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Evolution of Process Portals to Multi-Channel Architectures – A Service-Oriented Approach at ETA SA

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Evolution of Process Portals to Multi-Channel Architectures – A Service-Oriented Approach at ETA SA

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Abstract

This paper illustrates a typical pathway towards increasing electronic interaction with external business partners. Based on the case study of ETA SA, a Swiss manufacturer of watch movements and components, it explores current issues in portal-based B2B integration. In order to allow for tighter process integration with distinct customers, ETA conceives a multi-channel architecture which provides electronic services to customers using either direct or portal-based electronic channels. Since a multi-channel approach typically is associated with major integration challenges, the paper outlines and discusses the vision of service-oriented architecture for interorganizational integration.

1. Introduction

Progress in information technology (IT), and more specifically the emergence of the Internet, is considered a major accelerator in realizing closer forms of collaboration between business partners. On the customer side, the electronic channel has proved valuable in offering supplementary self-services to the customer which are information-based and need not be co-located with the product (Piccoli et al. 2004, Day and Hubbard 2003). In fact, many companies report closer customer relationships and improved operational efficiencies in their customer-facing or downstream processes (Chen and Chen 2004). From a technical view, portal-based solutions represent the dominant electronic collaboration platform as they impose the lowest integration requirements. However, in the medium and long term, companies will prefer closer integration with their business partners by directly connecting information systems across company borders.

This paper discusses the evolution of interorganizational systems as well as issues which may result from portal-based integration in B2B relationships. It uses a qualitative case study research design as described by (Yin 2002). Based on the case study of ETA SA, it explores different stages of electronic interaction with customers and outlines the need for offering electronic services using both, direct and portal-based electronic channels. Since complexity arises with the additional channel, we sketch a service-oriented multi-channel approach as target architecture for interorganizational integration.

This paper is structured as follows: Section 2 provides a systematic overview on different types of electronic interaction and outlines typical issues in implementing higher levels of process integration with external partners. Section 3 introduces the case of ETA SA, a Swiss manufacturer of watch movements and components: The firm is successfully using a customer process portal for interacting with its customer base, but is confronted with some class of customers demanding higher levels of process integration. In order to offer electronic services via different channels and to satisfy the requirements of each class of business partner, ETA conceives a multi-channel architecture, which is presented in Section 4. Section 5 derives key finding regarding interorganizational integration and outlines topics for future research.

2. State of the Art in Interorganizational Integration

2.1 Evolution of Interorganizational Integration

Starting in the 1970s, the evolution of information systems for interorganizational process integration is characterized by the convergence of three parallel technological evolution pathways:

- *Interorganizational Systems (IOS)* denote information systems that transcend organizational boundaries (Johnston and Vitale 1988, Hong 2002). Dating back in the early 70s, EDI-systems were introduced to enable structured data exchange. They were supplemented by ordering systems with higher-order data integration, shared databases and functionality. Compared to EDI-systems, ordering systems focused on the efficient support for collaborative processes rather than accelerated communication. Electronic marketplaces finally were established in order to provide multilateral (n:m) integration (Bakos 1991, Kaplan and Sawhney 2000, Mahadevan 2003). As figures on electronic business-to-business transactions underline, IOS have only been successful in certain industries and usually involve a limited number of (large-volume) transaction partners.

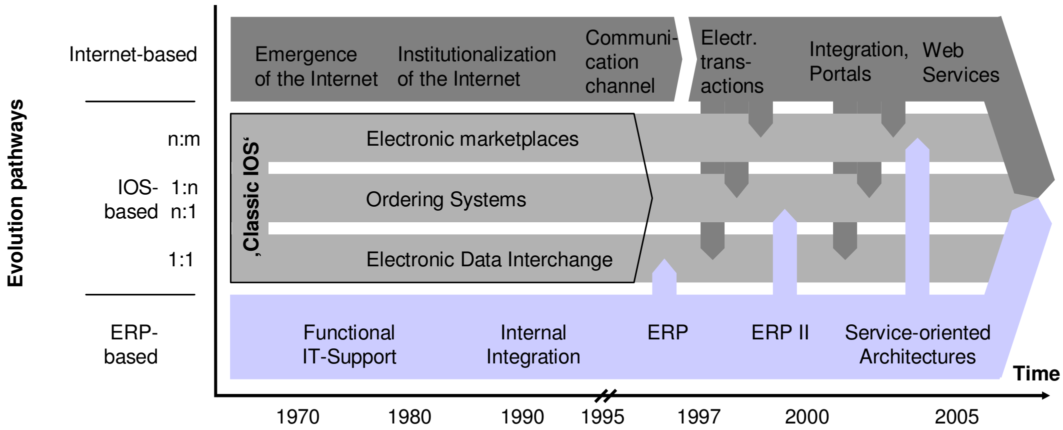

Figure 1: Convergence of interorganizational information systems (adapted from Alt 2004)

- Parallel to the emergence of IOS, *ERP-systems* introduced internal information integration into the company by providing cross-functional data integration and process support (Davenport 1998). The reach of ERP-systems gradually expanded to support collaboration with external partners (Davenport and Brooks 2004): ERP II (Weston 2003) or Business Networking Systems (BNS) (Alt and Fleisch 2000) provide functionality for both, CRM (customer relationship management) and SCM (supply chain management).
- The commercial diffusion of the Internet and especially the World Wide Web laid the foundation for the third major evolution path towards interorganizational integration. Following a phase of rapid growth of enterprise web sites since 1994/1995, companies gradually integrated Internet technologies with their existing information systems e.g. by deploying XML-based data exchange or connecting their ERP-systems directly to t Internet front end. The latter was supported by portal solutions which integrate content and functionality from heterogeneous data sources (Dias 2001).

