

Adaptive MarketPlace for Linking and InterFacing small and medium sized companies in the software industry (AMPLIFY)

Henning Baars, Stefan Jesse, Sixten Schockert¹ and Mischa Seiter²

¹ Universität Stuttgart, Chair of Information Systems I and II
{baars|jesse|schockert}@wi.uni-stuttgart.de

² International Performance Research Institute
mseiter@ipri-institute.com

Abstract

For SMEs in turbulent business environments, frequent formation and re-configuration of Virtual Organisations (VOs) becomes imperative. Critical challenges of effective and efficient VO set-up arise when trying to find a constellation of harmonising partners who are able to provide complementing products and services. The research project AMPLIFY addresses these issues by developing a solution for an open source marketplace that supports linking and interfacing of SMEs. This research in progress paper gives an overview of the current status of the project.

1 Motivation and Objectives

The core ingredient for a successful virtual organisation (VO) is a constellation of harmonizing partners who are able to provide both complementing and clearly defined products and services. The choice of partners is a pivotal factor that influences the behaviour of the partners in the inter-organizational network [Child/Faulkner 1998, p. 92; Bronder/Pritzl 1992, p. 36]. Missing fit has dramatic consequences: conflicts, opportunistic behaviour and instability.

For small and medium-sized enterprises (SMEs) in increasingly dynamic business environments, frequent VO formation and reconfiguration becomes imperative; effective and efficient VO set-up turns into a continuous and vital challenge [Kasper-Fuehrer et al. 2003]. The complexity of this task stems from a wide spectrum of relevant soft and hard factors to be considered, e.g. “organisational culture”, “skills and experience” etc. If partners’ goals are not compatible, network coordination is very expensive, at risk or even impossible [Sydow 2003, p. 312].

A prime example for such a dynamic business environment is the software sector. In essence, small and medium-sized software companies have to cope with the following challenges and changes [Crook 1996; Krishna et al. 2004, McGuire 1998]:

1. A rise in the complexity regarding system integration (esp. because of the establishment of highly distributed e-business systems), connectivity (e.g. the need to handle a variety of heterogeneous mobile devices) and flexibility (e.g. because of the proliferation of “Service-Oriented Architectures”).
2. A significant increase in competition from large international IT service providers (esp. in “offshore” countries).

The natural answer to these demands is specialisation, i.e. a focus on specific technologies, solutions or services. The downside of this approach is a decrease in the capability to deliver complete solutions for complex business demands. This in turn triggers the need for flexible and ad-hoc-cooperation among different software companies. While larger IT corporations usually have less problems to access possible partners and moreover have the possibility to make use of a plethora of B2B-collaboration solutions, small and medium sized software companies are usually more isolated.

The research project AMPLIFY (Adaptive MarketPlace for Linking and InterFacing small and medium sized companies in the software industry) addresses the challenges associated with VO set-up by aiming at the provision of a marketplace solution for the software industry. AMPLIFY supports identifying possible partners, setting up a collaboration environment, negotiation of service and product specifications and the assessment of partners and projects. The solution will reside on a shared knowledge base containing both structured data and semi-structured documents, which are integrated based on a coherent set of semantics and can be analysed with Text and Data Mining components. The AMPLIFY software is conceived to be fully integrable in other Business Environments by the facilitation of a Service-Oriented Architecture (SOA). It thereby builds an innovative bridge between Business Intelligence technologies and innovative approaches to inter-business system integration. Moreover AMPLIFY will incorporate feedback mechanisms for evolution and self-adaption.

Chapter 2 gives a short overview of the relevant state of the art. Chapter 3 introduces the AMPLIFY solution from a conceptual (chap. 3.1) and a technical (chap. 3.2) viewpoint. Chapter 4 summarizes the findings and provides a short outlook.

2 State of the art

AMPLIFY builds up on conclusions that suggest the necessity of industry specific marketplaces that support the forming of VOs under consideration of complex sets of domain specific attributes for partner identification. This kind of solution is primarily beneficial for industries which are project-driven like the software industry. [Nayak et al. 2001, pp. 81]. By focusing on the formation of VO complementary consortiums AMPLIFY transcends established E-Business-approaches like those discussed in [Mahadevan 2003]. The result of a market survey and literature review reveals that a collaborative business network solution for partner identification, partner collaboration and partner assessment does not exist. Although there are piecemeal tools for sub-tasks of a VO set-up, there is no solution that covers all aspects in a single and integrated approach.

