

CS 565

Business Process Management Systems

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COURSE OVERVIEW

- **Teaching hours:** Tuesday, Thursday 12:00-2:00 (room H206)
- **Tutorial hours:** TBA
- **Office Hours:** Tuesday, after lesson, or by appointment
- **Web site:** <http://www.csd.uoc.gr/~hy565>
- **Mailing list:** hy565-list@csd.uoc.gr
- Registering for the mailing list
 - send email to majordomo@csd.uoc.gr
 - subject empty; message body: subscribe hy565-list
 - you shall receive mailing list messages to the email account from which you sent the message
 - use it for posting questions
 - all course announcements will be posted on the mailing list

COURSE OVERVIEW

- **Prerequisite knowledge:** Database management systems CS360 - (formal prerequisite)
 - You're also expected to be familiar with operating system concepts, and have extensive programming experience
- **Coursework:**
 - **2 mandatory** assignments
 - An individual assignment on Petri-Nets (15%)
 - An individual business process modelling assignment (35%)
 - A **mandatory** survey report on course-related topics
 - Presentation in the class - oral examination (10%)
 - Written reports (survey papers) (40%)
- **Teaching Assistants:** Nikos Fanourakis (nikosfan@csd.uoc.gr)
- TA office hours will be announced during the term as required for the assignments

TIMELINE

- ~12 lectures until middle April (3 assisting lectures)
- 2 assignments
 - Assignment on Petri Nets (middle March – 2 weeks deadline)
 - Assignment on BP modelling (middle April – 4 weeks deadline)
- 1 project
 - Students' presentations (mainly group of 2) on course-related topics (starting after Easter vacations).
 - Reports - survey paper on the presentation topic (deadline beginning of June).

COURSE OVERVIEW

■ **Course Topics:**

- Business Processes (basic concepts, BP modeling)
- Design, analysis and verification methods
- Workflow systems organization and architecture
- Synchronization, control, communication, monitoring of process enactment
- Workflow analysis
- Workflow patterns
- Service-Oriented Computing
- Web-service technologies
- Service lifecycle management
- Cloud application Technologies
- Business Process as a Service (BPaaS)

BUSINESS PROCESSES

- A **business process** is a chain of activities involved in delivering a product or service to a customer
 - this chain of activities is not restricted to be **within** an organization; it may **span across** organizations
- **Business process design**
 - a knowledge-intensive human activity supported by **modeling, analysis** and **simulation** software tools
 - closely tied with business policy, enterprise organization, culture, etc.

EXAMPLES OF BUSINESS PROCESSES

- **Manufacturing** – a product assembly process, a quality assurance process, a corrective/preventive maintenance process.
- **Health** – a medical assessment, a drug approval
- **Banking** – bank transfer, credit check
- **Travel** – trip booking
- **Human resources** – a starters process, a leavers process, vacation request
- **Public sector** – application for a government service
- **Social events** – organize festival
- **Personal activities**: plan a trip, apply for job, university enrollment, make coffee...

BUSINESS PROCESS INSTANCES

- **Business process instances** are created for delivering a particular service
- **Process** indicates simply how things should be done.
- **Instance**, a live execution of process workflow to achieve a certain goal.
 - Involves **allocation of resources**, target **start and completion times**
 - Integrates **planning** and **scheduling** techniques
 - Thinking technically, objects are the basis of object oriented programming. When an **object (process instance)** of a class (**business process**) is created, the class is said to be instantiated. All the instances share the attributes and the behavior of the class.

