

e-Transformation Strategy : From EDI to Web-based e-Business Standard Framework

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Abstract. Recently, lots of EDI-VAN (Electronic Data Interchange-Value Added Network) companies challenge to convert their business systems into Web-based e-business frameworks to avoid high cost and closed structure of EDI system. This research proposes e-Transformation strategies for EDI-VAN companies to adopt Web-based e-business standard frameworks such as ebXML (e-business using XML) and RosettaNet. Four migration strategies for EDI companies are presented, and their properties are described in detail. Transformation procedures of two representative strategies are also provided for the convenience of medium-sized companies. The result of this work can be used as a practical guideline for EDI companies to develop their own transformation strategy suitable to its scale and capability, while minimizing the impacts on the pre-existing business processes.

Keywords: EDI, Web-based e-Business, Standard

1. Introduction

Lots of EDI-VAN companies have already transformed their business systems into Web-based e-business systems, and more and more companies are considering such an e-Transformation. Both the improvement of the Internet messaging technologies and the propagation of e-business standards such as ebXML (e-business using XML) and RosettaNet accelerate the transformation and business-to-business integration [2, 5, 6, 8].

In this research, we propose 4 e-Transformation strategies for EDI-VAN companies to adopt Web-based e-business standards together with their selection criteria. The characteristics of each strategy are explained in detail and transformation procedures of two representative strategies are given. The result of this work can be used as a practical guideline for an EDI company to develop its own transformation strategy while minimizing the impacts on the pre-existing EDI business processes [3, 4].

2. Paradigm Shift of e-Business Standard

As the business became global throughout the world, the limitations of those national EDI standards were revealed, which led to a joint development of international EDI standard by standardization organizations of USA and Europe under the support of United Nations. As a result of these efforts, UN/EDIFACT (EDI for Administration, Commerce and Transport) was approved as an international standard by ISO (International Organization for Standardization) in 1987. In spite of it all, vertical industry standards and proprietary communication standards of each VAN vendors coexist in the field and X.12 is still widely used in North America [1, 2, 9].

With rapid evolution of information technologies and the Internet, lots of companies have introduced a variety of enterprise information systems including ERP (Enterprise Resource Planning), CRM (Customer Relationship Management), SCM (Supply Chain Management) and BPM (Business Process Management) to manage their business activities efficiently. As the competition among companies becomes intense, companies are especially in need of process integration between those information systems to cope with the

market changes sensitively and thus improve their competitiveness. However, it is very difficult to satisfy those business requirements through the EDI-VAN system.

In EDI-VAN environments, business activities are performed within a closed network using a proprietary translation and communication software. Therefore, there is a fundamental limitation that EDI-VAN cannot support open and flexible transaction environments. All trading partners should use the same VAN service to communicate with each other. Transaction cost increases in proportion to transaction volume. Furthermore, since business documents are exchanged in batch mode, it is very difficult to handle transaction activities requiring real-time response.

Increasing risk cost is a more serious problem than transaction cost itself. Maintenance of outdated EDI system is problematic. It is difficult to hire a maintenance staff for old-fashioned system and EDI vendors usually set a pretty high price on maintenance and upgrade service.

Another limitation of EDI-VAN is that it lacks in flexibility. To cope with changes in business environment such as modification of business processes and addition of brand-new products or services, it is necessary to develop or modify translation software. However, illegible binary format, riveted data fields, and difficult document mapping make it hard to touch EDI translation software. Besides, extra development cost to integrate EDI system with enterprise information systems such as ERP, SCM, and CRM is also required [2, 3]. As is described above, EDI-VAN systems are difficult to cope with changes in business environments. However, it is also difficult to eliminate the old EDI system at a time, because core business functions such as order processing, financing and invoicing are still carried out based on the EDI system. Migrating core functions to the Internet environment without any considerate plan or fine control may affect the company negatively.

