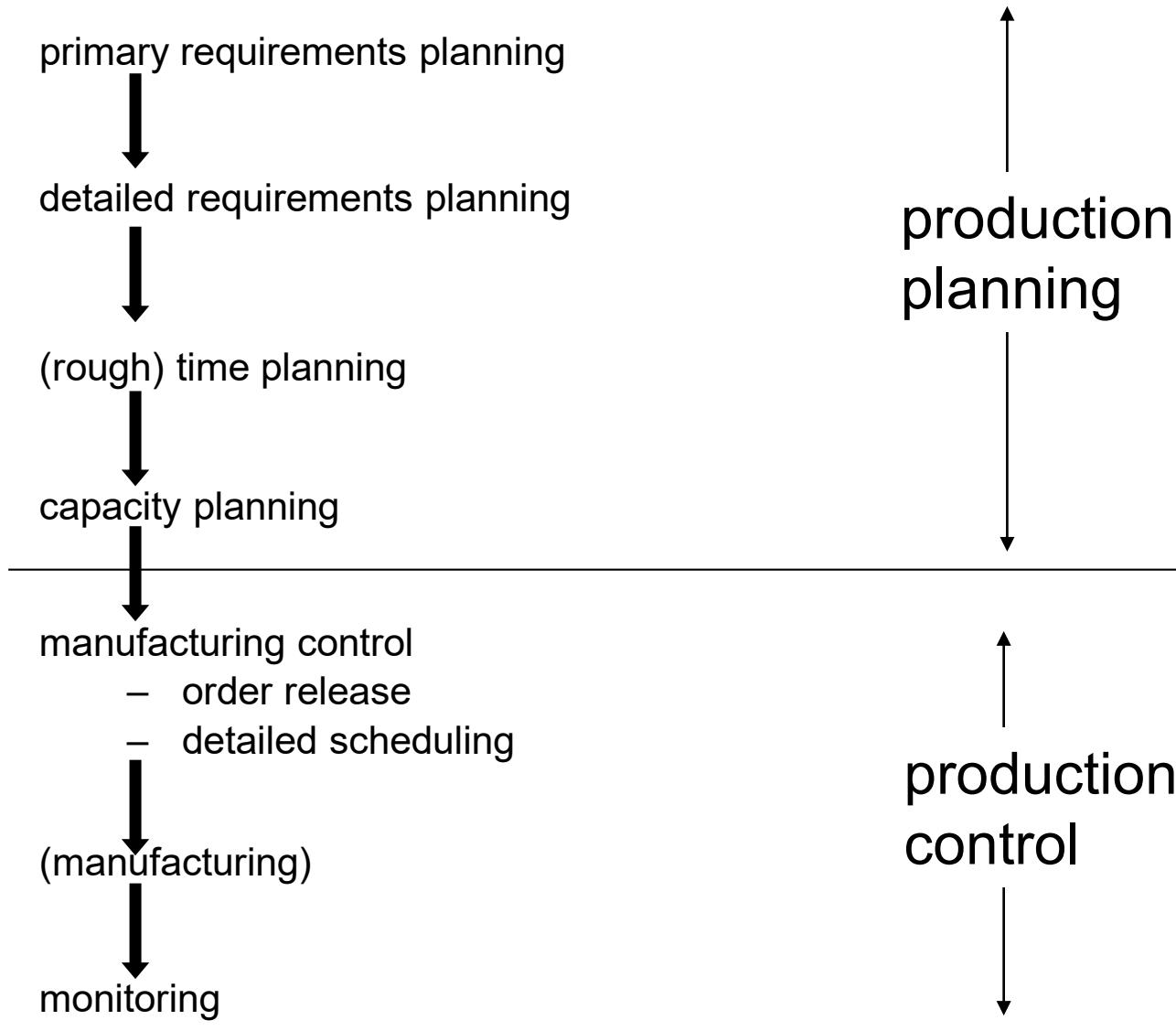
## plant maintenance systems

### Software vendors:

see e.g.

[http://en.wikipedia.org/wiki/List\\_of\\_CAx\\_companies](http://en.wikipedia.org/wiki/List_of_CAx_companies)

# Process of Production Logistics



# Warehouse

---

Stored goods can include any raw materials, components, or finished goods associated with agriculture, manufacturing, or commerce

trend towards **Automated Storage and Retrieval System (ASRS)** including vertical carousels, vertical lift modules, horizontal carousels, robotics, mini loads

**Major warehousing processes** include:

- goods receiving
- order preparation / picking
- shipping
- inventory management
- ...

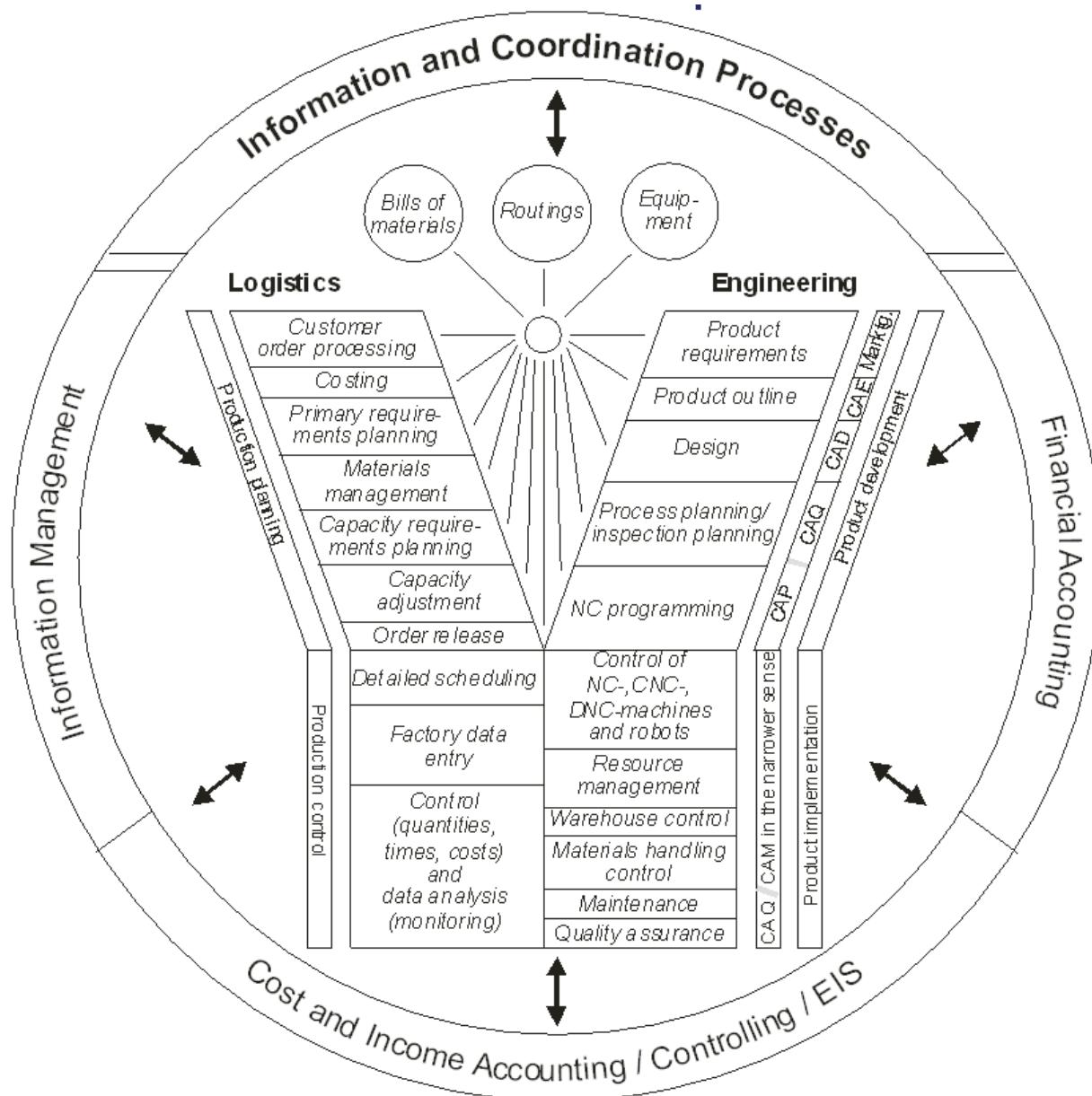


# CIM - Computer-Integrated Manufacturing

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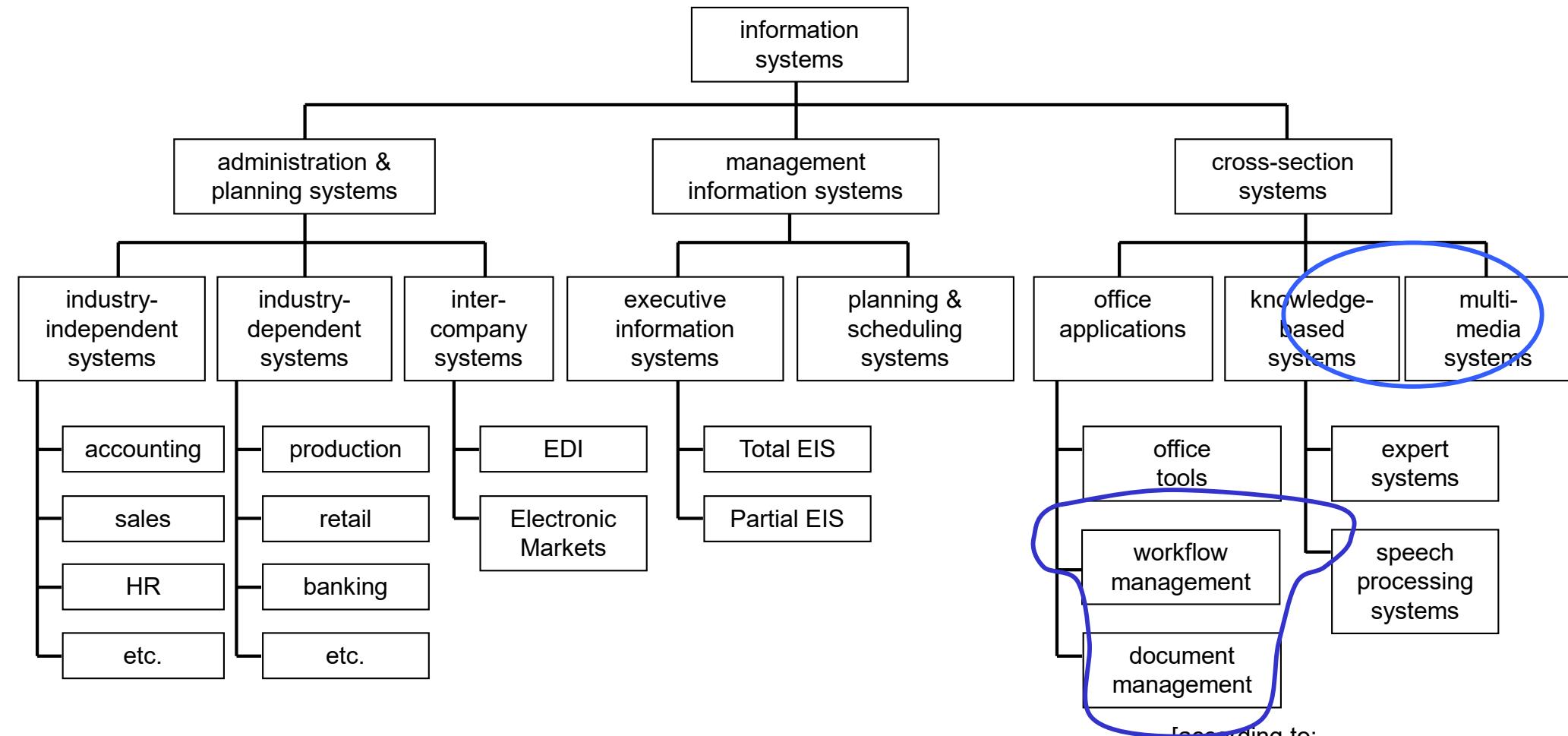
- manufacturing approach of using computers to control the **entire production process** in **one business information system**
- **goals of CIM:**
  - **technical goals**
    - efficient manufacturing
    - high product quality and high process quality
  - **organizational goals**
    - short cycle times for order processing
    - adherence to delivery dates
  - **economic goals:**
    - minimal capital binding for stocks
    - high **flexibility by variants**
    - fast reaction to customer wishes
    - permanent readiness for delivery

# Y-CIM-Modell (according to Scheer)



# Classification of Business Information Systems

according to **intended use (functional view)**



[according to:  
Stahlknecht, Hasenkamp, 2004]

# Cross-section Systems

---

- systems in the context of business workflows
  - **Groupware, especially** workflow management systems (**WFMS**)
  - document management systems (**DMS**)
  - (enterprise) content management systems (**CMS / ECMS**)

# CSCW = Computer Supported Cooperative Work

---

- interdisciplinary research area (computer science, economics, sociology, psychology, organization research)
- **CSCW** is a generic term which combines the ***understanding of the way people work in groups*** with the enabling technologies of computer networking, and associated hardware, software, services and techniques.
- **Groupware:**
  - products for CSCW (hardware and software)
  - examples: *Lotus Notes* (IBM), *Groupwise* (Novell), Microsoft *Exchange* and Microsoft *SharePoint*, *Zimbra* (VMWare)
- today: extension of these products with so called social software (social networks, wikis, blogs), e.g. *Lotus Connections* and *Lotus Quickr*

# Groupware

---

- **three levels of collaboration**
  - communication (email systems, video conferencing systems, bulletin boards)
  - coordination (workflow management systems)
  - cooperation (planning systems, group decision support systems, meeting rooms, group editors with WISIWYS-principle)
- classification according to *time* and *space*:

	<b>Same Time</b>	<b>Different Time</b>
<b>Same place</b>	Face to face interaction	Asynchronous interaction
<b>Different place</b>	Synchronous distributed interaction	Asynchronous distributed interaction

# Workflow Management Systems

---

- **Definition:**

“The management of processes through the execution of software whose order of execution is controlled by a computerized representation of the process.” (*WfMC, 1994*)

- **Advantages:**

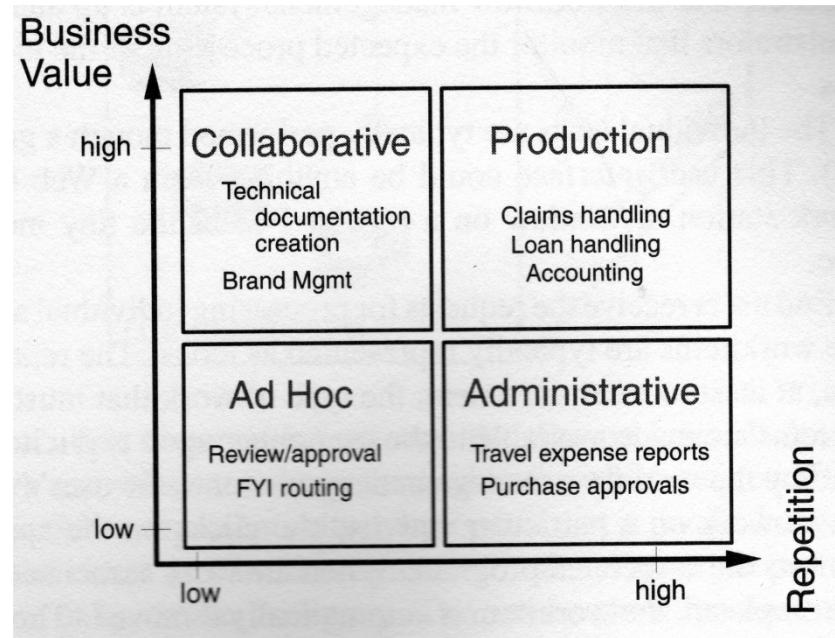
- transparency of workflow
- reduction of costs and time, improvement of quality
- flexibility, e.g. with respect to organizational changes
- increase of productivity by decrease of routine tasks like information retrieving, document forwarding, ...

- **Disadvantages:**

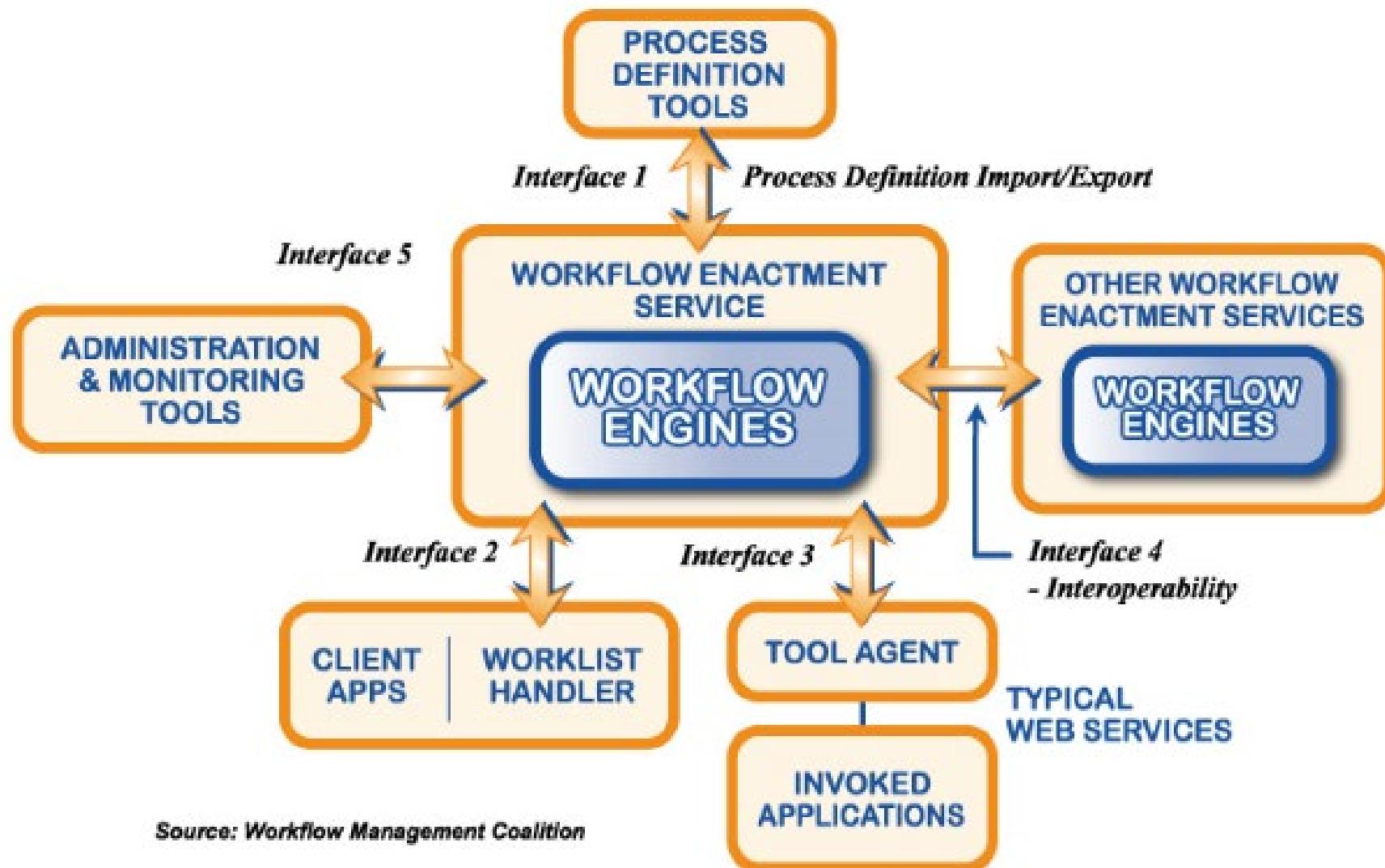
- acceptance problems of the employees
- small support of weakly-structured processes

# Classification of Workflows

- **administrative workflows:** show low business value; typically administrative processes
- **Ad-Hoc workflows:** generally, these processes have no predefined structure, or each process is constructed individually; often show a low repetition rate
- **collaborative workflows:** characterized by a high business value, but are executed only a few times; process is generally rather complex and is created specially for a particular task
- **production workflows:** have a high business value and a high repetition rate; their efficient execution provides a company with a competitive advantage



# WFMC Reference Model



# Business Process Execution Language (BPEL)

---

- OASIS (Organization for the Advancement of Structured Information Standards, <http://www.oasis-open.org/> ) specification
  - XML-based language for the definition and execution of business processes, URL: <http://docs.oasis-open.org/wsbpel/2.0/> (last version, April 2007)
- **goal:** orchestration of executable business processes on the basis of web services
- strong IT focus → inappropriate for working divisions
- strong market support (IBM, BEA, Microsoft, SAP, Siebel)

# Workflow/SOA Vendors and Products

---

## ■ Proprietär:

- TIBCO ActiveMatrix BPM
- IBM WebSphere
- Oracle Fusion, Oracle SOA Suite
- SAP NetWeaver BPM
- InterSystems Ensemble
- Software AG webMethods SOA Suite
- inubit BPM Suite
- Ultimus Adaptive BPM Suite
- Bizagi BPM Studio
- ...

