Contract-based Cross-Organisational Workflows
The CrossFlow Project♠

Heiko Ludwig, Yigal Hoffner

IBM Zurich Research Laboratory
Säumerstrasse 4, CH-8803 Rüschlikon
{hlu|yho}@zurich.ibm.com

1 Introduction

Advances in networking technologies, fast changing markets, the increased pressure to specialise and the demand of increasingly sophisticated consumers to purchase new services, are creating a need for cost-effective ways of finding, purchasing and managing services performed by other organisations on the consumer's behalf. This is putting organisations under pressure to set-up and manage business links with other organisations in a rapid, dynamic and flexible manner, and to outsource more of their business processes. Value chain integration, implemented by business processes across boundaries of individual organisations, is therefore becoming increasingly important.

Workflow Management Systems (WfMS) provide organisations with the means to initiate, control and monitor business processes, thereby reducing their operational management costs. One way of allowing business processes to cross organisational boundaries, is by linking the WfMSs of the respective organisations. Current WfMS, however,mainly support business process within the boundaries of one organisation.

The CrossFlow project aims to investigate the issues surrounding business processes crossing organisational boundaries and determine what is currently missing in and around WfMSs used in this context. In addition, the project will develop ways of making the coming together of two organisations within such a business relationship dynamic. This will be done by incorporating the linking of the WfMSs of two organisations in the larger process of finding suitable business partners, of match-making their offers and requirements, of reaching agreement between them, of setting up their systems and of linking them, and of the outsourcing from one organisation to the other in accordance with the contract.

CrossFlow is a European research project in the 4th ESPRIT framework. The main project contractor is IBM France; IBM Zurich Research Laboratory in Switzerland is acting as the project technical leader, while IBM's German Software Development Laboratory in Böblingen, Germany, contributes its FlowMark/MQSeries workflow management system and related expertise to the project. Technology providers in the consortium are GMD in Darmstadt, Germany, and the University of Twente in the Netherlands, who contribute their expertise in groupware [BY 97] and workflow management [GREFEN 99]. The user partners, KPN Research in Groningen, the Netherlands, and AGFIL in Dublin,

♠ The project presented in this paper is supported by the Commission of the European Union and the Swiss Government as ESPRIT project No. 28635.

Ireland, provide expertise in the application scenarios which were chosen to motivate the project and test its results. Sema Group in Madrid, Spain, acts as industrial observer in the consortium.

2 Issues for Cross-Organisational Workflow

Figure 1 shows a scenario where one provider organisation performs a *service* on behalf of a consumer organisation. Consumers initiate the outsourcing from their WfMS to a process in the WfMS of the other organisation (1). A consumer may also wish to intervene in an on-going process which it initiated in the other organisation (2.). [LUDWIG 98, LUDWIG 99]. Ultimately, results from the provider WfMS may be returned to the consumer (3).

