E-business process networks – successful value chains through standards

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Keywords

Process efficiency, Value chain, Supply chain management, Electronic commerce

Abstract

In the 1990s, companies focused on the design and implementation of their internal business processes to overcome functional barriers. The 2000s are about the integration between enterprises and inter-enterprise processes, particularly the improvement of supply chain management and customer relationship processes, The major enabler is the Internet, which has resulted in entire networks of e-business processes across various organizations. To design and implement those processes efficiently and effectively, more and more organizations use available industry standards in the form of reference models, e.g. the supply chain reference model (SCOR), the RosettaNet Standards, or software reference models. Unclear for many enterprises is how to use those standards. This article describes a comprehensive methodology for the use of reference models, to design and implement inter-enterprise collaborations within value chain networks. The methodology leads to fast and reliable results in value chain improvement. It increases the performance of the implementation procedure and the resulting business processes.

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Journal of Enterprise Information Management
Volume 17 · Number 1 · 2004 · pp. 20-30
 · ISSN 1741-0398
DOI 10.1108/09576050410510926

E-business processes and industry standards

While companies in the 1990s focused on the design and implementation of their internal business processes to overcome functional barriers, the 2000s are about the integration between enterprises, about inter-enterprise processes. These changing management paradigms are reflected in a changing information technology focus: the focus moves from integrated intra-enterprise application packages to Internet-based "e-enabled" and inter-enterprise focused application software.

The improvement of supply chain management (SCM) and customer relationship management (CRM) processes are key to enable the enterprise value chains. The major enabler is the Internet. That is why the resulting processes are called e-business processes, connected to entire networks of processes across various organizations.

In order to design and implement inter-enterprise e-business processes efficiently and effectively, more and more organizations use available industry standards in the form of reference models like the supply chain operations reference (SCOR) model, developed by the Supply Chain Council (SCC), the RosettaNet Standards, or software reference models. It increases the performance of the implementation procedure as well as of the resulting business processes. Standardization organizations like, e.g. the SCC consist of hundreds of member companies, developing reference models that reflect industry best practices. Other reference models are developed by solution providers, e.g. application software vendors or consulting companies. What is unclear for many enterprises is HOW to use those standards. Therefore, the following article describes a methodology for design, implementation and continuous improvement of inter-enterprise e-business processes, leading to successful value chains based on industry standards.

The methodology has been developed within a joint initiative between Intel, Siemens AG SBS, IDS Scheer and various technology partners (Kirchmer *et al.*, 2002).

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Available industry standards for e-business processes

Key areas of inter-enterprise value chains are covered by the supply chain operations reference (SCOR) model. Therefore SCOR is an excellent basis for the design of such e-business processes. Using this industry standard facilitates a broad use of the later developed approach. Many organizations to be integrated through e-business processes may already be familiar with SCOR and can use it as a joint communication platform.

'... SCOR ... includes a methodology that enables companies to analyze and improve their supply chain operations by helping them communicate supply chain information across the enterprise, measure performance objectively, identify supply chain performance gaps and improvement objectives ...'

In order to specify the detailed interactions between involved companies, the RosettaNet models were chosen. These standards are very common, especially for the high-tech industry. However, alternative models like the OAGI standards, can be used in the same way.

SCOR

The SCOR model (Supply Chain Council, 2001) has been developed and endorsed by the SCC, an independent non-for-profit organization. The SCC was founded in 1996, in the USA, and has now branches all over the world. SCOR is a business process reference model that contains all supply chain activities from a supplier's supplier to a customer's customer. This includes:

- all customer interactions from order entry through paid invoice;
- all product (physical goods, services, ...) transactions including equipment, supplies, spare parts, bulk product, software, etc.; and
- all market interaction from the understanding of the aggregate demand to the fulfillment of each order.

SCOR contains three levels of process detail. The top level (process types) defines the scope and content. It consists of the five top level processes:

(1) plan;
(2) source;
(3) make;
(4) deliver; and
(5) return.

The second level of SCOR, the configuration level (process categories), contains 30 process categories, like:

- "make-to-stock";
- "make-to-order";
- "engineer-to order"; or
- "production execution".

These process categories can be used to "configure" a company's supply chain. Companies implement their operations strategy through the configuration they choose for their supply chain.

