

E-Transformation from EDI to Web-based B2B Frameworks

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Abstract. Lots of EDI-VAN companies are in need of transforming their business transaction systems into Web-based e-Business frameworks because of high cost and closed structure of EDI systems. This research proposes several e-Transformation strategies for EDI-VAN companies to adopt Web-based e-Business frameworks such as ebXML and RosettaNet. Four transformation alternatives are presented and transformation procedure for a medium-sized company is described. 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 and information systems.

Keywords: EDI-VAN, ebXML, RosettaNet, e-Business Standard, E-Transformation.

1. INTRODUCTION

The Many companies have been using EDI (Electronic Data Interchange) systems to exchange business documents with their trading partners since the very inception of EDI in 1970's. Among those early EDI adopters quite a lot of companies are still using traditional EDI system over the VAN (value-added network) to conduct and manage their processes. VAN providers exclusively handle all the services such as connectivity, protocol conversion, security, auditing and mailboxes. They charge for every transaction they handle and the subscribers have to use a dialup modem to connect to the closed VAN and thus initiate the transaction, which results in the onerous batch processing.

IT (Information Technology) environment has undergone considerable changes for the past 30 years, which affects the enterprise structures and business activities and

thus induces significant changes in traditional EDI-VAN systems. The main cause of those changes is the rapid dissemination of the Internet. Now, the Internet is recognized as a cost-effective alternative to replace the closed EDI-VAN environment (L. Pak. 2003, Nahid. 1998).

Many 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 advancement of the Internet technologies and the propagation of e-Business standards such as ebXML (e-Business using XML) and RosettaNet accelerate the changes in B2B (Business-to-Business) environment (ebXML. 2001, Sanjay. 2003, Jagdev. 2001).

In this research, we propose four E-Transformation strategies for traditional EDI companies to adopt Web-based e-Business standards together with the selection criteria. Each strategy is explained in detail and the trans-

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formation procedures of two representative strategies are given. The result of this work can be used as a practical guideline for an EDI-VAN company to develop its own transformation strategy (Ying, 2003, Youcef, 2004).

The rest of this paper is organized as follows. Section 2 explains the paradigm shift of e-Business standards. Section 3 and 4 present four E-Transformation strategies and the selection criteria of each strategy. Section 5 explains about the hybrid approach. Section 6 provides the procedures of two transformation strategies for mid-size companies. Finally, we conclude this paper in section 7.

2. EVOLUTION OF E-BUSINESS STANDARDS

2.1 Overview of EDI Standard

EDI is a standard for computer-to-computer exchange of machine-readable business documents. With EDI, business documents can be sent directly from one computer to the other, which eliminates manual data entry errors and thus improves data quality and processing efficiency. The benefits of EDI include cost saving, superior customer services, enhanced internal processing, higher business visibility and improved organizational competitiveness (Nahid, 1998, Simon *et al.*, 2000).

At first, EDI had been used to exchange information within a company or related groups with a proprietary format, so the range of its utilization was quite limited. As there grows the needs for exchanging information between companies within an industry, vertical industry standards for EDI were established. After these industry standards, national standards supported by each government were developed. The X.12 and GTDI (Guidelines for Trade Data Interchange) are the typical examples of those national standards developed by ANSI (American National Standards Institute) and Europe respectively.

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 (Nahid, 1998, Martin, 2002).

2.2 Threat to Traditional EDI

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 sensitively changing market and thus improve their competitiveness. However, it is very difficult to satisfy those business requirements with the traditional 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 (L. Pak, 2003, Ying, 2003).

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.

2.3 Emerging Web-based e-Business frameworks

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 traditional EDI-VAN (ebXML. 2001, Sanjay 2003, RosettaNet 2002).

3. E-TRANSFORMATION STRATEGIES

We have reviewed 21 migration cases of Korean company from the multi-national corporation to small and medium-sized company 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

VAN extension strategy is to use additional services provided by most EDI-VAN vendors such as internet connectivity, bridging to other open e-Business standards protocols. 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 traditional EDI-VAN 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 traditional EDI-VAN system to support Web-based transaction processing. Therefore, it can be restrictive in supporting e-Business standards that have recently appeared. Proprietary EDI processes and document formats provided by VAN vendors are generally used between trading partners. Following Figure 1 illustrates this extension strategy.