## ■ Open Source:

- JBoss Enterprise SOA Platform (Red Hat)
- Camunda BPM

# Document Management Systems (DMS)

---

- A document management system (DMS) is a computer system (or set of computer programs) used to track and store **electronic documents** (e. g. e-mails, fax) and/or **images of paper documents**
- **starting point: optical archives**

## **functionalities:**

optical storage  
scanner  
indexing  
barcode, OCR\*  
COLD\* storage  
retrieval  
long-time archiving

## **motivation for usage:**

database reorganization  
microfiche replacement  
installation of call centers  
process integration  
decentralization / sales force  
lack of physical storage room  
long periods for safekeeping

\*OCR : Optical Character Recognition

\*COLD: Computer Output on Laser Disk

# Advantages of DMS

---

- improvement of processing time
- better customer service
- better process quality
- minimization of failures
- better document security, less document loss
- cost reduction with increasing volume
- less required space
- higher motivation of employees

# Possible Savings with DMS

---

- **50 - 90%** processing time reduction (transport, wait time, investigation, administration, management, etc.)
- **20 - 40%** reduction of working steps (document retrieval, transport, distribution, search, document filing, etc.)
- **20 - 40%** reduction of processing costs (working time of employees)

# Content-Management (CM)

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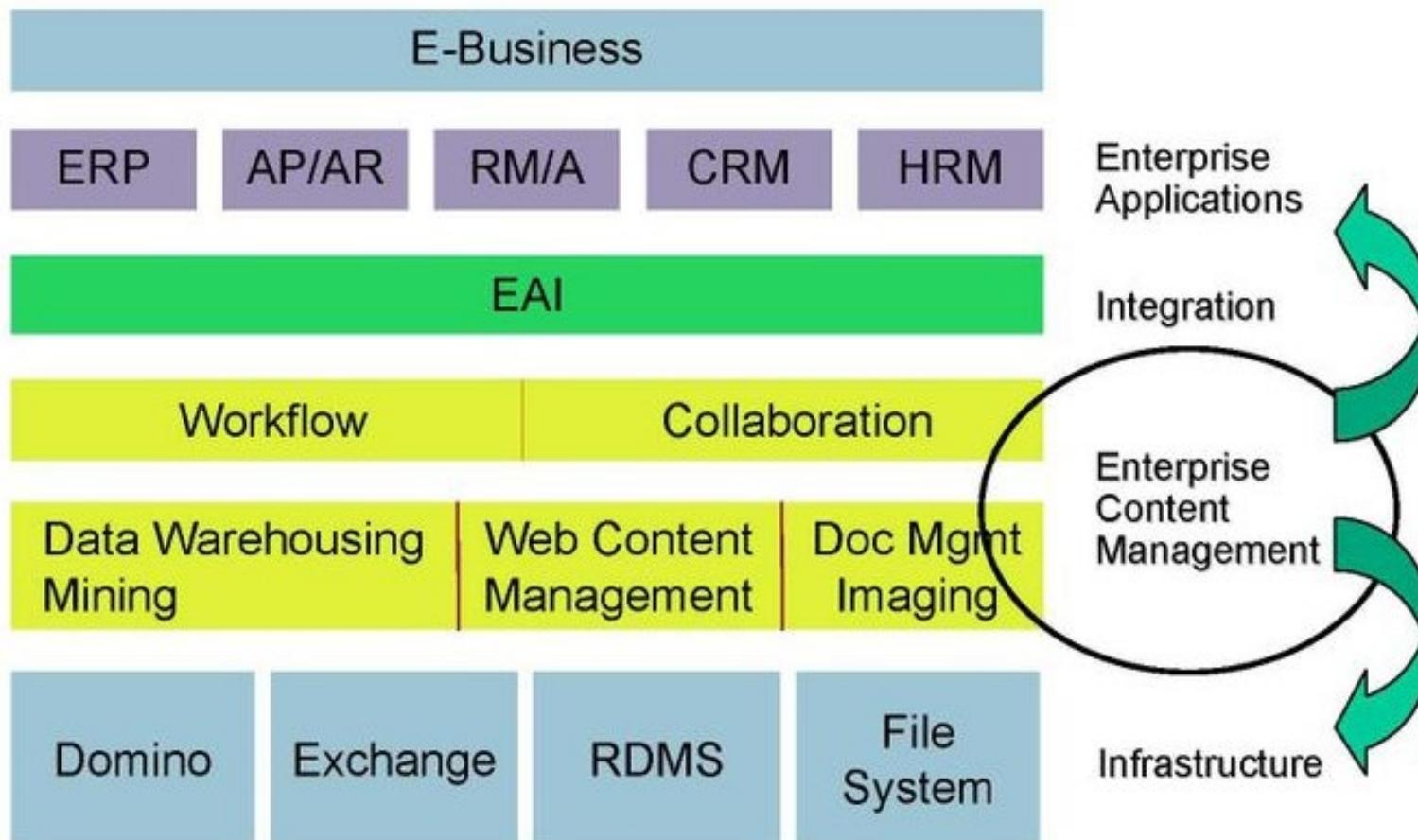
- formerly (midst of 1990s): pure computer-based content creation and maintenance for web sites because these functionalities used a huge amount of resources
- today two different meanings:
  1. **Web Content Management** respective Web Site Management:  
management of the content, the functionality and the layout of a web site
    - example: Typo3 (<http://www.typo3.net>)
  1. **Enterprise Content Management (ECM):**  
content extension, not only pure web content but also documents and rich media asset, e.g. audio and video files

# Basic Features of a Content Management System (CMS)

---

- insertion, update and archiving of articles in a repository, as well as the presentation of the content
- main characteristics: **segregation of content, structure and design**
- simple content creation, programming knowledge is not necessary
- **functionalities** include:
  - version control
  - locking mechanisms
  - business data catalogue, integration of different kind of information sources
  - propagation of information
  - clearing procedures
  - blogs, wikis, task lists
  - e-mail integration
  - etc.

# ECM as an Enterprise Information Infrastructure

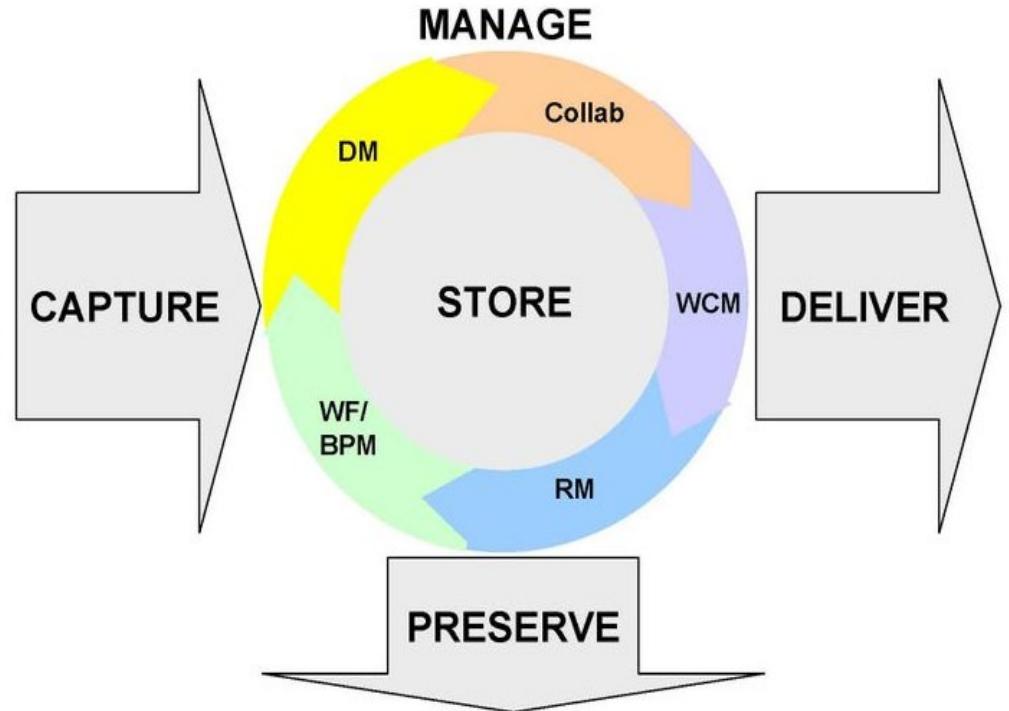


Quelle: AIIM 2001 Industry Study

(Association for Information and Image Management)

# AIIM Model for ECM

- Technologies and components to
  - **Capture**,
  - **Manage**,
  - **Store**,
  - **Deliver and**
  - **Preserve**content and documents in business processes
- main applications
  - Document Management (DM),
  - Collaboration (Groupware),
  - Web Content Management (WCM),
  - Records Management (RM, Archiving)
  - Workflow / Business Process Management (BPM)



Source: AIIM / PROJECT CONSULT 2003

can be combined or used alternatively

# ECM Products

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- see [http://en.wikipedia.org/wiki/List\\_of\\_content\\_management\\_systems](http://en.wikipedia.org/wiki/List_of_content_management_systems), e. g.



Lotus Web Content Management  
Rapidly manage intranet, extranet, Internet and portal assets



Microsoft  
Office SharePoint  
Server 2010

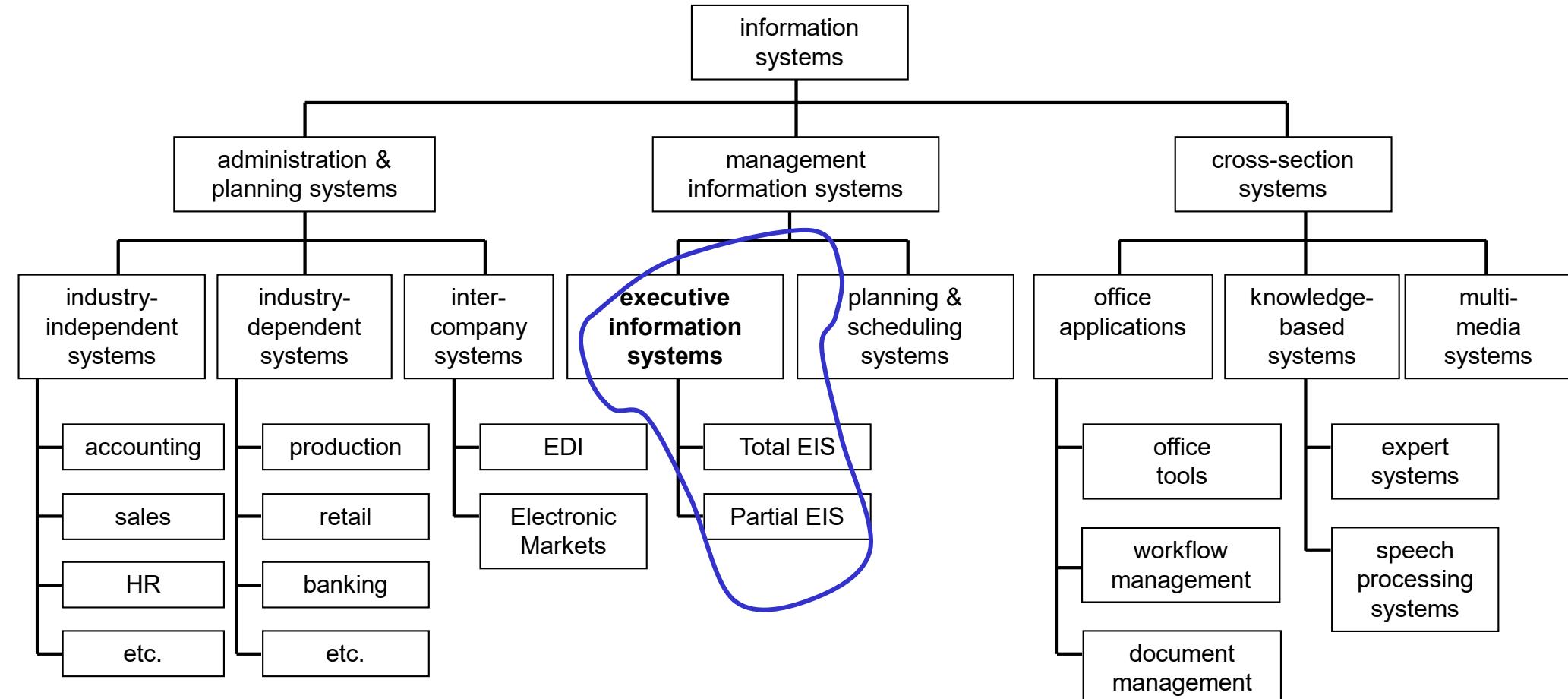


# Gartner Quadrant - ECM Products



# Classification of Business Information Systems

according to **intended use (functional view)**



[according to:  
Stahlknecht, Hasenkamp, 2004]

# Executive Information Systems (EIS)

---

- retrieval of information for the **upper management** level to support them in the **preparation of decisions**
- no operational functionalities
- two kind of EIS:
  - **total EIS**: support of the whole enterprise (**data warehouse**)
  - **partial EIS**: for specific enterprise areas, e. g. sales, marketing, human resources, or for specific functions, e .g. projects (**data mart**)

# Why EIS ?

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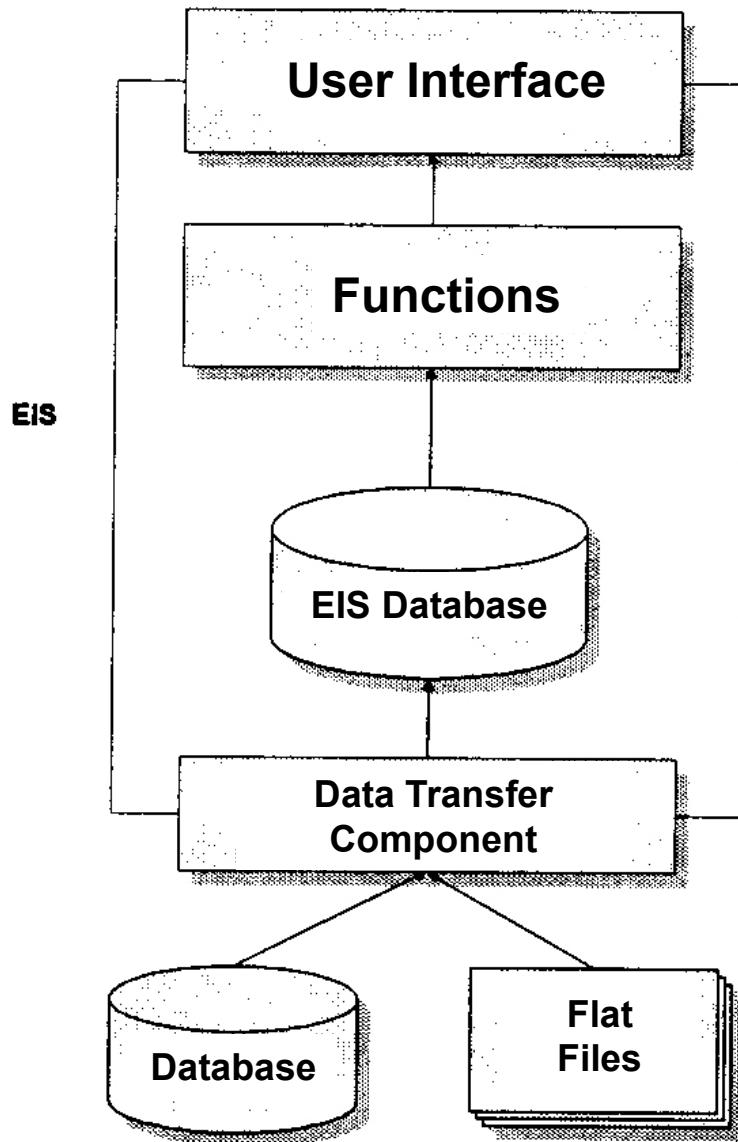
- possibility to **generate the relevant information for enterprise success** out of the huge amount of existing data
- **bridges the gap between information needs and information range**
- **necessary information characteristics:**
  - relevant
  - present at the right time
  - presented in a suitable way („easy to understand by the management“)

# Dangers of EIS

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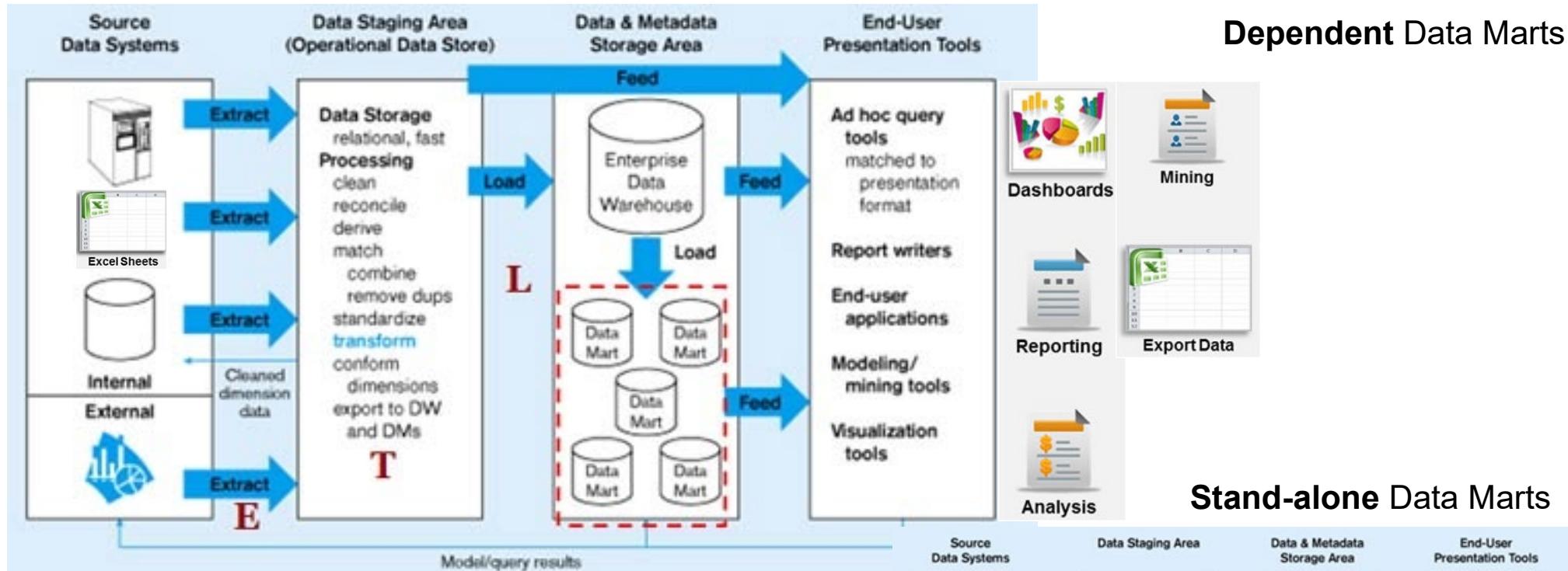
- a too broad information range can lead to
  - ignore important problem-specific data (**gap of relevance**)
  - suppress important signals by too high aggregation levels (**bad balance effects**)
- wrong conclusions by **inconsistent data (consistency gap)**
- wrong conclusions by **old data (up-to-dateness gap)** caused by long information ways

# Schematic EIS-Architecture



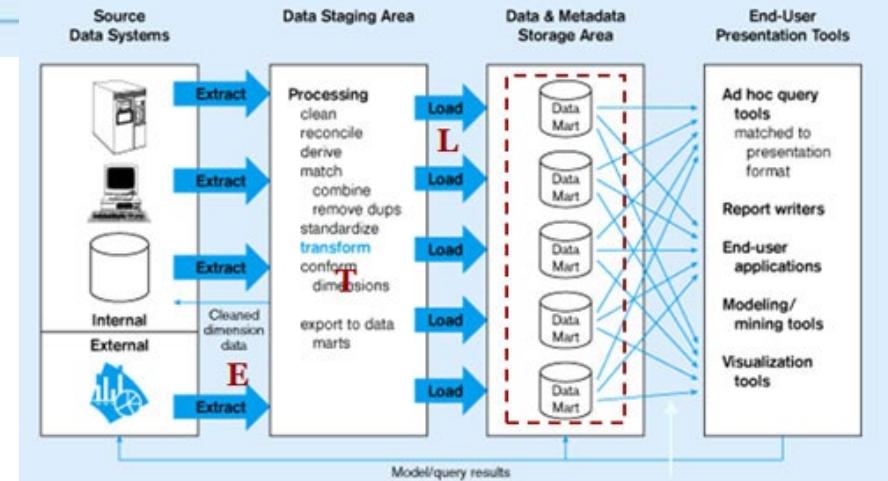
- implementation effort depends on the heterogeneity of the relevant data sources
- important component: ***data transfer component*** (→ ETL-process, i.e. Extract-Transform-Load)
- Individually definable reporting functions
- export functionality (→ Excel, Word, E-Mail, Fax)

# Data Warehouse / Data Mart



## Data Mart:

- content-limited or department-specific data warehouse
- In contrast to a central data warehouse, **several decentralized data marts** can exist in the company
- different implementation options



# Different Kinds of management-relevant Information

---

- **Units:** productions, consumptions, stocks, technical capacities
  - origin: production
- **Values:** transaction volume, costs, profit, product profitability
  - origin: sales, accounting
- **Personal:** number, staff assignment, qualification and skills, age structure
  - origin: human resource module
- **Performance Indicators:**
  - origin: logic interconnections of the different data groups

# Performance Indicators

---

**within processes often called Critical Success Factors (CSFs)**

- **proportions** (percentages)
  - e.g. percentage of development costs of a product to its overall costs
- **reference numbers**
  - e.g. € / person, material consumption /article, time effort / project phase
- **index numbers**
  - artificial numbers, mostly used as indicators to describe temporal changes, e.g. price trend, growth in sales

# Storage of Information – Database Systems (DBS)

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- Two kinds of DBS
  - Relational Database Systems
  - Multi-dimensional Database Systems