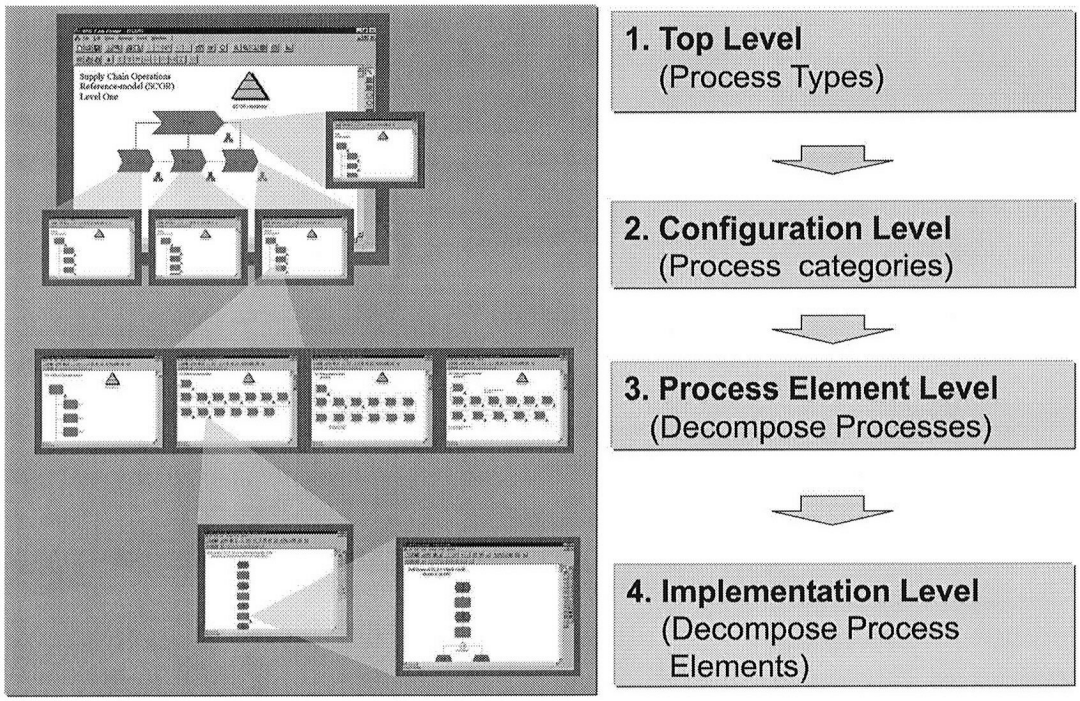
The third SCOR level, the process element level (decomposed processes) is used to fine-tune the operations of a company. It consists of:

- process element definitions;
- process element information inputs and outputs;
- process performance metrics;
- best practices;
- system capabilities necessary to support best practices; and
- systems/tools to be used.

Companies implement their supply chain solution on Level 4 (or even more levels of detail). Level 4, called implementation level (decomposed process elements), defines practices to achieve competitive advantage and to adapt to changing business conditions. This level is company specific and therefore not in scope of SCOR. The structure of SCOR is shown in Figure 1.

SCOR also includes a methodology that enables companies to analyze and improve their supply chain operations by helping them communicate supply chain information across the enterprise, measure performance objectively, identify supply chain performance gaps and improvement objectives.

Figure 1 Structure of SCOR



The SCOR methodology has essentially four steps:

(1) Analyze the basis of competition.
(2) Configure the supply chain.
(3) Align performance levels, practices and systems.
(4) Produce a plan for supply chain improvement backed up with projected ROI.

The methodology is applied to produce supply chain improvement project proposals backed up with sound business cases and high-level specifications of proposed solutions.

RosettaNet

The RosettaNet group is an industry organization that drives collaborative development and rapid deployment of Internet-based business standards, creating a common language and open e-business processes that provide measurable benefits and are vital to the evolution of the global, high-tech trading network (RosettaNet, 2000). RosettaNet has been founded in 1998, in the USA, and has now also achieved a global presence. The RosettaNet standards consist of a three-level business process architecture that supports inter-enterprise e-business interactions:

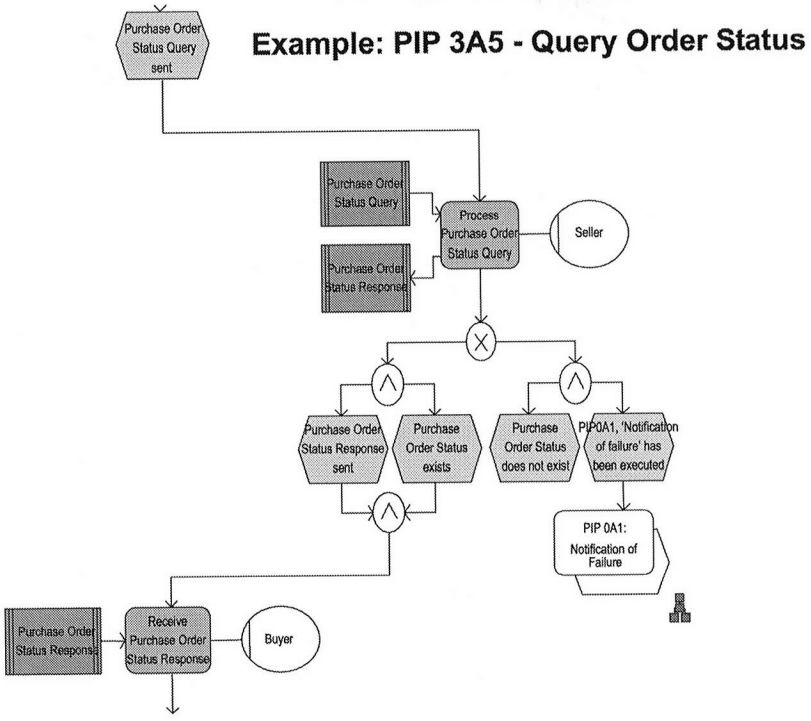
(1) partner interface processes (PIPs);
(2) RosettaNet dictionaries; and
(3) RosettaNet implementation framework (RNIF).

Relevant for the context of the initiative described in this article is, first of all, the business view described in the PIPs. However, it is an important aspect that the use of the PIP standards also ensures the technical implementation of the defined solutions.

A PIP describes activities, decisions and interactions necessary to fulfill an entire inter-enterprise business transaction. They also define structure and format of business documents. An example of a PIP process definition is shown in Figure 2. It is an excerpt of an event-driven process chain (Scheer, 1998).

The Open Applications Group (2002) or the Business Process Management Initiative (2002) offer similar standards that can be used as an alternative to, or in combination with, the RosettaNet standards.

Figure 2 Example of a PIP process model



Others

In order to identify the relevant inter-enterprise supply chain interactions between companies the Y model developed by Scheer (Scheer, 1994a, b) can be used. It includes all relevant business processes of a company, the planning as well as the execution activities. Each involved company can be represented by one Y model based on which the interactions can be easily defined. Since it also includes activities that are not in the scope of SCOR, e.g. research and development, the Y model can, on one hand, be used complementary to the SCOR model, on the other hand, to identify the areas that will be specified using SCOR. The use of the Y model is especially important to create a high-level entry point into inter-enterprise process definition activities. An example for the use of the Y model to describe the collaboration areas between a manufacturer of locomotive engines and a supplier is shown in Figure 3.

On the implementation level, software reference models can be added to the mentioned reference models as, for example offered by SAP (Kirchmer, 1999; Gulledge *et al.*, 2002).

Procedure for the efficient and effective use of standards

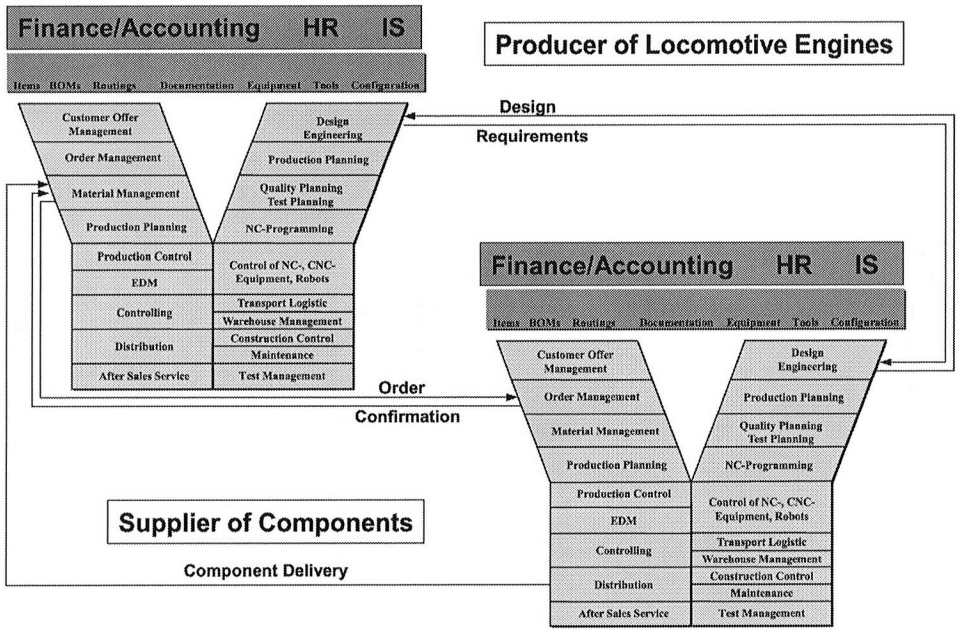
After selecting the reference models to be used, a procedural model has to be developed, describing HOW the business reference models for the design of inter-enterprise e-business process networks can be used. The ARIS architecture provides the basis for process description and the eBPI approach provides the framework within which the presented reference models are used.