BUSINESS PROCESSES

- **Technical challenges** arise because organizations are distributed systems that execute many process instances concurrently in an uncertain environment that includes human intervention and decision making
 - furthermore, **failures** and **exceptions** occur frequently and **replanning** must be integrated with execution.
- Need **automated tools** that not only **instantiate process templates**, but also have the ability to **generate dynamically executable process templates**

BUSINESS PROCESS VS WORKFLOW

- A (core) **business process** is the **end-end chain of activities** involved in delivering a product or service to a customer (internal or external)
 - “**end-end**” means the following:
 - a business process starts with an initial **contract** with the customer
 - runs through to completion of the contract
 - can be viewed as a **closed loop**: a customer’s satisfaction with a service influences requirements for future services
- Core business processes are usually **transactional & development processes** (purchasing, manufacturing, marketing, sales)

BUSINESS PROCESS VS WORKFLOW

- Business Processes are basically **collection of activities** cutting across **various departments**, producing a valuable output for the customers (e.g. Sales Process, Procurement Process).
- **Workflow** is used to **automate these repetitive activities** and hence business processes. So workflow will bring automation and efficiency to the business process.
- A **Business Process** is related to any kind of activity (manual, automated) which realizes a **business objective**.
- A **Workflow** is an (partial) **automation** of a **Business Process**.

