

Technology Briefing Report on Process Support by Intecs Sistemi s.p.a

1 - Overview

Today's enterprises must deal with global competition, reduce the cost of doing business, and rapidly develop new services and products. To address this requirements enterprises must constantly reconsider and optimize the way they do business and change their information systems and applications to support evolving business processes. Workflow technology, with its new powerful paradigm for supporting, controlling and improving structured work using Information Technology (IT), facilitates these, providing methodology and software for both process support and control, allowing to improve as well as to enforce processes.

The workflow concept has evolved from the notion of process in manufacturing and the office. Such processes have existed since industrialization and are products of a search to increase efficiency by concentrating on the routine aspects of work activities. They typically separate work activities into well-defined tasks, roles, rules, and procedures which regulate most of the work in manufacturing and the office. In the domain of workflow, there are three evolution steps: material, information, and human (or business) processes.

Initially, processes were carried out entirely by humans who manipulated physical objects: they are known as material processes, whose scope is to assemble physical components and deliver physical products.

With the introduction of IT, processes in the work place are partially or totally automated by information systems. These are information processes, which relate to automated tasks (i.e. tasks performed by programs) and partially automated tasks (i.e. tasks performed by humans interacting with computers): the basic infrastructure for supporting these processes are database, transaction processing, and distributed system technology. But recently, organizations have realized that it is not enough to use IT to address their crucial concerns.

This realization and the present breakdown in the productivity of knowledge-based workers has lead to an identification of a new type of process: the so-called human, or business, process. Business processes are market-centered descriptions of an organization's activity, implemented as information processes and/or material processes.

Workflow concept reflects this change of prospective: workflow becomes closely related to reengineering and automating business processes. The software development process must be seen as a part of the overall business process. Both processes need automatic support, and, even if workflow should provide adequate support for both, different tools for supporting the workflow paradigm might be necessary.

Within the workflow domain, the following definitions hold:

- Workflow (WF).

A WF is composed of multiple tasks (also called steps or activities). We distinguish two types of tasks: simple tasks which represent individual indivisible activities, and compound tasks which represent some activities which can be divided into sub-activities (both simple tasks and even other compound tasks). An entire workflow can be regarded as a large compound task. A simple task may be a program which can run on processing entities, which include application systems, servers supported by client-server systems or Transaction Processing Monitors, Data Base Management Systems, etc. Tasks are operations or a sequence of operations that are submitted for execution at the processing entities using their interfaces. In addition to a collection of tasks, a workflow defines the order of task invocation or conditions under which tasks must be invoked, task synchronization, and information flow (dataflow).

- Workflow management (WFM).

WFM is a technology supporting the reengineering (including automating) of business and information processes. It involves:

1. defining workflows, i.e. describing those aspects of process that are relevant to control and coordinate the execution of its tasks (and possibly the skills of individuals or information systems required to perform each task), and
2. providing for fast (re)design and (re)implementation of the processes as business needs and information systems change.

Hence, WFM involves everything from modelling processes up to synchronizing the activities of information systems and humans that perform the processes. As consequence, the first issue is to model the process. Since capturing a process means understanding it, this usually involves interviewing people with expert knowledge about the process. Interview methodologies such as those used for expert (or knowledge-based) systems design are appropriate for conducting such interviews. When enough knowledge about the process is obtained, workflow specification is performed to capture the process.

Performing workflow specification requires a workflow model, which typically includes a set of concepts useful to describe processes, their tasks, the dependencies among tasks, and the required roles that can perform the specified task. Workflow specification is usually performed using workflow specification languages, which use rules, constraints, and/or graphical constructs to describe the ordering and synchronization of tasks in a workflow, and task attributes to describe the tasks and the roles to perform them.

- Workflow management system (WFMS).

A WFMS is one which provides procedural automation of a business process by management of the sequence of work activities and the invocation of appropriate human and/or IT resources associated with the various activity steps. In other words, a WFMS provides the ability to specify, execute, report on, and dynamically control workflows involving multiple humans and HAD (Heterogeneous, Autonomous, and Distributed) systems.

WFMSs provides support to WFM technology, described above. This means that, even if WFMS systems are usually produced as a single physical package, the following logical components can be distinguished:

- a definition tool to create the process description; this can be based on a definition language, an object relationship model, or in simple systems a set of routing commands to transfer a document or form between participating users;
- an engine tool, which interprets the process description, controls the instantiation of processing and sequencing of activities, adding work items to the user work lists and invoking tools as necessary;
- a worklist handler, responsible for progressing work requiring user attention, which interacts with the engine via the worklist (i.e. a desktop);
- an handler for tool invocation;
- a mechanism to control the transfer of case data between users and applications, or to provide a means of shared access to such data.