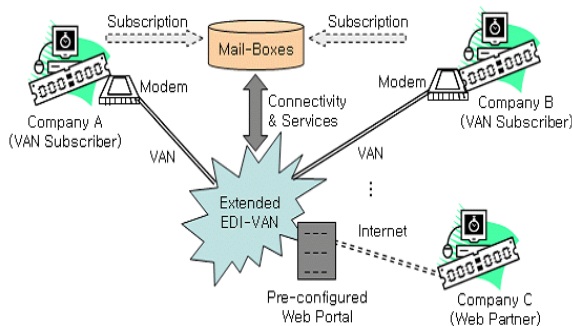


Figure 1. EDI-VAN extension.

The advantage of adopting this strategy is that it can be implemented with low cost, minimal efforts, and with rapidity. Companies can incorporate web connectivity and new e-Business framework services into their transaction system by simply subscribing add-on services and with minimal system changes. This approach, however, still bases on the conventional VAN system. Its functionalities are restricted by the level of services that the VAN provider offers. For those companies with large transaction volume or with the need of real-time customer response, this approach will be a very restrictive strategy.

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 at once as depicted in the Figure 2 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.

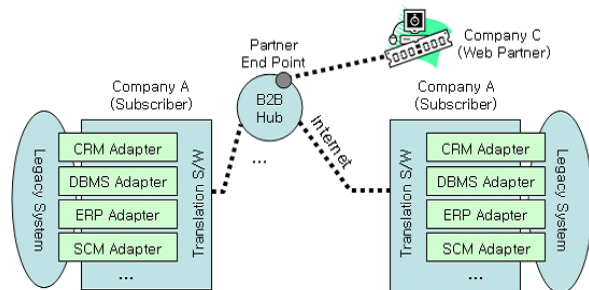


Figure 2. Using e-Business hub.

The major advantage of this strategy is that it can drastically replace old VAN infrastructures and services in a short time. Implementation cost and system changes are relatively small and affordable. This strategy can coexist with conventional VAN system if it is needed. The main disadvantage of this strategy is that it requires subscription to the service provider and thus its functionalities are limited by the level of services of that provider. Operating cost depends on the provider's service charge policy and thus will be less favorable for companies with huge transaction volume.

3.3 Self-implementation of Alternative Framework

This strategy can be used to satisfy individual com-

panies' 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-implementation strategy can be more affordable to satisfy high performance and heavy traffic requirements than the other strategies.

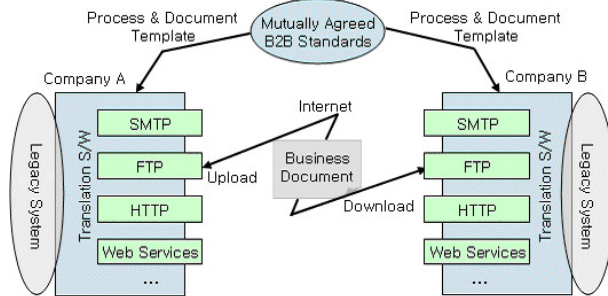


Figure 3. Self-implemented B2B system over FTP.

Above Figure 3 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.

The main advantage of this strategy lies in its high customizable implementation feature. Companies can specialize the actual implementation for their own needs. This means that the success of this strategy largely rely on the companies' IT capabilities. Major disadvantage of this strategy is its somewhat high acquisition cost. If the implementation is not guided well, the acquisition cost and time will rise steeply. Another disadvantage is that this strategy constantly requires relatively high operation cost and managerial efforts to maintain the system.

3.4 Adoption of Integrated Business Infrastructure

This strategy requires an enterprise-wide whole migration 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 unified infrastructure. The migra-

tion 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.

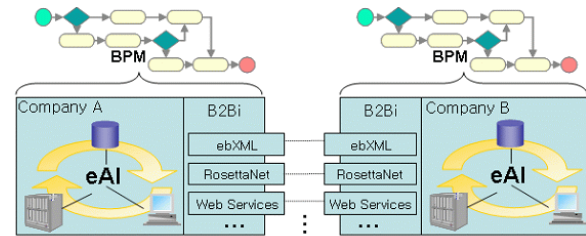


Figure 4. Incorporating integrated business infrastructure.

