Workflow Automation with Lotus Notes for the Governmental Administrative Information System

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The paper presents an introductory overview of the workflow automation area, outlining the main types, basic technologies, the essential features of workflow applications. Two sorts of process models for the definition of workflows (according to the conversation-based and activity-based methodologies) are sketched. Later on, the nature of Lotus Notes® and its capabilities (as an environment for workflow management systems development) are indicated. Concluding, the experience of automating administrative workflows (developing a Subsystem of Inter-institutional Document Management of the VADIS project) is briefly outlined.

1. The notion of workflow automation

Workflow (WF) is a set of activities that is needed for the execution of a task. Each set of such activities has to be carried out in accordance with the organisational processes.

Workflow automation (WFA) was first used for material flows in industry, designing automated control systems; later on, in automation of information processes and database transactions (i.e., operations of manipulation with database data). Approximately in 1985, a group of engineers have proposed to automate business processes based on paper documents at the offices, introducing the concept of 'workflow software' [1].

Workflow automation tools computerise, improve the co-ordination and control of information connections in organisational processes, while the activities can be automated or executed by the personnel. A comparative review of workflow automation tools is given in Fig. 1.

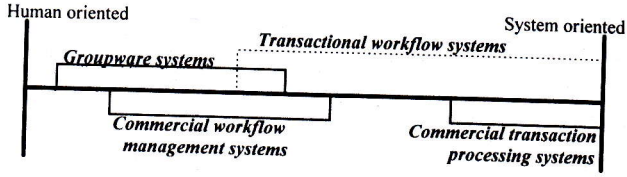

Fig. 1. Comparison of workflow technologies [2].

In the process of workflow support tools evolution, the following stages and corresponding application types can be indicated: imaging systems, forms routing systems, enhanced electronic mail systems, groupware systems, multi-system applications, which contain in themselves WF tools of different types.

Workflow management systems employ different contemporary information technologies: database management, client - server architectures, heterogeneous distributed computing, messaging infrastructure, enabling of mobile users, document management, graphic user interfaces, integration with legacy and new systems, etc.

Workflow systems (WFS) could be classified according to three aspects: recurrence (uniqueness) of the processes under automation, value of organizational processes and infrastructure used for WFS realisation. According to the first two of these aspects, workflow systems are divided into four groups (see: Fig. 2):

- Production workflow systems: destined for automating especially intensive routine work of predefined order. They are realised using transaction processing systems. Specialised software tools: InConcert, FileNet, FloWare, FlowMark, ViewStar.
- Administrative workflow systems: meant for the automation of administrative work based on paper forms. Specialised software tools: Jetform, Staffware.
- Collaborative workflow systems: destined for the automation of especially important organisational processes, which are not oriented to transactions. The most widely used software tool is Lotus Notes.

- Ad hoc (special) workflow systems: devoted to the automation of routine office work based on unstructured information. Specialised software tools: Action, Keyfile.

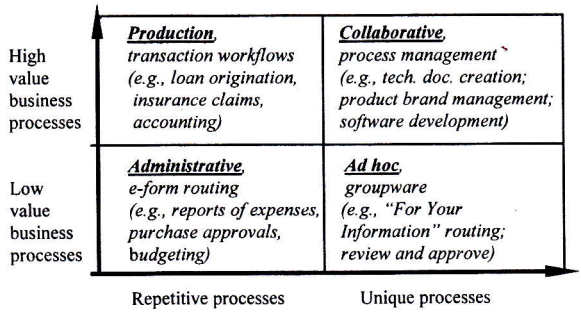

Fig. 2. Types of workflow systems applications [3].

Alternative ways of realising workflow systems are chosen according to what is received by those who have to perform a pre-defined job:

* *all needed information and a description of routing* (that can be realised using even customary e-mail systems);
* *only the references* to information (needed for work) which is stored in shared distributed databases;
* *the main document with references* to supplementary information.