ARIS architecture as basis for process description

The "architecture of integrated information systems" (ARIS), developed by Scheer (Scheer, 1998a, b; 2002), can be used as a framework to describe business processes efficiently, but nonetheless completely, thus manage the knowledge about business processes. Using ARIS, a process can be examined from five different points of view (see Figure 4):

(1) Organization view (Who takes part in the process, which companies, departments or people?).

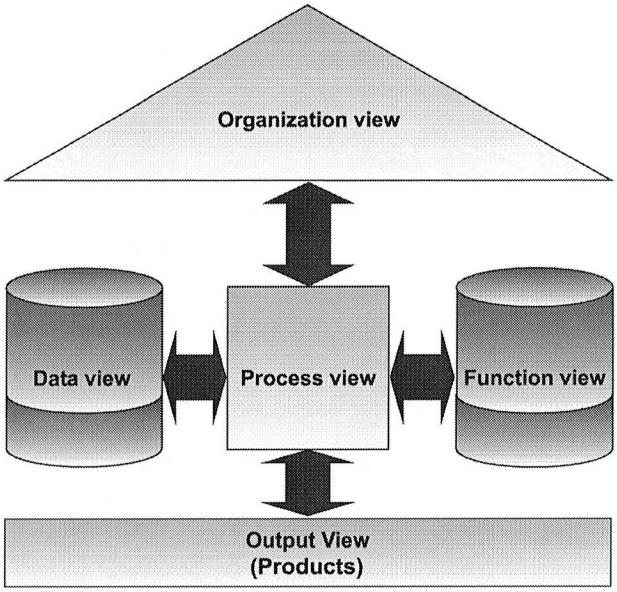
Figure 3 Use of the Y-model to identify inter-enterprise collaboration



(2) Function view (What is done in this process?).
(3) Data view (What information is produced or needed?).
(4) Output (result) view (Which outputs/results/deliverables are produced?).
(5) Control view (How do the four other views interact? Who works on which functions using which data and in which operational logic to produce which deliverables?).

If it is possible to answer the questions concerning the various views, then a business process is adequately described. All the knowledge necessary for an efficient and effective business process life-cycle management is gathered. The control view, in

Figure 4 ARIS information system views



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particular, plays a central role, as it brings together the individual views and thus forms the foundation for successfully functioning business processes. The different views can be described on a pure business concept level, an information technology (IT) specification level (defining IT solution types, e.g. SCM) and an implementation level (defining concrete IT solutions, e.g. a specific SCM system).

Every view of the ARIS architecture can be described by various modeling methods. They can be used to answer and communicate the mentioned questions. The ARIS architecture can be used as structure for information modeling methods. A big advantage for the practical use of the ARIS architecture is the availability of a software tool based on this architecture, the ARIS Toolset.

'... The objective of eBPI is to deliver, on one hand, a structure for managing the life-cycle of e-business processes successfully; on the other hand, to leave enough flexibility to adapt procedures continuously to changing environments ...'

The ARIS architecture is especially suited for the use in inter-enterprise environments (Kirchmer, 2002):

- The use of the Internet allows companies to change and extend their offerings. Instead of selling CDs, music files can be downloaded directly from the Web, for example. Or packages in transit can be tracked through the Internet – as additional customer service. Therefore the examination of a specific "output (product) view" of business processes, as suggested by the ARIS architecture, is extremely important in an e-business inter-enterprise environment.
- E-business processes enable the efficient and effective collaboration between enterprises, directly or through so-called "e-marketplaces". This means that responsibilities are shared between organizational units of the collaborating enterprises. As a consequence, the examination and maybe change of organizational structures becomes key for design and implementation of e-business processes; again, an aspect handled in a specific view of the ARIS architecture.
- The collaboration of different organizations leads to a "process-to-process" integration, to e-business process networks. The coordination of all aspects necessary to achieve this integration is handled as a key aspect in the control view of the ARIS architecture.

eBPI approach as basis for the procedural model

The eBPI approach is a general procedure to use the ARIS architecture in an inter-enterprise e-business environment (Kirchmer, 2002). The objective of eBPI is to deliver, on one hand, a structure for managing the life-cycle of e-business processes successfully; on the other hand, to leave enough flexibility to adapt procedures continuously to changing environments, typical of an e-business initiative. eBPI is an information model-based approach to e-business, combining aspects of efficiency and effectiveness.

