# CHAPTER 2

# eCOMMERCE

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## 2.1 INTRODUCTION

Concepts such as electronic data interchange (EDI) and now electronic commerce (eCommerce) have a high profile among users and suppliers alike, not to mention standards bodies. These concepts/terms have many different meanings in various contexts and perspectives [1].[1] In addition, marketing people and those seeking to raise investment funds use these terms in a variety of ways. However, the underlying principles and characteristics of eCommerce include:

1. Being business transaction-based (of both a financial and nonfinancial nature).
2. Using information technology (IT) (computers and telecommunications).
3. Interchanging electronic data involving establishment of commitments among Persons, where "Person" is a committing entity or party in a business transaction.

"From a commercial, legal and standardization perspective, one can view electronic commerce as:

**Electronic commerce:** a category of business transactions, involving two or more Persons, enacted through electronic data interchange, based on a monetary and for profit basis. Persons can be individuals, organizations, and/or public administrations" [2].

[1]The International Organization for Standardization/International Electrotechnical Commission Joint Technical Committee (ISO/IEC JTC 1) Business Team on Electronic Commerce (BT-EC) in its report to JTC 1 stated "BT-EC recognizes that Electronic Commerce (EC) can be defined in many different ways. But rather than attempting to provide a satisfactory definition, the Team has chosen to take a more heuristic approach to EC and to do so from a global perspective, that is, world-wide, cross-sectorial, multi-lingual, various categories of participants (including consumers)."

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Electronic Commerce can be broadly categorized into the following scenarios, with the understanding that each scenario holds in both directions.

- Business to business
- Business to public administration
- Individual to business
- Individual to public administration
- Public administration to public administration

eCommerce requirements in Section 2.2 are taken from the BT-EC report, which focused on individual-to-business and individual-to-administration scenarios, in order to bring human needs for eCommerce into play.

This chapter focuses on satisfying the overarching requirement that information to be exchanged is publicly defined and available so that it can be shared. Standards bodies and industry forums have been addressing this need over the past decade in two respects: (1) semantic definition of data entities as building blocks for information exchange, and (2) organization and registration of the data-element descriptions so that the information can be shared. Standards activity has more recently evolved business-process and information modeling, where information exchange occurs within a business collaboration framework using business-collaboration protocol patterns. This chapter highlights standardization activity related to the information exchange requirements from the business perspective, i.e., the "why," "what," "when," and "with whom," with respect to information to be shared as driven by business needs. Not to minimize the importance of "how" this is done, that aspect of information exchange is left to other chapters in this volume.

The remaining sections of this chapter provide a broad overview of activity being conducted in standards bodies and industry forums in connection with standardized definition and exchange of information. Section 2.2 gives a picture of the global view of the requirements driving eCommerce. The foundation underlying standards activity related to the next generation of electronic exchange of business information is covered in Sections 2.3 and 2.4. Section 2.5 discusses standardized semantic components as a requisite for eCommerce. Section 2.6 provides an overview of standards activities related to interchanging standardized semantic components among organizations according to well-defined business collaboration protocols.

## 2.2 eCOMMERCE REQUIREMENTS

### 2.2.1 Consumer Interest in eCommerce Standardization

According to the ISO/IEC JTC 1 Business Team on Electronic Commerce (BT-EC), there are several reasons for consumer interest in eCommerce and its standardization [1, Sec. 5.2]:

- eCommerce will first touch most facets of society and daily living, including fundamental services such as banking, shopping, etc. If the individual cannot cope with this, she or he will become socially disadvantaged and a two-tier society will be created.
- A second, closely related point, is that eCommerce may be the only way certain products or services will be offered for sale in the future. Not being conversant with

eCommerce will reduce an individual's choice (choice being a fundamental consumer right).

- Third, eCommerce can, through economies of scale, provide better offers to the consumer than traditional city-center stores. Those conversant with eCommerce may be able to enjoy lower prices; those not conversant, may pay higher prices.
- Fourth, eCommerce may be the most suitable way for people living in remote areas, single parent families, people at work, or for disabled consumers to shop. Consumers who are not able to use eCommerce systems or do not trust them will be disadvantaged when this becomes a means of purchase.
- eCommerce currently presupposes that the user has access to a computer and a modem. The costs associated with this (equipment, software, installation, and, not least of all, training costs) will be a barrier to some. The use of other delivery techniques where the user already has invested in existing equipment (e.g., TV sets, screen phones) needs to be considered according to market requirements.
- Following on from the preceding point is the issue of eCommerce delivery systems being compatible with other emerging technologies (e.g., smart house control technologies). Through compatible systems, the user would be able to avoid purchasing, installing, and learning several different pieces of incompatible equipment and systems.

A concern that underpins several of the previous points is the ease of use of eCommerce systems. This concern has derived from the problem many users have when using existing low functionality self-service, or smart card systems.

One way of achieving ease of use is consistency at the user interface. Today's user interface solutions can hardly be described as consistent. If the systems are not easy to use, large numbers of users will not be able to use them, or will use them inefficiently. This will in turn impact market acceptance.

On a positive note, users can achieve advantages using eCommerce, provided that the systems are easy and consistent to use, and physically and psychologically accessible. eCommerce should also be available via technologies other than the PC, e.g., through TVs, screenphones, and mobile phones.

### 2.2.2 Consumer Requirements for eCommerce

The following consumer requirements are not necessarily specific to eCommerce, but generic for information and communication technologies (ICT). Some of them are already met, partially or in full, by computerized information systems currently in use.

It should be noted that it is important to see all the requirements in relation to each other, as they are interlinked. Resolving just one or two of the issues will not ensure that consumer interests are satisfactorily taken into account.

Requirements are not presented in any hierarchical order of importance. This is because the relevance and thereby importance of each and every requirement is situation-dependent. In some situations, some of the requirements may not be applicable.

1. **Ease of Use** (a) eCommerce must be easy to use for all intended user groups. Following ergonomics software principles for user interface design[2] should help

[2]For example, ISO/IEC 9241—10 Dialogue Principles, and ISO/CD 13407—2 Human Centered Design Processes for Interactive Systems.

achieve ease of use. Information presentation should follow a natural flow. A system should be designed taking into account the mental models of the users. The model of a systems designer should be behind the scenes, but should not intrude on the users' perception of the system. (b) eCommerce standards should address ergonomical aspects of hardware, software, services, and support. Existing standards should be applied.[3] (c) Metaphors and supporting icons should be standardized to help facilitate ease of use. (d) A usability metrics tool is needed. [*Note:* Ease of use can be measured in terms of performance (e.g., the time taken by users to complete a predetermined task, and/or number of errors, and/or satisfaction with a service: see ISO/IEC 9241—11 Guidance of Usability). Goals for ease of use (known as usability statements) should be developed.]

2. **Consistent User Interface Elements** A system must have consistent user interface elements. It is especially important that the methods of processing, storing, and accessing the systems are consistent for the user. [*Note:* A consistent user interface can be achieved by different means, e.g.:
   (a) All components of the user interface are uniform; this requires standardization.
   (b) The user interface adapts to the user, so that the user always meets a personalized uniform interface. This principle is the subject of the prEN 1332-4 "Identification Card Systems; Man Machine Interface:—Coding of User Requirements on Smart Cards."]
3. **Adaptability** A system should be adaptable to meet a user's specific requirements and abilities. For example, a system should provide output in a format and at a pace that meets the individual's needs.
4. **Provision of System Status Information** The status of a system (e.g., waiting for input, checking, fetching) should always be available for the user (i.e., feedback). Different mechanisms should be employed to give complete feedback to the user. Messages should be positive and not place blame on the user. Equally, mechanisms for feedforward (especially of consequences of actions) should be available ("if you start downloading the file you have selected it will take 76 minutes. Press «Cancel download» or «Download»"). Feedforward is an attribute that helps build trust in the system.
5. **Error Tolerance and System Stability** The system should anticipate errors of operation and be forgiving. Informative error messages should lead the user forward. The system should be robust and should remain stable if users try services that cannot be delivered or make choices that are redundant.
6. **Minimize the User's Need to Remember System Operation** A system should display dialog elements to the user and allow them to choose from items generated by the system or to edit them. Menus are a typical technology to achieve this goal.
7. **Explorability** The system should encourage users to discover its functions, without the system crashing.
8. **Design for All** eCommerce standards should support the principle of "design for all." This is a process of creating products, systems, and services that are accessible and usable by people with the widest possible range of abilities operating

[3]For example, ISO 9241.

within the widest possible range of situations. This could be facilitated by standards on the interchange of different input/output devices needed to match the individual's requirements (e.g., a blind person wants voice output). Equally, an individual's requirements could be encoded in a standardized way (see below) so that the user interface of the system is adapted to the individual's requirements (language preference, input mode preference, etc.).

9. **Functionality of Solution** A standard supporting eCommerce should take into account the requirements of different user groups and the user tasks that a system conforming to the standard is able to support. In the scope of an eCommerce standard, it should be stated by which groups and for which tasks the system should be used, and in which operating environments. This statement should be open for review. There may be occasions where a system is not intended for all users, e.g., it is intended to be childproof. In these instances, the scope of the underlying standard should state which users and tasks the system is not designed for and why these groups' requirements are not taken into account.
10. **Multicultural Aspects** Multicultural aspects (these are regarded by some as geographical localization issues) need to be considered when developing eCommerce standards. These aspects might be affected by religion (e.g., no shopping on Sunday, national legislation, the shape and size of clothing/footwear). (See Section 2.2.3.3 for more discussion on cultural adaptability.)
11. **Multilinguistic Aspects** Multilinguistic aspects need to be considered. Existing standards should be applied and where necessary new ones developed. (See Section 2.2.3.2 for more discussion on multilinguistic aspects.)
12. **Terminology** As part of a user-centered design, the terminology used in user interfaces, (including brochures, user instructions, and information presented by the system) should meet basic generic user requirements.[4]
13. **Comprehensible Standards** Standards on consumer input should be unambiguous and easy to understand, i.e., written in plain language so that nontechnical people can comprehend them and contribute. ISO Guidelines on standards writing must be met.
14. **Interoperability** Different services should be interoperable so that, in theory, any service can be accessed on any appropriate network on any relevant device, thus avoiding the acquisition of access to several different networks and terminals for similar services.
15. **Compatibility** Compatibility within a system should be ensured; for example, new versions of systems should be compatible with previous versions of the same system. Components for systems originating from different manufacturers should also be compatible. Different systems should be compatible so as to allow their joint operation.
16. **Privacy** The system should ensure the privacy of the individual.
17. **Security of Information** It should not be possible for unauthorized people to follow a user's activities on an electronic network. Electronic footprints are to be avoided. Standards should help provide methods for checking this, especially in open and decentralized networks. Necessary system-generated footprint data

[4]Or meet ISO Guide 37 requirements.

should be deleted after an appropriate time. The system should not allow disclosure of information about the user to unauthorized people and should indicate clearly to whom information is given. Security of information sent, stored, received or deleted must be ensured. The level of security should be clearly stated to the user. Electronic signatures and encryption devices are clear candidates for standardization.

18. **Cost Transparency** The system must be transparent regarding all costs involved. Cost information should be presented in a standardized way. This includes both initial costs incurred by the user and subsequent costs for subscribing to and operating the system, especially when interworking on networks, or when using on-line help or other fundamental services (e.g., directory enquiries or short-message service on a mobile phone). Disconnecting from a service must be free of charge or the charge must be stated in a standardized way at the point of purchase.
19. **Reliability of Information** The system should indicate reliability of information (possibly by quoting sources) provided on the system (e.g., "Balance of account is xxx ECU at 1000 hours on yyyy-mm-dd. Note: Bank clearing system has been out of action last two days").
20. **Quality of Service and System Reliability** There should be a way to determine and present quality-of-service and system reliability. This should include the development of performance indicators. This information should be displayed at the point of sale.
21. **Rating and Grading Systems** eCommerce standards should allow for the application of rating and grading systems. Standards for evaluating and presenting ICT systems in terms of ease of use, cost, durability, system reliability, and information reliability (source and content) will need to be developed.
22. **Consumer Participation Throughout the System Development Process** Active consumer participation should be ensured throughout all phases of the standardization process in order to ensure user-friendly systems. This includes the programming of standardization work, priority setting, and participating in the technical work.
23. **Ecological Aspects** Developments should be sustainable in an ecological sense. Scientific and objective methods are needed to assess the environmental friendliness of products over their entire lifetime. This information should be indicated in a standardized way.
24. **Ethical Aspects** Scientific and objective methods are needed to assess ethically sound products (e.g., no child labor, no support of ideologies based on discrimination or violence). This information should be indicated in a standardized way.

### 2.2.3 Horizontal Aspects

The BT-EC [1, Sec. 6.1] identified four horizontal issues as being of general relevance for all scenarios involving eCommerce and gave these horizontal issues prominent attention in its work. These issues are:

- IT enablement
- Localization, including multilingualism

- Cross-sectorial aspects
- Cultural adaptability

From a user perspective, these four horizontal issues need to be addressed in a harmonious manner.

***2.2.3.1 IT Enablement*** A key characteristic of commerce worldwide, in particular in the business-to-business and business-to-administration domains, is that it consists of business transactions that:

1. Are rule-based, i.e., mutually understood and accepted sets of business conventions, practices, procedures, etc.; and
2. make extensive use of "codes," often table-based, representing predefined possible choices for common aspects of business transactions. Examples include countries, currencies, languages, and manufacturers and their products.