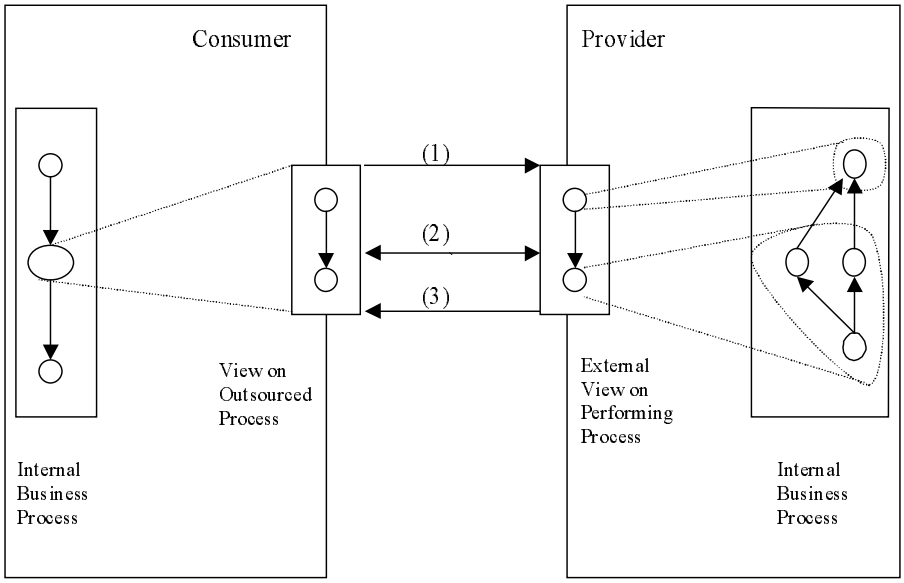

Figure 1: Outsourcing scenario showing interactions between a service provider's process and a service consumer's process.

Unlike interactions between the users and the managers of a WfMS within one organisation, interactions across organisational boundaries represent the execution of a business relationship. The nature of the relationship between the organisations whose business processes are connected through their workflows cannot be understood or dealt with properly by concentrating solely on the problem of WfMS inter-operability, e.g addressed by the Interface 4 of the Workflow Management Coalition [WfMC 96] or by the JointFlow workflow facility [OMG 98]. In other words, providing inter-operable WfMSs is a necessary but insufficient step in enabling cross-organisational workflows. A business relationship connects organisations that are independent with respect to their internal processes, their technical standards, their terminology and their finances. Therefore, beyond interoperability, several issues have to be addressed beyond interoperability:

1. ***Contractual basis of cross-organisational relationships:*** Organisations specify their relationships with the outside world through contracts, e.g. service, purchase contracts

and employment contracts [HOFFNER 98]. If part of a workflow is to be performed by another organisation, a number of things will be specified in a service contract. The description of the task that is to be performed and some implicit or explicit specification of its expected quality. In some case the contract may also specify what the consumer can monitor and have control over in the out-sourced task. In addition we may find a specification of the consequences of failure to deliver what was promised in the contract.

One of the objectives of the project is to provide infrastructure to *specify* service contracts, *advertise* and *search* for service contracts, *establish the connection* between organisations on the basis of the agreed contracts, and enable the *supervision* of the quality guarantees.

2. ***End-to-end connection:*** The end-to-end view deals with all boundaries that exist between organisations [HOFFNER 97]. Where the boundaries are a result of the technical difference between the organisations and their authorities (e.g. management, process models, WfMSs, naming conventions, applications and distributed platforms), these differences will have to be overcome by some form of translation. Other aspects of boundaries (e.g. separate authorities, different objectives, different ideas of what constitutes sensitive information, and different security policies) require other forms of treatment at the boundary. Gateways can be used to deal with the boundaries that have to be crossed. For example, by ensuring that only contract-specified interactions are allowed to cross the organisational boundary.

   The project develops the appropriate gateways needed in this project and the means to instantiate and link them with the related WfMS.

The project aims to focus on the above issues in the context of the application domains which are of interest to the user partners: outsourcing in the insurance and logistics industries.

3 The CrossFlow Approach

The main concept of CrossFlow is the dynamic establishment of a relationship between consumer and provider. The lifetime of the service provision/consumption relationship is divided into four phases:

1. The consumer searches a suitable service offer and reaches a contract that specifies the service and related issues with its provider [HOFFNER 99].
2. The two organisations configure their system resources, link the necessary components together with the WfMSs and take the necessary organisational preparations.
3. The service is outsourced and is performed by the provider. Further interactions between the two processes may take place as shown in figure 1.
4. The service teminates and the connection is withdrawn.

Figure 2 illustrates the main elements of the system and their interactions. As a prerequisite to the dynamic construction of the service relationship, a provider has to decide to offer one of its internal processes as a service to other organisations (a). The

information that is relevant to external parties needs to be advertised (b) in a place that is known to potential consumer, the *trader* [OMG 96]. If a process in a WfMS of a consumer requires an activity that has to be performed by another organisation, the WfMS triggers the *search manager* (c) to look for a suitable offering (d). As a result of the trading process a contract is agreed on (e). In conjunction with the steps (a) and (c) both participating organisations defined in an Internal Enactment Specification (IES) of how the contract relates to their respective internal processes. This IES and the agreed contract are used to generate *proxy-gateways* (g) that deal with the crossing of organisational boundaries between both organisations. In addition, Co-operative Support Services (CSS) are generated (h) to deal with outsourcing issues which are not covered by the WfMS themselves (this will be explained in detail below). The proxy-gateways and CSSs are connected together with the WfMS to form a link from one WfMS to the other (i/j). When this infrastructure is in place the outsourcing can be initiated and a process in the provider WfMS can now be activated on behalf of the consumer organisation (k).