The phases illustrated in Figure 1 neither dictate a strict development path every company has to pass through, nor a predefined sequence (Venkatraman 1994). Nonetheless, the illustration helps in explaining the convergence towards a technological platform for interorganizational integration, reproducing the development of integrated ERP-systems in an interorganizational environment. Web services which allow for application-to-application integration across heterogeneous platforms using open internet standards, and service-oriented architectures are expected to stimulate this development (Hagel and Brown 2001, Daniel and White 2005).

2.2 Interaction Types and Corresponding Levels of Agreement

Interorganizational information systems can be classified according to their interaction type (cf. McAfee 2005a, Fleisch 2001, Reimers 2001). Human-human-interaction describes traditional forms of interaction between humans which may be supported by electronic means, e.g. groupware or e-mail (cf.

Figure 2). In the case of human-machine-interaction, external users are getting direct access to internal data and applications. This is typically realized by internet front ends or portals which bundle data and applications on the basis of users and roles. Machine-machine-interaction finally describes the direct communication between two information systems without human intervention. It leads to consistently automated processes and requires a linkage of applications across company borders. EDI is the standard example for machine-to-machine interaction, but is being succeeded by XML and Web Services.

		Interaction type		
		Human-Human	**Human-Machine**	**Machine-Machine**
Number of steps	**Multi-Step**	- Meeting people via a networking website, e.g. Friendster. LinkedIn - Collaboratively generating a document using groupware like Lotus Domino	- Shopping at an eCommerce Website - Requesting and approving purchases using procurement software such as Ariba	- Executing a RosettaNet Partner Interaction Process (PIP) - Reviewing and accepting a consumer's bid on priceline.com
	Single-Step	- Sending an email - Sending an instant message	- Checking stock prices using the Internet - Submitting a WWW search engine request	- Sending an EDI transmission - Receiving an XML-formatted message

Figure 2: Interaction types in interorganizational processes (McAfee 2005a)

In order to allow IS-mediated interaction, different levels of agreement have to be in place (Figure 3): At the lowest level, information systems have to share agreements about how data is to be transported over a network. Once agreements at this basic transport level, e.g. through standard internet protocols such as HTTP, are in place, human-human and human-machine interactions can take place. Since information systems are not as flexible as humans in interpreting documents, further ex ante agreements have be made for human-machine or machine-machine-interactions. This includes data definitions and document syntax defining the contents and structure of messages, as well as process-level information.

	Agreement	Examples of agreement	Examples of Standards
Level 3: Process	Parameters of business process(es) making use of inter-machine messages. *Necessary for all multi-step machine-machine interactions.*	Sequence of steps, possible branches, possible endpoints, exception triggering	RosettaNet Partner Interaction Process (PIP)
Level 2: Payload	Contents and structure of messages sent between machines. *Necessary for all single-step machine-machine interactions.*	Data Definitions, document syntax, acceptable values	UN/EDIFACT EANCOM
Level 1: Transport	Link/network used to transmit messages between machines. *Necessary for all computer-mediated interactions. Sufficient for human-human and human-computer interactions.*	Network choice, encryption, encoding, transmission integrity mechanisms	HTTP XML SOAP

Figure 3: *Levels of agreement in information system interactions (adapted from McAfee 2005a, McAfee 2005b)*

3. Limitations of B2B Portals – The Case of ETA SA

3.1 Company Background and Business Network

'The Swatch Group' is a Switzerland-based group that covers the entire value chain of the watch industry, including component manufacturers, well-known brands (e.g. Omega, Rado, Tissot, Certina and Swatch) and local sales organizations. ETA SA Manufacture Horlogère Suisse is a member of 'The Swatch Group' and one of the world's largest manufactures of finished watch movements and components.

The desire for greater customer orientation and better servicing its global customer base was the starting point for e-Business activities of ETA SA in 1998. The activities focused mainly on streamlining order fulfillment in ETA's customer service (ETA-CS), which is responsible for the distribution of spare parts, repair of watch movements and technical support. Figure 4 illustrates ETA's major customer groups: Among the approximately 1'500 business customers worldwide are brands, which partly belong to the same parent company, spare part dealers and watchmakers, as well as training organizations. The heterogeneous customer base imposes different demands for IT-support with large companies placing high volume orders on the one end and watchmakers with occasional orders and no IT-support except for a personal computer on the other end of the spectrum. The business network further comprises external logistics and financial service providers, which handle out-tasked activities of the order management process.