Many of these sets of agreed-upon rules used in business worldwide and their associated lists of tables/codes are de jure and de facto standards. The BT-EC noted that numerous international standards are already in use in support of commerce worldwide. The problem is that most are paper-based and lack a computer-processable version. Even if distributed in electronic form, these standards cannot be "plugged-in" for use in eCommerce. Much of the intelligence in these international standards is humanly understandable explicitly or implicitly. They have not been described formally using formal description techniques, i.e., in their present form they do not support "computational integrity." Consequently, each enterprise using these code sets has to spend considerable time and effort to (1) determine their meaning and interpret them; (2) build applications; and, (3) hope that they interoperate with other networks or enterprises.

***2.2.3.2 Localization/Multilingualism*** Human beings like to name objects. But the approach of using names is not very IT friendly, cost-efficient, or time-efficient. Depending on the interplay of multilingual and localization requirements, in eCommerce, a singular product or service being offered for sale will have multiple names and differing names even in the same language. Thus, if we wish to ensure rapid and widespread use of eCommerce globally, we must on the one hand identify objects, i.e., products or services being offered for sale, in an unambiguous, linguistically neutral, and IT-processable and eCommerce-facilitated manner, and, on the other hand, present the same via a range of linguistic names (and associated character sets) from a point-of-sale perspective, i.e., human-readable user interface, as required by the local marketplace.

In order to provide a focus for its work on horizontal issues, the BT-EC utilized four real-world examples, namely:

- Currency Codes
- Country Codes
- Language Codes
- Commodity Codes

These examples represent standards used for commerce worldwide and are currently implemented by enterprises and their information systems in a wide variety of ways. There

are also no standard ways for the interworking among these and similar standards. This impedes global interoperability. The widespread use of the Internet is exacerbating existing ambiguities.

From a BT-EC perspective, these four examples underline the fact that with respect to eCommerce there may be less of a need for new standards. Rather, the immediate challenge may well be the development of a category of information technology standards that will facilitate the development of information-technology-enabled versions of existing standards used in commerce, and do so in a manner that also supports the interplay of localization and multilingual requirements, i.e., "bridging standards."

The BT-EC recommended the following objectives for such standardization work in support of eCommerce:

1. Standards must focus on the interface (as opposed to implementation) as the best means of arriving at globally harmonized solutions for interoperability from both a business and information technology perspective.
2. Standard interfaces among information systems must be technology neutral, accommodating advances in technology to the extent possible. Further, such standard interfaces must be linguistically neutral to the furthest extent possible.
3. In order to empower users and consumers, standards should be adaptable to local and multilingual requirements at national and regional levels, while ensuring full transparency of available market solutions to the consumer. Multilingualism must be considered. The expansion of open, multilingual standards could significantly increase the volume and value of worldwide eCommerce.

***2.2.3.3 Cross-Sectorial/Cultural Adaptability*** Cross-sectorial issues pertain to differing, at times conflicting, understandings of business practices, object identification, etc., among economic sectors [1, Sec. 6.4]. The challenge here is that of resolving two sets of issues:

1. Industry sectors, scientific fields, and professional disciplines assign their own uses or meanings to the terms of a natural language. Quite often natural languages are used in a manner called "technical languages": the same word/term frequently has very different meanings in other industry sectors. This reflects the trend in various sectors toward using existing nontechnical "common language" words as terms with new technical meanings.
2. "Scientific language" terminology arising from efforts to create multilingual equivalency in addition to cross-sectorial interoperability in support of eCommerce adds to the complexity. A case study on the cross-sectorial issues [3], with respect to scientific languages, led to the conclusion that a scientific language can be considered a culturally neutral exchange language, which, in turn, has multiple natural language and culturally dependent linguistic equivalent terms.

Technical languages and their use in particular industry sectors present particular challenges to cultural adaptability and cross-sectorial interoperability, because they do not have the attributes of scientific languages. Technical languages as linguistic subsystems are difficult enough to handle even within their industry sector, in one natural language. To this are added the challenges of localization, multiculturalism, and cross-sectorial in-

teractions in eCommerce. Associating technical languages with a controlled vocabulary of terms is one means of providing cross-sectorial interoperability. Cultural adaptability is accomplished by making multilingual equivalents to the controlled vocabulary terms.

In conclusion, it should be noted that within industry sectors established standards and conventions exist for unambiguous identification and referencing of unique objects, and for naming them (often multilingually), along with associated rules. Although not originally designed to interoperate across and among industry sectors, many of these sectorial standards have common core constructs that could be utilized to support cross-sectorial eCommerce and in a manner that accommodates localization and multilingual needs.

## 2.3 OPEN-EDI

eCommerce standardization activity, addressing the requirements of Section 2.2, has taken place in the past 12 years under a banner referred to as "Open-edi." Not to be confused with electronic data interchange (EDI), Open-edi, which is a term for "the automated exchange of any predefined and structured data for business purposes among information systems of two or more organizations," provides a reference model framework for the standards that are needed for the next generation of information exchange [3].

Open-edi is defined as "electronic data interchange among multiple autonomous organizations to accomplish an explicit shared business goal according to Open-edi standards" [4]. Defining a totally new paradigm from traditional EDI, the Open-edi Reference Model provides the foundation for current developments in eCommerce, eBusiness in particular, where eBusiness is defined as "a generic term covering information definition and exchange requirements within and between enterprises, including customers." [5] The scope of Open-edi is to provide standardization in the field of generic information technology standards for open electronic data interchange needed to attain global interoperability among the systems used by organizations. Such interoperability is viewed from both a business and information technology perspective. The Open-edi vision is that there will be:

- Cross-sectorial information exchange, with
- Information to be exchanged, structured, and predefined, requiring
- No prior agreements among trading partners, nor
- Human intervention in interfacing with computer applications,
- Specified in a manner that is independent from underlying IT systems.

### 2.3.1 Open-edi Conceptual Model

A conceptual model for electronic data interchange standards and services was created by the Special Working Group on Electronic Data Interchange (SWG-EDI) as a framework for positioning and harmonizing all edi-related standards and activities into a cohesive whole [6]. Particular attention was given to a top-down approach for modeling multilateral information flows. Figure 2.1 is a schematic representation of an Open-edi transaction. The transaction consists of information exchanges among autonomous parties shown by the various shaped objects.

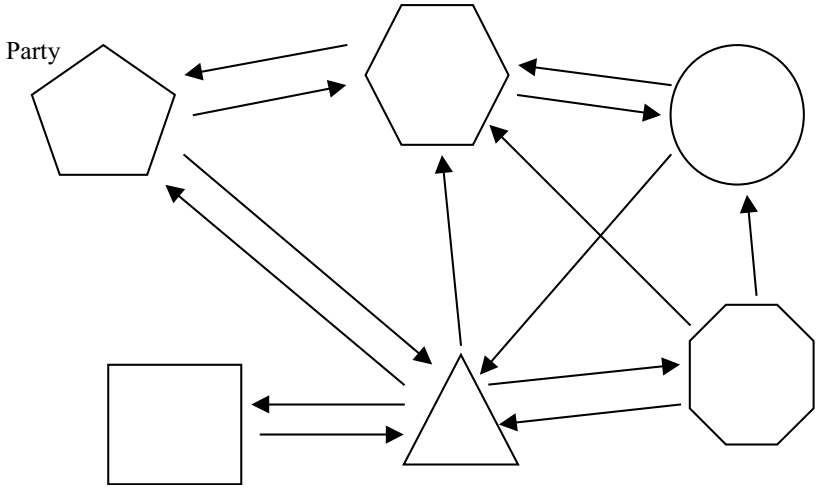


**Figure 2.1** Schematic representation of an Open-edi transaction.

The SWG-EDI found three aspects of information flow to be important considerations in Open-edi:

1. The independent decision-making capabilities of the autonomous parties must be preserved in the associated information flow. Each party must be allowed the freedom to make decisions based on the semantic content of the information interchanges and on factors known only to itself.
2. Rule-based techniques can be applied to the business and semantic behavior of the parties within an information flow. By requiring that each participant engage in specific interchange scenarios according to predefined rules, it is possible to reduce or eliminate operational ambiguities and misinterpretations.
3. Infrastructure support services are required to realize the exchange of information. They must operate according to mutually accepted standards in all aspects of the exchange, such as data usage and representation, security, auditing, and communications.

These three aspects are also reflected in the organizational capabilities of parties. Figure 2.2 illustrates this concept as three concentric ovals representing an abstraction of a party (shown as a pentagon in Figure 2.1) referred to as an information management domain (IMD). It provides more detail about the parties shown in Figure 2.1. The innermost oval (the edi Principal) represents the logical part of an IMD that is responsible for the decision-making, goal-oriented business activities of a real organization. The second ring (the Business Agreement Service) represents the activities related to the business rules and semantics involved in information exchange. The outer ring (the edi Support Service) represents the IT infrastructure required to realize the goals of an information exchange.

Only the interorganizational aspects of information flows should be standardized. Therefore the model is not concerned with the internal decision-making aspect, because

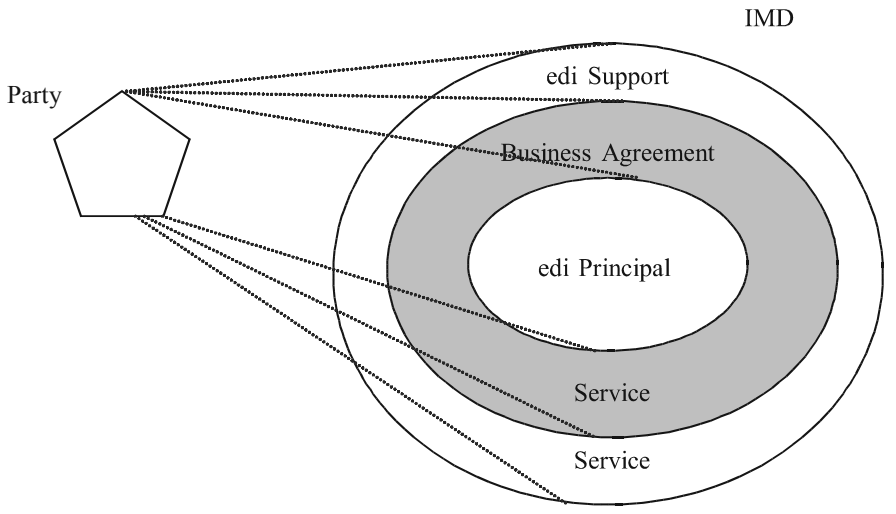


**Figure 2.2** Breakdown of an information management domain (IMD).

this deals with proprietary, nonstandard activities. The other two aspects represent the areas important to Open-edi.

The Open-edi Conceptual Model provides a framework and specification of those aspects of Open-edi transactions that require standardization. Business and organizational requirements provide input to the model, but are not within the model itself. Further, the model is ultimately realized by Open-edi implementations, which are also outside the scope of the model. Figure 2.3 illustrates the components of the Open-edi Conceptual Model.

### 2.3.2 Open-edi Reference Model

In Figure 2.3 the Open-edi Conceptual Model contains a part called the Open-edi Reference Model, which contains descriptions, or the requirements and constraints on the functional components. It is concerned with the business rules and activities that must take place and not with the standards required to specify them. The reference model is subdivided into two views, or perspectives:

1. The business operational view focuses on high-level operations and their associated requirements and constraints, as regarded from the business user's perspective.
2. The functional service view focuses on the infrastructure requirements for realizing the operations described in the business operational view.

In summary, by viewing a multilateral Open-edi transaction as a schematic of parties and information flows, as in Figure 2.1, we can better see the overall scope of a business transaction. However, by looking more closely at the parties involved, we find that each organization can be abstractly modeled as a three-tiered entity, i.e., an IMD, as shown in Figure 2.2. Further, the two outer portions of the IMD abstraction can be related directly to the two views represented within the Open-edi Reference Model. These relationships are illustrated in Figure 2.4.