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. As shown in Figure 4, nowadays, the integrated infrastructure is usually implemented with BPM and eAI solutions that support Web Services.

Adopting this approach requires lots of cost and time. It can deeply affect to the way how the company do their business. For those companies with small transaction volume and small set of e-Business services, it's not a good choice. Integrated infrastructure can provide diverse e-Business services considering future changes in the business environment.

4. SELECTION OF A STRATEGIC ALTERNATIVE

A guideline for selecting a proper strategy is described in this section. The guideline is developed by considering various aspects that EDI companies are faced with when they intend to migrate to Web-based e-Business frameworks. In this research, we define several important factors affecting B2B transactions. Based on these factors described in Section 4.1, companies can build their own profiles and select a proper strategic alternative by referencing the alternative selection matrix which is explained later (Refer to Table 4).

4.1 Factors Affecting B2B Transactions

According to companies' situations and their industry domains, there are lots of factors that influence B2B transactions. Among those factors, we have chosen three important factors-network, IT capability, and B2B Mes-

saging – focusing on technical aspect and physical environment of B2B e-Commerce. We define three maturity levels for each factor, which are H (High), M (Medium), and L (Low).

4.1.1 Network Factor

Network factor consists of two sub-factors; connectivity and bandwidth companies require. These factors describe a criterion for deciding network capability and capacity of the company that wants to migrate to Web-based e-Business frameworks.

Table 1. Network factor.

Sub-factors	Maturity level
connectivity	H: always connected, 24x7x365
	M: usually connected, but daily variations exist
	L: not continuously connected like using phone lines
bandwidth	H: Unlimited
	M: T1 or T3
	L: Partly T1 and telephone connection

Companies using telephone lines to connect with other companies usually do not have need of implementing large scale e-Business frameworks. Similarly, it is unusual that companies requiring high bandwidth and constant connection perform their business transactions depending on manual work processes or fax machines.

Practically, network capability is closely associated with IT capability which is described in the next section.

4.1.2 IT Capability Factor

IT capability factor is a criterion for measuring a company’s IT infrastructure and its IT capabilities to support migration. Table 2 illustrates this factor.

Generally, large companies have matured level IT capabilities, and they usually have lots of legacy systems to be integrated and utilize a number of tools for data transformation. On the contrary, small-sized companies have few back office system and depend on manual work processes and small scale packages. Therefore, they can’t afford to invest in migration to the new e-Business frameworks and they would act passively.

4.1.3 B2B Messaging Factor

B2B messaging factor is a criterion for identifying incorporated B2B standard and comprehending the volume and types of B2B transactions.

Selection of an e-Business standard framework at a company is influenced by the number of B2B processes and supported protocols of the company. Moreover, the ratio of B2B transactions and volume of large transactions

Table 2. IT Capability factor.

Sub-factors	Maturity level
IT budget (USD)	H: hundreds of millions
	M: several millions
	L: hundreds of thousands or so
B2B staff	H: 10~20 fulltime staffs exclusively allocated to B2B integration and e-Commerce
	M: 1~2 fulltime B2B staffs
	L: no fulltime B2B staff
integration with back office systems	H: requires integration with any system from B2B servers to EAI system
	M: requires integration with a major back office system
	L: no integration with back office system is required
back office systems	H: a number of ERP and MRP systems
	M: a single medium-sized ERP system
	L: accounting package, spreadsheet, and so on
data transformation	H: incorporates high level intra business utilities for B2B transaction and EAI. Has knowledge about various types of data
	M: Understands various tools and a few format of B2B types
	L: No data transformation function, only manual input is need

are also factors affecting companies’ subscription to EDI-VAN or e-Business hub services. If the transaction volume is huge, the cost of EDI-VAN or hub services becomes very expensive. In this case, the company may prefer to adoption of integrated business infrastructure or self-implementation of alternative framework rather than using EDI-VAN or hub services.

4.2 Strategy Selection Matrix

Once each company has recognized its requirement level for the above factors, then the company may refer our strategy selection matrix for the choice of e-transformation strategy.

In the selection matrix, the entry of ‘N. A.’ means that such a requirement combination actually doesn’t occur in the real world company or it’s meaningless. For instance, a company with high B2B messaging requirement and high IT capability may not ask for a low level internet connectivity or bandwidth with dialup modem. Such a meaningless case is marked as ‘N. A.’ in the matrix.

