The EBMG Reference Model on Electronic Markets:

The Korean Case of JODAL

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Abstract

The Reference Model on Electronic Markets was developed to provide an overview of the different organizational as well as technical aspects one should pay attention to when assembling a comprehensive Electronic Commerce System. The model was developed by the Electronic Business Media Group (EBMG) at the Institute for Information Management (University of St. Gallen, Switzerland).

In this paper we are applying the Reference Model on Electronic Markets onto the special case of the JODAL project that deals with the continuos IT-support of the procurement process within the public sector in Korea. In the end, one of the JODAL aims will be the integration of existing EDI procedures with newly built-up EC

applications on the Internet. So far, only big companies could afford to apply EDI effectively. The focus of the current project is to connect as many business partners as possible (also small and medium-sized companies) to the new EC-system, at the same time reducing the importance of the monopolistic VANS structures.

The project is carried out by the NCA (National Computerization Agency of Korea). The NCA is one of the promoters of EDI in the public sector in Korea. It fulfils tasks similar to the Central Computer and Telecommunication Agency (CCTA) in the UK or the National Computer Board (NCB) in Singapore.

1 Introduction

.1 EC in Korea

Electronic communication to support business transactions has been used fairly long. Early concepts of EDI (Electronic Data Interchange) have been developed as long ago as the 1960s. Among the first large applications were CRS (Computerized Reservation Systems) in the airline industry [Kärchner 96] and EFT (Electronic Funds Transfer) in the banking and finance industry [Sviokla/Rayport 94]. EDI changed the structure of some industries to a great extent [Kim 94], reducing time and cost and boosting the productivity of business processes. With the unexpected and explosive growth of the Internet, electronic commerce (EC) became a serious issue for the private and public sector alike. Park [Park 97] states that electronic commerce can be summarized in three words: paperless, timeless, borderless. The classical limitations of time and space dwindle - thanks to EC - and competition on a local and international scale will consequently be intensified. EC in amalgam with EDI is expected to have a tremendous impact on the competitiveness of firms and the structure of markets and industries [e.g. Malone et al. 87, Benjamin/Wigand 95].

Korea, of course, cannot be an exception. Since the early 80s proprietary IOS (Interorganizational Systems) and EDI have been introduced in both, the public and the private sector. Online shopping and electronic banking were introduced. In 1989, the Korean government started to initiate EDI-projects to develop and advance EDI-message standards. The fist pilot projects relating to trade and customs were initiated by the Ministry of Trade and Industry and the NCA[1] (National Computerization Agency of Korea). The KT-Net (Korea Trade Net) is a direct result of this initiative. KT-Net uses a Message Handling System (MHS) based on X.400. Although the number of potential participants is estimated to be around 70'000, only 3'294 participants registered until June 1996. A succeeding project aimed at using EDI in transportation (especially railway and shipment). The establishment of KL-Net (Korea Logistics Network) was a positive consequence. Since 1994, EDI has also been used in the health care sector (Medi-Net) which uses a MHS on the basis of X.435. A current project relates to EDI-use for taxation purposes. The dissemination of EDI (exchange of information in a standardized format) in Korea has, on the one hand, been closely linked to governmental initiatives, the private sector, on the other hand, preferring proprietary data formats [Kim/Kim 96].

Today several initiatives to set up open electronic shopping malls, to introduce electronic commerce in business-to-business transactions, and to make electronic payment systems available are underway [Kim/Hong 97]. The public sector has a set of initiatives on its own, of which the

[1] The NCA plays an important role in the deployment of EDI in the public sector in Korea. It fulfills tasks similar to the Central Computer and Telecommunication Agency (CCTA) in the UK or the National Computer Board (NCB) in Singapore. The agency today comprises four divisions in charge of planning and implementing IT-deployment in the pubic sector – *IT Service Division* –, researching IT standards and standard setting for governmental agencies – *IT Research Division* –, controlling and auditing public IT projects – *Information Systems Audit Division* –, and supporting Ministry of Information and Communication IT policies – *Information Society Research Division*. The EDI Development Team, responsible for JODAL is part of the IT Service Division.

introduction of EDI in the public procurement process, called JODAL (Korean word for procurement) is the most important project currently carried out by several governmental agencies under the lead of the NCA.

.2 Structure of the Paper and Research Methodology

The present paper applies the Reference Model on Electronic Markets – or EM Reference Model – [Schmid/Lindemann 97] onto the JODAL project. The reference model was developed by the EBMG[2] (Electronic Business Media Group) at the Institute for Information Management (University of St.Gallen, Switzerland). The model outlines the different organizational as well as technical aspects one should pay attention to when assembling a comprehensive electronic commerce system.

The data used in the paper is based on the extensive project documentation and in-depth interviews with various members of the JODAL project team (the „EDI Development Team"). The reference model is a result of several years of applied research in Electronic Markets and Electronic Commerce, focusing on electronic market structures, market services (electronic malls), and generic services (e.g. logistics, payments).

The following contents of the paper are organized as follows. In the following section the notion of continuos IT support is explained and the derived goals of the JODAL project are introduced. The third section looks at the characteristics of the reference model. The results of applying the model onto our case are presented in a forth section. Some concluding remarks point to further research issues and draw a sum up of the main findings.

2 Continuos IT-support and the JODAL Project

When referring to Electronic Markets, we usually think of three succeeding transaction phases: information phase, agreement phase, and settlement phase (discussed further in the section *Business View*). Different tools and systems for the support of single phases of electronic commerce transactions (such as electronic shopping applications [e.g. Schmid 95], electronic product catalogues [e.g. Segev et al. 95, Geyer et al. 96], electronic payment systems [e.g. Zimmermann et al. 96], logistics [e.g. Alt et al. 95]) have been developed and are ready to use. However, those systems still cover only a part of the whole business transaction. When considering e.g. the current obligation of customers to interact with a set of different systems to execute a single transaction, the need for a seamless support of electronic business transactions turns obvious. The goal is to build a system that does not only encompass an overall IT support, but also guarantees adequate organizational support (e.g. the implementation of legal regulations). The rationale to develop a Reference Model on Electronic Markets was to provide an easy overview and integrative

[2] Since 1989, the Electronic Business Media Group has been carrying out research on Electronic Markets and Electronic Commerce, analyzing the impact of new media. They examined architectural frameworks of EMs, logistical issues, developed reference models, and realized pilot projects in the area of Electronic Commerce systems (e.g. the Telecounter prototype of an Electronic Banking system). The EBMG is part of the Institute for Information Management Institute (University of St.Gallen, Switzerland). Current research is focused on the strategic potentials of electronic commerce working in close cooperation with several industrial partners (AGI, ATAG Ernst & Young, Daimler-Benz, Danzas, Swiss Bank Corporation, Swiss Life Insurance, Swiss Telecom, Swiss Post, Swissair). For further information contact Hans-Dieter Zimmermann (email: Hans-Dieter.Zimmermann@iwi.unisg.ch) or visit our Web site (http://www.businessmedia.net).

framework of the different organizational and technical aspects [Schmid 97] that need to be considered when assembling a comprehensive Electronic Commerce System.

