RosettaNet Case Study

(Today's view)

Version: 1.0

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Contents

Figures

Tables

Version History

Version 0.1	16 August 2001	Pete Wenzel and Jackson He drafted based on a RosetaNet internal document
Version 0.2	26 August 2001	Jackson He made changes after F2F meeting on 08/24
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Preface

Purpose of the Document

The purpose of this document is to demonstrate how the Business Internet Consortium XML Convergence Workgroup's B2B Conceptual Model can be used to analyze a current B2B solution, using the case of the current RosettaNet B2B architecture. It shows the relevance of the model to real-world implementation. It also shows what technologies and standards work today in the various sections of the model, while many other pieces are still missing or less defined.

Intended Audience

e-Business architects and business managers who are responsible for strategy and implementation of B2B solutions; B2B standard bodies (W3C, OASIS, OAGI, etc.); B2B vendors and solution providers; members of other BIC workgroups.

Prerequisites

Readers of this document should have read*: High-Level Conceptual Model for B2B Integration*.

Scope of the Document

This is a high-level architecture discussion, which does not contain certain specific implementation details.

Structure of This Document

The layers described in the High-Level B2B Conceptual Model are followed, citing the specific examples for each layer that are defined by RosettaNet.

Acknowledgements

Many thanks to Pete Wenzel and the RosettaNet Engineering and Architecture Team, who generously provided input.

1 Architecture Conceptual Model

Figure 1 is a conceptual B2B model. A detailed description of this model is available in a separate document (*High Level Conceptual Model for B2B Integration*).