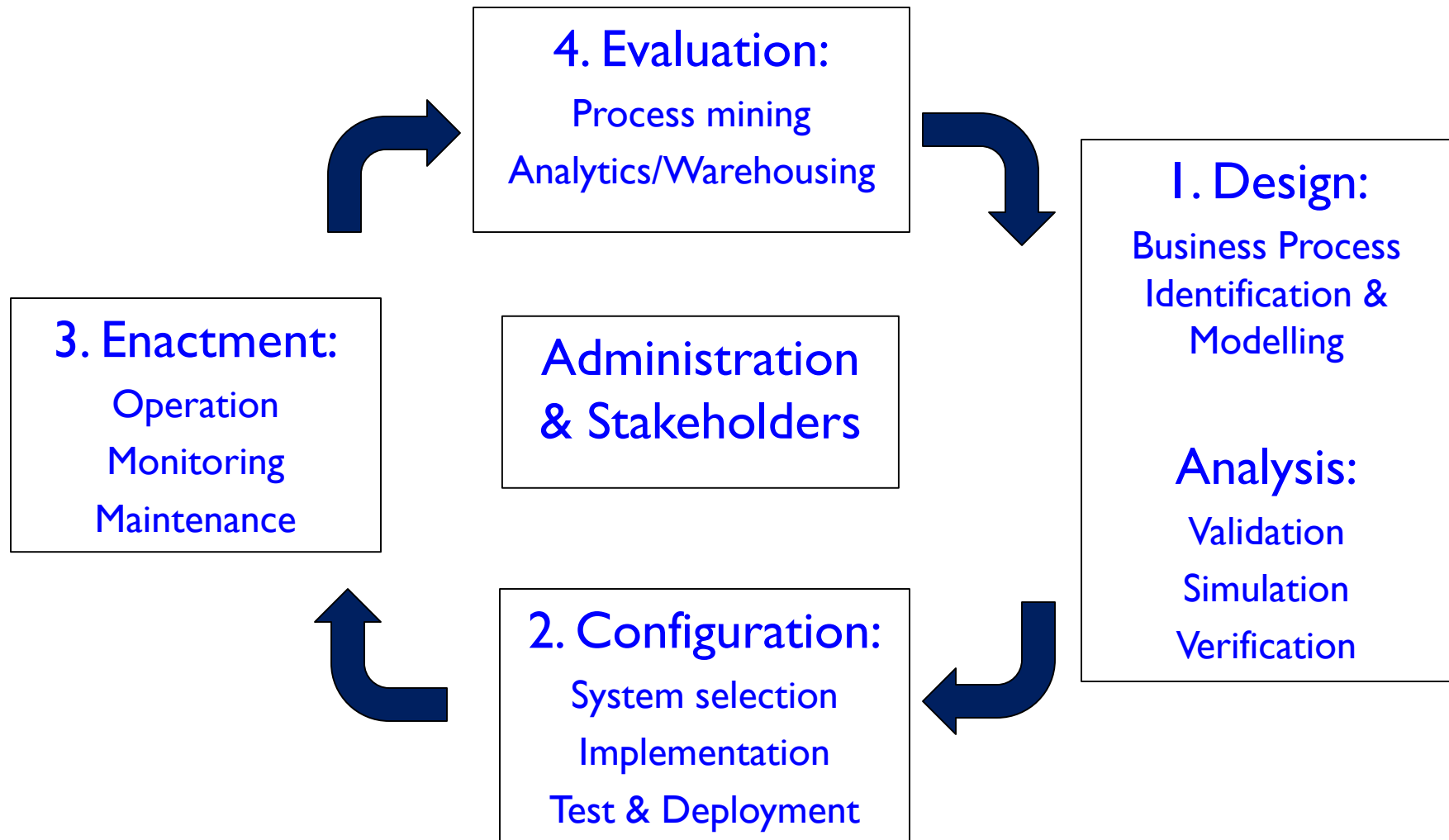
BUSINESS PROCESS MANAGEMENT SYSTEM

- Created through joining distinct pieces, such as **Business Rule Engines, Business Process Modelling, Business Monitoring & Human Workflow**
- Subsumes functionality of a **Workflow Management System** by also supporting process-specific aspects, such as simulation, BP modelling, BP intelligence
- Comprise:
 - **Process Engine** (platform to model & execute BPs)
 - **Business Analytics** (reports & dashboards)
 - **Content management** (system to store & secure BP content)
 - **Collaboration tools** (intra- & interdepartmental tools, including discussion forums, dynamic workspaces & message boards)

WORKFLOW MANAGEMENT SYSTEMS

- Automate the **coordination of activities** and the **transfer of documents / information / control** within a business process
- Follow pre-defined **rules** (**process or workflow definition**) for delivering work to the appropriate software component or human worker / team
- Such considerations must be **built into the process definition** or else handled by the resources themselves
- Specification of such low-level process or workflow definition is a human design activity assisted by software tools specific to the WFMS.

BUSINESS PROCESS LIFECYCLE



BUSINESS PROCESS MANAGEMENT – MAIN STEPS

BPM

1

Design

Break the process down into multiple tasks.

2

Model

Model it using suitable BPM software.

3

Execute

Execute the process, or put a system in place.

4

Monitor

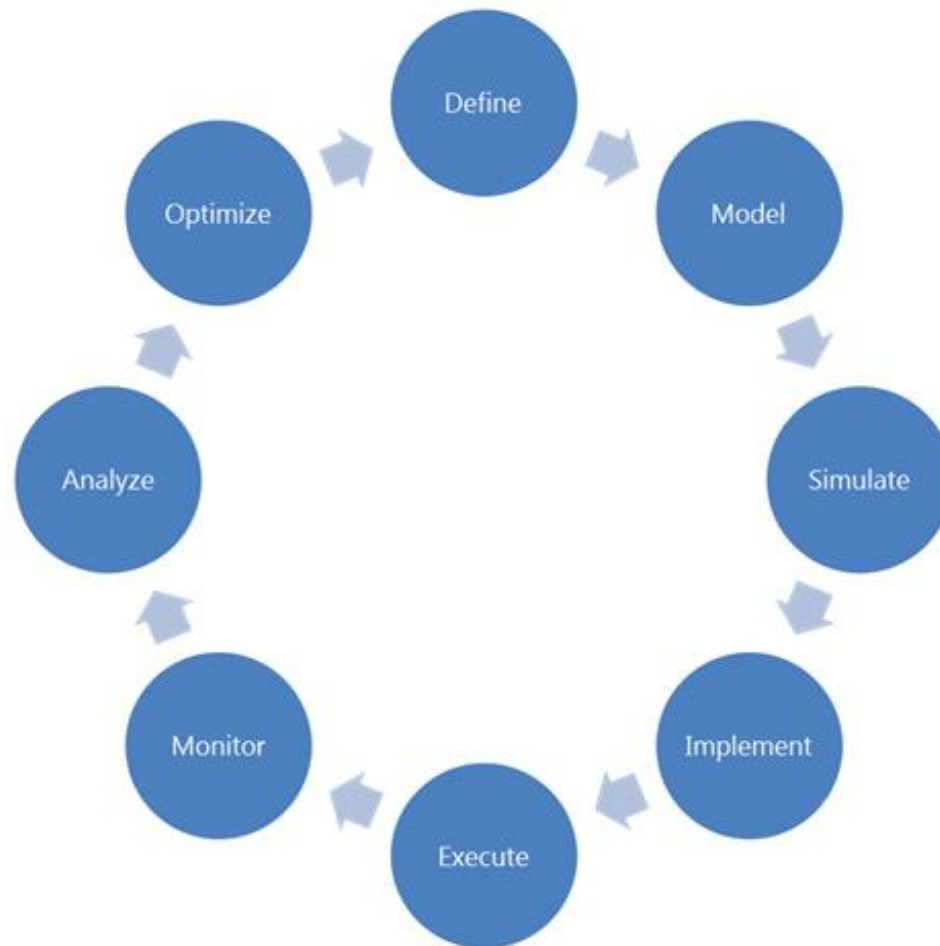
Monitor and analyze the system.

