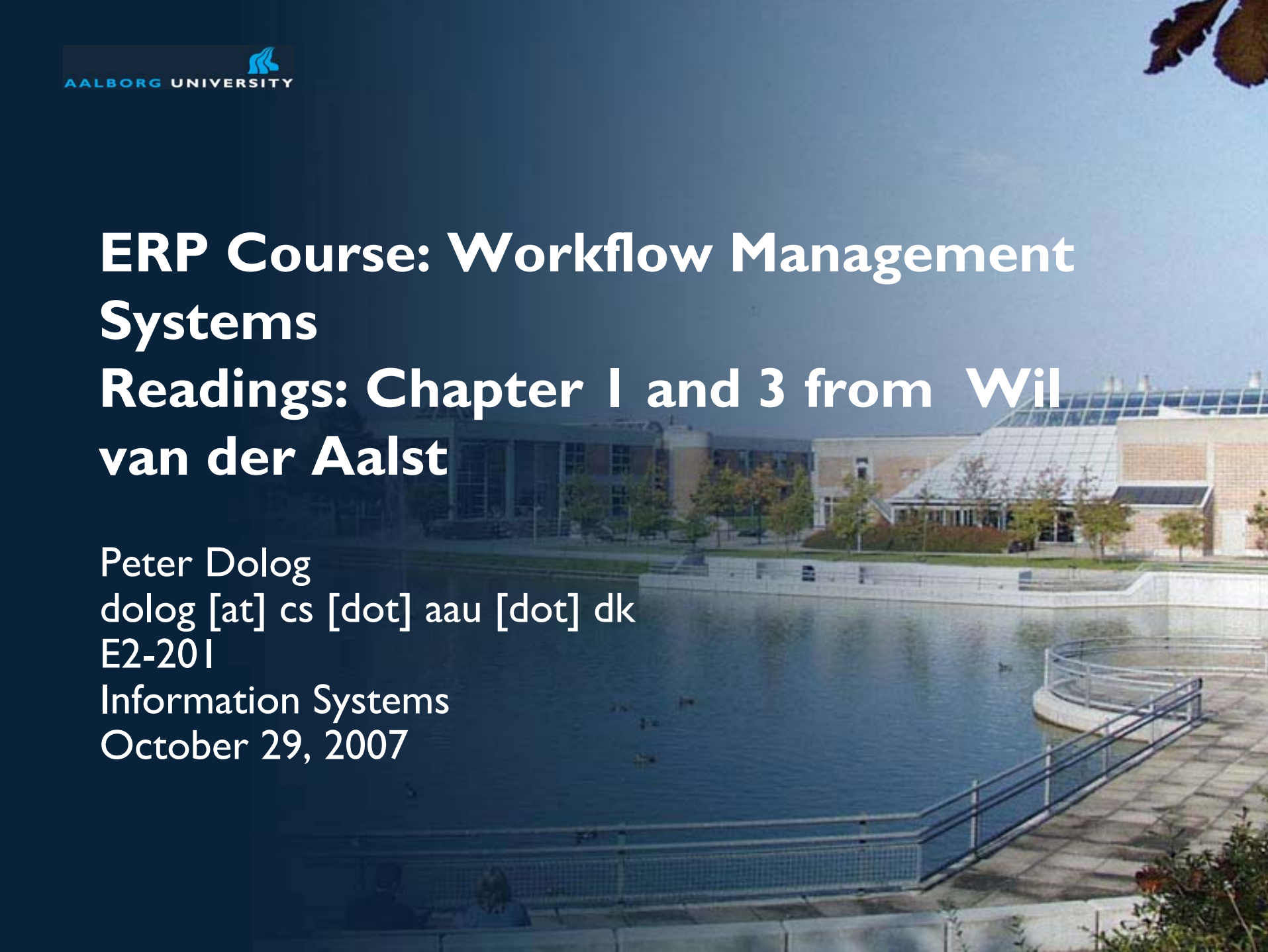


ERP Course: Workflow Management Systems

Readings: Chapter 1 and 3 from Wil van der Aalst

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Information Systems
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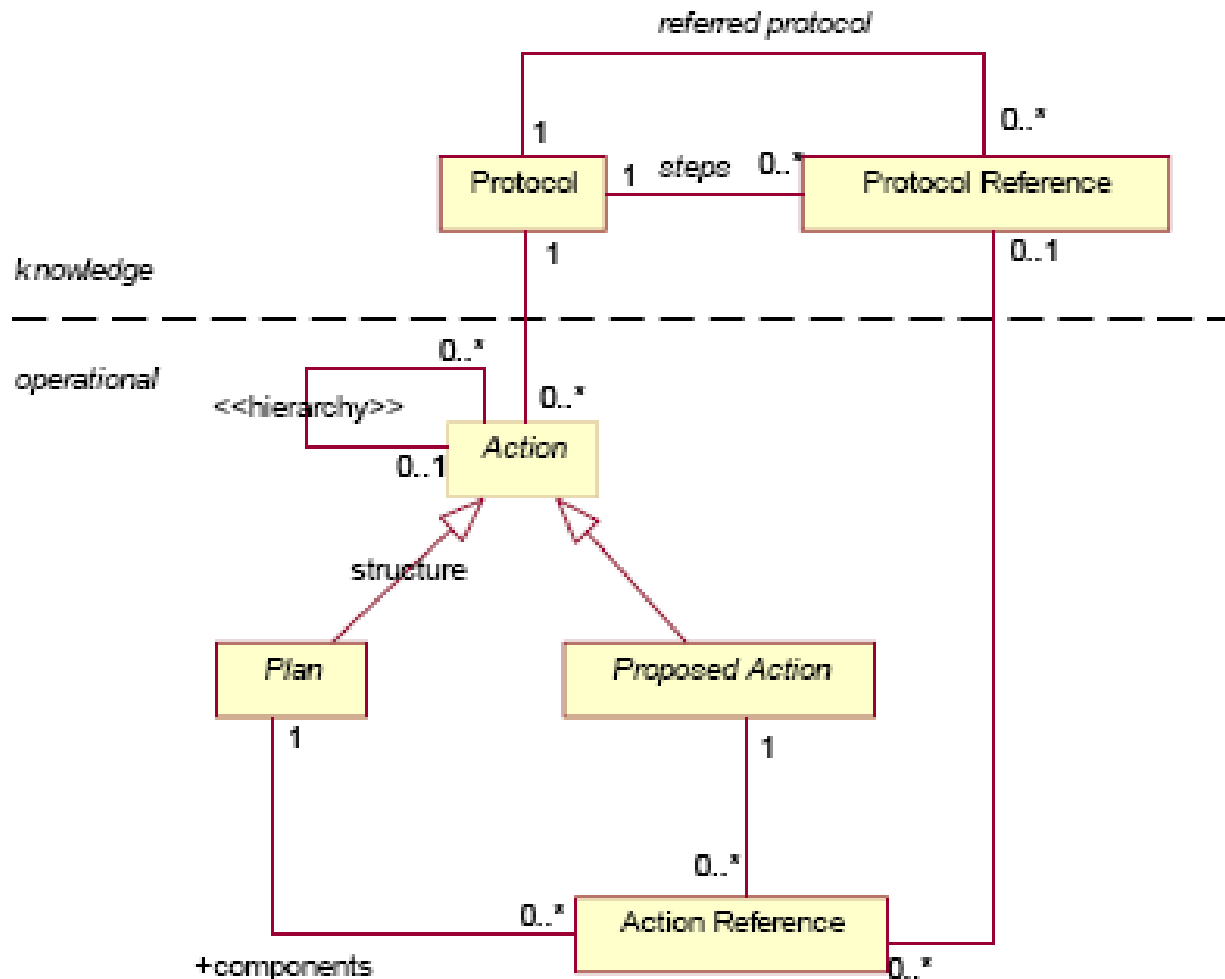