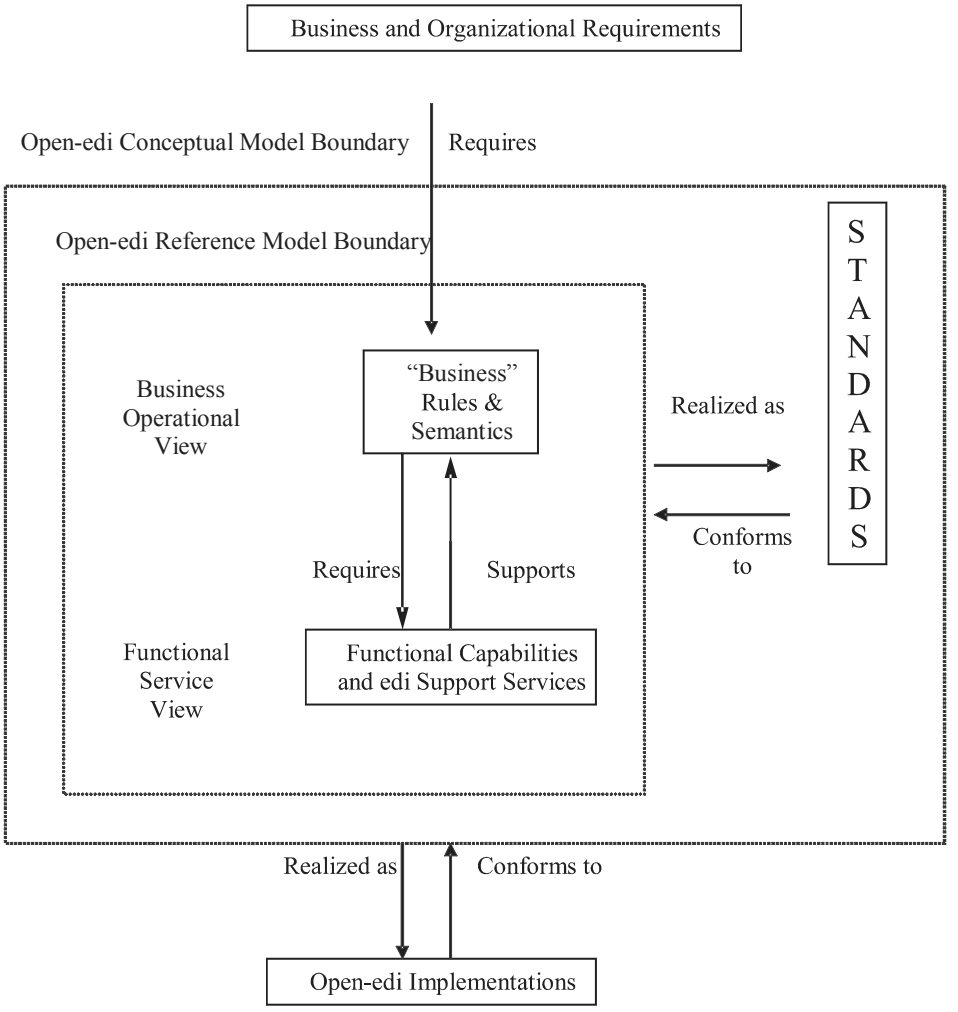


**Figure 2.3** The Open-edi Conceptual Model.

***2.3.2.1 Problems with EDI*** Interoperation among application programs requires that there be "common ground" in their exchange of information, so that there can be common understanding and agreement on the information being jointly processed. Common ground in this exchange of information is accomplished in current EDI methodology through a neutral, application independent syntax, i.e., typically for business data, a translated X12 or UN/EDIFACT interchange file. All consideration of application programs, how to facilitate their interoperation, functionality variations, and the business practices behind them are deliberately ignored. Instead, the current EDI standardization process in X12 and UN/EDIFACT concentrates solely on the structure and content of the translated interchange file.

Problems associated with X12 and UN/EDIFACT standards and the standards-development process, are well documented and begin with the lack of an agreed upon semantic

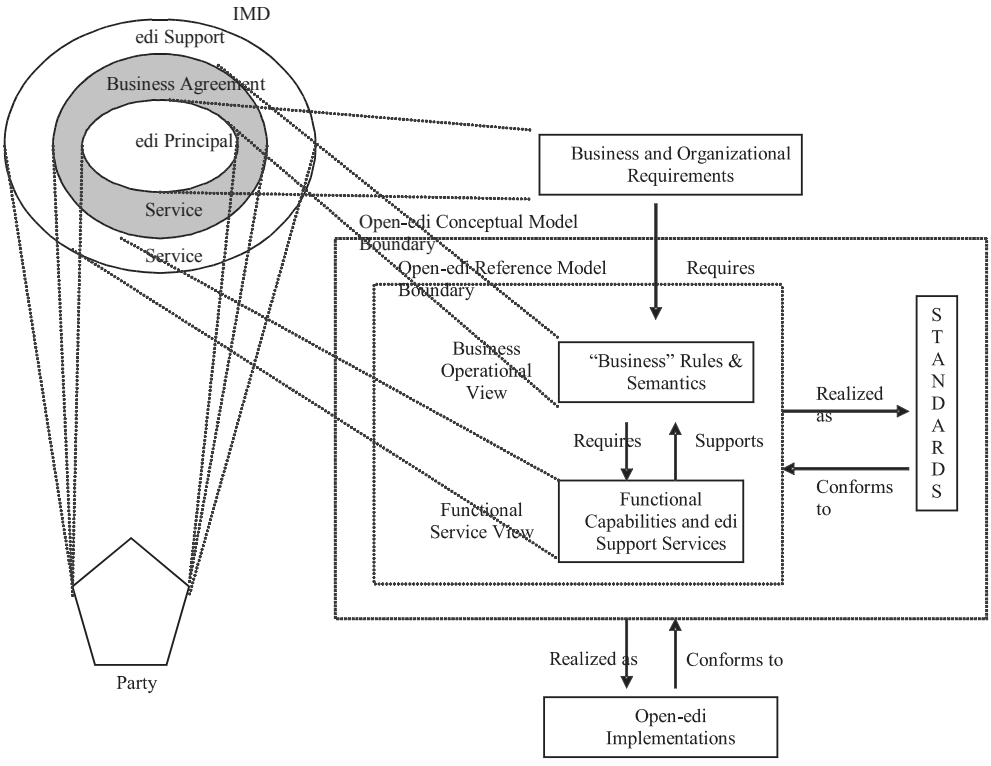


**Figure 2.4** Relationship between the Open-edi Reference Model and IMDs.

definition of the information to be exchanged. Data-centric EDI standards that are organized into service segments that control the data interchange information content, and messages that provide the generic interchange structure attempt to include the solution for every industry. For example, the UN/EDIFACT Purchase Order (PO) transaction set contains over 1200 data elements. However, a paper PO contains about 40 different data fields (assuming a single item is ordered). Why does the EDI equivalent have 30 times as many data possibilities? The reason is that the PO transaction set includes more than just the data related to a specific order being placed. As the PO standard was created and maintained over time, it was predominantly IT experts who participated in the work. Their knowledge was mostly based on "what" was in their corporate databases. Because of that, they expected that their data requirements would be fulfilled in the PO standard. There was no analysis as to whether the corporate purchasing application (or any other one) actually "used" or "required" those data. As more companies used the PO (as well as other EDI transaction sets), more data elements were added. Because many of the EDI transaction sets were used across many industries, this addition of data requirements proliferated.

To help bring true data requirements back to a manageable level, industry groups created implementation conventions (ICs) (not standards) that would limit the use of data elements to what the companies in a given industry agreed to. This generally resulted in an 80% reduction, i.e., 240 data elements in the case of the PO, still six times as many as a paper PO. Additional problems with this approach were that changes in EDI standards

were not coordinated with changes in ICs, and international coordination of ICs was especially rare.

Individual companies further limited their implementation to a subset of an industry IC, eliminating another 80%, thus resulting in 45–50 data elements, which is almost the same number as a paper-based PO. However, if one compares the POs of any two companies in the same industry, their data requirements are not identical. Further, even if a particular company is big enough to dominate another company with its requirements, not every partner it trades with can deliver all the data it requires, thus resulting in different implementations. Trading partner agreements must be made on which EDI transactions they intend to use, which IC will be used for each transaction, individual data elements to be used in each IC, etc.

Before one can engage in EDI with a particular partner, resources are required not only to identify the requirements for data to be exchanged, but also to integrate the IC into the business process, particularly at the receiving end. Finally, the information exchange must be tested before going live. Time and expertise needed to navigate new transactions and changes through the standards process took anywhere from 18 months to several years.

This process is required for each new trading partner, and for each EDI message with that partner—a very costly effort that only the Fortune 1000 companies in each country could afford. The resultant EDI standards are not really standards at all, only a tool to be used as a starting point in the analysis of information to be exchanged in a business process. The initial X12 and UN/EDIFACT goal of developing standard semantics was not realized. As summarized in the Open-edi Reference Model [4],

> The economic advantages of Electronic Data Interchange (EDI) are widely recognized. However, the cost of setting up an EDI relationship is still very high due to the need for a detailed bilateral business and technical agreement between the involved business partners. The initial high cost of establishing such an agreement does not justify short-term partnerships. It has also been found that implementations involving the management of a large number of partners and their associated agreements are not productive. Consequently, most EDI implementations have been successful only:
>
> In long term partnerships
>
> Between a limited number of partners

An example of this situation is taken from the Healthcare EDI Coalition (HEDIC) where "the cost and complexity of EDI have prevented many small-to-medium enterprises from participating in electronic commerce." Even where "the explosive growth of the Internet and the rapid development of web-based applications are the primary drivers for creating a new *Virtual e-marketplace* in healthcare, the effects of the web on healthcare eCommerce have been minimal. The market drivers in healthcare eCommerce have traditionally been manufacturers, distributors and GPOs. The eCommerce sites developed by these companies are simply IP-based versions of existing relationships using the Internet to provide access to additional product information, server-based electronic order status and purchasing options for their customers" [7].

***2.3.2.2 The Open-edi Solution*** It is essential to understand that for Open-edi to overcome the current impediments to implementing EDI, a new paradigm must be envisioned that shifts the focus on EDI standards from the interchange file to the information contained in the business processes.

In the words of the Open-edi Reference Framework

> Open-edi lowers these barriers by introducing standard business scenarios and the necessary services to support them. Once a business scenario is agreed upon, and the implementations conform to the Open-edi standards, there is no need for prior agreement among trading partners, other than the decision to engage in the Open-edi transaction in compliance with the business scenario. Since Open-edi takes a generic approach, it enables organizations to establish short-term relationships quickly and cost effectively. Business scenarios and the necessary supporting services would be available to all that wish to use them, thus providing the necessary means for implementing Open-edi.
>
> The field of application of Open-edi is the electronic processing of business transactions among autonomous multiple organizations within and across sectors ( e.g., public/private, industrial, geographic). It includes business transactions that involve multiple data types such as numbers, characters, images and sound.
>
> The Open-edi Reference Model has been developed primarily to provide standards required for inter-working of organizations, through interconnected information technology systems. This model is independent of specific:
>
> - Information technology implementations
> - Business content or conventions
> - Business activities
> - Organizations
>
> The Open-edi Reference Model identifies required standards for Open-edi and provides a reference for those standards by defining the basic concepts used to develop them. It serves as the basis for coordination of work between the different agencies involved in EDI standardization. It provides the framework for this co-ordination and for the integration of existing and emerging standards and the development of future standards. [4, Clause 0, Introduction]

### 2.3.3 MoU Management Group Concerning Standardization in the Field of eBusiness

In order to follow through with on-going activities according to the Open-edi framework, a Memorandum of Understanding (MoU) has been established among international standardization organizations, namely:

- The International Electrotechnical Commission (IEC)
- The International Organization for Standardization (ISO)
- The International Telecommunication Union (ITU)
- The United Nations Economic Commission for Europe (UN/ECE)

Along with the participation of International User Groups, these organizations coordinate relevant work programs at the highest level to optimize the use of scarce resources. Figure 2.5 shows a MoU matrix of standards activity [2].[5]

[5]Annex J update to Memorandum of Understanding between the International Electrotechnical Commission, the International Organization for Standardization, the International Telecommunication Union and the United Nations Economic Commission for Europe concerning Standardization in the Field of Electronic Business, Annex A: Division of Responsibilities.

| | Meta-standards | Standards | Guidance | Produce Product | Conformance and Certification | Used by |
|---|---|---|---|---|---|---|
| **Environment** | Cultural Adaptability | International<br>National<br>Bilateral | Lawyers | | Courts | Commerce and government |
| **Formal recognition** | ISO/IEC<br>JTC 1/SC 32 | ISO, ISO/IEC, ITU<br>National and regional standards bodies<br>UN/ECE<br>CEN<br>IETF<br>ASTM<br>OASIS | ISO/IEC<br>JTC1 SC 32<br><br>UN/ECE<br><br><br>ASTM | | ISO/IEC | Standards bodies<br>Suppliers<br>Users |
| **BOV activity models** | ISO/IEC<br>JTC 1/SC 7 and SC 32<br>ISO TC 184 | ISO, IEC and ITU sectorial bodies<br>CEN<br>National standards bodies<br>WfMC | WfMC | Non-standard products | | Users |
| **BOV data models** | ISO/IEC<br>JTC 1 SC 21/WG 3 and SC 32<br>ISO TC211 | Trade bodies<br>User groups<br>WTO<br>WCO<br>ICAO<br>IMO<br>SWIFT<br>ebXML<br>UN/ECE | as previous column plus sectorial groups | Suppliers | UN/CEFACT | Suppliers<br>Users |
| **FSV technology** | ISO/IEC JTC 1<br>ISO TC211<br>IETF | ISO/IEC various TCs and JTC1/SCs<br>CEN<br>IETF<br>W3C | ISO/IEC<br>JTC 1/SC 32<br>JTC1/SC27<br>TC 215<br>CEN TC 251<br>IETF<br>W3C | Manufacturers<br>Suppliers | Many<br>NIST<br>Open Group | Suppliers<br>Users |

**Figure 2.5** MoU Matrix: A road map for electronic business.

## 2.4 BUSINESS OPERATIONAL VIEW

The remainder of this chapter on eCommerce focuses on aspects of the business operational view (BOV) as defined in the Open-edi Reference Model. The BOV is defined as "a perspective of business transactions limited to those aspects regarding the making of business decisions and commitments among organizations, which are needed for the description of a business transaction" [4, Clause 4, The Open-edi Reference Model].