The eBPI approach is structured into four major phases:

(1) development of the e-business process vision;
(2) specification of the resulting e-business processes;
(3) realization of the e-business processes; and
(4) continuous improvement of the e-business processes.

The starting point eBPI is the elaboration of an e-business process vision. Core deliverables are e-business process scenarios, a high-level description of the envisioned collaboration of organizations. These scenarios are further specified in the following phase of eBPI. This specification phase includes the definition of inter-enterprise and intra-enterprise processes, necessary to realize the defined scenarios, and the selection of the required e-enablers, such as application software products. The selected e-enablers are used to realize the e-business processes in the following phase of eBPI, which combines

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software implementation and e-integration activities. The realization phase triggers a continuous improvement of the implemented e-business processes (CPI). Key is here the definition of an effective business process performance management. The CPI can then restart the whole eBPI procedure in order to reflect customer, new market and technology developments.

While the e-business process vision focuses on complete e-business scenarios consisting of one or more processes, the specification phase focuses on individual e-business processes, and the realization phase on sub-processes or functions to ensure rapid results. Those sub-processes or functions are reassembled to complete business processes, which lay the basis for the continuous process improvement

The phases of eBPI are not just in a "process sequence" with a defined beginning and a defined end. The continuous improvement will trigger – sooner or later – another visioning phase. Also, the different phases influence each other, which may cause changes in preliminary eBPI phases triggered by activities in the current phase.

The structure of eBPI is shown in Figure 5.

Procedure for the integrated use of reference models

The selected reference models reflect all ARIS views of the relevant inter-enterprise business processes. Focus of the procedure to be developed is on the Vision and Specification phases of the eBPI approach.

Starting point of the eBPI procedure is the elaboration of an e-business process vision, which equates to the results of the SCOR methodology as used to identify and prioritize supply chain improvement projects. Core deliverables from the SCOR analysis within the Vision phase are e-business process scenarios in the form of a high-level description of the envisioned collaboration between organizations of the extended supply network.

Therefore, a first modeling step is the identification of scope, both for the relevant process and chosen products (goods, services, others) (Kirchmer, 2002). The relevant activities of each company can be either identified using SCOR, or on a broader base, using the Y model.

The standard elements of the top level of the SCOR definition (the process types "plan", "source", "make", "deliver", and "return") have been found being too general. Therefore, one usually starts the supply chain configuration by defining the roles within each tier of the supply network (e.g. manufacturer at facility X, distributor, customer, etc.) and the major activities using a value added chain diagram (VACD) as method. An example for a level 1 supply chain definition using the VACD structure is shown in Figure 6. This representation is actually one level above the configuration model of SCOR, which would reveal the process categories (e.g. source to stock, make to order, deliver to order, etc.) for each role. This means, the SCOR reference model is used as the basis for the process definition, but it is adapted to the specific use by specifying the high-level activities through the roles of the executing organizational units.

As a result of applying a SCOR analysis to the supply chain, an inter-enterprise e-business scenario can be identified and prioritized based on best practices and specific patterns of the supply chain definition.

The "model object" encapsulating the scenario model is positioned on the supply chain VACD as shown in Figure 6, which refers

Figure 5 Structure of the e-business process improvement procedure (eBPI)

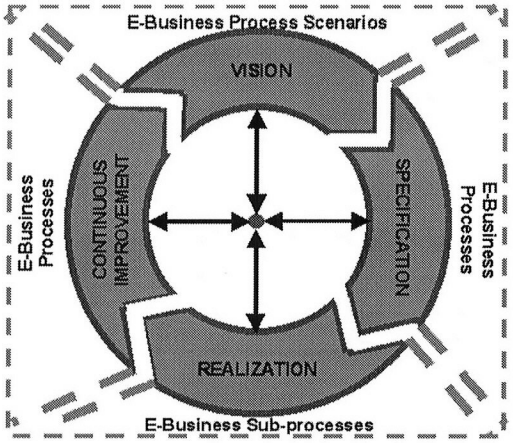
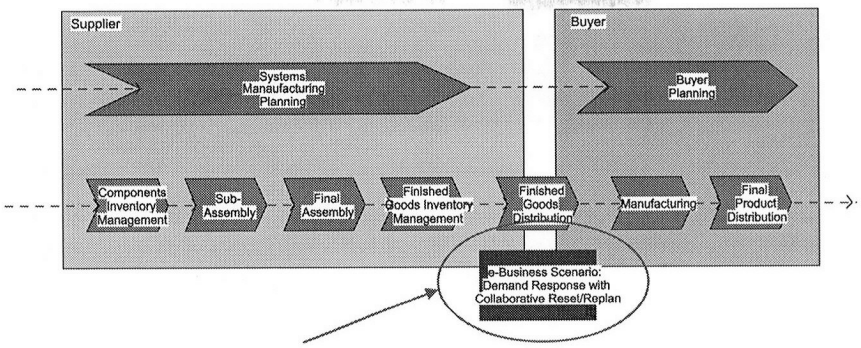