There have been several alternative EDI technologies to overcome the limitations of traditional EDI systems, which include *Open-EDI*, *Internet-EDI*, *Web-EDI*, *Interactive-EDI*, and *XML/EDI*. These technologies were mainly developed to provide additional Internet connection services over the VAN so that VAN vendors withhold existing EDI users from secession. So, they have a significant difference from the Web-based e-business frameworks, which are basically open.

Web-based e-business framework is an environment where technical backgrounds and operational milieu of B2B e-commerce are based on the standard Web technologies such as XML, HTTP(S), and Web Services. Notable Web-based e-business frameworks include ebXML, RosettaNet, BizTalk, eCo and so on. With the Web-based e-business framework, companies can migrate from VAN to the Internet and do their business in accordance with the international B2B standards. Web-based e-business framework is regarded as a good alternative to overcome the limitations of the conventional EDI-VAN [5, 6, 7].

3. e-Transformation Strategies for EDI company

We have reviewed *migration cases in real world* and typified those cases into four strategies, which are EDI-VAN extension, utilization of e-business hubs, self-implementation of alternative e-business framework, and finally adoption of integrated business infrastructure.

3.1. EDI-VAN extension

This strategy is to use additional services provided by most EDI-VAN vendors. Use of services such as Web-EDI and Internet-EDI is an example of this strategy. EDI-VAN extension can be a good strategy to EDI companies having small transaction volume, since it preserves former investments on EDI system and does not affect existing business processes. However, there still exist the problems of EDI systems such as operational and maintenance costs, batch processing, and integration issues with various enterprise information systems.

EDI-VAN extension is a kind of add-on to pre-existing EDI-VAN system to support Web-based transaction processing. Therefore, it is difficult to support e-business standards that have recently appeared. Proprietary EDI processes and document formats provided by VAN vendors are generally used between trading partners.

3.2. Utilization of e-business hubs

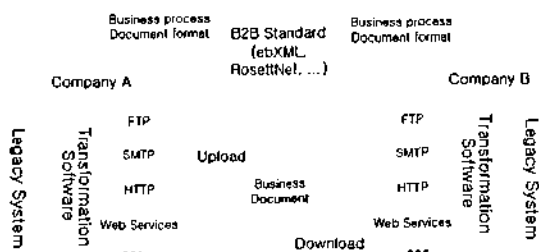
An e-business hub is an organization or company that equips with various e-business frameworks and services over the Internet. It provides very complicated transformation software, legacy adapters, and APIs which are

developed using XML and Web Services technologies to facilitate integration with enterprise information systems.

This strategy removes all the costs of EDI-VAN and supports business transactions that conform to the latest e-business standards. It can be a good strategy for small or medium-sized companies that have never used EDI-VAN but want to adopt Web-based e-business standards. If a company should cover multiple B2B standards with many partners, this could be a good alternative.

3.3. Self-implementation of alternative e-business framework by EDI companies

This strategy can be used to satisfy individual companies' particular business requirements by selectively using Internet technology and e-business standards. Companies with high IT capability and leading market initiative often select this strategy to perform customized business transactions using their own processes and documents. Especially, when the transaction volume is too high to be dealt with e-business hubs or EDI-VAN extension, self-implemented high performance system can be applied.



<Fig. 1> Example architecture of self-implemented B2B system

<Fig. 1> illustrates example architecture of this strategy. To apply this strategy, it is usually required to construct Web infrastructure within a company. The infrastructure should be designed and developed to have sufficient scalability and performance in preparation for the future growth of e-business volume. Even a simple implementation of a central FTP server can be very effective to exchange XML business documents with this strategy. This strategy has a wide range of applicability according to the selected technologies and business processes. The most important thing is to implement Internet messaging technology to safely exchange business documents. Communication protocols such as HTTP(S), FTP, SMTP, SOAP, AS1, and AS2 are used for this.

