

MODELLING THE DYNAMIC RELATIONSHIPS BETWEEN WORKFLOW COMPONENTS

L. Pudhota E. Chang & J. Davis

School of IS, Curtin University of Technology, PO Box U1987, Perth WA 6845, Australia

Keywords: workflow models, dynamic relationship, modelling

Abstract: Whether the economy is strong or weak, competition is fierce. The need for business change to maintain a competitive edge comes faster in this rough business environment causing the business process model to get more dynamic and complex. However, one has to manage it so the efficiency of business processes are maximised. This paper develops a modelling approach for dynamic business processes, defining exceptions and enabling business strategies to be captured vigorously while simultaneously allowing changes to be handled. We introduce the MAO workflow model, and we propose the automation of workflow components using MDA

1 EXISTING WORKFLOW MODELS

General Organisational Workflow Models

In general, we found that most workflow modelling and workflow design are only concentrated on the operational aspects of the organisation (Siebert, 1996) (Sheth et al., 1998) (Marshak, 1994) (<http://www.loria.fr/~skaf/cours/workflow/workflow/sld00.htm>). Although operational aspects of workflow design are crucial to the organisation, we note that they are passive in changes and they are not dynamic. They only change when there is a management decision. Collaborative workflow is a new type of workflow that has to be integrated into the existing operational workflow.

Marshak Organisational Workflow Model

As per the paper by Marshak, R.T.: (Marshak, 1994), in any organisation, a workflow can be disseminated into three categories.

a Ad-hoc workflows involve human coordination, collaboration, co-decision, and often appear in office processes such as product documentation or sales proposals.

b Administrative workflows involve repetitive, predictable processes with simple task coordination rules, such as routing an expense report or travel request through an authorisation process.

c Production workflows (automated tasks being performed repeatedly) production workflow

encompasses an information process often involving interaction to one or more distributed/heterogeneous/autonomous information systems.

Dr Hala Skaf-molli Workflow Model

According to Dr Hala Skaf-molli (<http://www.loria.fr/~skaf/cours/workflow/workflow/sld00.htm>), workflow can be categorised into four groups.

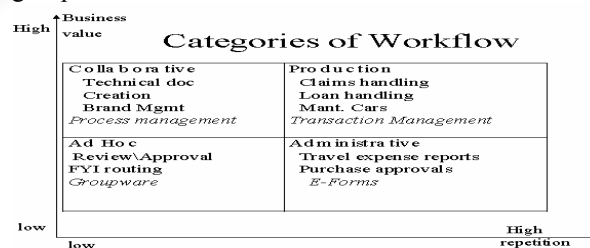


Figure 1: Categories of Workflow by Dr Hala Skaf-molli

Lano's Classification

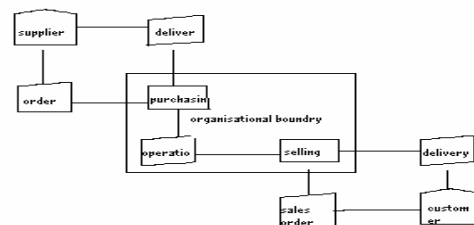


Figure 2: Lano's Classification

According to Lano's Classification, we see that supplier, customer, delivery and order are external to the organisational boundary and purchasing, operational and selling are classified as part of organisational boundary. This model is suitable for some organisations and may not be standard across other organisations.

2 ISSUES IN ORGANISATIONAL WORKFLOW COMPONENTS

We find that an organisation would contain a number of organisational units and divisions, such as management, administration, operation and customer service. Each one of these organisational units could comprise of a number of smaller functional units for which each may have one or many workflow components for which they carry out specific tasks, responsibility and workflow processes. Therefore, an organisational workflow is a composition of a number of workflow components. Some workflow components are active when changes take place and some are passive.