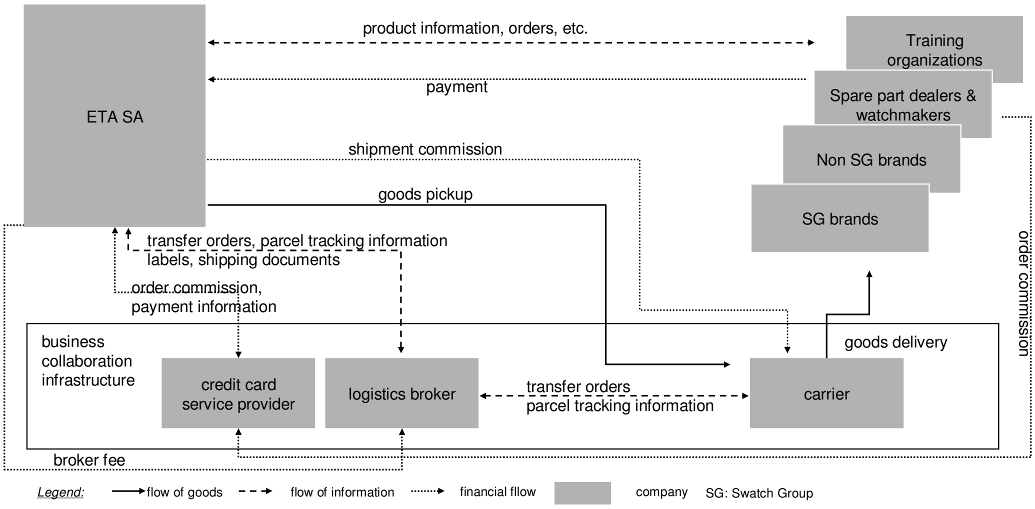

Figure 4: Business network of ETA SA

3.2 Process Architecture

ETA-CS initiated electronic process integration with its customers in 1999 by implementing the ETA Online Shop (EOS), a first generation e-commerce solution for the distribution of watch spare parts worldwide (Alt et al. 2000). Starting with an initial functional range of a typical electronic catalogue (search, transaction workflow, and shopping basket), ETA-CS gradually upgraded the EOS by introducing personalized shopping baskets, retainable delivery addresses and online payment. Although the EOS supported spare parts ordering, some important activities in the customer process where not addressed: This related to the identification of the correct spare part in the first place, and the repair and maintenance of movements.

Consistently pursuing the ultimate customer support, ETA-CS applied the concept of process portals in order to extend the range of electronic services offered to their customers (Alt et al. 2002). Traditionally, a portal denotes an internet-based systems that provides link libraries and guides users according to their interests (Dias 2001). Extending this concept, process portals as defined in (Österle 2001, Puschmann and Alt 2005) follow the more transaction-oriented electronic commerce vision. As comprehensive portal systems, they support customer processes by grouping services and thus provide customers with a single point of contact.

During the design phase, ETA-CS identified around 50 potential electronic services. In 2004, the Customer Service Portal (CSP) went online, implementing a first set of services and integrating the existing EOS functions.

Figure **5** illustrates an extract of the portal services that were deployed for collaborative order management with customers along with the implementation status as of January 2006.

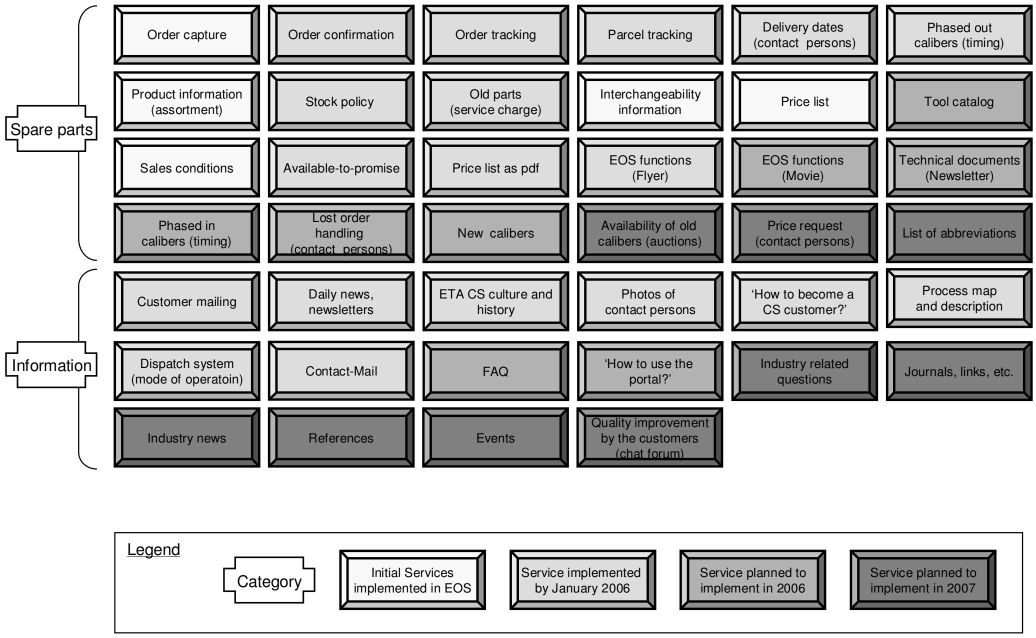

***Figure 5:** Electronic services in the Customer Service Portal and implementation status at ETA CS*

The main portal services offered by ETA-CS are bundled into customer process components reflecting their support for the customer's activities (Alt et al. 2002): Portal services within the process component *information* support requirements specification and planning activities. They include product documentation, sales conditions and company information. The *spare parts* component subsumes a variety of portal services for spare parts ordering ranging from availability check, to pricing, order capture and order as well as parcel tracking.

3.3 Integration Architecture

Since the services to be bundled in a process portal usually originate from a multitude of applications and data sources, an appropriate integration architecture is a prerequisite for successfully employing process portals (Puschmann and Alt 2005). Supplementing the logical functional view on applications (application architecture), the integration architecture describes how the heterogeneous application systems are technically integrated within the portal (Alt and Österle 2004).

ETA's CSP mainly uses mechanisms of data integration, which connect different applications by exchanging data (cf. Ruh et al. 2001, Linthicum 2000). Figure 6 shows the main data flows between the relevant applications and databases, categorized by the data integration patterns introduced in (Schwinn and Schelp 2003).