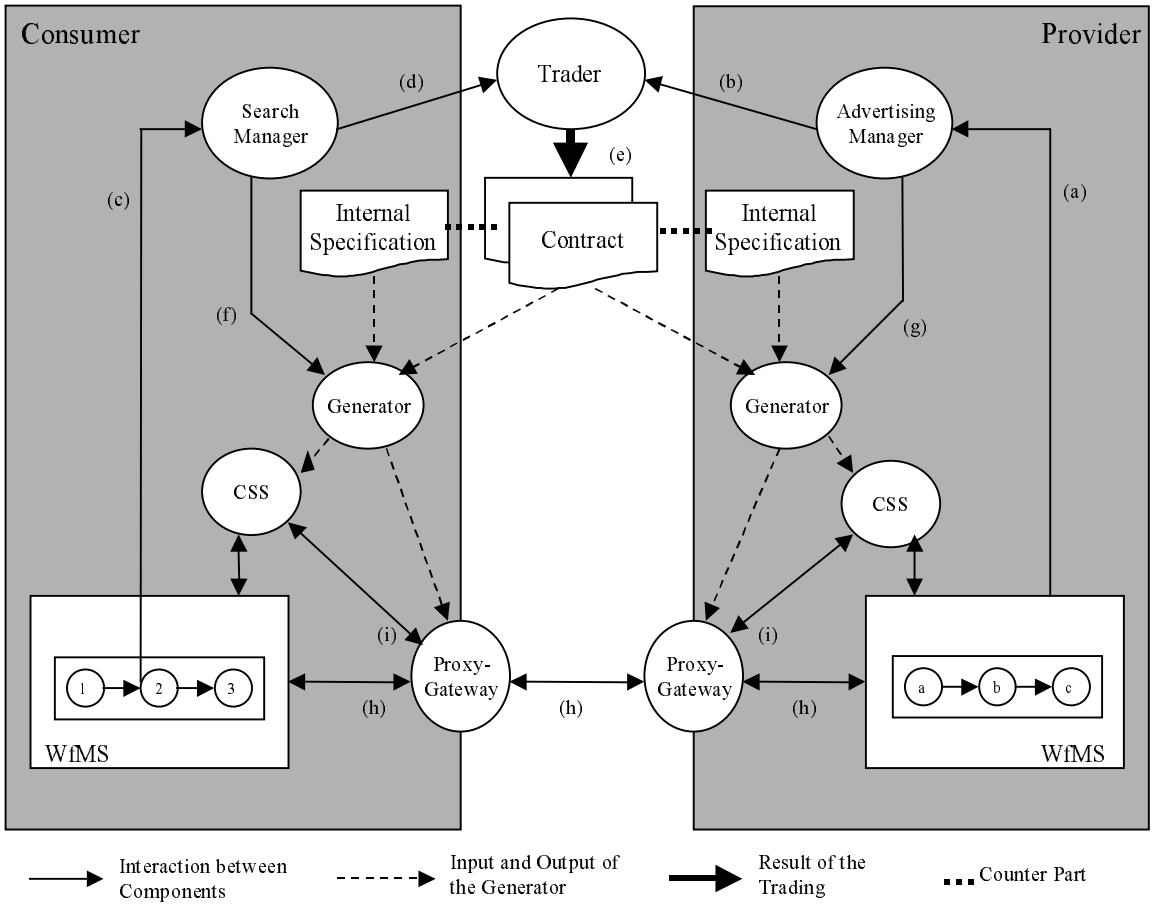

Figure 2: Main components of the CrossFlow project.