The workflow models most WFMSs support are activity-based, and consist of elements similar to the following:

- workflow: a partial or total ordering of a set of tasks;
- task: a partial or total order of operations, descriptions for human actions, or other tasks;
- manipulated objects: documents, data records, images, phones, fax machines, printers, etc.
- role: a placeholder for a human skill or an information system service required to perform a particular task;
- agent: humans or information systems that fill roles, perform tasks, and interact during workflow execution.

Nesting of tasks is usually supported, with the aim of providing different levels of abstraction. WFMSs, which enhance group communication, information sharing, and work process automation in a structured way, mainly consist in two applications: form routing and shared database workflow. While form routing involves automatic routing of documents from one person to another in order to take an action, in shared database workflow users consult a tracking database to check the status of a document and ensure the effectiveness of the workflow in the work process.

Workflow products are typically client-server software products in which the work is performed within defined timescales.

2 - Role in evolution process

Workflow technology plays an important role in the reengineering/evolution process. Once an organization captures its business in terms of business processes, it can reengineer each process to improve it or to adapt it to changing requirements. Reasons cited for business process redesign include increasing customer satisfaction, improving efficiency of business operations, increasing quality of products and productivity, reducing costs, facilitating migration from one technology to another one.

Workflow seems to be a concept closely related to reengineering and automating business and information processes in an organization. And these are the keys for processes improvements.

3 - Relevance to RENAISSANCE

Workflow technology will facilitate the evolution of a (legacy) system. A workflow may describe business process tasks at a conceptual level necessary for understanding, evaluating, and redesigning the business process. On the other hand, workflows may capture information process tasks at a level that describes the process requirements for information system functionality and human skills. The distinction between these two workflow perspectives is not always made, and sometimes the term workflow is used to describe either, or both, of the business and information systems perspectives. With an abstract description of the overall business process in terms of workflows, both maintenance and evolution of the system should be easier. Workflow technology might be also used to represent and describe the RENAISSANCE method itself.

4 - Available support

There are many workflow software products available on the market. We do not intend to describe and compare them; the remaining of this section provides a summary for the feature and capabilities currently supported by commercial WFMSs.

- *Workflow model.* All WFMSs provide both activity-based, and communication-based workflow models for specifying workflows.
- *Specification language.* All WFMSs of which we are aware provide graphical workflow specification languages. Many provide also rule-based or constrained workflow specification languages.
- *Testing, Analysis, and Monitoring tools .* Commercial WFMSs provide testing tools to simulate a workflow by allowing input of sample data and triggering events.
- *System Architecture and interoperability* Most of WFMSs have open client-server architectures and complete application programming languages (API). All of them support exchange of information among users or systems via e-mail or a shared (usually WFMS vendor proprietary) database. Only limited interoperability among office applications is usually supported, and just a limited number of WFMSs provides such support.
- *Correctness and Reliability* Data consistency on objects accessed by a workflow execution must be granted. Concurrency control, recovery, and

transaction coordination should be necessary, but commercial WFMSs currently provide limited capabilities to deal with these problems.

5 - Maturity assessment

Workflow technology is quite mature: currently WFMSs provide support to the intuitive and powerful workflow paradigm for capturing business processes, reasoning about them, and using process specifications to produce corresponding implementation that are supported by the information systems. They only support document/form/image-centered processes, computer supported cooperative work (CSCW) and office automation applications, that's quite enough for the evolution of a legacy software product. But they still have a number of significant limitations, most of them directly attributable to the lack of standards. Significant limitations are listed in the following:

- lack of interoperability among WFMSs
- lack of support for interoperability among HAD systems or among WFMS and HAD systems
- inadequate performance for some business processes
- lack of support for correctness and reliability
- weak tool support for analysis, testing and debugging workflows.