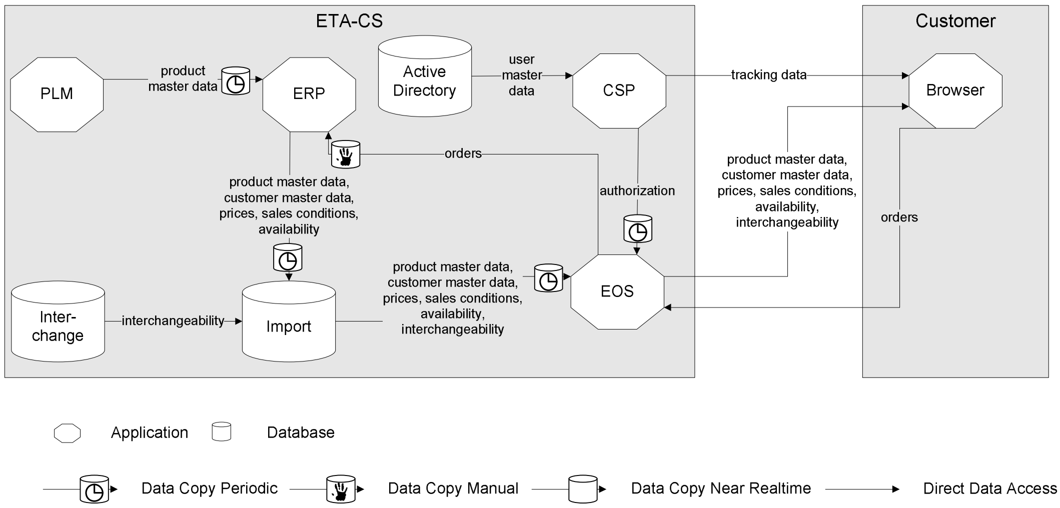

Figure 6: Integration architecture of the CSP

Although virtually integrated from a customer's perspective, the CSP relies on two separate systems: The EOS provides the core order management services whereas the portal system itself provides additional services such as authorization and authentication or tracking functions. The EOS periodically obtains the major part of its master data from an import database which acts as a staging area and pre-processes data obtained from the ERP and a dedicated database containing spare parts interchangeability information. Since ETA's product lifecycle management (PLM) system represents the leading system for product master data, text files with spare part master data are periodically exported and subsequently imported into the enterprise resource planning (ERP) system. The obtained product master data is supplemented by additional data from the ERP-system such as spare part prices, conditions and availability information. Additionally, the CSP provides authorization data to the EOS. User master data is managed by an active directory database which is queried online by the CSP. Orders placed in the EOS are copied to the ERP system involving a "human firewall" for manual verification of orders.

3.4 Limitations of Portal-based Integration

Considerations regarding the further development of ETA's Customer Service Portal were initiated by customer feedback: Several larger customers, especially larger brands belonging to 'The Swatch Group' complained about capturing spare parts orders twice, in their own ERP system and in the CSP. Consequently, they requested direct electronic integration. ETA-CS reacted by initiating a pilot study with Watch Co., one of its larger customers, in order to re-examine the current order management process and discuss different integration options. Figure 7 illustrates the actual order management process flow between ETA-CS and Watch Co. using the activity diagram notation defined in (Österle 1995). It shows the various manual or IT-supported activities (nodes), their temporal dependencies (edges) and processors in form of organizational units (vertical boxes or swim lanes).

