



Universidad de Oviedo



# Software architecture and Enterprise environment



SOFTWARE  
ARCHITECTURE

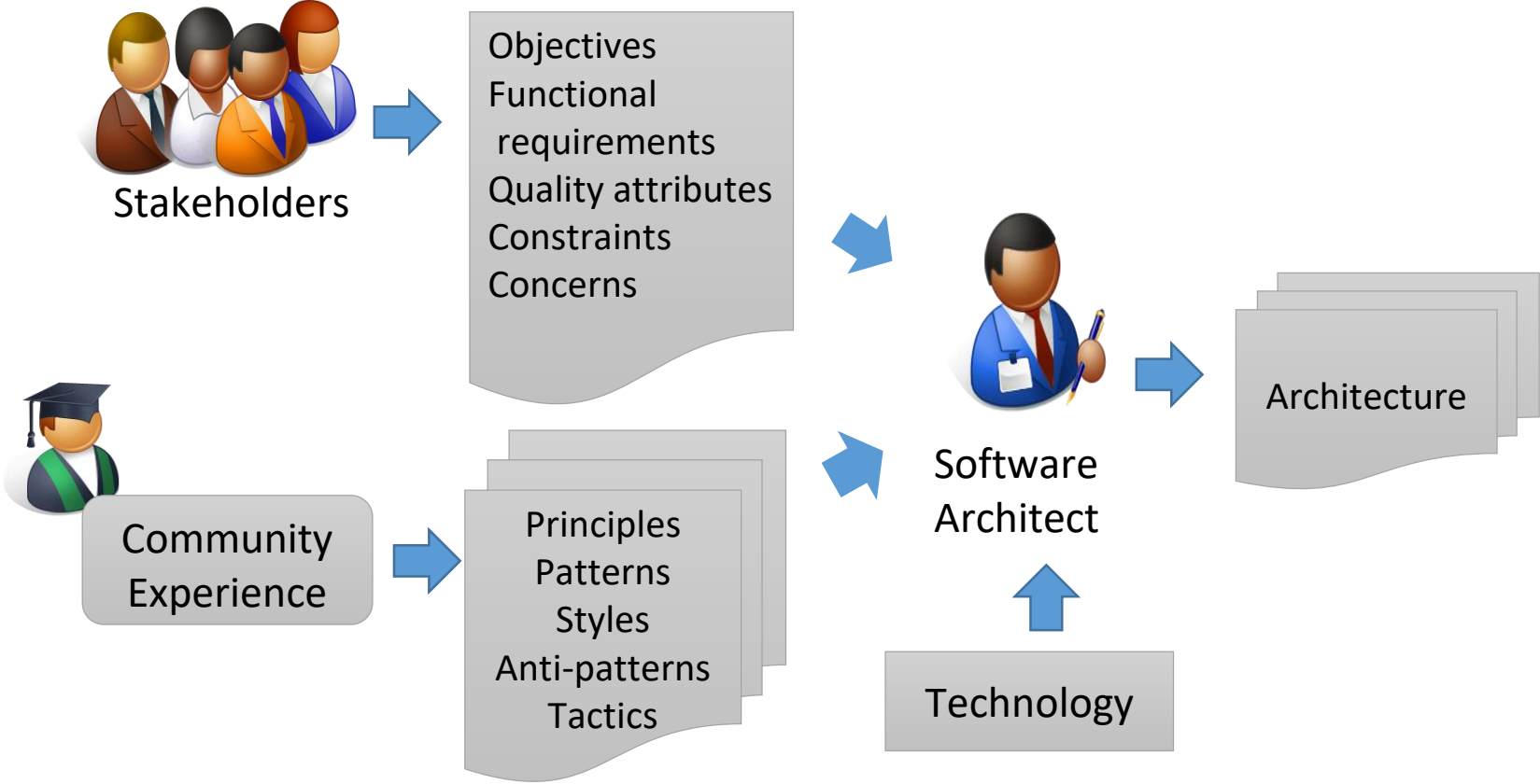
Course 2019/20

Jose E. Labra Gayo

# Role of software architect

Software architect at enterprises

# Software architect process





# Role of software architect

## Architectural drivers

Understanding the goals  
Capturing, refining and  
challenging  
requirements and constraints

## Designing Software

Creating the technical  
strategy, vision and  
roadmap

## Technical Risks

Identifying, mitigating and  
owning the technical risks to  
ensure that the architecture  
"works"

## Architecture evolution

Continuous technical  
leadership and ownership of  
the architecture throughout  
The software delivery

## Coding

Involvement in the  
hands-on elements of  
the software delivery

## Quality Assurance

Introduction and adherence  
to standards, guidelines,  
principles, etc.

# Other architects...

## Enterprise architect

Support organization's business strategy with IT solutions and information

## Solutions architect

Focuses on the ongoing projects and works in designing IT solutions based on requirements from the organization business

## Business architect

Focuses on the organizational business needs and understands in details how the organization works

## Software architect

Focuses on the ongoing project similarly to solution architects. They have a deeper knowledge in technology

