Supporting Large-Scale End User Specification of Workflows, Work Coordination and Tool Integration

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Workflow Management Systems are a common example of end user development, in that they support end user specification of work process models, end user enactment (running) of these models, and end user evolution of workflows. Example applications of Workflow Management Systems include office automation, software process modelling and business process codification. We describe a novel workflow management system which provides visual support for end users to specify both simple and complex aspects of workflows, including workflow models, communication and collaboration techniques, and the tools used to perform work. We illustrate both the utility of these work coordination mechanisms and the degree of scalability they provide for both novice and experienced end users. We also outline the architecture of our system, our experiences with this workflow tool, and our future research directions.

Many software systems now support varying degrees of end user development. Many systems, such as MS Word™, provide users with complex facilities to dynamically configure their tools; Web browsers, such as Netscape™, provide users with mechanisms for integrating third-party software applications; and cooperative work systems, such as Lotus Notes™ and TeamFLOW™, allow multiple users to coordinate their work with others. Due to the complexity of the work environments these and most other software systems are deployed, end users often desire (or even require) mechanisms for dynamically specifying their work processes, coordination mechanisms with other people, tools and processes, and the set of tools and tool interactions they require in order to most effectively perform their work.

For example, office workers performing an order entry processing need to follow an agreed process to correctly analyse stock requirements, create orders, process supplied stock and keep accurate records. Supervisors and clerks need to work on this process, and they need to utilise various tools (database, spreadsheet, word processor, etc.), and various documents. Their work must be coordinated to achieve the desired process outcome, and the process itself may need to be evolved (changed) to better support the company’s order processing requirements.

Workflow Management Systems (WFMSs) and Process-Centred Environments (PCEs) have been developed to enable end users to specify their work processes and coordinate their work with others. WFMSs have become popular for use in various fields, including office automation, business process reengineering and software development (Bandinelli...
et al., 1996; Medina-Mora et al., 1992; Swenson et al., 1994). Such systems typically allow users to model work processes using graphical and textual notations, and then run (enact) these process models to guide (or enforce) work on particular projects. Most workflow and process modelling notations and tools permit users to specify steps in their work processes, the artifacts and tools used to perform each step, and the other users and tools they need to interact (coordinate) with during work. Workflow systems are typically used in conjunction with other tools for performing work, such as document editors, information systems and software development tools (Bandinelli et al., 1996; Medina-Mora et al., 1992). Often multiple people collaborative on a project and therefore, use these tools and the workflows (Swenson et al., 1994). Thus end users of workflows require support for not only modelling, enacting and evolving workflows, but support for coordinating their work with others and integrating a variety of different tools into their work processes.

Unfortunately most existing workflow and process modelling systems do not provide sufficient support for specification of workflows, work coordination mechanisms and tool usage by end users. Many allow end users to specify their work processes, but once in use these work processes are difficult to change (Swenson et al., 1994). Many other WFMSs and PCEs provide complex, formalised languages which are difficult for many end users to understand and modify (Bandinelli et al., 1993; Grundy and Hosking, 1998; Baldi et al., 1994). Many WFMSs do not provide sufficient work coordination and collaborative process usage facilities to allow process models to be effectively utilised concurrently by several users (Ben-Shaul and Kaiser, 1996; Bandinelli et al., 1996; Grundy et al., 1996a). Most current WFMSs and PCEs provide only limited support for integration of third-party tool descriptions into the process enactment environment, limiting the degree of tool integration supported (Valetto and Kaiser, 1995; Bandinelli et al., 1996).

We describe a workflow/process modelling environment we have developed which supports the end-user specification of simple and complex workflow models via mainly visual language techniques. These specifications can be used on small, single-user process models but scale up for large, multi-user workflows. A visual language for specifying “event handling” mechanisms, both for the workflow tool and other integrated tools, is used by end users to automate tasks, support work coordination, and extend the workflow environment capabilities. Novice end users can utilise this to support simple notification and coordination facilities, but the notation and its implementation scale up to supporting sophisticated environment extension by experienced end users. Third-party tool and document descriptions can be incorporated into our workflow models, and tools can be invoked by the event handling language. Tightly integrated tools which utilise the same implementation platform as our workflow environment can be constrained from within the workflow tool by end users. We compare our environment’s support to other workflow/process modelling systems, and briefly describe its architecture, our experiences using the tool, and our future research directions.
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