The architecture of contemporary workflow automation systems usually is composed of the following main structural blocks or hierarchical levels:

- *file manager*; e.g., the common electronic-mail system or a shared file server,
- *database* with parallel access conflict resolution, data security, indexing, querying and other means of database management systems (DBMS); e.g., relational or object-oriented database systems;
- *workflow monitors*, storing the information on WF elements: users, their roles, activities, current and foreseen events, etc.

The evolution of WFA tools is strongly influenced by strengthening of unified Internet, WWW and other standards at a rapid pace. Specialised terms and standards of workflow automation subjects (regulating interconnections between application systems and means of process description, WFA administration, monitoring, execution, etc.), are

prepared by a non-profit organisation "Workflow Management Coalition" [4].

2. Conceptual models of workflow description

When organising the computerisation, automation, and management of any workflows, the following three main phases of this process are usually singled out: /1/ *analysis* of the problem area, /2/ definition, description, *specification* of workflows to be automated, /3/ reorganisation and *automation* of the examined process.

Analysing the problem area for a workflow automation is planed, it is useful to clear up the following information at first [5]: who participate (people, computers) at the workflows; what activities are clasped; what events trigger what activities; why some person performs the indicated activity; who is responsible and for what activity; why a certain activity is necessary.

Specification of workflows under automation includes:

(1) definition of documents and other data which represent the activities;

(2) indicating of performers who participate in workflows;

(3) indicating software tools, which are used by performers for the execution of appointed jobs;

(4) definition of workflow routes from one step to another.

For the definition and specification of investigated workflows two main types of process models are used:

1) Language/Action (i.e., based on communication cycles) conceptual models [6]. The main concepts of these models are the following: customer (requester), performer, observer (supervisor), approver; elementary work loop with preparation - negotiation - performance - acceptance phases (see: Fig. 3-a); duration; events of qualitative changes (e.g., propositions, contra-propositions; promises; statements about the end of performed actions; made and cancelled agreements; conditions of satisfaction). The novelty of such process representation models is the explicit introduction, separate representation of dialogue, negotiation phases among partners of collaboration (see: Fig. 3-b). That allows to represent collaborative processes more coherently, indicating important alternatives of events development possibilities.

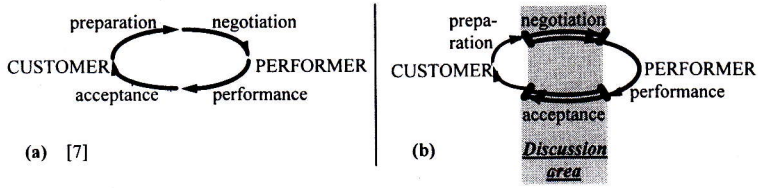

Fig. 3. Schemes of the basic constructions of Language/Action models.

(The Business Action Theory and Generic Business Framework [8] are included into this category, too; because the phases of a Business Process here correspond rather well to Workflow loop stages of Language/action models: {*Business prerequisites, Exposure and contract search*} → preparation, {*Contract establishment and negotiation*} → negotiation, {*Contractual (mutual) commitments, Fulfilment*} → performance, *Completion* → acceptance);

2) Conceptual models of activities. The main concepts are: processes, activities, information objects, roles, actors. The example of process decomposition expression by a conceptual model of this type is given in Fig. 4.

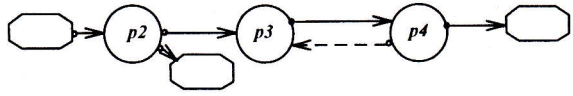

Fig. 4. Example of workflow representation by a model of activities.

In our case, both types of workflow representation models were used (see: Sec. 4.1, Fig. 6 and 7).

3. Lotus Notes as a tool of workflow systems realisation

Lotus Notes® is a distributed client/server platform that allows to develop applications containing data to be shared by groups of users across a network. It is comprised of a set of document databases that reside on top of a messaging infrastructure. Leveraging the distributed storage and messaging features, the Integrated Development Environment (IDE) provided by Notes™ enables Rapid Application Development and Deployment (RADD) of strategic enterprise-wide business applications [9].

