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Workflow Modeling and Implementation
(Extended Abstract)

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1. Introduction

The widespread of personal computers along with the increased use of local area networks has allowed people in different places to work together. The software that supports a group of people to work together electronically is called groupware or group support systems. Workflow management software is a kind of groupware that gains market attention recently.

The origins of workflow management lie in the need to describe the organization and ordering of tasks for manufacturing processes in production engineering. These processes are organized as production lines where each work item is processed and passed on individually through a sequence of tasks. Similar concepts were later adapted to the workflow management in integrated office systems.

The concept of integrated office systems (or paperless offices) was first introduced in the 1970s. However, the market never really matured until the advent of the personal computer and local area networks in the 1980s. Now the popularity of these technologies has laid a solid foundation for office systems supporting a wide variety of office applications such as electronic mail, meetings, and workflow management.

A major function of modern office is to decompose complex problems into modules that can be assigned to and different workers to handle. The processed modules are then integrated to solve the problems. In the problem solving process, workers need close communication and cooperation. Traditionally, the communication and cooperation were performed through a manual and inefficient way. A workflow system is a computer software environment installed on a networked environment to support workflows among office workers. Early research indicates that the use of workflow software can generate the following benefits (Hales and Lavery, 1991):

- Productivity increase,
- Faster response,
- More control, and
- Higher employee morale.

A key issue in designing workflow software is the representation of process models. The approach must be intuitively appearing and user friendly. In this paper, we present a framework for representing process models and a multimedia environment for workflow management developed in the Technology Research Division of the Institute of Information Industries.

2. A Graph-based Approach to Workflow Modeling

An office is composed of static entities such as workers, furniture, machines, and dynamic work procedures that link static entities. The work procedures in offices are often initiate by workers. For instance, when a worker needs to buy a personal computer, he must fill out a request form to gain proper approval. The equipment request form is a document to be handled based on a predetermined process. It may need to be submitted to the worker's supervisor to gain approval and then be forwarded to the purchasing department to acquire the equipment. A typical office includes some basic components that must be modeled by workflow software:

1. **Agent.** An agent is an entity that can make independent judgments in a workflow system. It can be a user who uses the workflow system to handle his documents or an intelligent agent built in the workflow system to route documents.

2. **Authority.** Authorities define the legal domain in which an agent is allowed to perform its job. For example, a project manager may be authorized to approve purchase requests with an amount below $2000.

3. **Action.** Actions are the actual decision an agent makes. For instance, approving or declining a purchase request is an action.

4. **Activity.** Activities are basic elements of a work. It is defined as a thing that can be performed by an agent alone such as fill out a travel request form or sign a check.
5. **Work.** A work is a group of related activities. It is different from an activity in that a work includes activities that must be performed by different agents. For example, "filling out a purchase request" and "approving a purchase request" are two activities that can be combined to become a work called "equipment purchase."

6. **Task.** Works with related objectives can be grouped into a task. For instance, we can group two works, travel request and expense reimbursement, into a task called "business travel."

7. **Workflow.** A workflow is the process (or steps) by which all activities of a work are completed. Since a work is composed of activities that need to be completed by different agents, workflows indicate the linkages among the activities and agents. Formally speaking, workflows can be defined as a set of (activity, agent).

   For most organizations, workflows can be divided into three basic flow types: sequential, parallel, and cooperative. Sequential flows allow activities to be processed sequentially. That is, precedent activities must be completed before the following activity can begin. A simple example is that approving a purchase request must follow the activity of filling out a purchase request.

   Parallel flow requires activities to be processed concurrently. The most common example is the parallel circulation of documents. If you have a document that you would like to share with 10 colleagues, you may define 10 parallel flows rather than a sequential flow with 10 steps. Another use of parallel flows is opinion survey. A copy of the questionnaire is sent to all subjects simultaneously.

   Cooperative flow is composed of a group of interdependent activities. These activities cannot be decomposed into sequential or simultaneous activities conveniently. Committee meetings that determine whether a purchase should be approved are examples of cooperative flows.

   Although we decompose an office into seven components, they are highly related. An agent can initiate, modify or terminate a work, define its flow, and take actions on activities.

   Figure 1 shows the graphical symbols of the workflow modeling primitives. In addition to the primitives, the workflow modeling language also needs to have manipulation operations such as the creation, addition, modification, and deletion of activities, work, and workflow, and the definition of agents and their authorities.

3. **Multimedia Workflow System Environment**

   The above graph-based approach for workflow modeling has been implemented in a multimedia environment by the Technology Research Division of the Institute of Information Industry. As shown in Figure 2, the environment includes two levels: tool environment and tool application. At the center of the workflow management software is a workflow engine that supports document flow, filing, retrieval, and various other functions. The workflow engine includes five modules: model manager, database manager, script interpreter, workflow controller, and communication agent.

4. **Concluding Remarks**

   Improving office productivity is a major goal of office automation. Due to the increased use of PCs and computer networks, office automation systems can extend beyond just word processing and spreadsheets to handling communication and cooperation in group work. This paper has shown how group processes can be modeled and a multimedia environment for implementing such a system.

5. **References**


Figure 1. Primitives of Workflow Modeling
Figure 2. Multimedia Workflow System Environment