# Enterprise architecture approaches

Model driven approach

Zachman framework





































Initiative driven approach

TOGAF

# Model driven approach

## Zachman framework (created by J. Zachman, 1987)

### Classification scheme for enterprise descriptions

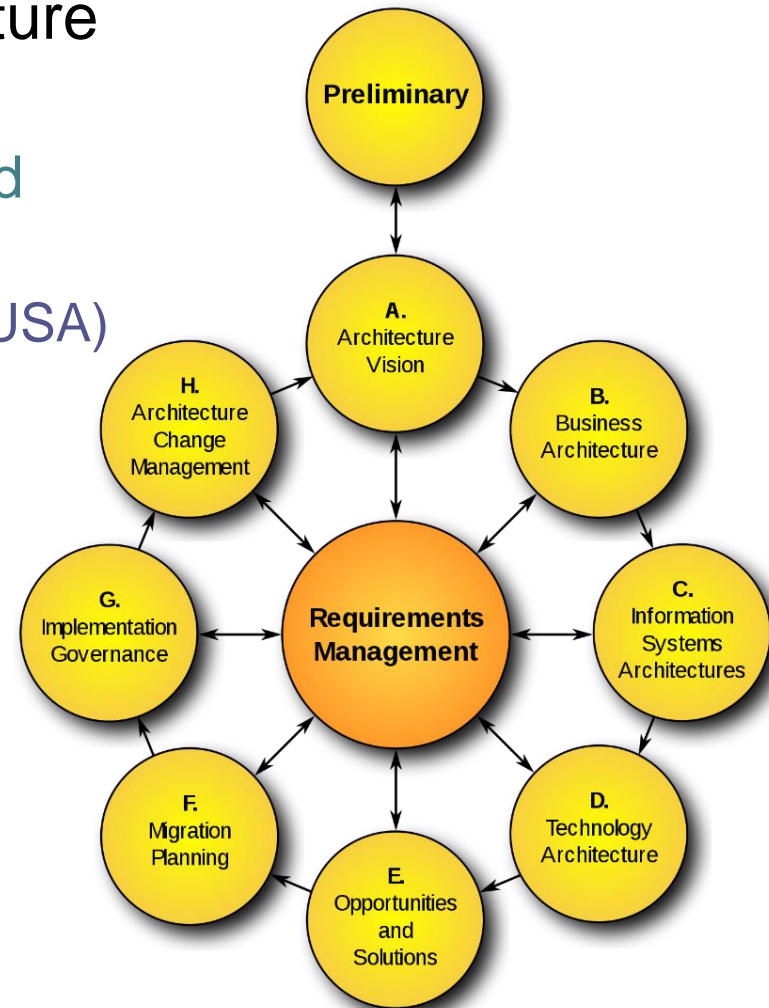
	WHAT	HOW	WHERE	WHO	WHEN	WHY	
SCOPE CONTEXTS	<div>Inventory Identification</div> <div></div> <div>Inventory Types</div>	<div>Process Identification</div> <div></div> <div>Process Types</div>	<div>Network Identification</div> <div></div> <div>Network Types</div>	<div>Organization Identification</div> <div></div> <div>Organization Types</div>	<div>Timing Identification</div> <div></div> <div>Timing Types</div>	<div>Motivation Identification</div> <div></div> <div>Motivation Types</div>	STRATEGISTS AS THEORISTS
BUSINESS CONCEPTS	<div>Inventory Definition</div> <div></div> <div>Business Entity Business Relationship</div>	<div>Process Definition</div> <div></div> <div>Business Transform Business Input</div>	<div>Network Definition</div> <div></div> <div>Business Location Business Connection</div>	<div>Organization Definition</div> <div></div> <div>Business Role Business Work</div>	<div>Timing Definition</div> <div></div> <div>Business Cycle Business Moment</div>	<div>Motivation Definition</div> <div></div> <div>Business End Business Means</div>	EXECUTIVE LEADERS AS OWNERS
SYSTEM LOGIC	<div>Inventory Representation</div> <div></div> <div>System Entity System Relationship</div>	<div>Process Representation</div> <div></div> <div>System Transform System Input</div>	<div>Network Representation</div> <div></div> <div>System Location System Connection</div>	<div>Organization Representation</div> <div></div> <div>System Role System Work</div>	<div>Timing Representation</div> <div></div> <div>System Cycle System Moment</div>	<div>Motivation Representation</div> <div></div> <div>System End System Means</div>	ARCHITECTS AS DESIGNERS
TECHNOLOGY PHYSICS	<div>Inventory Specification</div> <div></div> <div>Technology Entity Technology Relationship</div>	<div>Process Specification</div> <div></div> <div>Technology Transform Technology Input</div>	<div>Network Specification</div> <div></div> <div>Technology Location Technology Connection</div>	<div>Organization Specification</div> <div></div> <div>Technology Role Technology Work</div>	<div>Timing Specification</div> <div></div> <div>Technology Cycle Technology Moment</div>	<div>Motivation Specification</div> <div></div> <div>Technology End Technology Means</div>	ENGINEERS AS BUILDERS
COMPONENT ASSEMBLIES	<div>Inventory Configuration</div> <div></div> <div>Component Entity Component Relationship</div>	<div>Process Configuration</div> <div></div> <div>Component Transform Component Input</div>	<div>Network Configuration</div> <div></div> <div>Component Location Component Connection</div>	<div>Organization Configuration</div> <div></div> <div>Component Role Component Work</div>	<div>Timing Configuration</div> <div></div> <div>Component Cycle Component Moment</div>	<div>Motivation Configuration</div> <div></div> <div>Component End Component Means</div>	TECHNICIANS AS IMPLEMENTERS
OPERATIONS CLASSES	<div>Inventory Instantiation</div> <div></div> <div>Operations Entity Operations Relationship</div>	<div>Process Instantiation</div> <div></div> <div>Operations Transform Operations Input</div>	<div>Network Instantiation</div> <div></div> <div>Operations Location Operations Connection</div>	<div>Organization Instantiation</div> <div></div> <div>Operations Role Operations Work</div>	<div>Timing Instantiation</div> <div></div> <div>Operations Cycle Operations Moment</div>	<div>Motivation Instantiation</div> <div></div> <div>Operations End Operations Means</div>	WORKERS AS PARTICIPANTS
	INVENTORY SETS	PROCESS TRANSFORMATIONS	NETWORK NODES	ORGANIZATION GROUPS	TIMING PERIODS	MOTIVATION REASONS	

# Initiative driven approach

## TOGAF (The Open Group Architecture Framework)

Enterprise architecture framework and methodology

First published in 1995, Dpt. Defense USA)