Shortly asserting, Lotus Notes is a new generation software design tool, the main distinctions of which are the following:

- based on an *object-oriented* paradigm (see: the scheme of Lotus Notes *class hierarchy* [9, p. 142(128)], the tables of *programmable objects* [9, p. 147] and *events associated with objects* [9, p. 148]; the description of Notes' *programming language LotusScript* [10]);
- bearing a *client/server* architecture;
- *integrating*: (1) text processing, (2) multimedia hypertextual distributed shared database, (3) e-mail, threaded discussion (teleconferencing), electronic blackboards, (4) World Wide Web possibilities; in addition, (5) realisation of software agents, automatic routing of sent information, (6) flexible replication of databases, (7) information security assurance, (8) full functionality to mobile users, and other possibilities.

The applications of Lotus Notes systems can be classified according to the axes of increasing complexity of structure and increasing interaction possibilities (see: Fig. 5). The analysis of current Lotus Notes applications, distributed Lotus Notes templates, etc. allows to say, that till now most important application type of Notes™ is process tracking, i.e. information support to emerging processes at enterprises. In addition, at present especially quickly spreads using of Lotus Notes and Lotus Domino for maintenance of especially large and complicated interactive WWW sites.

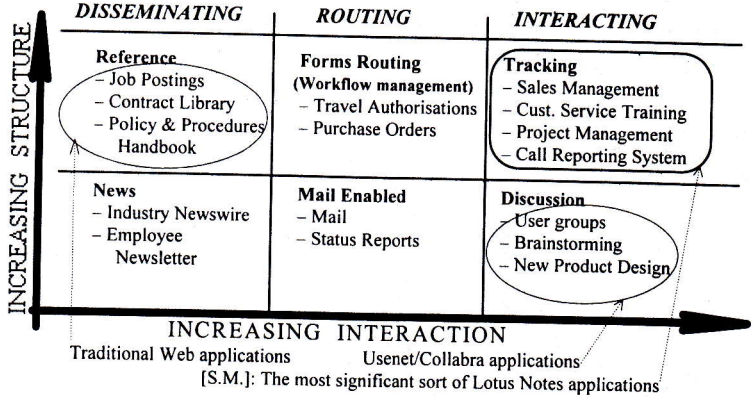

Fig. 5. Classification scheme of Lotus Notes applications [11].

The main Lotus Notes features suitable for automating workflows are as follows:

1) Software agents, formulas, macro means, object-oriented programming language LotusScript. (*Agents are used for*: (1) routing of workflows, (2) sending of periodic messages on important or postponed actions, (3) sending of electronic letters, (4) viewing of DB information, (5) execution of document maintenance tasks, (6) rapid distribution of information, (7) execution of non-periodical routine activities. *Software agents can be started* differently: [a] launched by user from the Notes client menu or agent window, [b] after the foreknown changes in the document database, [c] at the appointed time moment, [d] executed directly from macro-commands, LotusScript programs, or an action part of other agents);

2) Integration of application programs, using object linking and embedding OLE2 technology, field exchange Notes/FX possibilities, action buttons NotesFlow;

3) flexible tuning of regulated access to shared databases in a distributed environment;

4) Name and address book, as a model of organisational structure and relations to external environment of the enterprise (or corporation).

As a workflow automation tool, Lotus Notes in most cases is used for: routing of received requests, directing to the corresponding service departments; error tracking; processing of travel and alike applications; etc. [12].

Price-performance ratio evaluation of Lotus Notes in the area of common Intranet applications (i.e.: Document publishing, E-mail, Database access, Discussion databases, Workflow, and Transaction processing) and it comparison with alternative Web software products (from Netscape, Microsoft, Sun, public domain sources, IBM, Oracle, FTP, O'Reilly and DEC) is concluded in [13].