Table 3. B2B Messaging factor.

Sub-factors	Maturity level
Number of trading partners	H: hundreds of thousands of partners
	M: thousands of partners
	L: tens of partners
Transaction volume per day	H: thousands ~ tens of thousands
	M: thousands
	L: hundreds
Ratio of B2B transactions	H: 15 ~ 25%
	M: 5 ~ 10%
	L: 0 ~ 5%
Number of B2B processes	H: Many processes including design, quality management, demand forecasting, ordering and inventory management process
	M: Major processes such as demand forecasting, ordering, and inventory management process
	L: Focusing on ordering and inventory management process
Types of transactions	H: dozens of different message types
	M: ten or more message types
	L: less than ten message types, or manual work using papers
Data size of large transactions	H: from several mega bytes to several giga bytes
	M: 100 kilo bytes or so
	L: tens kilo bytes
Supported data types	H: EDI and a variety of XML standards
	M: EDI and a few XML standards
	L: fax, e-mail, web page, and spreadsheet
Supported protocols	H: EDI-VAN, EDI-Internet, RosettaNet, and Web Services
	M: EDI-VAN, and RosettaNet
	L: HTTP, SMTP, and FTP

4.2.1 Selection of Integrated Infrastructure

Following Table 5 is obtained by summarizing the cases of integrated infrastructure from the above selection matrix. As is seen in this table, the selection of integrated infrastructure can be a sound choice for those companies with high or medium requirements for all those three factors. Any of the factors are not marked as low level in this table, which means that the integrated infrastructure is not good for those low requirements cases.

Table 4. Strategy Selection Matrix.

F ₃	F ₂	F ₁	e-Transformation Strategy
H	H	H/M	Integrated Infrastructure
		L	N.A.
	M	H	Integrated Infrastructure
		M	Self-Impl/Hub Service
		L	N.A.
	L	H/M/L	N.A.
M	H	H	Integrated Infrastructure/Self-Impl
		M	Self-Impl/Hub Service
		L	N.A.
	M	H	Self-Impl/Hub Service
		M/L	Hub Service
		L	H/M/L
L	H	H/M/L	N.A.
		H	Self-Impl/EDI-VAN Extension
	M	M/L	EDI-VAN Extension
		L	H
	L	M/L	EDI-VAN Extension
		L	M/L

Table 5. Selection of integrated infrastructure.

B2B Messaging	IT Capability	Internet
H	H	H/M
	M	H
M	H	H

4.2.2 Selection of Self-implementation

For a company that has high level request for one factor and medium level request for the others can possibly think of the self-implementation strategy.

Table 6. Selection of self-implementation.

B2B Messaging	IT Capability	Internet
H	M	M
M	H	H/M
	M	H
L	M	H

It is notable that even for a company demanding low level B2B messaging requirement, if its IT capability is medium and internet connectivity request is high, self-implementation strategy can be a good choice. Because its B2B messaging request level is low, the company may build up relatively simple form of e-Business along with its partners by adopting well-known messaging protocols

such as FTP, SMTP or HTTP(S) not by implementing somewhat complex and heavy B2B messaging standards.

4.2.3 Selection of Hub Service

Similar to the self-implementation strategy, hub service strategy can also be considered for those companies with high level request for one factor and medium or high level request for the others. Unlike the self-implementation strategy, even a company with low and medium internet connectivity can possibly use this strategy.

Table 7. Selection of hub service.

B2B Messaging	IT Capability	Internet
H	M	M
M	H	M
	M	H/M/L

Distinct from the self-implementation strategy that is useful for the company with low level B2B messaging requests, hub service strategy is recommendable for those companies with medium or high B2B messaging requirements. Since the B2B messaging request is relatively high for those companies, in such cases where their partners request a support for the well-known B2B standards, exploiting external hub service can be more cost-effective than the self-implementation strategy.

4.2.4 Selection of EDI-VAN Extension

Companies with the low level B2B messaging and IT capability may possibly think of the EDI-VAN extension.