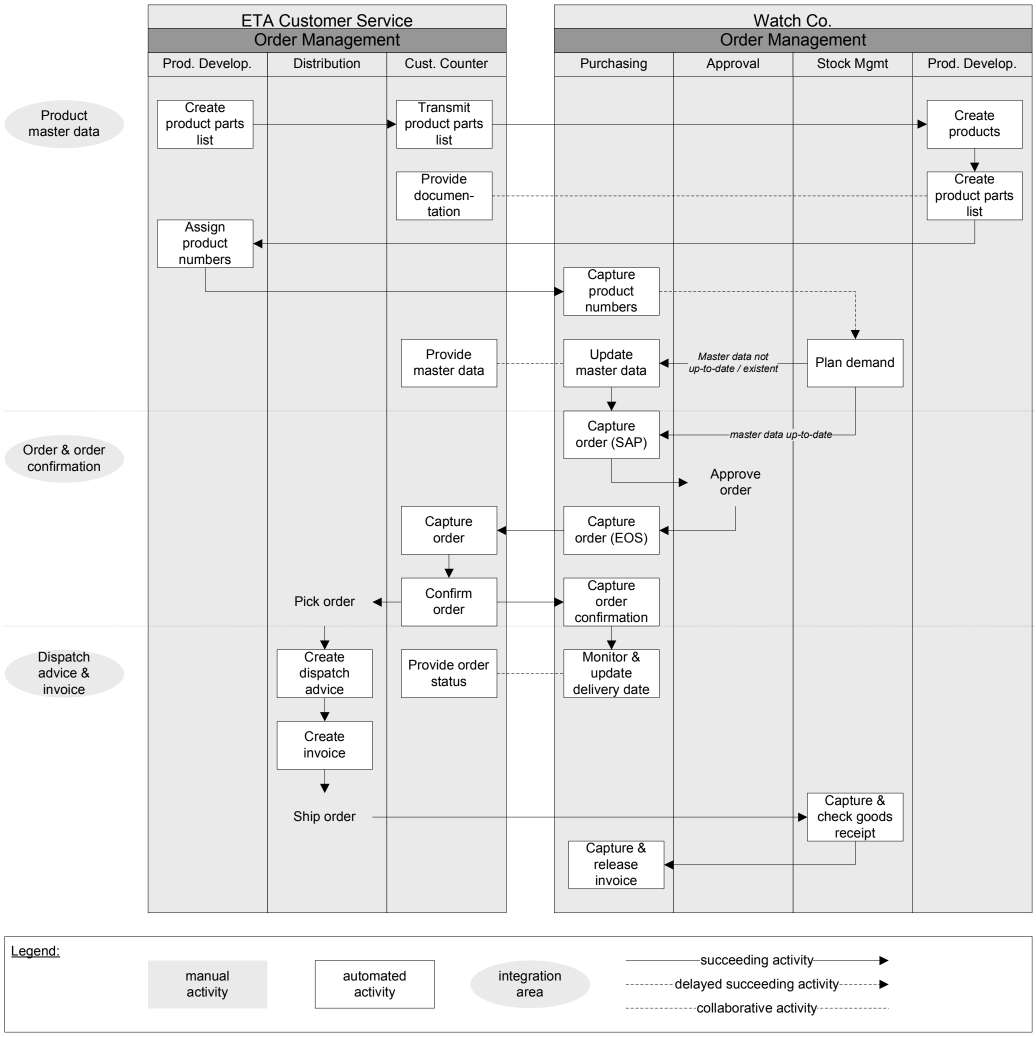

Figure 7: Current order management process between ETA-CS and Watch Co.

The analysis revealed several pain points which have been grouped into three different integration areas according to the main information elements exchanged between ETA-CS and Watch Co.:

- *Manual exchange of product master data.* Since customers usually use their own number system for spare parts, manual product number assignment activities are carried out on both sides. After the initial product identification is entered into Watch Co.'s ERP system, the purchasing department of Watch Co. has to regularly screen the CSP for product master data updates such as price changes, and copy those changes into the ERP system.
- *Multiple order capture and manual order confirmation.* Based on automatic demand signals, the purchaser at Watch Co. generates orders in the ERP system. After a manual approval, the purchaser has to re-enter these orderr into the EOS. ETA-CS confirms the order via fax and the purchaser copies the relevant information into the ERP system.
- *Manual dispatch information and invoice transfer.* Following the order confirmation, the purchaser at Watch Co. regularly checks the order tracking module on the CSP for adjusted order information such as changing delivery

dates. This data is manually entered into Watch Co.'s ERP system in order to allow timely stock management and requirements planning. The final dispatch advice is printed at ETA-CS and shipped together with the invoice and the goods. Stock management and purchasing at Watch Co. manually transfer the relevant information of those documents into the ERP system after receiving the goods.

The actual pain points in the case of ETA-CS underline some general limitations of process portals which are typical to B2B collaboration. Although process portals are usually directly integrated with company-internal backend systems, they primarily support human-machine interaction and require manual activities on the business partner's side. Since process portals by definition support activity sequences, they can be categorized as multi-step, human-machine interaction systems based on the typology introduced in section 0. Accordingly, process portals do only require comparably low standardization efforts on the transport level, i.e. an internet connection and browser, in order to be successfully deployed to external partners. Due to these low standardization requirements, process portals are widely used in industrial practice today and will certainly remain an important interorganizational integration mechanism in the future (Daniel and White 2005). They usually satisfy the requirements of smaller business partners with a low transaction volume and relatively basic internal IS support. Nonetheless, they impose some severe limitations in high-volume B2B relationships with larger customers or suppliers:

- Portal users have to adapt to the business process defined by the portal provider. The complexity of serving the predefined process rises as portal users are forced to utilize multiple process portals with different business partners.
- Large portal users which deploy an ERP system internally, have to re-enter information, which is not only a time-consuming but also an error-prone activity.
- Since portals rely on a human interface for transferring data, the real-time capability of portal-based integration is limited.

3.5 Process Vision and Related Benefits

Based on this analysis, ETA-CS developed a process vision for closer integrating large, ERP-equipped customers and providing a direct machine-machine communication channel for the identified main integration. Objectives are

- to periodically transmit electronic product master data from ETA-CS to customers,
- to receive orders directly out of the customers' ERP systems,
- to transmit a machine readable order confirmation after entering an incoming order in ETA's ERP system,
- to electronically transmit dispatch advices and invoices to its customers,
- to ensure the reusability of the implemented EOS based order tracking services for every customer,
- and to maintain all electronic services for human-machine interaction in parallel on the CSP as the central "one face to the customer" communication platform.

In addition to the process design, ETA-CS estimated the costs and benefits associated with the future order management process.

Figure 8 summarizes the benefits related to the integration areas for both sides, ETA-CS and Watch Co. The specified benefit quantifications were further converted into an estimation of potential cost savings and compared to the overall costs of the project.

	ETA-CS		Watch Co.	
	Benefits	**Quantification**	**Benefits**	**Quantification**
Product master data	fewer free text orders	15 min. expense for decoding one free text order position	fewer free text orders	15 min. expense for decoding one free text order position
	fewer wrong deliveries per invoices	15 wrong invoices per year	no manual update of master data	5 min. expense per product and year
			fewer wrong deliveries per invoices	1 % wrong deliveries per invoice and per year
Order & order confirmation			no double order capture	3 min expense per order + 2 min expense per position
			no manual capture of delivery date	1 min expense per position
			no monitoring and update of delivery dates	2 hours expense per year
Dispatch advice & invoice	Elimination of paper-based invoice	10 min expense per order	no manual capture of delivery note	1 min expense per position
			no manual capture of invoice	1 min expense per position

Figure 8: Benefit estimation for future order management process

The decision for providing an additional direct communication channel could not be based solely on the sketched cost-benefit analysis. Instead, the crucial factor for justifying the project is rooted in strategic considerations:.ETA-CS anticipates several strategic benefits by establishing a sustainable machine-machine-integration platform for spare parts order management. These benefits comprise improvements in process quality due to up-to-date and accurate master data as well as in process efficiency due to better process transparency.