Figure 6 Example of a supply chain definition



to an example scenario: "demand response with collaborative reset/replan". It can then be specified using SCOR Level II and III elements as a guideline. This means the scenarios are defined using the SCOR structure, but the process elements are specified according to the specific situation. The scenarios are role-based, so that they can be used in all similar situations. The scenario models define how business processes are distributed between the various roles and which business documents are exchanged. They cover all ARIS process views. An example of an e-business scenario model is shown in Figure 7.

In order to get a handle on an e-business scenario, we determine the information flow between SCOR Level III process elements on either side of the partner boundary in a particular community of business partners for some segment of a supply chain. The information flow, as defined by the SCOR in/out data elements, defines the interactions of the scenario.

The process parts of the e-scenarios exchanging documents between roles and therefore between enterprises can now, as mentioned, be further specified using elements of SCOR Level III and the RosettaNet PIP specifications. Again, all ARIS views are covered. Figure 8 shows an example of such a process specification.

Further RosettaNet PIP elements, especially the detailed process models, can be

Figure 7 Example of an e-business scenario

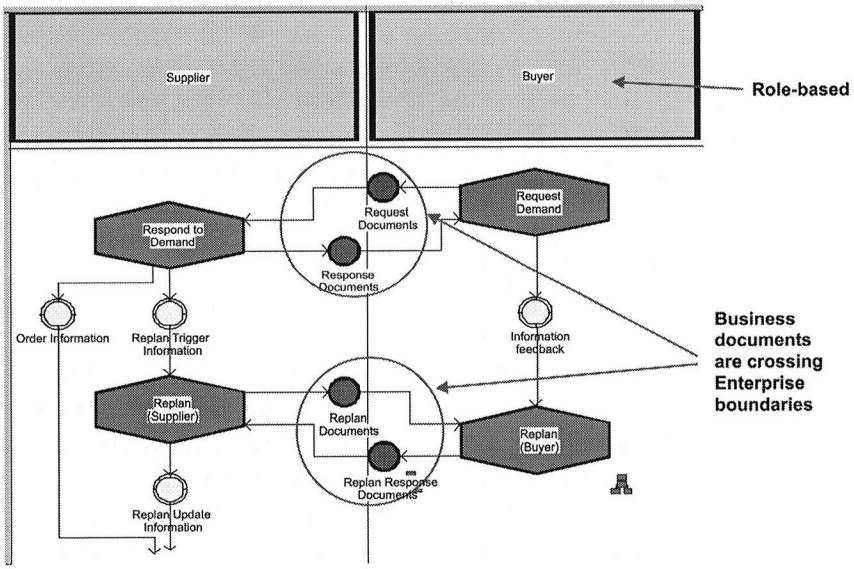


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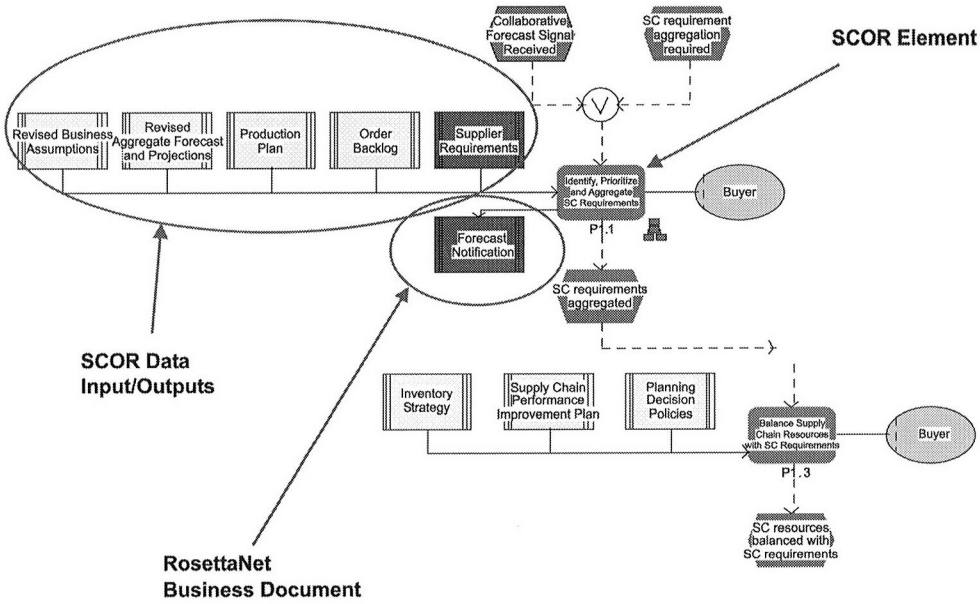
Figure 8 Process definition using SCOR and RosettaNet elements