Table 8. Selection of EDI-VAN extension

B2B messaging	IT Capability	Internet
L	M	H/M/L
	L	M/L

If we consider the case is unreal that a company with low level requests on both the B2B messaging and IT capability requests high level internet connectivity, we can see that the internet connectivity factor doesn't affect to the selection of EDI-VAN extension strategy.

Since a company with low level B2B messaging request usually has not very high IT capability; it may be considerable to extend the EDI-VAN to incorporate web-based e-Business services.

5. EVOLUTION OF MIGRATION STRATEGY

If we look into the real cases in which migration strategies are selected by companies that intend to change their B2B transaction methods, we can find that hybrid strategies are often adopted by many companies. Hybrid

approach, which means using a few mixed strategic alternatives, is often adopted owing to various reasons. Among those reasons, it is more often adopted because companies need varying strategy as they grow in size.

In this section, hybrid approach with the concept of evolution of migration strategy is addressed.

5.1 Hybrid Approach

We can easily find many practical cases where mixed strategies are used at multi-national organizations such as Intel, Nokia, and Samsung. Those companies have adopted enterprise-wide integrated business infrastructure, but they also utilize other pure strategies along with the main strategy. They are using existing EDI-VAN or EDI-VAN extension for some business processes. They can use external e-Business hub services doing businesses with medium and small sized companies. Also, they are using self-implementation strategy for B2B transactions with large scale trading partners.

Hybrid approach is frequently used because current executable strategy often differs from the final strategy for companies' e-Transformation. Because a total migration of core business process to Web-based environment at one time can be dangerous to the company that has been performing the processes in the EDI-VAN environment for a long time, EDI-VAN extension is often used for the core businesses instead. External hub services are used for the other additional business processes or newly added ones. Self-implementation can be utilized for large volume transactions, and integrated infrastructure establishment is sought for effectively integrating existing legacy systems.

According to situations and environment of each company, four pure strategies can be utilized together for the hybrid approach mixing each other in many combinations.

5.2 Evolution of Migration Strategy

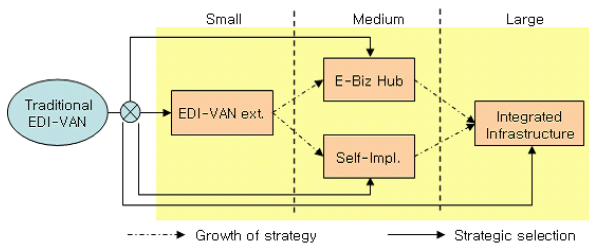
In general, as the size of a company increases, the maturity level of factors described in Section 4.1 such as network requirement, IT capability, and B2B messaging factor becomes high and also the volume of B2B e-Commerce grows. Therefore, if we assume the size of a company grows as time goes by, its migration strategy can be evolved along with its growth as shown in Figure 5. This means that an appropriate strategy can be determined by the size of a company and its migration strategy evolves as it grows up. The criteria we used in this paper to classified the company size is explained in the table 9.

For example, a small EDI-VAN company would adopt EDI-VAN extension strategy at first to support Web-based e-Business transactions. If it grows up to a medium sized company, the migration strategy of the company can be changed into e-Business hub services or self-implementation strategy. After all, if the company's overall capability matures and its size becomes very large, then integrated infrastructure would be implemented by

Table 9. Classification of company in 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
supply chain role	large OEM/EMS/Supplier	Components, subassemblies supplier/EMS	small supplier

the company to support high volume B2B transactions efficiently.

**Figure 5.** Evolution of transformation strategy.

As migration strategy evolves according to the growth of a company, the hybrid approach would be utilized within the company's Web-based e-Business framework. That is, the hybrid approach puts together the existing migration strategy and a newly needed strategy in changed business environment.

6. 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.

6.1 Steps for 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.

6.1.1 Process Gap Analysis

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.

6.1.2 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.

6.1.3 Setting Up the 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.

6.1.4 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.

6.2 Steps for Self-implementation Strategy

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

6.2.1 Setting Up the 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.

6.2.2 Process Gap Analysis

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.

6.2.3 Selection of Web Technologies

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.

6.2.4 Metadata creation and environment setup

Once implementation strategy is set, operational en-

vironment for additional data fields is established, as is described in the hub strategy.

6.2.5 Setting Up the Translation/Management S/W

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.

6.2.6 Setting Up the 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.

6.2.7 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.

7. 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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