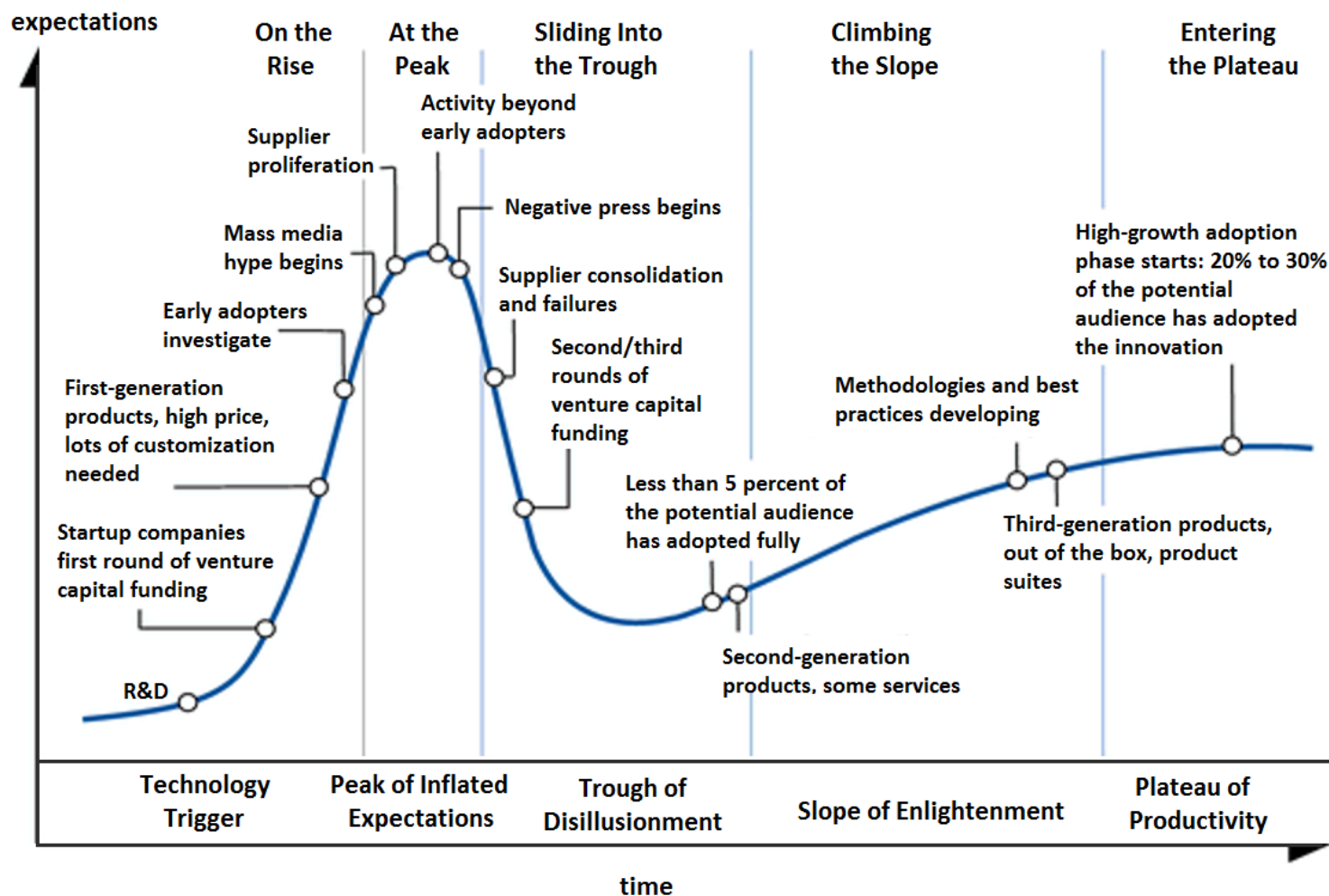


Source: Wikimedia commons



# Architecture hype cycle

Proposed by Gartner, first published in 1995



# Enterprise software

IT Software taxonomy

# Enterprise Software

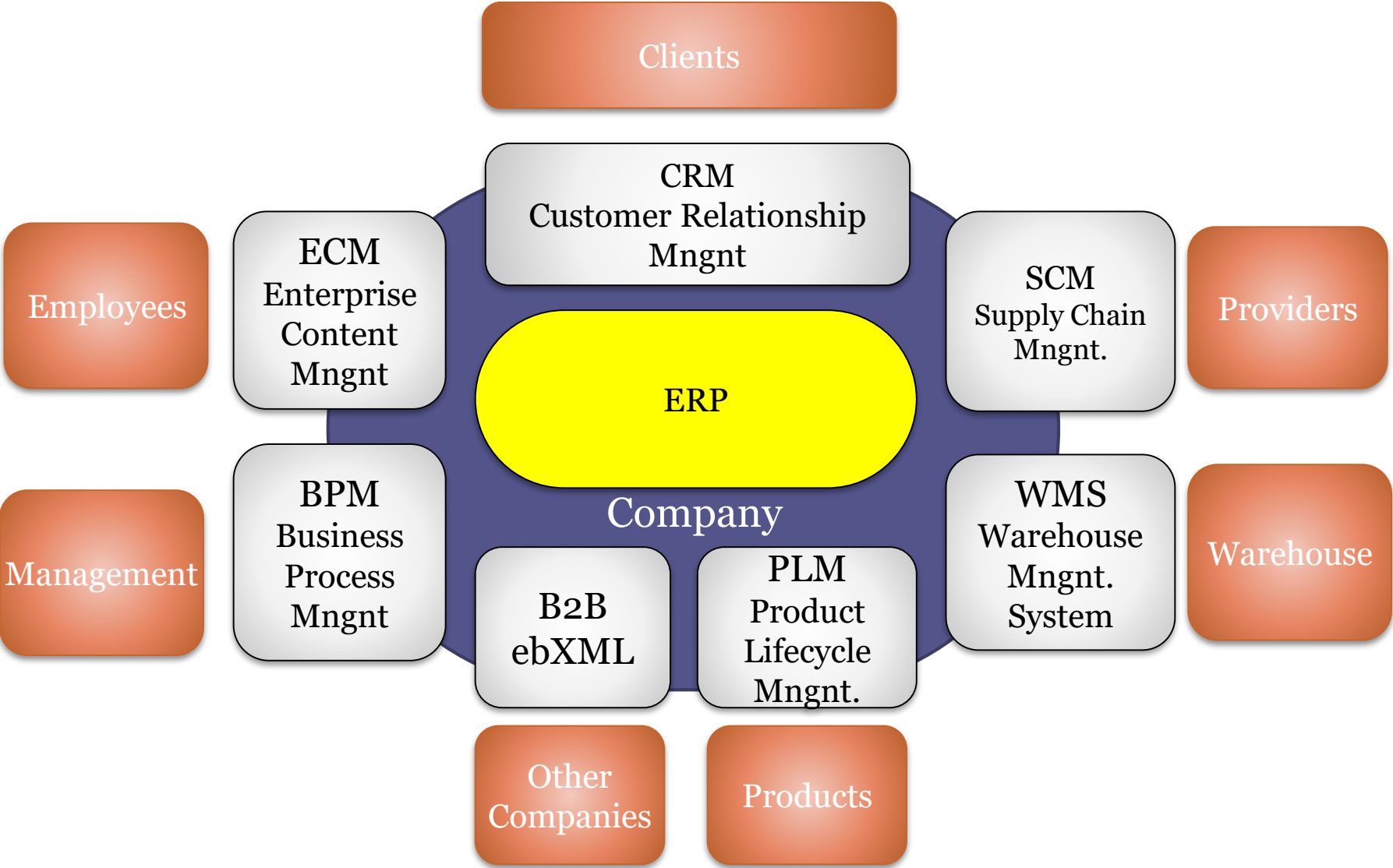
IT software taxonomy

System Classification:

CRM, ERP, SCM, ECM, PLM, EAI...



# Enterprise information systems



# ERP

## ERP (Enterprise Resource Planning)

Appeared at the end 90s

2000 year increased its adoption

Enterprise Technological Structure

Central data base

Real time access

Centralized management of production, logistics,  
inventory, accounting, billing...

# ERP

## Advantages

Performance and quality

Reuse established  
business best  
practices

Process continuity

Information uniformity

Concept of unique and  
single data

Continuous

technological update

Decision-making support

## Challenges

Complexity:

Customization, Deployment,  
Training, etc.

Involve people

Adapt existing processes

Overestimate software  
benefits

Too much dependency on  
some specific software

High costs to change to other  
software

Adapting existing processes  
to provided processes

# ERP

## Applications

### SAP R/3

3 layers client/server architecture

Based on a domain-specific language: ABAP

ABAP: Advanced Business Application Programming

SAP = biggest european software company

### Other systems:

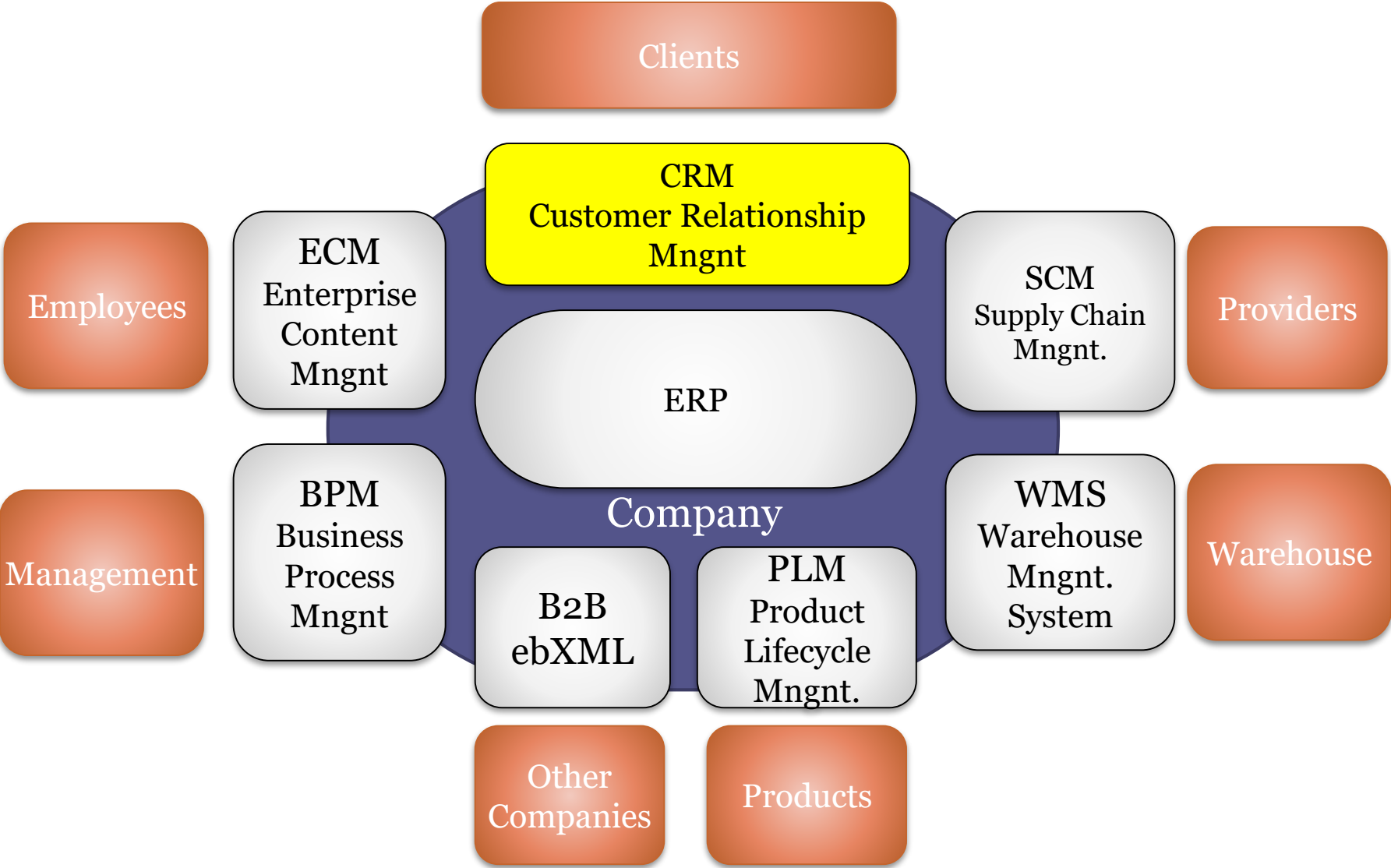
Comercial:

Oracle Fusion, Microsoft Dynamics NAV, SAGE, ...