Microsoft Access



SYBASE®



# Relational Database Model

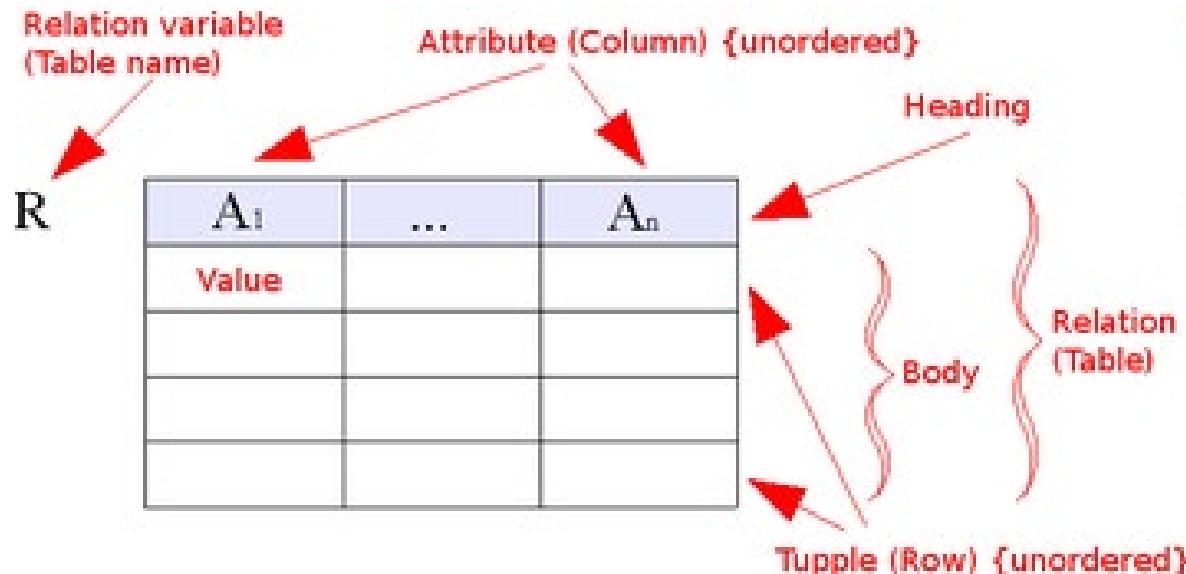
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- dominant storage form for structured data
- **accumulation of tables**
- data independence: separation of application from physical storage structure
- queries by standardized language **SQL (Structured Query Language)**
- relational database design and **normalization to avoid redundancies**
- a **transaction** is a **sequence of database operations**, which transforms the database from one consistent status to another
- **ACID principle** = atomicity – consistency – isolation – durability

# Relational Model

publisher		
Publ_id	Name	Adress
1	Dpunkt	Heidelberg
2	Klett	Stuttgart
3	Goldmann	München
4	MITP	Bonn

book			
isbn	Title	Publ_id	price
3-608-93421-9	Otherland	2	25.50
3-784-3877-0	Die Firma	3	8.00
3-653-9876-X	Herr der Ringe	4	12.99



**different normal forms  
(1NF .. 6NF, BCNF,  
DKNF)**

# Solution: Data Warehouse (DW) and Data Mart (DM)

---

- A **data warehouse (DW)** is a **separate database used for reporting**
- DW is optimized for speed of data analysis → data in data warehouses are denormalised via a dimension-based model
- to speed data retrieval, data warehouse data are often stored multiple times
- a DW has **three layers**, a staging, an integration and an access area
- **Staging** is used to store raw data for use by developers (analysis and support)
- the **integration layer** is used to integrate data and to have a level of abstraction from users
- the **access layer** is for getting data out for users
- data are used for data mining, online analytical processing (→ **Business Intelligence**)

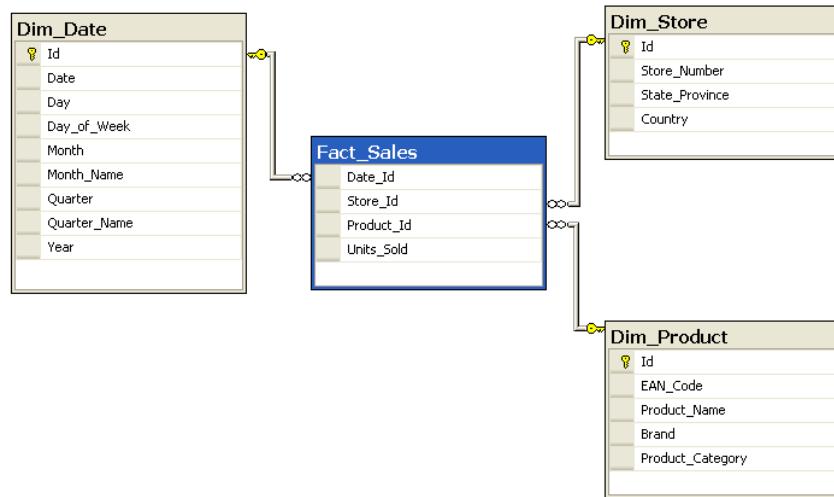
# Data Mart (DM)

---

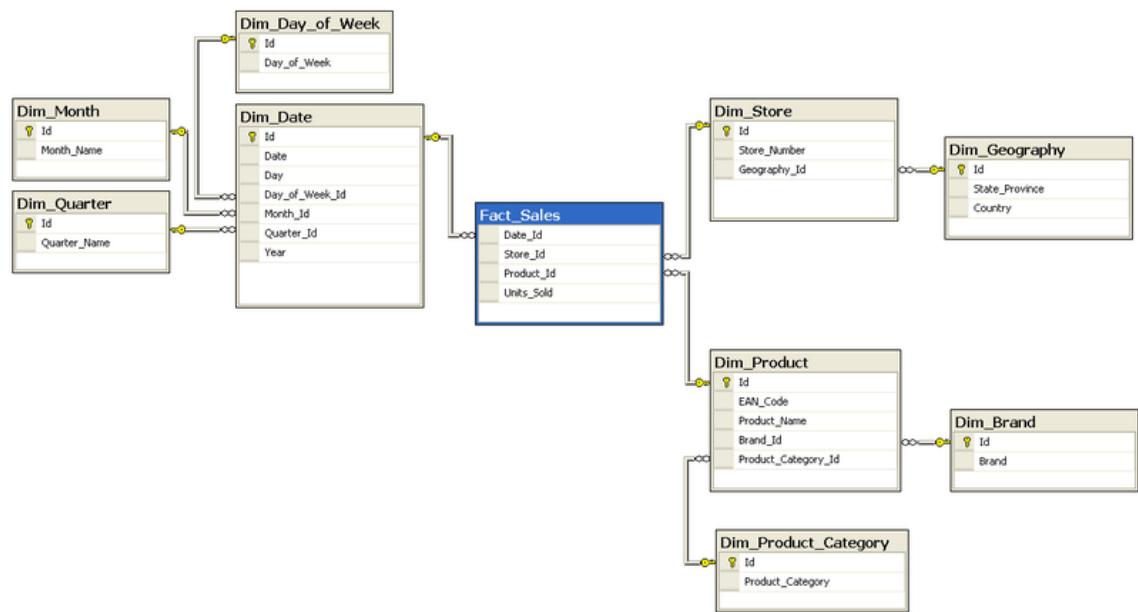
- A **data mart (DM)** is the access layer of the data warehouse (DW) environment that is used to get data out to the users
- a DM is a subset of the DW, usually oriented to a specific business section or team
- a data mart is a **data repository that may or may not derive from a data warehouse** and that emphasizes ease of access and usability for a particular designed purpose
- **DM advantages:**
  - easy access to frequently needed data
  - creates collective view by a group of users
  - improves end-user response time
  - ease of creation; lower cost than implementing a full Data warehouse
- **DM disadvantages**
  - limited scalability, duplication of data,
  - data inconsistency with other silos of information

# Dimension-based Models

- **Star schema:**
  - consists of one or more **fact tables** referencing any number of dimension tables
  - effective for handling simpler queries



- **Snowflake schema**
  - general schema
  - represented by centralized fact tables which are connected to multiple dimensions
  - dimensions are normalized into multiple related tables



# Data Differences in DBS

	<b>operational systems</b>	<b>executive information systems</b>
<b>data pool:</b>	<ul style="list-style-type: none"><li>• normally actual data</li><li>• often only for a certain enterprise section <b>(operational data)</b></li></ul>	<ul style="list-style-type: none"><li>• data collected over the whole enterprise</li><li>• data collected over a long period</li></ul>
<b>data format:</b>	<ul style="list-style-type: none"><li>• data pool has grown uncoordinated</li><li>• different formats</li><li>• no common data model</li></ul>	<ul style="list-style-type: none"><li>• integrated access to all data is necessary</li></ul>
<b>data access:</b>	<ul style="list-style-type: none"><li>• a lot of transactions → <b>OLTP</b> <b>(Online Transaction Processing)</b></li><li>• short transaction times</li></ul>	<ul style="list-style-type: none"><li>• long-term, complex analyses and computations (<b>OLAP</b> = Online Analytical Processing)</li></ul>

# Data Characteristics

---

- **subject-oriented**
  - the data in the data warehouse is organized so that all the data elements relating to the same real-world event or object are linked together
- **non-volatile**
  - data in the data warehouse are never over-written or deleted — once committed, the data are static, read-only, and retained for future reporting
- **integrated**
  - the data warehouse contains data from most or all of an organization's operational systems; data are made consistent (unique format, semantic integration)
- **time-variant**
  - data are snapshots of operational databases → keys must contain a time component

# Preparation of Information

---

## data evaluation and data preparation

- it should be possible to ask queries in a natural way
  - natural language
  - graphical support

(avoidance of time-consuming on-the-job training for managers)
- analyses of the data:  
**Business Intelligence**
  - **data mining**: detection of so far unknown relationships within data (e.g. analysis of consumer behavior, preparation of customer profiles)
  - **Online Analytical Processing (OLAP)**
    - enables complex **multi-dimensional** data evaluation, e.g. sales volume of a product group per customer group

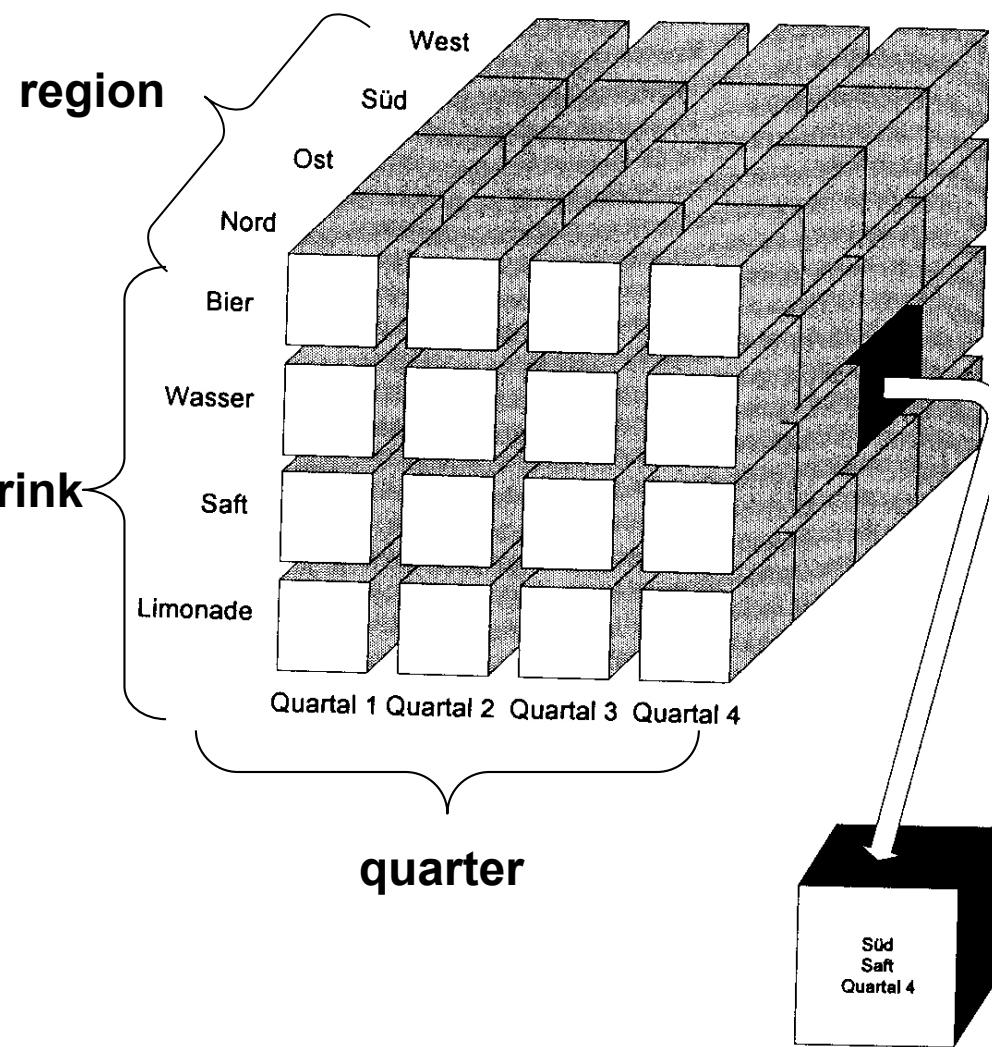
# OLAP

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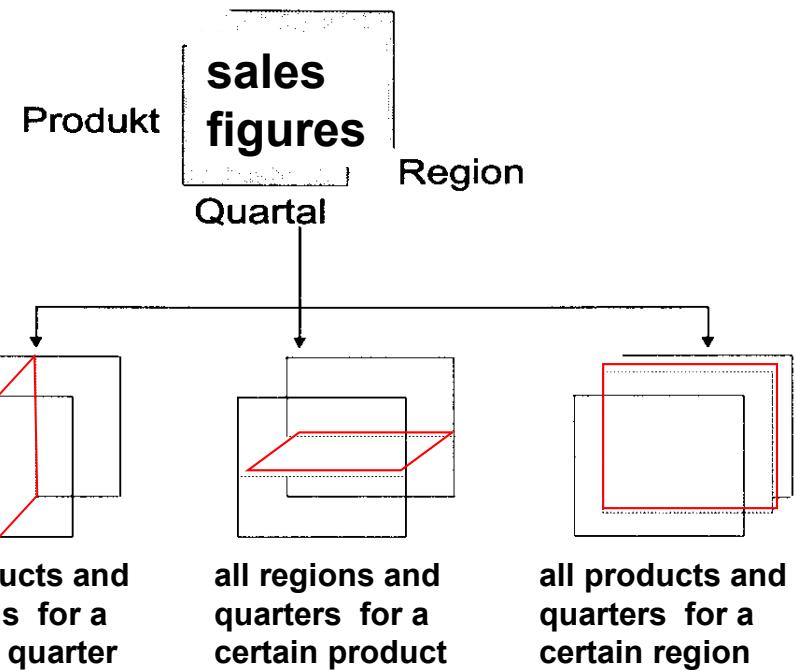
- OLAP concept (1995) was developed by Codd, the founder of the relational database schema
- **dimension-oriented data view:** structuring of enterprise performance metrics as logically independent **dimensions** (e.g. product, article group, customer group, sales area, enterprise area, time, region, ...)
- combination of dimensions (→ ***hypercube***)
- navigation within the dimensions via so-called ***consolidation paths***, e.g.
  - time – calendar year – quarter – month – week,
  - time – business year – quarter – month – week
- usage of ***drill down***- und ***roll up*** techniques within the navigation; roll up = aggregation of the data of a ***consolidation path***; ***drill down*** = backward differentiation
- derivation of specific views: **slicing** and **dicing**

# OLAP

## Dicing



## Slicing

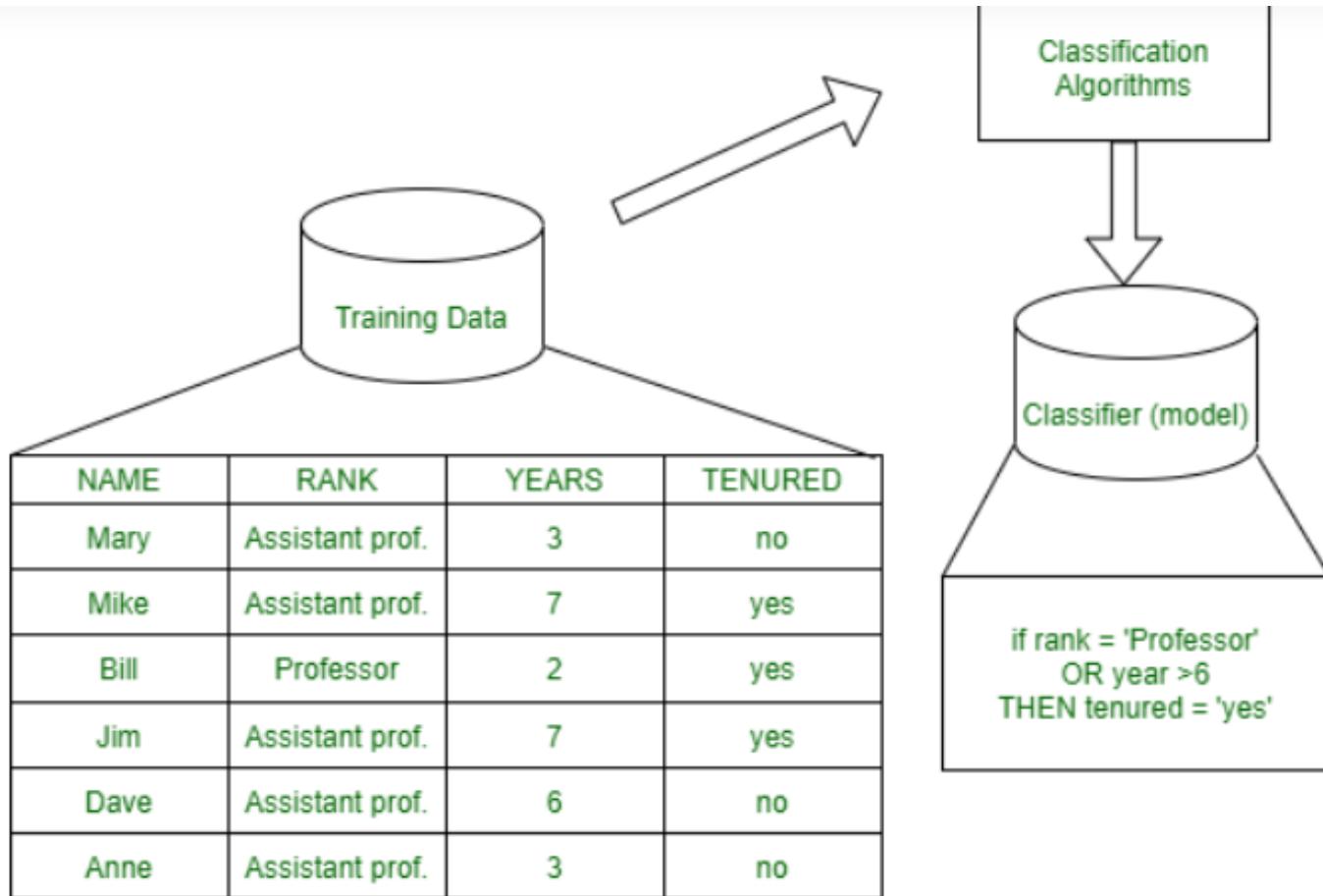


# Data Mining Methods

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- **Classification:** Assignment of records based on their properties to an already pre-determined class, e.g. by decision tree method
  - Example: Prediction of customer churn behavior, fraud detection and manipulation
- **Association:** Calculation of relationships according to certain rules
  - Example: "If someone buys beer in a supermarket, then he/she will probably buy chips, too."
- **Segmentation (Clustering):** Grouping due to similarities of the objects
  - Example: market and customer segments
- **Forecast:** Prediction of numerical values based on historical data,
  - Example: weather forecast

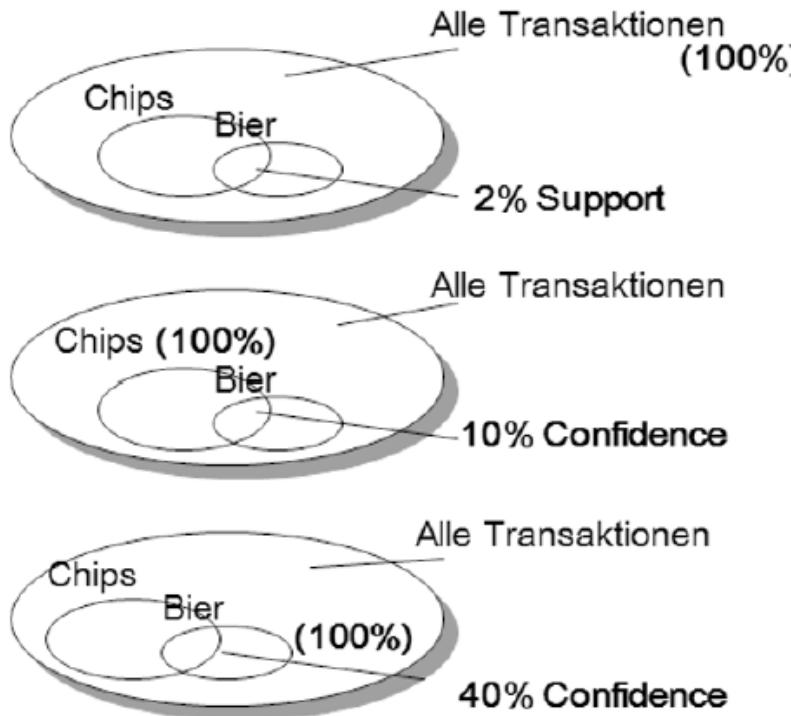
# Example Classification



*Test data are used to estimate the accuracy of the classification rule*

# Example Association

- 1.000.000 Transaktionen insgesamt
- 200.000 Chips
- 50.000 Bier
- 20.000 Chips und Bier



## Market basket analysis:

The search is for a rule such as "When a customer buys beer, he also buys chips to a certain percentage rate."