Nevertheless, there is a basic consideration to be taken into account. Although the technology is quite mature, also the maturity and the understanding of the task must be carefully evaluated, especially in case of complex tasks (like software development). Since workflow describes a process, the process to be represent must be known. The greater the maturity assessment for the process, the greater the benefits of using workflow technology. On the other hand, using workflow leads to a better understanding of the process, which increases the maturity assessment of the process itself. There is a strong relationship between workflow and the maturity of a process definition. Metrics for evaluating the maturity assessment of processes should be used, at least to evaluate the cost/benefit ratio of adopting the workflow paradigm, i.e. the metric defined by the Software Engineering Institute (SEI), which defines 5 degrees of maturity (Initial, Repeatable, Defined, Managed, Optimizing) and which has been then refined by introducing some intermediate levels.

6 - Inapplicability

Implementing workflow can have profound implications for the internal organisation of companies, and the way people do their jobs. Once the decision to use WF technology has been evaluated and taken, big care must be taken in selecting the appropriate WFMS, especially when data consistency and integrity are key issues. The (communication) infrastructure for WFMSs must be seriously taken into account, because it could be the reason for inapplicability (e.g. problems of data security when the infrastructure is the web). Moreover, when concurrency and failures characterize the business process, existing WFMSs (not the WF technology) seem to be poor to

provide adequate support. Of course, the workflow paradigm can not be applied when there is weak understanding (or no understanding at all) of the task itself, or, in general, when the maturity assessment for the process is quite low.

7 - Future development

Future development aims to cover the areas in which today's WFMSs are weak. There are two guidelines for future work:

- to improve infrastructure technology
In particular, two infrastructure technologies, Distributed Object Management (DOM) and Customized Transaction Management (CTM), can be combined with the WFMS capabilities that commercial WFMS already provide. DOM should grant system interoperability, while CTM should allow to satisfy correctness and reliability requirements.
- to define a standard
A standards body called the Work Flow Management Coalition was formed in 1993. It is a group of companies who have joined together to address the lack of standards in WFMSs.

8 - Other comments

The concern to overcome the widespread stagnation of service-sector productivity has spawned the field called business process reengineering and the explosive growth of a new industry devoted to workflow. According to the Gartner group, the workflow industry did about \$300 million of business in the US in 1992, and is expected to reach \$2.5 billion in 1996. Since workflow systems rely on common operating systems, networks, and client-server architectures, a convergence between workflow and operating systems is underway, and workflow systems are beginning to come also to the attention of operating systems designers.

Appendix A : A List of commercial products

This appendix simply provides a (non comprehensive) list of commercial WFMSs, without any evaluation.

WFMS	Company
Action Workflow	Action Technologies
Amadeus	Amadeus Software Research
Archive Lite	Johnson Computer Software Team Limited
AWD	DST Systems Inc.
BeyondMail	Beyond Inc.
CMDT	ICL Ltd
DM2	Intergraph Corporation
EPIC/WF	Computron Technology
FloWare	Plexus
FlowFile	Standard Platforms Ltd
FlowMan	Logical Software Solutions
FlowMark	IBM
FlowMaster	Ing. C. Olivetti & Co s.p.a
FormFlow	Delrina Corp.
ICONDESK/Flow	Ing. C. Olivetti & Co s.p.a
ImagePlus/400	IBM
InConcert	XAIT Xerox
InForms-Designer, InForms-Filler	Novell Inc.
Jetform Server	Jetform Corp.
JobMarker	Keyfile Corporation
Keyfile	Keyfile Corp.
Life*FLOW	Computer Resources International Inc.
LinkWorks	Digital Equipment Co
LotusForms	Lotus Development Corp
LotusNotes	Lotus Development Corp.
OPEN/Workflow	Wang Laboratories Inc.
PageNet Workflow	PageNet Ltd
PME	MD&A Business Information System

PowerFlow	Optike Imaging Systems
Proces Weaver	CAP Gemini Innovation
ProcessIT	AT&T Global Information Solutions
ProcessWise	ICL Ltd
PROMINAND	IABG
RoleModel	ICL Ltd
SoundPractice	Eatock Young
Staffware	Staffware Corp.
Taskware	Lombard Document Systems Ltd
TeamRoute	Digital Equipment Co
TeamWARE Flow	TeamWARE
Visual WorkFlo	FileNet Corp.
WinWork	Logica
Workflow	CSE-Systems Ges.m.b.H
Workflow 2020	Fischer International Systems Co
Workgroup Templates	Microsoft Corp.
WorkMan	Reach Software Corporation
WorkManager, WorkRouter	Hewlett-Packard Co.
WorkParty	Siemens Nixdorf
WorkXpert	Mentor Graphics Corporation
XWorkflow	Ing. C. Olivetti & Co s.p.a

Appendix B: Bibliography

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