Open source:

OpenERP, webERP, ...

# Enterprise information systems





# CRM - Customer Relationship Management

## CRM - Customer Relationship Management

Manage relationships between Company and clients

Client lifecycle

Acquisition - Improve - Retain

Manages interactions with current and future clients

Involves:

Sales

*Marketing*

Client service

*Call-centers*

Technical support



# CRM - Customer Relationship Management

## Advantages

Helps identify best clients

Adapt products to client needs

Anticipate needs

Keeps track of client's contacts

## Challenges

Client satisfaction

Labor cost reduction

Geographical and temporal diversity

Profile management and privacy

Social client and user communities

Combination with social networks (twitter, facebook,...)

Product reviews (Amazon, Booking,...)



# CRM - Customer Relationship Management

## Applications

Lots of CRM are integrated with ERP systems

SAP, Oracle, Microsoft CRM

Others:

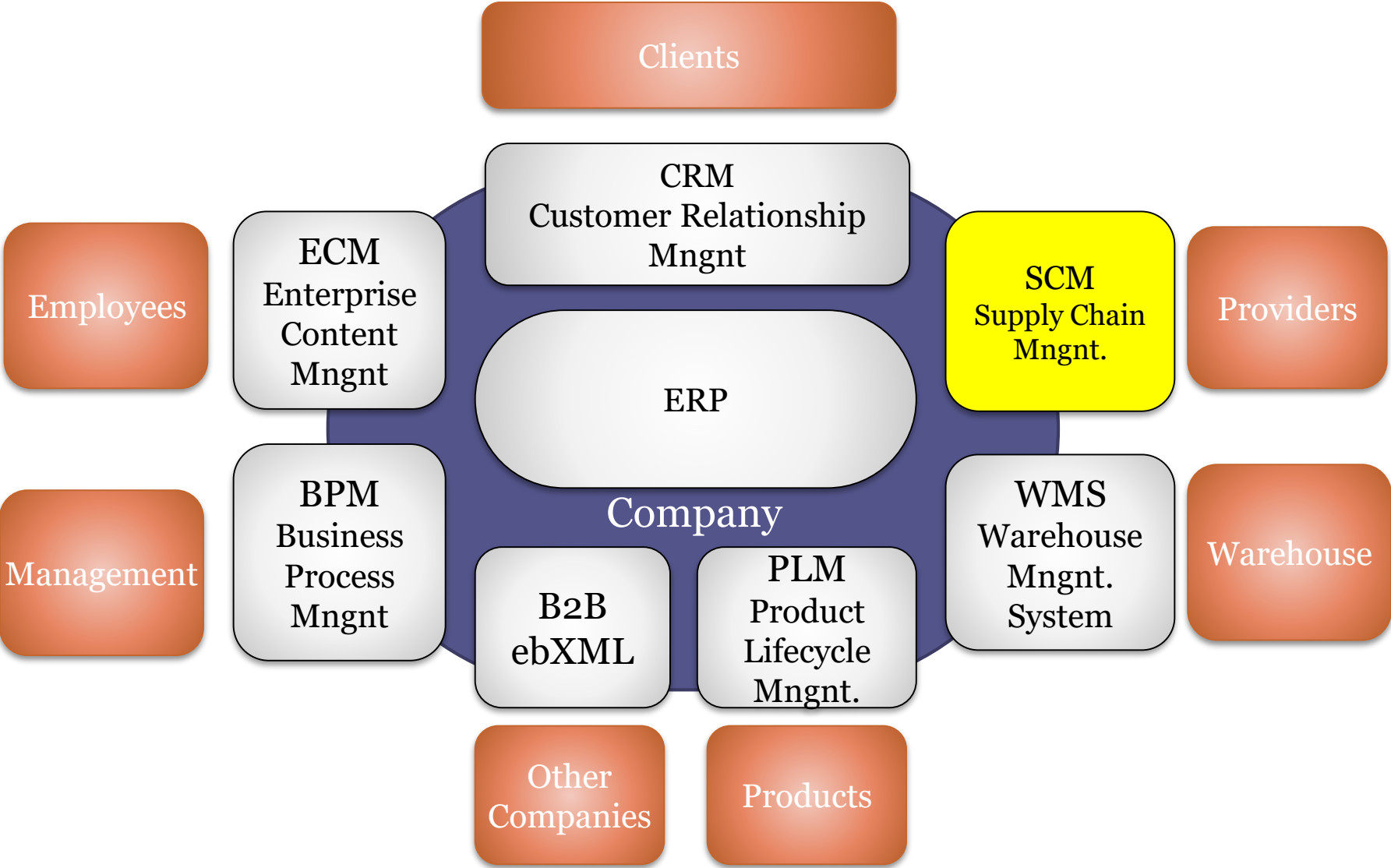
Salesforce.com

webCRM

...