Workflow Management Systems

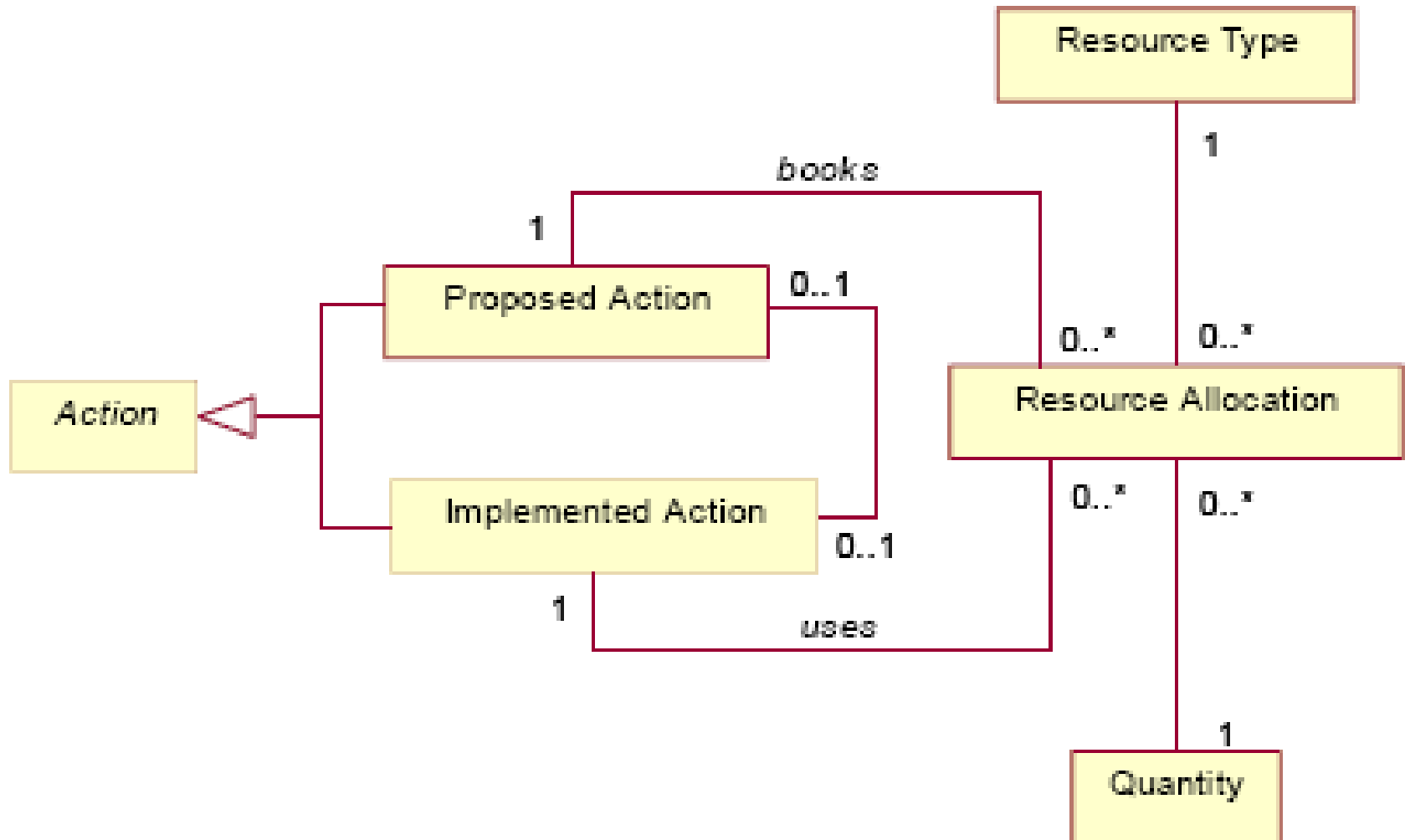
A workflow management system (WFMS) is a software package that can be used to support the definition, management and execution of workflow processes.