In detail there is no...

- ...solution for finding partners that incorporates systematic encapsulation in industrial, cultural and organisational knowledge needed for this task. Sophisticated partner selection is one of the key decisions for new inter-organizational networks for it has strong impact on productivity, quality and competitiveness of the network [Ellram 1990, Möller/Gamm 2005].
- ...solution that includes partner identification as well as partner collaboration and partner assessment in an integrated fashion.
- ...solution offering automatic and structured negotiation of requirements and Service Level Agreements (SLAs).
- ...coherent set of criteria for finding and evaluating potential partners for business networks in the software sector. Rather there is great variety of selection criteria in literature; e. g. [Dickson 1966] identifies 23 commonly used selection criteria; [Ellram 1990] emphasizes financial issues (e.g. financial stability and economic performance) and managerial, organizational and cultural issues (e.g. strategic fit and top management compatibility) as well as technological/technology issues (e.g. design and manufacturing capabilities) [cf. Weber et al. 1991 for an overview].
- ...marketplace solution including advanced data mining and OLAP (OnLine Analytical Processing) functionalities like trend analysis, association analysis, categorisation and clustering.
- ...solution that includes a connection of Business Intelligence and Semantic Web technologies for the integration of structured data and unstructured documents.

3 The AMPLIFY Solution and its features

3.1 Supported Process of AMPLIFY

The AMPLIFY solution features can be arranged along the general process of setting up a virtual organisation [cf. e. g. Mowshowitz 2002]. Figure 1 breaks this process down in roughly six phases and visualizes the supported (sub-) processes and functions.

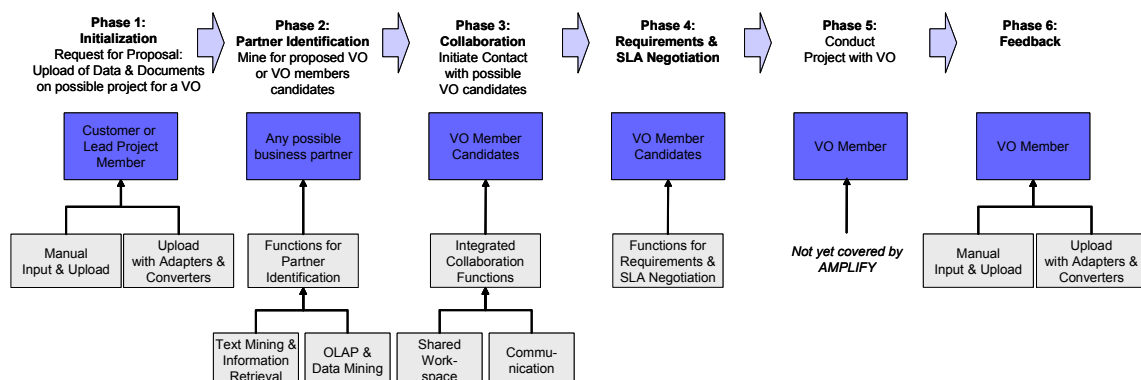


Fig.1: Processes supported by AMPLIFY

Phase 1: Initialization

In the initialization phase request for proposals on possible projects for a VO are published. Web interfaces for the automatic import of data and documents on planned VOs from proprietary systems as well as functions for a manual input/upload of such data are provided.

Phase 2: Partner Identification

Phase 2 comprises functions for an effective and user friendly identification of proposed VOs or potential business partners based on both structured data and unstructured documents. These functions are based on data mining, OLAP and semantic web technologies and consider a wide array of technical, organisational and business related parameters. An important prerequisite for these features is the formalisation (in a machine-readable form) of semantics for the successful cooperation of SMEs with an industry specific focus on the software sector. The "IT Infrastructure Library" (ITIL, see www.itil.co.uk) will be used for structuring and describing the services to be provided by the partners of proposed Virtual Organisations.