4. Automation of administrative workflows at VADIS project

VADIS project is aimed at development of the Administrative information system of the Government of the Republic of Lithuania [14].

The Lotus Notes software was selected as a basic VADIS environment (after comparison of it with the relational database management systems, Novell, Microsoft and Netscape solutions). I.e., there was decided that Lotus Notes corresponds best the

VADIS requirements, ensures the integrity of VADIS infrastructure, interacts with the existing information systems, allows to expand and administrate VADIS in a sufficiently efficient manner in the next stages of VADIS development.

Theoretical material presented in the previous sections of this paper was used implementing the Inter-institutional document management subsystem of VADIS project. Here, typical administrative workflow solutions were chosen and started to gradually implement them in a few pilot VADIS institutions (the very first of which are: Ministry of Social Assurance and Labour, Ministry of Environmental Protection and the Office of Lithuanian Government); with plans to implement that in all the VADIS institutions, later on.

4.1. Analysing current administrative workflows at the pilot VADIS institutions both sorts of workflow representation models (see: Sec. 2) were probed. Examples of their usage are presented in Figures 6 and 7. The main knowledge acquisition methods used for this were generalisation of taken information material (document registration journals, rules, etc.), interviews with application area experts (and ordinary employees), iterative refinement of the designed draft models in common discussions with them.

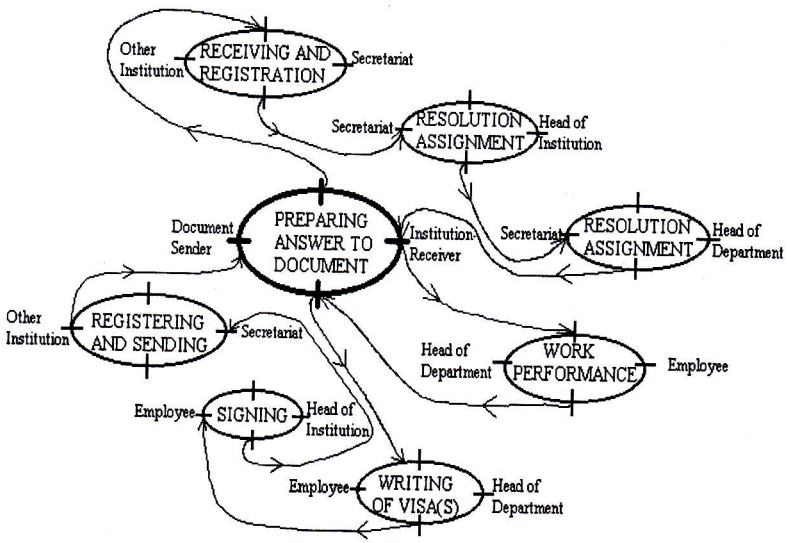

Fig. 6. Workflow cycle of inter-institutional document management.