A workflow system (WFS) is a system based on a WFMS that supports a specific set of business processes through the execution of computerized process definitions

Analysis Patterns - Planning



Analysis Patterns – Resource Allocation



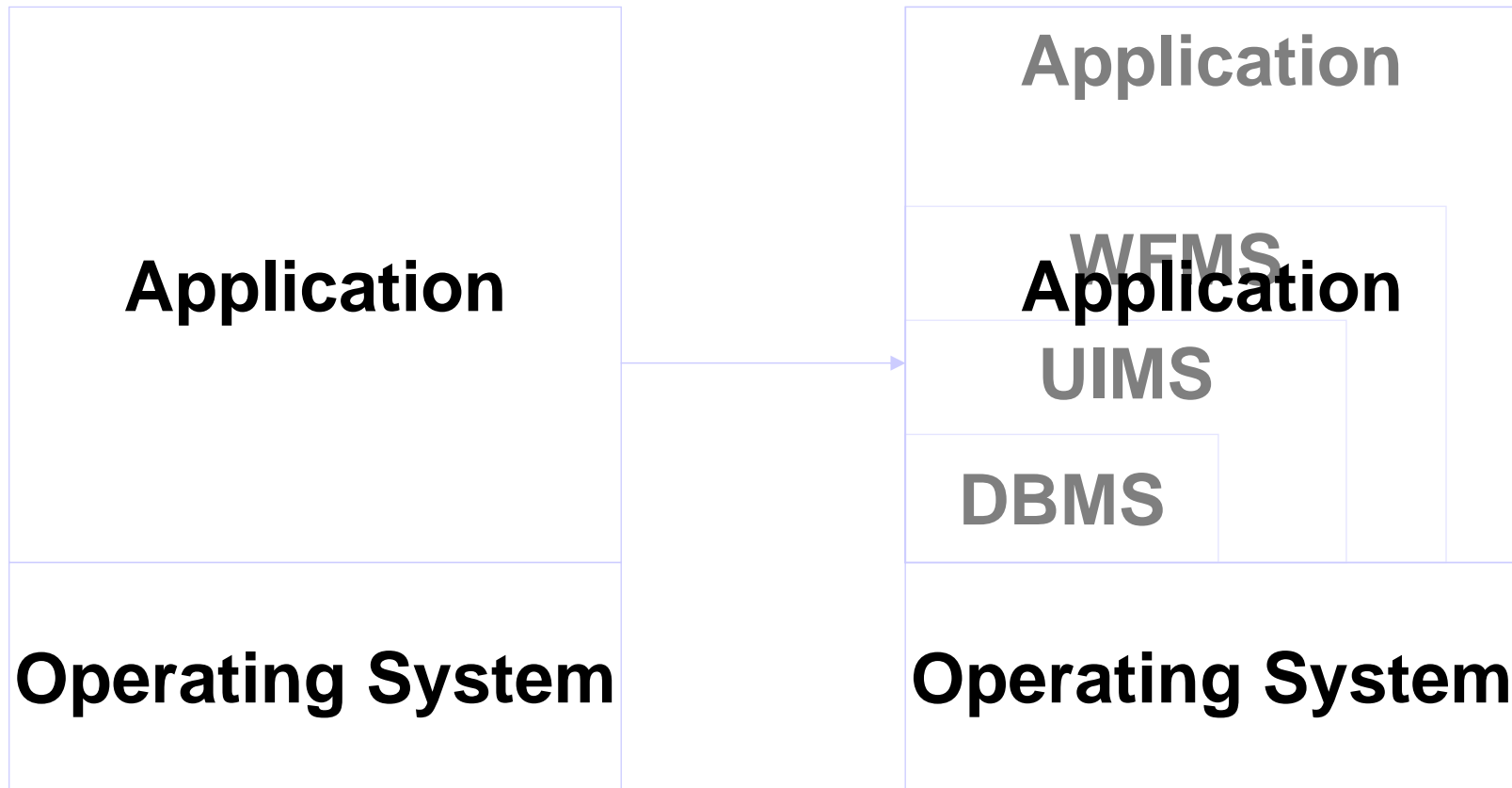
The Same Principle

Processes

Resources and their classifications

Applications – execution

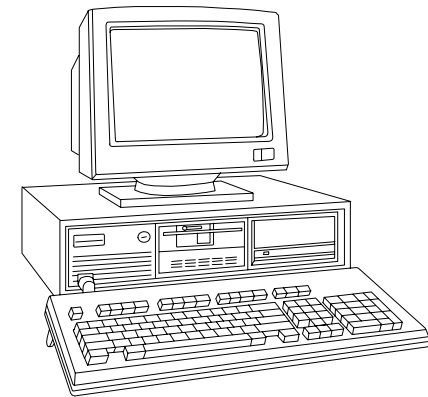
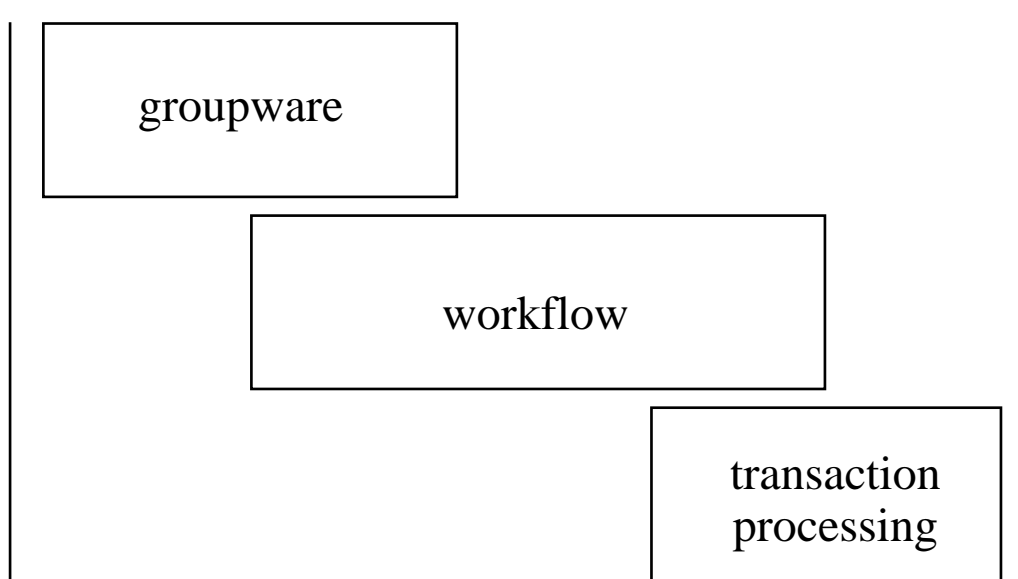
Separation of Concerns



Workflow Systems (Wil van der Aalst)

human oriented

system oriented



P2P	A2P	A2A
=	=	=
Person	Application	Application
To	To	To
Person	Person	Application

Basic Concepts

Case – thing/item/work/service to be produced/solved/served

Process/Procedure

Tasks – logical step applicable for many cases; can have several work items

Conditions – assigned to the tasks; determine orders

Activities – performance of a task on a case by a resource

Processes

Primary – produce products

Secondary – support processes (maintenance, marketing, financial administration, human resource management)

Tertiary – managerial processes

Resources

Resource

(participant, actor, user, agent)

A resource can execute certain tasks for certain cases.