Phase 3: Collaboration

Phase 3 initiates the contact with possible VO candidates by an automatic set-up of collaborative environments with shared workspaces and synchronous communication functions for the interaction on a person-to-person level.

Phase 4: Requirements & SLA Negotiation

The virtual organization approach makes explicit the need for dedicated management activities that explore and track the abstract requirements needed to realize some objective while simultaneously, but independently, investigating and specifying the concrete means for satisfying the abstract requirements [Mowshowitz 1997, p. 375]. Therefore Phase 4 consists of functionality for the elicitation, analysis and management of requirements and service level agreements necessary for contracting of the proposed VO. Methods which foster the differentiation of requirements and solutions like e. g. Quality Function Deployment [Herzwurm et al. 2000] have to be supported. Formal assistance in setting up adequate documents as well as semantic support by best practice specifications will assist the VO members to form a solid base for project execution.

Phase 5: Project execution

This phase is up to now not covered by the AMPLIFY solution. But extensions in future concerning ongoing project and/or quality management facilities are possible.

Phase 6: Feedback

Phase 6 provides functionality for feedback and calibration that allow a constant optimisation and adoption of the AMPLIFY marketplace. By incorporating a rich set of data collection and feedback functions, the AMPLIFY solution becomes an evolutionary Business Networking tool. It collects aggregates and distributes industry knowledge for the purpose of founding dynamic VOs among SMEs in the software industry.

3.2 AMPLIFY architecture

The AMPLIFY component will be open source and will be build upon a flexible Service-Oriented Architecture (SOA) that is designed for an addition of functions to automati-

cally trigger business modelling software for process interconnection, or for adding connectors to proprietary ERP software of the involved partners. Starting point for the proposed system vision is a layered approach to architecture definition that reflects state-of-the-art approaches (e.g. cf. [Medjahed et. al 2003]). The 4-layer-architecture for the AMPLIFY system is visualized in Figure 2.

Presentation Layer

The presentation layer consists of a portal for presentation of the AMPLIFY functionality to users of potential business partners/VO members with localisation and personalisation features and web service components for presenting the AMPLIFY functionality to automatic “agents” from other complementary systems. The difference to the web services in the SOA Integration Layer is that the SOA Integration Layer is developed to access functions from other systems while web service components in the presentation layer make AMPLIFY functionality accessible to other systems.