The *Co-operative Support Services* (CSS) supervise particular aspects of the service provision/consumption relationship with respect to the conditions of the contract. A Quality-of-Service (QoS) CSS monitors agreed service guarantees. A Level-of-Control (LoC) CSS deals with the problem of aborting an outsourced process, rolling it back and

compensating for the changes where this is necessary.

Where a contract between the provider and consumer is transacted often, much of the above process can repeat itself, and any previously generated components can be reused. This can significantly simplify the set-up of the connections.

4 The CrossFlow Application Scenarios

The CrossFlow project derives its requirements from two different application scenarios that also serve as the testbed for the results of the project:

- *Outsourcing insurance motor claims* is provided by AGFIL, an insurance company. AGFIL outsources major parts of its motor claims handling for comprehensive cover to different service providers. This includes an external call centre, a loss adjuster agency, different loss adjusters and garages. The business relationship of AGFIL with the call centre is static, but some of the relationships in the scenario are established on a case-by-case basis, as is the case with the garages.
- *Parcel delivery* is provided by TNT Express, one of the subsidiaries of KPN. In this scenario, consumers integrate the TNT logistics service into their WfMS processes, and are also given the capability to monitor and control TNT's service progress.

These scenarios provide a restricted application domain for the project. Thereby helping to scope the project and reduce its complexity to a level addressable by current technology. Limiting the scope of the project is of particualr importance in the context of contracts.

Conclusions

Enabling cross-organisational workflows as part of a larger business relationship, necessitates dealing with much more than the problem of WfMS inter-operability. By taking a 'holistic' approach, the CrossFlow project attempts to put the setting up of a link between the WfMSs and the subsequent passing out of a process, in the context of an agreed contract. The contract serves as part of the specification for the necessary components and their configuration, as the definition of what can and should happen. The contract also serves to determine the actions to be taken when things deviate from the agreed regular course of action.

References

[BY 98] R. de By, W. Klas, J. Veijalainen (eds.); *Transaction Management Support for Cooperative Applications*; Kluwer Academic Publishers, 1998.

[GREFEN 98] P. Grefen, B. Pernici, G. Sánchez (eds.); *Database Support for Workflow Management*; Kluwer Academic Publishers, 1999.

[HOFFNER 97] Hoffner, Y. and Crawford, B.; Using Interception to Create Domains in Distributed System, *Joint International Conference on Open Distributed Processing (ICODP) and Distributed Platforms (ICDP)*, 27-30 May 1997 Toronto, Ontario, Canada.

[HOFFNER 98] Hoffner, Y. and Schade, A.; Co-operation, Contracts, Contractual Match-Making and Binding, *2nd International Enterprise Distributed Object Computing Workshop (EDOC '98)*, 3-5 November 1998, San-Diego, USA.

[HOFFNER 99] Hoffner Y.; Supporting Elements of the Contract Life-Cycle, to appear in *IEEE 9th International Workshop on Research Issues on Data Engineering, RIDE-VE'99*, Sydney, Australia, March 23-24, 1999.

[LUDWIG 98] H. Ludwig; Analysis Framework of Complex Service Performance for Electronic Commerce, in M. Tjoa, R. Wagner (eds.): *Proc. of the 9th International Workshop on Database and Expert Systems Applications*; IEEE Computer Society Press, 1998.

[LUDWIG 99] H. Ludwig; Termination Handling in Inter-Organisational Workflow - An Exception Management Approach; *In Proc. of the 7th Euromicro Workshop on Parallel and Distributed Processing*, 1999.

[OMG 96] OMG; *CORBA Trading Object Service*, Document orbos/96-05-06, Object Management Group and X/Open, 1996.

[OMG 98] OMG; *OMG BODTF Workflow Management Facility*, Document Number bom/98-06-07, Object Management Group, 1998.

[WfMC 96] Workflow Management Coalition; *Workflow standard - interoperability abstract specification*; Tech. Report WfMC-TC-1012; The Workflow Management Coalition, 1996.

[CrossFlow Web Site] http://www.crossflow.org