Human and/or non-human (printer, modem): limited capacity.

Resource class

A set of resources with similar characteristic(s).

Role

(skill, competence, qualification)

Classification based on what a resource can do.

Group

(department, team, office, organizational unit)

Classification based on the organization

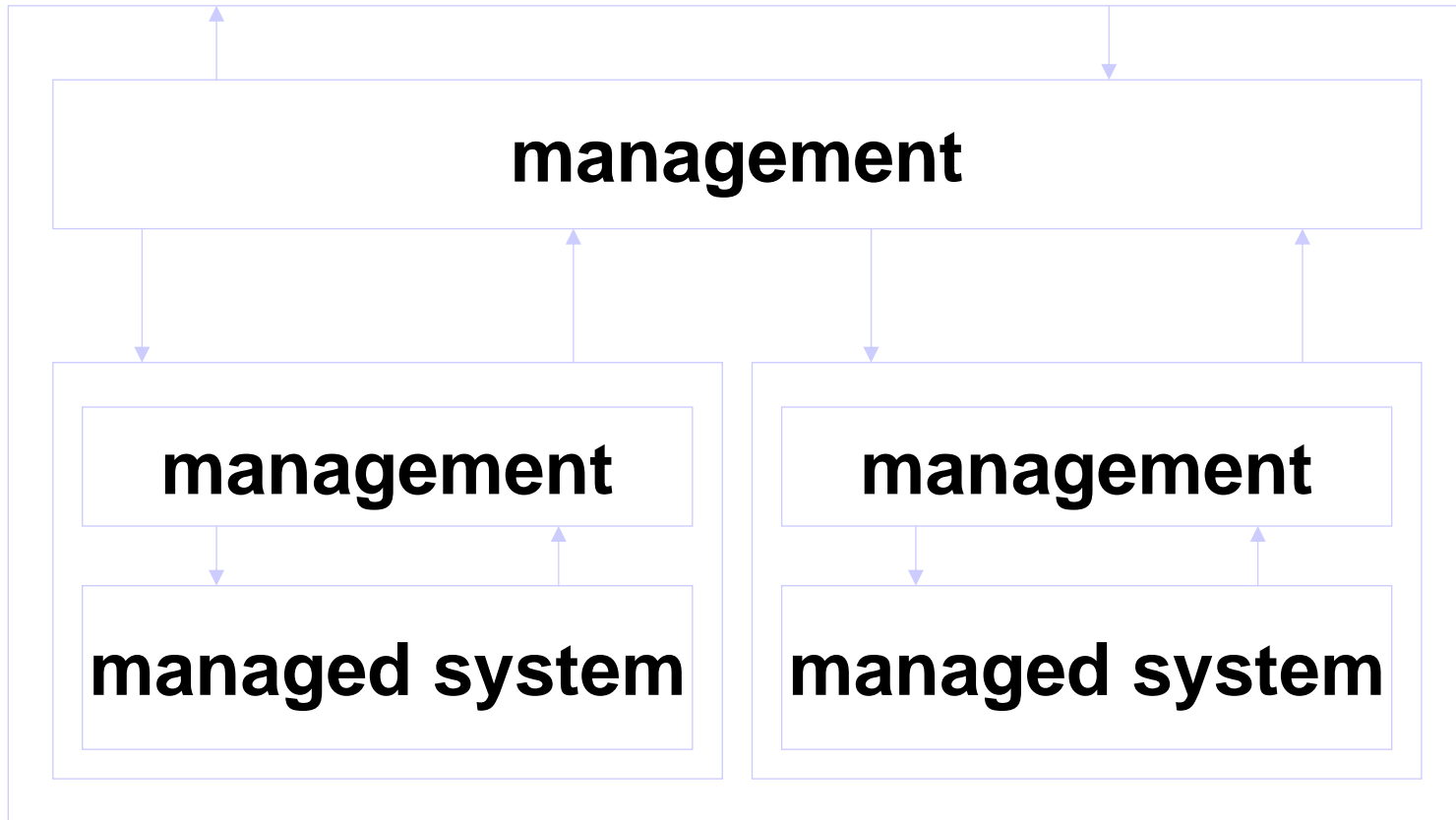
Resource Organization

Hierarchical

Matrix

Network

Managing Processes



Management

Real Time – frequent (control of machines and vehicles)

Operational – decisions made regularly (allocation of resources, routing and cases)

Tactical – decisions are made periodically (capacity planning and budgeting)

Strategic – decisions are made on long term basis (structural aspects of processes)

Information Systems for BP

Office Information Systems

Transaction-Processing Systems

Knowledge Management Systems

Decision Support Systems

Control Systems

Modelling Workflows

Petri Nets

A classical Petri net is a four-tuple (P, T, I, O) where:

P is a finite set of places,

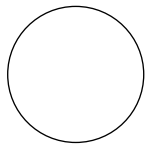
T is a finite set of transitions,

$I : P \times T \rightarrow \mathbf{N}$ is the input function, and

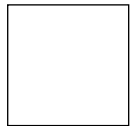
$O : T \times P \rightarrow \mathbf{N}$ is the output function.

The state (marking) of a Petri net (P, T, I, O) is defined as follows:
 $s : P \rightarrow \mathbf{N}$, i.e., a function mapping the set of places onto $\{0, 1, 2, \dots\}$.