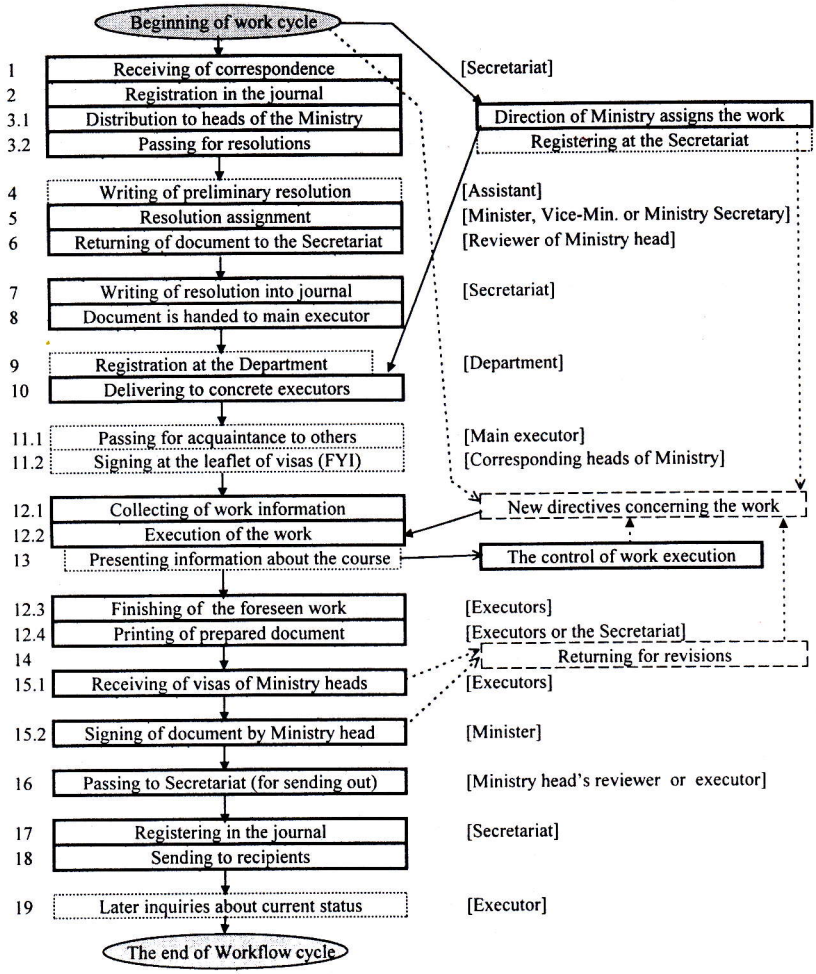

Fig. 7. Detailed workflow cycle of inter-institutional document management.

4.2. The selected implementation tool for the realisation of Inter-institutional document management subsystem of VADIS project was Lotus Notes.

According to Fig. 2 of the 1st sec., for the realisation of administrative workflows not Lotus Notes fits best. But it is good having in mind later development of the Governmental administrative information system *towards collaborative workflow*

systems. E.g., the other step in this direction is: starting to implement the subsystem for work groups (members of which belong to different institutions) who are preparing drafts of Seimas (i.e. Lithuanian Parliament) laws.

From the other side, the fact that Lotus Notes is especially powerful tool for implementation of groupware systems, has a *negative side*, too:

- experienced Lotus Notes programmers are needed. I.e., even for those who know this programming tool, at the beginning there were serious difficulties to clear up some subtle but essential parameters of Lotus Notes application development environment;
- at the very beginning of implementation of Lotus Notes applications, it is rather difficult to explain for users why such 'strange' tool was selected; the questions like this are given to us: "we have seen so good system implemented with FoxPro, and we would like to have the same solution (and windows design) in this case, too". Only after explaining, showing the scale of possibilities which are given by Lotus Notes - they agree (after some time): "yes, it is needed for us".

The development of the workflow automation software was rather slow in our case. One of main reasons was peculiarity of interaction with application area personnel: as usual, they present inform concerning their needs not in advance and not 'all at once', but in small portions, and after receiving new version with last modifications of designed software. From the other side, sometimes only after realisation of needed Lotus Notes application decisions - the more efficient way of organizing that are cleared up.

The User Guide of the system under implementation is prepared correspondingly to 4 distinct *levels of viewing any Lotus Notes systems*: 1) data bases (and possible user roles in them), 2) Lotus Notes navigators and views; allowed actions in each of them, 3) documents: their possible forms and corresponding action buttons, 4) fields of documents: their data types, lists of possible values, and actions buttons.

In addition to technological qualities, rather big importance for our system acceptability to the users has a fact that we are using a *Lithuanian version of Lotus Notes* (i.e.: v4.13). That simplifies the learning process, allows to prepare the User Guide of the system in less complicated style. (E.g.: the possibilities to use various sorts of search with indication of needed dates on special menu: "between", "before", "after" and other - are clear to a user without additional explanations).