The JODAL project, initiated by the Office of the President of South Korea, is a joint EDI undertaking of the NCA, the OSROK (Office of Supply of the Republic of Korea, recently renamed to SA – Supply Agency), and other organizations: MIC (Ministry of Information and Communication), and KIITF (Korean Information Infrastructure Taskforce). OSROK is the governmental authority in charge of public procurement.

The total contracting value of OSROK in 1995 amounted to Won 10 trillion (equal to US$ 12.5 billion). The customers are 22'000 public administration offices, ranging from central government, to military, educational and public health institutions. There are about 14'000 suppliers registered to tender. Normally OSROK requires a minimum contracting value of Won 50 million (about US$ 62'500); purchase orders below that number will be handled by the individual organizations themselves. The public customers are divided in three categories for the purpose of the project: The first group is source of more than 101 transactions in the last two years and will receive their own Unix based EDI converter; the second group generates between 11 and 101 transactions in the past two years and will be equipped with a PC based converter; the third group with less than 11 transactions will use translation services provided by the VANS operators.

The plan that designs the EDI/EC appliance in public procurement was developed in 1995 and a first draft outlining the architecture was proposed in spring 1996. The participating organizations were given the following tasks:

- OSROK: implementation of the plan and pilot project, development of the necessary EDI standards, diffusion of the system,
- NCA: support of the implementation of plan and pilot project, development of necessary EDI standards, and training,
- MIC: provides the legislative framework,
- KIITF: support of the pilot project.

12 new EDI document types are to be created. A special focus is paid to the development of a variety of user interfaces customized to fit the needs of the different participating parties (the public procurement agency, big companies as well as small companies, insurance companies, etc.). The potential number of users is estimated to be 36'000.

Figure 1: Governance structure of the JODAL project

One of the key issues to be addressed is the problematic situation with the VANS provider(s). So far EDI diffusion in Korea was hindered by the monopolistic behavior of the single VANS provider chosen by the government. The VANS market will be opened to competition to speed up diffusion.

Whereas the leadership role for the implementation phase remains with OSROK, the NCA keeps the main financial and project responsibility as depicted in Figure 1. The MIC will allocate the necessary resources to the NCA that will redistribute to the OSROK and supervise the project. The development of the necessary infrastructure and software is managed by local system developers.

3 The Reference Model on Electronic Markets

The following figure (Figure 2) is the graphical representation of the EM Reference Model. It basically consists of four different layers and three succeeding transaction phases. The layers represent the different views on electronic markets. Whereas the upper two layers concentrate on business and transaction-related organizational and institutional issues, the lower layers focus on applications and underlying information technology. The result is a modular overview of various aspects and components of electronic market systems. The following chapters report the result of the JODAL system components being applied to the different views and phases of the reference model.

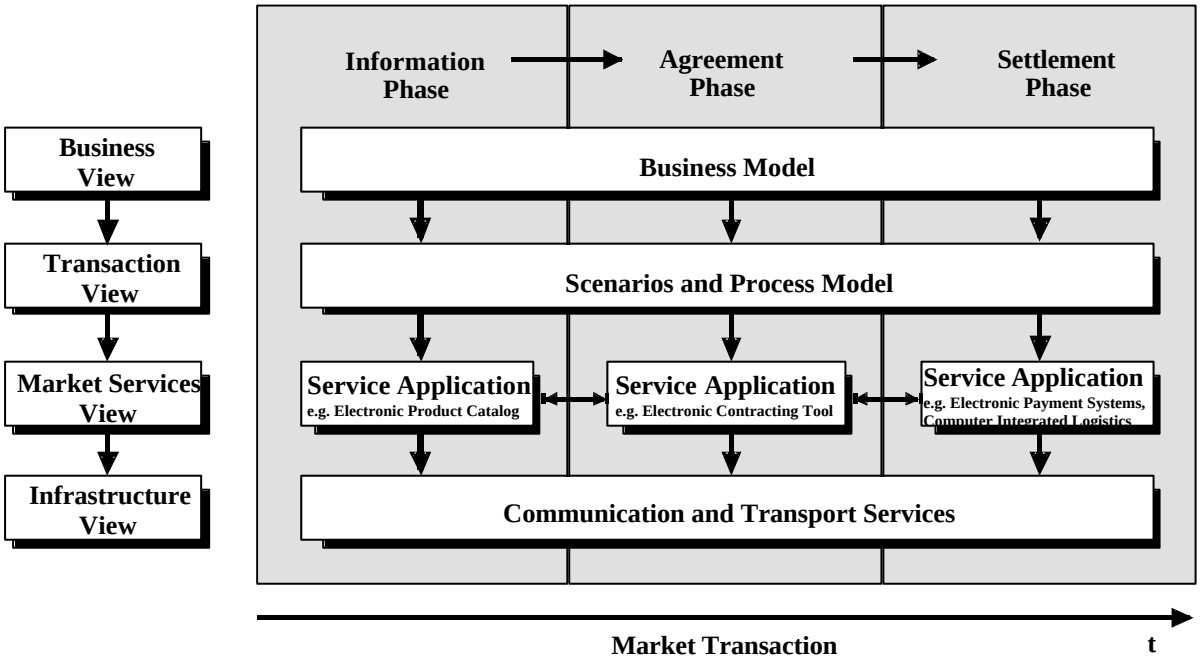

Figure 2: The Reference Model on Electronic Markets

Box: Definition of Electronic Markets and Electronic Commerce

Electronic Markets

The following definition by Schmid [Schmid 1993, 468] shall serve as a common denominator for the comprehension of the concept of an „Electronic Market“:

> *„Electronic Markets in a narrow perception are marketplaces supported by telematic infrastructures which support the exchange of goods and services through all phases of a market transaction.“*

If not all transaction phases are supported we talk of electronic markets in a broader sense [Schmid 1993, 468]:

> *„Electronic Markets in a broader sense are information systems that support all or some phases and functions of a market transaction.“*

The definition says that either all or only a fraction of economic relations between market participants of equal standing are represented in an Electronic Market and that Electronic Market Services support the interaction among the parties involved.