4. Design of a Multi-Channel Architecture at ETA SA

4.1 Multi-Channel Architecture

Responding to the results of the pilot study with Watch Co., ETA-CS decided to supplement its existing Customer Service Portal with a selected set of directly accessible machine-machine services. These services are targeted at distinct customer groups, mainly intra-group brands and local distribution companies. Since ETA-CS has invested in establishing CSP as electronic collaboration platform with customers over the past eight years, one of the major challenges was to conceive an appropriate process and integration architecture. In order to allow for coordinated development, design and control of product and knowledge flows to and from customers over different channels, ETA-CS decided to design a multi-channel architecture.

Channels typically comprise (a) institutional or organizational channels (e.g. subsidiaries, sales agents or call centers) and (b) communication channels (e.g. phone, fax or internet portal) (Gronover 2003). Accordingly, multi-channel management covers two main activities (Figure 9):

- Interaction management supports the interaction between customer process activities and core process services at the best possible rate by utilizing the appropriate communication channels. In the case of ETA-CS, existing interactions with customers via phone, fax, e-mail and the CSP will be complemented in the future by offering an additional communication channel based on a direct transfer of XML messages via FTP.
- Channel management handles the internal alignment and coordination of different organizational channels. Since customer interactions are coordinated by the so-called 'Customer Counter' at ETA-CS, no additional issues arose related to this topic.

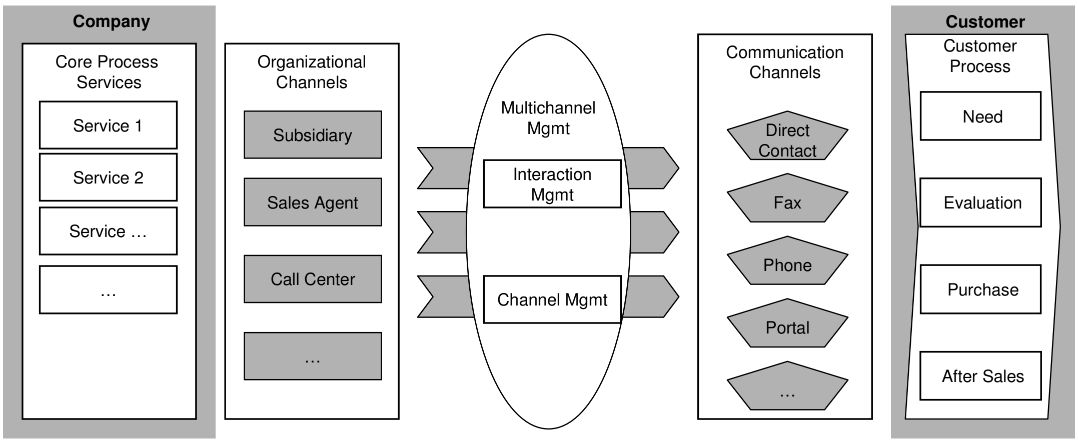

Figure 9: Elements of Multi-channel Management (Gronover 2003)

As a consequence, for ETA-CS design of the multi-channel architecture focuses on conceiving an integration architecture which supports interaction management and coordinates the technical integration of application systems with different electronic communication channels.

4.2 Process Architecture

With regard to the future process architecture, key design decisions concerned interaction management, i.e. determining which services to offer additionally via the machine-machine-interaction channel.

Category / Service	Communication channel	Fax/Letter	Email	CSP	FTP/XML
Spare parts	Order capture	X		X	X
	Order confirmation	X	X	X	X
	Order tracking			X	
	Parcel tracking			X	
	Delivery dates (contact persons)			X	
	Phased out calibers (timing)			X	
	Product information (assortment)			X	X
	Stock policy			X	
	Old parts (service charge)			X	
	Interchangeability information			X	
	Price list			X	X
	Tool catalog			X	
	Sales conditions			X	
	Available-to-promise			X	X
	Price list as pdf			X	
	EOS functions (Flyer)			X	
	EOS functions (Movie)			X	
	Technical documents (Newsletter)	X	X	X	
	Phased in calibers (timing)			X	X
	Lost order handling (contact persons)			X	
	New calibers			X	X
	Availability of old calibers (Auctions)			X	
	Price request (contact persons)			X	
	List of abbreviations			X	
Information	Customer mailing	X	X	X	
	Daily news, newsletters	X	X	X	
	ETA-CS culture and history			X	
	Photos of contact persons			X	
	'How to become a CS customer?'			X	

	Process map and descriptions			X	
	Dispatch system (mode of operation)			X	
	Contact-Mail			X	
	FAQ			X	
	'How to use the portal?'			X	
	Industry related questions			X	
	Journals, links, etc.			X	
	Industry news			X	
	References			X	
	Events			X	
	Quality improvement by the customers (chat forum)			X	

Figure 10: Assignment of services to communication channels

ETA-CS systematically reconciled the services currently offered on the CSP with the additional requirements gathered in the pilot study and assigned its services to the communication channels

Figure 10 illustrates that ETA-CS maintains the CSP as central communication platform and continues to offer the entire set of services via the CSP. Only selected services will be additionally offered via FTP/XML, mainly master data services such as product information, pricing, availability as well as functions for order entry and confirmation. In addition to offering existing portal services via the direct channel, ETA-CS extends its service portfolio to electronic delivery notes and invoices that will be accessible via multiple channels.