So far, no analysis has been done in literature for the classification of workflow components, their inter-relationships or formal definition of their attributes and processes. There has been some existing workflow modelling techniques used in literature to help modelling the workflow and dynamic aspect of the workflow, such as Petri Nets (Aalst et al., 1999), Event-driven Models, State Event and Action Rules (Nutt, 1996) (Aalst et al., 2000), UML Activity Diagrams, Sequence Diagrams and Extended Activity Diagrams (Gautama et al., 2000) (Gantama et al., 2003). We found that these techniques allow for modelling for existing processes. However,

a. They don't model the inter-relationship between the workflow components. Some aspect of concurrency and asynchronous execution of the different workflow process (i.e. multi-threading); and

b. Their current use does not deal with the dynamic aspect of workflow models or provide a clear indication where the flexibility is allowed, when changes occur or how the organisation can adapt the changes at Just-In-Time; and

c. These modelling techniques only model one aspect of organisational workflow, and sometimes have too low a level of representation and they are basically not applicable at the conceptual level of development of complex organisational workflow systems (Bossidy et al., 2003) (Chang et al., 2003).

The necessity for modelling the workflow at a higher level of granularity that involves many sub-workflow components and workflow processes, their interfaces, interaction and relationships

3 MAO MODEL [MANAGERIAL, ADMINISTRATIVE AND OPERATIONAL]

In our study, we have found that there are many workflow components within an organisation and these workflow components interact with each other to achieve the organisation goals and objectives. Therefore, we disseminate the organisation workflow into following levels (refer to figure 3:)

Operational workflow relates to the core business operations. It is usually measured by its performance and by the volume of its output. The operational workflow is the main source of value generation for the organisation.

Administrative control workflows are involved in making decisions and prioritising tasks and scheduling tasks. The administrative task workflow is measured by its efficiency.

Managerial workflow carries out business decisions, which in turn control entire business administration and is measured by the financial and final results.

3.1 MAO in Collaborative Workflow Environment

The advent of the Internet has provided mechanisms to allow organisations to bind together, for carrying out sales over great distances at any time. It has created new modes for operation service and marketing and enabled partnerships previously inconceivable within a wide array of businesses as well as other human activities. A consequence of this connectivity and information richness is that one is faced with an increasingly dynamic business environment and workflow. Several factors characterise this collaboration (Chang et al., 2003), namely:

A strong information infrastructure that extends beyond the original closed walls of the *individual enterprise*. High connectivity and electronic handling of information, of all sorts including data and documents.

An increasingly *collaborative approach* between what were more traditional *individual enterprises*. Utilisation of new forms of electronic interaction, provision of services and utilisation of services. Ability to self-organise and reconfigure the business of the organisation, perhaps even the organisation as

a whole. Use of multiple channels for sales and marketing. These features are increasingly exhibited by successful modern business organisations. We have found that our MAO model is suitable for a collaborative environment.

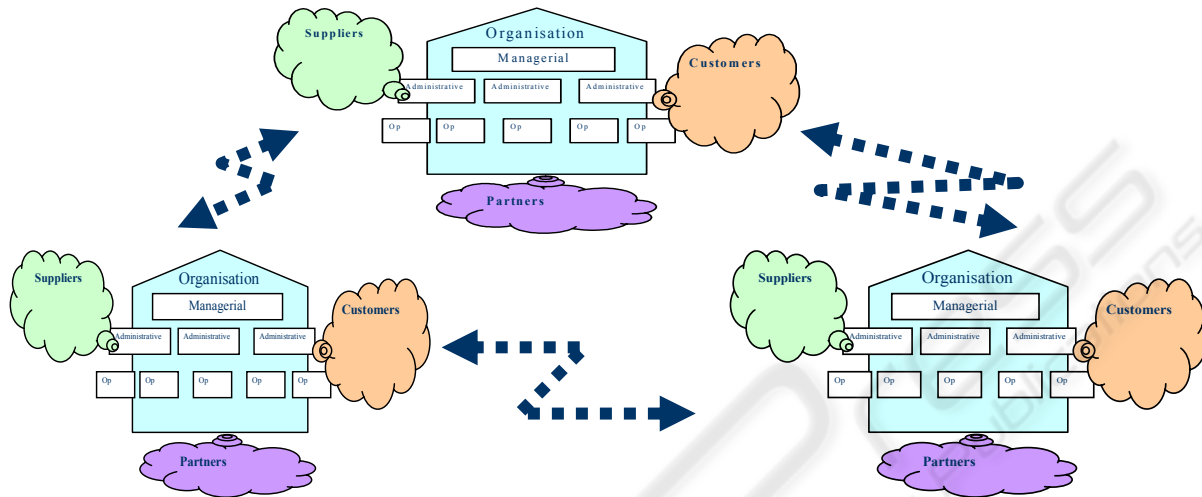


Figure 3: Collaborative workflow model for Logistic Consortium

4 HIERARCHICAL RELATIONSHIPS BETWEEN WORKFLOW COMPONENTS AND SUB- WORKFLOW COMPONENTS

Through analysis we have defined the relationships in an organisation as follows:

1. **Operational Workflow** is the main source of value generation for the organisation

2. **Administrative Workflow** is divided into four subcomponents, Administrative control workflows are involved in making decisions and prioritising tasks and scheduling tasks. The administrative task workflow is measured by its efficiency.

3. **Managerial Workflow** carries out business decisions, which in turn control entire business administration and is measured by the financial and final results. Their hierarchy of the aggregation of the workflow components is shown below:



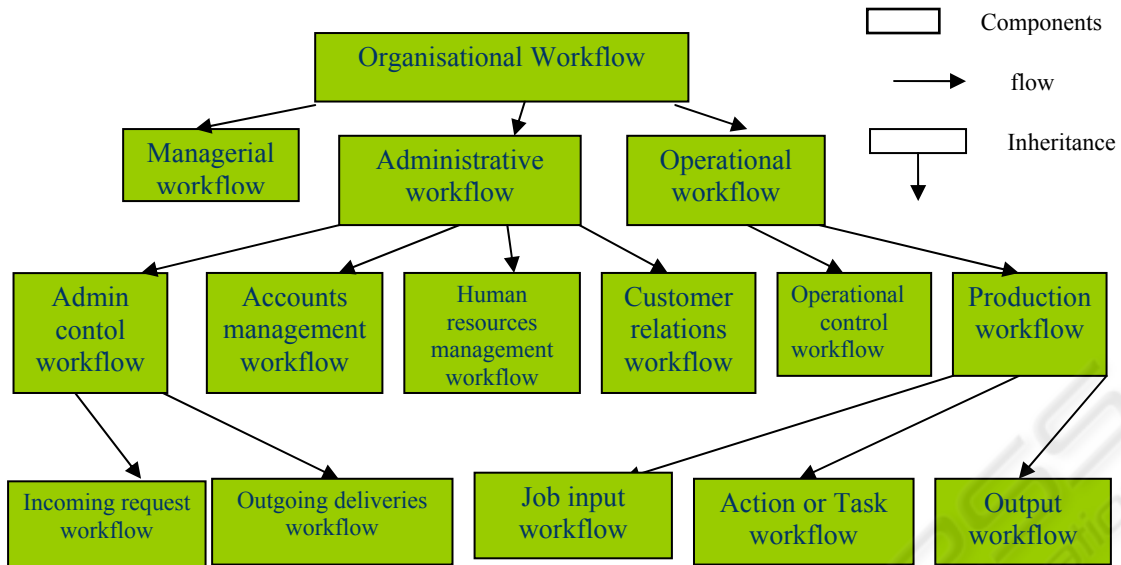


Figure 4: Hierarchy Decomposition of Enterprise Workflow Model

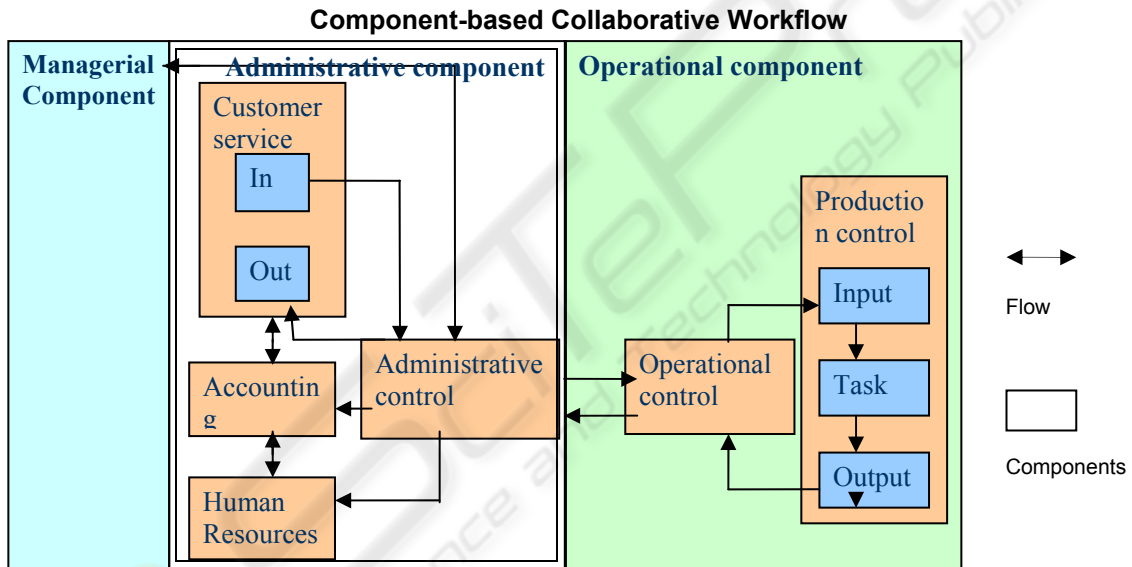


Figure 5: Collaborative Workflow Components

5 WORKFLOW COMPONENTS

We define the collaboration of these workflow components by the following collaboration diagram, in figure 5 shows three major workflows. The arrows show one way of the flow control. Customer service workflow relates to events such as order request and order fulfilment. Incoming order workflow takes the customers input and outgoing service workflow delivers the goods and services to the customers. Note that **administration** workflow and **operational** workflow are relatively structured and stable in an organisation. Their changes are not random or frequent. The efficiency of

administrative workflow management and performance of the operational workflow management create value for the organisation. However, we find that the course of the above two workflows is due to changes in the managerial workflow component. **Managerial workflow** governs the entire administrative workflow and operational workflow. It is executed through strategic decision-making, and this strategic execution is driven by business operation planning, change management and outcome evaluation. Over the execution of the managerial workflow component, it collaborates with the administrative workflow component and operational workflow component. Managerial workflow component is the