5

Optimize

Make changes to the process to improve it

GARTNER'S BPM LIFECYCLE



PROCESS MODELLING

- What are the main business processes in an organization? how to describe them? (text, excel sheets, figures, ...)
- One must define, for each basic product or service the organization offers, the **activities involved**, the **relationships** among them, their **resource requirements** etc.
- Human activity supported by **specific software** to record the process model, run simulations, etc.
- **Design decisions** are usually made based on **experience** and analogy to previous designs, depending on the **nature of business**, its **goals**, **standards**, **legacy**, **infrastructure** etc.

PROCESS MODELLING

- **Validation** can be supported:
 - through **workshops** - checking that model captures all possible instances
 - **Simulation** - reveal model deficits, wrong behaviour
- **Verification** is used to check for the satisfaction of particular properties (e.g., deadlocks)

VALIDATION VS VERIFICATION

Criteria	Verification	Validation
<i>Definition</i>	The process of evaluating work-products (not the actual final product) of a development phase to determine whether they meet the specified requirements for that phase.	The process of evaluating software during or at the end of the development process to determine whether it satisfies specified business requirements.
<i>Objective</i>	To ensure that the product is being built according to the requirements and design specifications. In other words, to ensure that work products meet their specified requirements.	To ensure that the product actually meets the user's needs, and that the specifications were correct in the first place. In other words, to demonstrate that the product fulfills its intended use when placed in its intended environment.
<i>Question</i>	Are we building the product <i>right</i> ?	Are we building the <i>right</i> product?
<i>Evaluation Items</i>	Plans, Requirement Specs, Design Specs, Code, Test Cases	The actual product/software.
<i>Activities</i>	<ul style="list-style-type: none">•Reviews•Walkthroughs•Inspections	<ul style="list-style-type: none">•Testing

Source: <http://softwaretestingfundamentals.com/>

PROCESS CONFIGURATION

- Different ways can be exploited to implement a business process:
 - a set of policies and procedures with no support from a business process management system
 - Through a selection of an implementation platform:
 - Technical information is completed for the proper enactment of the process by the business process management system:
 - Interaction of the employees with the system
 - Integration of existing software systems (incl. legacy ones)
- Need for supporting transactional properties at the process and activity level

PROCESS CONFIGURATION

- Implementation then needs to be **tested** to detect potential runtime problems
 - **Integration** & **performance** tests
- Finally, the business process system is **deployed** in the target environment
- Additional steps might be required, such as:
 - **Training** of personnel
 - **Migration** of process data to the realization environment

PROCESS ENACTMENT

- Process **instances** are enacted according to the organisation goals
 - Initiation usually follows a defined **event**
- Execution is **distributed** with different **resources**, **programs** or **people** carrying out the involved activities
- Usually an **orchestration of process activities** is carried out through the use of a **process execution engine**