To evaluate such a rule two measures are necessary: **Support** and **Confidence**

Measurement "**Support**" provides information on the simultaneous purchase of the two products

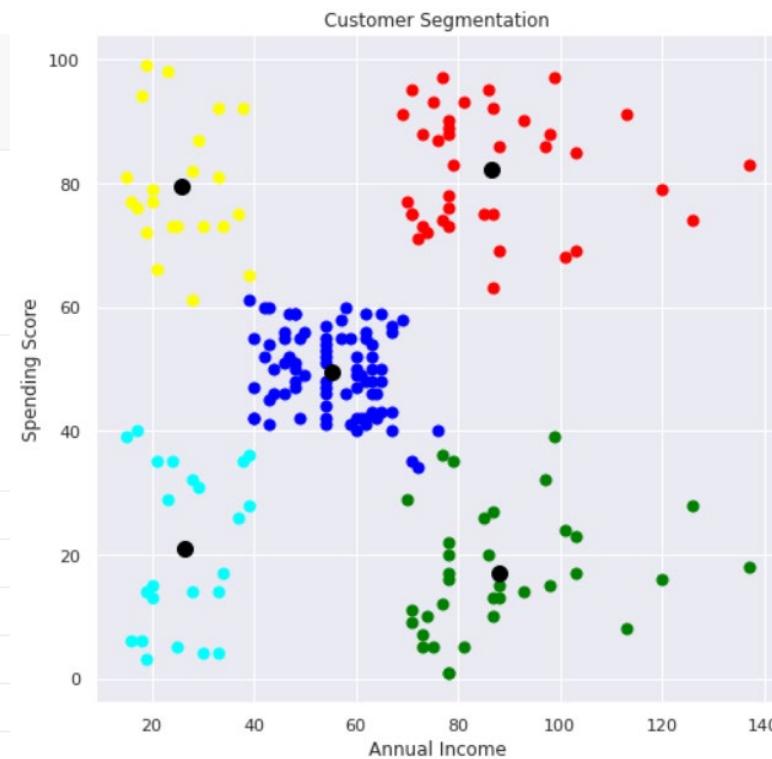
Measure "**Confidence**" says something about the extent of validity of an association rule

# Example Segmentation

## About this file

This file contains the basic information (ID, age, gender, income, spending score) about the customers

CustomerID	Gender	# Age	# Annual Income (k\$)	# Spending Score ...
Unique ID assigned to the customer	Gender of the customer	Age of the customer	Annual Income of the customer	Score assigned by the mall based on customer behavior and spending nature
1	Female	56%	18	70
2	Male	44%	15	137
3	Male	19	15	39
4	Male	21	15	81
5	Female	20	16	6
6	Female	23	16	77
7	Female	31	17	40
8	Female	22	17	76
9	Female	35	18	6
10	Female	23	18	94
11	Male	64	19	3



**cyan cluster:** they become potential opportunities for the mall and can be targeted by giving special discounts.

**yellow cluster:** can be thought of like the ideal group

**green cluster:** they are also potential opportunities for the mall to target.

**red cluster:** the mall must ensure that their interests are met as time moves on.

# Information Presentation

---

- **presentation form**
  - print-out (reports)
  - on-screen display
- **representation**
  - in table form
  - visualization by graphics, diagrams
- **information processing**
  - only passive information queries
  - further treatment and evaluation is possible, e.g. by spreadsheet programs, trend evaluations, drill-down procedures, ...
- **information point in time**
  - at the moment mainly reporting (periodically or on demand)
  - active system hints according to noticeable discrepancies („**online alert system**“)

# Map Metaphor/ Mobile BI

The image illustrates the integration of geographical data and mobile business intelligence. On the left, the Power BI Desktop interface is shown with a map of the Pacific Northwest (Washington, Oregon, Idaho, Montana) and a bar chart titled "amount by City + State". The desktop also features a "Visualizations" pane and a "Fields" pane where filters for "amount", "city", and "City + State" are selected. A pink arrow points from the desktop's field list to the mobile device's dropdown menu. On the right, a tablet and a smartphone both display a "Sales Pipeline" dashboard. The tablet's dashboard includes sections for "Win This Month", "Estimated Revenue", "Pipeline", and "Opportunities". The smartphone's dashboard includes sections for "Opportunities volume", "Won/Lost Trend", and "Opportunities by Sales Agent". Both devices have a dropdown menu in the top right corner that lists location filters: "All Locations", "Only Seattle", and "Only Washington".

Visual Tools

geodata - Power BI Desktop

amount and amount by City + State

Rose, ID  
Bozeman, MT  
Butte, MT  
Concord, OR  
Eugene, OR  
Everett, WA  
Helena, MT  
Missoula, MT  
Nampa, ID  
Olympia, WA  
Pocatello, ID  
Portland, OR  
Puyallup, WA  
Salem, OR  
Seattle, WA  
Spokane, WA  
Tacoma, WA  
Vancouver, WA  
Yakima, WA

amount by City + State

amount and amount by City + State

amount by City + State

All Locations  
Only Seattle  
Only Washington

EIS - 25

# Actual Trends

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- **Predictive Analytics**
  - Prediction of future developments, e.g. impact of entry of new suppliers, early reaction to dynamically changing competitive conditions
- **Agile BI**
  - Use of agile development methods (Scrum) in the implementation / introduction process of BI systems → fast implementation of dynamically changing requirements, timely solutions
- **Self Service BI**
  - easy to use, especially Visual BI (for example map displays)
  - Use of the Sandboxing Concept: Specialists will be provided with free data in a demarcated database area; only after test-specific preparation of specific analyses and reports adoption into "regular operation"
- **Mobile BI**
  - not just the transfer of existing applications into a mobile environment, but adaptation of the available operating concepts (for example "wiping") → less IT-savvy employees can have access to BI information and analyses

# Summary EIS

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- an **EIS** can **only** be seen as **one part** of an **overall management information system**
- the **adjustment with organizational structures and business processes** is a **necessary precondition** for a successful introduction of an EIS
- **historically grown, often informal information channels** can not be integrated in an EIS without information loss (→ **enterprise social network platforms**)

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# **Supply Chain Management (SCM)**

- **Supply Chain**

- **Network of organizations and processes for:**

- Procuring materials, transforming them into products, and distributing the products

- **Upstream supply chain:**

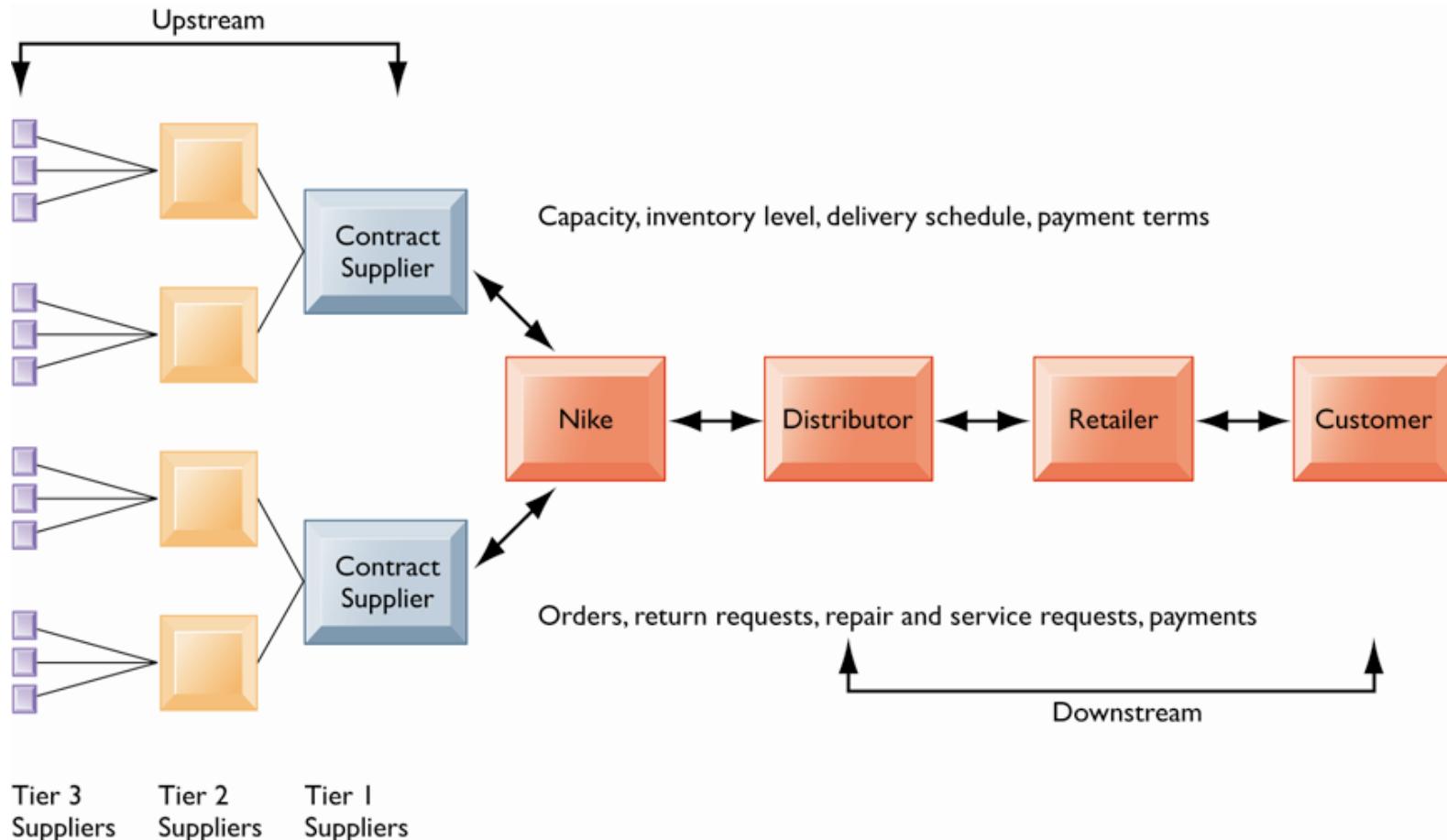
- Firm's suppliers, suppliers' suppliers, processes for managing relationships with them

- **Downstream supply chain:**

- Organizations and processes responsible for delivering products to customers

- **Internal supply chain**

## Example: Nike's Supply Chain



This figure illustrates the major entities in Nike's supply chain and the flow of information upstream and downstream to coordinate the activities involved in buying, making, and moving a product. Shown here is a simplified supply chain, with the upstream portion focusing only on the suppliers for sneakers and sneaker soles.

# Effects of Supply Chain Management

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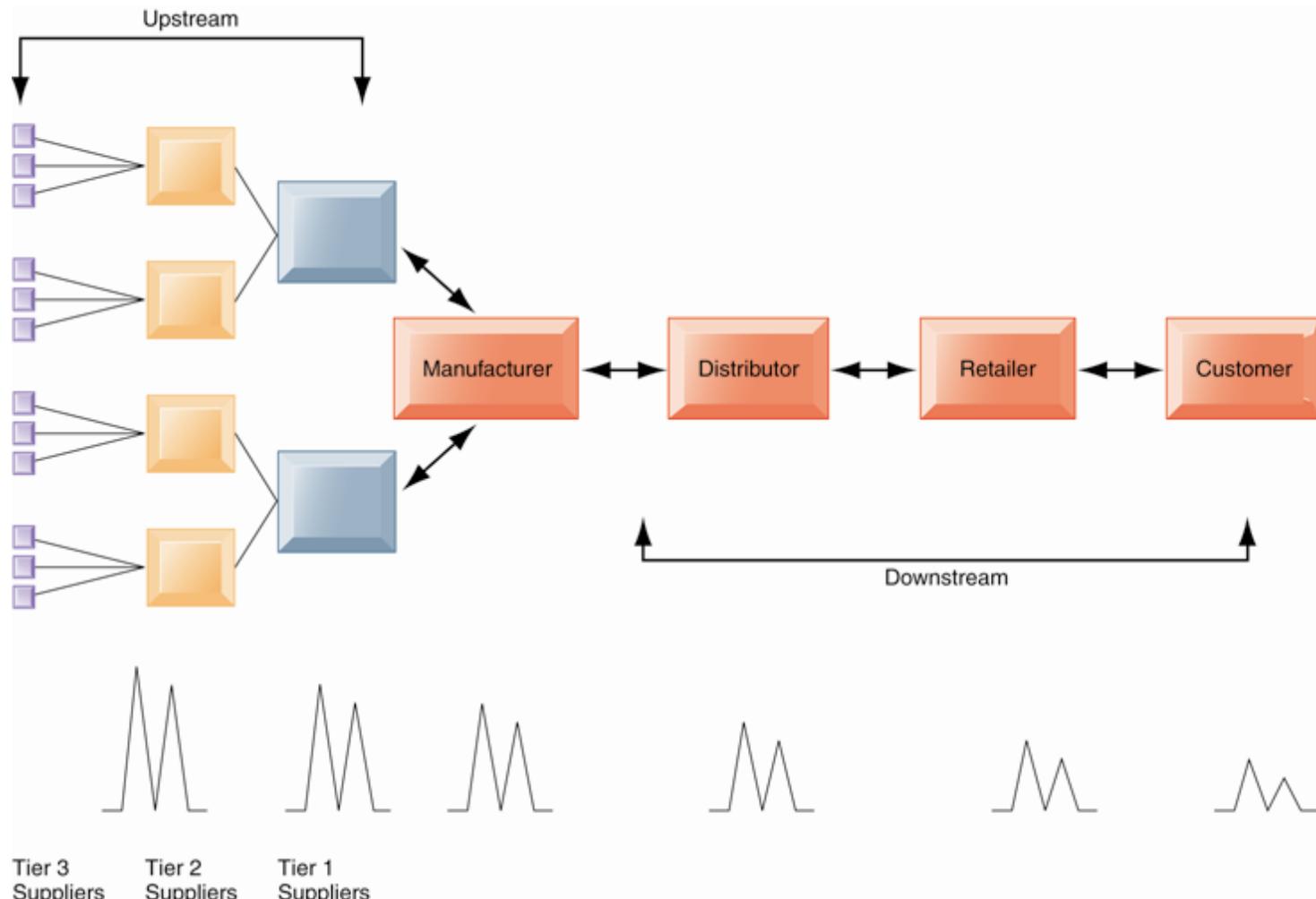
- **Inefficiencies cut into a company's operating costs**
  - Can waste up to 25% of operating expenses
- **Just-in-time strategy:**
  - Components arrive as they are needed
  - Finished goods shipped after leaving assembly line
- **Safety stock:** Buffer for lack of flexibility in supply chain
- **Bullwhip effect**
  - Information about product demand gets distorted as it passes from one entity to next across supply chain

## Business Value of SCM Systems

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- **match supply to demand; reduce inventory levels**
- **improve delivery service**
- **speed product time to market**
- **use assets more effectively**
- **reduced supply chain costs lead to increased profitability**
  - Total supply chain costs can be 75% of operating budget
- **increase sales**

## *Example of the Bullwhip Effect*



Inaccurate information can cause minor fluctuations in demand for a product to be amplified as one moves further back in the supply chain. Minor fluctuations in retail sales for a product can create excess inventory for distributors, manufacturers, and suppliers.

- **Supply chain planning systems**

- Model existing supply chain
- Enable demand planning
- Optimize sourcing, manufacturing plans
- Establish inventory levels
- Identify transportation modes

- **Supply chain execution systems**

- Manage flow of products through distribution centers and warehouses

# Global Supply Chain Issues

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- **Greater geographical distances**
- **Greater time differences**
- **Participants from different countries**
  - Different performance standards
  - Different legal requirements
- **Internet helps manage global complexities**
  - Warehouse management
  - Transportation management
  - Logistics
  - Outsourcing

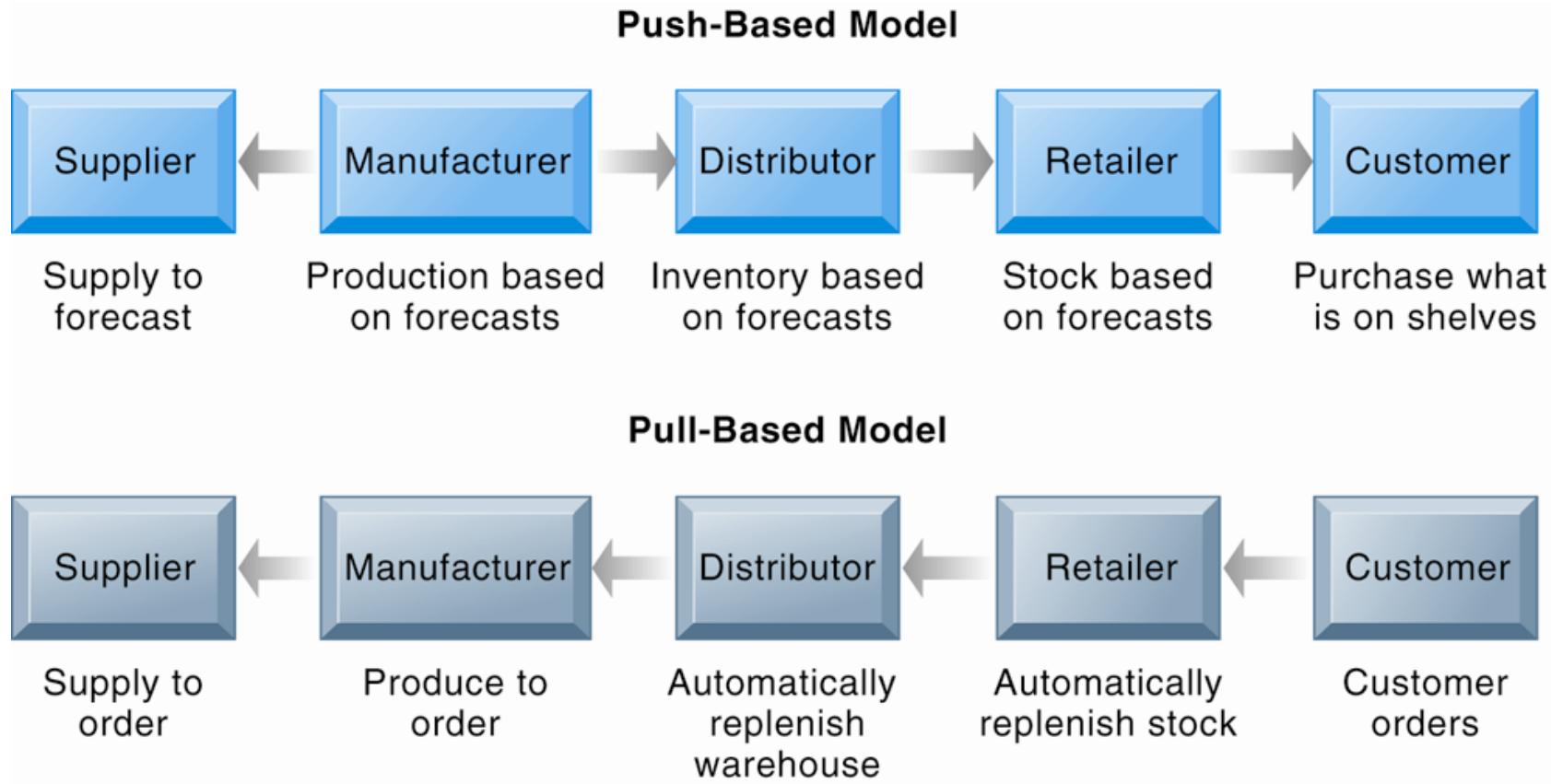
## Supply Chain Management Models

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- **Push-based model (build-to-stock)**
  - Earlier SCM systems
  - Schedules based on best guesses of demand
- **Pull-based model (demand-driven)**
  - Web-based
  - Customer orders trigger events in supply chain
- **Internet enables move from *sequential* supply chains to *concurrent* supply chains**
  - Complex networks of suppliers can adjust immediately

## ***Push- Versus Pull-Based Supply Chain Models***

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The difference between push- and pull-based models is summarized by the **slogan**:  
***"Make what we sell, not sell what we make."***

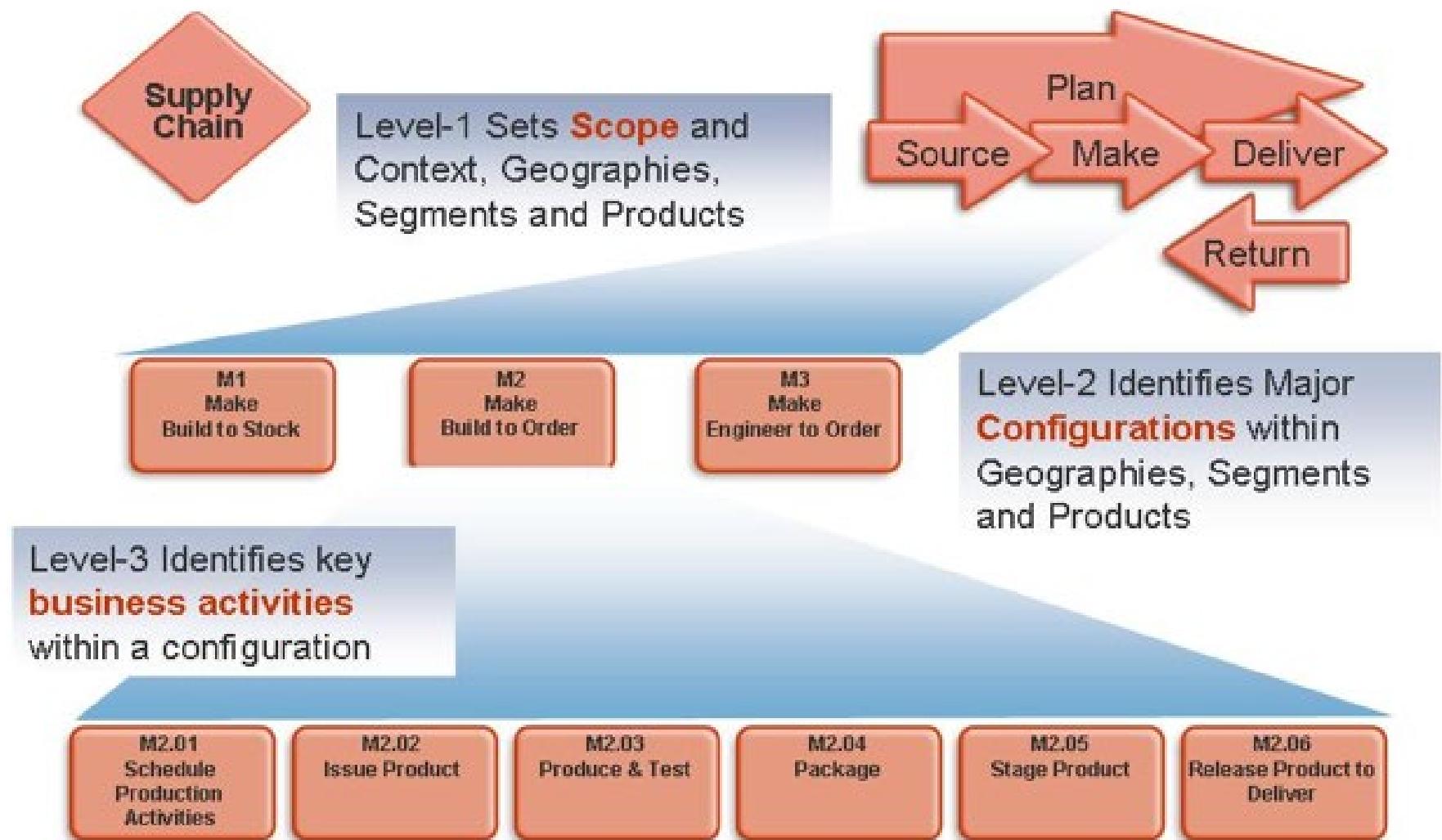
## Supply Chain Operations Reference Model (SCOR)

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- **process reference model** which enables users to address, improve, and communicate supply chain management practices within and between all interested parties
- **developed in 1996**
- endorsed by the **Supply-Chain Council (SCC)**, now part of the **American Production and Inventory Control Society (APICS)**, as the **cross-industry “de facto” standard strategy, performance management, and process improvement diagnostic tool for supply chain management**
- **SCOR is based on 3 major "pillars":**
  - Process modeling and re-engineering
  - Performance measurements
  - Best practices

# SCOR Pillars and Framework Levels

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## SCOR Management Processes

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**SCOR is based on six distinct management processes: Plan, Source, Make, Deliver, Return, and Enable**

**Plan** – Processes that balance aggregate demand and supply to develop a course of action which best meets sourcing, production, and delivery requirements.