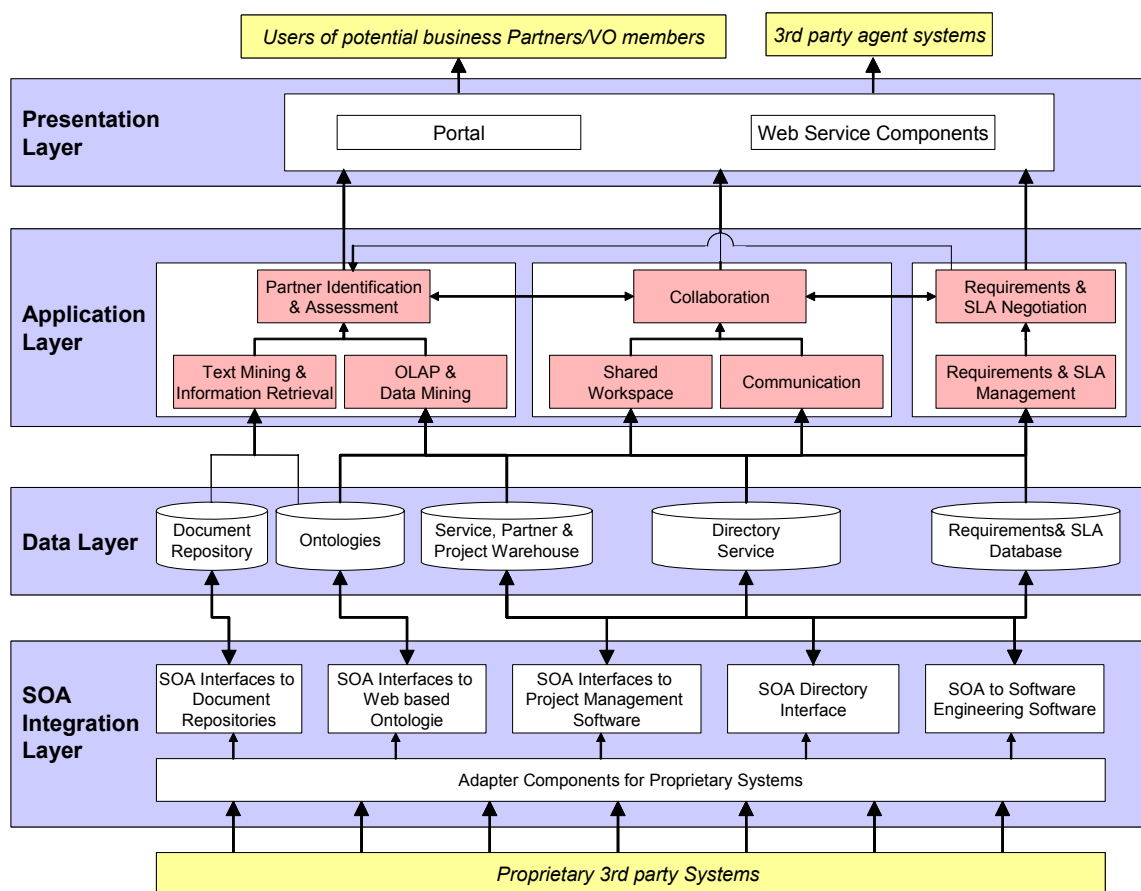


Fig. 2: AMPLIFY layered architectural approach

Application Layer

The core functionality regarding the proposed benefits for the SMEs relies in the functions for partner identification and assessment, collaboration, and negotiation of requirements and service level agreements. For each of these functional blocks individual components are defined. A text mining & information retrieval component for accessing knowledge stored in unstructured documents, an OLAP & data mining component to effectively query knowledge in the form of structured data and a partner identification & assessment component which binds together the two before mentioned com-

ponents for integrated knowledge access. A shared workspace for potential VO consortiums, a communication component for synchronous interaction between VO member candidates and a collaboration component that integrates these two functions. At last Requirements & SLA Negotiation components that enable a data-based driven specification of the services and products which will be exchanged between potential VO partners.

Data Layer

The AMPLIFY solution is in essence an evolving knowledge base which incorporates industry specific semantics (here: the software sector). The knowledge has to be stored in adequate repositories which have to provide access interfaces to the functions in the application layer and must be able to persistently keep relevant knowledge both in the form of structured data and unstructured documents. Moreover ontologies codify semantics which can be used by all other components and the directory service component provides administrative services for the whole platform.

SOA Integration Layer

To exchange data and documents between different AMPLIFY service providers as well as to build connections to third party proprietary systems of the SMEs' users, there have to be interfaces which are easily accessible over open network environments. This is especially relevant for automatic data and document up-load and exchange. All relevant integration components are placed in a "SOA Integration Layer". SOA can be seen as an application architecture in which all functions, or services, are defined using a description language and have invokable interfaces that are called to perform business processes [Dostal/Werner 2005]. Each interaction is independent of each and every other interaction and the interconnect protocols of the communicating devices (i.e., the infrastructure components that determine the communication system do not affect the interfaces). Because interfaces are platform-independent, a client from any device using any operating system in any language can use the service. In many cases there will be "adapter components" which have to be developed for different types of systems. The architecture of this layer will be flexible enough to dynamically add or exchange such adapters.

4 Summary and Outlook

The core functionality regarding the proposed benefits of AMPLIFY for the SMEs relies on the functions for partner identification and assessment, collaboration, and negotiation of requirements and service level agreements. We believe that the exploitation of the AMPLIFY platform provides business value to the participating SME companies who use the platform to form business networks as well as to marketplace providers who host and maintain the open source AMPLIFY solution and use the shared AMPLIFY data base for its customers on a fee-basis. Bundled with the hosting, the platform providers can offer added-value-services like training, consulting and support. To achieve this, in-depth requirements analysis and continuous validation of results will be conducted. So far we experienced tremendous interest in joining the project – especially from European SMEs but also from the standardisation forum itSMF (see www.itsmf.com). This underscores the possible impact of the project results.