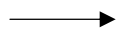
Graphical Symbols for Petri Nets



Place



Transition

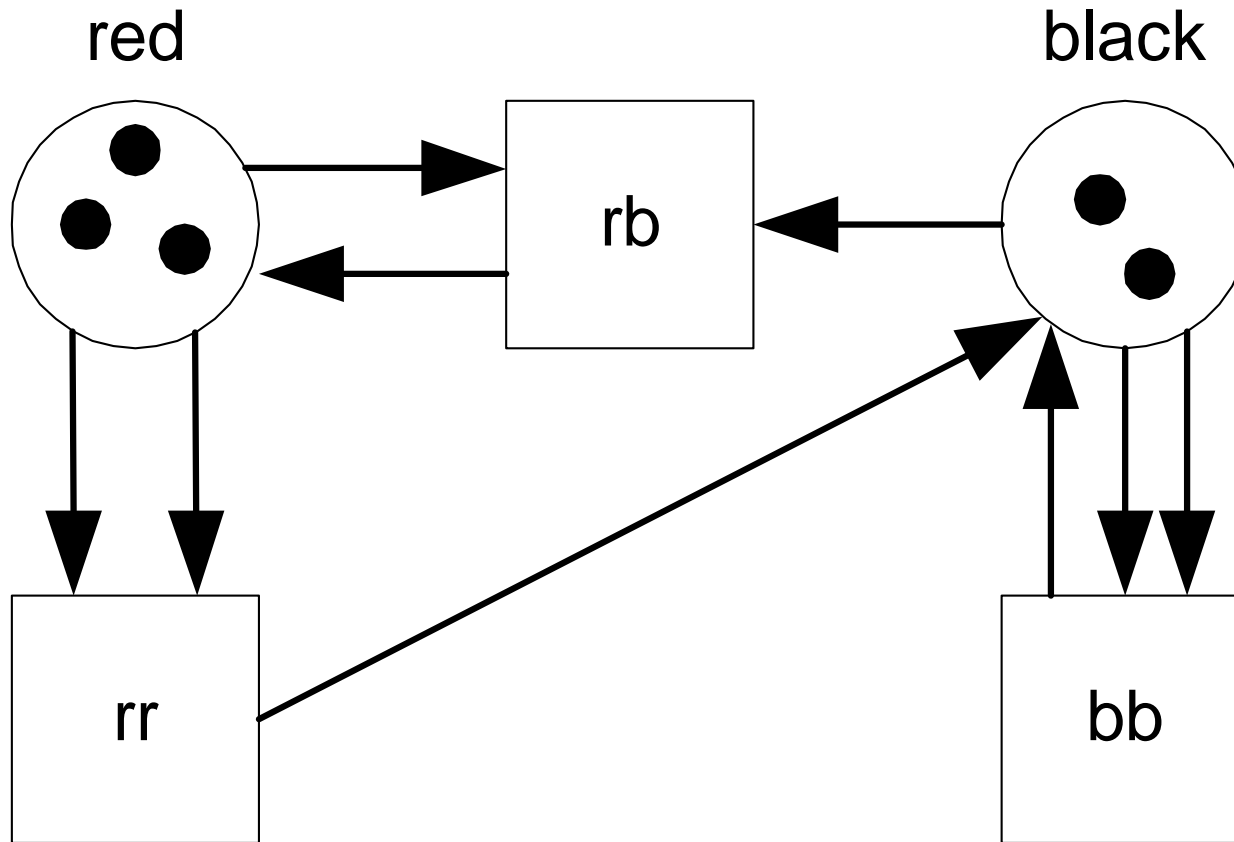


Arc



Token

Example



Roles of Tokens

Tokens can play the following roles:

- a **physical object**, for example a product, a part, a drug, a person;
- an **information object**, for example a message, a signal, a report;
- a **collection of objects**, for example a truck with products, a warehouse with parts, or an address file;
- an **indicator of a state**, for example the indicator of the state in which a process is, or the state of an object;
- an **indicator of a condition**: the presence of a token indicates whether a certain condition is fulfilled.

Roles of Places

- a type of **communication medium**, like a telephone line, a middleman, or a communication network;
- a **buffer**: for example, a depot, a queue or a post bin;
- a **geographical location**, like a place in a warehouse, office or hospital;
- a possible **state or state condition**: for example, the floor where an elevator is, or the condition that a specialist is available.

Role of Transition

- an **event**: for example, starting an operation, the death of a patient, a change seasons or the switching of a traffic light from red to green;
- a **transformation of an object**, like adapting a product, updating a database, or updating a document;
- a **transport of an object**: for example, transporting goods, or sending a file.

Network Structures

Causality

Human Intervention

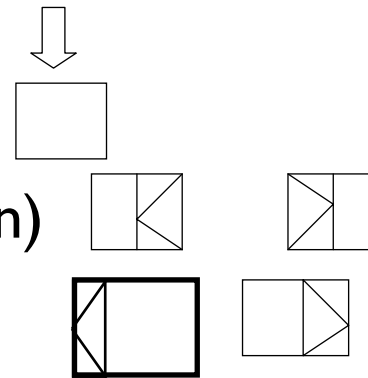
Parallelism (AND-split - AND-join)

Choice (XOR-split – XOR-join)

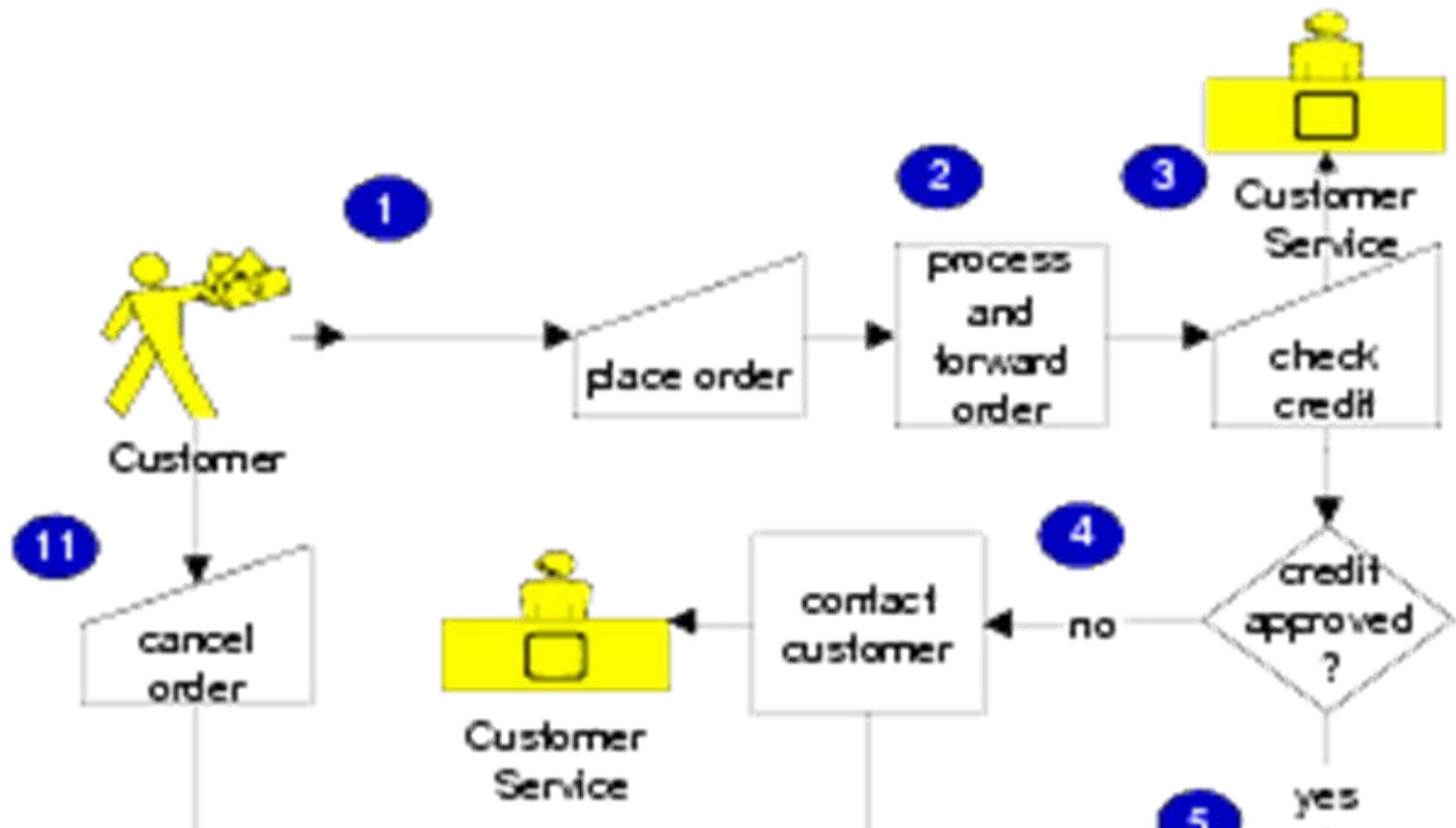
Iteration (XOR-join - XOR-split)