used on the Levels IV and further, in conjunction with software reference models. The use of SAP and RosettaNet reference models has been positively tested. This highest process specification can now be implemented, based on identified application software packages and the technical components of the RosettaNet standards in the Realization phase of eBPI.

The Realization phase triggers a continuous improvement phase for the implemented e-business processes. Figure 9 shows the described approach in an overview, using the "Intel-Siemens" initiative as an example.

Application of the defined procedure

The developed methodology has been tested within the joint project with Intel, Siemens and IDS Scheer. Workshops were organized to provide realistic examples of the SCOR to RosettaNet mapping methodology, using the ARIS Toolset as the enabling software tool.

Key tool functionality

Since the ARIS architecture had been chosen as the basis for the process description, the ARIS Toolset (ATS), a set of software tools based on ARIS, was a natural fit for this initiative (IDS Scheer AG, 2000). However, several characteristics were especially important for the final selection of the tool.

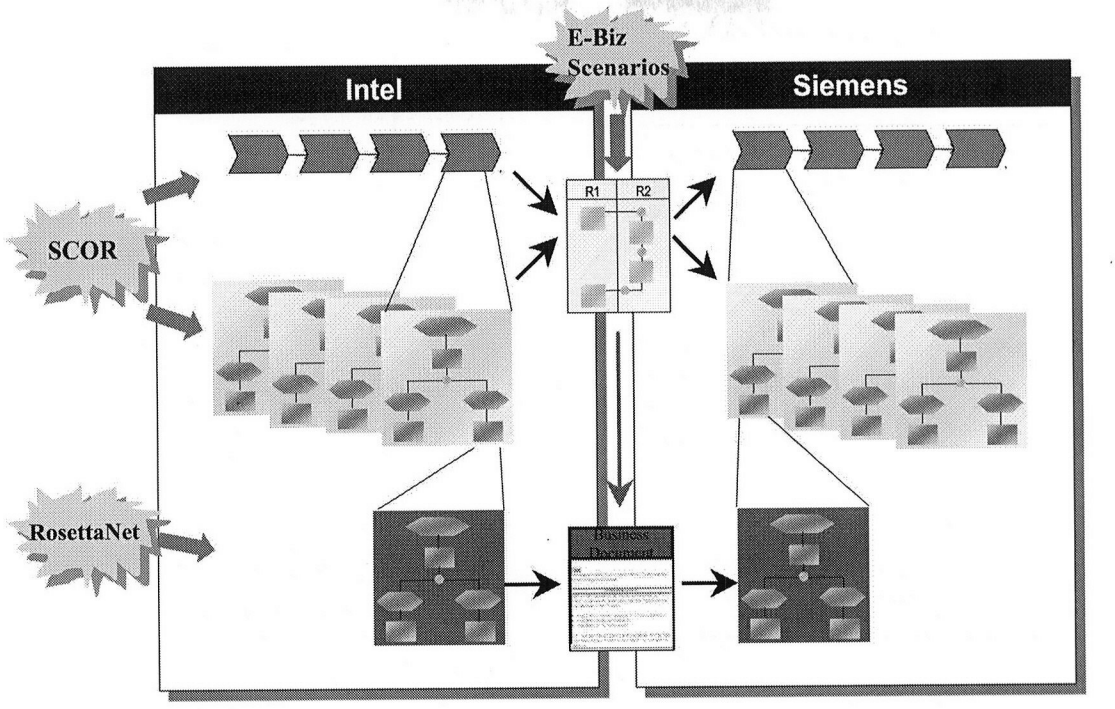
Key is, of course, that the described methods are supported. But it is also important that the ATS allows UML modeling and interfaces to software development tools. Therefore, developed requirement definitions can be used as a basis for necessary software development very efficiently, without any double work.