# Enterprise information systems



# SCM - Supply Chain Management

## SCM - Supply Chain Management

Processing client requirements

Purchase orders management

Inventory management

Goods reception and storage

Supplies and stocks management



# SCM - Supply Chain Management

## Advantages

Forecast future demands

Inventory control

Improve business relationships

Feedback and state of each element in supply chain

## Challenges

Planning

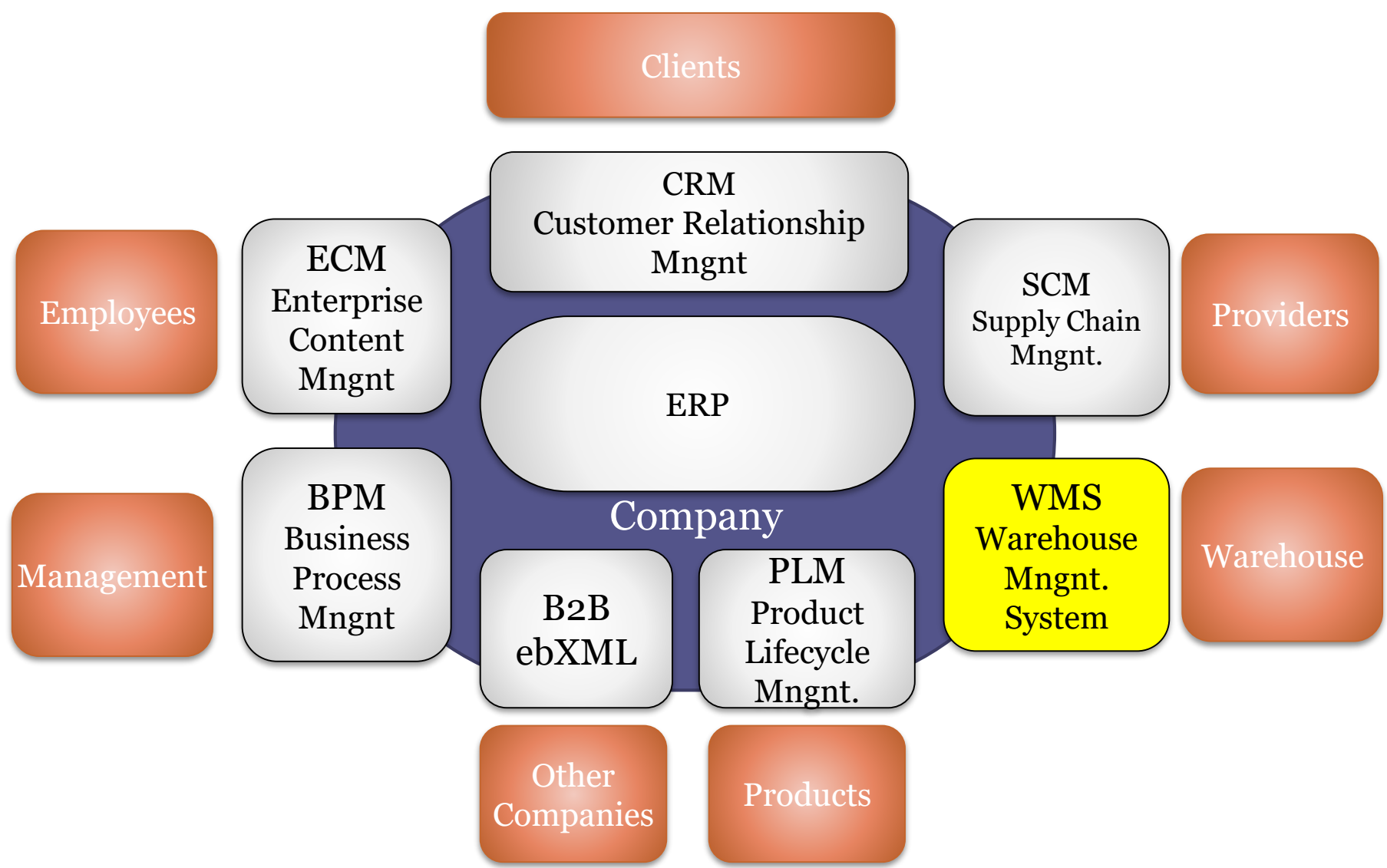
Lack of knowledge

Inaccurate forecasting demands

Lack of collaboration



# Enterprise information systems



# WMS - Warehouse Management Software

## Warehouse Management Software

Product control in warehouses

Technology for identifying products

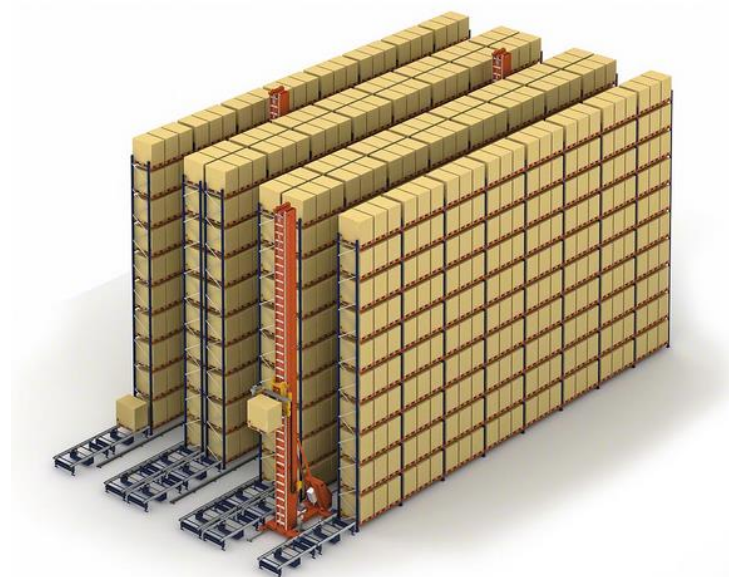
Picking, barcode scanners, RFID, etc.

Automated warehouses

Stacker cranes, *miniloads*

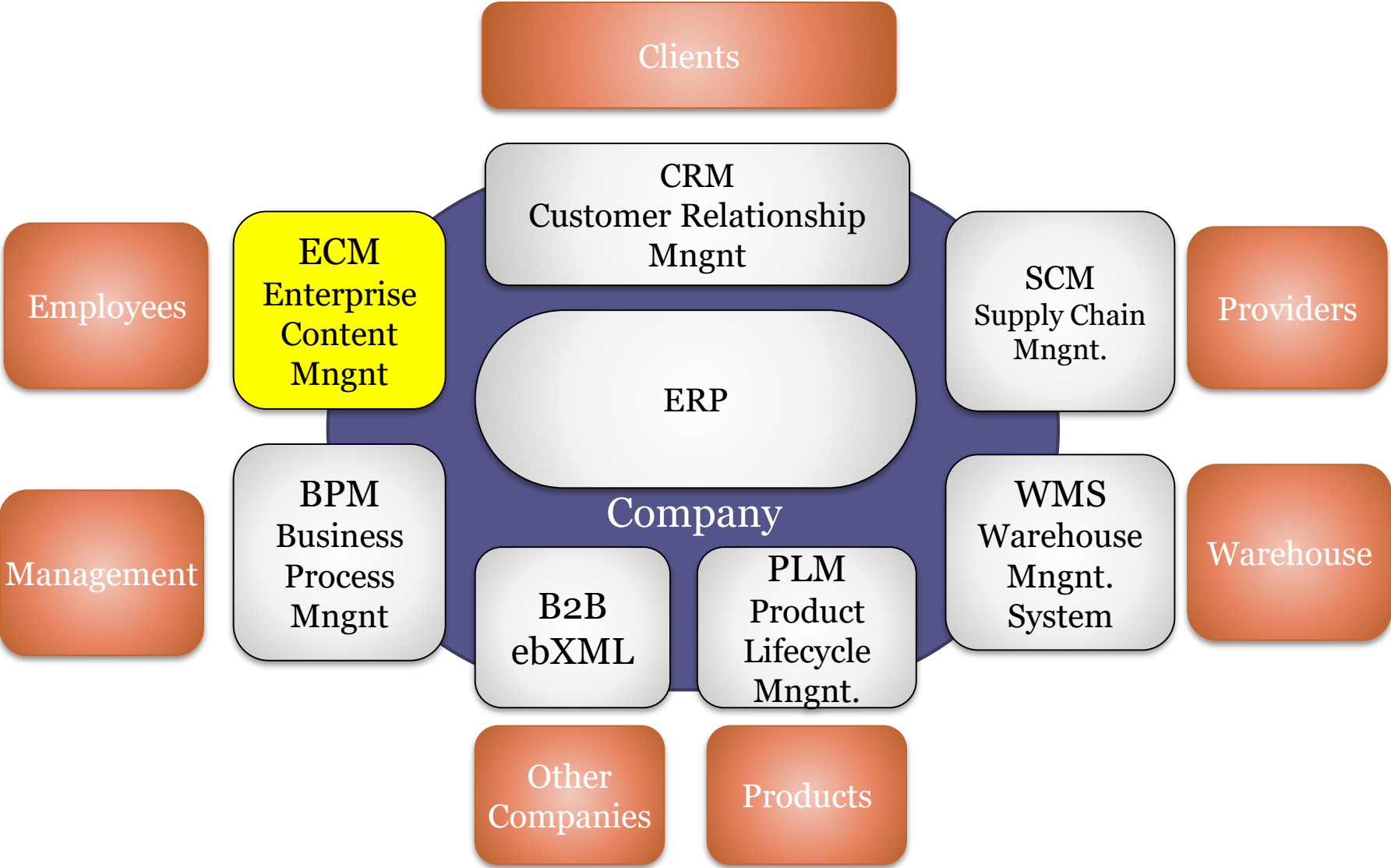
Examples:

Mecalux EasyWMS





# Enterprise information systems



# ECM - Enterprise Content Management

Goal: Paperless office

Became popular in 2006

# ECM - Enterprise Content Management

## Components

### Capture and recognition

Scan and obtain documents

Character recognition: OCR, HCR, etc.