References

- Bronder, C., Pritzl, R. (1991): Leitfaden für strategische Allianzen, in: Harvard Manager, Vol. 13, No. 1, pp. 44-53.
- Child, J., Faulkner, D. (1998): Strategies of Cooperation: Managing Alliances, Networks, and Joint Ventures, Oxford, 1998.
- Crook, C. (1996): Strategic Planning in the Contemporary World: Nonlinearity, Complexity and Incredible Technological Change, in: American Programmer, Vol. 8, No. 3, March 1996, pp. 9-14.
- Dickson, G.W. (1966): An analysis of vendor selection systems and decisions, in: Journal of Purchasing, Vol. 2, No. 1, 1966, pp. 5-17.
- Dostal, W.; Werner, S. (2005): Service-orientierte Architekturen mit Web Services: Konzepte - Standards – Praxis, Heidelberg – München: Elsevier, Spektrum Akad. Verlag, 2005.
- Ellram, L.M. (1990): The Supplier Selection Decision in Strategic Partnership, in: Journal of Purchasing and Materials Management, Vol. 26, Fall 1990, pp. 8-14.
- Herzwurm, Georg; Schockert, Sixten; Mellis, Werner (2000): Joint Requirements Engineering. QFD for Rapid Customer-Focused Software and Internet-Development, Braunschweig – Wiesbaden: Vieweg – Gabler Verlag, 2000.
- Kasper-Fuehrer, Eva C.; Ashkanasy, Neal M. (2003): The Interorganizational Virtual Organization, in: International Studies of Management & Organization, Vol. 33, No. 4, Winter2003, pp. 34-64.
- Krishna, S.; Sahay, S.; Walsham, G. (2004): Managing cross-cultural issues in global software outsourcing, in: Communications of the ACM, Vol. 47, No. 4, April 2004, pp. 62-66.
- Nayak, Nitin; Bhaskaran, Kumar; Das, Raja (2001): Virtual Enterprises – Building Blocks for Dynamic e-Business, in: Australian Computer Science Communications, Vol. 23, No. 6, January 2001, pp. 80-87.
- Mahadevan, B. (2003): Making Sense of Emerging Market Structures in B2B E-Commerce, in: California Management Review, Vol. 46, No. 1, Fall2003, pp. 86-100.
- McGuire, Eugene G. (1998): Complexity, Chaos and Software Development: Issues in Innovation and Diffusion, in: Tor Larsen, Eugene McGuire (Ed.): Information Systems Innovation and Diffusion: Issues and Directions, pp. 435-444, Hershey, USA - London, UK 1998.
- Medjahed, Brahim; Benatallah, Boualem; Bouguettaya, Athman; Ngu, Anne H. H.; Elmagarmid, Ahmed K. (2003): Business-to-business Interactions: Issues and Enabling Technologies, in: The VLDB Journal - The International Journal on Very Large Data Bases, Vol. 12, No. 1, 2003, pp. 59–85.
- Möller, Klaus; Gamm, Nils (2006): Partner Selection and Network Performance - an Empirical Analysis of Impact and Mediating Factors in German Business Networks (2006), to appear in: Economics and Management of Networks: Franchising Net-

works, Cooperatives and Strategic Alliances, Springer 2006 (paper presented at the International Conference on Economics and Management of Networks - EMNet 2005, Budapest, 15.-17.9.2005, www.univie.ac.at/EMNET/2005/index2005.htm).

Mowshowitz, A. (1997): On the Theory of Virtual Organization, in: Systems Research & Behavioral Science, Vol. 14, No. 6, Nov./Dec1997, pp. 373-384.

Mowshowitz, A. (2002): Virtual Organization: Toward a Theory of Societal Transformation Stimulated by Information Technology, Westport, CT: Quorum Books, 2002.

Sydow, J. (2003): Management von Netzwerkorganisationen: Zum Stand der Forschung, in: Sydow, J. (Ed.), Management von Netzwerkorganisationen, pp. 293-354, Wiesbaden 2003.

Weber, Charles A.; Current, John R.; Benton, W.C. (1991): Vendor selection criteria and methods, in: European Journal of Operational Research, Vol. 50, No. 1, 1991, pp. 2-18.