Capacity constraints

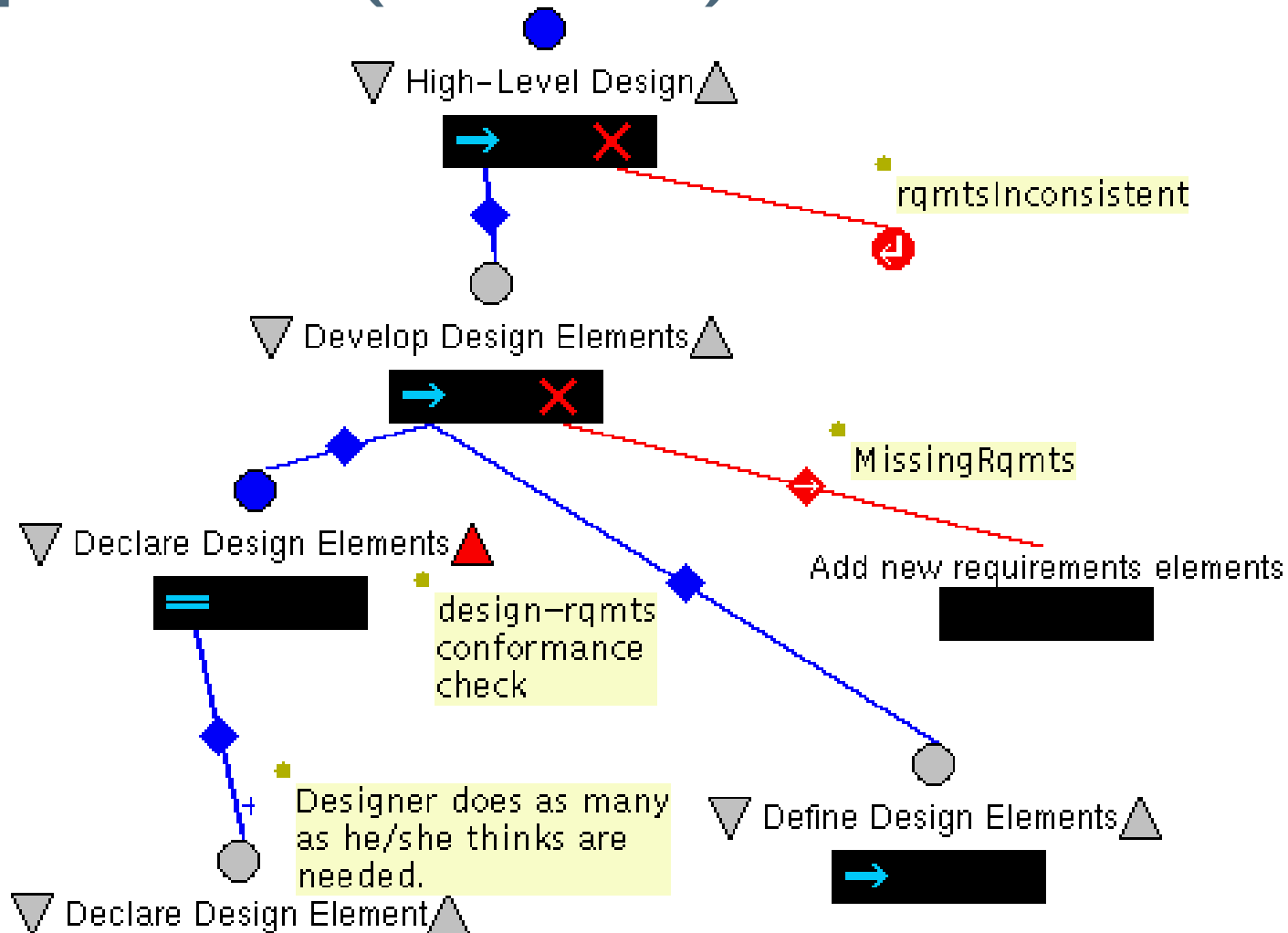
- Feedback loop
- Mutual exclusion
- Alternating