primary cause of the dynamic workflow changes of an organisation. In our opinion, the managerial workflow is usually unstructured, dynamic and the process changes over time and is driven by market pressure, economic competition and business value therefore managerial workflow is dynamic, flexible and sometimes ad-hoc. Therefore, if we make the administrative and operational workflow components flexible, which inturn causes managerial workflow changes; the administrative workflow and operational workflow component can be automatic or semi-automatic changes. We have found that no work exists in the current literature of modelling dynamism of the managerial workflow. However, some work exists in modelling flexible workflow that can deal with changes in literature close to administrative workflow and operational workflow (Aalst et al., 999) (Chiu et al., 998) (Horn et al., 998) (Joeris, 2000).

6 AUTOMATED WORKFLOW COMPONENTS

A workflow model represents a group of workflow components. It explicitly captures different characteristics of the target area. Frequently, the choice of characteristics to retain is dictated by relevance (Dillon et al., 993). We propose that the steps of modelling the workflow which can result in effectively capturing the changes.

Step 1 Modelling relationships between workflow components

Step 2 Modelling the collaborative organisational workflow components

Step 3 Modelling workflow components to extended activity diagrams and/ or Class diagrams

Step 4 Utilising MDA to produce quick prototype
Decomposition workflow concept will be presented Ref to Figure 1.

- Detailed relationships and collaborations of different workflow components will be described in detail and the abstract conceptual model of workflow and methodology framework shown in Figure 4 will be further described in detailed

- There are so many different technologies that are used to develop a system and different platforms on which the same system can run. Therefore, it is necessary to model the business requirements using an independent way. The concept of **Model Driven Architecture** is that this

data can then be modelled on a specific platform from which one can implement the system. It allows

the requirements of the customer to be recorded in a clear and concise way to develop a system using a platform independent model.