### 2.4.1 Emphasis on Semantics

Key to the BOV perspective is the semantic definition of information being exchanged in business transactions. This point has been evident in the recent work of eBusiness eXtensible Markup Language (ebXML), an 18-month international initiative, the purpose of which is "to research and identify the technical basis upon which the global implemen-

tation of XML can be standardized" [8]. As noted in ebXML, XML is really not a language, but a framework for developing an unlimited number of languages. XML by itself provides a syntax (schema for describing data or message structures), not semantics (meaning, behavior, or presentation). XML is flexible and extensible, easy to implement, and small enough for processing by Web browsers. XML standardizes the syntax of information exchange in a text-based notation designed to be obvious to both people and processes.

However, ebXML was established with the understanding that semantic definition of information is the real issue in information exchange. XML is catching on quickly because of the obvious appeal of being able to quickly develop a new document or message type, which contrasts greatly with the lengthy organizational debates by which new UN/EDIFACT message standards are developed. Anyone using XML can invent new tags for particular subject areas and define the document schema. However, this can lead to the proliferation of multiple schemas for the same application or business process, with the same content being described using different element or attribute names, or different content using the same names. XML contains a namespace mechanism that avoids naming collisions by associating an element with the authority for that element, but this is a syntactic remedy for avoiding collisions that does not address the issue of semantic incompatibility. The lack of standard content models and semantics clearly impedes interoperability.

In contrast,

> Open-edi describes flows of information using Information Bundles (IBs) which cause predefined changes in the states of the parties to the exchange. Parties using Open-edi make the commitment that they will adhere to the predefined rules associated with the registered scenario attributes, roles and IBs (including registered Semantic Components (SCs)) necessary to support the exchanges of commitments applicable to the parties involved in the business transaction.
>
> The characteristics by which Open-edi is recognized and defined are:
>
> - Actions based upon following predefined rules
> - Commitment of the parties involved
> - Communications among parties are automated
> - Parties control and maintain their states
> - Parties act autonomously
> - Multiple simultaneous transactions can be supported [2, Clause 5]

Business process and information models, described in Section 2.6, facilitate business process and business information integration among trading partners that is needed to accomplish these Open-edi objectives.

### 2.4.2 BOV Requirements

The evolution of information and communications technologies has created a need and opportunity for different user groups to engage in business relationships, using these technologies. This requires automated methods to carry out information exchange among organizations.

Standards required for Open-edi cover a wide spectrum of areas and include commercial aspects, support for national and international laws and regulations, information tech-

nology perspectives, and telecommunications and interconnections security, etc. To these are added public policy requirements of a generic and horizontal nature such as consumer protection and privacy. [4]. Figure 2.5 describes how the Open-edi Reference Model serves as the basis for coordination of work of different standardization areas and types of standardization for Open-edi.

In addition, the widespread adoption and use of Internet and World Wide Web (WWW)-based technologies, by organizations as well as individuals, has added urgency to the need to identify and specify the key components of a business transaction. For such specifications to be carried out as electronic business transactions supported by automated methods of the functional support services requires a standard-based approach for business semantic descriptive techniques in support of the BOV of Open-edi.

The sources of requirements on the BOV aspects that need to be integrated and/or taken into account in the development of business descriptive techniques for Open-edi-based business transactions include.[6]

- Commercial frameworks and associated requirements.
- Legal frameworks and associated requirements.
- Public policy requirements, particularly those of a generic nature such as consumer protection and privacy.
- Sectorial and cross-sectorial requirements.
- Requirements arising from the need to support cultural adaptability requirements. This includes meeting localization and multilingualism requirements, i.e., as may be required to meet requirements of a particular jurisdiction or desired for providing a good, service, and/or right in a particular market [9]. Here distinguishing between IT interfaces and their multiple human interface equivalents is the recommended approach [9].

Figure 2.6 provides an integrated view of the business operational requirements" [2, Sec. 0.2].

### 2.4.3 BOV Methodology

Taking Unified Modeling Language (UML) as the FDT of choice, many standards bodies and industry consortiums have adopted a UML-based methodology for modeling business processes involving information exchange, e.g., SWIFT, RosettaNet and Uniform Code Council/(UCC/EAN), Accredited Standards Committee (ASC) T1, ITU—Sector Telecommunication (ITU-T), and the United Nations Centre for Trace Facilitation and Electronic Business (UN/CEFACT). This is in keeping with Objective 2 of Section 2.2.3.2, where UML artifacts capture and represent the business process and information exchange semantics independent of any data protocol, e.g., XML.

Looking at the telecommunications industry as an example, many years have been spent in efforts to adopt business process and information modeling in a way that any technology can be utilized to exchange the data. This came about as a result of enormous efforts in migrating the data protocol of interface specifications from OSI/CMIP to Com-

[6]This list of sources of requirements is basically a summary of two Annexes of [4]: Annex A (Informative) Standardization Areas and Types of Standardization Activities [ISO/IEC 14662 (E), pages 25–29]; Annex B (Informative) Requirements for Open-edi Standards [ISO/IEC 14662 (E), pages 30–33].

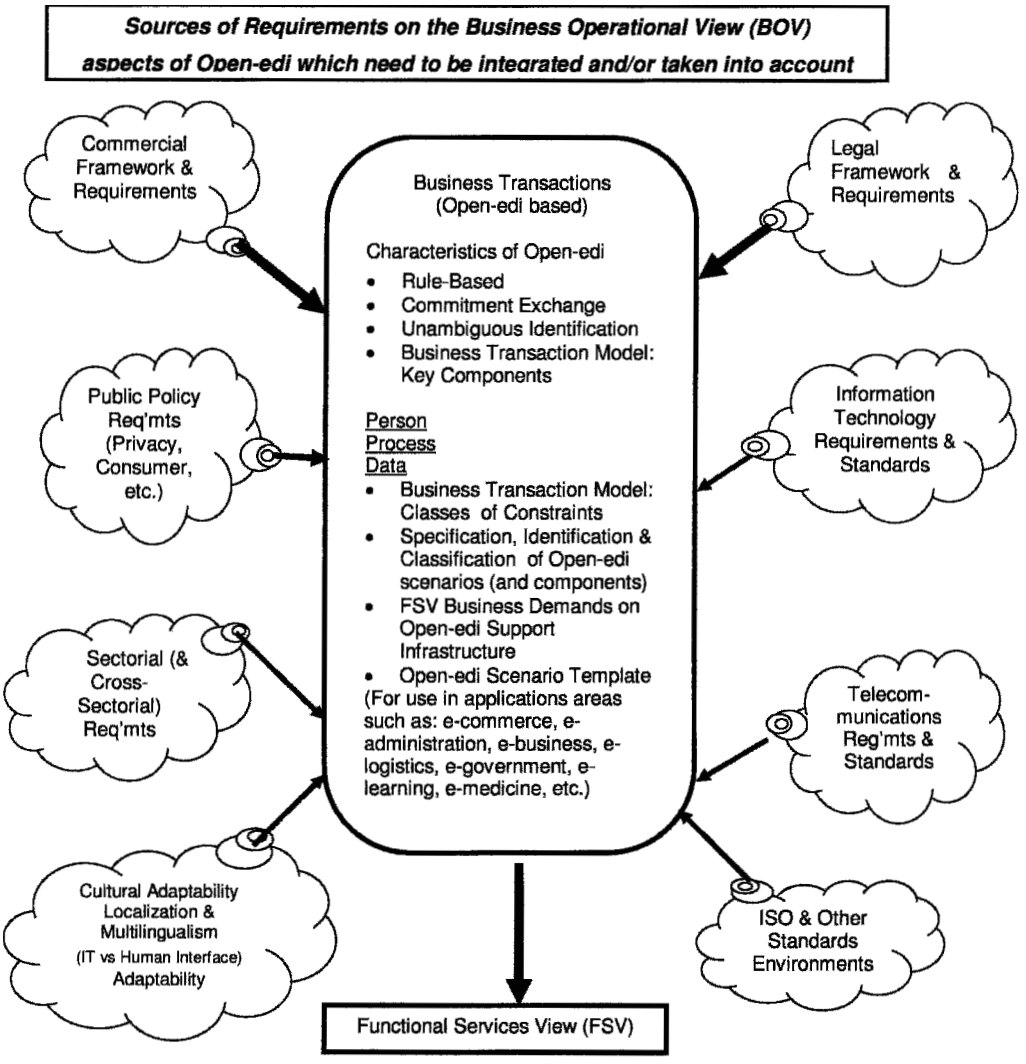


**Figure 2.6** Integrated view—business operational requirements.

mon Object Request Broker Architecture (CORBA) to Extensible Markup Language (XML). Business process and information modeling is now seen as the means to "future-proof" the interface standardization work. The Unified TMN Requirements, Analysis, and Design (UTRAD) methodology of ITU-T Study Group 4 "specifies an iterative three-phase process with features that allow traceability across the three phases. The three phases (i.e., requirements, analysis, and design) apply industry-accepted techniques using object oriented analysis and design principles. The techniques should allow the use or development of commercially available support tools" [10]

In the case of UN/CEFACT, the organization set up under UN/ECE that oversees international trade facilitation, including administration of UN/EDIFACT standards, XML is considered to be a protocol-specific derivative of a protocol-neutral UML business

process and information model. CMIP and CORBA would be related to XML through the common protocol-neutral UML artifacts. Going straight to XML implementations falls short as a data-centric view that is not capable of capturing the business process context and behavior of a UML specification. XML-based standards, if such could ever be developed and administered, would not be sufficient. Pair-wise trading partner agreements would continue, not addressing the problems that exist today with UN/EDIFACT or X12 EDI.

An example of UML-based requirements, analysis, and design methodology, facilitating knowledge transfer from business experts to IT developers, uses workflows starting with business modeling, as follows:

- The UN/CEFACT Modeling Methodology (UMM) Business Modeling Workflow elicits and organizes business processes and information in the business-to-business domain. This includes the creation of packages to categorize key concepts and business models. The type of questions that are asked by the modeler of the business domain expert and the business process analyst in this workflow are:
  - —What are the business(es) and domain(s) to accomplish the business goal?
  - —What are the Business Goals and Level 1 Business processes?
  - —What are the Business Area(s)?
  - —What are the Process Area(s)?
  - —Are there existing Business Processes in libraries that meet our needs (key component of the reusability of UMM model components)?
  - —What disciplines or expertise areas does this process cross?
  - —What is the scope of the process and who are the stakeholders?
  - —What are the process constraints?
- The UMM Requirements Workflow uses Business Modelling Workflow artifacts (deliverables) as input to understand the requirements of the resulting business-to-business solution. This includes the creation of detailed requirements, the discovery of business entities and UMM use case diagrams. The type of questions that are asked by the modeller of the business domain expert and business process analyst in this work flow are:
  - —What is the purpose of this process?
  - —What business roles such as manager signature authority, clerk, etc., participate in the process?
  - —What business entities are engaged?
  - —What are the collaborations between business roles?
  - —How does the process start, what are the conditions, inputs and how does it stop, what are the outputs?
  - —How do we know the process is done?
  - —What should the availability of the process be: 24/7 or 8/5?
- The UMM Analysis Workflow further elaborates the Requirements Workflow use cases by detailing the activities that occur, collaborations between roles, and initial UMM class diagrams. These IBs can be expressed as conceptual UML class diagrams. The artifacts produced in the Analysis Workflow draw upon information in UMM Library(ies), or may populate the UMM Library(ies) where relevant informa-

tion is not available. The type of questions that are asked by the modeller of the business process analyst in this workflow are:

—What are the business transaction patterns?

—What are the IBs (business documents) that flow between roles?

—What level of security do I need on this process?

- The UMM Design Workflow precisely defines the dynamics of the collaboration, along with the structure of data (IBs) exchanged between business partners. The type of questions that the modeler asks herself/himself for this workflow are:

  —What business information entities should be used for structuring the business documents ?

  —What network technology should we implement this process in?

  —How does the business document relate (map) to the database structure? [11]

## 2.5 SEMANTICS (DATA DEFINITION STANDARDS)

This section focuses on defining the semantic content of information, whereas Section 2.6 provides an overview of standards activities related to interchanging commonly defined information among organizations.

### 2.5.1 IT-Enablement

"IT-enablement" is the term used to identify the need to transform currently accepted standards used in commerce worldwide from a manual to a computational perspective. eCommerce, in particular the business-to-business or business-to-administration categories, introduces a requirement for standards that are prepared, structured, and made available for unambiguous usage within and among information systems. This requirement can be expressed as "computational integrity," in particular

> *the expression of standards in a form that ensures precise description of behaviour and semantics in a manner that allows for automated processing to occur, and the managed evolution of such standards in a way that enables dynamic introduction by the next generation of information systems.* [1, Sec. 6.2]

The objective of IT-enablement is to capture in a computer-processable manner, and one that maximizes interoperability, the implicit rules and relations (i.e., those known to "experts") of the code sets found in standards used in commerce worldwide. That is, specify the standard code sets within an entity relationship and/or object technology perspective, using formal description techniques. Also, address issues arising from change management in "code tables," i.e., synchronization, backward compatibility, migration. IT-enablement is based on the premise that a detailed and exhaustive identification of standards and "conventions," etc., used in support of existing commerce, will eliminate many barriers to eCommerce.