4.3 Integration Architecture

The transition to a multi-channel approach imposes some severe architectural challenges on ETA-CS. By introducing multiple electronic communication channels, the overall complexity of ETA-CS integration architecture is multiplied as illustrated by the following examples: New interfaces between the existing applications have to be implemented and managed, e.g. in order to transmit invoices and delivery notes from the ERP-system to the CSP. Additionally, the lacking separation of business and interaction logic in today's software architectures inevitably leads to a duplication of application logic in different systems when assigning services to multiple channels (cf. Lippert et al. 2001). As an example, the presentation of product master data in the CSP cannot be directly reused for the direct channel. Instead, the logic of product master data selection has to be re-implemented and subsequently maintained in the import database. Channel synchronization represents an additional challenge: Integration relationships between internal applications at ETA-CS have to be synchronized in order to guarantee a consistent view of the order management process covering all communication channels. However, this represents at the same time a non-quantifiable ETA internal benefit since intra-company transparency is increased.

The future integration architecture developed at ETA-CS is illustrated in Figure 11 and reflects some key design decisions regarding the implementation of the direct service interfaces.

ETA-CS decided to strengthen the role of its ERP system as the leading system for order management related functions by allowing direct order entry into the ERP system without the deviation over the EOS. Order confirmations, delivery notes as well as invoices will be directly transferred from ETA's ERP system to the ERP system of its customers. The same data is transferred in parallel to the CSP in order to maintain a central information platform providing all order-related functions including full visibility of the order status. Master data needed by the customer such as product, condition and availability information will be periodically extracted from the import database and transferred to the customers ERP system.

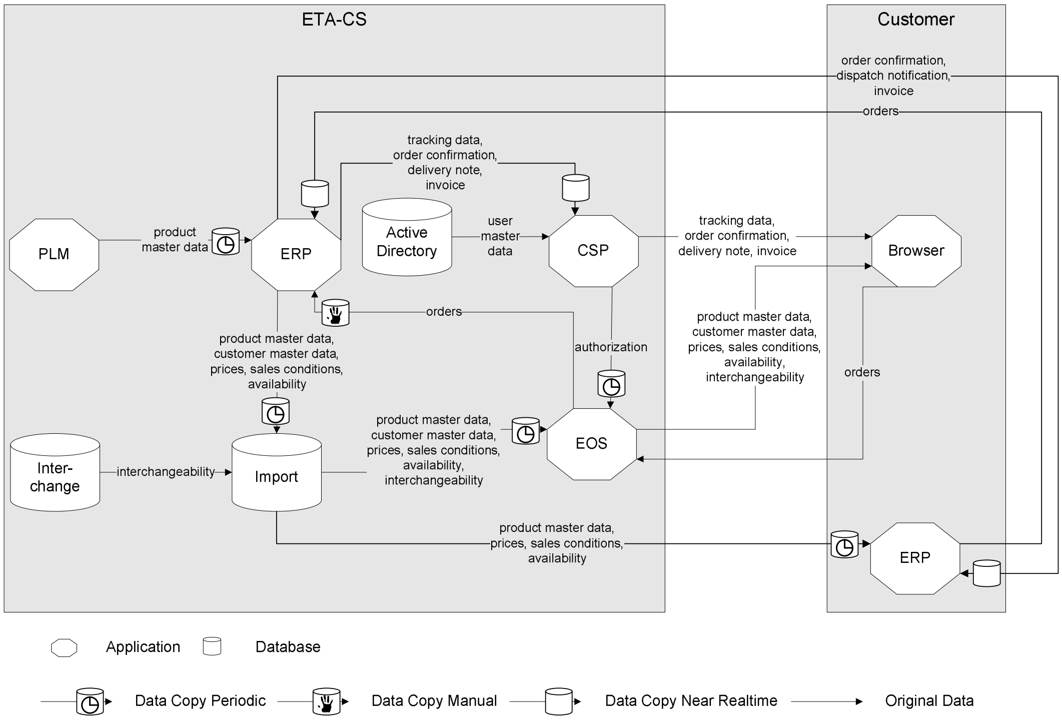

Figure 11: Future integration architecture at ETA-CS

With regard to the integration mechanism, data items to be exchanged between ETA-CS and its customers will be defined and encoded in XML and transferred via FTP. The whole integration process will be managed by the enterprise application integration (EAI) broker software.

4.4 Vision: Towards a Service-Oriented Multi-Channel Architecture

Since the complexity rises with any additional electronic channel, some more architectural reflections regarding future interorganizational systems are necessary. The emerging concept of service-oriented architectures (SOA) is suited to reduce the complexity inherent to multi-channel architectures (Newcomer and Lomow 2004). The term SOA was coined by analysts from the Gartner Group in 1996 (Natis 2003) and is currently revitalized in the hype around Web Service technologies. In its essence, SOA describes a paradigm for the structured design of multi-level, distributed integration architectures based on services. Services provide distinct functions of application systems over a network and adhere to the following design principles:

- *Interface orientation.* Services are stable interfaces that provide a complete technical and functional service description and abstract from the service implementation details
- *Interoperability.* Services are interoperable, i.e. they adhere to certain technical and functional industry standards in order to allow cross-platform and cross-organizational integration.
- *Autonomy and Modularity.* Services encapsulate functions with a high level of interdependencies (cohesion) and are at the same time highly independent from other Services (loose coupling).
- *Demand orientation.* Services are demand-oriented, i.e. they offer functions on a business-oriented level of granularity.