Electronic Commerce
In the understanding of Schmid, Electronic Commerce forms part of an Electronic Market System:
„Electronic Commerce is the set of IT supported electronic markets services that support the interaction of the participants through all or some of the transaction phases."
Steyer [Steyer 97] suggests an alternative definition:
„EC is the transfer of property rights by using information infrastructures which support one or more phases of a transaction"

.1 Business View – „Understanding the market"

Before building an electronic commerce system for a specific business sector we first need to understand the rules of the particular business segment (the market) in which the system will operate. Understanding the complex relationships within such a market requires a preceding analysis of the social and economic framework. The following criteria must be examined:

- potential business partners,
- activities, strategies, and intentions of participating parties and applied policies,
- product scope,
- business behaviour of market participants,
- existing sub-systems,
- business rules (e.g. payment conditions),
- organisational rules (organisational structure [market, hierarchy, etc.], procedures, responsibilities),
- transfer of property rights,
- etc.

A continuos IT-support of electronic commerce transactions on the business layer level can only be realized by means of integrating applications and synchronizing preferences of business partners taking into account the prevailing external conditions. The integration of applications is mainly examined from a software engineering point of view (e.g. the integration of databases). A generic approach for this is e.g. the Basic Semantic Repository (BSR) by ISO [ISO/IEC JTC1/SC30 1996a].

The socio-economic environment of electronic commerce is shaped by a number of different players or interest groups. Electronic commerce applications must meet the requirements of all participants. Today, most Internet applications have a strong focus on supplying the customer with information (advertising, company information, product information) thus supporting only the first phase.

Figure: Intermediary service between the government and the industry

To fully explore the existing relations between the market participants as well as their interactions and information flows it is convenient to draw up a sector network analysis as depicted in Figure 3 for the JODAL system.

Figure 3: Public Procurement: Sector Network of JODAL Participants

The **potential business partners** of the JODAL system are the following (approx. 26'000):

- government procurement agency (OSROK),
- public agencies (approx. 22'000):
  central administration, local government, public corporation, schools, hospitals, etc.
- suppliers: big companies and SMEs (approx. 14'000),
- insurance companies,
- banks.

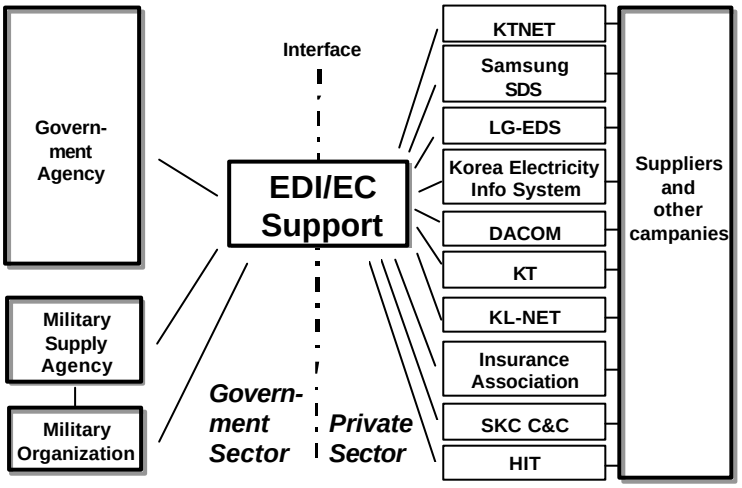

Figure: Proposed structure of the Jodal-EDI VAN-System

Activities, strategies, and intentions of participating parties and applied policies

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Folgende Kriterien sind hierbei relevant:

- product scope

As a central supply agency of korean government, OSROK deals with much varity of products and services from tangible goods to intangible one while procuring goods, making contracts for government construction project and stockpiling and releasing raw materials.

- business behavior of market participants
- existing sub-systems
- business rules (e.g. payment conditions)

Legal restriction: no encrypted data is allowed to pass over public networks, Korea is still a separated country and public security plays an important role

Information systems are not widely spread in public as well as private companies, often, EDI is the trigger for first contact with IT in organizations (dissemination of IT-systems within a company)

- organisational rules (organisational structure [market, hierarchy, etc.], procedures, responsibilities)
- transfer of property rights

xxx

1. OSROK
The OSROK is a government agency in charge of public procurement. Orders handled by the OSROK require a minimum contracting value of Won 50 million (about US$ 62'500). The total contracting value in 1996 amounted to Won 14 trillion (equal to US$ 15.5 billion). The figures illustrate the importance of the negotiation of low prices with potential suppliers. The OSROK is in charge of preparing a product catalog containing products, product information and negotiated prices which will be distributed to the public agencies. OSROK prices are said to be the lowest countrywide due to the fact that it disposes of an enormous market power.

2. Suppliers
Suppliers conducting trade with the OSROK are interested in high turnovers. They are in a comparably weak market position. But large company has a relatively big bargaining power compared to that of SMEs.

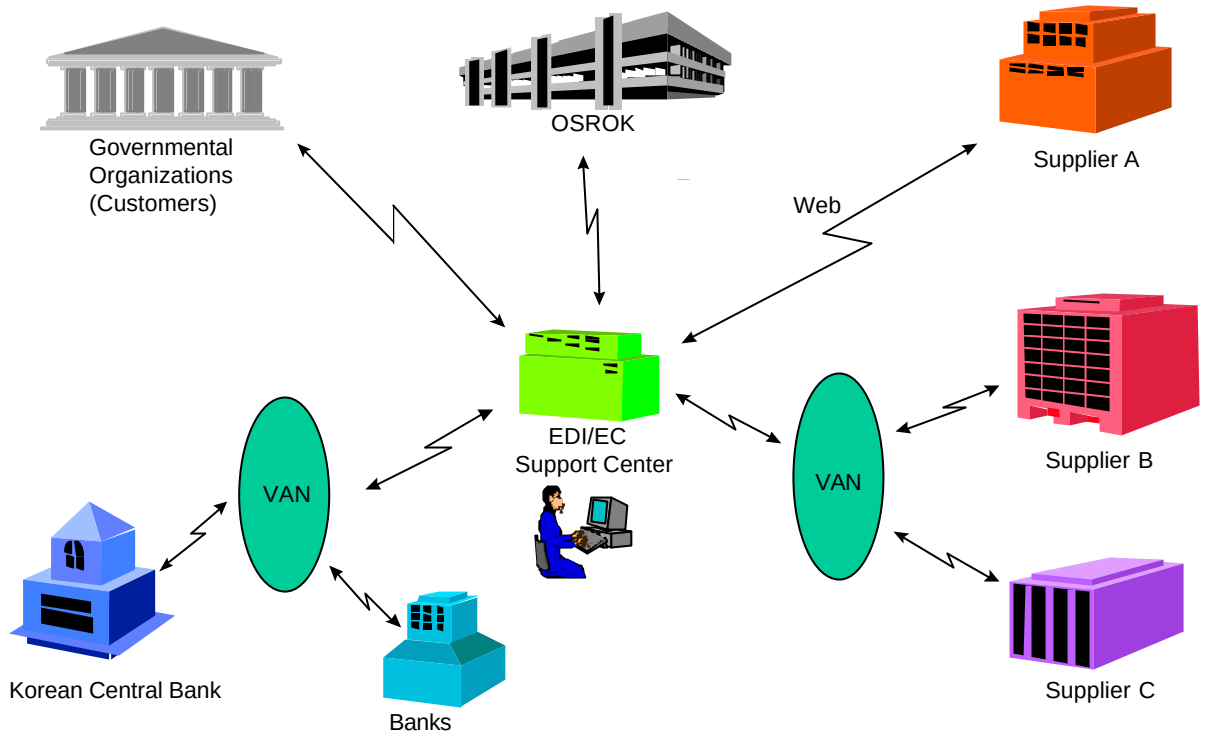
3. Insurance company
Every bidders who take part in bidding must contract insurance policy to assure
Each tender must be accompanied by a certain part of the total amount to be deposited with an insurance company. The money is meant to prevent companies from faking tenders. Provided a companies denies to stick to its tender after being eligible it looses the deposit.