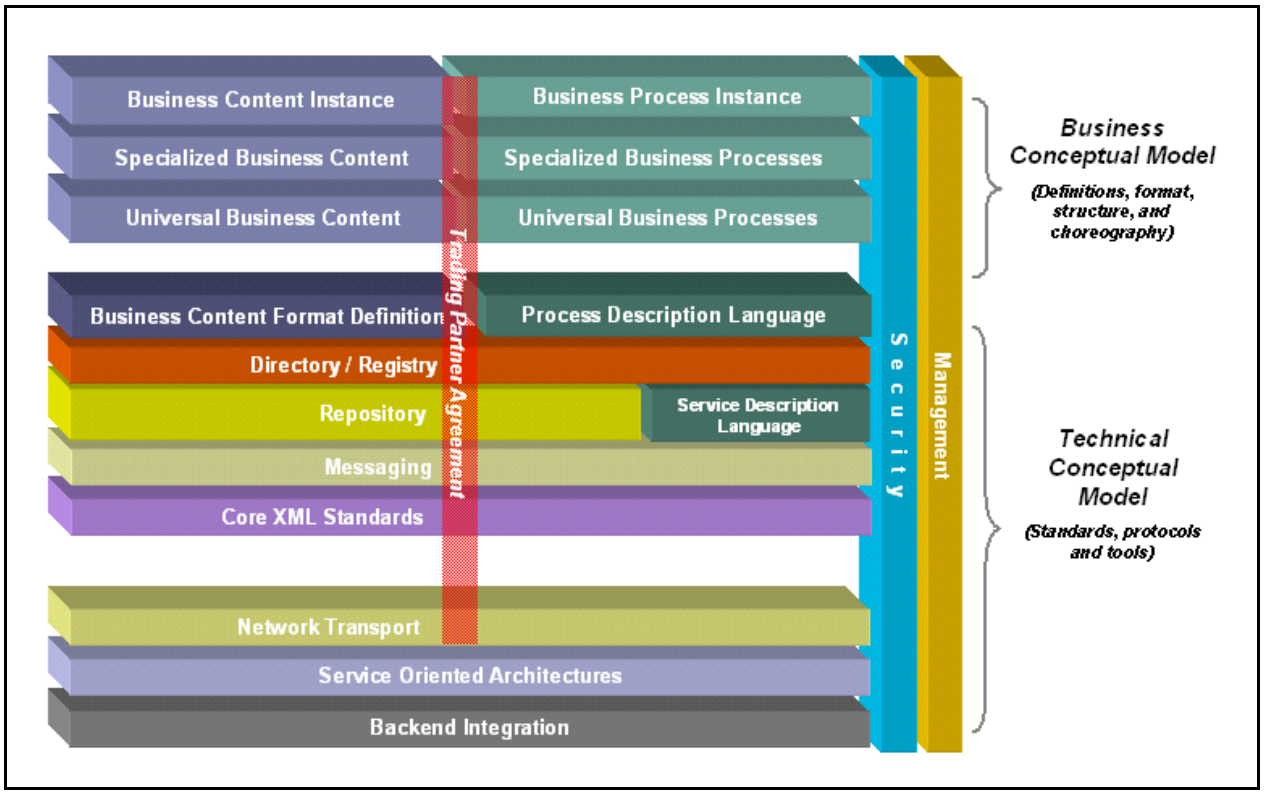

Figure 1. B2B Integration Conceptual Model

The bottom two layers (Service-oriented Architecture layer and Backend integration layer) are out of the scope RosettaNet core functionality. The following sections of this document describe the instantiation of the present RosettaNet architecture in the context of this model, from the messaging layer up.

Note: Please read the Conceptual Model document for descriptions of each layer before proceeding with the following sections.

2 Architecture Layers – Current Instantiation

This section references Figure 1, and is based on the current instantiation of the B2B Conceptual Model. The following subsections describe each layer of instantiation from the bottom to the top and from left to right. The bottom two layers (Service-Oriented Architecture and Backend Integration layers) are out of the scope of RosettaNet core functionality. Only RNIF 2.0 will be discussed here, not previous versions.

2.1 Network Transport

RNIF 2.0 relies on SSL and HTTPS for message transport. Business content could also be transferred over SMTP, using an S/MIME envelope for confidentiality.

2.2 Core XML Standards

RosettaNet is an XML-based protocol for automated B2B transactions among business partners. The XML Document Type Definition (DTD) is the foundation of all RosettaNet business document formats. Several XML capabilities are leveraged in the current business messages that are not supported in the DTD. This requires that a human-readable message guideline also be provided, external to the DTD. The message guideline captures the complete message structure, as well as code lists, additional validation logic and constraints, and specific cardinality requirements. XML schema has added functionality that should enable a machine-readable structure in the future.

2.3 Messaging Services

Currently, RosettaNet uses its own Messaging Service, the RosettaNet Implementation Framework (RNIF) Core Specification, currently published as version 2.0. At the heart of the RNIF 2.0 Core Specification is the RosettaNet Business Message, a transfer protocol-independent container that packages together the business payload, associated header components, and an optional digital signature, all of which must be exchanged as a unit between two endpoints of a RosettaNet interaction. RNIF 2.0 specifies the use of the MIME multipart/related type for the basic enveloping construct to bundle the different elements of a RosettaNet Business Message. In addition, the S/MIME v2 multipart/signed data type is used for digital signatures, and the application/pkscs7-mime data type for content encryption.

2.3.1 Packaging

The individual XML-based business messages involved in a Partner Interface Process (PIP™) (i.e., business action messages and business signal messages) are exchanged in a container that packages together other related entities, such as RNIF-specified header documents, business document attachments of any type, and a digital signature. This container with its constituent parts is the basic unit of exchange between two

RosettaNet endpoints, and is known as a "RosettaNet Business Message." Figure 2 shows the basic structure and components of the RosettaNet Business Message.