**Source** – Processes that procure goods and services to meet planned or actual demand.

**Make** – Processes that transform product to a finished state to meet planned or actual demand.

**Deliver** – Processes that provide finished goods and services to meet planned or actual demand, typically including order management, transportation management, and distribution management.

**Return** – Processes associated with returning or receiving returned products for any reason. These processes extend into post-delivery customer support.

**Enable** (New process since Version 11, Dec 2012) - Processes associated with establishing, maintaining and monitoring information, resources, assets, business rules, compliance and contracts required to operate the supply chain.

## SCOR Performance Measurements

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- SCOR model contains **more than 150 key indicators** that measure the performance of supply chain operations
- as with the process modeling system, SCOR metrics are organized in a hierarchical structure.
  - Level 1 metrics are at the most aggregated level, and are typically used by top decision makers to measure the performance of the company's overall supply chain. Level 1 Metrics are created from lower level calculations.
  - Level 2 Metrics are primary, high level measures that may cross multiple SCOR processes.
  - Level 3 Metrics do not necessarily relate to a SCOR Level 1 process

## SCOR Levels in Metrics

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- **Level 1: Strategic metrics a.k.a. Key Performance Indicators (KPI)**
  - Measure overall supply chain performance; health of the supply chain
  - Set the scope and objectives for a supply chain, project or organization
  - Translate a business problem or strategy into something measurable
  - Establish the priority or priorities for organization
- **Level 2: Diagnostic metrics**
  - Measure a part of the supply chain and/or a part of the strategic metric
  - Provide direction to where problems originate
  - Caution: Level 2 metrics do not by definition add up to a level 1 metric
- **Beyond level 1 and 2: all metrics are called level 3**
  - SCOR does not specify levels for metrics that are not level 1 or 2
  - These metrics serve as further diagnostic tools

## SCOR Best Practices

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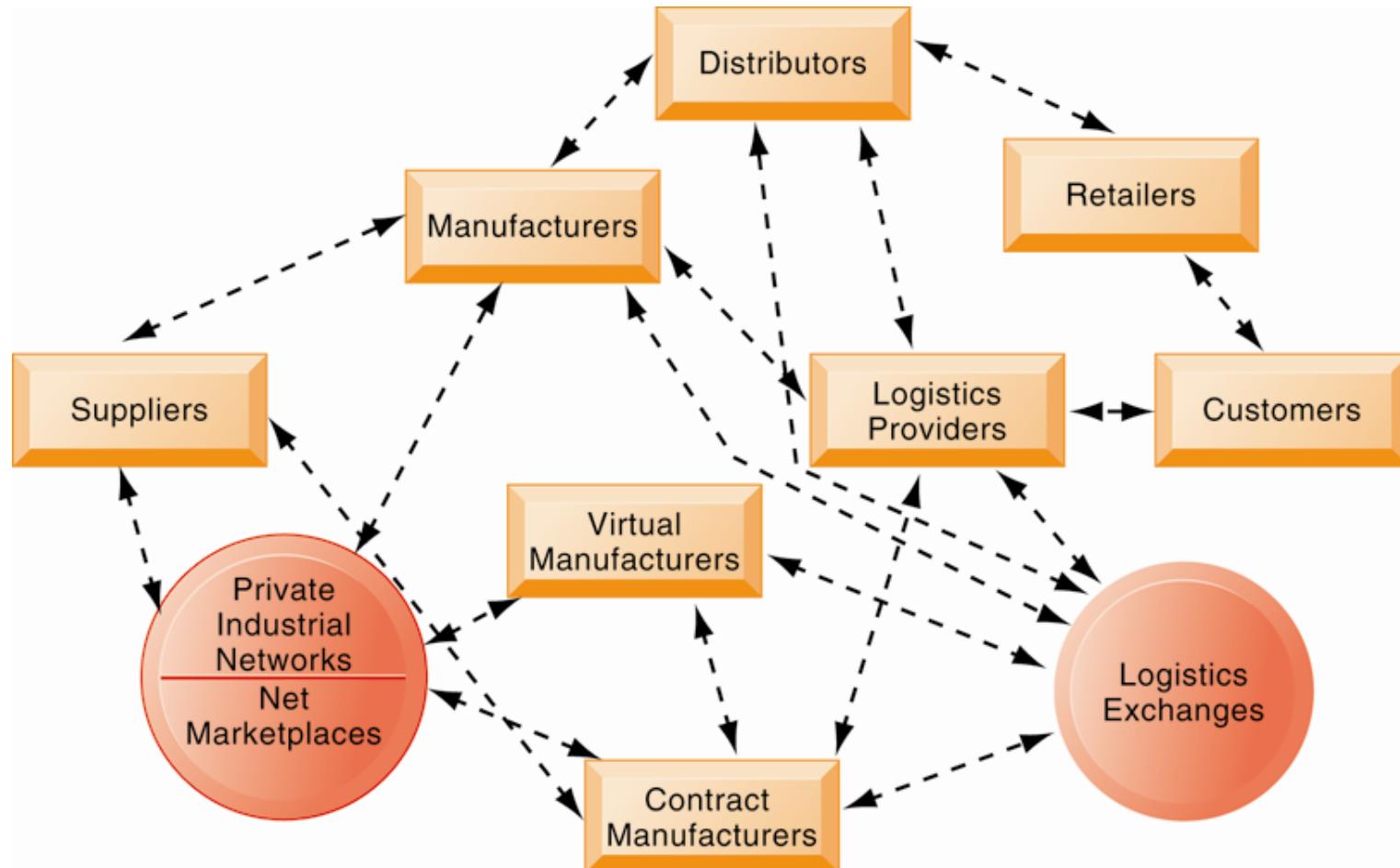
- Over 430 executable practices derived from the experience of SCC members are available.
- The SCOR model defines a best practice as a current, structured, proven and repeatable method for making a positive impact on desired operational results.
  - Current – Must not be emerging (bleeding edge) and must not be antiquated.
  - Structured – Has clearly stated Goal, Scope, Process, and Procedure.
  - Proven – Success has been demonstrated in a working environment.
  - Repeatable – The practice has been proven in multiple environments.
- “Method” is used in a very broad sense to indicate: business process, practice, organizational strategy, enabling technology, business relationship, business model, as well as information or knowledge management.
- Positive impact: operational improvement related to the stated goal and could be linked to Key Metric(s). The **impact** should show either as **gain** (increase in speed, revenues, quality) or **reduction** (resource utilizations, costs, loss, returns, etc.).

# SCOR Performance Attributes and Level 1 Metrics

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Performance Attribute	Performance Attribute Definition	Level 1 Metric
Supply Chain Reliability	The performance of the supply chain in delivering: the correct product, to the correct place, at the correct time, in the correct condition and packaging, in the correct quantity, with the correct documentation, to the correct customer.	Perfect Order Fulfillment
Supply Chain Responsiveness	The speed at which a supply chain provides products to the customer.	Order Fulfillment Cycle Time
Supply Chain Flexibility	The agility of a supply chain in responding to marketplace changes to gain or maintain competitive advantage.	Upside Supply Chain Flexibility Upside Supply Chain Adaptability Downside Supply Chain Adaptability
Supply Chain Costs	The costs associated with operating the supply chain.	Supply Chain Management Cost Cost of Goods Sold
Supply Chain Asset Management	The effectiveness of an organization in managing assets to support demand satisfaction. This includes the management of all assets: fixed and working capital.	Cash-to-Cash Cycle Time Return on Supply Chain Fixed Assets Return on Working Capital

## The Future Internet-Driven Supply Chain



The future Internet-driven supply chain operates like a **digital logistics nervous system**. It provides **multidirectional communication** among firms, networks of firms, and e-marketplaces so that entire networks of supply chain partners can immediately adjust inventories, orders, and capacities.

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# **Customer Relationship Management (CRM)**

## Why CRM is a Customer and Competitive Necessity

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- It typically **costs 5-10 times** as much to acquire a new customer as it does to retain an existing one.
- “Some companies can **boost profits by almost 100%** by retaining just 5% more of their customers.” Harvard Business Review (Reicheld & Sasser)
- A McKinsey study showed that the average **new customer** spends **\$24.50** at a given web site in the **first 3 months** as a shopper. The average **repeat customer** spends **\$52.50** every 3 months.
- Most companies **lose 50%** of their customers in 5 years (Harvard University)
- On average **only 15%** of a site’s customers consider themselves **loyal** to it. The loyalty rating among people who had experienced a problem was **only 6%**. Customers who had not experienced problems indicated a customer loyalty rating of **19%**. The loyalty rating among customers who had experienced problems but were satisfied with the way they were handled: **21%**. (Digital Idea)
- **70% of repeat purchases** are made out of **indifference** to the seller, NOT loyalty. (eLoyalty)
- The web customer is ‘**only 1 click** away from your competition’.

# Customer Relationship Management (CRM)

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- **Knowing the customer**
- **in large businesses, too many customers and too many ways customers interact with company**
- **CRM systems:**
  - Capture and integrate customer data from all over the organization
  - Consolidate and analyze customer data
  - Distribute customer information to various systems and customer touch points across enterprise
  - Provide single enterprise view of customers

## **What is Customer Relationship Management (CRM)?**

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### **Customer Relationship Management (CRM) is ...**

... a collective term for processes and strategies regarding individualized relationships between enterprises and customers, prospects, and business partners for marketing, sales and service with the goal of winning new customers, extending existing customer relationships across the entire customer life cycle, and improving competitiveness and business success by optimizing the profitability of individualized customer relationships

- integration of sales, marketing, service and support strategy, process, people and technology to maximize customer acquisition, customer value, relationships, retention and loyalty

# CRM Strategies

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- Customer Acquisition
  - gain the greatest number of new “best” customers as early in their “lifespan” as possible
- Customer Retention
  - retain and expand your business and relationships with your customers through **up-selling**, **cross-selling** and **servicing**
- Customer Loyalty
  - offer programs to ensure that your customers happily buy what you offer only from you
- Customer Evangelism
  - enable loyal customers to become a volunteer sales force
- Cost Reduction
  - reduce costs related to marketing, sales, customer service and support
- Enhance your e-business strategies

# **Customer Relationship Management (CRM)**

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CRM systems examine customers from a **multifaceted perspective**. These systems use a set of integrated applications to address all aspects of the customer relationship, including customer service, sales, and marketing.

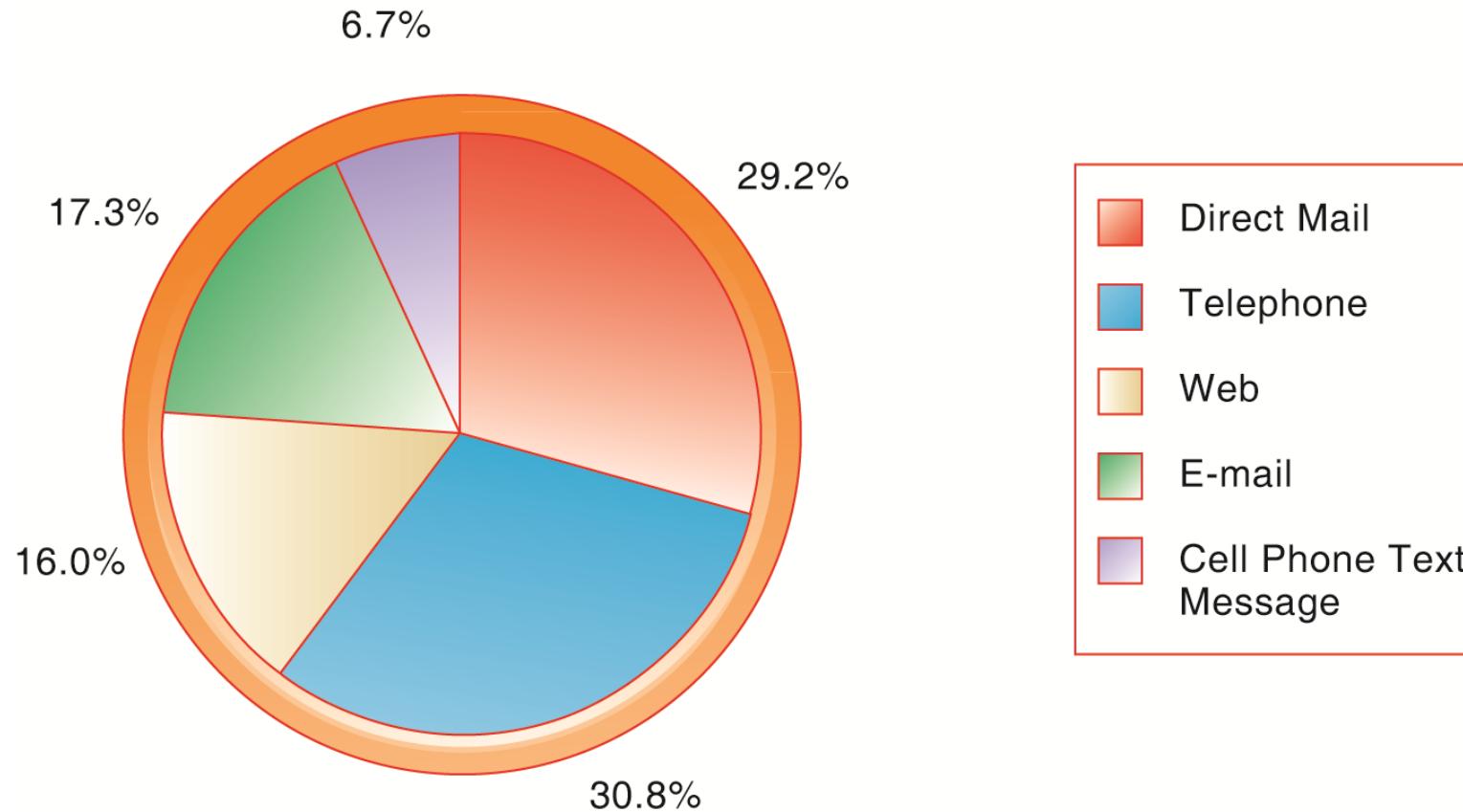
- **Packages range from niche tools to large-scale enterprise applications**
- **more comprehensive CRM applications have modules for:**
  - Partner Relationship Management (PRM)
    - Integrating lead generation, pricing, promotions, order configurations, and availability
    - Tools to assess partners' performances
  - Employee Relationship Management (ERM)
    - Setting objectives, employee performance management, performance-based compensation, employee training

- CRM packages typically include tools for:
  - Sales force automation (SFA)
    - Sales prospect and contact information, sales quote generation capabilities
  - Customer service
    - Assigning and managing customer service requests, Web-based self-service capabilities
  - Marketing
    - Capturing prospect and customer data, scheduling and tracking direct-marketing mailings or e-mail, cross-selling

## *Example: How CRM Systems Support Marketing*

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Responses by Channel for January 2013  
Promotional Campaign

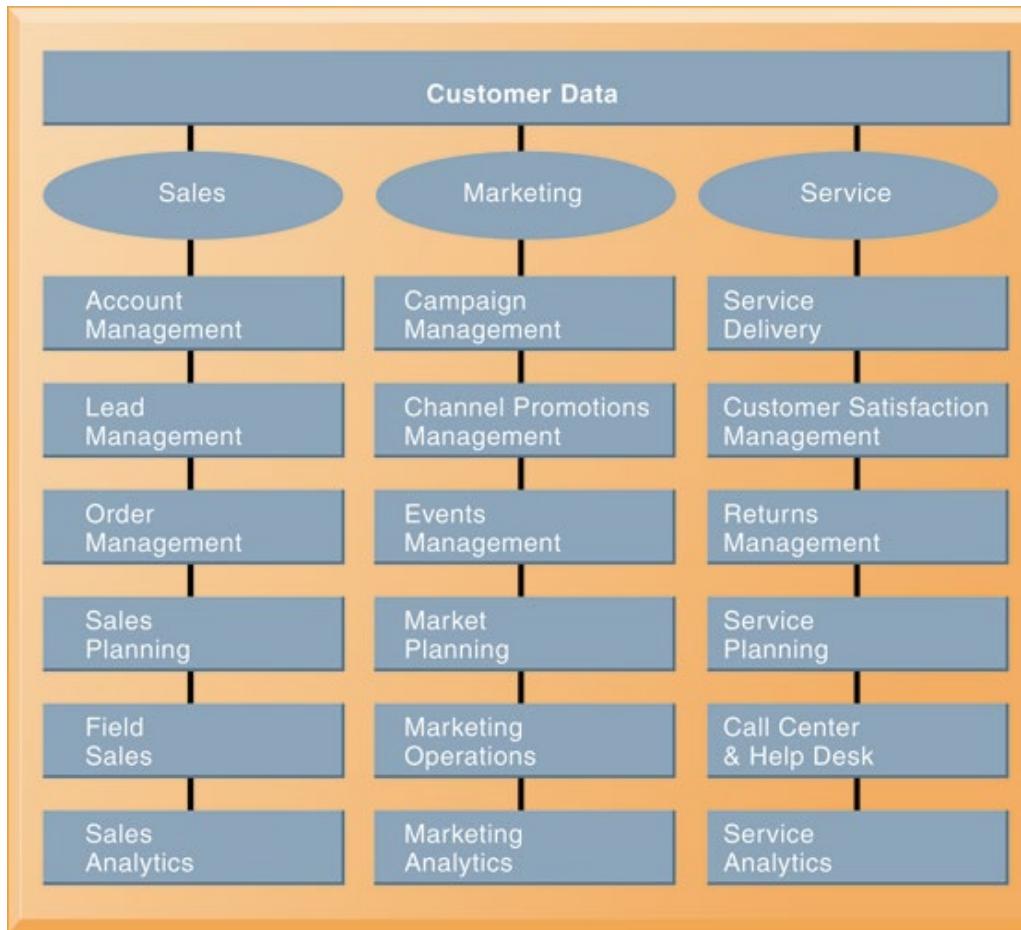


Customer relationship management software provides a single point for users to manage and evaluate marketing campaigns across multiple channels, including e-mail, direct mail, telephone, the Web and wireless messages.