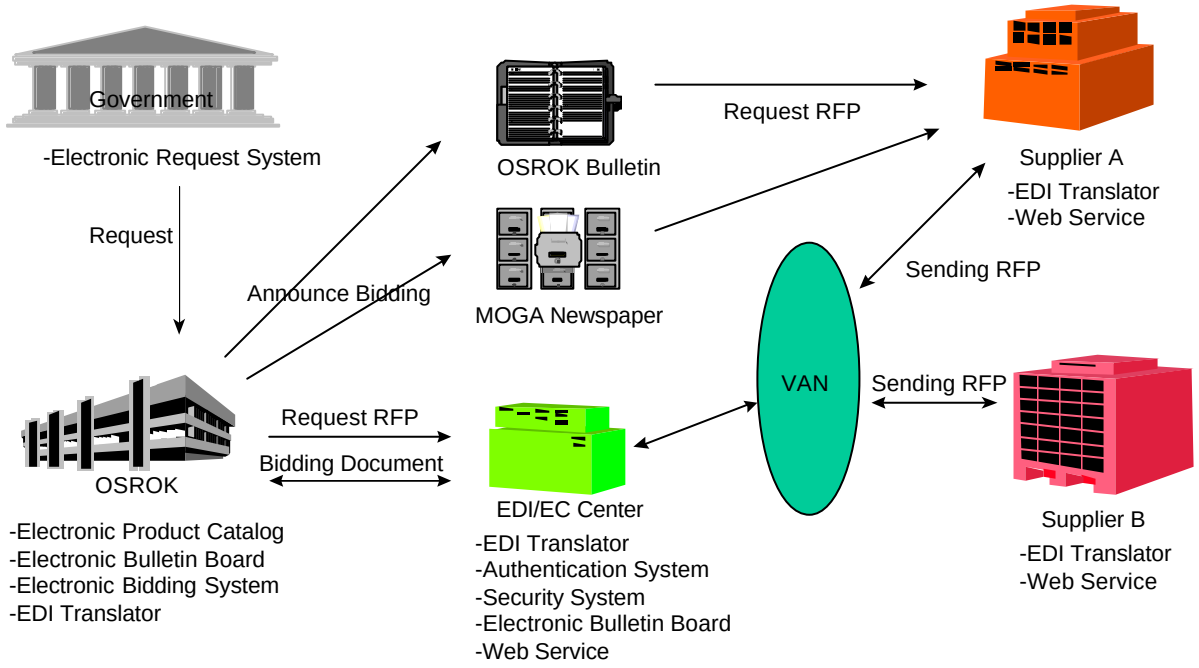
4. Others
???????

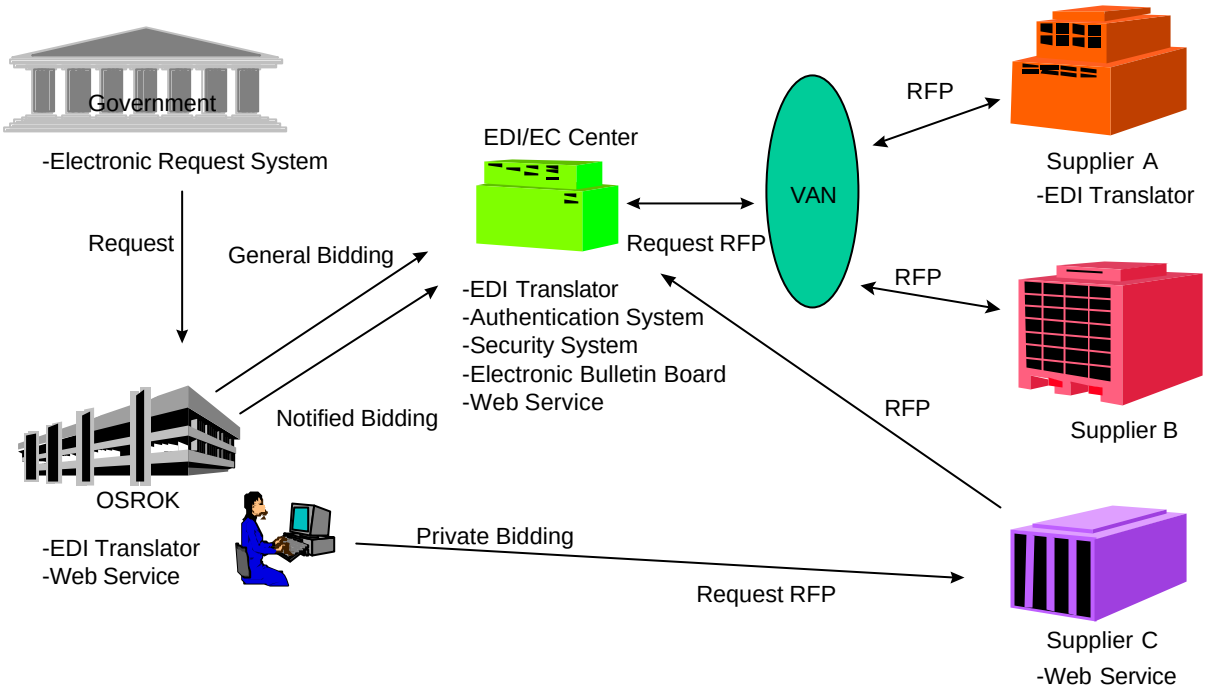
Additional players on the infrastructure layer:

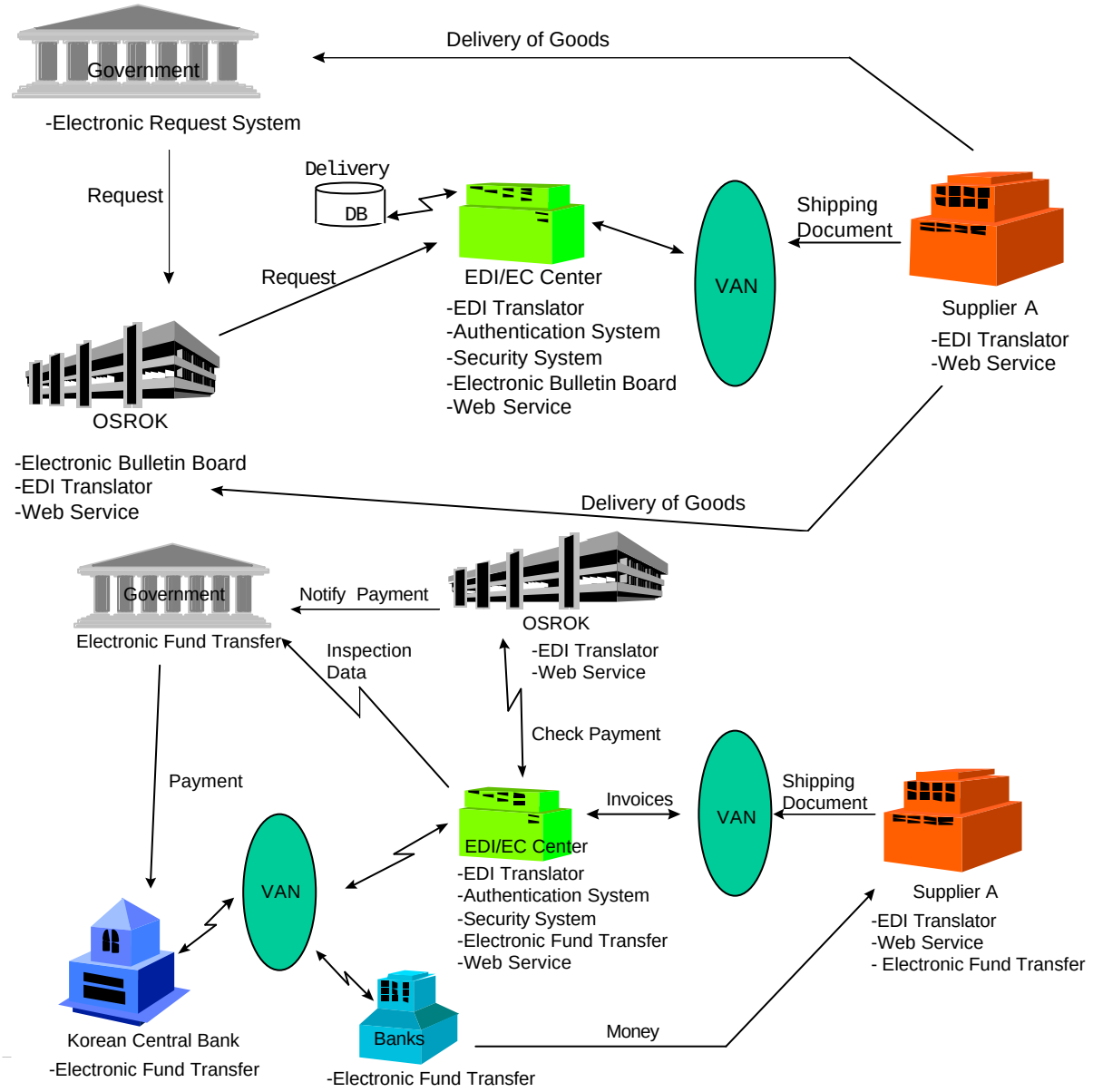
VANS
(currently 10 Anbieter in Korea)

EDI/EC support center
(independent of existing VANS companies), intermediary for the storage of data and the maintenance of electronic mailboxes via MHS, can also be employed as authentication authority and notary


Governmental
Organizations
(Customers)
OSROK
Supplier A
Web
EDI/EC
Support Center
VAN
VAN
Supplier B
Supplier C
Korean Central Bank
Banks


Government
-Electronic Request System
Request
Announce Bidding
OSROK
Request RFP
Bidding Document
-Electronic Product Catalog
-Electronic Bulletin Board
-Electronic Bidding System
-EDI Translator
OSROK Bulletin
MOGA Newspaper
EDI/EC Center
-EDI Translator
-Authentication System
-Security System
-Electronic Bulletin Board
-Web Service
Request RFP
Supplier A
-EDI Translator
-Web Service
Sending RFP
VAN
Sending RFP
Supplier B
-EDI Translator
-Web Service


Government
-Electronic Request System
Request
General Bidding
Notified Bidding
OSROK
-EDI Translator
-Web Service
EDI/EC Center
-EDI Translator
-Authentication System
-Security System
-Electronic Bulletin Board
-Web Service
Request RFP
VAN
RFP
Supplier A
-EDI Translator
RFP
Supplier B
RFP
Private Bidding
Request RFP
Supplier C
-Web Service



.2 *Transaction View – "Understanding the way of doing business"*

The second layer explores the area of business transactions resulting into the identification of process models and business scenarios. In recent literature, this field has been the territory of Business Process Reengineering (BPR), inter-organizational BPR (ioBPR) [e.g. Klein 96], Business Network Redesign (BNR) and other, more technology-related approaches, such as EDI and Open-edi. A special method for the analysis and description of trade procedures has been developed by Lee and Bons [Lee/Bons 95]. Klein et al. gave a literature review about BPR, ioBPR, BNR, EDI and developed a (generic) process model for the EDI integration in the health sector [Klein/Schad/Webster 96, 15ff]. The Open-edi approach as it has been developed by the ISO, focuses on the definition of standardized business scenarios depicting the suitable interactions of the business partners [ISO/IEC JTC1/SC30 96b].

The development of a business scenario generally requires three succeeding steps: Firstly, the current process model must be identified. This involves a classification of roles and respective information objects. The transaction procedures are redesigned (second step) so that they can be supported by information technology. In the third step the optimized processes have to be described which will then form the basis for the implementation of the new IT-system. We chose a part of the JODAL project (the "invitation to tender") to illustrated the procedure to build a business scenario.