IT-enablement recognizes that within ISO, IEC, and ITU, there are committees that have the domain responsibility and expertise in areas of work, the primary purpose of which is to manage and control the content. IT-enablement also recognizes that outside of ISO/IEC/ITU, there are many other organizations that have domain responsibili-

ty and expertise in subject areas relevant to global eCommerce. Their "content" and industry sector domain-oriented standards require an IT-enabled version for use in eCommerce.

### 2.5.2 Data Definition Standards Examples

***2.5.2.1 T1 Standards*** A number of T1 standards describe information that must be exchanged across the Telecommunications Management Network (TMN) X-Interface, i.e., interenterprise, to support the preordering and ordering of services between a service customer and a service provider. Such services are exchange-access services, administrative services, local exchange services, and customer account record exchange (CARE) services to support the requirements of the open telecommunications environment. These T1 standards describe shared information that was developed to support the regulatory and business requirements resulting from interconnection of network operators/service providers, initially within the United States, and more recently within the global telecommunications industry.

The T1 standards, listed in Figure 2.7 and partially described in the following subsections are examples of IT-enabled codes. These codes are critical codes used in the exchange of information. These codes are IT-enabled in that they are "prepared, structured and made available for unambiguous usage within and among information systems" by virtue of having:

- Semantic definition as agreed to in due process development of standardized codes
- Unambiguous format and structure
- Coordinated assignment of codes on demand from a centralized reference database
- Availability through on-line access via the Internet

| T1 Standard Name | T1 Standards Reference |
|---|---|
| Telecommunications Service Priority Code | ANSI T1.211 |
| Equipment Entity Identification Code | ANSI T1.213 |
| Manufacturers Identification Code | ANSI T1.220 |
| Network Channel Code | ANSI T1.223 |
| Network Channel Interface Code | ANSI T1.223 |
| Facility Identification Code | ANSI T1.238 |
| Exchange Carrier Code | ANSI T1.251 |
| IAC Code | ANSI T1.251 |
| Company Code | ANSI T1.251 |
| Location Entity Identification Code | ANSI T1.253 |
| Circuit Identification Code | ANSI T1.266 |

**Figure 2.7** T1 standards utilized in the TMN-X interface.

The key success factor in this use of common standards for designating operator's network interconnections has been the delegation of maintenance responsibility for the codes by the standards organization. While the design of information format structures is evolutionary and relatively stable, the assignment of code values is extremely volatile. This is especially true of the identification of network operators/service providers, and network locations, where new industry entrants demand new codes, sometimes with one-day turnaround. Only through the use of a dedicated resource with technical knowledge and tools to administer coding would this be possible.

Questions are often raised on funding the cost of a maintenance agent. Standards are assumed to be publicly available from the Standards Development Organization (SDO) as part of the benefit of paying an annual membership fee to the SDO. What justification is there for additional charges for maintenance agent services such as:

- Coordinated assignment of codes on demand from a centralized reference database
- Availability of IT-enabled codes through on-line access via the Internet
- Technical advisory groups that provide opportunity for user input to coding requirements and administration rules/conventions
- User documentation and training
- On-site consultation for code conversion and implementation
- On-call resource for subject matter expert consultation

From a maintenance agent perspective, such services are mandatory in order to facilitate implementation of standardized codes needed to accomplish interoperability and flowthrough. Users of maintenance agent services in connection with T1 standards have expressed sentiments that these are services that they "can't live without." Yet, the value of maintenance agent services is extremely difficult to quantify. It is the author's opinion that the telecommunications industry needs to be educated on the necessity of maintenance agents and brought to a realization that the cost of maintenance services must be factored in as part of the cost of doing business. In providing an essential service to the industry, maintenance agents should be permitted to recover their costs by charging reasonable and nondiscriminatory prices.

*2.5.2.1.1 Location Entity Identification Code* A detailed description of the Location Entity Identification Code format and structure of T1.253 is provided in this subsection as an illustration of an IT-enabled code. The Location Entity Identification Code has four formats [12].

1. **Location Entity Identification Code/Network Site Format** The Network Site Format of the Location Entity Identification Code is a standardized code that uniquely identifies a physical location, e.g., a telecommunications service company structure housing equipment or personnel. This format consists of a sequence of Geographical Code, Geopolitical Code, and Network Site Code data elements, resulting in a code that totals eight characters, as shown in Figure 2.8.

   Character positions that require alphabetic (A–Z), numeric (0–9), or either alphabetic or numeric characters are represented by A, N, and A/N, respectively. Allowing both AA and NN for the Network Site Code data structure provides for the maximum number of Network Site Codes, for use in the Network Site Format and

| Elements/Positions | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Geographical Code | A | A | A | A | | | | |
| Geopolitical Code | | | | | A | A | | |
| Network Site Code | | | | | | | A | A |

or

| Elements/Positions | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Geographical Code | A | A | A | A | | | | |
| Geopolitical Code | | | | | A | A | | |
| Network Site Code | | | | | | | N | N |

**Figure 2.8** Location Entity Identification Code/Network Site Format.

Network Entity Format (see following), without conflicting with the Network Support Site Format (see following) or the Customer Site Format (see following).

2. **Location Entity Identification Code/Network Entity Format** The Network Entity Format of the Location Entity Identification Code is a standardized code that uniquely identifies the function of equipment or personnel housed in a telecommunications service company structure. This format consists of a sequence of Geographical Code, Geopolitical Code, Network Site Code, and Network Entity Code data elements, resulting in a code that totals eleven characters, as shown in Figure 2.9.
3. **Location Entity Identification Code/Network Support Site Format** The Network Support Site Format of the Location Entity Identification Code is a standardized code that uniquely identifies the geographical location and function of telecommunications service company equipment normally outside of a telecommunications service company structure. This format consists of a sequence of Geographical Code and Geopolitical Code data elements plus a Network Support Site Code data element, resulting in a code that totals eleven characters, as shown in Figure 2.10.
4. **Location Entity Identification Code/Customer Site Format** The Customer Site Format of the Location Entity Identification Code is a standardized code that uniquely identifies a customer's presence at a location at which network elements or network systems equipment exists. This format consists of a sequence of Geographical Code and Geopolitical Code data elements plus a Customer Site Code data element, resulting in a code that totals eleven characters, as shown in Figure 2.11.

*2.5.2.1.2 Company Code* A second illustration of an IT-enabled code is the Company Code (CC) Format of T1.251. Company Code is a unique four-character alphanumeric code (N A/N A/N A/N) assigned, as appropriate, to all telecommunications service providers. Based on company operations, more than one code may be required for each entity [13].

| Elements/Positions | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Geographical Code | A | A | A | A | | | | | | | |
| Geopolitical Code | | | | | A | A | | | | | |
| Network Site Code | | | | | | | A | A | | | |
| Network Entity Code | | | | | | | | | A/N | A/N | A/N |

or

| Elements/Positions | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Geographical Code | A | A | A | A | | | | | | | |
| Geopolitical Code | | | | | A | A | | | | | |
| Network Site Code | | | | | | | N | N | | | |
| Network Entity Code | | | | | | | | | A/N | A/N | A/N |

**Figure 2.9** Location Entity Identification Code/Network Entity Format.

| Elements/Positions | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Geographical Code | A | A | A | A | | | | | | | |
| Geopolitical Code | | | | | A | A | | | | | |
| Network Support Site Code | | | | | | | A | N | A/N | A/N | A/N |

**Figure 2.10** Location Entity Identification Code/Network Entity Format.

| Elements/Positions | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Geographical Code | A | A | A | A | | | | | | | |
| Geopolitical Code | | | | | A | A | | | | | |
| Customer Site Code | | | | | | | N | A | A/N | A/N | A/N |

**Figure 2.11** Location Entity Identification Code/Network Entity Format.

Company Codes are assigned to telecommunications service providers for unique identification. The code set is used in mechanized systems throughout the industry to facilitate the exchange of information. Applications of the Company Code include, but are not limited to:

- NECA FCC Tariff No. 4.
- Routing and rating practices.
- Industry-recognized guidelines, including Access Service Requests (ASR), Multiple Exchange Carrier Access Billing (MECAB), Small Exchange Carrier Access

Billing (SECAB), Carrier Access Billing Systems (CABS), and Exchange Message Record (EMR).

- Interexchange Carrier systems used to audit Exchange Access bills.
- Telecommunications companies operating in the international arena.

#### 2.5.2.2 ITU-T Recommendation M.1400

Similar discussions related to the TMN X-Interface information requirements are taking place internationally in the ITU-T. ITU-T Recommendation M.1400, *Designations for Interconnections among Operators' Networks*, defines designations and additional information primarily for human-to-human communication between various telecommunications operators. It defines both identification and additional information to be exchanged between two operators. Recommendation M.1400 defines the presentation format of data at human–computer interfaces, but does not define the data communication format for interaction between computer systems.

The definition of information is independent of which function or stakeholder in the virtual enterprise it supports. Provisioning, maintenance management, performance management, testing, and trouble administration are within the currently understood scope of Recommendation M.1400. Also, this Recommendation is intended to support communication between network operators, but may also support communication between a network operator and service operators, brokers, retailers, customers, and installation providers.

Because Recommendation M.1400 is presented in informal natural language, tables, and figures, it has been agreed that a new draft Recommendation be added to the ITU-T Question 2/4 work plan for the purpose of developing a formalized Recommendation, while at the same time keeping Recommendation M.1400 stable and maintainable for functional enhancements. The new draft Recommendation is ITU-T Recommendation M.fides (Formalization of Interconnection Designations). Figure 2.12 shows an application schema graph of the "kernel" of Recommendation M.fides, i.e., an external terminology schema for grammar used in codification and screen presentation [14].

Since the TMN-X Interface requires a computer-to-computer exchange of information over the entire life cycle of the interactions between a service provider and a service customer, the scope of operations to be supported by M.fides may be greater than that currently covered by Recommendation M.1400. Since the definition of information is independent of which function it supports, it should not only be consistent whenever it is used, but it should be organized in interface specifications according to the requirements of each function, referred to in eCommerce as business collaborations. Initially a service provider may indicate a catalog of network services/products available at specific locations. A service customer would select from the catalog what it wants to order and provide minimal information necessary for ordering. The service provider would confirm the order and initiate design activity, adding to the information. Eventually maintenance and billing records would be completed, etc.

Recommendation M.fides could be developed assuming the UML-based UTRAD methodology, starting with business process requirements (including mechanization), and continuing with formalized analysis and design. Information requirements should be modeled and standardized as business information objects, cross industry to the extent possible. In support of this, TSC T1M1 has proposed that the telecom industry build a TMN-X interface registry, referred to as a Global Telecommunications Data Dictionary (GTDD), that could be used as a protocol-neutral reference database for interface imple-

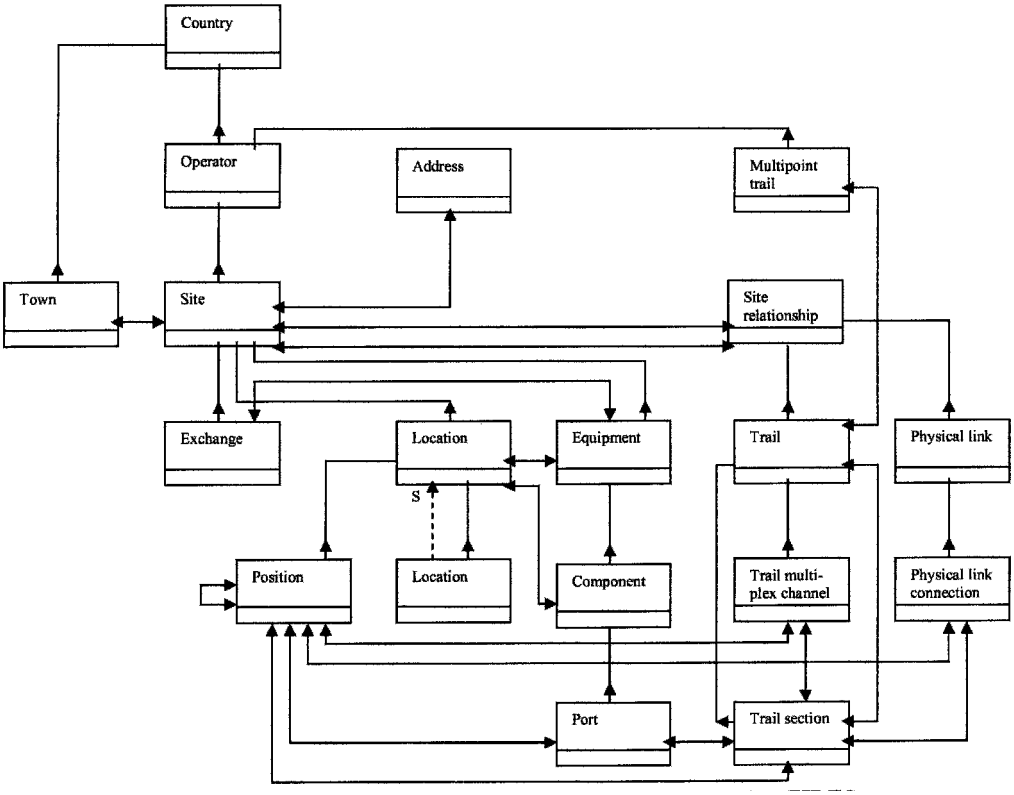


**Figure 2.12** Application schema graph for a kernel of M.fides.

mentations, XML being one. For example, a repository of XML schemas would reference the standard information items in the GTDD (see Section 2.6.4).