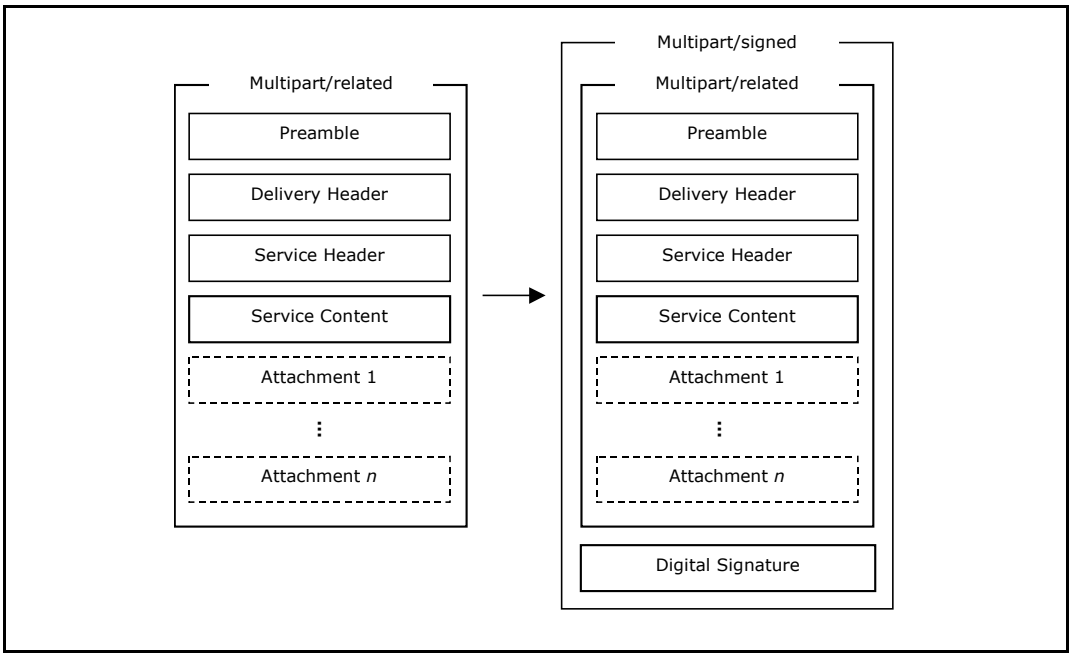

Figure 2. Structure of Unsigned and Signed RosettaNet Business Messages

A RosettaNet Business Message always contains a Preamble header, a Delivery Header, a Service Header, and a Service Content. Service Content comprises an action message or a signal message. If Service Content is an action message, one or more attachments may be included, and referenced from within the action message element to which it relates. As shown, the headers, Service Content and Attachments are packaged together using a MIME multipart/related construct. A RosettaNet Business Message can optionally be signed digitally, in which case the S/MIME multipart/signed construct is used to attach the signature.

The RNIF 2.0 Core Specification owns and defines the schemas for the Acknowledgment and Exception messages (referred to as *signal* messages) that govern the reliable messaging aspects of the PIP message exchanges. The Core Specification also defines the standard message exchange patterns, including the retry and timeout constraints and the corresponding interaction flow diagrams for one-action and two-action PIPs, for both the synchronous and asynchronous modes of interactions. The interaction flows clearly identify the logical sequence of steps involved in processing a received RosettaNet message such as (optional) signature verification, (optional) decryption, message structure validation, grammar/schema validation, etc., and the error or exceptions conditions that could occur at each processing step.

2.4 Dictionary and Repository

The RosettaNet dictionaries define a common set of properties for use by the business process (PIP) specifications and associated business documents and guidelines. RosettaNet dictionaries are classified as Business Dictionaries and Technical Dictionaries.

Today's PIP message guidelines repeat information extracted from the business dictionary (by duplicating the relevant Business Properties, Business Entities, and Fundamental Business Entities used within the document), and may make reference to the technical dictionaries for semantics.

2.5Business Content Format Definition

A Business Content Format is a container for structured business information that is made up of dictionary entry structures, document structures, attachments, etc.

The following different types of business content format definitions are defined in the RosettaNet Business Dictionary:

- Business Data Entities (BDE),
- Fundamental Business Data Entities (FBDE)
- Quantitative Fundamental Business Data Entities (QFBDE) Business Properties.

All Business Documents contain a unique document identifier as well as the date and time that the document was generated. The Business Document design pattern includes the following information in a hierarchical structure:

- Role identity, partner identity, business identity; similar to the information contained in the letterhead of a business document.
- Contact information of the initiating role (in case of errors or a requirement for clarification / issue resolution).
- Partner type, role type and supply chain code; conditional composition constraints are predicated upon this information.
- Document identifier; each responding document must include the identifier of a requesting document. This allows documents to be associated with specific private-process instances, tracked and reconciled.
- Date and time stamp; used for auditing and legal control purposes.

Universal Business Content

Universal Business Content consists of common types of content that are used within most or all business transactions. The goal of defining universal business content is to make business content definitions more manageable and increase reuse. RosettaNet currently defines the following Universal Business Content:

2.6.1 Business Dictionary Content

The *RosettaNet Business Dictionary* defines the properties used in basic business activities between trading partners. These are the Business Properties (e.g. business address), Business Data Entities (e.g. ActionIdentity) and Fundamental Business Data Entities (e.g. BusinessTaxIdentifier, AccountNumber) etc. There is a single business dictionary that encompasses all supply chains served by RosettaNet (currently Electronic Components, Information Technology and Semiconductor Manufacturing). The business entity structures in any business message will be a constrained subset of the entities and properties drawn from the business dictionary. This subset is chosen based on the use requirements of the PIP scenario.