1. Current JODAL process

2. Redesigning the process

As depicted in Figure X, the current process involves a lot of human interaction (telephone, personal contact). In order to establish a fully IT-supported system, human interaction has to be replaced by interaction between databases and applications. The resulting schemes is "leaner" and the order of events is optimized for an implementation in the EC-system. Nevertheless, it is most likely that it will not be possible to implement the redesigned process in one go. A gradual implementation seems to be more appropriate and therefore, the first project phase will usually only include the realization of a part of the changes.

3. Optimized JODAL process

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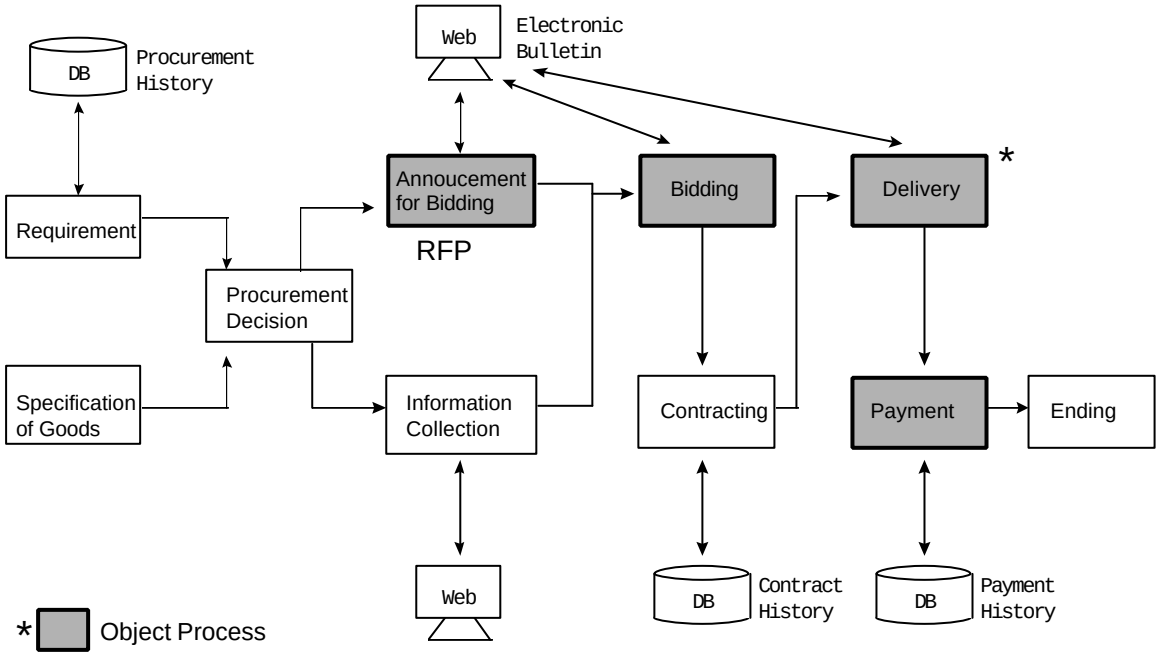
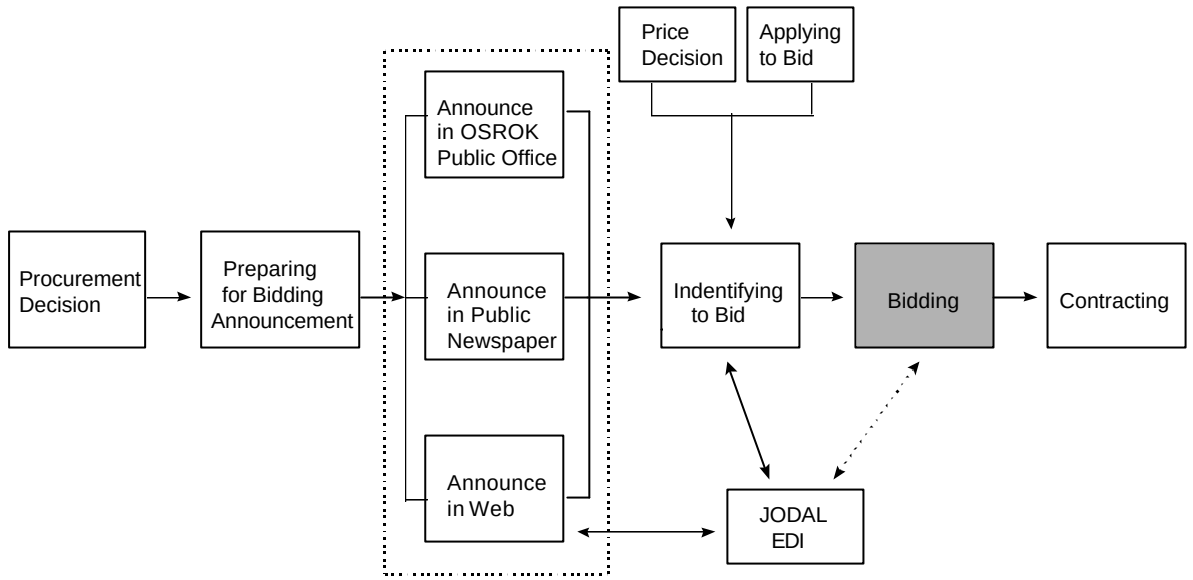
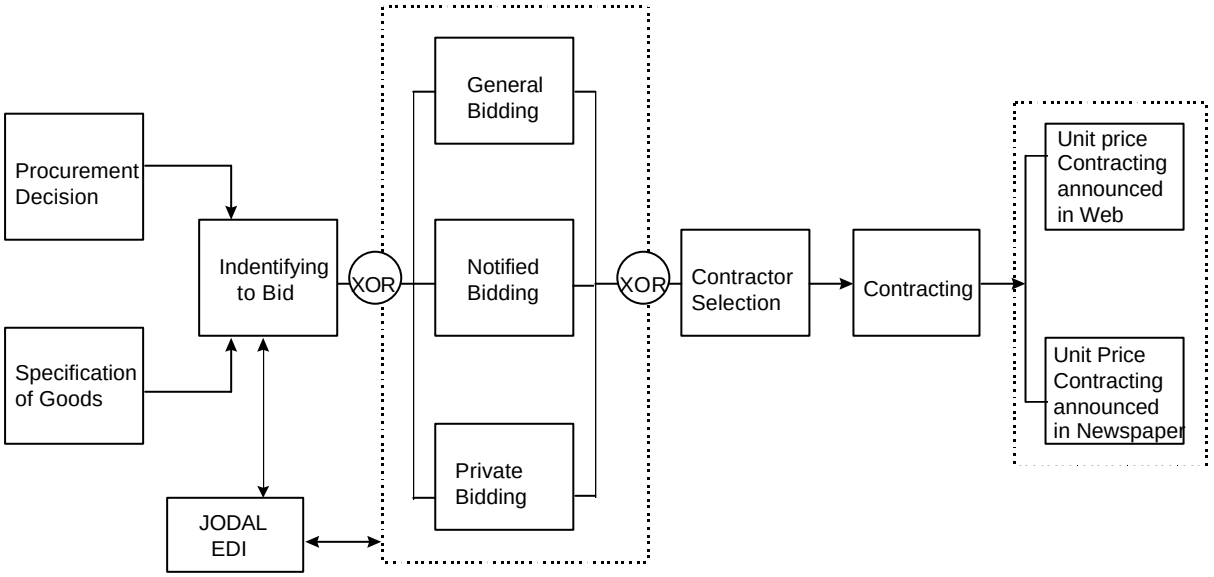
4) Transaction View of JODAL Operation - Context Diagram