### Management:

Document indexing

### Storage

Document management

### Maintenance

Security copies, archive, etc.

### Sending

Transformation and publishing

# ECM - Enterprise Content Management

## Systems

Microsoft Sharepoint

Oracle Content Management

EMC Documentum

## Open source

Alfresco

LogicaDOC

Plone

...

# ECM - Enterprise Content Management

## Knowledge Management

Combines unstructured information sources

## Groupware

Software for collaborative working groups

Example: Lotus Notes

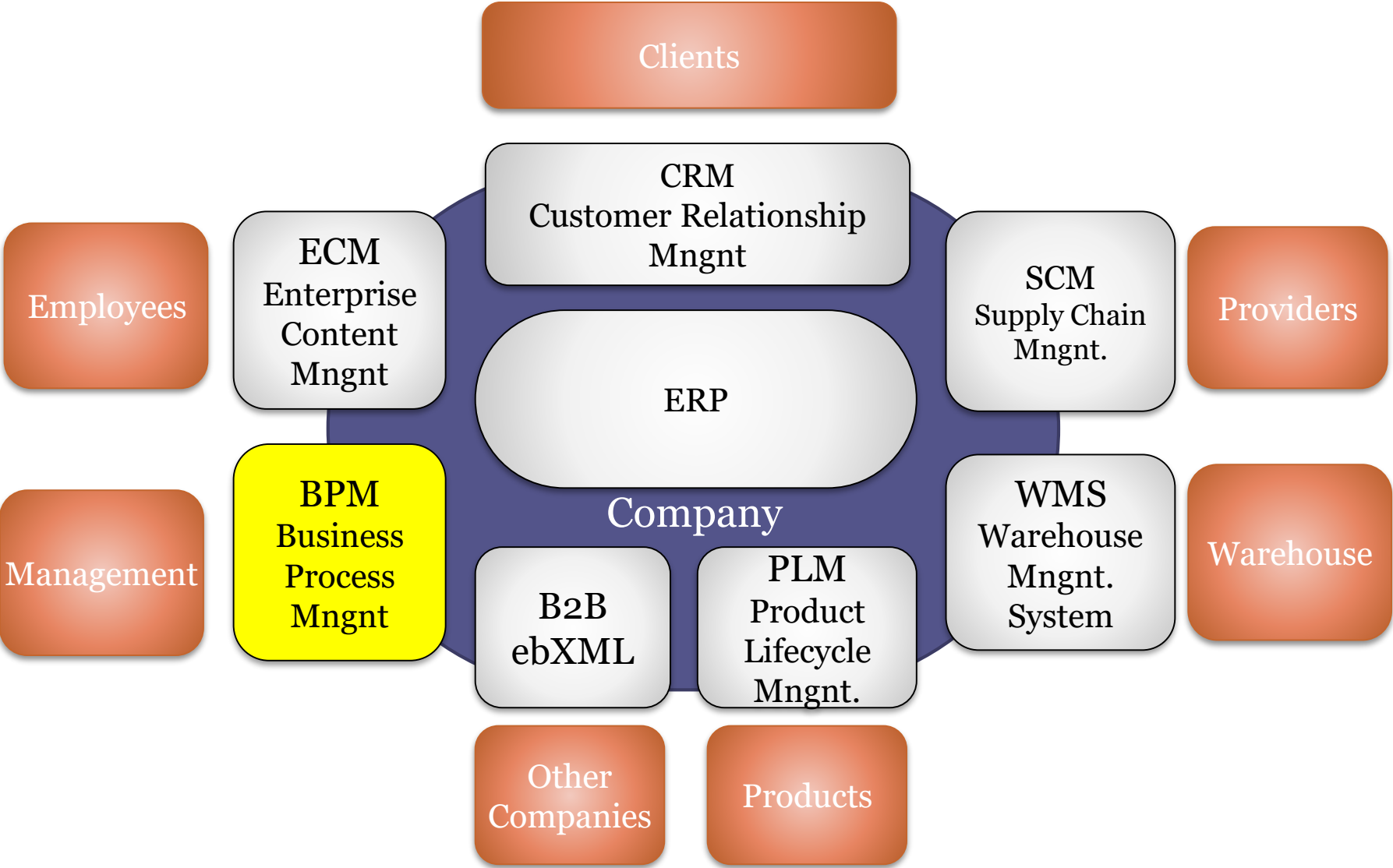
Enterprise Wikis

Example: Confluence

## Document manager

Examples: LogicalDOC, Ricoh

# Enterprise information systems



# BPM - Business Process Management

Business process:

Set of procedures or activities with a business goal

*Workflow:*

Business workflow automation

BPM:

Business process lifecycle management through workflows

# BPM - Business Process Management

Decision support systems

BI: Business Intelligence

Report creation

Data mining

Predictions and decision support



# BPM - Business Process Management

OLAP (Online Analytical Processing) tools

Multidimensional analysis (OLAP Cube)

Enables to do operations

Sums, averages, etc. over groups of data

Solutions:

Microsoft, Oracle Business Objects,...