2.7 Specialized Business Content

Specialized Business Content is defined for specific business model, supply chain, or locales that is uniquely needed to complete particular business transactions. RosettaNet currently defines the following Specialized Business Content:

2.7.1 Technical Dictionary Content

The *RosettaNet Technical Dictionary* defines the properties of products, components, devices and services that span the EC, IT and SM supply chains. (Note: formerly distinct *EC Technical Dictionary* and *IT Technical Dictionary* are now integrated into the unified *RosettaNet Technical Dictionary*.) The Technical Dictionary helps to ensure that when communicating about products, human users and computers are using the same language and understand the characteristics of the technical information being exchanged.

The Technical Dictionary captures the component characteristics, component features and component associations. Characteristics are quantitative properties that have a well-defined type and default unit of measure. Features are qualitative properties that may be single- or multi-valued. Additionally, the Technical Dictionary captures the enumerated set of valid feature values, if they exist. Associations capture component interrelationships necessary for describing complex products.

The Technical Dictionary also captures component functional or operational property specifications. These include resource consumption characteristics and functional architecture associations. The dictionary also captures constraint descriptions that define the boundary conditions within which complex products can operate.

2.8 Business Content Instance

This layer describes the particular business content exchanged during a business transaction. An instance could contain recursive combinations of universal and specialized business content defined in the lower layers. For example, a purchase order from one company to another contains specific business content that is uniquely suited to the business transaction, which could be a combination of both universal and specified business content. It also contains complex recursive combinations and attachments, if required by the business transactions.

2.9 Service Description

This layer is not applicable in the current instantiation. Business processes are defined in the PIP and implemented directly according to the RNIF specification.

2.10 Directory Services

RosettaNet does not currently provide an automated way for trading partners to discover each other. That is, a trading partner cannot advertise the set of PIPs it supports in some publicly accessible registry, nor can it register the range of performance profile parameters it can accept for the supported PIPs. Thus, there is no provision for two trading partners to negotiate a trading partner agreement automatically, based on their own performance control profiles.

RosettaNet's PIP specifications have been registered with UDDI recently, and it is expected that trading partners may reference these entries when registering their own business process capabilities.

Once trading partners have discovered each other through some external means, they must negotiate their trading partner agreements manually and then configure their software accordingly, again in a manual fashion.

2.11 Process Description

This section addresses the representation of the published specifications. Currently, RosettaNet uses UML diagrams and natural language (in Word documents) to describe business processes. However, the processes are not provided in a directly executable format; therefore, it is not yet possible to use PIP specifications downloaded from the RosettaNet web site to configure a RosettaNet solution implementation automatically.

An example of a typical UML interaction diagram is shown in Figure 3:

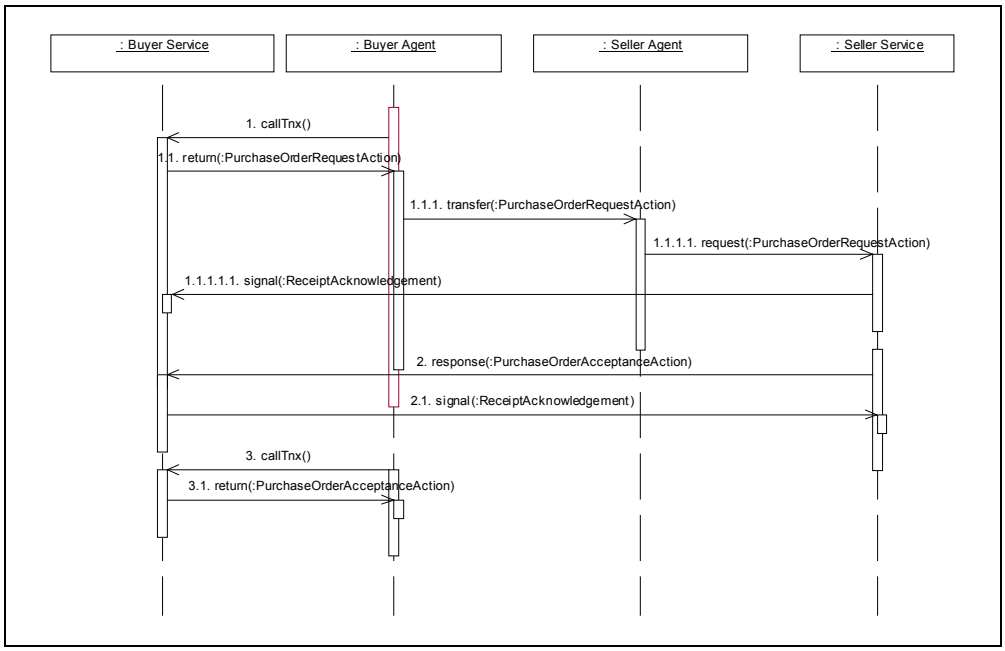

Figure 3. Example RosettaNet Business Process

Business Processes (Universal and Specialized)

A Business Process is the way that business documents are transferred and used by each party who participates in the process. A process may be embedded in a business transaction, interacting with other business processes in order to accomplish the larger transaction. A set of business processes will define the sequencing, interactions, and choreography of transactions between business partners.

For public processes to be interoperable in the RosettaNet community, the information format and the sequence of message exchanges they implement must conform to RosettaNet specifications. Organizations may have to implement new private processes or modify existing ones (that mesh the back-end systems to the public processes) to support their public processes.

A major part of RosettaNet's standardization effort is the alignment of business processes between trading partners in a given supply chain in several targeted vertical industries (such as information technology, electronic components, and semiconductor manufacturing). RosettaNet specifies these as Partner Interface Processes (PIPs).

RosettaNet divides the entire e-business supply chain domain for which PIPs are specified into broad classifications called "clusters." Each cluster is further sub-divided into two or more "segments." Each segment comprises several PIPs. Each PIP contains one or more Activities, and each Activity contains one or more Actions. An example of this relationship is:

- CLUSTER 3: Order Management
  - Segment A: Quote and Order Entry
    - PIP 3A4: Manage Purchase Order

        - Activity: Create Purchase Order
            - Action: Purchase Order Request
            - Action: Purchase Order Acceptance
        - Activity: Change Purchase Order
            - Action: Purchase Order Change
            - Action: Purchase Order Acceptance
    - Segment B: Transportation and Distribution
    - Segment C: Returns and Finance
    - Segment D: Product Configuration

Each PIP in a segment represents a well-defined business process subset that can be executed as a business transaction, and is named with the cluster, segment, and sequence number of the PIP in the segment. For example the Manage Purchase Order PIP is fourth in sequence in Segment A (Quote and Order Entry) of the Cluster 3 (Order Management). Hence the Manage Purchase Order PIP is identified by the name PIP3A4.

PIPs include specification of partner business roles (Buyer, Seller etc.); business activities involved between the roles; and type, content, and sequence of business documents exchanged by the role-interactions while performing these activities. They also specify the authentication, authorization, non-repudiation, secure transfer, persistent encryption, acknowledgment, timeout, retry, response style (synchronous vs asynchronous) parameters for these interactions. Structure and content of the business documents exchanged are specified through XML Document Type Definitions (DTDs) and associated Message Guidelines. These PIP parameters are highly constrained to foster reuse of core implementation packages.

Trading partners that participate in a PIP instance exchange business documents that conform to the DTDs and Message Guidelines included in the PIP specification, using network protocols that are specified by the RosettaNet Implementation Framework.

RosettaNet has defined three types of business processes, although current PIPs are not designed to take advantage of or to support these variations:

- Universal Business Process: Specifies business processes that are applicable to **all businesses**, regardless of the vertical industry

- Business Model-Specific Processes: Specifies business processes that are not Universally applicable, but instead are specific to a business with specific characteristics

- Vertical (Supply Chain) Business Processes: Specifies business processes that are not Universally applicable but instead are specific to a business operating within a specific industry

Figure 4 is an example PIP interaction diagram that shows the business roles, messages, and their sequence of exchange in the execution of a PIP instance.