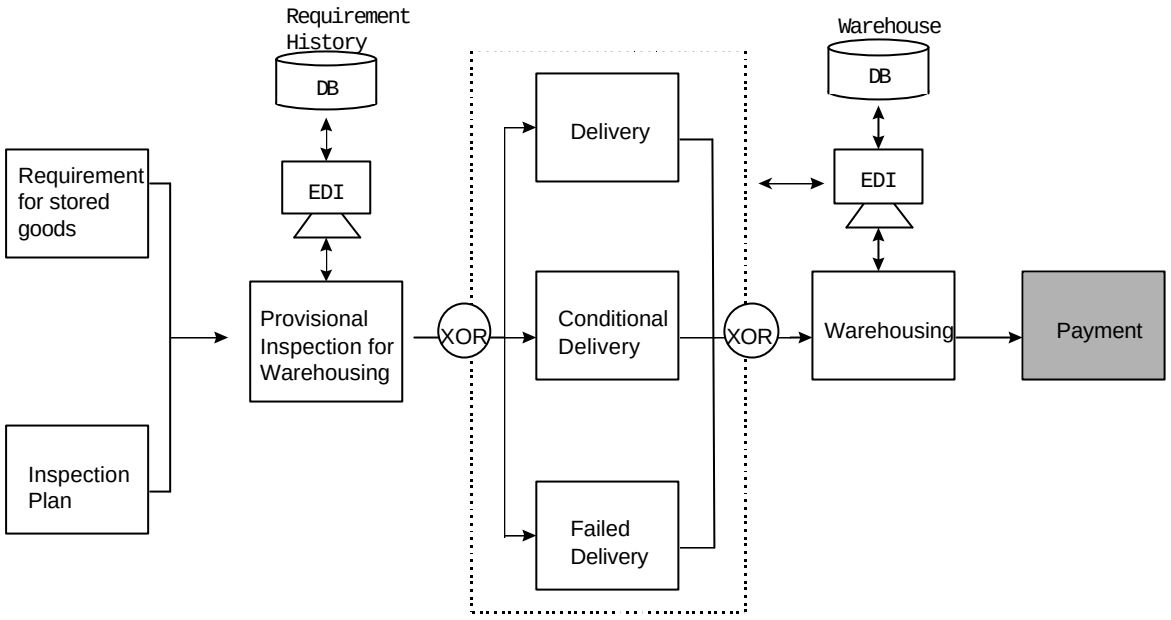
4-1) 2nd level of Transaction View
(1) Announcement for Bidding (RFP)



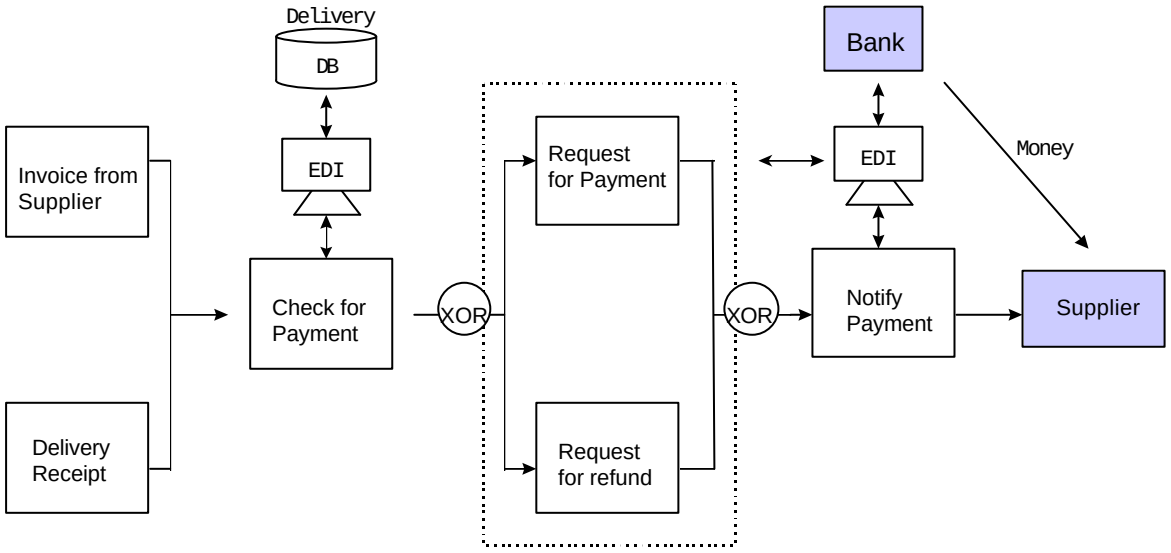
4-1) 2nd level of Transaction View
(2) Bidding



4-1) 2nd level of Transaction View
(3) Delivery



4-1) 2nd level of Transaction View
(4) Payment



In order to achieve a future integration of a fully IT-based Electronic Commerce System, there are currently two important issues under discussion at the NCA. The first focuses on the implementation of payment systems. So far, the transfer of encrypted data via public networks had been prohibited. Data for personal use, on the other hand, is not restricted by law and may be transferred in an encoded form (one example is a local electronic shopping mall, MetaLand www.metaland.com). The second issue encompasses the setup of a Certification Authority for Korea. However, both projects

are subject to one common aspect: the corresponding governmental regulations have to be changed to actually be able to provide the infrastructure needed for the envisioned future steps.

.3 Market Services View – „Understanding modules and interfaces“

As mentioned before, literature on Electronic Markets distinguishes between different succeeding phases of market transactions (e.g. 5 phases [Zbornik 96] or 3 phases [Schmid 93]). According to Schmid an Electronic Commerce transaction can be classified into the following three major phases:

Figure 4: Traditional Transaction Phases

- **Information Phase**
  In the information phase customers collect information on potential products and services. They look for possible suppliers, asking for prices and conditions. The information phase covers the initial satisfaction of a consumer's need for information to conciliate his demand for a product or service with the offer.