An ITU-T project that covers the entire scope of the TMN X-Interface would require a registration authority for all of the X-Interface. Each ITU-T experts group would continue its stewardship responsibilities, but would channel its information to the registration authority. Further, the registration authority would require the support of maintenance agents to carry out the day-to-day activity of coordinating the updates to the reference databases.

***2.5.2.3 ITU Carrier Code*** A prime GTDD candidate that requires the support of a maintenance agent is the ITU Carrier Code (ICC). The ITU-T currently maintains a list of ICCs for the purpose of identifing network operators or service providers ("Operators") that are recognized by the national regulatory administrations. Specification of ICCs for interconnecting operators is a mandatory requirement of ITU-T Recommendation M.1400.

The ICC equivalent in North America is the four-character CC based on the T1.251 standard (see Section 2.5.2.1). Company Codes are used to uniquely identify telecommunications carriers or operators in North America and internationally.

Currently, there is no complete and accurate list of international and domestic operators. The creation of a single, integrated code set based on ICCs and CCs would facilitate the exchange of information between operators regarding call routing, maintenance, and

billing issues across international and North American networks. In addition, a single, accurate, up-to-date list of operator identifiers would facilitate the increase of mechanization and the growth of electronic business and commerce by providing an industry standard that uniquely identifies an operator. Such a list of operator identifiers would fully support the requirements of Recommendation M.fides (see Section 2.5.2.2).

In recognition of this situation ITU-T Study Group 4 proposed a new approach to administering ICCs, opening the door for maintenance agents in the ITU-T. In the proposal, the ITU Telecommunications Service Bureau (TSB) would establish a central Web page for the ICC list. In order to simplify updating the data on the ICC list for national administrations that have a large number of ICCs and to keep the list up-to-date, it was proposed that national administrations can maintain a list of their ICCs on their own Web page, or authorize an organization to establish a Web page on their behalf. It was proposed that through a Web link on the ITU ICC Web page, one could access the national administration's Web page. Together, the central ITU ICC Web page and the linked national administrations' Web pages would be referred to as the ITU distributed ICC Web.

A trial of the ITU distributed ICC Web was implemented in January 2002. The National Exchange Carrier Association (NECA), maintenance agent for T1.251 Company Codes, revised its Web site and created a new Web page to provide information on ICCs along with a list of approximately 3000 ICCs for North American operators. The list of North American ICCs was developed from the publicly available Company Codes that comprise a subset of the complete list of greater than 9600 Company Codes. The list of North American ICCs is updated monthly. This compares with approximately 670 ICCs in the TSB ICC database as of April 2002.

The TSB revised the ITU Web site to provide a separate page for the ICCs for each national administration, in its corresponding role with respect to the ITU distributed ICC Web. In addition, the TSB and NECA coordinated the removal of ICCs for North American operators on the ITU ICC list and the addition of those ICCs to the list on NECA's Web site.

The ITU-distributed ICC Web trial was demonstrated to ITU-T Study Group 4 in April 2002. The TSB ICC link to the NECA Company Code Web site seamlessly showed over 3000 ICCs/publicly available Company Codes and corresponding contact information for North American operators within the context of the TSB ICC Web page for the United States. The successful trial of the ITU Distributed ICC Web capability was characterized by one expert as "providing a quick look for recent information." It is expected that such maintenance agent capability will be extended to other enumerated lists in the development of the GTDD.

### 2.5.3 Harvest Existing Business Information

Efforts are underway to identify existing code sets that are already rule-based (explicitly or implicitly) and where the rule base has a "source authority," such as relevant ISO or ISO/IEC committees for code sets originating in those SDOs. One such effort is a New Work Item recommended by the ISO/IEC JTC 1 BT-EC titled, "IT-enablement of Widely Used Coded Domains" [15], which focuses on "coded" rather than "encoding" and provides a tool for the preparation of new standardized codes as well as for IT-enablement of existing standards.

In proposing the creation of the ebXML Initiative, the Techniques and Methodologies Working Group (TMWG) of UN/CEFAFCT recommended that UN/EDIFACT standard semantics be used in XML applications to provide a firm foundation for interoperability

[16]. The proposal went on to say "it is essential that XML Document Type Descriptions (DTDs) (or Schemas, when standards for them exist) encode information about the mapping between element and attribute definitions and their foundation semantics." Efforts to create IT-enabled codes such as in ebXML will benefit from the vast repository of data semantics that has been assembled in UN/EDIFACT and X12 directories. In addition, encoding UN/EDIFACT and X12 data semantics in XML applications will provide a clear migration path for traditional EDI applications that choose to take advantage of the Internet and provide reassurance that existing EDI implementations will interoperate with XML implementations in the meantime.

This motivation leads one to seek the best method for mapping UN/EDIFACT data items directly to XML. Several organizations and industry initiatives are investigating the translation of EDI data items to XML, but there is as yet little consensus on the best way to achieve it. Some are developing algorithms to autogenerate XML elements and DTDs directly from EDI directories. However, the TMWG has advised against this approach. Autogeneration can lead to semantically meaningless names that are hard to use and that do not facilitate reuse. Furthermore, because of redundancy in the data dictionaries, autogeneration would result in semantically equivalent elements with different names.

The TMWG believed that industry consensus could be achieved on a methodology for mapping EDI to XML, such as the appropriate use of elements and attributes, naming rules, and the granularity of the XML constructs. Further, the TMWG recommended that best practices be identified through cooperation with other organizations working on XML specifications for eCommerce, anticipating that the recommended practices will include human input to cleanse the generated output.

The TMWG recommendations have been partially realized in efforts of the ebXML Initiative. Subject matter experts have focused on data requirements for a variety of application domains. Walking through real-world business scenarios, data entities involved in information exchange have been identified, both in generic definition and subtype definitions based on the context of the business process and imposed constraints. Such data entities are then specified as attributes in business entity types that will become prime candidates for standardization.

A recommended procedure for developing the business information content, i.e., "payload," of an ebXML message according to this approach follows:

1. Describe eBusiness requirements, drawing from common business processes and business entity types in the ebXML Registry/Repository that have been developed independently of any existing or developing business processes.
2. Use the business process context characteristics to extend/adjust the business entity types in completing the attributes of the eBusiness requirements class diagram, showing business-entity-type classes, attributes, and relationships together with class definitions.
3. In the analysis workflow, transform the eBusiness requirements class diagram into a precise object-oriented class diagram, built on registered, normalized business information entities.
4. The business documents to be exchanged will contain instantiations of the attributes of the business information entities and formed into XML constructs. (It should be noted that in addition to XML constructs, the transformation from UML artifacts to any other protocol-specific data syntax is the intended objective, as discussed in Section 2.4.3.)

## 2.6. SHARED SEMANTICS FOR INTEROPERABILITY (DATA EXCHANGE STANDARDS)

Once the semantic content of shareable information is defined and standardized, it needs to be organized and related to eCommerce applications, i.e., interoperable business processes, such that the benefits of common semantics can be realized among trading partners.

Sections 2.3 and 2.4 discussed the Open-edi concept of exchanging electronic data among organizations without prior agreement. In an effort to accelerate an implementation approach to the Open-edi Reference Model, the predecessor to the UN/CEFACT TMWG, an ad hoc committee (AC.1) of the UN/ECE WP.4 was created to investigate the available technologies for creating the next generation for electronic information exchange among business trading partners.

AC.1 reported that the most promising technology to address the shortcomings of EDI was that of business process and information modeling (BPIM). Through BPIM, information standards would not have the problem of ambiguity. Instead, as per the Open-edi Reference Model, scenarios, i.e., complete processes and their information requirements, including constraints, execution options, exceptions, etc., would be specified. Further, AC.1 recommended that object technology should be used in BPIM, since it offered many, if not all, aspects required to describe the real world, which consists of objects.

AC.1 recognized that even with BPIM, business policies would dictate doing things differently, even in regard to external processes. AC.1 proposed that the next generation standards would be BPIMs, standardized for a particular business goal, such as "catalog ordering." The standardized BPIM would contain "all" the possible activities that could be part of that goal. In other words, the standardized BPIM would be a supermodel for a given business process. Since such models would have many execution alternatives (paths through the model) each path would be identified as a scenario. Depending on their internal processes, one trading partner may be able to execute all the scenarios of a model, whereas another may only execute a certain number of them. For two trading partners to engage in the same business process, they must both be able to execute at least one scenario in common. In regard to small- and medium-size enterprises (SMEs), it is envisioned that the software providers would create applications that implement BPIMs for the most popular scenarios.

As WP.4 transitioned itself to the new organization, now known as UN/CEFACT, AC.1's BPIM recommendation became the foundation for the new work. UN/CEFACT created the TMWG in order to continue the work of AC.1. Based on the original recommendation, UN/CEFACT also created the Business Process Analysis Working Group (BPAWG) and encouraged UN/EDIFACT and other working groups to move toward adopting BPIM as a requisite for maintaining UN/EDIFACT.

As the TMWG identified the necessity to decompose business processes to their more generic components, it also concluded that a consistent modeling methodology and technique for conducting the analysis and design must be utilized. Thus, it became important to explore the benefits of using modeling techniques and methodologies to identify the data requirements and data flows of a particular business process. Resulting models would provide an interface specification that enables nonstandard data, internal to a business process, to be mapped and translated to a representation of standardized data in a standardized business process collaboration.

Models that provide the interface specification would constitute the new eBusiness standards, once they are certified as satisfying the business requirements. These new standards would be independent of the interchange data syntax, transport infrastructure, and server software.

### 2.6.1 Business Process Modeling in ebXML

The first application of BPIM is the ebXML Initiative. ebXML is an international initiative established by UN/CEFACT and the Organization for the Advancement of Structured Information Standards (OASIS). Phase one of this initiative extended for 18 months and completed in May 2001. Technical work on ebXML now moves forward as a coordinated activity between members of UN/CEFACT and OASIS. Figure 2.13 shows the foundational role of BPIM in the ebXML technical architecture [17].

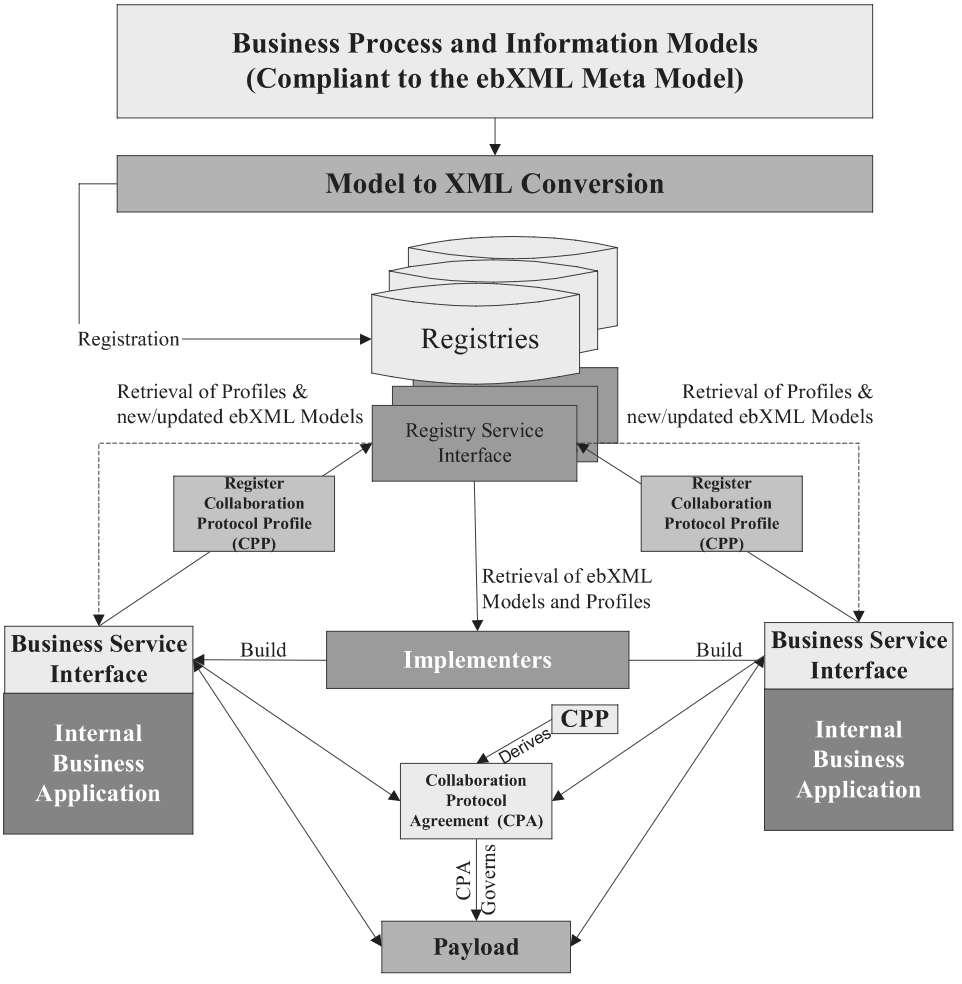


**Figure 2.13** ebXML technical architecture.

#### 2.6.1.1 Business Process Modeling Requirements

According to the ebXML Requirements Specification,

> The *Business Process Project Team* detailed requirements and deliverables will:
>
> - Provide a technical specification for business process definition (BPDS), enabling an organization to express its business processes so that they are understandable by other organizations, thereby enabling integration of business processes (see, for example, eCo strategic framework-services and interactions)
> - Provide an explicitly specified process metamodel that is not merely implied by instantiations or derivations
> - Provide a BPDS that is usable—
>   —globally
>   —cross-industry
>   —by small, medium, and large organizations
>   —by for-profit and government and/or non-profit organizations
> - Provide a BPDS that enables an organization to express its business processes to such an extent that other organizations can discover—
>   —the kind of organization the process belongs to
>   —the business processes belonging to an organization
>   —the interaction points in the organization's business process in order to determine whether and how to engage in business
>   —the kinds of information exchanges required to conduct a particular interaction in the business process
>   —company interactions and services and categorize them
> - Provide for BPDS compatibility by—
>   —allowing for forward migration from existing frameworks to the degree possible
>   —carrying forward accumulated best of breed experience such as—OAG, RosettaNet, HL7—into the ebXML "superset"
>   —enabling mapability between content provider defined processes
>   —enabling organizations or industry verticals to be able to compare business processes
> - Provide for BPDS re-usability/extensibility by—
>   —allowing a company to 're-use' and extend standard, template, or actual business processes as starting points for definition of specific business processes
>   —encouraging industry verticals to base their model on the high level framework
>   —supporting re-usable data components
>   —supporting re-usable process components
> - Enable business processes to be accessible and readable by—
>   —making BPDS-based processes machine readable
>   —expressing processes defined under BPDS in parsable, navigable XML
>   —making processes defined under BPDS visually (diagrammatically) viewable
>   —identifying at least one industry standard based tool or technique, through which BPDS compliant processes can be defined through diagrammatic drawing
> - Provide a process to create and maintain a—
>   —glossary of terms related to business process methodology vocabulary such as—functional, non-functional, vertical, message, segment, data type—using TMWG Unified Modeling Methodology document Annex 1 as a starting point