PROCESS ENACTMENT

- Activities have to be **coordinated** to ensure **correct sequencing** and that **compatible variants** of the activities are performed
- **Coordination** takes place via **mechanisms** such as events, message passing, document transfer etc.
- A **WFMS** uses information contained in a low-level process plan definition to **route work items to appropriate resources** and **provide the necessary coordination signals**
- Resources will be involved in **enacting multiple processes** and **instances of the same process** in a time-sharing manner

PROCESS ENACTMENT

- Resources are encapsulated in components which view the processes in which they participate as a queue of work items waiting to be acted upon
- Depending on how the system is organized, a component may simply work on the next task whose preconditions are satisfied or consider prioritization rules if such exist
- Processes may interfere with each other due to the capacity of shared resources.

PROCESS MONITORING & ADAPTATION

- Process **monitoring** provides accurate information (e.g., notification about completed tasks, delays, interrupts) on the **status** of process instances (the state in particular) & statistics on process performance
- **Log data** in the form of an ordered sets of log entries are also kept in a log file storing information about events occurring during process execution
- Such information is fed to a **managing process** that compares progress with the concrete process plan
- Minor differences may simply require **updating process configuration** (e.g., by shifting tasks)
- These **changes** need to be **propagated** to the resources executing the plan.

PROCESS MONITORING & ADAPTATION

- **Process adaptation** may require the planned activities to be **altered** during execution
 - this may include **backtracking**
 - or even **undoing or redoing effects** of previous activities and **regenerating** the plan

PROCESS EVALUATION

- Evaluation of execution logs through process mining & analytics.
 - Quality of business process models
 - Adequacy of execution environment
- In some cases, the business process itself will need to be updated (process evolution)
 - Changes at runtime seem to become permanent
 - Exist indications that the design needs to be improved

MAIN BP STAKEHOLDERS

- **Process participants** – domain experts
- **Process owners** – domain experts, management, business background
- **BPM consultants** – Process experts
- **Software architects and developers** – IT experts implementation
- All these people from different backgrounds, they speak **different languages**

SUMMARY

- A **process** is a **collection of activities** related to a specific commitment for providing a product or service
 - **Example:** each damage claim represents a single instance of the process of damage claim handling
- An **organizational process** is a collection of activities related to a **specific commitment**, adding value to a product / service of an organization
 - **Example:** processing damage claims in an insurance company
- A **workflow process** is an automated organization process
 - **Example:** processing damage claims “orchestrated” by a **workflow management system**