- **Agreement Phase**
  Negotiations between suppliers and customers take place in the agreement phase. The phase serves to establish a firm link between supplier and buyer that will eventually lead to a contract, fixing details such as product specifications, payment, delivery, etc.

- **Settlement Phase**
  The last of the conventional steps is called settlement phase. The (physical/virtual) delivery of the product ordered will take place during this phase. Also possible after sales interactions like guarantee claims or help desk services occur.

In order to connect all JODAL participants to the system, several interfaces and gateways had to be designed (see Figure 6). Three individual interfaces had been planned to meet the different user demands (compare table 3). On the business view, the biggest challenge was to coordinate the different interest groups. However, from a technical perspective, the integration of the „classical„ EDI (X.400) services and the Internet (WWW) is and will be one big obstacle.

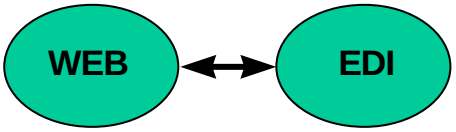


Figure 1: JODAL objective: gateway between "classical" EDI world and the Internet

An in-depth description of the definition of planned gateways and interfaces can be found in the Handbook on the JODAL EDI Master Plan [Jodal development team 96].

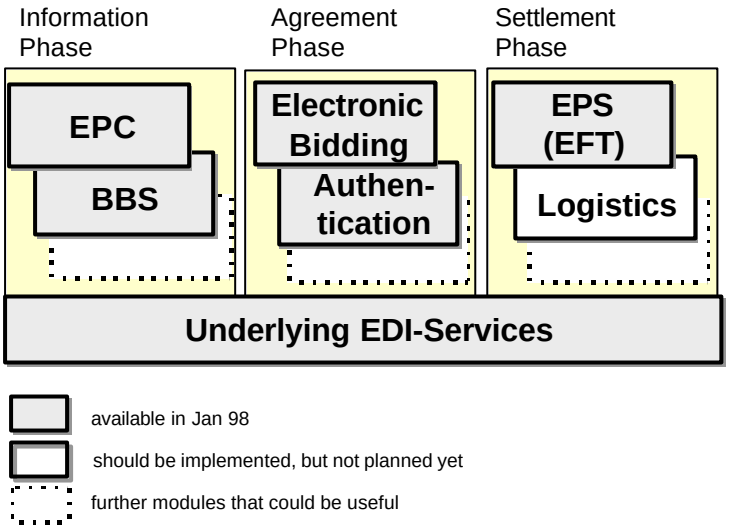


Figure: Survey of Jodal application modules (planned/useful)

.4 Infrastructure View – „Understanding technology“

The last layer deals with the set-up of the underlying telecommunication infrastructure. The final goal is to achieve a seamless communication between all parties. This layer comprises all components that are necessary to build up a distributed system.

One aim is to establish a connection between the classical EDI-world and the World Wide Web thus creating a global business medium which is fully transparent to the user. This could help to expand business into the retail sector. Until now, only big companies can afford to connect to a VANS (Value Added Network Service Provider) performing EC via EDI. Nowadays, the Internet is increasingly used by small and medium-sized companies and private households, thus enabling new participants to take part in Electronic Commerce. The technological challenge is to connect both worlds defining interfaces between applications and gateways between VANS and the Internet/WWW. Another technological aspect is the integration of security systems (e.g. provided by TTPs and notary services).

The following figure gives an overview of the technical infrastructure required for the JODAL system.

Figure 5: EDI/WWW Integration of JODAL participants

Interfaces

Table 1 and 2 give an overview of the number of transactions and organizations involved in the last two years of trading with the OSROC:

Number of transactions	Number of organizations

Number of transactions	Number of suppliers

more than 100	475
51 - 100	279
11 - 50	1,656
5 - 10	1,694
less than 5	5,918
total	10,022

Table 1: Invitations to tender

more than 100	198
11 - 100	288
2 - 10	1,140
1	1,176
total	2,802

Table 2: Actual business transactions

Due to the number of transactions realized during the last two years period, we can classify the potential users into three different groups:

Identified user groups (number of transactions realized within reference period)	**Technology esteemed to be appropriate**
Frequent users (> 100 TAs)	own EDI converter on the basis of UNIX or PC
Irregular users (11-100 TAs)	own PC-based EDI converter
Rare users (< 11 TAs)	EDI/EC „Translation Service„ supplied by VANS

Table 3: User groups and planned technology

4 Conclusions

The JODAL system is scheduled to be fully operational from the beginning of the year 2001. From then on, all parties will be obliged to use the JODAL infrastructure for public procurement. The NCA expects to stimulate hereby a great boost of EDI-system-use in Korea. The Korean government is firmly set on a course to fully connect to the Information Superhighway, wiring up its business world and society alike. It remains though to be seen, whether the Korean experiment to force the deployment of EDI on a broad scale will not face, to some extent, similar hurdles in the diffusion of EDI as other countries to their discomfort [Klein 96].

The use of the EM Reference Model for the description of the JODAL project has demonstrated that such a generic model may help to better summarize and understand the complex relations and processes which electronic market systems usually encompass. The model may thus be well used for the initial designing, the general structuring and implementation of electronic markets projects and initiatives. Future research should focus on refining some of the parts of the model, to keep each module in line with current theoretical and practical progress. The model may be extended to embrace new developments. Furthermore, the model should be applied to other specific cases to further validate it, drilling down into each single module. At the current stage, the model helps to examine and study phenomena of electronic markets on a modular basis, helping to reduce complexity and to get a general idea of the market system with its implicit business rules.

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Appendix – Abbreviations

BNR	Business Network Redesign
BPR	Business Process Reengineering
BSR	Basic Semantic Repository
CA	Certification Authority
CCTA	Central Computer and Telecommunication Agency
CRS	Computerized Reservation Systems
EBMG	Electronic Business Media Group
EC	Electronic Commerce
EDI	Electronic Data Interchange
EFT	Electronic Funds Transfer
EM	Electronic Markets
EPC	Electronic Product Catalogue
ioBPR	inter-organizational BPR
IOS	Interorganizational Systems
ISO	International Standardization Organization
IT	Information Technology
JODAL	Korean for Procurement
KIITF	Korean Information Infrastructure Taskforce
MHS	Message Handling System
MIC	Ministry of Information and Communication
NCB	National Computer Board
OSROK	Office of Supply of the Republic of Korea
TTP	Trusted Third Party
VANS	Value Added Network Services

WWW World Wide Web

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