'... a "business process warehouse" of reference models has been built which creates, together with the defined procedures and the enabling ARIS tool, a "business process factory"...'

Important was also the integration of ARIS to EAI and business process execution environments. This again allows an easy and effective transfer of the developed process models into the process execution. This reusability of process models increases the value of this structured design tremendously.

The next advantage is the availability of all required reference models in the tool: SCOR, RosettaNet PIP definitions and SAP reference

Figure 9 Defining e-business process networks with SCOR and RosettaNet



models are available in the ATS. This allows a straightforward use of the business content of those industry standards.

Possibilities to publish models over the Internet and even to support an Internet-based model development were crucial for this inter-enterprise initiative. People of various locations, even of different continents, were involved. Therefore, communication and model exchange over the Web is key.

Also, the availability of ARIS Process Performance Manager, a tool to support the business process controlling, was an interesting aspect. It allows the measurement of the implemented processes.

Overall, the ease-to-use of the tool and the fact that all involved organizations had already been using the ATS is another decision factor. Just as the used reference models are industry standard, the selected tool had also to be widely used to be able to duplicate the developed approach easily.

Lessons learned

The following benefits have been achieved:

- A single integrated repository of SCOR models, standard e-business scenarios, and RosettaNet PIP information enables the support of future Value Chain Projects dealing with inter-enterprise processes.
- The project teams will be able to easily access the business documentation of standards like RosettaNet.
- Once a solid meta-architecture is developed for the SCOR to RosettaNet mapping effort, other standards can be incorporated easier.
- Based on these standard models, project teams then will be able to model their specific processes as necessary. Selecting complete reference models or just specific parts and elements of those will expedite their efforts and lead to a much higher standardization across project teams working off the same reference database.
- The outcome of new projects based on this approach will be additional templates.

All in all, a "business process warehouse" of reference models has been built which creates, together with the defined procedures and the enabling ARIS tool, a "business process factory". This combined software and tool environment enables an efficient and effective design and implementation of e-business process networks.

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References

Business Process Management Initiative (2002), *The Business Process Management Initiative – BPMI*, available at: www.bpmi.org

Gulledge, G., Simon, G. and Sommer, R. (2002), "Using ARIS to manage SAP Interoperability", in Scheer, A.-W., Abolhassan, F., Jost, W. and Kirchmer, M. (Eds), *Business Process Excellence – ARIS in Practice*, Springer, Berlin, New York, NY.

IDS Scheer AG (2000), *Business Process Management – ARIS Toolset Products*, White paper, February, IDS Scheer AG, Saarbrücken.

Kirchmer, M. (1999), *Business Process Oriented Implementation of Standard Software – How to Achieve Competitive Advantage Efficiently and Effectively*, 2nd ed., Springer, Berlin, New York, NY.

Kirchmer, M. (2002), *e-Business Process Improvement (eBPI) – Building and Managing Collaborative e-Business Scenarios*, White Paper, Berwyn, PA.

Kirchmer, M., Brown, G. and Heinzel, H. (2002), "Using SCOR and other reference models for e-business process networks", in Scheer, A.-W., Abolhassan, F., Jost, W. and Kirchmer, M. (Eds), *Business Process Excellence – ARIS in Practice*, Springer, Berlin, New York, NY.

Kirchmer, M. (1999), "Market- and product-oriented definition of business processes", in Elzinga, D.J., Gulledge, T.R. and Lee, C.-Y. (Eds), *Business Process Engineering*, Kluwer Academic, Norwell, MA, pp. 131-44.

Open Applications Group (2002), *Best Practices and XML Content for eBusiness and Application Integration*, available at: www.openapplications.org

RosettaNet (2000), *RosettaNet Overview*, available at: rosettanet.org (accessed May 2000).

Scheer, A.-W. (1994a), *CIM – Computer Integrated Manufacturing*, 3rd ed., Berlin, New York, and others.

Scheer, A.-W. (1994b), *Business Process Engineering*, 2nd ed., Berlin, New York, and others.

Scheer, A.-W. (1998a), *ARIS – Business Process Frameworks*, 2nd ed., Berlin, New York and others.

Scheer, A.-W. (1998b), *ARIS – Business Process Modeling*, 2nd ed, Berlin, New York and others.

Scheer, A.-W., Abolhassan, F., Jost, W. and Kirchmer, M. (Eds) (2002), *Business Process Excellence – ARIS in Practice*, Springer-Verlag, Berlin, New York, NY.

Supply Chain Council (2001), *Supply-Chain Operations Reference-model – Overview of SCOR Version 5.0*, Supply Chain Council, Pittsburgh, PA.