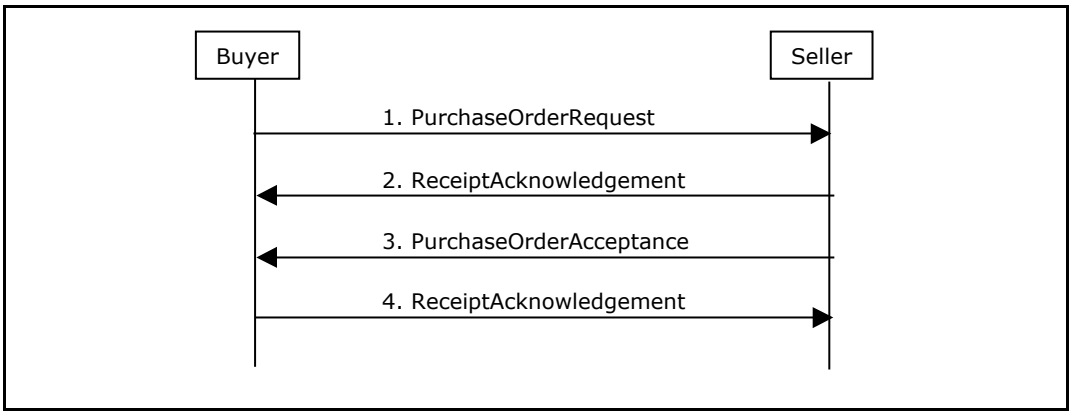

Figure 4. Sample PIP Interaction Diagram

The messages involved in a PIP business document exchange can be classified into two broad categories – "business action" messages and "business signal" messages.

Business actions are messages with contents that are of a business nature, such as a Purchase Order or a Request For Quote. The DTDs and the associated Message Guidelines for business actions are included as part of the corresponding PIP specification.

Business signals are positive and negative acknowledgment messages that are sent in response to business actions for the purpose of aligning PIP state between the partners. Business signals are specified by and are part of the RosettaNet Implementation Framework. RNIF 2.0 specifies one positive type and one negative type of business signals.

A *Receipt-Acknowledgment* signal is a positive acknowledgment of receipt of a Business Action message. It is sent when an action message is received by a trading partner and found to be a structurally and syntactically valid RosettaNet business action message. This message is sent only if it is required by the PIP and it is almost always required. A signed receipt acknowledgement containing the original message digest provides for non-repudiation of receipt.

An *Exception* signal is a negative acknowledgment message that is sent to indicate an error. In RNIF 2.0, there is only one type of exception message (versus three in RNIF 1.1). Individual exceptions have been converted to exception types within the same exception signal. This change allows for faster implementation of additional or changed types. An exception terminates the transaction and it must be re-initiated.

The *Notification-of-Failure* administrative PIP allows the initiator to terminate the PIP after an exception or time-out. This is used to guarantee that the partner is not undertaking any business activity based on the aborted PIP.

Broadly speaking, RosettaNet activities can be classified as one-action and two-action activities. A one-action activity involves the initiator sending a request action to the responder and the latter returning a business signal. A two-action activity involves the initiator sending a request action to the responder, and the responder returning a receipt acknowledgment to the initiator. This is followed by the responder returning a response action to the initiator, and the initiator returning a receipt acknowledgement

to the responder. One-action and two-action activities can also use either one or both of the synchronous and asynchronous modes of interaction, as prescribed by their corresponding PIP specifications.

With the exception of the 1.x versions of PIP3A4, which include three activities (Create Purchase Order, Change Purchase Order, and Cancel Purchase Order), all other PIPs include only a single activity. This actually complicates alignment with other horizontal standards like ebXML. However, the situation is remedied with the 2.0 version of PIP3A4, which now only contains the Create Purchase Order activity. The Change Purchase Order and Cancel Purchase Order activities are now embodied by PIP3A8 and PIP3A9, respectively.

Currently, PIP specifications are not fully machine-processable. They are distributed across a number of documents using a variety of notations whose consistency is difficult to ensure. The current PIP specifications (at least since mid-2000) are all machine-generated from a database of PIP characteristics. The requirements documents used to communicate these parameters are also highly structured. Each PIP version is described by a Word document using natural language and UML notations, one or more DTDs (one for each action message), and one or more message guidelines (one for each action message). Each DTD describes the structure of an action message while the corresponding message guideline describes the data types, entity instances, and constraints (mostly cardinality related) that apply to the data elements.

2.13 Business Process Instance

Similar to Business Content Instance, this layer describes the particular business process required to perform a particular business transaction, which could be simple or complex (recursive) combinations of universal and specialized business processes as needed for trading partners to communicate.