Mappings to Domain Symbols

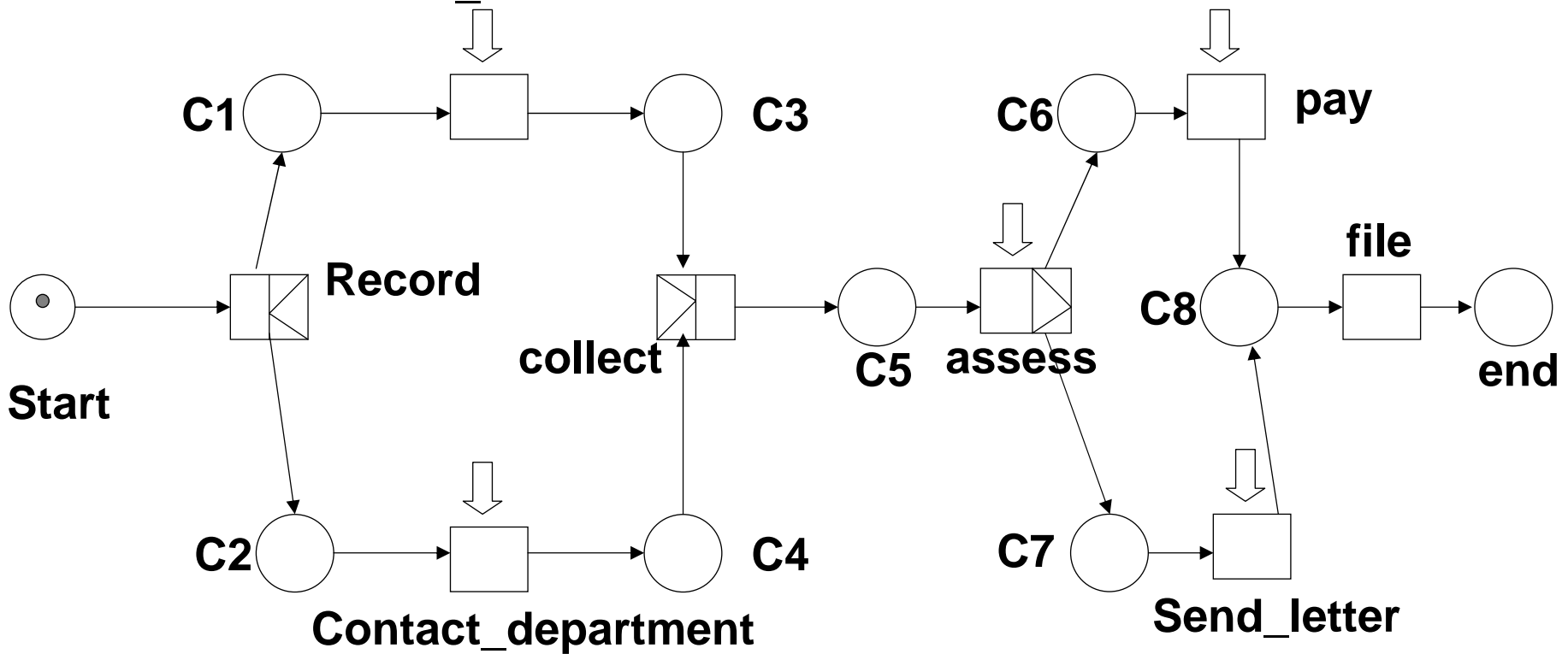


Requirements (from SOE)