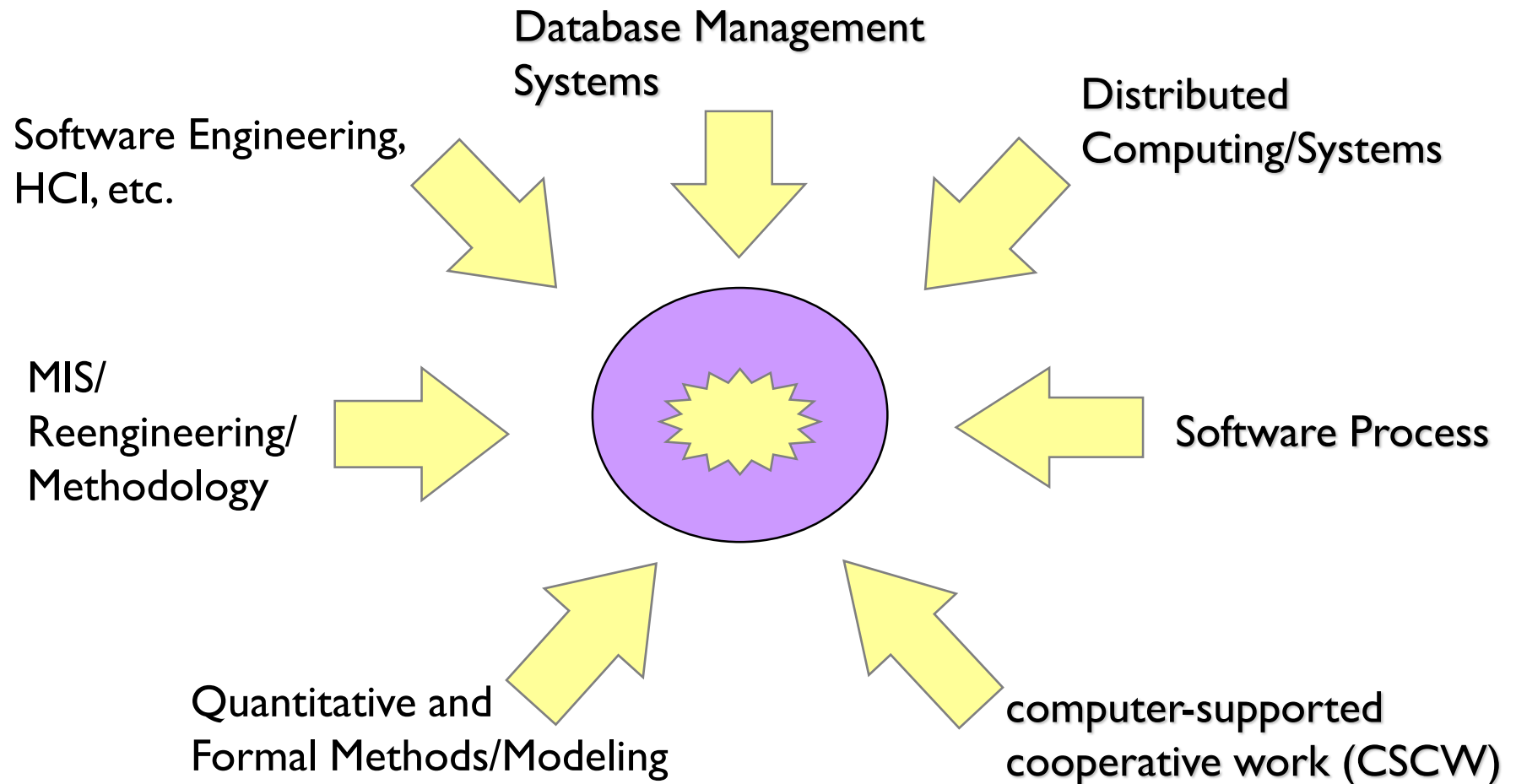
SUMMARY

- **Workflow management** is the automated **coordination, control** and **communication** of work, both of people and computers, in the context of **organizational processes**, through the execution of software in a **network** of computers whose order of execution is controlled by a computerized **representation** of the business processes
- **Workflow management system**: “a system that defines, creates and manages the execution of workflows through the use of software, running on one or more workflow engines, which is able to interpret the process definition, interact with workflow participants and, where required, invoke IT tools and applications”
[WFM Coalition]

LIST OF NOTABLE WFMS

- Activiti
- Apache ODE
- Apache Taverna
- Bizagi
- Bonita BPM
- Camunda BPM
- Collective Knowledge
- IBM BPM
- SAP Business Workflow
- Signavio Workflow Accelerator
- YAWL

SUMMARY



RECOMMENDED READING

- **Mathias Weske. Business Process Management – Concepts, Languages, Architecture. Springer-Verlag, 2007.**
- J.Vom Brocke and M. Rosemann. Handbook on Business Process Management I – Introduction, Methods, and Information Systems. Springer-Verlag, 2010.
- M. Ould. Business Processes – Modelling and Analysis for Re-Engineering and Improvement. Wiley, 1995
- Wil M. P. van der Aalst. Business Process Management – A Comprehensive Survey. Hindawi Publishing Corporation, 2013.
- Mustafa Jarrar: Lecture Notes on Introduction to Business Process Management, Birzeit University, Palestine, 2015
- https://en.wikipedia.org/wiki/Workflow_management_system
- <https://www.youtube.com/watch?v=NXbGlilFidA>
- <https://www.youtube.com/watch?v=04hnuyZWhAA>
- <https://www.youtube.com/watch?v=3KJjKY8k9Lk>.