# BPM - Business Process Management

Operational intelligence

Real-time monitoring

Balanced scorecard

Graphical visualizations of different metrics

Complex event processing

# BPM - Business Process Management

## Notations

### BPMN (*Business Process Model and Notation*)

Visual notation defined by OMG

Represents business processes

More oriented to business people

### BPEL (*Business Process Execution Language*)

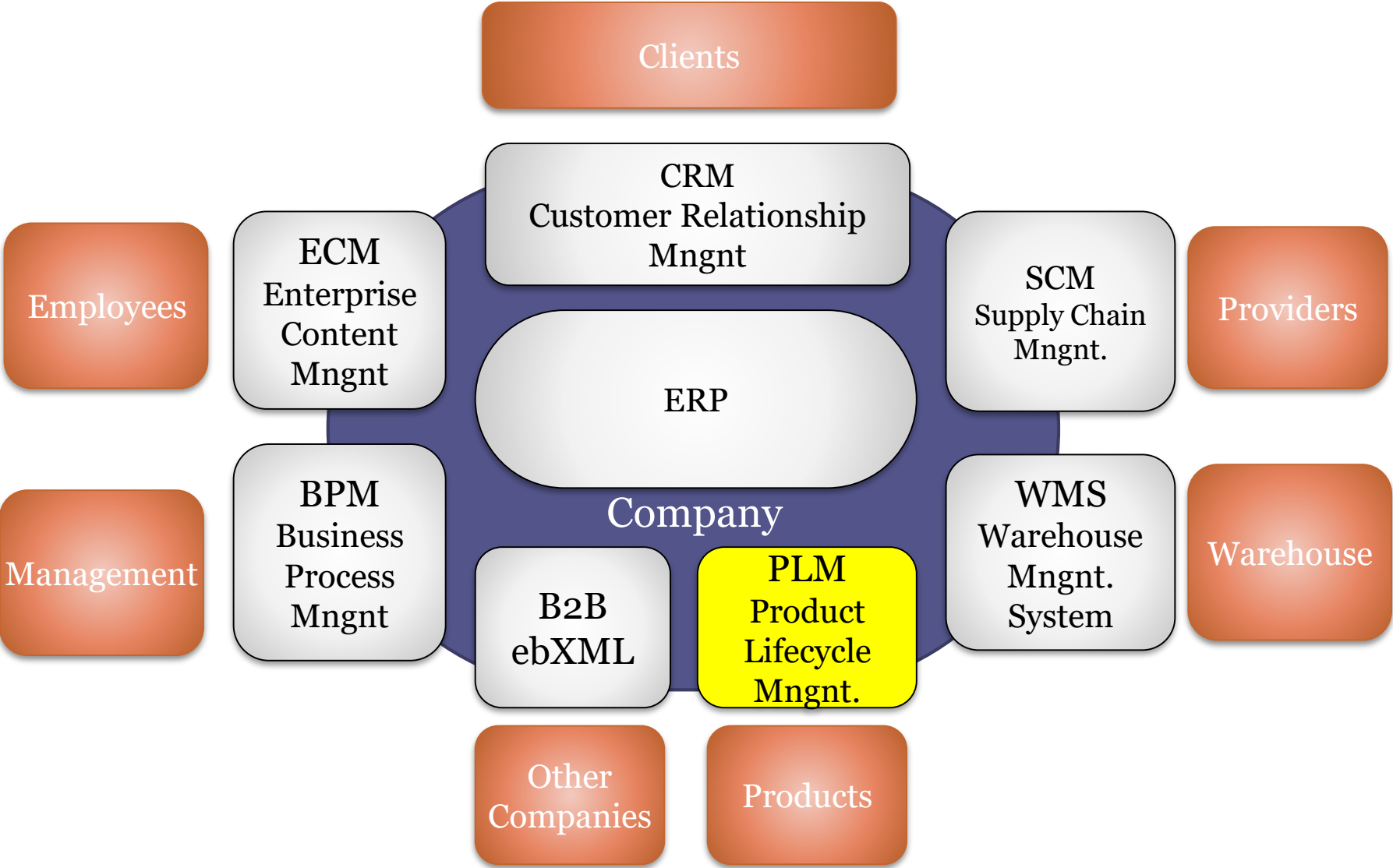
Defined by OASIS

Defines relationships between web services (orchestration)

Integration with WS-\* standards

More oriented to developers

# Enterprise information systems



# PLM - Product Lifecycle Management

Integral product lifecycle management  
Phases

Conceive

Design

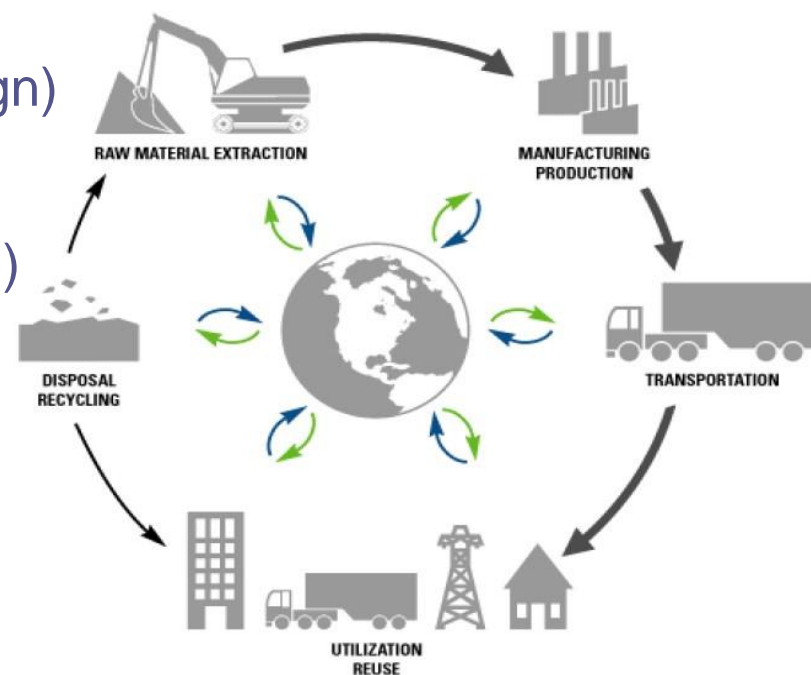
CAD tools (Computer Aided Design)

Realize

CAE (Computer Aided Engineering)

Service

Repair and maintenance



# PLM - Product Lifecycle Management

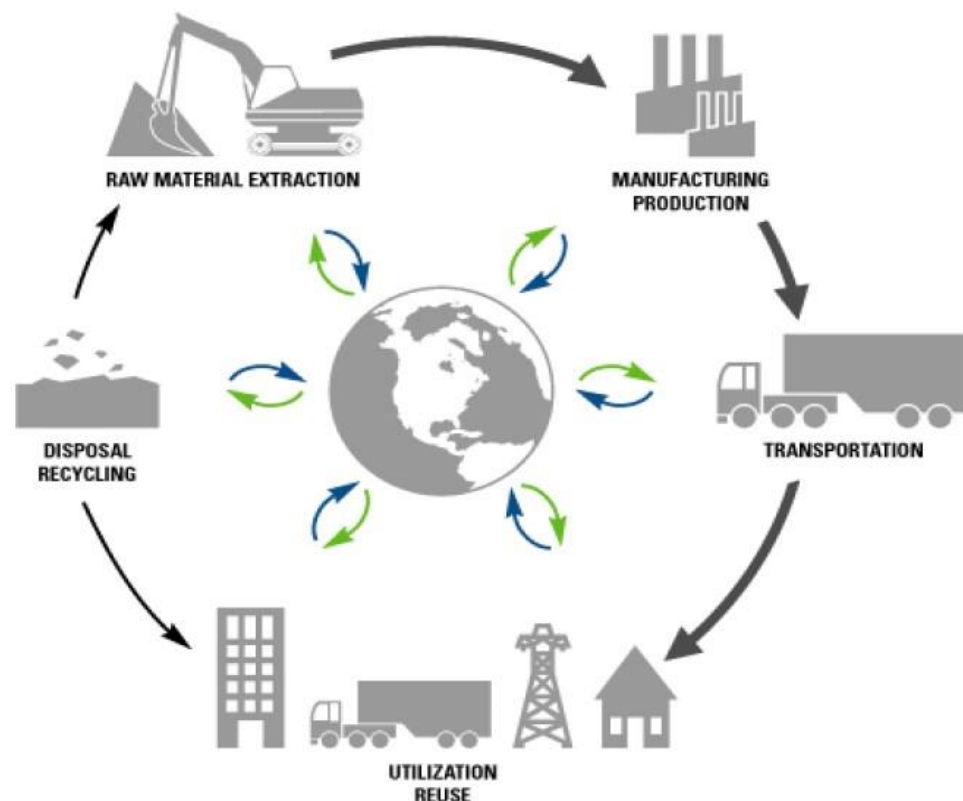
Solutions :