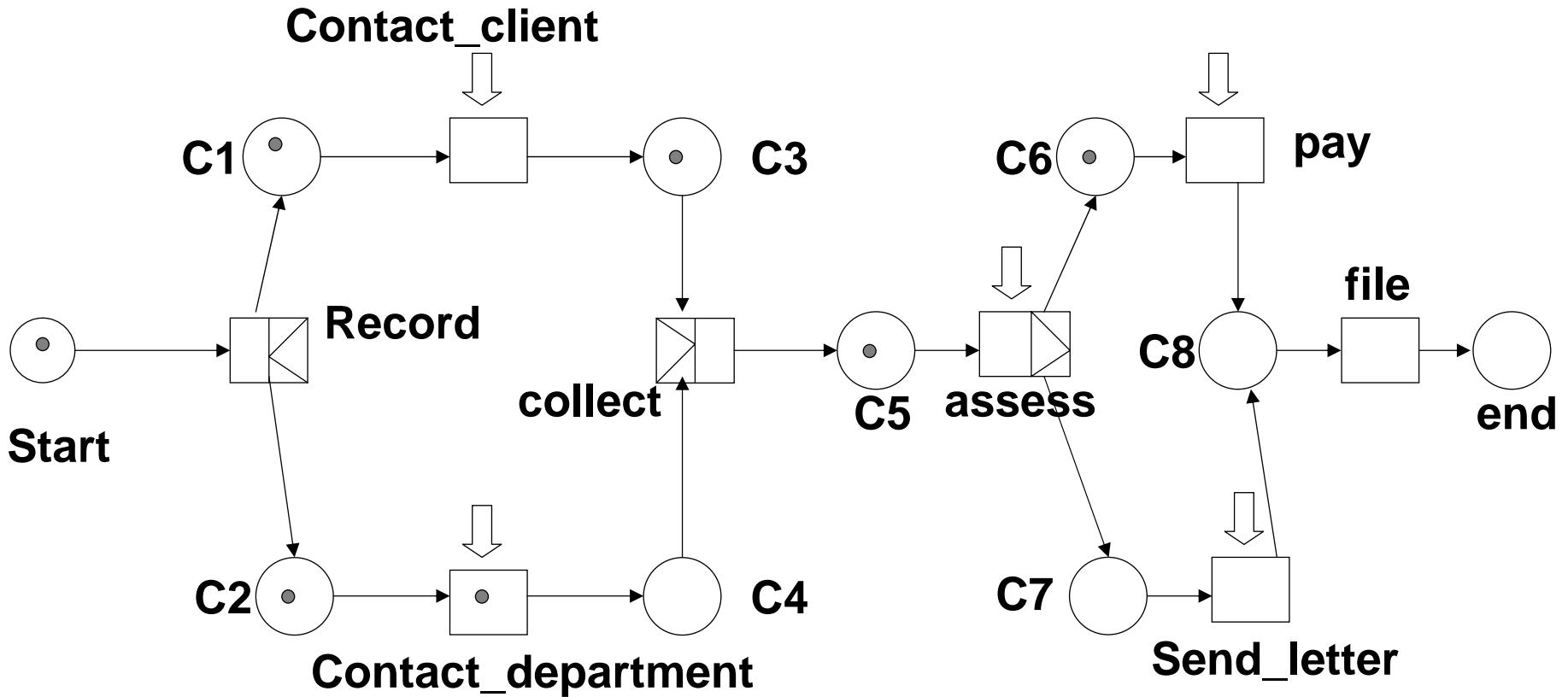


Process for Insurance Complaint

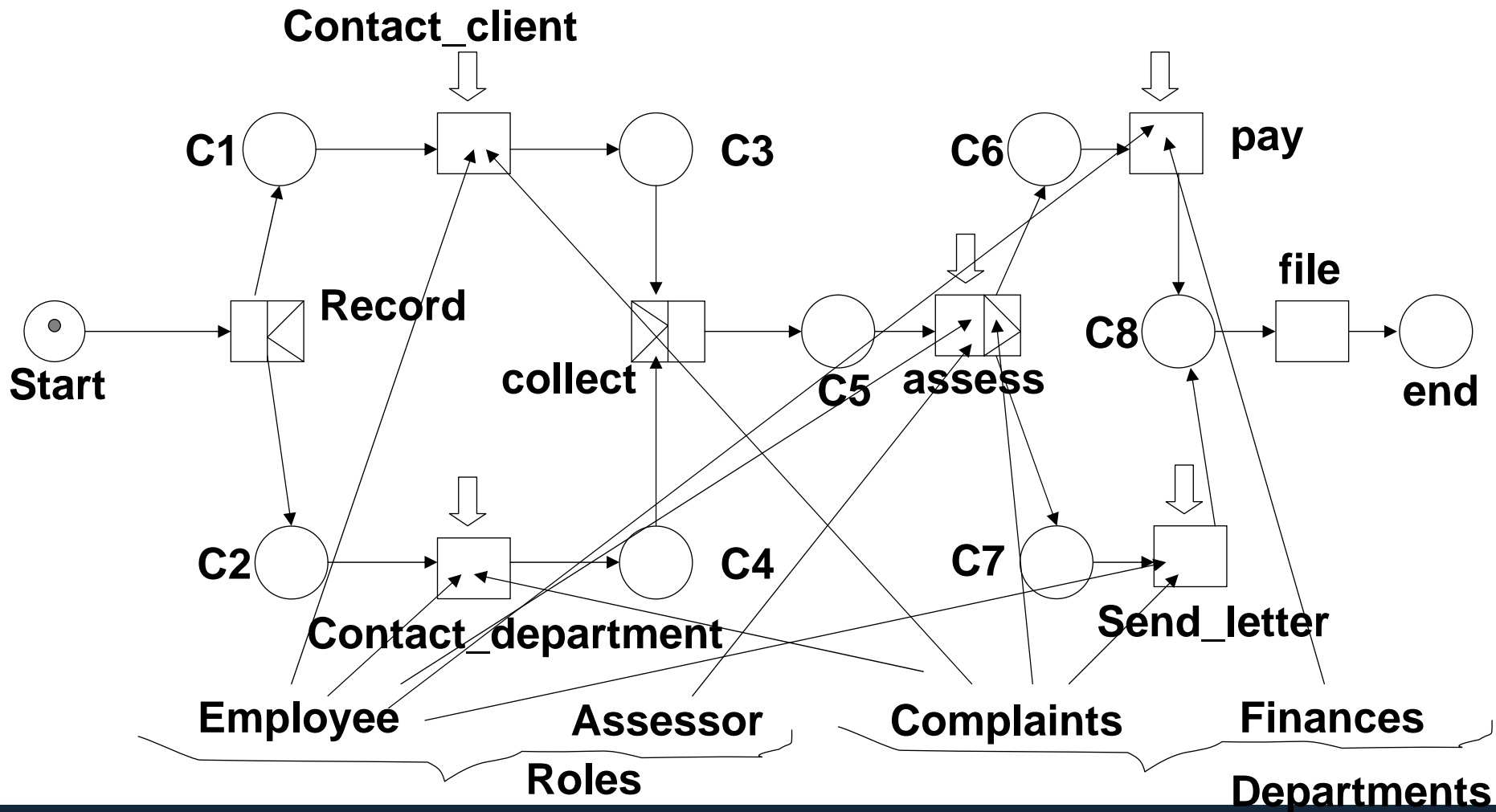
Contact_client



More Cases



Allocating Resources



Real Situation

Pool of workflows ready to be followed at the next step

Pool of candidate work items to be executed at the next step

Pool of cases to deal with

Pool of resources which can be selected

Problem is how to find optimal number of resources to have to achieve a certain performance of a company with number of tasks to be followed according to the workflows

Allocating Principles

In what order are the work items transformed to activities?

- How many resources are available and how many work items are pending?

By which resource are the activities carried out?

- Ability to perform some tasks

Heuristics for work item allocation

FIFO

LIFO

Shortest Processing Time (SPT)

Shortest Rest-Processing Time (SRPT)

Longest Rest-Processing Time (LRPT)

Earliest Due Date (EDD)

Heuristics for Resource Allocation

Let resource practice its specialty

As far as possible, let a resource do similar tasks in succession

Strive for the greatest possible flexibility for the near future

Allocation methods in workflow engines:

Push driven approach:

- Matching resource properties with work items properties

Pull driven approach

- Resources themselves take an initiative

Bottlenecks in the Workflows

Number of cases in progress too large

Completion time too long compare to the actual processing time

Level of service too low

Performance Indicators

External performance indicators (case-oriented)

- Average completion time, reliability of completion time

Internal performance indicators (resource oriented)

- What effort is required to achieve external performance
- Level of resource utilization, number of cases per resource, in progress, number of rollbacks, rate of turnover

(Re-)designing Workflows

What? – select a workflow that has to be re-designed

Why? – establish an objective of the workflow to be (re)designed

How? – establish steps which must be carried out and in which order

Who? – allocate resources

Principles

Establish Objectives

Ignore the existence of resources when defining the process

As far as possible, make one person responsible for processing of a case (case manager)

Check the need for each task

Consider the scope of tasks

Strive for the simplest possible process

Carefully weigh a generic process vs. several versions of the same process

Principles (cntd.)

Carefully weigh specialization vs. generalization

As far as possible, try to achieve parallel processing of tasks

Investigate the new opportunities opened up by recent developments in networking and databases

Treat geographically scattered resources as if they are centralized

Allow a resource to practice its specialty

As far as possible, allow the resource to perform perform similar tasks in succession

Try to achieve as much flexibility as possible for the future

Allow a ressource to work as much as possible on the same case