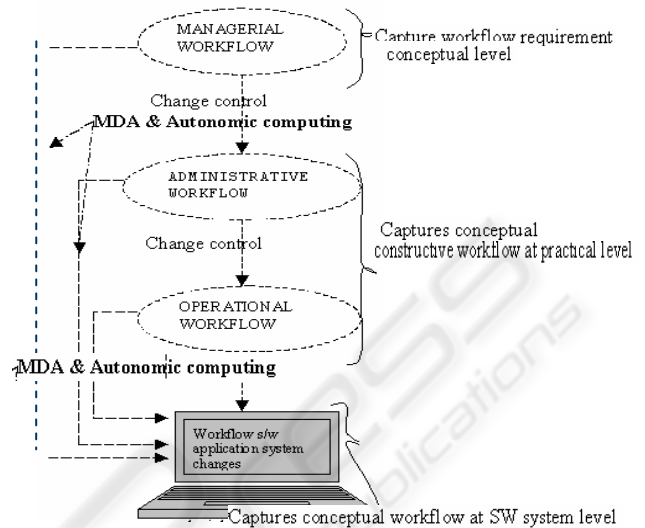


Figure 6: Proposed MDA transformation of design models Prototype

7 CONCLUSION

In this paper, we have discussed, developing modelling approach for dynamic business processes, exceptions and to enable business strategy to be captured vigorously while simultaneously allowing changes to be handled. We have discussed the MAO workflow model, MAO workflow model in collaborative environment, hierarchical relationship of MAO in collaborative environment, Component-based collaborative workflow model, and we have also proposed MDA transformation of design models to the generation of code in a specific language (Johanna et al., 2003).

REFERENCES

Siebert, R.: Adaptive workflow for the German Public Administration. *International Conference on Practical Aspects of Knowledge Management*, 996.

Aalst, W.M.P. van der; Basten T.; Verbeek, H.M.W.; Verkoulen, P.A.C.; Voorhoeve, M.: Adaptive Workflow On the Interplay Between Flexibility and Support. *Proceedings of the first International Conference on Enterprise Information Systems*, Vol 2, pages 353-360, Setubal, Portugal, March 999.

Han Y.; Sheth, A; Bussler,C.: A Taxonomy of Adaptive Workflow Management, *Proceedings of the CSCW-98*

- Workshop Towards Adaptive Workflow Systems*, Seattle, USA, November 4, 1998.
- Chiu, D.K.W; Karapalem, K; Li, Q: Exception Handling with Workflow evolution in ADOME-WFMS: a Taxonomy and Relocation Techniques, *Proceedings of the CSCW-98 Workshop Towards Adaptive Workflow Systems*, Seattle, USA, November 4, 1998.
- Horn, S. & Jablonski, S.: An Approach to Dynamic Instance Adaption in Workflow Management Applications, *Proceedings of the CSCW-98 Workshop Towards Adaptive Workflow Systems*, Seattle, USA, November 4, 1998
- Nutt G.: The evolutions Toward Flexible Workflow Systems, *Distributed Systems Engineering*, Vol. 3, No. 4, pp. 276-294, December 1996.
- Aalst, W.M.P van der; Jablonski, S.: Dealing with workflow change: Identification of issues and solutions, *Computer Systems Science And Engineering*, September 2000.
- Joeris, G.: Modeling of Flexible Workflows and Their Decentralized Enactment in flow.net, *Special Issue of International Journal of Computer Systems Science And Engineering*, September 2000.
- Marshak, R.T.: "Falling in Love with Distinctions", In "New Tools for New Times: The Workflow Paradigm", Future Strategies Inc., 1994
- Dillon, T., Tan, P.L, "Object Oriented Conceptual Modeling" Prentice Hall London, 1993.
- Gautama, E Chang, E. Isorc 200 IEEE conference on Distributed Extended Activity diagram for workflow modelling. Germany July 2000.
- <http://www.loria.fr/~skaf/cours/workflow/workflow/sld00.htm>
- Gantama, E., Chang, E., Jayaratna, N. & Pudhota, L., 2003 " A methodology for flexible work flow modelling " Int. Journal on Computer system, Science and Engineering, Vol 8 No3,UK.
- Bossidy, L. & Charan, R. 2003, Execution, New York
- Chang, E. et. al. web services for collaborative logistics IEEE conference on industrial informatics Benff, Canada sept. 2003.
- Johanna Ambrosio " Tools for the code generation 2003