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# CRM Software Capabilities

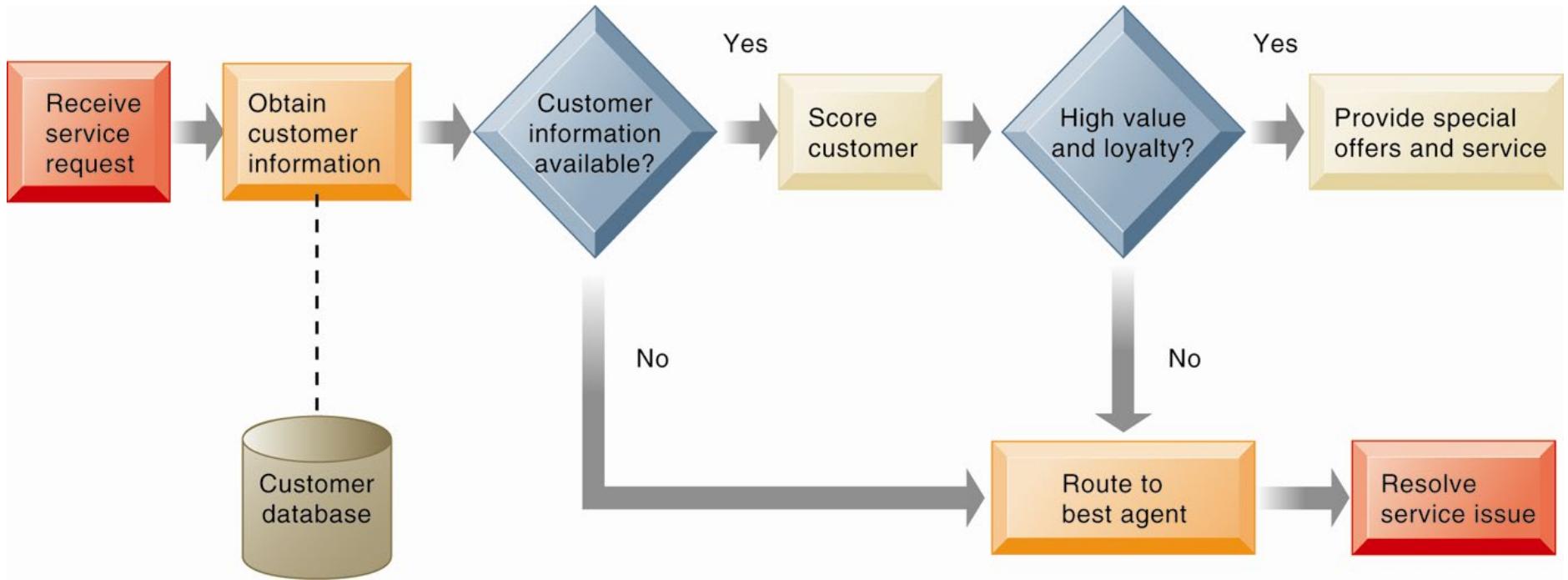
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The major CRM software products support business processes in sales, service, and marketing, integrating customer information from many different sources. Included are **support for both the operational and analytical aspects** of CRM.

## *Example: Customer Loyalty Management Process Map*

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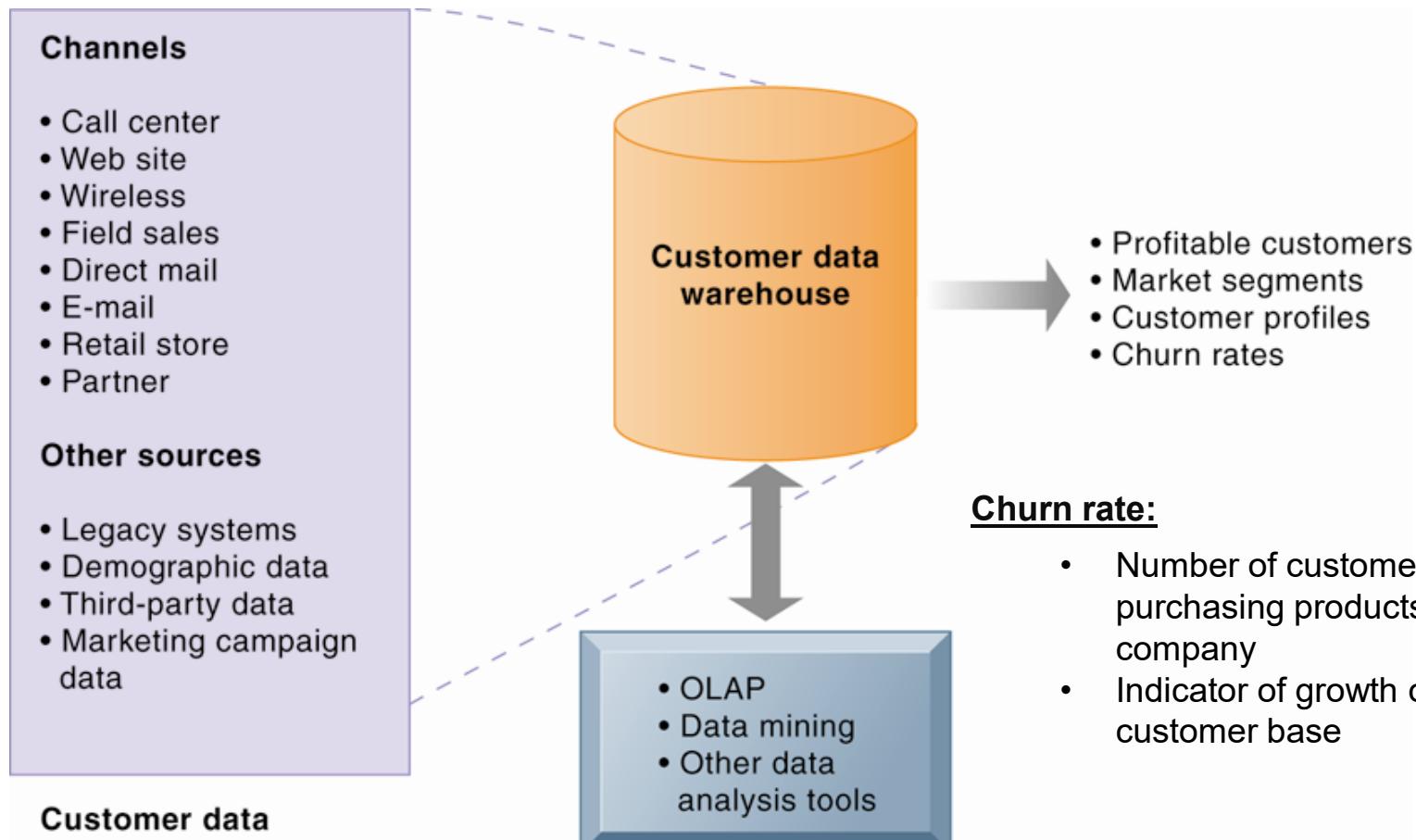
This process map shows how a best practice for promoting customer loyalty through customer service would be modeled by customer relationship management software. The CRM software helps firms identify **high-value customers** for **preferential treatment**.

## Types of CRM

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- **Operational CRM:**
  - Customer-facing applications such as sales force automation, call center and customer service support, and marketing automation
- **Analytical CRM:**
  - **Based on data warehouses populated by operational CRM systems and customer touch points**
  - **Analyzes customer data (OLAP, data mining, etc.)**
    - Customer lifetime value (CLTV)

## Example: Analytical CRM Data Warehouse



Analytical CRM uses a customer data warehouse and tools to analyze customer data collected from the firm's customer touch points and from other sources.

## Business Value of CRM Systems

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- Increased customer satisfaction
- Reduced direct-marketing costs
- More effective marketing
- Lower costs for customer acquisition/retention
- Increased sales revenue

# Current Top CRM Products

Worldwide CRM Software Spending By Vendor, 2014  
Market Size: \$23.1B, 13.3% Growth over 2013

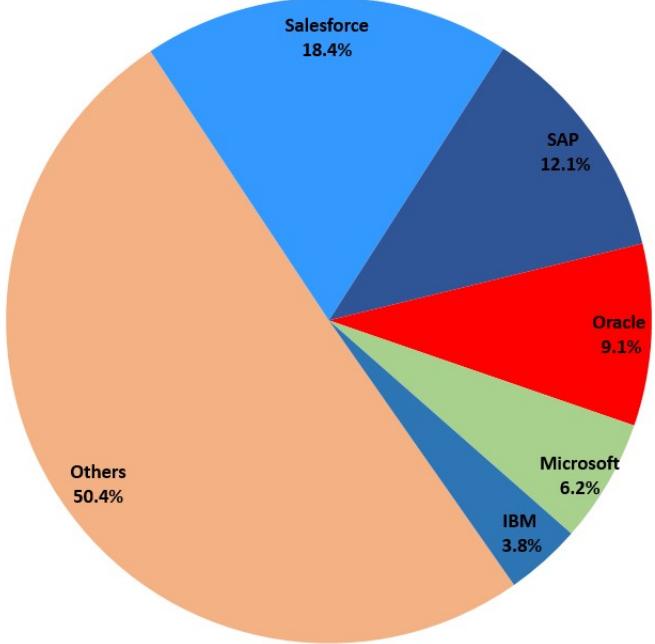


Table 1

CRM Software Spending by Vendor, Total Software Revenue Worldwide, 2013 (Millions of Dollars)

Company	2013	2013 Market	2012 Revenue	2012-2013
	Revenue	Share (%)		Growth (%)
salesforce.com	3,290.3	16.1	2,525.6	30.3
SAP	2,621.5	12.8	2,327.1	12.7
Oracle	2,096.5	10.2	2,015.2	4.0
Microsoft	1,392.4	6.8	1,134.0	22.8
IBM	792.1	3.9	649.1	22.0
Others	10,283.5	50.2	9,351.2	9.9
<b>Total</b>	<b>20,476.3</b>	<b>100.0</b>	<b>18,002.2</b>	<b>13.7</b>

Source: Gartner (May 2014)



## Trend: Social CRM

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- Incorporating social networking technologies
- Company social networks
- Customer interaction via social media like e.g. Facebook
- Integration of social media with enterprise applications

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# **Knowledge Management (KM)**

# The Knowledge Management Landscape

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- **Knowledge management systems among fastest growing areas of software investment**
- **Information economy**
  - 37% U.S. labor force: knowledge and information workers
  - 45% U.S. GDP from knowledge and information sectors
- Substantial part of a firm's stock market value is related to **intangible assets: knowledge, brands, reputations, and unique business processes**
- Well-executed knowledge-based projects **can produce extraordinary ROI**

# Important Dimensions of Knowledge

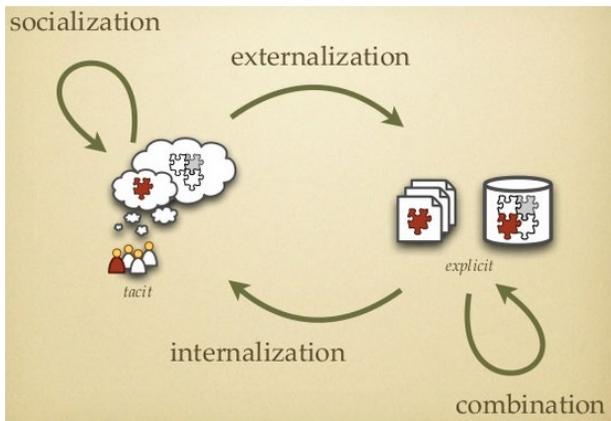
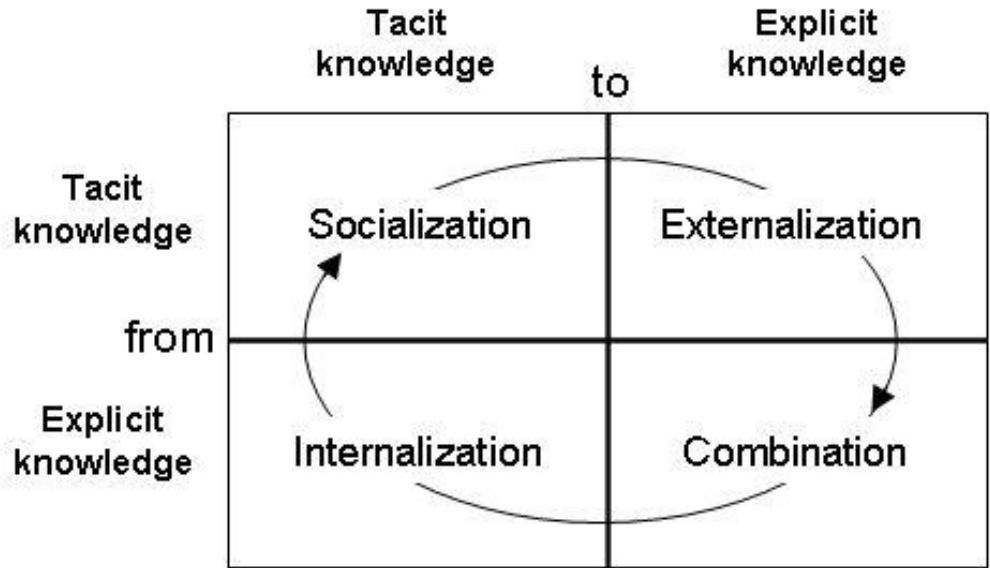
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- **Knowledge is a firm asset**
  - Intangible
  - Creation of knowledge from data, information, requires organizational resources
  - as it is shared, experiences network effects
- **Knowledge has different forms**
  - may be *explicit* (documented) or *tacit* (residing in minds)
  - Know-how, craft, skill
  - how to follow procedure
  - knowing why things happen (causality)
- **Knowledge has a location**
  - cognitive event
  - both social and individual
  - “sticky” (hard to move), situated (enmeshed in firm’s culture), contextual (works only in certain situations)
- **Knowledge is situational**
  - Conditional: Knowing when to apply procedure
  - Contextual: Knowing circumstances to use certain tool

# Spiral of Organizational Knowledge Creation (SECI Model, Nonaka/Takeuchi 1996)

**Socialization** is a process of creating common tacit knowledge through shared experiences; in socialization, a field of interaction is built where individuals share experiences and space at the same time

**Externalization** is a process of articulating tacit knowledge into such explicit knowledge as concepts and/or diagrams (e.g. creating a new product concept or developing a new production process)



**Combination** is a process of assembling new and existing explicit knowledge into a systemic knowledge; what commonly occurs is the combination of a newly created concept with existing knowledge to produce something tangible (e.g. a new product model).

**Internalization** is a process of embodying explicit knowledge into tacit knowledge or an individual's know-how or operational knowledge; an excellent example of this is “**learning by doing or using.**” Explicit knowledge that is available as text, sound, or video facilitates the internalization process

# Value of Knowledge

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- To transform information into knowledge, firm must **expend additional resources to discover patterns, rules, and contexts where knowledge works**
- **Wisdom:**
  - Collective and individual experience of applying knowledge to solve problems
  - involves where, when, and how to apply knowledge
- **Knowing how to do things effectively and efficiently in ways others cannot duplicate is prime source of profit and competitive advantage**
  - for example, having a unique build-to-order production system
- **Organizational learning: Process in which organizations learn**
  - **Gain experience** through collection of data, measurement, trial and error, and feedback
  - **Adjust behavior to reflect experience**
    - create new business processes
    - change patterns of management decision making

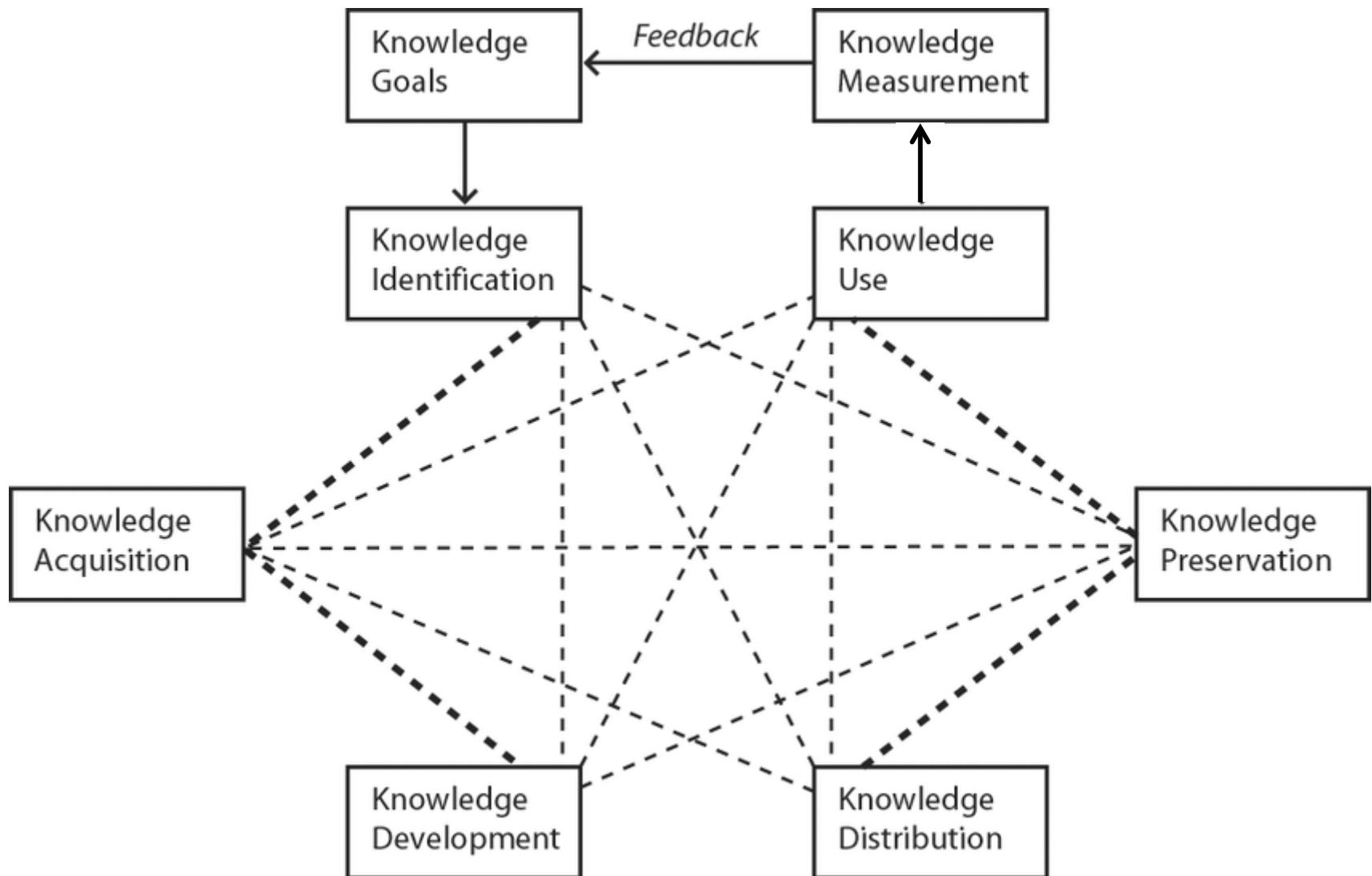
# Knowledge Management

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- **no common definition**
- **multidisciplinary approach** to achieve organizational objectives by making the best use of knowledge
- **set of business processes** developed in an organization **to create, store, transfer and apply knowledge**
- **Knowledge management value chain:**
  - each stage adds value to raw data and information as they are transformed into usable knowledge
  - Knowledge acquisition
  - Knowledge storage
  - Knowledge dissemination
  - Knowledge application

# Knowledge Management Model (Probst et al., 1997)

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# Knowledge Management Value Chain

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## 1. Knowledge acquisition

- Documenting tacit and explicit knowledge
  - Storing documents, reports, presentations, best practices
  - Unstructured documents (e.g. e-mails)
  - Developing online expert networks
- Creating knowledge
- Tracking data from Transaction Processing Systems and external sources

## 2. Knowledge storage

- Databases
- Document management systems
- Role of management:
  - Support development of planned knowledge storage systems
  - Encourage development of corporate-wide schemas for indexing documents
  - **Reward employees** for taking time to update and store documents properly

# **Knowledge Management Value Chain**

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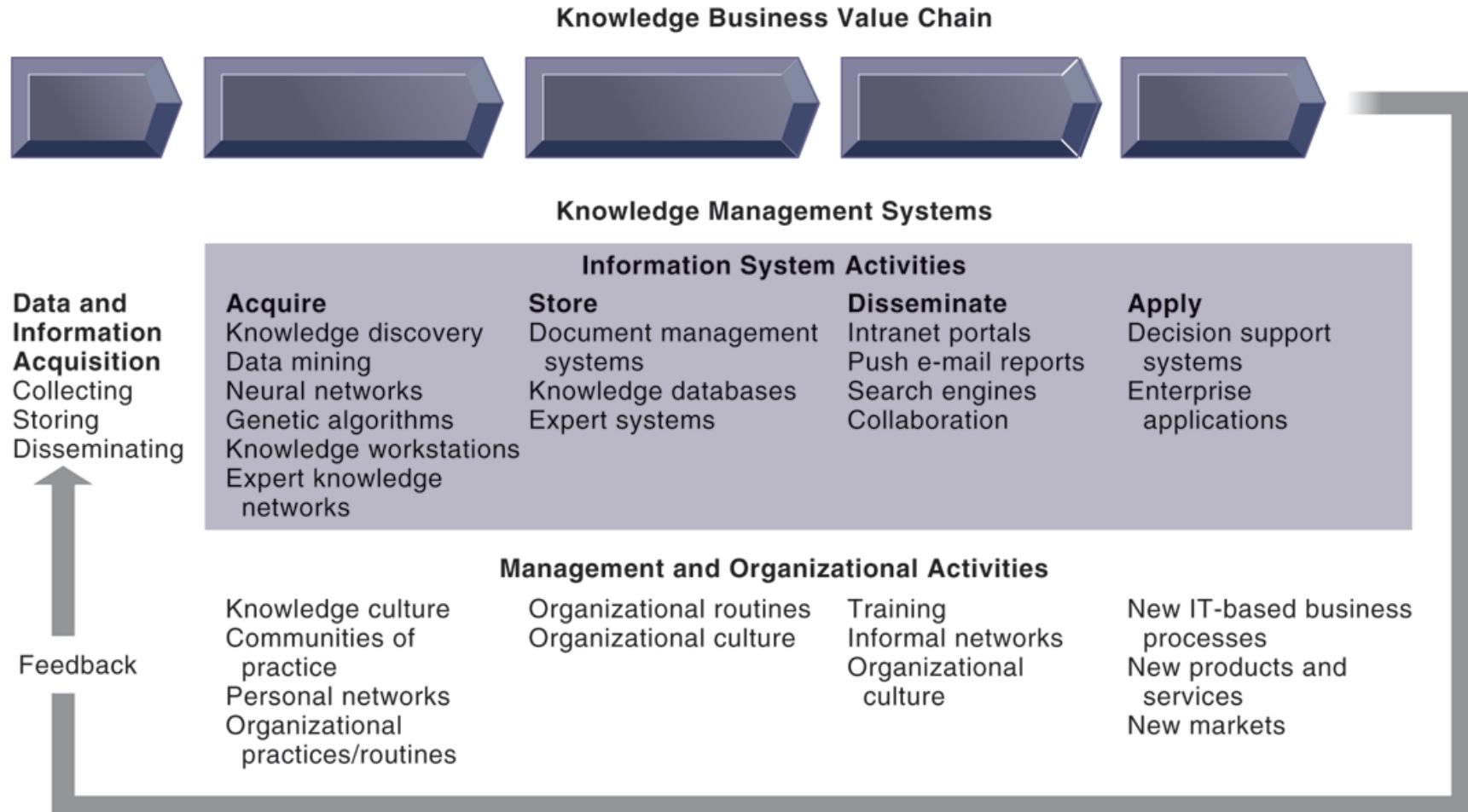
## **3. Knowledge dissemination**

- Portals, wikis
- E-mail, instant messaging
- Search engines
- Collaboration tools
- A deluge of information?
  - Training programs, informal networks, and shared management experience help managers focus attention on important information.