—glossary of terms specific to each business process to be modeled

—glossary of XML tags

—library of documents based on identified services and interactions

—web site for ready access to glossaries

- Be developed in conjunction with the *Registry and Repository Project Team* to incorporate technical specifications, models, and required glossaries into the ebXML repository" [18]

***2.6.1.2 Business Process Modeling Methodology*** Many of the requirements just listed were fulfilled through the use of the UN/CEFACT modeling methodology (UMM) metamodel, contributed as part of the *Business Collaboration Framework* of Edifecs Commerce. To provide a flavor of this metamodel, the Executive Summary of the Edifecs Commerce submission follows:

> Business partners must collaborate if they are to remain competitive. A high level of collaboration is possible when business partners link their businesses processes through an interface of network computer e-business services that enforce commercial trading agreements modeled as collaborative exchanges of business information, in agreed sequences and within agreed timeframes. A commercial trading agreement is modeled as a business process model expressed with the Unified Modeling Language (UML) and the Object Constraint Language (OCL). The UML is a language expressive enough to specify the structure and behavior of objects that interact in any conceptual domain of discourse. A process model, however, is a specification of the structure and behavior of objects interacting at business partner interfaces, a specialized domain of discourse. This document describes an extension to UML to include business process domain specific syntax and semantics. This extension is termed the e-Business Process Metamodel. The metamodel is organized into the following views so that each process model can be viewed from a number of perspectives. [19]

These perspectives, as incorporated into the UMM, are:

- The Business Domain View (BDV)—the partitioning of business domain into business areas and process areas and business processes. This view establishes the business context of the process which is a precursor to evaluating the likelihood of finding reusable previously defined process descriptions or terminology in the UMM libraries.
- The Business Requirements View (BRV)—the view of a business process model that captures the use case scenarios, inputs, outputs, constraints and system boundaries for business processes and their interrelationships within business process collaborations. This view is how the business domain expert sees and describes the process to be modeled. This is in the language and concepts of the business domain expert.
- The Business Transaction View (BTV)—the view of a business process model that captures the semantics of business information entities and their flow of exchange between roles as they perform business activities. This view is an elaboration on the business requirements view by the business process analyst and is how the business process analyst sees the process to be modeled. This is in the language and concepts of the business process analyst, who may have to help convey ideas to the software designer and the business domain expert.
- The Business Service View (BSV)—the view of a business process model that specifies the component services and agents and their message (information) exchange

as interactions necessary to execute and validate a business process. This is in the language and technical concepts of the software developer. [11]

These perspectives support an incremental model construction methodology and provide levels of specification granularity that are suitable for communicating the model to business practitioners, business application integrators, and network application solution providers.

#### 2.6.1.3 REA, Economic Ontology for Business Requirements View

The business semantics of the UMM BRV perspective are based on an accounting ontology called resource–event–agent (REA). REA is a framework for specifying the accounting concepts and relationships involved in business collaborations. REA is an elementary set of concepts derived from basic definitions in accounting and economics. A business transaction or exchange joins two parties together in a pair of commitments, noting that the two parties to a simple market transfer expect to receive something of value in return when they trade. For example, a seller, who delivers a product to a buyer, expects a cash payment in return. REA provides a foundational business collaboration pattern that consists of a pair of commitments between agents (Persons in Open-edi terms) that are fulfilled by events that signal the transfer of resources.

An ontology, according to the most generally accepted eCommerce definition of that word, is a "specification of a conceptualization" [20]. The REA ontology is a specification of the declarative semantics involved in a business collaboration (or more generally, in a business process). The theory behind REA comes from the field of microeconomics with specific ties in many instances of the use of economic definitions in the practice of building enterprisewide information systems. The UMM BRV applies the REA ontology definitions to the collaborative space between enterprises where market exchanges occur in closely synchronized fashion among two or more trading partners.

##### 2.6.1.3.1 The Basic REA Ontology

The basic REA model was first published in the July 1982 issue of *The Accounting Review* [21]. Figure 2.14 illustrates the basic class structure of REA ontology. The left-to-right configuration of economic *R*esources, economic *E*vents, and economic *A*gents in a typical business collaboration pattern is the source of the model's REA name.

A successful business collaboration involves first and foremost two types of *Economic Events,* each of which details the *Economic Resources* involved in an exchange between two Trading *Partners.* For example, a supplier (trading partner) transfers ownership of an automobile (economic resource) to a customer (trading partner), in return for which (*duality* association) the Customer will provide money (economic resource) to the supplier. There are two mirror-image instantiations of the object pattern shown in Figure 2.14, where one transfer represents the legal or economic consideration given for the other.

The declarative semantics shown here are central to all trading relationships. Economic resources are objects that have value and are under the control of one of the two collaborative agents. Trading partners always expect requited transfers of resources when they engage in commerce. Hence, Figure 2.14 is a pattern for all economic exchanges [22].

##### 2.6.1.3.2 Adding Commitments to the Basic Exchange Ontology

In electronic commerce, the actual trading phase of an exchange is well accommodated by the object

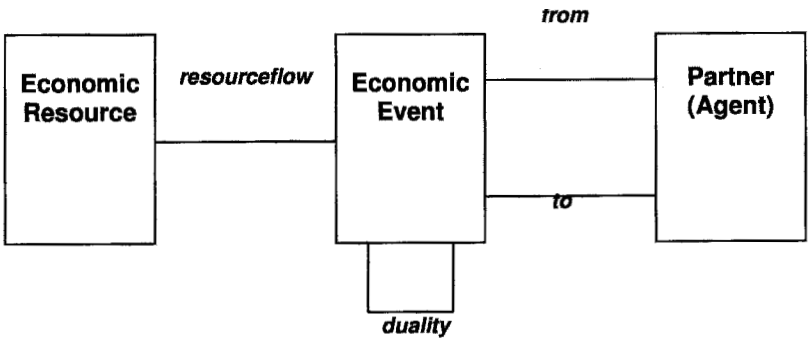


**Figure 2.14** Basic REA ontology.

structure shown in Figure 2.14. However, trading partners in long-term relationships need more trusted and predictable structures where both parties contract for their exchange behavior in advance. The REA ontology accommodates this expansion with the addition of the classes shown as *Economic Commitments, Economic Contract,* and *Agreement* in Figure 2.15.

A *Commitment* is a promise by a trading partner to initiate an economic event in the future. Performing the economic events *fulfills* that commitment. A commitment should always be *reciprocated* by the other trading partner, who commits to initiate another type of economic event in return. An *Economic Contract* is a bundle of reciprocating commitments between trading partners, who bind themselves to one or more economic exchanges

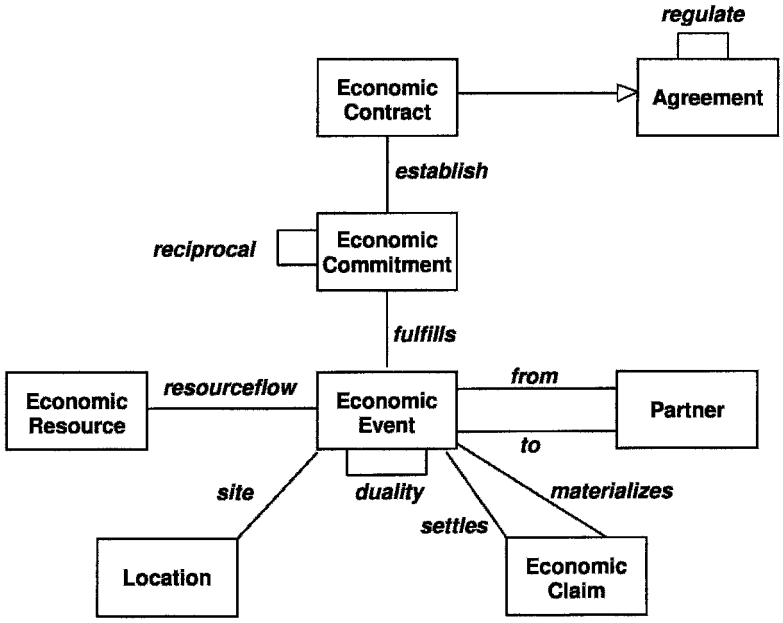


**Figure 2.15** REA ontology with commitments.

in the future. A contract is a subtype of the more general object class called *Agreement,* and agreements can regulate other agreements.

In the case of the automobile-for-money exchanges discussed in the prior section, commitments would involve the customer agreeing to accept delivery of an automobile on a certain date, in return for which he or she would be contractually obligated to making a series of cash payments to the supplier for that purchase.

In the bottom part of Figure 2.15, two additional objects of the REA ontology are illustrated: *Economic Claim* and *Location.*

- Materialization of a *Claim* is sometimes needed when trading partners insist on documentation of partially completed exchanges (for example, when a customer takes possession of an automobile before paying for it in full). If needed, claims can be instantiated by documents like invoices or by accounting artifacts like accounts receivable. Their inclusion here is more a matter of business custom than ontological completeness.
- A *Location* is another object that is sometimes needed to fill out the specification for a full economic transfer. A location simply identifies the place where an Economic Event takes place.

The economic and ontological foundations of commitments are explained more completely by Geerts and McCarthy [23].

*2.6.1.3.3 Adding Types to the Basic REA Exchange Ontology* The object pattern portrayed in Figure 2.15 is primarily *descriptive* in the sense that it illustrates what actually occurred in an economic exchange or what has been committed to. In the UMM and the business entity type (BET) [24] specification, these *descriptive* components have been augmented by *prescriptive* components that allow the specification of control policies or collaboration patterns. These prescriptive components are enabled by the inclusion of type images of the basic descriptive objects [25]. The class diagram of Figure 2.16 shows these additions.

The addition of Types to Figure 2.16 proceeds in two stages:

- Four of the base descriptive classes—Economic Resource, Economic Event, Partner, and Location—have classes added for their types. These new classes are connected to the descriptive objects by *typifies* associations. An example of a Resource Type could be different models of automobiles. An example of an Economic Event Type could be the classes of retail transaction and wholesale transactions, each with different pricing structures. An example of Partner Type could be different classes of employees, each type with separate training requirements. And finally, an example of Location Type might be different types of loading docks with different sizes and stress capability levels.
- The full design of the Economic Commitment would necessitate associations between the commitment and each of the new Type-level objects. These are illustrated in the figure with *specifies* associations.