3.4. Adoption of integrated business infrastructure

This is an enterprise-wide whole migration strategy that introduces specialized business integration infrastructure and platform. Once an integrated Internet messaging infrastructure and middleware are constructed, a variety of e-business standards and application systems are integrated over this infrastructure. The migration is performed intensively in a short period at an enterprise level with the introduction of large-scale information systems such as EAI (Enterprise Application Integration), B2Bi, eAI (e-business Application Integration), BPM (Business Process Management) and so on.

In most cases, multi-national corporations or large-scale companies usually support multiple e-business standards simultaneously. And their transaction volume is immense. Thus, the adoption of integrated business infrastructure is preferable considering expensive external services, performance and availability aspects. However, this requires large investment and high IT capability of that company. Nowadays, the integrated infrastructure is usually implemented with BPM and eAI solutions that support Web Services.

4. Selection and application of strategy

4.1. Variation of preferred strategy with company size

If we look into the strategies that are selected by other companies for migrating web-based e-business framework, then we can see that there exists a preferred strategy depending on their company size. That is to say, for large companies or multi-national organizations, adoption of integrated business infrastructure is preferred, for medium-sized companies the strategies of e-business hub and self-implementation are recommended, and finally for small-sized companies EDI-VAN extension is preferred. <Table 1> summarizes detailed criteria that are used classify company size in this research.

<Table 1> Classification criteria for company size

Criteria	Large	Medium	Small
Employee	1000-	100-1000	10-100
Coverage	Multi-national corporation	Sometimes multi-national	Regional presence
Revenue (\$)	Hundreds of millions to billions	Hundreds of millions	Tens of millions
Role in the supply chain	Large OEMEMS/Supplier	Supplier of components or subassemblies/MES	Small Supplier

If it is natural that the size of company grows as the company develops its business, then we can depict the evolution of preferred strategy together with the company size over the time horizon. If an EDI-VAN company has constantly propelled web-based e-Transformation and in the meantime its business has developed, then company's preferred strategy can probably be changed. This leads to a mixed strategy in the end.

4.2. Utilization of mixed strategy

Seldom can we find cases that pure migration strategies are solely used by EDI companies, but most companies use various mixed strategies instead. We can easily find the cases where mixed strategies are used in the multi-national organizations such as Intel, Nokia, and Samsung. These companies use EDI-VANs or e-business hubs according to their partners' regional presence or roles in the supply chain as well as building their own integrated infrastructures. In addition to this mixed usage, for some business processes where massive transaction volume is expected, self-implementation strategy is familiarly introduced.

5. Transformation procedures

Among the above 4 pure strategies, EDI-VAN extension strategy needs few extra efforts of the VAN subscriber. And procedures for transformation with integrated infrastructure are richly presented by solution vendors and customer companies. Thus in this research, we will present transformation procedures of e-business hub and self-implementation strategy.

5.1. Transformation procedures of e-business hub strategy

General transformation procedures for those companies that have selected e-business hub strategy can be summarized to the following 4 steps.

(1) Gap analysis of business processes

First of all, gap analysis between the conventional EDI transaction and newly introduced e-business standards as well as the comparison of the business documents is required. After identifying structural differences between the two business documents, mapping and transformation relationship are found for equivalent data fields. Handling scheme for newly introduced data fields is also determined, which is typically utilization of default values or linkage from the backend enterprise information systems. Through the gap analysis, the differences in data fields and business processes are clearly defined, and thus additional requirements are identified.

(2) Metadata creation and environment setup

Additionally, required information that is found at the gap analysis needs to be generated and its operational environment should be established. At this step, works for recognizing related companies are carried out, such as issuing and exchanging DUNS or DUNS+4 unique identity, generating PKI-based key pairs and then delivering or registering public key to hub service agency and partner company. Defining each company's role in business process and configuring various transports, route and protocol agreements are also performed. A database system to store and manage additional data fields is developed, and extra adapters to integrate company's legacy systems with hub system are installed.

(3) Development and configuration of translation software

In this step, translation software that is provided by hub service vendor is mainly configured. Since the offered translation software and adapters are versatile and have higher configurability than old EDI-VAN translation software, the portion of ad-hoc or in-house development is not so high. For business processes where provided adapters or translation software are hard to support, and thus custom programming is inevitable, API and Web Services connectivity provided by hub service vendor can ease the development efforts.