## **4. Knowledge application**

- To provide return on investment, organizational knowledge must become systematic part of management decision making and become situated in decision-support systems.
  - New business practices
  - New products and services
  - New markets

# Knowledge Management Value Chain



**Knowledge management today involves both information systems activities and a host of enabling management and organizational activities.**

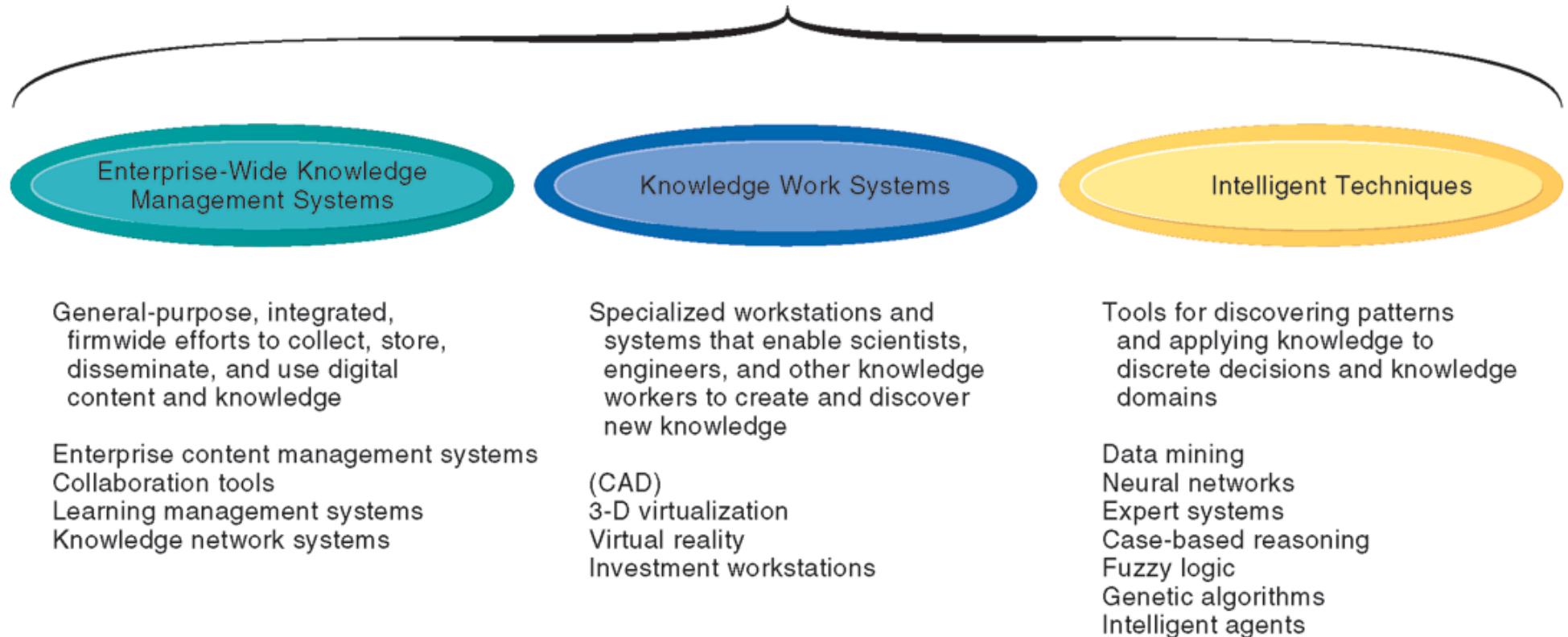
# Organizational roles and responsibilities

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- **Chief knowledge officer executives (CKO)**
- **Dedicated staff / knowledge managers**
- **Communities of practice (COPs)**
  - Informal social networks of professionals and employees within and outside firm who have similar work-related activities and interests
  - Activities include education, online newsletters, sharing experiences and techniques
  - Facilitate reuse of knowledge, discussion
  - Reduce learning curves of new employees

# Major Types of Knowledge Management Systems

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There are **three major categories of knowledge management systems**, and each can be broken down further into more specialized types of knowledge management systems.

# Three major types of knowledge in enterprise

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## 1. Structured documents

- Reports, presentations
- Formal rules

## 2. Semi-structured documents

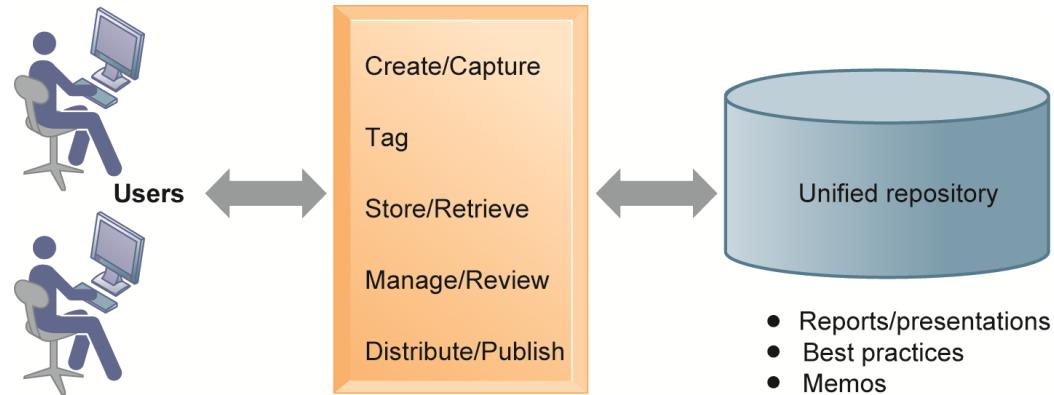
- E-mails, videos

## 3. Unstructured, tacit knowledge

- **80% of an organization's business content is semi-structured or unstructured**

# Enterprise Content Management Systems (ECMS)

- Help capture, store, retrieve, distribute, preserve
  - Documents, reports, best practices
  - Semistructured knowledge (e-mails)
- Bring in external sources
  - News feeds, research results
- Tools for communication and collaboration
  - Blogs, Wikis, and so on



An **ECMS** has capabilities for classifying, organizing, and managing structured and semi-structured knowledge and making it available throughout the enterprise.

# Enterprise Content Management Systems (ECMS)

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- **Key problem—Developing taxonomy**
  - Knowledge objects must be tagged with categories for retrieval
- **Digital asset management systems**
  - Specialized content management systems for classifying, storing, managing unstructured digital data (e.g. photographs, graphics, video, audio)
- **Knowledge network systems**
  - Provide **online directory of corporate experts** in well-defined knowledge domains
  - **Search tools** enable employees to find appropriate expert in a company

# Social Media Categories

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- **Support of communication:**
  - **Blogs**, Webinars, Microblogging, social networks, news groups, and **Instant Messengers**
- **Support of collaboration** and knowledge management:
  - **Wikis**, Social Bookmarks / Social Tagging, review and information sites
- **Multimedia area:**
  - Photo-sharing, Video-Sharing, Livecasting, Vlogs und Podcasts
- **Entertainment area:**
  - Virtual worlds, Online Games, Mobile Apps

# Social Media Use in Different Enterprise Departments

Type of social media	Corporate function					
	R&D	Marketing	Customer service	Sales	HR	Organisation
Blogs	◐	◑	◐			
Business networks				●		◐
Collaborative projects	●					
Enterprise social networks	◐			◑		●
Forums	◑	◐	●			
Microblogs		◐	◐		◐	
Photo sharing		◑				
Products/services review	◐	◑		●		
Social bookmarking		◑				
Social gaming		◑				
Social networks	◐	●	◐		◐	◐
Video sharing		●	◐			
Virtual worlds	◐	●		◐		

Importance: (empty) none or almost none; (◐) low; (◑) medium; (●) high; (●) very high

•Aichner, T. and Jacob, F. (March 2015). "Measuring the Degree of Corporate Social Media Use". *International Journal of Market Research*. 57 (2): 257–275.

## Collaboration and Social Tools

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- **Social bookmarking**
  - Sharing and tagging bookmarks
- **Folksonomies**
  - User-created taxonomies for tagging
- **Examples:**
  - Delicious
  - Slashdot
  - Pinterest

## **Learning Management Systems (LMS)**

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- provide **tools for management, delivery, tracking, and assessment of various types of employee learning and training**
- **Support multiple modes of learning**
  - CD-ROM, Web-based classes, online forums, live instruction, and so on
- **automate selection and administration of courses**
- **assemble and deliver learning content**
- **measure learning effectiveness**

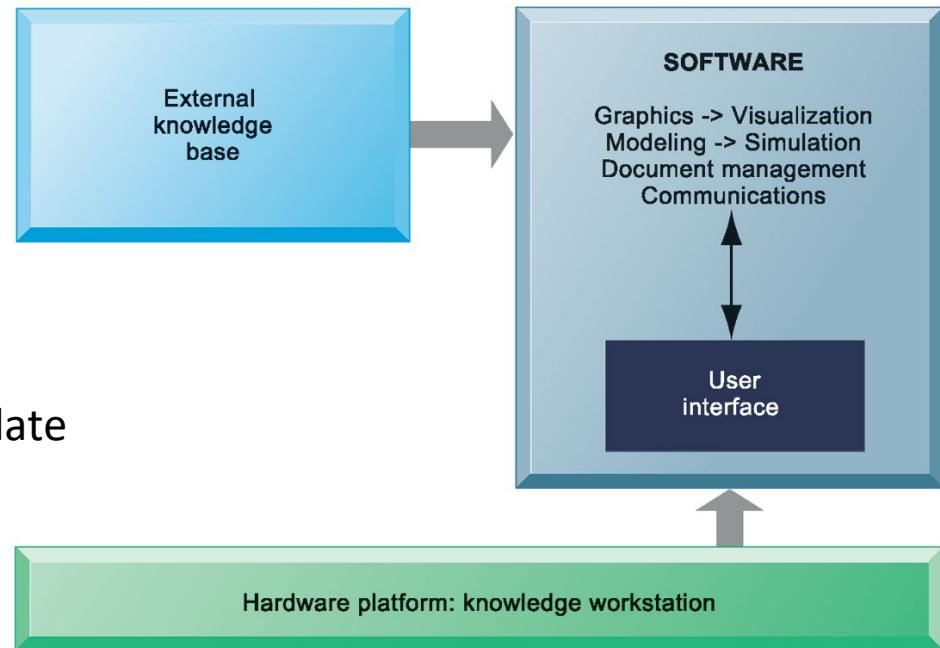
# Knowledge Work Systems

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- Systems for knowledge workers to **help create new knowledge and integrate that knowledge into business**
- **Knowledge workers:**
  - Researchers, designers, architects, scientists, engineers who create knowledge for the organization
  - **three key roles:**
    1. Keeping organization current in knowledge
    2. Serving as internal consultants regarding their areas of expertise
    3. Acting as change agents, evaluating, initiating, and promoting change projects
- **Requirements of knowledge work systems**
  - Sufficient computing power for graphics, complex calculations
  - Powerful graphics and analytical tools
  - Communications and document management
  - Access to external databases
  - User-friendly interfaces
  - Optimized for tasks to be performed (design engineering, financial analysis)

# Examples of Knowledge Work Systems

- **CAD (computer-aided design)**
  - Creation of engineering or architectural designs
  - 3-D printing
- **Virtual reality systems**
  - Simulate real-life environments
  - 3-D medical modeling for surgeons
  - Augmented reality (AR) systems
  - VRML (VR Modeling Language)
- **Investment workstations**
  - Streamline investment process and consolidate internal, external data for brokers, traders, portfolio managers



Knowledge work systems require strong links to external knowledge bases in addition to specialized hardware and software.

# Intelligent Techniques

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- **Intelligent techniques:** Used to capture individual and collective knowledge and to extend knowledge base
  - **To capture tacit knowledge:** expert systems, case-based reasoning, fuzzy logic
  - **Knowledge discovery:** neural networks and data mining
  - **Generating solutions to complex problems:** genetic algorithms
  - **Automating tasks:** intelligent agents
- **Artificial intelligence (AI) technology:**
  - Computer-based systems that **emulate human behavior**  
**(→ machine learning)**

## Expert Systems

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- **Capture tacit knowledge in very specific and limited domain of human expertise**
- **Capture knowledge of skilled employees as set of rules in software system** that can be used by others in organization
- typically **perform limited tasks** that may take a few minutes or hours, for example:
  - Diagnosing malfunctioning machine
  - Determining whether to grant credit for loan
- used for **discrete, highly structured decision making**

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# E-Commerce

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## An Overview

# Content

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- Definition of electronic commerce (EC) and description of its various categories
- framework of EC
- major types of EC transactions
- drivers of EC
- EC business models
- benefits of EC to organizations, consumers, and society
- major limitations of EC

# Electronic Commerce: Definitions

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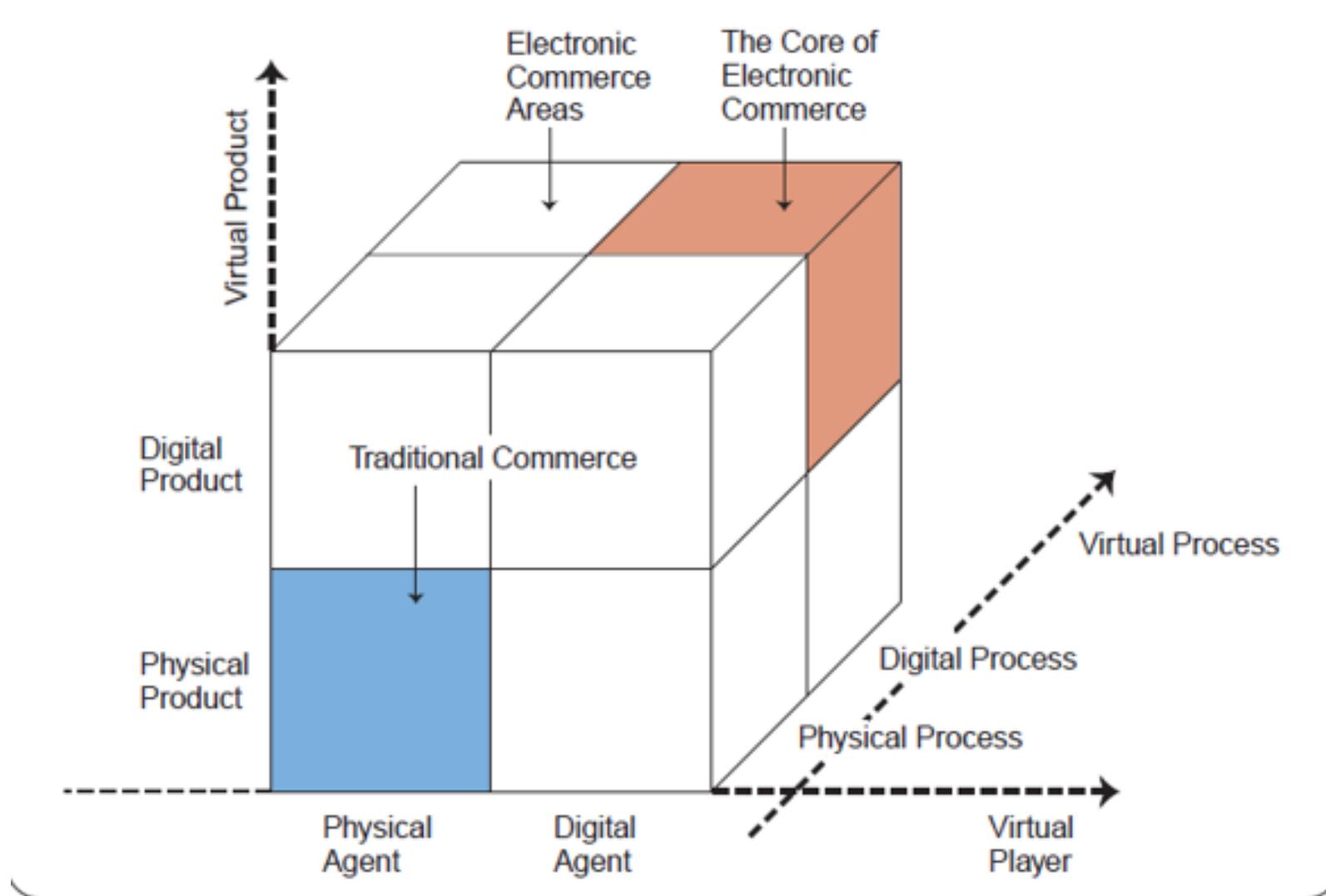
- **electronic commerce (EC)**  
the process of buying, selling, or exchanging products, services, or information via computer
- **e-business**  
a **broader definition of EC** that includes not just the buying and selling of goods and services, but **also servicing customers, collaborating with business partners, and conducting electronic transactions within an organization**

# Electronic Commerce: Major EC Concepts

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- Pure Versus Partial EC
- EC Organizations
  - **brick-and-mortar (old economy) organizations**  
Old-economy organizations (corporations) that perform their primary business offline, selling physical products by means of physical agents
  - **virtual (pure-play) organizations**  
Organizations that conduct their business activities solely online
  - **click-and-mortar (click-and-brick) organizations**  
Organizations that conduct some e-commerce activities, usually as an additional marketing channel

# Dimensions of Electronic Commerce



Source: Choi et al., 1997, p. 18.

# Electronic Commerce: Definitions and Concepts

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- **ELECTRONIC MARKETS AND NETWORKS**

- **electronic market (e-marketplace)**

an online marketplace where buyers and sellers meet to exchange goods, services, money, or information

- **intranet**

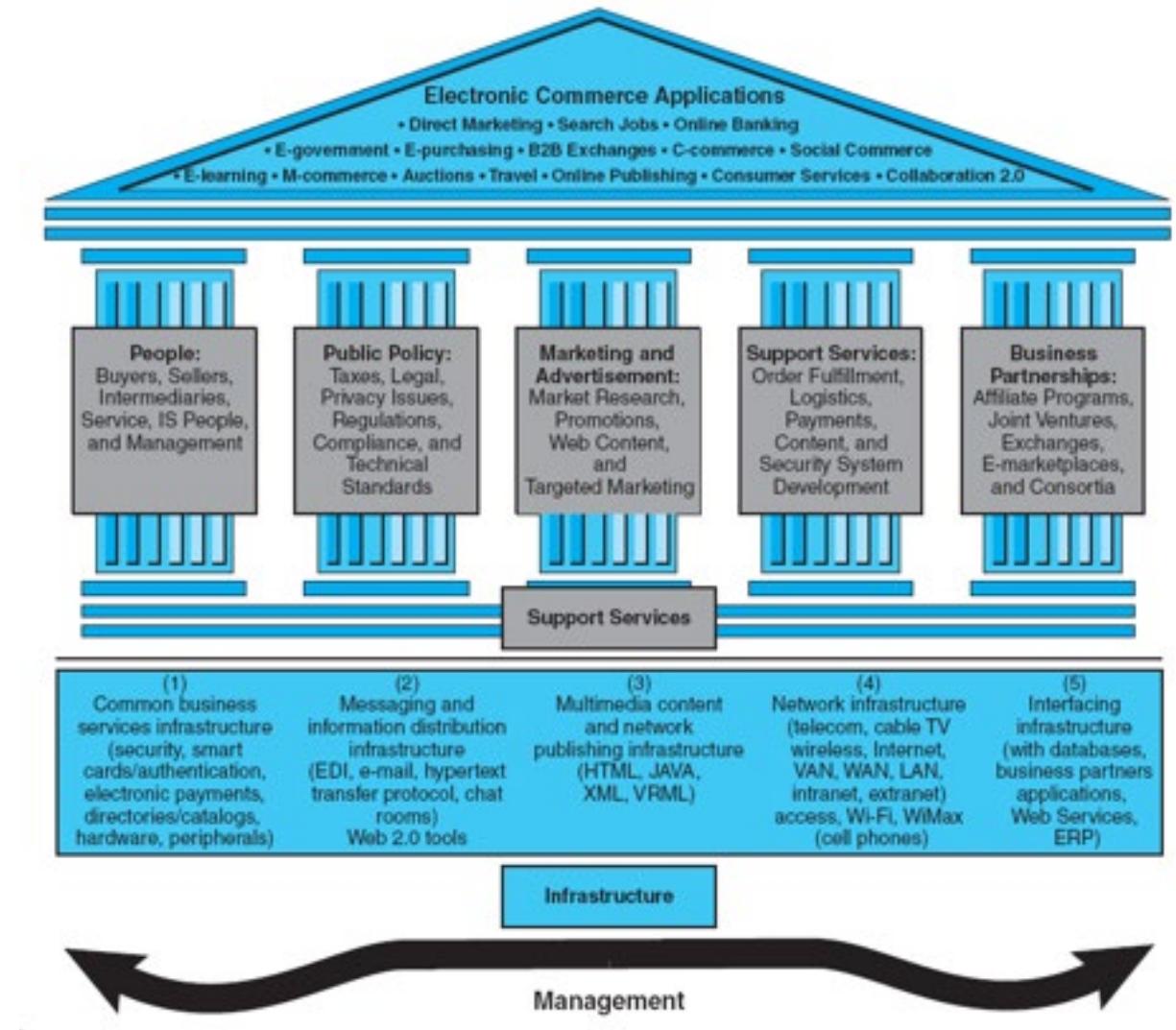
an **internal corporate or government network** that uses Internet tools, such as Web browsers, and Internet protocols