At the time when the *alternative possible software tools* of our project implementation were investigated, there was some doubt: "does our selection of Lotus Notes will not be outdated because of future changes in the world market of groupware, workflow, Internet/Intranet products (with extremely tight competition between vendors)?". But till now Lotus Notes and Lotus Domino are still evolving rapidly and earnestly: solving previous shortages, giving new possibilities, allowing us to widen and intensify the implementation of automated workflow solutions.

Despite of some temporary difficulties, implementation of the Inter-institutional documents management subsystem of the VADIS project is going forth. The implementation process is especially successful in those ministries, where customers came to conclusion by themselves: "current information processing technologies - no longer correspond the actual needs". The number of such institutions in Lithuania is growing; that allows to look at the workflow automation perspectives in the future with optimism.

References

[1] A. Sheth. Workflow automation: applications, technology and research. Tutorial. *SIGMOD95 Conference*, California, 1995. http://www.cs.uga.edu/LSDIS/~amit/SIGMOD95-tutorial.ps

[2] A. Sheth, D. Georgakopoulos, S. Joosten, M. Rusinkiewicz, W. Scacchi, J. Wileden, A. Wolf. Report from the *NSF Workshop on Workflow and Process Automation in Information Systems*. Technical report, University of Georgia, UGA-CS-TR-96-003, July 1996. (Also in: *ACM SIGMOD Record*, September 1996). http://lsdis.cs.uga.edu/activities/NSF-workflow/final-report.ps

[3] C. Mohan. State of the art in workflow management research and products. Presentation. *5th International Conference on Extending Database Technology*, Avignon, France, March 1996 ; *ACM SIGMOD International Conference on Management of Data*, Montreal, Canada, June 1996. http://www.almaden.ibm.com/cs/exotica/sigmod96.eps

[4] WfMC. *The Workflow Management Coalition Specifications*. Brussels, Belgium, 1997. http://www.aiai.ed.ac.uk/WfMC/

[5] S. Joosten. Trigger modeling: a tutorial. University of Twente, The Netherlands, 1996. http://www_is.cs.utwente.nl:8080/~joosten/tutorial.html

[6] T. Winograd. Where the action is. *Byte*, 1988, Vol. 13, No. 13, pp. 256A-258.

[7] *Action Workflow Analysis Users Guide*. Action Technologies, 1993.

[8] U. Melin. Information systems and organisational change. *Proceedings of the 20th Information Systems Research Seminar in Scandinavia, IRIS 20 "Social Informatics"*. Hanko, Norway, June 1997. http://www.ifi.uio.no/iris20/proceedings/33.htm

[9] M. Hawker, J. Arteaga, G. Krause, D. Morrison, H. Nakamura, R. Strobl. *Lotus Notes Release 4.5: A Developer's Handbook*. ITSO redbook. IBM Corporation, International Technical Support Organization, 1997. 590 p. http://www.lotus.com/developers/redbook.nsf (in "PDF" format)

[10] *LotusScript Technology Learning Center for Notes 4.6*. GE Capital IT Solutions Groupware Practice, Lotus Business Partner Program, 1998. http://www3.lotus.com/learningcenters/46script.nsf

[11] D. Nelson. Lotus Notes and the Internet: compared and contrasted. Lotus Development Corporation, Rochester New York, 1996. http://www.rochesterny.com/lotus/2136.htm

[12] B. Reinwald, C. Mohan. Structured workflow management with Lotus Notes release 4. *Proceedings of the 41st IEEE Computer Society Int. Conference (CompCon)*, Santa Clara, CA, 1996, pp. 451-457. http://www.almaden.ibm.com/cs/exotica/exotica_wf_notes0296.ps

[13] J. Becknell. Notes/Intranets: cost of ownership study. Business Research Group, Lotus Development Corporation, 1996. http://www.lotus.com/home.nsf/tabs/search

[14] E. Kulbokas, E. Telešius, R. Valentukonienė. Administrative information system of the Government of the Republic of Lithuania: Main solutions. *Baltic IT Review*, 1997, No. 2, pp. 70-73.