A multi-channel architecture based on SOA, is usually subdivided in four distinct layers (cf. Newcomer and Lomow 2004, Zimmermann et al. 2005):

The application layer contains the existing application landscape, including systems for ERP, PLM, etc. The service layer consists of various services which provide business logic that needs to be accessible by different electronic communication channels. The interaction layer comprises so-called interaction services, i.e. functional elements that handle the communication channel-specific interaction between the business services and corresponding front ends on the presentation layer (cf. Lippert et al. 2001, Zimmermann et al. 2005).

Figure **12** applies the concept of a service-oriented multi-channel architecture to the case of ETA-CS.

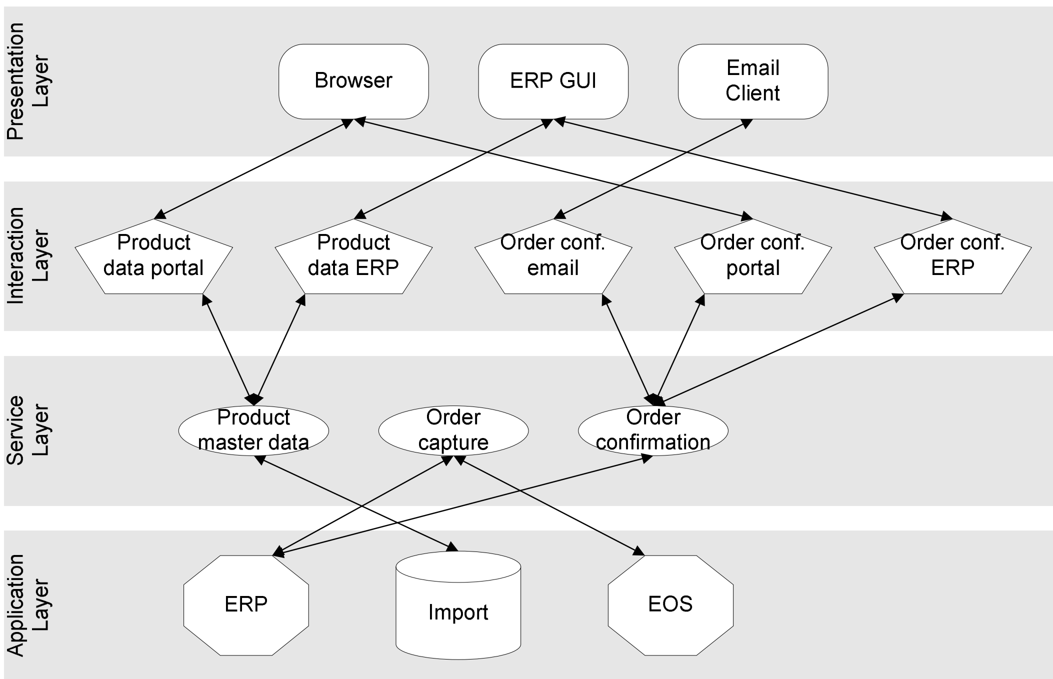

Figure 12: *Concept of a service-oriented multi-channel architecture at ETA-CS*

The service layer contains services encapsulating the key business functions relevant to ETA-CS customers, such as product master data, order capture and order confirmation. These services are implemented by interfaces to the existing applications and do not incorporate any channel or presentation-specific logic. Several interaction services implement the requirements of the specific communication channel and evoke the business services as needed. The order confirmation service e.g. is transformed by different interaction services in order to be presented in the portal, to be sent via email or to be directly transferred to a customer ERP-system. The sketched separation of interaction and business logic leads to a software architecture that is more easily maintainable due to the reduced number of duplicate functions. Another advantage of the service-oriented architecture approach to interaction management is, that existing business services can be easily offered over new communication channels, providing improved process flexibility for ETA-CS. The major obstacle of the sketched architecture is that the distinct separation of the different layer requires a major redesign of the existing application landscape.

5. Conclusion and Outlook

Related to the evolution of interorganizational systems, the case of ETA-CS illustrates a typical pathway towards increasing electronic interaction with external business partners: ETA-CS started with a first generation e-commerce solution in order to provide its customers with electronic order entry functionality. In a second stage, ETA-CS subsequently introduced and rolled out a Customer Process Portal which provides a comprehensive set of electronic services covering the entire customer process. Although the Customer Process Portal has gained broad acceptance over the last years, larger customers recently started to complain about the lacking process and system integration in spare part order management. In the future, ETA-CS will offer selected electronic services via both, the portal-based and the direct channel.

Based on the experiences of ETA-CS, the following challenges can be derived in interorganizational integration:

- *Need for serving multiple electronic channels in interorganizational B2B integration*: Although portals have been the dominant collaboration platform over the past years, B2B relationships increasingly require the support for multiple electronic channels. The preferred electronic channel usually depends on the stability of the business relationship, the associated transaction volumes as well as on the level of company-internal integration.
- *Need for interorganizational agreements at the payload and process level:* Since higher levels of process integration require additional agreements with the business partners, companies have to closer align master data definition, message formats and process sequence with their business partners.
- *Need for an interorganizational integration architecture:* With the need for serving multiple electronic channels, the complexity of implementing these channels based on the existing application landscape rises. Service-oriented architectures provide a powerful concept for realizing multi-channel integration. Consequently, future interorganizational systems will most probably build on service-oriented architectures. Open web service standards will further contribute to the convergence of internal, ERP-based and external, Internet-based integration.

When conceptualizing service-oriented architectures for B2B relationships, a number of future research questions arise. Among them figure reference architectures for interorganizational process integration as well as the definition of business semantics for the specific business context, e.g. by aligning “public processes” and providing semantic specifications for web services.

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