- **extranet**

a network that uses the Internet to link **multiple intranets**

# EC Framework

- EC applications are supported by infrastructure and by the following five support areas:



# Classification of EC

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By the nature of the **transactions** and the **relationships of the participants**

- **business-to-business (B2B)**

E-commerce model in which all of the participants are businesses or other organizations

- **business-to-consumer (B2C)**

E-commerce model in which businesses sell to individual shoppers → **e-tailing**  
(Online retailing)

- **business-to-business-to-consumer (B2B2C)**

E-commerce model in which a business provides some product or service to a client business that maintains its own customers

- **consumer-to-business (C2B)**

E-commerce model in which individuals use the Internet to sell products or services to organizations or individuals who seek sellers to bid on products or services they need

# Classification of EC (cont.)

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- **Intra-business EC**

E-commerce category that includes all internal organizational activities that involve the exchange of goods, services, or information among various units and individuals in an organization

- **business-to-employees (B2E)**

E-commerce model in which an organization delivers services, information, or products to its individual employees

- **consumer-to-consumer (C2C)**

E-commerce model in which consumers sell directly to other consumers

# Classification of EC (cont.)

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- **e-government**

E-commerce model in which a government entity buys or provides goods, services, or information from or to businesses or individual citizens

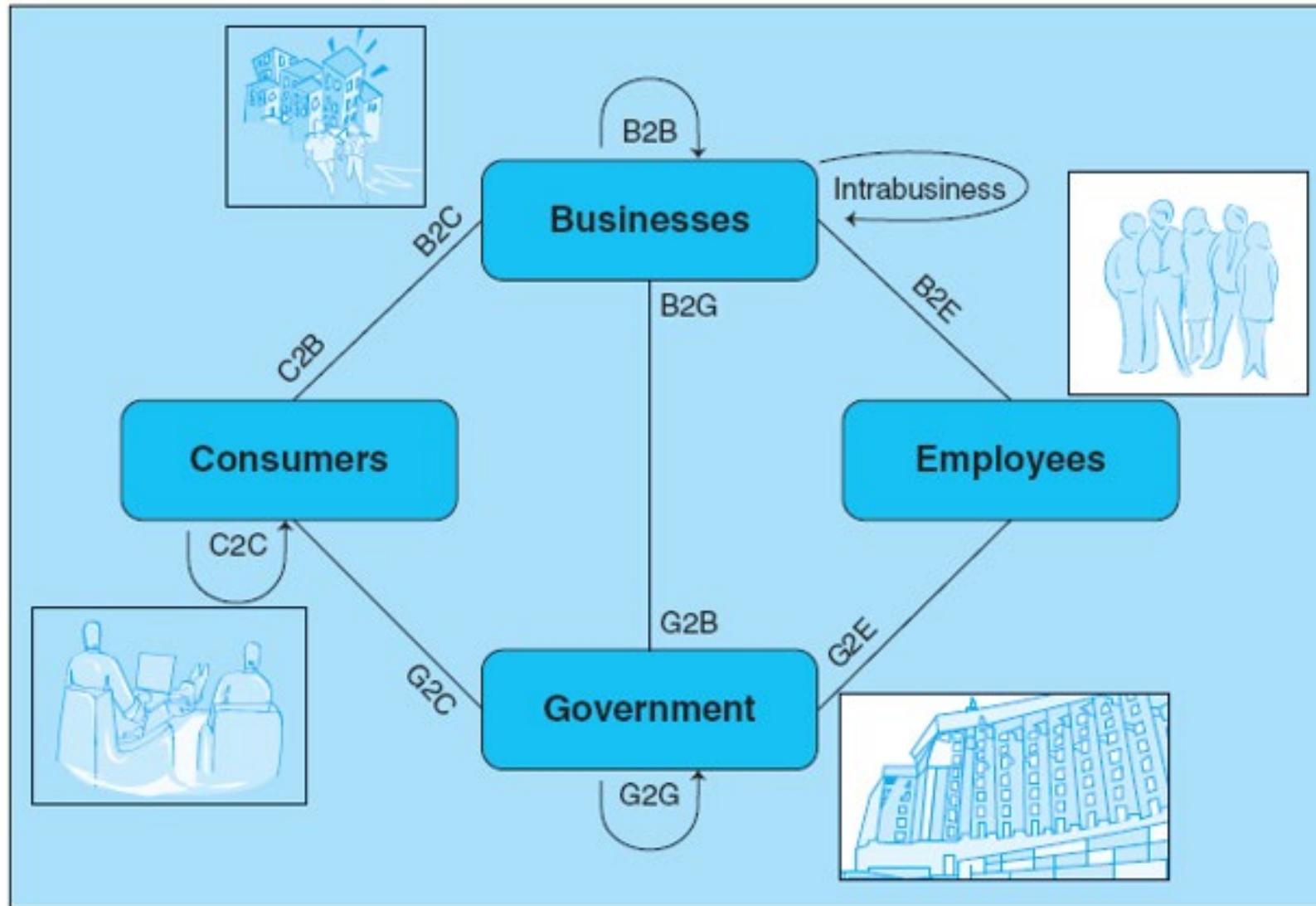
- **mobile commerce:**

EC transactions and activities conducted in full or in part in a wireless environment (**m-commerce**)

- **social commerce**

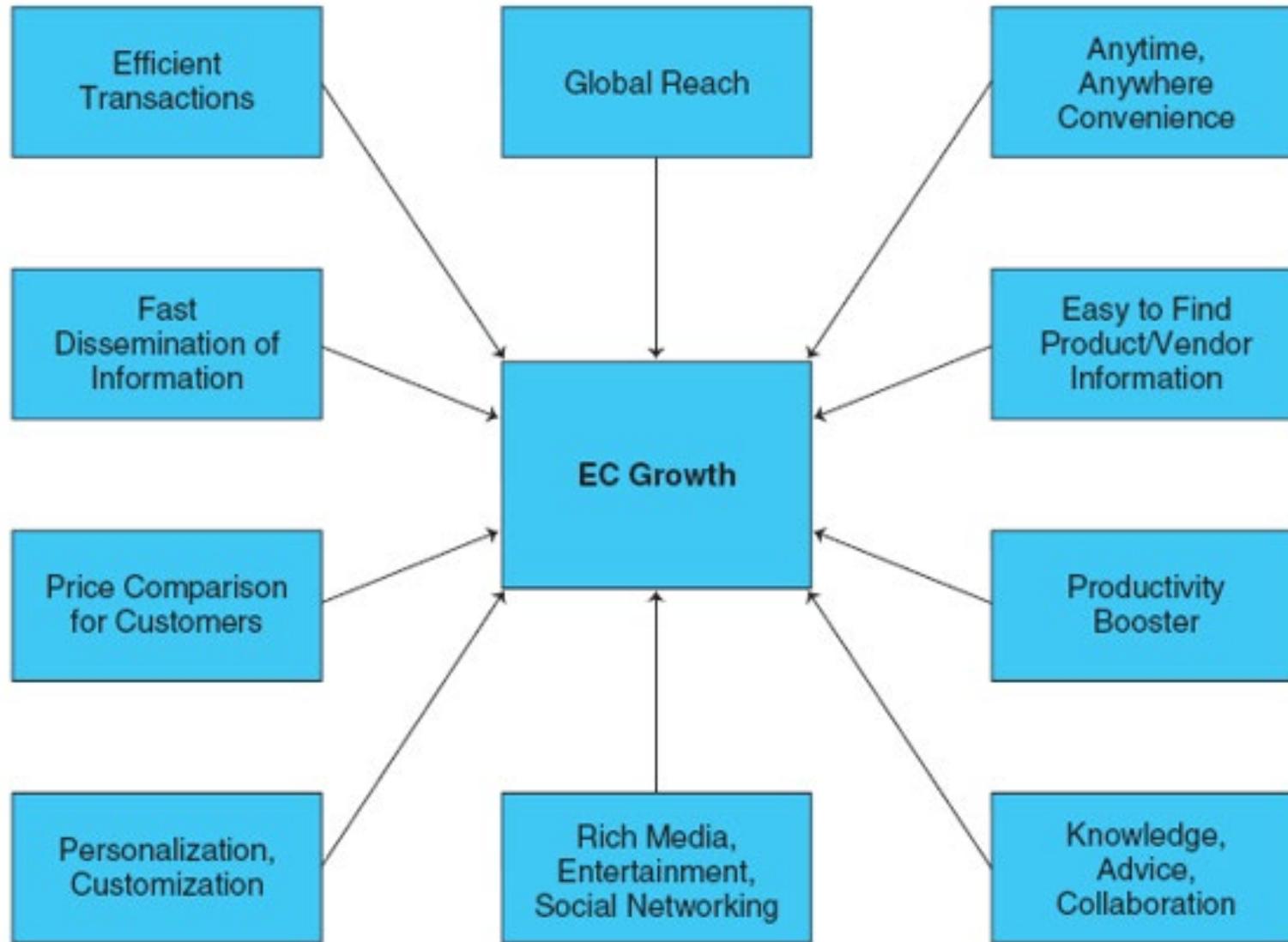
The e-commerce activities conducted in social networks and/or by using social software (i.e., Web 2.0 tools)

# Categories of Transactions

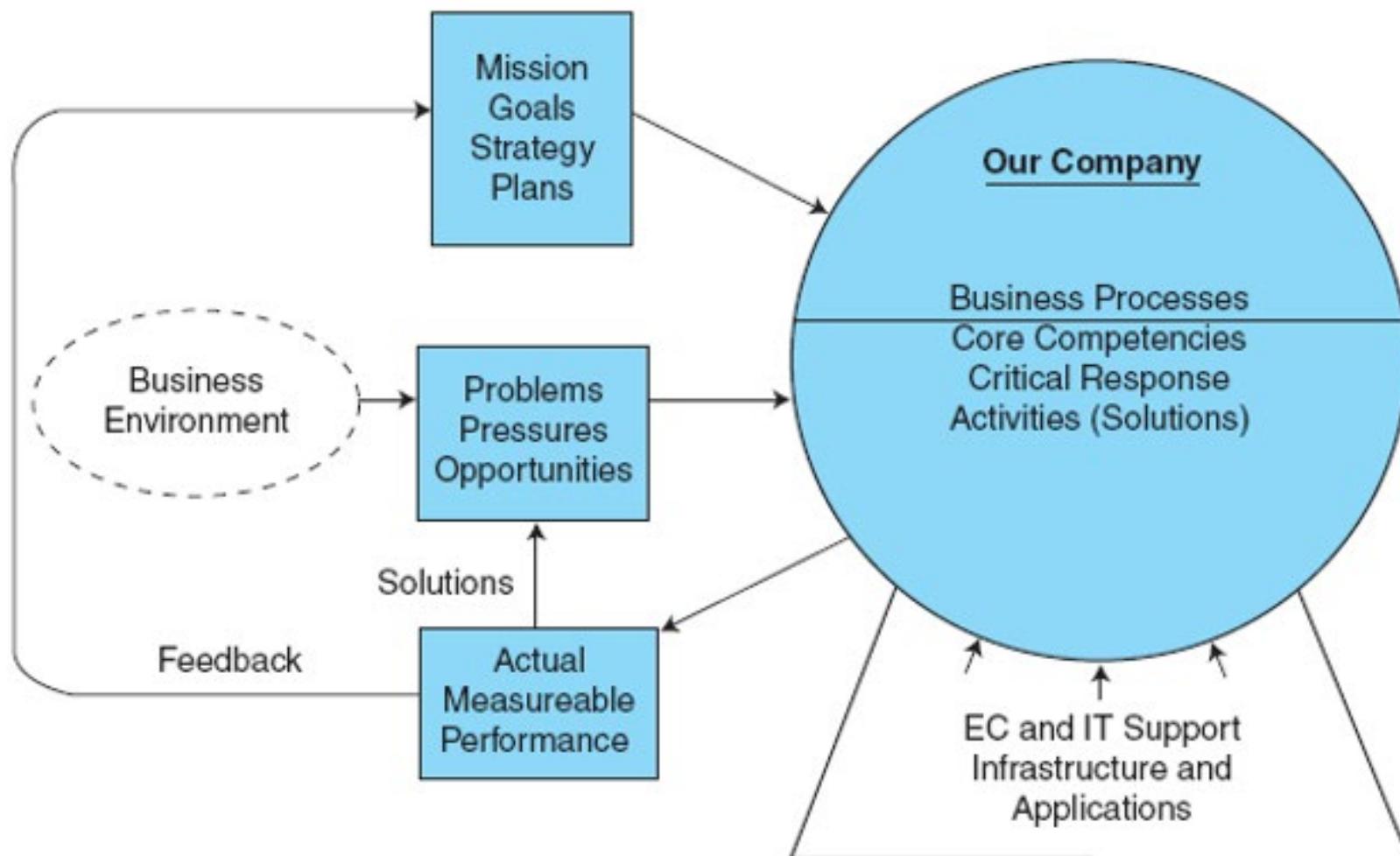


# Major Capabilities that Contribute to the EC Growth

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# The Business Environment and Performance Impact Model



# Electronic Commerce Business Models

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## business model

- A method of doing business by which a company can generate revenue to sustain itself

A business model is composed of the following **six elements**:

- A description of the customers to be served and the company's relationships with these customers, including what constitutes value from the customers' perspective (**customers' value proposition**)
- A **description of all products and services** the business will offer
- A **description of the business process** required to make and deliver the products and services
- A **list of the resources** required and the identification of which ones are available, which will be developed in house, and which will need to be acquired
- A **description of the organization's supply chain**, including suppliers and other business partners
- A **description of the revenues expected (revenue model)**, anticipated costs, sources of financing, and estimated profitability (financial viability)

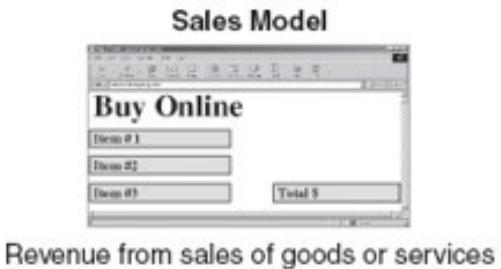
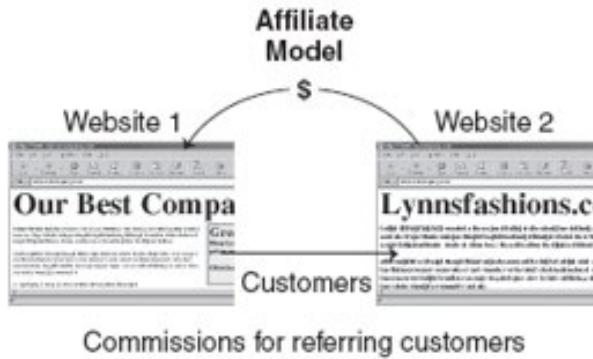
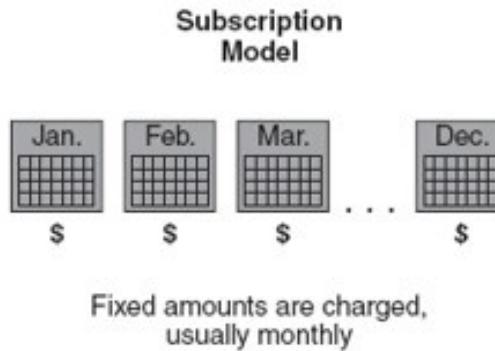
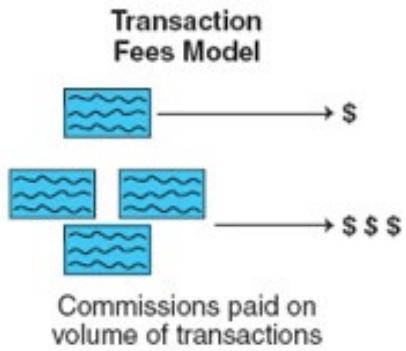
# Revenue Models

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A **revenue model** outlines how the organization or the EC project will generate revenue

- **Sales:** Companies generate revenue from selling merchandise or services over their Web sites.
- **Transaction fees:** A company receives a commission based on the volume of transactions made.
- **Subscription fees:** Customers pay a fixed amount, usually monthly, to get some type of service.
- **Advertising fees:** Companies charge others for allowing them to place a banner on their sites.
- **Affiliate fees:** Companies receive commissions for referring customers to others' Web sites.
- **Other revenue sources:** Some companies allow people to play games for a fee or to watch a sports competition in real time for a fee. Another revenue source is licensing fees (e.g., datadirect-technologies.com). **Licensing fees** can be assessed as an annual fee or a per usage fee.

# Common Revenue Models



# Typical EC Business Models

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- **Online direct marketing:** this model is especially efficient for digitizable products and services
- **tendering (bidding) system:** a model in which a buyer requests would-be sellers to submit bids; the lowest bidder wins', also known as a *reverse auction*
- **name-your-own-price model:** allows buyers to set the price they are willing to pay for a specific product or service, aka *demand-collection model*
- **Find the best price:** according to this model, a customer specifies a need and then an intermediate company matches the customer's need against a database, locates the lowest price, and submits it to the consumer (aka *search engine model*)
- **Electronic marketplaces and exchanges,** e.g., stock and commodities exchanges
- **Viral marketing:** Word-of-mouth marketing in which customers promote a product or service to friends or other people
- **Group purchasing:** Quantity (aggregated) purchasing that enables groups of purchasers to obtain a discount price on the products purchased

# Typical EC Business Models (cont.)

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- **Online auctions:** online shoppers make consecutive bids for various goods and services, and the highest bidders get the items auctioned (e.g. Ebay)
- **Product and service customization:** a product or service is created according to the buyer's specifications (e.g. Dell, Nike)
- **Information brokers (informediaries):** Information brokers provide privacy, trust, matching, search, content, and other services (e.g. Froogle.com)
- **Bartering:** Companies use bartering to exchange surpluses they do not need for things that they do need
- **Deep discounting:** Companies offer products and services at deep discounts, as much as 50 percent off the retail price
- **Membership:** a popular off-line model, in which only members get a discount, also is being offered online

# Typical EC Business Models (cont.)

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- **Value-chain integrators:** This model offers services that aggregate information-rich products into a more complete package for customers, thus adding value. ( e.g. car-buying-related services, such as financing and insurance)
- **Value-chain service providers:** These providers specialize in a supply chain function such as logistics (e.g. UPS) or payments (e.g. PayPal)
- **Social networks, communities, and blogging:** Many companies are developing commercial benefits from social networks, communities, and blogging (e.g., for paid advertising or as a sales channel)
- **Direct sale by manufacturers:** according to this model, the manufacturer eliminates all intermediaries, selling directly to customers
- **Important Hint:**
  - To succeed in the fast-moving marketplace, **business and revenue models must change with changing market conditions** (e.g. Amazon)

# Benefits of EC to Organisations

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- **Global reach:** locating customers and/or suppliers worldwide, at reasonable cost and fast
- Business always open
- **Customization/personalization:** Make it to consumers' wish, fast and at reasonable cost
- **Sellers specialization (niche market):** Seller can specialize in a narrow field (e.g., dog toys), yet make money
- Ability to innovate, use new business models
- Rapid time-to-market and increased speed
- Lower communication costs
- Supply chain improvements
- Efficient procurement (e-procurement)
- Improved customer service and relationship (better CRM)
- Up-to-date company material
- EC helps SME to compete against large ones by using special business models
- Lower cost of distributing digitalizable products
- ...

# Benefits of EC to Customers

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- **Ubiquity:** Can shop any time from any place
- more, customized and cheaper products/services
- **Instant delivery:** Digitized products can be downloaded immediately upon payment
- **Information availability:** Easy finding what you need, with details, demos, etc.
- Convenient auction participation
- Enable **telecommuting:** people can work or study at home
- **Electronic socialization:** Can socialize online in communities yet be at home
- **Find unique items:** Using online auctions, collectible items can be found
- ...

# Benefits of EC to Society

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- **Enable telecommuting**
- **More public services:** Make education, health, etc., available for more people. Rural area can share benefits; more services for the poor
- **Increased standard of living:** Can buy more and cheaper goods/services
- **Close the digital divide:** Allow people in developing countries and rural areas to accept more services and purchase what they really like

# Technological Limitations of EC

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- **Lack of universal standards** for quality, security, and reliability
- **telecommunications bandwidth** is insufficient, especially for m-commerce
- It is difficult to integrate Internet and EC software with some existing (especially legacy) applications and databases
- Special Web servers are needed in addition to the network servers, which add to the cost of EC
- **Internet accessibility** is sometimes still expensive and/or inconvenient
- Order fulfillment of large-scale B2C requires special automated warehouses
- ...

# Nontechnological Limitations of EC

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- **Security and privacy concerns** deter customers from buying
- **Lack of trust** in EC and in unknown sellers hinders buying
- **People do not yet sufficiently trust paperless, faceless transactions**
- **Many legal and public policy issues**, including taxation, have not yet been resolved or are not clear
- **National and international government regulations** sometimes get in the way
- **Mature measurement methodologies are not yet available**, e.g. for online advertising
- Some customers like to feel and touch products
- Also, **customers are resistant to the change** from shopping at a brick-and-mortar store to a virtual store
- In many cases, the number of sellers and buyers that are needed for profitable EC operations is insufficient
- **Online fraud** is increasing
- **difficulty to obtain venture capital** due to the failure of many dot-coms
- ...