Siemens TeamCenter

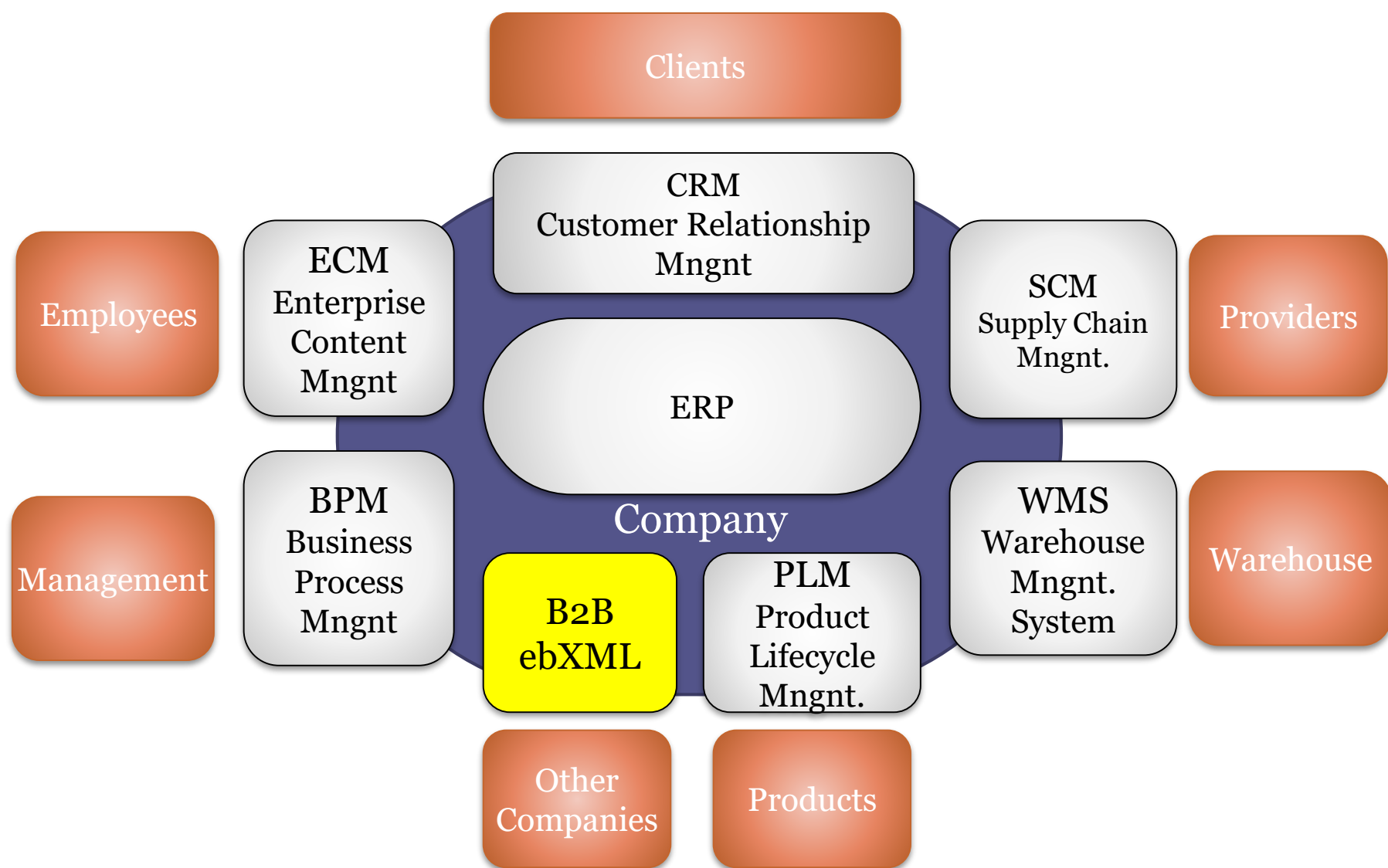
SAP PLM

Sopheon

...



# Sistemas información empresarial



# Relationship with external agents

Some common terms

B2B: Business-to-business

B2C: Business-to-consumer

C2C: Consumer-to-consumer

Most of e-commerce is B2B

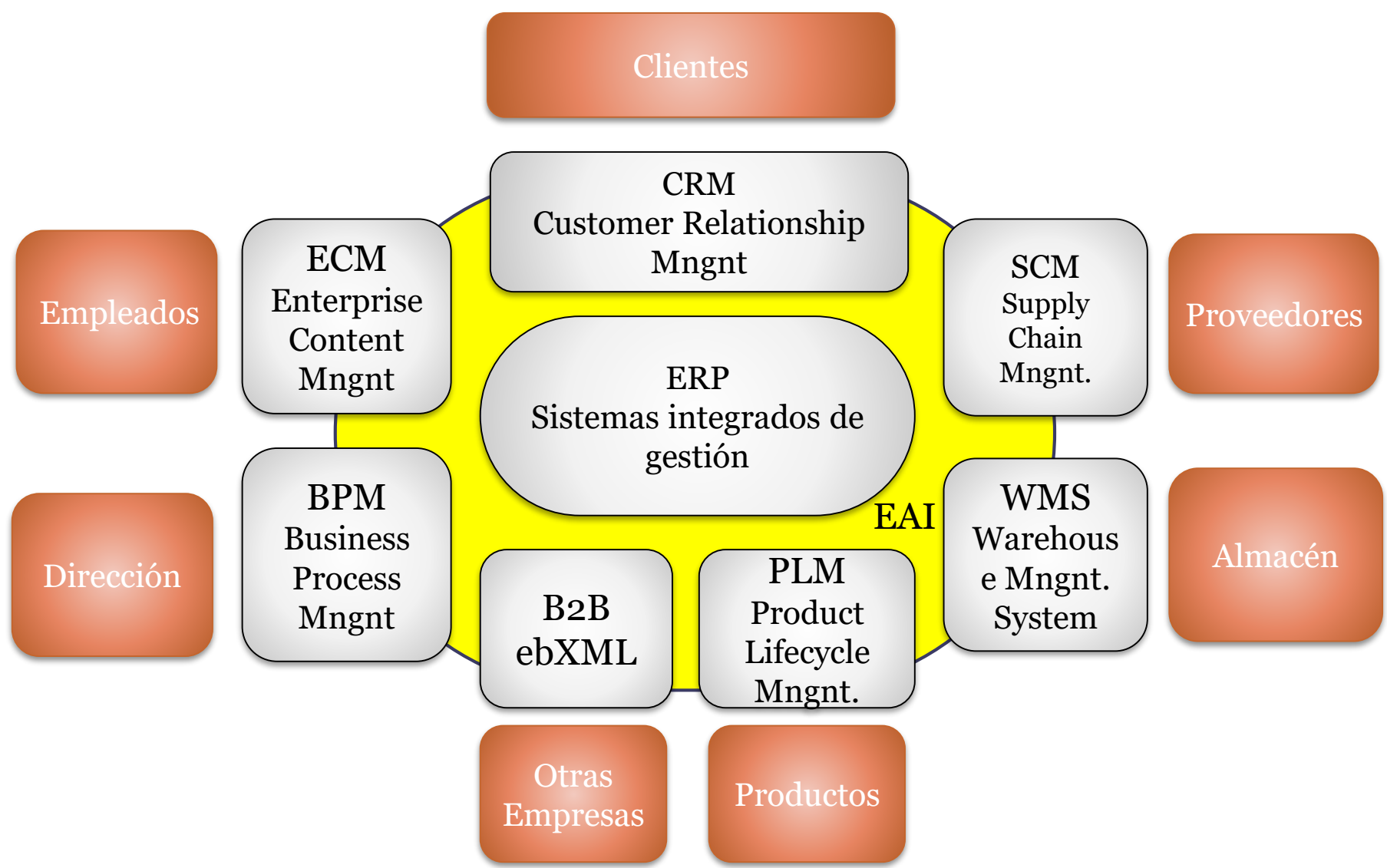
Information exchange standards:

EDI (Electronic Data Interchange)

ebXML: XML based technologies for e-commerce



# Enterprise information systems



# EAI

EAI: Enterprise Application Integration

Glue between different systems

See:

Integration patterns (previous lesson)

# Software product lines

# Software product lines

Product line: products that share a set of functionalities to satisfy some given market segment

## Goal:

- Reduce development effort

- Improve productivity

- Evolve from a single product to a product line

- Strategic reuse



# Software product lines

## Requirements

Identify generic solutions to common problems

Component based development

Generic Platforms

Software reuse

Generic architecture from which individual product architectures can be derived

Automatic system generation



# Software and enterprise services

# Towards services

Trend towards services

As a service family

Software as a service (SaaS)

Platform as a service (PaaS)

Infrastructure as a Service (IaaS)

Microservices

Service ecosystems

# Service level terminology

## Service Level Indicators (SLI)

Quantitative measure of some aspect of the level of service that is provided

Examples: error rate, system throughput, availability

## Service Level Objective (SLO)

A target value or range of values for a service level that is measured by an SLI

Example: average search request latency should be less than 100 milliseconds

## Service Level Agreement (SLA)

An explicit or implicit contract with your users that includes consequences of meeting (or missing) the SLOs they contain.



# Service governance

Release management and deployment

Reliability and security

API management

Dependencies

Monitoring

Production support

Incidence response

On-call rotations

Cost model

Client onboarding

Documentation

Disaster recovery

Recommended books (free)  
Site Reliability Engineering  
<https://landing.google.com/sre/>

# Evolutionary architectures

Support incremental, guided change as a first principle

Main quality attribute: evolvability

Adoption of fitness function



# End of presentation