Workflow and Resource Management


Lecture Objectives

In this class, you are going to learn:
- Resource Classification
  - Applying Resource Classification to Workflow
  - Task Assignment Methods
  - Task Ordering Disciplines
Workflow management concepts

A workflow definition is composed out of three parts:

- **process definition**: a description of the process itself
- **resource classification**: a classification of the resources to be used
- **resource management rules**: how to map work onto resources

**Why?**

- Avoid hard coding of resources (otherwise the process needs to be changed in case of personnel changes).
- Organizations have structure (c.f. organigram)
- Work distribution needs to be described: Who is doing what?
- Ordering of work items: In what order do we need to do things?
Resource classes

- **Resource**
  (participant, actor, user, agent)
  A resource can execute certain tasks for certain cases.
  Human and/or non-human (printer, modem)

- **Resource class**
  A set of resources with similar characteristic(s) and specialties.
Example: 4 roles

Example: 4 groups
Result: 8 resource classes

Resource classification
Mapping resources onto resource classes.
A resource may belong to multiple resource classes.
The organigram can be used for resource classification

resources distributed over roles and groups

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Resource Classification
  • Applying Resource Classification to Workflow
  • Task Assignment Methods
  • Task Ordering Disciplines
Mapping work items (task+case) onto resources

Constraints:
• A task is labeled with an expression in terms of resource classes.
• A resource is placed in a number of resource classes.
• Additional constraints: separation issues, case management.

While satisfying these constraints the WFMS-engine has to decide:
• Who is doing what?
  Push and pull control, load balancing, specialization, flexibility.
• In what order?
  FIFO, LIFO, SPT, EDD, priority control.

Convention used in this course

- Each task executed by a resource (worker) is labelled with one role and one group.

Wil van der Aalst.
A Simple Example

Complaints handling

- Each year travel agency Y has to process a lot of complaints (about 10,000). There is a special department for the processing of complaints (department C). There is also an internal department called logistics (department L) which takes care of the registration of incoming complaints and the archiving of processed complaints. The following procedure is used to handle these complaints.
Complaints handling

- An employee of department L first registers every incoming complaint. After registration a form is sent to the customer with questions about the nature of the complaint. This is done by an employee of department C.
- There are two possibilities: the customer returns the form within two weeks or not. If the form is returned, it is processed automatically resulting in a report which can be used for the actual processing of the complaint.
- If the form is not returned on time, a time-out occurs resulting in an empty report. Note that this does not necessarily mean that the complaint is discarded.

Complaints handling (2)

- After registration, i.e., in parallel with the form handling, the preparation for the actual processing is started.
- First, the complaint is evaluated by a complaint manager of department C. Evaluation shows that either further processing is needed or not. Note that this decision does not depend on the form handling. If no further processing is required and the form is handled, the complaint is archived.
- If further processing is required, an employee of department C executes the task ‘process complaint’ (this is the actual processing where certain actions are proposed if needed).
- For the actual processing of the complaint, the report resulting from the form handling is used. Note that the report can be empty.
- The result of task ‘process complaint’ is checked by a complaint manager of department C. If the result is not OK, task ‘process complaint’ is executed again. This is repeated until the result is acceptable.
- If the result is accepted, an employee of department C executes the proposed actions.
- After this the processed complaint is archived by an employee of department L.
### Roles and groups

The following roles are identified:
- **Employee** (E)
- **Complaint manager** (CM)

The following groups are identified:
- **Department C** (DC)
- **Logistics department** (LD)
Assumptions so far ...

- Eventually every work item is executed by a single resource.
- Every resource is working on one activity at the same time.

Some observations:
- There may be a need to further limit the set of resources i.e., we need to be able to specify further constraints.
- There may be many resources that have the right role/group combination, i.e., work distribution is needed.
- There may be many work items that can be executed by the same resource at a given point in time, i.e., work items need to be ordered.
Further Allocation Constraints

- **Exclusion of class(es)**
  - e.g., for task execute, choose a staff who belongs to (E, DC) but not CM
- **Separation of Function**: one member of staff is not allowed to perform two successive tasks on the same case
  - For accountancy purpose
- **Case Management**: successive tasks need to be carried out by a single employee (case manager)
  - Better service and more efficient
- **Case Attribute Value Dependent**
  - Dynamic allocation

Example

if compensation > 10000 HKD then role := manager else role := employee
Allocation Principles

Process definition
- routing
- trigger
- task
- condition

Resource classification
- resource
- role
- group

case

allocation

Entity-Relationship (ER) diagram
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Push versus pull
Push control

- workflow enactment service
- push to a selected "victim"

Pull control

- workflow enactment service
- pull selected work items
Most WFM systems are hybrid, e.g., Staffware.
Who is doing what?

• Pull control
  – Determined by people, i.e., a "race" among resources.
  – Select to start and/or select to allocate work item.

• Push control
  – Round robin.
  – Weighted round robin.
  – Shortest queue.
  – Select the most specialized resource (i.e., do not allocate "generalists" unless needed).

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In what order?

• Pull control
  – Determined by people, i.e., a "race" for attention.
  – System may "suggest" urgent work items or offer multiple view on the work available.

• Push control
  – System decides whether the worker can view and/or select multiple work items, i.e., order may be enforced or suggested.

• In both cases possible queueing disciplines are:
  – FIFO (First In First Out)
  – LIFO (Last In First Out)
  – SPT (Shortest Processing Time)
  – EDD (Earliest Due Date)
  – PRIO (Prioritization based on case attributes)

Example
(taken from "Operations Management" by Roberta Russell & Bernard W. Taylor)

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Note that unlike most scheduling problems work items emerge on the fly!
FIFO (also known as FCFS)

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EDD

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Comparison

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We will return to the topic of workflow analysis and simulation...
Conclusions

- Important to allocate suitable resources to enact a process
- Resource classification based on roles and groups
- Task assignment discipline: push and pull
- Task ordering discipline: FIFO, LIFO, SPT, EDD, PRIO
- Next, we analyze correctness and performance of workflow