(4) Web interoperability test

Finally, collective test for established web-based e-business framework is performed, which is typically composed of 3 subsequent test phases.

The first test phase is to verify the trading partner's web connectivity by accessing to partner's URL. In this phase, it is checked whether the business document can pass through each company's firewall and successfully delivered via hub service.

The second test phase is to test the validation of partner's standard compliance. After transmitting a test business document to a trading partner, the reaction of the partner is checked against the e-business standard. In this phase, we can make sure that the data fields, document structure, and business context are exactly composed and correctly understood each other. Usually, two kinds of business documents that are valid or invalid are exchanged between partners and the other's reaction is checked respectively.

The last test phase is end-to-end test between two trading partners' backend information systems where test business documents are generated and consumed. After this final test phase, they actually schedule the tested business process when to go live in production mode.

5.2. Transformation procedures of self-implementation strategy

Self-implementation strategy requires 3 more steps compared to hub strategy.

(1) Design and construction of web environment

Web environment is indispensable to those companies that select self-implementation strategy. What is most important in this step is to grasp the volume of transaction and business processes. After the volume is estimated, we can determine the number of web servers and application servers needed. In the typical web environment setup, it is mostly required such as web server, web application server, firewall, database server, and proxy. In accordance with their performance requirements, cluster design for load balancing and fault tolerance is carried out. The size of web environment should be wisely determined to incorporate how the company's future web-based business volume will grow and what's the estimated bandwidth for the other business purpose.

(2) Gap analysis with conventional business processes

Just like the hub strategy, in this step, we can find out whether there exist any requirements for data translation or extra data fields. The interaction of business process is also established in this step by referring to well-known e-business standards.

(3) Web technology analysis and implementation strategy setting

In this step, technical specifications are determined in order to meet data and process requirements that are identified in the gap analysis. This is the most important step in the self-implementation strategy, where technology and implementation strategy are selected considering its capability concerning the web technology and outsourcing possibility. Bring the balance between process designer and IT engineer is crucial. While process designer usually prefers comprehensive and detailed process definition, IT engineer favors state-of-

the-art technology and full implementation of a few core business processes. Though it uses plain technology with simple process definition, if it fulfills business requirements well, it can be a good alternative plan for self-implementation strategy.

(4) Metadata generation and environment setup

Once implementation strategy is set, operational environment for additional data fields is established, as is described in the hub strategy.

(5) Development and configuration of translation/management software

Full implementation of required functionalities is done in this step. In addition to the translation software that will be the core of system, management software to control and maintain the system operation needs to be developed.

(6) Design and application of partner managerial policies

Managerial policies for trading partner need to be made and applied by company itself. A wide variety of policies can be chosen from the simple one that maintains partner's login ftp account and password, to a more complex one that involves access control such as connection time-zone, traffic volume and release of idle connection. Because partner management requires somewhat elaborative tasks and operational efforts, much consideration should be taken into the selection of policy. Ill adopted partner management policy can incur incessant costs in proportion as the company size and e-business transaction volume grow, thus careful decision is needed.

(7) Web interoperability test

Test is carried out in 3 phases as it is done in the hub strategy. In the self-implementation strategy, test of additional software such as monitoring, management and partner policy control should be performed together with web interoperability test.

6. Conclusion

In this research, we have presented 4 pure transformation strategies for EDI-VAN companies to adopt web-based e-business standard framework. Besides, we have discussed how those pure strategies are mixed with each other in real application and how they evolve as the company develops. Transformation procedures of e-business hub and self-implementation strategies are given for medium-sized companies' web-based e-business migration.

Even though many EDI companies have tried to introduce web-based e-business, they have suffered from vague execution procedures and lacks of systematic strategies. We hope the result of this research contributes to those companies' successful migration toward the next generation e-business standard frameworks.

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