In addition to these two groups of additions, there are other REA associations in the UMM that are not illustrated here in an effort to minimize diagram complexity. These include:

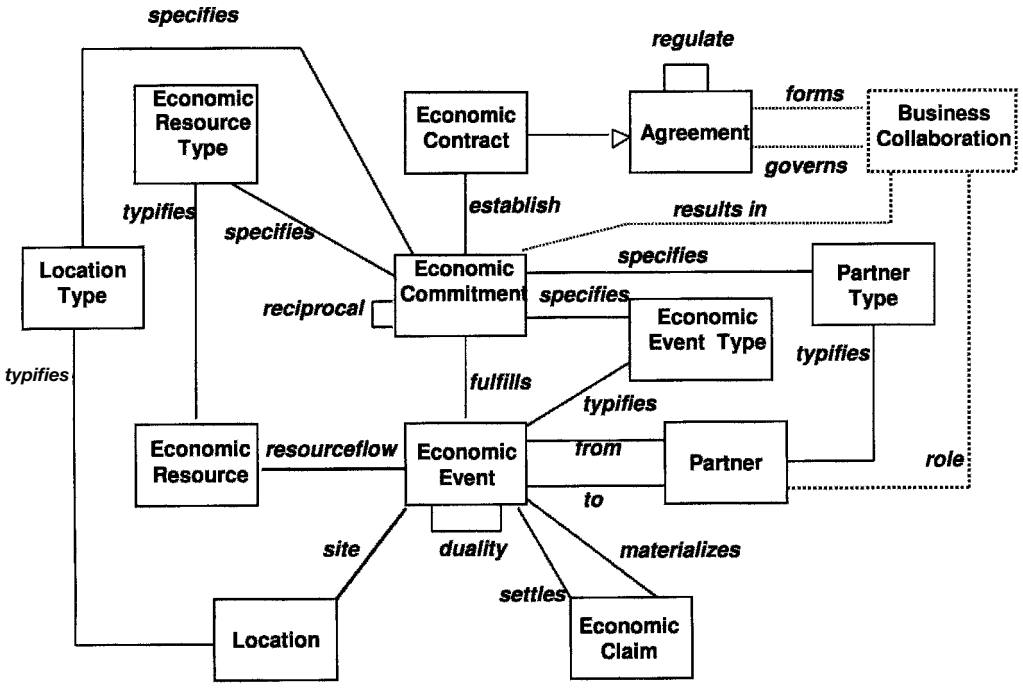


**Figure 2.16** REA ontology with Types.

- Partner—*participates*—Economic Commitment
- Economic Commitment—*destination*—Location
- Partner—*participates*—Agreement
- Partner—*participates*—Economic Commitment
- Economic Commitment—*reserves*—Economic Resource

And finally with regard to Figure 2.16, the partial integration of the elements of the REA ontology with the components of the UMM business collaboration framework is illustrated by showing the class for Business Collaboration (with dotted lines) and some of its associations with REA classes (also illustrated with dotted lines). Outside of its use with the UMM, the REA ontology has a three-level architecture that is explained by Geerts and McCarthy [26]. In the UMM, this three-level architecture is effected by the integration of REA components within the business collaboration framework and by the connection of the BRV to the BDV above it and the BTV below it.

REA concepts are more fully specified in working drafts of the UN/CEFACT eBusiness Transition Working Group [27], base documents for *UMM User Guide* to be released in 2003.

### 2.6.2 tML Framework

A telecommunications industry application of XML, *tML Framework,* was approved as ITU-T Recommendation M.3030 in August 2002 under the ITU-T alternate approval

process (AAP). (This can also be thought of as a specific industry extension of ebXML.) The tML Framework is a framework for the development of standards for the management of telecommunications networks based on a markup language derived from XML for telecommunications network management. The markup language derived from XML is referred to as the telecommunications Markup Language (tML).

The current version of the tML Framework focuses on the TMN X-Interface. Subsequent versions may add scope to include other TMN interfaces. Figure 2.17 shows the scope of the tML Framework.

The scope of Recommendation M.3030 includes Rules, Objectives, and Guidelines for:

- Specifying business document structure (i.e., tML Schemas) for X interface applications of tML
- Use of common vocabulary structure

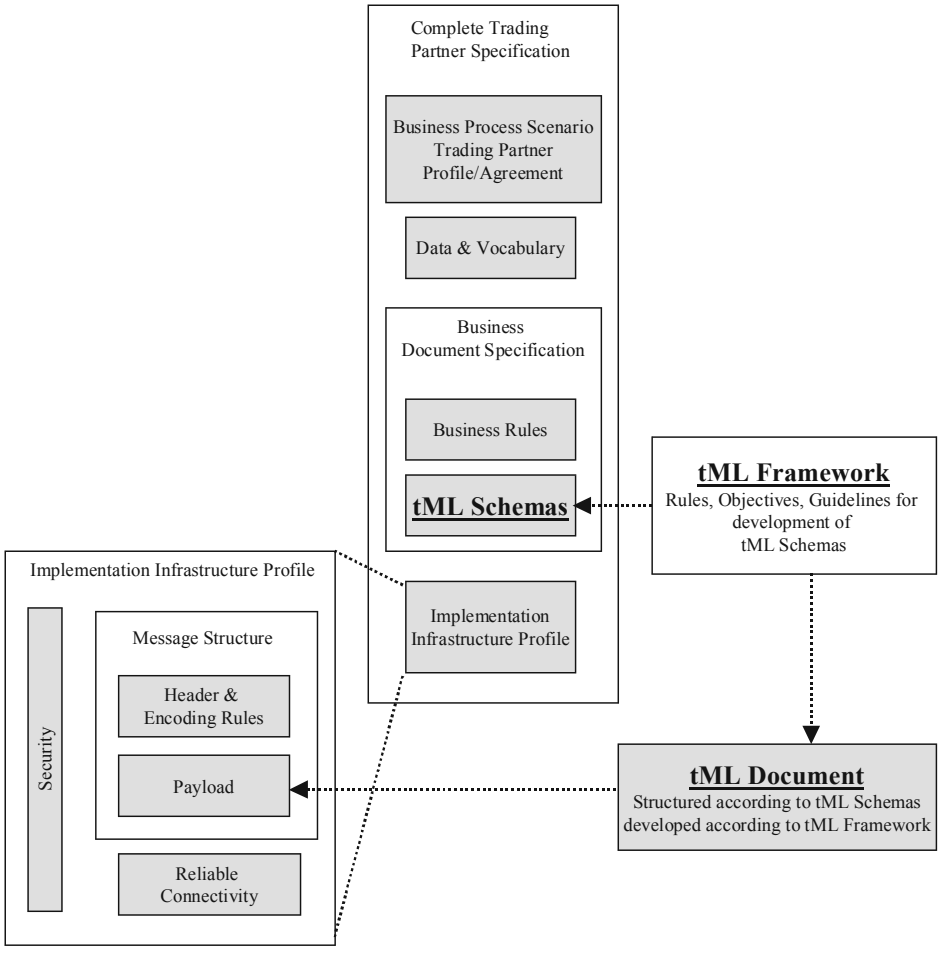


**Figure 2.17** tML framework scope.

- Use of namespaces
- Mapping from existing standards to tML
- Specification of metadata used

The scope of this Recommendation does not specify the following items because trading partners specify these items through negotiation:

- Business Process Scenario
- Implementation Infrastructure Profile—Specification of any particular communications protocol profile (including provisions for reliability, availability, and survivability, or RAS), and provisions for security, privacy, and non-repudiation.
- Data and Vocabulary content [28]

### 2.6.3 Business Application Contracts in TM Forum's New-Generation OSS

A third BPIM application is current work in the TeleManagement Forum (TM Forum) on new-generation operation support systems (NGOSS). In this BPIM application, shared semantics for interoperability are shown to apply within an enterprise as an extension to the business-to-business discussion. It is apparent that distinctions in information exchange between enterprises versus within an enterprise are diminishing with ever-increasing interoperation among competitive service providers and outsourcing of operations. Information is exchanged between computer application components via business application contracts, defined as "the central concept of interoperability in the NGOSS™ Architecture. Through contracts, public shared services are described and defined in a technology-neutral fashion" [29]. Upon invocation of a contract, a logical business component can carry out one or more operations to produce the agreed upon set of outputs.

***2.6.3.1 Business View*** A business application contract specification can be thought of as a UML use case at the level of a business transaction within a collaborative business process. A collaborative business process is identified in the UMM in the recursive decomposition of the business domain to a business area to a process area to a business process [11]. Such a business process is at the granularity level of a "business collaboration," where individual business transactions can each be identified that conform to one of six business transaction design patterns. Business transaction design patterns currently defined in the UN/CEFACT business collaboration metamodel, and which may apply to contract specifications, are:

- Commercial Transaction—Used to model the "offer and acceptance" business transaction process that results in a residual obligation between both parties to fulfill the terms of the contract.
- Query/Response—Used to query for information that a responding partner already has, e.g., against a fixed data set that resides in a database.
- Request/Response—Used for business contracts when an initiating partner requests information that a responding partner already has and when the request for business information requires a complex interdependent set of results.
- Request/Confirm—Used for business contracts where an initiating partner requests confirmation about their status with respect to previously established contracts or with respect to a responding partner's business rules.

- Information Distribution—Used to model an *informal* information exchange business transaction that therefore has no nonrepudiation requirements.
- Notification—Used to model a *formal* information exchange business transaction that therefore has nonrepudiation requirements.

All six patterns can have an outcome of "success" or "control fail," i.e., for any control parameter violation such as timeout, processing exceptions, nonrepudiation, and authorization exceptions.

Contract specifications are under development in Phase 2 of the NGOSS project as a result of TM Forum plug-and-play catalyst activity, and otherwise as identified through the TM Forum enhanced Telecom Operations Map (e-TOM) [30] activity. As in the development of a TM Forum Business Agreement (BA) specification, a contract specification should be accompanied by detailed, categorized requirement statements, including information exchange requirements, for business application contracts at a conceptual level.

***2.6.3.2 Systems View*** Contract specification artifacts may include:

1. An activity diagram for the "Business Process," referred to as a System Process Plan, that identifies each contract specification, characterized as a business transaction design pattern.
2. An activity graph for each contract specification according to its respective business transaction design pattern.
3. A conceptual class diagram, initially without attributes, for the information to be exchanged.
4. Sequence diagram for the interactive protocol for the contract specification, as available in UN/CEFACT business service interaction design patterns.
5. For information provider contracts, identification of attributes of business entities to be exchanged via the contract, by reference to a registry of shareable data (see Section 2.6.4). Shareable data entities would be represented in shared information models as attributes of business entities. Data types of the data elements would be specified utilizing the TMF Common Information Structure [31]. Since business application contracts may require data entities not yet in the shared information models, rules must be developed for reference to and change management for the business entity library as the shared information models are incrementally constructed as required by the contract activity.

Taking the business application contract attributes from the NGOSS Architecture Technology Neutral Specification [32] into account, as well as the characteristics of the business application contract definition just listed, these artifacts could be the basis for a business application contract template. Once validated, the template could be released for widespread contract specification, utilizing distributed resources that agree to work in close cooperation with the centralized registry/repository of shared information models.

It has been recommended that the shared information modeling activity lay some groundwork using "something that already exists," e.g., the Distributed Management Task Force (DMTF) methodology and framework model [33]. In particular, any business entities that already may have been modeled, such as product, service, or order would be useful, at least as a reference. In addition, it has also been recommended to refer to the TM

Forum Systems Integration Map (SIM) as a means to organize the knowledge base of NGOSS system artifacts such as system process plans, business application contracts, and shared information models [29].

The NGOSS Shared Information/Data Model (SID) is a fundamental component for achieving interoperability in the NGOSS Technology Neutral Architecture. SID represents a synthesized view of information derived from various industry models. As stated by the SID team, the SID model represents a federation of model fragments. This converged model should be very attractive to service providers, independent software vendors, equipment vendors, and others who have the objective of creating a common model and a language that expresses shared information/data terminology. The SID work should be related to the ITU-T SG4 and T1M1 GTDD (see Section 2.6.4) for information to be exchanged on the TMN X-Interface.

***2.6.4 Global Telecommunications Data Dictionary*** The GTDD is a structure that stores telecommunications terminology and its semantic description. It is a catalog of terminology that can be used by administrators, designers, applications developers, and standards developers for information resource management. As such, the GTDD is a resource to be used in developing standards for interoperable information interchange in telecommunications OAM&P applications. Such standards would permit consistency in data interchange and understanding. Also, the GTDD is a resource for applications developers that may have a need to discover terminology used in information interchange. ITU-T Recommendation M.1400 is a primary source for describing information that is shared among network operators, i.e., designations for interconnection, and is thus likely to provide a substantial contribution to the GTDD.

The most substantive work to date on GTDD requirements has been in the context and support of the tML Framework project. With the ITU-T Recommendation M.3030, tML Framework, having been approved in August 2002 , there is more urgency in completing the requirements for a GTDD that is capable of gathering the telecommunications terminology and semantic description required for tML implementations.

One of the goals of the GTDD is to reuse applicable terms that are available in commercial libraries. Initial studies have shown this to be a promising approach. Preliminary work in Eurescom has utilized CommerceOne's Common Business Library (CBL) as a reference. Also, analysis of CBL applicability to the tML initiative in T1M1 has been documented, showing a significant percentage of direct application of CBL data elements [34].

## 2.7 SUMMARY

This chapter provides a snapshot view in time of some eCommerce standardization activities from the business perspective of information exchange. In particular, standardization activities with which the author has been directly engaged in an effort to influence the convergence of telecommunications and cross-sectorial information exchange standards, are highlighted. In terms of the Open-edi conceptual model, emphasis has been placed on the business operational view, which "focuses on high-level operations and their associated requirements and constraints, as regarded from the 'business' user's perspective." The functional services view of Open-edi is left to the IT infrastructure, i.e., IP networks in the context of this volume.

The key concept to be noted is that information exchange standards are ideally developed within the context of a business collaboration framework and are represented by a formal description technique that is independent of data protocol syntax. A business process and information modeling methodology is the key to making interface standards future-proof in the onset of evolving data exchange protocols. The challenge of managing eCommerce, as defined in the Introduction to this chapter, is fundamentally met through the development and implementation of standards that provide for process and information interoperability. Formulation of business user's requirements on the IT infrastructure would then be a natural outcome of such information exchange standards, which would in turn drive IP network solutions.

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