2.14 Trading Partner Profiles and Agreement

Unlike some other horizontal standardization efforts, in particular ebXML, that provide a high degree of flexibility for the customization of security and performance control parameters at the trading partner agreement level, RosettaNet PIPs rigidly specify such parameters in an attempt to foster wide interoperability. Even though RosettaNet does not officially sanction the overriding of such parameters in trading partner requirements, in practice most solution provider implementations support the overriding of such parameters to allow the flexible implementation of bilateral trading partner agreements.

2.14.1 Legal Requirements

At present, RosettaNet does not define a standard Trading Partner Agreement that can be used to define the legal terms of partners who wish to use RosettaNet's defined business processes. These agreements are proprietary, and must be negotiated privately between the parties.

2.14.2 Connectivity

A RosettaNet solution implementation must include a trading partner database that identifies the set of trading entities the local system is configured to trade with. For each such trading partner, the communication endpoints that it will employ for receiving messages using different transfer protocols (currently HTTP/HTTPS, SMTP) need to be registered, along with all the parameters required to execute those protocols.

For HTTP and HTTPS, these typically include all URL components (protocol, server, port, path, query string). SMTP requires an email address.

The Messaging Service layer, described in section 2.3, makes use of this configuration information.

2.14.3 Security Definition

Digital certificates for SSL handshakes, digital signatures, and S/MIME-based encryption for different configured trading partners must also be recorded in the trading partner database, as well as rules defining when and how to use these features. Other security-related elements might include Certificate Authority policy and Certificate Revocation/Validation procedures.

The Security layer (Section 2.15) describes the use of these items and settings.

2.14.4 Process Definition

PIPs that each trading partner will initiate and PIPs that each trading partner will respond to must also be registered. Since PIPs do not prescribe the allowable transfer protocols, the proper transfer protocol to use between a pair of trading partners for a particular PIP must also be assigned in the trading partner database.

2.15 Security

The RNIF Core Specification dictates the authentication, authorization, encryption and non-repudiation parameters essential for conducting secure electronic business over the Internet.

Authentication is the process of reliably establishing the identity of the message sender. RNIF requires the use of digital signatures that conform to the S/MIME v.2 specification and the associated digital certificates issued by a third party mutually trusted by the two trading partners, as an effective way to establish the authenticity of the message sender. Authentication at the transfer protocol level may also be accomplished, e.g. through the use of SSL and/or HTTP client authentication.

Authorization is the process of making sure that a sending party or sending party's organization is permitted to send the subject message (or perform the subject business action). In addition to the identity as specified in the service header, RNIF recommends the use of digital signatures that conform to the S/MIME v.2

specification and the associated digital certificates to establish the identity of the communicating party for authorization purposes also.

Non-Repudiation is the process of assuring that a particular person or service sent or received a message. For example, a sender would be unable to deny having sent a message called non-repudiation of origin & content; and a receiver would be unable to deny having received a message called non-repudiation of receipt. Again digital signatures on messages sent are used to provide both non-repudiation of message origin & content and non-repudiation of receipt; the latter with a signed receipt acknowledgment that includes the digest of the originally received message.

RNIF 2.0 defines an S/MIME-based mechanism to encrypt the payload part of a RosettaNet Business Message, with an option to encrypt the Service Header also if needed. Encryption of payload ensures privacy and prevents unauthorized access to payload during transit. Even the service header carries sensitive information, such as the name of the PIP, subject business action type, etc., which can be used to infer meaningful statistical information regarding business activities between trading partners. Hence RNIF 2.0 provides an option to encrypt the service header also if desired.

2.16 Management

Currently, RosettaNet has not addressed this layer yet.

APPENDIX A REFERENCES

- *RosettaNet Implementation Framework: Core Specification,* Version: Validated 02.00.00, 13 July 2001. (Source: http://www.rosettanet.org/rnif/)
- *Understanding a PIP Blueprint*. RosettaNet, 1999, 2000. (Source: http://www.rosettanet.org)
- *RosettaNet Technical Conventions and Style Guide.* RosettaNet, 2000. (Source: http://www.rosettanet.org)
- RosettaNet PIP Specifications (complete collection). RosettaNet, 1998-ongoing. (Source: http://www.rosettanet.org)
- RosettaNet Dictionaries (business, technical). RosettaNet, 1998-ongoing. (Source: http://www.rosettanet.org)